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



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Journal of Indian Academy of Forensic Medicine (JIAFM)

The official publication of Indian Academy of Forensic Medicine

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

Journal of Indian Academy of Forensic Medicine

Volume: 34

Number: 1

Jan- March 2012

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Print ISSN: 0971-0973. Electronic ISSN: 0974-0848. IndMED www.medind.nic.in/jal/jalm.shtml

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JIAFM

A Quarterly Publication

Volume 34, Number 1, January-March, 2012

I feel immense pleasure to present before you the first issue of 2012. I would like to inform all of you that our esteemed Journal of Indian Academy of Forensic Medicine which is published quarterly since 1991 has been started gaining wide recognition not only in India but globally among the scientific community. I am trying to maintain your faith and trust in me to bring this journal to highest level of its achievements.

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

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

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

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

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

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Editorial:

Use of Computer and IT in improving the Quality of Medico-legal Services in India

Hon'ble Court has shown its concern for preparation of Medico-legal record by junior and not properly trained Casualty Medical Officer. There is need for more and more involvement of Forensic Medicine experts in Medico-legal work in the casualty. Diagrammatic illustration of injuries in the form of sketch diagram in medico-legal report and post-mortem reports is of immense value for court and all concerned stake holders in better appreciation of findings and reaching to conclusive opinion during trial.

The decisive and conclusive medical evidence which should be able to connect the alleged accused with the crime and go against the defence version whenever case come for appeal before a higher court regarding the cause of death has been relied by the court for conviction. Manner of preparation of medical record and its legibility is very important in saving lots of time and improving the quality of medical records in adding better administration of justice which is all about the speciality of Forensic Medicine.

The prosecution, with a view to connect the appellants with the crime, relied upon:

- (i) Motive;
- (ii) Direct evidence of assault on the deceased;
- (iii) Extra Judicial Confession;
- (iv) Medical evidence;**
- (v) Conduct of the appellants

In Mukhtiar Singh & Ors. vs. State of Punjab, Criminal Appeal No. 480 of 1985, Date of Judgment: dated 30.11.1995, Hon'ble SC observed that:

".... **(iv) Medical evidence:** According to PW1, Dr. Dalal, the cause of death was coma as a result of dislocation of 2nd/3rd cervical vertebrae which was ante mortem in nature and sufficient to cause death in the ordinary course of nature. The doctor then opined the possibility of the dislocation of second and third vertebrae due to Lathi blow cannot ruled out, but since the body was in a burnt condition it was not possible to specify the exact type of the weapon with which the injury may have been caused.

During the cross-examination, PW1 admitted the possibility of injuries No.1, 2 and 3 on the dead body of Pritam Kaur having been suffered in a fall from a height cannot be ruled out. At the places where injuries No.1 and 2 were located no bony injury was found.

SC concluded that "thus, we find that the medical evidence is neither decisive nor conclusive and it fails to connect the appellants with the crime and does not go against the defence version of the deceased having died instantaneously as a result of the fall. The absence of any bony injury is more consistent with the defence version than the prosecution case."

In the same case (Supra) at point 17, SC quoted another judgment, **Shivaji Sahebrao Bobade & Anr. vs. State of Maharashtra, AIR 1973 SC 2622**, SC court held:

"...Thus too frequent acquittals of the guilty may lead to a ferocious penal law, eventually eroding the judicial protection of the guiltless. For all these reasons it is true to say, with Viscount Simon, that "**a miscarriage of justice may arise from the acquittal of the guilty no less than from the conviction of the innocent ...**" In short our jurisprudential enthusiasm for presumed innocence must be moderated by the pragmatic need to make criminal justice potent and realistic.

A balance has to be struck between chasing chance possibilities as good enough to set the delinquent free and chopping the logic of preponderant probability to punish marginal innocents. We have adopted these cautions in analysing the evidence and appraising the soundness of the contrary conclusions reached by the courts below. Certainly, in the last analysis reasonable doubts must operate to the advantage of the appellant..."

The Indian Medical Council (Professional Conduct, Ethics and Etiquettes) Regulations, 2002, in Chapter I at point 1.3, mentioned about Maintenance of medical records:

1.3.1 Every physician shall maintain the medical records pertaining to his/her indoor patients for a period of 3 years from the date of commencement of the treatment in a standard proforma laid down by the Medical Council of India and attached as **Appendix 3**.

1.3.2 If any request is made for medical records either by the patients/authorized attendant or legal authorities involved, the same may be duly acknowledged and documents shall be issued within the period of 72 hours.

1.3.3 A registered medical practitioner shall maintain a Register of Medical Certificates giving full details of certificates issued. When issuing a medical certificate he/she shall always enter the identification marks of the patient and keep a copy of the certificate. He/She shall not omit to record the signature and/or thumb mark, address and at least one identification mark of the patient on the medical certificates or report. The medical certificate shall be prepared as in Appendix 2.

1.3.4 Efforts shall be made to computerize medical records for quick retrieval.

Thus, computerization of medical record is important not only for easy retrieval and about the quality of medical record especially of medico-legal record of immense value in administration of justice.

Role of Court in Computerization of Medical Record:

Many High courts reacting to the quality of writing which is not legible and consumed lot of time in deciphering the said writing and its impact on disposal of the cases. Some examples are illustrated below:

Scenario in State of Delhi:

Hon'ble Delhi High Court in case of **State of Govt. of NCT of Delhi vs. Jitender and State vs. Virender @ Ballu & Anr., Judgment dated 19.01.2012** observed that "Further from the perusal of the Post Mortem report and the MLC prepared in the present case and in many other cases, which comes to the notice of this court daily, during routine court proceedings, where Medico-legal reports are prepared and the doctors attend the court for their depositions relating to post-mortems and different types of MLC(s). In most of the cases, the said writing in the MLC(s)/Post-mortem reports are not at all legible and lot of time is consumed in deciphering the said writing. In all those cases, the doctors/Autopsy Surgeons have to first describe the contents written in the MLC(s) and post-mortem reports, so that the same can be dictated and can be converted into legible words."

Court further added that "Sometimes the concerned doctors have either left the services of the hospital or are not traceable and other doctors are directed to appear in the court in their place, but due to illegible handwriting of the concerned doctors(s) including the signatures, put on the MLC(s) the doctor who is deputed in the place of such Doctor(s) are most of time are not able to decipher the handwriting of the concerned doctor and feel great inconvenience in communicating the exact facts mentioned in the reports and MLC(s) during their examination, which adversely effects the ends of justice and unnecessarily consumes lot of time of the court.

Suggestions for Improving the Quality of Medico-Legal Record:

Further lots of other deficiencies have been observed by court regarding the manner of preparation of MLC(s) and the post-mortem reports. Consequently, following suggestions be implemented for improvement of Medico-legal and post-mortem reports for better administration of Criminal Justice:

- (a) The MLCs, especially the postmortem reports be prepared by computer typing, rather than handwriting to save the time of the court, defence lawyers and the accused and to give better clarity to the accused persons, as to what is against them.
- (b) The MLC(s) at present in the Casualty of the hospital are being prepared by very junior or trainee doctors resulting in incomplete information being mentioned in the MLC(s), about the injury and the associated findings. Therefore, the MLC(S) should not be prepared by the doctors who are not properly trained in Forensic Medicine.
- (c) Any injury(s) found on the body of the injured including burn injuries(s), should be clearly illuminated on the sketch diagram(s) of the human body which are already on the back side of the MLC's and along with that the colour changes, dimensions of injury(s), duration of injuries(s), depth of injury(s), location in respect to land marks of the body, be clearly mentioned, which medical facts are most essential for better appreciation of the injuries and for better appreciation of facts during the trial.
- (d) Further along with postmortem reports the injuries found on the body of deceased should also be illustrated on the sketch diagram of human body, including exit and entry wound of bullet injuries at least in burn and murder cases.
- (e) Histo-pathological report of organ(s) of the deceased be submitted at the earliest, rather it is observed, it is not being submitted/done at all in most of the cases.
- (f) The subsequent/final opinion regarding the cause of death, by the Autopsy Surgeon is opined very late in most of the cases, due to delayed, reporting/collection of FSL/Chemical Analysis report of viscera, and histopathological report, which results in grave injustice to the fundamental rights of the accused and the victim during the trial for speedy justice. Therefore, FSL report be given in a time bound manner, at least in serious cases.

Hon'ble Court had directed that the copy of this order be sent to **Principal Secretary, Health**, and **Principal Secretary Home, Govt. of NCT of Delhi**, for compliance and circulate amongst all the **Medical Superintendent(s) of the Hospitals of Delhi Govt.**

Scenario in State of Punjab:

Similarly in the States of Punjab and Haryana, in terms of the order passed by the Punjab & Haryana High Court on 6.7.2011, learned counsel appearing for the State of Punjab has produced minutes of meeting held under the Chairmanship of Principal Secretary to Government, Punjab, Department of Health and Family Welfare, in terms of which it has been, inter alia, decided that from 1.09.2011 onwards, all post-mortem reports/medico-legal reports shall be computer typed. Even if, some report is prepared in hand initially, a fresh typed copy duly signed by the concerned doctor shall be supplied later. With the challan invariably computer typed copy shall be submitted.

Scenario in State of Haryana:

Dr. Narvir Singh, Director General Health Services, Haryana was appeared in court and appraised that as for as State of Haryana is concerned, copy of the communication dated 20.04.2011 has been produced stating therein that doctors have been advised to prepare a legible post-mortem report or medico-legal report. Learned counsel for the State submitted that fresh instructions regarding preparation of the aforesaid documents on computer are in the process of being issued.

Scenario in Union Territory, Chandigarh:

Similarly, Union Territory, Chandigarh submitted that the matter is under active consideration and necessary instructions shall be issued, which shall be produced in court on the next date of hearing. Certain more hospitals in the States of Punjab and Haryana and Union Territory, Chandigarh, issue computerized post-mortem reports/medico-legal reports.

Role of MCI:

This is the right time for other States in India to follow the judicial trend for better administration of justice and reducing the backlog of cases and enhanced conviction rate. Regulatory body Medical Council of India should realise the intent behind these direction of the Hon'ble Court and restore the reduced faculty and implement restructured new curriculum to meet the demand of judiciary in larger public interest.

Mukesh Yadav
Editor

Original Research Paper

Age Determination from Clavicle: A Radiological Study in Mumbai Region

*S.S. Bhise, **G. S. Chavan, **B. G. Chikhalkar, ***S. D. Nanandkar

Abstract

The bones of human skeletons develop from separate ossification centres. From these centers ossification progresses till the bone is completely formed. These changes can be studied by means of X-rays and these changes are age related. It is therefore possible to determine the approximate age of an individual by radiological examination of bones till ossification is complete.

This radiological study was carried out with the objective to assess the general skeletal maturity around Medial end of clavicle, of subjects in Mumbai region. 131 males between age group of 9-25 years and 68 females between age group of 3-23 years attending the outpatient department of this hospital were selected. Age confirmed from history and noting the birth dates from driving license, passport, rations card or voter's card. The cases were selected after ruling out the nutritional, developmental, and endocrinal abnormality which affects the skeletal growth. Data analysis was done in P4 computer using HPSS software. At the end conclusions were drawn which are compared with available results of various previous studies.

Key Words: Epiphyseal Fusion, Ossification Centres, X-Rays

Introduction:

Determination of the age of an individual from the appearance and the fusion of the ossification centres is a well accepted fact in the field of medical and legal professions. Epiphysis of bones unites during age periods which are remarkably constant for a particular epiphysis.

The determination of age presents a task of considerable importance from the viewpoint of the administration of justice. It is not possible to enunciate a hard and fast rule for age determination from this union for the whole India because the various geographical areas of our country differ in climatic, dietetic and disease factors. The present study was carried out to study roentgenographically the epiphyseal appearance and fusion of medial end of clavicle in subjects between age group of 3 to 25 years attending outpatient department of this hospital.

Aims and Objectives:

- To assess the skeletal maturity at medial end of clavicle for a known chronological age in subjects of Mumbai region.

- Do Comparative study of appearance & fusion of medial end of clavicle with known standards.
- To evaluate sex related variation & its correlation with age.
- To know variation if any & exception of appearance & fusion of medial end of clavicle.
- To evaluate the medico legal aspects of different ages.
- To suggest any additional radiological investigation to aid and to reduce range in determining age.

Material and Methods:

The study was carried out in Grant Medical College and Sir J. J. Group of Hospitals Mumbai which is a tertiary referral centre. The objective was to assess the general skeletal maturity of medial end of clavicle in subjects in Mumbai region. 131 males between age group of 9-25 years and 68 females between age group of 3-23 years attending the outpatient are selected. Age confirmed from history and noting the birth dates from driving license, passports ration card or voter's card. The cases were selected after ruling out the nutritional, developmental, and endocrinal abnormality which affects the skeletal growth. X-rays of medial end of clavicle, AP view were taken at department of radiology. The epiphysis of medial end of clavicle was observed for appearance (A) and non appearance (NA) and different phases

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of fusion were graded according to Dr. William Sangma et al and Mckern and Stewart's methods. The 5 stages were as follows-

- **Stage 1 (F1): Non union** – when the epiphyseal cartilage did not begin to decrease in thickness
- **Stage 2(F2): Commence of union** – when the thickness of epiphyseal cartilage was found to be reduced appreciably (1/4th united)
- **Stage 3(F3): Incomplete union** – when the epiphysis has begun to fuse with shaft and complete union was well underway (1/2 united)
- **Stage 4(F4): Complete union** – when the epiphyseal cartilage was bony in architecture and its density indistinguishable from the epiphysis and diaphysis in its neighbourhood but an epiphyseal line called epiphyseal scar could still be distinguished. (3/4 united)
- **Stage 5(F5): Complete union** – with absence of epiphyseal scar.

The appearance and fusion of medial end of clavicle was evaluated radiologically and the results were compared with the previous known standard studies

Results and observations:

Table No. 1 shows in males in 34 cases (89.6%) at 9 – 15 years and in 4 cases (10.4%) at 15 – 16 years centre was not appeared. In 6 (60%) cases at 15 – 16 years and 4 cases (40%) at 16 – 17 years centre was appeared

F1 stage of fusion was seen in 2 cases (40%) at 16 – 17 years age group and in 3 cases (60%) at 17 – 18 years age group.

F2 stage of fusion was seen in 1 case (10%) at 16 – 17 years age group, in 5 cases (50%) at 17 – 18 years age group, in 1 case (10%) at 18 – 19 years age group and in 3 cases (30%) at 19 – 20 years age group.

F3 stage of fusion was seen in 5 cases (17.2%) at 17 - 18 years age group, in 18 cases (62.1%) at 18 – 19 years age group, in 3 case (10.3%) at 19 – 20 years age group and in 3 cases (10.3%) at 20 – 21 years age group .

F4 stage of fusion was seen in 1 case (4.8%) at 18 - 19 years age group, in 1 case (4.8%) at 19 – 20 years age group, in 10 cases (47.6%) at 20 – 21 years age group and in 5 cases (23.8%) at 21 – 22 years age group and in 4 cases (19%) at 22 – 23 years age group.

Complete fusion (F5) was seen in 5 cases (27.8%) at 21 - 22 years age group, in 3 cases (16.7%) at 22 – 23 years age group, in 6 cases (33.3%) at 23 – 24 years age group and in 4 cases (22.2%) at 24 – 25 years age group.

Table No. 2 shows in females in 26 cases (83.9%) at 3 – 13 years, in 3 cases (9.6%) at 13 – 14 years and in 2 cases (6.5%) centre was not appeared.

In 2 (25%) cases at 14 – 15 years, 3 cases (37.5%) at 15 – 16 years and in 3 cases (37.5%) 16 - 17 centre was appeared

F1 stage of fusion was seen in 1 case (33.3%) at 15 – 16 years age group and in 2 cases (66.7%) at 16 – 17 years age group.

F2 stage of fusion was seen in 2 cases (50%) at 17 – 18 years age group and in 2 cases (50%) at 18 – 19 years age group.

F3 stage of fusion was seen in 2 cases (33.3%) at 17 - 18 years age group, in 4 cases (67.7%) at 18 – 19 years age group.

F4 stage of fusion was seen in 3 cases (60%) at 19 - 20 years age group and in 2 cases (40%) at 20 – 21 years age group.

Complete fusion (F5) was seen in 4 cases (36.4%) at 20 - 21 years age group, in 4 cases (36.4%) at 21 – 22 years age group and in 3 cases (27.3%) at 22 – 23 years age group.

Discussion:

In present study both males and females in majority of cases show epiphyseal appearance at 15 – 16 years age group.

In present study males show epiphyseal union at 23 - 24 years age group and earliest union occurred at 21 years. Females show epiphyseal union at 21 - 22 years age group and earliest union occurred at 20 years.

The present study findings are close to Flecker, Galstaun, B. D. Chaurassia, Parikh, and Krishan Vij. [(5, 7, 9, 13]

According to Stevenson (1924) in both males and females earliest union occurred at 18 years but in present study for males, earliest union occurred at 21 years of age and for females it is 20 years of age. Present study and Stevenson show different results because they are performed in different races (Table - 3).

In present study majority of cases show complete union at 23 – 24 years for males and at 21 – 22 years for females. These findings are in tandem with study carried out by B. D. Chaurassia and Parikh because both studies are done in India.

Conclusions:

From the present study it can be concluded, that-

- Epiphysis of Medial end of Clavicle appears at 15 – 16 years in both males and females
- Epiphysis of medial end of clavicle fused in most of the cases at 23 – 24 years for males and at 21 – 22 years for females. Earliest

union occurs at 21 years in males and at 20 years in females.

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Table 1

Extent of Appearance and Fusion of Medial End of Clavicle in Males Different Age Groups

Extent of appearance & fusion	9-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	24-25	Total
	Cases (%)											
NA	34(89.6)	4(10.4)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	38(100)
A	0(0)	6(60)	4(40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	10(100)
F1	0(0)	0(0)	2(40)	3(60)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	5(100)
F2	0(0)	0(0)	1(10)	5(50)	1(10)	3(30)	0(0)	0(0)	0(0)	0(0)	0(0)	10(100)
F3	0(0)	0(0)	0(0)	5(17.2)	18(62.1)	3(10.3)	3(10.3)	0(0)	0(0)	0(0)	0(0)	29(100)
F4	0(0)	0(0)	0(0)	0(0)	1(4.8)	1(4.8)	10(47.6)	5(23.8)	4(19)	0(0)	0(0)	21(100)
F5	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	5(27.8)	3(16.7)	6(33.3)	4(22.2)	18(100)

Table 2

Extent of Appearance and Fusion of Medial End of Clavicle in Females Different Age Gps

Extent of appearance & fusion	3-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	Total
	cases (%)											
NA	26(83.9)	3(9.6)	2(6.5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	31(100)
A	0(0)	0(0)	2(25)	3(37.5)	3(37.5)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	8(100)
F1	0(0)	0(0)	0(0)	1(33.3)	2(66.7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	3(100)
F2	0(0)	0(0)	0(0)	0(0)	0(0)	2(50)	2(50)	0(0)	0(0)	0(0)	0(0)	4(100)
F3	0(0)	0(0)	0(0)	0(0)	0(0)	2(33.3)	4(67.7)	0(0)	0(0)	0(0)	0(0)	6(100)
F4	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	3(60)	2(40)	0(0)	0(0)	5(100)
F5	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4(36.4)	4(36.4)	3(27.3)	11(100)

Table 3

Comparison of Time of Fusion (n Years)

Author	Year	Race	Sex					Earliest Union (Yrs) Male/female
			Males		Females		Mixed	
			Appear	Fusion	Appear	Fusion		
Stevenson's	1924	White and Negroes		22-24		22-25	--	18
Davies& Parson	1927	English		--		--	25	
Flecker	1932	Australians		21		21	---	
Galstaun	1937	Bengalies (Indians)	15-19	22	14-16	20	--	
Krogman	1962	U.S.A.		--		--	25-28	
Stewart	1973	U.S.A.		26 or more		--	--	
Chaurassia	1980	Indian		--		--	21-22	
Parikh	1990	Indian		--		--	22	
Inderbir	1993	Indian		--		--	25	
Krishnan Vij	2001	Indian		--		--	20-22	
Present study	2010	Mumbai (Indian)		23-24		21-22	--	Male-21 Female-20

Original Research Paper

An Entomological Study to Determine the Time since Death in Cases of Decomposed Bodies

*Parmod Kumar Goyal

Abstract

Forensic entomology is the application of knowledge of insects during investigation of crimes or other legal matters. For investigation of crime, it is very important to determine time since death, which is easy to determine in the early post-mortem period, but poses a problem in the late stages. In this study an effort has been made to determine post-mortem interval in the late stages (decomposed bodies) by studying insect evidence. Insect evidence in the form of blow flies in their different stage of development was found on fresh and decaying corpses. Beetles were found on skeletonised bodies. Since the arthropods are poikilothermic and their development period gets influenced by ambient temperature therefore a record of prevailing temperature was maintained for the set period. Average temperature and humidity was calculated from the meteorological department at Raja Sansi Airport, Amritsar, from the day of recovery of body to rearing up of insects to adult stage. Identification of insects was carried out in collaboration with Zoology Department of Guru Nanak Dev University, Amritsar.

Key Words: Forensic entomology, Post-mortem interval, Decomposed bodies, Blow flies, Beetles

Introduction:

The determination of post-mortem interval (PMI) is one of the main objectives of doing medicolegal autopsy. In the early post-mortem period, the PMI can be calculated from algor mortis, rigor mortis, livor mortis, eye changes, and gastric contents etc. [1] In the late post-mortem period in addition to signs of decomposition, insect play a considerable role in calculating PMI. Sarcophagus flies, lay their eggs on moist areas, particularly around the eyes, nose, mouth and if exposed anus and genitalia. The eggs hatch into larvae, which grow and shed their skins a number of times, each moult being called an instar, finally they pupate and a new winged insect emerges. The time from egg lying through the instar to pupae depends on the species and on the ambient temperature. [1]

Materials and Methods:

The study was carried out on 47 decomposed bodies brought for post-mortem examination in the Department of Forensic Medicine and Toxicology at Government Medical College, Amritsar.

Bodies were divided into four stages of decomposition i.e. fresh, bloated, decay and dry. [2] Signs of decomposition like colour changes, marbling of skin, foul smelling gases, bloating of body features, skin slippage, degloving of skin, easy pull out of hairs, loosening of nails and teeth, colliquative putrefactive changes, adipocere formation, conditions of viscera whether recognizable or not, degree of skeletonisation of body etc were noted. [3]

Bodies were screened thoroughly for the adult arthropod specimens flying or crawling over it. Crawling insects were collected with a camel hair brush and flying insects by making aerial collections with sweep nets. The collected adult specimens were dry mounted for identification. The body was screened for eggs, larvae or pupae particularly around the eyes, ears, nostrils, mouth, vagina, anal region and wounds. The collected material in the form of eggs, larvae or pupae were reared by transferring them to 500 ml transparent glass beaker partially filled with sterilized sand covered with circular piece of filter paper. A piece of flesh from same body was provided as food for the development of material to adult stage. After transferring immature stage insects the mouth of jar was covered with muslin kept in position with rubber bands. [4]

The glass beakers were observed daily for emergence of adults and development period was noted. The emerged adults were preserved by dry mounting for identification. The standard

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data about total development period of identified species was collected from literature, as well as from their rearing under experimental conditions and time of infestation by insects was calculated by subtracting the observed development period from it and this data were used for making estimates regarding the time of death. [5]

Since the arthropods are poikilothermic and their development period gets influenced by ambient temperature therefore a record of prevailing temperature was maintained for the set period. [6] Average temperature and humidity was calculated from the meteorological department at raja sansi Airport, Amritsar, from the day of recovery of body to rearing up of insects to adult stage. Identification of insects was carried out in collaboration with Zoology Department of Guru Nanak Dev University, Amritsar.

Observations:

Table 1: Frequency Distribution of Dead Bodies according to Various Characteristics

Characteristic	Number (%)	
Distribution of cases according to age (in years)	0-20	5 (10.63)
	21-40	25 (53.19)
	41-60	10 (21.27)
	>60	4 (8.50)
	Unknown	3 (6.38)
Distribution of cases according to Sex	Male	41 (87.23)
	Female	4 (8.50)
	Unknown	2 (4.25)
Distribution of cases according to the location from where dead body was found	Water	11 (23.40)
	Ground	33 (70.21)
	Buried	3 (6.38)
Distribution of cases according to the stage of decomposition	Fresh	7 (14.89)
	Bloated	23 (48.93)
	Decay	15 (31.91)
	Dry	2 (4.25)

Table 2:

Distribution of cases based upon entomological evidence found*	Adult fly	29 (61.70)
	Egg colonies	16 (34.04)
	1 st instar larva	11 (23.40)
	2 nd instar larva	10 (21.27)
	3 rd instar larva	7 (14.89)
	Pupae	2 (4.25)
	Beetles	8 (17.02)
Distribution of cases based upon insects identified*	Sarcophagidae	45 (95.74)
	Calliphoridae	45 (95.74)
	Muscidae	45 (95.74)
	Silphidae	15 (31.91)
	Dermestidae	17 (36.17)

*values are more than total number of dead bodies studied as in many bodies more than one entomological evidence or insect was found

Table 3: Decomposition Stage wise Distribution of Arthropods

Decomposition stage	Arthropod	Developmental state
Fresh (up to 36 hours)	Calliphoridae (Diptera)	Adult
	Sarcophagidae (Diptera)	Adult
	Muscidae (Diptera)	Adult
Bloated (36 hours to 7 days)	Calliphoridae (Diptera)	Adult and larvae
	Sarcophagidae (Diptera)	Adult and larvae
	Muscidae (Diptera)	Adult
Decay (7 days to 3 months)	Calliphoridae (Diptera)	Adult and larvae
	Sarcophagidae (Diptera)	Adult and larvae
	Muscidae (Diptera)	Adult and larvae
	Silphidae (Coleoptera)	Adult and larvae
	Dermestidae (Coleoptera)	Adult and larvae
Dry (3 months to 1 year)	Dermestidae (Coleoptera)	Adult and larvae

Discussion:

The present study was conducted on putrefied bodies recovered from ground, water and burial. Rodriguez and Bass [7] conducted their studies on buried corpses, Whereas Vanlaer Hoven and Anderson [8], Arnaldos et al [9] Devinder and Meenakshi [2] conducted their studies on putrefied carcasses on ground. Campobasso et al [10] studied various factors influencing putrefaction as well as crop pattern of insects. In this study also it was observed that in bodies underwater and in burial, process of putrefaction was delayed. In the present study it is quite clear that when the body was in fresh, bloated and early decay stage, dermestidae (Beetles) were conspicuously absent. They were only seen when skeletonisation occurred, whereas blow fly i.e. green and blue bottled were the main insect attracted to the corpses in wet stage. Knight [11] Kulshrestha and Satpathy [12, 13] also observed same as in the present study.

Decomposition process is slowed in winter season and buried bodies as favourable factors for decomposition and bacterial growth are not available. This was evident from the current study, it took longer time for bodies to get putrefied and even infestation of these bodies with arthropod also took longer time and even rearing of arthropod took longer time. Similar observations were made by Bass [14], Arnaldos [9] and Carvalho & Linhares. [15]

Conclusions:

Forensic entomology is a highly specialized branch of Forensic Science which needs special equipment and facilities. In this study an effort has been made to calculate the post-mortem interval from entomology, but to

make the study applicable for legal purpose further studies needs to be done and standard data should be prepared for the local arthropod of the region and then standard life cycle under various weather condition should be prepared and visit to the scene of crime should form a part of the exercise.

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Original Research Paper

Profile of Deaths due to Electrocution: A Retrospective Study

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Abstract

We carried out a retrospective analysis of deaths due to electrocution from the medico-legal deaths reported to our institution. Majority of the victims were males belonging to the age group of 11-50 years. Almost all deaths were accidental and most of them were concentrated in the period of monsoon implicating the important role of wetness in causing these deaths. In contrast to the studies done in the West, bathtubs, heaters or hair dryers were not involved in any of the deaths. The mortality rate due to electrocution was significantly higher at 4.4 per one lakhs (100000) population in the present study as against the figures of 0.94 and 0.14 from Bulgaria and Canada respectively. Most of the deaths were either instantaneous or immediate and most of the deaths were preventable by electrocution. It signifies that people living at home did not have elementary knowledge of risks of electrocution; therefore awareness about use of good quality electric appliances and cables is the need of the hour.

Key Words: Electrocution, Gujarat, India, Accidental Deaths, Burns

Introduction:

Electricity is such an integral part of life, that it's hard to imagine life without it. But, with the advantages and convenience of electricity come the hazards as well. Sometimes, the use of electricity may result in cases of morbidity or mortality and most of these are accidental in nature, [1-5] Although, on rare occasions, electricity has also been put to use for suicidal [6-11] and homicidal purposes. [2]

A distinct pattern is seen in deaths due to electrocution all over the world. In the Western world, accidental deaths caused by electrocution are not common owing to the good safety measures and high level of awareness. However, many cases of suicides are reported. As against this, in developing countries like India, accidental deaths caused by electrocution are for more common than suicidal deaths.

Materials and Methods:

The present study comprises of an analysis of the Medico-Legal autopsies that we conducted during the period of 2004-2008 (five years). During this period, we received 5028 cases for autopsies and of these 102 cases were of electrocution. We collected the general information about these cases from the history, the police papers and post mortem reports.

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This information was then entered in a proforma made for this purpose and there after analysed.

Results:

Most of the victims were male 75 and the remaining were female 27(26.47%). (Table 1) On an average we received 20 cases per year. This was 2.02% of the cases we autopsied and 4.4 per 100000 populations per year. Most of these cases, 52(50.99%), were concentrated in the months of June, July and August. (Table 2) The age of the victims was spread over the range of 1 year to 70 years, though most of them fell in the age group of 11-50 years. (Table 3) Most of the victims suffered electrocution while they were working in their homes. (Table 4) The common voltage used in India is 220-240v and therefore they suffered the same. (Table 5) In 48 cases (47.06 %), only entry marks were seen, while 34 cases (33.34 %) showed both the entry and exit marks. In 9 cases (8.82 %), no marks were seen. In 19 cases (18.62 %), there were additional marks (non electrocution injuries) over and above the entry and or exit marks of electrocution. 13 cases (12.74 %) showed burns on the body and clothes as per the sites involved. (Table 6) Upper limbs were the most common sites to show the electrocution marks, 91 cases (89.21 %). This was followed by lower limbs 29 cases (28.43 %). (Table 7)

In 68 cases, the surrounding area, at the site of incident, was found to be damp or wet, while it was dry in 34 cases (33.33%). (Table 8) 98 (96.07%) victims died on the spot or we can

say that declared dead when brought to our hospital. 3 cases (2.94%) cases survived the initial shock, though died within 24 hours of the incident. One victim died after 24 hours. (Table 9) All cases except one were accidental and the exception was suicidal. We did not find any case of homicidal electrocution.

Discussion:

Males accounted for a major number of fatalities (73.53%). This is in consistency with the work of other researchers. [1, 2, 12, 13] Most of our cases fell in the age group of 11-50 years (84.29%). This finding is also in consistency with the work of others, though Rautji et al [12] narrowed down the range to 21-40 years and Dokov [13] classified age group as 25-44 years. Surprisingly, the age group of 0-10 years was also not spared. In our study there were 7.84 per cent cases in this group while in another study from India [12] the figure was 11.8 per cent and from the one in Turkey it was 31.7%. [1]

In the present study, electrocution deaths accounted for 2.02% of total, while Rautji [12] reported the figure of 1.98 per cent and Tirasci et al [1] reported 3.3%. In terms of deaths due to electrocution per one lakhs population the figure turns out to be 4.4. This is significantly higher when compared to studies done by Dokov et al in Bulgaria [13] and Laupland et al [15] in Canada who reported the figures of 0.94 and 0.14 respectively. The average number of fatalities reported by Dokov was 35 in the span of 22 years, while in our study it was about 20 per year. Obviously many factors like illiteracy amongst the general public, lack of awareness about the hazards of electricity, poor maintenance of equipments and wire linings etc. must have been responsible for this difference. As per the site of the body involved, findings in our study were in consistency with the work of Rautji et al [12] and Dokov et al [13] in most of the cases it was the upper extremity followed by lower extremities.

In our study, in 48(47.06 %) cases, only entry marks were seen and both entry and exit marks were seen in 34(33.34 %) cases. in contrast to the findings of the other worker from India [12] who had figures as high as 86.27 % for cases with only entry marks and 13.73 % for both entry and exit wounds. Surprisingly, in their study there was not a single case of electrocution without any mark. In our study there were 9 (8.82%) cases lacking a mark of electrocution. Such cases were seen in the rainy season, first being the easy passing of current in damp material and second, and the lowered resistance of skin of the victims due to wetness

or dampness. These cases certainly became cases of negative autopsies. In such cases the cause of death was ascertained by inference after full legal and medical investigations.

Tirasci et al [1] and Karger [14] reported "wet" cases of electrocution using bathtubs, heaters and hair dryers. We did not find any such case and there was no such case reported by other workers from India. [2, 12] This difference can be explained on the basis of the fact that the prevalence of bathtubs and hair dryers is almost negligible in India. However, we did get cases of electrocution due to involvement of water by way of the effects discussed earlier. In fact, the wet surrounding was responsible for 68 (66.67 %) cases in the present study. Almost half of our total cases, 52 (50.99%), were concentrated in three months of the year, namely June, July and August. These are the months of monsoon in this part of the world. These findings are consistent with the findings of other worker [12] from Delhi, India.

Tirasci et al also report maximum number of cases in the months of June, July and August but the season during this period in Turkey is summer rather than monsoon. Most of our victims (73.63 %) suffered electrocution in the surroundings of home.

Even in cases of deaths due to electrocutions; some other injuries may be seen. In our study we found non electrocution injuries in 19 (18.63%) cases. In all, except two cases, these injuries were trivial and consistent with fall on ground after getting electrocuted. Injuries found in the remaining two cases are worth mentioning. In one of the cases, the victim was travelling in an auto-rickshaw when a live wire fell on the auto-rickshaw and the victim was thrown out of the rickshaw due to electrocution.

In the second case, the victim got electrocuted on the first floor and fell on ground floor suffering serious injuries. In both of these cases, injuries sustained were consistent with the history available. These victims died late due to effects of injuries. Surprisingly, other authors were silent on this aspect of non electrocution injuries in their studies. [2, 12, 13, 15]

In our study, in addition to the injuries we also found flame burns in 13 (12.75%) cases. Four of such cases were due to high voltage and two of them actually died due to burn. Over all, four of our victims died late (24 to 48 hours) due to either effects of injuries or burns, after surviving the initial shock of electrocution. In this region, cases of electrocution fall in a category in which some compensation from various agencies as well as some civil laws is awarded. Therefore these

cases of delayed deaths were attributed to electrocution and termed accidental.

All deaths, except one in our study were accidental, the exception was suicidal. The suicide knew the technicalities of electricity being electrician; other victims were not trained in any way to deal with electricity.

Conclusion:

- Most of the deaths were accidental, only one case was suicidal. It is in contrast to studies done in West where suicidal cases were as high as 2/3rd. [14]
- Males were the predominant victims.
- In the rainy season, more than 50 per cent deaths occurred.
- Most of the deaths were either instantaneous or immediate.
- Rate of fatality is significantly higher in India as compared to Bulgaria¹³ and Canada¹⁵ other parts of world.
- We did not find any cases of deaths involving bathtubs, heaters and hair dryers.
- More than 73.54 per cent deaths occurred in domestic surroundings. It signifies that people living at home did not have elementary knowledge of risks of electrocution.
- Most of the deaths were preventable.

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Table-1: Cases according to Sex

Sex	No.	%
Male	75	73.53
Female	27	26.47
Total	102	100

Table- 2: Cases according to Months/ Year

Month	2004	2005	2006	2007	2008	No.	%
Jan	1	1	1	0	0	3	2.94
Feb	2	0	0	1	1	4	3.92
Mar	0	2	1	0	0	3	2.94
April	2	3	0	1	2	8	7.84
May	1	1	1	1	2	6	5.88
Jun	7	3	5	6	1	22	21.57
July	2	1	2	3	5	13	12.75
Aug	3	4	7	1	2	17	16.67
Sep	0	2	3	0	3	8	7.84
Oct	0	2	1	2	2	7	6.86
Nov	0	3	1	0	1	5	4.90
Dec	2	1	0	1	2	6	5.88
Total	20	23	21	16	21	102	100

Table 3: Cases according to Age

Age (Yr.)	No.	%
<1	0	0
1-10	8	7.84
11-20	19	18.62
21-30	31	30.39
31-40	20	19.60
41-50	16	15.68
51-60	7	6.86
61-70	1	0.98
71-80	0	0
81-90	0	0
>90	0	0
Total	102	100

Table 4: Cases according to Place of Incident

Place	No.	%
House	75	73.54
Industrial	7	6.86
On road	12	11.76
Others	8	7.84
Total	102	100

Table- 5: Cases according to Types of Mark Present over the Body

Type of marks	No.	%
Only entry mark	48	39.02
Entry and exit	34	27.64
No marks	9	7.32
Additional marks	19	15.45
Burns	13	10.57
Total	123	100

Table- 6: Cases according to Site of Mark

Site of marks	Entry	Exit	Others	No	%
Upper limb	70	13	8	91	55.82
Lower limb	7	14	8	29	17.79
Head & neck	4	1	8	13	7.98
Chest	6	2	9	17	10.43
Abdomen	3	2	8	13	7.98
Total	90	32	41	163	100

Table- 7: Cases according to Surrounding of the Place of Incident

Surrounding	No	%
Wet	68	66.67
Dry	34	33.33

Original Research Paper

Victim Profile and Pattern of Thoraco-Abdominal Injuries Sustained in Fatal Road Traffic Accidents

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Abstract

The present research aims to highlight the pattern of thoraco-abdominal injuries sustained by the victims of fatal road traffic accidents (RTA) in Manipal, South India. The study is an autopsy based observation of thoraco-abdominal injuries in victims of fatal road traffic accidents during 1999 – 2003. Road traffic accidents accounted for most of the injury related deaths (77%) during the study period. A male preponderance (86%) was observed with a male-female ratio of 6:1. Individuals in the age group of 21 to 50 years formed the most vulnerable (83%) group. External thoracic injuries were more common than internal thoracic injuries in the thoracic region. In the abdominal region, internal injuries were more common than external injuries. Lungs (61%) and kidneys (23%) were the most commonly involved organs in the thoracic and abdominal regions respectively. Majority of the victims were two wheeler occupants (35%) followed by pedestrians (23%). The study indicates the pattern of thoraco-abdominal injuries sustained along with the trend of road traffic accidents in the region.

Key Words: Thoraco-Abdominal Injuries; Road Traffic Accidents; Blunt Force Trauma

Introduction:

Accidents are a counter product of modernization and hasty life and are considered as a modern day epidemic. Analysis of the trend of RTA and associated risk factors influence the planning of preventive and remedial measures pertaining to the human habitations, roadways and in the setup of health care institutions for any eventualities. A number of studies on various aspects of non-natural deaths reported road traffic accidents to be the major cause of mortality arising from non-natural causes in different regions of India. [1, 2] Accidents rank fourth among the leading causes of death. Among all accidental deaths, road traffic injuries claim 1.2 million lives every year and form the main bulk of deaths from non-natural causes. More than 25% of the global accidental deaths occur in South East Asia region. [3]

It is estimated that by the year 2020, 8.4 million people will die every year of injuries. Injuries from road traffic accidents is estimated to be the third most common cause of disability worldwide and the second most common cause of disability in the developing world. [4]

There are differences in the road use and pattern of road traffic injury across different countries. Regional differences exist in the pattern of injury sustained by different types of road user that can have significant implications in the development of prevention policies. The present research is aimed at understanding the pattern of thoraco-abdominal injuries caused in road traffic crashes in and around Manipal, South India.

Material and Methods:

The present study was carried out in the Department of Forensic Medicine, Kasturba Medical College (KMC), Manipal. KMC is situated in Udupi district of coastal Karnataka, in South India. The present research is a retrospective analysis of the autopsies conducted during January 2000 and December 2003 at the aforementioned center. All the deaths from RTA were included in the study. The autopsy case files and information furnished by the police in inquest documents were studied in detail. A detailed Victimologic profile was made. The data were compiled with a focus on the analysis of injuries in the thoraco-abdominal region with special reference to the nature of the

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wound, and organs most commonly affected in road traffic accidents.

Results:

A total of 633 autopsies were conducted during the study period (2000 – 2003), of which 222 were injury related deaths. Age distribution of the victims is shown in Figure 1. RTA alone accounted for the majority (77%, n=171) of injury related deaths. Detailed distribution of injury related deaths during the study period is shown in Figure 2. With regards to the victim profile in fatal road traffic accidents, males were more commonly involved (86%, n=147), male-female ratio being 6:1. The most vulnerable age group to sustain injuries was 21-50 years (83%, n=142). Two wheeler occupants were the most common victims of road traffic accidents (n=59, 34.5%) followed by pedestrians (n=43, 23%). The exact status of 19 victims of RTA in the study remained unclear at the time of autopsy. The most common offending agents in were heavy motor vehicles (n=76, 44%). In 43 cases (25%), the offending vehicles could not be identified and remained unknown indicating the incidence of 'hit and run' cases. Details of the victims and offending vehicles in RTA are shown in Table 1. Injuries to the thoraco-abdominal region were observed in 155 cases (91%). Distribution of thoraco-abdominal injuries is shown in Figure 3. External thoracic injuries were observed in 136 cases. Contusions were the most common external thoracic injury (n=72) followed by abrasions (n=56), lacerations (n=7) and incised wounds (n=1). Fractures of ribs were observed in 95 cases, sternum in 17, and clavicle in 15 and vertebrae in 9 cases of fatal road traffic accidents. Internal thoracic injuries were observed in 80 cases. Among internal thoracic injuries, lungs were the most commonly involved organ (n=49, 61.3%) followed by the heart (n=9, 11.3%). (Figure 4)

External abdominal injuries were involved in 74 cases. Contusions were the commonest (n=38) followed by abrasion (n=29), laceration (n=5) and incised wounds (n=2). Internal abdominal injuries were observed in 153 cases. Kidney was the most commonly involved abdominal organ (n=33) in road traffic accidents followed by the liver (n=29). (Figure 5) Among the abdominal injuries sustained in road traffic accidents, the kidneys sustained more contusions than lacerations where as in the liver lacerations were more common than contusions.

External injuries to the thorax were more frequent than internal injuries while in the abdomen, internal injuries were more frequently observed than external injuries.

Discussion:

RTA cause mechanical trauma, resulting in morbidity, disability and even mortality. The fatality rate in road traffic accident in India is one of the highest in the world and reported to be 20 times more than that reported in developed countries. [3] In our study, fatal road traffic accidents accounted for most of the injury related deaths. Our findings are comparable to that reported in the earlier studies from different regions in India. [1, 5] The incidence, however, is much higher to that reported by Wong et al. in a study conducted in Singapore. [6] The lesser number of cases in their study may be attributed to very good and spacious roads, and excellent awareness and abidance of traffic rules by the people in Singapore. The patterns of injuries in RTA are quite different in developed countries as compared to developing countries like India and also in different cities within India. Road use pattern in the Indian cities is very different from those in developed countries. Two wheelers, motorized as well as non-motorized vehicles form the main components of Indian traffic.

Research has shown that the two wheeler occupants are among the majority to be affected in RTA. [7] In our study most of the victims who sustained thoraco-abdominal injuries in the road traffic crashes were two wheeler occupants followed by pedestrians and pedal cyclists. The more number of two wheelers and its utility in this region possibly can be directly related to these injuries. Our findings are in agreement with the study by Jha et al [8] other studies, however, report an increased incidence of injuries in the pedestrian group. [9, 10] Two wheeler occupants are reported to be the commoner victims of RTA in the neighbouring city of Mangalore. [11]

With regard to offending vehicles in fatal RTA in our study, the heavy motor vehicles constituted 44.4% followed by two wheelers (14.0%). Our findings may be attributed to the high speed, narrow roads, and hilly terrain of the region. Similar observations are made in the earlier studies. [8-10] The study observed that the age group of 21-50 years was most susceptible to mechanical injuries with a very evident male predominance of the victims. In our study, the male to female ratio was reported as 6: 1. Our findings are in accordance with the studies done by Husaini et al [5] and Wong et al. [6] Jha et al [8] and Kaul et al [9] have reported a lower male-female ratio of 3: 1 while a higher male-female ratio of 9: 1 was reported by Singh and Dhatarwal. [10] Highest incidence of road traffic fatalities in the age group of 21-50 years in

our study is in general agreement with the studies done by other researchers. [5, 6, 8, 9] Males are usually the earning members of the family in this region and are increasingly exposed to traffic making them more vulnerable to the RTA. Kanchan et al. have reported the age and gender variations in the trend of road traffic fatalities [12] and various earlier studies have discussed the probable causes for the vulnerability of younger males to accidents. [2, 13, 14] The increase in population and vehicles in general leading to increased congestion on the Indian roads can be directly related to the number of RTA. Road traffic fatalities are reported to be the common cause of unintentional injuries among children in the region. [15]

Thoraco-abdominal involvement in the RTA can be related to the anatomical location of this region that makes it easily susceptible to impact in any form of blunt force trauma. In our study significant number of victims had combined thoraco-abdominal injuries followed by thoracic injuries and abdominal injuries alone. In modern day civilian trauma centres, thoracic injury directly accounts for 20-25% of deaths due to trauma; and thoracic injury or its complications are a contributing factor in a further 25% of trauma deaths. [16]

Most of the victims in our study were two wheeler riders and pedestrians and the common region of injury was the chest. This semi-yielding nature makes the area more vulnerable to injuries commonly seen as contusions and abrasions. Our findings in this regard correlate well with the earlier studies. Thoracic injuries were more often seen in RTA similar to other study groups. [5, 17]

Blunt force trauma to the chest can damage the organ without damaging the thoracic wall. Sub grouping thoracic injuries to external and internal thoracic injuries revealed that external thoracic injuries are more common than the internal, which correlates with the observations made by the previous researchers. [18] Among the internal thoracic injuries, lungs were the most common organ involved followed by the heart. Injury to the lungs and heart may be due to impact of these organs to the solid rib cage and the shearing forces to the hilum of the lungs and the heart by the impact of a moving vehicle without any rib fractures or due to a direct impact of the fractured ribs to the heart and lungs. The lungs occupy most of the rib cage, and thus are probably more vulnerable to injury when compared to the heart. Our findings are in agreement with the earlier studies by other researchers. [5, 19] In the present study,

kidneys were the more commonly involved solid organ than the liver in the abdomen region. These findings are in contrast to studies by Husaini et al [5] and Kaul et al [9] where the liver was the most commonly affected organ followed by the spleen. Liver being the largest internal organ and owing to its anterior location is more often the target of blunt force trauma as reported in the earlier studies. Chandulal reported involvement of the abdominal organs like the liver, spleen, bladder, and kidneys in a descending order of frequency in road traffic crashes. [20] The analysis of risk stratification in road traffic accidents reveals that two wheeler riders were more commonly injured than the pedestrians. These findings can be correlated to the involvement of younger age group who use two wheelers as a more common mode of transport. The heavy vehicles were the offending vehicles in maximum number of cases suggestive of the fact that the accidents with the heavy vehicle usually have a fatal outcome owing to a greater impact. The involvement of the heavy vehicles may be due to rash driving and lack of discipline among the drivers. Unknown vehicles were involved in a number of cases in our study which are reported as 'hit and run' cases. Unknown vehicles have been reported to be the major offending agents in motor vehicle accidents. [18-20]

The thoraco-abdominal injuries require multidisciplinary approach of management. This post-mortem study of pattern of thoraco-abdominal injuries, its type-pattern and nature of external and internal injuries involved is an attempt to highlight the trends in the region. The risk stratification in the susceptible population and the study of nature of offending agent in RTA can help the authorities in propagating safety measures and better availability of health care on roads.

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Fig 1: Age (years) Distribution of the Victims

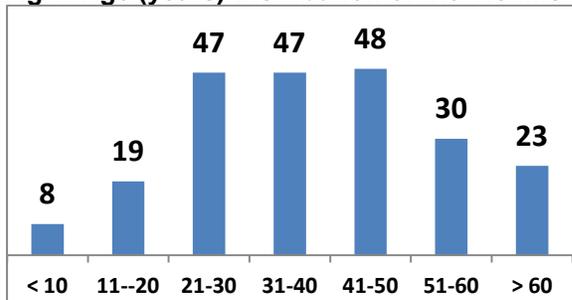


Fig. 2: Circumstances of the Deaths

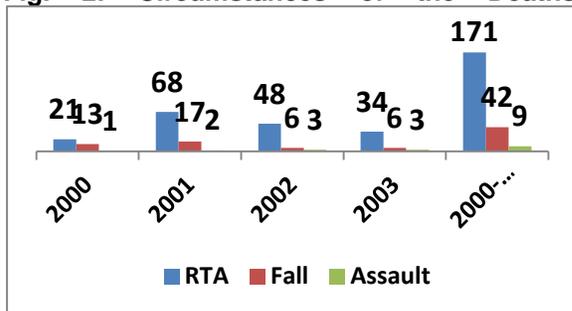


Fig. 3: Thoraco-Abdominal Injuries Sustained in Road Traffic Crashes

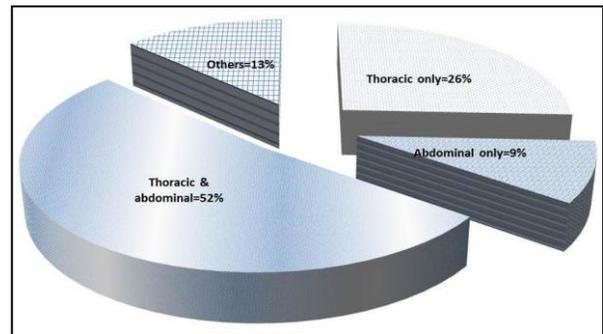


Fig. 4: Distribution of Thoracic Injuries

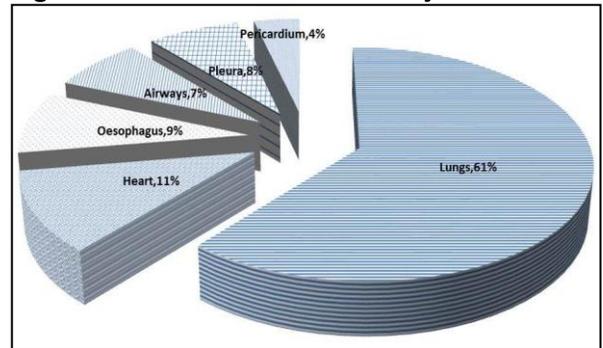


Fig. 5: Distribution of Abdominal Injuries

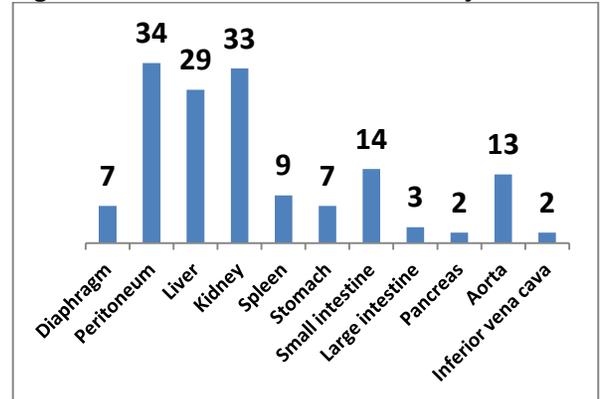


Table 1: Victims and Offending Vehicles in Road Traffic Accidents*

Victim	Offending vehicle
Pedestrian (n=40, 23.4%)	Two wheeler (n=24, 14.03%)
Pedal-cyclist(n=18,10.5)	Auto-rickshaw (n=04, 2.3%)
Vehicular passengers:	Light motor vehicle (n=21, 12.3%)
Two wheeler (n=59, 34.5%)	Heavy motor vehicle (n=76, 44.4%)
Auto-rickshaw (n=2, 1.2%)	Unknown (n=43, 25.1%)
Light motor vehicle (n=21, 12.3%)	Others (n=03, 1.8%)
Heavy motor vehicle (n=12, 7.0%)	
Unknown (n=19, 11.1%)	

* This being a retrospective study, exact cause and responsibility of road traffic incident was not established at the time of autopsy. The information is based on history and initial police investigations

Original Research Paper

A Study of Sexual Dimorphism of Femoral Head In Gujarat Region

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Abstract

Various diameters of head of femur have been in use for sex determination. These diameters vary region wise also. Therefore we undertook the study in Jamnagar region of Gujarat. Maximum diameter of the femoral head was measured in 184 dry, normal, adult, human femora (136 male & 48 female) obtained from M. P. Shah Medical College Jamnagar Gujarat. Mean Values obtained were, 43.75 and 40.33 for right male and female, and 43.88 and 40.64 for left male and female respectively. Higher value in male was statistically highly significant ($P < 0.001$) on both sides. The data was subjected to demarking point (D.P.) analysis. Maximum head diameter identified 11.90% of right male femora and 7.25% of left male femora; in female it identified 4% of left female femora while it was not useful (0.00%) for right female bone. Though the sex of the bone can be determined from head of the femur bone, in itself it is far from conclusive.

Key Words: Head diameter, Sexual dimorphism, Femur, Jamnagar region

Introduction:

The determination of sex from skeletal remains is immensely important medico-legally as well as anthropologically. Morphological (Non-metrical) methods such as the visual inspection of bone depend largely on the ability and experience of an observer. However, metrical methods for sexing from bones are simple, allow no individual variations and are entirely objective assessment.

Sex determination is relatively easy if the entire skeleton is available, pelvis and skull are the most reliable bones for this purpose. [1] However, in medicolegal cases one does not always have a complete pelvis or skull. Therefore it is important to be able to assess sex from the other parts of the skeleton also.

Sexual dimorphism of femoral head is studied by several workers in different populations: Javdekar, [2] Kate in sample from fifteen cities of India, [3] Singh & Singh, in Varanasi zone India, [4] Dittrick and Suchey in the Prehistoric Central California skeletal remains. [5]

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Iskan and Shihai in Chinese femora, [6] Steyn and Iskan in South African whites, [7] King, Iskan and Loth in Thai femur, [8] Trancho et al in Spanish people, [9] in Nigerian population, [10] Igbigbi and in Black Malawians, [11] Purkait and Chandra in Bhopal, India, [12] Asala in South African white and black [13] and in South African Blacks. [14]

According to Krogman and Iskan [1] standards of morphological and morphometric attributes in the skeleton may differ with the population samples involved and this is true with reference to dimensions and indices (average and range) and as a general rule standards should be used with reference to group from which they are drawn and upon which they are based, they are not interchangeable. So, present study was carried out to ascertain values of maximum head diameter of femora from Gujarat region; and to evaluate its possible efficacy in determining correct sexual identification.

Material and Methods:

Material for the present study consisted of 136 male (67 of right & 69 of left side) and 48 female (23 of right & 25 of left side) dry, human, adult femora from the skeletal collection of Anatomy department, M.P. Shah Medical College, Jamnagar, Gujarat. Femora showing pathological abnormality or from the persons outside Gujarat region were not included in study.

Vertical (superoinferior), mediolateral & anteroposterior diameters of head were measured as mentioned below-

Vertical diameter: The ends of the calliper touching the highest and lowest point on the margin of head [15]. (Figure: 1)

Mediolateral diameter: The ends of the calliper touching the medial most and lateral most point of the head [15]. (Figure: 1)

Anteroposterior diameter: The ends of the calliper touching the farthest point on the anterior and posterior surface of the head [15]. (Figure: 1)

Each bone was measured thrice and measurements were repeated by two independent observers, mean of these observations was taken as a final reading to nullify any intra and inter-observer error. Data collected was tabulated and analysed statistically side wise and sex wise by demarking point (D.P.) analysis.

Results:

Right femur: Table 1 showed that the maximum head diameter of right male femur varied from 37.00mm to 51.00mm (average: 43.75 & S.D.:2.72) and of right female femur varied from 37.00mm to 44.00mm (average: 40.33 & S.D.:2.18).

Mean value of maximum femoral head diameter was higher in male as compared to female. Calculated t-value and P value showed that the difference in the mean head diameter in male and female was statistically highly significant with $P < 0.001$. With the demarking points definite sexual classification in male right bone (>46.87) was 11.94 % (no=8) and in female right bone (<35.59) was 0.00%.

Left femur: As illustrated in Table 1 the maximum head diameter of left male femur varied from 36.00mm to 51.00mm (average: 43.88 & S.D.:2.83) and of left female femur varied from 35.00mm to 45.00mm (average: 40.64 & S.D.:2.22).

Mean value of maximum femoral head diameter was higher in male as compared to female. Calculated t-value and P value showed that the difference in the mean head diameter in male and female was statistically highly significant with $P < 0.001$.

By means of demarking points, definite sexual classification in male left bone (>48.20) was 7.25 % (no=5) and in female left bone (<35.59) was 4% (no=1).

Differences in the maximum femoral head diameter value between right & left male and right & left female were not statistically significant, so were not evaluated further.

Discussion:

Mean value of femoral head was higher in male as compared to female. Calculated t-

value and P value showed that the difference in the mean Femoral head in male and female was highly statistically significant with $P < 0.001$ on both side.

For right male bone calculated range (Mean \pm 3S.D.) was 35.59-51.91 and for right female bone it was 33.79-46.87. With the help of these demarking points, right femur with maximum head diameter more than >46.87 can be correctly classified as a male and right femur with maximum head diameter less than <35.59 can be correctly classified as a female. However if the head diameter of bone is between 35.59 mm and 46.87 mm, sexing was not possible due to overlapping. With the demarking points, definite sexual classification in male right bone (>46.87) was 11.94 % (no=8) and in female right bone (<35.59) was 0.00%

For left male bone calculated range was 35.39-52.37 and for left female bone it was 33.08-48.20. So, left femur with maximum head diameter more than >48.20 can be correctly classified as a male and left femur with maximum head diameter less than <35.39 can be correctly classified as a female. However if the head diameter is between 35.39 mm and 48.20 mm, sexing was not possible due to overlapping. With the demarking points, definite sexual classification in male left bone (>48.20) was 7.25 % (no=5) and in female left bone (<35.59) was 4% (no=1).

Axial skeleton weight of the male is relatively and absolutely heavier than that of the female, and the initial impact of this weight is borne by the femur in transmission of the bodyweight [16]. As a result articular surfaces taking part in weight transmission are massive in male resulting in higher value of head diameter in male bilaterally.

Comparison of maximum head diameter of male between present study and other studies has been shown in (Table 2). Mean maximum male femoral head diameter value in present study was 43.75 (right) & 43.88 (left). In other studies it varied from 41.50 to 48.46. Mean male value of maximum head diameter in present study was lower than all populations except sample from various cities of India [3] with the mean male value of 41.50mm. (Table2). However, values from study in Bhopal [12] correlated with present study.

Mean maximum female femoral head diameter value in present study was 40.33 (right) & 40.64 (left). In other studies it varied from 38.39 to 43.02 (Table: 2). Mean female value of maximum head diameter in present study was lower than American Blacks & Whites, [17] South African Whites[6] and Californian sample

[5]; was higher than what was observed by Purkait et al in Bhopal [12] and in various other Indian samples studied by Kate, [3] but was identical to that found in Thai [8], Chinese [6] and Spanish femora [9]. This difference in the value of maximum femoral head diameter in between populations may possibly be a result of factors affecting bone morphology like genetic constitution, diet, nutrition status, environment and physical activity.

The most marked difference between the present study and other studies is the low percentage of correct sexual classification in present study (11.94% & 7.25% for right & left male respectively, 0% for female bones bilaterally).(Table 2) This could be explained on the basis of statistical method applied. While most of the studies referred above were based on multivariate analysis, present study had used the demarking point analysis. Percentage of correctly sexed bone dropped down sharply with the statistically calculated demarking points. Though the bones which could be identified by Demarcation Points are mostly few in numbers but identification of bone is with 100% accuracy, this makes demarking point analysis and results obtained from it very much vital in medicolegal cases. [18]

Conclusion:

Mean values of maximum femoral head diameter of normal human adult femora from Gujarat region, in male were 43.75 mm (Right) & 43.88 mm (Left) and for female were 40.33 mm (Right) & 40.64 mm (Left). By demarking point analysis maximum head diameter identified 11.94% of right male femora, 7.25% of left male femora, 0.00% of right female femora and 4% of left female femora.

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Figure 1: Measurements of femoral head

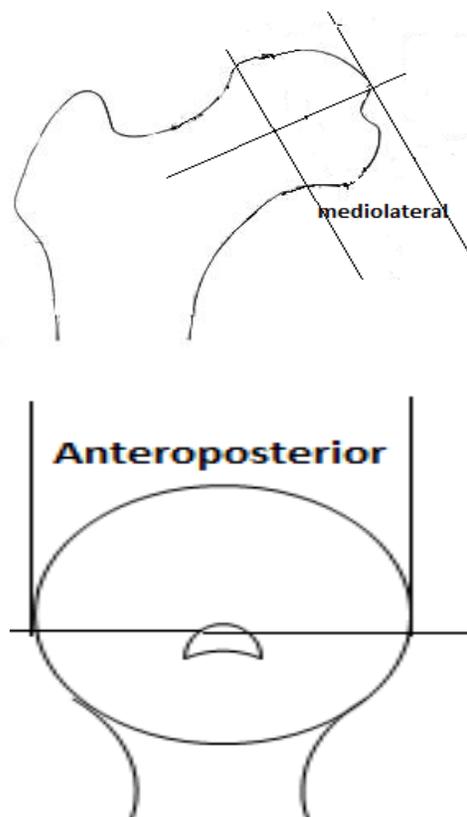


Table: 1
Statistical Values of the Maximum Head Diameter of the Femur (All Dimensions in Mm)

Statistical values	RIGHT		LEFT	
	Male (N=67)	Female (N=23)	Male (N=69)	Female (N=25)
Range	37-51	37-44	36-51	35-45
Mean	43.75	40.33	43.88	40.64
S.D.	2.72	2.18	2.83	2.22
t-value	6.07		5.81	
P value	P< 0.001		P< 0.001	
Calculated Range mean±3S.D.	35.59-51.91	33.79-46.87	35.39-52.37	33.08-48.20
Demarking Points(D.P)	>46.87	<35.59	>48.20	<35.39
% & no. identified by D.P.	11.94% (no=8)	0.00% (no=0)	7.25% (no=5)	4% (no=1)

Table: 2
Comparison of Maximum Head Diameter

Population & Study	Maximum Head Diameter						
	Male			Female			
	Mean	S.D.	% Identified	Mean	S.D.	% Identified	
Javdekar B.S.(1962),	45.26	-	-	40.37	-	-	
Kate B.R.(1964), India	41.50	-	-	39	-	-	
Iscan & Miller(1984), Amer. Blacks	47.8	2.39	-	42	2.33	-	
Iscan & Miller(1984), Amer. Whites	48.2	2.52	-	42.2	2.28	-	
Dittrick J & Myers (1986), California	47	2.5	88.70	42.2	1.9	88.70	
Iscan & Shihai (1995), Chinese	46.16	2.62	83.10	41.13	2.64	79.50	
Trancho et al (1997), Spanish	47.15	2.46	91.23	41.13	1.93	91.23	
Iscan & Steyn(1997), south African whites	48.46	2.65	87.50	43.02	2.42	84.00	
King C.A. et al (1998),Thai	45.1	1.98	88.40	39.3	1.93	97.10	
Purkait & Chandra(2002), Indian	44.28	2.48	91.00	38.39	2.14	91.30	
Present Study	Rt.side	43.75	2.72	11.90	40.33	2.18	0.00
	Lt.side	43.88	2.83	7.25	40.64	2.22	4.00

Original Research Paper

Abdominal Organ Involvement in Blunt Injuries

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Abstract

Visceral injuries of the abdomen following blunt trauma present a great medico-legal problem to the forensic experts. Thus the doctor should remain alert to the development of signs and symptom after blunt trauma to the abdomen in vehicular accident otherwise he may be charged of negligence. Among 55 fatal cases of blunt abdominal injury, maximum number of cases belongs to the age group 20-29 yrs. Males were the predominant victims with ratio 4:1. It was found that road traffic accidents by heavy vehicle like bus; car and truck were responsible for 70% of blunt abdominal injuries. Among 55 cases of blunt injury, the incidence of the involvement of liver, spleen, small intestine, kidney, stomach and urinary bladder were 67%, 30.91%, 18%, 10.9%, 9.09%, 5% cases respectively. Genitals were found injured in 3% cases of blunt injury abdomen. For Blunt Injuries of Abdomen majority of the cases i.e. 78.18% were of accidental, 18.18% were homicidal and 3.6% suicidal in nature. Immediate cause of death was shock and hemorrhage and in those cases where death was delayed, cause of death was septicemia.

Key Words: Blunt Injuries, Vehicular Accident, Visceral Injuries

Introduction:

Visceral injuries following blunt trauma present a great medico-legal problem to the forensic experts. Medico-legal problems increases more when there are visceral injuries in absence of any evidence of external mark by blunt trauma.

Abdomen is considered as a magic box both by the surgeons as well as the physicians. Sometimes exact injury is diagnosed only when abdomen is opened either during operation by the surgeon or during autopsy by the autopsy surgeon.

Sometimes there may not be any external injury still patient had died of intra-abdominal hemorrhage. On the other hand the treating doctor should also be remain alert to the development of clinical features regarding after blunt trauma to the abdomen after vehicular accident to avoid charged of negligence upon them.

In this study the epidemiological, medico-legal and clinic-pathological aspects of blunt abdominal injuries are studied in the cases that were brought to the mortuary of Chhatrapati Shahu ji Maharaj Medical University, UP, Lucknow.

Material and Methods:

The materials for the present study were the 55 fatal cases from all age group and both sex having history of blunt injuries of the abdomen sent by police for medico-legal autopsy to the mortuary of C.S.M Medical University, Lucknow in 2007-08 were studied. Decomposed bodies were not considered in the study. Only those cases taken into consideration in which cause of death is clear, certain & exclusively due to blunt trauma abdomen.

Results:

The age of the victims in present study varied from 1-70 years. The peak incidence was observed in the age group of 20-29 years comprising 38.18% of cases. It was also observed that 29.09% belonged to the age group 30-39 years. So the highest number of cases due to blunt force injuries to the abdomen occurred in second to fourth decade. (Table-1) Individuals related to extreme of the age group were least affected i.e. 50-70 years & 0-9 years. Males comprised a majority and constituted 78.18% compared to females who were only 21.82%.

Largest number of cases was due to crushing by heavy motor vehicles, next were

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due to direct impact by some blunt object and fall from height. (Table-2) Out of 55 cases of Blunt injury abdomen, 92.73% cases had visible signs of external injury either on anterior and posterior aspect of abdomen or both. On the other hand in 7.27% cases did not show any sign of external injuries on the abdomen, but there was underlying fatal visceral injuries.

Out of 55 cases, 3.64% cases were suicidal, 18.18% cases were homicidal and rest 78.18% was accidental in nature and hence the accidental cases were most common among blunt injury abdomen.

Out of 55 cases, liver was found injured in 67.27% cases, spleen in 30.91% cases, small intestine in 18.18% cases, kidney in 18.18% cases, stomach in 9.09% cases, urinary bladder in 5.45% cases, gallbladder in 7.27% cases and pancreas in 5.45% cases and genitals in 3.64% cases. Hence liver is the most common injured organ in Blunt injury abdomen. Next one is spleen then small intestine and stomach. Genitals were found injured only in 3.64% cases, and in all cases cause being motor vehicle accident.

Discussion:

As shown in table 1, most common age group affected in this series was between 20-29 yrs. It was consistent with the findings of Kuloski, [1] Asogwa, [2] Chandra et al. [3] The second most common age group was between 30 – 39 years of age. It was also consistent with the observations of the previous authors. Persons below 10 years of age contribute very less (3.75%) while in the study of Chandra et al [3] (1979) the incidence was 11.39%. This reduction in children fatalities could be due to better treatment, better education and more attention by parents.

As shown in table 2 maximum number of cases of blunt injuries of abdomen was due to crushing by motor vehicles. Next higher were due to direct impact of blunt object as Lathi. Very few cases were due to fall from height and one case was due to fall of roof wall. Gordon Turner and price [4], Keith Simpson and Modi [5] were of same opinion, that accidental crush injuries due to motor vehicles were more common. In 55 cases of blunt injuries of abdomen, external injuries were present on anterior aspect in 87.27% cases and on posterior aspect in 5.45% cases. According to Modi, there is no definite pattern of blunt injuries of abdomen. They do not tell whether the blunt injuries are inflicted more on anterior or posterior aspect. In 7.27% cases, no external injuries were found but there were fatal visceral injuries.

Modi have the same opinion that in some cases there is no external abdominal injury, even that there is deep seated visceral injuries of abdomen.

Out of 55 cases, 3.64% cases were suicidal, 18.18% cases were homicidal and rest 78.18% were accidental and hence the accidental cases were most common among blunt injury of abdomen. According to Modi and other foreign writers, accidental cause of blunt injuries of abdomen was most common, that was also found in present study.

As shown in Table 3, Liver was commonest organ injured in 67% cases. Out of 37 cases, 26 cases were due to injury by motor vehicles, four cases due to fall from height, 6 cases due to direct blow on abdomen by lathi, hockey etc., one case was due to fall of roof upon the deceased. Tonge et al [6] had reported 24.9% incidence of liver injury in fatal road accidents. Kaur [7] study showed liver injuries in 16.55% cases of motor cyclists.

As shown in Table 4, splenic injury was found in 30.91% cases. Tonge et al [6] reported splenic injury in 21% of cases. Another observation derived in the present series shows out of 17 cases, 13 cases were due to injury by motor vehicles, one case due to fall from height and three cases due to direct blow by some blunt object.

As shown in table 5, Injury to intestine was found in 18% cases. This incidence was 6.2% in the observation of Tonge et al. [22] All 10 cases were due to injury by motor vehicles.

As shown in table 6, Kidney was found injured in 10.91% cases. Out of 6 cases, 4 cases were due to injury by motor vehicles and 2 cases due to direct blow by some blunt object. It is consistent with the findings of Kaur [7] in which she reported that kidney injury was found more commonly in fatal heavy motor vehicular and two wheeler accidents.

As shown in table 7, stomach was found injured in 9.09%. All cases were injured due to motor vehicles. Tonge et al [6] reported the incidence of 0.8% while Bruce et al (1965) reported stomach injury in 2% of cases.

Urinary bladder was found injured in 5% cases. All cases were injured due to injury by motor vehicles. Incidence of urinary Bladder injury reported by Tonge et al [6] was 4.9%. Kaur [7] in her study of fatal auto vehicular two wheeler accidents reported incidence of 1.37%.

Gall Bladder was found injured in 7.27% cases and pancreas was found injured in 3.45% cases. The incidence of gall bladder & pancreatic injury reported by Tonge et al [6] was 1.7%; the similar explanation had been given by Orr. [8]

Conclusion:

- Crushing by heavy motor vehicles is the most common mode (70%) of blunt trauma abdomen.
- Majority of victims were young adult males between 20-39 years of age group.
- In majority of cases (92.7%) of blunt abdominal injuries have signs of external abdominal injuries, but in very few cases (7.2%) does not show any external signs of abdominal injuries, but there is deep seated fatal visceral injuries.
- Liver is the most commonly organ involved in blunt injuries of abdomen followed by spleen, small intestine, kidney, stomach, gall bladder, urinary bladder and pancreas in decreasing order respectively.
- In most of the cases, involvement of more than one viscera is reported.
- Most of the cases of blunt abdominal injuries were accidental in nature, very few are homicidal and suicidal in nature.
- Most common cause of death was shock and haemorrhage, especially when the person dies within few hours. In those cases where death was delayed, cause of death was septicaemia.

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Table 1: Age & Sex of the Victims

Age Groups (in Yrs)	Male		Female		Total	
	No.	%	No.	%	No.	%
0 – 9	3	5.45	0	0	3	5.45
10 – 19	6	10.91	1	1.82	7	12.73
20 – 29	14	25.45	7	12.73	21	38.18
30 – 39	13	23.64	3	5.45	16	29.09
40 – 49	5	9.09	1	1.82	6	10.91
50 – 59	1	1.82	0	0	1	1.82
60 – 69	1	1.82	0	0	1	1.82
70 – 79	0	0	0	0	0	0
80 – 89	0	0	0	0	0	0

Table 2: Mode of Injuries Inflicted

Modes of blunt injuries of abdomen		Cases (%)
(a)	By motor car, bus, truck	39(70.91)
(b)	By crushing in crowd, or injured heavy object e.g. fall of roof wall	1(1.82)
(c)	By fall from height	5(9.09)
(d)	By direct impact of Blunt object eg. Lathi/ Hockey/Kick	10(18.18)
Total		55(100)

Table 3: Blunt injuries of Liver

Internal Organs		Cases (%)
(a)	Liver	22 (59.46)
(b)	Liver + Stomach	1(2.70)
(c)	Liver + Gall Bladder	2 (5.41)
(d)	Liver + Kidney	2 (5.41)
(e)	Liver + Spleen	3(8.11)
(f)	Liver + Small intestine + Spleen + Stomach	1(2.70)
(g)	Liver + Small intestine + Kidney + Spleen	1(2.70)
(h)	Liver + Small intestine + Spleen + Pancreas	1(2.70)
(i)	Liver + Small intestine + Spleen + Gall Bladder	2(5.41)
(j)	Liver + Small intestine + Stomach + Genitals	1(2.70)
(k)	Liver + Small intestine + Large intestine + Spleen + Genitals + Gall Bladder	1(2.70)
Total		37(100)

Table 4: Blunt injuries of Spleen

Internal Organ		Cases (%)
(a)	Spleen	7 (41.18)
(b)	Spleen and liver	3(17.65)
(c)	Spleen + Kidney + Pancreas	1(5.88)
(d)	Spleen + Liver + Small intestine + Stomach	1(5.88)
(e)	Spleen + Liver + Small intestine + Kidney	1(5.88)
(f)	Spleen + Liver + Small intestine + Pancreas	1(5.88)
(g)	Spleen + Liver + Small intestine + Gall Bladder	2(11.77)
(h)	Spleen + Small intestine + Liver + Genitals + Gall Bladder	1(5.88)
Total		17(100)

Table 5: Blunt injuries of Small Intestine

Internal Organs		Cases (%)
(a)	Small intestine	1(10.00)
(b)	Small intestine and Pancreas	2(20.00)
(c)	Small intestine + Large intestine + Liver + Spleen + Gall Bladder + Genitals	1(10.00)
(d)	Small intestine + Liver + Spleen + Gall Bladder	2(20.00)
(e)	Small intestine. + Liver + Stomach + Genital	1(10.00)
(f)	Small intestine + Liver + Spleen + Pancreas	1(10.00)
(g)	Small intestine + Liver + Spleen + Stomach	1(10.00)
(h)	Small intestine + Liver + Kidney + Spleen	1(10.00)
TOTAL		10(100.00)

Table 6: Blunt injuries of Kidney

Internal Organs		Cases (%)
(a)	Kidney	2(33.33)
(b)	Kidney + Liver	2(33.33)
(c)	Kidney + Spleen + Pancreas	1(16.67)
(d)	Kidney + Liver + Spleen + Small intestine	1(16.67)
Total		6 (100.00)

Table 7: Blunt injuries of Stomach

Internal Organs		Cases (%)
(a)	Stomach	2(40)
(b)	Stomach + Liver	1(20)
(c)	Stomach + Spleen + Small intestine + Liver	1(20)
(d)	Stomach + Liver + Small intestine + Genital	1(20)
Total		5(100)

Original Research Paper

Determination of Sex by Sciatic Notch/Acetabular Ratio (Kelley's Index) in Indian Bengali Skeletal Remains

*Partha Pratim Mukhopadhyay

Abstract

Kelley used the sciatic notch is to acetabular ratio as the osteometric method to differentiate between male and female hipbones. The present study was designed to examine the applicability of this index (sciatic notch /acetabular height ratio) and the rule of thumb (of Kelley) in Indian Bengali skeletal remains. A preliminary attempt was made to derive a sectioning point and propose a new "rule of thumb" approach for determining sex from skeletal remains.

The study showed that bones with sciatic notch /acetabular height index equal or greater than .93 (or 93 when expressed as a percentage) was definitely female and those with values less than .93 were male. The results of applying this new rule on the present series of Indian Bengali hipbones indicate that 93.3 % of the total sample could be correctly classified in to the proper sex. Of those 92.8% of the males and 93.75% of the females were correctly classified by the new rule. The present new rule of thumb approach is a valid, effective, reliable, population specific and easy method to differentiate between male and female pelvis in Indian Bengali skeletal remains

Key Words: Forensic anthropology, sex determination, hipbone, Kelley's index, Indian Bengali

Introduction:

Sexual dimorphism of the human hipbone has been extensively researched, reviewed and published in forensic as well as anthropological literature. [1] Earlier works on sexing of the innominate were based on morphological features. [2] Subsequently researchers adopted osteometric methods to quantitatively differentiate between male and female hipbones. Primarily those objective methods were based on (a) osteometry (b) derivation of indices or ratios (c) linear discriminate function analysis. All of these methods in essence were population specific. [3, 4]

The indices /ratios were effectively used to determine sex of skeletal remains only when they belonged to one major racial group. [5] In 1979, Kelley [6] used the sciatic notch is to acetabular index to differentiate between male and female hipbones. It was proposed to overcome the limitations posed by the racial difference in osteometry.

Kelley while working on an American sample showed that 90% of the adult skeletal remains could be correctly classified in the proper sex. Kelley suggested a useful "rule of thumb" approach whereby innominate with an index of more than 88 were classified as female and those 86 or less as male.

Kelley's index (rule of thumb approach) however had low discriminatory capacity for both English and Dutch sample. [7] The investigators showed that the index was an efficient indicator of male pelvis but it proved little better than chance at correctly determining sex in the female pelvis.

The present study was designed to examine the applicability of the index (sciatic notch /acetabular height ratio) and its rule of thumb (of Kelley) in Indian Bengali skeletal remains. Also a preliminary attempt was made to derive a sectioning point and propose a new "rule of thumb" approach for determining sex from skeletal remains (hip bone) in Indian Bengali population.

Materials and Methods:

A study was conducted at the department of Forensic Medicine, Calcutta National Medical College, Kolkata, West Bengal, India. The sample comprised of 30 adult fully ossified innominate bones from the museum collection of the department. The bones with documented sex belonged to the population of

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the area and were supplied from cadaver dissection for routine teaching purpose.

Osteometric measurements were taken by a technical quality divider and metallic (steel) graduated scale with readings up to one mm. All measurements were taken keeping the bone in the anatomical positions. To test the intra observer differences and repeatability of those measurements ten randomly selected hipbones were measured after one week and the values of the two groups were tested by a paired t test. No significant difference was found in the two measurements of all the three variables.

The following measurements (in cm.) were taken. (Figure 1)

1. **Sciatic notch width (AB):** Measured from the ischial spine to the pyramidal process of the posterior border of the ilium.
2. **Acetabular height (CD):** This is the vertical diameter of the acetabulum measured along the axis keeping the bone in anatomical position.

The **Sciatic notch /Acetabular index (SAI)** was calculated for each bone from the following formula – **SAI = AB/CD x 100**

Metric data was summarized as maximum, minimum, range, mean and standard deviations. One-Sample Kolmogorov-Smirnov Test was used to examine the normality of the distribution. Sectioning point (sum of the mean of the two sexes divided by two) was obtained for each variable. Student t-Test for independent sample was performed to examine the difference in the means of the variables in the two groups.

Sex was determined by using the Kelley's rule and compared with the documented sex of the bone. Subsequent sectioning point for the sciatic notch /acetabular ratio was calculated from the sample and it was applied for to determine the sex of the bone. This new rule of thumb was then compared with the Kelley's and examined in the sample under study. Statistical analysis was performed using SPSS software version 10.0 for windows. A two-tailed P value of less than 0.05 was considered significant.

Results:

The table 1 and 1A shows the summary statistics of the variables used in the present study. The sciatic notch width in males was 4.39 and in females it was 4.91cm. The mean acetabular height in cm for the male and female were 5.29 and 4.80 respectively.

The results of t-Test are seen from table number 2. The t-test indicates that there is significant difference in the mean sciatic notch width and Kelley's index between male and

female. The acetabular height was also significantly different in the two sexes. ($t = 6.95$, degree of freedom = 28, p value = .000)

Table 3 shows the results of applying Kelley's rule of thumb approach to the study sample in the present series. It was observed that moderate 76.7% of the total bones could be correctly classified into its proper sex. Of these, 64.28% of the male bones and 87.5% of the female hipbones were classified correctly by the Kelley's rule. According to Kelley's method bones with sciatic notch /acetabular height ratio equal or greater than 88 were female while those with values less or equal to 86 were male.

Table 4 shows the sectioning point obtained for the variables in the present series. For the Kelley's index the sectioning point for Indian Bengali sample was 0.93. The Kelley's index was significantly greater in females than in males ($t = 8.39$, degree of freedom = 28, $p = 0.000$). Thus we computed the cut off value of 0.93 from the present series and formulated a new rule of thumb (Hereafter Called the new rule). The new rule was as follows. Bones with sciatic notch /acetabular height index equal or greater than .93 (or 93 when expressed as a percentage) were definitely female and those with values less than .93 were male.

Table 5 shows the results of applying the new rule on the present series of Indian Bengali hipbones the results indicate that 93.3 % of the total sample could be correctly classified in to the proper sex. Of those 14 (92.8%) of the males and 15 out of 16 (93.75%) of the females were correctly classified by the new rule.

Discussion:

The present investigation was conducted to examine the applicability of Kelley's index in sexing hipbones of Indian skeletal remains. The results clearly indicate that the Kelley's rule of thumb approach could correctly classify only moderate of the hipbones. This is in consonance with works on English and Dutch samples where % could be correctly assigned to its proper sex. [7] Regarding sex specific application of Kelley's rule the results are better for female than male bones. This fact is contrary to the earlier observation on English and Dutch sample where males could be classified with greater accuracy. This proves, though highly dimorphic, the pelvis shows some racial /population variation in Morphometric.

The Kelley's index was significantly different in the two sexes. The index was greater in females than in males. Taking the individual variables it was seen that the mean Acetabular

height was more in males and this difference was statistically significant. This finding is in congruence with the observations of investigators on European sample. [6, 7]

The sciatic notch width in the present series were comparable with those from a North Indian study [10] that showed the mean width for males was 4.49cm (standard deviation 0.44) and for females it was 4.84 cm (standard deviation of .48)The sciatic notch width is significantly different in the two sexes. The sciatic notch is rather a better indicator of sex in the hipbone as has been postulated by earlier workers. [8, 9, 10, 11] In the present study a new rule of thumb was formulated on the basis of the sectioning point and the standard deviation of the values of the index in the two sexes. On applying this rule 93.3% of the bones could be correctly assigned to its proper sex. These results are better than the Kelley's approach when applied to the Indian Bengali sample. Thus the present investigation clearly showed that the sciatic notch /acetabular height index is a good method of sexing human hipbones in Indians when the new rule is applied. This will be equally effective even in fragmentary remains as the index can be easily calculated by measuring the two variables.

This method has one shortcoming that had also been highlighted by Kelley. The main difficulty lies with defining the exact anatomical landmark for the measurements and the effects of wear and destruction of the bony points in bones that are obtained for forensic casework. Also the chances of inter-observer variations could not be tested in this series, as it was a single author work. However in the present series a standard protocol [10, 11] was followed for the measurement that has been described in the method section.

Besides the present work is a preliminary study as the sample comprised thirty fully ossified human bones belonging to the Indian Bengali population. Given the diversity of the Indian population and the results of earlier works [12], such a small sample size is not at all effective in providing results that can be generalized. This approach need to be further worked out with a larger sample preferably in a multicentric study. There is also ample scope to examine the regional variation in Indian bones and its applicability in sexing skeletal remains.

It is concluded that the present new rule of thumb approach is a valid, effective, reliable, population specific and easy method to differentiate between male and female pelvis in Indian Bengali skeletal remains. This will have useful application in anthropology, archaeology and Forensic casework involving unidentified

human remains belonging, the Indian Bengali population.

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Table 1A: Showing summary statistics

	SEX		Statistic
SCIATICN	Male	Mean	4.3929
		Std. Deviation	.3050
		Minimum	4.00
		Maximum	5.30
	Female	Mean	4.9125
		Std. Deviation	.2778
		Minimum	4.50
		Maximum	5.30
ACETABUH	Male	Mean	5.2929
		Std. Deviation	.1817
		Minimum	5.00
		Maximum	5.60
	Female	Mean	4.8000
		Std. Deviation	.2033
		Minimum	4.40
		Maximum	5.10
KELLYS	Male	Mean	.8317
		Std. Deviation	7.785E-02
		Minimum	.77
		Maximum	1.06
	Female	Mean	1.0237
		Std. Deviation	4.511E-02
		Minimum	.94
		Maximum	1.10
		Range	.17

Table1: Descriptive Statistics of the Variables

	N	Minimum	Maximum	Mean	Std. Deviation
KELLYS	30	.77	1.10	.9341	.1151
SCIATICN	30	4.00	5.30	4.6700	.3888
ACETABUH	30	4.40	5.60	5.0300	.3142

Table 3: Percentage of correct sex prediction

	Kelley's rule	Frequency	Percent
Using Kelley's rule (Greater than 88 Female 86 Or Less Male)	Correct	23	76.7
	Incorrect	7	23.3
	Total	30	100.0

Table 5: Percentage of Sex Prediction

	Using New rule	Frequency (%)
Using new rule (Greater than 93* Female Less than 93 Male) * Expressed as percent	Correct	28 (93.3)
	Incorrect	2 (6.7)
	Total	30(100)

Table 4: Showing the Sectioning Point

	SECTIONING POINT
SCIATIC NOTCH WIDTH	4.65
ACETABULAR HEIGHT	5.14
KELLEY'S INDEX	0.93

Fig. I: The Measurements, Used in the Study

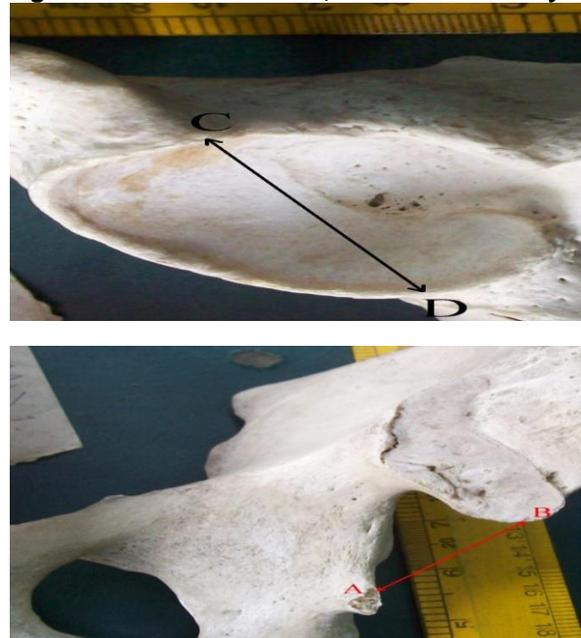


Table 2: Showing the Result of T-Test for Equality of Means

		t-test for Equality of Means						
		T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
							Lower	Upper
SCIATICN	Equal variances assumed	-4.884	28	.000	-.5196	.1064	-.7376	-.3017
	Equal variances not assumed	-4.853	26.583	.000	-.5196	.1071	-.7395	-.2998
ACETABUH	Equal variances assumed	6.957	28	.000	.4929	7.084E-02	.3477	.6380
	Equal variances not assumed	7.011	27.981	.000	.4929	7.030E-02	.3489	.6369
KELLYS	Equal variances assumed	-8.396	28	.000	-.1920	2.287E-02	-.2388	-.1451
	Equal variances not assumed	-8.112	20.244	.000	-.1920	2.367E-02	-.2413	-.1426

Original Research Paper

Physician's Perspectives about Consent in Medical Practice A Questionnaire Based Study

*Sanjay Gupta, **Ravi Panchal

Abstract

It is a principle recognised not only by our own but by other legal systems that ignorance of the law is no excuse for violating it. Obtaining informed consent is act like a shield to protect a medical practitioner from litigation suits and claims and also help in maintaining autonomy of the patient. With this background, the study was aimed to assess knowledge and various other perspectives of medical fraternity regarding some aspects of consent. A cross sectional survey was conducted at Pramukhswami Medial College, Karamsad during the year 2009. Total 150 physicians in the institute were given questionnaire, asking for information about their knowledge & level of satisfaction. Out of which 117 physicians have responded. 68.42% physicians felt satisfied about their knowledge of consent in medical practice but 76.31% physicians responded that their knowledge about various aspects applicable to them is limited or nil. 54.39% physicians expressed that they knew validity of consent. 50% physicians were not clear what to do if relatives deny for giving consent in emergency situation. Medical practitioner should upgrade their knowledge regarding medical jurisprudence and legal medicine to avoid any litigation, by regular medicolegal training programmes.

Key Words: Consent; Physician; Knowledge; Satisfaction; Training Programme

Introduction:

As per Section13 of Indian Contract Act, two or more persons are said to consent when they agree upon same thing in same sense. [1] The word 'consent' means voluntary agreement, compliance or permission. [2] According to section 90 of Indian Penal Code, a consent is not such a consent as is intended by any section of this code, if the consent is given by a person under fear of injury, or under misconception of fact, and if the person doing the act knows, or had reason to believe, that the consent was given in consequences of such fear or misconception; or If the consent is given by person who, from unsoundness of mind, or intoxication, is un able to understand the nature and consequences of that to which he gives consent; or unless the contrary appears from the context, if the consent is given by a person who is under twelve years of age. [3]

It is clearly observed from the literature review that informed consent is a vital component of medical practice. [4]

Legal concepts of battery, self-determination, and the fiduciary relationship create a legal foundation for informed consent. The patient's moral right to self-determination and the corresponding duty of health professionals to "do no harm" create a strong moral basis for gaining a patient's informed consent. [5] The process of informed consent is one mechanism for protecting a patient's dignity in the health-care environment. [6] Now days, more and more patients are demanding detailed information about their disease, various diagnostic methods available and options available for treatment. Consent is not mere submission of the patient to a particular treatment, but a process of communication requiring the fulfilment of certain established elements like competence, sufficient disclosure, understanding and volunteering. [7]

Considering the above facts, the study was undertaken to know their perspectives (level of satisfaction & knowledge) about some aspects of consent in medical practice.

Methodology:

A cross sectional survey was conducted at Shree Krishna Hospital and Pramukhswami Medial College, Karamsad during the year 2009. All physicians who possess degree MBBS and above were included for the study. Self designed, validated questionnaire Proforma which covered sets of questions and

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hypothetical situation, commonly seen in the medical practice is given for all participants to check their level of satisfaction and knowledge about consent in medical practice. Ethical clearance was obtained from Institutional Ethics Committee prior to the study. Total 150 Proforma were distributed among physicians of various specialities, out of which 114 responses were received within stipulated period.

The perception about consent from various levels of physicians including professor, associate professor, assistant professor, tutors, medical officers and residents were obtained. These physicians were belonging to various specialities of medicine including preclinical,

Para-clinical and clinical departments. Their implied consent was taken for the study. They were informed that this Proforma is the part of study and they are free to accept or deny completing it. They were asked not to disclose their name and Department. Various types of questions were kept to check their level of satisfaction, and their knowledge about consent in general, age for consent and role of consent in emergency situations. Received responses were checked and cross checked for subjective (level of satisfaction) and objective (level of knowledge) ailments. The results were tabulated and statistically analysed.

Results:

Table 1: Response to the Question

Trait	Response	Number	%
How satisfied are you with your knowledge about consent in medical practice?	Satisfied	78	68.42
	Not satisfied	36	31.58
	Total	114	100

Table 2: Level of Knowledge

Trait	Number	%
No knowledge	42	36.84
Limited knowledge	45	39.47
Most of things	20	17.55
All aspects	7	06.14
Total	114	100

Table 3: General Aspects of Consent

Sr. No.	Trait	Yes, (%)	No (%)	Total (%)
1	Do you know the various types of consent applicable in medical practice?	32(28.07%)	82(71.93%)	114(100%)
2	Do you that whose consent is valid?	62(54.39%)	52(45.61%)	114(100%)
3	Do you know some sections of Indian Penal Code applicable to consent in medical practice?	2(1.75%)	112(98.25%)	114(100%)

Table 4: Response to Age for Consent

Sr. No.	Trait	Disagree	Somewhat agree	Fully agree	Total
1	Only a person above 18 years of age with sound mind can give valid consent for general & physical examination?	17(14.91%)	25(21.93%)	72(63.16%)	114(100%)
2	A child above 12 years of age with sound mind can give valid consent for simple, general & physical examination?	50(43.86%)	30(26.32%)	34(29.82%)	114(100%)

Table 5: Consent in Emergency Situation

Sr. No.	Trait	Correct response	Incorrect response	Total
1	A male patient in unconscious state brought to emergency dept. t of a hospital with alleged history of vehicular accident. Surgeon felt need of craniotomy. In absence of relative or legal heir, what should he supposed to do?	107(93.86%)	7(06.14%)	114(100%)
2	An unconscious patient requires an emergency surgery but relatives/legal heir are not ready to give consent. What a physician should do?	57(50.00%)	57(50.00%)	114(100%)

Discussion:

It is depicted from the table 1 that about two third (68.42%) physicians have expressed that they are satisfied with their knowledge about consent in medical practice while one third (31.58%) felt unsatisfied. The reason for dissatisfaction may be that they are not keeping themselves updated with various aspects of consent in medical practice.

It is obvious from the table 2, as far as level of knowledge is concerned, less than one fourth (23.69%) physicians have responded that they know most of aspects (including 6.14% expressed all aspects) of consent applicable to

them in their practice. More than three fourth (76.31%) physicians have admitted that their knowledge about consent is either nil or limited. If we compare table 1 and 2, it can be said that most of physicians felt satisfied despite of having limited knowledge about the consent in medical practice. The reason may be their limited access to various medicolegal training programmes or it could be just lack of interest to learn medical jurisprudence. These questions were subjective and operational definitions of what these terminology mean were not clearly highlighted that was the limitation of the study. To overcome the ailment of subjectivity, authors

have mentioned various other aspects of consent applicable in medical practice in questionnaire proforma which were then asked to cross check their responses.

It is depicted from table 3 that responses to serial no.1 were quite alarming. 71.93% physicians responded that they do not know various types of consent applicable to them in medical practice. If we look at response to serial no.2, it was observed that only 54.39% physicians knew validity of consent. From this observation, it can be opined that 26.34% physicians were knew validity of consent without having knowledge of various types of consent applicable to medical practice. In another words, it can be say that a large number of physicians are practicing medicine without having knowledge and understanding of various aspects of consent applicable in their context. It is also observed from serial no.3 of table-3, 98.25% physicians were not aware about law applicable to consent.

The reason may be lack of realization to its importance in their context. Author felt that this is a serious concern which needs to be addressed. It is of paramount importance that all physicians must know the actual meaning of valid consent. The valid consent is one which is informed, given voluntarily without any fear or misconception in mind by a person who is eligible for it. The Supreme Court of India in a recent Judgment, Samira Kohli vs. Dr. Prabha Manchanda & ANR, Appeal (civil) 1949 of 2004 (SC) has elaborated various aspects of consent taking. It has further laid down certain guidelines for taking a real or valid consent. As such it is an attempt to stream line consent process in India. [8] It is observed from table 4 that many physicians are not having concept of age for consent. When we have checked the response to some hypothetical situation applicable in day to day practice, it was opinion of 63.16% physicians that only a person above 18 years is eligible for giving consent even for simple general & physical examination. These observations again raise doubt about their knowledge of valid consent. It can be clearly inferred from section 87-89 of Indian penal code that a child above 12 years of age can give consent for simple, general or physical examination which is not associated with any harm to his/her life. In cases where a procedure is associated with harm or may lead to grievous hurt or death, consent of a person above 18 years is mandatory if he or she is in position to give. [9-10]

It is depict from the table 5, two different emergency situations were given to them and it

was observed that most of physicians have right concept what to do in emergency situation if relatives or legal heir are not there to give consent but they were confused and their responses were 50-50 (only 50% responded correctly) if relatives deny for consent. It can be inferred from section 92 of Indian penal code that act done in good faith for benefit of a person without consent is not an offence if the circumstances are such that it is impossible for that person to signify consent, or if that person is incapable of giving consent, and has no guardian or other person in lawful charge of him from whom it is possible to obtain consent in time for the thing to be done with benefit. [11] So it is obvious that if relatives or legal heir are denying for consent in the situation where major patient is in unconscious state, it is not advisable to perform surgery against their refusal. As mentioned by Christian P Selinger that there are several legal exceptions to the right of consent concerning minor, patient with mental illness, patient suffering from communicable disease and incapacitated patient (as mentioned here in the present study). [12]

Conclusion:

1. The study reflects that physicians are not equipped with their knowledge of consent in medical practice.
2. Physicians felt frequent need of arranging training programme/seminar by the subject expert to address issues related to consent and various other medicolegal aspects.
3. Medical practitioner should upgrade their Medico-legal knowledge to avoid any litigation in future.
4. Regular medicolegal training programmes are need of hour.

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Original Research Paper

Nomenclature for Knot Position in Hanging A Study of 200 cases

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Abstract

Hanging is one of the common methods of committing suicide world wide. Position of the knot, in hanging cases is important as it determines the post-mortem findings of the head and face and can also be used to predict the expected autopsy findings. Although hanging has been described in forensic literature since ages, there has been no proper scientific nomenclature for classifying the position of knot in hanging cases. This paper describes a new nomenclature of exact knot position on the neck based on commonly used anatomical landmarks with self explanatory terms of classification, so that it can be understood and used by the autopsy surgeons and the pathologists with ease.

In the present study 200 cases of hanging were studied retrospectively and position of knot is classified according to a newly described nomenclature. The new nomenclature classifies the position of knot into 6 major classes each of which are further subdivided into 3 subcategories thus making 18 different positions on each side of neck. The most common position of knot was found at occipitomastoid region (32%) and the least common position being at mental region (2%).

Key Words: Hanging, Nomenclature, Knot Position

Introduction:

Hanging is caused by suspension of the body by a ligature around the neck having a knot or a loop. The position of knot in cases of hanging is one criterion on which other variable findings of hanging are based. The knot position determines the tilt of the head, the presence or absence of saliva and its direction of flow, the obliquity of the ligature mark, etc. The literature describes the hanging on basis of knot position as typical or atypical. Therefore to designate the position of the knot in a scientific manner is important to indicate the constellation of findings dependent on its position.

Material & Method:

In this study 200 cases of hanging were studied retrospectively to locate the position of knot and the subsequent findings based on it.

The position of the knot was ascertained from the presence of ligature material, impression of the knot and direction of the ligature mark on the neck.

It is classified according to the proposed new scientific nomenclature.

Results:

The age group of study was between 10-65yrs with lowest being 13 years and the highest being 62years. Maximum no. of cases was seen between the age group of 16-25 years (48%). There were 136 males and 64 females in the study. Fixed knot was present in 26 cases (13%), loop in 25 cases (12.5%) and sliding knot was seen in 141 (70.5%) cases. In 8 cases type of knot could not be ascertained. In all cases of hanging by fixed knot the position of knot was higher up i.e. at the classified anatomical landmark or at the supra position. The sliding knot or the loop was found to constrict the neck at level lower (sub) to the anatomical land mark. The incidences of various knot position has been depicted in table 1.

Discussion:

In a case of hanging, the knot is that point of ligature around the neck where maximum force of traction occurs and the part of ligature diagonally opposite to the knot bears the maximum body weight thus exerting maximum pressure on underlying neck structures. The sequential pressure including tractional force from maximum pressure to minimum on particular structures like trachea and larynx, jugular veins, carotid and vertebral arteries, neck muscles, thyroid cartilage, hyoid bone, vertebral column and other adjacent structures are

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determined by the position of the knot and the type of knot. The knot position determines whether the effects of pressure/traction are unilateral or bilateral. The mechanism of death and the autopsy findings of the neck and above it are also primarily dependent on the position of the knot. Inconsistency in knot position and the direction of flow of saliva or other body fluid suggests suspicious death and foul play.

At present, there is no scientific nomenclature for classification of knot position in the ligature around the neck in hanging cases. The literature mentions only about typical and atypical hanging based on position of knot on the occiput or otherwise [1-4]. Few texts have mentioned about the position of knot being at the angle of mandible, mastoid, occiput or below chin or on either side of neck [5-8] but no proper classification have been mentioned.

I Morild [9] classify hanging as typical-complete, typical-incomplete, atypical-complete, and atypical-incomplete. P Betz and W Eisenmenger [10] have made an attempt at assigning the location of knot scientifically, dividing the possible positions of the knot around the head into four quadrants and at four sites, denoting these sites by roman numbers.

In the proposed new nomenclature the position of knot has been assigned in relation to the anatomical landmarks and the post mortem findings are consequent upon the position of knot. The head and neck has been divided into six segments based on anatomical landmarks, covering the whole circumference of the neck and adjoining part of head and face. Each segmental position has been further divided and prefix sub- and supra- added to indicate the position of knot, and cover all possible location of the knot. (Fig1)

1. Mental position of the knot:

The knot is situated over the chin in midline or just right or left to the midline. When the knot is on the under surface of lower jaw or in the neck, it is sub mental and when above the chin, it is supra mental. In supra mental position, the knot impression may not be present as the knot does not touch the skin. The chin is directed upwards and anteriorly causing upward inclination of the face. The saliva may not dribble out but gets collected in the oral cavity and may come out when the body is laid on the ground. Maximum weight of the body is borne by the posterior part of the ligature on the back of the neck. Larynx and trachea do not get completely and/or suddenly compressed and occluded.

Death usually occurs due to cerebral anoxia, venous congestion, asphyxia due to backward

fall of tongue, fracture of cervical vertebrae when associated with sudden drop or combination of two or more of them. Hypostasis will be seen on the posterior aspect of face and hence the face may appear normal rather than congested.

The Proposed Nomenclature for the Knot Positions in Cases of Hanging:

	Position of the knot	Subtype
1.	Mental	Mental Sub mental Supra mental
2.	Mandibular	Mandibular(Left/Right) Sub Mandibular Supra mandibular
3.	Mandibulo mastoid or Auricular	Mandibulo-mastoid or Auricular (Left/Right) Infra Auricular or Infra Lobular Supra Auricular
4.	Mastoid	Mastoid or Retro-Auricular (Left/Right) Infra Mastoid Supra mastoid
5.	Occipital or Occipito Mastoid	Occipital or Occipito- Mastoid (Left/Right) Infra Occipital Supra Occipital
6.	Mid Occipital	Mid-Occipital Infra Mid Occipital Supra Mid Occipital

The supra mental position of knot is rarely fatal because the head slips out of the noose and the constriction around the neck is loosened very soon , but when it is associated with double circle of loop around the neck, it causes constriction of neck by the loop.

2. Mandibular position of knot:

The knot is situated between the chin and the angle of mandible just over the lower border of mandible. When it is on the under surface of the lower jaw or on the neck, it is sub mandibular. When it is on the surface of the cheek over the body or ramus of mandible, it is supra mandibular and may or may not touch the surface of the cheek.

The chin in mandibular position of knot is directed towards the side of the knot and slightly upward and the head is tilted opposite to the knot. Saliva dribbles out from the angle of mouth opposite to the knot and may flow downwards and laterally on the skin surface towards the angle of mandible before dropping on the body or clothing. Tongue deviates to the side of tilt of the head and may or may not protrude out. Hypostasis on the face will be on the side opposite to the knot.

3. Mandibulo mastoid or Auricular:

The knot is situated on lateral aspect of the neck between the angle of mandible and mastoid process. When it is below the ear lobe or in the region of neck, it is called infra auricular

or infra lobular, when I over the pinna, called auricular and when above the pinna, called supra auricular.

In supra auricular knot, the impression of the knot may not be seen. When the knot is sliding, it is usually situated below the ear lobule and when fixed, usually over or above the pinna. The head is tilted opposite to the knot; the saliva dribbles out from the angle of mouth opposite to the knot. The line of flow of saliva is almost parallel to the line of suspension.

4. Mastoid

The knot is situated over the mastoid process or in the mastoid region. When it is situated below the mastoid region in the neck, it is sub mastoid and when above the mastoid, it is supra mastoid. In supra mastoid position, the knot impression is usually not seen. Sometimes faintly seen or partly seen because of the presence of scalp hair or because it is not touching the scalp.

5. Occipital or Occipito Mastoid:

The knot is situated between the posterior midline and the mastoid process on occipital region called occipital position. When it is below the occipital region at the nape of the neck, it is called infra occipital and when above the level of occiput and not touching the head, it is supra occipital. Saliva flows from lower half of the lip close to the lateral angle of the mouth, from the side opposite to the knot. It may drop on the clothes or the chest and not flow up to the lower border of mandible. This was the most common site of knot position found in our study (32%)

6. Mid Occipital:

The knot is situated in posterior mid line. When it is situated below the occiput, it is called infra mid occipital and when over the occiput, it is called supra mid occipital. The head is tilted anteriorly and downwards and the chin is directed downwards and posteriorly. Saliva in such cases flows from the lower lip downwards and may not flow over the chin before it drops on the clothes or the body surface. The direction of ligature material near the knot is inverted 'V' and limbs of this 'V' may be visible very clearly, faint with impression with knot or may or may not be visible in case of supra position of knots because in such cases the knot is situated above landmark and hence neither the knot nor the limb are clearly evident in ligature mark.

Conclusion:

The present nomenclature for assigning the knot position in cases of hanging if applied offers the exact location of the knot in reference to the anatomical bony landmarks and also predicts the associated autopsy findings on the

head and neck and the possible mechanism of death. Any gross inconsistencies in this regard would serve to indicate foul play or the presence of suspicious circumstances.

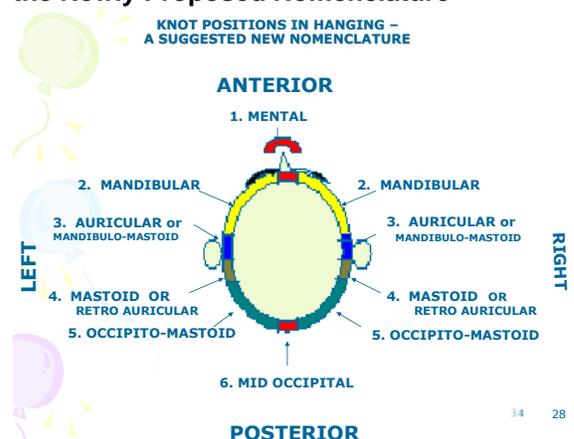
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Table- 1: Incidence of various knot position

Position of knot	Right	Left	Midline	Total
Mental	-	-	1	1
Supra	0	0	1	1
Sub	0	0	2	2
Mandibular	2	1	-	3
Supra	6	5	-	11
Sub	2	4	-	6
Mandibulo-mastoid	4	5	-	9
Supra	5	3	-	8
Sub	20	9	-	29
Mastoid	2	4	-	6
Supra	9	1	-	10
Sub	15	16	-	31
Occipitomastoid	3	3	-	6
Supra	1	2	-	3
Sub	21	34	-	55
Occipital	0	6	8	14
Supra	0	0	0	0
Sub	3	2	0	5

Fig-1: Various Knot Position According to the Newly Proposed Nomenclature



Original Research Paper

Newer Trends in Hanging Death

*Ashok Kumar Samanta, ** Soumya Ranjan Nayak

Abstract

A total of 105 cases of deaths due to hanging were studied in a span of 5 years time. This present study throws some light on the emerging trends that Hanging is increasingly being adopted by a relatively younger age group who are mostly illiterate and of poor socio-economic status. Hanging being viewed as giving swift painless death and without much expenses and without arousing much suspicion, this mode is increasingly adopted to commit suicide. Dribbling saliva mark, which was a hallmark of Ante-mortem hanging, is increasingly seen in less number of cases. No incidence of fracture of Hyoid bone being seen in this study, due to the fact that most cases were of lower age group and also may be due to most of the victims adopting soft ligatures and low suspension points. Transverse tears in the Carotid arteries were not seen here and on subjecting to Histo-pathological study, we could detect disruption of intimal layer of Carotid artery. Effect of pressure on layers of skin were seen on Histo-pathological study showing vital reaction changes useful for labelling Ante-mortem hanging.

Key Words: Hanging deaths, Ante-mortem hanging, Fracture of throat skeleton

Introduction:

Since ages people in distress with mounting pressures of life, break down to end their life and invariably it is seen that the easier route which is readily available to them is death by hanging. Hanging deaths have fascinated so many minds and increased frequency of hanging cases have developed interest to take up active projects. In the past, so many Forensic Pathologists have taken an active interest in hanging deaths and have done many studies in quest for an answer to their enquiring minds.

Aims & Objectives:

Many literature articles on hanging exist and each differs from the other in their approach to the subject. The present study on hanging makes a detailed autopsy examination and tries to compare and correlate established findings by previous authors. An attempt is made to establish newer trends and deviations from the earlier studies. A newer dimension of Histo-pathological examination has been added to this present study to highlight microscopic events. An attempt is done to find plausible explanations to findings got in the study keeping in view the Indian scenario.

Materials & Methods:

The materials taken for this study are those autopsy cases which had history of death by hanging as reported by the police inquest and the period of prospective study was for 5 years. Regular autopsy examination is done with special attention to thorough examination of the neck structures. Skin samples are taken from the ligature mark and also corresponding area of the underlying carotid vessels and sent for Histo-pathological examination along with control. Demographic history is collected from the relatives and also the police, regarding various epidemiological parameters and a special protocol was made for this purpose. The result so obtained was then subjected to statistical analysis.

Observations:

A total of 105 cases of deaths due to hanging were studied out of total 1468 autopsy cases within a three years time. Among all autopsy cases, incidence of hanging deaths came to 7.15% with males forming 4.42% and females forming 2.72% thus showing a higher preponderance of males to females. Segregating sex-wise, females showed a higher preference than males, to hanging as a form of committing suicide (13.88% & 5.51% respectively). Bulk of male cases belonged to age range of 21 – 40 years (80%) but bulk of female cases were restricted to a lower age range of 11 – 30 years (90%). The minimum & maximum age range noted for males were 16 yrs & 45 yrs respectively and for females, 18 yrs

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& 35 yrs respectively. Socio-economic status of the victims showed that majority of them belonged to poor or average status (80% males & 85% females) and rest of them can be categorized to above average status. Analysing the Educational status, it was seen that most of the cases belonged to Illiterate group (45.7% combined sex) followed by High school dropouts (38.10%) and Graduates (15.23%). On analysis of Occupational status, most of the victims were Daily Labourers (30.48% combined sex) followed by housewife (20%), business class (18%), service (16%) and students (14.3%). With respect to preference to site, majority of the victims have chosen the safe confinement of the house (66.15% Males & 80% Females) to commit suicide by Hanging. As per the history given by Police or site visit, it was found that majority of the males (70.76%) adopted Complete suspension mode and majority of females (57.50%) choosing Partial suspension mode of Hanging. (Table 1 & 2)

On External Examination, majority of both sex combined (58.09%) utilized Slipping knot for the process of hanging. A Discontinuous Ligature mark was seen in about 92.38% of cases. 40.95% of cases had utilized Cloth based and 46.67% of cases adopted Rope as Ligature material. In all the cases, the Ligature mark was running in Oblique direction with 82.85% showing atypical position of the Knot either at right or left mastoid area. Rest 17.14% showed typical knot position. As pertaining to Level of Ligature mark over the neck, 88.5% of the cases were above the Thyroid Cartilage level and rest almost over the Thyroid cartilage. On closer examination with a hand lens, Ecchymotic spots were observed along the upper border of Ligature mark in 18.46% of males and 35% of female cases with an average duration of suspension of ligature in males being 10.5 hours and 11.7 hours in females. Dribbling Saliva mark was seen in about 32.31% of males and 15% of females, the total incidence being only in 25.71% of cases. Conjunctiva petechiae were found in about 46.67% of cases, majority of them being seen in the group adopting Complete & Atypical type of hanging. 91 cases (86.7%) showed the normally seen Glove & Stocking pattern of Post-mortem lividity. 90 cases (86.5%) showed faecal incontinence.

On Internal Examination, the neck structures were dissected carefully and examined in detail to detect injuries due to the process of hanging. In this present study, not a single case exhibited Hyoid bone or Thyroid cartilage fracture. There were no Transverse tears in the intima of Carotid artery in any of the

cases. 48 cases (45.7%) showed Visceral Pleura petechial hemorrhages. In 47 cases (44.76%) right side of the heart showed dark fluid blood and in the rest it was empty. Signs of Asphyxia like Nail bed cyanosis and visceral congestion were observed in all the cases in this study. In about 95 cases, where the cadaver was relatively fresh, section of Skin from Ligature mark and corresponding Carotid Artery were taken for histopathological examination. In all the cases subjected for HP examination of the Skin, the report showed Vital reaction [1] with features like infiltration of Neutrophils, RBC, Hemosiderin laden Macrophages which was not seen in the control samples taken from normal areas not involved with the Ligature Mark. In the Carotid artery samples, there were features of disruption of the Tunica Intima layer from the Tunica Media with infiltration of Neutrophils, RBC and Hemosiderin laden Macrophages.

Discussion:

It is of common view that Hanging is mostly suicidal and in this present study, all the cases were attributed to suicide as per Inquest report and proved later from Autopsy examination. Suicide by hanging was usually adopted by the subjects because of convenience and minimal requirements for committing the act. The present study showed age range of the victims from 11 – 40 years where victims are under increased pressures and burdens of life and when combined with illiteracy (45.7%) and poor socio-economic status (82.5%), might have led to failure to cope with pressures of life and thereby committing suicide by hanging. The common pressure situations faced could be domestic quarrels, failure in love affairs, mental illness, poverty, failure in examinations, dowry torture, unemployment etc as quoted by the National Crime Record Bureau, 1994.

The usual material utilized for committing the act in this study were those that were readily available nearby which includes Rope and Cloth based materials like saree, dhoti, lungi etc.[2] The fact that most of the male victims in this study adopted complete hanging and majority of females adopted partial mode of hanging was explained due to the ease of higher reach for tying the knot to the ceiling by the males and utilizing rope based ligature material. Dribbling Saliva mark [5] which signifies Ante-mortem hanging was seen in only 25.71% of cases because of the fact that relatives in their hurried attempt to resuscitate the victim and save them from dying, might have led to erasure of the mark from the body.

Majority of the conjunctiva petechiae [5] were observed in those subjects adopting a combo of Complete and Atypical hanging which might signify the role of rise of venous pressure in these positions along with increased duration of suspension, average being 10.5 hours. The present study did not show any Hyoid bone fracture because of younger age of the study group and the usual age showing fracture in earlier studies quotes average age of 40 years or above. [3, 4] So also not a single case showed transverse tears [2] in the intima of carotid artery which can be explained by the fact that most of the cases were from low suspension points. [4, 6, 7] Histo-pathological examination findings of skin and carotid artery indicated Vital Reactions signifying ante-mortem hanging. Compression of Skin layers and Disruption of Intima of Carotid artery signifies the effect of pressure on the layers of Carotid artery by the Ligature material during the act of hanging.

Conclusion:

The present study throws some light on the emerging trends that Hanging is increasingly being adopted by a relatively younger age group who are mostly illiterate and of poor socio-economic status. With increasing disparity between the poor and the rich and due to high ambitions, these victims fall short of their expectations and who then adopts to commit suicide by hanging. Hanging being viewed as giving swift painless death and without much expenses and without arousing much suspicion, this mode is increasingly adopted to commit suicide.

Dribbling saliva mark, which was a hallmark of Ante-mortem hanging, is increasingly seen in less number of cases. No incidence of fracture of Hyoid bone being seen in this study, due to the fact that most cases were of lower age group and also may be due to most of the victims adopting soft ligatures and low suspension points. Transverse tears in the Carotid arteries were not seen here and on subjecting to Histo-pathological study, we could detect disruption of intimal layer of Carotid artery. Effect of pressure on layers of skin were seen on Histo-pathological study showing vital reaction changes useful for labelling Ante-mortem hanging.

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Photo 1: C.S. study of Carotid Artery 1



Photo 2: C.S. study of Ligature mark 2

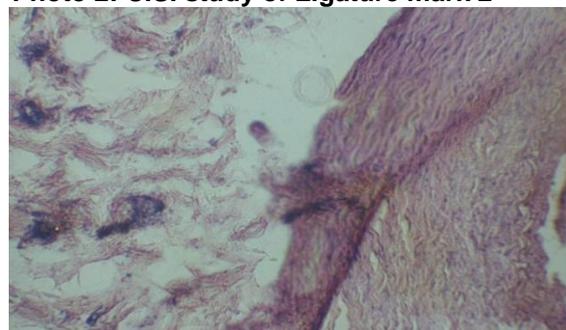


Table 1: Literacy Status

S. No.	Literacy Status	Males	Females	Total (%)
1	Illiterate	28	20	48(45.70)
2	High School Dropout	24	16	40(38.10)
3	Graduates & Above	12	4	16(15.23)
4	Unknown	1	0	1(0.97)
Total		65	40	105(100)

Table 2: Occupational Status

S. No.	Occupation	Males	Females	Total (%)
1	Manual Labourers	27	5	32(30.48)
2	Housewife	0	21	21(20.00)
3	Students	9	6	15(14.28)
4	Service	15	2	17(16.19)
5	Business	13	6	19(18.09)
6	Unknown	1	0	1(0.96)
Total		65	40	105(100)

Table 3: Incidence of Conjunctival Petechiae

S. No.	Type of Hanging	Cases	Percentage
1	Complete & Typical	2	04.08
2	Complete & Atypical	26	53.07
3	Partial & Typical	3	06.12
4	Partial & Atypical	18	36.73
Total		65	100.00

Original Research Paper

Pattern of Ligature Mark in Cases of Compressed Neck in Rajkot Region: A Prospective Study

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Abstract

Ligature mark may be the only evidence available in cases of asphyxial deaths due to either hanging or strangulation. A thorough examination of the ligature mark and analysis of the information provided by it is therefore, a must to arrive at the most probable cause of death and differentiate between hanging and the ligature strangulation. A prospective study was conducted at the Department of Forensic Medicine, P.D.U. Medical College & Hospital, Rajkot from January 2008 to December 2008. During that period out of 2159 cases, 90 cases of hanging and 7 cases of ligature strangulation were selected for the present study. We found that deaths due to hanging constituted 4.17% of the total unnatural deaths subjected to medicolegal autopsy; young adults of the age group 21 to 30 years accounted for the maximum cases 40% and the male: female ratio was 2:1. Chunni (34.44%) was the most common ligature material used. The mark was obliquely placed (100% cases) above thyroid cartilage (80% cases). In all the cases of ligature strangulation the mark was transverse and below the level of thyroid cartilage.

Key Words: Hanging, Ligature strangulation, Ligature mark

Introduction:

Compression of neck is a broad term used for non specific causes of neck pressure which may be sudden. Ligature mark is found in two types of neck compression- (I) Hanging (II) Ligature strangulation. Hanging is a form of death produced by suspension of the body by a ligature round the neck, constricting force being the weight of the body (or apart of the body weight). [1] In India hanging is among the top 5 methods of choice for committing suicide. [2]

Strangulation is a violent form of death which results from constricting the neck by means of a ligature or by any other means without suspension of body. [1] In hanging, ligature material may be any substance that is available at the time of the impulse has been used by the suicides as a ligature. Knot is frequently in the form of a single knot to produce a running noose or fixed by a granny or reef knot, occasionally a simple loop is used. [1] There may be more than one turn around the neck and / or more than one knot imparting corresponding complexity to the mark.

A running noose can tighten at the time of suspension and may then produce a mark which takes a horizontal turn but it is likely to be above the thyroid cartilage. Ligature mark depends on the nature and position of the ligature used, and the time of suspension of body after death. If the ligature is soft, and the ligature removed immediately after death, there may be no mark. Again, the intervention of a thick and long beard or clothes on the neck leads to the formation of a slight mark.

Sometimes, the pattern of the ligature material is impressed on the skin and a characteristic diagonal mark of the strands found when the rope is used. The wide band of cloth when used as a ligature on the bare skin may cause a narrow ligature mark, due to tension lines in the stretched cloth. The mark is a groove or furrow the base is pale, hard leathery and parchment like and margins are red and congested. Ecchymoses and slight abrasions in the groove are rare, but may be found in some cases for instance in judicial hanging.

Usually only one mark is found. Multiple marks may be present due to multiple turns around the neck or upward displacement after application due to fall. The mark is usually situated above thyroid cartilage between larynx and the chin and is directed obliquely, upwards following the line of mandible and interrupted at the back or may show an irregular impression of a knot, reaching the mastoid processes behind the ears towards the point of suspension.

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The mark may be found on or below the thyroid cartilage, especially in case of partial hanging. It may be circular if a ligature is first placed at the nape of neck and then its two ends are brought horizontally forwards and crossed, and carried upwards to the point of suspension from behind the angle of the lower jaw on each side. The mark will be circular and oblique if a ligature is passed round the neck more than once. Near the position of the knot, it is like an inverted "V".

In strangulation, ligature may be applied as one turn around the neck or even less, as homicide have been perpetrated by assailant pulling U shaped ligature against the front and sides of neck, while standing at the back.

Ligature mark is a well defined and slightly depressed mark corresponding roughly to the breadth of the ligature, usually situated low down in the neck below thyroid cartilage and encircling the neck horizontally and completely. The marks are multiple if the ligature is twisted several times round the neck. The mark may be oblique as in hanging if the victim has been dragged by a cord after he has been strangled in recumbent posture or if the victim was sitting and assailant applied a ligature on the neck while standing behind him, thus using the force backwards and upwards. The base of the mark, which is known as a groove or furrow, is usually pale with reddish and ecchymosed margin.

It becomes dry, hard and parchment like, several hours after death, if the skin has been excoriated. The pattern of ligature may also be seen very often, there are abrasions and ecchymoses in the skin and adjacent to marks. In some cases, the mark in the neck may not be present at all, or may be very slight, if the ligature used is soft and if it is removed soon after death. However, it is not necessary that all these differentiating features are present simultaneously in all cases. In practice, the distinction between the two groups is important because strangulation is usually homicidal and hanging in vast majority is considered to be suicidal. [3] So there is always a necessity to differentiate hanging mark from strangulation mark before giving an opinion otherwise an error in judgment can convict an innocent or a murderer can go Scot free in the society.

The ligature mark is a vital piece of evidence especially when the killer has taken away the actual ligature. Taking the most important finding i.e. ligature mark into consideration, there are a few points like (1) level (2) continuous/non-continuous (3) oblique/transverse of the ligature mark which differentiate hanging from ligature strangulation.

Many times there are so many difficulties faced in diagnosing ligature mark of hanging and strangulation on many occasions. The author has made an attempt to establish the most reliable factor for differentiating pattern of ligature mark of hanging from ligature mark of strangulation.

Material and Method:

This prospective study was conducted in all cases of death due to hanging and ligature strangulation for the purpose of studying the pattern of ligature mark at the Department of Forensic Medicine, P.D.U. Medical College & Hospital, Rajkot from January 2008 to December 2008. During that period out of 2159 cases, 90 cases of hanging and 7 cases of ligature strangulation were selected for the present study. A detailed history from police and relatives regarding age, sex, socio economical status, marital status, habits, illness (mental / other disease / deformity), previous attempted suicides, suicide note if any etc. were taken. Detailed history from police regarding scene of crime, position of body etc. were taken. Irrespective of information collected, both external and internal post mortem findings were observed meticulously especially the ligature mark. During observation of ligature mark, all the parameters like its site, size, level, number, discontinuity and obliquity were noted.

Observations:

As per Table 1, maximum 39 cases (40.2%) of hanging and ligature strangulation deaths were reported in age group of 21-30 years. Out of 36 cases, 24 (64%) male and 12 (34%) female died due to hanging while 3 case of ligature strangulation equal reported in male.

As per Table 2, Chunni was used as a ligature material in maximum 31 cases (34.44%) of hanging followed by nylon rope in 28 cases (31.1%) of hanging whereas in ligature strangulation cases, ligature material was not known in maximum number 3 cases (42.85%).

In all cases of hanging only one ligature mark was present. The ligature mark was situated above thyroid cartilage in 72 cases (80%) and in 49 cases (54.44%), the length of ligature mark was less than neck circumference. Ligature mark was one in number in 6 cases (85.71%) of ligature strangulation, in all 7 cases (100%) it was situated below thyroid cartilage and the length of ligature mark was equal or less than neck circumference.(Table 3)

In all cases of hanging underlying soft tissues of neck were pale, white and glistening, ligature mark was incompletely encircling the neck in 72 cases (80%) and obliquely present

around the neck all 90 cases (100%) of hanging. In all cases of ligature strangulation underlying soft tissues showed extravasation of blood. The ligature mark was completely encircled and transversely present around the neck in all 7 cases (100%) of ligature strangulation. (Table 4)

Discussion:

In the present study 4.49% cases were declared on autopsy of hanging and strangulation deaths which is similar to study of Sheikh et al. [10] In the present study maximum number of cases 40.2% were reported in the age group 21-30 years, which is consistent with observations of Sheikh et al [10] (42.4%) and Joshi et al [11](44.18%). In present study 66.67% male and 33.33% female cases were observed in hanging, which is consistent with observations of Sheikh et al [10] and Jani et al. [12] Churni as a ligature material was used in 34.44% cases of hanging in the present study. In study by Sharma B R et al [13] commonest ligature material was Churni in 17 cases (30.90%). Number of ligature mark is one in all cases of hanging are similar with observation of Momonchand et al (96.7%). [14]

In present study six case of ligature strangulation where number of ligature mark is one while in one case, number of ligature mark is more than one. Ligature mark was situated above the level of thyroid cartilage in 72 cases (80%) of hanging which is similar with observation of Naik S K (82.94%). [15] In all 7 cases (100%) of ligature strangulation, ligature mark was found below thyroid cartilage.

Out of 90 cases of hanging, in 49 cases (50.51%) the length of ligature mark was less than neck circumference and in all cases of ligature strangulation; length of ligature mark was equal to the neck circumference.

In all 90 cases (100%) of hanging the direction of the ligature mark was oblique which was consistent with the observation by Naik S K. [15] In all 7 cases (100%) of ligature strangulation, the direction of the ligature mark was horizontal which was consistent with observations of Naik S K. [15] Ligature mark was completely encircled in 18 cases (20%) of hanging and in 72 cases (80%) of hanging the ligature mark was incompletely encircled, which was consistent with observations of Naik S K. [15] In all cases of ligature strangulation, the ligature mark was completely encircling the neck. Out of 97 cases of neck compression, in internal appearance of neck underlying soft tissues were pale, white and glistening in 90 cases (100%) of hanging while in 7 cases

(100%) of ligature strangulation it showed extravasations of blood.

It is a well-accepted fact that the ligature mark of hanging and strangulation are not found at same level. Authors have reported that hanging mark is situated higher in the neck usually above the laryngeal prominence. [4-8] Jason P J et al [9] have reported that position of mark of hanging depends on how the device was fixed and the suspension point. Reddy KSN [8] has mentioned that mark of hanging is situated above the level of thyroid cartilage, between larynx and chin in 80% cases. It may be situated at the level of thyroid cartilage in about 15% cases and below the level of thyroid cartilage in about 5% cases, especially in partial suspension. [8] In the present study, it was observed that ligature mark was on or above the level of thyroid cartilage in most cases of hanging. It is also well known fact that discontinuity along the course of the ligature mark is another important criterion while describing ligature mark of hanging or strangulation. Authors have mentioned that hanging mark almost never completely encircles the neck. [4-9] In strangulation, unless the killer is pulling upwards, there will be no gap in the mark. However, there can be discontinuity along the course of ligature mark due to interposing clothing, scalp or beard hairs or fingers of the victim in both hanging and strangulation. [5]

In the present study, it was noticed that though discontinuity of the mark was a common feature in most cases of hanging still it was missing in 20% cases of hanging. In strangulation deaths, discontinuity of the ligature mark was not present even in a single case.

Observation is incomplete when obliquity along the course of the ligature mark is not noted in cases of hanging and strangulation. Authors have reported that hanging mark is situated obliquely across the circumference of neck. [5-8] where suspension point is low, the pull on the rope is almost at right angle to the axis of the body, so the resulting mark may be almost horizontal. In strangulation, unlike hanging, the mark tends to encircle victim's neck horizontally. However, the mark may be oblique as in hanging, if the victim has been compressed by a cord while in recumbent posture, or if the victim was sitting and the assailant applied the ligature on the neck while standing behind victim, thus using the force backward and upward. [6, 8] Simpson K has opined that the mark of hanging usually rises to a 'peak' pointing the junction of the noose and vertical part of the ligature, this being a distinguish feature from ligature strangulation.

However, exceptions occur if the suspension point is low, a horizontal mark may be produced which can be confused with strangulation. In strangulation, the mark is usually horizontal and will not show any rising peak to a suspension, as do many hanging. Present study revealed that obliquity along the course of ligature mark was a constant feature in all deaths due to hanging. In ligature strangulation; horizontal ligature mark was observed in all cases.

Conclusion:

Obliquity in the course of ligature mark being directed upwards to the knot position is a better criterion for diagnosis of hanging than the factor of discontinuity which may not be present in all cases of hanging. It can be thus concluded that the presence of discontinuity along the course of ligature mark is highly suggestive of hanging but its absence neither rules out hanging nor concludes strangulation. Therefore, based upon the low level of ligature mark and absence of discontinuity, opinion as a case of ligature strangulation should not be given in haste unless obliquity along the course of ligature mark is completely ruled out.

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Table 1: Age & Sex Wise Distribution of Hanging and Ligature Strangulation Deaths

Age grps (yrs)	Type of neck compression				Total (%)
	Hanging		Ligature strangulation		
	M	F	M	F	
0-10	1	0	0	1	2(2.06)
11-20	4	12	0	0	16(16.4)
21-30	24	12	3	0	39(40.2)
31-40	15	4	1	1	21(21.6)
41-50	11	1	0	0	12(12.3)
51-60	5	0	0	0	5(5.15)
>60	0	1	1	0	2(2.06)
Total (%)	60(66.6)	30(33.3)	5(71.4)	2(28.5)	97(100)

Table 2: Distribution of Ligature Material

Type of material	Hanging (%)	Ligature strangulation	Total (%)
Chunni	31 (34.44)	0	31 (31.96)
Nylon rope	28 (31.1)	0	28 (28.87)
Sari	15 (16.66)	0	15 (15.46)
Cotton rope	15 (16.66)	0	15 (15.46)
Shirt	1 (1.11)	0	1 (1.03)
Handkerchief	0	2 (28.57)	2 (2.06)
Metal wire	0	2 (28.57)	2 (2.06)
Not known	0	3 (42.85)	3 (3.09)
Total (%)	90 (92.78)	7 (7.22)	97 (100)

Table 3: Relationship between Numbers, Level & Size of Ligature Mark

Type of Neck compression	Number			Level			Size in relation to neck circumference		
	1	2	3	Above TC	On TC	Below TC	Size<NC	Size= NC	Size >NC
Hanging No. (%)	90(100)	0	0	72(80)	14(15.56)	4(4.44)	49(54.44)	0	41(45.56)
Lig. Strangulation No. (%)	6(85.71)	1(14.28)	0	0	0	7(100)	0	7(100)	0
Total No. (%)	96(98.97)	1(1.03)	0	72(74.22)	14(14.43)	11(11.34)	49(50.51)	7(7.21)	41(42.26)

* TC- Thyroid cartilage, NC- Neck circumference

Table 4: Relationship between Direction, Encirclement and Internal Appearance of Ligature Mark

Type of neck compression	Internal appearance		Encirclement		Direction	
	Pale white	Extravasation of blood	Complete	Incomplete	Transverse	Oblique
Hanging (%)	90 (100)	0	18(20)	72 (80)	0	90(100)
Lig. Strangulation (%)	0	7(100)	7(100)	0	7(100)	0
Total (%)	90 (92.79)	7(7.21)	25(25.77)	72(74.22)	7 (7.21)	90 (92.79)

Original Research Paper

Pattern of Injuries due to Electric Current

*Bharath Kumar Guntheti, ** Sheikh Khaja, *** Uday .P .Singh

Abstract

A one year study, from October 2007 to September 2008, was under taken in an attempt to study the pattern of electrical injury, the cause of death, manner of death, and diagnosis by histopathological examination. The study was compromised of 62 cases brought with history of electrical shock. Of the total 62 cases, males were 57(91.93%) and females were 5(8.06%) the mean age is 26 .27 year. The peak age of victims are 21-30 years age group 24 cases (38.71%).In the age group of 1n 0-10 years age group victims 3. Most of cases were due to low tension and domestic circuit. The patterns of electrical injuries are noted, such as entry, exit and both entry, exit wounds, flash burns and no electrical signs. The maximum victims showed dermo-epidermal degree of electrical burns .The histopathological examination is an important aid in diagnosis of electrical injuries and recommendations about preventive safety measures to reduce the mortality.

Key Words: Entry Wound, Exit and Pattern, Flash Burns, Electrocution

Introduction:

Electricity is an integral part of modern society, without electricity existence of human life seems difficult, but it has capacity to stand life and destroyed the life up to the death. The most fatalities caused due to electricity are accidental and result from passage of an electric current [both low & high voltage] through the body .Suicides and homicides from electrocution are very rare. They are always affected by alternate current and use of direct current is rare. In developing countries like India, lack of awareness, not operating as per standards and cheap alternates are available at low cost, those are most common causes of electrocution, that leads to penalty of lives, the electrical fatalities are increased.

Most of the times, the Forensic Pathologist is able to diagnose the electrical injuries with pathognomic marks present where as in absence of typical marks, he may face problems. In such conditions circumstantial and laboratory evidence are aids in diagnosis. This study was under taken in an attempt to study, the pattern of electrical injuries, the cause and manner of death. Histopathological examination offers an important aid in diagnosis of electrical injuries.

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Materials and Methods:

In present study a total of 62 Electrical injury cases were admitted in Mamata General Hospital, Khammam for a period of one year from October 2007 to September 2008. In this study the cases were evaluate difference to sex, voltage, contact details, body region distribution. Involved by domestic, industrial, about scene of incident, history given by victims and their relatives, typical and non-specific electrical injuries, flash burns, cause of death ,manner of death, extent of injuries, and confirmed by histopathological examination were recorded. Detailed postmortem examination was conducted on 5 bodies who succumbed out of the 62 cases. All findings are compiled in especially designed Proforma for study and data was collected and statistically analyzed and compared with previous literature.

Observations:

Out of the total 62 cases, males were 57(91.93%) and females were 5(8.06%). The age wise distribution of cases shows that in 21-30 years age group 24 cases (38.71%), with male preponderance of 22 (33.87%) and females 2(3.23%) followed by 31-40 years age group, only males victims 14 (22.58%). In the age group of 11-20 years only male victims are 13 (20.97%) and in 0-10 years age group female victims 2 (3.23%) and male victim only 1(1.61%). In the age group 51-70 years male victims 2 (3.23%) and female victim 1(1.61%).

The Low tension accidents were 42(67.74%) and high tension 20(32.26%) noted. The epidermal electrical burns are common

34(54.84%) followed by dermo-epidermal 12(19.35%) and deep 3(4.84%). The commonly associated injuries are lacerations followed by fractures and Abrasion next is head injury. Highest number of victims have received treatment within 1 hour 43(69.35%) followed by 1-2 hours 11(17.74%) and more than 2 hours 3(4.84%).

As per hospital stay most victims, were admitted within 3 days 40(64.51%), followed by 3-10 days 16(25.80%), and more than 10 days 1(1.61%). The results reveal that discharges were after treatment 40(64.52%), followed by referred cases 10(16.13%) and left against medical advice are 7(11.29%), lastly deaths were 5 (08.06%). In our study, most of the electrical injury cases were entry wounds 47 (75.80%), followed by exit wound 24(38.71%) and both entry and exit wounds 22 (35.48%), next was flash burns 16(25.80%).

In 13(20.96%) cases no signs of electrocution were observed. In our observation only entry wound were 25(40.32%) and both entry and exit wounds were 22(38.48%) cases. Majority of entry wound were involved in right hand 25(40.32%) followed by left hand 9(11.51%) and head and neck 5 (8.06%), next is thorax 4(6.45%); lastly right feet in 1(1.61%). In 3(4.84%) cases both hands are involved. The most common site of entry wound is hand. (Table No. 41). Only exit wound were 2(3.23%) and both entry and exit wounds 22(38.48%) were observed. Majority of exit wounds are involved in left feet 13 (20.96%), followed by right feet 6(9.68%) and left hand 4(6.45%), lastly left thigh 1(1.61%).

The commonest site of exit wound is feet. Our study shows in 16 (25.80%) cases were flash burns. Majority of flash burns are effected on face and neck 6(9.68%) followed by thorax 3(4.85%) and upper limbs 3(4.84%) next is abdomen 2(3.23%), lastly whole body in 2(3.23%) cases were 95-98% of T.B.S.

Our study revealed that in all death cases, there was internal viscera congestion and in one case diffuse petechial hemorrhage in brain white matter was noted.

Discussion:

The widespread commercial utilization of electrical power has been associated with a rapid increase of both fatal and nonfatal injury. In India, death occurs mostly at voltage between 220-240 volts alternative current however death due to lower voltage had also been reported. [2, 7, 14] The knowledge of incident of electrical injuries and underlying causes is of prime importance, the ultimate goal being their

prevention. In general the injuries caused by electrical force that reach the statistics are those that are fatal or that cause disability for some duration. Accounts of industrial accidents are usually accompanied by an investigation report and this provides useful information. On the other hand accidents occurring within the home are poorly documented or not reported at all. For the year oct-2007-sept-2008, even though they constitute a miniscule percentage 0.811% compared to wide spectrum of causative factors of medico-legal deaths. It is still on higher note and requires rapt attention as it is the field where all most all the fatalities are accidental in nature and mostly due to human error. There are different types of electrical injuries such as entry wound, exit wound, both entry and exit wounds and flash burns and no signs of electrical injuries. Of the total 62 cases, male were 57 and female were 5 including children. The percentage of male victims 57(91.93%) were more compared to female victims 5(8.06%) as mention in other studies. [4, 5, 10, 14, 15] The reason for such a marked male predominance in a variety of studies from different communities probably includes the fact that only males are involved in the electrical works.

The peak incidence was more in the age group of 21-30 years 24(38.71%) then other groups. The reason can be attributed to the fact the age at which one earns for lively hood, whereas at extreme ages the fatality was quite rare. These results are consistent with the work of others in age group 0-11 years (2.38%) and 9%. [7] Least number of cases 2(3.23%) in age group 51-60 and 1(1.61%) in 61-70 years age group. In children electrical accidents are due to playing near power lines, removal of entangled kite from live wires. [1] In extreme ages electrical accidents are quite rare.

Accidental electrocution among these would have occurred because of carelessness, ignorance, haste, malfunction of appliances or equipment such as ineffective insulation, lack of protective earthing, faulty grounding and short circuits. [7]

Out of 62 cases, 59(95.16%) were due to domestic supply of current and 3(4.84%) were industrial supply of current. Cases of electrocution are increasing year after year due to increased utility of electrical appliances without taking proper pre caution in the domestic front. The main factor is being the frequent power cut, low voltage for most of the time, year after year, consistent with others. [6]

Low-voltage victims are 42(62.74%) more than high-voltage victims 20(32.26%). [7] In death cases 5, out of this 4 cases due to high-

voltage and 1 case is low voltage current. [8, 9] The majority of electrical burns are epidermal 34(54.84%) as compared to dermo-epidermal burns (i.e. mixed degree of burns) 12(19.35%) and deep burns 3(4.84%). In 13(20.97%), no sign of electrical injury was found, results are similar with others. [7] In addition to electrical injuries, the common injuries were laceration (5) fracture (5) then abrasion (4), and head injuries (2) are associated with a fall due to the electric shock. [7-10] Majority of victims received treatment within one hour 43(69.35%), then between 1 to 2 hours 11(17.74%); more than 2 hours 3(4.84%) and brought dead 5(8.06%) cases. Similar findings made by. [6]

Majority of victims stayed in hospital less than 3 days 40(64.51%) as compared to 3-10 days 16(25.80%) and more than 10 days 1(1.61%) these findings are inconsistent with others. [15] Most of victims were discharged 40 (64.52%) whereas referred cases were 7(11.29%). These results are inconsistent with other studies. [15, 7] Out of total 62 accidental cases 5 cases were brought dead and all victims are males. In this study no suicidal and homicidal cases were recorded. [7-9]

The analysis of medical literature confirms the rarity of suicide or homicide by electrocution. [11, 13, 16] In this study the majority of the fatalities are the result of accidental contact with electricity normally domestic supply. Under estimation of the danger of live circuits carelessness play a part in work place incidents 30 (48.39%), where as ignorance, faulty domestic appliances, frayed or broken flex of electric cables, improper earthing accounts for many of the 16(25.80%) domestic accidents.

The production of electrical injury depends on voltage, amount of current flow, the area of the contact and duration of contact. [13] An electrical burn occurs only if the temperature of the skin is raised enough for a sufficiently long period to produce damage. On the other hand, a glancing contact or fall against conductor results in break in the circuit; in the cases of high-tension supplies the victim is usually repelled violently. [11, 16] The fatal injuries may be then due to fall. It was noted that contact injuries resulted in 49(79.32%) of cases. In 13 (20.96%) cases no electrical burn mark found. There was can be enough current to make it difficult for a person to remove himself from source of current.

From our study, it was noted that electrical injuries are only entry wound in 25 cases, only exit wound in (3.22%) and both entry and exit wounds in 35.48% cases. Flash burns

were found in 25.80% cases. In 20.98% cases no electric burn was found. These results are consistent with studies by others. [1, 5, 7, 15]

In present study the exit wounds were present in the feet, in majority of cases left foot 19.35% cases followed by right foot 9.67% cases and left leg 3.22% cases lastly left hand 3.22% cases. [7, 15] 16(25.80%) flash burns are seen, majority affected face and neck. In 2 cases (90-98%) T.B.S. area is involved; where as in flash burns T.B.S varied from 20-95%. [5, 7] In addition to electrical injuries, are Lacerations (5), fractures (5) are more common than abrasion (4) and head injuries (4). These are associated with electric shock due to fall from electric pole. These results are similar with others also. [7] 59(95.16%) cases were affected by domestic supply where as industrial 3(4.83%). These results are differing from those observed 67% [6] and 84% [2] and 62% [7] and 88%. [15] Low-voltage cases were 42(67.74%) more as compared to high-voltage 20(32.25%). [2-15] An arc produces considerably more burn than a contact that readily transmits the current and the greater the resistance offered by the individual tissue, the greater is the damage. [13] 57 victims were alive, whereas 5 persons dead on the spot.

It is well known that the electric current is particularly more dangerous when it use one of the circuits involving the heart muscle and in this study hands were involved in 37 cases. Electrocution deaths are uncommon and are usually due to ventricular fibrillation from a direct effect on the heart or respiratory paralysis from a direct effect on respiratory muscles, or in cardio-respiratory arrest following damage to autonomic centers within the brainstem. [1-15] Deaths may also be caused by burns and secondary trauma or subsequent multi organ failure. [9, 12] The effects of electricity depend on the voltage, type of current (direct or alternating) the area and duration of contact, skin resistance and path of current flow through tissues and organs [9] and the region of the body in contact with an electrical conductor. [15] Most electrocution is accidental and no suicides and homicides are seen in our study.

These studies are similar to other studies. [3, 5, 9, 10, 15] In 13 cases no electric burn was found. In some cases the victims in contact with water and iron box, three way plug, switch board. Unlike dry skin, wet skin does not offer resistance to the passage of electric current these producing no visible electric burn mark at the site of contact. [11, 13, 15] These findings are similar with others 6.97% and 6% [6] and 7%. [15] Three persons was found to have

consumed alcohol it is well known that consumption of alcohol and consequent intoxication had adverse effects, in form of motor incoordination, increased reaction time, and improper judgment. [13] Among 62 cases, 5 died, and postmortem examination was conducted. In all cases internal organs showed congestion and in one case had diffuse petechial hemorrhage in the brain. Similar studies are conducted by others 74% [10] and 72%. [5] The pathognomonic features of electrocution are the electric marks and joule burn when low or medium voltage current is involved. [11, 13, 15] Electrical marks are not always obvious especially are the hands of manual workers. Among 5 death cases, entry wound in 4 cases, exit wound in 2 cases and flash burn 2 cases noted. These findings are similar in studies conducted by others. [1, 5, 7, 15]

Proof of an electric mark is obtained by histopathological examination. In this context, we had found that histopathological examination could be an important aid in study, where the findings were suggestive of electrical injuries. Of these changes, the most common findings were nucleus streaming, dermo-epidermal junction separation and coagulation necrosis. Electrical injuries frequently represent high temperature burns and this produces characteristic finding of severe thermal denaturation of collagen causing it to stain blue with hematoxylin. The epidermis is often separated and elevated with micro blisters within the squamous epithelium as well as in the horny layer. Nuclei of epidermal cell at the site of an electrical burn frequently show stretching of and narrowing of the contour to produce a palisade type of appearance. This change is often referred as streaming of the nuclei. These findings are similar to studies carried by others. [7, 11, 13] From the present study we conclude that histopathological examination offers an important aid in diagnosis of electrical injuries.

Though fatalities caused by electricity are preventable, still deaths due to electrocution are on the rise. This study revealed that the commonest site of entry wound is palmar and crease fold of hands. The inference is that commonest site of exit wound is feet. This concludes that flash burns mostly affect face and neck. In 13 cases electrical burn marks were not observed, it suggests that the electrical marks not present in all cases. This concludes that the pattern of electrical injuries such as entry wound alone; exit alone, both and flash burns and no external typical signs. All cases were in accidental nature no suicidal and

homicidal cases were observed. This concludes that the manner of electrocution is accidental in nature. From the study conducted it is evident and important that electrocution deaths be through documented and investigated for safety prevention and compensatory reasons.

Summary:

Accidental electrical accidents are more common in both sexes in the age group of 21-30 years. Only 3 children sustained electrical injuries in our study. Electrical injuries are more common in male, rural population, laborers, in day time and at work place is commonest place for accidental. Domestic, low-voltage accidents were more common, and unskilled personnel affected more. Most of the accidents occurred during monsoon and maximum victims are treated within 1 hour. Among 62 cases, 49 cases had contact electrical injuries and in 13 cases no signs of electrical burn marks found, whereas in 16 cases flash burns are observed. Out of 25 cases only entry wound, in 2 cases only exit wound and both entry and exit wounds in 22 cases were observed. 47 entry wounds with both entry and exit wounds noted. Commonest site of entry wound is hand. Of 24 exit wounds with both entry and exit wounds were recorded. Commonest site of exit wound was feet. Of 16 cases of flash burns, majority were affected on face and neck. In 2 cases flash burns extended to 90-98% of TBS. Associated injuries are seen in 16 cases only, majority are lacerations and fractures. Of 5 cases succumbed death, out of 62 cases, postmortem examination was conducted. In all cases internal viscera showed congestion and in one case diffuse brain petechial hemorrhage was observed. High voltage current is the most common factor for fatal injuries.

Recommendations:

The following precautionary measures against electrocution are suggested: Proper precautions should always be taken while handling any electrical fittings or gadgets, water heaters, electric blankets. Constant vigilance in the observance of safety precautions and their extension as may be required is needed to maintain the high degree of safety and maintain standards in industry and the home. Education of the public especially in children in respect of potential dangers is a worthwhile investment. To limit the risk of fire and electrocution to the minimum in the house, the house holders should not only have the wiring of the house approved by the electricity board but also may connection be made only by a professional of repute.

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Table1: Pattern of Electrocution

Pattern	Cases	%
Entry wound	47	75.80
Exit wound	24	38.71
Entry Wound alone	25	40.32
Exit Wound alone	2	3.22
Both entry & exit	22	35.48
Flash burns	16	25.80
No signs of electrocution	13	20.96
Total	62	100

Table 2: Pattern of Entry Wound

Pattern	Cases	%
Head and neck	6	37.50
Thorax	3	18.76
Abdomen	2	12.50
Upper limbs	3	18.75
Whole body	2	12.50
Total	16	100

Table 3: Pattern of Exit Wound

Pattern	Cases	%
Left foot	13	54.16
Right foot	6	25.00
Left hand	4	16.67
Left thigh	1	4.16
Total	24	100

Table 4: Pattern of Flash Burns

Pattern	Cases	%
Right hand	25	53.19
Left hand	9	19.14
Both hands	3	6.38
Head and neck	5	10.63
Right foot	1	2.12
Total	47	100

Figure1: Entry Wound



Figure 2: Exit Wound



Figure3: Flash Burn



Figure 4: Contact Mark



Original Research Paper

Trends of Maxillofacial Trauma at Tertiary Care Hospital in Rural Area of Southern Punjab

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Abstract

A four years retrospective study from was conducted to analyze the pattern and magnitude of maxillofacial trauma in medico-legal cases coming to the casualty of a rural hospital of Punjab. The study revealed that out of 1237 medico-legal cases 130 (10.5%) suffered maxillofacial trauma. The commonest age group prone to maxillofacial injury was between 16-30 years. Male preponderance was quiet evident (6:1). The commonest cause of such injuries was road traffic accident including 83.1% of the total cases. Soft tissue was the most common type of maxillofacial trauma (52.3%). Most common bones involved were nasal bone and mandible (18.5% each) and the commonest associated injury was involvement of limbs (30.0%). Most common weapon involved was blunt (90.8%). Drawing public attention and awareness towards the traffic rules especially use of helmets by the motorcyclists and separation of pedestrians from motor vehicles could possibly reduce the number of maxillofacial trauma cases.

Key Words: Medico-Legal Case, Maxillofacial Trauma, Road Traffic Accidents

Introduction:

Maxillofacial injuries occur in a significant proportion of medico-legal cases and pose a therapeutic challenges to trauma, maxillofacial and plastic surgeons practicing in developing countries [1]. Being the most exposed part of the body face is particularly vulnerable to traumatic injuries. In the rural area road traffic accidents are still the major cause of maxillofacial trauma. This may be due to the lack of enforcement of traffic laws by police and insufficient compliance of the population in obeying traffic rules [2, 3].

The present study is aimed at determining trends of maxillofacial trauma to create public awareness and help guide the development of its preventive measures.

Method:

The study was retrospective analysis from Apr 1st, 2007 to Mar 31st, 2011 of maxillofacial trauma in all medico-legal cases admitted in the emergency department of Adesh Institute of Medical Sciences and Research, Bathinda. The institute is situated in the rural area of South-West Punjab on the national highway (NH-64).

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Information regarding gender, age, demography, mode of occurrence, type of injury was confirmed from the hospital records, victim's attendants and police. The collected data were analysed, observations discussed and compared with other studies.

Objectives:

1. To analyse causative agents and pattern of cases.
2. To draw public attention and awareness towards facial trauma.
3. To suggest preventive measures, this possibly could reduce incidence of these cases.

Observations and Results:

Demographic profile: Maxillofacial trauma contributed for 10.5% (130/1237) of all medico-legal cases attending the emergency department of the institution during the study period of four years. The percentage of male victims (85.4%) was more than the females (14.6%), in the ratio of 6:1 and the commonest age group involved was between 16-30 years (54 cases; 44.6%) followed by 31-45 years (41 cases; 37.7%). (Table 1)

Rural victims (57.7%) were more than the urban which comprised 42.3% of the total cases. (Table-2)

Cause of injury: the most common cause of facial trauma was road traffic accident (108 cases; 83.1%) followed by assault (10 cases; 7.7%) as shown in Table 3. Motorcyclists formed the majority amongst road traffic accidents.

Type of Injury: Out of 130 patients, 68 cases (52.3%) had soft tissue injuries and 58 cases (44.6%) suffered from fracture of different facial bones. There were 3 cases that had fracture or extraction of teeth and one case had dislocation of temporo-mandibular joint (Table 4). Mandible and nasal bone fractures were the most common types of bony injuries comprising 24 cases each (18.5%) as shown in Table 5.

Associated Injuries: The most common associated injury was involvement of limbs (39 cases; 30.0%) followed by head (28 cases; 21.5%) as shown in Table 6.

Weapon Used: Most common weapon involved was blunt (118 cases; 90.8%). [Table 7]

Discussion:

During the period of four years the present study revealed that out of total 1237 medico-legal cases admitted in the emergency department 130 (10.5%) cases presented with maxillofacial trauma. The higher prevalence of males in maxillofacial trauma (6:1) is well documented. [1, 2, 4-7]

It is due to greater male exposure on roads, active social life and drug use. Majority of the victims were between the age group of 16-30 year 54 (44.6%).

This is possibly due to the fact that during this phase of life there is great personal independence, social excitement, intense mobility, careless driving and involvement in violence. [2, 8] Rural victims also outnumbered the urban 1.4:1, which probably is due to less awareness towards the traffic rules.

The most common cause of maxillofacial trauma was road traffic accident 108 (83.1%), consistent with other studies [1, 2, 7-8] and amongst them motorcyclists formed the majority which again signifies the importance of traffic rules and use of protection measures.

Most of the cases suffered from soft tissue injury 68 (52.3%) and fracture of facial bones 58 (44.6%) and the most common bones fractured were mandible and nasal bone 24 (18.5%) each.

This is consistent with other studies. [1, 2, 7, 8] Maximum associated injuries were involvement of limbs and head 39 (30.0%) and 28 (21.5%) respectively. Most common weapon involved in maxillofacial trauma was blunt 118 (90.8%) as face is most exposed part and prone to injuries especially in road traffic accidents.

Conclusion:

Management of injured patient should also be aimed at reducing the incidences of maxillofacial injuries by using preventive and interventional programs.

There is need to ensure strict compliance of traffic rules and regulations, implement improved safety devices in automobiles, use of helmets by motorcyclists, separation of pedestrians from motor vehicles and educating people to obey traffic rules especially at school level and in rural areas could reduce the number of maxillofacial trauma.

Table 1: Age and Gender Wise Distribution

Age Groups	Male	Female	Total	%
0-15	4	5	9	6.9
16-30	54	4	58	44.6
31-45	41	8	49	37.7
46-60	12	2	14	10.8
>60	0	0	0	0.0
Total	111	19	130	100.0

Table 2: Gender & Area Wise Distribution

Area	Male	Female	Total	%
Rural	67	8	75	57.7
Urban	44	11	55	42.3
Total	111	19	130	100.0

Table 3: Cause of Injury Wise Distribution

Cause of Injury	Number	%
RTA	108	83.1
Assault	10	7.7
FFH	5	3.8
Electric Burns	4	3.1
Burns	2	1.5
Railway Accident	1	0.8
Total	130	100.0

Table 4: Type of Injury

Type of Injury	Number	%
Soft Tissue	68	52.3
Facial Bones	58	44.6
Teeth	3	2.3
Joint	1	0.8
Total	130	100.0

Table 5: Type of Bone Involved

Type of Bone	Number	%
Nasal	24	18.5
Mandible	24	18.5
Maxilla	11	8.5
Zygomatic	4	3.1
Orbit	3	2.3
Total	66	50.8

Table 6: Associated Site of Injury

Associated Site	Number	%
Limbs	39	30.0
Head	28	21.5
Chest	14	10.8
Neck	5	3.8
Abdomen	1	0.8
Total	87	66.9

Table 7: Type of Weapon Involved

Weapon	Number	%
Blunt	118	90.8
Sharp	5	3.8
Electric Burns	4	3.1
Flame Burns	2	1.5
Firearm	1	0.8
Total	130	100.0

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Original Research Paper

Serial Bomb Blasts in North-East India: A Postmortem Study

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Abstract

Terrorism has become a global phenomenon and most of the countries, whether developed or developing, are facing terror activities. Recently the terror activities have become a regular feature in India where more than 15 major terrorist strikes occurred from 2008 to 2010. Assam, the gateway of northeast India, on 30th October 2008 witnessed a strategically planned terrorist multiple consequential serial bomb blast attack where more than 13 bombs were exploded within a span of merely 10-20 minutes. The news on the next day indicated the initial death of 66 persons; and 470 sustained minor to severe injuries during the explosions in different places. Out of these ultimately 90 persons had died, which was the highest mortality in any blast in the Assam till that date. The dead bodies of 56 victims were brought to Gauhati Medical College and Hospital mortuary for postmortem examination. During autopsy apart from the demographic data collected on interaction with police, relatives of the victims and inquest papers of every victim, the postmortem findings were recorded in details and the difficulties faced in the management of this disaster in mortuary will be discussed in this paper.

Key Words: Bomb Blast, Injuries, Terrorist, Post-mortem

Introduction:

Terrorism has become a global phenomenon and most of the countries, are facing terror activities for one or the other reasons. The manmade disasters have the potential to rival the natural ones in enormity and the impact on human life. [1] Recently the terror activities have become a regular feature in India where more than 15 major terrorist strikes occurred from 2008 to 2010. The Assam, the gateway of northeast India, on 30th October 2008 witnessed a strategically planned terrorist multiple consequential serial bomb blast attack where more than 13 bombs were exploded within a span of merely 10-20 minutes that was marked as a "never before phenomenon", in its four adjoining districts viz Kamrup, Bongaigaon, Barpeta & Kokrajhar. There is no official data on exact composition of the improvised explosive devices used by the attackers. According to media reports these were executed by the persons involved with modern skills and materials like cyclotrimethylene trinitramine or royal demolition explosive (RDX), pentaerythritol tetranitrate (PETN) and trinitrotoluene (TNT).

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The dead bodies of 56 victims were brought to Gauhati Medical College and Hospital mortuary for postmortem examination. During autopsy apart from the demographic data collected on interaction with police, relatives of the victims and inquest papers of every victim, the postmortem findings were recorded in details and the difficulties faced in the management of this disaster in mortuary are being presented in this paper.

Observations and Results:

The table 1 depicts in sequence septet blasts; first occurred at 11.30 am at three sites and then at the interval of five minutes there was another explosion followed by three more blasts in different parts in a distance of 223km. Most of the victims were in their prime age of 21 to 40 years comprising of 75% of the victims. (Table 2)

Males were six times more commonly involved than the females. (Table 3) Out of the total victims, 36 were from Guwahati and 20 were from outside Guwahati. (Table 4) Victims of blast injuries were predominantly from business class. (Table 5) The thorax plus upper limbs were most commonly (51.79%) affected part of

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the body in this study and head was injured in 35.71% of the cases. (Table 6)

Maximum casualties were due to burns & haemorrhage and shock comprising of 3/4th followed by head injuries. (Table 7)

Table 1: Place, location and timings of bomb blast

Place and location	Date and Time	Distance from Dispur
Ganesh Guri (Guwahati)	30/10/2008 at 11.30 AM (Bomb was planted in car)	0KM
Pan Bazaar (Guwahati)	30/10/2008 at 11.30 AM	9KM
Krishna Nagar (Barpeta Road)	30/10/2008 at 11.30 AM	141KM
Pagalstan (Bongaigaon)	30/10/2008 at 11.35 AM	194KM
DC Court (Guwahati)	30/10/2008 at 11.40 AM (Bomb was planted in two wheeler)	10KM
Pooja Mandal (Kokrajhar)	30/10/2008 at 11.40 AM	223 KM
Fish Market (Kokrajhar)	30/10/2008 at 11.40 AM	223KM

Table 2: Age wise distribution of the victims

Age in years	No. Of cases	%age
0-10	2	3.57
11-20	4	7.14
21-30	20	35.71
31-40	22	39.29
>40	8	14.29
Total	56	100

Table 3: Sex wise distribution

Sex of the victims	No. Of cases	%age
Male	48	85.71
Female	8	14.29
Total	56	100

Table 4: Residential status of subjects

Locality of the victims	No. of cases	%age
Locals	36	64.29
Outsiders	20	35.71
Total	56	100

Table 5: Occupation wise apportionment

Occupation	No. of cases	%age
Govt. servants	7	12.5%
Private business	44	78.57%
Students	5	8.93%
Total	56	100

Table 6: Impact sites of blast over the body

Impacts	No. Of cases	%age
Head injuries	20	35.71
Face and neck	11	19.64
Thoracic and upper limbs	29	51.79
Abdomen	1	1.79

Table 7: Causes of Death in Blast Victim

Cause of death	No. Of cases	%age
Burns	25	44.64
Haemorrhage and shock	16	28.57
Head injury	14	25
Septicaemia	1	1.
Total	56	100

Map: showing relative positions of blast sites in Assam



The map of sites of blast shows that all are in a straight high way

Discussion:

A bomb is an explosive device made up of usually some kind of a container filled with explosive material; designed to cause destruction when set off. The explosion of the bomb has to be triggered, usually a clock, a remote control, or some kind of sensor, usually pressure (altitude), radar, or contact. The description and adaptation or preparations of an explosive is defined in section 4 (d) of Indian Explosive Act 1884. (2) Explosions can be atomic, mechanical and chemical. A bomb blast is a type of chemical explosion. Explosives are classified into low and high explosives. Primary high explosives like mercury fulminate and lead azide are too sensitive to be used in bulk and are ideal for detonators. Secondary high explosives are less sensitive and do not explode on handling. To produce an explosion they must be subjected to shock wave from other detonating explosive, usually supplied by a detonator or blasting cap. [2, 3, 4]

One of the places attacked in this study, Ganesh Guri, is the most bombed site (this was 19th time) in India. The bomb was planted in a car parked under the flyover. Similarly all other places which were targeted are among the most crowded placed.

Maximum numbers of cases were seen in the age group of 20-40 years as persons in this age group are mostly the bread earners of their family and go out for other household works too. In India, being a patriarchal society, most of the outdoor activities are performed by male. So, male were common victims in this attack.

Most of the people dying in the blast were from Guwahati but the city being business centre of Assam, people from other parts of the state were also commonly involved. As the attack targeted most crowded business centres the blasts victims were predominantly people engaged in their own business.

Closed space explosions cause an increase in mean injury severity scores, primary blast injury in admitted patients and overall mortality. [5] Patients injured in open spaces are more likely to suffer from penetrating injury and less likely to suffer from the effects of the blast wave compared with patients injured in semi confined spaces and buses. Victims in proximity to the epicentre of the blast are more severely injured than the victims farther away. The most severe types of thoracic injuries after terrorist attacks are caused by penetrating missiles. Abdominal organs such as liver, spleen and kidneys, which are partially protected by the rib cage, are less frequently injured. [8] Blast induced burns are present in up to 27% of the people injured by an explosion and is associated with immediate mortality and a high rate of coexisting primary blast injury. [5] In our study the most common part of the body injured was combined thorax and upper limbs. Burns was most common type of injury seen on dead bodies of the victims. Burn injuries were common in this attack as the bombs were planted in car or two wheeler in parking due to which the vehicles standing by the side caught fire. Bomb blasts with heavy casualties present an unusual circumstance in the mortuary. In present study there were hundreds of emotional relatives to identify the bodies and they wanted quick disposal of their cases.

Deficiency of police made it more difficult to control the crowd and it created a law and order situation. The staff in mortuary was not sufficient to deal with such a large number of cases and request for more paramedical staff & sweepers were sent to hospital administration immediately. District administration was asked to send executive magistrates and police personnel; to control the law & order situation, to conduct the inquest & other documentary formalities as early as possible. Whole staff was called on duty for faster disposal of cases. The prime objectives of the necropsies are identification, documentation of the injuries and reconstruction of the events. [7]

In present study, 49 bodies were identified by the relatives on the basis of facial features, clothes and personal belongings. Out of 7 charred bodies, 4 were identified the same day based on belongings and 1 was similarly identified next day. Last 2 bodies were claimed by more than 2 families for which samples for DNA analysis were sent to SFSL Kahilipara, (Guwahati) for identification.

Human intelligence is central in preventing such type of terrorist attacks. People are to be more vigilant and should inform the

police immediately if they notice any suspicious object or person. Law enforcement agencies should be strengthened for routine checkup of vehicles. Unlawful use of LPG cylinders for fuel should be severely punished. Parking laws should be properly enforced. Proper technologies like CCTV cameras should be installed in markets & crowded places to nab the culprits. Understanding the modus operandi of the terrorists by security agencies may help in nabbing the culprits and preventing terrorist attacks. [7]

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Fig.1: conglomeration of dead bodies inside the mortuary campus



Fig. 2: Body with stippling on right thigh garment region



Review Research Paper

Application of Genetics and Molecular Biology In Forensic Odontology

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Abstract

Various methods of Forensic Science have been applied to solve many mysteries of world including criminal investigation. Forensic odontology researches are usually associated to the dentist's field of action by using bite marks, dental records and radiographs plays an important role in solving many crimes. These methods help in age determination and sex identification of the people who have lost their identity after death. Nevertheless, since the development of genetics and molecular biology there were an increase in number and quality of solved cases. The present article emphasizes the importance to associate certain forensic biology areas to traditional investigation methods in human identification, especially with forensic odontology. It also shows that in some situations, teeth are an important source to genetic analysis and molecular studies. Finally it was concluded that knowledge of forensic genetics applied to traditional forensic investigations would produce an increase of information to Justice.

Key Words: Forensic Odontology, Genetics, Human Identification

Introduction:

Forensic odontology researches are usually consists of analysis, expertise and evaluation of dentistry related episodes, but it can also be extended to other areas if it is necessary for justice and administration interests. The most common studied area where a dentist acts as a forensic expert is related to oral maxillo-facial trauma caused by different sources such as mechanical, physical and chemical and dental analysis used for human identification. [1]

Development of genetics in the 80's allowed innovations to medical field as well to forensic sciences. This was due to discovery of specific mini satellite regions of human genome which had the so called DNA (deoxyribonucleic acid) "digital impressions". Its analysis led to human individuality information. From that point, genetics research dealing with DNA polymorphism has had a great development

This human identification methodology relies upon three important steps: DNA isolation or extraction, amplification of specific DNA regions using PCR technique (Polymerase Chain Reaction) and molecule profiles analysis. [2] Human individuality identification tests using DNA are based upon polymorphism of several mini and micro satellite loci. This polymorphism in autosomal chromosomes is considered a great individuality indicator. First, in order to do the amplification phase highly specific probes were developed which allow simultaneous scanning in several loci of the sample. After the material amplification using PCR technique, they are analysed in agarose or polyacrylamide gel or in automatic sequencer. Depending on the quality and quantity of the obtained sample, analysis can be done from nuclear DNA or mitochondrial (mt DNA), both show advantages and limitations. [3]

Computer aid in several laboratory steps associated to biotechnology and forensic mathematics increase the reliability of examinations to determine sex, age estimation, parenthood and human identification. Therefore it became mandatory that forensic experts in several areas of criminal investigation, forensic medicine and dentistry would associate classical investigation techniques to molecular biology analysis and DNA examination in order to achieve more reliable, objective and specific results facing complex cases.

Expertise examination must show a multi disciplinary approach; therefore the

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present paper presents a scientific literature review aiming to point out the importance of forensic genetics used along with traditional investigation methods in human identification, mainly with forensic odontology. It also intends to show the tooth forensic relevance as a source of material to genetic and molecular studies.

Molecular Biology Studies:

Nowadays, Forensic Anthropology has molecular biology as a powerful allied, mainly in species, family background, sex and age investigation. Since that, determination of species using bone, tooth, hair or organic fluid samples was done searching for exclusive human molecular indicators. Those indicators are polymorphic and easily detectable in the population. They can refer to a gene, a restricted site or any other DNA sequence which presents different allelic version to that locus. The mechanisms that explain polymorphism can be single changes in nucleotides (substitution) such as SNP (Single Nucleotide Polymorphism), VNTR (variable number of tandem repeats) and STR (short tandem repeats) and the insertion or exclusion of DNA sequences (Indels), such as Alu insertions. It is important to add that some indicators are specific to a determined population, this happens because the difference of frequency between two big populations is more than 50% (such as Europeans and Africans). Those indicators are named ancestor indicators (AIMs). [4]

In order to increase age estimative precision of decomposed bodies such as bones several researches have been developed trying to relate mainly the racemic mixture of aspartic acid (D/L) from tooth tissues with one's chronological age. It is well known that aspartic acid, particularly in its dextrogen form (D), linearly increases along aging. [5] Other biochemical indicators such as gelatinase A and glutamic acid from dentine are also being researched to be used in age estimation. [6]

Human Identification Using DNA:

Genetic material can be obtained from several biological sources such as body fluids, soft tissues and mineralized tissues. When dealing with living suspects in parenthood test (father, mother and son), genetic material is preferably obtained from either blood (leukocyte) or buccal mucosa.

On the other hand, if it is necessary to verify genetic relation involving pot-mortem material, time from death and corpse condition are relevant factors to choose which method of DNA extraction is to be used. In a recent death case blood, viscera and soft tissue are the first

choice of materials, but as time goes by those sources become inappropriate, leading towards the mineralized tissue sources like bones and teeth. Bones are an important source to obtain genetic material since they are located inside the body and are mineralized; also the cortical part protects the medullary part from external factors and micro-organism that may degrade the DNA. [7]

Teeth as Genetic Material Source:

Teeth also are a good source to obtain genetic material. This is true mainly because of their great tissue resistance (enamel, dentin, cementum and pulp) against external injuries. [8] Pulp tissue is a loose connective tissue and it degrades easily when compared to others dental tissues. Dental pulp is protected by tooth structures and therefore can present better condition than others soft tissue for DNA extraction. Lessing et al [9] showed that pulp can be a source of DNA in teeth that had been kept or obtained in different conditions.

Amelogenin can also be studied from dental material that had been through adverse situations. There are several techniques to obtain dental material to extract DNA such as tooth grinding or crushing, tooth horizontal sectioning, pulp extirpation by tooth irrigation and sectioning and nitrogen liquid cryogenic pulverization. [10]

Some legal precautions must be followed when dealing with dental material as source to obtain DNA since the process destroys the material used in the examination. Those precautions involve proper teeth identification, describing all characteristics and if it is possible, taking pictures and radiographs in the original positions when they are removed from dental arch. Those precautions are done to preserve dental characteristics of evidences in order to prove their genuine value when doubts are raised concerning their origin or the results of the person identity.

After the dental recording and filing phase and before the handling of samples, it is necessary to decontaminate dental surface, Sodium Hypochlorite is substance most used, but it is necessary to have an optimization among concentration, time and applying method of this substance. [11]

Multi Disciplinary Approach in Human Identification:

In Forensic dentistry, DNA examination can be used together with traditional techniques showing great results to identify destroyed or advanced decomposed stage corpses. [12] Besides that, DNA analysis obtained from oral

mucosa cells has great importance in dental impressions, also known as bite marks. Normally, the primary investigation approach of this type of evidence is related to the analysis of dental characteristics left in the victim or in the object. Nevertheless, when those marks do not give a conclusive result, biological material collection from the place where bite was applied is extremely important to find the identity of the person who was responsible for the mark. Among the techniques to obtain DNA from human skin there is the double swab technique which consists of applying a swab with distilled water followed by another dry swab on the bite mark. This technique showed good results to obtain biological material to be researched. [13]

In the Borgula et al [14] experimental research was demonstrated that is possible to analyse the genotype of specific bacteria found in the oral cavity (*Streptococcus*) of individuals as an alternative when it is not possible to obtain the DNA of the one who caused the bite mark.

In more complex cases such as presented by Bilge et al [15] a multi field approach investigation was necessary to identify a corpse. Anthropologic techniques, forensic dentistry, computer superposition (face/cranium) and DNA investigation were used. Sex was determined by cranium characteristics and as well by amelogenin analysis. Age was estimated using longitudinal divided crown measurements and computer superposition showed a positive identification between victim facial structures and the found head.

DNA was extracted from dental pulp, bones, muscle tissues and compared to genetic profile of the victim's presumed daughter and wife. Fatherhood indication was verified in 11 examined loci. In another case, Sweet et al [16] presented an identification of human parts from a woman that had been disappeared for 3 years. Investigations showed that the presumed victim had 3 smear cell laminas in the laboratory files. DNA was extracted and compared to genetic profile obtained from the dental sample of the found corpse. The result was positive, showing coincidence in 8 of the 8 examined loci, including amelogenin.

In the identification of charred bodies, the great resistance of mineralized tissues allows the victims to be identified not only by DNA extracted from bone material [17], but also from dental material. Sweet et al [18] showed an identification of a homicide victim that had been

charred with fuel. DNA was obtained from dental pulp extracted from intra osseous third molar.

Facing an overwhelming result presented in the forensic literature and from the even more reliable techniques, DNA examinations and Molecular Biology analysis became an essential tool to help or solve investigation matters that had been considered irresolvable in crime investigation and Forensic medicine. Therefore it is mandatory that those who are in forensic investigations must acquire knowledge about forensic genetics to provide greater justice and benefit the society.

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Review Research Paper

Scenario of Hooch Tragedy in Gujarat State

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Abstract

Currently, the Hooch Tragedy occurred in July 2009 at Ahmedabad, Gujarat, resulting in the death of 136 people from consumption of bootlegged liquor. This was the highest death toll in Gujarat from consuming moonshine since 1989 when 132 people had died in a matter of days in Vadodara. The number of patients admitted in the four hospitals of Ahmedabad-Civil Hospital, V.S. Hospital, LG Hospital and Shardaben Hospital had risen to 276 with nearly 100 needing observation either in ICUs or surgical wards. Embarrassed by the scale of the tragedy in a state where consumption and sale of liquor is officially banned, police swept through Gujarat in search of those, illegally selling home-made liquor.

Gujarat is the country's only state where sale and consumption of liquor is banned in deference to Mahatma Gandhi, a Gujarati who was passionately opposed to liquor. This has led to a proliferation of illegal liquor dens, whose home-made brew is mostly consumed by those from low income families who can't afford high priced drinks available outside the state.

Key Words: Hooch Tragedy, Moonshine Tragedy, Liquor, Brew

Background:

Gujarat had banned alcohol consumption since 1961 as homage to Mohandas Karamchand Gandhi. However bootlegged alcohol, known as Hooch (abbreviation of hoochinoo, name of liquor making Alaskan tribe), is widely available, allegedly under the patronage of the local police. [2] The tragedy happened at a time when the police had clamped down on bootleggers thus creating a shortage of Indian Made Foreign Liquor (IMFL) bottles. Trends of hooch tragedies in Gujarat have indicated that they mostly happen when police takes dry laws seriously and clamps down on bootlegging, because regular drinkers find it hard to let go of the habit, or when bootleggers do good business and the demand is so good that they go to any extent to meet it.

Year	City	Deaths
1976	Ahmedabad	100
1987	Ahmedabad	108
1988	Vadodara	200
1989	Veraval	32
2005	Surat	12

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Gujarat has witnessed several occasions of alcohol poisoning, claiming the lives of more than 400 people after the ban was enforced. [3]

To counter the liquor mafia, the state government in 1997 formed the State Prohibition Department, which was dismantled in 2006 because of a shortage of police personnel. During the tenure of the department there were no incidents of alcohol poisoning in Gujarat. [4] In 1997, the RJP government in Gujarat formed the State Prohibition Department, armed with 3,000 policemen and dozen IPS officers. It could not stop trafficking of alcohol, but effectively controlled bootlegging. Not a single hooch tragedy was reported in its time. But in 2006, BJP Chief Minister decided to dismantle the department to strengthen the state police force, which was facing a 28 per cent shortfall.

The result -- prohibition-related crimes shot up by 26 per cent. The illicit liquor tragedy in Gujarat has claimed many lives. Nearly 136 people have died, and many others have lost their eyesight. The recent hooch tragedy is clearly a result of failed policing. Recognising the failure, the BJP government has decided to build a similar crack team on the 1997 model to counter the liquor mafia. The state government is also planning to revise laws to make punishments tougher. But it seems like a meaningless cycle - building, breaking and rebuilding teams to enforce prohibition. Precious human lives are lost in the process.

Gujarat's government has estimated that it loses Rs 30 Billion [5] (\$ 615 Million, € 441

Million, £ 379 Million) a year in excise revenues from prohibition, hinting at the true magnitude of the state's underground alcohol trade. Several other Indian states have tried prohibition in the past, but all except Gujarat have abandoned it.

Current incident:

On 7th July 2009, ten people died in Behrampura, Ahmedabad [6] after drinking spurious liquor a concoction of country brew with high percentage of ethyl alcohol.

The liquor was brewed in the house of one bootlegger, who also died after consuming the liquor. His death triggered panic in the area. By then, several people were complaining of vision loss, nausea, stomach-ache and uneasiness and were admitted to V S Municipal Hospital. All victims died of heart attack. The death toll rose to 43 next days [7] and crossed 120 by July 12. [8] There were 276 people admitted in various hospitals with nearly 100 of them in intensive care units. [9]

The Forensic Science Laboratory (FSL) report on the Gujarat hooch tragedy reveals that the country-made liquor, consumed by many in Ahmedabad, had a large dose of methyl alcohol – four times the permissible dose - making it lethal. As high as 48% methanol was found from sample of soil stained with Lattha (country-made liquor).[10] In all, 136 people died in Ahmedabad after consuming this liquor.[1] More than 1000 litres of hooch containing methanol was brought to Ahmedabad from Mehamdabad, Kheda district. [11]

Deaths from drinking illegally brewed cheap alcohol are common in India, where few people can afford licensed liquor. Known locally as **Desi Daru** (pronounced THEY- see DAA-roo), illicit liquor is often spiked with pesticides or chemicals to increase its potency. The spirits are sold in plastic sachets that cost less than Rs 10, mainly to poor labourers in the state.

In Gujarat, the problem is worse because the state law prohibits the sale of all liquor. Some people believe that this is happening because producers, police and politicians are all involved in making easy money. According to sources, at least seven police stations in Ahmedabad knew about the hooch sale and did nothing to check it. There are 44 brokers who regularly collect *hafta* (extortion money) from 32 illegal liquor manufacturers and then share the spoils with the cops. There are at least two brokers associated with each station.

Reactions:

After the incident, there had been demands for repealing the prohibition of alcohol

in the state. [12] In a survey, 60 % people agreed that prohibition of alcohol in Gujarat should be scrapped, while 40 % disagreed. Some people believes that 'Dry law' not culprit, hooch deaths in 'wet' places too. It is universally recognised, as also in India - where several states have abolished prohibition on the consumption of alcohol - which the policy leads directly to criminalisation and to illicit liquor. It is what drives the liquor trade underground. Prohibition is an invitation to more such tragedies to take place.

Some people criticised the Gujarat government and claimed that "Blanket prohibition has never worked in this free world". [13]

The Gujarat state chief minister [14] and home minister, whose ministry oversees the state police force has faced calls for his resignation after more than 100 people died from drinking bootlegged alcohol in the western state of Gujarat. Police abetted in bootlegging, hundreds of protesters attacked buses with sticks, threw stones at police and burned effigies of chief minister. Members of a women's rights group raided a bootlegging shop, destroyed the alcohol stocks and handed the owner over to police. The police are hand in glove with the bootleggers and that's how (the illegal business) has proliferated, resulting in this tragedy.

The chief minister appealed to the citizens of Ahmedabad for keeping calm and promised to take deterrent action against the guilty. Under public pressure to crack down on illegal booze, police raided illegal alcohol outlets and rounded up more than 800 alleged bootleggers. They have also arrested the alleged main supplier of the deadly alcohol. Authorities have asked a retired judge to investigate the deaths and suspended six police officers for negligence. However, activists accuse officers and politicians of taking bribes and turning a blind eye to the bootlegging.

Following the tragedy, the police conducted more than 8000 raids in the state, book 6713 persons for violation of prohibition. [15] Chief Minister held a high-level meeting with Home Department officials and top police officers to review the case even as many schools and colleges remained voluntarily closed in view of the "*bandh*" calls given by various organisations to protest against the liquor tragedy. The state government introduced a bill in the state Assembly to amend the Prohibition Law:

Lattha, defined [16] in the proposed amendment to Bombay Prohibition Act 1949, as: "Spurious liquor, which contains methanol or any

other poisonous substances, which may cause harmful or injurious effect on human body or death to a person”

Punishment: [16-18]

- Minimum 7 years and maximum 10 years imprisonment plus fine to anyone manufacturing, selling, buying, keeping or transporting *lattha*
- Capital or life imprisonment to manufacturer, distributor or seller of *lattha* in case of death due to spurious liquor
- Life imprisonment to anyone supplying raw material for manufacturing *lattha* in case of death due to spurious liquor
- One year imprisonment and Rs. 3000 fine to any prohibition or police officer failing to send sample of seized liquor for forensic test
- Vehicle transporting liquor, including *lattha*, not to be released on bond till court judgment.

However, the Bill still remains a Bill as the governor of India is yet to sign on the same. "Stringent laws may not be a sure way of deterring criminals from wrongdoings, but they certainly help in reining them in and later in their prosecution," a government official said.[19]

The amended bill has proposed 7 to 10 years imprisonment for those found guilty of manufacturing, selling or distributing country liquor in cases where consumption of the same does not result in death. The Bombay Prohibition Act 1949 had undergone amendments in 1964, 1978, 2003 and 2005.

The Bombay Prohibition (Gujarat Amendment Act) 2009 makes it mandatory for the police to send the seized consignment of

country liquor to the Forensic Science Laboratory in Gujarat for testing before suitable charges are filed against the culprits.

The seized vehicles in which the liquor is carried are to be auctioned and the proceeds deposited in the state government treasury, the amended bill states.

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Review Research Paper

An Overview of Bite mark Analysis

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Abstract

Human bite mark analysis is by far the most demanding and complicated part of Forensic Dentistry. Although bite marks of an individual do have uniqueness due to specific characteristics and arrangement of the teeth, when it comes to bite mark analysis, it is complicated by numerous factors, being presented as a challenge to the Forensic Odontologists. The aim of this paper is to give a brief overview of bite mark analysis: its usefulness and limitations. The study and analysis of such injuries is challenging and complex. The correct protocol for collection, management, preservation, analysis and interpretation of this evidence should be employed if useful information is to be obtained for the courts.

This article throws light on the details of evidence collection techniques and step by step method to analyse the bite mark injury. It also provides insight about the modern methods now implemented in the analysis of bite marks. Conclusions from the analysis of bite mark evidence can assist the justice system to answer crucial questions about interaction between people present at the scene of crime.

Key Words: Bite marks, Evidence, Comparison, Analysis

Introduction:

Bite mark analysis is currently contentious. [1] It is a vital area within the highly specialized field of forensic science and constitutes the commonest form of dental evidence presented in criminal court. [2] The science of bite mark identification can be used to link a suspect to a crime. Bite mark analysis can elucidate the kind of violence and the elapsed time between its production and examination. It can show if the bite mark was produced intra-vitam or post mortem and in case of several bite marks, identify the sequence of them. [3] It can be extremely useful in establishing a link between the bitten person and the biter or excluding the innocent. [4]

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Collection of Bite mark Evidence:

Two aspects of Forensic significance of the bite marks are the anatomical location and the severity. The third influence on the ability of the injury to be properly assessed is the quality of the evidence collection. [5] Bite mark evidence is collected from both the bite victim and suspect, but it should be remembered that the bite victim could be the suspect in the cases.

Controversies Regarding Bite Mark Evidence:

There are number of factors which can alter the bite mark evidence. Hence there is controversy regarding the legal status of bite mark evidence. Errors in recording, comparison, analysis and interpretations of bite marks may lead to serious consequences. So many attempts have been made to establish "standards" for gathering evidence and interpretation of evidence. [7] The American Board of Forensic Odontology (ABFO) and The British Association of Forensic Odontology (BAFO) has published guidelines which describe that evidence should be collected from both victim and suspect and represent a sound basis for such collection. Deviations from these recommendations may be questioned. [6, 8]

Collection of Bite Mark Evidence from the Bite Mark Victim:

Both in the living and deceased victims the following vital information should be recorded:

- **Demographics**-Name, age, sex, race, case number, date of examination and name of the examiners should be recorded.
- **Location of the bite mark**-Describe the anatomic location, indicate the contour of the surface (flat, curved or irregular) and state of the tissue characters. Underlying tissue-bone, cartilage, muscle or fat
- **Shape of the bite marks**- whether it is round, ovoid, crescent or irregular in shape.
- **Colour of the mark, size of the mark**- Both vertical and horizontal dimensions should be recorded in metric system (figure 1).
- **Type of injury**- due to bite mark may be Petechial haemorrhage, Contusion, Abrasion, Laceration, Incision, Avulsion, Artefact etc.

Data collection from the victim-Bite mark evidence should be gathered from the victim after obtaining authorization from the authorities. Determine whether the bite mark has been affected by washing, contamination, embalming, decomposition etc. [7]

Steps in Examination of Victim:

The most important evidence from the bite mark victim is photography. Numerous photographs of the injury should be taken immediately. Shots would include:

1. With and without the ABFO no.2 scale;
2. In colour and black and white;
3. On and off camera flash (oblique flashes can highlight the three dimensional nature of the same bites);
4. An overall body shot showing the location of the injury;
5. Close-ups that can easily be scaled 1:1;
6. UV photography if the injury is fading;
7. If the bite is on a movable anatomic location, then several body positions should be adopted in order to assess the effect of movement.

All the photographs should be taken with the camera at 90° (perpendicular) to the injury. It has been recommended that bite marks are photographed at regular 24 hour intervals on both deceased and living victim as their appearance can improve. [6] The lighting should be arranged at an angle to shadow indentations which will appear more definite on the positive print, but precautions should be taken to prevent excessive heat from the photographic lamps causing distortion of the material and filters may be used to mask or enhance various shades of coloration that are associated with the marks.[9] Photographs of the bite marks must be of highest standard if the forensic significance of the injury is to be maximized.[6]

In general, photography provides the safest means of obtaining a permanent record of marks. Use of stereoscopic photography is advocated by some authorities to produce greater definition of details, but this method has many inherent problems. Ultra-violet and Infra-red illumination may be necessary under some circumstances to bring out some details that may not be obvious in the normal positive print. [10]

The next step is salivary swabbing. The amount of saliva deposited with a bite mark is about 0.3ml and distributed over a wide area of 20 cm. Points that are helpful in the collection of salivary swabbing are described below—

- One square centimetre piece of Rizla type of cigarette paper held in forceps is used after wetting it with fresh water or distilled water. The whole bite mark and the adjacent area should be swabbed using light pressure and in circular motion. [11] Air dries the paper by placing it on a clear microscopic slide. After drying swabs are packed and sent to the laboratory. A control sample is prepared using same method but without swabbing the saliva.
- Saliva obtained from swabbing is used to determine the blood group antigens using absorption-elution or absorption-inhibition group testing. Identification of saliva is done by demonstrating its amylase activity in hydrolysing a starch substrate.[12]
- In case of sexual assault, oral swabs should also be taken for semen. Mouth washes (with water) can be used to obtain test samples for spermatozoa.[7,11,12]

If the bite marks have penetrated the skin, an impression of the marks should be made. [7] Ordinary plaster of Paris or dental stone was used initially for the purpose, but it was seen that the water soluble substances in the material would leach out and delicate surface lesions would be destroyed. Therefore less damaging materials like rubber-base and silicone-base impression compounds are preferred now-a-days. [9]

There are two methods for making impressions:

Method I: Pour the material covering the bite area. Place wire gauze and inject additional material over it.

Method II: A special tray is constructed using cold cure confining to the shape of bite mark and impression is made.

Master casts must be poured with type-IV stone and duplicate casts should also be made. Either visible light cure or epoxy resin

clear material may be used to make stable rigid model.

Bite print recording is similar to the method used to lift finger prints from crime scenes, finger print lifting tape can be used to lift the “non-perforating” bite marks after brushing the bite mark with finger print lifting powder.

In case of dead victims with bite marks, bite marks can be excised along with the underlying tissues after fixing an acrylic stent around the bite mark to avoid shrinkage of the tissue. The specimen is then stored in 4% formalin. [7] One interesting development in the collection of bite mark evidence from the bite mark victims is the acquisition of 3D images of the bite mark. This is performed using specialist software, such as that produced by Lumin IQ and enables by assessment of grey scale levels, a three dimensional rendition of standardized images. They may offer a means of demonstrating the depth of an injury without the problematic use of skin impressions. [6]

Collection of Bite Mark Evidence from the Suspect:

The collection of evidence from the bite suspect must commence only after proper consent has been acquired. [6] The consent has to be written, signed by the suspect as well as a witness. [9] A detailed history of the individual including history of dental treatments (after and just before the bite marks) has to be noted. [7]

Evidence collection again begins with copious photography. Shots that should be taken include:

- Overall facial shot;
- Close-up photograph of the teeth in normal occlusion & biting edge-to-edge;
- Photograph of the individual opening mouth as wide as possible;
- Lateral view. [6]

After the photographs, a thorough examination of the individual should be carried out. TMJ status, facial asymmetry, muscle tone, maximum opening of mouth, deviation while opening & closing movements have to be recorded under extraoral examination. Intraoral examination includes tongue movements, periodontal status and dental examination. [7, 11] A full dental examination is carried out completing a detailed description of the teeth present and missing, the associated restorations and carious lesions and information on the degree of attrition of teeth and measurements of individual teeth and spaces. Any abnormalities in tooth form or arch form are noted together with the relationship of the opposing teeth and jaws. [9, 11] The next stage is to take two high

quality impressions of both the upper and lower arches.

If the individual wears a dental prosthesis, impressions should be taken with this being worn and also without. [6] One set of models is used as direct evidence and the other set for the purpose of comparison. [9] Alginate can be used for making impressions, but the preferred material being rubber or silicone based impression material due to its dimensional accuracy and as they can be poured multiple times, if required. (Figure 2 & 3)

The next stage is to take registrations in the dental wax in centric occlusion, edge-to edge bite and in protrusive and lateral excursions of the jaws.

These positions are again duplicated and the one set of wax bite registrations can be used to set the study models on a dental articulator and the other set of wax bite registrations used for comparison of the imprints with those of the bite marks. [9] If indicated, a buccal swab should be taken of the suspect in order to obtain a DNA sample. [6]

Bite Mark Analysis, Comparison and Evaluation:

Bite marks are never considered accidental, although some injuries caused by teeth (for example a child accidentally strikes his/her parent in the mouth leaving tooth marks on the hand) may be. The American Board of Forensic Odontology provides a range of conclusions to describe whether or not an injury is a bite mark. These are:

- a) **Exclusion** – The injury is not a bite mark.
- b) **Possible bite mark** – An injury showing a pattern that may or may not be caused by teeth could be caused by other factors but biting cannot be ruled out.
- c) **Probable bite mark** – The pattern strongly suggests or supports origin from teeth but could conceivably be caused by something else.
- d) **Definite bite mark** – There is no reasonable doubt that teeth created the pattern.

The first stage of analysis is to determine if the injury is a bite mark, and then to provide a statement on the forensic significance. [6] While evaluating the bite mark firstly the cause of the mark has to be determined, since bite marks may be caused by nonhumans or humans. [7]

1. Size, shape and arrangement of teeth:

Human incisor teeth produce rectangular marks whereas canine teeth produce triangular

marks in the cross-section. Animal bites (dogs, cats) usually puncture the skin and the cross-sectional size of the tooth is small and circular. Number of incisor teeth and the distance between individual teeth may be greater with animal bites.

2. Size of Dental Arch:

Width of adult arches from canine to canine is 2.5-4cm. Children arches are smaller than the adults whereas 'dogs and cats' arches are smaller than children.

3. Evaluation of the bite mark photographs:

Attempts should be made to thoroughly analyse the bite marks in vivo and in vitro rather than mere superimposition of marks in the photographs over the models.

4. Evaluation of the arches:

Shape of the arch should be noted. Central lines of upper and lower arches should be established

5. Suction marks:

The presence of suction marks in the centre of the arch marks is a sign of bite marks of human origin. But now it is considered that suction marks are caused due to injury to the blood vessels when compressed between the jaws of the biter.

6. Characteristics in the mark:

Ascertain the characteristics of individual marks within the arch. Areas of injuries may indicate occlusal level of particular tooth or sharp cusp. Tooth numbers should be identified. Placement of tooth marks in the arch and missing teeth should be noted.

Pattern analysis in bite marks

It is the assessment of the bite pattern that often serves to be most revealing. [6]

Comparison techniques for bite mark analysis can be classified as direct and indirect methods. They use life-size 1:1 photographs and models of teeth.

In direct method, model from the suspect can be directly placed over the photograph of the bite mark to demonstrate concordant points (figure 4). Videotape can be used to show slippage of teeth producing distorted images and to study dynamics of the bite marks.

Indirect method involves preparation of transparent overlay of occlusal or incisal surfaces of teeth which are then placed over the scaled 1:1 photographs of the bite injuries and a comparison is undertaken. If overlay analyses are restricted to those bite marks displaying unique characteristics, the process in the hands

of an experienced odontologist can be highly accurate. [6, 7, 13, 14]

There are five main methods of bite mark overlay production—

- Computer-based;
- Two types of radiographs
- Xerographic; and
- Hand-Traced.[15]

For many years, hand-traced overlays were the method of choice. According to Sweet & Bowers, computer-generated overlays were by far the most accurate in terms of both tooth area and rotation. Results demonstrated that both the main techniques were reliable, and the choice of method was down to personal preference. [15]

Odontometric triangle method: In this objective method, a triangle is made on the tracing of bite marks and teeth models by marking three points, two on the outermost convex points of canines and one in the centre of the upper central incisors. Three angles of the triangles are measured and compared. (Fig. 5)

Other special methods in bite mark analysis:

- **Vectron** –used to measure distance between fixed points and angles.
- **Stereometric graphic analysis** – This can be used to produce contour map of the suspect's dentition.
- **Experimental Marks** –may be produced on pig skin, baker's dough or rubber for analysis.
- **Scanning Electron Microscopic** analysis of bite mark wounds [7,16-18]
- **Image perception technology** [19]

However, while the overlay production method has been shown to be reliable, the application of these to the bite mark photographs and the assessment of degree of match has not much scientific support. Again, a range of conclusions is available to odontologists to describe the results of a bite mark comparison:

- **Excluded-** Discrepancies in bite marks and suspect's dentition.
- **Inconclusive-** Insufficient forensic detail or evidence to draw any conclusion on the link between the two.
- **Possible biter-** Teeth like the suspect's could be expected to create a mark like the one examined but so could other dentitions.
- **Probable biter-** Suspect most likely made the bite; most people in the population would not leave such a bite.
- **Reasonable medical certainty-** Suspect is identified for all practical and reasonable purposes by the bite mark. [6]

Human anterior teeth are unique and that this asserted uniqueness is replicated on the

bitten substrate in sufficient detail to enable a match to a single individual to the exclusion of all others. [20] While many cases have bite marks with good unique details, in majority it is not and therefore caution should be taken while assessing any bite mark injury using pattern analysis. [6]

Bite marks and DNA:

Use of DNA in bite marks was pioneered in an effort to eliminate the subjectivity associated with conventional analyses. [21] While the recovery of DNA from saliva has been reported, it is not always assured. It has been proposed that the presence of nucleic acid degrading enzymes (nucleases) within saliva can readily degrade DNA, especially if it is on a living victim, as the skin's ambient temperature accelerates the process. [6] As human mouth contains over 500 distinct species of bacteria, and every individual will have a slight different combination, dependent on oral hygiene status, dental status and presence or absence of prosthesis. One research group has suggested that the genotypic identification of oral streptococci may be of use in bite mark analysis. [22]

Therefore, it appears that the technique is a valuable addition to forensic dentistry although its use will be limited by the access to the expertise and equipment to undertake it. [6]

Bite marks on inanimate objects:

It is important for both, investigative Professionals and Odontologists to be aware that bite marks in an inanimate objects can be of assistance in criminal investigations, although the same principle of bite mark assessment applies i.e. the bite must hold a high level of forensic significance before it can be considered for comparison to a suspect for the purposes of identification. [6]

In literature, bite marks are found in a variety of non-human substrates like pencils, pacifiers, envelopes, bank books, wooden cabinets, pipe stems, and mouth pieces of musical instruments and more commonly in food stuffs such as apple, cheese, sandwiches, chocolates, chewing gums etc. [7, 23, 24]

Since the bite marks in food substances may produce exact mesiodistal dimension of teeth, records should be made as soon as possible. Saliva swabbing can be taken from the bite marks for blood group analysis or DNA analysis. [7, 12] The Forensic value of bites in non human materials is based upon the nature of the material itself and in case of perishable items, how long ago the bite took place and

what steps were taken to preserve the object. [25]

Preservation and Analysis of Bite Marks in Inanimate Objects:

Storage of the food materials with bite marks can be done by placing them in airtight bags and then refrigerator or by using preservative solutions made up of equal parts of glacial acetic acid, formalin and alcohol. Long term preservation can be done by taking photographs and by preserving models.

In case of bite marks in inanimate objects like cheese, chocolate, apples etc. a 'docking' procedure may be undertaken. The dental model of a suspect is applied to the cast of the bitten object to determine if they 'dock' or match. Such analyses are relatively simple and are easily documented for presentation in court. Bites on flat surfaces like paper can be analysed using an overlay technique, similar to skin. The conclusions that are reached are the same as those for traditional bite mark analyses. [6]

In a bite mark analysis two simultaneous and opposite paths develop. The inclusive path is one in which the unique features of a suspected biter's dentition show a strong and consistent linking in a tooth-by-tooth and arch – to-arch comparison with the pattern recorded in the bitten skin or object. The exclusive path is one in which the suspected biter's dentition does not show linking with the bite mark injury in an arch-to-arch and tooth-by tooth analysis. It is usually the exclusionary process that is accomplished more frequently and easily than the inclusionary path. [7]

Conclusion:

The serious nature of the crimes in which bites are found often dictates that the highest level of Forensic standards should be applied and need for individuals trained and experienced in the recognition, collection and analysis of this type of evidence is increasing. Analysis of such injuries should only be undertaken if unique or, in certain circumstances where class characteristics exist. With recent advances in research, more objective methods of bite mark analysis like salivary DNA recovery and bacterial genotyping have become the main stay of investigation in such crimes.

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Fig. 1: Measurement of bite mark



Fig.2: Impression of dentition of an individual using rubber base impression material



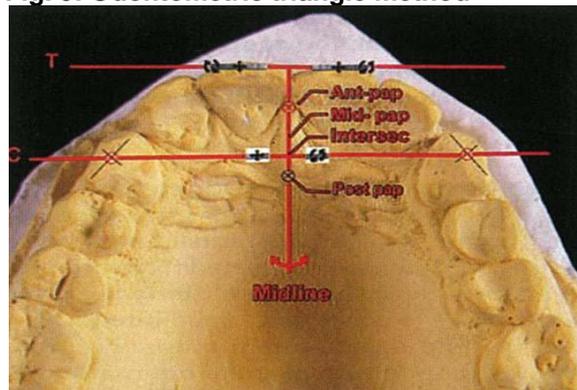
Fig. 3: Master cast (after making impression of dentition)



Fig. 4: Comparison of model from the suspect with given bite mark



Fig. 5: Odontometric triangle method



Review Research Paper

Second Autopsy: The Indian Scenario

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Abstract

A Medico-legal autopsy is conducted to ascertain the cause of death, time of death, identification of the deceased, etc. in unnatural and/or suspicious deaths. However, the very purpose for which an autopsy is conducted may either not be served or appear to be poorly served in many a cases. In such times, another autopsy is requested and conducted on an already autopsied body commonly known as second autopsy. Rules are still unclear & varying for medico legal autopsy at different places resulting in unwarranted issues. This has resulted in a surge seen in cases of second autopsy or re-postmortem examination. With no rules governing the conduct of even a second autopsy and the sorry state of medico-legal autopsies as such in India, a lot of issues, wanted and unwanted, creep up while conduct of a second autopsy.

An effort is made to draw attention towards the issues associated with the conduct of a second autopsy in India and few suggestions proposed to overcome those difficulties.

Key Words: Medicolegal, Second autopsy, Re-post-mortem examination

Introduction:

A medico-legal autopsy is conducted to ascertain the cause of death, time of death, identification of the deceased, etc. in unnatural and/or suspicious deaths. However, the very purpose for which an autopsy is conducted may either not be served or appear to be poorly served in many a cases. In such times, another autopsy is requested and conducted on an already autopsied body. For sake of convenience of understanding, this may be labeled as a re-postmortem examination or a second autopsy. There are certain conditions that are confused as second autopsy but do not come under the ambit of second autopsy. They include request by an autopsy surgeon for assistance from another surgeon, psychological autopsies and expressing of opinion from the photographs, radiographs, records of the autopsy. Even exhumation per se does not include a second autopsy.

In recent years, there has been an upsurge in demand for a second autopsy. It may not always dispel the doubts arising in the mind of the person making a request for the same and may not serve the purpose it is intended to serve. In fact, sometimes, it may actually create more confusion than help; for e.g. the sensational Tandoor murder case of New Delhi [1995], where two autopsies conducted on the same body showed two different causes of death (burns and firearm injuries) and the Scarlett Keeling Case of Goa [2008], where the two autopsies concluded with two entirely different causes and manners of death (drowning and homicide following rape.)

This perplexity arises mostly because of first autopsy being incomplete. Also second autopsy may sometimes be erroneous as many artifacts get introduced during the first autopsy. The body may have been cremated, buried, coffined or embalmed after the first autopsy thereby adding many other unsuspected artifacts that create confusion in diagnosis. Also, some poisons get destroyed with passage of time and are not detectable from the samples collected during the second autopsy. [1]

Barring a few disadvantages, there are some advantages too in performing a second autopsy. It helps to clear the doubts arising in the minds of the relatives who are not satisfied with the report of the first autopsy when the cause of death remains unchanged even after second examination. In cases of first autopsy being incomplete, a subsequent meticulous

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autopsy may demonstrate the findings that lead to the real cause of death.

Wherever the identity of the deceased is in question and the second autopsy is being conducted for establishing the same, some excellent material can be obtained from the second autopsy like the hairs, teeth, personal effects, etc. in addition to finding of deformities, implants, dentures, etc.

Scenario:

In India, second autopsy is most commonly requested by relatives who are not satisfied with the findings of the first autopsy. In some instances, the request for a second autopsy is being made by the investigating agencies for expert opinion concerning the first autopsy wherein some questions have been left unanswered or some issues unattended. Also when there is a suspicion that the doctor conducting the first postmortem has some interest in concealing the facts/not bringing out the facts of the examination, a second autopsy is requested. In cases where involvement of the police is suspected in concealing facts, the request for a second autopsy is being asked after the body has been shifted out of the jurisdictional area of the investigating authority where the first autopsy has been conducted.

Most of the medico-legal autopsies in India are done at primary and secondary health centers by medical officers having the basic MBBS qualification. They do not have adequate hands-on training in autopsy techniques. The situation is worsened by unavailability of adequate basic facilities for conduct of an autopsy. Many primary health centers do not even have a designated room for conducting autopsies, and the body is usually examined on the stretcher itself in a corner vacated for this purpose. Autopsies conducted in such situations are bound to be incomplete and inaccurate and is the first thing that strikes at a second autopsy. All the body cavities are not opened leave alone examined. Therefore, at second autopsy, almost always the first autopsy surgeon finds himself at receiving end, as all the fingers point towards him for conducting an unsatisfactory examination.

Moreover, there have been instances where a second examination has been done at the same centre where first examination was done. This leads to persistence of doubt in the minds of the requesting party regarding veracity of the second autopsy.

There are no set guidelines all over the country as to the jurisdictional limits where a body can be sent for re-examination. Some

states have clear jurisdiction still it is open to the next of kin where he wants a second autopsy to be conducted. Procedural delays are common and with lack of storage facilities, improper transportation and high temperatures, most of the bodies start getting decomposed and organs autolyzed, making it difficult to get a correct opinion at second autopsy. [2]

In India, it is a frequent habit to send whole organs for examination especially for histopathology. In such cases, no opinion can be afforded in respect of such "missing" organs [Recent classical case at Goa of the British teenager, Scarlett Keeling whose body when re-examined (third examination) in the UK was found to have some organs missing]. On some occasions, organs/tissues are being retained as teaching material for academic purposes without appropriate consent/information. [3] Such organ or tissue usually is, or could be the one with the most significant findings of the case. Opinion of the doctor conducting the second autopsy is hence, based only the material made available to him for review and may not always be the correct or complete opinion.

In India, the commonest mode of disposal of dead body is by cremation. When doubts arise thereon, only ashes available are sometimes sent for expert opinion by requesting a second autopsy.

Another recent trend has been seen where the party requesting for a second autopsy wants one of its representative to be present during the conduct of second autopsy. In India, usually no outsider is allowed to witness any medico-legal autopsy, though there are no written rules for the same. As a result, many a times, during the second autopsy, an outsider is being allowed to be present in the autopsy room, which is an unwanted and unhealthy practice.

Suggestions:

Basic facilities for conduct of an autopsy like autopsy block, instruments and refrigeration facilities should be provided to all the PHCs along with basic hands-on training for all doctors who are supposed to conduct autopsy, so that the first autopsy will be complete and informative.

General guidelines need to be framed, followed all over the country, as to which cases can be subjected for second autopsy. Only executive magistrates should be empowered to order a second autopsy. In no case should the police be allowed to take a decision regarding the conduction of a second autopsy. What may start as a "one-off case" may become precedence and not before long would become

a routine? Only a magistrate can remove the element of arbitrariness in deciding what cases need a second examination on merits of each case. This shall reduce the number of unnecessary second autopsies. Also the absence of guidelines regarding the referral centre to which an autopsied body is to be taken for re-examination, can raise allegations of arbitrariness and can result in unnecessary demand for a third examination. Hence, jurisdictional limits should be formulated so that one is clear where to go for a second autopsy. This shall help in reducing procedural delays and also help in preventing the bodies/ organs from getting decomposed.

Minimum requirements for conduct of a second autopsy should be laid down with respect to requisition letter, availability of first autopsy report etc. Second autopsy should not be allowed to be conducted at the same centre where the first autopsy was conducted. Moreover, at another centre, the doctor conducting the second autopsy must preferably be a person of the rank of Professor of Forensic Medicine of a Government Medical College. It would be best if a panel of doctors is formed, that includes a surgeon/ gynaecologist/ pathologist etc., depending upon the case.

The usual practice of sending the whole organs for histopathology or chemical analysis or microbiological examination should be dropped/ discouraged. Instead, only those parts that are required for further examination should be removed and accordingly documented too. Also for teaching purpose, pathological specimens should be collected only after getting consent from the police and relatives, which should be properly recorded.

With regards to availability of material after cremation, nothing much can be done on this issue. Only if the body is buried, a second autopsy can provide some useful information.

As in all autopsies, no third party should be allowed to be present during the conduction of the second autopsy. Instead, as is a routine with custodial deaths in India (as per the recommendation of the National Human Rights Commission), videography of the second autopsy may be allowed to remove suspicion and to keep a permanent record that itself would avoid future re-examinations. Routine videography of all autopsies would be a financial burden on the state with minimal benefit (keeping in view the number of second autopsies in comparison to the total number of autopsies conducted) and hence cannot be recommended as a remedy to prevent incidences of second autopsies.

Conclusion:

The rules for conduct of an autopsy are clearly laid down in Indian law. But there is no mention of any specific rule that govern a second autopsy. With so many issues raising a question mark regarding usefulness of a second autopsy, its time that guideline be framed and followed. In the absence of such rules, the natural inference is that the rules that apply for a first autopsy also apply for the second one.

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Review Research Paper

Voice Fingerprinting: A Very Important Tool against Crime

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Abstract

In the recent world of technology, there are many methods to determine the individuality of a person. One of them is the voice – unique individual characteristic. Each person's voice is different because the anatomy of the vocal cords, vocal cavity, oral and nasal cavities is specific to the individual. Comparison of two recorded speech by means of spectrogram or voice prints for the purpose of identification is called as Voice fingerprinting. Forensic voice analysis has been used in a wide range of criminal cases such as murder, rape, drug dealing, bomb threats and terrorism. Investigator has two complementary ways of making identification through voice analysis. First, he or she will listen to the evidence sample and the sample taken from the suspect, comparing accent, speech habits, breath patterns and inflections. Then a comparison of the corresponding voiceprints is made. In this paper we discussed about the history of sound spectrogram, basic method of recording the voice & comparison, its utility in the solution of crime & admissibility in the court of law.

Key Words: Voice fingerprinting, Forensic phonetics, Sound spectrogram

Introduction:

Sometimes voice is the only clue for police & Forensic Scientists to identify criminal. Especially in cases of telephoned bomb threat, demand of money in kidnapping cases etc. Speech sounds come from the vibration of the vocal cords inside the larynx or voice box. The cavities of the mouth, nose, and throat act as resonators, making the sounds louder. The teeth, lips, tongue, hard and soft palate are the articulators that shape the sounds into speech. [1] Each person's voice is different because the anatomy of the vocal cords, vocal cavity and oral and nasal cavities is specific to the individual. People in different parts of a country speak with different accents. Some people run their words together, while others talk with pauses between their words. Identification is done by analyst by comparison of two recorded speech by means of spectrogram or voice prints. [1]

Forensic specialists who examine spoken or written materials in relation to legal matters and crimes are known as Forensic stylists or forensic linguists.

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Suspects knowingly or unknowingly leave recordings of the voices on the telephone, voice mail, answering machines, or hidden tape recorders, and these samples can be used as evidence. Forensic voice analysis has been used in a wide range of criminal cases such as murder, rape, drug dealing, bomb threats and terrorism. [2]

History:

In 1867, Melville Bell (Father of telephone inventor Alexander Graham Bell), an expert on philology (the study of language) and phonetics (the study of spoken sounds), created a system of hand written symbols that could represent any spoken sound on paper. He called his system "visual speech." Lawrence G. Kersta, a physicist and engineer at Bell Telephone Laboratories in Murray Hill, New Jersey invented the sound spectrograph. [1]

Early form of the sound spectrograph, or automatic sound wave analyser was invented by Bell laboratory engineers in 1941. During World War II, it was used to identify voices making German military communications over the radio. [1]

Method:

In the classic sound spectrograph, sounds are recorded on a magnetic disk and sent to an amplifier, which makes the sound more intense. The sounds then go through a scanner or frequency analyser, which separates the sounds into different frequencies. Frequency is a measurement of how often the molecules of

the air vibrate as sound waves pass them. A filter selects a group of frequencies and, with the help of the analyser, converts them into electrical signals. These signals move the pen like stylus, which marks paper on the recording drum. The stylus produces a series of jagged lines that show both the frequency and the intensity or loudness, of the sounds.

The process is repeated with other groups of frequencies. Kersta's new sound spectrograph had four parts: a tape recorder-player, a scanner or frequency analyser, a filter, and a stylus. Today many parts of a sound spectrograph are computerized. [1]

The spectrograph's printout is called a spectrogram. Each spectrogram shows 2.5 seconds of spoken sounds, represented as a graph. The vertical axis indicates frequencies of the sound & horizontal axis shows the time. The spectrogram reflects the fact that each sound of the human voice actually consists of many sounds occurring at the same time. The most important of these sounds are called fundamentals. Fainter overtones called harmonics occur at pitches above those of fundamentals. The spectrogram shows the frequencies of both fundamentals and harmonics. [1]

The analyst first listens to the two tapes repeatedly, trying to detect similarities and differences in the way the voices make single sounds and groups of sounds, the way breathing interacts with the sounds, and unusual speech habits, inflections, and accents. At the end of the examination, the analyst reaches one of five conclusions: The samples definitely match, the samples probably match, the samples probably do not match, the samples definitely do not match, or the test was inconclusive. An analyst must find 20 points of similarity and no unexplainable differences in order to declare a definite match. A definite non match requires 20 or more differences between the two tapes. [1]

However, there is no international standard for the minimum number of points of identity needed in this comparison. In brief, the investigator has two complementary ways of making identification through voice analysis. First, he or she will listen to the evidence sample and the sample taken from the suspect, comparing accent, speech habits, breath patterns, and inflections. Then a comparison of the corresponding voiceprints is made. [2]

Utility:

In 1960, device was used by New York City Police to solve the mystery of series of telephone calls threatening to place bombs on

planes. Kersta claimed that sound spectrography could be used to tell one person's voice from another with accuracy greater than 99 percent. Even when professional mimics were asked to imitate others' voices, original voices from the imitations can be easily separated by looking at their spectrograms. [1]

It is use for studying language by scientists and helping people with speech or hearing problems by therapists. Voice identification is sometimes used for security purposes as well. Aside from helping to uncover information, phonetics can be helpful in interpreting meaning from the sound of speech. Again, a simple example would be the difference in meaning between the following statements: "I like it" versus "I like *it*" versus "I *like* it." All three are written the same but spoken quite differently and because of different emphasis carry a different meaning. [3]

Voice analysis has also been applied to the investigation of tapes said to be made by Osama bin Laden, the world's most wanted terrorist at one time. Since the terror attacks in New York and Washington on September 11, 2001, bin Laden has apparently issued a number of video and audiotapes. This signifies that Forensic voice analysis has been very useful in the current trend terrorism. [2]

Isshiki et al (1964) have presented classification system for hoarseness using spectrograms. Cooper (1974) reported spectrographic analysis as a tool to describe and compare fundamental frequencies & hoarseness in dysphonic patients before and after vocal rehabilitation. The voice spectrogram will have significant use in the evaluation of medical treatment for voice disorders too. [4]

Discussion:

Oscar Tosi of Michigan State University have said that they dislike the term voiceprint because it suggests a greater degree of precision than may be justified. Accurate voice identification is difficult because individual voices change constantly. No one says the same word or speech sound twice with exactly the same frequencies and intensities. Emotion, physical health, and changes such as the wearing of dentures (false teeth) can affect the sound of a person's voice. [1]

Voices also alter, sometimes strikingly, with age. Many phoneticians believe that the voice not only changes over time from aging and growth, but also from temporary factors such as stress, illness, and intoxication. If a person moves from one country or region to another, his or her accent may change. [5]

As computer scientists say, "Garbage in, garbage out": If data being analysed are incorrect or unclear, conclusions drawn from the analysis will probably be incorrect as well. "Garbage" may come from sounds in the background, such as other voices, music, or the noise of machinery. Michael McDermott and Tom Owen say that some examiners reject up to 60 percent of the samples of unknown voices sent to them because the quality of the samples is too poor for accurate analysis. Experienced spectrographic analyst Tom Owen told Katherine Ramsland in an interview reprinted in Court TV's online crime library, "When you're comparing a known and an unknown voice using a verbatim exemplar [both voices speaking exactly the same words], there are no errors." [1]

On the other hand, Jonas Lindh of the department of linguistics at Goteborg University in Sweden claimed in a 2004 paper, "Several experiments have shown that spectrograms are not reliable to verify identity." [6]

However, in one analysis of 2,000 cases by the Federal Bureau of Investigation, the error rate in both false identification and false elimination of suspects was found to be very low. Voice identification played a key role in the investigation of the crimes of Peter Sutcliffe, the so called Yorkshire Ripper, who murdered several women in the North of England in the late 1970s. [2]

Katherine Ramsland writes in her series of articles about Voiceprints in the Court TV online crime library, "All of the studies that have been done on spectrographic accuracy, including a 1986 FBI survey, show that those people who have been properly trained and who use standard aural and visual procedures get highly accurate results. The opposite is true where training and/or analysis methods are limited." [7]

Voice analyst Steve Cain calls the technology "a very important tool in the arsenal against crime." Voice can be altered electronically as man's voice can be altered to sound convincingly like a woman's. There are several different electronic means of voice alteration. One type is known as speech inversion. Here, the frequency signal is in effect turned inside out around a designated frequency. Put another way, the parts of the speech that are "high" are made to sound "low," and vice versa. Another means of electronic voice alteration is known as speech encryption. Here, speech is digitized and the digital signal manipulated to make the text of the speech unrecognizable to the listeners ear. But the

speech can be decoded, or decrypted, at the receiving end to yield the original recognizable speech. [2]

Application in the court of law:

The Michigan state police set up a voice identification unit in 1966. Sound spectrograph evidence was first admitted into a court in 1967 during a military trial (court-martial), United States v. Wright. Judge Ferguson wrote a lengthy dissent, saying that voice identification by sound spectrograph did not meet the Frye standard of general acceptance by the scientific community. [1]

The first reported application of the voiceprint technique in a criminal proceeding occurred in the 1966 case of People v. Straehle. The defendant, a police officer, had telephoned the operator of an illicit gambling enterprise to warn him of an impending police raid. Later, during a grand jury inquiry, the police officer denied making the call. At the ensuing perjury trial, the prosecution introduced voiceprints of the telephone calls and sample voiceprints of the defendant's voice, supported by the expert opinion of Lawrence Kersta that all recordings were of the defendant's voice. [8]

When voiceprint evidence is admitted, it is used mainly to support other evidence. Law enforcement personnel may even, with court permission, tap a phone to acquire information that can potentially be useful in a prosecution. [2] Voice print analysis is inadmissible in the federal system. Under the proposed fusional framework, this Forensic Linguistic Analysis Techniques (FLATs) fails under the Daubert standard of expert testimony. [9]

In 1976 the New York Supreme Court pointed out, in the case of People v. Rogers, that fifty different trial courts had admitted spectrographic voice identification evidence, as had fourteen out of fifteen U. S. District Court judges, and only two out of thirty- seven states considering the issue had rejected admission. The Rogers court stated that this technique, when accompanied by aural examination and conducted by a qualified examiner, had now reached the level of general scientific acceptance by those who would be expected to be familiar with its use, and as such, has reached the level of scientific acceptance and reliability necessary for admission. [10]

The Indian Evidence Act, prior to its being amended by the Information Technology Act, 2000, mainly dealt with evidence, which was in oral or documentary form. Nothing was there to point out about the admissibility, nature and evidentiary value of a conversation or

statement recorded in an electro-magnetic device. Being confronted with the question of this nature and called upon to decide the same, the law courts in India as well as in England devised and developed principles so that such evidence must be received in law courts and acted upon. [10]

In India at Chandigarh Forensic Science laboratories voice identification techniques are regularly conducted and the Supreme Court has held that voice identification data is admissible in court. In India at Bangalore, SRC Institute of Speech and Hearing has the facility for voice analysis. The All India Institute of Speech and Hearing, Mysore, which has been working in the field for many years now, even wants to start a one-year PG Diploma course in forensic voice analysis. [10]

Conclusion:

The introduction of spectrographic identification in criminal proceedings raises significant evidentiary problems, primarily concerning the question of relevancy but its utility can't be neglected against the crime. However, acceptance of voiceprints has never obtained the acceptance that fingerprints have, and voiceprint analysis remains a controversial subject. The technique of voice identification by means of aural and spectrographic comparison is still an unsettled topic in law. Although the spectrographic voice identification method has progressed greatly since it was first introduced

to a court of law back in the mid 1960's, it still faces stiff resistance on the issue of admissibility in the courts today.

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Review Research Paper

Pathological Autopsy: Most Valuable Aid in the Present Medical and Medico-Legal Scenario

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Abstract

It is a fact that the advancements in medicine would not have been possible without the help of autopsies, may be pathological or clinical or medico-legal. Mankind has been immensely benefited by the autopsies all these years. With the changing disease patterns, re emerging diseases, environment and social system, autopsies have become more necessary and relevant than before. The objectives of an autopsy examination are not being achieved at the highest level due to under trained medical officers who handle more than 80% of autopsy work in India and also due to the unwillingness or inertia of pathologists or clinicians to perform the autopsies. Here the in this article we try to highlight the contributions of pathological autopsies to the medical sciences & our social system. We also discuss why there is urgent need for more and well organized clinical or pathological autopsies through out the nation.

Key Words: Pathological autopsy, Medico-legal autopsy, Cause of death, Diagnostic errors, Research

Introduction:

“A surgical operation is attended with pain and is for the benefit of the Individual, an autopsy is free from pain is for the benefit of humanity”. **Paul. H. Brussaral**

It is a well known fact that the advancement of medical science would not have been possible without the help and useful contributions from the autopsies, especially the pathological/clinical autopsies. Mankind has been immensely benefited by the autopsies all these years. Even after knowing this fact, the pathological autopsies are not getting their due place in the medical field or in our society. With the changing disease patterns, reemerging diseases, epidemics of new diseases, persons without proper medical cause of death and with the changing social system, autopsies have become more necessary and relevant.

In a study of 53 autopsy series identified, 42 reported major errors and 37 reported class I errors. 26 autopsy series reported both major and class I error rates in clinical diagnosis.

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The possibility that a given autopsy will reveal important unsuspected diagnoses has decreased over time, but remains sufficiently high that encouraging ongoing use of the autopsy appears warranted. [1] This article is an attempt to remind the medical fraternity and society regarding the importance and contribution of clinical autopsies and to stress over the need for conducting more clinical autopsies than ever.

Decline in the Rate of Pathological Autopsies:

An autopsy is a comprehensive study of dead body, performed by a trained physician, employing a recognized dissection procedure and technique. Autopsy is derived from the Greek word **Autopsia** means seeing with one's own eyes. [2] There is a gradual and steady decline in the clinical autopsies worldwide including the developed countries, which in fact made steady progress in the medical research by them. The pathological or clinical autopsy performed by the pathologist or clinician helps the pathologist to know the pathology of organs due to diseases and it has academic and research value. [3]

There are many reasons for the decline in the number of autopsies. One of the reasons may be that, it may induce extra stress on the already distressed family who has lost their loved one. They prefer to take the body and complete the last rituals rather than getting the autopsy done on it. One of the proposed reasons for the death of the autopsy described by O'Grady is an increased confidence in new

diagnostic tools, particularly modern imaging techniques. Surprisingly, the rate of misdiagnosis detected at autopsy (about 40%) did not improve from 1960-70, before the advent of computed tomography, ultrasound, nuclear scanning, etc, to 1980 and after. [4]

There is also gross lack of information in both public and medical professionals regarding the clinical autopsies, especially the methods and the advantages. There are misconceptions regarding autopsy, such as the fear of disfigurement of their loved ones as well as there is lack of interest from the medical community to convince, pursue the relatives or to educate the common man regarding the medical and social aspects of clinical / pathological autopsies.

Why we need them more than ever:

The pathological autopsy is performed with the consent of the relatives of the deceased to arrive at the diagnosis of cause of death where diagnosis could not be reached during the treatment or to confirm diagnosis where it was doubtful. [5]

Over estimation of Cause of Death:

Globally majority of sudden unexpected deaths are attributed to cardiac cause. This happens not just in rural areas but also in corporate hospitals. This kind of certifications will lead to over inflated figures in national health statistics leading to formulation of wrong, unwanted health policies. Diseases of pancreas and gall bladder pose more problems for diagnosis and are less mentioned in the death certificates. In such situations the clinical autopsy can help to conclude the exact cause of death if performed. In a study where 406 consecutive autopsy cases during 2 years were studied and they observed that with each age increase of 10 years added 16.2% to the risk of the diagnostic comparison to be categorized in classes I and II (major discrepancy) in comparison to classes III, IV and V. Age and hospital ward influenced the distribution of diagnostic discrepancy or concordance between clinical and autopsy diagnosis. [6]

Clinical Data:

Even with the progress and sophistication in investigations and invasive procedures, the difference between clinical diagnosis and autopsy diagnosis is 10%. This is really a matter of concern to all the medical professionals and to the society too. Potential medical adverse events are not uncommon in decedents undergoing forensic autopsy. They are particularly associated with potential diagnostic errors. Forensic autopsy may provide information that could be used to improve care

and reduce deaths due to potential medical adverse events. [7]

Taking these in to consideration, a clinical autopsy will definitely gives an edge in early detection, management and survival period or cure of the patient by unfolding the pathology of that condition in a systematic way.

Satisfaction to the Next Concerned:

In a study carried out on the relatives of the deceased on whom clinical autopsy was conducted, 80% of them said that they were benefited by the pathological autopsy. Before they felt deficiencies in the treating doctors but changed their opinion, that they are happy to learn that due care has been taken while treating the deceased. They were also happy for knowing the correct cause of death which was ambiguous before. Many felt that they have contributed for the advancement of medical sciences. The autopsy relieved distressed parents of the children who felt the guilt and responsibility for the death of the child.

Advantages to the Deceased Family:

There are considerable benefits in clinical research and the understanding of the diseases if relatives are prepared to give consent to the carrying out of post mortems to foster this knowledge. However it is essential that the request is handled sensitively and the all relevant information is given to the relatives about the post mortem and about the possibility of any tissue being removed, retained and stored. It is essential that the general public is reassured that the correct procedures are in place, and implemented and regularly monitored. [8] Clinical autopsies have identified some of the congenital anomalies which were overlooked or not diagnosed when the person was alive. These findings will help in genetic counselling of the families to identify the problem and to take proper precautions in future. They also help in removing the guilt from the minds of the relatives that they could not do much or afford good treatment if the autopsy finds lesion which is incompatible with life. They well feel relieved especially the parents of the child. This data will benefit them to claim insurance amount which might have been rejected on some grounds like self destruction or self induced etc.

General Benefits:

Medical education is the top most beneficiary of these autopsies. Lots of teaching materials like specimens, slides are procured during autopsies. It will also help to improve the knowledge of all concerned. The samples, obtained being used in a wide range of research, education and training of medical and

allied students. [9] Health care organizations and health care providers can assess the quality of the care & treatment provided by them or their team. They can correlate their diagnosis with autopsy diagnosis and improve if necessary. Autopsy reveals or confirms cause of death in nearly three quarters of cardiac surgical deaths and provides information that differs significantly from pre-mortem clinical impression more than 20% of the time. As such, the autopsy remains important to quality assurance in cardiac surgical care. [10] Unknown public health hazards can be identified and notified for the benefit of the society. Above all a correct data is very much essential for national health statistics which in turn prove of immense value when forming the national health polices.

What is the need of the hour now?

There are no standard procedures or guidelines to conduct autopsies. [11] A national protocol of standard autopsy procedures and documentation is the need of the hour. In most of the new medical colleges of India, there is no autopsy work for the Pathologist or to the Forensic medicine faculty. Teaching faculty must stop under valuing the autopsies and their role in day to day medical practice. They must appreciate the autopsies and conduct autopsies for their own benefit and to the community which they are serving. They must encourage the involvement of post graduates to perform autopsies under strict supervision. The high discrepancy rates documented at the UHWI are similar to those reported globally. This study supports previous attestations that the necropsy remains a vital tool for determining diagnostic accuracy, despite modern modalities of clinical investigation and diagnosis. [12]

Whenever they are performing the clinical autopsies, they must allow the presence of interdisciplinary faculty involved in respective cases. They must fix an early and appropriate time suitable for both Pathologist and the Clinician, so as to have a good & productive interaction during and after autopsy to form a scientific conclusion. The pathologist is able to exclude the possibility of internal injury and document the presence and extent of natural disease. [13] Video, slides, photographs, specimens & samples to be collected with the consent of the next kin of the deceased for permanent records. There is an urgent need to develop a national protocol and man power facilities for clinical autopsies in every major hospitals of the country.

Above all public education regarding the clinical autopsies can't be overemphasized. A

well educated/informed person will definitely encourage, support and co-operate for the procedure, which is hindered by many misconceptions. This can be done by Government agencies and NGO's.

Conclusion:

It is high time that we must realize the importance of clinical autopsies. Despite decline, the pathological autopsies find a prominent position in the medical literature, more so in the fields of Neurosciences, CVS oncology, Haematology, & Respiratory fields. Government must liberalize the rules pertaining to the permission of conducting Medico-legal autopsies and encourage all qualified persons to perform clinical autopsies for quality results & reports.

Public education and propaganda targeted at the benefits clinical autopsies for the persons in particular and to the society in general. The society always accepts and welcomes things which are beneficial to it. It is essential that we must highlight these benefits in all possible means. Making autopsy compulsory on all the uncertified deaths can also be done by legislation. Usefulness of clinical autopsies to the mankind is unquestionable, so let us all do our best to encourage it

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Case Report

A Suicidal Hanging with Unusual Findings at Crime Scene

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Abstract

A 42 year old male, was found hanging by a plastic rope in his unbolted bed room. The rope was found attached to two suspension points (one end attached to the window panel and the other side to the ceiling knob) and the middle part of it used for the binding of neck. There was no knot present in the ligature as the right hand was found holding the ligature loop for the purpose of constriction of neck. A towel was found covering the head and underneath the ligature material on the neck used for padding. Blood stain was present on the floor below the suspended body which oozed out from the haemorrhoids. He was holding the cloth, wore in lower half of the body up to the mid thigh label, which appreciated by the authors as cadaveric spasm that developed in his flexor muscles of left hand. Detailed autopsy, crime scene examination and police investigation supported the manner of death as suicidal.

Key Words: Cadaveric spasm; Ligature; Suicide

Introduction:

A method of suicidal hanging usually carried out by attaching one end of a ligature material to a higher point such as ceiling beams, staircase etc. and the other end by forming into either a fixed loop or a slip knot which is placed around the neck. The person stands on a chair or other support and jumps off or kicking away the support. An absence of knot in ligature on neck, or complex tying of ligature material in hanging is very rarely found. The co-occurrence of padding underneath the ligature in neck and unusual body position due to cadaveric spasm, can lead to suspicion of homicide or accidental autoerotic deaths. The Forensic Pathologist must be aware of the unusual presentation of suicidal hanging which may suggest foul play.

Case report:

A 42 years male, labourer, was found hanging in the bed room of his house by a plastic rope at 11.30 P.M. The door was not locked. The one end of the ligature was bound to the window. The other side of the ligature was fixed to the ceiling fan knob and the end part was just found hanging down. He was last seen alive at 6 P.M on the same day by the neighbours. A cotton towel was found covering the head and the neck below the ligature.

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Ligature material was just wrapped around the neck without any knot. The loop of the ligature at neck was made by holding the ligature in middle in between the two suspension points (Fig.1). The left hand was found holding the dhoti (lower part cloth) firmly; he was wearing, up to the thigh region (Fig. 2). Blood stain was found on his under garment, the dhoti and the floor below the completely suspended body (Fig. 3). He was separated from his wife about 10-15 years back and had been staying with his nephew. He was a known alcoholic and had been depressed due marital dispute. Suicide note or sexual aids such as pornographic material and bondage was not found at the crime scene.

Autopsy Findings:

Autopsy was conducted on the next day about 12 hours after death. The body was of middle aged male, moderately built and nourished, length was 162cm and weight 65kg. The right eye was closed and the left partially opened. The pupil were dilated and cornea hazy. The ligature material was found in situ neck. The right forearm was in flexed and adducted position with the ligature found entangled in the hand (Fig.4). Rigor mortis was present all over the body. No signs of decomposition were found over the body.

The ligature mark (Fig.5) of width ranging from 0.6cm to 1.4cm, brownish black in colour, obliquely present over upper 1/3rd of neck, 6cm below the mentum, 10cm above the suprasternal notch at anterior midline, 3.5 cm below the right angle of mandible and over the right mastoid process at the right side of neck,

4.5 cm below the left mastoid process at left side of neck and at the back of neck merged with the posterior hairline. No ligature mark was present at left anterior part of neck. There was no knot mark present. Layer dissection of neck revealed, no bruising of neck muscles and fracture of hyoid thyroid complex. All organs were congested and fluidity of blood was observed. No other external injury was present over the body. Anal examination revealed multiple haemorrhoids at 7'o clock and 11'o clock positions. Toxicological blood studies, found no evidence of drugs or alcohol. Cause of death was asphyxia due to hanging by a ligature. The investigation of the scene, victim and witnesses revealed findings that supported the manner of death as suicide.

Discussion:

In our case the person tied the ligature material to the two high suspension points and used the middle part as loop the constriction of neck was quite unusual. The literature regarding use of ligature material in this manner is not available. The towel was tucked between the neck and the ligature, which act as a pad. The victim might think that it will lessen the feeling of pain due to the ligature constriction. The placing of soft material below the ligature at neck found occasionally. Serafettin Demirci et al. [1] reported soft materials such as a scarf, hood, the collar of a coat or shirt had been used as padding against the ligature loop in 11 cases of suicidal hanging. F.A. Benomran et al. [2] also reported a case where a vest was tucked between the neck and the ligature. The noose was partly cushioned with a bike tube with the obvious aim of reducing the pain was reported by Krill A. et al. [3]

The right hand was found holding the ligature loop at the left side of neck instead of a knot in the ligature, for the purpose of constriction of neck. Hanging without knot has been rarely reported. Kumar V.[4] reported a case of suicidal hanging where there was no knot present in the noose. Hanging cases reported by Pollak S et al.[5] where the fingers were interposed between loop of the ligature and neck because of staggering fell into the noose when still engaged in preparing the suspension.

Immediately after the death, at the crime scene, the deceased's left hand was found holding the dhoti firmly. This spasm in his flexor muscles of left hand appreciated by authors as cadaveric spasm, which may be developed because of the intense and/or emotional activity during the process of hanging. Cadaveric spasm

often indicates the last activity one did prior to death and is therefore significant in forensic investigations. While stepping down from the sofa, he was holding the dhoti up to the thigh level in his left hand. It is a usual practice holding the dhoti in hand above the knee level as it may sometimes obstruct the movement of the body, especially when a person rose to or step off from a higher point. There is rarity literature regarding this condition in suicidal hanging. Cadaveric spasm is a rare condition but usually associated with violent deaths like firearm wound of head, drowning and strychnine etc. It also occurs in circumstances of intense emotion like fear, severe pain, exhaustion, excitement.

The blood on the floor and clothes was due to post-mortem blood oozing out from the haemorrhoids. Similar types of cases were reported by Kanchan T. et al[6] and Bharadwaj D. N. et al[7] This blood stain may wrongly interpreted by the investigating police as that due to self-inflicted injury or possibly case of homicide followed by post-mortem suspension of the body. The findings aroused the suspicion of homicide or autoerotic deaths but the examination of scene of crime and other circumstantial evidences ruled out these manners.

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Fig. 4: Ligature material grasped in hand



Fig. 1: Ligature material tied to the two suspension point and loop was grasped in right hand



Fig. 3: Blood stain on the floor



Fig. 2: Towel used for padding and cadaveric spasm of left hand



Fig.5: Ligature mark on neck



Case Report

Occupational Injury at Gangsaw Machine A Rare Occurrence

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Abstract

Since last few decades, occupational injuries have been a major cause of morbidity and mortality among people working in factories, especially those working with unprotected rotating machines. Women are specifically prone to such injuries because of their long unprotected hairs being trapped in moving parts of the machines. Long hairs can get entangled in moving machinery resulting in complete or partial avulsion of scalp. A large scalp avulsion injury may lead to severe bleeding and may cause trauma to forehead, eyebrows and per auricular tissue, which may further bring fatal results aesthetically and functionally. Severe deformities as a result of this trauma may lead to severe psychological trauma, disabling the patient to lead a normal social life. Here, we are presenting a case report of a patient who had an occupational injury causing scalp avulsion with cervical spine injury at gang saw machine.

Key Words: Scalp Avulsion, Cervical Injury, Gang Saw Machine, Occupational Injury

Introduction:

An occupational injury is a bodily damage resulting from working. The term "avulsion" refers to the tearing away of tissues from their attachments. [1] The scalp is made up of five layers histologically. They are the skin, subcutaneous fat, galea aponeurotica, sub epicranial space and the periosteum. The external 3 layers of the scalp exist fairly independent of the cranial bone and function as one structure in the movement of frontalis muscle and occipitalis muscle. Therefore, scalp injuries usually involve the 3 outer layers along with sub epicranial space but sometimes may include the periosteum as well. [2] The gross injury is avulsion of a large area of scalp, which can be torn from the head thereby exposing aponeurosis or skull. This may happen if the hair becomes entangled in machinery, as was formerly not uncommon in women in factories. [3] Long hairs can get entangled in moving machinery resulting in complete or partial avulsion of scalp. [4]

This case report highlights the risks of working with gang saw machine, which are quite common in areas nearby Jaipur district. Women are quite prone to such occupational injuries due to their loose clothes and long hairs being entangled in moving rotating machine.

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Case History:

A 43 years old female as per bed headed ticket record was working in marble gang saw machine. Marble gang saw machine is used for cutting marble blocks into slabs at different thickness and sizes. Rajasthan is richest source of marble stone and there are lots of marble industries in Kishangarh in Ajmer district. While working on gangsaw machine in Kishangarh, her hairs were caught in the moving belt of the gang saw machine and trapped against rotator of the machine and suffered fatal injury. She was first admitted and treated at Govt. Medical College Ajmer on 4/9/08 and then brought to SMS Medical College on 18/9/08 for further treatment. At the time of admission patient was in shock and quadriplegia was present. She died on 21/9/08. The dead body was transferred to the mortuary and autopsy was done vide PMR NO. 840/PMR/S1/08 dated 21/9/08.

External Injuries seen at autopsy were-

1. A large avulsion of the scalp in an area of 15X12 cm involving vault of the skull over both parietal super medial aspect, frontal in posterior aspect and anterior margin of occipital region on rt. Side with exposure of aponeurosis of scalp with signs of healing and formation of brown red granulation tissue.(Fig. 1)
2. Abrasion of size 2x1/2 cm over right upper lip with partially healed margin.
3. Diffuse swelling over back of neck extending on either side of lateral aspect. On further dissection there was fracture of body of 6th cervical vertebrae. At this level spinal cord

was showing subdural contusions extending from C5-C7 level of vertebrae. The spinal cord is soft and edematous at this level and brownish red in color. All above injuries were antemortem in nature.

Autopsy findings were complete avulsion of scalp extending from right side of forehead on anterior aspect to the occipital protuberance on posterior aspect.

Internal examination: reveals fracture of 4th and 5th ribs with underlying brownish red haematoma on right side with no hemothorax.

Fig.1: Avulsed scalp of female covered with granulation tissue; an occupational injury



Discussion:

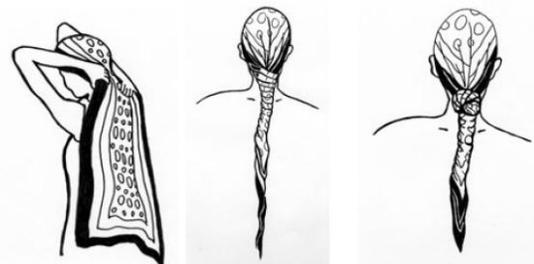
Women in our country especially in the villages of Rajasthan have a peculiar way of wearing of clothes like Ghaghara odhni while working. The hairs are twisted in and around the odhni and the whole amalgam are put on the back while working (Fig.2). [4] There is likely chance of entanglement of odhni along with long hairs in gang saw machine causing partial or complete avulsion of scalp. Such type of injury is rarely reported. Long hairs can get entangled in moving machinery resulting in complete or partial avulsion of scalp. Complete scalp avulsion results in serious consequences, which include hospitalization, economic loss, devastating disfigurement, and psychological effects on the patient. [5] This report shows a rare mishap which resulted in death of a female due to scalp avulsion as a result of hair entrapment in a rotating machine.

Most of us have heard about how machinery doesn't discriminate between product and people — it'll do the same to both. Many people discover this through unfortunate means: an injured machine operator sharing the details of his or her accident or a family member reflecting on the circumstances that took a loved one. Machines that have moving parts and workers especially women who operate them have an uneasy relationship. Machines make workers more productive and enable them to form and shape material in ways that would be

impossible with hand tools. Technology can make machines safer, but as long as workers need machines to help them process material — to cut, shear, punch, bend, or drill — they'll be exposed to moving parts that could harm them. Much of the danger occurs at the point of operation, where the work is performed and where the machine cuts, shears, punches, bends, or drills.

In this industrial and automotive age it is not uncommon to see patients who have had the misfortune to lose by accident a large area of the scalp. [6] Scalp avulsion is a rare but severe injury and usually happens as an industrial accident. [7] One has to develop processes, procedures, criteria, requirements, and methods to attain the best management of the hazards and exposures that can cause injury to people, and damage property possible, or the environment; Guard the entire blade except at the point of operation (the working portion of the blade between the bottom of the sliding guide rolls and the table). Use an adjustable guard for the portion of the blade above the sliding guide rolls so that it raises and lowers with the guide. Properly adjust the blade guide, gang saw wheels must be fully enclosed To reduce the incidence of such fatalities, employers, trade and worker associations, and policy makers should focus on effective, targeted workplace safety interventions such as frequent hazard identification and training for specific hazards.

Fig 2: Mechanism of avulsion injury



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Case Report

Rupture Uterus: Carelessness or Negligence?

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Abstract

Uterus is the most unique reproductive organ in humans. Rupture uterus is a hazardous complication of pregnancy and labour, and carries high risk both to the mother and the foetus. Uterine rupture during third trimester of pregnancy is a rare complication but if there is rupture and not suspect with in time may have fatal out come for the mother, foetus or both. In this modern medical era, prenatal check-up, advanced non invasive diagnostic facilities and subsequent treatment does not produce such life threatening complication. Rupture uterus cases are observed due to either carelessness of the patient or negligence of the doctor. Three cases of rupture uterus are discussed in this paper of full term pregnancy, had complete antenatal visits with all investigations including ultrasonography and attended the hospital well in time before death. Most cases of rupture uterus are preventable with good ante-natal and intra-partum care, and proper identification of high-risk cases.

Key Words: Ruptured Uterus, Foetal death, Intra-abdominal bleeding

Introduction:

The uterus is an amazing part of every woman's body. It is the most unique reproductive organ in humans. It is the part of a woman's body that creates an environment where an embryo can grow. Rupture uterus is a hazardous complication of pregnancy and labour, and carries high risk both to the mother and the foetus. Although its incidence is still higher in developing country as compared to the developed countries, there has been a definite decline in the resulting morbidity and mortality. This can be attributed to improved antenatal and intrapartum care, better anaesthetic and surgical techniques, availability of higher antibiotics and improved blood transfusion facilities. Rupture uterus in nulliparous patients is generally associated with mullerian anomalies. [1]

Uterine rupture is often catastrophic complication with a high incidence of fetal and maternal morbidity. Several factors like previous damage due to dilatation and curettage operation or manual removal of placenta, grand multiparae, congenital malformation of uterus, abruption placenta, rupture of classical or hysterotomy scar increase the risk of rupture of uterus.

Injudicious use of oxytocin, use of prostaglandin for induction of abortion or labor, forcible external version under general anesthesia and fall or blow on the abdomen are known to increase the risk of uterine rupture during pregnancy. [2]

The initial symptoms and signs of uterine rupture are typically nonspecific; a condition that makes diagnosis difficult, which sometimes delays definitive therapy. From the time of diagnosis to delivery, only few minutes are available before clinically significant fetal morbidity becomes inevitable. Fetal morbidity invariably occurs because of catastrophic hemorrhage, fetal anoxia, or both.

The inconsistent premonitory signs and the short time for instituting therapeutic action make uterine rupture a fearful event. Prognosis depends upon the manner in which labor is managed prior to the accident, type of rupture, morbid pathological changes at the site of the rupture and the effective management. The major causes of death are hemorrhage, shock, sepsis. [2]

CASE NO: 1

History:

A family of three members (husband, wife, male child) was residing in an area of Surat. The female was pregnant and passing her last month of pregnancy. The female had complained about abdominal pain. So, she was immediately shifted to nearest maternity home at 10:30 a.m. The gynaecologist saw the patient and insists to admit in his hospital. The patient was admitted in his hospital. At about 1:30 p.m,

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patient was complaining about severe abdominal pain. The staff nurse of the hospital had attempted to deliver the baby, but she could not. Only head of the baby came out at that moment. The staff had not informed to the gynaecologist instead of repeated request by her husband. On that day at 6:30 p.m gynaecologist came and saw the patient. He had refused to shift the patient to another hospital and also refused for caesarean section. On the same day, at 8:30 p.m both mother and baby were died.

Dead body of deceased, aged about 28 years brought to Government Medical College, Surat for post- mortem examination with following findings.

External Findings:

- A female wearied sari which was stained with blood at places.
- Marks of pregnancy were present over abdomen.
- Rigor mortis was present all over body.
- Faint post mortem lividity was present over back of body except pressure area
- Abdomen distended. (Girth at umbilicus: 85 cm.)
- Conjunctiva was pale.
- Injection marks were present over back of wrist, lateral aspect of right forearm and right cubital fossa.

Internal Findings:

- Abdominal cavity contains 3.5 litre of blood.
- Foetus and placenta were found in peritoneal cavity.
- Enlarged uterus of size 26.5 cm x 13.0 cm.
- Rupture was present over lower part of uterus of size 13 cm x 7.5 cm x full thickness of wall.
- Foetal head was fixed in pelvic brim.
- Fetus: Male, full term, wt: 3.100 kg

Viscera preserved for chemical analysis and histopathological examination. After considering all reports and post-mortem findings cause of death was "Shock as a result of haemorrhage due to rupture of uterus."

CASE NO: 2

A dead body of female aged about 29 years brought to Forensic Medicine department, SMIMER, Surat on dated 01/08/06 at 12:20 p.m with following findings.

History:

A pregnant female, residing in an area of Surat, had abdominal pain on 31/07/06, immediately she was shifted to the nearest maternity home and admitted there. In critical condition doctor decided to shift the patient to SMIMER hospital. She was expired in the

casualty department during treatment under suspicious condition.

External Findings:

- Clothes were stained with blood.
- Rigor mortis was present all over body.
- Post-mortem lividity was appreciable over back of body except pressure area.

Internal Findings:

- Abdominal cavity contains 4.5 litre of blood.
- Uterus was gravid.
- Oblique rupture was present over front of left side of uterus of size 18cm x 3.8 cm x full thickness of wall.
- Fetus: Full term male, Wt: 2809 gm, presenting part was fixed in pelvic brim.

The cause of death in this case was "Shock as a result of haemorrhage due to rupture uterus."

CASE NO: 3

A female aged about 28 years residing in an area of Surat who was pregnant. She had complained of abdominal pain at 10:00 p.m. Her husband had arranged private vehicle to shift his wife to casualty department of SMIMER hospital but during transportation she was dead. The post- mortem examination revealed following findings.

External Findings:

- Striae were present over lower abdomen and upper portion of thigh.
- Abdomen was distended.
- Faint post-mortem lividity present over back of body except pressure area.
- Conjunctiva pale.

Internal Findings:

- Abdominal cavity contains 3 litre of blood.
- Uterus was gravid.
- Oblique rupture was found from fundus of size 8 cm x 5 cm x full thickness.
- Fetus: Full term male, Wt: 2600 gm

The cause of death was "Shock as a result of haemorrhage due to rupture of uterus".

Discussion:

Rupture uterus is a life threatening obstetric problem. Rupture in primigravida in first or second trimester generally occurs in congenitally malformed uterus like unicornuate or bicornuate uterus with or without rudimentary communicating-noncommunicating horn. [3] Rupture of uterus occurs because of inability of malformed uterus to expand as a normal uterus. [4]

The rupture in rudimentary horn is likely to occur in late first trimester or even in second trimester. Rarely pregnancy can go on till late second trimester before rupture. The

haemorrhage occurring because of rupture is massive and can be life threatening, unless diagnosed and treated promptly. [5]

Obstructed labour due to cephalo-pelvic disproportion and malpresentations, continued to be a major causative factor of rupture uterus. Sinha and Roy also recently reported an incidence of 24.4% scar rupture, while Kulkarni and Kendre reported 56.12% scar rupture in their series on rupture uterus in rural India. There are increasing number of cases of scar rupture is due to an increasing use of caesarean section in place of difficult vaginal delivery. Although better alternatives in terms of fetal outcome and decreased maternal morbidity, improved these caesarean sections should not be accompanied by an increase in the rate of scar rupture.

All patients with previous caesarean scars should be made aware of the importance of ante-natal care in all subsequent pregnancies. They also require careful pre-natal supervision, proper selection of cases for vaginal delivery, early hospital admission, and close supervision in labour. [6, 7]

The high risk mother with contracted pelvic, previous history of caesarean section, hysterotomy or myomectomy, uncorrected transverse lie, grand multiparity are likely to rupture should have mandatory hospital delivery. Ultrasonography (USG) may be helpful in diagnosing such anomalies before rupture, which will help in decreasing the morbidity and mortality associated with rapid and massive hemoperitoneum occurring because of rupture of uterus. [8] Treatment usually involved is removal of ruptured horn.

As it leaves a scar on upper part of the uterus, it is important to avoid pregnancy for at least one year by barrier or hormonal contraceptives. In addition, future pregnancy requires proper monitoring, early hospitalization, and elective caesarean section at term. As to the choice of surgery, conservation of the uterus by re-suturing the rent should be attempted wherever possible. With availability of higher antibiotics and better non-steroidal anti-inflammatory drugs, good results have been obtained. However, in cases with severe haemorrhage and shock requiring Hysterectomy, operative time and exposure to anaesthesia are vital factors, and a quick sub total hysterectomy should be resorted too. [4]

Conclusion:

Most cases of rupture uterus are preventable with good ante-natal and intra-partum care, and proper identification of high-

risk cases. High risk cases should have mandatory hospital delivery. Fatal outcomes in all cases are either due to mishandling the case or improper/incomplete treatment was provided to the deceased. The treating doctor should keep in the mind such complications especially in the case of previous operation /elderly primi / primi with foeto-pelvic disproportion.

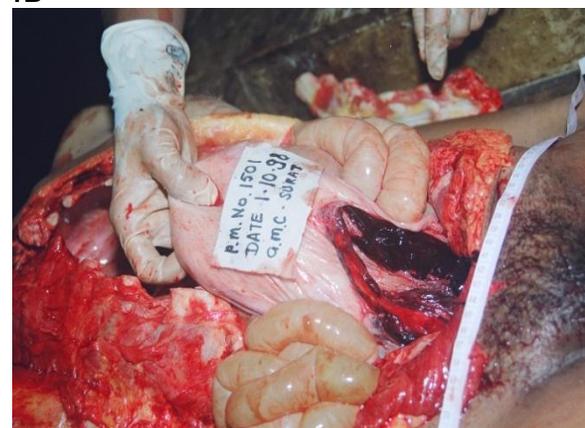
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Photographs of Case 1A



1B



Photographs of Case 2A



2B



Photographs of Case 3A



3B



Case Report

MRKH Syndrome: Psychological Disturbances and Suicide

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Abstract

The Mayer- Rokitansky-Küster-Hauser (MRKH) syndrome has been known to be associated with psychological abnormalities. However, hardly any case has been reported of suicide by an individual suffering from such syndrome, as per the author's knowledge.

A 19 year old female was brought to Safdarjung hospital mortuary for post mortem examination. After eliciting a detailed history from the relatives of the deceased, going through the previous investigation reports and after post mortem examination it was confirmed that the deceased was suffering from MRKH syndrome. The mental stress associated with the diseased state resulted in the female committing suicide by ingesting some unknown substance. Emotional support forms the basis of treatment in such cases. Surgical treatment is also employed in some cases so as to help them lead normal sexual life.

This paper deals with the pathology and psychological profile of the patient suffering from this syndrome and the therapeutic options that may be considered to ameliorate the stress associated with the disease.

Key Words: MRKH Syndrome; Suicide; Psychological Abnormalities

Introduction:

The Mayer- Rokitansky-Küster-Hauser (MRKH) syndrome or Rokitansky syndrome is a malformation of the female genitals which occurs in one in 4000 female live births. The most common pathology is the interrupted embryonic development of the Müllerian ducts [1], which is best explained on the basis of polygenic and multifactorial inheritance. [2] HOX genes, which are a family of regulatory genes that encode for the transcription factors, are essential for the proper development of the mullerian tract in the embryonic period. [3] HOXA 13 has been found to be altered in hand foot genital syndrome. The syndrome has also been associated with abnormal galactose metabolism. [4]

Malformative combinations including Müllerian anomalies can sometimes affect different organs derived from the mesoderm such as the heart, lung, and urogenital system. [5]

Renal agenesis, pulmonary hypoplasia, hip dysplasia, ear anomalies and other skeletal defects are the frequently reported malformations associated with MRKH syndrome. Of the patients with this syndrome 15% have an absent kidney, 40% have a double urinary collecting system [6], and 5% to 12% have skeletal abnormalities. [7]

Unilateral renal agenesis (RA) is embryologically associated with genital and sometimes extragenital malformations. The associated genital malformations are due either to agenesis or hypoplasia of all derivatives of the ipsilateral urogenital ridge (frequently with unicornuate uterus on the opposite side) or to distal mesonephric anomalies. [8]

Two well known variants of the syndrome include the type 1 (typical) and type 2 (atypical) MRKH syndromes. The former is an isolated form of congenital agenesis of the vagina and uterus while the latter, termed as 'GRES' syndrome (genital, renal, ear, skeletal) by Strübbe et al [9] is usually associated with multiple systemic anomalies.

More recently, Oppelt et al [10] have classified their 53 cases of MRKH syndrome in three recognizable subtypes: typical, atypical and MURCS (Müllerian duct aplasia, renal aplasia, and cervicothoracic somite dysplasia) association. As is evident from the pathology characterising the syndrome, it results in

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multitude of symptoms especially related to the femininity of the female.

These females begin to question their identity as a woman and to experience a sense of confusion regarding their gender, bodies, social and sexual roles [11]. Though much has been written about the mental agony of such females, there has been hardly any case reported of suicide.

Case Report:

A 19 year old female was brought to Safdarjung hospital with history of consumption of unknown substance on 06/06/2010. She died during the course of treatment on 07/06/2010 at 6 am. A detailed history revealed that the deceased had been married for 6 months, seeking gynaecological advice because of lower abdominal pain and infertility. Her husband also gave a history of mental distress of the deceased as a result of which she didn't bathe for many days and hence suffered from infective dermatitis. The ultrasound examination report mentioned that the right kidney, uterus and right ovary could not be delineated. [Fig 1] The autopsy was conducted on 10/06/2010. On external examination, it was a body of an adult female with rigor mortis present all over the body and hypostasis present over the back of the body. Eyes were closed and cornea clear. Features suggestive of infective dermatitis with multiple scratch abrasions were present all over the body. [Fig 2] Right ear canal was absent and in place of the ear lobule a skin tag was present. Right foot was inverted. [Fig 3] Vaginal opening was present though the vagina ended abruptly, with absent cervix. She had no scars or any other marks on her body with normally developed secondary sexual characteristics.

On internal examination, the stomach wall was congested and hemorrhagic containing 100 ml of brownish material. The right kidney and uterus were absent. [Fig 4] Both the ovaries were present and normally developed. The cause of death was reserved pending the viscera analysis report.

Discussion:

The diagnosis of the syndrome is usually made at puberty. However, in this case the diagnosis was delayed till after marriage. Case has been reported by Abdel-Fattah MS et al [12] wherein the diagnosis of the MRKH syndrome was made only after menopause. With features such as normal secondary sexual characteristics, absence of uterus, absence of right kidney, ear defects, and skeletal deformity, this case is consistent with type 2 variant of Rokitansky syndrome.

Although, substantial literature is available discussing the psychological effects of MRKH syndrome on women, **this is the first reported case of a successful suicide, as per the author's knowledge.** In a recent study, Boersma et al concluded that the patients suffering from the syndrome had varied emotional reactions ranging from positive responses like relief, fighting back, to negative responses such as shock, confusion, fear, depression and suicidal tendencies, feeling isolated, ashamed, or guilty to more avoidant/cut-off responses such as dismissal or denial. [11] In the present case, the deceased could not handle the distress associated with the condition leading to self neglect by way of not bathing subsequently resulting in infective dermatitis. The increased stress further culminated in a successful attempt to suicide.

Treatment:

As the condition has significant effect on the mental well being of the individual, the treatment should also focus on ameliorating the psychological stress. Adequate and timely counselling along with medical interference can help the females to overcome depression. Family support plays an imperative role to console and raise the self respect. The surgical or dilator treatments are often experienced as shameful and may serve to strengthen their negative beliefs. Although the successful creation of a neo-vagina ameliorates some of the difficulties, the disease often seems to have a lasting negative impact on these women's view of themselves. [11]

Conclusion:

The MRKH syndrome greatly affects the psychological profile of the female resulting in mental trauma and stress. Psychological counselling is the primary treatment modality which can ameliorate the stress associated with the condition.

Fig 1: Ultrasound Scan



Fig 2: Dermatitis



Fig 3: Skeletal Deformity



Fig 4: Absent Uterus



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Case Report

Assessment of Age in Foetus: A Medicolegal Aspect

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Abstract

A Medicolegal case of embryo/foetus was received from the department of forensic medicine for the assessment of age of the foetus. The report for the assessment of age was prepared on the basis of gross appearance, radiological and histological examinations. On radiological examination of the limb tissue, the age of the foetus /embryo was approximately 3 months. The ossification centres for metatarsal bones were visible which appear at the 10th week of intrauterine life. Also on USG the femur length was found to be 10 mm which also suggests the age to be around 3 months. The smooth junction between the epidermis and dermis suggests age of the embryo/foetus to be less than 3 months because the epidermal ridges and dermal papillae become prominent at the end of 3rd month. From the basal layer of epidermis down growths were seen which were suggestive of growth of hair follicles. Hair follicles become prominent by the 10th week of intra uterine life which again reveals that the age of foetus is around end of 3rd month. From the observations, the age of the foetus was found to be more than 2 and half months but less than 3 months i.e. between 10-12 weeks.

Key Words: Embryo, Age assessment, Histology, Radiology, Ossification Centres

Introduction:

Embryology is the study of intrauterine development of an individual. The development is divided into stages, i.e. embryonic and foetal. Embryonic stage covers first two months while the foetal period of development runs from 3rd month to birth. Embryonic period is important as there is development of organs and different systems of the body which give the foetus a human look. [1] Forensic anthropology is affected by the unavoidable limits concerning difficulties in standardization of methods and procedures. Age estimation is one of the main tasks of forensic anthropology and odontology both on the dead and the living. [2]

The process of development is ordinarily divided into two sets of sequential changes called embryogenesis and organogenesis. Although embryogenesis has been extensively explored, the literature related to organogenesis appears relatively deprived of adequate scientific attention. Gestational age is the age of unborn baby. Proper assessment of foetal well-being requires an accurate knowledge of gestational age of the foetus. [3]

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Age assessment in foetus is important from the medico-legal aspect in cases of criminal abortion, infanticide, still born or dead born baby, fabricated abortion, marriage, divorce, adoption, inheritance etc. [4]

Observations & Results:

A case of an unknown piece of embryo was received from the Department of Forensic Medicine of GGS Medical College, Faridkot for age assessment. The obtained tissue looked like the fragmentary remains of placental tissue/endometrial tissue, along with one upper limb and two separate lower limbs.

One of the lower limbs appeared complete and the other only as lower part. Digits in the feet were webbed but had nails grown up to the tips of the toes and the nails were soft. No other part of embryo was identifiable. Nor was the sex of the foetus identifiable from any part of these remains. The assessment of age was prepared on the basis of following points:

Gross Appearance:

Formalin fixed sealed jar was received from the Department of Forensic Medicine. Two lower limbs and one upper limb were there in the jar. One lower limb was with thigh and leg while the other was having only leg part. In the feet toes were webbed and the nails were present. As the nails were apparent and considering the fact that the nails start appearing at the end of 3rd month of intrauterine life, the age is around end of 3rd month of intrauterine life.

Photo-1: Gross Appearance of remains: UL- upper limb, LL-lower limb



Radiological Examination:

After this the tissue (lower limbs and upper limb) was sent to the Department of Radiodiagnosis for the ossification centres. X-Rays were done for both the limbs. On radiological examination of the limb tissue, the age of the foetus /embryo was approximately 3 months. The ossification centres for metatarsal bones were visible which appear at the 10th week of intrauterine life. Also on USG the femur length was found to be 10 mm which also suggests the age to be around 3 months.

Photo-2: CM-Centre of ossification for metatarsal bone

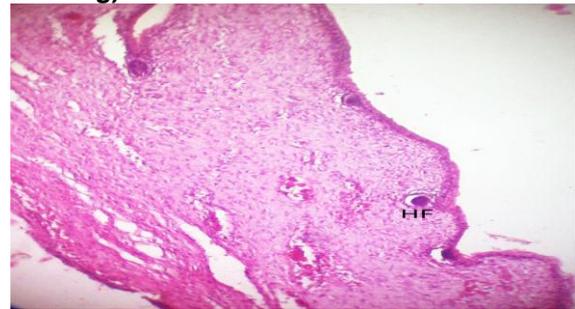


Histological Examination:

A skin tissue from the obtained foetus was taken for histological examination. The paraffin block of the tissue was prepared and cut. The sections were stained with H and E stain. Under light microscope, it was seen that in the epidermis the basal layer was multilayered and the junction between the epidermis and dermis was smooth i.e. there was no appearance of epidermal ridges and dermal papillae. The smooth junction between the epidermis and dermis suggests age of the embryo/foetus to be less than 3 months because the epidermal ridges and dermal papillae become prominent at the end of 3rd month.

From the basal layer of epidermis down growths were seen which were suggestive of growth of hair follicles. Hair follicles become prominent by the 10th week of intra uterine life which again reveals that the age of foetus is around end of 3rd month.

Photo-3: Histological examination (H & E Staining) HF- Hair Follicle



So from the above findings the age of the embryo/foetus appears to be more than two and a half months and less than 3 months (between 10-12 weeks)

Discussion:

Histological examination & embryological basis:

Limb buds become visible as out pouchings from the ventrolateral body wall at the end of the 4th week of intrauterine life. Initially they consist of a mesenchymal core, derived from the somatic layer of the lateral plate mesoderm that forms the bones and connective tissue of the limbs, covered by a layer of cuboidal ectoderm. The hind limb buds somewhat lag behind in development, as compared to those of the forelimbs. [5]

According to Haase Rule- At the end of 2nd month the hands and feet are webbed and the placenta begins to form. At the end of 3rd month the nails start appearing and are soft. [4]

At the apex of each limb bud the ectoderm thickens to form an apical ectodermal ridge (AER). AER is a multilayered epithelial structure which interacts with mesenchyme in the limb bud, promoting outgrowth of the bud. The upper limb bud is paddle shaped and the lower limb buds are flipper like. At about 55 days the tips of the toes are separated and interdigital degeneration begins. [6]

Initially, the embryo is covered by a single layer of ectodermal cells. In the beginning of the 2nd month, this epithelium divides and a layer of flattened cells, the periderm or epitrichium is laid down on the surface. [5]

The cells of periderm continually undergo keratinization and desquamation and are replaced by cells arising from the basal layer. Proliferation of cells in the stratum germinativum also forms epidermal ridges which extend into the developing dermis. These ridges begin to appear in the embryo at 10th week and are permanently established by the 17th week. [6] The dermal papillae develop below the epidermis in the 4th week. [7]

Hair begins to develop early in the foetal period (9-10 week), but they don't become easily recognizable until about the 23rd week. A hair follicle begins as a proliferation of the stratum germinativum of the epidermis and extends into the underlying dermis. [6] Hair primordial originates in the stratum basale (3rd month). Epidermal buds, each in contact with a mesodermal hair papilla, burrow into the dermis and expand into hair bulbs. [7]

The bones are preformed in cartilage. At birth the cartilage shows centres for the shafts of the metatarsals, phalanges and for the calcaneus, talus and often the cuboid. The cartilage is first apparent in the 6th week and forms the various bones which are distinct by the middle of the 3rd month. [8]

This co-relates with our study in which the age of the embryo was between 2 and half to 3 months. The length of the diaphysis of the foetal femur is often used for gestational age prediction. Careful measurements of the ossified diaphysis of the femur are necessary in order to obtain an accurate estimate of gestational age. The entire femur should be imaged and the thin bright reflection of the cartilaginous epiphysis should not be included in the measurements. [9]

In our study, the length of femur was 10mm on ultrasound & thus the age of the foetus is 13 weeks (gestational age estimation by femur length)

Conclusion:

From the above findings, the age of the foetus is between 10-12 weeks

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Case Report

Electrocution Method to Conceal Homicide A Rare Case Report

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Abstract

Killing of a human being is one of the most serious or major crimes. Assailants are very keen to conceal crime by different methods, so there may be wrong interpretation by inexperienced autopsy surgeons and hence it may lead to injustice. So it is important that our keen observation and opinion should be conclusive for the administration of justice. In this paper we are presenting a rare case which was brought by police as a case of electrocution. After meticulous autopsy and crime scene visit, the case turned to be of homicidal manner. The cause of death was manual strangulation with head injury and electrical injuries were post-mortem in nature. The deceased was under the influence of alcohol. The necessary investigations like histo-pathological examination also ruled out ante-mortem nature of electric injury. The present paper highlights the importance of meticulous autopsy and crime scene visit for determination of cause and manner of death.

Key Words: Manual strangulation, Head injury, Post-mortem electrocution, Scene of crime

Introduction:

Deaths due to electrocution are infrequent; virtually all such deaths are mostly accidental in nature with suicides much rarer & homicides least common. In India, the electricity supplied in domestic houses is usually 220-240 volts alternating current with 50 cycles per second. [1] Homicidal electrocution is caused by placing live wire at some place which the victim is expected to touch. [2] The viscera should be analyzed to know whether the victim was impaired at the time of incidence. [3]

Manual strangulation is a form of violent asphyxia death when the constriction of the air passage at the neck is caused by means of pressure of human fingers, palms or hands upon the throat. Usually murderers use more force to kill the victim than is ordinarily required; hence the evidence of the pressure applied, will be overtly manifested locally.

The modes of death in case of manual strangulation are asphyxia, congestive suboxia and vagal inhibition; the latter being more common. Evidence of certain typical findings such as head injury and intoxicating drugs in the stomach of the deceased will suggest homicide, even in absence of signs of struggle. [4]

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The mentality of assailant after strangling their victims is to hide the crime by disposing of the dead bodies by burning, burying, throwing them into water or concealing them in distant places in most of cases, electrocution, hanging and throwing the dead body on railway track. The visit to scene of crime by medico-legal expert has a great bearing upon the medical opinion.

Case Report:

This paper presents a case of 45 year old male who was brought dead to casualty of Government Medical College, Aurangabad on 15th September 2008 by his wife and son with history of sudden unconsciousness after accidental electrocution while ironing the cloths at 11 hrs in the morning. The police also suspected the same due to electrical injuries over hands.

Autopsy Findings:

External Examination:

On examination, the deceased was a moderately built, well nourished male of weight 56 kg, and length 158 cm. with congested face. There were petechial haemorrhage in conjunctivae, bleeding from left ear, lividity fixed, rigor mortis generalized and well marked.

Injuries over Neck:

Multiple finger tip contusions and nail scratch abrasions were present over thyroid region over anterior and both lateral aspect of neck, reddish in colour.

Photo 1: Multiple Abrasions & Contusions over Neck



Other injuries:

1. Abraded contusion over left forehead of size 5cmX3cm, irregular, reddish.
2. Burn injury over right forearm dorsal aspect, 15X7cm, base pale, no e/o vital reaction.
3. Electric burns over dorsum little finger, middle finger and dorsum of left hand of sizes 0.5X 0.5cm, 1X1cm and 2.5X1cm respectively, pale yellow, no e/o hyperaemia surrounding injury and any other vital reaction.
4. Electric burns over right palm two in number of sizes 1X1cm each, appeared as pale yellowish crater. There was no e/o vital reaction and hyperemia surrounding injury.

Photo 2: Electric Burn over Dorsum of Hand



Photo 3: Electric Burns over Right Palm



Internal Examination:

Neck: Evidence of contusion over strap muscles on both sides corresponding to overlying

injuries, reddish in colour. There was e/o fracture of thyroid cartilage and cricoid cartilage in midline with blood infiltration in fractured margins, reddish. There were e/o petechial haemorrhages around epiglottis.

Photo 4: Petechial Haemorrhages around Epiglottis



Head: Under-scalp contusion over left fronto-temporal region of size 12X10cm, with e/o underlying subarachnoid haemorrhage of size 10X9cm, reddish. There was e/o petechial haemorrhage in white matter of brain.

Investigations:

Viscera: Alcohol was detected in blood of concentration 145mgm ethyl alcohol /100 ml and in stomach-136 mgms/100 gms.

Other viscera: Acro reaction was negative.

Histopathology:

No inflammatory reaction seen on skin from alleged site of electric shock indicating the nature of injury as post-mortem.

Visit to Scene of Crime:

Scene of incidence was visited by a team of Forensic expert, police and electrical technical expert. It was a room of size 10X10 feet. The iron press was kept on table with outer coat of wire partially burnt and inner coat intact. We found candle on table near iron press which was used to burn the outer coat of the wire of the iron press.

Photo 5: Scene of Crime



Discussion:

Manual strangulation is the common mode of homicide both in adults and children, as

the fingers and hands are readily available for use. The adults with good physique can also be throttled, if under influence of drink or drugs [4]. Important signs of asphyxia were prominently seen in most of the cases. Amongst them blunt head injuries were common. Family related matters were the main motive behind the killing. [5] An electrical injury occurs when a current passes through the body, interfering with the function of an internal organ or sometimes burning tissue. Electrical injuries have become a more common form of trauma with a unique Patho-physiology and with high mortality. They may result from contact with faulty electrical appliances or machinery or inadvertent contact with household wiring or electrical power lines. [6] Electrical burns have a characteristic appearance and pathological findings. There is streaming of the epidermal nuclei at the point of contact with the current microscopic blisters of the epidermis. [7, 8]

In the present case, the significant findings were of manual strangulation with head injury and electrocution was post-mortem. The signs of struggle were absent. The electric injuries were made on the deceased after his death to conceal the crime of homicide. Viscera preserved for chemical analysis revealed the

alcohol. The assailants tried to conceal the crime by electrocuting the deceased after death by throttling. But, after considering the findings of autopsy, chemical analysis, histopathology examination and crime scene visit, it became clear that the victim was under the influence of alcohol, so that it was easy to overpower such well built man without resistance because of incapacitation due to alcohol and head injury and to strangle him manually with ease.

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