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Editor,

Dr. Mukesh Yadav

Dean/Principal

Siddhant School of Medical Science and
Hospital, Mainpuri, UP

Residence:

G-216, Parsvanath Edens,
Alfa-II, Greater Noida, G.B. Nagar, U.P.INDIA
Ph. No. 0120-2326060, Cell: 08527063514
Email: drmukesh65@yahoo.co.in

Joint Editor

Dr. Akash Deep Aggarwal

Associate Professor,
Department of Forensic Medicine,
Govt. Medical College, Patiala
Punjab, INDIA

Residence:

H.No. 14, Desi Mehmandari,
Patiala-147001, Punjab, INDIA
Cell: 9815652621
Email: toakashdeep@yahoo.co

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From Editor's Desk

JIAFM

A Quarterly Publication

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I feel immense pleasure to present before you the First issue of 2015. 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**.

It has been informed that the title J Indian Acad Forensic Med 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, J Indian Acad Forensic Med

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- The Scope of the Journal covers all aspects of Forensic Medicine and allied fields, research and applied.

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Editorial

Quality of Forensic Medicine Education Need for Proactive Approach and Reforms by the MCI

Forensic Medicine Education is going to play a great role in any civilized democratic government. The efficient criminal justice delivery system cannot function without quality of investigations based on quality of Forensic Medicine Experts. Quality of Forensic Medicine Education both at the UG and PG levels depends on the evaluation and monitoring by the Medical Council of India as well as on MCI Assessors and Head of Forensic Medicine Departments. How meticulously MCI Assessors doing their assignment of Assessment and how prepared are Head of Departments during assessment. This quality of assessment cannot be a onetime event but a gradual continuous process.

With the privatization of medical education task of both MCI Assessors and Head of Departments has increased many fold. Familiarity with the MCI Assessment process and requirement during assessment both for MCI Assessors and Head of Departments is very crucial. With reduction in duration of promotion from Assistant Professor to Associate Professor (with four years experience) and from Associate Professor to Professor (with three years experience) i.e. a faculty joining as Assistant Professor with timely promotion can become Professor and Head within seven years even not eligible to become PG Teacher (eight year post PG teaching experience) further made the situation challenging.

Professor & Head of Departments who are not very well aware of MCI Assessment during UG and PG MCI Inspection usually faced embarrassing situation. They themselves are not very well acquainted with the research and publication work, facing a tough challenge during MCI Inspection, especially for PG MCI Inspection as well as preparing PG Students to become eligible for appearing in the PG Examination with research publication presented during conference and/or accepted for publication in a National/Indexed Journal.

Responsibility of Head of Department/Dean:

Quality of Forensic Medicine education depends on how Head of Departments are prepared for MCI assessment for UG/PG MCI Inspection and minimum standard requirement to be fulfilled during Assessment. Head of Forensic Medicine should keep all the formalities related to SAF and Data about Clinical Material (Number of Postmortem cases, Sexual Offence cases and other medico-legal cases) dealt by the staff of the Forensic Medicine along with PG Students.

They should keep ready list of publications in desired format for last three years published by the staff of the Forensic Medicine.

Role and Responsibility of Assessor regarding Faculty:

Quality of Assessment by MCI Assessors depends on how meticulously they are doing their assessment task without creating panicky situation in the department and institution they are assessing. Objectivity of assessment depends on how much they are familiar with the SAF, terms used in it and meaning and scope of assessment with little room for subjectivity.

- All teachers should be physically identified: Physically Verified
- Detailed proforma (with photograph affixed) in respect of every teacher must be obtained which signed by the concerned teacher. HOD and Head of Institution-Obtained
- To ensure that staff is full time, paid and not working in any other institution simultaneously: Confirmed
- Whether demonstrators in PG Department are same i.e. PG Students or Additional Demonstrators are needed?
- Signatures of Assessors should not only be on last page, but on all pages.

Rules and Regulations have Binding Force and have Got Statutory Force:

In recent judgment dated 12th September 2014 of the Division Bench of Allahabad High Court while referring to MCI Regulations, 2002 observed that apart from the above, rules and regulations framed by the Medical Council of India, have got statutory force and are binding. It has been settled long way back by majority judgment of constitution bench of Hon'ble Supreme Court in the case reported in [R] Dr. Preeti Srivastava and another. vs. State of M.P., (1999) 7 SCC 120, and has been the consistent view of Hon'ble Supreme Court that the Medical Council of India is the regulatory authority and has power to maintain the standard of education as well as medical professionals. To meet out the requirement, the Medical Council of India may frame rules and regulations which have got statutory force and are

mandatory in nature with binding effect, vide many judgment of the Hon'ble Supreme Court. Medical Council of India vs. Rama Medical College Hospital and Research Centre, Kanpur and Anr., (2012) (8) SCC 80; Priya Gupta vs. State of Chhattisgarh and Ors., (w2012) 7 SCC 433; Harish Verma and Ors. vs. Ajay Srivastava and Anr., (2003) (8) SCC 69; Maharashtra University of Health Science represented by Deputy Registrar vs. Paryani Mukesh Jawaharlal and Ors., (2007) (10) SCC 201; State of Madhya Pradesh and Anr. vs. Kumari Nivedita Jain and Ors., (1981) (4) SCC 296.

Following Questions Need Considerations at the Level of MCI:

1. Clearly defining the terms and their meaning used in SAF used during the MCI Assessment
2. Terms like "Complement", "Unit" need to be defined in its scope precisely so that it can be objectively assessed as adequate and/or inadequate.
3. Cold storage facility for Storing how many bodies is considered adequate
4. Can PG Committee Member become MCI Inspector?
5. Is there not conflict of Interest while taking decision on its own report in PG Committee Meeting
6. How MCI is ensuring compliance of time schedule and number of approved PG Students?

Starting of Post Graduate Medical Courses and Their Recognition:

MCI has amended PG Regulations 2000 in the year 2009 published in the Gazette on 21st July 2009. Following regulations of MCI need to be remembered for recognition of PG course if permitted and further approval after five years: An institution intending to start a Post Graduate medical education course or to increase the annual intake capacity in an already ongoing course shall obtain prior permission of the Central Government as provided under section 10A of the Act.

The institution shall apply for recognition of the Post Graduate medical qualification to the Central Government through the affiliating university, when the first admitted batch shall be due to appear for the examination to be conducted by the affiliating university.

Failure to seek timely recognition as required in sub-clause 2 shall invariably result in stoppage of admission to the concerned Post Graduate Course.

The recognition so granted to a Post Graduate Course shall be for a maximum period of 5 years, upon which it shall have to be renewed.

The procedure for 'Renewal' of recognition shall be same as applicable for the Award of recognition.

Failure to seek timely renewal of recognition as required in sub-clause-4 shall invariably result in stoppage of admissions to the concerned Post Graduate course.

The existing/new medical colleges should mandatorily have the department of Blood Bank with component of blood separation unit and Transfusion Medicine.

There are many institutions where PG students have suffered due to non compliance of these regulations.

The following sub-clause 9(3) is included after sub-regulation 9(2) in terms of Gazette notification dated 23rd March, 2006.

"3. (i) The Universities and other authorities concerned shall organize admission process in such a way that teaching in postgraduate courses starts by 2nd May and by 1st August for super specialty courses each year. For this purpose, they shall follow the time schedule indicated in Appendix-III.

(ii) There shall be no admission of students in respect of any academic session beyond 31st May for postgraduate courses and 30th September for super specialty courses under any circumstances. They Universities shall not register any student admitted beyond the said date.

(iii) The Medical Council of India may direct, that any student identified as having obtained admission after the last date for closure of admission be discharged from the course of study, or any medical qualification granted to such a student shall not be a recognized qualification for the purpose of the Indian Medical Council Act, 1956.

The institution which grants admission to any student after the last date specified for the same shall also be liable to face such action as may be prescribed by MCI including surrender of seats equivalent to the extent of such admission made from its sanctioned intake capacity for the succeeding academic year."

Minimum Requirements for a Post Graduate Institution:

An institution conducting both undergraduate and Post Graduate teaching shall satisfy the minimum requirement for undergraduate training as prescribed by the Medical Council of India and shall also fulfill additional requirements for Post Graduate training depending on the type of work being carried out in the department. The extra staff required to be provided in various departments shall be as given in Appendix-I. [Para 11.2 (a)]

The above sub-clause 11.2(a) is substituted in terms of Gazette Notification dated 20.10.2008.

“(a) An institution conducting both Undergraduate and Post Graduate teaching shall fulfill the prescribed minimum requirements for undergraduate training and also additional requirements for Post Graduate training depending on the type of work being carried out in the Department. The additional staff required to be provided in following Departments shall be as under:

S. N.	Name of the department	Designation of Additional Staff	Additional staff required for each department
1	Department of Pathology	(i) Assoc. Professor/Reader	1
		(ii) Asstt. Professor /Lecturer	1
		(iii) Tutor/Demonstrator	1
2	Department of Radio-Diagnosis	(i) Assoc. Professor/Reader	1
		(ii) Asstt. Professor /Lecturer	1
		(iii) Tutor/Demonstrator	1
3	Department of Anaesthesiology	(i) Assoc. Professor/Reader	1
		(ii) Asstt. Professor /Lecturer	1
		(iii) Tutor/Demonstrator	1

Source: PG Regulations, 2000, Page 14, 15

Staff – Faculty:

(a) A clinical department or its unit training candidates for broad or super specialities, shall have a minimum of three full time faculty members belonging to the concerned disciplines of whom one shall be a Professor, one Associate Professor/ Reader/ and one Assistant Professor/ Lecturer, possessing the qualification and experience prescribed by the Medical Council of India; Provided that the second or subsequent additional unit may be headed by an Associate Professor.

Of these faculty members only those who possess a total of eight years teaching experience, out of which at least five years teaching experience as Assistant Professor/Lecturer gained after obtaining Post Graduate degree, shall be recognized as Post Graduate teachers.

The above sub-clause 11.1(a) is substituted in terms of Notification published in the Gazette of India on 20.10.2008. The following provision is added to Regulation 11.1(a) in terms of Gazette Notification dated 9th December, 2009.

“Further provided that no teacher shall be considered as a postgraduate teacher in any other institution during the period till the postgraduate course at the institute which has been granted permission considering him as a postgraduate teacher is recognized u/s 11(2) of the Indian Medical Council Act, 1956.”

MCI has no means to ensure compliance of above Standard. New form has some provisions of joining and leaving faculty, but no other mechanism has been placed to check monitoring and enforcement of the above regulation after Gazette Notification dated 9th December 2009. MCI should prepare as separate list of PG Teachers on its website and include a provision on faculty database along with date of PG MCI Inspection and upload of Declaration Form.

Restoration of Reduced Medical Faculty:

The following is included in terms of Notification published in Gazette of India on 6th October, 2001.

Appendix I			
S. N.	Name of the Department	Designation of Additional Staff	Additional staff required for each department
1	Department of Anatomy	(i) Assoc. Professor/Reader	1
		(ii) Asstt. Professor /Lecturer	1
		(iii) Tutor/Demonstrator	1
		(iv) Steno typist/Computer Operator	1
2-11	Department of physiology, Biochemistry, Pharmacology, Pathology, Microbiology, Community Medicine, Radio-Diagnosis, Radiotherapy, Anaesthesiology Department of Forensic Medicine	As above	

Till 2000 there was requirement of extra/additional staff in 11 subjects as per the Appendix-I to Regulations 2000 (page 25, 26)

Extra staff required in the following departments in addition to that prescribed in the Minimum Standard Requirements for the Medical College for 50/100/150 Admissions Annually Regulations respectively for conducting postgraduate courses in an undergraduate medical college.

The above Appendix-I is deleted in terms of Notification published in the Gazette of India on 20.10.2008, which aggravated the situation of deteriorating the quality of Forensic Medicine Education

along with other Pre and Para Clinical specialties. There is no mechanism till date with MCI to ensure implementation of its own regulations.

In addition to the faculty staff, the strength of Residents / Registrars / Tutors / Demonstrators, as well as technical and other para medical staff shall be as per the staff strength prescribed for 50 or 100 or 150 students in the "Minimum Requirements for 50/100/150 MBBS Admissions Annually Regulations." [Para 11(c)]

Solutions & Suggestions:

- Uniform nomenclature of MD Degree (Forensic Medicine and State Medicine) and name of Forensic Medicine & Toxicology Department in India
- Experienced MCI Assessors and Head of Departments with experience should be invited to provide training to all participants on regional basis and or State Basis. Transparent mechanism for selection of MCI Assessors with full credentials (Experience, No. of Publications, Honesty and Integrity, etc.) displayed on MCI Website.
- Mandatory display of PG/UG MCI Assessment Reports on the MCI Website, and Annual Report of MCI about number of PG Seats increased on year to year basis and number of PG Seats remains vacant on year to year basis along with periodical review to know the demand and supply of specialist in the India.
- Demonstrators/Tutors with PG Degree in Forensic Medicine as in case of Pathology, Radiology and Anaesthesiology
- Casualty Medical Officer's with MD Forensic Medicine with mandatory physical verification and Declaration Form during MCI Inspection both UG & PG
- There is need to define Minimum number of Postmortem, Medicolegal cases and other to be called adequate and more objective assessment
- Minimum age of PG Guide as per UGC Regulations 2010, so that he will sign Theses before retirement age on superannuation (67 years in case of Private Medical Colleges) three years before retirement in that institute in case of Private Medical College.
- Timely information to all Head of Departments regarding any change in policy matters related to specialty like: change in Standard Assessment Form (SAF) for UG/PG MCI Inspection
- Minimum No. of PG Students allotted to each teacher each year [Check with discussion of ratio of PG Teacher with no. of students]
- Perception of PG Student's satisfaction with No. of PG Teachers in terms of guidance and time given by the PG Teacher
- There is need for further modification of SIF PG MCI

MCI should ask from faculty based on their qualification, experience and research publications to apply for becoming MCI Assessors for UG and PG inspections. Prepare a list of MCI eligible assessor and then randomly select them zone-wise or state-wise for MCI Assessment.

There is need to create a helpdesk in the MCI where any medical faculty member can ask for any clarification about MCI Rules and Regulations in case of any ambiguity in a timely member.

There is need to develop human resource inventory for each specialty, designation-wise as a national database to predict the need in future and vacancies likely to occur after approaching retirement age and or age of 70 years for private medical colleges.

MCI should encourage Institution and Specialist Associations to organize workshops and seminars to create awareness about new amendment and or any ambiguity in the MCI Rules and Regulations as a prt of CME programme. These small steps will not create transparency in MCI Functioning but definitely improve the quality of medical education in the specialty of Forensic Medicine in India and thus, serve the purpose and fulfill the objectives of the Indian Medical Council Act, 1956.

Dr. Mukesh Yadav
Editor, J Indian Acad Forensic Med

Original Research Paper

A Radiological Study of Age Estimation from Epiphyseal Fusion of Distal End of Femur in the Central India Population

¹Bipinchandra Tirpude, ²Swapnil Patond, ³Pankaj Murkey, ⁴Ninad Nagrale

Abstract

There is no statistical data to establish variation in epiphyseal fusion in population in population of central India. This significant oversight can lead to exclusion of persons of interest in a forensic investigation. Epiphyseal fusion of the distal femur in 150 individuals was analyzed on radiological basis to assess the range of variation of epiphyseal fusion at each age. In the study the X-ray films of the subjects were divided into three groups on the basis of degree of fusion. Firstly, those which were showing No Epiphyseal Fusion (N), secondly those showing Partial Union (PC), and thirdly those showing Complete Fusion (C). Observations made were compared with the previous radiological studies. The ossification at distal end of femur at the Knee joint in Males and Females is completed in all instances (100%) at the age groups of 18-20 years and 16-20 year respectively. From this study, range of 1-2 years of margin of error can be concluded.

Key Words: Epiphyseal Union, Knee Joint, Distal end of femur

Introduction:

Epiphysis of the bones unites during age periods which are remarkably constant for a particular epiphysis. [1]

Epiphysis of the bones unites at the particular age and this is helpful in age determination. In law the crime and punishment is entirely based on criminal responsibility and this in turn depend on the age of a person. [2]

Age is helpful in identification of an individual which in turn is helpful in both civil and criminal cases. [3] It has been also stated that the study of epiphyseal union of bones is considered a reasonable scientific and accepted method for age determination by the law courts all over the world. [4]

India is a vast country with diversity in social customs, multiple religions, dietary habits and variations in climatic conditions.

In Modi's textbook [5] it is quoted that owing to variation in climatic, dietetic, hereditary and other factors affecting the people of the different states of India, it cannot be reasonably expected to formulate a uniform standard for the determination of the age of the union of epiphyses for the whole of India.

Human growth is continuous process which goes through, first a developmental stage and second, the maintenance of status. In the developmental stage, changes in skeletal and dental morphology occur in an age-age predictive sequence. [6]

Reddy KSN stated that the bones of human skeleton develop from a number of ossification centers. At 11-12th week of intrauterine life, there are 806 centers of ossification, at birth there are about 450.

The adult human skeleton carries only 206 bones. [7] It has been approved by research that the epiphysio-diaphysial union in Indian occurs about a year or two in advance than the Europeans. [8] Jit and Balbir Singh revealed that Precocity of epiphyseal union has been attributed to racial and climatic factors. [9]

Works in different regions of India-North (Punjab, Delhi and UP), East (Bengal) and South (Chennai) have given different ages of fusion of the epiphysis. Further, workers in the same region have also given different ages of fusion of the epiphysis of the same bone and in the same sex. This difference could possibly be due to in adequate material or recording of incorrect ages of the subjects. [10]

Corresponding Author:

²Assistant Professor,
Dept. Forensic Medicine
Datta Meghe Institute of Medical Sciences
Sawangi (Meghe), Wardha; Maharashtra
E-mail: Swapnil1985@yahoo.co.in

¹Prof & HOD, Dept. of Forensic Medicine,
MGIMS Sevagram, Wardha; Maharashtra

³Prof, Dept. of Forensic Medicine,
MGIMS Sevagram, Wardha; Maharashtra

⁴Assist. Prof, Dept. Forensic Medicine,
CM Medical College, Kachandur, Durg, Chhattisgarh
DOR: 16.09.2014 DOA: 10.01.2015
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It was, therefore, decided to reinvestigate the problem in the central part of India by radiological examination, taking care that adequate material was examined and only those subjects investigated whose ages has been recorded with reasonable degree of accuracy.

Aims and Objectives:

1. To estimate age from epiphyseal fusion in distal end of femur at knee joint.
2. To asses age specific difference in epiphyseal fusion at distal end of femur.
3. To compare bisexual difference in epiphyseal fusion at distal femur.
4. To assess and evaluate the difference in the epiphyseal fusion at distal end of femur in Central part of the India with other part of India on the basis of previous studies.

Material and Methods:

The present study was carried out in Department of Forensic Medicine MGIMS Sevagram Wardha. A total of 150 male and females participated in this study. The subjects included students of schools, College from district. Approval from ethical committee and informed consent was taken from all subjects prior to each investigation.

The subjects were from 13-20 years of age group. They are born to parents living in Central India and have lived since birth. The subjects do not have any disease/deformity pertaining to bones or chronic disease affecting the general health. The X-ray films were taken and films were developed with the help of experienced technicians. The part taken for X ray was Knee for distal end of Femur.

Skeletal maturity was evaluated according to the Jits and Kulkarnis classification. [10] For the study the X-ray films were divided into three groups for each epiphysis:

1. Those showing No epiphyseal union (NF)
2. Those showing partial union (PF)
3. Those showing complete union (CF)

Observation and Result:

In this study Males showed partial fusion in 12(14.63%) in 14-15 years of age group. 8(9.76%) in 15-16 years age group. 10(12.20%) cases and 2(2.44%) cases in 16-17 years and 17-18 years of age group respectively at distal end of Femur. (Table 2)

While distal end of Femur in males was completely fused in 2(2.4%) cases in 15-16 years, 6(7.32%) cases showed complete fusion in 16-17 years and 12(14.63%) cases seen in 17-18 years of age group. In 22(26.83%) cases complete fusion was seen in age group of 18-20 years. (Table 2)

Females showed partial fusion in 1(1.47%), 4(5.88%), 5(7.35%) cases in 13-14 years, 14-15 years and 15-16 years respectively. There was exception in 18-19 years of age group where only one case Showed partial fusion in our study. (Table 3)

Present study showed complete fusion of distal end of Femur in females in 4(5.88%) and 7(10.29%) cases in 14-15 years and 15-16 years of age group respectively. It was completely fused in all 41(60.30 %) cases between 16-20 years of age group. (Table 3))

Discussion:

Out of 150 subjects 82 males and 68 females from age group of 13-20 years, were studied for epiphyseal fusion of distal end of Femur and examine radiologically in this study. (Table 1) The distal end femur in males shows complete fusion in all 22(26.83%) cases in 18-20 years of age group. (Table 4)

The observation of present study was consistent with study of Saxena and Vyas [21] who conducted their work on population of Madhya Pradesh, Narain and Bajaj [19] and Das Gupta et al [21] study on the population of Uttar Pradesh along with Bokaria et al study in the population of Rajasthan [14] and Kausar and Varghese [23] study in the population of Karnataka.

The higher limit in present study also coincides with work of Flecker in the Australian [13], Davies and Parson [11] in the population of England, Stevenson in the population of United State and Paterson [24], in the population of UK.

It was also observed that Study done by Hepworth in the population of Punjab [12], Pillai [18] in the population of Madras and Galstaun in the population of Bengali in India [16], did not match with the observation of present study, rather their observations showed early fusion by about 1-2 years in distal end of Femur.

Distal end of Femur in female showed complete fusion in 41(60.30%) cases between 16-20 years of age groups, except in 18-19 years of age group where 1(1.47%) case showed partial fusion.

The observations of this study are in accordance with Das Gupta et al [21] study in the population of Uttar Pradesh, Basu and Basu's observations among Hindu population [15], finding of Bokariya et al [14] in the population of Rajasthan, Kausar and Varghese [23] who conduct study in the population of Karnataka, Paterson [17] in the population of UK. The finding of present study also coincides with study of Flecker. [13]

Summary and Conclusions:

The ossification at distal end of femur at the Knee joint in Males and Females is completed in all instances (100%) at the age groups of 18-20 years and 16-20 year respectively. By comparing the available literature about ossification of long bones, fusion was delayed one to three years in this study with population of Central India than those parts of south India and population of Bengal.

Age of skeletal maturity in both males and females in this region are nearly similar to those of Madhya Pradesh, Uttar Pradesh and Rajasthan. As this study is done in Central India region the application of standards of this study may be considered ideal for application in the region of Central India.

Population in Central India is mixed type comprising of various religions and castes. The opinion about age should always be given in the range. From this study, range of 1-2 years of margin of error can be concluded. For estimation of age relevant joints should be radiologically examined for different centres and opinion should be arrived considering the status of multiple centers.

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Fig. 1: Lateral & AP View of Knee Joint Showing Partial Fusion Distal End of Femur



Table 1: Age and Gender Wise Distribution

Age(yrs)	Males		Females	
	Case	(%)	Case	(%)
13-14	8	9.76	6	8.82
14-15	12	14.63	8	11.76
15-16	10	12.20	12	17.65
16-17	16	19.51	10	14.71
17-18	14	17.07	14	20.59
18-19	10	12.20	8	11.76
19-20	12	14.63	10	14.71
Total	82	100.00	68	100.00

Table 2
Distal End of Femur Fusion in Males

Age (yrs)	Not Fused(%)	Partial Fusion(%)	Complete Fusion (%)	Total
13-14	8(9.76)	0(0.00)	0(0.00)	8(9.76)
14-15	0(0.00)	12(14.63)	0(0.00)	12(14.63)
15-16	0(0.00)	8(9.76)	2(2.44)	10(12.20)
16-17	0(0.00)	10(12.20)	6(7.32)	16(19.51)
17-18	0(0.00)	2(2.44)	12(14.63)	14(17.07)
18-19	0(0.00)	0(0.00)	10(12.20)	10(12.20)
19-20	0(0.00)	0(0.00)	12(14.63)	12(14.63)
Total	8(9.76)	32(39.02)	42(51.21)	82(100)
χ^2 -value	132.10			
p-value	0.000, S,p<0.05			

Note: - Figures in parenthesis indicates percentage

Table 3
Distal End of Femur Fusion in Females

Age(yrs)	Not Fused (%)	Partial Fusion(%)	Complete Fusion (%)	Total
13-14	5(7.35)	1(1.47)	0(0.00)	6(8.82)
14-15	0(0.00)	4(5.88)	4(5.88)	8(11.76)
15-16	0(0.00)	5(7.35)	7(10.29)	12(17.65)
16-17	0(0.00)	0(0.00)	10(14.71)	10(14.71)
17-18	0(0.00)	0(0.00)	14(20.59)	14(20.59)
18-19	0(0.00)	1(1.47)	7(10.29)	8(11.76)
19-20	0(0.00)	0(0.00)	10(14.71)	10(14.71)
Total	5(7.35)	11(16.18)	52(76.47)	68(100)
χ^2 -value	76.14			
p-value	0.000, S,p<0.05			

Note: - Figures in parenthesis indicates percentage

Table 4
Comparison of Age of Fusion in Distal Epiphyseal End of Femur

S.N.	Researcher	Region	Age of fusion	
			Male	Female
1	Stevenson (1924) [24]	USA	19	19
2	Davies and Parson (1927) [11]	England	19	19
3	Hepworth (1929) [12]	Punjabi	16½-17 ½	16 ½-17 ½
4	Paterson (1929) [17]	UK	18	16-17
5	Todd (1930) [25]	USA	17½-18½	17½-18½
6	Flecker (1932) [13]	Australians	19	17
7	Pillai (1936) [18]	Madras	14-17	14-17
8	Galstaun (1937) [16]	Bengalis	14-17	14-17
9	Basu and Basu (1938) [15]	Hindu(Bengal)	-	16
10	Narain and Bajaj (1957) [19]	Uttar Pradesh	18-19	18-19
11	Saxena and Vyas (1969) [20]	Madhya Pradesh	18-19	18-19
12	Das Gupta et al (1974) [21]	Uttar Pradesh	18-19	16-17
13	Schaefer and black(2005) [22]	Bosnian	17-20	-
14	Connor JE, Bogue C(2008) [26]	Irish	17-17.9	17-17.9
15	Bokariya et al (2009) [14]	Rajasthan	18-19	16-17
16	Kausar and Varghese (2011) [23]	Karnataka	18-18 ½	16-16 ½
17	Present Study (2013)	Central India	18-19	16-17

Original Research Paper

A Study of Incidence of Alcohol Use In Fatal Road Traffic Accidents

¹Aditya Madhab Baruah, ²Rituraj Chaliha

Abstract

Road Traffic accidents (RTAs) are a leading killer in India snatching valuable human resources resulting in undefined economic and social loss. A leading cause for this malady is alcohol consumption and subsequent misadventure on the road which not only harms him but also the poor ones on the road. Though the co relation between the two is well known, we have been unable to tackle this menace. The present study was carried out with a view to analyze the incidence of alcohol consumption among the victims of road traffic incidents brought for autopsy to the Department of Forensic Medicine, GMCH, Guwahati. We found that males are most exclusively involved in accidents following alcohol consumption with 20-29 age group most affected. Majority of the victims were lowly educated and were pedestrians or riders of two wheelers. The mean BAC is found to be 167.28 mg/dl. Concrete steps needs to be taken starting from Government intervention to public awareness to prevent this harmful occurrence.

Key Words: Alcohol Consumption, RTA, Males, BAC

Introduction:

India is a rapidly growing country in a phase of transition with increased urbanization, industrialization, and motorization. With such a rapid pace of progress accidents are a reality waiting to happen. Death in the accidents is an inescapable fact and so is the influence of alcohol in the same. Road traffic accidents (RTA) cause largest number of injuries and fatalities worldwide by killing around 1.2 million people each year and injuring 50 million. [1]

The total number of deaths every year due to road accidents has now passed the 135,000 mark, according to the latest report of National Crime Records Bureau (NCRB). [2] The NCRB report further states that drunken driving is a major factor for road accidents. It is reported in India that 25 % of fatalities in road traffic accidents occur due to drunken driving.

Changing social norms, urbanization, increased availability, high intensity mass marketing and relaxation of overseas trade rules along with poor level of awareness related to alcohol has contributed to increased alcohol use.

Sale of alcohol in India has been growing steadily at 6% and is estimated to grow at the rate of 8% per year. About 80% of alcohol consumption is in the form of hard liquor or distilled spirits showing that the majority drink beverages with a high concentration of alcohol. [3] There is progressive loss of driving ability as blood alcohol concentration increases due to increase in reaction time, false confidence, impaired concentration and decreased visual and auditory acuity.

In India maximum permissible limit of blood alcohol concentration is 30 mg% but unsafe consumption of alcohol mixed with driving not only puts the individual in harm but also the co passengers of the vehicle and also the unfortunate ones in the road.

The concentrations of alcohol in blood and other body fluids are highly correlated, and both measurements are widely used as evidence to prove the over-consumption of alcohol in Forensic and legal medicine.

Thus a systemic study of these cases in matters like population profile, time of incident, place of occurrence, cause of death, blood alcohol concentration involved etc. enables us to evaluate different aspects of alcohol related traffic incident deaths.

Aims and Objectives:

1. To evaluate the causes and other contributing factors leading to death in Road traffic incidents with alcohol consumption.
2. To study the level of alcohol present in body by analysis of blood

Corresponding Author:

¹Post Graduate Trainee,
Department of Forensic Medicine & Toxicology,
Gauhati Medical College,
Bhangagarh, Guwahati, Assam 781032
E-mail: baruaditya@gmail.com

²Prof & HOD

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Materials and Methods:

The study was conducted in victims of fatal road traffic accident cases brought to mortuary of Gauhati Medical College and Hospital for medico-legal autopsy from 1st July 2013 to 30th June 2014. Various data were collected like age, sex, occupation, religion, date and time of crash, type of vehicle, type of road user and history of alcohol intake was taken and noted in a specially designed proforma.

Blood samples were collected from femoral vein. [4] About 10 ml of blood was collected by a sterile syringe in glass capped bottles containing sodium fluoride as preservative. The blood samples were quantified by gas liquid chromatography. Victims of RTA cases with hospital stay greater than 48 hours have been excluded from the study.

Observation and Results:

A total number of 3034 autopsies were carried out during the study period of which deaths due to road traffic accidents have been attributed to 952 cases. Out of these 952 cases 188 cases had evidences of alcohol in their blood constituting nearly 20% of total accidents involved. (Table 1) In this study out of total 188 cases, males were the most exclusively involved with 186 cases and only two female cases were noted. (Table 2)

In the present study, the age of the victims varied from as low as 16 years to as high as 71 years. (Table 3) It was observed that the age group between 20 to 29 years of age contained the highest number of cases, 72 (38.30%) closely followed by the age group between 30 to 39 years of age with 60 cases (31.91%). (Table 3) Regarding occupation 30.85% were businessman followed by cultivators and those engaged in private jobs. 23 students were also involved in our study. (Fig. 1)

Majority of the victims were lowly educated with the highest number of cases involved being of those who were under matric (35.64%), primary educated (13.30%) or illiterate (5.85%). Only 10.1% of cases were of those who were graduates or higher. (Table 4)

For the study the 24 hours of the day has been divided into four categories of 6 hour each and the data analysis showed that most of the incidents occurred in the evenings 6pm-12 midnight (45.21%) and afternoons (41.49%) in our study. (Table 5) Present study showed that pedestrian with 60 cases (31.91%) constituted the highest number of involved victims followed by those riding a motor cycle with 51 cases (27.13%). (Table 6) It was observed that before the accident alcohol was consumed over at a

friend's home, 59 cases (31.38%) followed by at one's own place with 42 cases. 30 cases had consumed alcohol in commercial institutions like bar, dhaba and local country shops. (Table 7)

In our study the Blood Alcohol Concentration of 68 cases (36.17%) was above 201 mg/dl with 38 cases (20.21%) and 36 cases (19.15%) between 51-100 mg/dl and 151-200 mg/dl respectively. Least number of cases is observed between 0-50 mg/dl.

The mean BAC is found to be 167.28 mg/dl. (Fig. 2) Of the cases, 185 of them exceeded the permissible BAC which is 30 mg/dl. Only 3 cases had BAC less than the allowed limits. (Table 8)

Discussion:

It was observed that nearly 20% of the victims had evidences of alcohol present in their body at the time of the accident. These findings are similar to other studies [5, 7], which showed involvement of alcohol in 20-25% of cases.

However National Center for Injury Prevention and Control, US [8] found alcohol as culprit in nearly 40% cases. The high involvement of males in the study is consistent with the findings of others. [5, 9, 10] It is observed that the age group between 20 to 29 years of age contained the highest number of cases, 72 (38.30%) closely followed by the age group between 30-39 years of age.

These findings are consistent with other authors work. [9, 11-13] But in contrary Ahlner J et al [14] and Rao Y et al [7] found 41-50 as the most commonly involved age group.

The reason behind involvement of the younger age group is that they are most actively involved in occupation and hence are most ambulatory and use alcohol as a means of recreation. Less involvement of the extremes of age is thus self-explanatory as they tend to remain indoors and avoid alcohol.

In the study of the cases involved 58 victims (30.85%) were businessman followed by cultivators and those engaged in private jobs. 23 students were also involved in our study. This can be attributed to the fact that these people are commonly mobile and have easy access to alcohol leading to accidents. The victims were mostly lowly educated with the highest number of cases involved being of those who were under matric (35.64%), primary educated (13.30%) or illiterate (5.85%). This can be attributed to the reason that people with grater educational background are more vigilant to the surroundings and avoid risk taking behavior.

However people with low educational background are usually not well employed and

have to move around for better prospects making them more likely to meet with an accident. Highest number of cases occurred between 6pm-12 midnight and 12 noon -6pm and least number of cases was seen in the interval between 6am-12 noon.

These findings are similar with the findings of Jani C B et al [9] and Rao Y et al [7] who indicated higher incidence of cases in evenings and nights. However the study differs with the findings of Arora P et al [12] who indicated maximum crashes during day time.

This can be due to the fact that more number of people returns from their place of work and activity at that time. Also alcohol consumption mostly takes place after one has completed their daily chores. This coupled with fatigue of the whole day and the urge to reach home quickly leads to more number of crashes in the nights and evenings.

Pedestrians with 60 cases (31.91%) constituted the highest number of involved victims also drivers of various vehicles and the pillion rider in case of two wheelers. The drivers both of two wheelers, three wheelers, four wheelers etc. are commonly involved along with pedestrians. Passengers of cars are less commonly involved. [6, 10, 12, 15]

Pedestrians being the most common victims can be explained by the fact that under the influence of alcohol they lack the general traffic sense which ultimately proved fatal.

Further the absence of proper footpaths and well defined crossing sections makes them more vulnerable to accidents. Drivers implicated is due to the reason that under the influence of alcohol there is a decrease in driving ability and reaction time which leads to more careless driver behavior and subsequent accidents.

Consumption of alcohol before accident took place over at a friend's home in 31.38% cases followed by at one's own place.

Significantly 30 cases had consumed alcohol from commercial places like bar, dhaba and illegal liquor stores. 29 cases had consumed alcohol over at a relative house.

This can be attributed to the reason that alcohol is taken usually at a social gathering to celebrate a particular occasion or festival along with friends and relatives in the confines of one's own residence. However commercial institutions which serve alcohol are more located in the outskirts of the region and the highway which increases the risk of accidents.

The Blood Alcohol Concentration of victims shown in our study was similar to the other studies. [9, 10, 12] A high BAC leads to different manifestations leading to difference and

error in judgment which leads to increased number of accidents. Also pedestrians with high BAC lose their direction sense and wander their way onto incoming vehicles leading to casualty.

Conclusion:

Drunk driving is a major problem in India and other developing regions of the world. The problem is unrecognized and hidden due to lack of good quality research data from many countries. Strict enforcement supplemented with education is one of the most powerful tools to tackle the problem in low-and middle-income countries and needs serious consideration.

Many other measures like increasing the legal drinking age, restricting the availability of alcohol by limiting timings, and controlling the unabated promotion of alcohol seems promising, but needs implementation. Many broader issues also need closer examination to develop and implement rational alcohol policies.

As such a few suggestions are advocated:

1. National information systems should be strengthened with appropriate knowledge, skills, techniques and resources to include information on driving under the influence of alcohol as an important element in road safety information systems within police and health sectors.
2. Independent studies by medical institutions should be undertaken periodically to examine the problem by both qualitative and quantitative research methods.
3. Health screening for alcohol problems should be undertaken in hospital emergency rooms among all persons with a RTI.
4. Physicians in emergency rooms should be trained to detect alcohol involvement in RTIs and use of breathalyzers should be promoted.
5. The autopsy centers in various parts of the country should be provided with their own laboratories and institutions for carrying out the blood alcohol estimations and to not only depend on the Forensic Science Laboratories for the results. This will also help the enforcement agencies in implementing the law of the land
6. The existing sections of the motor vehicles Act, which deal with drinking and driving, should be widely publicized through multimedia channels.
7. Current enforcement mechanisms should be reinforced by ensuring the availability of trained police and dedicated teams; the use of breathalyzers in a scientific manner; the introduction of random checks; an increase in current penalty levels; and to the strict

enforcement and implementation of laws in a random (geographically), visible, uniform and regular (periodically) manner.

8. Public education programmes must be specific and target oriented.

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Table 1: Alcohol and RTA involvement

Total RTA's Cases	Cases with evidence of Alcohol consumption (%)
952	188(19.75)

Table 2: Sex wise Distribution

Sex	Cases	Percentage
Male	186	98.94
Female	2	1.06
Total	188	100

Table 8: Victims with BAC above Legal Limits

Above legal limits	Cases	Percentage
Yes	185	98.40
No	3	1.60

Table 5: Time of Incidence

Time of incidence	Cases	Percentage
12 midnight-6am	20	10.64
6am-12noon	5	2.66
12noon-6pm	78	41.49
6pm-12 midnight	85	45.21
Total	188	100

Table 3: Age wise Distribution

Age (Yrs)	Cases	Percentage
0-9	0	0
10-19	13	6.91
20-29	72	38.30
30-39	60	31.91
40-49	36	19.15
50-59	5	2.66
above 60	2	1.06

Table 4: Educational Status of Victims

Educational status	Cases	Percentage
Primary	25	13.30
Illiterate	11	5.85
Under Matric	67	35.64
Matriculate	43	22.87
HS Pass	21	11.17
Graduate	17	9.04
Post Graduate	2	1.06
Unknown	2	1.06
Total	188	100

Table 6: Types of Victims

Victim type	Cases	Percentage
Pedestrian	60	31.91
Driver	20	10.64
Passenger	17	9.04
Motor cyclist	51	27.13
Pillion rider	21	11.17
Bicyclist	19	10.11
Others	0	0.00
Total	188	100

Table 7: Place of Alcohol Consumption before Accident

Place where taken	Cases	Percentage
Own Home	42	22.34
Friends home	59	31.38
Work Place	16	8.51
Relative house	29	15.43
Commercial	30	15.96
Not specified	10	5.32
Unknown	2	1.06
Total	188	100

Fig. 1: Occupation of the Victims

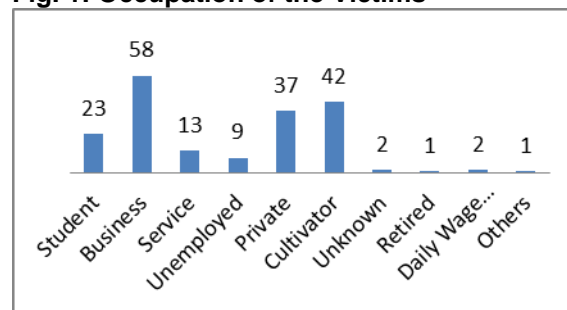
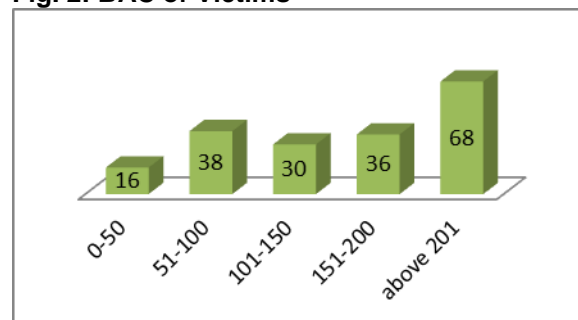


Fig. 2: BAC of Victims



Original Research Paper

A Study of Fatal Internal Injuries without Significant External Injuries in Road Traffic Accidents in Imphal from 2009-2014

¹Supriya Keisham, ²Salam Bitam Singh, ³Rishilu Kamei, ⁴Memchoubi Ph.

Abstract

A retrospective study of the road traffic accident cases starting from July 2009 to June 2014 was done. The aim was to find out those cases where fatal internal injury occurred without visible or significant external trauma. 84 cases out of 362 cases were selected. These cases were analysed regarding parameters like age and sex of the victim, the type of vehicle involved, manner of production, period of survival, type of road, cause of death, wearing apparel of the victim and relationship between visible external and internal injuries. In all these cases, a fatal internal injury was present in the absence of corresponding external injury. Therefore, it is suggested that absence of visible external injury should not be taken lightly as it may be associated with a fatal wound inside. The first 6 hrs turned out to be the most crucial. Head should be properly investigated for any injury as this has turned out to be the most vulnerable part. Nevertheless, a complete bodily investigation is a must to avoid any unwanted incident as well as a safeguard from allegations of medical negligence.

Key Words: Road Traffic Accidents, Fatal Internal Injury, External Injury

Introduction:

On Sep 11, 2001, the twin towers of the WTC were destroyed and history recorded over 3000 people was killed. Not many people are aware that about the same number of people die every day worldwide on roads.

Our roads which are meant to take us places often become venues of loss and sources of sorrow. WHO has decided to tackle the root causes of road accidents, a global scourge characteristic of our technological era, whose list of victims insidiously grows longer day by day?

How many people die or are injured? How many families have found them-selves mourning, surrounded by indifference that is all too common, as if this state of affairs were an unavoidable tribute society has to pay for the right to travel? [1]

Material and Methods:

A retrospective study of the road traffic accident cases starting from July 2009 to June 2014 was done.

Corresponding Author:

⁴Assistant Professor,
Department of Forensic Medicine,
Regional Institute of Medical Sciences, Imphal
E-mail: mem010177@gmail.com

¹Demonstrator,

^{2&3} PG Trainee

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The cases were analysed regarding parameters like age and sex of the victim, type of vehicle involved, manner of production, period of survival, type of road, cause of death, wearing apparel of the victim, and relationship between visible external and internal injuries.

Observations and Results:

In the five studies, there were 362 RTA cases. Of these only 84 cases showed internal fatal wound without significant external injury. Out of these total 84 cases, 70 were male and 14 were female. (Table 1) Maximum number of victims were aged 50 yrs and above, followed by 41-50 yrs, 31-40 yrs, 21-30 yrs, 11-20 yrs and 0-10 yrs group. (Table 2)

In this study we observed that Pedestrians were the most vulnerable group, followed by two-wheeler riders, driver of four-wheelers, occupants of four-wheelers, cyclists and pillion riders. (Table 3)

More than 50% of the victims survived only up to 6 hrs; few survived more than 24 hrs. (Table 4) Majority of the cases occurred on highways, followed by metallic roads and 'katcha' roads. (Table 5) Intracranial haemorrhage was the most common cause of death followed by brain injury. Other causes of death included haemorrhagic shock, post-operative death, injury to liver, injury to vital organs. (Table 6)

In the head and neck region, in 60 cases external injuries corresponded with internal

injuries and in 12 cases, did not correspond. In the chest, 3 cases showed corresponding external and internal injuries and 31 cases external and internal injuries did not correspond. In the abdomen, 2 cases showed corresponding injuries and in 22 cases, external and internal injuries did not correspond. (Table 7)

Regarding wearing apparel, 60 cases were thickly clothed and 24 were thinly clothed. (Table 8) Four wheelers were the most common causative agents. (Table 9)

Discussion:

In this study, it is observed that fatal internal injuries without significant external injury were more commonly seen in the older age group in males, mostly pedestrians, involving mainly the head and victims were usually thinly clothed. The causative agent was a four-wheeler in most of the cases.

Age could be a deciding factor since majority of the victims was in the older age group. The reasons could be the slower reflexes, weakening eyesight and physique of people in this age group. In other studies of road traffic accidents, 21-30yrs [2-4] and 20-40 yrs were more commonly involved as young adults in these age groups are more ambulatory and hence exposed to greater risk as compared to persons belonging to other age groups. Since the present study deals with a different aspect, older age group is involved.

Sex probably has some influence since males were more frequently involved. An association could be assumed between the lacks of adequate body fat and hence lesser cushioning effect from blunt trauma in case of males as compared to females.

Various studies by different workers [2, 4-7] also showed male preponderance.

The reason suggested by these workers was that male preponderance could probably be due to the social structure of the Indian society as most of the outside work is carried out by males and tendency of males not following the traffic rules and regulations. Moreover, females have minimal outdoor activity as compared to males. Pedestrians were the most vulnerable group as impact from any oncoming vehicle is bound to produce more serious effects. Some other authors also found pedestrians as the largest group of casualty in their studies. [4, 8, 9]

The period of survival was low in most of the cases since the internal trauma was massive.

Majority of the cases occurred on highways since vehicles usually ply at very high speeds on these roads.

The main cause of death turned out to be head injury (intracranial haemorrhage and brain injury) indicating that the head is the most vulnerable part of the body. This is similar with other studies. [2, 10-12]

Four-wheelers were the most commonly involved agents, producing severe internal injuries. This finding is similar with a study regarding the relationship between the type of vehicle and the internal injuries produced, which stated that collision between passenger vehicles and very large vehicles generate massive internal injuries by transmission of force through the victims. [13]

Conclusion:

Road traffic accidents are increasing worldwide causing loss of valuable lives. Most of them can be prevented by providing not only road safety education but also by increasing the emergency treatment procedures.

Absence of visible external injury should not be taken lightly. A fatal internal injury may be lurking inside. The first 6 hrs is the most crucial period. Head should be properly investigated for any injury as this has turned out to be the most vulnerable part. Nevertheless, a complete bodily investigation is a must. This will help in saving valuable lives and also in avoiding allegations of medical negligence later on.

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Photo 1: Liver Laceration without Any External Injury on the Abdomen



Photo 2: Intracranial Hemorrhage and Skull Fracture without Significant External Injury



Table 1: Sex-Wise Distribution

Sex	Cases	Percentage
Male	70	83.3
female	14	16.6

Table 2: Age-Wise Distribution

Age(years)	Cases	Percentage
0-10	1	1.19
11-20	10	11.9
21-30	12	14.28
31-40	16	19.04
41-50	17	20.23
50 & above	28	33.3

Table 3: Type of Victims

Type of Victim	Cases(84)	Percentage
Rider	23	27.38
Pillion rider	4	4.76
pedestrian	32	38.09
Occupant	9	10.71
Cyclist	6	7.14
Driver	10	11.90

Table 4: Period of Survival

Period of Survival	Cases(84)	Percentage
0-6 hrs	50	59.52
6-12 hrs	2	2.38
12-24 hrs	15	17.85
>24 hrs	17	20.23

Table 5: Type of Road

Type of Road	Cases(84)	Percentage
Metallic	23	27.38
Kutchha	10	11.90
Highway	51	60.71

Table 6: Cause of Death

Cause of Death	Cases(84)	Percentage
Haemorrhagic shock	6	7.14
ICH	57	67.85
Vital organ injury	2	2.38
Brain injury	9	10.71
Lung	1	1.19
Kidney	1	1.19
Spleen	0	0
Heart	1	1.19
Major vessel	0	0
Post op	4	4.76
Liver	3	3.57

Table 7: Relationship between Visible External and Internal Injuries

Injuries	Corresponds	Not corresponds
Head & neck	60	12
Chest	3	31
Abdomen	2	22

Table 8: Wearing Apparel

Wearing apparel	Cases(84)	Percentage
Thinly clothed	24	28.57
Thickly clothed	60	71.42

**Table 9
Type of Vehicle and Manner of Production**

Manner of production	Cases	Type of vehicle involved							
		Victim						Agent	
		Pedestrian	Two wheeler rider	Pillion rider	Four wheeler driver	Occupant	Cyclist	Two wheeler	Four Wheeler
Knocked down	52	32	10	3	1	1	5	12	40
Run over	0		0						
Head on collision	17	0	9	1	3	3	1	7	10
Self -accident	15	0	4	0	6	5	0	0	0

Original Research Paper

Age Determination from of Ossification Center Fusion around Knee Joint in Mumbai Region: A Radiological Study

¹S.S. Bhise, ²B. G. Chikhalkar, ³S. D. Nanandkar, ⁴G. S. Chavan, ⁵Anand P Rayamane

Abstract

The bones of human skeletons develop from separate ossification centers. 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 knee joint, of subjects in Mumbai region. 170 males between age group of 3-25 years and 66 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:

To establish exact identity of an individual age determination is essential not only in cases of living but also for the dead too.

Age has to be determined not only for identification purpose but also for various civil and criminal purposes. The determination of age presents a task of considerable importance from the view-point 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 India is composed of areas which differ in climatic, dietetic and disease factors which affect skeletal growth.

Determination of the age of an individual from the appearance and the fusion of the ossification centers is a well-accepted fact in the field of medical and legal professions.

Corresponding Author:

¹Assistant Professor,
Department of Forensic Medicine,
Grant Medical College & JJ hospital
Byculla Mumbai 400008
E-mail: sadanand_bhise@rediffmail.com

² & ⁴ Assoc. Prof,

³ Prof & HOD

Assist Prof, Dept. of FMT
Govt Medical College, Mysore
DOR: 12.06.2014 DOA: 10.01.2015
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The present study was carried out to study roentgenographically the epiphysal appearance and union at the knee joint especially lower end of Femur, Upper end of Tibia and Fibula. This study was carried out in subjects between age group of 3 to 25 years attending outpatient department of this hospital.

Aims and Objectives:

- To assess the skeletal maturity Knee joint for a known chronological age in subjects of Mumbai region.
- Comparative study of appearance & fusion of ossification centers at Knee joint with known standards
- To evaluate sex related variation & its correlation with age.
- To know variation if any & exception of appearance & fusion of centers of ossification.
- 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. Hospital in Mumbai which is a tertiary referral centre attached to Government Medical College with the objective to assess the general skeletal maturity of knee joint of subjects in Mumbai region.

Total 170 males and 66 females

between age group of 3-25 years attending the outpatient department of this hospital were selected. Age confirmed from history and noting the birth dates from driving license, passports ration card or voter's card. The cases selected after ruling out the nutritional, developmental, and endocrinal abnormality which affects the skeletal growth. X-ray of Knee joints were taken at Department of Radio-diagnosis. The epiphysis of Knee joints were observed for appearance (A) and non-appearance (NA) and different phases of fusion were graded according to William Sangma et al and Mckern and Stewart [13] into five stages as follows:

- **Stage 1(F1)Non-union:** when the epiphysial cartilage did not begin to decrease in thickness
- **Stage 2 (F2) Commence of union:** when the thickness of epiphysial 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 epiphysial cartilage was bony in architecture and its density indistinguishable from the epiphysis and diaphysis in its neighbourhood but an epiphysial line called epiphysial scar could still be distinguished. (3/4 united)
- **Stage 5 (F5) Complete union:** with absence of epiphysial scar.

Skeletal maturity was evaluated radiologically studying the various centres of ossification and the results were compared with the previous known standard studies.

For lower end of Femur and upper end of tibia only last two stage of fusion cases were taken in this paper as its ossification centres appears just before birth, remaining cases were in early stages of fusion And for upper end of Fibula both Appearance and last two stages of fusion were taken.

Observations and Results:

In our study regarding fusion of lower end of femur in males F1 stage of fusion was seen in 11 cases (100%) at 3-12 years age group. F2 stage of fusion was seen in 27 cases (87%) at 3-12 years age group, in 2 cases (6.5%) at 12-13 years and 13- 14 years age group respectively. (Table 1)

F3 stage of fusion was seen in 9 cases (34.6%) at 3-12 years age group, in one case (3.8%) at 12-13 years age group and in eight cases (30.8%) at 13-14 years age group, in 5

cases (19.3%) at 14-15 years' age group and in three cases (11.5%) at 15 – 16 years age group.

F4 stage of fusion was seen in 6 cases (17.1%) at 15-16 years age group, in 10 cases (28.6%) at 16-17 years age group, in 16 cases (45.7%) at 17-18 years age group and in 3 cases (8.6%) at 18-19 years age group.

Complete fusion (F5) was seen in 18 cases (26.9%) at 18-19 years age group, in 7 cases (10.4%) at 19-20 years age group, in 15 cases (22.4%) at 20-21 years age group and in 27 cases (40.3%) at 21-25 years age group. (Table 1)

In present study various stages of fusion of lower end of femur in females were seen as F1 stage in seven cases (100%) at 3-11 years age group. F2 stage of fusion was seen in 11 cases (84.6%) at 3-11 years age group, in 1 case (7.7%) at 11-12 years and 12-13 years age group respectively.

F3 stage of fusion was seen in 3 cases (30%) at 3-11 years age group, in 2 cases (20%) at 11-12 years age group, in one case (10%) at 12-13 years & 14-15 years age group respectively and in three cases (30%) at 13-14 years age group. (Table 2)

F4 stage of fusion was seen in three cases (30%) at 14-15 years age group & 16-17 years age group respectively and in four cases (40%) at 15-16 years age group. Complete fusion (F5) was seen in 2 cases (7.7%) at 16-17 years age group, in four cases (15.4%) at 17-18 years age group, in 6 cases (23.1%) at 18-19 years age group, in three cases (11.5%) at 19-20 years age group and in 11 cases (42.3%) at 20 – 23 years age group. (Table 2)

Extent of appearance and fusion of upper end of tibia in males in our study is observed as F1 stage of fusion was seen in 12 cases (100%) at 3-12 years age group.

F2 stage of fusion was seen in 28 cases (90.3%) at 3-12 years age group, in two cases (6.5%) at 12-13 years and in one case (3.2%) 13-14 years age group. F3 stage of fusion was seen in seven cases (26.8%) at 3-12 years age group, in one case (3.8%) at 12-13 years age group and in nine cases (34.4%) at 13-14 years age group, in four cases (15.4%) at 14-15 years' age group and in five cases (19.2%) at 15-16 years age group. (Table 3)

F4 stage of fusion was seen in one case (6.3%) at 14 -15 years age group, in five cases (31.3%) at 15-16 years age group, in eight cases (50%) at 16-17 years age group and in 12.5% cases at 17-18 years age group.

Complete fusion (F5) was seen in two cases (2.4%) at 16-17 years age group, in 14 cases (16.5%) at 17-18 years age group, in 20

cases (23.5%) at 18-19 years age group, in seven cases (8.2%) at 19-20 years age group, in 15 cases (17.6%) at 20-21 years age group and in 27 cases (31.8%) at 21-25 years age group. (Table 3)

In present study regarding fusion of upper end of Tibia in females subjects F1 stage of fusion was seen in nine cases (100%), F2 stage of fusion was seen in seven cases (100%) at 3-11 years age group. (Table 4) F3 stage of fusion was seen in five cases (41.7%) at 3-11 years age group, in three cases (25%) fusion occurred at 11-12 years age group, in one case (8.3%) at 12-13 years and in three cases (25%) at 13-14 years age group. (Table 4)

F4 stage of fusion was seen in one case (11.1%) at 12-13 years age group & 16-17 years age group respectively and in four cases (44.4%) at 14-15 years age group, in three cases (33.3%) at 15-16 years age group.

Complete fusion (F5) was seen in one cases (3.4%) at 15-16 years age group, in four cases (13.8%) at 16-17 years age group and 17-18 years age group respectively, in six cases (20.7%) at 18-19 years age group, in three cases (10.3%) at 19-20 years age group and in 11 cases (37.9%) at 20-23 years age group.

Discussion:

Distal end of Femur:

In present study males showed epiphyseal union at 18-19 years age group and earliest union occurred at 18 years. Females showed epiphyseal union at 16-17 years age group and earliest union occurred at 16 years. This observation of fusion of distal end of Femur is two year later in both males and females as that given in Galstaun study in Bengalis population. [5]

Proximal end of Tibia:

In present study males show epiphyseal union at 17-18 years age group and earliest union occurred at 16-17 years but after 17-18 years age group there is no F4 stage of fusion.

Females show epiphyseal union at 16-17 years age group and earliest union occurred at 15-16 years after 16-17 years there is no F4 stage of fusion. Our findings are close to Parikh, Homi S. Mehta study in Mumbai. Union in females was close to Hepworths study and in males' correlated with Narayan and Bajaj and Flecker work. [7, 8, 10, 12]

Conclusions:

In present study majority of cases show complete union for Lower end of Femur at 18-19 years for males and at 16-17 years for females. These findings are close to study carried out by Parikh, Homi S. Mehta and

Narayan & Bajaj because all these studies are done in India and for Upper end of Tibia union was seen at 17 to 18 years for males and 16 to 17 years for females.

These findings are in tandem with study carried out by Homi S. Mehta, Parikh, Narayan & Bajaj because all these studies were done in India. From the present study it can be concluded, that fusion of epiphysis of Lower end of Femur occurs in most of the cases at 18 – 19 years for males and at 16 – 17 years for females and upper end of Tibia fuses at 17 - 18 years in males and 16 to 17 years in females.

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Fig. 1: Fusion Stage 1 (2Yr/F) & 2 (5Yr/F) at Lower End of Femur and Upper End of Tibia

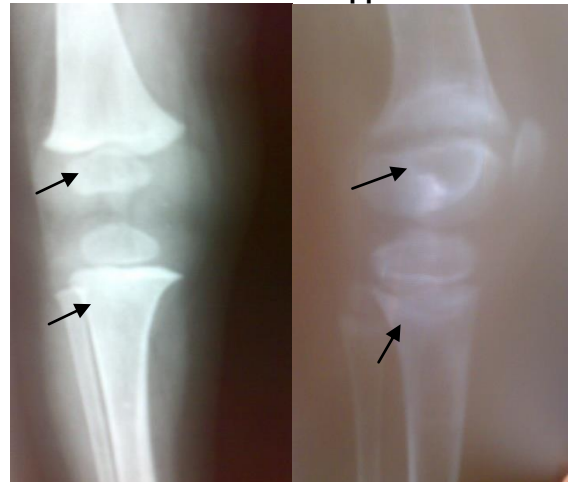


Fig. 2: Fusion Stage 3 (10Yr/F) & 4 (15Yr/F) at Lower End of Femur and Upper End of Tibia**Fig. 3: Fusion Stage 5 (16Yr/F) at Lower End of Femur and Upper End of Tibia****Table 1
Incidence and Extent of Fusion of Lower End of Femur in Different Age Groups in Males**

Extent of appearance & fusion	3-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-25	Total
	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	Cases (%)
NA	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
A	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
F1	11 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	11 (100)
F2	27 (87)	2 (6.5)	2 (6.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	31 (100)
F3	9 (34.6)	1 (3.8)	8 (30.8)	5 (19.3)	3 (11.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	26 (100)
F4	0 (0)	0 (0)	0 (0)	0 (0)	6 (17.1)	10 (28.6)	16 (45.7)	3 (8.6)	0 (0)	0 (0)	0 (0)	35 (100)
F5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	18 (26.9)	7 (10.4)	15 (22.4)	27 (40.3)	67 (100)

**Table 2
Incidence and Extent of Fusion of Lower End of Femur in Different Age Groups in Females**

Extent of appearance & fusion	3-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-23	Total
	Cases (%)	Cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	Cases (%)
NA	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
A	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
F1	7 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (100)
F2	11 (84.6)	1 (7.7)	1 (7.7)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	13 (100)
F3	3 (30)	2 (20)	1 (10)	3 (30)	1 (10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	10 (100)
F4	0 (0)	0 (0)	0 (0)	0 (0)	3 (30)	4 (40)	3 (30)	0 (0)	0 (0)	0 (0)	0 (0)	10 (100)
F5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (7.7)	4 (15.4)	6 (23.1)	3 (11.5)	11 (42.3)	26 (100)

**Table 3
Incidence and Extent of Fusion of Upper End of Tibia in Different Age Groups in Males**

Extent of appearance & fusion	3-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-25	Total
	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	cases (%)	Cases (%)
NA	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
A	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
F1	12 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	12 (100)
F2	28 (90.3)	2 (6.5)	1 (3.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	31 (100)
F3	7 (26.8)	1 (3.8)	9 (34.6)	4 (15.4)	5 (19.2)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	26 (100)
F4	0 (0)	0 (0)	0 (0)	1 (6.3)	5 (31.3)	8 (50)	2 (12.5)	0 (0)	0 (0)	0 (0)	0 (0)	16 (100)
F5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (2.4)	14 (16.5)	20 (23.5)	7 (8.2)	15 (17.6)	27 (31.8)	85 (100)

Table 4
Incidence and Extent of Fusion of Upper End of Tibia in Different Age Groups in Females

Extent of appearance & fusion	3-11 cases (%)	11-12 cases (%)	12-13 cases (%)	13-14 cases (%)	14-15 cases (%)	15-16 cases (%)	16-17 cases (%)	17-18 cases (%)	18-19 cases (%)	19-20 cases (%)	20-23 cases (%)	Total Cases (%)
NA	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
A	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
F1	9 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (100)
F2	7 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7 (100)
F3	5 (41.7)	3 (25)	1 (8.3)	3 (25)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	12 (100)
F4	0 (0)	0 (0)	1 (11.1)	0 (0)	4 (44.4)	3 (33.3)	1 (11.1)	0 (0)	0 (0)	0 (0)	0 (0)	9 (100)
F5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (3.4)	4 (13.8)	4 (13.8)	6 (20.7)	3 (10.3)	11 (37.9)	29 (100)

Table 5
Comparison of Time of Fusion (In Years)

Author	Year	Race	Sex					
			Males		Females		Mixed	
			Fusion of Lower end of Femur	Fusion of Upper end of Tibia	Fusion of Lower end of Femur	Fusion of Upper end of Tibia	Lower end of Femur	Upper end of Tibia
Galstaun	1937	Bengalis (Indians)	14 - 17	15 - 17	14 - 17	14 - 15		
Pillai	1936	Madrasis	.....	.....	.....	.....	14 - 17	14 - 17
Flecker	1932	Australia	19	18	17	.....	
Davies & Parson	1927	English					19	19 - 20
Hepworth	1929	Punjab					16.5 - 17.5	16.5 - 17.5
Homi S.Mehta	1963	Mumbai	18 - 19	17 - 18	16.5 - 17	15 - 15.5		
Parikh	1990	Indian					18 - 20	18 - 20
Narayan & Bajaj	1957	UP	.....	.....	.....	.....	18 - 19	18 - 19
Present Study	2010	Mumbai (Indian)	18 - 19	17 - 18	16 - 17	16 - 17	.....	.....

Original Research Paper

Comparative Study of Three Different Methods of Overlay Generation in Bite Mark Analysis

¹M. Jonathan Daniel, ²Nupur Bhardwaj, ³S.V. Srinivasan, ⁴V. K. Jimsha, ⁵Fremington Marak

Abstract

Bite mark is considered as a pattern produced by human or animal dentition in any substance capable of being marked by those means. Bite marks may be found at the crime scene and overlays generated from these bite marks are being used for comparison with the dentition of the suspect. This study was aimed to evaluate and compare three overlay generation techniques i.e. wax-impression, radiographic and computer assisted methods and validate the best method of overlay generation. Impressions of maxillo-mandibular arches were made and study models were prepared in dental stone. Overlays were generated by aforesaid three methods and overlays generated by each method were compared. Kruskal- Wallis ANOVA H test was used for comparison of the three methods and computer generated overlays were found to be the best as the H value was highest in this case. Computer assisted method of overlay generation proved to be the best method of overlay generation and should be widely used for bite mark analysis in future as it is free from subjectivity incorporated in other techniques.

Key Words: Bite marks, Overlays, Overlay Generation Techniques

Introduction:

Personal identification is important in criminology and Forensic Odontologists are key personnel for identifying a highly individual dentition which in turn could be used to convict or exculpate a suspect. [1, 2] Odontologic evidence is third to fingerprints and DNA analysis as most accurate means of identification. It was rightly said by Furness that "the criminal may lie through his teeth though teeth themselves cannot lie."

Actually in human identification anything different, such as variation from normality, becomes an important tool when trying to establish identity of suspect. [3]

Individuality of human dentition allows Forensic odontostomatologists to reach a strong opinion of association in cases of identification and bite mark analysis.

It is especially useful in cases of heinous crimes such as sexual assault wherein bite marks are very commonly found on breasts and genitals in females and in cases of child abuse where multiple bite marks are seen. [4]

Normally main focus is on analyzing bite mark injuries on human bodies but bite marks on food may also play an important role in the forensic investigation of a crime especially because marks on food items tend to be more accurate and reproducible than skin. [5, 6]

Bite mark is considered as a pattern produced by human or animal dentition in any substance capable of being marked by those means. Bite mark analysis assumes that uniqueness of dentition can be accurately recorded on skin or an object.

They are assumed to be different even in identical twins. [7] Generally bite marks consist of superficial abrasion, subsurface hemorrhages or bruising of skin. Characteristic of human bite marks are superficial abrasion or subsurface hemorrhages looking like an arch.

They are caused by incisors, canines and premolars depending on amount of skin incised. If less amount of skin is incised, pattern is elliptical extending up to canines but pattern is oval when more skin is incised and premolar imprints are also found in such cases. Abrasions caused by canines are in shape of points.

If perpetrator has dentures additional specific marks can be expected. Such peculiarities can be responsible for specific

Corresponding Author:

²Postgraduate Resident Ist Year
Department of Oral Medicine and Radiology
Mahatma Gandhi Post Graduate Institute of Dental Sciences, Pondicherry-605006 Puducherry (UT), India
E-mail: dentonoopur@gmail.com

¹Prof & HOD,

³Assoc. Prof

⁴Assist. Prof

⁵Assoc. Prof & HOD, Dept. of Forensic Medicine
Indira Gandhi Medical College and Research Institute
Pondicherry -605009, Puducherry (UT), India
DOR: 14.08.2014 DOA: 07.01.2015
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wounds and are additional markers for identification. Though the mechanism of bite mark is not clearly understood, the pattern of injury is invariably affected by force and length of time in bite in combination with other physiological and mechanical factors.

Biting is a dynamic procedure involving three moving systems maxilla, mandible and victims reaction. So the same dentition can produce bite marks that exhibit variations in appearance. [8] Depending on part of body and constitution of skin bite mark can be distorted-primary distortion is caused by dynamics of bite and secondary distortion may be time, posture or photography related.

Bite mark investigation involves physical comparison of unknown mark found on skin or objects to known exemplars of suspect's teeth followed by metric analysis of suspect's teeth. Comparison protocols include measurement and analysis of pattern, size and shape of teeth against similar characteristics observed in an injury on skin or a mark on an object. [9]

The tooth exemplar independent of method used to produce it is called an overlay when biting surface data is transferred to a clear transparent sheet; this is then compared with injury on skin or a patterned mark.

Overlays can be hollow when only perimeter of biting edges is recorded to produce facsimile images and inner aspect of tooth image is left transparent while the compound overlays provide images of individual features such as chipping, erosion or wear facets also.

A compound overlay provides 3D topography of teeth surfaces when a partial bite mark exists and identification is otherwise difficult and in such cases identification comparison can be based on individual features of a single tooth. [10]

Dental study model is the most accurate for collecting evidence for human bite mark identification. [11] In this study, an attempt was being made to evaluate and compare three overlay generation techniques i.e. wax-impression, radiographic and computer assisted method and validate best method of overlay generation from dental models.

Materials and Methods:

This study was a single centre clinical and radiographic prospective study which included healthy volunteers with complete set of natural upper and lower anterior teeth. Subjects with impaired mouth opening, compromised periodontal status, developmental tooth anomalies, and loss of anterior tooth structure,

orthodontic appliances and intra oral prosthesis were excluded from the study.

Impressions were made for maxillary and mandibular arches for all volunteers who agreed to participate in the study. Impressions were then rinsed thoroughly. Study models were made from these impressions using dental stone and were serially numbered. For each model so prepared, overlays were generated by three methods namely wax impression method, radiographic method and computer generated method. Thus a total of 75 overlays were generated.

1. Wax Impression Method:

Upper and lower dental models were pressed into a sheet of modelling wax (Hindustan modelling wax No.2) to obtain impression of biting edges of six upper and lower anterior teeth by applying manual pressure. Care was taken not to perforate wax sheet. Wax impression of biting edges of anterior teeth was obtained on wax sheet.

A transparent sheet was placed over the obtained wax impression and periphery of each shallow depression was hand traced with a black fine tipped marker pen to obtain hollow volume overlay for both arches to simulate a human bite.

ABFO scale No.2 was placed on left side of obtained wax impression overlay as laterality marker and sides were marked with a marker pen. (Fig. 1, 2)

2. Radiographic Method:

Wax impression was obtained as described earlier and the depressions were coated with a radioopaque dye (iohexol) with a thin hairbrush and allowed to dry. (Fig. 3)

Now the wax sheet was placed on an occlusal film size No.4 (57* 76mm). A radiographic image of wax impression was obtained using 60 kvp, 10 ma and central ray directed perpendicular to wax sheet.

Bite marks present as white teeth marks in a dark background when film is processed. These white marks were traced on a transparent sheet to obtain radiographic overlay. ABFO scale No. 2 was placed on radiographic overlay so obtained as laterality marker and sides were marked with a marker. (Fig. 3, 4)

3. Computer Assisted Method:

Dental study model was placed on a scanner with incisal edges touching the glass plate of the scanner. An ABFO No.2 scale was placed on left side of cast as laterality marker and the model was scanned.

The scanned image so obtained was imported into Adobe-photoshop software version 10.0. Biting edges were selected using magic

and tool and selection was smoothed. Again a new layer was created to obtain a hollow volume overlay. The image so obtained was printed on a transparent sheet to have computer assisted overlay (Fig. 5, 6). [12]

Now for each dental study model three overlays were there. Each overlay was placed over the biting surface of dental model one by one for assessing the degree of match and each time a value between 0 to 3 was assigned depending on degree of match (Table 1). [13, 14] This method of comparison is called indirect comparison method and the method of analysis is non-metric analysis.

Results:

Spearman Rank Correlation results were suggestive for intra-observer reliability between observation 1 and 2 of first observer and inter observer reliability between observation 1 and 2 of first observer and second observer. Kruskal Wallis ANOVA test was used to compare matching between the three methods of overlay production.

There was no significant difference in matching overlays by wax impression and radio opaque methods ($p > 0.05$) but both these methods varied significantly from the computer assisted method ($p < 0.05$). (Table 2)

There was no significant difference in matching cases between wax and radio-opaque methods as H-value is 0.40.

There was a significant difference in matching cases between wax impression and computer generated methods as H-value was 28.68. Numbers of moderate and excellent matching cases were higher in computer generated method compared to that of wax imprint method. There was a significant difference in matching cases between radio opaque and computer generated methods as H-value was 25.48.

Numbers of moderate and excellent matching cases were higher in computer generated method compared to that of radio opaque method. Hence, computer generated method was found to be a better method relative to radiographic method. There was a significant difference in matching cases among different methods ($p < 0.05$).

Number of moderate and excellent matching cases were higher in computer generated method (44%) compared to that of other two methods. Hence, computer generated method was found to be best method. (Table 3)

Discussion:

A bite mark may be defined as a mark having occurred as a result of either a physical

alteration in a medium caused by the contact of teeth, or a representative pattern left in an object or tissue by the dental structures of an animal or human. Bite marks analysis is based on the premise that 'no two mouths are alike'.

Bite marks are thus, considered as valuable alternative to fingerprinting and DNA identification in forensic examinations. The human bite mark is capable of withstanding the extreme conditions of the environment and is a ready source of information that can be identified even in the deceased individual.

In the present study we attempted to assess the reliability of three commonly used methods of overlay generation for analysis of bite marks. In our study H-value was 0.4 when we compared wax-impression and radiographic methods which suggests no significant difference in results between these two methods.

This probably could be attributed to the fact that dental models were pressed on wax sheet arbitrarily without any standardisation of force for various models which could have led to variations in area of indentations created on wax sheet. As regards to wax impression method our study also correlated with a previous study by Saritha Maloth et al [10] where they have recommended that it should be discontinued as there is lot of scope for manipulation and observer bias.

Sweet and Bowers also concluded in their study that subjective process of hand tracing should not be used. [15, 16] Similar result for wax impression method was also obtained in study by Khatri et al. [17]

Further the same wax impression was used for radiographic method also which probably affected the radiographic overlays too.

Some magnification or distortion could have incurred while taking radiographs. None of the overlays generated by radiographic method also matched accurately.

This finding of our study was not in accordance with prior study by Sweet et al [15, 16] where they found that area of tooth was best measured by radiographic method.

One reason for this variation in result could be that Sweet et al directly scanned the radiographs with bite indentations which probably reduced the subjectivity instead of tracing the periphery of indentation on radiographs on transparent sheet as we did in our study. H-value was significant when either of these methods were compared to computer assisted method i.e. there was significant difference in results.

In our study we have found maximum number of excellent matching overlays in computer assisted method i.e. 44% while in another 44% there was moderate matching.

Reason for this could be the fact that dental models were directly scanned and later biting edges were selected by inbuilt tools in software which minimised subjectivity and manipulation bias and allowed for more accurate reproduction of biting edges compared to the previous two methods.

Thus the result of our study showed that computer assisted method was the best method of overlay generation. This is in accordance with previous studies by Sweet et al, Maloth et al and Khatri et al. [10, 15-17] Mc Namee et al also suggested in their study that both direct and indirect computer assisted methods using Adobe photoshop software were reliable for overlay generation. [18]

An even better way of generating computer assisted overlays could be the use of Dental Print software that generates different comparison overlays from 3D dental cast images depending on pressure of the bite or distortion caused by victim biter reaction; this procedure is entirely automatic and thus avoids observer bias and it is impossible for third parties to manipulate the image. [19]

Conclusion:

Bite mark analysis is an important aspect of forensic dentistry that is invaluable in solving crimes and in identification of persons involved in criminal activities. The human bite mark is capable of withstanding the extreme conditions of the environment and is a ready source of information that can be identified even in the deceased individual.

The uniqueness of human dentition and analytical techniques usually allow an exact identification of perpetrator. But the better way of interpretation should be the statement that there is a possibility to exclude the suspect or a high probability that the suspect is the cause of bite mark.

The science of bite mark identification is quite new and potentially valuable. Bite marks if analysed properly not only can prove the participation of a particular person or persons in crime but also help in exoneration of the innocent. It is strongly recommended to discontinue hand tracing methods which depend on subjective input by Odontologists and use computer assisted methods which have comparatively higher reliability and accuracy.

The field of bite mark science is continuing to develop, and so is the need for

those who are trained and experienced in the identification with regard to the cases relating to the bite marks. [20]

With respect to possible failures of DNA identification, Forensic stomatological investigations should be considered routinely in all cases of bite injuries. Experience of examiners has an influence on results but still the method has a high level of reliability.

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Fig. 1: Wax Impression of Biting Edges

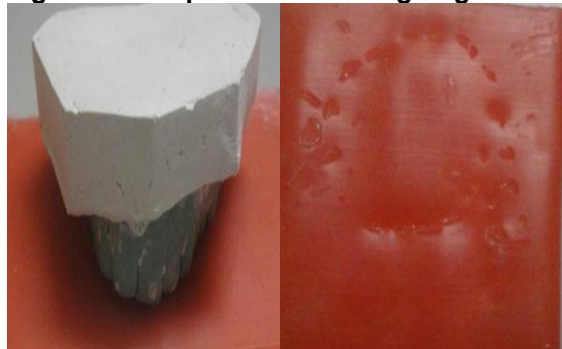


Fig. 2: Biting Edges Tracing and Wax Imprint Overlay

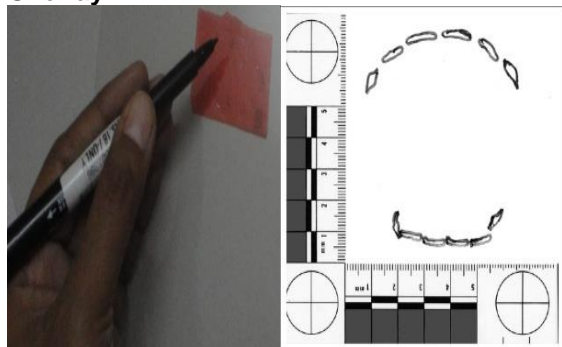


Fig. 3: Radiograph of Wax impression after coating with Dye



Table 1: Numeric Values for Matching

Numeric	Match
0	No match
1	Slight match
2	Moderate match
3	Excellent match

Fig. 4: Processed Bite Mark Radiograph & Overlay

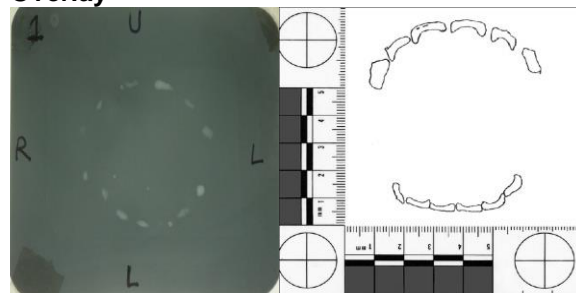


Fig. 5: Scanning of Dental Model



Fig. 6: Traced Biting Edges and Computer Assisted Overlay

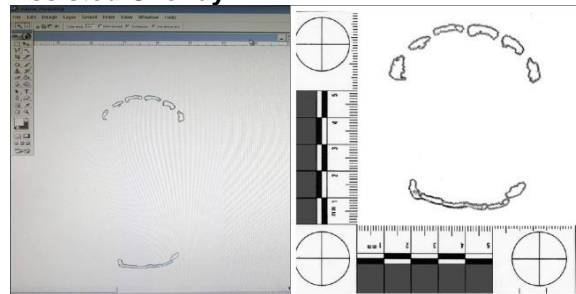


Table 2: Kruskal-Wallis ANOVA Test Comparing the Three Methods

	H-Value	P-Value
Wax impression and radio opaque method	0.4	0.52
Wax impression and computer method	28.68	0.0000
Computer assisted and radio opaque method	25.48	0.0000

Table 3
Kruskal-Wallis ANOVA Test Comparing Matching Cases by Methods

Method	Matching				Total	Kruskal Wallis ANOVA Test Statistic		
	No	Slight	Moderate	Excellent		Sum of Ranks	H Value	P Value
Wax Imprint	7(28.0)	15(60.0)	3(12.0)	0(0.0)	25(100.0)	656.5	37.35	0.0000
Radio Opaque Method	6(24.0)	14(56.0)	5(20.0)	0(0.0)	25(100.0)	730.0		
Computer Generated	0(0.0)	3(12.0)	11(44.0)	11(44.0)	25(100.0)	1463.5		
Total	13(17.3)	32(42.7)	19(25.3)	11(14.7)	75(100.0)			

Original Research Paper

Femicide: A Retrospective Study in Indian Scenario

¹Sujan Kumar Mohanty, ²G. Bala Maddileti, ³Virendra Kumar, ⁴Sachidananda Mohanty,
⁵K. Bhaskar Ready, ⁶V. Bhuvan

Abstract

Femicide is considered as killing of women, regardless of motive or perpetrator status. In India, violence and crimes against women like rape, kidnapping & abduction, murder and dowry death have increased over the years and evolved as a major social problem. To find out correlation between the crime and social status of victim, the present study was carried out to analyse different aspects of femicide from victims' profile. This retrospective study analysed 150 cases of femicide, which had been brought for medico-legal autopsy during a period of five years (November 2006 to October 2011). Females of 11-40 years of age were the common victims. In most of the killings, the alleged offender was a male relative of the victim. In majority of the cases, the weapons used were either hard & blunt or sharp cutting without any defence wounds. Death was commonly due to cranio cerebral injuries. Majority of the victims were illiterate, married, hailing from rural population & economically backward class and housewives by occupation. The findings may help the State and law making agencies to improve certain social issues, which indirectly reduce the crime against women.

Key Words: Autopsy; Familial Disharmony; Femicide; Own House; Relative

Introduction:

Femicide was first used in England in 1801 to signify the killing of a woman. [1] Russell defined the term femicide as the killing of females by males because they are female. [2] These include mutilation murder, rape murder, woman battery, wife killing and immolation of widows in India while honour crimes in Middle East countries. Again femicide was redefined as all killings of women, regardless of motive or perpetrator status. [3] Roughly 66,000 women are violently killed around the world each year, accounting for around 17% of all intentional homicides. [4]

Analysing the global data on homicide, it was observed that almost 80% of victims were men and most perpetrators were also men.

Why should we discuss femicide then? Because the great majority of women were killed in the domestic context and this was not limited to any specific country or region.

In Europe, women were killed by a family member in 50% of cases from 2008 to 2010 while for men, it was just 15%. There was a clear relation between the killing of women and the killing due to partner and family violence.

In North America, the per cent of family and intimate partner violence related femicide reaches 70%. [5] According to NCRB, [6] violence and crimes against women like rape, kidnapping, abduction, murder and dowry death have increased over the years in India.

In the year 2011, female homicide constituted 26.9% of total homicide, which was 9.9% increase over the year 2010. The incidence of dowry deaths during 2011 had increased by 25.8% over the year 2001. A study in India [7] observed that out of 152 burnt wives, 47 cases (31%) were homicidal in nature.

Since ancient days, femicide has been prevalent in our male dominated society, where the males have the mind-set to use the females as an article. In the present era, after evolution, urbanisation, improvement in socio-economic status, openness in political and religious

Corresponding Author:

¹Assistant Professor
Department of Forensic Medicine
Meenakshi Medical College & Research Institute
Kanchipuram, Tamilnadu; India 631552

E-mail: suju2411@yahoo.in

²Assist. Prof

³Prof & HOD

⁴Prof & HOD, Dept. of Forensic Medicine
MKCG Medical College & Hospital
Berhampur, Odisha; India

⁵Prof, Dept. of Forensic Medicine
Meenakshi Medical College & Research Institute
Kanchipuram, Tamilnadu

⁶Tutor

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thoughts, the society believes that women have the right to be free from all kind of violence.

Femicide is not only a crime but also a violation of women's basic human rights. Still then incidence of femicide is gradually increasing day by day. Though the incidence, pattern and methods of femicide are varying from region to region, culture to culture and time to time, but the most common element is that, it is a gender biased killing of females in a domestic environment.

Certain factors like poverty, unemployment, illiteracy & lack of awareness towards female education, poor family atmosphere, early marriage, rejection and frustration, disbelief, lack of understanding, male dominance, alcohol & drugs abuse, illicit sexual relations and fear of infidelity strongly trigger the expression of aggressive and violent behaviour against the females.

The present study has been undertaken to explore those different aspects of femicide in relation to victims' profile with specific emphasis on changing pattern in the present scenario.

Materials and Methods:

This study was carried out over a period of five years starting from 1st November 2006 to 31st October 2011 in the Department of Forensic Medicine and Toxicology, M.K.C.G. Medical College & Hospital, Berhampur, India.

Being the referral centre, it receives cadavers from the Berhampur city and outskirt villages in the district of Ganjam and also neighbouring districts of southern Odisha. A total of 1701 medico-legal autopsies were conducted during the above mentioned period.

Out of 590 established homicidal cases, 150 cases of femicide were taken as study material. All unnatural deaths, where the cause of death could not be ascertained due to insufficient/improper history, gross decomposition and inadequate finding, were excluded from the study.

The history and sociological aspects of deceased were obtained from accompanying persons/relatives and police as per the predesigned proforma. Each homicidal case was examined and evaluated at autopsy, both externally and internally. Emphasis was given on presence of any mechanical injury causing death, signs of struggle or defence wounds.

Simultaneously Dead body challan, Inquest report, Bed head tickets from hospital (if available) were studied. Qualitative estimation of alcohol was carried out in the departmental laboratory by subjecting vitreous fluid to dichromate test to find out the simultaneous

intake of alcohol by the victim in all cases except in those cases where vitreous was decomposed, body was extensively burnt and victims of less than 10 years of age.

In the present study, depending on the prevailing standard, socioeconomic statuses were categorized as low, middle and high depending upon the income per family per year i.e. up to Rs. 0.1 million as low, Rs. 0.1-0.3 million as medium and more than Rs. 0.3 million as high. The educational status has been classified as illiterate who are not able to read or write, Primary-up to class VII, higher Secondary (from Class VIII-X) and College and above.

The victims belonging to areas under Notified area council and Municipal Corporation were considered as urban group while other cases reported from nearby Panchayat areas were considered as rural group.

To evaluate seasonal occurrence of crime the year was divided into summer (March to June), rainy (July to September) and winter (October to February), which are more or less the main seasons of India. Statistical Analysis was done using SPSS software. The data collected were analysed by using chi-square test. The p-value ($p \leq 0.05$) was considered as statistically significant.

Observations and Result:

In present study out of 590 homicidal cases, 150 cases (25.42%) were femicide. About 60% of the victims were from 11-40 years of age. (Fig. 1) In majority of cases, the weapons used were either hard & blunt or sharp cutting edge. (Table 2) but defence wounds were absent in most of victims. (Fig. 5)

In our study familial disharmony was the chief cause in half of the femicide. (Fig. 2) In most of the killings, male person ($p < 0.0001$) was the alleged accused (Table 1), who was a family relative of the victim. (Fig. 3)

It was seen in this study that Victims' own house was the scene of crime in 70% cases. (Fig.4) Death was due to head injuries in 36.67% of cases. (Fig. 6) More than 80% of the victims were not addicted to tobacco or alcohol. (Table 3) Almost all the victims were Hindu and from rural background in this study. (Table 4)

Majority of the victims were from low economic status (73.33%) and either illiterate (60%) or educated only up to primary school level. (Table 4) Majority of the victims were married (67%) and housewives (56.67%) by occupation. (Table 4) Half of the incidents occurred during day time with almost equal number of cases seen during summer & rainy season.

Discussion:

The incidence of the crime is almost the same as different studies carried out in different parts of India [8-10] and Malaysia. [11] The lower percentage of femicide in comparison to males mainly attributed to their custom, social values and preference to stay inside the houses.

But in contrast, studies from USA, [12] Turkey, [13] Egypt [14] and Pakistan [15] revealed lower incidence of female killing and at the same time higher incidences were observed in studies from Norway & Denmark [16] Poland [17] and Australia. [18]

Other prominent factors like poverty, animosity and loss of faith and confidence among various relationships, loopholes on the part of the law enforcing agencies and judiciary also play their part to the increased trend of femicide. Subsequently on age wise study, majority of victims (60%) belonged to 11-40 years of age group, almost similar to studies conducted in USA, Turkey, Norway & Denmark and South Africa. [12, 13, 16, 19, 20]

Least number of cases was reported at the extremes of age. This vulnerability of females in the active period of their social life could probably due to the resultant effect of youth, non-tolerance to psychosocial and sexual harassment, the attitude to retaliate and fight for their rights.

Familial disharmony came out as the most common cause behind the heinous act against the women, consistent with other studies in Norway & Denmark, Australia and London. [16, 18, 21] Lack of mutual trust & understanding amongst couples, sexual starvation, issueless for years, fear of infidelity, poverty and illiteracy are the factors which destroy the harmony in the family, ending with the violent act. Dowry was the cause in 16.67 % of cases. In 2 cases, murder was committed after sexual assault.

Accused alleged were mostly the males. In almost 90% of cases, the victim and alleged offender were known to each other consistent with other studies [18, 22] and to the surprise, they were family relatives in almost 65% cases i.e. may be husband, son and brother-in-law. Studies worldwide also reflect a similar picture.

Majority of female victims were killed by their spouse, [9, 16] close acquaintances, [20, 21] a relative, [22, 23] and intimate relation. [19, 24] In the present study, single offender was alleged in most of the cases but in case of dowry deaths, the alleged offenders were more than one & of both sexes. Due to psychosocial and hormonal factors, males are the usual offenders.

The male dominant mind set, selfishness, illicit sexual relations, personal benefits and shattered moral & social values have increased the violence against females in domestic environment.

Females were paradoxically exposed to more dangerous or lethal attacks in the assumed safe & secure place i.e. four walls of their own house which is consistent with different studies in India, [9] Norway & Denmark, [16, 25] Australia, [18] South Africa, [19, 20] UK, [21] and USA. [22, 24] The preponderance of indoor occurrence of crime could be because most of victims were usually confined to the house and killed by relatives.

Hard and blunt weapons followed by sharp cutting instruments were more commonly used than strangulation. Not a single case of firearm death was reported. Different worldwide studies represented different picture. Blunt trauma was more common in India, USA and Germany, [9, 22, 26] whereas sharp cutting weapons were common in Norway & Denmark and Australia. [16, 18]

Firearms were described as the most common weapon of offence in USA, South Africa and Canada. [12, 19, 27] When any person comes in the heat of passion in the domestic circuit, he finds the common household articles present at hand to use as a weapon of offence. The use of firearm in the rural population of this locality is very rare. This is probably due to non-availability of the firearms to the poor farmers quiet easily.

Defence wounds are the results of the immediate and instinctive reaction of the victim to save herself by raising the arm or grasping the weapon to ward off the attack. In 22 cases, where sharp & blunt weapon were used for killing, defence wounds were absent in most of the victims (90.9%) which is consistent with other study from India. [28]

The females were usually killed by close acquaintances in the family where the victim hardly expects such a lethal attack and also it is presumed that females can be overpowered easily & in some instances involvement of multiple assailants reduce the chance to defend.

Head injuries were the most common cause of death which is almost consistent with other study from India. [9] This can be attributed to the fact of availability of hard and blunt household article which had been used as a murder weapon.

It was noted that, majority of the victims were non addict. Qualitative analysis of alcohol in vitreous fluid was done in 19 cases. Not a single case was found positive for alcohol, which

suggested that, none of the female victims had consumed alcohol prior to their demise.

A study in Turkey [13] reported blood alcohol only in 2 cases of female homicide. But in contrast, high prevalence of blood alcohol was observed in Norway & Denmark, [16] Australia [18] and South Africa. [20]

Due to socio-cultural practices in this part of India, the alcohol consumption or addiction to any substance is very insignificant in rural female population.

In an effort to establish any relationship of blood group with susceptibility to femicide, it was observed that victims of 'B' group (42.85%) were more than 'A' (28.57%) groups.

Majority of the victims were Rh +ve. Just contrast to this, in the population in India [29] 'O' group (37%) is the predominant blood group followed by 'B' group (33%), 'A' group (22%) and 'AB' group (7%).

Lester D and Hathaway D [30] pointed out that in samples of organ donors, homicide victims had significantly more individuals with type O and type B. The more number of femicide victims having B blood group could not be explained and demands further studies.

Most of the victims were from Hindu community hailing from rural areas, similar to other studies [9, 31] and this was as per the relative population structure prevailing in this region. Females of low socioeconomic group and illiterate females (60%) were most common sufferers and the incidence decreases with higher education as supported by similar studies from India [9] and USA. [12]

Married females (67.67%) were most commonly exposed to this heinous crime, similar to studies in Poland and Australia. [17, 18] Most of them were housewives, very similar to studies from India and South Africa. [9, 19, 32]

There is always lack of care & attention towards female education in large families with low economic status. Early marriages are much more prevalent in this region mostly due to custom and social beliefs.

Due to lack of understanding in between the couple & family, usually they are unable to solve the disputes in family through dialogue.

Ultimately poverty, poor education and economical dependency of females appear to be vital factors in femicide. Same number of cases had occurred during day and night indicating no substantial diurnal variation, so also no seasonal variation as almost equal number of cases were reported during summer and rainy season contrast to a study in South Africa [20] which described winter to summer as predominant season.

Conclusion:

Up to date knowledge of the prevailing trends of femicide may help the law makers in preventing this heinous crime, though this could be a Himalayan task.

But to decrease the rates of femicide substantially, certain fruitful steps can be taken like uplifting the social life of the female, alleviating illiteracy by rural educational programs, providing economic independence by creating better job opportunities for the females, prohibition or restricted sale of alcohol, safe guarding their interests and rights, awareness programmes to eradicate various superstitions, etc. Along with the socioeconomic improvement, the crime investigating agencies including medico legal aspects and judiciary system is to be strengthened so that the laws can be enforced stringently.

A wide range of further investigation especially on the effects of surroundings, inherent characteristics and psychiatric illness can be carried out on the victims to point out some more predisposing factors which on use can prevent femicide to a large extent.

Assessing the burden of the issue on the socio-economic, cultural and multidirectional after effects, we feel that continuous research in this field is the need of the hour, to divulge various factors and implement strategies to prevent loss of innocent lives.

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Fig. 1: Age Distribution of Victims

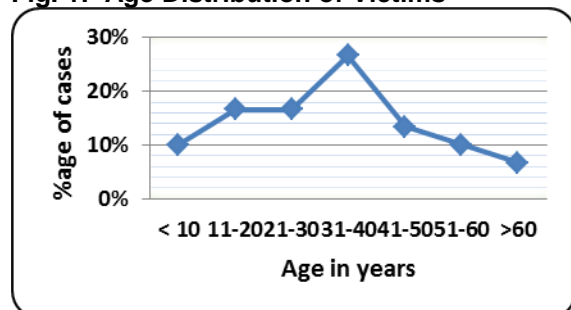


Fig. 2: Causes of Homicide

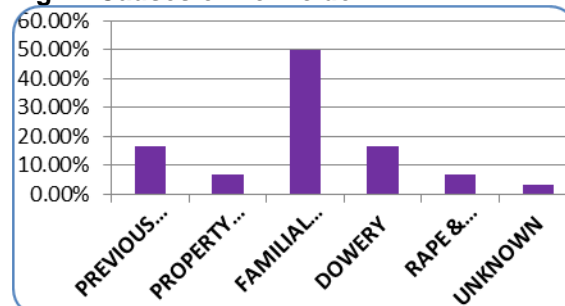


Fig. 3: Relation of Victims to Known Alleged Offenders

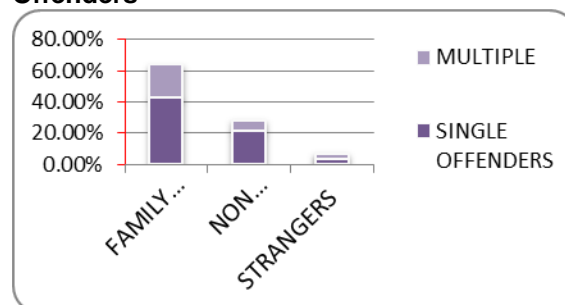


Fig. 4: Place of Occurrence

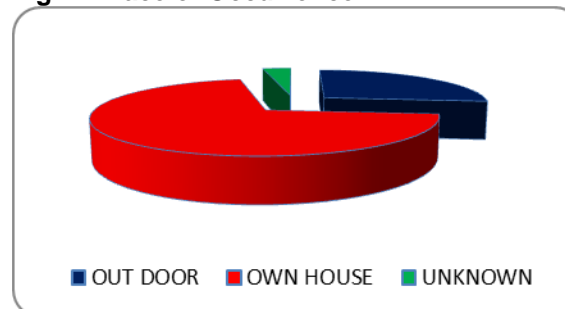


Fig. 5: Defence Wounds

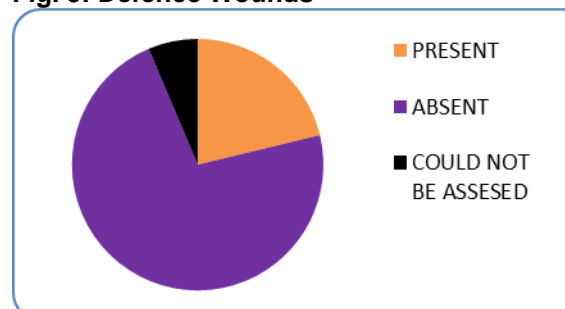


Fig. 6: Causes of Death

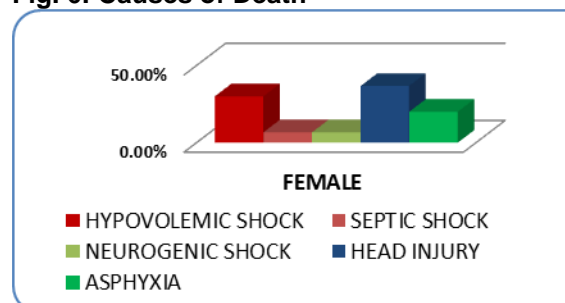


Table 1: Alleged Offenders

Alleged Offenders	Cases	%
Male accused	115	76.67
Female accused	5	3.33
Both	20	13.33
Unknown	10	6.67
Total	150	100.00

 $\chi^2 = 42.7$, d. f. = 3, $p < 0.001$ **Table 2: Common Methods Used in Femicide**

Weapons used	Cases	%
Sharp cutting	50	33.33
Hard & blunt	60	40
Strangulation	15	10
Thermal	20	13.33
Others	5	3.33
Total	150	100

 $\chi^2 = 19.92$, d. f. = 4, $p < 0.0005$ **Table 3: Addiction Status of Victims**

H/o addiction	Cases	%
Tobacco	5	3.33
Alcohol	0	0.00
Alcohol & tobacco	5	3.33
Non-addiction	130	86.67
Unknown	10	6.67
Total	150	100.00

 $\chi^2 = 69.1$, d. f. = 4, $p < 0.0001$ **Table 4: Socio-Demographic Profile**

Area of domicile	Cases	%
Rural	145	96.67
Urban	5	3.33
	150	100.00

 $\chi^2 = 41.76$, d. f. = 1, $p < 0.0001$

Socio-economic Status		
Low	110	73.33
Medium	25	16.67
High	5	3.33
Unknown	10	6.67
	150	100.00

 $\chi^2 = 39.45$, d. f. = 3, $p < 0.001$

Educational status		
Illiterate	90	60.00
Primary	30	20.00
High school	10	6.67
College	10	6.67
Unknown	10	6.67
	150	100.00

 $\chi^2 = 30$, d. f. = 4, $p < 0.0001$

Marital status		
Married	100	66.67
Unmarried	35	23.33
Widow	10	6.67
Divorcee	0	0.00
Unknown	5	3.33
	150	100.00

 $\chi^2 = 47.96$, d. f. = 4, $p < 0.0001$

Occupational status		
Housewife	85	56.67
Labourer	20	13.33
Farmer	15	10.00
Dependent	15	10.00
Student	5	3.33
Unknown	10	6.67
	150	100.00

 $\chi^2 = 29.02$, d. f. = 5, $p < 0.0001$

Original Research Paper

Hand Index and Psychiatric Illness

¹DK Atal, ²N Bhatt, ³MS Sulaiman, ⁴S Das

Abstract

The shape of the hand has been considered as an important criterion in the study of palmistry and other related sciences since ancient times. A scientific measurement of the shape of the hand can be achieved by calculating its breadth and length, taking into consideration its various landmarks. Previous workers have studied the various measurements related to the human hand and have pointed out significant association with various diseases. However, such studies are few in number. Hand index is found to be an important tool in determination of nature, personality, predisposition to certain diseases, and many other unique points about an individual. The current study was conducted in the Outpatient Department of Psychiatry of the Himalayan Institute Hospital, Dehradun. The hand index of patients with psychiatric illness was studied and the results were compared with a control group. An effort was made to find out whether there is any correlation between dimensions of the hand and presence of psychiatric morbidity of an individual.

Key Words: Hand Index, Psychiatric illness, Dehradun

Introduction:

Various indices are used to determine race and sex of an individual. However, there are few indices which are used to determine the nature and personality of individual, predisposition to certain disease, etc. Hand index is one such index. It is ratio between the 'hand width' (i.e. Maximum palm width) and the 'hand length' (i.e. the distance between the tip of the middle finger and the distal wrist crease). It is also observed that Hand Index changes with age. The present study was carried out with the objective of finding an association between hand-index and psychiatric morbidity.

Materials and Methods:

The study was conducted as a part of Short Term Research Project at the Himalayan Institute of Medical Sciences. The Hand index of patients of psychiatric illness, received in the outpatient Department of Psychiatry of the Himalayan Institute Hospital, Dehradun was studied and compared with a control group. Total 50 subjects (25 Psychiatric patients and 25 Control) were included.

Corresponding Author:

1Assistant Professor,
Department of Forensic Medicine,
HIMS, SRH University, Jolly Grant,
Dehradun, Uttarakhand-248140
E-mail: drdevinderatal_fmt@rediffmail.com
2& 3MBBS Student
4Prof & HOD
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The psychiatric patients in age group of 18- 60 years, capable of providing informed consent, were included in the study. However, violent/ uncooperative patients, patient with mental retardation and patients who cannot provide consent were excluded. The data obtained was statistically analysed to find out any significant correlation.

Observations and Results:

A total of 50 subjects (25 Psychiatric patients and 25 Control) between age group of 18-60 years were studied. Patients with mental retardation and those who cannot provide consent were excluded. The statistical analysis was done to find out mean, standard deviation and statistical significance.

The Mean hand index was found to be 48.64cm in the psychiatric patients compared to 44.23cm in Controls. This was found to be significantly different among the psychiatric patients as compared to the control group ($p < 0.001$, $df = 48$, $t = 4.530$). This observation points to a definite association between the hand index and psychiatric illness. (Table1)

Discussion:

Various studies suggest that hand dimensions are the result of hormonal influences. Sex hormones regulate genes, which are responsible for chondrocyte proliferation and growth of digits. The second digit in males is shorter than forth digit, but in females second digit is of same length or longer than the fourth digit. Low 2D:4D ratio reflects embryonic exposure to high level of testosterone. [1]

Studies also prove correlation between hand dimensions and sex linked behaviours, altruism music aptitude and various illnesses including prostate cancer, anxiety, etc. [2-5]

To our knowledge, this was the first study on the association between hand index and psychiatric illness. But correlation between hand parameters and psychological disorder has been done by few researchers.

Kornhuber et al conducted a study on Second and Fourth digit ratio (2D:4D) in Alcohol Dependent Patients and observed that alcohol dependent patients had smaller 2D: 4D ratios compared to controls with preserved sexual dimorphism but with reduced right-left differences.

The diagnostic accuracy is highest for right hand in males followed by the left hand in males, right hand in females and left hand in females. [6]

Bailey et al observed that males with lower finger length ratios had significantly higher physical aggression scores. However, finger length ratio did not predict anger, hostility, or verbal aggression in both sexes. [7]

Hanoch et al studied Second and Fourth digit ratio (2D:4D) and impulsivity in Offenders and Non-offenders. It was found that offenders exhibited smaller right hand digit ratio measurement compared to non-offenders.

In this study multi-step correlation analysis was done and it was finally observed that marginal significant correlation between 2D:4D ratio measurement and impulsivity scores.

However, within the groups, a significant correlation was found among offenders. This study therefore, emphasized the importance of studying the relationship between biological markers, impulsivity and criminal behaviour. [8]

Very few studies suggest direct correlation between hand parameters and psychiatric illness. Shamir et al studied biometric parameters of hand as an index of Schizophrenia. 38 patients with schizophrenia and 42 controls were graded on 13 parameters having relation with mental health issues.

It was concluded that schizophrenics had higher values than control in 3 out of 13 parameters (Proximal inter-phalangeal joint, Low

transverse line and Eponychium of the middle finger). [9] Bruin et al observed that males with autism/Asperger syndrome had a significantly lower 2D:4D ratio than males with anxiety disorders. Similarly, males with attention deficit-hyperactivity disorder (ADHD)/oppositional defiant disorder (ODD) showed a significantly lower ratio than the group with anxiety disorders. [10]

The current study corroborates with the general principle of earlier studies and shows that this principle can be extrapolated to mental illnesses also.

Conclusions:

The current study has shown significant difference between the hand indices of psychiatric patients and the control group ($p < 0.001$, $df = 48$, $t = 4.530$). However, the present study was a short term research project where a small sample size was studied to find a correlation between hand index and psychiatric illness. In addition, mentally retarded patients who cannot provide consent had also been excluded. So, the authors suggest further study with a larger sample size for increased accuracy and reliability.

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Table 1
Hand Index in Psychiatric Patients and Control Cases

Hand Index	Psychiatric Illness	N	Mean	Std. Deviation	S.E. Mean	t	df	Sig. (2- tailed)
	Mental Illness	25	48.64	2.833	0.567	4.530	48	0.000
	Control	25	44.23	3.954	0.791			

Original Research Paper

A Prospective Study of Injury Pattern in Victim of Assault Attended in South Mumbai Government Hospital

¹H. R. Thube, ²B. G. Chikhalkar, ³S. D. Nanandkar

Abstract

Assault was the main crime since long back from history. The present study was conducted in accident and emergency Department of Grant Medical College and Sir JJ Hospital located in south Mumbai over the period of two years from October 2011 to September 2013. Total 1288 cases of assault observed out of which 1100 were male (85.4%) and 188 were female (14.6%). The age group which was maximally affected in case of male and female was same i.e. 21-30 year. In males majority of injuries were simple in nature 803 (73%). While in females no grievous injury noted.

Most commonly body part involved in assault was head face and neck 959 (47.92%). The commonest injury in male victim was lacerations 543 (49.4%). The weapon of assault in male victims was hard and blunt object in maximum 51.4% while in females 45.2% were body parts such as fist and kicks. Out of 272 grievous injuries the 31.2% injuries were caused by hard and blunt weapons. Thorough examination and interpretation of injury is of vital medico-legal importance and plays crucial role for judiciary to deal with interpersonal violence.

Key Words: Assault, Grievous, Laceration, Weapon

Introduction:

According to Section 351 of the IPC 'assault' is defined as 'every attack or threat or attempt to apply force on the body of another in a hostile manner'. [2]

Assault cases were dealt in casualty department for primary treatment purpose, doing medico-legal work and for certification purpose. The injury certificate is issued on the request of investigating police officials and it will be important evidence in court of law.

Assessment and interpretation of injury depends on a good history, an appropriate physical examination and recording the findings contemporaneously, clearly, and unambiguously. Such documentation (whether notes, body charts, or computer records) may be reviewed by other doctors, legal advisers, and the courts. Based on the queries generally faced by casualty medical officer, the present work is aimed to study the medico-legal aspect of clinical medico-legal cases in casualty with special reference to assault cases.

Corresponding Author:

¹Junior Resident-III,
Department of Forensic Medicine & Toxicology,
Grant Medical College and Sir JJ Hospital,
Byculla, Mumbai 400008.

E-mail: drharshalthube@gmail.com

²Prof, ³Prof & HOD

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Material and Methods:

Present study was conducted in casualty of tertiary care government hospital Mumbai which is working round the clock and where continuous service for medico-legal case is rendered. The cases which were brought to casualty and which were of medico-legal nature and which were registered as cases of EPR (Emergency Police Register) were attended in casualty.

The detailed examination of assault cases was done after taking consent. The documentation in register done by casualty medical officer was reviewed. Total 1288 cases included in study. The history was obtained from patient, accompanying people and relatives and or from accompanying police by taking proper informed consent.

The injuries were examined and documented in detail with respect to its situation, size, nature, causative factor, probable weapon and it was correlated with the history with specific attention to its age and nature of injury.

Observations and Results:

The study showed that in assault victims there were male preponderance (85.4%) over females (14.6%). (Table 1) While the majority of male 509 (46.3%) and female 154 (81.9%) victims were from same age group i.e. between 21- 30 years. (Table 2)

Out of total 2001 injuries inflicted over all victim's body, maximum 646 (32.28%) injuries

were lacerations followed by abrasions 402 (20%). Contusions comprised 298 (14.9%) injuries while swelling present of different body parts were 259 (12.9%). Incised injuries were 239 (12%) and stab injuries were 68 (3.3%). There were three burn (0.2%) injuries and one firearm injury noted. (Table 3)

Laceration was commonest injury in both male and female. In male victims there were 543 (49.4%) lacerations followed by abrasion in 368 (33.5%). In female victims laceration were 103 (54.8%), followed by contusion in 85 (45.2%) cases.

In this study collectively these lacerations observed mainly 68% (n=441) on head face and neck region, followed by 103 (16%) on lower limbs. (Fig.1) Total 1288 assault cases observed in this study, out of which grievous injury were 973 (75.5%) and 272 (21.1%) were simple in type. In 43 injuries (3.3%) opinion reserved pending for further investigations. (Table 5)

In our study in 803 (73%) males majority of injuries were simple in nature. While in 272 (24.7%) males injuries were grievous in nature. In females there was no grievous injury at all. And in 170 (90.4 %) injuries were simple in nature. But in females 18 (9.6%) cases opinions regarding severity of injury were reserved pending. [Fig 2]

In present study hard and blunt weapon used in maximum cases 634 (49.2%) assault cases followed by body part in 343 (26.6%) cases while with sharp weapon in 222 (17.2%) cases. Pointed weapons used in 68 (5.3%) cases and other miscellaneous weapon including firearm weapon used in 21(1.6%) assault cases. (Table 6)

When hard, blunt weapons and sharp weapons both used by assailant causes 85 (31.3%) grievous injuries each out of total 272 grievous injuries. In male victims the hard and blunt weapon used in 565 (51.4%) cases. The body parts like fist, kick were used in 258 (23.5%) males. In female victims the body parts were used in 85 (45.2%) including fist and kicks. The hard and blunt weapons used in 69 (36.7%) females. (Table 7)

Abrasions were mainly located in head face and neck region 136 (34%) cases as compared to 67 (17%) on trunk, 103 (25%) on upper limbs and 96 (24%) on lower limbs. No abrasion was found on back. Contusions mainly observed over head face and neck region 138 (46%) followed by 91(31%) over upper limbs, 33 (11%) over back, 19 (6%) over lower limbs and 17 (6%) over anterior trunk.

The incised wound found in assault cases located mainly located over upper limbs i.e. 103 (43.1%) followed by head face and neck in 85 (35.56%) injuries, over lower limbs in 34 and over anterior trunk in 17 injuries.

34 (40%) fractures were of upper limb bones, followed by 17 (20%) lower limbs and 17 (20%) of facial bones. Stab injuries were mainly located over anterior trunk i.e. 51 (75%) and over back in 17 (25%) cases. No stab injury was noted over face, over upper and lower limbs. Single firearm injury was observed over face. In present work majority of injuries were observed over head, face and neck region. (Fig.3)

Discussion:

In study period of two years from October 2011 to September 2013, total cases attended in casualty were 6870 out of which 1288 EPR (Emergency Police Record) cases were registered as medico-legal cases.

Frequency of male and female victims of assault in the present study was coincides with other studies. [9, 10, 13, 15, 16, 20, 21] The male preponderance is also similar in the studies of Ranney et al and Hofnera et al. [18,19] The reason for predominance was due to more aggressive behavior and more exposure to environment and assault.

Common Age group of victims of assault in the present study coincides with the studies of Honaken et al [4], Farooqui et al [21] and Bhullar. [17] Some variations were seen when compared with studies of Albrechtsen et al [8], Hocking et al [9] and Subba et al. [20] Both male 509 (46.3%) and female 154 (81.9%) affected victims of the assault were of young and productive age group between 21- 30 years.

Out of these injuries lacerations were more commonly noted 646 (32.28%). These findings were inconsistent with similar studies as in Fothergill et al [10] major injuries were contusions (53%) and Howe et al [14] laceration 21%. The reason for variation could be because of difference in nature and aggressiveness of assailant. Also the weapons used for assault by assailant may be differ in other similar studies.

In Shepherd et al [5] the majority of injuries in male victims were laceration which was consistent with our study but the major injuries in female victims were hematomas which was inconsistent with present work.

In this study injuries present on body of assault victim were classified as simple or grievous as per section 320 IPC. [2] The majority of the injuries 973 (75.5%) in our studies were simple in nature. In males 272 (24.7%) injuries were grievous in nature. In females there was no

graveous injury at all. This gender wise difference in severity of injury is significant one (P value <0.001). Probably its because of defensive nature of female in assault.

Type of Weapon:

In majority of cases hard and blunt weapons like lathi, bamboo, stone, iron rod etc. were used by assailant. No specific weapon was used but the victims were assaulted by fist and kick by the assailant and used their body parts as weapons in 343 (26.6%) cases. In one case firearm weapon was the weapon of assault.

In present study the percentage of use of body part by assailant during assault were consistent with other studies. [16, 20] However injuries sustained by sharp weapon were (17.2%) inconsistent with studies of Butchart et al and Zarger et al. [12, 16]

Out of the male victims 565 (51.4%) sustained injuries by hard and blunt weapon. One male was injured by firearm weapon. In case of female victims the majority weapons used for assault purpose were body parts 85 (45.2%) including fist and kicks.

The weapon which is used for assault depends on its availability, the aggressiveness and intention of assailant. Hard and blunt weapon was commonly used in male and body parts in female victims. It may be due to; the assault on female by known person, domestic violence and quarrel with neighbor.

Type of Weapon and Seriousness of Injury:

Out of 272 grievous injuries 85 (31.2%) caused by hard and blunt weapon and 85 (31.2%) by sharp weapon. Both these weapons in combination cause 170 (62.6%) grievous injuries which were major contribution.

All the cases in which victim sustained injuries by pointed weapon were grievous injuries and no simple injuries were noted. In domestic and other assault cases body parts such as fists, kick etc. causes 34 (12.4%) grievous injuries out of 272. Maximum injuries were caused by hard and blunt weapons and sharp weapons. In all 1288 assault cases majority of injuries were lacerations. Out of 2001 injuries lacerations were 441 (32.28%).

These lacerations observed mainly observed over head face and neck region i.e. in 441 cases (68%), followed by 103 (16%) on lower limbs. In present work majority of injuries were observed over head, face and neck region. The face is a particular target in assault, though more so in men than in women.

These findings were consistent with other studies like Shepherd & Shapland et al [11] who noted facial injuries were common with respect to laceration, contusion and fractures.

In the study of Fothergill & Hashemi et al [10] they noted half of all male injuries and 42% of female injuries were located over face.

Kjaerulff et al [7] noted Sixty-five percent of the lesions were in the head and neck region, 13% over trunks, 18% in the upper extremities and 5% in the lower extremities.

In the study of Howe & Crilly et al [14, 15] the commonest site of injury was to the neck, face and throat (55%). Subba et al [20] noted most frequent site was head and neck (57.06%), followed by upper limbs (17.74%).

Conclusions:

Out of 6870 medico-legal cases observed in casualty over study period maximum 37.5% were of assault cases. There was male preponderance in assault cases with male and female ratio was 5.85:1.

The age group which was maximally affected in case of male was 21-30 years and same in case of female. Most commonly body part involved in assault was head face and neck 959 (47.92%). Grievous injuries sustained during assault were seen in 24.2% male victims.

While in females no grievous injury noted. The weapon of assault in male victims was hard and blunt object in maximum 51.4% while in females 45.2% were body parts such as fist and kicks.

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Fig. 1: Site in Different Type of Injuries

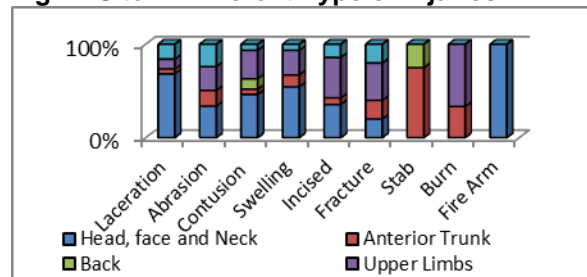


Fig 2: Severity of Injury in Male and Female Victims

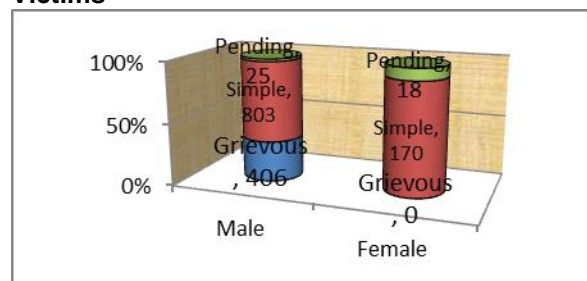


Fig. 3: Type of Weapon used vis-a-vis Seriousness of Injury

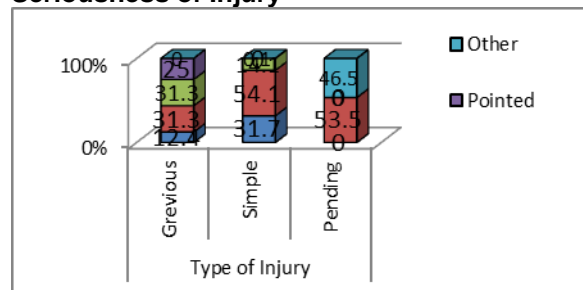


Table 1: Gender wise Distribution of Total Assault Cases

Gender	Frequency	Percentage
Female	188	14.6
Male	1100	85.4
Total	1288	100

Table 2: Age and Sex Wise Distribution

Age Grp (yrs)	SEX		Total (%)
	Female (%)	Male (%)	
11-20	0 (0)	34 (3.1)	34 (2.6)
21-30	154 (81.9)	509 (46.3)	663 (51.5)
31-40	34 (18.1)	423 (38.5)	457 (33.5)
41-50	0 (0)	117 (10.6)	117 (9.1)
>50	0 (0)	17 (1.5)	17 (1.3)
Total	188 (100)	1100 (100)	1288 (100)

Table 3: According to Type of Injury Inflicted

Type of Injury	Frequency	Percentage
Laceration	646	32.28
Abrasion	402	20
Contusion	298	14.9
Swelling	259	12.9
Incised	239	12
Fracture	85	4.2
Stab	68	3.3
Burn	3	0.2
Fire Arm	1	0.1

Table 5: Type of Injury According to Seriousness

Injury	Frequency	Percentage
Simple	973	75.5
Grievous	272	21.1
Pending	43	3.3
Total	1288	100

Table 4: Gender wise Distribution of Type of Injury

Type of Injury	SEX		Total (%)
	Female (%) (n=188)	Male (%) (n=1100)	
Abrasion	34 (18.1)	368 (33.5)	402 (31.2)
Contusion	85 (45.2)	213 (19.4)	298 (23.1)
Laceration	103 (54.8)	543 (49.4)	646 (50.25)
Incision	17 (9)	222 (20.2)	239 (18.6)
Stab	0 (0)	68 (6.2)	68 (5.3)
Fracture	0 (0)	85 (7.7)	85 (6.6)
Burn	1 (0.5)	2 (0.2)	3 (0.2)
Fire Arm	0 (0)	1 (0.1)	1 (0.1)
Swelling	0 (0)	259 (23.5)	259 (20.1)

Table 6: Type of Weapon used for Assault

Weapon	Frequency	Percentage
Hard & Blunt	634	49.2
Body Parts	343	26.6
Sharp	222	17.2
Pointed	68	5.3
Other	21	1.6
Total	1288	100

Table 7: Gender wise Use of Different Weapon

Weapon	Gender		Total (%)
	Female (%)	Male (%)	
Body Parts	85 (45.2)	258 (23.5)	343 (26.6)
Hard & Blunt	69 (36.7)	565 (51.4)	634 (49.2)
Sharp	17 (9)	205 (18.6)	222 (17.2)
Pointed	0 (0)	68 (6.2)	68 (5.3)
Other	17 (9)	4 (0.4)	21 (1.5)
Total	188 (100)	1100 (100)	1288 (100)

Pearson's Chi Square value-129.9, df 4, P value- < 0.0001,

Original Research Paper

Age Determination in Manipuri Subjects from the Eruption of Teeth and Epiphyseal Union of Upper Limb

¹Soreingam Ragui, ²Th. Bijoy Singh, ³TH. Meera, ⁴H. Nabachandra

Abstract

The present study aims to determine the age of the Manipuri population by computing regression formulae from the eruption of the permanent canine & second molar, and also from the epiphyseal union at the elbow and wrist joints. 320 Manipuri subjects of 10 to 15 years (i.e. 244 male, 76 female) coming to the Forensic Medicine department of a tertiary health care hospital at Imphal for age determination from October 2011 to September 2013 were studied. The age of eruption of permanent canines is 10 years in both sexes; whereas the eruption of second permanent molar is 11-12 years in females and 11-14 years in males in the Manipuri population. The medial epicondyle fuses with the shaft of humerus in 11-14 years in both the sexes. The epiphyseal fusions of 1st metacarpal take place in 13 -15 years in females and 12-14 years in males. A combined regression formula was calculated for males and females. It can be used as a standard for determination of age in Manipuri subjects by substituting the various stages of dental eruption or epiphyseal union.

Key Words: Canine, Second Molar, Epiphyseal Union, Regression Formulae

Introduction:

Age estimation in living as well as dead is one of the most important tasks for a forensic practitioner. In a developing country like India, illiteracy is a major factor for un-awareness regarding importance of registration of births or improper maintenance of records.

It is a prerequisite for personal identification and it is increasingly important in criminal and civil matters. [1] The notion of the age and time had come into the mind of the human being for centuries, possibly millennia.

In this universe, most of the things, natural or artificial can be dated, numbered, quantified or measured. One can also measure life span of a person as well as one's age from the moment of conception. India is a very vast country with diversity of climate and population. Hence, no uniform data can be applied to the whole country. [2]

There are three steps for age estimation:

1. Physical examination
2. Dental examination and
3. Radiological examination

Various workers have established data for estimation of age from dental and radiological findings in different ethnic groups. [3-5]

However, no such data is available for the Manipuri population. Hence, this study has been taken up in a tertiary health care teaching hospital at Imphal.

Materials and Methods:

After obtaining approval of the Institutional Ethics Committee, 320 Manipuri subjects in the age group of 10-15 years (i.e. 244 male, 76 female) coming to the Forensic Medicine department of a tertiary health care teaching hospital at Imphal for age determination from October 2011 to September 2013 have been included for the study.

Criteria for Selection of the Cases:

1. Subject must be a Manipuri by birth.
2. Subject must be of sound health with no dental caries, cavity or any chronic illness which might interfere with the eruption of tooth and fusion of bone.
3. Age of the subject should be verified by parents and birth certificates.

The particulars with relevant information of each case were recorded in a separate proforma. The informed consent was taken in written form and the general physical

Corresponding Author:

¹Post Graduate Trainee
Department of Forensic Medicine,
Regional Institute of Medical Sciences,
Imphal -795004

E-mail: raguisoreingam@gmail.com

²Professor

³Assoc. Prof,

⁴Prof & HOD,

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examination was done to detect any disease or deformity which may affect the fusion of the epiphyses and eruption of tooth.

The oral cavity was examined with the help of a torch light and a dental mirror by widely opening the mouth with a tongue depressor. A detailed dental examination was done with special emphasis on the eruption of permanent canine and second permanent molar.

The same subject was subjected to X-ray of elbow and both wrist joints (AP view) to know the degree of fusion in the lower end of humerus and metacarpal bones.

The radiographs were studied jointly with the radiologists. The stages of eruption of tooth were graded as follows:

- **Stage 0:** Fall out of the temporary tooth and non-eruption of corresponding permanent tooth.
- **Stage 1:** When tip of crown of tooth penetrated the gum margin (positive clinical eruption).
- **Stage 2:** When the crown has grown into oral cavity beyond gum margins but not yet reached the occlusal plane.
- **Stage 3:** When the colossal surface comes in contact with its counterpart and bite is complete. [6]

The degrees of fusion of the various epiphyses with their respective diaphysis were graded as:

- **Degree 0:** A dark radiolucent line throughout the joint separating the joint surfaces.
- **Degree 1:** The area of fusion (radio opaque area) is seen in the middle or on either side of the joining surfaces. The measured length of the radio opaque area should be less than half of the total length of the epiphyseal surface.
- **Degree 2:** The area of fusion (radio opaque area) should be more than half of the total length of the epiphyseal surface but it has not completely covered the entire length.
- **Degree 3:** Complete fusion (radio opaque area) is seen in the entire length of the joining surface. [7]

For this study, following sites were examined in the upper limb viz. trochlea, lateral epicondyle, medial epicondyle, 1st to 5th metacarpal. The findings were recorded in the respective proforma, tabulated and statistically analysed by using SPSS 16 software.

Observations and Results:

In the present study, out of the total 320 cases, 76.25% of the cases were males and 23.75% were females. Meitei with 245(76.56%) cases were the maximum cases examined with

respect to caste followed by Manipuri Tribal with 58(18.12%) cases and Manipuri Muslim with 17(5.32%) cases. (Table 1)

It is evident from this study that the age of eruption of permanent canines is 10 years both males and females; whereas the eruption of second permanent molar is 11- 12 years in females and 11-14 years in males. (Table 2)

The fusion of trochlea to the capitulum takes place in 11-12 years in females and 12 -13 years in males; whereas the fusion of lateral epicondyle to capitulum occurs in 11-14 years in females and 12-14 years in males.

The medial epicondyle fuses with the shaft of humerus in 11 to 14 years in both the sexes. The epiphyseal fusions of 1st metacarpal take place in 13-15 years in females and 12-14 years in males. (Table 3)

In this study, a suitable regression formula for computing the age of an individual from the eruption of tooth and degree of epiphyseal union was calculated. The formulae for each variable were derived separately and combined formulae were also derived.

The combined formulae may be used when all the variables are present and regression formulae for the individual if only one variable is examined.

The combined equation has the advantage of being more accurate as it is evident from the standard error, which is least and also there is maximum positive correlation. Separate equations were derived for both females and males. (Table 4, 5)

Finally, after calculating the age for each individual by using the regression formulae for both males and females, it is compared with the known age (age from birth certificates).

It is observed that in females, the mean difference between the age as per the birth certificate and calculated age by the regression formulae is -0.8947, which is less than 1.

There is also positive correlation of 0.702 between the two sets of data and the standard deviation is 1.06557. (Table 6)

Similar findings are observed in males and there is positive correlation of 0.631 between the two sets of data, and the standard deviation is 0.99945. (Table 7)

Discussion:

There was not much difference between the times of eruption of the canine and the second molar teeth with respect to sex in the Manipuri population in the present study. Similarly, Shuper A et al [8] found similar number of erupted teeth in both sexes in a study on the Jewish Israeli children for deciduous tooth

eruption. However, workers like Hagg U and Taranger J [9] and Savera BS and Steen JC [10] found that eruption is generally earlier in girls.

This earlier eruption might be due to earlier age of puberty in females with earlier associated secretion of growth hormone which may affect the tooth eruption in the studied population.

Gaulstaun G [11] also studied 7000 X-rays of Bengali subjects and found that fusion of trochlea, lateral epicondyle, and medial epicondyle take place at 10-12 yrs, 10-12 yrs, 14 years in females and 11-16yrs, 11-16yrs and 16 years in males respectively.

These findings may be favourably compared with findings of the present study. However, these findings are in contrast with those of Borosvansky L and Hnevkovsky L, [12] and Sahni D and Jit L [13] who observed later fusion of the epiphyses as compared to the present study.

Various workers like Jaswant AD et al [14], Rai B and Anand SC [15] have presented certain regression formulae for their respective regions. In this part of the country too, some workers like Sangma WB et al [16] and Bijoy Th et al [17] had earlier presented regression formulae by using the staging of epiphyseal union of the long bones alone.

In our study, we derived regression formulae using both the stages of dental eruption and epiphyseal union and found that the age of an individual has a positive correlation with these two variables.

The standard error is the minimum when we combined both the above variables and also the positive correlation is the maximum when all these variables are used to derive the formulae.

The timing of dental eruption and epiphyseal union are influenced by many factors, which include diet, geographical location, race, sex, etc.

According to Swami D et al [18] The eruption of teeth is known to be affected by dietary, climatic, racial and geographical variations and according to Krogman WM, [19] the time of the appearance of ossification centres and their union are also influenced by the factors like sex, nutrition, and deficiency of vitamin D, calcium and hormones released from the anterior pituitary, thyroid and parathyroid glands.

This imposes the need for deriving certain formulae for the estimation of age in this part of the country which has a unique diet and demography. In this study, an attempt has been

made to calculate a separate formula for both female and male for the Manipuri population.

Using the derived regression formulae, it was found to be almost matching with the known age, with positive correlation between the two.

Conclusion:

There is positive correlation between eruption of teeth and epiphyseal union of bone with the chronological age of an individual.

This regression formula can be used as a standard for determination of age in Manipuri subjects by substituting the various stages of dental eruption or epiphyseal union in the derived formulae, which is a simple and more accurate way of estimating the age than the usual method of age determination by using the data of other country or states.

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Table 1
Distribution of Cases With Respect to Sex and Caste in Different Age Groups

Age Group (Yrs)	Sex		Caste		
	Male	Female	Meitei	M. Tribal	M. Muslim
10 ≤ to <11	22 (9.02)	5 (6.58)	21(8.57)	4 (6.89)	2 (11.76)
11 ≤ to <12	16 (6.56)	4 (5.26)	18(7.35)	0	2 (11.76)
12 ≤ to < 13	69 (28.28)	24 (31.58)	83(33.88)	8 (13.80)	2 (11.76)
13 ≤ to <14	76 (31.14)	22 (28.94)	72(29.39)	21(36.21)	5 (29.42)
14 ≤ to <15	48 (19.67)	15 (19.75)	44(17.96)	15(25.86)	4 (23.42)
15 ≤ to <16	13 (5.33)	6 (7.89)	7 (2.85)	10 (17.24)	2 (11.76)
SUB. TOTAL	244 (100)	76 (100)	245 (100)	58 (100)	17 (100)
TOTAL	244 (76.25)+	76(23.75) = 320 (100)	245 (76.56) +	58 (18.12) + 17 (5.32) = 320 (100)	

Table 2
Minimum &Maximum Age of Different Stages of Eruption in Permanent Canine and Second Molar

Degree of Eruption STAGE	Canine(Years)				2 nd Molar (Years)			
	Female		Male		Female		Male	
	Min	Max	Min	Max	Min	Max	Min	Max
0	10	12	10	14	10	13	10	13
1	10	10	10	10	11	12	11	14
2	0	0	10	11	0	0	11	14
3	11	15	10	15	12	15	10	15

Table 3
Minimum & Maximum Age of Epiphyseal Fusion in the Lower End of Humerus and Metacarpals

Degree of Fusion	Trochlea(Yrs)		Lat. Epicondyle (Yrs)		Med Epicondyle (Yrs)		1 st metacarpal (Yrs)		2 nd ,3 rd ,4 th ,5 th Metacarpal (Yrs)	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
0	10-13	10-15	10-13	10-15	10-13	10-15	10-14	10-15	10-13	10-15
1	0	12-13	0	12-14	11	11-14	0	12-13	13-14	12-15
2	11-12	11-13	11-14	11-14	12-14	12-14	13-15	12-14	12-15	12-15
3	12-15	11-15	12-15	11-15	12-15	11-15	12-15	11-15	12-15	11-15

Table 4
Different Statistical Results of Manipuri Male (10 to 15yrs)

Variables	Coefficient of Correlation	Regression Equation	Standard Error
Canine	.392	$Y = (.746) X_1 + 10.513$	± 1.176
2 nd MOLAR	.601	$Y = (.699) X_2 + 10.912$	± 1.022
Trochlea	.535	$Y = (.477) X_3 + 11.772$	± 1.080
Lat. Epicondyle	.531	$Y = (.475) X_4 + 11.866$	± 1.083
Med. Epicondyle	.459	$Y = (.434) X_5 + 12.188$	± 1.136
1 st Metacarpal	.409	$Y = (.401) X_6 + 12.279$	± 1.167
2,3,4,5 Metacarpal	.386	$Y = (.401) X_7 + 12.312$	± 1.179
Combined	.677	$Y_M = (.155)X_1 + (.453)X_2 + (.137)X_3 + (.044)X_4 + (.149)X_5 + (.163)X_6 + (.149)X_7 + 10.588$	±.952

Table 5
Different Statistical Results of Manipuri Female (10 to 15yrs)

Variables	Coefficient Of Correlation	Regression Equation	Standard Error
Canine	.577	$Y = (.902) X_1 + 10.284$	± 1.052
2 nd MOLAR	.632	$Y = (.672) X_2 + 11.162$	± .9639
Trochlea	.639	$Y = (.639) X_3 + 11.299$	± .9676
Lat. Epicondyle	.652	$Y = (.635) X_4 + 11.392$	± .9582
Med Epicondyle	.636	$Y = (.590) X_5 + 11.661$	± .9546
1 st Metacarpal	.629	$Y = (.546) X_6 + 11.995$	± .9733
2,3,4,5 Metacarpal	.675	$Y = (.617) X_7 + 11.943$	± .9219
COMBINED	.816	$Y_F = (.370)X_1 + (.270)X_2 + (.45)X_3 + (.162)X_4 - (.042)X_5 - (.506)X_6 + (.9)X_7 + 10.396$	±.76108

X_1 =Stage of eruption of permanent canine. X_2 =Stage of eruption of 2nd permanent molar.

X_3 =Degree of epiphyseal fusion of trochlea X_4 =Degree of epiphyseal fusion of lateral epicondyle.

X_5 =Degree of epiphyseal fusion of medial epicondyle. X_6 =Degree of epiphyseal fusion of 1st Metacarpal.

X_7 =Degree of epiphyseal fusion of 2nd, 3rd, 4th and 5th Metacarpal. Y_M = Calculated age of the male individual.

Y_F =Calculated age of the female individual.

Table 6
Mean Difference between the given Age and the calculated age by the Regression Formula (Females)

Paired sample Statistic(Female)							
	N	Mean	Mean Difference	Correlation Coefficient	Standard deviation	Standard deviation	Standard Error
Age(certificates)	76	12.7632	-0.8947	0.762	1.25293	1.06557	0.14372
Age(calculated)	76	13.6579			1.64562		0.18877

Table 7
Mean Difference between the given Age and the calculated age by the Regression Formula (males)

Paired sample Statistic(Male)							
	N	Mean	Mean Difference	Correlation coefficient	Standard deviation	Standard deviation	Standard Error
Age(certificates)	244	12.62	0.2593	0.631	1.276	0.99945	0.082
Age(calculated)	244	12.3607			0.94773		0.06067

Corrigendum

We are regreted for publication of Research Paper entitled “Age Estimation from Sternum for Age Group 25 Years On wards” in J Indian Acad Forensic Med. October-December 2014, Vol. 36, No. 4 and in J Indian Acad Forensic Med. July-September 2014, Vol. 36, No. 3 two times.

Due to error in communication and typing names of some co-authors was missed in this paper. The names of Authors may kindly be read on page No. 340 in fourth issue in the published manuscript as follows:

1. **Mukul Chopra,**
Assistant Professor,
Dept. of Forensic Medicine
Christian Medical College, Ludhiana
2. **Harpreet Singh**
Associate Professor
Department of Forensic Medicine
M.M.I.M.S.R. Mullana, Ambala
E-mail: moharamar@gmail.com
3. **Balbir Kaur**
Professor
Department of Forensic Medicine
M.M.I.M.S.R. Mullana, Ambala
4. **Rekha Goel**
Professor
Department of Radiology
M.M.I.M.S.R. Mullana, Ambala

Original Research Paper

Profile of Pattern of Medico-Legal Cases in the Casualty of A Teaching Hospital of Western Region of Nepal

¹Sidhart Timsinha, ²Suvarna Manjari Kar, ³Madan Prasad Baral, ⁴Malshree Ranjitkar

Abstract

The casualty Department of any hospital is an important area as most of the medical emergencies and almost all medico-legal cases report first to casualty of a hospital. The prime duty of a doctor is to treat and save the life of the patient, however once treatment is over then the same doctor has to carry out exhaustive documentation of medico-legal cases. This study was aimed to understand the pattern of Medico-legal cases and epidemiological factors in this region. This prospective study was carried out during the period of 1st January 2013 to 30th July 2014. Total 1735 medico-legal cases recorded/admitted in medico-legal register of the casualty department were included in the study which comprised of information regarding various parameters obtained from medico-legal register and hospital record of individual patient. The study revealed that RTA (50.71%) constituted majority of medico-legal cases followed by physical assault (16.81%) and poisoning (11.81%) with male preponderance. Maximum numbers of victims (26.50%) were in the age group 21-30 years followed by age group 11-20 years (19.79%). Majority of the medico-legal cases came from Kaski district 56.74%.

Key Words: Medico-legal cases, Profile, Casualty

Introduction:

A medico-legal case is a case of injury or illness related to legal matters where attending doctor after proper history, examination, and elicitation of findings in a patient gives opinion and suggests; some investigation by law force agencies is essential to establish and fix responsibility for the case in accordance with the law of the land.

The casualty department is backbone of every hospital as all medical cases of medical emergencies along with substantial proportion of medico-legal cases first report to the casualty. [1] Profiling of medico-legal cases is an essential aspect for the prevention of preventable casualties in future and to study the genuine crime in the area. [2]

Profiling helps in knowing the burden of medico-legal cases on different departments. Ours is a tertiary care hospital where different medico-legal cases are reported.

The study is based on medico-legal cases reported to the casualty of Manipal Teaching Hospital. It was therefore undertaken to find out and analyze the distribution of medico-legal cases, the burden of medico-legal cases in respective departments, and the various epidemiological factors.

It would be helpful to the Medico-legal expert and law enforcing agencies such as the police and the judiciary and ultimately in the process of scientific crime detection and proper administration of justice at large in such cases.

Material and Methods:

A hospital based prospective study was conducted on medico-legal cases reporting to casualty of Manipal Teaching Hospital during the period of 1st January 2013 to 30th July 2014.

Total 1743 medico-legal cases recorded/admitted in medico-legal register of the casualty department were included in the study which comprised of information regarding various parameters obtained from medico-legal register and hospital record of individual patient.

The data obtained were entered in Microsoft excel worksheet and then analyzed. Observations were presented in tables and graphs, discussed and compared with other studies.

Observations and Results:

The casualty department gets various types of medico-legal cases and maximum cases reported were of Road Traffic Accident

Corresponding Author:

¹Assistant Professor
Department of Forensic Medicine
Manipal College of Medical Science,
Pokhara, Nepal
E-mail: mth@manipal.edu.np
Prof & HOD
Resident IInd Year
Resident Ist Year
DOR: 08.10.2014 DOA: 03.02.2015
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884 followed by physical assault 293 cases. (Table 1) In our study out of 1743 cases, maximum number of cases 462 was reported in the age group 21-30 years followed by age group 11-20 years which showed 345 cases. (Table 2) In respect to gender distribution, 1137 were male as compared to 606 female and male to female ratio was 1.87:1. (Fig. 1)

The hospital is surrounded by as many as 16 districts and cases came from all most all districts. In our study most of the medico-legal cases came from Kaski district (56.74%) as compared to other districts (43.26%). (Fig. 2)

The casualty medical officer seeks opinion from subject experts about that cases which he found on first examination. In the present study we found that opinion from expert was sought in all cases.

In 941 cases opinion was taken from single department and in 536 cases from more than two departments. (Table 3) In present study most commonly opinions were sought from Surgery department (1025), followed by Orthopedics department (291) and Medicine department (245). (Table 4) In this study maximum number of cases were reported in the month of summer (516) followed by winter (438) and rainy season. (Fig. 3)

Discussions:

Present study revealed that maximum number of cases were of RTA (50.71%) followed by physical assault (16.81%) and poisoning (11.81%) this may be attributed to rapid increased in registered vehicles with poor road infrastructure carelessness of the drivers followed by rash and negligent driving supported by consumption of alcohol. Our finding was consistent with studies conducted by other workers. [3]

In this study male outnumbered female. Similar findings were also reported by Marri Murad and Malik Yogendra. [4, 2] This is because males are more involved in outdoor activities, aggressive and main bread earner for the family, so this makes them more vulnerable to accident or injury. The male to female ratio was 1.87:1 which is consistent with findings of Garg Vishal. [3]

Most common age group involved in medico-legal cases was between 21-30 years as this age group is economically most productive and lead more active life, involved in outdoor sports and outdoor house hold activities making them more susceptible to accident or injury.

This finding was similar to findings of other studies. [3, 5, 6] Maximum number of medico-legal cases was from Kaski district

(56.74%) when compared to other districts (43.26%). Our hospital is located in Kaski District and it being the oldest and largest Tertiary Care Hospital in the district the casualty covers not only large number of cases from the same district but also from other districts of the region.

Present study showed that maximum number of medico-legal cases reported in summer season. This may be because summer months is a more active month, there is great deal of work or outdoor activities done making people more prone to injuries.

It was observed that all variety of medico-legal cases occurred in all months of the year without any specific distribution except for lightening cases which was seen only during the month of May and June.

This may be due to reason that this part of the Nepal is mainly a hilly region, so thunder storms occurs frequently during this two pre-monsoon months causing casualty. The usual victims of lightening were those working in fields and doing outdoor activities.

Opinion from expert was sought in most of the cases. Single department opinions (53.98%) were most common but more than one department opinions (30.75%) were also not uncommon. Maximum opinions were sought from Department of Surgery (58.80%), followed by Orthopedics (16.69%) and Medicine (14.05%) which shows the workload in these respective departments. Surprisingly in only two cases expert opinion was obtained from Forensic Medicine Department.

Conclusion and Recommendations:

There should be great reformation of medico-legal service in Nepal. The first attending doctor in the casualty i.e. casualty medical officer is mostly MBBS and he seeks opinion from experts regarding medico-legal cases.

This leads to increased workload of different departments. This sometimes led to shifting of responsibility of duty while giving a medico-legal opinion by the first treating doctor.

This aspect forces us to think whether the current hours allotted to the subject of Forensic Medicine for practical training of students during MBBS curriculum is sufficient or we should demand increase in time in the curriculum?

In Nepal there is no posting under Forensic Medicine department during the period of internship so the limited knowledge gained at MBBS does not suffice to opine on medico-legal cases. Therefore for better exposure to medico-legal cases posting under Forensic Medicine Department has to be mandatory.

The sensitive job of medico-legal works should be given to interns and medical officer under supervision of senior officers as part of their training in the field and also to avoid imprecision in giving the opinion.

Poor opinion is no good than any opinion at all as the later can mislead the case and leads to administration of injustice.

Therefore there is a need to increase awareness on the role of clinicians with respect to their ethical responsibilities as providers. There is also a need to formulate standard operating procedure (SOP) in the context of doctors, nurses and police and their respective medico-legal roles.

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Table 1: Categories of Medico-Legal Cases

Category	Cases	Percentage (%)
RTA	884	50.71
Physical Assault	293	16.81
Poisoning	206	11.81
Thermal Burns	86	4.93
Sexual assault	1	0.05
Brought dead	70	4.01
Fall from height	102	5.87
Near drowning	15	0.86
Near hanging	24	1.37
Electrical injury	17	0.97
Occupational injury	3	0.17
Fire arm injuries	13	0.74
Blast injuries	3	0.17
Alcohol intoxication	9	0.51
Lightening	17	0.97
Total	1743	100

Table 2: Age Wise Distribution of Cases

Age group (Yrs)	Cases	Percentage (%)
0-10	165	9.46
11-20	345	19.79
21-30	462	26.50
31-40	272	15.60
41-50	181	10.38
51-60	129	7.40
61 & above	189	10.84
Total	1743	100

Table 3: Opinion Sought per MLR

No. of opinion in one MLC	Cases	Percentage
Single Department opinion	941	53.98
Two Department opinion	536	30.75
More than two Department opinion	266	15.26
Total	1743	100

Table 4: Opinion Sought from Departments

Name of Department	Cases	Percentage
Surgery	1025	58.80
Orthopedics	291	16.69
Medicine	245	14.05
ENT	62	3.55
Dental	60	3.44
Ophthalmology	58	3.33
Forensic medicine	2	0.12
Total	1743	100

Fig. 1: Gender Wise Distribution of Cases

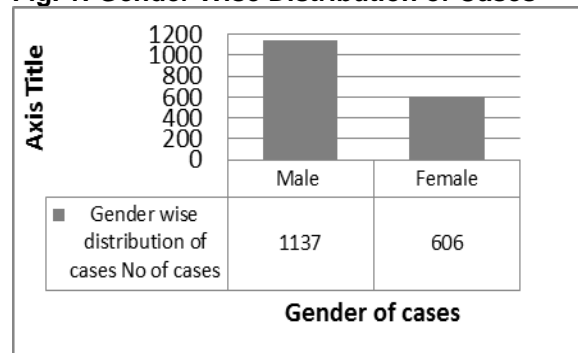


Fig. 2: Area Wise Distribution of Cases

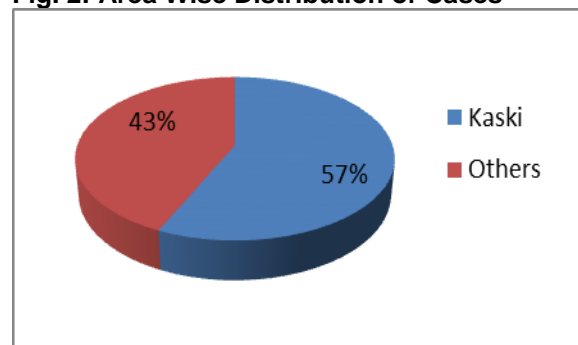


Fig. 3 Monthly Distributions of Total Cases

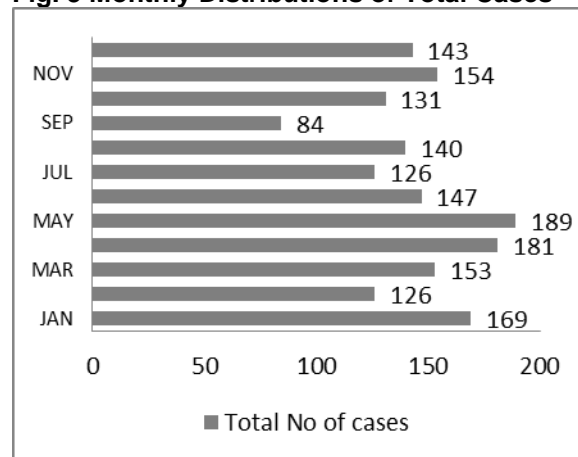


Table 5
Monthly Distribution of Different Categories of Medico-legal Cases

Categories	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
RTA	84	58	81	94	100	75	63	76	38	70	80	65	884
Poisoning	20	20	21	25	23	21	19	19	7	10	5	16	206
Physical assault	26	23	26	27	41	16	17	19	17	19	31	31	293
Fall from height	10	9	7	13	6	9	9	12	6	5	9	7	102
Hanging	4	2	0	2	3	1	0	3	2	0	4	3	24
Drowning	2	1	3	2	2	0	1	1	1	1	0	1	15
Burns	20	5	8	8	7	3	5	2	7	5	10	6	86
Lightening	0	0	0	0	5	12	0	0	0	0	0	0	17
Electric injury	1	2	0	2	1	4	1	0	1	4	1	0	17
Brought dead	2	3	5	7	4	5	5	6	4	6	11	12	70
Occupational injury	0	0	0	0	0	1	1	0	0	0	1	0	3
Firearm injury	0	0	0	0	0	1	0	0	0	10	0	2	13
Blast injury	0	2	0	0	0	0	0	1	0	0	0	0	3
Alcohol intoxication	0	2	2	1	0	0	0	0	1	1	2	0	9
Sexual assault	0	1	0	0	0	0	0	0	0	0	0	0	1
Total	169	128	153	181	192	148	121	139	84	131	154	143	1743

Original Research Paper

A Study of Medical Negligence Cases decided By the District Consumer Courts of Delhi

¹Mukesh Yadav, ²Pooja Rastogi

Abstract

Indian Medical Association vs. V.P. Shantha and Ors (1995) is a three-Judge Bench decision. The principal issue which arose for decision by the Court was whether a medical practitioner renders 'service' and can be proceeded against for 'deficiency in service' before a forum under the COPRA, 86.

There is an urgent need to check increasing trend in number of medical negligence cases and deteriorating quality of healthcare in India. Study of decided cases of medical negligence can provide an insight into the reasons for medical negligence cases, factors mainly responsible for medical negligence and impact of doctor-patient relationship, etc.

This study is attempted to explore the insight into ground realities & problems in the present healthcare system with ways & means to prevent these in healthcare institutions and medical fraternity. High cost of healthcare coupled with practice of defensive medicine will further aggravate the situation. Out of 48 cases studied 43 (89.58%) belongs to private hospitals and only 05 (10.42%) belongs to Government Hospitals. Surgical & Allied specialties and investigational specialties are more at risk of alleged medical negligence and subsequent probability of proof of medical negligence. Outcome of this study will definitely be beneficial for all, for healthcare provider it will help in improving the quality of healthcare and doctor-patient relationship, restoration of lost trust in medical profession.

Key Words: Medical Negligence, Damage, Damages, Duty, Dereliction of Duty, Compensation

Introduction:

The "World Consumer's Right Day" is celebrated globally on March 15th and the "National Consumer's Right Day" on December 24th each year in India to create awareness among consumer's about their rights. Supreme Court verdict in 1995 brought the medical profession under the purview of the Consumer protection Act, 1986. [1-3]

Doctors are always afraid of its impact on them, many landmark judgments given by various consumer forums against doctors and health institutions to award compensation in alleged negligence cases, percussions of which can be felt every moment a doctor think of providing its services to a new patient. The Consumer Protection Act, 1986 (COPRA, 86), is a benevolent social legislation.

It lays down the rights of the consumers and provides there for promotion and protection of the rights of the consumers.

Profession differentiated from Occupation:

The Supreme Court dealt with how a 'profession' differs from an 'occupation' especially in the context of performance of duties and hence the occurrence of negligence.

The Court noticed that medical professionals do not enjoy any immunity from being sued in contract or tort (i.e. in civil jurisdiction) on the ground of negligence.

However, in the observation made in the context of determining professional liability as distinguished from occupational liability, the Court has referred to authorities, in particular, **Jackson & Powell** [4] and has so stated the principles, partly quoted from the authorities:

"In the matter of professional liability professions differ from occupations for the reason that professions operate in spheres where success cannot be achieved in every case and very often success or failure depends upon factors beyond the professional man's control. In devising a rational approach to professional liability which must provide proper protection to the consumer while allowing for the factors mentioned above, the approach of the Courts is to require that professional men should possess a certain minimum degree of

Corresponding Author:

¹Director/Principal/Dean

Siddhant School of Medical Science, Mainpuri, U.P

E-mail: drmukesh65@yahoo.co.in

²Prof & Head, Dept. of Forensic Medicine

SMSR, Sharda University, Greater Noida, UP

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competence and that they should exercise reasonable care in the discharge of their duties.

In general, a professional man owes to his client a duty in tort as well as in contract to exercise reasonable care in giving advice or performing services." [4]

Scenario of Medical Negligence around the Globe and in India:

India is recording a whopping 5.2 million injuries each year due to medical errors and adverse events. Of these biggest sources are mishaps from medications, hospital acquired infections and blood clots that develops in legs from being immobilized in the hospital.

A landmark report by an Indian doctor from Harvard School of Public health (HSPH) has concluded that more than 43 million people are injured worldwide each year due to unsafe medical care.

Approximately 3 million years of healthy life are lost in India each year due to these injuries. [5]

Medical Mishaps and Fatal Errors:

- Health care errors is the 8th leading cause of death in the world
- Over 7 million people across the globe suffer from preventable surgical injuries every year (WHO)
- Globally, 234 million surgeries take place every year, one in every 25 people undergo a surgery at any given time.
- In developing countries, the death rate was nearly 10% for a major surgery
- Morality from general anaesthesia affected one in 150 patients while infections were reported in 3% of surgeries with the mortality rate being 0.5%

Table 1: Reported Deaths due to Medical Negligence every years Globally

S. N.	Country	No. of Deaths every year
1	United States	98000
2	Canada	24000
3	Australia	18000

Source: Compiled from article published in the Times of India [5, 6]

- Nearly 50% of the adverse effects of surgery were preventable
- 5.2 million medical injuries are recorded each year in India
- 43 million people get injured each year due to unsafe medical care worldwide
- About two-thirds of medical injuries occur in low and middle income countries like India

Sources of Medical Mishaps: Wrong medications, Hospital acquired infections, Blood clots.

Legal Scenario of Medical Negligence in India:

Have doctors become more negligent now? The kinds of malpractice hitting the headlines are not new: in 1953, a boy with a fractured limb died in Pune as a doctor operated on him without proper anaesthesia. [7]

Now the numbers are what first stand out, and what also make the questions necessary. According to a 2013 study (Global Burden of Unsafe Medical Care) by Dr. Ashish Jha of Harvard School of Public Health, of the 421 million hospitalizations in the world annually, about 42.7 million adverse events of medical injury take place, two-thirds of which are from low-income and middle-income countries.

India records approximately 5.2 million cases a year, ranging from incorrect prescription, wrong dose, wrong patient, wrong surgery, and wrong time to wrong drug. [8]

With public awareness, claims and litigation are rising. In the country's consumer courts, they now top the list of 3.5 lakh pending cases. According to Dr Girish Tyagi, registrar of Delhi Medical Council, the appellate authority for dealing with such cases, the number of cases from overcharging, needless procedures, wrong doctors to wrong decisions has zoomed in the last two years, from about 15 complaints a month to 40 now. [8] A report by the Association of Medical Consultants shows that there were 910 medico-legal cases against doctors between 1998 and 2006 in Mumbai. Now they are going up by 150-200 cases every year. [8]

But it's the gap in the law that seems to leave both patients and doctors at a dead end. "For the longest time in India, medical negligence was not seen as compensable," says Barrister, Sushil Bajaj of The Integrated Law Consultancy, Delhi. [8]

Justice S. Ahmad observed that Medical Negligence plays its game in strange ways. Sometimes it plays with life; sometimes it gifts an "Unwanted Child" as in the instant case where the respondent, a poor labourer woman, who already had many children and had opted for sterilisation, developed pregnancy and ultimately gave birth to a female child in spite of sterilisation operation which, obviously, had failed.

Smt. Santra, the victim of the medical negligence, filed a suit for recovery of Rs. 2 lakhs as damages for medical negligence, which was decreed for a sum of Rs. 54000/- with interest at the rate of 12 per cent per annum from the date of institution of the suit till the payment of the decretal amount. [9]

Duties of Doctors:

In two decisions rendered by the Supreme Court of India, namely, *Dr. Laxman Balakrishna Joshi vs. Dr. Trimbak Babu Godbole & Anr.*, 1969 [7] and *A.S. Mittal vs. State of U.P.*, 1989 [13], it was laid down that when a Doctor is consulted by a patient, the former, namely, the Doctor owes to his patient certain duties which are (a) a duty of care in deciding whether to undertake the case; (b) a duty of care in deciding what treatment to give; and (c) a duty of care in the administration of that treatment.

Role of Indemnity Insurance and Cost of Treatment:

It's also pushing doctors toward heavy professional indemnity policies. "It is usually around Rs.10 lakh, with a premium of Rs.3000-Rs.5000 per annum," says Dr. Neeraj Nagpal, Convenor, Medico-Legal Action Group, Chandigarh.

If a doctor wants to cover himself against a claim of Rs.11.5 crore, the amount awarded to Saha, the premium will be between Rs.300000 and Rs.600000 annually.

For that a doctor will have to attend to a large number of patients every day and raise his fees substantially. "With rising litigation, everyone will have to pay through their nose."

Hon'ble Supreme Court of India in *Jacob Mathew vs. State of Punjab & Anr.*, 2005 [11] observed that with the awareness in the society and the people in general gathering consciousness about their rights, actions for damages in tort are on the increase.

Medical Ethics and Medical Negligence:

In *M/s Spring Meadows Hospital & Anr. vs. Harjol Ahluwalia through K.S. Ahluwalia & Anr.* JT, (1998) [12], it was observed as under:

"In the case in hand we are dealing with a problem which centres round the medical ethics and as such it may be appropriate to notice the broad responsibilities of such organisations who in the garb of doing service to the humanity have continued commercial activities and have been mercilessly extracting money from helpless patients and their family members and yet do not provide the necessary services.

The influence exerted by a Doctor is unique. The relationship between the doctor and the patient is not always equally balanced.

The attitude of a patient is poised between trust in the learning of another and the general distress of one who is in a state of uncertainty and such ambivalence naturally leads to a sense of inferiority and it is, therefore,

the function of medical ethics to ensure that the superiority of the doctor is not abused in any manner. It is a great mistake to think that doctors and hospitals are easy targets for the **dissatisfied patient.** It is indeed very difficult to raise an action of negligence.

Not only there are practical difficulties in linking the injury sustained with the medical treatment but also it is still more difficult to establish the standard of care in medical negligence of which a complaint can be made.

All these factors together with the sheer expense of bringing a legal action and the denial of legal aid to all but the poorest operate to limit medical litigation in this country."

It was further observed as under:

"In recent days there has been increasing pressure on hospital facilities, falling standard of professional competence and in addition to all, the ever increasing complexity of therapeutic and diagnostic methods and all this together are responsible for the medical negligence.

That apart there has been a growing awareness in the public mind, to bring the negligence of such professional doctors to light. Very often in a claim for compensation arising out of medical negligence a plea is taken that it is a case of bona fide mistake which under certain circumstances may be excusable, but a mistake which would tantamount to negligence cannot be pardoned.

In the former case a court can accept that ordinary human fallibility precludes the liability while in the latter the conduct of the defendant is considered to have gone beyond the bounds of what is expected of the reasonable skill of a competent doctor." [12]

Error in Judgment and Medical Negligence:

In this judgment, reliance was placed on the decision of the House of Lords in **Whitehouse vs. Jordan & Anr.**, (1981) [10]. **Lord Fraser**, while reversing the judgment of **Lord Denning** (sitting in the Court of Appeal), observed as under:

"The true position is that an error of judgment may, or may not, be negligent; it depends on the nature of the error.

If it is one that would not have been made by a reasonably competent professional man professing to have the standard and type of skill that the defendant holds himself out as having, and acting with ordinary care, then it is negligence. If, on the other hand, it is an error that such a man, acting with ordinary care, might have made, then it is not negligence."

Aims and Objectives:

The following aims and objectives have been decided for the present study:

1. To study the pattern of medical negligence cases in Delhi
2. To study the reasons for medical negligence in Delhi
3. To know the profile of hospitals (Govt. /Private)

Material & Methods:

Delhi District Consumer Dispute Redressal Commission's 50 judgments of alleged medical negligence cases from year 2009 to 2014 were collected for study. After thorough study of judgments, 15 cases in which medical negligence was proved were selected for further analysis in present study. Judgments were accessed from website <http://confonet.nic.in/> [by using Key Word "Medical Negligence" in text phrase search box]

Assumptions:

Following assumptions has been made based on limitation of research methodology:

- All case are uploaded on the NCDRC Website
- All cases are searchable with Text Phrase "Medical Negligence"

Various parameters /variables such as medical subjects and consultant involved in medical negligence, hospital liability, consent, medical records, unqualified staff, investigative tests, operative skill and diagnosis, hospital facility, operative and postoperative complications, referral, advice, current update, time to attend patient, other deficiency in services etc. were studied, and discussed.

Observations and Discussion:

Type of Hospitals:

In this study out of 48 cases studied 43 (89.58%) belongs to private hospitals and only 05 (10.42%) belongs to Government Hospitals. (Table 2)

Table 2: Type of Hospitals /Institutions/Clinics (Govt. /Private)

S.N.	Contents	Cases (n=50)	% (n=48)
1	Private Hospitals	43	89.58
2	Govt. Hospitals	05	10.42
	Total cases	48	100.00
3	Not Admitted for Trial	02	
	Grand Total	50	

*Two cases excluded

Reason for this low number of Government Hospitals could be following:

- Free services/services at low price provided by Government Hospitals and whenever there is not expected outcome from treatment/procedure/intervention it causes

less hurt to them as there is at least less financial damage.

- Number of Government Hospitals is less as compared to private hospitals (including individual clinics) in Delhi i.e. why private hospitals are more prone to case of medical negligence.
- Perception among consumers that Government Hospitals are not covered under the Consumer Protection Act, 1986. There is need to study on perception of consumers on this aspect.
- Low level of awareness on consumer court law
- It is presumed that patients coming to Govt. Hospitals are mainly poor and illiterate and not having knowledge/Awareness of COPRA, 1986. There is need to study the relationship between socioeconomic status and literacy and level of education and awareness among patients visiting government hospitals and low level of medical negligence cases.
- There is need to further study regarding whether patient's expectations from govt. hospitals are less as compared to high cost healthcare in private hospitals and doctors or not.

Reasons for Less number of Cases in DCDRC in Delhi:

- High cost of healthcare and claim for higher compensation after Amendments in 2002 (in District Consumer Court up to Rs.2000000/ and in SCDRC claim from Rs.2000000 to 1 Crore)
- High per capita income in Delhi

Outcome of Consumer Court Cases in terms of proof of 'Deficiency in Service' and/or adoption of 'unfair trade practices':

It was revealed from outcome of consumer court cases in terms of whether negligence proved or not that out of 48 cases deficiency in service/unfair trade practice proved only in 15 (31.25%) cases while in 33 (68.75%) cases complainant were not able to prove the allegations of medical negligence against doctors/hospitals. (Table 3)

Reasons for this could be lack of awareness and knowledge among all stake holders (patients/lawyers) and complexity of cases of medical negligence, lack of Second Opinion/Expert Opinion on the issue of allegations of medical negligence or Second Opinion/Expert Opinion not supported the allegation.

Table 3: Distribution of Medical Negligence Cases (Negligence: Proved/Not Proved)

S. N.	Contents	Cases (n=48)	%
1	Negligence not proved	33	68.75
2	Negligence Proved/Partially	15	31.25
	Total cases	48	100.00

*Two cases excluded as not admitted for hearing

There is need to create awareness and interaction among medical fraternity and patient and advocate dealing with medical negligence cases. Forensic Medicine Expert can play a great role in this field either practice as Expert for filing cases of Medical Negligence in various Consumer Court Cases or can provide consultation to aggrieved patients and aggrieved hospital / doctors.

Specialty-wise Distribution of Medical Negligence Cases:

Present study showed that Orthopaedics, Obstetrics & Gynaecology, General Surgery and General Medicine specialty doctors faced with allegations of Medical Negligence (Deficiency in Service) in 07 (14.29%) cases each, followed by specialty of Ophthalmology 06 (12.24%) and Cardiology 05 (10.20%) cases and ENT 02(4.08%) cases respectively. (Table 4)

Table 4: Specialty-wise Distribution of Medical Negligence Cases

S. N.	Subject of Specialization	Cases(n=48)	%
1	Orthopaedics	07	14.58
2	Ophthalmology (Paediatrics)	06	12.50
3	Obst & Gynae	07	14.58
4	Dentistry	04	8.33
5	Surgery	07	14.58
6	Medicine	07	14.58
7	ENT	02	4.17
8	Cardiology (Super specialty)	04	8.33
09	Miscellaneous (Physiotherapy)	01	2.08
10	Diagnostic/Investigation (Radiology, Pathology, etc.)	03	6.25
	Total	48	100.00
11	Cases Excluded	02	

Surprisingly doctors practicing dentistry faced with allegation of medical negligence in 04 (8.16%) cases which is a significant finding.

Table 6**Distribution of Medical Negligence Case (Medicine vs. Surgical Specialty)**

S. N.	Specialty Surgical/Medicinal	No.	%	Negligence Not Proved	%	Negligence Proved	%
1	*Medicine & Allied	11	24.49	09	81.82	02	18.18
2	Surgery & Allied	29	59.18	19	65.52	10	34.48
3	Dentistry	04	8.16	03	75.00	01	25.00
4	Miscellaneous (Physiotherapy, Diagnostic)	04	8.16	02	50.00	02	50.00
	Total cases	48	100.00	33	68.75	15	31.25

Summary & Conclusions:

Out of 48 cases studied 43 (89.58%) belongs to private hospitals and only 05 (10.42%) belongs to Government Hospitals.

Surgical & Allied specialties and investigational specialties are more at risk of

Surgery & Allied Specialty are at more risk of allegations of Medical Negligence:

Our study showed that out of 48 cases of medical negligence studied, Surgery and Allied Specialty faced with allegation of medical negligence in 29 (59.18%) cases against only 12 (24.49%) cases belongs to Medicine and Allied Specialty. Surprisingly 04 (8.16%) cases each belongs to allegation of medical negligence against Dentistry doctors and Doctors /Hospitals provided Diagnostic/ Investigation/ Physiotherapy services. (Table 5)

Reasons could be attribute to high cost of treatment for surgical interventions as well as degree of damage (physical disability, suffering) suffered by the complainant in availing surgical services as against services availed from medicine and allied specialty doctors/hospitals.

Table 5: Distribution of Medical Negligence case (Medicine vs. Surgical Specialty)

S. N.	Specialty Surgical/Medicinal	Cases	%
1	Medicine & Allied	12	24.49
2	Surgery & Allied	29	59.18
3	Dentistry	04	8.16
4	Miscellaneous (Physiotherapy, Diagnostic)	03	8.16
	Total cases	48	100.00

Negligence against Surgical & Allied Specialty easy to prove:

Present study revealed that it is easier to prove allegations of medical negligence against Surgery and Allied Specialty as compared to Medicine and Allied Specialty.

Chances of proof of allegations of medical negligence against Diagnostic Specialty (Radiology, Pathology, Biochemistry, etc.) are highest at 50% cases, followed by Surgery & Allied Specialty with 34.48%, Dentistry with 25% and with least chances of prove in Medicine & Allied Specialty with only 18.18% respectively. (Table 6)

alleged medical negligence and subsequent probability of proof of medical negligence.

Medical ethics and regulations, 2002 [14] awareness among medical faculty will go a long way in preventing future medical negligence cases in India.

Recommendations:

- There is need for similar studies and frequent audit of medical negligence cases to find out the new and emerging causes of medical negligence in future.
- Doctors and hospital owners are advised to go for Indemnity Insurance cover of adequate limit to prevent loss by complementation to the stakeholders.
- With increasing cost of healthcare claim for medical negligence are bound to be raised in future. Govt. should increase funding for healthcare and coverage by health insurance so that cost of healthcare can be controlled to some extent.
- Medical Ethics teaching and training on soft skills, especially of communication skills will go a long way in not only improving the quality of health care and satisfaction of patients but also in preventing medical negligence cases.
- Need for Classification of Medical Negligence Cases
- Need for further Research

Limitations:

- No uniformity in allegations due to cultural and educational variations

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Original Research Paper

Clavicle Fractures: A Retrospective Autopsy Study

¹Ravindra S Honnunar, ²A. G. Vijaykumar, ³Somshekhar S Pujar, ⁴Vishal V Koulapur

Abstract

The clavicle is the first bone in the body to ossify, and it does so by intramembranous ossification. The medial growth plate is responsible for 80% of the length of the clavicle. Ossification occurs between 12-19 years of age and fusion to the clavicle occurs between the age of 22-25. This retrospective study is undertaken to investigate and analyze the epidemiology of clavicle fractures. To classify clavicle fractures Allman classification was used. In our study male constitutes 84% and female 16%, left hand side clavicular fractures in 68% of cases and 32% for the right-hand side, sternal part of clavicle fractures in 64% of cases, middle part of clavicle fracture in 20% of cases, acromial part of clavicle fracture in 8% of cases and compound fractures in 8% cases. Clavicle fractures are also common in the context of high-energy injury or multiple traumatic injuries. In these situations, it is important to examine the patient for other associated injuries.

Key Words: Clavicle Fractures, Allman and Neer Classification, Trauma, Injuries

Introduction:

Clavicula means "key" and is the diminutive of clavis in Latin, (in Greek it is cleido). The clavicle is the first bone in the body to ossify, and it does so by intramembranous ossification (fifth week of gestation).

The medial growth plate is responsible for 80% of the length of the clavicle. Ossification occurs between 12-19 years of age and fusion to the clavicle occurs around age of 22-25 years.

Sternoclavicular dislocations in young adults are in fact epiphyseal fractures. The clavicle is S-shaped i.e. concave ventrally-laterally and convex ventrally-medially.

The clavicle is not present in animals that use their forelimbs for standing. It acts as a bony protection for the vessels and for the brachial plexus.

As the clavicle is S-shaped it rotates upwards and moves backwards during elevation of the arm so the anterior curvature clears the underlying structures and does not compress them under normal conditions.

The clavicle transmits the supporting forces of the trapezius muscle to the scapula through the coraco-clavicular ligament, and it is also a bony framework for muscle origins and insertions which optimize the biomechanics of the shoulder under active movement of the arm. [1] In the United States the clavicle is the most frequently fractured bone in the body in childhood, accounting for 10-16% of all fractures in this age group.

Clavicular injuries affect 1 in 1000 people per year. Bimodal incidence occurs in men younger than 25 years and older than 55 years. The annual incidence rate of clavicular fractures is estimated to be between 30 and 60 cases per 100,000 populations. [2]

Aim and Objective:

- To Investigate and analyze the epidemiology of clavicle fractures.

Material and Method:

It is a retrospective study of 50 cases of clavicle fracture in autopsied cases at Jawaharlal Nehru medical college, Belgaum during 2010 to 2013 Years.

To classify clavicle fractures Allman classification was used. [2]

Allman Classification:

- Group I-middle 1/3
- Group II-lateral 1/3 (acromial)
- Group III-medial 1/3 (sternal)

Neer made a significant revision to the Allman classification scheme. Group II (distal clavicle) fractures were further divided into 3 types based on the location of the clavicle fracture in relation to the coraco-clavicular

Corresponding Author:

¹Associate Professor,
Dept. of Forensic Medicine & Toxicology,
Jawaharlal Nehru Medical College, Belgaum
E-mail: rshonnunar@yahoo.co.in

²Assist. Prof, Dept. of FMT
Adhichunchanagiri Institute of Medical Sciences,
Mandya

^{3 & 4} Assist Prof, Dept. of FMT
Jawaharlal Nehru Medical College, Belgaum
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ligaments. The reason for this modification was that distal clavicle fractures behave differently depending on the exact location of the injury. The designations are as follows

- **Type I Fractures:**

Minimally displaced and occur lateral to an intact coraco-clavicular ligament complex; these fractures may be treated non-operatively and symptomatically

- **Type II Fractures:**

Occur when the medial fragment is separated from the coraco-clavicular ligament complex; the medial fragment is displaced cephalic by the pull of the sternocleidomastoid muscle, and the distal fragment is displaced caudally by the weight of the upper extremity, with the intact coraco-clavicular ligament complex; the resulting deformity leads to marked displacement of the fracture ends, predisposing this fracture type to a higher prevalence (up to 30%) of nonunion.

- **Type III Injuries:**

Minimally displaced or non-displaced and extend into the acromioclavicular (AC) joint; as with type I fractures, these injuries can be treated symptomatically; the development of late AC degenerative changes can be treated with distal clavicular excision.

Observations and Results:

In this retrospective study of total 50 cases of clavicular fracture, male (84%) outnumbered the female (16%). (Table 1) In our study, we found left hand side clavicular fractures in 68% of cases and 32% for the right-hand side. (Table 2)

We observed in this study sternal part of clavicle fractures in 64% of cases, middle part of clavicle fracture in 20% of cases, acromial part of clavicle fracture in 8% of cases and compound fractures in 8% cases. (Table 3)

Discussion:

Because of its subcutaneous position, the clavicle may be fractured easily, with the fracture often being an isolated injury. However, clavicle fractures are also common in the context of high-energy injury or multiple traumatic injuries. In these situations, it is important to examine the patient for other associated injuries, such as rib fractures, scapula fractures, other fractures about the shoulder girdle, pulmonary contusion, pneumothorax, hemothorax, and closed head injuries.

Clavicle fractures may be caused by direct or indirect trauma. The most common mechanism is an indirect one, involving a fall directly onto the lateral shoulder during road traffic accidents.

Examples of a direct mechanism would be a blow from a hockey stick or a direct fall onto the clavicle. At-risk athletes include those in football, hockey, and soccer and those at risk for falling during roller skating, skiing, bicycling, or horseback riding.

A less common mechanism for clavicle fractures is a fall onto an outstretched hand.

Gender:

In our present study male constitutes 84% and female constitutes 16%. Robinson et al [3] found the male: female ratio to be 2.6:1. Nordqvist reported an annual incidence of clavicular fractures in men between 15-19 years at about 150 per 100 000 and in females about 50 per 100 000. [4]

Clavicular injuries occur 2.5 times more commonly in males than in females, reflecting a greater involvement of males in contact and violent sports and motor vehicle accidents (MVs). Clavicle fractures, the most common of all pediatric fractures, can present even in the newborn period, especially following a difficult delivery. A large peak incidence occurs in males younger than 30 years due to sports injuries.

A smaller peak occurs in elderly patients, who tend to sustain clavicle fractures during low-energy falls. [2]

Fracture Side:

In our study, we found left hand side clavicular fractures in 68% of cases and 32% for the right-hand side. Nordqvist reported right and left sides being fractured with a relative frequency of 47.5% and 52.5%, respectively. [4]

Hill et al reported a pre-dominance of injuries of the left clavicle with a right-left distribution of 36.5% and 63.5%, respectively [5]. Bilateral clavicular fractures are rare. [6] There were no cases in our study.

Fracture location:

In this study we found sternal part of clavicle fractures in 64% of cases, middle part of clavicle fracture in 20% of cases, acromial part of clavicle fracture in 8% of cases and compound fractures in 8% cases.

The distribution of fracture location by anatomical site in study by Nordqvist and Robinson was about three out of four fractures located in the middle part of the clavicle. The acromial part was involved in about one out of four fractures, while the sternal part was affected in just a few cases. [3, 4]

In adults, clavicle fractures account for 2.6-5% of all fractures and 44% of all shoulder girdle injuries. Middle third (group I) fractures account for 69-82% of all fractures of the clavicle, whereas distal third (group II) fractures

account for 12%, and medial third (group III) fractures occur in 6% of cases. [7] While the overwhelming majority of clavicle fractures are benign, there is a possibility of associated, life-threatening intra-thoracic injuries.

Kendall et al reported a fatality from an isolated clavicle fracture from transection of the subclavian artery [8] this was the first such reported case in the literature.

The fatality may have been due to the fact that the fall was not witnessed and the patient lay unassisted for an unknown period of time. The patient never regained spontaneous circulation, and the injury to the subclavian artery was diagnosed at autopsy.

The postmortem examination revealed a mid-clavicular fracture with transection of the subclavian artery. A 2.6-L hemothorax and damage to parietal and apical pleura were noted, but no other injuries were present.

Although this case is unique, it does emphasize the need to be aware of the potentially catastrophic complications of damage to the vascular structures in close proximity to the clavicle.

Conclusion:

Clavicle fractures are common and easily recognized because of their subcutaneous position. Fracture union usually progresses regardless of the treatment initiated. Despite the innocuous appearance of clavicle fractures, however, potential treatment difficulties and possible complications warrant careful attention to these injuries.

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Table 1: Sex Wise Distribution of Cases

Sex	Numbers	Percentage
Male	42	84%
Female	08	16%

Table 2: Fracture Side Wise Distribution of Cases

Fractured side	Numbers	Percentage
Right	16	32%
Left	34	68%

Table 3: Fracture Site Wise Distribution of Cases

Fracture location (%)	Numbers	Percentage
medial 1/3 (Sternal)	32	64%
Middle	10	20%
lateral 1/3 (Acromial)	04	08%
Compound fractures	04	08%

Original Research Paper

Study of Os Zygomaticum Bipartitum In Skulls of Central India

¹Ashutosh S. Mangalgiri, ²Dibya K. Satpathy, ³Rajendra Bhojwani

Abstract

Zygomatic bone is commonly known as cheek bone, forms prominence of cheek. Present study was conducted on 228 zygomatic bones of 114 dry skulls. Zygomatic bone may divide into two parts either by horizontal or vertical suture. A horizontal suture was observed dividing the zygomatic bone into two parts in two zygomatic bones out of 228 zygomatic bones studied (0.87%). An inferior type of horizontal suture was observed dividing the zygomatic bone. Two zygomatic bones belong to the same skull i.e. bilateral bipartite zygomatic bone. Suture can be well identified by radiography and CT scan.

Primary cartilaginous joint between sphenoid and basi-occiput was not ossified. Complete metopic suture was also observed. Condition is a rare one and therefore can be easily misinterpreted as zygomatic bone fracture in medico legal cases. Therefore the condition should be kept in mind by Forensic experts and maxillofacial surgeons. Both CT scan and Radiography are important tools in the diagnosis of zygomatic suture and should be considered as primary diagnostic tools in the diagnosis of suture. Presence of zygomaticum bipartitum is addition to the literature.

Key Words: Zygomatic bone; Suture; Os Japonicum; Fracture

Introduction:

Zygomatic bones are pair of quadrangular bones, forms the prominence of cheeks. It articulates superiorly with the frontal bone through fronto-zygomatic suture, posteriorly joins with the temporal bone to complete the zygomatic arch and antero-inferiorly articulates with maxilla.

Zygomatic bone ossifies in membrane from a single centre. [1] Zygomatic bone may sometimes divide into two or three parts, called as bipartite or tripartite zygomatic bone respectively. The condition is more commonly seen in Mongolian race, making the malar prominences flat, hence the condition is called as os japonicum. The incidence of os zygomaticum bipartitum is very low in India.

The present study was undertaken to elucidate the incidence and to document the evidence of bipartite zygomatic bone.

Corresponding Author:

¹Professor, Department of Anatomy
Chirayu Medical College & Hospital,
Near Bairagarh, Bhopal; MP 462030

E-mail: Ashutoshmangalgiri@yahoo.co.in

²Prof, Dept. of Forensic Medicine & Toxicology
L. N. Medical College & Hospital, Bhopal

³Assoc. Prof, Dept. of Radiodiagnosis
People's College of Medical Sciences & RC, Bhopal
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Materials and Methods:

Present study included 228 zygomatic bones from 114 human adult dry skulls, irrespective of sex. Skulls were taken from Chirayu medical college and L. N. Medical College, Bhopal. Skulls were observed for the presence of any suture in the zygomatic bone and its pattern. Suture was also observed on plain radiograph and CT scan.

Observations:

Out of 228 zygomatic bones studied suture was observed in two zygomatic bones. The zygomatic bones were completely divided into two parts by a horizontal suture. (Fig. 1 & 2)

The zygomatic bones were divided by horizontal suture into large upper and small lower part i.e. inferior type.

The zygomatic bone superiorly articulates with frontal bone and antero-inferiorly with the maxilla. Radiologically the suture of bipartite zygomatic bone can be conveniently demonstrated by Towne's view. The suture line is seen as a increased density through the zygomatic bone. (Fig. 3)

In CT scan the suture was seen in the zygomatic bone completely dividing it into two parts. (Fig. 4) No oblique divisions were observed in the present study. Primary cartilaginous joint between posterior surface of the body of sphenoid and anterior surface of basi-occiput was not fused. Complete metopic

suture was also present. No wormian or inter-parietal bones were seen in the skull. In present study the incidence of bipartite zygomatic bone was found to be 0.87% in 228 zygomatic bones in skulls of Central India.

Discussion:

Zygomatic bone may divide into two parts by either vertical or horizontal sutures; the condition is termed as bipartite zygomatic bone. The division of zygomatic bone was first reported by E. Sandifort in the 1779. [2]

The presence of bipartite zygomatic bone was documented by Gruber; Hilgendorf and Le Double. [3-5] Hilgendorf reported bipartite zygomatic bone in two cases out of 11 skulls studied and named as 'Os japonicum'.

Os japonicum was named because of its higher incidence in Japanese population. [4]

The horizontal division may be complete or incomplete. Sometimes horizontal suture divides the zygomatic bone into upper larger and lower smaller part. [1] The horizontal division of zygomatic bone may be of superior and inferior type. [6] In inferior type of bipartite zygomatic bone, small lower portion of zygomatic bone was reported by Hanihara et al. [6]

In superior type of horizontal suture divided the zygomatic bone at the site of frontal process. [7] A variant of zygomatic bone was reported by Gruber and Jeyasingh et al, in which maxilla directly articulated with the temporal bone without actual division of zygomatic bone. [3, 8] Zygomatic bone usually ossifies from a single centre usually at the eighth week or end of the second month of intra uterine life.

Ossification extends from this centre upwards medially towards frontal bone, forwards and backwards towards maxilla and temporal bone respectively. Other centers may exist in case of divided bone. [9] According to Hauser & De Stefano subdivision of the zygomatic bone are modifications of secondary appositions from which definitive zygomatic bone develop. [7]

An aberrant centre may have been developed in the region of zygomatic bone or the original single centre may split into two leading to bipartite zygomatic bone. The condition may have a genetic background. [6]

The incidence of bipartite zygomatic bone was reported in 3 bones of two individuals of Punjab-Kashmir region. [6] Jeyasingh et al reported the incidence of 4% out of 500 skulls from Uttar Pradesh. [8]

In skulls of Madhya Pradesh the only one skull was reported to have bipartite zygomatic bone. [10] Present study reported 2 bipartite zygomatic bones with an incidence of

0.87%. Though this condition has no functional significance but clinically it is of high relevance. Zygomatic bone because of its exposed position on face is more liable to injury. [11]

Unilateral bipartite zygomatic bone may be mistaken for the fracture zygomatic bone. In accidental cases craniofacial, maxillofacial surgeon and forensic experts should be able to differentiate between fracture and the bipartite zygomatic bone.

Conclusion:

Presence of horizontal or vertical suture in the zygomatic bone responsible for the condition called as os Japonicum. Incidence of bipartite zygomatic bone was very low in Central India (0.87 %). As the incidence is very low, the condition may be overlooked.

Due to rarity of the condition, it mimics the fracture zygomatic bone and can be misinterpreted as fracture of zygomatic bone in cases of child abuse or in accidental cases. Knowledge of this condition is therefore essential for the maxillofacial surgeons and Forensic experts.

Fig. 1: Bipartite Zygomatic Bone on Right Side (Arrow Heads Pointing Horizontal Suture)



Fig. 2: Bipartite Zygomatic Bone on Left Side (Arrow Heads Pointing Horizontal Suture)



Fig. 3: X-Ray of Bipartite Zygomatic Bone on Both Sides and Metopic Suture (Arrow Heads Pointing Horizontal Suture & Arrow Pointing Metopic Suture)

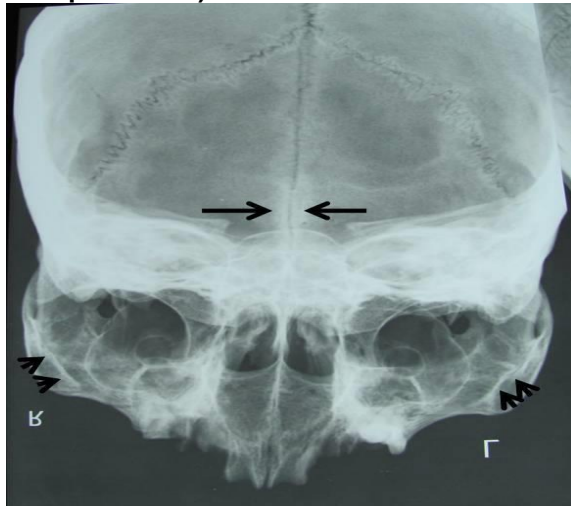
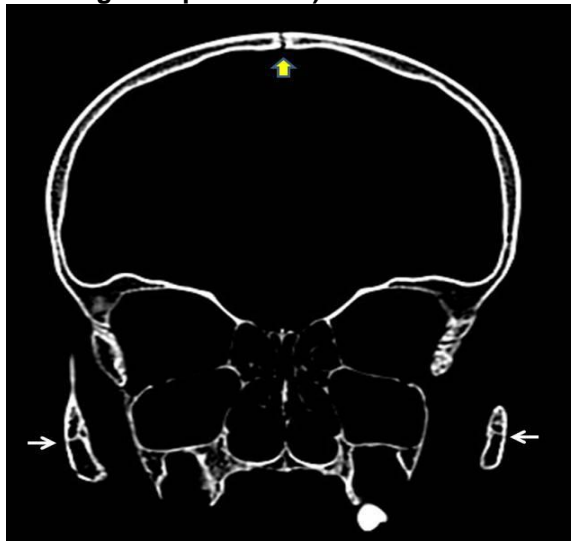


Fig. 4: CT Scan of Bipartite Zygomatic Bone on Both Sides and Metopic Suture (Arrows Pointing Horizontal Suture and Yellow Arrow Pointing Metopic Suture)



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Original Research Paper

A Study of Histopathological Changes of Suprarenal Glands in Cases of Ante-mortem Burn Deaths

¹Raihan Uddin Ahmed, ²H.K. Mahanta

Abstract

In case of agonal death like burn, hanging or other form of asphyxial death various histopathological changes occur in the suprarenal glands. Sometimes under certain circumstances the diagnosis of death by ante-mortem burn becomes difficult. The histopathological changes in suprarenal glands will probably help in these cases to arrive at a diagnosis of ante-mortem burn deaths. This study comprised of suprarenal glands dissected out during medico-legal autopsies from 35 cases of deaths due to burn brought to the mortuary of Department of Forensic Medicine, Assam Medical College & Hospital, Dibrugarh from 1st June 2012 to 31st May 2013.

This study revealed that definite histopathological changes occur in the suprarenal glands in a considerable number of cases of death due to burn (57.14%). Bilateral adrenal hemorrhage is rarely diagnosed clinically as its presentation is generally non-specific. The clinical importance of bilateral adrenal hemorrhage is that it may lead to acute adrenal insufficiency and possible death. Therefore, when a sudden deterioration in a patient with thermal injuries is encountered, adrenal insufficiency must be considered. The findings of the present study show the relation between stress and its effects on the suprarenal glands.

Key Words: Hanging, Asphyxial Death, Histopathology, Suprarenal Gland, Burn

Introduction:

Histopathology is the science concerned with cytological and histological structure of abnormal or diseased tissue. In case of agonal death like burn and hanging or other form of asphyxial death various histopathological changes occur in the suprarenal glands. Adrenal haemorrhage occur secondary to both traumatic conditions and atraumatic conditions. Burns accounts for maximum traumatic haemorrhages.

Thermal injuries elevate corticosteroid secretion for weeks after injury, severely stressing the adrenal glands. Overload of the hypothalamic-pituitary-adrenal axis is thought to make this system unusually vulnerable to acute infarction.

During agonal death due to burn or suicidal hanging or other form of asphyxial deaths suprarenal glands face stress to great extent. This leads to both, gross and histological changes in the glands. [1]

Sometimes a person may be murdered by some other means and the body may be burnt, in such cases we can go for the histopathology of the suprarenal glands. [2]

In ante-mortem burn we will find both gross and histopathological changes in the suprarenal glands. The suprarenal glands, being more delicate and sensitive organs of stress, will show some histological changes in the substance of the glands in ante mortem burn deaths in the early hours after life. Changes in the suprarenal glands in such cases can be accepted as a corroborative evidence of ante mortem burn deaths.

Aims and Objectives:

- To study the histopathological changes that occurs in the suprarenal glands in cases of ante-mortem burn deaths.

Materials and Method:

The materials for the present study comprised of suprarenal glands dissected out during medico legal autopsies from 35 cases of deaths due to burn brought to the mortuary of Department of Forensic Medicine, Assam Medical College & Hospital, Dibrugarh by investigating authority during the period of one year from 1st June 2012 to 31st May 2013.

The cases with time since death more than 24 hours were not included, as many authors found that the suprarenal glands,

Corresponding Author:

¹Post Graduate Trainee,
Department of Forensic Medicine,
Assam Medical College, Dibrugarh
E-Mail: ahmed_raihan@rediffmail.com

²Prof & HOD

E-Mail: hkmahanta89@gmail.com

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particularly the medulla undergoes autolysis within a short period of time after death. [3] The deaths from scalds, chemical burns and electrical burns were also not included.

The suprarenal glands were observed macroscopically as such and on longitudinal cut section for evidence of congestion, hemorrhage, color change and any other pathological conditions. The materials were then collected separately in convenient wide mouthed glass bottles or vials and preserved in 10%formol saline. The containers were then labeled properly as regards the name of the tissue, post-mortem number, date of collection, serial number and transferred then from the mortuary to the laboratory for processing, staining and examination for histopathology under the microscope.

Results and Observations:

Out of 35 cases of death due to burn, in 20(57.14%) cases hemorrhages were seen in the substance of the suprarenal glands under microscope. In 15 (42.86%) cases no hemorrhage was found the in the substance of the suprarenal glands. (Fig. 1)

It was observed that out of 20 cases of death due to burn where hemorrhagic areas were found in the suprarenal glands under microscope, four (20%) cases showed unilateral hemorrhage and 16(80%) cases showed bilateral hemorrhage. (Table 1)

It was observed that in 20(57.14%) cases of death due to burn the suprarenal glands were enlarged and congested. (Photo 1) In 15 (42.86%) cases the suprarenal glands showed no gross changes. (Fig. 2)

In 20 (57.14%) cases of death due to burn petechial hemorrhage was found over the suprarenal glands. In 15 (42.86%) cases no petechial hemorrhage was found over the suprarenal glands. (Photo 2)

Discussion:

It is seen that in 57.14% cases of death due to burn there was congestion and enlargement of the suprarenal gland. The cut sections of these enlarged and congested glands showed hemorrhagic areas. In 42.86% cases there were no gross changes in the suprarenal glands. Regarding postmortem appearance of suprarenal glands in death due to burn, J.B. Mukherjee mentioned that the glands are enlarged and congested. [4]

C.G. Tedeschi [5] documented increased functional activity along with enlargement of the adrenal glands in deaths due to burn. Weiskotten, [6] found that in 10 autopsies following uncomplicated superficial

burns there was markedly swollen and deep red suprarenal glands with marked congestion of the blood vessels and scattered areas of hemorrhage penetrating the parenchymal cells.

Pack G.T. [7] observed the presence of hemorrhage as well as the increase in size of the glands from 4-7 grams in the normal individual to 20-25 grams in victims of death due to burn. Kuehne HM and Hamilton HM, also found in their study enlarged and congested suprarenal glands in victims of burn death. [8]

In the present study in 57.14% cases of death due to burn, hemorrhage was found in the substance of the suprarenal glands under microscope. As mentioned earlier, Weiskotten [6] found scattered areas of hemorrhage penetrating the parenchymal cells in the burn deaths.

R.I. Harris [9] in a death from a scald of second and third degree found that both adrenal glands were characterized by hemorrhage involving the medulla and cortex of the glands. Pack observed the presence of hemorrhage in the suprarenal glands of victims of burn death. Vijay Kumar et al found suprarenal hemorrhage in 27.5% of cases of death due to burn. [7]

In the present study out of 35 cases of death due to burn, in 20 (57.14%) cases hemorrhagic areas were seen under microscope. Out of these 20 cases with microscopic hemorrhagic area, in 80% cases adrenal hemorrhage was found to be bilateral and in 20% cases it was unilateral. Vijay Kumar et al found bilateral suprarenal hemorrhage in 71.4% cases and unilateral hemorrhage in 28.6% cases. [10] This finding is similar to the finding of the present study.

Conclusion:

The subject of this study on ante-mortem burn death have been undertaken in the sense that there was likelihood of producing some histological changes in the architecture of the suprarenal glands due to generalized effect upon the glands by the burn and also to find out the incidence of the histological changes.

In the present study it was noticed that definite histopathological changes occur in the suprarenal glands in a considerable number of cases of death due to burn (57.14%).

In cases of deaths due to burn with both septicemia and without septicemia such histopathological changes are seen. Bilateral adrenal hemorrhage is rarely diagnosed clinically as its presentation is generally non-specific. The clinical importance of bilateral adrenal hemorrhage is that it may lead to acute adrenal insufficiency and possible death.

Therefore, when a sudden deterioration in a patient with thermal injuries is encountered, adrenal insufficiency must be considered.

The findings of the present study show the relation between stress and its effects on the suprarenal glands which will be of value in some cases as corroborative evidence to the other findings in diagnosis of cases of death due to burn.

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Table 1: Microscopic Changes in Single or Both Suprarenal Glands in Death Due to Burn

	Cases
Total Burn Cases Studied	35
Suprarenal haemorrhage	20
Unilateral Haemorrhage (%)	4(20.0)
Bilateral Haemorrhage (%)	16(80.0)

Fig. 1: Haemorrhagic Areas in Suprarenal Glands Microscopically in the Victims of Death Due To Burn (n = 35)

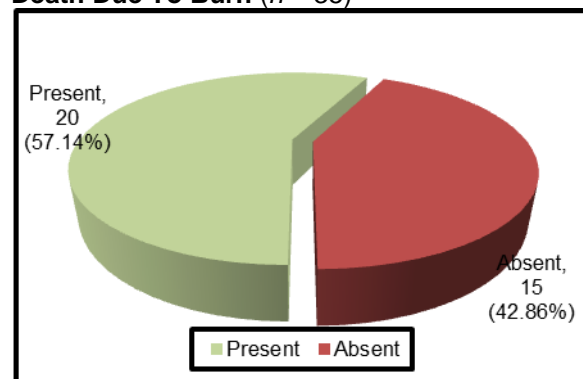


Fig. 2: Enlargement and Congestion of Suprarenal Glands in Victims of Death to Burn (n=35)

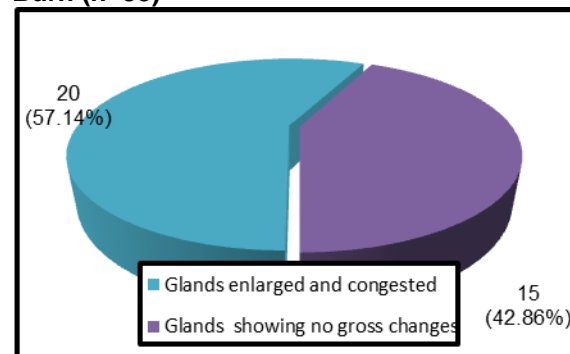


Photo 1: Enlarged and Congested Suprarenal Gland in Case of a Death due to Burn



Photo 2: Hemorrhagic Area Seen in Suprarenal Gland in Case of Burn Death

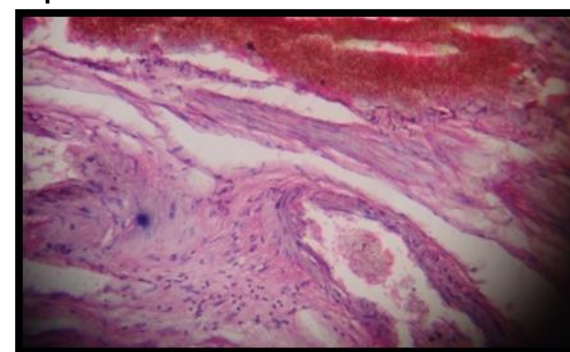
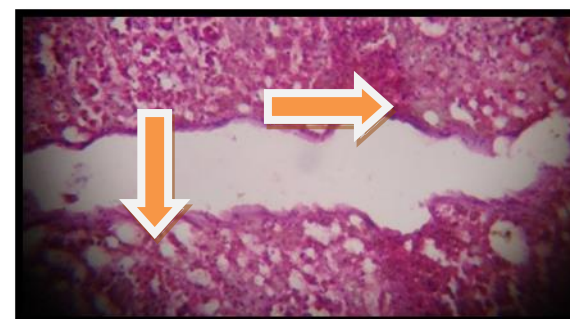


Photo 3: Dilated Capillaries and Hemorrhagic Areas Seen in Suprarenal Gland in Case of Death Due To Burn



Original Research Paper

New Injury Severity Score in Fatal Blunt Thoracoabdominal Trauma in North East Delhi

¹Vivek Srivastava, ²Anil Kohli, ³K. K. Banerjee

Abstract

The trauma scores provide a standardized database of autopsy findings. This may lead to increase in the quality of trauma treatment and assessment of preventable death. Recently, researchers have proposed a new injury severity score (NISS), which is computed as the simple sum of squares of the three most severe AIS injuries. The present study was undertaken to focus light upon the new injury severity score (NISS) of fatal thoracoabdominal injuries in Northeast Delhi. A total number of 93 cases were studied during a period of one and a half years. The highlights of the study are that the largest numbers of cases (51.6%) are in NISS 50-75 group. NISS has a mean of 46.59. There is a negative correlation between new injury severity score (NISS) and Ps with an *r*-value of -0.472 ($p < 0.005$). An increase in NISS leads to a decrease in period of survival.

Key Words: Thoracoabdominal Trauma, Injuries, Injury Severity Score, Fatal

Introduction:

The regular use of trauma scores in Forensic Medicine may provide a standardized database of autopsy findings. This may lead to increase in the quality of trauma treatment and assessment of preventable death.

In the recent past no study assessing the thoracoabdominal injuries using ISS/NISS has been done in northeast Delhi region. Hence the present study was undertaken.

The American Medical Association, for Automotive Medicine & the Society of Automotive Engineers established the Abbreviated Injury Scale (AIS) in 1973.

It has been revised several times, and latest revision was in 2005. In its present form the AIS codes injuries based on their anatomic site, nature and severity. [1] The injury severity score (ISS) is also an anatomically based ordinal scale, with a range from 1 to 75.

To compute the ISS the nine AIS body regions are grouped into six: head or neck, face, chest, abdominal or pelvic contents, extremities or pelvic girdle, and external.

The ISS is then calculated as the sum of the squares of the highest AIS scores for the three most severely injured body regions. [1]

Recently, researchers have proposed a new injury severity score (NISS) which, unlike the ISS, considers the three most severe injuries, regardless of body region. The NISS is computed as the simple sum of squares of the three most severe AIS injuries. [1] NISS being the latest and effective method for studying post-mortem injuries is used in our study.

Material and Methods:

Cases of blunt thoracoabdominal trauma brought for medico-legal autopsy to the Mortuary of the Department of Forensic Medicine, University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi during a period of one and a half years were taken up for the study. A total of 93 cases were studied irrespective of age and sex of victims.

All the cases showing fatal blunt thoracic and/ or abdominal injuries with or without external injuries were included.

Bodies showing severe degree of decomposition particularly of the internal organs were excluded from this study to avoid false interpretation of findings. The severity of the injuries was established using the NISS. NISS of each injured body region was calculated using Association for Advancement of Automotive Medicine, 2005 protocols. [2]

Relationship between NISS and survival time was established using regression analysis and obtaining coefficient of correlation.

Corresponding Author:

¹Assistant Professor,
Dept. of Forensic Medicine,
N.S.C.B. Medical College, Jabalpur
E-mail: drvivek.lko@gmail.com

²Assoc. Prof, Dept. of Forensic Medicine,
U.C.M.S. and G.T.B. Hospital, Delhi

³Prof, Dept. of Forensic Medicine,
U.C.M.S. and G.T.B. Hospital, Delhi
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Observations and Results:

In our study mean NISS was 46.59. Largest number of cases (48) belongs to 50-75 NISS group i.e. 51.6% followed by 25.8% cases of NISS score 25-50. (Table 1) Amongst these 48 cases of highest NISS Score, the maximum were of the 21-30 year age group. (Table 2)

In the present study largest number of blunt fatal thoracoabdominal trauma were those who were dead on arrival i.e. 39 cases and belonged to NISS 50-75 group. (Table 3)

The Correlation between NISS and period of survival in the victims of fatal thoracoabdominal injuries is significant at the 0.01 level (2-tailed) in our study. (Table 4)

Discussion:

The results showed a negative correlation between NISS and Ps (period of survival) with an r -value of -0.472 ($p < 0.005$) and Coefficient of a determination $r^2 = 0.19$. (Table 4) **This means that as NISS increases period of survival decreases.**

A weak negative correlation between period of survival and NISS values, pointed to the fact that direct correlation between period of survival and NISS was only 22% and the rest of correlation i.e. 78% depended on other factors as effective emergency medical system and triage, prompt and correct diagnosis, adequate medical treatment and care, etc.

The present study is in agreement with the study of Kumar et al [3] who studied 51 cases of vehicular accident showing abdomino-pelvic trauma, along with associated injuries.

A detailed ISS score was done in all the cases and it was seen that victims in their 30s and 40s died only if their severity score was above 50. It was also observed that when the score was less than 20, the mortality level was minimal, while above 20 there was linear increase.

This study is also in agreement with the study of Nikolić et al [4] who studied correlation between survival time and severity of injuries in fatal traffic accidents in the Institute of Forensic Medicine, University School of medicine, Belgrade. The sample included 272 persons: 193 males and 79 females.

They also found a weak negative correlation between outliving period and ISS values in his sample (coefficient of linear correlation $r = -0.452$) and Coefficient of a determination ($r^2 = 0.20$).

But our study differs from the study done by Rautji et al. [5] as their study was on traumatic deaths involving any region of the

body whereas the present study was confined to fatal thoracoabdominal injuries. (Table 5)

Head injury contributed to a large number of deaths in their study. Most of the victims of head injury had only minor injuries present over other parts of the body leading to a lower injury severity score. In our study 2-3 major organs had significant trauma leading to higher injury severity score.

Our study also differ from the study done by Milić J et al [6] who studied causes of death in long-term survivors of injuries sustained in traffic accidents at the Institute of Forensic Medicine, University School of Medicine, Belgrade. The sample included 31 persons injured in traffic accidents with outliving period longer than 15 days: 21 males and 10 females ($\chi^2 = 0.047$; $p > 0.1$).

There was a weak positive correlation between outliving period and age in their sample (coefficient of linear correlation $r = 0.35$).

The authors combined the autopsy and available clinical data in order to get the ISS value for each case. The mean ISS value was 36.18 (SD = 8.70). There was no correlation between outliving period and severity of trauma (coefficient of linear correlation $r < 0.14$).

Conclusion:

Maximum cases are in NISS (50-75) group i.e. 43% of cases. NISS had a mean of 46.59 in our study. There is a negative correlation between NISS and Period of survival with an r -value of -0.472 ($p < 0.005$).

There is a weak negative correlation between ISS and period of survival. Further studies are needed on this topic where physiological parameters should also be included along with anatomical parameters for trauma scoring.

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Table 1: Cases According to New Injury Severity Score

NISS Score	Cases	Percentage
0-25	21	22.6
25-50	24	25.8
50-75	48	51.6
Total	93	100

Table 2: Age Groups in Relation to New Injury Severity Score

Age grps (Yrs)	New Injury Severity Score			
	0-25	25-50	50-75	Total
0-10	3	2	2	7
11-20	5	5	9	19
21-30	7	4	16	27
31-40	2	5	9	16
41-50	3	3	7	13
51-60	1	4	1	6
>60	0	1	4	5
TOTAL	21	24	48	93

Table 4: Correlation between NISS and Period of Survival

		Period of survival(Ps)	NISS
Ps	Pearson Correlation Significance (2-tailed) N	1.000	-0.472 0.000 93
NISS	Pearson Correlation Significance (2-tailed) N	-0.472 0.000 93	1.000

Table 5: Comparison of NISS between Our Study and of Rautji et al Study

NISS	Present study (North East Delhi)	Rautji et al ⁵ (South Delhi)
NISS 0-25	22.6%	
NISS 25-50	25.8%	61%
NISS 50-75	51.6%	24.5%

**Table 3
Survival Period in Relation to New Injury Severity Score**

NISS Score (2005)	Survival Period						
	Dead on arrival	<2 hrs	2-6 hrs	6-12 hrs	12-24 hrs	1-7 days	1-4 Weeks
0-25	6	4	3	2	3	3	0
25-50	15	1	2	2	1	3	0
50-75	39	4	2	1	0	1	1
Total	60	9	7	5	4	7	1

Original Research Paper

Suggestions for the Medical Experts in Custody Deaths

¹R. Sudha, ²M. A. Mujeeb Siddiqui, ³D. Sravan Kumar, ⁴N. Rupesh Kumar, ⁵Jayasurya, ⁶A. Kranthi Kiran

Abstract

Human death itself is an untoward and unfortunate one for all near and dear ones. Component of unexpectedness specially raises suspicion among relatives, media and community. Deaths in police custody is among the major chunk of such deaths even though low in terms of incidence but having heavy potential of creating major hue and cry. A retrospective study of custodial deaths in various police stations of Andhra Pradesh from 1978 to 1999 was conducted. In spite of diverse difficulties encountered, records of 90 cases could be gathered from various sources like Legal cell of DGP's office, from report of various commission of Inquiry which are available in the library of A.P. Assembly.

An attempt was made to review administrative and medico-legal aspects of 90 cases with regards to circumstances of death, various causes of death, nature of death and lapses on the part of the doctors involved in such cases has been made in the present study. Various suggestions are also put forward in the judicial commission to prevent recurrence of such deaths. To the best of our belief and knowledge, such study are very far and few off in bio medical literatures in India.

Key Words: Custodial Death, Medico-legal, Police

Introduction:

The incidence of police torture and brutality often hit the headlines in newspapers and expose Police to severe criticism from different sections of the Society.

Exposure of such incidents causes national and international concern. Noteworthy among them are case of one student Leader of Goa by name Fernandez Moses receiving inhuman torture in the hands of Police for addressing a peaceful meeting of students in a college of Goa. [1] Figures compiled by the National crime Records Bureau show that during the year 1990-92 as many as 258 rapes and 197 deaths in Police Custody were reported from all over the country. [2]

The custodial deaths generate more heat than light. The National Police Commission (1971) analysed police torture deaths in 8 states, found that police were blamed in 11 out of 17 judicial enquiries, 37 out of 82 magisterial Enquiries, 23 out of 430 enquiries by other agencies.

Corresponding Author:

¹Associate Professor,
Department of Forensic Medicine
Osmania Medical College, Hyderabad (AP)
E-mail: dr.rambarapu.sudha@gmail.com

^{2, 3, 4, 5} Postgraduate Student,

⁶Resident

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The National Police Commission recommended that in all cases of custodial deaths there should be mandatory judicial enquiries. [3]

Materials and Methods:

This is a retrospective study of 90 cases of custodial deaths recorded in various police stations of AP during the period 1978-1999.

The case records were gathered from various sources like legal cell of D.G.P's office, Reports of commission of inquiries from the Library of AP. Legislative Assembly and in some cases through personal communication from doctors. In spite of inherent and diverse short comings shortcomings, available data was gathered, tabulated and analysed to identify flaws and to deduce some logical suggestions at various stages of medical investigation of custody death.

Observations and Result:

In this study out of total 90 victims all were males except one case. (Fig. 1) It was observed in this study that in maximum cases (55.55%) death occurred in lock up or in police premises followed by hospital as indoor patient (28.9%). (Table 1) Except a case of Journalist, all other cases were from low socio economic state of the society with no education.

In present study out of 90 deaths, 19 were natural deaths, 30 due to various injuries, 38 cases due to suicides and three due to other causes. (Fig. 2) Among suicides the commonest method of suicide is hanging. Out of 38 suicides,

28 cases were hanging, five cases of poisoning, three cases of drowning, and one case each of burns and cut throat were present. (Fig. 3)

Regarding the manner of Deaths in our study death due to injuries were accidental in nature (8 cases), due to police beating (13 cases), due to public and police beating (8 cases), and one cases due to insect bite. (Fig. 4)

Fig. 1: Male Female Ratio in Custodial Deaths

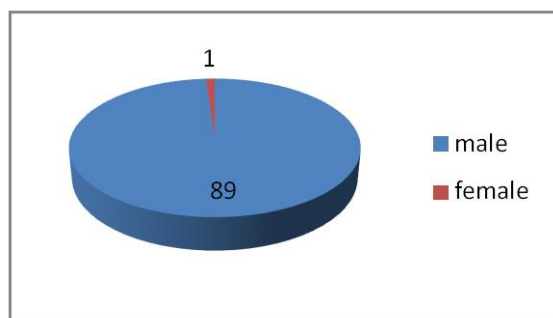


Fig. 2: According to Type of Death

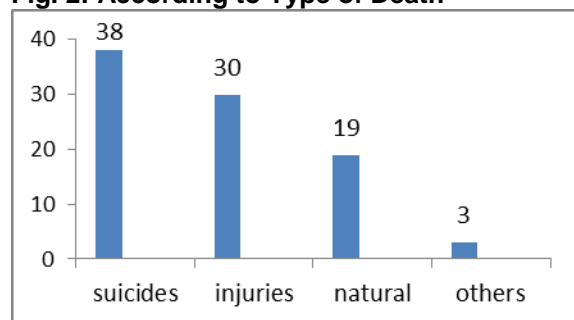


Fig. 3: Method of Suicides in Custody

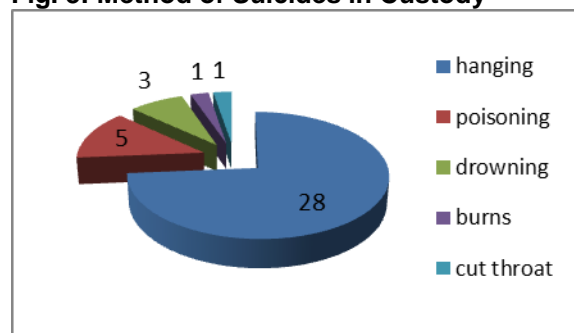


Fig. 4: Deaths due to Injuries

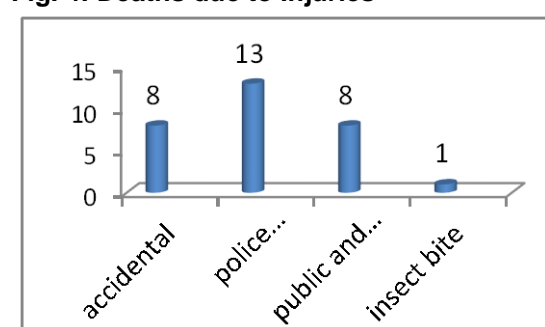


Table 1: According to Place of Death

Place of Death	Cases (%)
Lock up/ police station premises	50(55.55)
Hospital- Brought dead	14(15.55)
Hospital- Died as indoor patient	26(28.90)
Total	90(100)

Discussion:

Out of 90 cases only one victim is female and most of them are from low socioeconomic state of society with no education. In this study 19 cases were natural deaths, 38 suicides, 9 accidents, 30 due to injuries (9 accidental, 13 homicidal, 8 beaten by police and public).

As common victims of custody death are male and from lower socioeconomic strata, who were bread winners of family and hence larger social impact over and above legal repercussions.

In addition, in majority of cases victims died unnaturally (71 cases, 78.89 %); this indicated that custody is not a safe place for the arrested ones. We suggest that home department shall ensure the safety of arrested ones; not only because they are humans but they are potential "accused" of some crime and the entire investigation of the crime ends with end of life of "accused".

The duress in the custody, adversely affects the psych of "accused"; compelling him to end the life. We are of the feeling that, it can be taken care by sensitizing police officials to handle such persons; off course without compromising the laws of land. Some lapses were noticed by the commission of inquiry on the part of Doctors and also investigating police officers. [4]

Suggestions:

Following important ones shall be taken care:

1. Scientific Photographs (with case number and 2-D scale) of the deceased should be taken and preserved.
2. Body should not be sent to the post mortem examination before the nearest relatives arrive.
3. Proper steps should be taken to see that the dead bodies are well preserved to prevent rat bites and other post-mortem changes and artefacts.
4. Post-mortem staining changes misinterpreted for injuries, which shall not be.
5. Controversies about the age of injuries (one to ten days old or older than twelve days) deceased in the lock-up for 10 days.
6. Delays in expressing the opinion regarding cause of death shall be addressed.

7. Post mortem examination done in perfectly, evidence was influenced.
8. Clothing of the deceased should be seized and shall not be handed over to relatives.
9. Improper maintenance of histopathology records shall be checked.
10. The sizes and nature of injuries were not taken into consideration before opining the cause of death. Such deviation from scientific exercise must be avoided.
11. Avoid delay in sending viscera for chemical analysis(as alcohol may not be detected if there is delay)
12. Doctors should not refuse to conduct post-mortem.
13. Hospital in charge and doctor failed to provide ambulance to transport the dead body from police station to the Hospital for which he was suspended. Though trivial, but such issues if taken care helps in reducing agony of the relatives.

Conclusion:

Though the frequency with which the custodial deaths occurring are decreasing. They will continue to occur in spite of all precautionary measures. They not only sully the fair image of Indian Democracy but also provide the grist for the Anti-Indian propaganda mills abroad.

Custodial deaths occur even in countries with excellent human rights records because of occasional lapses of standards. Therefore the above lapses and suggestions put forth by various commissions would help in reducing the frequency of custodial deaths.

We feel, similar scientific evaluation of such deaths across the country and dissemination of the conclusions arrived there of shall help all concerned, not only in reducing custody deaths but also act as a bane in reducing controversies surrounding them.

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2. National Crimes Records Bureau 1990-1992
3. National Police Commission 1971
4. Commissions of Inquiries 1-27

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1.	K.A. Mukhtadar	1978
2.	Sri Justice M. Krishna Rao	1986
3.	Sri Justice A.D.V. Reddy	1986
4.	Sri P. Ramakrishna	1986
5.	Sri E.L. Bhagiratha Rao	1986
6.	Sri K. Sriranganayakulu	1986
7.	Sri P.V. Ranga Reddy	1986
8.	Sri B. Rama Rao	1986
9.	Sri A.D.V. Reddy	1987
10.	Sri P.L. Subbiah	1987
11.	Sri G.J. Stephen	1989
12.	Sri P.V. Ranga Reddy	1989
13.	Sri Veerabhadra Rao	1989
14.	Sri C. Narsimhulu	1989
15.	Sri B. Narsinga Rao	1989
16.	Sri V.V. Ramana dham	1989
17.	Sri C. Jacob	1990
18.	Sri A Sanjeeva Rao	1991
19.	Sri K. Padmanabha Goud	1992
20.	Sri A Sanjeeva Rao	1993
21.	Sri Koka Govinda Rao.	1993
22.	Sri Koka Govinda Rao.	1994
23.	Sri D.V. Ramana Moorthy	1996
24.	Sri K. Padmanabha Goud	1996
25.	Sri K. Padmanabha Goud	1998
26.	Sri A Sanjeeva Rao	1998
27.	Sri B.V. Ranga Raju	1999

Original Research Paper

A Biometric Approach for Personal Identification Using 2-D Lip Images of Brahmin & Baniya Communities

¹Shalini, ²Vibhuti Narayan Singh, ³Mukesh Yadav, ⁴Pooja Rastogi**Abstract**

Personal identification is an important fact in Forensic investigation. Identification through biometric systems is motivated by real life criminal and Forensic applications. Present study was to determine any differences in lip patterns and lip measurements between two communities and to ascertain whether this behold the potential for determination of sex of an individual. A total of 80 subjects of both Brahmin and Baniya community of Bundelkhand region of 20-40 years were taken. Lip measurements were taken along with the lip images and classified according to Tsuchihashi's classification. Statistical analysis indicated that there were significant differences between sexes of both communities. There is correlation of photographic length and width ratio to actual dimension of lips in both the sexes. The overall accuracy for sex determination in **Brahmin** community is found to be **47.1875 %**, whereas in **Baniya** community it was **38.125%**. Hence, the percentage of determining the differences in lip images of males and females in both communities was **42.65%**. This study can provide a preliminary idea about the use of lip images and measurements along with lip pattern as a biometric system in sex determination among both communities.

Key Words: Cheiloscropy, Lip images, Lip pattern, Sex determination

Introduction:

Human identification leads to mutual trust that is essential for the proper functioning of society. We have been identifying fellow humans based on their voice, appearance, or gait for thousands of years. However, a systematic and scientific basis for human identification started in 19th century when Alphonse Bertillon introduced the use of a number of anthropomorphic measurements to identify habitual criminals. "**Biometric**" recognition is based on two fundamental premises about body traits; **distinctiveness & permanence**.

The applicability and identification accuracy of a specific biometric trait essentially depends to what extent these two premises hold true for the population at hand.

Identification the biometric system searches a database for a reference matching a submitted biometric sample and if found, returns a corresponding identity. A biometric is collected and compared to all the references in a database. [3]

Cheiloscropy is a Forensic investigation technique that deals with identification of humans based on lips traces. [4] The use of lip prints were first recommended as early as in 1932 by **Edmond Locard (1877-1966)**, one of France's greatest criminologists. Perhaps the greatest research of Cheiloscropy completed has been from Japanese doctors **Suzuki** and **Tsuchihashi** in 1970 and 1974 wherein lip prints were obtained from 280 and 1,364 Japanese citizens (respectively). [1]

During the studies, lip prints were classified into five main types. Type I represents a lip possessing full vertical grooves. Type II (Pronounced "one-dash") has partial grooves running vertically on the lip. Type II represents branched grooves while Type III represents intersected (diamond) grooves that look similar to crosses. Type IV represents the reticular (rectangular) (pattern similar to wire mesh or boxes). [5]

Very few people know that just like fingerprints, even lip prints can be instrumental in identifying a person positively. Lip prints are normal lines, fissures in the form of wrinkles and

Corresponding Author:

¹Assistant Professor
Department of Forensic Science & Criminology
BabasahebBhimraoAmbedkar University
Lucknow U.P. 226025

E-mail: shalinichauhan89@gmail.com

²Pvt. Handwriting & Fingerprint Expert, Jhansi U.P

³Dean/Principal/Director
Siddhant School of Medical Science and Hospital,
Mainpuri, UP

⁴Prof & HOD, Dept. of Forensic Medicine
SMS&R, Sharda University Greater Noida, UP
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grooves present in the zone of transition of human lip between the inner labial mucosa and outer skin. [2] The appearances of lip prints, like finger prints, vary from person to person. The use of lip prints is not so popular but exists as a methodology in forensic science. Studying in depth and establishing further facts and truth in lip print will certainly help us, as useful evidence in Forensic science. [3]

With the ever-increasing demands placed upon law enforcement to provide sufficient physical evidence linking a perpetrator to a crime, it makes sense to utilize any type of physical characteristic to identify a suspect of an offense. Lip prints and their patterns have unique markings that can be entered into a specific classification. Results of this project identified a legitimate need to actively pursue lip images along with pattern analysis and comparison within the law enforcement and legal system. [6]

Hence, the objective of the present study was to determine whether there are any differences in lip patterns & lip measurements (using lip images) between two different communities, and to ascertain whether this behold the potential for determination of sex of an individual from the configuration, to access correlation between length and width ratio with actual dimension of lips respectively.

Material and Methodology:

The materials used in the present study are as follows:

- Digital camera
- Two rulers of 30 cm
- Vernier calliper

This study consisted of 80 subjects who include 40 Brahmins (20 males and 20 females) and 40 Baniyas (20 males and 20 females). All the subjects belong to both "Brahmin" and "Baniya" community of Bundelkhand Region of India, in the age group of 20-40 years.

Procedure:

The subjects were made to sit in a relaxed position and after cleaning the lips the subject was asked to keep the mouth as well as his/her face stationary. After that original (actual) dimension of lips were taken with the help of Vernier calliper. The actual dimension of the subject was noted down. Width of oral opening was measured from right cheilion to left cheilion.

Height of the upper lips was taken from labrale superior to stomion and height of the lower lips was taken from stomion to labrale inferior.

Then the photograph of the subjects were taken from three distances i.e. 10cm,

15cm, & 20cm respectively, with the help of digital camera in **VGA size (640x480) pixels**. During this the subject was asked to keep his/her face stationary. After taking the photograph of all the subjects the photograph was made to crop to **(440x280) pixels**.

The color printouts of all the photographs were taken & then we measure the dimension of lips at 10cm distance, 15cm distance, and 20cm distance. Along with this the recording was done by noting the combinations of groove types found in each lip image.

Because most lips contain more than one type of pattern, the lips were divided into two compartments as lower lip & upper lip. Both upper and lower compartment is studied and the combination of groove patterns for both was recorded. The lip patterns were classified based on the classification of Tsuchihashi. [1]

Statistical Methodology:

This study was done by using Software Package for Social Services (SPSS). The frequency of each lip print type was calculated. The Chi square (X^2) test was applied to determine whether there were significant differences in lip prints & images between sexes or community. Independent **t-test** was performed to determine the differences in each lip measurement between sexes. $p < 0.01$ is significant and $p > 0.01$ is not significant.

Result and Discussion:

Here we observed through Wilk's lambda among **Baniya males & females** that Actual lip length of male & female (0.6001), photographic lip length of male and female at 10 cm (0.5615), photographic lip width of male and female at 10 cm (0.4388), photographic lip length of male and female at 15 cm (0.5145), & photographic lip length of male and female at 20 cm (0.4708).

Value are highly differentiable, i.e. we can differentiate the gender on the basis of above lip dimension of male & female as corresponding values are near to one, which determine the differences between male and females of Brahmin community. (Fig. 1)

In our study we also observed through Wilk's lambda among **Brahmin males & females** that Actual lip width of male & female value is highly differentiable, (0.6379) i.e. we can differentiate the gender on the basis of actual lip width of male & female as value suggest that there is no relationship between them. (Fig. 2)

In this study we found that there is correlation of photographic length and width ratio to actual dimension of lips however the percentage of accuracy was not so high. The

percentage of accuracy in determining females was not high as in males.

Our study showed that the overall accuracy for sex determination in **Brahmin** community is **47.1875%**, whereas in **Baniya** community the overall accuracy is **38.125%**.

Therefore, the percentage of determining the differences in lip images of males and females & on the basis of community correctly was **42.65%**.

Table 1 and 2 shows overall lip pattern type i.e. I, I', III, IV and II respectively for both male and females of both community.

Hence, it is concluded that in both the communities type I lip pattern is preferably found in both males and females.

Conclusion:

In the present study an attempt has been made to determine the whether there are any differences in lip patterns & lip measurements (using lip images) between two different communities, and determination of sex of an individual from the configuration.

We also try to find out whether basics of lip biometric can be used for person identification and frequency of occurring of lip patterns within community as well as between male and females. Hence, on the basis of the observation and result obtained it was clearly and conclusively demonstrated that lip patterns & lip measurements (using lip images) can be used to determine the sex or community of a person however, the percentage of accuracy generated for each measurement was not high.

There is somewhat correlation between photographic length and width ratio with actual dimension of lips. The percentage of accuracy in determining females was not as high as in males. Further work on the subject and

maximize the number of subject involves in the study can help to make cheiloscopy a practical reality at the ground level of the Forensic identification process.

In our study, we have researched on the lip biometrics using lip images and there is no such relevant research available as of now. Many research scientists have worked on the lip prints but no one had researched on the 'lip images' regarding biometrics. Hence, our research is a pioneer in this field.

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Table 1: Frequency of Lip Pattern Types of Brahmin Community

S.N.	Lip Pattern Type	Frequency		Total (%)
		UL	LL	
1	Type I	16	17	33(41.25)
2	Type I'	6	13	19(23.75)
3	Type II	3	2	5(6.25)
4	Type III	11	3	14(17.5)
5	Type IV	4	5	9(11.25)

Table 2: Frequency of Lip Pattern Types of Baniya Community

S.N.	Lip Pattern Type	Frequency		Total
		UL	LL	
1	Type I	11	18	29(36.25)
2	Type I'	8	13	21(26.25)
3	Type II	4	0	4(5.00)
4	Type III	11	4	15(18.75)
5	Type IV	6	5	11(13.75)

Fig. 1: Sex Validation through Lip Dimension of Actual and Photographic Length and Width of Male and Female among Brahmin Community (Mean Difference)

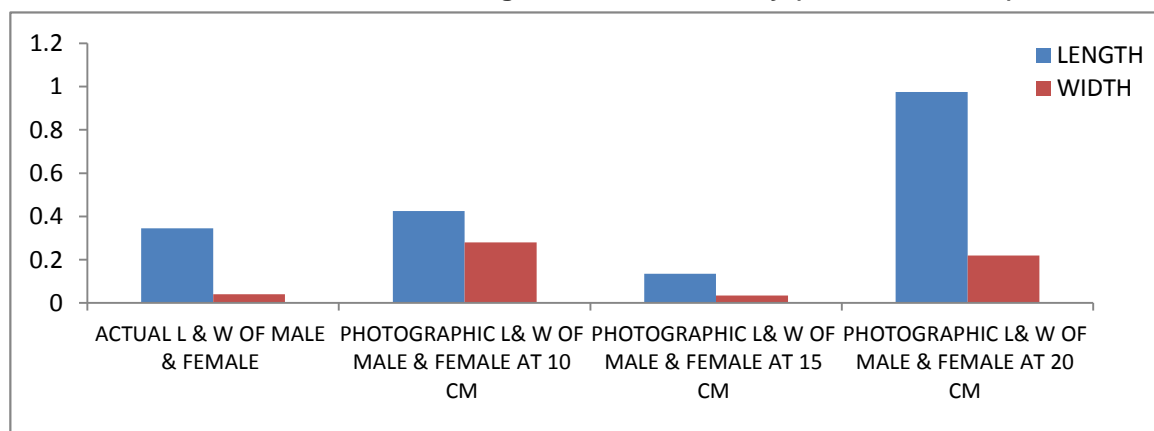
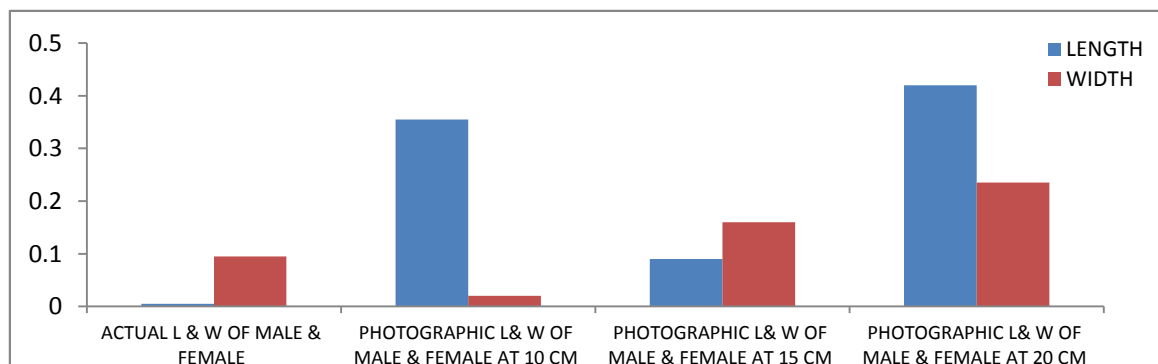


Fig. 2
Sex Validation through Lip Dimension of Actual and Photographic Length and Width of Male and Female among Baniya Community



How much more shall I wait?

I waited for someone to help.

But even he, who had laughed with me last, left me alone.

I waited for an ambulance to come

But, of that, I could imagine the sound only.

I waited for someone who could attend to me.

But, hardly could I see one,

in that "dreamy" state.

And now, even when, I am no more,

should I wait further for my MLC to the fore?

Then in the cold room, I could have "chilled",

but here too, it was already more than "filled".

If now, are the inquest papers ready or should I have left little bit late?

Am I supposed to further wait, or shall I calm down for the final take?

Don't scare me now, if you are "merely" thinking about my viscera.

Yes, you might be planning for my viscera for the sake.

But now you can 'keep' it.

As of now 'I' am 'one' no more.

A stomach can wait for the results....

Dr. Arvind Kumar

Associate Professor, Dept. of Forensic Medicine

Lady Hardinge Medical College, New Delhi

E-Mail: arvindkhudania1@gmail.com

Review Research Paper

Husain-Usmani Model for Grief Truncation Acronym “Seeding of Solace” (SOS): An Integrated Approach

¹Munawwar Husain, ²Javed Ahmad Usmani

Abstract

There are various situations that require consolation for the bereaved. Each one of the situation demands special task to be effective. This study focuses exclusively on grief counselling of the bereaved restricted to the mortuary. It is the culmination of decades of cumulative experience of the authors in dealing with myriad complexities associated with autopsy, the thin line of balance required to be maintained with confidentiality and disclosure, and at the same time discharging the task of counselling in a highly charged atmosphere some time bordering rebellion. An attempt has been made to construct a model named “**Husain-Usmani Model for Grief Truncation acronym ‘Seeding of Solace’ (SOS)**”.

It is hoped that by following this model some level of amelioration of grief could be achieved and the situation could be saved from getting worse aptly a distress call SOS - Save Our Soul. At the same time it is advised that personal discretion is required tantamount to situational freaks because no two situations are alike.

Key Words: Grief Counselling, Bereaved, Husain-Usmani Model, Seeding of Solace, SOS

Introduction:

There are different types of grief situations in health and health care setting. Each of these situations would demand some modification in counselling for the bereaved.

Much work has been done in this and related field covering aspects like Accident and Emergency (A&E) Department [1], how to communicate bad news [2], teaching physicians how to break bad news [3], and ethical problems associated with grief counselling. [4]

Communication is like a poniard, it pierces and prescind towards better the obnoxious thoughts pervading freely in the mind of the bereaved provided the communication is used as a symbol [5], enriched by empathy [6] which in turned is governed by the narrator's own perception and culture, [7] necessarily meeting those of the bereaved.

In health care system and more accurately in a setting of tearing and incising of flesh that is mortuary, empathy assumes many dimensions.

These dimensions are namely, perspective taking (the ability to take on the viewpoint of another person), emotional dimension (experience other's perception), and concern (for the welfare of the other person). [8]

The autopsy surgeon who is delegated the task of quenching voracious thirst by answering questions like “did it?” or “didn't it?” must realize that language is ‘rule governed’ and that ‘it shapes and reflect attitude’ [9] both of the questioner and the answerer.

Emotive language can break the barrier in communication whereas evasive language builds the blockade. Hence it is important that the autopsy surgeon must rely on listening rather than on hearing. Faulty assumptions must never be passed.

With this background the authors now venture to discuss the model created in this respect and elaborate upon the role it can play constructively. We urge the readers to pass the torch in a relay effort aimed at mitigating guilt, remorse and anger in the survivors of the deceased.

Prelude to SOS:

All medico-legal cases brought to the mortuary for autopsy have met sudden unnatural death, whatever their age or physical constitution may be.

It is but natural that this factor alone produces grief compounded by grief, vindictiveness, helplessness, hopelessness,

Corresponding Author:

¹Professor & formerly Medical Superintendent & Principal, School of Nursing,
Dept. of Forensic Medicine

J N Medical College, AMU, Aligarh 202 002

E-mail: hussain_uia@yahoo.co.in

²Prof & Chairman Dept. of Forensic Medicine, JNMC,
AMU, Aligarh

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remorse, anger, and non-reconciliation to the event fate has brought to their door-step.

Persons having natural interest in the undoing of victim's life have strong urge to know the exact sequence of events that led to the demise of the unfortunate individual.

The authors experience tells us that they have two arbitrary questions to pose initially:

- (1) Whether the person would have survived if timely help or medical aid would have been provided to the deceased?
- (2) If he had been harbouring gross pathology ante mortem, would that have contributed significantly to hasten his death despite the extent of wounding?

These two questions are important for them because (a) they would know against whom to direct their anger and retaliation, and (b) this would have a soothing effect once they realize that assault may not be the sole cause of death. Contributory factor(s) have existed.

Both these questions are easy to answer for the autopsy surgeon because both these relate to post-mortem findings. Caution must be exercised at all cost.

Nevertheless with credible medical evidence and beading together of events it would not be difficult to weave soothing gossamer.

However, the manner of delivery of such information would require tactful communication and accepting medico legal and medico moral obligations.

Seeding:

By the term 'seeding' in Husain-Usmani model it imply that an attempt has been made to assuage the feeling of the relatives/acquaintances of the deceased right at the mortuary.

It must be realized that seeding done correctly would alleviate much of their sufferings.

Since the timing is correct it would tend to eliminate the recondite notion of contamination of information in case the information is given later by the autopsy surgeon recalling and churning out of memory.

Extemporaneous deduction of facts would send the message of truthful information provided. The communication tools to be used are necessarily in the following order:

- (a) Do not resort to lying or making equivocating statements.
- (b) Avoid parroting or paraphrasing of sentence because that gives an impression of gnawing words to accommodate fictitious information.

- (c) Since there is no such thing as perfect communication, ergo use narration's nimbleness to your advantage, i.e., use ample cognitive canvas giving an impression that your perception is influenced by their culture and that you feel remotely linked to their current state of emotional devastation.
- (d) Be empathic and shape your language in conformity to the situation.
- (e) Do not mislead but integrate your findings to the extent of revelation without resorting to circumscribing the issue or letting their curiosity stagnate.
- (f) Merge your attitude, beliefs, and values with those of the information seeker at least temporarily – or so it would seem to them.
- (g) Dispel the notion of sunk-cost fallacy because it would further push them in to the morass of violence begets violence or like begets like.
- (h) Finally the ethics of simplicity must be approached but with caution.

Solace:

- (a) Since probably it may be one-time meeting therefore, effort should be made to plant as much soothing seeds as possible for later germination into miles and miles of foliage.
- (b) Of course there is constraint of time, space and circumstance. Use your judgment in this regard.
- (c) Action in speech must be gradatory and not sudden. Enough time must be given to allow the information to sink to a conformity level where the brain allows the mind to accept it.
- (d) One must be sedulous and seem to be so. Hear them but respond only after listening for hearing and listening are not the same. These are the two sides of the same coin but carry collateral connotations.

This attempt would determine their next course of action.

We wouldn't dare say that solace would be able to bring complete harmony in their physical and mental construct; yet to a certain extent it would denominate their anguish and make their lives easier for them to spend.

We have hardly seen relatives or friends of the deceased crying or sobbing at mortuary ambushed by their private agony.

On the contrary their faces seem to be hardened with ample demonstrable streak of apparent resoluteness.

Our endeavour should be to soften their faces. It is easier said than done. Nevertheless, its reach is far in to the future and fruition is for posterity.

Conclusion:

This discourse is closed by raising the rainbow of hope and optimism higher. Data show that communication skills do not necessarily improve with years of medical practice alone [10] but can be learnt. [11]

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OBITUARY

If the radiance of a thousand suns

Were to burst at once into the sky

That would be like the spendor of the Mighty one-----

I am became death

The shatterere of worlds.....

1. **Dr K Guru Raj:** Former Professor, Stanley Medical College, Chennai
2. **Dr Kamala Andhram:** Former Professor, Madras Medical College, Chennai
3. **Dr Thiyagrajan B.:** Former Professor, Coimbatore Medical College, Coimbatore
4. **Dr D. K. Sakalley:** Dean, N.S.C.B. Medical College, Jabalpur
5. **Dr B L Sirohiwal:** Professor, Pt. B.D. Sharma, PGI, Rohtak, Haryana

Review Research Paper

BDSM: A Sexual Deviance Rather a Sexual Culture An Overview

Sunil M Doshi

Abstract

Since ancient time, sex and sex related aspects have generated controversies in terms of philosophical, medical and criminal point of view. Paraphilias are among the most popular as well as complicated sexual deviances. Their documented prevalence and their actual existence follow the iceberg phenomenon, with the part of ice above water represented by documented prevalence and the part below it by its actual existence. The terms "Sadism and Masochism" are comparatively well known, but as a part of its native term "BDSM" is not that much familiar, as specially in our Medical education. BDSM term is actually pairing of multiple terms like "Bondage with Discipline", "Dominance with Submission" and "Sadism with Masochism". However, its actual origin is unclear. In present era, BDSM has become a sexual culture for their practitioners and for the general population it is still a sexual perversion. This article aims to focus on various terminologies of BDSM along with their historical, legal and psychological aspects.

Key Words: BDSM, Sexual deviance, Paraphilia, Sadism, Masochism

Introduction:

Culture differentiates what should be normal and what should not be. It is fully possible what is meant for us as taboo may be acceptable routine for others. Sex and sex related aspects have more or less similar status.

One of the sex related aspect is sexual deviance, which simply means deviation from ordinary sex. The other related term is paraphilia, which can be defined as a type of sexual deviance in which sexual arousal obtained by atypical objects, urges, behaviour or situations. There is a controversy concerning paraphilia and to define what is normal versus deviant or disordered behaviour. [1]

Types of sexual behaviour traditionally seen as unnatural or perverted or deviant would include homosexuality, sadomasochism, exhibitionism, voyeurism, fetishism, transvestism, zoophilia, necrophilia, pedophilia etc. [2] There are around hundreds of paraphilias but very few are documented as cases. Neither sexology nor any other discipline has been able to explain how humans develop any particular sexual interest. [3]

Corresponding Author:

Assistant Professor
Smt. B. K. Shah Medical Institute and
Research Centre, Vadodara
E-mail: drsunil2347@gmail.com
DOR: 01.11.2014 DOA: 05.02.2015
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The terms "Sadism and Masochism" are comparatively well known but as a part of its native term "BDSM", which in present era have become a culture, is not that much familiar, as specially in our Medical education.

Historical Aspect of BDSM:

Neither there is any full proof evidence of time of origin nor there is any evidence regarding particular place or specific culture of origin of BDSM. Rather there is possibility that what we know today as BDSM have multiple points of origin.

Approximately 490 B.C. older painting called "The Tomb of Whipping" at Etruscan tomb near Tarquinia, Italy, represents two men canning a woman when they are in erotic situation. [4] In 9th century B.C. whipping ceremonies were organised with the context of sadomasochistic exercises by ancient Sparta.

"Kamasutra" by Vatsayan, In Indian literature known to have mentioned different types of hitting practices to be executed at the time of love making to enhance pleasure, provided acceptance by the partner.

So Kamasutra may be the first documented proof explaining the sadomasochistic practise as well as their limitations and safety regulations.

BDSM Terminologies:

BDSM term is a union of multiple terms like Bondage with Discipline, Dominance with Submission and Sadism with Masochism. However its actual origin is unclear.

Within BDSM communities however these terms refer to consensual erotic practices from which great amount of pleasure and sensation can be derived. [5]

Bondage and Discipline are the practices of restraining. Bondage is related with physical restraining while Discipline is somewhat psychological restraining.

The scene of Bondage is like binding of partner by pieces of cloths, strings, metal chains or leather belts to bed or pillar.

The practice of Discipline involves behavioural control of one over the other. For example, drafting certain rules and breaking those rules will invite punishments. This type of punishments may include caning, slapping and humiliation. These practises may or may not be associated with sexual intercourse.

Dominance and Submission are the practices of certain "Role play" mostly. One is dominating over the other. This kind of play may be limited to certain time period of the day, the duration may vary.

It may be carried out in an erotic manner or in context of day to day lifestyle. For example, "Animal play" or "Pet play" where one participant plays a role of a dog or a horse, submissive to his/her Dominant owner and has to follow the commands given. Sometimes, the plays are going publically. Study by Ernulf and Innala showed that Preference for the dominant role was expressed by 71% of the male heterosexuals and for the submissive role was expressed by 89% by heterosexual females. [6]

Sadism and masochism are the practice of giving and getting pain for sexual gratification. The terms "sadism" and "masochism" came from Donatien Alphonse Francois de Sade, a French writer and Leopold Von sacher Masoch, an Austrian novelist accordingly, who had described this terms first time. [7]

Sadism defined as sexual arousal linked to the active infliction of humiliation, subjugation or torture of the sexual partner while Masochism is defined as sexual excitement linked with the passive experience of physical or emotional humiliation, subjugation or torture. [8]

Sadistic practices are more common among men and masochistic practices are more common in women, but not exclusively. [8] In extreme cases of Sadism, there is a frenzy to commit a violent act, such as murder, known as Lust murder. [9] It is said that every sadist is a dormant masochist and vice versa. [10]

There are numerous other terminologies in relation to BDSM practices. For example, "Age play" involves acting like younger or older

person as a part of the play. "Wax play" involves using of melted hot wax over partner's body.

"Medical play" involves, one being a doctor and the other being a patient as a part of BDSM scene. The term "Switch" used to describe switching of the role as a dominant or submissive within a single play or at predefined time. "Edge play" is somewhat more challenging and may cause very serious injuries. This includes the plays involving usage of fire, knife cutting, erotic asphyxiation, firearms etc.

"Cock and ball torture", popularly known as CBT, involves masochistic activities related to male genital organs torture.

The term "Safe words" used to describe various predefined words set by the participants to stop the play immediately when the scene goes beyond tolerance. Ordinary words like "stop" or "no" are generally not used because of unintentional spontaneous usage.

Legal Aspect:

The role and development of paraphilias across cultures is also variable, with cultures defining what is legal or illegal. [11] Consent has significant role whenever the issues of BDSM come across. Mutual understanding of both the partners is utmost importance.

Exposing themselves about what they actually feel and what they actually want will decide the scene of play. Making certain rules of the play and defining certain limits may reduce the chances bizarre complications.

BDSM practices are always invited from either sides except in a very few cases, where they are carried out just to fulfil their partner's physical and/or psychological needs.

Even when there is full agreement, certain situations like injured partner seeking medical treatment and the case may be filed as MLC case by hospital staff on prima facie. The scene may go beyond the limits and the partner may file a complaint. Ending of such relationship may provoke the participant to file false complain for the purpose of revenge.

Consent differentiates BDSM from domestic violence or sexual assault. Sadistic husband may convert the play into domestic violence if wife is not a masochist. There is also a chance of conversion of BDSM practice into a case of Rape. Presence of fresh multiple injuries along with evidence of recent sexual intercourse make the task easy for the prosecution.

However proper examination with special attention to types of injuries, time since injuries, presence of atypical old scars and scene visit may help in investigation. Some practitioners use contracts to be signed by both

partners to prevent any type of legal consequences in western countries.

The similarity in between sexual assault and sexual sadism is that both involve violence, but violence is used for the purpose of executing sex in cases of Rape, while violence is prerequisite of arousing sexual drive in cases of Sadism. Only a small proportion of rapists qualify for the diagnosis of sexual sadism. [12]

Even if the act is totally consensual, question is up to which extent the court will allow these injuries to be placed under section IPC 87.

According to IPC 87, Nothing which is not intended to cause death, or grievous hurt, and which is not known by the doer to be likely to cause death or grievous hurt, is an offence by reason of any harm which it may cause, or be intended by the doer to cause, to any person, above eighteen years of age, who has given consent, whether express or implied, to suffer that harm; or by reason of any harm which it may be known by the doer to be likely to cause to any such person who has consented to take the risk of that harm.

In short, Indian law does not permit the injuries, grievous in nature or which are likely to cause death, even under consent. In other way, it permits rest of the injuries under consent of persons above eighteen years of age.

Current Scenario:

BDSM activities are legal in Germany, Japan, Netherlands, Canada and Austria. They are considered illegal in Switzerland and United Kingdom. United states have different laws for different states related to these practices.

In India, the actual status is unclear. Due to expanding usage of internet and social networking sites, BDSM is gaining popularity day by day. Lots of materials in the form of educational videos, documentaries, discussion forums, dating sites are available online.

Some dating sites are providing BDSM partners and charge accordingly. Mostly they serve by providing Dominating partners for submissive customers.

Such services may not include sexual intercourse at all. BDSM rather became a culture with timely get-together, public plays, clubs activities etc. Folsom street fair is an example of this. It is an annual BDSM street fair held at San Francisco. [13]

Psychological Aspect:

There are multiple believes in society about the mental status of BDSM practitioners. Some consider them mentally ill while some consider them perverted.

According to International Classification of Diseases [ICD-10, (F65.5)], 'sadomasochism' are "Disorder of sexual preference" and described as,

"A preference for sexual activity which involves the infliction of pain or humiliation, or bondage. If the subject prefers to be the recipient of such stimulation this is called masochism; if the provider, sadism. Often an individual obtains sexual excitement from both sadistic and masochistic activities." [14]

Several studies on BDSM practitioners found them normal as far as their responsibilities toward family, towards society is concerned. To be diagnosed as a mental disorder, diagnostic criteria have been defined. According to Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)

The diagnostic criteria for Sexual Sadism are:

1. Over a period of at least 6 months, recurrent, intense sexually arousing fantasies, sexual urges, or behaviours involving acts (real, not simulated) in which the psychological or physical suffering (including humiliation) of the victim is sexually exciting to the person.
2. The person has acted on these sexual urges with a non-consenting person, or the sexual urges or fantasies cause marked distress or interpersonal difficulty." [15]

For Sexual Masochism are:

- Over a period of at least 6 months, recurrent, intense sexually arousing fantasies, sexual urges, or behaviours involving the act (real, not simulated) of being humiliated, beaten, bound, or otherwise made to suffer
- The fantasies, sexual urges, or behaviours cause clinically significant distress or impairment in social, occupational, or other important areas of functioning" [14]

A study found that BDSM enthusiasts scored better on a variety of personality and psychological tests as compared to general population, because of extroverted nature and being less neurotic. [16]

They are not at all psychologically different from general population most of the times. What they want is something that is in addition to normal day to day sex to obtain highest pleasure and intimacy.

Engagement in BDSM was not significantly related to any sexual difficulties rather it is simply a sexual interest and for most participants it is not a pathological symptom of past abuse or difficulty with "normal" sex. [17]

Studies have also been conducted to investigate, how and why do this type of deviations are generated in selected minds, is there any correlation between past child abuse or any specific biochemical derangements in brain or this is in relation to any obvious pathology of brain or endocrine dysfunctions.

Some hypothesis proven wrong and some have proven right. For example, Monoamine hypothesis, which states monoamine mechanisms may be operated in psychopathological variations of sexual behaviour. [18]

There may be an association of brain pathologies with paraphilia e.g. temporal lobe epilepsy, tumors or limbic system dysfunction. [19] Their arrangements for the scene, their usage of predefined "safe words" to stop the on-going play, their respect towards each other, their drafting and following certain rules, all these may illustrate their sincerity and a level of their psychological status towards BDSM culture.

Ice berg phenomenon can be applied in relation to BDSM culture. The part of the ice above water applies to revealed cases and the part below water to hidden cases of BDSM.

It is quoted by Kelsey Chow, *"I wish I could read minds. It's a dangerous superpower, so I'd wish for it to come with a switch where I could turn it off if I wanted to. You'd learn a lot about people, that's for sure!"*

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Case Report

Fatal Homicidal Shotgun Injury at Unusual Site

¹Pradeep Kumar MP, ²Shashikanth Naik CR

Abstract

A shotgun is a firearm that is usually designed to be fired from the shoulder, during the 19th century; shotguns were mainly employed by cavalry units. Both sides of the American Civil War employed shotguns. U.S. cavalry used the shotgun extensively during the Indian Wars in the latter half of the 19th century. In 2011, a total of 478,400 fatal and nonfatal violent crimes were committed with a firearm. Homicides made up about 2% of all firearm-related crimes. There were 11,101 firearm homicides in 2011, down by 39% from a high of 18,253 in 1993. In our case husband shot his wife with a shotgun at an unusual site and she was treated for two days after the incident. In this case cause of death was opined as "Death was due to peritonitis consequent upon Fire Arm Injury sustained". Interpreting a shot gun injury requires an in-depth knowledge of ballistics. In cases where the firearm is a front loading country made firearm a thorough knowledge of unconventional ballistics is also of great importance.

Key Words: Shotgun, Homicide, Firearm, Autopsy

Introduction:

A shotgun (also known as a scattergun and pepper gun, or historically as a fowling piece) is a firearm that is usually designed to be fired from the shoulder, which uses the energy of a fixed shell to fire a number of small spherical pellets called shot, or a solid projectile called a slug. [1]

Shotguns are also long-barreled weapons, but they have a smooth, non-rifled barrel and usually fire a charge consisting of multiple, round shot instead of a single projectile.

Common action types include pump action, semiautomatic, single-shot, and double-barreled varieties. [2]

Three general classes of shots are used in shotguns: [3]

- a. **Bird Shot:** is generally used for hunting fowl and small animals. The shots are small ranging in diameter from 1 to 3.5mm.
- b. **Duck Shot:** it derives its name from its original use against large game such as deer. The shots are larger than bird shot being 6 to 8mm in diameter.

- c. **Rifled Slug:** is lead or steel and lead projectile for a shotgun with wing like helical ribs on its outer surface that, due to the passage of air during flight, give it rotational movements and so produce a spinning projectile from a smoothbore weapon.

Shots (pellets) are of two types: [4]

- Soft or drop shot is made of soft lead.
- Hard or chilled shot is made from lead and hardened by antimony. The shots may be plated with copper.

In 2008-2009, there were 11,227 firearm offences in England and Wales with 58 homicides and 330 serious injuries. [5] In 2011, a total of 478,400 fatal and nonfatal violent crimes were committed with a firearm. Homicides made up about 2% of all firearm-related crimes.

There were 11,101 firearm homicides in 2011, down by 39% from a high of 18,253 in 1993. The majority of the decline in firearm-related homicides occurred between 1993 and 1998. Since 1999, the number of firearm homicides increased from 10,828 to 12,791 in 2006 before declining to 11,101 in 2011. [6]

Case Report:

Autopsy was conducted at the Department of Forensic Medicine and Toxicology, Bangalore Medical College & Research Institute, Bangalore, Karnataka, India.

Prior to autopsy body was subjected to X-ray examination at Department of Radiodiagnosis, Bangalore Medical College & Research Institute, Bangalore.

Corresponding Author:

¹Assistant Professor

Department of Forensic Medicine & Toxicology
Bangalore Medical College and Research Institute,
Bangalore.

E-mail: prdp326@gmail.com

²Post Graduate cum Tutor

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Body of a 23 year old female was brought to our mortuary. As per the history by the concerned police, her husband is said to have shot her with a shotgun on 8th Jan 2013.

Later, she was treated at Victoria Hospital for two days and died on 10th Jan 2013.

On external examination, the length of the body was 170cm, moderately built and moderately nourished. Rigor mortis present all over the body. Post mortem staining was present over back of the body. Medical intervention injection mark was present over front of right elbow and back of left wrist. Foley's catheter found in-situ.

External Injuries:

- An oval entry wound, 4.5cm x 4cm. present over outer aspect of right thigh, 16cm from anterior superior iliac spine and 75cm above sole.

The surrounding area of 14cm x 12cm are burnt and blackening, annular bruising present around the wound. Margins of the wound are ragged and irregular. (Fig. 1)

The direction of the wound is upwards, inwards and to the midline crossing the inguinal canal from below and entering the right part of the abdomen up to the vertebra. (Fig. 4)

Track of the wound contains black particles, pellets and foreign materials at places. Most of the pellets are found in the abdomen near the Para-Vertebral muscles. (Fig. 5)

- Multiple punctured wounds present over front of lower part of abdomen on the right side, 5cm from anterior superior iliac spine with multiple blebs and extravasated area of 15cm x 12cm. Multiple granular pellets were felt. (Fig. 2)

Internal Injuries:

On opening the abdominal cavity 2000ml of blood tinged fluid was present in the peritoneal cavity (Fig. 3), mesentery showed blackish discoloration.

Coils of intestine showed black particles at places and punctured at multiple sites. (Fig. 6) Right peri-nephric area shows blood extravasation.

Pellets recovered from the body, foreign materials in the wound track, swabs around the entry wound and blood were collected and sent to Forensic Science Laboratory, as per standard protocol.

Cause of death was opined as **"Death was due to peritonitis consequent upon Fire Arm Injury sustained"**.

Fig. 1: Entry Wound Over Outer Aspect of Right Thigh



Fig. 2: Multiple Punctured Wounds over Lower Aspect of Front of Right Side of Abdomen

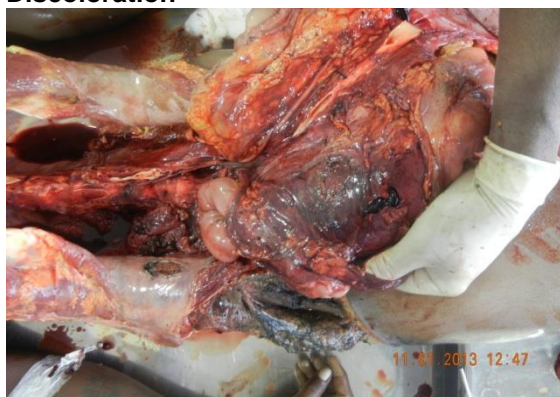


Fig. 3: Blood tinged fluid in Peritoneal Cavity



Fig. 4: Entry Wound Tract



Fig. 5: Blackening of Wound Tract with Foreign Materials**Fig. 6: Mesentery Showing Black Discoloration****Discussion:**

The firearm used in this case was a front loading country made shotgun. Interpretation of shot gun injuries in case of unconventional ballistics relating to manner of death requires expertise. Wounds created by shotguns are much larger than those created by handguns, and vary from massive disruption to a widespread pattern of pellet holes when fired at a distance.

Loose contact and close range shotgun wounds usually demonstrate features of the skin

searing and or blackening and the cherry red discoloration of carbon monoxide uptake in the subcutaneous tissue within the wound track. [7]

Once a shot shell has been fired, the mass of pellets gradually begins to expand and separate as distance from the muzzle increases, and this allows assessment of range of fire in most shotgun wounds. [2]

The correct interpretation of gunshot wounds by forensic pathologists not only provides valuable information that can assist law enforcement in their investigation but also is essential for the final determination of manner of death. [8]

Conclusion:

The lacunae in the interpretation of gunshot injuries, especially in cases of shot gun are a major challenge to the forensic expert conducting autopsy.

Interpreting a shot gun injury requires an in-depth knowledge of ballistics. In cases where the firearm is a front loading country made firearm a thorough knowledge of unconventional ballistics is also of great importance.

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Case Report

Death due to Accidental Explosion of a Balloon Filling Cylinder: A Case Report

¹Faraz Ahamed, ²Ramesh C., ³V. T. Venkatesha, ⁴Ameena Ahamed

Abstract

An explosion is a process where any substance or device capable of creating a sudden gas expansion, releasing potential energy and thus creating a pressure wave. Blast injury is becoming more common in non-military population due to terrorist acts and unsafe use of domestic gases, but it is still rare to see such injuries and deaths. Explosive related deaths fall into three categories: accidental, homicidal and suicidal. Accidental deaths normally occur either at the work place or when untrained, unlicensed individuals handle legal or illegal fireworks or explosive/inflammable material. Physicians and surgeons need to have a basic understanding of the patho-physiology of such injuries, because the major prognostic factor for favourable outcome is accessible and timely medical and surgical treatment along with implementations of preventable occupational measures for safety.

We report a case where a 33 year old male succumbed to an accidental explosion of a balloon filling gas cylinder.

Key Words: Cylinder, Traumatic amputation, Explosion, Blast lung, Tympanic membrane rupture

Introduction:

An explosion is a process where any substance or device capable of creating a sudden gas expansion, releasing potential energy and thus creating a pressure wave.

Compression of the air in front of the pressure wave, which heats and accelerates air molecules, leads to sudden increase in atmospheric pressure and temperature transmitted to the surrounding environment as a radially propagating shock wave, known as the 'Blast wave'. [1]

Injuries directly inflicted by this sudden increase in air pressure after an explosion are referred to as 'primary blast injuries', and mainly affect primary gas containing structures (lungs, middle ears and gastrointestinal tract). [1-3]

A minimum pressure of about 700 kPa (100 lbs/sq inch) is necessary for severe tissue damage in humans. [4]

Secondary blast injuries result from blast-energised bomb fragments and other displaced objects causing penetrating trauma. Tertiary blast injuries occur when the body is accelerated away from the blast wave at first and is then abruptly decelerated on rigid objects resulting in blunt force trauma. [1]

Quaternary injuries (Miscellaneous blast related injuries) encompass injuries caused by collisions, falling masonry, buildings, beams, etc. [5] Explosive force is highly directional. The parts of the body directly exposed to the explosive force only are injured. An explosion at ground level mainly injures legs and feet.

When a person is in front of a bomb when it blows up, the face, chest, forearms, hands, inner thighs and legs below knees are injured, but the back of the body, the lower legs and face escape. If a person is bending down over the bomb, the face, chest, legs and hands are severely damaged. [4]

Orthopaedic trauma resulting from an explosion is manifested as a primary, secondary, tertiary or quaternary (miscellaneous) blast injury in isolation or in combination.

Although uncommon in survivors, the direct effects of changes in atmospheric pressure caused by the blast wave (primary blast injury) can fracture bones and it is probably responsible for limb avulsions in victims exposed to stress waves of sufficiently high intensity. [6, 7]

Corresponding Author:

¹Postgraduate Student cum Tutor
Department of Forensic Medicine
Kempegowda Institute of Medical Sciences
Bangalore, India.

E-Mail: far.raaz@gmail.com

²Assist. Prof,

³Professor

⁴Postgraduate student cum Tutor

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Case History:

On 28-03-2014 at around 12:25 PM, a 33 year old man who used to sell gas-balloons for a living met with an accidental explosion of the gas cylinder with which he was filling the balloons. He sustained severe damage to both the lower limbs and was admitted to a nearby accident and trauma centre where he was being treated. But he eventually succumbed to the injuries on 29-03-2014 at 08:35 PM. Body was preserved in the cold storage and autopsy was conducted on 30-03-2014 at 01:30 PM.

Autopsy Findings:

The victim was found to be a 33 year old male, with amputated lower limbs. He measured 133cm in length from the stump of amputated left lower limb to the vertex. He was moderately built and nourished, of brown complexion. Cold stiffening was present throughout the body.

Faint livor mortis was present over the back of the body. Dried blood stains were present at nostrils, over left cheek and both ears. Injection marks were present over the upper part of right side of chest, left cubital fossa and lower 1/3rd of the right forearm.

Hospital bandages were present over the lower limbs and left forearm. On removing the dressing, both lower limbs were amputated. (Fig. 1) Left lower limb was amputated below knee, stump length measuring 60cm from the left antero-superior iliac spine. Blood stained fluid is seen oozing out from left stump. (Fig. 2)

Right lower limb was amputated at the junction of middle and lower 1/3rd of thigh (above knee) and stump length measuring 30cm from the right antero-superior iliac spine. (Fig. 3)

Tympanic membranes were ruptured irregularly on both sides. The external auditory meatus was blood stained on both sides. An abrasion measuring 5x3cm was present over inner aspect of right forearm in the middle 1/3rd.

Another abrasion measuring 6x3cm was present over the front of left knee. Multiple punctuate abrasions of varying shapes and sizes ranging from 0.1x0.1cm to 1x1cm with bluish-black discoloration were present over the right side of face, inner aspect of left forearm and over the front of abdomen in the right lateral and umbilical regions, inner aspect of right arm and right forearm. (Fig. 4-6)

Internal examination revealed a scalp contusion of size 10 x 6 cm over the left fronto-parietal region. There were no skull fractures, the meninges were intact and the brain appeared to be oedematous without any intracranial haemorrhages.

There were no injuries to the chest wall and ribs. Both lungs showed patchy haemorrhages. Heart and pericardium were intact. Abdominal walls and intra-abdominal viscera were intact. Both kidneys were congested.

Histopathology of lung tissue revealed enlargement of alveolar spaces, rupture and thinning of alveolar septae, interstitial perivascular haemorrhages (showing a cuff-like pattern around the pulmonary vessels) but no evidence of air or fat embolism.

Death was due to the **blast lung injury and traumatic amputation of limbs.**

Fig. 1: Both Lower limbs Amputated

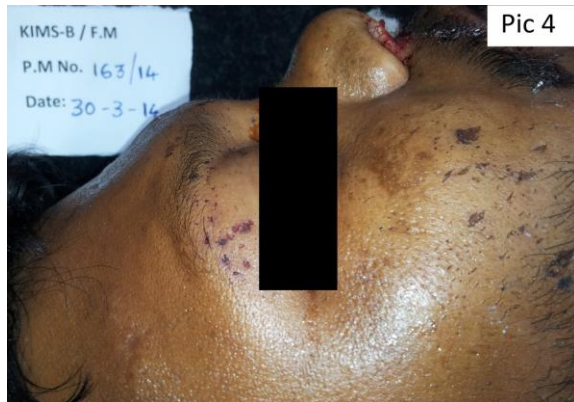


Fig. 2: Blood oozing from Left Stump



Fig. 3: Right Stump



Fig. 4: Multiple Punctate Abrasions on Right side of Face**Fig. 5: Abrasions on Right Arm****Fig. 6: Multiple Abrasions around Umbilical Region****Discussion:**

In the non- military population, blast injuries caused by things other than terrorist acts are rare. Explosive related deaths fall into three categories - accidental, homicidal and suicidal.

Accidental deaths normally occur either at the work place or when untrained, unlicensed individuals handle legal or illegal fireworks or explosive/inflammable material. Accidental

explosions at workplace typically involve mines, road construction and demolition sites. [8]

The characteristic injury patterns resulting from explosions have been thoroughly discussed in literature. Blast injuries mediated by different mechanisms; victims usually suffer from a combination of primary blast effects to gas containing organs, blunt force injuries, penetrating trauma and burns. Lungs, middle ear and gastrointestinal tract are most vulnerable to extreme pressure. [1]

Blast lung injuries are caused by pressure wave. The pressure front causes wall displacement towards the spinal column leading to transient high intra-thoracic pressure.

The elevated intra-thoracic pressure leads to tearing of alveolar septae, stripping of airway epithelium, and rupture of alveolar spaces with consequent alveolar haemorrhage, oedema and alveolar- venous fistulae. [1]

Blast lung injuries are most common after closed space explosions (e.g., in a bus) as compared with open spaced explosions (e.g., an open market). [9, 10] Eardrums may rupture at pressure as low as 2psi, whereas pulmonary damage should be expected in 50% of cases exposed to 70psi. [11]

A review of literature of cited cases of explosive related deaths found perforated ear drums in the majority of cases (76-86%). [10, 11]

The lung injury is considered an important parameter defining mortality in those who survive the explosion. [1] Limb amputation can carry a grave prognosis: according to a report by Mellor in 1989, only 9 out of 52 servicemen who had sustained traumatic amputations from explosions survived. [12]

The post-mortem examination is critical to the investigation of explosive related deaths. In our autopsy based study, we found a significant blast lung injury without co-existing blunt or penetrating chest trauma supported by histopathological findings expected after an open- space explosion.

Conclusion:

The blast injury, ear drum perforations along with the traumatic amputation of limbs were considered to be the primary blast injuries. The multiple abrasions were considered to be the secondary blast injuries due to fragments or shrapnel or missiles. The scalp contusion was considered to be the tertiary blast injury.

We have presented this autopsy based investigation to provide further insight into blast injuries, which are rare events. Physicians and surgeons need to have a basic understanding of the patho-physiology of such injuries, because

the major prognostic factor for favourable outcome is accessible and timely medical and surgical treatment along with implementations of preventable occupational measures for safety.

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Case Report

Sudden Death due to Uterine Rupture in a Primigravida with Placenta Accreta in Unscarred Uterus: An Autopsy Report

¹C Behera, ²Karthik Krishna, ³Rajesh Kumar, ⁴SK Gupta

Abstract

Spontaneous rupture of uterus during pregnancy is a known complication of placenta accreta. Some of the known risk factors for the trophoblastic invasion of the uterine wall leading to placenta accreta during pregnancy are multi-parity, previously scarred uterus, etc. The clinical management of such cases is found in scientific literature; however sudden death due to uterine rupture as a complication of placenta accreta, in a primigravida is not reported till date. We encountered a case, where a 27 year old primigravida, at 29th week of gestation who had no known risk factors, succumbed to death, due to spontaneous uterine rupture. The diagnosis of placenta accreta in this case could be made, only during the autopsy. The clinical presentation and the autopsy findings are discussed in this paper, with a note on diagnostic difficulties, especially in the developing countries.

Key Words: Placenta accreta; Sudden death; Primigravida; Unscarred uterus; Autopsy diagnosis

Introduction:

Placenta accreta is the close adherence of the placenta to the uterine wall. [1] It is a rare clinical condition with incidence ranging from 1: 500 to 1: 93000 deliveries. [2, 3, 4] It may be classified as:

1. **In accordance with its Extension:** focal, partial and total.
2. **Depending on its location:** body or segmental.
3. **According to its Penetration into Uterine layers:** placenta accreta (without penetration, reaching the myometrium: 78-80%), increta (penetrates the myometrium: 15%) and percreta (reaches the uterine serosa, can penetrate it and invade the neighbouring organs: 5 to 7%). [2]

The exact mechanism of placenta accreta is not known, however it may be due to defective or excessive trophoblastic invasion. The risks are high in patients with previous history of placenta previa, curettage and abortion, caesarean delivery, uterine endometrial ablation and radiation or any uterine surgeries.

Corresponding Author:

¹Assistant Professor,
Department of Forensic Medicine
AIIMS, New Delhi, India- 110029
E-mail: drchitta75@rediffmail.com

²Senior Resident

³Junior Resident

⁴Prof & HOD

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From the clinical point of view, pregnancy with maternal age more than 35 years, multi-parity or increased alpha-fetoprotein and β -hcG are the known risk factors. [1]

In most of the cases, it is diagnosed at the time of delivery, however pre-natal diagnosis can be made with ultrasound, colour Doppler ultrasound, Magnetic resonance Imaging (MRI) and cystoscopy. In placenta accreta, maternal and peri-natal mortality are high (7- 11.4% and 9.76% respectively) and are mainly due to complications of placenta percreta. [2]

We hereby report a case of sudden death in a primigravida of 29 weeks of gestation, with no known risk factors, and only post-mortem diagnosis of placenta accreta could be established, as a cause of uterine rupture and death.

Case Report:

A 27 year old primigravida, with 29 weeks of gestation, presented to a clinic on 18/08/2013 with complaints of pain abdomen and vomiting since past 3 hours. Her Last Menstrual Period was on 03/02/2013 and expected date of delivery was on 09/11/2013. There was no history of trauma to the abdomen.

She was hemo-dynamically stable at the time of admission. She was given tocolytics, antispasmodics, calcium and antiemetics. The pain was relieved and she was kept under observation and close monitoring. Ultrasound abdomen showed free gas/blood clot in the peritoneal cavity. (Fig. 1)

There was no evidence of free fluid collection. No other abnormality was detected in

this scan report. Ultrasound abdomen was performed for foetal well-being, which revealed a single live intrauterine foetus, of 29 weeks of gestation, with the transverse lie. The foetus appeared to positioned completely on the right side; the placenta was fundal in position. The estimated weight of fetus was 1594grams. Fetal heart rate was 139/min.

After about 8 hours of admission, the patient complained of abdominal pain. The blood pressure had collapsed to 80/50 mm of mercury. The general condition of the patient started worsening with increased perspiration. She was immediately referred in emergency to a tertiary care hospital at about 3:00 PM on the same day, but was declared brought dead at 5.45 pm on the same day, at the referred hospital.

The case sheets of the patient showed that her antenatal check-ups were regular and normal, except for an episode of enteric fever on 30/03/2013. The titres of *S. Paratyphi A 'H'* were 1:160. Her Blood Group was A, Rh-negative while blood group of her husband was B, Rh-positive.

The patient had married about five years back. Her husband was serving in the military and hence they seldom stayed together for the initial three years of their marriage. She had not conceived for the next two years, even after unprotected sex. The patient was also diagnosed to have polycystic ovaries (as per the Ultrasound examination done on 24/12/2012).

She had bulky ovaries with cystic lesions (measuring 30x21 cm) with single functional cyst and fluid in Pouch of Douglas. She was diagnosed as a case of primary infertility and was prescribed ovulation induction using Clomiphene citrate 50 mg on 03/01/2013.

The ultrasound examination which was done on 16/03/2013, showed a single gestational sac within the endometrium of the uterus, with a single live foetus of gestational age of 5 weeks. Also, the ultrasound examination done on 30/03/2013, showed a gestational sac with a single live foetus of gestational age of 8 weeks within the endometrium of the uterus, eccentrically implant on the right side. (Fig. 2)

The third ultrasound examination conducted on 11/04/2013 had revealed a single live intrauterine foetus of 10 weeks gestation, with adequate liquor with decidual reaction. Also, there was a borderline splenomegaly, with the splenic span being 13cms.

Autopsy Findings:

The body was that of a medium build female, of age 27 years. Rigor mortis was

present all over the body. Faint post-mortem lividity was present on the back and dependant parts of the body in supine position.

The abdomen was distended. There was no external injury present over the body.

On opening the abdominal cavity, an organised blood clot along with fluid blood measuring 2.5 litres in volume was present in the peritoneal cavity. The blood clot was found adherent to the right side of the fundus, near the isthmus of the uterus. (Fig. 3)

On examination of the Uterus: A laceration (rupture) on the uterine wall within to outwards was present, situated at the right side of the fundus region. The laceration was of size (12 x 6) cm, of partial thickness, involving the serosa and the myometrium partially. (Fig. 4)

On examination of the placenta: It was found tightly adherent and inseparable from the uterine wall. Placental vessels had invaded the full thickness of the myometrium.

Discussion:

Death is said to be sudden or unexpected, when a person not known to have been suffering from any dangerous disease, injury or poisoning is found dead or dies, within 24 hours, after the onset of terminal illness.

Cases of sudden death due to uterine rupture in placenta accreta are rarely reported in medical literature. De Roux SJ et al reviewed cases of haemo-peritoneum due to placenta accreta-percreta and found less than 50 such cases, being reported in the past 100 years.

They have reported a fatal case of placenta accreta in a multi-gravid uterus who had later succumbed, due to cardiovascular collapse. [5] Also, few non-fatal cases of uterine rupture, due to placenta accreta are described in literature. Imeseis et al cited a case of uterine rupture in a primigravida uterus which was managed surgically.

He reported that both the mother and fetus had survived without any morbidity. [6]

Kazandi et al also reported two cases of uterine rupture but those were in multi-parous women. [7] Esmans et al and LeMaire et al stressed the need to consider the diagnosis of placenta accreta, even during the early pregnancy (14th week and 16th week respectively) citing their observations.

They had reported the incidence of intra-peritoneal haemorrhages, due to the spontaneous rupture of uterus, with placenta percreta in multi-parous women. [8, 9] The associations of placenta accreta with one or more risk factors like previous caesarean section, dilatation and curettage, multi-parity,

twin pregnancy were observed by Moriya M et al, Endres and Barnet and Topuz S. [10-12]

In our case, the patient was a primigravida, at 29th week of gestation. She was not in labour. There was no previous history of any surgery on the uterus. There was no history of trauma to the abdomen. The fetal was in transverse lie position. Although, she had completed all the antenatal check-ups, yet the ultrasound examination could not detect the placental trophoblastic invasion (placenta accreta). The first ultrasound examination had revealed an eccentric implantation; however the reason was not established.

The treating physician had also suspected pelvic inflammatory disease based on the ultrasound reports, but no clinical symptoms were documented in the patient.

On the fateful day, the patient complained of abdominal pain, for which she was initially admitted at a clinic. She was referred to a higher centre in view of her deteriorating condition.

In developing countries like India, Doppler colour ultrasound/ MRI are not routinely done in the antenatal check-ups due to cost factors. Both Doppler and MRI have been found as the investigating tool of choice, to diagnose prenatal placenta accreta, even before any haemorrhagic complications occur. [13-15]

Unfortunately, in our case, it was the post-mortem diagnosis of placenta accreta. At autopsy, a bulky, congested uterus was present, with a rupture on its right lateral wall, near the isthmus. There was a hematoma of volume 2.5 litres in the peritoneal cavity, which was adhered to the breached wall of the uterus. The placental blood vessels and the trophoblastic tissues were grossly visible on the surface of the uterus, suggestive of placenta accreta.

The histopathological examination of the ruptured site on the uterus could not confirm the sub variety of placenta accreta due to post-mortem autolysis. However, the gross examination and clinical features were suggestive of placenta percreta.

The fetus was in transverse lie, an 'unfavourable' position for normal delivery and a risk factor for the uterine rupture. The patient in our case was not in labor and the role of transverse lie for the uterine rupture was ruled out. We report this case, to highlight the fateful complication of placenta accreta, even in the primigravida uterus which needs high degree of clinical suspicion and early management.

If feasible, colour Doppler or MRI is recommended routinely, which is helpful not only

to diagnose placental invasions, but also to differentiate subtypes of placenta accreta. [16]

Caesarean delivery followed with hysterectomy may be considered as the ideal treatment to prevent any future complications due to re-occurrences. However, in young women who are planning for future pregnancy a conservative management (using intervention radiology or medical chemotherapeutic agents) can be opted but with strict monitoring. [17-18]

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Fig. 1: Ultrasound Abdomen showing Free Gas/Blood Clot (Arrow Head) In the Peritoneal Cavity

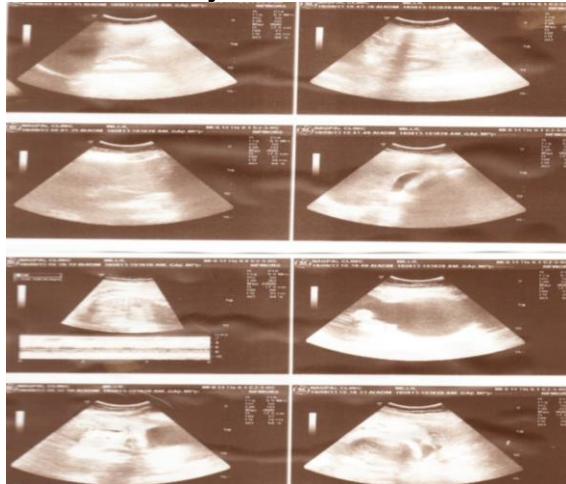


Fig. 2: Ultrasound Abdomen Showing Single Gestational Sac With-in Endometrium of Uterus Eccentrically Implanted on the Right Side

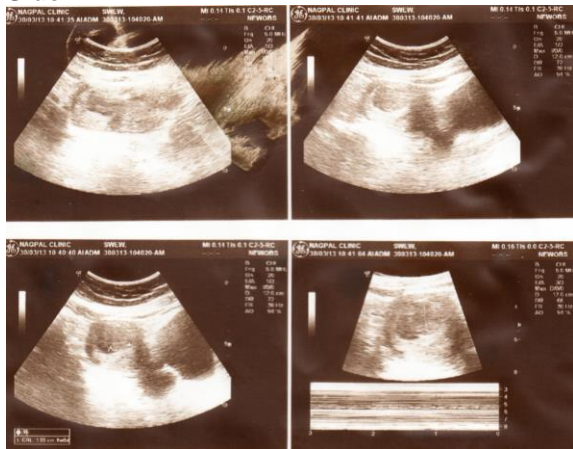


Fig. 3: Haemo-Peritoneum Seen as Clotted Blood Adherent to Right Side of Uterus



Fig. 4: Rupture Site and the Visible Placental Vessels in Uterus



Case Report

Lightning Death: A Case Report

¹Sumangala CN, ²Pradeep Kumar MP

Abstract

Death due to lightning is a rare phenomenon in day to day autopsy. Even though, fatalities due to lightning are more in rainy, hilly areas, such cases are rarely encountered in and around Bangalore. Lightning is mostly associated with rain and many a times electrocution are also commonly seen which has to be differentiated from injuries due to lightning. Adults and elderly are people involved in lightning related injuries and many are non fatal but, if children are involved it may lead to a fatal consequence. Such parameters are to be studied in cases of fatal lightning death in both adults and children. Lightning fatalities are rarely read in literature in medical science and lot needs to be studied in this view as many bread earners are involved in such fatalities. In a country like India where the climate is of both tropical and subtropical type study about lightning deaths needs more emphasis in aspects of both treatment and prevention of human fatalities. Here, one such fatal case of lightning of a child is reported, though uncommon in children than in adults.

Key Words: Lightning, Injury, Death, Electrocution, Fatalities

Introduction:

In many cultures, lightning has been viewed as part of a deity or a deity itself including the Hindu God Indra. In French and Italian culture it express "Love at first sight".

For some political parties such as the People's Action Party in Singapore and the British union of Fascists lightning flashes are symbol of power. [1] Lightning is defined as a momentary, atmospheric, transient, high current electric discharge whose path length is measured in kilometers from sky to earth.

In lightning, very high voltages and amperages are involved and happen when highly charged thunder cloud discharges via a huge arc to the ground. Most lightning discharges are within clouds, while some cause electrical discharge from a cloud to earth. Most human deaths are caused by cloud-to-earth lightning strikes. [2]

Lightning injury can occur in five ways: direct strike, orifice entry, contact, side flash, and blunt trauma. The primary cause of death in victims of lightning strike is cardiac arrest, which may be associated with primary ventricular failure or asystole.

Lightning acts as an instantaneous, massive direct current shock, simultaneously depolarizing the entire myocardium.

In many cases intrinsic cardiac automaticity may spontaneously restore organized cardiac activity and a perfusing rhythm. But concomitant respiratory arrest due to thoracic muscle spasm and suppression of the respiratory center may continue after return of spontaneous circulation.

Unless ventilation is supported, a secondary hypoxic (asphyxial) cardiac arrest will develop. [3] In fact, lightning injuries have panoply of clinical signs and several pathologies might follow, among which brain injury; sensory-neural hearing loss; esophageal perforation; and even polyradiculoneuritis.

If this list of particularities is incomplete, nevertheless it is clear that cardiac arrest or fatal arrhythmias represent the main cause of immediate or sudden death; but renal failure, septicemia and other complications might have their role.

Generally, under the term 'electrocution' authors include lesions caused from the accidental contact with an electricity conductor (fulguration); lesions related with the discharge of atmospheric electricity (lightning); and tissue damage due to the creation of an electrical arc (burn).

Authors have as well classified through a diversity of ways the electrical lesions that lead to thermal tissue damage and depending on the gravity of the situation; with the lesions classified in electrical petechiae; erosive lesions; necrotic

Corresponding Author:

¹Assistant Professor, Dept. of Forensic Medicine, Bangalore Medical College and Research Institute, Bangalore

E-mail: rameshsumi1@yahoo.com

²Asst. Prof

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wounds and carbonization of the corpse in extremely severe electrical shocks.

Apart from all this obvious external signs, lightning is notorious as well for a very particular cutaneous sign, namely the Lichtenberg figures, which are not burns, but arborescent red areas on the skin following such an injury, described initially from the German physicist Georg Christoph Lichtenberg in 1777. [4]

Case Report:

An eleven year old female child, resident of a village around 100 kms from Bangalore is said to have sustained lightning at around 8.30 pm on 28th April 2012. On the next day, 29th April 2012 the child developed fever, vomiting and generalized edema and was taken to a local hospital for treatment. As the condition deteriorated the child was referred to higher center for further treatment on 30th April 2012.

Clinical Findings:

Medical examination of the child revealed irritable general condition, absence of pulse and blood pressure. Cold peripheries, cyanosis and generalized edema were noted.

Respiratory examination revealed the presence of surgical emphysema. Later the child is said to have succumbed to the same on 30th April 2012. Treatment with Inter-costal drainage, IV fluids and anti-inflammatory drugs were done.

Post-Mortem Findings:

Externally Edema was present. On internal examination Organs were congested with petechiae present in the white matter of the brain. Lungs exuded blood mixed with froth.

Histo-Pathological Examination:

1. **Brain:** Congestion and edema
2. **Lungs:** Multiple sections studied show widened alveolar septae with numerous congested capillaries and edema. Bronchioles appear within normal limits. Occasional alveoli show Intra-alveolar haemorrhages.
3. **Liver:** Dilated and congested sinusoids.
4. **Heart:** Left circumflex artery, right coronary artery, left anterior descending artery are within normal limits. Aorta and pulmonary artery are within normal limits. Both atria and ventricles are within normal limits.

Based on Post-mortem findings, Histo-pathological examination report, cause of death was opined as **"Death is due to surgical emphysema, consistent with lightning"**.

Discussion:

Lightning is unique from other forms of generator-produced high-voltage electricity. One must understand the physical properties of

lightning to understand the spectrum of injuries incurred from a lightning strike. The duration of exposure is the single most important factor in understanding the difference between high-voltage injuries and lightning injuries. [5]

Lightning is a unidirectional massive current impulse to be clearly differentiated from direct or alternating current. Lightning occurs when the large potential difference between cloud and ground, measured in millions of volts, is broken down. Upon attachment, this potential difference disappears as an enormous current flow impulsively for a short time. Thus, lightning is best thought of as a "current" phenomenon rather than a "voltage" phenomenon. [6]

According to Joule's law (energy = current² × resistance × time), as the resistance goes up, so does the heat generated by the passage of the current. In humans, when low energy levels are encountered, much of the electrical energy is dissipated by the skin.

It takes a finite amount of time for the skin to break down when exposed to heat or energy. After lightning meets the body current it is initially transmitted internally, after which the skin breaks down and there is an external "flashover."

As current flashes over the outside of the body it can vaporize moisture on the skin and blast apart clothes and shoes, leaving the victim nearly naked. While the current from a lightning strike only flows internally for a short time, it can cause short-circuiting of electrical systems such as the heart, respiratory centers, and autonomic nervous system, as well as spasm of arterioles and muscles. [7]

India had 473 lightning deaths from 1982 to 1989. [8] The number of fatalities ranged from 117 in 1983 to 28 in 1987. The resulting annual fatality rate of 0.1 deaths per million people seems very low in view of several factors.

First, at least two thirds of the population of India lived in rural areas during this period. Second, the author describes that the majority of the lightning deaths occurred in the country side. Finally, a report for a portion of one year in the state of Orissa (Table 1) found an annual rate of 2.5 deaths per million. Since India is so populous, a better determination of its rate has a major effect on the lightning death rate worldwide. [9]

A study by Asha Nath et al shows the variation of lightning storms in different geographic regions of India, annual variation, surface temperature, thermodynamic structure, occurrence of thunderstorms and development of lightning in relation to temperature change of

surface air, comparative study of lightning flash count between pairs of typical land/ oceanic regions of India, and a correspondence between lightning flash count and climate regimes over India. [10] All these parameters are to be studied for further research.

Conclusion:

Adults and children are to be educated about the dangers of lightning. Precautions are to be taught to children at schools and at home.

Precautions for Avoiding Lightning Injury:

The key to safety is individual education and responsibility. The exceptions to this rule are when adults are in charge of groups of children and for large, planned events. In the former situation the adult must assume responsibility for the children and have a plan for evacuation. A simple motto to teach children is "If you see it, flee it; if you hear it, clear it."

The "30-30 rule" states that when the time between seeing lightning and hearing thunder is 30 seconds or shorter, persons are in danger and should be seeking shelter.

Outdoor activities should not be resumed for 30 minutes after the last lightning is seen or the last thunder is heard. Because lightning can strike where there is no rain, people should not delay evacuation just because there is no rainfall. [11]

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Table 1: National rates of Annual lightning deaths per million people during the first decade of the 21st century

Country	Decadal fatality rate	Maximum annual rate
Bangladesh	0.9	0.9
Brazil	0.8	0.8
Canada	0.1	0.3
China	0.5	0.7
Guangdong	0.9	0.9
Guizhou	1.2	1.2
Hainan	10.6	10.6
Hong Kong	0.04	0.04
Greece	0.2	0.4
India (Orissa)	2.5	2.5
Lithuania	0.1	0.1
Malaysia	3.4	3.4
Nepal	2.7	2.7
South Africa (rural)	8.8	8.8
South Africa (urban)	1.5	1.5
Srilanka	2.4	2.4
Vietnam	1.2	1.2
Bac Lieu	8.8	8.8
United States	0.2	0.2
Yemen (Saada)	71.4	71.4
Zimbabwe	14.2	14.2

Case Report

Battered Baby Syndrome: A Barbaric Act

¹Rajendra Singh, ²Yogesh Sharma, ³PN Mathur, ⁴Nimish Khatri

Abstract

Battered baby syndrome is a heinous crime and brutish act. Knowledge of such cases gives us the thought that we are still living in barbaric era. By the thought of such cases one gets goose bumps. The battered child refers to the child usually less than three years of age, though it may occur at any age, who suffers repeated non-accidental injuries, sometime fatal, caused through episodes of violence by a parent or guardian. Physicians have a duty and responsibility to the child to require a full evaluation of the problem and to guarantee that no expected repetition of trauma will be permitted to occur. Forensic expert also has an important role to play in uncovering the cases of battered baby syndrome. We present two incidences of battered baby syndrome aged 12 year and 5 year. The first was a male child who committed suicide by hanging after beaten repeatedly by her mother. The second case was a female child, admitted in our hospital pediatrics side beaten repeatedly by her father.

Key Words: Battered baby syndrome, Crime, Trauma, Suicide

Introduction:

Battered baby syndrome is a heinous crime and brutish act. Unfortunately it is crime which is successfully hidden by its perpetrators. Child battering is one of the least documented violations in the country, says the records.

The reasons are manifold. In India, much like the rest of Asia, children are expected to respect and obey authority figures such as teachers, guidance counselors and principals and not question their actions. Rebellion is perceived as a sign of a bad upbringing. This sensibility perpetuates a culture of abuse. [1]

Battered baby syndrome is also known as child abuse syndrome, Caffey's syndrome, shaken baby syndrome, non-accidental injury in childhood, and maltreatment syndrome.

A battered child is one who has received repetitive physical injuries as a result of non-accidental violence, produced by a parent or guardian.

It has been seen that eldest or youngest child is a victim as it might be as a result of pregnancy before marriage or unwanted child a result of failure of contraception or illegitimate child. Cases found more in low socioeconomic class group than higher class family where family disharmony, long standing emotional problems or financial problems are more likely.

Many parents have criminal records or psychiatric problems with the background suggesting, battering parents were 'battered children' themselves. In addition to physical injury, there may be non-accidental deprivation of nutrition, care and affection. [2, 3] They are brought to the doctor with vague history, narrated by the parents, for sustaining the injury like, fall from a stair, bed or a table or that the baby "bruises very easily". [4]

The classical features of syndrome are obvious discrepancy between the nature of the injuries and explanation offered by the parents, and delay between the injury, and medical attention which cannot be explained. The constant feature is repetition of injuries at different dates, often progressing from minor to more severe. A particular feature is the denial by the parent of any injury. [2, 5]

Case Reports:

Here we were presented two cases of Battered baby syndrome

Case One:

An autopsy of a 12 year old male child was conducted as a case of hanging with following findings:

Corresponding Author:

¹Resident Doctor,
Department of Forensic Medicine and Toxicology,
S. P. Medical College, Bikaner, Rajasthan
E-mail: rajkulhari11@gmail.com

²Assoc. Prof & HOD, Dept. of FMT,

³Prof & HOD, Dept. of FMT,
Jhalawar Medical College, Jhalawar, Rajasthan

⁴Resident Doctor, Dept. of Pediatrics,
JLN Medical College, Sewangi (Meghe),
Dist. Wardha, Maharashtra

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- Rigor mortis well developed, post-mortem staining present on back & was fixed.
- Multiple abrasions and contusions were present on body at places in different stage of healing. (Fig.1)
- A shallow brown coloured parchment like ligature mark of size 17 cm x 4.0 cm – 2.5 cm was present over neck antero-laterally above the thyroid cartilage and was running obliquely, upward, laterally and backwards on both sides.
- It was disappearing in hair of back of neck on right side and on left side was up to left mastoid process.
- The ligature mark was 3cm below the left ear lobule and 7cm below right ear lobule. On dissection, the underlying tissue was white glistening. (Fig. 2)

The Police did not mention any injury in **fardsurathall & panchnama** submitted by them before post-mortem examination.

The Investigating Officer and father of deceased were called and shown the injuries present on body.

On interrogation with father of deceased, he conveyed that the child was beaten repeatedly by his mother by a wiper without any reason and in his absence.

The father told about mother that she regularly takes nitrazepam daily otherwise she could not sleep throughout night. She also takes alcohol off and on.

There is no history of smoking and any other intoxicating drugs. The mother's self-childhood history was not good. Her mother got separated from his father in her early age and she remained with her mother till marriage in a poor socioeconomic environment.

The father also told that he is having two other sons also but only eldest son was bitten by her mother. The father when asked why she had beaten the child, she always threatened that she would file a case of dowry against him.

After beating, the child was not going to school for 3-4 days but surprisingly none of teacher observed and asked the reason for not coming to school. The neighbors also knew it but they were afraid of reporting the matter to the police due to threaten by mother of deceased.

The father of deceased who is a class-IV in government service is living separately from family and wife has put a case of dowry against husband. During the period of separation she got love affairs with some other individual but this relationship does not appears to the cause of repeated beating as child was beaten before.

Fig.1: Contusions on Leg on Dissection



Fig. 2: Ligature Mark due to Hanging



Case Two:

A female child, 4 year old, was admitted in Department of pediatrics in our hospital by her mother; with chief complaints of swelling over left arm, multiple skin lesion and excessive crying since last 5 days. She had given history of infection on face, back and legs since 5 days and past history of trauma to arm due to fall from bed 12 days back.

On examination the child was poorly nourished. The temperature, pulse and respiration were normal. She was reluctant to move the left upper limb.

Firm, ill-defined tender swelling was present on proximal half of left arm. Multiple abrasions were present on both lower limbs, back of abdomen, both upper and lower limbs at places with brownish black scab & hypopigmented scars. (Fig. 3 & 4)

A bluish contusion of size 4cm x 3 cm was present on left buttock. The milestones were delayed. Blisters were present on sole of left foot and healed burn lesion on right ankle. (Fig. 5) Child was very irritable.

On investigation Hemoglobin was 4mg%. X-rays revealed fracture of shaft of upper third of left humerus. (Fig. 6)

On interrogation, mother of child was very reluctant to give an accurate account of the facts. She told that child fell from bed and having allergy to everything. When repeatedly

questioned, she confessed that the retrieval line had been pulled out by the father. On further probing she narrated that it was not an accidental fall from bed and allergy to anything. She told that she have three female child.

Fig. 3: Hypo-pigmented Scar on Forehead



Fig. 4: Hypo-pigmented Scar & Abrasion



Fig. 5: Burn lesion by 'Cigarette burn'



Fig. 6: Fracture of left Humerus



Both parents were illiterate & belong to lower socioeconomic family. Father takes alcohol daily. Because of female child, father was very much frustrated as they have already 2

female children in family before this. He used to beat her repeatedly by slapping and burn by cigarette towards this youngest one.

Discussion:

The case history of two children presented above illustrates some common features of the "battered baby syndrome." These are:

1. The discrepancy between the information offered by parents & clinical findings.
2. Both parents deny any physical abuse of the child.
3. Repetitive nature of the traumatic episodes.
4. One child of a family, commonly the eldest or the youngest & often unwanted.
5. Family belongs to poor socioeconomic status.
6. Alcohol and Drugs consumed in both cases.
7. Delay in seeking medical advice and treatment.
8. Unhappy childhood experiences in parents.
9. Child beaten by dominating person in family.
10. A particular type of cigarette burn present on sole. Such burns are most often seen over parts not normally covered by clothing. The mark may be rounded or bizarre in appearance. [6]
11. Discord between the parents & the marriage may be unstable.

Before diagnosing battered baby syndrome, we must have proper knowledge of some other pathological conditions in which long bones fractures occur with history of seemingly minor trauma. Even these kinds of fractures occur recurrently and show pathological changes similar to those of physical abuse, i.e. osteogenesis imperfecta, scurvy, congenital syphilis, spina bifida etc. In bleeding disorder, such as purpura, hemophilia etc., recurrent collection of blood may look like contusions. [3]

Before labeling a case as "battered baby syndrome" it should be thoroughly investigated and all the possibilities of accidental injury should be ruled out so as to avoid unnecessary harassment of an innocent. [7]

In a case of child abuse, a Multidisciplinary Team (MDT) is widely accepted and commonly used approach globally. This method unites all the agencies involved in managing the case of child abuse and facilitates their joint efforts towards the common goal of protecting children and convicting criminals.

Generally the different systems work more or less independently with little coordination with each other. Such an approach may cause emotional trauma to the child repeatedly at every stage – history narration,

treatment, investigation, prosecution and protection. An MDT approach makes such services less intrusive, more child sensitive and child friendly. [8]

In medical education, the specialties that should specifically deal with battered child syndrome are Pediatrics and Forensic Medicine. Searches of various Indian textbooks that are commonly used by students in various regions of the country show that most of them do not vividly cover the topic.

The textbooks that do mention it, do not have specific instructions as to what the doctor's or nurse's action should be, should they suspect battered child syndrome. Under such circumstances, the chance of child battering being reported to any authority is very slim.

It is rare that doctors take the trouble of reporting and insisting on the child's welfare in terms of changing custody and involving police and child welfare organizations. This leads to most cases of child abuse and violence go unreported. The absence of an official agency to look into specifically child abuse only aggravates this menace. [1]

Conclusions:

Doctor, who is approached for first-aid by the parents, must keep their eyes open. In the past the numbers of cases of battered baby syndrome were less, reason for it appears to be joint family. Nowadays there is misuse of dowry cases, as mentioned in first case. This has been already stated by honorable courts. Neighbor should be vigilant & they should report any such crime to police.

The school teachers should be vigilant. They always keep their eye open on student, who are not coming to school for seven days or more without prior information & they should asked the student, after taking in confidence for reason of absence from school. If child gives history of repeatedly beaten by parents, should be reported to police.

It has been found that poverty & alcohol abuse are two main devils that results in battered baby syndrome & measures should be taken for upliftment of socioeconomic status.

Because the cases we have reported are only two, it does not mean that such instances are rare in our country. These are just curtain raisers to a bigger tragic drama. Forensic expert has an important role to play in uncovering the cases of battered baby syndrome and gathering evidence for their successful prosecution.

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Case Report

Fatal Penetrating Lacerated Wound By Tusk of Indian Wild Boar

¹S.P Akhade, ²K.R Rohi, ³L.G. Phad, ⁴P.G Dixit

Abstract

Attack of wild boar is rare and death by single injury on body due to attack of wild boar is rarest of rare. Although wild boars do not generally pose a threat to people, they occasionally attack humans. Due to the clearing of natural boar habitats, the number of interactions, including aggressive ones, between humans and boars has increased. When dealing aggressively with a human, boar will charge at them. When ramming into a person, the boar will slash the tusks upwards, creating sizeable open lacerations on the skin. Due to the height of the boar relative to a human, most wounds are inflicted to the upper legs, fatalities do occasionally occur. Wild boar attacks are under reported. There are very few cases of human attack by wild boars mentioned in literature. This case is reported for single fatal penetrating lacerated injury to lower limb inflicted by tusk of wild boar.

Key Words: Fatal, Indian Wild boar, Single injury, Penetrating Lacerated injury, Tusk, Lower Limb

Introduction:

The Wild Boar is a medium-sized mammal with a large head and front end, which leads into a smaller hind. "The Indian wild boar is found during the day in high grass or bushes, sometimes in forest and often in high crops the females and young as a rule associating in herds or "sounders" usually of ten or a dozen, and rarely exceeding about twenty individuals, whilst the adult males keep apart. [1]

Adult boars can measure from 90-200 cm (35 to 79 inch) in length, not counting a tail of 15 to 40 cm (5.9 to 15.7 inch), and have a shoulder height of 55 to 110 cm (22 to 43 inch).

As a whole, their average weight is 50–90 kg (110–200 pounds), though boars show a great deal of weight variation within their geographical ranges, Mature sows from Southeast Asia and southern India may weigh as little as 44 kg (97 lb). [2]

After 2 years of age male wild boar grow tusks from both the upper and lower canines curving upwards.

The top tusks are hollow and act as a permanent whetstone against which the lower tusks are continually sharpened. The lower tusks are indeed extremely sharp.

Tusks can reach 5.5 to 6 cm in length. Females do not grow the upper 'sharpening' tusks as do the males, and their lower tusks are smaller, 2.5 to 3 cm long. Female 'tusks' are still quite sharp, but do not protrude from the lip, as they do in the males. [3]

Although wild boars do not generally pose a threat to people, they occasionally attack humans. Due to the clearing of natural boar habitats, the number of interactions, including aggressive ones, between humans and boars has increased. When dealing aggressively with human, boars will charge at them.

When ramming into a person, the boar will slash the tusks upwards, creating sizeable open lacerations on the skin. Due to the height of the boar relative to a human, most wounds are inflicted to the upper legs, fatalities do occasionally occur. [4]

Wild boar attacks are under reported. There are very few cases of human attack by wild boars mentioned in literature. Here we present a case of wild boar attack with fatal penetrating laceration on thigh.

Case History:

A 42 year old male patient presented to emergency department in drowsy and disoriented state at 02.30 p.m. on 11/02/14 following a wild boar attack, which he sustained at 08.00 a.m. on 10/02/14. Wild boar attacked him from behind, while he was working in his

Corresponding Author:

¹Assistant Professor, Dept. of Forensic Medicine
K.J. Somaiya Medical College, Mumbai
E-mail: akhade.swapnil@gmail.com

²Assist. Prof, Dept. of Community Medicine
Rajiv Gandhi Medical College, Thane

³Junior Resident II, Dept. of Forensic Medicine
Government Medical College Nagpur

⁴Prof & HOD, Dept. of Forensic Medicine
Government Medical College Nagpur

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farm by hearing his scream the nearby farmers came for rescue and the wild boar ran away into the adjoining woods.

He was bleeding heavily, while shifting him to primary health centre situated 10 kilometers away and further referred after packing the wound to our Tertiary Care hospital situated 200 kilometers apart, it takes around 24 hours to the relatives because of poor economic condition. On admission he was in drowsy state and was given one point of whole blood but condition was not improving.

He was taken into operation theatre same night the wound was examined and around 200cc blood wiped off and no active bleeding found at the injured site as peripheral vessels were collapsed and patient was in state of peripheral circulatory failure, the wound was repacked and given one more point of blood the condition was deteriorating and the patient died on 12/02/14 at 7.00 a.m.

Autopsy Findings:

The body was that of a moderately built and moderately nourished male with a height of 1.2 m and weight of 51 kg.

External examination revealed the single penetrating lacerated wound on poster medial aspect of lower one third of left thigh of size 6cm*2cm*4cm, directed obliquely upwards and medially, with tailing on lower lateral end for 0.3 cm, edges of injury were rugged red.

The wound make a tear on posterior wall of femoral artery with muscle damage.

There was hematoma with infiltration of blood in muscles but no obvious bone injury corresponding to the wound.

On Internal examination all the internal organs were intact and pale.

The cause of death was attributed to **hemorrhagic shock due to penetrating laceration to thigh by wild boar tusk.**

Discussion:

Death due to attack by wild boar is very rare. As per literature the most frequent site of injury among reported cases of wild boar cases is posterior thigh. Death due to attack by wild boar is very rare. According to the literature, the most frequent site of injury among reported cases of wild boar attack was the posterior thigh. [5-7] However, wild boar wounds can be fatal.

There are three reported cases of deaths due to wild boar attacks, with the cause of death being cranio-cerebral injury, multiple abdominal penetrating injuries and hemorrhagic shock due to lacerations to thigh by wild boar tusk, also named them as tusk injuries. [5-6]

Gunduz et al related this pattern to the physical characteristics of the wild boar. [4]

This is possibly due to the shoulder height of an adult wild boar, which is 90 cm on average, which approximately corresponds to the height of the thigh. In contrast to previous reports of Manipady et al and Shetty et al, there was only single lesion on the postero-medial aspect of the thigh.

The wild boar has a typical method of attack wherein it rushes forward, pointing the tusks towards the animal to be attacked and inflicts the injuries. It goes back, takes position, and attacks the victim again.

This repeated nature of attack continues until the victim is completely incapacitated owing to multiple penetrating injuries, which can have fatal consequences. As the boar continues its assault while the victim is on the ground, secondary lesions can occur in any anatomical location depending on the relative position of the victim. [7]

In the present case, there was only a single attack by the wild boar causing the single penetrating lacerated wound. The medial side of wound seemed to be caused by the lower tusk whereas the tailing represents injury while removal of lower tusk. There were no secondary injuries as mentioned in previous literature. This indicates that the boar attack was a defensive act and was not offensive in nature.

The penetrating injury inflicted by the wild boar is in below and upwards due to the anatomical position of the tusks.

Such attacks may occur in a distant uninhabited wilderness rather than on the well-travelled path where the boar is tolerant of people and less likely to attack.

In the present case, the wild boar attack occurred at the border of agricultural field and adjacent to forest the normal habitat of the wild boar. Therefore, the people living in similar geographical surroundings are vulnerable to attack by wild boar.

This case is reported for its rarity, for the pattern of the possible injuries in a boar attack, and to stress that how fatal a single injury could be even though present over the thigh. From Forensic point of view if any dead body is found in such circumstances, then possibility of attack by wild animal like wild boar could be a possibility and should be ruled out.

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Fig. 1: Penetrating Lacerated Wound

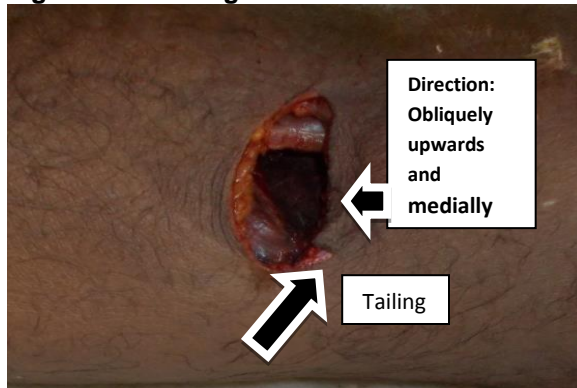


Fig. 2: Tear In Posterior Wall of Femoral Artery

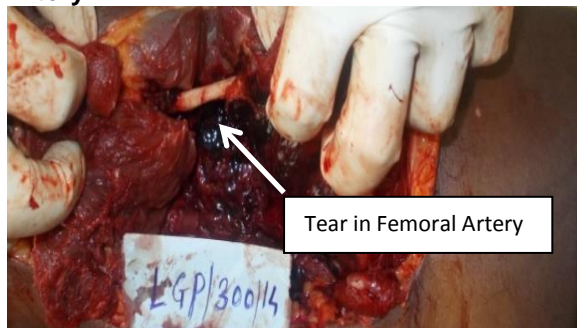


Fig. 3: Indian Wild Boar



Fig. 4: Front view of Indian Wild Boar



Case Report

Fatal Asian Giant Hornet's Sting: First Case Series from Kumaon Hills of Uttarakhand, India

¹Paramjeet Singh, ²Ashok Kumar, ³Sandeep Raj Saxena, ⁴Yatendra Singh, ⁵Vinita Rawat, ⁶C.P. Bhaishora

Abstract

Hornet stings are medically important stings which can cause allergic manifestations and in severe cases, may lead to acute renal failure (ARF), myocarditis and hepatitis. Venom from hornet stings can also contribute to myocardial injury or liver impairment. The delay in diagnosis, treatment and unawareness of fatal complication may also be a contributory factor for fatal outcome. In the remote, backward area of hills of Uttarakhand, where the emergency medical facilities are not easily available, lead to increase mortality. Here, we report the case series of farmers who were working in their field in a village at an altitude of around 6500 feet above sea level. Out of six farmers who were bitten by hornet three died before reaching our hospital and one in our hospital. Only two farmers could survive out of six. We are describing three cases of hornet stings that reached our hospital leading to ARF, myocarditis and hepatitis. Case two complicated with ARF and myocarditis and case three with hepatitis. Both of these recovered their body physiology after a 26 days and 6 day stay in the hospital, respectively, whereas Case one died.

Key Words: Hornet sting; Acute renal failure; Multiple hornet stings; Hepatitis

Introduction:

The insect order Hymenoptera consists of many medically important groups of stinging insects: Apoidea (bees), Vespoidea (paper wasps, hornets and yellow jackets commonly referred as wasps [1] and Formicidae (ants). [2]

Hymenoptera venoms are concentrated and highly complicated mixtures of biochemically active agents. [7] Though allergic manifestations to Hymenoptera stings are well documented, severe reactions to 'Hymenoptera' stings are generally attributed to allergic mechanisms. In cases of multiple stings, severe reactions and even death may result from the toxic actions of venom. [7]

Systemic complications such as ARF, cardiac, liver and respiratory complications have also been reported. [4, 5, 7] Here, we report the case series of farmers who were working in their field in a village at an altitude of around 6500 feet above sea level.

Out of six farmers who were bitten by hornet three died before reaching our hospital and one in our hospital. Only two farmers could survive out of six.

We are describing three cases of hornet stings that reached our hospital with three different clinical manifestation followed by multiple hornet stings at the same time.

Case Reports:

Case One:

A 34 -year-old male was referred to our hospital with complaints of multiple hornet stings on face, back, upper and lower limbs, from one of the peripheral hospital. (Fig. 1)

On examination, there was generalized swelling of the body and multiple rounded erythematous lesions of 2-4 cm size, with skin necrosis. Features of cellulites were also present over face, neck, back and extremities. (Fig. 1) The patient was in altered sensorium having tachypnea, and oliguria.

The systolic blood pressure of the patient was 80 mm of mercury. The patient was put on inotropic support and was shifted to ICU. On ABG analysis the patient was having metabolic acidosis with pH of 7.1.

Corrective measures were taken. ECG was showing sinus tachycardia with non specific ST-T changes, suggestive of myocarditis. The patient's condition deteriorated progressively and in the afternoon he had sudden cardiac

Corresponding Author:

¹Associate Professor, Department of Medicine, Government Medical College, Haldwani, Uttarakhand
E-mail: pisgrover@gmail.com

²Assoc. Prof, Dept. of Medicine,

³Prof, Dept. of Medicine

⁴Assist. Prof, Dept. of Medicine

⁵Assoc. Prof, Dept. of Microbiology

⁶Prof & HOD, Dept. of Forensic Medicine

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arrest. Cardio-pulmonary resuscitation was done and patient was put on ventilator support.

Despite all efforts by ICU team the patient could not be survived.

Case Two:

Our 2nd case was of 38 years old male who had hornet bites on face, neck, back and upper limbs. There were total 26 bite marks. The patient was having severe pain at the site of bites, generalized swelling all over the body and oliguria. He was anemic and having features of intravascular hemolysis.

Investigations revealed Hemoglobin only 4.4 gm%, TLC 27,700/cubic mm & platelet count 4.5 lacs/ cubic mm. Urine examination was positive for RBCs. CPK and transaminases were also mildly elevated with CPK- 487 U/L, SGOT- 264 U/L & SGPT of 448 U/L. His renal functions were deranged with Blood Urea of 108 mg% & Serum Creatinine of 2.3 mg%.

The patient was put on intravenous antibiotics, antihistamines along with corticosteroids. The patient was shifted to ICU for and was transfused 4 units packed RBCs and 5 units of fresh frozen plasma as prothrombin time (PT) was also prolonged.

Two days after admission to the hospital the patient's condition deteriorated. He developed anuria, hypertension and tachypnoea. His blood urea rose to 164 mg% and serum Creatinine to 7.7 mg%.

The patient developed metabolic acidosis and was hemodialysed. During the course of his illness the patient required hemodialysis support seven times.

The patient gradually improved with the treatment. His liver as well as renal function tests improved and after a stay of 26 days in our hospital he was discharged.

Case Three:

Third case was 34 years female the only female among the seven who were stung by hornets. She fortunately had only 6 bites on face and back as she was wearing a 'sari' which protected her from the stings of the hornets.

She was having severe pain at bite sites. There was swelling and erythema around the lesions. She was not having any features suggestive of acute renal failure or hemolysis.

On investigations she had raised WBC and polymorph count. She had mild elevation of liver and muscle enzymes with SGOT- 384 U/L, SGPT- 100 U/L and CPK of 356 U/L. Her renal function tests and urine examination was normal. She had normal ECG.

She was managed conservatively in the medicine ward with intravenous fluids,

antibiotics, antihistamines and other supportive measures. She became completely well in 6 days and took care of her husband the only other survivor who had renal failure and was on hemodialysis support. (Case 2 described above)

Discussion:

Insect bites and stings can have a spectrum of clinical symptoms ranging from minor allergic reactions to rhabdomyolysis, acute myocardial infarction, acute renal failure and even anaphylactic shock.

Stinging insects are classified as hymenoptera which includes apids (honey bees, Africanized bees) and vespids (wasps, yellow jackets & hornets). Hornet stings are generally followed by minor allergic reactions and rarely anaphylaxis. [1, 2]

The incidence of anaphylaxis caused by insect stings has been estimated from 0.3 to 3% in the general population. [3] In cases of multiple bites there can be systemic involvement including liver, kidney, heart, muscles and brain.

The patients may have acute myocardial infarction, acute renal failure, acute myocarditis, and acute encephalomyelitis. [4-6] The venom may contain a variety of components, such as melittin, apamine, phospholipases, hyaluronidase, acid phosphatase, histamine, and kinin. These have direct and indirect hemolytic effects, neurotoxic and vasoactive properties which can cause intravascular hemolysis and rhabdomyolysis. [7]

Mass envenomation by hornets may trigger massive allergic reaction leading to the systemic complications and even death as seen in our case. One of our cases died due to cardiac derangement. However case no 2 & 3 could be saved due to meticulous support and various combination regimes.

In our case series total six person were bitten by hornet sting. One died on spot within one hour as there was no health facility in that remote village of hilly region. One died during treatment nearby P.H.C (Primary Health Centre) and one during transportation to our hospital.

One of our patients died in our hospital. Out of six farmers who had stings of hornets only two could survive.

In the present cases, there was a prolonged delay in the initiation of treatment due to lack of awareness about severe complication that may arise due to sting and the unusual manifestation may causes considerable difficulties in establishing the diagnosis. Lack of healthcare facilities and delay in getting treatment may all add to the severity and complications.

Conclusion:

The delay in diagnosis, unawareness of fatal complication & delay in treatment may also be a contributory factor for fatal outcome. In the remote, backward area of hills, where the emergency medical facilities are not easily available, lead to increase mortality.

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Fig. 1: Sting Marks with Central Skin Necrosis & Erythematous Borders on Back of Case one



Fig. 2: Multiple Sting Marks With Central Skin Necrosis & Erythematous Borders Umblicated Lesions on Back of Case Two



Fig. 3: Sting mark with Central Skin Necrosis & Erythematous Borders on the neck of case Three



Fig. 4: Asian Giant Hornet nest at an altitude of 6500 feet



Case Report

Sudden Deaths Due to Choking

¹Soumya Ranjan Nayak, ²Manoj Kumar Jena, ³Bibhuti Bhusan Panda, ⁴Purnima Singh

Abstract

Death due to accidental choking is observed in all age group and small children below 4 years of age are the common victims. Choking is commonly seen in children when objects such as small toys, table tennis ball and coins are placed in mouth and inhaled. Food is the most common cause of choking and food which is the life provider can become an asphyxiating agent at times. Children younger than one year of age are more likely to aspirate food, whereas older children tend to choke on non-food items. Aspiration of gastric contents is common in individuals with a decreased level of consciousness in drug overdose and during anaesthesia. The risk of aspiration is high after removal of an endotracheal tube because of residual effects of sedative drugs, the presence of a nasogastric tube, swallowing dysfunction related to upper airway sensitivity, glottic injury and laryngeal muscular dysfunction. Aspiration can present with acute respiratory distress but in many elderly individuals, it is silent. We hereby report cases of sudden death due to choking which were brought to our mortuary for autopsy.

Key Words: Choking, Sudden death, Aspiration, Autopsy

Introduction:

Death due to choking is among the top five causes of accidental death in United States which comprises of approximately 2500 deaths per year. [1] Choking is a form of asphyxia which is caused by impaction of a foreign body in the respiratory passage usually between pharynx and bifurcation of trachea. [2]

More than 17000 infants and children are treated in the hospital emergency department for choking each year and more than 80% of these cases occur in children below 4 year age. [3]

Choking incidences occur in people of all ages but children under 3 years are more vulnerable.[1] Here we present a series of such cases brought to S.C.B Medical College & Hospital, Cuttack.

Case one:

A seven years old boy while playing with his friends violently coughed and turned blue and fell down unconscious.

Corresponding Author:

¹Assistant Professor,
Dept. of Forensic Medicine and Toxicology
S.C.B Medical College, Cuttack, Odisha, Pin-753007
E-mail: soumyarnayak@yahoo.com

²Prof. & HOD, Cuttack,

³Assistant Professor, Dept. of FMT,
IMS & SUM Hospital, Bhubaneswar,

⁴Post Graduate Student, Dept. of FMT,
V.S.S Medical College, Burla

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Then he was shifted to S.C.B Medical College & Hospital, Cuttack where the doctors declared him brought dead. During post-mortem examination, the nail beds were bluish in colour. Rigor mortis was present all over the body.

No injury could be detected on the body. On internal examination, a black colour whistle was found lodged in the larynx obstructing the lumen. (Fig. 1) Laryngeal mucosa was edematous and congested. All other organs were intact and congested.

Autopsy surgeon opined choking as the cause of death due to obstruction of respiratory passage by a foreign body.

Case Two:

A 15 years old adolescent girl was brought dead in the casualty of S.C.B.M.C.H, Cuttack with alleged history of sudden loss of consciousness while playing with her friends.

During autopsy examination, face and sclera was congested with presence of sub conjunctival haemorrhages on both eyes. Nail beds were bluish in colour.

Tongue was found bitten and fecal discharge seen. Post-mortem lividity found on back and buttocks and no injury could be detected on the body.

On internal examination petechial haemorrhages were found on the surface of heart and visceral pleura. One white colour balloon was seen impacted in the laryngopharynx obstructing the airway. (Fig.2)

All the internal organs were intact and congested. Opinion as to cause of death was

issued as **Asphyxia as a result of choking.** (Fig. 3)

Case Three:

A 30 years old man was admitted in the casualty of S.C.B Medical College & Hospital, Cuttack due to road traffic accident and expired on the same day during treatment. During post mortem examination upper lip was found lacerated with dislocation of all incisors and canine teeth. Both maxilla and mandible found fractured in to pieces. Multiple superficial injuries were present all over the body.

There was a contusion of size 6cmx5cm on mid frontal area of scalp and right temporalis muscle found contused. Skull, duramater and brain were intact. Copious amount of fluid blood found within trachea, bronchus and bronchioles obstructing the air passage.

Fluid blood was also seen within esophagus and stomach. All other internal organs were intact. In this case death of the deceased was **due to choking resulting from inhalation of fluid blood.**

Case Four:

One fatty built middle aged man was found dead in the early morning in his bed room. During post mortem examination no injury either external or internal could be detected on his body. Copious amount of partially digested food particles were found inside trachea, bronchus and bronchioles blocking the lumen.

Similar type of food particles were found in stomach emitting strong smell of alcohol. All the internal organs were deeply congested. In this **case death was due to choking as a result of aspiration of stomach contents.**

Discussion:

Obstruction of the respiratory passage can be mechanical or anatomical origin. [4] Mechanical obstruction occurs due to foreign body like food particles, small toys, coins or lemon. [4] Choking can also occur when vomited material is inhaled or when a large food bolus or a piece of meat is accidentally impacted in the glottis. [5] Anatomical obstruction occurs due to anatomical structures such as tongue, swollen tissues of mouth and throat like inflamed epiglottis or results from injury to neck. [4]

Choking may occur following tonsillectomy or any operation on pharynx or larynx from a gauge pack left out inadvertently. [5] Complete blockage of the respiratory passage is not required as sudden death due to laryngeal spasm can occur by small object blocking the lumen partially. [5]

Incomplete obstruction eventually becomes complete when respiratory tract

mucosal oedema, inflammation, hemorrhage and bronchospasm occurs. [6]

Choking deaths are commonly seen at the extremes of ages with young children and elderly having the greatest rate of fatality. [4]

Choking is a common cause of accidental death in children less than one year age and 90% of choking deaths occur before the age of 5 years. [6] Children aged 1 to 3 years are vulnerable to choking because of their increased mobility, inability to judge the appropriateness of placing small objects in their mouth and appreciate the size of a piece of food, small airways, inadequate dentition for chewing and weaker cough reflex. [6]

Food is the most common cause of choking in all age groups. [4] Out of 17000 cases of Pediatric choking in the year 2001, 60% cases were related to food and 31% were due to non-food substance. [3]

As per the American Academy of Pediatrics, food particles commonly responsible for choking are hard candy, chewing gum, nuts and seeds, chunks of meat, whole grapes and popcorn etc. [7]

According to SoneaQureshi and Richard Mink, the most frequent aspirated objects are organic food items such as peanut, popcorn, hot dogs or vegetable matter. [8]

Objects other than food include balloons, coins, pen tops and pins. [8] Home is the most common place for choking incidents involving children. [6]

Most adults choking deaths occur at home, in a nursing home or in a psychiatric institution and only a third of fatalities happen in a restaurant. [6] In adults, choking incidences mostly occur during eating. [7]

Choking incidences commonly occur in children, intoxicated adults, mentally challenged and in some manual professionals like electricians, fisherman and carpenters who held small items between their teeth while working. [9]

In adults, predisposing factors include a decreased protective airway reflex resulting from aging, poor dentition with a tendency to swallow whole food, alcohol consumption and ingestion of other CNS depressants impairing gag reflex. [6] Abnormal position while eating or an emotional outburst can trigger choking episodes. [6]

Choking is almost always accidental in nature. [10] Choking can also occur at the time when the victim has been laughing or crying or someone out of fun had slapped him on his back, while the foreign body was in his mouth or

during rape or violent sexual intercourse after a heavy meal. [5]

Aspiration of regurgitated vomitus in to the lungs is commonly seen in acute alcoholics or during operations under ether anaesthesia or in young infants. [11] Choking may occur due to inhalation of blood from facial injuries, such as a broken nose, or dislodged teeth and laceration of the lips and gums inflicted during flight, if the victim becomes unconscious and lies on his back. [10]

A case of choking usually presents with vigorous coughing and respiratory distress, change in voice quality and swallowing problem, bluish discoloration of face, lips and nails and sudden loss of consciousness. [9] Foreign body impaction in larynx mostly accidental in nature and requires urgent intervention to save the life of the patient. [9]

Conclusion:

Choking incidences can be minimized by avoiding foods of the same size and shapes of a child's airway like grapes, nuts, chunks of meat and popcorn and also by choosing safe age appropriate toys and learning CPR and Heimlich manoeuvre and by not letting children play with coins.

It can also be minimized by serving food in small manageable bites to children and by teaching them to sit down during meals and snacks and not to talk and laugh with food in mouth. Parents should be careful about deflated balloons, coins, batteries and parts of small toys.

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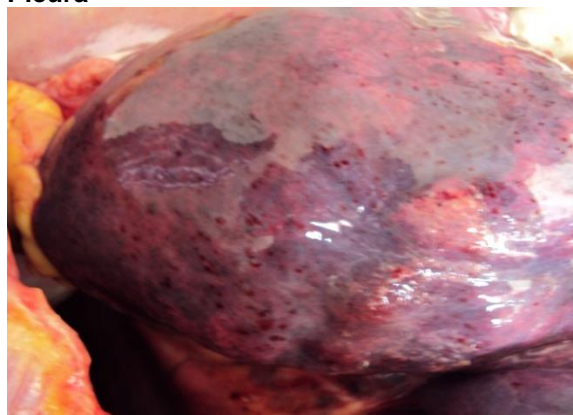
Fig. 1: Whistle Present within Larynx



Fig. 2: A Balloon Obstructing the Laryngopharynx



Fig. 2: Petechial Haemorrhages on Visceral Pleura



Case Report

Holoprosencephaly with Synophthalmia: A Perinatal Autopsy

¹Sajeeb Mondal, ²Rajashree Pradhan, ³Shouvanik Adhya

Abstract

Holoprosencephaly with Synophthalmia is a rare congenital developmental disorder which was diagnosed by perinatal autopsy. This case report presents a detailed gross and histologic examination of eyes and brain of a baby with synophthalmia. Incidence of synophthalmia is 1 in 16000 born animal and 1 in 25000 that end in miscarriage. (Tabers cyclopedic medical Dictionary ISBN0-8036-0654-O) A 24 years primi presented with IUD at 29 weeks of her gestation. On internal examination forebrain failed to separate and, had cyclopia (Single Eye) and nose in the form of proboscis (Tubular appendage). Histopathological examination confirmed eye ball structure. Final autopsy diagnosis was Holoprosencephaly with Synophthalmia. Genetic cause and toxin can interfere with embryonic forebrain dividing process. One highly teratogenic substance is Cycloamine (Teratology Society). Cause of death identified as multiple congenital anomalies. Karyotyping was indicated but not feasible due to delayed autopsy. This case presented here not only of its rarity but also rarity of its diagnosis by perinatal autopsy. Legal and ethical constraints need to be addressed carefully otherwise perinatal autopsy which is gold standard in diagnosing perinatal death will be a dying art.

Key Words: Holoprosencephaly, Synophthalmia, Perinatal Autopsy Primipara, Malformation

Introduction:

Holoprosencephaly with Synophthalmia is a rare congenital developmental disorder. It is a cephalic disorder in which the pros encephalon (the forebrain of the embryo) fails to develop into two hemispheres. Hox gene which guide placement of embryonic structures fail to activate along the midline of the head allowing the structures that are normally paired on the left and right to merge. As per the observation of the National Institute of Neurological Disorders and Stroke (NINDS), "In most cases of holoprosencephaly, the malformations are so severe, that babies die before birth. [1]

Case History:

A 24 Years primi presented with IUD at 29 years of gestation. USG done at the same time reported only baby with midline facial defect. Birth weight of the baby was 800 gms.

Corresponding Author:

³Associate Professor,
Department of Forensic Medicine & Toxicology,
College of Medicine & JNM Hospital, WBUHS,
Kalyani, West Bengal
E-mail: shouvanikadhya@gmail.com

¹Assist. Prof, Dept. of Pathology,
College of Medicine & Sagore Dutta Hospital,
West Bengal

²Assist. Prof, Dept. of Pathology
DOR: 31.01.2015 DOA: 06.02.2015

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Head Circumference (HC) was 20 cm, Crown Ramp length (CR-Length) was 28 cm, Chest Circumference (CC) was 23 cm, and Femur Length (FL) was of 6 cm.

On external examination no structures of face developed except a midline aperture containing eye- ball. (Fig. 1)

On internal examination forebrain fails to separate and represented by triangular globular structure and single optic nerve. (Fig. 2) Histopathology confirmed eye – ball structure. (Fig. 3) Other viscera were normal. No abnormality detected in placental and umbilical cord biopsy. Final autopsy diagnosis made as Holoprosencephaly with Synophthalmia. Cause of death was multiple congenital anomalies.

Discussion:

According to the National Institute of Neurological Disorders And Stroke (NINDS) in most cases of Holoprosencephaly the malformations are so severe that babies die before birth. In our case also baby died before birth and the foetus presented with most severe facial defect that is cyclopia and the nose in the form of proboscis. In our case the USG findings was baby with midline facial defect.

On autopsy the additional information obtained was Holoprosencephaly. According to the study of C Rose et al in which autopsy revealed new information in 25% of cases [2] and according to Jones N et al post- mortem

examination provides additional information in 38% of cases. [3]

Ideally in all cases of congenitally malformed babies karyotyping should be done but in our case the time interval between the death of the baby and the autopsy done was not feasible to take sample for karyotyping.

Some of the physicians think that antenatal sonography is enough for diagnosing the cause of death. However illustrated by Routine Antenatal Diagnostic Imaging with Ultrasound (RADIWU) [4, 5] antenatal ultrasound fails to identify a large proportion of major congenital anomalies for which autopsy is a must as in our case Holoprosencephaly was missed by imaging.

Throughout the world perinatal autopsy rate is declining due to social, ethical and legal constraints but to diagnose a genetic syndrome which is essential for accurate counselling for future pregnancy planning perinatal autopsy is a must.

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Fig.1: Holoprosencephaly with Synophthalmia



Fig.2: Holoprosencephaly



Fig. 3: Histology of Cornea & Iris

