Volume 39 Number 3 July - Sept. 2017

OF FORENSIC MEDICINE



(A Peer Reviewed Journal)

(Official Publication of Indian Academy of Forensic Medicine) www.iafmonline.in

Editor Dr. Dasari Harish

Joint Editor Dr. Manish Nigam

Publication Quarterly ISSN: 0971-0973



Editor Dr Dasari Harish Professor & Head Department of Forensic Medicine & Toxicology Government Medical College & Hospital Chandigarh, INDIA 160030 Ph: 0172-2665253-59 ext 1064 Cell: +91-9646121551 Email:editoriafm@gmail.com, dasariharish@gmail.com



Joint Editor

Dr Manish Nigam Professor & Head Department of Forensic Medicine and Toxicology Deputy Medical superintendent Sri Aurobindo Medical College and PG Institute And associated hospitals, Indore (MP) Cell: +91-9826213412 Email: jurimanish@gmail.com



Member Editorial Team

Dr Amandeep Singh Associate Professor Department of Forensic Medicine & Toxicology Government Medical College & Hospital Chandigarh, INDIA 160030 Ph: 0172-2665253-59 ext 1048 Cell: +91-9646121610 Email:dramandeep@gmail.com



Member Editorial Team

Dr Mandar R Sane Assistant Professor Department of Forensic Medicine & Toxicology Government Medical College & Hospital Chandigarh, INDIA 160030 Ph: 0172-2665253-59 ext *4338 Cell: +91-9589896664 Email: drmrsane@gmail.com

Indian Academy of Forensic Medicine (IAFM)

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



Governing Council 2016-2019

President Dr. Kalpesh Shah

General Secretary Dr.Madhu Godhikirikar

Vice Presidents

North Zone:	Dr. Pankaj Gupta
South Zone:	Dr. Cyriac Job
East Zone:	Dr. A.J.Patowary
West Zone:	Dr. Sudhir Ninave
Central Zone:	Dr. Shiv Ratan Kochar

Editor

Dr.Dasari Harish

Treasurer Dr.S.K.Daddu

Joint Secretaries

North Zone:	Dr. Rajeev Joshi			
South Zone:	Dr. Krishna Rao GM			
East Zone:	Dr. Putul Mahanta			
West Zone:	Dr. Ganesh Govekar			
Central Zone:	Dr. Manish Kumath			

Joint Editor

Dr. Manish Nigam

Executive Members

Dr. S.D. Nanadkar (Ex. President, IAFM) Dr. Ajay Kumar Dr. Sudha R. Dr.T. K. K. Naidu Dr. Rai Sudhir Prasad Dr. Tulsi Mahto Dr. C.B.Jani (Ex. Secretary, IAFM) Dr. Rajesh C. Dere Dr. M. I. Sheikh Dr. O.P.Murthy Dr. Abhishek Yadav Dr Yogendra Bansal

Journal of Indian Academy of Forensic Medicine (JIAFM)

The Official Publication of Indian Academy of Forensic Medicine

Editor Dr. Dasari Harish

Professor & Head Department of Forensic Medicine & Toxicology Government Medical College & Hospital Chandigarh, 160030 Ph: 0172-2665253-59 ext 1064 Cell: +91-9646121551 Email: editoriafm@gmail.com, dasariharish@gmail.com

Joint Editor Dr. Manish Nigam

Professor & Head Dept. Forensic Medicine and Toxicology Deputy Medical superintendent Sri Aurobindo Medical College and PG Institute and associated hospitals, Indore (MP) Cell: +91-9826213412 Email: jointeditorjiafm@gmail.com jurimanish@gmail.com

Editorial Team

Dr. Amandeep Singh (GMCH, Chandigarh) Dr. Mandar Sane (GMCH, Chandigarh)

International Advisory Board

Prof. Derrick J Pounder, Dundee, UK Prof. D N Vieira, Coimbra Portugal Prof. Dan Dermengiu, Romania Prof. Peter Vanezis, London, UK Prof. Roger Byard, Australia Dr. Michael S. Pollanen, Canada Prof. Leandro Duarte De Carvalho, Brazil Dr. Shubhakar K.P. UK Dr. BL Meel, South Africa Dr. John Clark, Glasgow, UK Dr. George Paul, Singapore Dr. Serap Annette AKGUR, Turkey Dr. Clifford Perera, Sri Lanka Dr. B.N. Yadav, Nepal Dr. K. P. Saha, Bangladesh Dr. Gorea R.K KSA

National Advisory Board

Srivastava A.K. (U.P.) Pillay V.V. (Kerala) Jani C.B. (Gujarat) Bose T.K (West Bengal) Pradeep Kumar G. (Karnatka) Verma S.K. (New Delhi) Kumar Shantha B. (Tamil Nadu) Gupta B.D. (Gujrat) S.C. Mahapatra (Odisha) Manju Nath K.H, (Karnatka) Das Sanjoy, (Uttarakhand) Mahtoo Tulsi, (Jharkhand)

- Ravindran K. (Puducherry) Rastogi Prateek (Karnatka) Potwary AJ (Assam) Singh R.K. (Chhatisgarh) Dongre A.P. (Maharastra) Sharma Aditya (H.P.) Yogendra Bansal (Chandigarh) Khanagwal V. (Haryana) Rastogi Pooja (U.P.) Khaja Shaikh (A.P.) P.P. Mukhopadhyay (W.B.) Naik R.S. (Maharastra)
- Job Cyriac (Kerala) Vinita K. (U.P.) Mohite Shailesh (Mumbai) Yadav Jayanti (M.P.) Kochar S.R. (Rajasthan) L. Fimate (Manipur) K H Chavali (Raipur) Gaurav Sharma (Haryana) R S Bangal (Maharashtra) S S Oberoi (Punjab)

Printed and published by Dr. Dasari Harish, Editor, JIAFM and Dr. Manish Nigam, Joint Editor, JIAFM on behalf of Indian Academy of Forensic Medicine at Sanjay Printers, Chandigarh

ii

Journal of Indian Academy of Forensic Medicine

	Volume: 39 • Number: 3 • July – Sept. 2	2017
	Contents	
Sr. I.	From the Editor's Desk	Page 223-223
II.	Editorial	224- 228
	Original Research Paper	
1.	Profile of Death due to Road Traffic Accidents (RTA) in Urban Region of Uttar Pradesh, India. Anuj Gupta , Alok Kumar , Prachi Gupta	229-234
2.	Profile study of Organophosphorus Poisoning at Valsad: 2 Year Study. K.S.Lad, V.C.Patel, Pragnesh Parmar	235-238
3.	Sexual Homicides(A retrospective study at RIMS, Imphal from 2000-2014). Memchoubi Ph., Th. Meera Devi, Nandeibam Pabitramala Devi, Nani Gopal Das	239-242
4.	Histopathological timing of Intra Cranial Hemorrhage in Head Injuries with Blunt Force. P.Umamaheswara Rao, C. V. V. Lakshmi	243-247
5.	The Epidemiology and Patterns of Head Injuries with Skull Fractures in Homicidal Deaths. Suraj Sundaragiri, Vijayadurga Koppada, Srikanth Tandur	248-254
6.	An Approach To Brought Dead Cases To Hospital-An Autopsy Based Study. Padmini Hannah Noone, Fairoz Khan	255-260
7.	Determination of Sex from Cranial Length, Cranial Height and Length- Height Index. Murli Lalwani, Jayanthi Yadav, Arneet Arora, BP Dubey	261-265
8.	Digital Measurement of Dentinal Translucency in Correlation with Age Maturity - a Fact or Fiction?. Gopika M.G, Sunayana Manipal, Dinesh T, Rajmohan M, Naveen, Prabu D, Nagarathinam A.E	266-270
9.	Sexual Dimorphism by Mastoid Length in Bhopal Region of Central India. Murli Lalwani, Jayanthi Yadav, Arneet Arora, BP Dubey	271-275
10.	Sterilization Methods on Extracted Human Teeth - A Comparative Study on Evaluation of Efficacy. Vidya G Doddowad, Mohamad Ayas, Premalatha BR, Madhuri Kulkarin	276-278
11.	Level of MBBS Student's Perception – Tested in Advance Before Start of Autopsy Demonstration. Madhusudhana Reddy D	279-282
12.	Pattern of Filling up of Medical Certification of Cause of Death (MCCD) at a Tertiary Care Hospital: Pitfalls and Suggestions. B.L. Bamboria, Vishal B. Surwade, B.D.Gupta	283-286
13.	Pattern of Unnatural Female Deaths at Mortuary of Civil Hospital, Ahmedabad. Rakesh Kumar Mori, Sandip Raloti, Kalpesh Shah, Sadikhusen Momin, Jigesh V Shah, Dharmesh S Patel	287-291
14.	Profiling of Cases Brought to Causality for Alcohol Examination: A Two Year Study. Amandeep Singh, Gagandeep Kaur Kalsi, Ajay Kumar, Dasari Harish, Tanya Singh	292-297
15	Analysis of Deaths Due to Poisoning; A Two Year Retrospective Study. Chanpreet Kaur Pawar, Gurmanjeet Rai, Ashok Chanana, Gaurav Pawar, Kuldeep Kumar, Manpreet Kaul, Swati Tyagi, Kamaljeet Singh	298-302
16	Evaluation of Foramen Magnum Dimensions for Sex Determination. Madhusudan R. Petkar, Sandesh B. Datir, Chandeep Singh Makhani, Jamebaseer Farooqui,	303-307

Rajendra S. Bangal, Kalidas D. Chavan

17 Thoracic Artefacts Due to Resuscitative Procedures Encountered During 308-311 Autopsy. Shailesh Vasantrao Parate, S. Harish, Girish Chandra Y. P., Ashok Kumar Samanta.

Review Research Paper

18	Legal Perspectives In Negligence Cases. Rajesh Sangram	312-315
19	The Intriguing Section of 307 IPC – Dangerous to life is it? Ashish Tyagi, Shashank Tyagi, Hitesh Chawla, Nishtha Malik, PK Paliwal	316-321
	Case Reports	

- **20** Metal Implant A Hidden Clue to Identification A Case Report. Arun Kumar 322-324 Jaiswani, Rajesh Dere, Hemant Kukde, 4Mahesh Sabale, R.R. Savardekar
- 21 Multidisciplinary Approach in a Case of Cinderella Syndrome: A Case 325-327 Report. H.K.Khartade, H.M.Pathak
- 22 A case of Sudden Death Due To Non Traumatic Acute Sub Dural 328-330 Haemorrhage. Manas Ranjan Sahu, Manoj Kumar Mahanty, Sudipta Ranjan Singh, Sasank Shekhar Maharik

Copy Right © **All rights reserved:** No part of this publication may be reprinted or publish without the prior permission of the Editor, JIAFM. Submission of all manuscripts to the journal is understood to imply that it is not being considered for publication elsewhere. Submission of multi authored papers implies that the consent of each author has been obtained. In this journal, every effort has been made NOT to publish inaccurate or misleading information. However, the Editor, Joint Editor, Peer Review Group and Advisory Board accept NO liability in consequences of such statements. The Journal of Indian Academy of Forensic Medicine is indexed in **Scopus, IndMED** and **Indian Citation Index**

Print ISSN: 0971-0973. Electronic ISSN: 0974-0848.

www.iafmonline.in

Address request for reprint or further information relating to any article may please be made with author and in case of multi authored article, please communicate with Corresponding Author or the First Author

The journal is indexed with Scopus, IndMed & Indian Citation Index and made available online by following website:

www.iafmonline.in http://indmed.nic.in www.indianjournals.com

Subscription Information

- Members of IAFM will receive the free of cost.
- Non Members and Institutions (Annual Subscription rates)
- Personal: In India, Rs. 1000/ (Rest of the world: US\$ 200/ or equivalent)
- Institutions: In India, Rs. 5000/ (Rest of the world: US\$ 400/ or equivalent)
- We Accept: Bank Cheque / Demand Drafts (Add Rs. 50/- for outstation Cheques)
- The Scope of the Journal covers all aspects of Forensic Medicine and allied fields, research and applied.

Subscription orders and payments should be made in favour of "Editor IAFM, payable at Chandigarh"

From the Editor's Desk

JIAFM A Quarterly Publication Volume 39, Number 3, July - September, 2017

Dear Friends,

It gives me great pleasure to present the third issue of year 2017 to the Hon'ble Members of the Academy. The members of the Editorial Board strive hard in their endevour to bring up the starrndard of the journal. Every member does this task in addition to his professional job and commitments.But, as we have promised you, we are not leaving any stone unturned. We hope that you enjoy and like this Academic Feast as you have enjoyed the previous ones.

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

Jai Hind & Long Live IAFM

Dr. Dasari Harish Editor

Claims for missing issue

A copy will be sent free to the member / subscriber provided the claim is made within 2 months of publication of the issue & self addressed envelop of the size 9+x 12+is sent to the Editor. (Those who want the journals to be dispatched by Registered Post must affix Rs. 50/ worth postage stamps).

Corrigendum

 In the previous issue, in the Photographs Section, it was inadvertently written that Dr. Hasumati Patel was conferred the Life Achievement Award. She was Awarded Fellowship of the Academy and Dr. Sheikh Khaja was awarded Lifetime Achievement Award.

The Editorial Board sincerely regrets this inadvertent mistake.

2. **Dr. Yogender Bansal**, Prof., Department of Forensic Medicine & Toxicology, PGIMER, Chandigarh, is Member, Executive Committee from North.

His name was not included in the list of Executive Members in the Governing Council of the Journal. His name has now been included.

The Editorial Board sincerely regrets this inadvertent mistake.

Editorial

Young Pregnant Mothers -Problems and Medico-legal Implications

¹Dasari Harish, ²Ajay Kumar

Abstract:

In the recent years, the reporting of early pre-teen pregnancy as a result of %ape+is on the rise. In some cases, courts allow termination, but in the others, the young girl is forced to carry on the unwanted %pregnancy+to the full term. The recent case of the 10½ yrs old girl, who underwent caesarean section at 35 - 36 weeks in our institute, is still fresh in the minds of the people. A similar case had come to PGIMS Rohtak in May this year, where a 10 year old girl was repeatedly raped by her step-dad, but she was lucky that her pregnancy was detected to be between 18 to 22 weeks and hence underwent MTP.¹ In this paper we will be discussing on the physical challenges and various other legal aspects of continuing the pregnancy in such young girls to the full term if termination is denied to the survivor of sexual assault.

Key words: Adolescent Pregnancy, Small Pelvis, Complications, Criminal Law Amendment Act, POCSO Act

Introduction:

Adolescent Pregnancy is defined as pregnancy in a girl between 10 -19 years. This age group is further divided in to 10 -14 years and 15 - 19 years.² As per available literature, about 16 million girls aged 15 to 19 and some 1 million girls under 15 give birth every year mostly in low and middle-income countries. Complications during pregnancy and childbirth are the second cause of death for 15-19 year-old girls, globally. Every year, some 3 million girls aged 15 to 19 undergo unsafe abortions. Babies born to adolescent mothers face a substantially higher risk of dying than those born to women aged 20 to 24.³

In India, teenage pregnancy accounts for 18 - 20 % of the total pregnancies, majority of them being married women. Adolescent deliveries in the hospital are about 4 - 6 %.⁴ Young primiparas, aged 15 years or less at the time of delivery form an important obstetric entity in view of increased hazard to both mother and

Corresponding Author:

²Associate Professor,

¹Professor & Head, Editor J Ind Acad For Med,

Dept. Forensic Medicine & Toxicology, Government Medical College & Hospital, Chandigarh the infant. Meticulous prenatal care and close observation should be employed to safeguard both the mother and the infant.⁵

Pregnancy & Abortion:

Pregnancy is a condition of having a developing embryo or fetus in a female, when an ovum is fertilised by a spermatozoa.⁶ It is most likely to occur between the ages of 14-45 years,⁷ and is a matter of joy in the family; but problems arise when pregnancy occurs in very young and unmarried girls as a result of sexual assault. The heinous act of %ape+ and the unforeseen developments related to it, typically throws the lives of young girls into turmoil, at least for a particular time period. It forces the girl and her parents to make perhaps some of the most agonizing decisions of their life. Whether she carries the baby to term, as 50 percent of pregnant teenagers elect to do, or should she terminate the pregnancy (abort the foetus) is the most important question to be answered by them.8

The term 'abortion' is derived from the Latin word 'aboriri', which means "to miscarry" or 'abortio', which in the 16th century, was brought to use in the English language.⁹ Legally, abortion or miscarriage means the premature

expulsion of the foetus from the mother's womb at any time of pregnancy, before full term.⁶ This is also referred to as 'termination of pregnancy'.

In India, the termination of pregnancy is governed by the MTP Act 1971.¹⁰ The MTP Act provides for abortion up to 20 weeks of gestation period. The problem arises if the legal time period for procuring the abortion as per MTP Act has passed as the Act does not allow abortions beyond 20 weeks of gestation, except in cases where continuation of pregnancy poses an immediate danger to the mothers life. Any person/ doctor breaching the provisions of the said Act would invite imprisonment up to seven years.¹⁰ In the exceptional life threatening cases, the doctor is immune to any proceedings under the law. Pregnancy as a result of rape results in such a mental trauma as would warrant its termination - Humanitarian Ground.¹¹

Pelvis in the young:

The pelvis is formed by the sacrum and coccyx [the axial skeleton] and the pelvic girdle, which is made of two innominate bones [apendicular skeleton].¹² The innominate bone itself is made of three bones, the ilium, ischium and the pubis, which fuse during puberty. The ramus of ischium and pubis fuse by 6 - 7 years, the centre for ossification of the triradiate cartilage appears by the 13 years and all the three bones fuse by around 15 years to form the acetabulam, the iliac crest appears by 14 years and the ischial tuberosity by about 15 - 16 years. The five sacral segments remain separate till puberty and ossification of intervertebral discs starts from below upwards with the onset of puberty and is complete by about 20 -25 years.¹³ All the above form the very important part of the 'Birth Canal'. Both the pelvic inlet and the outlet are not properly developed in such a young age and pregnancy with its related stress and strain on the musculo-skeltol system might result in disruption of the same.

Pregnancy in the young:

The growth of the fetus inside the uterus in the immature pelvis of a young girl is a challenge. Pregnancy in very young girls, before the complete fusion of ossification of triradiate cartilage, may result in dislocation and displacement of the constituent bones of the triradiate cartilage. If due to the pressure of the developing fetus the secondary ossification centres get displaced, then the new bone formation will get affected and will result in permanent disability and morbidity.

The growth and development of four dimensions of the pelvic birth canal was analyzed in one study and a longitudinal sample of 90 well-nourished girls aged 8 through 18 was undertaken in the study. As per the results, the pelvic basin grows more slowly and continuously through late adolescence as compared with stature growth of the subjects. Similarly, size of the birth canal was smaller in the first 3 years past menarche than at age 18. At low gynecologic ages, a significantly greater percentage of growth to adult size is required in the pelvis as compared to stature, and growth of the birth canal continues beyond the asymptote for statural increase. The pelvis was smaller and less mature among girls with early menarche than among girls with late menarche at the same menarcheal ages. These results indicate that immaturity of the birth canal of the pelvis may have significance for obstetric risks among young teenage primiparous girls.¹⁴

The pubic symphysis is a nonsynovial, fibrocartilaginous, midline joint that connects the superior pubic rami. The joint is reinforced by four ligaments: the superior, inferior, anterior, and posterior pubic ligaments. The interpubic cartilaginous disc and the anterior pubic ligament are the most important structures maintaining stability of the joint. The physiologic width of the normal cleavage differs with age, ranging from 10 mm at the age of 3, to 6 mm at 20 years of age, to 3 mm at 50 years of age.¹⁵ Women have a greater thickness of the fibrocartilaginous disk, which allows more mobility of the pelvic bones, providing for a greater pelvic diameter to facilitate childbirth. Contrary to this the young primigravida has narrow width and so a lesser pelvic diameter which hinders the normal childbirth.

During pregnancy, under the influence of hormones, particularly relaxin, the gap in the symphysis pubis can increase by at least 2-3 mm.¹⁶ During labor or just after the labor, when the patient is out of anaesthesia the pubic symphysis diastasis occurs, i.e, the separation of the right and left pubic rami occurs and it may increase to a width of greater than 10 mm.¹⁷ This may result from rapid or prolonged vaginal birth or assisted forceps delivery, or it can occur prenatally. If there is complete separation or a traumatic tear, the joint will be completely unstable and the tear can sometimes be heard by women.¹⁸ The lack of clinical trials makes determining a recommendation for a specific conservative method to manage Symphysis Pubis Diastasis (SPD) difficult. Bed rest in the lateral decubitus position and a pelvic girdle are the most extended conservative methods in SPD management. Individualized physiotherapy including progressive mobilizations and stretching as well as lumbopelvic and pelvic-floor strengthening and stabilizing exercises might help manage SPD symptoms and their maintenance over time. The majority of women tend to have complete resolution of signs and symptoms, and surgical treatment is suggested only for those women who remain symptomatic after a long follow-up.¹⁹

Some of the other morbid conditions associated with young pregnancy are the pelvic floor injuries, pubic bone injuries, sacral fractures and pregnancy associated pelvic girdle pain (PPGP) injuries. If normal delivery is attempted in such young girls then any one of the above mentioned injuries are possible. The other complications could be pre-eclampsia, preterm labour, severe mental depression, suicidal tendencies, fetal distress, SIDS, low birth weight, etc.²⁰

Discussion:

Cases of teenage and pre-teen pregnancies are on the rise, now-a-days. The age for consent to sexual intercourse has been raised to 18 years, as per the Criminal Law Amendment Act, 2013.²¹ If the girl is married, the consenting age is the same as before, that is, 15 years. This implies that sexual intercourse with a girl less than 18 years is rape, even with her consent - the so called "statutory rape".

Young girls, who have just attained puberty or attaining puberty, are so innocent as to be unaware of what the perpetrators of the crime (rape) are doing to them, as most of these people are their relatives/ neighbours/ acquaintances of the family and hence, enjoy a relation of trust with the child. This, is what is abused by them in their quest for satisfaction of their lust. The POCSO Act²² has viewed this type of sexual violence as a more serious and grave offence and has coined the term, 'Aggravated sexual offence' to describe them.

In India, medical termination of pregnancy can be performed up to 20 weeks of gestation period. After this, the patient has to approach the courts for relief. In certain cases, the Hon'ble Supreme Court has allowed termination up to 24 weeks gestation period.²³ As per the draft bill of amendment of the MTP Act, 2014, the gestation period for termination has been raised to 24 weeks.²⁴ Studies have also shown that certain neural and cardiac anomalies can only be diagnosed after 20 weeks.²⁵

According to one study, all teenage groups were associated with increased risks for pre-term delivery, low birth weight and neonatal mortality. Infants born to teenage mothers aged 17 or younger had a higher risk for low Apgar score at 5 min. Restricting the analysis to white married mothers with age-appropriate education level, adequate prenatal care, without smoking and alcohol use during pregnancy yielded similar results.²⁶ Teenage mothers face the possibility of premature labor, or labor that starts before 37 weeks gestation. Physically, teenage mothers have immature reproductive organs that may not be prepared to carry an infant to term. A 2002 study concluded that an immature cervix and metabolic system play a role in causing preterm birth in teen moms.²⁷

In one study, a total of 309 pregnant women were recruited from May 1 to June 30, 2016 with mean age \pm standard deviation was 28.4 \pm 5.86 years. The incidence of low back pains (LBPs) and pelvic girdle pains among the pregnant women was 106 (34.3%) and 178 (57.6%), respectively. The pain was severe among 26 (9.2%) pregnant women, which warranted analgesic usage. Pain radiation was reported in> 50% of cases. There was an incidental finding of urinary incontinence in 36 (12.6%) cases. Low back/pelvic girdle pain was not associated with body mass index (BMI) (P = 0.390).²⁸ It can be inferred from the fact that when well developed adult female pelvis has such high incidences of low back pains (LBPs) and pelvic girdle pains, the immature pelvis of the young primigravidas would have much higher incidence of the same.

Sometimes intrapartum sacral stress fracture due to pregnancy-related osteoporosis can occur in very young primigravida. Pregnancy itself will result in osteoporosis which may lead to fracture during vaginal delivery. Sacral fractures during pregnancy and postpartum period, especially resulting from childbirth, are very rare. To date, there are two cases in the literature. In cases who even do not have risk factors related to vaginal delivery such as high birth weight infant and the use of forceps, exc., sacral fracture should be considered in the differential diagnosis of LBP and hip pain started soon after child birth.²⁹

The incidence of pregnancy-related osteoporosis is unknown and the mechanisms of pregnancy-related osteoporosis is also unclear.30 Several possible mechanisms had been suggested. First, calcium deficiency and hypoestrogenemia can give rise to bone mineral loss in pregnant or lactating women.³¹ Calcium is needed for fetal growth and lactation. To meet the increased demands for calcium during fetal development, especially the third trimester of pregnancy, the maternal intestinal absorption of calcium doubles. Even with calcium homeostasis during pregnancy, loss of BMD in the spine and hip can occur.³² More, et al.,³³ found that all markers of bone turnover increased during normal pregnancy and failed to reach baseline level by 12 months postpartum.

Pregnant women with pregnancyinduced hypertension (PIH) or preterm labor need specific treatment, such as magnesium sulfate injection or prolonged bed-rest. These can lead to stress or fatigue fractures during delivery.³⁴ The treatment of choice in majority of the teen pregnancies is the C section as compared to the normal vaginal delivery, However, the scar of the C section will keep on reminding them of the ugly incident and its associated trauma.

Conclusion:

Pregnancy in the young is fraught with number of complications and hence it is termed as a high risk pregnancy. The incidence of such cases is also increasing day by day. Meticulous planning, constant monitoring of the young mother for any complications, both to her and her child, proper decision making as to when and whether to go in for Caesarean section, proper nutrition of the young mother, etc are some of the important aspects that have to be taken care of for the safety and well being of the mother and the child.

Then again, certain studies have shown that biologic "immaturity" does not appreciably affect the reproductive performance of the adolescent and the likely hood of "operative deliver" is not increased.^{35,36}

Acknowlegment:

"This article is being reproduce from the North State Journal of Anatomy with due permission from the Editor"

References:

- https://www.thequint.com/women/2017/07/19/10-yearold-girl-denied-abortion-after-rape. Accessed on 14th August 2017.
- Treffers PE. Teenage pregnancy, a worldwide problem.[Dutch]. Ned Tijdschr Geneeskd. 2003;147:2320-5. As quoted by James DK, Steer PJ, Weiner CP, Gonik B. High risk pregnancy management options. III rd Ed. Saunders Elsevier. 2006:27-9.
- 3. http://www.who.int/mediacentre/factsheets/fs364/en/. Accessed on 14th August 2017.
- 4. Sharma JB. Text book of obstetrics. 1st. Ed. Avichal Publishing. Kala Amb, Himachal Pradesh. 2014:599
- The young primipara A H. Mohammed Hassan, Frederick H. Falls, Clinical study January 15, 1964 Volume 88, Issue 2, Pages 256. 269.
- Reddy KSN, Murty OP. The Essentials of Forensic medicine and toxicology. 33rd Ed. The Health Sciences Publishers. New Delhi. 2014. p. 392-400
- Biswas Gautham. Review of Forensic medicine & toxicology. 2nd Ed. Jaypee Brothers Medical Publishers Pvt. Ltd. New Delhi. 2012 pp:313.
- healthy children.org https://www.healthychildren.org/English/agesstages/teen/dating-sex/pages/Teenage-Pregnancy.aspx. Accessed on 14th August 2017.

ISSN 0971-0973

- https://www.google.co.in/search?rlz=1C1CHBF_enIN75 3IN754&q=origin+of+the+word+abortion&oq=origin+of+ the+word+abortion&gs_l=psyab.3..0j0i22i30k113.75873.85790.0.86415.27.27.0.0.0.0. 392.5369.0j7j16j1.24.0...0...1.1.64.psyab..3.24.5362...35i39k1j0i131k1j0i67k1j0i20k1.Geqquo DPmfQ. Accessed on 14th August 2017.
- The Medical Termination of Pregnancy Act, 1971; Act 34 of 1971. Available at: http://tcw.nic.in/Acts/MTP-Act-1971.pdf. Accessed on 14th August 2017.
- Kumar A, Harish D, Singh A: Increasing the limits of gestation period as prescribed in the MTP Act 1971 in light of the recent Supreme Court judgements. J Ind Acad For Medicine, 2016;38(4):389-92.
- https://embryology.med.unsw.edu.au/embryology/index. php/Musculoskeletal_System_-Pelvis_Development. Accessed on 14th August 2017.
- Vij K. Textbook of Forensic medicine and toxicology. Principles and practice. 6th Ed. Elsivier IndiaPvt. Ltd. 2014. pp 41.
- Marquisa LaVelle Moerman Growth of the birth canal in adolescent girls. Am J Obs Gynecol. 1982; 1982;143(5): 528-32.
- Pedrazzini A, Bisaschi R, Borzoni R, Simonini D, Guardoli A. Post partum diastases of the pubic symphysis: a case report. Acta Biomed 2005 Apr.;76(1):49. 52.
- Jain S, Eedarapalli P, Jamjute P, Sawdy R. Symphysis pubis dysfunction: a practical approach to management. The Obstetrician & Gynaecologist. 2011;8(3):153-158.
- Cowling PD, Rangan A. A case of postpartum pubic symphysis diastasis (SPD). Injury 2010 Jun.;41(6):657. 659.)
- Khorashadi L, Petscavage JM, Richardson ML. Postpartum symphysis pubis diastasis. Radiology Case Reports. 2011;6(3):29-31.
- Diastasis of symphysis pubis and labor: Systematic review. https://scholar.google.co.in/scholar?q=diastasis+of+sy mphysis+pubis+and+labor+systematic+review&hl=en& as_sdt=0&as_vis=1&oi=scholart&sa=X&ved=0ahUKEwi c6PqzIfTVAhVGQ08KHTYuCOUQgQMIJTAA. Accessed on 14th August 2017.
- 20. Sharma JB. Text book of obstetrics. 1st. Ed. Avichal Publishing. Kala Amb, Himachal Pradesh. 2014:599.
- 21. The Criminal Law Amendment Act, 2013. Act 13 of 2013.
- 22. The Protection of Children from Sexual Offences Act, 2012.Act 32 of 2012.

- Barwa J, Singh A, Kumar A, Harish D. Revising the current mtp act: hasn't the time come yet??. JIAFM 38(4):499-502.
- http://www.prsindia.org/uploads/media/draft/Draft%20M edical%20Termination%20of%20Pregnancy%20Amend ment%20Bill%202014.pdf. Accessed on 14th August 2017.
- Todros T, Capuzzo E, Gaglioti P. Prenatal diagnosis of congenitalanomalies. Images Paediatr Cardiol. 2001;3(2):3-18.
- Xi-Kuan Chen, Wen SW, Fleming N, Demissie K, Rhoads GG, Walker M. Teenage pregnancy and adverse birth outcomes: a large population based retrospective cohort study. Int J Epidemiol. 2007;36 (2):368-73.
- 27. http://www.livestrong.com/article/96985-complicationsteenage-pregnancy/. Accessed on 14th August 2017.
- Usman MI, Abubakar MK, Muhammad S, Rabiu A, Garba I. Low back pain in pregnant women attending antenatal clinic: The Aminu Kano teaching hospital experience. Ann Afr Med. 2017;16(3):136-40.
- Oztürk G1, Külcü DG, Aydo E. Intrapartum sacral stress fracture due to pregnancy-related osteoporosis: a case report.. Arch Osteoporos. 2013;8:139. https://www.ncbi.nlm.nih.gov/pubmed/23615864. Accessed on 14th August 2017.
- Ka Yeong Yun, Si Eun Han, Seung Chul Kim, Jong Ki, Kyu Sup Lee. Pregnancy-related osteoporosis and spinal fractures. Obstet Gynecol Sci. 2017;60(1):133-7.
- Holmberg-Marttila D, Sievanen H, Tuimala R. Changes in bone mineral density during pregnancy and postpartum: prospective data on five women. Osteoporos Int. 1999;10:41. 46.
- Tsvetov G, Levy S, Benbassat C, Shraga-Slutzky I, Hirsch D. Influence of number of deliveries and total breast-feeding time on bone mineral density in premenopausal and young postmenopausal women. Maturitas. 2014;77:249. 254.
- More C, Bhattoa HP, Bettembuk P, Balogh A. The effects of pregnancy and lactation on hormonal status and biochemical markers of bone turnover. Eur J Obstet Gynecol Reprod Biol. 2003;106:209. 213.
- Clemetson IA, Popp A, Lippuner K, Ballmer F, Anderson SE. Postpartum osteoporosis associated with proximal tibial stress fracture. Skeletal Radiol. 2004;33:96. 98.
- 35. Mc Anarney ER. Young maternal age and adverse neonatal outcome. Am J Dis Child 1987;141:1053-9.
- Sukanich AC, Rogers KD, McDonald NM. Physical maturity and outcome of pregnancy in primiparous women younger than 16 years of age. pediatrics. 1986;78:31-6.

Original Research Paper

Profile of Death due to Road Traffic Accidents (RTA) in Urban Region of Uttar Pradesh, India

¹Anuj Gupta, ²Alok Kumar, ³Prachi Gupta

Abstract:

Road Traffic Accident (RTA) is one of the leading causes of morbidity & mortality in modern world, especially in the developing countries like India. In India alone, over 1,37,572 persons died in road traffic crashes and 4,94,893 injured in about 4,86,476 registered RTA in 2013. This is an autopsy based study in Agra region to study the profile of fatal road traffic accident and to identify preventable causes. During study period of one year (February 2012 to January 2013); 450 cases with unambiguous cause of death due to RTA were studied in detail. The study shows that most of the victims of RTA were male (86.7%) and in the age group 21-30 years (26.9%). Most accidents occurred on highways (58.7%) and in the month of June (10.4%). Most accidents happened during morning and evening rush hours. Our study found the pedestrians to be the majority of victims (28.7%) and heavy motor vehicles as the leading offending vehicles (39.8%). Fatal head injuries were seen in 50.4% of death. 45.3% victims couldn't avail any kind of medical aid, timely. This study emphasizes that interventions in RTA should include combined efforts from the community, private sector, governmental and non-governmental organizations.

Key Words: Road traffic accidents, Fatalities, Socio-demographic profile, injuries

Introduction:

A road traffic injury (RTA) is a fatal or non-fatal injury incurred as a result of a collision on a public road involving at least one moving vehicle.¹ RTA caused death of about 1.25 million people, injured another 20.50 million people non-fatally in 2013 worldwide.² Road traffic injuries are the leading cause of death among young people, aged 15-29 years.² Ninetypercent of road traffic deaths occur in low and middle income countries, while these countries, which hold 82% of the world**q** population, contain only 54% of the world**q** registered vehicles.²

Corresponding Author:

²Professor & Head,
 ¹Assistant Professor,
 ³PG Trainee,
 Department of Forensic Medicine & Toxicology,
 UPUMS, Saifai, Etawah

E. mail: drsalok@rediffmail.com. LM No. : LM / IAFM /555 DOR: 27/05/2016 DOA: 19/06/2017 DOI: 10.5958/0974-0848.2017.00044.6

While the global rate for road traffic deaths is 17.4 per 100 000, there is great disparity by income, with rates more than twice as high in low - and middle - income countries than in the worldos high income countries Half of those dying on the worldos roads are vulnerable road users i.e. pedestrians, cyclists and motorcyclists. Road traffic injuries are currently estimated to be the ninth leading cause of death across all age groups globally, without action; road traffic crashes are predicted to rise to become the 7th leading cause of death by 2030.³ They account for about 38 million disability-adjusted life years (DALYs) lost worldwide.⁴ Road traffic deaths and injuries globally costs approximately 3% of GDP; in low and middle - income countries it is estimated to cause losses of up to 5% of GDP economy loss.³ In such a scenario, it can be considered as a growing epidemic. In 2010, the UN General Assembly adopted Resolution 64/255 to establish the Decade of Action for Road Safety (2011. 2020).²

India is considered as a middle income group country and has reported about 1,37,572 deaths and 4,94,893 injured persons in about 4,86,476 registered RTA.⁵ These numbers translate into one road accident every minute, and one road accident death every four minutes. Of the deceased, 85% were male and 15% Female. RTA accounted about 39.6 injured people per laky population. ⁵ In 2013 Uttar Pradesh reported 30,615 RTAs (6.3% of India; 7th highest), with 16004 (11.6%) deaths. UP has 4.7% of total injured persons due to RTA.⁵

RTA continues to be a growing problem worldwide. The present study was conducted to find out various socio demographic factors prevailing during fatal RTAs and to point out preventable triggering factors and to identify measures for better management in critical hours of need

Aims and Objectives:

- 1. To study the Socio-economical Profile of victim of fatal road traffic mishaps in Agra region.
- 2. To study the various prevailing factor during fatal accidents like type of vehicle involved, time, place, conditions of person and road during mishap.
- 3. To identify and suggest preventable and protective measures, which may affect the outcome of mishap.

Materials and Methodology:

Present study was an autopsy based study carried out at the Mortuary of S.N. Medical College, Agra for period of one year from 01-02-2012 to 31-01-2013. Only cases with clear inference of death due to Road traffic mishap were included in study. A detailed Performa was prepared to record history, socio-demographic data, injuries. prevailing conditions and preventive measures etc. Information for the study was gathered from inquest report, dead body challan along with interview of the police personnel, relatives, friends and neighbors accompanying the deceased. The information thus collected was statistical analyzed. Ethical clearance was taken from the institutional Ethics Committee.

Observations:

During the study period, a total of

2027 medico legal autopsies were conducted, of which 522 (25.8%) were of alleged RTA. 450 (22.2%) cases with clear inference were included in study. Of these, 390 (86.7%) were male. Most commonly affected were people of age group 21-30 years, 121(26.9%) cases; followed age group 31-40 years, 100 (22.2%) cases (**Table - 1**)

Majority of the fatal accidents were found to occur on highways, accounting for 264 (58.7%) deaths, followed by 78 (17.3%) cases on village roads & traffic on city roads caused 77 (17.1%) deaths. (**Table - 2**)

Maximum casualties were observed in the month of June, 47 (10.4%) cases, while months of October & November witnessed least no. of fatal accidents - 30 (6.7%)cases, each. (**Table -3**)

Maximum number of incidence was observed during rush hour between 6.00 p.m. to 8:59 pm with 81 (18%) casualties, followed by morning hours between 09:00- 11:59 hour with 75(16.7%) casualties. Least number of incidents was found to occur during midnight hours between 00:00-2:59AM with 26 (5.8%) deaths. (**Table-4**)

Majority of the victims were pedestrians, 129 (28.7%) cases, followed by 116 (25.8%) victims who were riding light motor vehicle (car, jeep etc.). Occupants of motorized two wheeler (motorcycle, scooter etc.) constituted 104 (23.1%) cases, where as bicyclist were 32 (7.1%) cases. Combining together motorized two wheeler and bicycle occupants, total two wheeler occupants constitutes 136 (30.2%) cases, outnumbering pedestrians as most common group of victim. (**Table 5**)

Most common offending vehicles were the heavy motorized group like trucks, buses etc., causing 179 (39.8%) fatalities, followed by light motor vehicle (cars, jeeps etc.) 139 (30.9%) cases, while medium motor vehicle like tractors, pickup truck etc. were responsible for 37(8.2%) cases. (**Table 6**)

Again, 204 (45.3%) victims died 'on the spot' or before being brought to any trauma or medical care center, followed by 114 (25.3%) victims who died within 6 hrs of beginning receiving treatment. (**Table - 7**)

Isolated head injury has been found to be leading cause of death with 227 (50.4%) fatalities, In combination with other systemic injuries, head injury proved fatal in 335 (74.4%) cases; around 149 (33.1%) victims received fatal thoracic injuries and 142 (31.6%) received fatal abdominal injuries. Multi systemic injuries cause death to 71(15.8%) victims. (**Table - 8**) Among Pedestrians, 94 (72.9%) receive fatal head injury; of them, 73 (56.6%) received isolated fatal head injury. Among cyclists, 26 (81.2%) received fatal head injury and of them, 19 (59.4%) received isolated head injury. Isolated head injury caused death among 69 (66.3%) motorized two wheelers. (**Table - 8**)

Discussion:

Road traffic accidents caused death of about 1.25 million people while another 20.50 million people were injured non-fatally in 2013 worldwide.² Road traffic injuries are the leading cause of death among young people, aged 15. 29 years.² Ninety-percent of road traffic deaths occur in low- and middle-income countries, while these countries holds 82% of the world**q** population contains only 54% of the world**q** registered vehicles.^{2,3}

Half of those dying on the world¢ roads are vulnerable road users i.e. pedestrians, cyclists and motorcyclists. Road traffic injuries are currently estimated to be the ninth leading cause of death across all age groups globally, without taking any action, road traffic crashes are predicted to rise to become the 7th leading cause of death by 2030.³ They account for about 38 million disability-adjusted life years (DALYs) lost worldwide.⁴ Road traffic deaths and injuries globally costs approximately 3% of GDP, in lowand middle-income countries it is estimated to cause losses of up to 5% of GDP economy loss.³

In the present study, males [390 (86.7%)] constituted the majority of cases, the male to female ratio being 6.5:1. Singh H, et al^7 observed a male: female ratio of 9:1; as per Chaudhary, et a, l^8 it was 4.9:1, as per Menon, A et al,⁹ there was marked male preponderance in road accidents, and, as per Arvind K, et al,¹⁰ it was 7.49:1. The reason for this is probably due to the social structure where most of the outside

work are usually carried out by male and tendency of male to overlook traffic rules, rash driving, alcoholism and aggressiveness etc..

Age group most commonly involved in both sexes was 21. 30 years with 121 (26.9%) cases, followed by 31-40 years with 100 (22.2%) cases. This is in agreement with the observations of other workers.^{7,11,12}

In the present study, majority (58.7%) of the fatal accidents occurred on highways, followed village roads & city roads, respectively. Similar finding were made by Singh P.K. et al,¹³ Singh H, et al.⁷ Annual report by TRW also showed that, in 2012, majority of mishaps occurred on National highways (29.1% of total accidents & 35.3% fatal accidents) and state highways (24.2% of total accidents & 27.3% of fatal accidents) in India.¹⁴ This is due to the fact that Agra, being a major tourist spot, is well connected by State & National highways No: 2, 3, 11, 91 & the recently constructed Yamuna Expressway. They provide opportunity to young people to drive at high speeds, so they frequently meet with fatal accidents. On the other hand, city streets are too congested for high speed driving, so fatal accidents are less common there.

Present study show that the maximum number of accidents took place during the summer month of June (10.4%). Data by NCRB also concludes that most of RTA took place in summer month of May-July.¹⁵ Similar trend has been observed by of Asharam and Das Gupta,¹⁶ who reported that most of accidents took place in the months of summer followed by October and November. This could be attributed partly to driver`s fatigue and heat exhaustion while driving the long distances in the tropical heat and partly to the fact that these are also the vacation months eventuated by increased movement of people from one place to another.

Again, most of the fatal RTA were found to have occurred during evening hours from 18:00 to 20:59 (18% of cases) and morning hours from 09:00 to 11:59 hours as it is rush hour too for people go to their work places and schools/colleges. Similar trend was mentioned by study conducted by Singh H, et al.⁷ National crime record bureau`s data also concludes that most of the road traffic accidents in Uttar Pradesh occurred between 18:00 hrs to 20:59 hours (3620;14.8%), followed by cases between 15:00 to 17:59 hrs (3619; 14.8%).¹⁵ Similar observations were made by Singh. D, et al,¹⁷ who mentioned maximum fatal mishaps during evening time between 4pm-8pm (28%), followed by 8pm-12am (21.7%). Swapnil P, et al¹⁸ also mentioned similar observations.

We observed that majority of the victims were pedestrians, 129 (28.7%) cases, followed riders of LMVs and motorized two wheelers. Similar observations were made by Kyada HC, et al,¹⁹ who mentioned that majority of victims were pedestrians (33.9%), followed by occupants of heavy four wheelers, (23.2%) and occupants or drivers of two wheelers (22.2%). Singh PK, et al²⁰ stated that pedestrians constituted the majority of victims (37.6%), followed by vehicular occupants (28.3%) and two wheeler riders (18.1%)

In the present study, the most common offending vehicles were found to be heavy ehicles like trucks, buses, etc., followed by light motor vehicle (cars, jeeps etc.) Singh PK, et al²⁰ stated that trucks were the frequent offending vehicles (34.6%), followed by buses (22.9%) and LMVs (20%).

Conclusion:

Our study show that the problem of RTA and injuries is growing both in absolute number and relative term. Road safety is a multispectral and multidimensional issue, requiring attention from various aspect i.e. personal, governmental and social level

- Personal level:

- Education of the children to follow traffic rules from school level to be acquired in habit level.
- Proper and regular training of drivers for regular licensing.
- Training of drivers of commercial vehicles in basics of first Aid.

Govt. should

 make policy to allow only vehicles which follow latest safety norms like latest safe multisafety sited airbag, child seat etc.

- Strengthen infrastructure to create better pothole free road which should be illuminated at any time, in any weather.
- Regular training of the traffic law enforcers for better traffic and emergency management.
- equip law enforcers with modern electronic gadgets like camera, speed gun, breath alcohol analyzer etc. to record & keep strict check on implementation of traffic rules like speed limit, helmet, seat belt wearing, alcohol consumption, overloading, overcrowded vehicles etc.
- make effective provision to segregate fast moving traffic from slow moving vehicles and pedestrians.
- Create system for ensuring rapid availability of medical emergency services to victims road accident victims
- Create nationwide uniform emergency service call number.
- Impart specialized training of medical/paramedical professionals to take care of person injured in RTA in hour of critical need.
- make provision to take out outdated unsafe vehicles.
- Categorization of roads according to road quality for speed
- Promote education and awareness among common people to follow traffic rules.
- Promote educating common people to act and help others in case of emergency
- Establish multipurpose traffic control room system for recording and managing road jam, congestion, crime, speeding vehicles, accidents and emergencies.

Social-

- Mass media should volunteer and educate for road safety.
- schools should schedule regular classes or workshop to educate children about traffic rules, safe driving and basic first aid
- Youth should voluntarily involvement in various social programmes for awareness of common masses accidents.
- vehicle industries should invest for development of safer vehicles with better on

board first aid, emergency warning and alarm system.

- vehicle industries should volunteer for road safety and basic first aid educational funds.
- People should avoid illegal, overloaded, overcrowded public transportation.

Conflict of interest: None Financial assistance: None

References

- 1. Available from: www.who.int/topics/injuries_traffic/en/ . Accessed on 20 April 2017
- 2. Global status report on road safety 2015; World Health Organization; pg 2-4.
- http://www.who.int/violence_injury_prevention/roa d_safety_status/2015/en/. Accessed on 20 April 2017.
- World Health Organization. Road Traffic Injuries Fact Sheet No.358. Factsheet reviewed November 2016. Available from:
- 5. http://www.who.int/mediacentre/factsheets/fs358/ en/. Accessed on 20 April 2017.
- 6. The global impact Chapter 2. World report on road traffic injury prevention. http://www.who.int/violence_injury_prevention/pu blications/road_traffic/world_report/chapter2.pdf . Accessed on 20.04.2017
- Road Accidents in India 2013; government of India Ministry of road transport & highways Transport research wing new Delhi. Available at www.morth.nic.in/showfile.asp?lid=1465 ; Pg 1-2. Accessed on 20.04.2017
- Road Accidents In India 2012; Transport Research Wing (TRW), Ministry of Road Transport and Highways; Pg2 Available at: http://:morth.nic.in. Accessed on 2nd Feb 2017
- Singh H, Dhattarwal SK. Pattern and distribution of injuries in fatal road traffic accidents in Rohtak (Haryana). J Ind Acad For Med. 2004;26(1):20-3.
- Choudhary BL, Singh Deepak, Tirpude BH, Sharma RK, Meel Veena. Profile of road traffic accidents cases in kasturba hospital of mgims, sevagram, wardha, maharashtra, india. Medico Legal Update. 2005;5(4):1-12.
- 11. Menon A, Pai VK, Rajeev A. 'Pattern of fatal head injuries due to vehicular accidents in

Mangalore'; J Forensic Leg Med. 2008; 5(2):75-7.

- Arvind K, Sanjeev L, Deepak A Ravi R, Dogra TD. Fatal road traffic accidents and their relationship with head injuries: An epidemiological survey of five years. Indian J Neurotrauma. 2008;5(2):63-7
- Palimar V, Arun M, Singh B, Mohanty MK. Victimologic study of road traffic fatalities. Medico Legal Update. 2004;4(1):91-3.
- Kachre RV, Kachre VH, Asawa SS. Pattern of vehicular accidents in pravera region: a rural region of ahmadnagar district of maharashtra. J For Med & Toxicol. 2003;20(2):29-32
- Singh PK, Slong D, Devi TM. Pattern of road traffic accidents in imphal. J Ind Acad For Med. 2012;34(4):301-3.
- Road accidents in india 2012; government of india ministry of road transport & highways transport research wing new Delhi; Pg-19; available at www.morth.nic.in.
- 17. Accidental deaths and suicidesIn india 2013; National Crime Records Bureau, Ministry of Home Affairs, Government of India. Available at
- ncrb.nic.in/StatPublications/CII/CII2013/Home.as
 p
- Asharam, Gupta D. A study of injuries in fatal road traffic accident cases occurring in Varanasi area.1973 Deptt. of Forensic Med. B.H.U. ,Varanasi.
- Singh D, Moorthi K, Singh SP, Goel S. Profile of road traffic fatalities in adults a 40 year study in chandigarh zone of north west india. J Ind Acad For Med. 2014;36(1):47-51.
- Swapnil P. Akhade, Kiran R. Rohi, Manoj B. Parchake, Rajesh V. Kachare, Sunil Kadam, Chandrakant R Dode. Socio-demographic profile of head injury victims of fatal vehicular accidents in semi urban region of maharashtra.; J Ind Acad For Med. 2015;37(2):119-23.
- Kyada HC, Mangal HM, Momin SG, Vijapura MT, Bhuva SD. Profile of fatal road traffic accidents in rajkot city. J Ind Acad For Med. 2012; 34(2):135-8.

 Table 1 - Distribution of cases according to age & sex

	Age	Mal	е	Ferr	nale	Tot	al
S.No.	group (in vears)	No. of	%	No. of	%	No. of	%
1	0-10	26	67	5	83	31	6.9
2	11-20	74	19	10	16.7	84	18.7
3	21-30	107	27.4	14	23.3	121	26.9
4	31-40	88	22.6	12	20.0	100	22.2
5	41-50	44	11.3	10	16.7	54	12.0
6	51-60	27	6.9	5	8.3	32	7.1
7	61-70	20	5.1	4	6.7	24	5.3
8	71-80	4	1.0	0	0	4	0.9
9	>81	0	0	0	0	0	0
Т	otal	390		60		450	

Table 2-Distribution of cases according to place of accident

S.No.	Place of accident	No. of cases	%		
1	Highway	264	58.7		
2	City roads	77	17.1		
3	Village roads	78	17.3		
4	Other place	31	6.9		
	Total	450	100		

Table3 - Distribution of cases according to month of occurrence

S.No.	Month	Number	%
1	January	43	9.6
2	February	36	8
3	March	32	7.1
4	April	33	7.3
5	May	45	10
6	June	47	10.4
7	July	45	10
8	August	36	8
9	September	32	7.1
10	October	30	6.7
11	November	30	6.7
12	December	41	9.1
	Total	450	100

Table 4- Distribution of cases according to time of occurrence

S.No.	Time of accident	Number	%
1	00:00-02:59	26	5.8
2	03:00-05:59	40	8.9
3	06:00-08:59	54	12
4	09:00-11:59	75	16.7
5	12:00-14:59	58	12.9
6	15:00-17:59	71	15.8
7	18:00-20:59	81	18
8	21:00-23:59	45	10
	Total	450	100

Table 5- Distribution of cases according to type of road user

S No	Type of road	Ма	Males		Females		Total	
3.NU.	user killed	No.	%	No.	%	No.	%	
1	Pedestrians	105	26.9	24	40	129	28.7	
2	Cyclists	30	7.7	2	3.3	32	7.11	
3	Occupant of motorized two wheeler (motorcycle, scooter etc)	94	24.1	10	17	104	23.1	
4	Occupants of light motor vehicle (cars, jeeps etc.)	100	25.6	16	27	116	25.8	
5	Occupants of medium vehicles	17	4.6	2	3.3	19	4.2	
6	Occupants of Heavy vehicle (trucks, buses etc.)	18	4.6	2	3.3	20	4.4	
7	Others (Tanga, ricksaw, jugad, tractor, three wheeler etc.)	26	6.7	4	6.7	30	6.67	
	Total	390	100	60	100	450	100	

Table 6- Distribution of cases according to offending vehicles

S.No.	Offending Vehicles	No. of cases	%
1	Two wheelers	30	6.7
2	Light motor vehicle (cars, jeeps etc.)	139	30.9
3	Medium transport vehicles	37	8.2
4	Heavy vehicles (trucks, buses etc.)	179	39.8
5	Others	36	8.0
6	Unknown	29	6.4
	Total	450	100

Table 7: According to the Duration of Survival

S.No.	Duration of Survival	Cases	(%)
1	Spot/Brought dead	204	45.3%
2	0 to 6 hours	114	25.3%
3	6-24	40	8.9%
4	>24	92	20.4%
	Total	450	100.0%

**Table No 10 and Table no. 11 in on PAGE No. 307

Original Research Paper

Profile Study of Organophosphorus Poisoning at Valsad: A 2 Year Study

¹K. S. Lad, ²V. C. Patel, ³Pragnesh Parmar

Abstract:

A number of Organophosphorus compounds have been introduced in Indian market as agricultural insecticides, being effective against a wide range of insects and pests. But, a number of these compounds have proved to be more toxic to humans than their utility as insecticides, pesticides or fungicides. Organophosphate poisoning may cause life-threatening events, resulting in multi-organ failure. Substantial number of deaths can be averted by timely treatment and ventilator support. This study aims to evaluate certain factors which are very significant in relation to outcome of organophosphorus compound [OPC] poisoning like age, sex, socio-economical status, marital status, and reason of committing suicide, types of compound consumed and attempt to know their prevalence in society and to try to plan for future preventive strategy. The study was carried out on 106 cases of OPC poisoning which came to GMERS Medical College and Civil Hospital, Valsad from 01/09/2014 to 31/08/2016. M: F ratio was 1.4: 1. Majority of the cases were in age group 21-30 years, 42 (39.6%). Higher proportion of cases were from lower class of society, 55(51.9%), from rural area, 77 cases (72.6%), due to lack of education in affected community. Suicidal intent to consume the compound was the commonest . 69 cases (65.1%).

Key Words: Organophosphorus, Suicidal, Poisoning, Insecticide.

Introduction:

Organophosphorus [OP] compounds have been widely used over the last few decades in agriculture for crop protection and pest control. Thousands of these compounds have been screened and over one hundred of them have been marketed for these purposes. OPs constitute a heterogeneous category of chemicals specifically designed for the control of pests, weeds or plant diseases. Their application is still the most effective and accepted means for the protection of plants from pests, and has

Corresponding Author:

¹<u>Tutor</u> ²Tutor GMERS Medical College, Valsad

³Associate Professor, Dept. Forensic Medicine & Toxicology, GMERS Medical College & Civil Hospital, Valsad

E-mail: ladkamlesh13@gmail.com L.M.No: IAFM/LM/ 890 DOR: 22/02/2017 DOA: 24/07/2017 DOI: 10.5958/0974-0848.2017.00045.8

contributed significantly to enhance agricultural productivity and crop yields. Some have also been used in the medical treatment of myasthenia gravis, e.g.diisopropyl phosphorofluoridate [DFP], tetraethvl pyrophosphate [TEPP], and octomethyl pyrophosphotetramide [OMPA]. Some OP esters are still used to treat glaucoma [Ecothiopate]. In addition to these, beneficial agricultural, veterinary, and medical uses, some highly potent OP anticholinesterase compounds, including tabun, sarin and soman, have been used as % werve gases+in chemical warfare. They have also been used as plasticizers, stabilizers in lubricating and hydraulic oils, flame retardants, and gasoline additives.^{1,2}

Respiratory failure is a common complication of OP poisoning, being responsible for high mortality, so timely, effective treatment is crucial for survival. WHO estimated that approximately 3 million pesticide poisoning occurs worldwide and causes more than 2,20,0000 deaths per year.^{3,4} Developing countries like India and Sri Lanka report alarming rates of toxicity and death.^{3,4} The common reasons behind this may be agricultural based economy, poverty and easy availability of highly toxic poisons easily. The commonest poisons are organophosphates, carbonates, chlorinated hydrocarbons and aluminium phosphide. Mortality varies from place to place depending on the nature of poison, availability of facilities and treatment by qualified persons.³⁻⁵

Materials and Methodology:

In the present study of 2 years (from 01/09/2014 to 31/08/2016), cases of OPC poisoning coming to civil hospital Valsad, either emergency department or through from medicine OPD were considered, after obtaining Ethics Committee approval. Detailed history of every case regarding the type of the compound, its quantity, time/ reason and manner (either intentional or accidental) of consumption, age/ sex and occupation of person and marital status was taken. Patientos indoor case records, Post reports, Emergency notes mortem and sometimes inquest reports were also considered for information.

Observations:

In the present study, around 12542 cases were admitted in medicine ward of Civil Hospital Valsad, of which 153 cases (1.2%) were of poisoning. Of the total poisoning cases, 106 (69.3%) were of OPC poisoning.

Of these, 62 (58.5%) were males. Majority of victims were in the 21-30 years, 42 (39.6%), followed by 11-20 years . 23 cases (21.7%). The least no. of cases, 1 (0.9%), were in the 0-10 years. (**Table – 1**).

The incidence of OPC poisoning amongst the lower class was 51.9%, 55 cases. The middle and upper class accounted for 33 (31.1%) and 18 (17%) cases, respectively. (**Table – 2**). Again, cases from rural area were 77 (72.6%). (**Table – 3**).

Among the 106 cases, maximum, 39 (36.8%) consumed Dichlorovos, which is widely used in our region as an insecticide. It was followed by Malathion, 21 cases (19.8%). Some poisons were not detected due to lesser quantity

or any other technical reasons, 18 (17%). (**Table** – 4).

As regards the manner, 69 cases (65.1%) were suicidal and accidental 37 (34.9%). There were no cases of homicidal poisoning. (**Table – 5**).

Majority of OPC poisoning cases suffered from miosis, 96 (90.6%), nausea & vomiting, 94 cases (88.7%) and breathlessness, 64 cases (60.4%); while 59 (55.7%) showed altered sensorium. (**Table – 6**).

Among the 69 suicidal cases, 48 (69.6%) have domestic and social problems, failure in love or exam. While 21 cases (30.4%) had financial problems. **(Table – 7).**

Discussion:

According to the WHO, three million acute poisoning cases with 2,20,000 deaths occur annually; and of these 90% of fatal poisoning occurs in developing countries, particularly among agricultural workers. Pattern of poisoning in a region depends on variety of factors such as availability of the poisons, SE status of the population and religious/cultural influences.^{6,7}

Majority of the victims were male, as observed in other studies.^{3,4,8,9}

Age group of 11-30 years was the most commonly affected which is similar to other studies. $^{3,4,10-15}$

Valsad district has the largest tribal area and most of population does agriculture work. So naturally, high percentage of poisoning of lower class 55 cases (51.9%) was observed, similar to other studies.^{3,4,13,16}

In our study, among Organophosphorus compound, dichlorovos (36.8%) was most commonly consumed poison similar to Joshi, et al study, while diazinon was the most commonly used compound in the study by Patel, et al and Singh, et al.^{3,4,14}

In present study, the commonest motive of poisoning was with suicidal intention and the maximum numbers of victims were agricultural workers (72.6%), residing specifically in rural areas. This finding was similar to other studies because the use of the Organophosphorus compound as an insecticides, pesticides and fungicides is more in rural areas than urban.^{3,4,10}

We live in 21st century. In this time due to increasing population, competition is more in every field and the people are nowadays more pressurized or feeling stress due to financial problem, domestic problem, emotional problem like failure in love or exam phobia etc. We found that amongst these factors financial problems was seen in 21 cases (19.8%) which followed by domestic problem 48 cases (45.3%) and accidental cases 37 cases (34.9%) similar to other studies.^{3,4}

It has been observed that the incidence of death was found to be significantly more in those patients in whom a greater time interval had elapsed between consumption of the poison and hospitalization.⁴

Amongst the observed symptoms, nausea and vomiting, muscular weakness, excessive sweating and diarrhea were commonest. The same findings were observed by others.^{14,17}

Conclusion:

Organophosphorus poisoning is one of the most common poisonings in the rural areas of Gujarat, predominantly in the young population with a male predominance; belonging to low socioeconomic class.¹⁸⁻²⁰ The commonest motive of poisoning was suicidal. Lack of education, poverty, cheap and readily easy availability of the Organophosphorus compounds, unemployment and stressful life were the common reasons behind the reason of poisoning.

Hence awareness amongst agricultural workers and youth about the harmful and deleterious effects of organophosphorus compounds and up-gradation of the primary health centre facilities to render immediate management of this poisoning, could go a long way in helping to reduce both mortality and morbidity.

Similarly, strict implementation of the Pesticide Act and involving a new policy by the government to educate the public and youth in large about the dangerous, life threatening effects of Organophosphorus compounds could help amelerioating the harmful effects of such poisoning.

Conflict of interest: None Financial Assistance: None

References

- Pore NE, Pujari KN, Jadkar PS. Organophosphorus poisoning. Int J Pharma Bio Sciences. 2011;2(4):604-12.
- Kumar SV, Md. Fareedullah, Sudhakar Y, Venkateswarlu B, Ashok Kumar E. Current review on organophosphurus poisoning. Arch Appl Sci Res, 2010;2(4):199-215.
- 3. Patel DJ, Tekade PR. Profile of organophosphorus poisoning at maharani hospital, Chhattisgarh a three year study. J Ind Acad For Med. 2011;33(2):102-5.
- Joshi SC, Prakash C, Joshi A, Joshi G. Profile of organophosphorus poisoning at tertiary care hospital in uttarakhand. J Ind Acad For Med, 2013;35(4):346-7.
- 5. Mukherjee JB. Forensic medicine and toxicology, 2nd Ed. Arnold, 1994:490
- Reddy KSN. The essentials of forensic medicine and toxicology, 21st Ed, Medical Book Company, 2002:467
- Vij K. Textbook of forensic medicine and toxicology . principles and practice, 4th Ed, Elsevier, 2008:531
- 8. Aggarwal and Aggarwal. Trends of poisoning in Delhi. J Ind Acad For Med, 1998;20(2):32-5.
- Gannur DG, Prakash M, Reddy KSN. Organophosphorus compound poisoning in Gulbarga region . A five year study. Int J For Med Toxi, 2008;2(1):3-11.
- 10. Gupta B. Organophosphorus poisoning facts and myths. Medicine update. 1999;1345-8.
- Ingianna J, Herrero R. Comparative study of cases of poisoning by organophosphorus insecticides in various regions of Costa-Rica Rex. Bio-Trop, 1983;1(1):139-44.
- Kamath PG, Dalgi AJ, Patel BM. Diazinon poisoning. J Assoc Physicians Ind, 1964;14:477-81. As quoted by Patel DJ & Tekade PR at 3, above.
- Chaterjee SC. Poisoning with organic phosphate insecticides. JIMA, 1967;48(4):153-7. As quoted by Patel DJ & Tekade PR at 3, above
- Singh et al. Parathion poisoning in Punjab. JAPI, 1969; 17: 181-87. As quoted by Patel DJ & Tekade PR at 3, above

- Kar SM, Timsinha S, Agarwal P. An epidemiological study of organophosphorus poisoning at Manipal Teaching Hospital, Pokhara, Nepal. J Ind Acad For Med, 2010;32(2):108
- Goel A, Joseph S, Gupta TK. Organophosphate poisoning - predicting the need for ventilator support. J Assoc Physicians Ind, 1998;46:786-90.
- 17. Srinivasan V. Poisoning by Bug poison. J Ind Acad For Med, 1962;39(7):345-49.
- Dalal JS, Gorea RK, Aggarwal KK, Thind AS, Sandhu SS. Poisoning trends: A postmortem study. J Ind Acad For Med, 1998;20(2):27-31.
- Ottto KR, Spate HF. Suicidal trends in urban and rural districts of Brandenburg. Psychiatry Neuro Med. Psychol, 1975; 27(4): 239-46.
- 20. Nageshkumar G Rao. Textbook of Forensic Medicine and Toxicology, 2nd edition, Jaypee publication, 2010:266

Table: 1 Age & Sex-wise distribution

Age	Ma	ale	Female		To	tal
group	No.	%	No.		No.	%
0-10	1	0.94	0	0	1	0.94
11-20	14	13.21	9	8.94	23	21.69
21-30	25	23.58	17	16.03	42	39.62
31-40	12	11.32	7	6.61	19	17.92
41-50	7	6.61	6	5.66	13	12.26
>50	3	2.83	5	4.71	8	7.54
Total	62	58.49	44	41.50	106	100

Table: 2 Socio Economic Status:

SE Status	No. of cases	%
Upper Class	18	16.98
Middle Class	33	31.13
Lower Class	55	51.88
Total	106	

Table: 3 Area Wise Distributions

Area	NO. Of cases	%
Urban	29	27.35
Rural	77	72.64
Total	106	

Table: 4 Types of Poison

Types of poison	No. cases	%
Dichlorovos	39	36.79
Methyl Parathion	15	14.15
Malathion	21	19.81
Diazinon (Tic-20)	13	12.26
Unknown	18	16.98
Total	106	

Table: 5 Manner of poisoning

		•
Manner	No. of Cases	%
Suicidal	69	65.09
Accidental	37	34.90
Homicidal	0	0

Table: 6 Common clinical features

Features	No. of cases	%
Nausea And Vomiting	94	88.67
Miosis	96	90.56
Muscle Weakness	66	62.26
Altered Sensorium	59	55.66
Diahhrea	15	14.15
Breathlessness	64	60.37
Excessive Sweating	45	42.45

Table: 7 Reason for poison

Reason	No. of cases	%
Financial	21	19.81
Domestic	48	45.28
Accidental	37	34.90
Total	106	

Original Research Paper

Sexual Homicides (A retrospective study at RIMS, Imphal, from 2000-2014)

¹Memchoubi Ph., ²Th. Meera Devi, ³Nandeibam Pabitramala Devi, ³Nani Gopal Das

Abstract:

Sexual homicide is one in which there is physical evidence of sexual activity which has occurred in close temporal and physical proximity to the murder or when there is a legally admissible statement by the perpetrator of sexual activity. A retrospective study of sexual homicides cases in Imphal from 2000-2014 was conducted from the post mortem cases done during the period at Regional Institute of Medical Sciences, Imphal. The cases were analyzed with regard to annual incidence, age and sex incidence, marital status of the victims, external and internal injuries present on the body, perenial injuries, seasonal variation, crime scene, type of perpetrator, time of day of death, and circumstances and cause of death. The findings were compared with similar studies done in other parts of the world and the various causative factors were analyzed to formulate preventive measures. It was seen that Imphal had a higher incidence, elderly victims were lesser and poisoning (self consumption due to shame among survivors) figured high among the causes of death which is not seen in any of the other studies.

Key Words: Sexual Homicide, Victim, Perpetrator, Methods, Prevention

Introduction:

Sexual homicide is defined by Meloy¹ as one in which there is physical evidence of sexual activity in close temporal and physical proximity to the murder or when there is a legally admissible statement by the perpetrator of sexual activity. The victim is killed in the context of power, sexuality, and brutality with evidence or observations that include a sexual nature. These include: victims attire or lack of attire; exposure of the sexual parts of the victims body; sexual positioning of the victims body; insertion of foreign objects into the victims body cavities; evidence of sexual intercourse (oral, vaginal, or anal); and evidence of substitute sexual activity, interest, or sadistic fantasy.²

Corresponding Author:

¹Associate Professor,

²Professor,

³Post Graduate Trainee, Department of Forensic Medicine Regional Institute of Medical Sciences, Imphal.

Corresponding author: Dr. Memchoubi Ph. Email: mem010177@gmail.com L. M No: IAFM/LM/651/2007 DOR: 16/05/2016 DOA: 24/07/2017 DOI: 10.5958/0974-0848.2017.00046.X

Materials and Methodology:

A retrospective study of sexual homicides cases in Imphal from 2000-2014 was conducted from the postmortem cases done during the period at Regional Institute of Medical Sciences, Imphal. The cases were analyzed with regard to annual incidence, age and sex incidence, marital status of the victims, external and internal injuries present on the body, perineal injuries, seasonal variation, crime scene, type of perpetrator, time of day of death, and circumstances and cause of death. The findings were compared with similar studies done in other parts of the world and the various causative factors were analyzed to formulate preventive measures.

Results and Observations:

Out of a total of 3120 homicide autopsies conducted during the 15 yr-period, 27 were cases of sexual homicide, making an incidence rate of 0.9% (**Table 1**). Age-wise distribution (**Table 2**) showed highest incidence in the 11-20yr group with 11 cases (40.7%), followed by 31-40yr with 6 cases (22.2%), and least number of victims were from the >40yr group, with 1 case (3.7%) each. Most of the victims were unmarried, 23 (85.2%) cases (Table 4). Majority were Meiteis, 15 (55.5%); followed by Tribals 8 (29.6%); Muslims 3 (11.1%), while 1 (3.7%) was a Nepalese woman (Table 3). Twenty two (81.5%) victims were from the rural area (Table 5). Regarding the crime scene (Table 6), 8 (29.6%) were found in a paddy field or fish farm, 6 (22.2%) on river banks, 4 (14.8%) in the forest and hills, 4 (14.8%) at other peoplecs residence and 3 (11.1%) at their own residence, while 1 (3.7%) was found in a hotel and another (3.7%) at a Eighteen (66.7%) playground. the of perpetrators were strangers to the victims and the rest 9 (33.3%) were known persons or acquaintances (Table 7). Regarding seasonal variation (Table 8), 11 (40.7%) cases occurred during rainy season, 10 (37%) during winter, 4 (14.8%) during summer and 2 (7.4%) during spring. Regarding the time of the day (Table 9), 11 (40.7%) cases occurred during 12 noon to 6pm. 8 (29.6%) each during 6 am-12 noon and 6 pm-midnight. Majority, i.e., 11 (40.7%) victims were killed by blunt head injury followed by shock and hemorrhage due to multiple blunt trauma, 5 (18.5%) cases; manual strangulation 4 (14.8 %) cases, ligature strangulation 3 (11.1%) cases; drowning 2 (7.4%) and suffocation 2 (7.4%) cases each (Table 10). Regarding injuries on the body, 15 (55.6%) cases had gross external and internal injuries associated with perineal injuries; 7 (25.9%) had minimum external and internal injuries with perineal injuries and 5 (18.5%) had only perineal injuries. In fact, all the 27 cases had perineal injuries (Table 11).

Discussion:

Sexual homicide is a low occurrence phenomenon. Meloy in the U.S.¹ noted an incidence rate of 1-4%. Excessive violence is used which is referred to as overkill.² This type of crime is usually committed by males in their 20¢ or 30¢ upon female strangers or casual acquaintances,^{2,3} which is similar with our findings. The FBI noted an incidence rate of 0.9-0.5% from 1991-95 and 0.6% 2000 in the U.S.⁴ Our study showed an incidence rate of 0.9%, which also reflects a low occurrence. Age-wise distribution of the victims showed highest incidence in the 11-20yr group with 40.7%, and minimum above 40yr 3.7%. In a spatial analysis of 25 years of deaths in Los Angeles, the victims tended to be older with the single largest group in their middle years (35. 59 yrs) and it was concluded that the young and the old are the vulnerable populations.⁵ In our study, the younger group was most commonly affected and no case is found in the elderly group. This may be due to the joint family set-up in our society where the elderly are taken care of by their children and grand children unlike in the Western society where they live alone.

In an analysis of victimon journey to crime-trips, it was revealed that 35% of the victims were murdered in their home, 67% within a half-mile or less and 85% less than five miles of their residence.⁵ In our study, most of the victims (24 cases) were murdered a few kilometres away from home.

Sexual homicide is a heavily gendered crime with the vast majority of victims being female (and most offenders being male) and this bias is even more pronounced in the vulnerable populations of the young and old.⁶ In our study, all the victims were females.

Sexuality is the method used to effect revenge or express his hostility and anger and is often an exceptionally violent crime that is ‰ore an issue of hostility than sexual desire+.⁷ More recent research suggests that sexual

assault is motivated by the need to express power or anger or a combination of both.⁸⁻¹¹

Majority of the victims were Meiteis, 15 (55.5%); followed by Tribals. This could be due to the demographic dominance of the Meiteis.

Twenty two (81.5%) victims were from the rural area. this could be due to the fact that people in urban area are more conscious about their safety and hence the lower incidence.

Most of the victims were unmarried (85.2%). This indicates that single women are easy targets, mostly from acquaintances.

Eighteen of the perpetrators were strangers, while only 9 (33.3%) were acquaintances. This finding is slightly similar with observations made by other workers where the victims are female strangers or casual acquaintances, rather than consensual sexual intimates, of the perpetrator.¹²⁻¹⁴

Regarding seasonal variation, 11 (40.7%) cases occurred during rainy season, 10 (37%) during winter, 4 (14.8%) during summer and 2 (7.4%) cases during spring. No comment can be made on the seasonal variation.

Regarding time of the day, 11 cases (40.7%) occurred during 12 noon to 6pm, 8 cases (29.6%) each during 6 am-12 noon and 6 pm-midnight. The afternoon and evening time is when the unsuspecting girl meets the potential perpetrator since there is no night life in Imphal, which could be responsible for the maximum incidence during this time of the day.

As per Myers,¹⁵ in 91% of the cases, personal weapons (hands, fists, etc.), knives or cutting instruments, blunt objects, strangulation, or asphyxiation caused the deaths. Such weapons allow close interpersonal contact during the kill, and provide more sadistic fulfilment. They have the additional advantages of being readily available and relatively quiet, and therefore they are less likely to draw attention to the crime scene as the offense is occurring, allowing the perpetrator to carry out his acts at leisure if so desired.

Our study showed that 55.6% cases had gross external and internal injuries associated with perineal injuries. Studies by other workers^{7,11} found that most of the sexual homicide victims suffered multiple, severe, and excessive injuries which are more than that is necessary to cause death. Some workers opine that sexual homicides vary from careful planning to rageful killing, perhaps precipitated by the victimos rebuff and alcohol intoxication of the perpetrator. However, most manifest the characteristics associated with the disorganized, impulsive, and instrumental offender typologies.¹⁶⁻¹⁸ In this study too, majority of the victims were killed by blunt weapon injury, followed by manual strangulation and ligature strangulation. Whereas most murders in general, in this region, are accomplished by firearms (66%),19 the opposite is true for sexrelated killings.

Conclusion:

Scientific knowledge of sexual homicides remains limited and the need for

ongoing research in this area is crucial in light of the grave societal consequences produced by these crimes. Understanding the dynamics of sexual homicide may provide investigative direction to law enforcement. The aim of this study was to arouse awareness in the minds of the scientific community as well as the society at large, regarding the prevalence, in our own society, of a crime, which seems to appear only in western psychoqmovies. Hopefully, this aim has been achieved with the presentation of the scenario regarding this violent crime.

Conflict of Interest : None Financial Assistance: None

References

- 1. Meloy JR. The nature and dynamics of sexual homicide: an integrative review. Aggression and Violent Behaviour. 2000;5(1):1-22.
- Douglas JE, Burgess AW, Burgess AG, Ressler RK editors. Crime Classification Manual. 2006. 2nd edition. New York: Jossey-Bass, A Wiley Imprint. pp: 218-42.
- Myers WC, Reccoppa L, Burton K, McElroy R. Malignant sex and aggression: an overview of serial sexual homicide. Bull Am Academy Psychiatry Law. 1993;34:435-51.
- FBI. Uniform crime reports. Washington, D.C.: Department of Justice, 2003 Oct 27, https://archives.fbi.gov. Last accessed on July30,2015.
- 5. Van Patten IT, Delhauer PQ. Sexual homicide: a spatial analysis of 25 years of deaths in los angeles. J Forensic Sci, 2007;52(5): 1129-41.
- Safarik ME, Jarvis JP, Nussbaum KE. Sexual homicide of elderly females: linking offender characteristics to victim and crime scene attributes. J Interpersonal Viol 2002;17(5):500-25.
- 7. Groth AN. The older rape victim and her assailant. J Geriatr Psychiatr.1978;2:203-215.
- Groth AN, Burgess AW, Holmstrom LL. Rape: Power, anger, and sexuality. American J Psychiatr. 1977;134:1239-43.
- Hazelwood RR, Warren J. The criminal behaviour of the serial rapist. FBI Law Enforcement Bulletin. 1990;59(2):1-17.
- Hazelwood RR, Warren J. The sexually violent offender: Impulsive or ritualistic? Aggression and Violent Behaviour. 2000;5(3):267-79.
- 11. Pollock NL. Sexual assault of older women. Annals of Sex Research. 1988;1:523-32.

- 12. Dietz P, Hazelwood R, Warren J. The sexually sadistic criminal and his offenses. Bull American Acad Psychiatr Law. 1990;18: 163-78.
- Myers W, Blashfield R. Psychopathology and personality in juvenile sexual homicide offenders. J American Acad Psychiatr Law. 1997;25:497-508.
- 14. Ressler RK, Burgess AW, Douglas JE. Sexual homicide: Patterns and motives. 1st ed. Lexington, MA: Lexington Books; 1988.
- 15. Myers WC. Juvenile sexual homicide. 1st ed. London: Academic Press; 2002.
- Salfati GC. The nature of expressiveness and instrumentality in homicide: Implications for offender profiling. Homicide Studies. 2000;4(3):265-93.
- Salfati GC, Canter DV. Differentiating stranger murders: Profiling offender characteristics from behavioural styles. Behavioural Sciences and the Law. 1999;17:391-406.
- Roberts JV, Grossman MG. Sexual homicides in Canada. A descriptive analysis. Annals of Sex Research. 1993;6:5-25.
- Memchoubi PH, Momonchand A, Fimate L. Homicides in and around Imphal. Journal of Indian Academy of Forensic Medicine 2003; 25(1): 13-15.

Year	Total no of PME	No of cases	Percentage
2000	242	0	00.00%
2001	257	3	01.16%
2002	216	0	00.00%
2003	190	3	01.57%
2004	191	4	02.09%
2005	232	1	00.43%
2006	219	0	00.00%
2007	335	0	00.00%
2008	434	1	00.23%
2009	388	4	01.03%
2010	125	2	00.01%
2011	68	1	01.47%
2012	93	3	03.22%
2013	85	1	01.17%
2014	45	4	08.88%
Total	3120	27	00.86%

Table 1: Year wise incidence

Table 2: Age wise Distribution of victims

Age (Years)	No of cases	Percentage
0-10	3	11.10%
11-20	11	40.70%
21-30	5	18.50%
31-40	6	22.20%
41-50	1	03.70%
>50	1	03.70%

Table no.3: Caste distribution of victims

Caste	No of cases	Percentage	
Meitei	15	55.50%	
Manipuri Tribals	8	29.60%	
Manipuri Muslims	3	11.10%	
Others	1	03.70%	
Total	27	100%	
Table no /: Marital Status of victims			

Marital Status	No of cases	Percentage	
Unmarried	23	85.20%	
Married	4	14.80%	
Total	27	100%	

Table no.5: Residence of victims			
Resider	nce	No of cases	Percentage
Rur	al	22	81.50%
Urb	an	5	18.50%
Tot	al	27	100%

Table no.6: Place of occurrence

Place of Occurrence	No of Cases	Percentage	
Paddy Field & Fish	8	29.60%	
Farm			
River Banks	6	22.20%	
Forest & Hills	4	14.80%	
Others' Residence	4	14.80%	
including shops			
Own residence	3	11.10%	
Hotels	1	03.70%	
Play Ground	1	03.70%	
Total	27		

Table no.7: Relationship between victim and assailants

Relationship	No of Cases	Percentage
Known	9	33.30%
Unknown	18	66.70%
Total	27	

Table no.8: Seasonal Distribution/trend

Season	No of cases	Percentage
Winter(Nov-Jan)	10	37.00%
Spring (Feb- Apr)	2	07.44%
Summer (May-Jul)	4	14.80%
Rainy (Aug- Oct	11	40.70%

Table no.9: Time of Occurrence

Time of occurrence	No of cases	Percentage
6am to 12 noon	8	29.60%
12 noon to 6pm	11	40.70%
6pm to 12 midnight	8	29.60%
12 midnight to 6am	0	00.00%

**Table No 10 and Table no. 11 in on PAGE No. 247

Original Research Paper

Histopathological Timing of Intra-Cranial Hemorrhage in Head Injuries with Blunt Force

¹P. Umamaheswara Rao, ²C. V. V. Lakshmi

Abstract:

The implication of a crime as serious and complex as homicide indicates that complete anatomic study should be carried out as soon as possible in any death, which may have resulted from the purposeful, intentional or even accidental act of another person. Blunt cranio-cerebral trauma causes more homicidal deaths than do blunt injuries to all other areas on the body combined as head is the target of choice in the great majority of fatal assaults. The forensic expert must place his professional skills at the disposal of the law enforcement authorities by pin pointing the cause of death, object which caused the fatal injuries and the time of injury. The present analysis of epidemiologically representative ICH patient material was made in order to improve our knowledge by fixation of age of intracranial hemorrhages in relation to the occurrence of incident and by histopathological examination to enhance its legal value.

Key Words: Homicide, Head Injury, Subdural Hemorrhages, Histopathology, Fixation of Time of Injury

Introduction:

Forcible striking of the head results in abrupt change in its state of rest or uniform motion. Interviewing techniques are employed to ascertain facts, shift truth from untruth, and to probe cautiously without impairing forensic value and validity of facts and the data that the Forensic expert he elicits. Evidence suitable for presentation and acceptance in court is the sought after goal. Gross inspection of the brain at autopsy shows no other changes except a hematoma, however, microscopic analysis demonstrates what were considered trauma findings in the form of hemosiderin-laden macrophages in the perivascular and subdural space along with few macrophages in the white matter.

Corresponding Author:

¹ Associate Professor, Dept. of Forensic Medicine, ²Associate Professor, Dept. of Pathology, Govt. General Hospital Campus, Rangaraya Medical College, Kakinada Email id: druma_pothula@yahoo.in. L.M. No: IAFM/LM/798 DOR: 27/09/2016 DOA: 25/07/2017 DOI: 10.5958/0974-0848.2017.00047.1

An important diagnostic feature of Subdural hemorrhages (SDH) is their progressive metamorphosis with time. The different stages of evolution of a SDH are useful for establishing its age.¹ In an attempt to find more reliable and precise parameters to estimate timing in traumatic brain injuries, the present study was undertaken to evaluate the histopathological examination in cases of Intra-Cranial Haemorrhages (ICH). In ICH, epidural hematomas are relatively infrequent, hence SDH are taken for HPE in timing of injury in the present study.

Aim of the Study:

The objective of the present study was to attempt to find more reliable and precise parameters in relation to Indian sub continental climatic conditions, to estimate timing in traumatic brain injuries by fixation of age of intracranial hemorrhages in relation to the occurrence of the incident and legal value of histopathological examination. This is so, because the defense council may argue for a different episode being responsible, although in practice a well-documented episode would need to be identified.

Materials & Methodology:

A prospective study was carried out in Forensic Medicine, the department of Rangaraya Medical College, Kakinada, by taking 60 head injury cases caused by blunt force and RTA and included 20 homicidal cases with variable duration of injury after approval by the Institute's Ethics Committee. In all the 60 cases. histopathological examination was done. The cases were divided into 6 categories depending upon the time of occurrence of injury and time of death i.e. survival period with the help of Inquest reports & case sheets. Each postmortem examination of different categories was closely followed and brain was carefully dissected out and preserved in formalin solution. After complete fixation, histopathological examination was done in collaboration with the of dept. of Pathology,

The broad categories taken into consideration were:

1) < than 24hrs.	2) 3 to 5 days
3) 5to 7 days	
4) 7 to 10 days	5) 10 to 20 days
6) 3 to 4 weeks	

Results:

Shown in Table 1, Table 2 and Figure 1 to 6

Discussion:

The Intra cranial hemorrhages or hematomas are due to blunt impact. They are: 1) Epidural hemorrhages - either acute or chronic (>48 hrs) 2) Subdural hemorrhages ó acute, sub-acute & chronic, 3) Subarachnoid hemorrhages & Intracerebral hemorrhages.

If a person does not immediately die from SDH, the hematoma will gradually become encapsulated by cells from the dura and this sac of blood will press on the underlying gyri, flattening them, deforming the surface of the brain immediately underneath the sac.2 Since the brain cannot store oxygen, it relies upon a series of blood vessels to supply oxygen and nutrients. The pooling of blood from an intracranial hemorrhage or cerebral hemorrhage puts pressure on the brain and deprives it of oxygen. When a hemorrhage occurs due to head injury, thrombus or embolus, it interrupts blood flow around or inside the brain, depriving it of oxygen for more than three or four minutes, the brain cells die. Furthermore, the affected nerve cells and the related functions they control are damaged.

While the courts will go a long way in admitting expert testimony deduced from a wellrecognized scientific principle or discovery, the things from which the deduction is made must be sufficiently established to have gained acceptance in the particular field to which it belongs.3 Microscopically, as the subdural blood autolyzes and becomes organized, a series of changes occur. Within a few days or so, early macrophages migrate into the area and engulf blood, and hemosiderin may be identified on iron stains.4

The different stages of evolution of a SDH are useful for establishing its age. Aging of injury is best done by the microscopic examination of sections and evaluation of the associated inflammatory reaction to the injury, as follows:5

Conclusion:

The points of value in our study are to pinpoint the timing of head injuries not only with naked eye findings of intra cranial hemorrhages but also parallel study of histopathological examination of ICH, which is more conclusive and valuable and legally more useful and precise in courts of law while timing the injury. The values are more concurrent with the previous western studies even though climatic conditions are different from the Indian subcontinent.

Conflict of interest: None Financial Assistance: None References:

- 1. Adelson L. The pathology of homicide. Charles C Thomas. Publisher 1974.pp 409-11.
- 2. DiMaio V, DiMaio D. Forensic Pathology . 2nd Ed. CRC Press. 2001;pp: 168
- 3. Whitwell HL. Forensic neuropathology. Edward Arnold (Publishers) Ltd. 2005:196
- Dolinak D, Matshes E, Lew E. Forensic pathology principles and practice. 1st Ed. Academic Publishers. 2005;pp: 433
- 5. www.acnr.co.uk./mar_apr_2008, Pathology of Intracerebral Haemorrhage .
- DiMaio. Hand book of Pathology. 1st Ed. Landes Bioscience. 1999; 9

Table 1			
Time	Macroscopic	Microscopic	
Within Seconds		Rupture of blood vessel wall	
Seconds to minutes	Hematoma formation (bright red acute hemorrhage) Space-occupying effect. Distortion and compression of surrounding tissue (may include: raised intracranial pressure, internal herniations, brain stem compression)	Extravasation of blood, lysis of erythrocytes	
Several hours	Development of peri-haematoma, edema and ischemia. Increasing space-occupying effect.	Edema, ischemia, polymorph infiltrate.	

		Possible Microscopic Findings		Our findings
Time period following injury	Status of clot	Side of membrane facing dura	Side of membrane between clot and arachnoid	-
24 Hours	Fresh Red Blood Cells	Thin Layer of fibrin between dura and clot		Shows fresh RBC
48-72 hours	Fresh Red Blood Cells	Rare fibroblast (Spindle cell) at interface	Fibrin only	Shows RBC and thin layer of Fibrin towards arachnoid
4-5 days	RBC begin to break down	2-5 cell thick layer of fibroblasts	Occasional spindle	
5-10 days	Red Blood Cells are lacked; fibroblasts may extend into clot, early capillary formation	3-14 cell thick layer of fibroblasts; occasional small capillaries may be present, pigment	Layer still mostly fibrin with some fibroblasts	Lacking of RBC, macro-phages, few fibroblasts
3-4 weeks	Nearly liquefied	Membrane equal to Dura in thickness, pigment laden macrophages present	Fibroblastic membrane about ½ as thick as dura; occasional pigment laden macrophages	Laden macro phages, thick layer of fibroblasts
5 weeks	Large capillaries present	Membrane well formed	Membrane well formed	
1-3 Months	Large (giant) capi- llaries may be secondary hem- rrhage (red bleed)	Hyalinization of Membrane	Hyalinization of Membrane	-
3-6 Months		Hyalinized Membrane	Hyalinized Membrane	
With rebleed "Weeks to Month's	Friable brown clot			Organisation of the hematoma with phagocytosis of blood
				macrophages
Months to Years	Cavity containing dark blood-stained fluid			Continued resorption of blood clot
Months to Years	Cavity containing clear fluid resembling CSF with brown hemosiderin- stained cavity wall			Cavity lined by hyperplastic and hypertrophic glial cells; residual macrophages and hemosiderin

Table 2: Stages in Organization of subdural Hematoma⁶



Fig 1.Subdural hematoma - <24 hrs duration. Low power view showing fresh RBC (arrow). (10x)



Fig. 2 Subdural hematoma 3 to 5 days. Photomicrograph (10x) showing a thin layer of fibrin towards the arachnoid (single arrow) and dura (double arrow)



Fig) Subdural hematoma of 5-7 days duration . High power view showing laking of RBC(long arrow) and occasional macrophage(short arrow) and fibroblasts(40x).



Fig. 4. Subdural hematoma 7-10days duration . High power view showing pigment or hemosiderin laden macrophages (long arrows) and spindle shaped Few fibroblasts(small arows) are also seen (40x)



Fig. 5 Subdural hematoma 10-20 days duration. High power view showing hemosiderin laden macrophages (small arrows), capillaries (long arrows) and layers of spindle shaped fibroblasts (arrow heads) half the thickness of the dura.



Fig. 6. Subdural hematoma- 3-4weeks duration. High power view showing few pigment laden macrophages and fibroblasts as thick as the dura (40 x) Arrow heads show macrophages and long arrows show capillaries

**Contd. from Page no. 242

Table no.10: Cause of death of victims

Cause of Death	No of cases	Percentage
Blunt trauma head	11	40.74%
Manual Strangulation	4	14.81%
Ligature Strangulation	3	11.11%
Shock & Haemorrhage due to multiple blunt trauma	5	18.51%
Drowning	2	07.40%
Suffocation	2	07.40%
Total	27	100%

Table no.11: Pattern of injury on victims

Pattern of Injury	No Of cases	Percentage
Perineal injuries only	5	18.50%
Minimal external & Internal Injuries with perineal	7	25.90%
injuries		
Gross external & internal injuries with perineal	15	55.60%
injuries		
Total	27	100%

Original Research Paper

The Epidemiology and Patterns of Head Injuries with Skull Fractures in Homicidal Deaths

¹Suraj Sundaragiri, ²Vijayadurga Koppada, ³Srikanth Tandur

Abstract:

The present prospective study aims to establish the incidence and patterns of head injuries with skull fractures in homicidal deaths which were subjected to post-mortem examination in the mortuary of a tertiary teaching hospital for a period of two years. The study revealed that among the 10137 autopsies conducted in the study period, homicidal deaths accounted to 211(2.1%) cases. The main study population i.e. homicidal head injuries with skull fractures accounted for 0.96% of total autopsies (97 cases), 4% of total head injuries and 46% of total homicides, 92.4 % of total homicidal head injuries. Majority of the victims were aged between 21-30 years (37.1%). Males comprised the majority of victims as compared to females in the ratio 4.7:1. Most of the deaths occurred in places other than their residence (61.9%). Majority of the fatalities were caused by blunt weapon only (85.6%). Majority were associated with contusion of scalp (53.6%). 79.4% showed only skull fractures & 20.6% showed association with other causes of death in combination with strangulation (8.3%). Linear fracture (52.6%) of the skull was the commonest pattern among the skull fractures. Frontal bone was the commonest bone involved (16.5%). The commonest intracranial haemorrhage was found in cases with combination of subdural & subarachnoid haemorrhages (59.8%).

Key Words: Homicidal deaths, Head injuries, Skull fractures

Introduction:

The head is the vital and most vulnerable part of body to sustain injuries. It is for this reason that head injury is a most effective method of the homicidal deaths, with an increase in global incidence.

Corresponding Author:

¹Senior Resident,

Department of Forensic Medicine & Toxicology, JIPMER, Puducherry.

²Assistant Professor,

Department of Forensic Medicine & Toxicology, Apollo Institute of Medical Sciences and Research Centre, Chittor, Andhra Pradesh.

³Senior Resident, Department of General Medicine, Government Medical College, Nizamabad, Telangana.

Email: drsurajfm@gmail.com. L.M.No: IAFM/LM/1324/2017.

DOR: 28/10/2016 DOA: 26/07/2017 DOI: 10.5958/0974-0848.2017.00048.3 The recent increase in the trend of homicidal deaths involving head injury is a serious concern to the society. There has been a global raise in homicide and it causes over 500,000 deaths per year worldwide.^{1,2} Homicide is a common endpoint of many different behavioural pathways.³ It may be a result of arguments between acquaintances, domestic violence, drug addiction, robberies & terrorism.⁴

For every individual who dies as a consequence of violence, many more are injured and suffer from a spectrum of physical, sexual, reproductive and mental health problems.^{5,6} The killing of a person is the highest level of aggression found in all the cultures. Since ages, the very motive or reason for these killings has remained the same i.e. lust for money, women and land. To commit murder, two elements, **%** lens rea+ - or preplanning or a forethought/ intention, and **%** ctus reus+ - or the actual execution, should go together to constitute the crime.⁷ Alcohol abuse, hard drugs and stimulants constitute the recipe for a large

proportion of violent crimes.¹ Further, the newer generation is also influenced and taken to crime by glorification of murders in movies. Culpable homicide is murder, if the act by which the death is caused is done with the intention of causing death.⁸

The reason or motive the behind the homicide may be as trivial a reason like petty argument leading up to the more serious issues like revenge, financial conflicts, demand for dowry, infidelity, property gain, robbery, to conceal the crime after sexual assaults (rape), etc. Homicidal patterns varies from country to country and from one region to another, and are influenced by many factors like unemployment, low socioeconomics status, cultural, psychological, social influences, religious attitudes, criminal activities, drug culture, political family relationships like marital factors. disputes, motive behind killing, easily availability of weapons, methods of killing.9-12

Assailants usually select a region of the body where maximum damage can be inflicted with minimum effort.¹³ The ultimate outcome of the attempt depends on factors like type of weapon used, target site on the body, number of blows etc. The presence or absence of a skull fracture, its type and site along with the type of intracranial haemorrhages has immense significance in the final outcome in cases of such head injuries.¹⁴The thickness of the cranium is not uniform all throughout as there are thin plates of bones like the frontal and temporal bones and also the thickness is greater along the sutures.15,16

The greater the force of impact, the greater will be the damage and the more lethal the outcome.¹⁵ The head is the vital and most vulnerable part of body to sustain injuries. It is for this reason that head injury is a most effective method of the homicidal deaths. The various underlying factors, method of implication and the severity of trauma play a vital role in determining the ultimate result. The present study aims to establish this fact by examining homicidal skull fractures as a direct indicator of severity of trauma.

Materials and Methodology:

The present prospective study was undertaken to establish the incidence and patterns of head injuries with skull fractures in homicidal deaths which were subjected to postmortem examination in the mortuary of a tertiary teaching hospital, for a period of two years. A total of 10137 autopsies were performed during the study period, of which, homicidal deaths accounted for 211 (2.1%) cases and homicidal head injuries with skull fractures accounted for 97 (0.96%) cases. On the basis of police inquest and autopsy, the cases were selected and studied in detail. Detailed information regarding the circumstances of crime was sought from the police, victimos relatives and friends. These cases were examined regarding criteria such as their age, sex, socio-economic status, type of weapon used, type of skull fracture, association with other cause, time of death and location at which homicide had occurred. Postmortem examination of the cases was carried out as per the standards.

Photographs were taken at the mortuary during autopsy. All this information was collected on proformas, summed up, computerized master data sheet was prepared, analyzed, and statistics were prepared under discussed objectives.

Observations and Results:

The study revealed that among 10137 autopsies conducted for a period of two years, the total deaths due to head injuries constituted 2392(23.6 %) cases. The most common manner of death causing head injuries was accidental i.e. 2282 cases (95.4%), followed by homicide with 105 cases (4.4%) while suicides were only 5 (0.2%). Among the total homicidal deaths, 211 cases (2.1%) of all autopsies, the most common cause of death was head injury alone with 88 cases (42.2%), followed by strangulation (19.9%), stab injury (10.9%), cut throat (6.2%), smothering (5.2%), combination of head injury and strangulation (5.2%), combination of strangulation and burns (1%) and burns (1%). The main study population i.e. homicidal head injuries with skull fractures accounted for 0.96% (97 cases) of total autopsies, 4.1% of total head

injuries and 46% of total homicides, 92.4% of

total homicidal head injuries. (**Table 1**) The cases of homicidal skull fractures were divided into 8 sub-groups i.e. below 1 year, 1-10, 11-20, 21-30, 31-40, 41-50, 51-60 and >60. The highest number of cases were recorded in the 21-30 years age group i.e. 36 cases (37.1%), followed by 31-40 years age group which recorded 24 cases (24.74%) and no cases were seen in age group below 1 year. (**Figure 1**) Majority of the homicidal deaths being males with 80 cases (82.5%) and female deaths were17 in number (17.5%).

Seventy seven cases (79.4%) showed only skull fractures and no other associations. It was observed that 20 cases (20.6%) were associated with other injuries i.e. strangulation, 8 cases (8.3%), Stab (3.1%), multiple chop injury(2.1%), other fractures (2.1%) which were followed by burns (2.1%), Blunt injury abdomen(1%), cut throat (1%) & gagging (1%). (**Table 2**)

Fatalities were seen more among unmarried persons, 65 cases (67%), while status of 16 cases could not be known (16.5%). In 76 cases (78.35%), the victims were identified and the rest, 21 (21.7%) could not identified/ unknown. Accused was known in 43 cases (44.3%).

Most of the deaths were reported during the night time, numbering up to 66 deaths (68%) (**Figure 2**). Maximum number of victims died on the spot, 81.4%, followed by 12 cases which survived for less than 1 day (12.4%), 1 day to 1 month with 5 cases (5.2%) and the least which survived for greater than one month is 1 (1%). (**Figure 3**) Most of the deaths occurred in places other than their residence, numbering to 60 cases (61.9%).

Majority of the fatalities were caused by blunt weapon, 83 cases (85.6%), followed 8 cases (8.3%) by sharp weapon. 2 deaths were caused by both blunt and sharp, 2 cases by heavy sharp weapon, and 2 cases was inflicted by firearm injury (2.1%), each. (**Figure 4**) Skull fractures were associated mostly with scalp contusions in 52 cases (53.6%) followed by laceration in 30 cases (30.9%). Abrasions were noted in 4 cases (4.1%) and remaining cases presented in combinations. (**Table 3**) In the present study population, 87 cases (89.7%) presented with only vault of the skull fracture, followed by 9 cases (9.3%) with combination of vault & base and only 1 case presented with base of the skull fracture. (Figure 5) Majority, 51 (52.6%), showed linear or fissure fracture, followed by comminuted, 20 cases (20.6%; 10 cases (10.3%) showed both comminuted and depressed; followed by others. (Table 4). Further, 16 cases (16.5%) presented with frontal bone fracture only, which was the maximum, followed by temporal bone fracture, with 15 cases (15.5%), combination of temporal & parietal bone fracture with 10 cases (10.3%), combination of frontal & parietal with 9 cases, occipital bone fracture with 8 cases (8.3%), combination of frontal, temporal, parietal, occipital & base of the skull with 7 cases (7.2%), parietal bone with 5 cases, and other combinations. (Table 5) Maximum number (55.7%) of cases were found with combination of subdural haemorrhage (SDH) & subarachnoid haemorrhages (SAH), while extradural haemorrhage (EDH) was found in minimum. (1%) (Figure 6)

Discussion:

As the homicidal deaths are well planned, it becomes difficult for the investigating officer to elucidate the truth and they mostly rely on linking the act of crime to the criminal, basing on scientific/ circumstantial evidence. This becomes a challenging task for the investigating officers to explore and solve the mystery. At this step, autopsy examination by forensic medicine specialist is of immense importance to recognise the medicolegal injuries in the right perspective and further help the investigating officers and the judiciary in their legal conclusions.

Only few studies are available pertaining to the present study population. In the present study, homicidal skull fractures constituted 0.96% of total autopsies & 4% of total head injuries. Among the 10137 autopsies conducted, 211(2.1%) were homicidal in nature. Studies conducted by Mohanty,¹⁷ (3.4%) and Mishra¹⁸ (3.8%) also revealed similar findings. Among the total homicides, homicidal head injuries accounted for 49.7%, studies by Mishra¹⁸ showed 39.7% and Malik¹⁹ showed 82.2%.

The study population of homicidal skull fractures constituted 46%. Study by Malik, et al. & Punia²⁰ revealed 71.3% and 75%,

respectively. Skull fractures amounted to 92.4% of homicidal head injuries, which was similar with study by Chattopadhyay¹³ with 93.1% and Mishra¹⁸ with 97.2%. The most common age group was 21-30 years. Similar findings were observed in the studies conducted by others.^{17,20-25} Majority of the victims were males; similar findings were observed in various other Indian studies.^{20,26,27} This is due various factors like unsuccessful romantic disputes, marital disputes, infidelity, and related to dowry in females and unemployment, gang rivalry and arguments were the reasons in males.

It was observed that the study population was associated with other causes of death in 20 cases (20.6%). No other studies with such associations could be found. Maximum number of deaths were noticed among lower class, which is in accordance to the study by Hugar.²¹ Maximum homicides occurred during the night time which can be attributed to the factors like night fall or in darkness the chances of assailant being recognized is reduced, etc. A similar observation was made in studies conducted by Mohanty,¹⁷ Gupta²² and Henderson.²⁸ It was observed that married couples constituted the most (67.01%), as they were victims of infidelity, marital disharmony, dowry, etc.

Maximum number of victims died on the spot. This factor is determined by the place and time of occurrence and the presence of emergency vehicles and hospital nearby, time period of notification of the victim by other persons etc. Similar observation s are made out by Mishra,¹⁸ Hugar²¹ and Chattopadhyay.¹³ Most of the deaths occurred in places other than the residence of the victim, as found in the study by Mohanty.¹⁷ Maximum cases (67%) were second degree assaults, as observed by Hugar.²¹

Majority of the fatalities were caused by blunt weapon which is accordance with other studies.^{13,18,20,22,29} The type of weapon inflicting the injury or skull fracture mainly depended on its prior presence at the scene of crime. Contact with wall and ground was considered as blunt weapon in this present study which was the common mode. In some cases, cricket bat, flower vase, rice pounder, iron rod etc. was used. Fire arm was used the least as it is rarely available & weapons such as axe were also rarely used due to their heaviness, size and difficulty in concealment.

It was observed that most number of cases showed linear (52.6%) fracture. Similar observations was found in other studies.^{13,19,20} Most cases (89.7%) presented with vault of the skull fracture, as observed by Chattopadhyay.¹³ 16.5% cases presented with frontal bone Punia²⁰ fracture, as studied by and Chattopadhyay.¹³ In 59.8% cases, combination of SDH & SAH was found, as observed by Mishra.¹⁸

Conclusion:

Violence is often predictable and preventable. Identifying and measuring certain factors which appear to be strongly predictive of violence can provide timely warning to take required action, even if sometimes direct causality is difficult to establish. Sustained efforts by many sectors of society are often necessary to gain political commitments to tackle these.

Conflict of Interest: None. Financial Assistance: None

References:

- World report on violence and health: summary. Geneva, Switzerland: World Health Organization, 2002.[http://www.who.int/violence_injury_preventi on/violence/world_report/en/summary_en.pdf]
- Reza A, Mercy JA, Krug E. Epidemiology of violent deaths in the world. Injury Prevention. 2001;7:104-11.
- Rosenberg ML, Mercy JA. Assaultive violence. In: Rosenberg ML, Fenley MA (eds). Violence in America, a Public Health Approach. New York/Oxford: Oxford University Press. 1991:pp 14-50.
- Hasan Q, Shah MM, Bashir MZ. Homicide in Abbottabad. J Ayub Med Coll Abbottabad, 2005;17(1):78-80.
- Whitman S, Benbow N, Good G. The epidemiology of homicide in Chicago. J Natl Med Assoc. 1996;88(12):781-7.
- Butchart A, Mikton C, World Health Organization, United Nations Office on Drugs and Crime, United Nations Development Programme. Global status report on violence prevention, 2014.

J Indian Acad Forensic Med. July – Sept. 2017, Vol. 39, No. 3

Geneva: World Health Organization, 2014.[http://www.undp.org/content/dam/undp/libr ary/corporate/Reports/UNDP-GVA-violence-2014.pdf]

- Parikh C.K. Parikh's text book of medical jurisprudence, forensic medicine and toxicology for classrooms and courtrooms, CBC Publishers and Distributors, New Delhi, 6th Edition. 1990: 2.1pp, 3.51pp, 4.23pp.
- Section 300. Offences affecting the human body. Indian Penal Code 1860. [Cited 12 Jan 2016]. Available from http://indiankanoon.org
- 9. United Nations office on drugs and crime. 2011 Global study on Homicide. [Cited 12 Jan 2016]. Available from http://www.unodc.org/unodc/en/data-andanalysis/WDR-2011.html
- 10. Blumstein A, Rivara FP, Rosenfeld RB. The rise and decline of homicide-and why. Annual Review of Public Health, 2000;21:505-41.
- Decker, S. Deviant. Homicide: A new look at the role of motives and victim-offender relationships. Journal of Research in Crime and Delinquency, 1996;33:427-49.
- Farrington, D. Origins of violent behaviour over the life span. In: D. J. Flannery, A. J. Vaszonyi, & I. D. Waldman (Eds), The Cambridge handbook of violent behaviour and aggression. Cambridge, UK: Cambridge University Press. 2007.pp.19-48.
- Chattopadhyay S, Tripathi C. Skull fracture and haemorrhage pattern among fatal and nonfatal head injury assault victims . a critical analysis. J Inj Violence Res. 2010;2(2):99-103.
- Saukko P, Kinght B. Knights Forensic Pathology. 3rd ed. New York: Arnold Publication, 2004;174-221.
- Law SK. Thickness and resistivity variations over the upper surface of the human skull. Brain Topography. 1993:6(9):99-109
- 16. Khan AN. Imaging in skull fractures. [Cited 12 May 2015]. Available from http://emedicine.medscape.com
- Mohanty MK, Kumar M, Mohanram A, Palimar V. Victims of homicidal deaths- An analysis of variables. J Clin, Forensic Med. 2005;2(6):302-4.

- Mishra PK, Singh S. Fatal head injury in homicidal deaths in Bhopal region of Central India. Int J Pharm Bio Sci. 2012;3(4):(B)1103-8.
- Malik Y, Chaliha R, Malik P, Sangwan K, Rathi C. Head in homicides: a post-mortem study from north east india. J Indian Acad Forensic Med. 2013;35(3):249-50.
- Punia RK, Yadav A, Lalchand. Pattern of head injuries in homicidal deaths at jaipur during 2012-13, india: an autopsy based study. J Indian Acad Forensic Med. 2014;36(3):242-5
- Hugar SB, Chandra YPG, Harish S. Pattern of homicidal deaths. J Indian Acad Forensic Med, 2010;32(3):194-8.
- 22. Gupta A, Rani M, Mittal AK, Dikshit PC. A study of homicidal deaths in Delhi. Medicine, science and the law. 2004 Apr;44(2):127-32.
- 23. Patel DJ. Analysis of homicidal deaths in and around bastar region of chhattisgarh. J Indian Acad Forensic Med. 2012;34(2):139-44.
- Buchade D, Mohite S. Pattern of injuries in homicidal cases in greater mumbai- a three year study. J Indian Acad Forensic Med. 2011;33(1):46-9.
- 25. Shivakumar BC, Vishwanath D, Srivastava PC. Trends of homicidal deaths at a tertiary care centre Bengaluru. J Indian Acad Forensic Med. 2011;33(2):120-4.
- Shah JP, Vora DH, Mangal HM, Chauhan VN, Doshi SM, Chotaliya DB. Profile of homicidal deaths in and around rajkot region, gujarat. J Indian Acad Forensic Med. 2013;35(1):33-36.
- Vijayakumari N, Magendran J, Meiyazhagan K. Pattern of homicidal deaths at a tertiary care centre, chennai. a prospective study. Ind J Forensic Med Toxicol. 2013;7(1):121-4.
- Henderson JP, Morgan SE, Patel F, Tiplady ME. Patterns of non-firearm homicide. Journal of clinical forensic medicine. 2005 Jun 30;12(3):128-32.
- 29. Singh GO, Gupta BD. Evaluation of mechanical injuries in homicidal deaths (A retrospective study of 5 years). J Indian Acad Forensic Med, 2007;29(30):18-22.
Table 1: Incidence of study population of skull fractures among the total autopsies, total head injuries, total homicidal deaths & total homicidal head injuries.

Variable	Total Autopsies	%	Total Head Injuries	%	Homicidal Deaths	%	Homicidal Head Injuries	%
Homicidal Skull Fracture	97	0.95	97	4.05	97	45.97	97	92.38
Excluding Homicidal Skull Fracture	10040	99.05	2295	95.95	114	54.03	8	7.62

Table 2: Distribution of study population in association with other cause of death.

Association	Deaths	Distribution(%)
Only Head Injury	77	79.38
Strangulation	8	8.25
Stab	3	3.09
Other Fractures	2	2.06
Blunt Injury Abdomen	1	1.03
Cut Throat	1	1.03
Burns	2	2.06
Gagging	1	1.03
Multiple Chop Injury	2	2.06

Table 3: Distribution of study population of homicidal deaths of skull fractures according to the type of the scalp injury.

Scalp injury.			
Scalp Injury	Deaths	Distribution(%)	
Abrasion	4	4.12	
Abrasion & Contusion	1	1.03	
Abrasion & Laceration	8	8.25	
Contusion	52	53.61	
Laceration	30	30.93	
Laceration & Contusion	2	2.06	

Table 4: Distribution of study population of homicidal deaths of skull fractures according to the type of skull

fracture.			
Type of Skull Fracture	Death	Distribution(%)	
Linear	51	52.58	
Depressed	7	7.22	
Comminuted	20	20.62	
Linear & Depressed	2	2.06	
Comminuted &	10		
Depressed	10	10.31	
Penetrating	3	3.09	
Comminuted & Diastatic	1	1.03	
Comminuted, Depressed & Diastatic	1	1.03	
Comminuted, depressed & Perforating	1	1.03	
Comminuted & Perforating	1	1.03	

Table 5: Distribution of study population of homicidal deaths of skull fractures according to the bone of the skull involved in fracture.

Skull Bone	Cases	Distributi on(%)
Frontal	16	16.49
Temporal	15	15.46
Parietal	5	5.15
Occipital	8	8.25
Frontal & Parietal	9	9.28
Frontal & Temporal	3	3.09
Frontal & Occipital	1	1.03
Temporal & Parietal	10	10.31
Frontal, Parietal & Occipital	2	2.06
Frontal, Temporal & Parietal	2	2.06
Frontal & Base of the Skull	1	1.03
Frontal, Temporal, Parietal & Occipital	4	4.12
Frontal,Parietal,Temporal & Base of the Skull	1	1.03
Frontal, Temporal,Parietal,Occipital & Base of Skull	7	7.22
Base of the Skull	2	2.06
Occipital & Base of the Skull	2	2.06
Parietal & Base of the Skull	1	1.03
Temporal & Occipital	1	1.03
Temporal & Base of the Skull	2	2.06
Temporal,Parietal,Occipital & the Base of the Skull	2	2.06
Temporal, Parietal & Occipital	2	2.06
Temporal, Parietal & the Base of the Skull	1	1.03

Figure 1: Distribution of study population according to age.



Figure 2: Distribution of study population of according to the time of incidence.



Figure 3: Distribution of study population according to the time period of survival.



Figure 4: Distribution of study population of homicidal deaths of skull fractures according to the type of weapon.



Figure 5: Distribution of study population of homicidal deaths of skull fractures according to the part of the skull involved in fracture.



Figure 6: Distribution of study population of homicidal deaths of skull fractures according to intracranial lesion.



An Approach to Brought Dead Cases To Hospital -An Autopsy Based Study

¹Padmini Hannah Noone, ²Fairoz Khan

Abstract:

Brought dead cases pose difficulties in determining cause of death. Though the Registration of Births and Deaths Act gives guidelines for doctor who has attended the person during his last illness, to issue to the cause of death; once a person is brought dead to the emergency of a hospital, it becomes a medicolegal case. This is conveniently bypassed in some cases. This questions the basic ethical principle of equality and justice. Again, some hospitals issue brought dead certificates and some release the body without a proper death certificate.

The present study was conducted with the aim of analyzing the pattern of brought dead cases to the hospital, compare history given with the cause of death at postmortem examination, and understanding how the autopsy enhances the cause of death in cases in which it is not clear. The results showed a higher percentage of males (79.5%) than females (20.5%), and more in the age group 20-29 years (25.8%). There was a statistically significant correlation between history and cause of death. Natural cause, consistent with history of present illness, was seen in 12.9% cases; hidden, unnatural cause of death was seen in 2.3% of cases. New information, unknown previously, was found in 15.7% of cases. Unnatural cases comprised 51.5% of the total.

This article ends with algorithms based on the results which may help the State to execute its duty to protect its citizens and the citizens to be law abiding as well in an ethical and legally acceptable manner.

Key Words: Brought Dead, Cause of Death, Unnatural Deaths, Natural Deaths, Medico-legal Issues

Introduction:

Brought dead, also known as 'dead on arrival' cases,¹ pose difficulties in determining cause of death since the doctor is unable to examine the patient in the last hours of death. Though, as per the Registration of Births and Deaths Act,² the doctor who has attended the person during last illness has to issue the cause of death certificate to the best of his ability, many doctors are hesitant to give the same due to fear and inherent suspicion of foul play.

Corresponding Author:

²Assistant Professor,

¹Associate Professor,

Dept of Forensic Medicine and Toxicology, Vydehi Institute of Medical Sciences and Research Centre. Bangalore Email- padmini.noone@gmail.com. LM No : Not a member DOR: 18/11/2016 DOA: 06/09/2017 DOI: 10.5958/0974-0848.2017.00049.5

Depression and suicide in chronically ill and murder of the debilitated is not uncommon.¹ Also, most hospital guidelines say that all brought dead cases are medico-legal. Often, this may occur even in patients with known history of illness. The common man is pulled into dilemma since autopsy comes as an unexpected consequence. This rule gets bypassed in some cases.³ Instances such as these, question the fundamental ethical principle of equality and justice. The present study was conducted with the aim of analysing the pattern of brought dead cases to the hospital, compare history given to the cause of death at postmortem examination, to see how the autopsy enhances the cause of death in cases in which it is not clear. This was done with the aim of developing algorithms which may help to achieve a method which is both legal and ethically acceptable to the citizens and the state as well.

Materials and Methodology:

The study was conducted with the approval of the Institutional Ethics Committee. The data was collected from the 'brought dead register' at the Emergency Department during the period 2014 June - 2016 January. A total of 200 brought dead cases were taken. Then the postmortem reports of these cases, which were autopsied at the department of Forensic Medicine, in the same institution were perused. Sample size was based on the previous studies in this context.^{4,5} It was an observational, retrospective study. The history given at the Emergency, and at the time of inquest were analysed. Details as to age, gender, time of arrival to hospital, presenting complaints, history of past illness, and cause of death as per postmortem report, etc, were looked into.

The data was further analysed to see for correlation between history given at the time of inquest and the cause of death by Chi square test. All brought dead cases to the hospital in the duration specified were included in the study and cases with unclear history and unknown individuals were excluded from the study.

Results:

Of the 200 cases which were brought dead to the hospital, 111(55.5%) came in the day time (8 AM to 8 PM), 88 (44%) came in night time (8.01PM to 7.59 AM). Males were 159 (79.5%) and females, 41(20.5%). The age distribution is shown in Table 1. Post-mortem examination was conducted in 178 (89%) cases. 20 cases were not labelled medico-legal by the Emergency Department. 2 cases were taken to other institutions by the concerned police. When comparing the history, as per the brought dead register, with the history as per the inquest forms, same information was available in 105 (58.9%) cases, more information was provided by police in 69 cases (38.8%) and different information was available in 4 cases (2.3%). Cause of death at post-mortem examination was compared with history given, as shown in Table 2.

In order to check whether there was statistically significant correlation between the alleged cause of death, as per police history and the actual cause of death, as per post mortem report, the two were compared as per **Table 3**.

Chi-square test was applied to see for correlation between cause of death suggested, as per police history and cause of death as per post-mortem examination. This showed a statistically significant correlation. Fisherce Exact Test value was 15.473, exact significance (2 sided) 0.21

Discussion:

Full-fledged forensic pathology is in a way foreigng to Indian culture. Customs do not permit the relatives to eat until the body is cremated or enter their home after seeing a dead body without bath. Some are concerned about the sanctity of the body.^{6,7} Though most educated people understand the need for postmortem examination in spite of religious customs, it is not unusual to see them requesting to take the body away, without opening it. In our experience, even police officers have requested to do minimal autopsy on their colleagues because they were sure it was a heart attack. In all these situations we have convinced them that despite their dissent, post-mortem examination has to be done as per rules, though it is a challenging task.

This issue is compounded when the person has come for treatment to the hospital and dies on the way. In these circumstances, in addition to grief, the relatives find themselves in the midst of medicolegal work. Often they have obtained treatment recently, but when they rush back to the hospital for treatment, just for the technical reason of being brought dead the case may be made medicolegal.

Post-mortem examination report is one of the most important certificates in medicolegal practice. Why is consent from next of kin not required for post-mortem examination? As per jurisprudence, Dead men are no longer persons in the eye of law+.⁸ All the rights bestowed upon the person cease. The body, being the property of the State, the State decides on the best interests of the society. In Indian law, inquest is conducted to enquire into the cause and circumstances of death. S. 174 CrPC⁹ mentions that the officer in charge of the police station or police officer empowered by the state government in his behalf, has to intimate the nearest executive magistrate and conduct inquest once he receives information that 1) a person has committed suicide, 2) or has been killed or 3) has died under circumstances raising reasonable suspicion that some other person has committed an offence. So what is the police supposed to do when they receive information regarding brought dead cases in which the informant is not sure whether it is suspicious or not? This is not clearly mentioned in the CrPC. Many reputed textbooks tells that if no foul play is suspected, the dead body is handed over to the relatives for disposal.d⁰ This is not as per CrPC and the reference for this statement is not available.

Who has to decide to whether a case becomes medicolegal or non-medicolegal? Some recommend doctors to inform police in suspicious cases of brought dead.^{11,12} According to some, the investigating officer alone should decide on waiving of post-mortems.¹³

Guidelines to the procedure to be followed in Dead on arrival cases is given in The Handbook of NACPFMT.¹⁴ This instructs the doctor to maintain a brought dead register. If there are injuries, poisoning signs, suspicion regarding nature of death, it has to be made into medicolegal case. If there are no injuries, poison signs, suspicion regarding nature of death and if treated in the same hospital, cause of death certificate can be issued from the hospital after perusing the relevant documents.^{14,15} If same as above but brought dead to a different hospital, if the documents and examination confirm the same then with a cause of death certificate from the treating hospital, the body can be handed over.¹⁴ In the same situation, the hospital which received the brought dead case can also issue cause of death certificate if the documents conclude natural death by documented diagnosis. If there are no injuries, poisoning, looks like natural death, but not treated by any hospital it has to be made into medicolegal case and relatives have to be informed that this is the only way to get legally a cause of death certificate.¹⁴

Practically, what we see in situations when the body is released without post mortem

examination, is that often the relatives are made to sign a disclaimer that they do not need a cause of death certificate. This deprives them of their insurance claims and other document related processes. This also impedes the cause of justice. Brought dead certificates are issued by some hospitals.¹⁶ They cannot replace cause of death certificate. It is illegal and unethical as well as misleading the authorities.¹⁴ In many parts of India, bodies are cremated without bringing to the notice of police. So cases which need post-mortem examination are not examined, while cases which may not need post mortem examination are examined.¹⁷

Another problem constantly faced is inadequate documentation. All general practitioners have to maintain records of their patientos outpatient treatment as per MCI guidelines. Also, they need to give a referral letter whenever referring patients to hospitals. This will help in gathering documented proof of treatment and can help in finding cause of death.

Our results show that the history provided by the police shows a statistically significant correlation with the cause of death. Also the history given to the police is in much depth than the history given at the emergency, even in cases of natural death. The four cases which were brought with history of vague symptoms to the hospital for treatment showed the unnatural causes; poisoning (3) and hanging (1) on post-mortem examination. In 28 cases, new information unknown previously, was provided by postmortem examination. This shows that post-mortem examination definitely provided more information and enhances the cause of death.

Post-mortem examination is often considered to be synonymous with autopsy though it is not so. Autopsy is the method of dissection of the body, this has been developed in-depth by pathologists with the aim of examining the different organ systems. Most autopsy manuals follow techniques dating from 19th century AD. The methods of Virchow (1821-1902), M lettule (1853-1929), Ghon (1866-1936) and Rokitansky (1804-1878), are still the fundamental methods used for internal examination of organs during postmortem examination, and modifications of these

methods are commonly applied applied.¹⁸ Medicolegal practice in India expects a complete autopsy in all cases as of this day.^{13,19} However, in a country where most of the medicolegal work is done in health centres with limited facility, the extent of autopsy examination varies from the in depth examination done in medical colleges though on paper it looks the same.

In recent days, there is a dispute raised about unnecessary, post-mortems^{20, 21} and whether it is futile in brought dead cases.²¹ In our opinion, postmortem examinations are not unnecessary and cannot be futile. Several surveys in various countries have shown that where a physician offers a cause of death without the benefit of autopsy findings, the error rate is of the order of 25-50%, even in deaths in hospital.²² The effort, time and resources put into it may be futile if done in a mechanical way, besides every cadaver has to be considered carrying a potential risk for infection.²² Times have changed and methods of postmortem examination also has to change with time.

Newer methods have to be applied to postmortem examination. Radiological methods, Toxicology all have to applied in a logical way to get best results. Virchow, in all his wisdom had said <u>in</u> a systematic and scientific performance of an autopsy nothing is more difficult, and at the same time more important, than the insight into the reasons for pursuing a definite order of sequence in every detail of the examination . (Rudolf Virchow 1880).¹⁸ If we understand this, we will not be rigid in our approach. It is important to be systematic, knowing why we have to be so.

Putting together the analysis and the reasoning, we have developed an algorithm for managing cases of brought dead cases at hospitals (**illustration 1**) and postmortem examination in brought dead cases (**illustration 2**). This is meant for cases with history of natural disease with difficulty in establishing cause of death. This may be due to inadequate documents, delayed deaths, treated prior in a different hospital and brought dead to another. This may help to bridge the gap between the objectives of the state and the values of the citizens.

Conflict of Interest: None Financial Asistance: None

References:

- 1. http://lsg.kerala.gov.in/pdf/SystemStudy/Services/ References.pdf Accessed on 11-10-16
- Former Indian president APJ Abdul Kalam has died, aged 83. www.theguardian.com ' World ' India Jul 27, 2015. Accessed on 10-10-16
- Tirpude B, Nagrale N, Murkey P, Zopate P, Patond S. Medicolegal profile of brought dead cases received at mortuary. Journal of Forensic Medicine Science and Law. 2012;21(2):21-25
- Disania NL, Pathak AK, Punia RK. Autopsy study of brought dead cases in jaipur, rajasthan. IJCRR. 2014;6(22):6-9.
- Burton E C. Religions and the autopsy. Medscape News & Perspective Drugs & Diseases Cme & Education, Updated: Mar 20, 2012 http://emedicine.medscape.com/article/1705993overview. Accessed on 09-11-2016
- 6. Gatrad AR, Muslim customs surrounding death, bereavement, postmortem examinations, and organ transplants BMJ. 1994;309(6953):521-3.
- Mahajan V D. Rersons+. In: Jurisprudence and legal theory. 5th Ed. Lucknow: Eastern Book Company;2001.pp.380-82
- Section 174 in the criminal procedure code 1973. Available from https://indiankanoon.org/doc/411677/ Accessed on 2-9-17
- Biswas G. Review of Forensic Medicine and Toxicology Including Clinical and Pathological Aspects. 2nd edition, 2012, Jaypee Brothers Medical Publishers(P) Ltd.New Delhi. pp 35
- Singh AK, Singh K, Verma A. Study of medicolegal case management in tertiary care hospital. J Indian Acad Forensic Med. 2011;33(4):337-42.
- Medicolegal guidelines(internet) Official website, Dr. V.N.Jindal Goa Medical College available from http://www.gmcmec.gov.in/frameset/medicolegalg uidelines.html accessed on 11-10-16
- Murty OP, Kohli A, Millo T, Rani M, VermaSK, SikaryA K, et al. Uniform guidelines for postmortem work in india: faculty development on standard operative procedures (sop) in forensic medicine and toxicology Journal of Forensic Medicine & Toxicology. 2013;30(1&2):1-47

- Jagadeesh N. Procedure to be followed in Dead on Arrival cases.in : NACPFMTs. Practical Medicolegal Handbook for Forensic and Medical Practitioners(forthcoming)
- Physicians manual on medical certification of cause of death, office of registrar general, India, Govt of India, Ministry of Home Affairs, New Delhi, Sep 2012, 5th ed, p:1
- 15. Saralaya PK, Dzousa DH, Kiran J. Brought dead certificate. J Kar Med Leg Soc.2004:13(2);41-4.
- 16. Jagadeesh N ,The status of forensic medicine in India. Indian Journal of Medical Ethics 2008. 5: 4.
- ConnollyAJ,Finkbeiner WE, Ursell P C, Davis RL. Autopsy pathology: a manual and atlas 3rd edition.2016 Elsevier Health Sciences, philadelphia. Available from https://www.amazon.com/Autopsy-Pathology-Manual-Atlas-3e/dp/0323287808. Accessed on 2-9-17
- Government of Maharashtra. Chapter xii Post mortem and medico-legal work ref: hospital administration manual vol. I (revised) Available from http://www.mlam.in/pdf/forensicmedicineandscien ce/postmortemandmedicolegalwork.pdf
 Accessed on 2-9-17
- Khandekar I, Medicolegal investigationconstitutional validity of police officials existing practice of ordering post-mortem examination vis a vis 174 CrPC-A Cause of Concern, 15-12-15. Available from https://www.dropbox.com/s/0q06yelbcfzizj8/Govt %20Postmortem-%20Police-174%20CrPC.pdf?oref=e accessed on 11-10-16
- 20. Maharashtra government asks officials to study the report on ±innecessaryqpostmortems. India Medical Times. October 3, 2015. Available from
- http://www.indiamedicaltimes.com/2015/10/03/ma harashtra-govt-asks-officials-to-study-the-reporton-unnecessary-postmortems. Accessed on 11-10-16
- Saukko P, Knight B. The forensic autopsy. In :Knighton Forensic Pathology. 4th edition. CRC Press. Taylor and Francis. Boca Raton. pp:1-54

ISSN 0971-0973

Range of age	Number	Percentage
0-9	7	3.5%
10-19	18	9%
20-29	51	25.5%
30-39	36	18%
40-49	41	20.5%
50-59	23	11.5%
60-69	13	6.5%
70-79	8	4%
80-89	0	0%
90-99	1	0.5%
Not available	2	1%
Total	20	00

Table 2 Cause of Death

Cause of death in comparison with history	Number of cases (%)
natural consistent with history of previous illness	31 (17.4%)
natural consistent with history of present illness	23 (12.9%)
natural new information unknown previously	28 (15.7%)
hidden unnatural cause of death	4 (2.2%)
unnatural cause consistent with history	92 (51.7%)

Table 3 showing Cause of death as per inquest form and as per the post-mortem report

•	•	•
Cause Of Death	As Per Inquest Form	As Per PM Report
Injuries	66(37.1 %)	66(37.1%)
Hanging	10(5.6%)	11(6.2%)
Electrocution	9(5.1%)	8(4.5%)
Drowning	2(1.1%)	2(1.1%)
Poison and alcohol intoxication	2(1.1%)	5(2.8%)
Aspiration	0(0%)	4(2.2%)
Natural	77(43.3%)	82(46.1%)
unknown	12(6.7%)	0(0%)
Total number	17	/8

Table 1 Showing age range in years



Illustration (1) showing management of brought dead cases to hospital

Illustration (2) Showing flow chart for post-mortem examination in case of brought dead cases



Determination of Sex from Cranial Length, Cranial Height and Length-Height Index

¹Murli Lalwani, ²Jayanthi Yadav, ³Arneet Arora, ⁴B. P. Dubey

Abstract:

One of the most important objectives of postmortem examination is to establish the identity of the individual. Age, sex, stature are key factors to decide a person¢ identity. Various parts of the skeleton are useful in sex determination such as the pelvis, long bones, mandible and cranium. Among these, the skull can be used to ascertain individual sex with high accuracy. Most of the previous studies of sex differences in the skull were centred on morphological traits in a descriptive manner (cranioscopy) whereas the recent studies are focused on morphometry or craniometry in largely quantitative and statistical aspects. A prospective craniometric study was conducted to differentiate sex from dry human skulls, on the basis of cranial length, cranial height and cranial length-height index. The study was conducted on 160 human skulls (100 males and 60 females) of adult age, in the department of Forensic Medicine, Gandhi Medical College, Bhopal. On statistical analysis, the cranial length, height and length-height index were found to be useful parameters for determining sex of an individual (p<0.01 for cranial length and height and p>0.05 for cranial length-height index).

Key Words: Cranial Length, Cranial Height, Length-Height Index, Sex Determination

Introduction:

Human remains are very seldom preserved from antiquity with enough soft issues intact to make a visual determination of sex. In the field of forensic medicine, normally the available materials, after sufficiently long period of death, will be utilized to determine various body characteristics such as age, sex, etc for identification of individual. Gender has long been determined from skull, pelvis and the long bones

Corresponding Author:

¹Associate Professor,

Department of Forensic Medicine, Gandhi Medical College, Bhopal

²Additional Professor, ³Professor & Head, Department of Forensic Medicine, AIIMS, Bhopal

⁴Dean, LN Medical College & Hospital, Bhopal

E-mail: murliinfmt@gmail.com L. M. No: LM/IAFM/709

DOR: 25/07/2017 DOA: 09/09/2017 DOI: 10.5958/0974-0848.2017.00050.1

with epiphysis and metaphysis in unknown skeletons. Anthropometry is an important part of physical/ biological anthropology. Forensic anthropometry is as scientific specialization that emerged from the discipline of anthropology dealing with identification of human remains with the help of metric techniques.¹ Forensic anthropologists do not rely solely on morphology to estimate sex because there are several when circumstances this technique is insufficient. The use of anthropometry may arise under several sets of circumstances i.e, natural, intentional and accidental (air crash, train accidents, flood, fire etc) of the dead body.² The skull appears to be the main reliable bone apart from the pelvis exhibiting sexually dimorphic features.² Other bones such as clavicle, calcaneous, radius and ulna had also been found useful in some cases, although there exist regional and racial variations in the skeleton.³ Pre-adolescent bones are almost useless in sex identification as they show little or no dimorphic features or dimension due to the

fact that the secondary sexual characteristics do not develop save for hormonal influence at puberty.⁴ Measurement of length, basi-bregmatic height and length-height index of human skull are significant parameters for sex determination. Few studies have been done in this direction, hence this study was undertaken to determine the sex from skull.

Materials and Methodology:

The metric study for determination of sex from dry human crania was done in the department of Forensic Medicine Gandhi Medical College, Bhopal. All the skulls used for the study were adult. Only the intact, undamaged skulls with known sex and without any injury, pathology or congenital anomaly were selected for the study. Of the total 160 skulls studied 100 were male skulls and 60 were female skulls. Spreading caliper was used to measure the dimensions.

Measurements:

- 1. **Maximum Cranial Length (G-Op)**. Measured from glabella (G) to opisthocranion (Op), in mid-sagittal plane, using spreading caliper.
- 2. **Basi-Bregmatic Height (Ba-Br)** . Measured from Basion (Ba) to Bregma (Br) in vertical plane using spreading calliper.

Index:

Length-Height Index (H.I.): It is the ratio of vertical height of the skull (Ba. Br), to maximum length of the skull (G. Op) it is denoted as⁴:-

Height of skull from basion to bregma (Ba-Br)

H.I. = ------ x 100 Maximum length of skull (G-Op)

The data obtained was analysed statistically to find out the range, the mean and standard deviation. The observations were statistically computed and 2 qtest was used to measure the level of significance for determination of sex. The p valueqwas determined to find out whether the sexual differences between means were significant or not. These measurements and index were used to study sexual dimorphism in the skulls.

Observation and Results:

The result of both the measurements i.e. maximum cranial length and maximum cranial breadth were found to be higher in male skulls. The difference in the male and female sex was also found to be highly significant on applying the statistical tests.

1. Maximum Cranial Length (G-Op):

The length varied from 16.72 to 19.33 cm (mean = 17.93) for males and 16.08 to 18.22 cm (mean = 17.18 cm) for females. The \angle qtest for length was 8.32 (p < 0.01), which reveals the highly significant difference between male and female cranial length.

2. Maximum Cranial height (Ba-Br):

The maximum cranial height for male skulls varied from 11.82 to 14.80 cm (mean = 13.04 cm) and for female skulls from 11.60 to 13.26 cm (mean = 12.48 cm). The \pm qtest was 7.93 (p < 0.01), suggests highly significant difference between male and female cranial height.

3. Cranial Length-Height Index:

Cranial Index varied from 64.53-84.08 (Mean= 72.76) for males and 67.54-79.27 (mean= 72.65) for females. \angle qtest was 0.14 (P >0.05) suggest insignificant difference between male and female cranial Length-Height index.

Discussion:

Skull is one of the commonest parts of the skeleton used to opine on the sex of an individual. Sexual dimorphism is insignificant in the pre-pubertal age group. Although adult skulls show a few non-metric and metric differences, there is paedomorphic tendency in the human skull of either sex.⁵ Absolute sexual difference seldom exists.⁶ Hormones, nutritional status, cultural differences and environmental factors affect these variations. Skulls from different geographical areas vary much.⁷ Skull shapes may also vary within a population and even among the closely related. Generally speaking, dimensions of the male are larger than those of the female craniometric data.⁸

Cranial length:

Cranial length in the present study was found to be a significant parameter of craniometry for sex determination. The reliability of cranial length in sexual dimorphism is correlated with the various studies and that supported cranial length measurement a useful parameter for the purpose of identification of sex of skull.

In a craniometric study on 220 adult dry human skulls, Pathi et.al, found the maximum antero-posterior length for male 160. 187 mm with a (Mean . 174.7<u>+</u>6.64) and for female 158. 180 mm (Mean . 169.3 <u>+</u> 5.82) He reported significant difference between male and female cranial length (P<0.01). and show similarity with the present study perhaps due to the common racial origin of the skeletal material.⁹

Shah & Jadhav done a study on 500 medical students varying in age from 17 to 23 years. His findings of cranial length, are very much similar to those obtained in the present study. He summarized that the sex of an individual can be accurately determined with the head measurements.¹⁰

Sexual dimorphism between the genders increases with increasing age. Sexual differences in skull are better projected as one attains adulthood.¹¹ In a recent study by E. Briner et al. On a population from Italy was analysed for the prevalence and expression of endocranial characters as well as for the presence of some ectocranial epigenetic traits. Many differences in males and females are the result of allometric trajectories, with males shifted to be a larger size.¹²

Gender differences with respect to the mean cranial length were found to be significantly larger in males compared to females (p<0.001) by Ilayperuma from Sri Lanka¹³, Priyanka et al¹¹, Pathi et al⁹.

Studies by many others also substantiate this gender variation, though the metric values varied depending upon the racial population examined. Cranial length in present study and various other studies is found to be a reliable craniometric parameter for sex determination.

Cranial Hight (Ba-Br):

Cranial height is found to be highly significant craniometric parameter for sexual dimorphism. In various other studies also, it showed to be an important cranial measurement for sex determination. The findings of basibregmatic height by MacDonell and G.M. Morant correlate with the finding of the present study.^{14,15} The range of observations of cranial height in both male and female skulls by Manjunath also correlate with the present study.¹⁶ The results of study by Anatole and Lieberman (European skulls) indicate the cranial height to be less than the height measured in the present study.¹⁷ Anatole and Lieberman¹⁷ used different method to measure the cranial height.

They measured anthropological external and inner height, and radiological external and internal heights, the values of all of which are less than the present study. The height, as mentioned in all other studies, is more than that in the present study. Correlation is however seen with the other Indian study by Manjunath¹⁶, done on skulls of Indian origin.¹⁶ Bruner, et.al mentioned that the metric variables confirm that males have larger cranial diameters than female. Along the three main diameters, the Basi-Bregmatic height seems to be the major size determinant, suggesting that the vertical direction of growth is the preferential or, at least, the most variable axis of development in modern human crania.¹²

Christopher B. Ruff¹⁸, Todd¹⁹ and Hooton²⁰ found that craniofacial growth does not end with the adolescent growth period, but continues at a slow rate throughout adulthood. Christopher's study on craniofacial dimensions on 136 adult males, (prehistoric American skeletal sample for the Indian Knoll), were compounded in age group 20-34 years and 35-50 years and observed as .

S. No.	Measurement	20-34 years Mean (mm)	35-50 years Mean (mm)
1.	G-OP (L)	170.3	180.6
2.	Ba - Br. (H)	139.5	141.9

Cranial Length-Height Index:

Skulls of our study were classified as orthocranic (mean length-height index between 70. 75). It was observed in the present study that 55% male and 85% female skulls were orthocranic (L-H index between 70-75); and 27% male and 8.33% female skulls were hypsicranic (L-H index is more than 75), while 18% male and 6.67% female skulls were chamaecranic (L-H index is less than 70).⁴ El. Najjar⁴ and Kiyono et al²¹ in their study on West Japanese skulls found the mean length-height index of male skulls to be 73.63 and that of female skulls to be 73.42 and these values are closer to present study, but slightly higher.^{4,21} Findings of the studies by Peter Brown were further higher than the present study but orthocranic in classification.²² In the study by MacDonell (English skulls), findings were less than the present study and could be categorised as chamaecephalic.14 Dodo²³ (Japanese Jomon skulls), Yukio Christopher¹⁹ (Indian Knoll) and G.M. Morant¹⁵ (Tibetan skulls, all male) reported the mean length height index to be more than 75 and were higher than the present study and could be grouped in hypsicranic category.

Summary and Conclusion:

As per the present study, the cranial length and cranial height were found to be useful craniometric parameters for sex determination. Cranial height proved to be more significant, hence more reliable sexual dimorphic parameter than cranial length. Results of Cranial lengthheight index were insignificant for sex determination in present study so also in various other studies. However Cranial Length-Height index is useful parameter for classification of skull.⁴

Conflict of Interest: None Financial Asistance: None

References:

- Krishnan K. Anthropometry in forensic medicine and forensic science . <u>forensic anthropometry</u>. The Internet J Forensic Science. 2007;2(1):1-8
- Krogman WM. The human skeleton in Forensic Medicine. 3rd Edition. Springfield, Thomas.1986; Pp 277-87.

- 3. Stewart TD. Hardlickacs practical anthropometrics. The Wistar Institute Press, Philadelphia, 1947:253-60.
- El-Najjar, M.Y. and McWilliams, K.R. Forensic Anthropology: The Structure, Morphology and Variation of Human Bone and Dentition. Springfield, III: Charles C Thomas. Thomas press, Springfield, 1978:5-8.
- 5. Gray Henry. Gray Anatomy. The anatomical basis of medicine and surgery. 38th Edition. New York, Churchill Livingstone.1995; Pp 609-12.
- Bass WM. Human osteology. laboratory and field manual. 3rd Edition. Columbia, Missouri Archeological Society.1987
- Adejuwon SA, Salawu OT, Eke CC, Femi-Akinlosotu W & Odaibo AB. A craniometric study of adult humans skulls from Southwestern Nigeria. Asian Journal of Medical Sciences.2011;3(1):23-5.
- Roopapkhun S, Piyasin S, Vatanapatimakul N, Kaewprom Y, Sitthiseripratip K. Craniometric study of Thai skull based on Three-Dimensional Computed Tomogarpgy (CT) Data. J. Med. Assoc. Thai.2010;93(1):90-8.
- Pathi B, Sarangi AK & Misra KK. Anthropometric study of skull as an aid to sex determination. Journal of Indian Academy of Forensic Medicine.1982;5(1):13-7.
- Shah GV & Jadhav HR. The Study of Cephalic index in Students of Gujarat. J. Anat. Soc. India. 2004;53(1):25-6.
- Singh P and Purkait R. A Cephalometric Study among Sub Caste Groups Dangi and Ahirwar of Khurai Block of Madhya Pradesh. Anthropologist, 2006;8(3): 215-17.
- Bruner E, Averini M and Manzi G. Endocranial traits. Prevalence and distribution in a recent human population. Eur. J. Anat., 2003;7(1):23-33.
- Ilayperuma I. Evaluation of cephalic indices: A clue for racial and sex diversity Int. J. Morphol., 2011;29(1):112-7.
- Macdonell WR. A study of the variation and correlation of the human skull, with special reference to English Crania. Biometrika.1904; 3: 191-244. As quoted by Gohiya VK et al. Estimation of cranial capacity in 2025 year old population of madhya pradesh, a State of India. Int. J. Morphol. 2010;28(4):1211-1214
- 15. Morant, G. M. A first study of the Tibetan skull. Biometrika.1922-23;14:193-260. Available from:

https://biomet.oxfordjournals.org/content/23/3-4/249.

- Manjunath, K.Y. Estimation of cranial volume in Dissecting Room Cadavers. J. Anat. Soc. India.2002;51(2):168-72.
- 17. Tildesley, M.L. Determination of the cranial capacity of the Negro from measurements on the skull or the living head. Biometrika1927;19:200-6. Available from: www.citeulike.org/user
- Dekaban A. and Lieberman, J.E. Calculation of Cranial Capacity from Linear Dimensions. Anat. Rec.1977; 150: 215-220. Current Anthropology. August 2014;55(4):419-443
- Christopher, B.R. Age differences in craniofacial dimensions among adults from Indian Kholl, Kentucky, Am. J. Phys. Anthropol. 1980;53:101-8.
- Todd W. Cranial capacity and linear diversions in white and Negro. American journal of physical anthropology.1923;
 98-12. As quoted in: Current Anthropology, Vol. 53, No. S5, The Biological Anthropology of Living Human Populations: World Histories, National Styles, and International Networks (April 2012), pp. S196-S209
- Hooton, E.A. In Up from the Apeq p. 355. New York. Macmillan Col.1946. As quoted by Deepak S. Howale et al. Correlation Between Cranial Index and Foramen Magnum Index in Human Dried Skulls. Global Journal for research Analysis. 2014;3(1):3-6
- Kiyono, K. and H. Miyamoto. Anthropologische Untersuchungen ü ber das Skelett der Tsukumo-Steinzeitmenschen. II Der Schädel. Journal of the Anthropological Society of Tokyo.1926; Vol. 41, pp. 95-140, 151-208.
- 23. Brown, P. Artificial cranial deformation; A component in the variation in Pleistocene Australian Aboriginal crania. Archaeology in Oceania1981; pp. 156-167.
- Dodo Y. A metrical analysis of Jomon crania from the Tohoku district. Journal of the Anthropological Society of Nippon, Vol. 90 (Suppl.).1982; pp. 119-128. (In Japanese with English summary) As quoted by: Yuji Mizoguchi and Yukio Dodo.

Metric and Non-metric Characters of the Jomon Skulls from the Ebshima Shell-Mound in Northeastern Honshu, Japan. Anthropological Science. 2001; 109(1):23-56

Table1: Range, Mean and Standard Deviation of Maximum Cranial Length (G-Op)

Parameter	Male (n=100)	Female (n=60)	
Range	16.72 – 19.33	16.08 – 18.22	
	cms	cms	
Mean	17.932 cms	17.18 cms	
S.D.	0.596	0.514	
Mean <u>+</u> 3 S.D.	16.14 - 19.72	15.64 - 18.72	
Ztaat 0.22 mulue <0.01 Information I lighty significant			

Z test- 8.32, p value < 0.01, Inference – Highly significant

Table2: Range, Mean and Standard Deviation of Maximum Cranial Height (Ba-Br)

0 (/			
Parameter	Male (n=100)	Female (n=60)	
Range	11.82-14.80	11.60-13.26 cms	
-	cms		
Mean	13.04 cms	12.48 cms	
S.D.	0.525	0.366	
Mean <u>+</u> 3 S.D.	11.47-14.62	11.38-13.58	
7	0.04.1.6		

Z test- 8.32, p value < 0.01, Inference – Highly significant

Table3: Range, Mean and Standard Deviation of Cranial Length-Height Index (HI)

	0 0	
Parameter	Male (n=100)	Female (n=60)
Range	64.53-84.04	67.54-79.27
Mean	72.76	72.65
S.D.	3.03	2.34
Mean <u>+</u> 3 S.D.	63.67-81.85	65.63-79.67

Z test = 0.14, p value > 0.05, Inference – Insignificant

Table 4: Comparison of Cranial Height in Various Studies

ottudies					
Investigator	YEAR	MALE	Female		
Present study	2005-06	13.04	12.48		
MacDonell	1904	13.20	12.47		
Tildesley	1927	11.14	10.75		
(Auricular Ht.)					
E. Bruner et.al.	2003	13.47	12.65		
Yukio Dodo	1982	14.09	13.36		
Kiyono et.al	1928	13.58	12.96		

Digital Measurement of Dentinal Translucency in Correlation with Age Maturity - a Fact or Fiction?

¹Gopika M.G, ²Sunayana Manipal, ³Dinesh T, ⁴Rajmohan M, ⁵Naveen, ⁶Prabu D, ⁷Nagarathinam A.E

Abstract:

Background: Age estimation has been a dentistos cup of tea with regard to forensic dentistry. It is easy, widely adapted and reliable procedure during mass disasters. Traditionally, dentinal translucency has been measured using Vernier Calipers and technology is seldom used.

Objectives: This study was aimed at integrating the computer based digitalization to measure dentinal translucency on sectioned teeth translucency measurements.

Materials and Methods: Twenty extracted permanent teeth were collected and were sectioned. They were then mounted on the scanner and scanned. The scanned images were then measured using American Board of Forensic Odontology Scale (ABFO) No. 2 Scale. The length of translucency was measured using Adobe Photoshop

Results: Correlation coefficients of translucency measurements of the estimated age showed a high degree of correlation with the actual age with a mean difference of \pm 10. The relation was linear with translucency as a better indicator with advancing age

Conclusion: The translucency measurements obtained by the digital methods can be recommended to save time in comparison with the manual method.

Key Words: Age assessment, Dentinal translucency, Computer, Adobe Photoshop, Forensic Dentistry

Introduction:

Dentists have played a pivotal role in forensic investigations since 1776 when Paul Revere identified his friend Dr. Joseph Warren, due to the presence of a small denture that Paul Revere had fabricated for Dr.Warren.¹

Corresponding Author:

²Reader

¹Research assistant,
⁴Senior lecturer,
⁵PG student,
⁶Prof. & Head,
Dept.Public Health Dentistry, SRM Dental College,
Ramapuram, Chennai Tamil Nadu.

³Reader,
 ⁷PG student,
 Department of Oral Pathology,
 SRM Dental College, Ramapuram, Chennai Tamil Nadu.

Email id: gsunayana@yahoo.com. L. M. No: Not a Member DOR: 22/09/2016 DOA: 10/05/2017 DOI: 10.5958/0974-0848.2017.00051.3 The uniqueness of forensic science has always played a pivotal role during the identification of victims in a mass disaster or natural calamity where the information of the deceased is unavailable. It is also used in crime scene investigation for the identification of the identity of the criminal or deceased.

Estimation of post-mortem remains is a challengeable task and even more difficult is age estimation. As teeth can withstand significant amount of destruction, they tend to play a major role in reconstructive and comparative evidence. A lot of methods are available to estimate the age of individuals based on the dentition. Atlas method,² Moorrees, et al,³ and Anderson, et al² have all been used estimated the age of the children. In adults Gustafson¢ technique,⁴ Demirijians technique,⁵ Johanson¢ technique⁶ and Willem¢ techniques⁷ have been used in the 19th century of which, of noted popularity was the Gustafson¢ morpho-histologic approach,⁴ that has occupied a prime place in age

estimation. The next preferred technique was the Johanson¢ technique.⁶ All these techniques used the dentinal translucency as a key factor in age estimation. Age estimation based on dentinal translucency is a widely accepted method.²

Traditionally, measuring age based on dentin translucency was done with aid of Vernier Callipers. As with advancements in technology, this seems to be rather outdated approach that involves wasteful expenditure of time and energy. Hence, in order to provide a better solution to save time and the ease of storage, digitalisation seems to be a better alternative. Hence this study was aimed at describing a new digitally simple method for age estimation by analysing dentinal translucency as an aid in forensic identification.

Materials and Methodology:

Twentv permanent teeth from individuals in the age group 25 to 55 years, extracted for valid clinical reasons, such as malocclusion/orthodontic treatment, periodontal disease and caries, were obtained from the Department of Oral and Maxillofacial Surgery, SRM Dental College. The extracted teeth were thoroughly cleaned and soft tissue remnants removed from the root surface with a scalpel. The teeth were kept in 10% formalin and, following, xation, manual sectioning was done using Arkansas stone in the buccolingual plane as close as possible to the central axis of the tooth.

Each tooth section was placed next to an American Board of Forensic Odontology Scale (ABFO) No. 2 scale[2] (Fig.1) on the scanner platen. The long axis of the section was aligned parallel to the y-axis of the scale. Prior to scanning, the scanner setting was veri, ed to be 100% of the original to ensure life-size scanned images. Subsequently an image of 600 dpi resolution of the section with scale was obtained (Fig. 2). The scanner lid was kept open while scanning and ambient light conditions kept to a minimum (note: keeping the lid closed obstructs passage of the optical scanning light through the translucent zone, rendering the entire tooth section opaque). Scanned images were imported to Adobe Photoshop image-editing software for viewing and measuring the extent of translucency. The different dental tissues are generally appreciable on the image and dentinal translucency, in particular, appears as a dark region on the section (**Fig.2**).

Translucency was measured using a number of tools available on Adobe Photoshop. The method for measuring translucency that follows has been adapted from different steps described by Johansen and Bowers for digital analysis of bite mark evidence.^{[6}] For convenience of measuring apical and coronal extent of translucency, % juides+were placed on image (Fig.3). These guides can be the activated by inserting Photoshopos in-built %ulers+ along the edges of the image (on the Menu Bar choose View > Rulers, or Ctrl R, or Command R for Macintosh systems). Once the rulers are activated, guides are placed by clicking the cursor within the x-axis (horizontal part) of the ruler and dragging onto the image.

Click and drag as many guides as may be required onto the image but it is anticipated that two should suffice. To move a guide, the Move Tool is used; alternatively, the Ctrl key is held down (Command key for Macintosh systems) and the guide moved to the desired location. Once the respective guide has been placed at the apical and coronal extent of root dentin translucency, the distance between them can be obtained using the Measure Tool on the Toolbox (Fig. 3). Using this tool, a line is drawn between the guides; the distance (D1) is displayed in the Options Bar. If the Options Bar is not displayed, it can be activated by choosing Window > options. Measurements obtained using the Measure Tool is sensitive to 0.1 mm. The measuring line drawn can be kept vertical by holding down the Shift key. The units were ensured to be in mm by comparing with the reference ABFO No. 2 scale. In the event units are not in mm, choose Edit > preferences > units and rulers and select "mm" under units and click OK.

Statistical Analysis:

Age was estimated by using the translucency length obtained for each case using the formula

Age = $40.0391+(2.1063 \text{ x} \text{ translucency length})[^6]$

Correlation between age and dentin translucency length was done using Pearson's correlation.

Results:

Table 1: The actual age and estimated age of the study patients: It could be inferred from the present study that around thirteen samples show a discrepancy from the actual age to the calculated age, based on translucency of -3 to +9, and seven samples show a greater discrepancy form +11 to +17; considering \pm 10 as positive result and < \pm 10 as negative. Positive results with minor discrepancy were seen in 65% of the study population (i.e. from -3 to +9, 13 samples) and negative result was seen in 35% of the population.

Figure 4: Correlation between age and length of translucency: This picture depicts the correlation coefficient between the age and length measurement. A strong positive correlation exists (R=0.9299). This means that as the age increases, the length between the apical and coronal extent of root dentin translucency increases and vice versa. P value is measuring the significance of the correlation. The P value is < 0.00001. The result is significant at P < 0.01 which means that the result is significant at 99% confidence interval.

Discussion:

Dentinal translucency was extensively studied by Tomes⁸ and it was first applied in the field of forensic sciences by Bang and Ramm.9 Difference in refractive indices between intratubular organic and extra tubular inorganic material was equalized, resulting in increased translucency of the affected dentin that has been the key principle in age estimation using dentinal translucency. The apex of the tooth seems to be the most reliable source for age estimation.⁸ This was first observed by Miles, et al.¹⁰ Our study has used the apex of the tooth for age estimation. As the age advances, the translucency progresses from the apex towards the crown portion of the tooth. This suggests a linear relationship and the present study also adheres to this fact. It was also observed by Johnson, et al.⁶

We used digitalization of the sample, and observed that a good linear relationship was stabilized. It proves the fact that digitalization can be used over manual methods. This is in correlation with the studies done by Acharya, et al¹¹ and contradictory to the study done by Drusini, et al¹² and Valenzuela, et al.¹³ The present study shows that age was estimated within a range of \pm 10 suggesting that about 65% of the study population falls under this category. This is in agreement with the studies done by Simranjit Singh, et al¹⁴ but it is in contrast with the studies done by Acharya, et al^{11} who estimated the age within ±5 years. This difference needs to be validated further with studies done on a large scale and involving a wider age category of patients.

Advantages of This Method:

- 1. Software program that is used is commercially available and a widely used image-editing digital aid.
- 2. Accuracy of age estimation using present digital method is much higher to that of conventional method.
- 3. Images can be stored and conveniently retrieved for future use, irrespective of the condition of the actual tooth section.
- This method is least affected by environmental factors and the pathological process.¹⁵
- It can also be used on intact teeth and not necessarily on extracted teeth although tooth sections provide better detail.¹⁶
- 6. This method does not require a great level of expertise.
- 7. As the teeth are symmetrical in their position, any tooth from any relative position can be included for measuring purpose.¹⁶⁻¹⁸

Disadvantage of This Method:

- 1. Wider variations seen.¹⁹
- 2. There is no global accepted definition of the upper and the lower limits of root dentin translucency.²⁰

Limitation of the Present Study:

1. In order to validate this study a larger sample size needs to be taken.

- 2. Ideally, the formula that we had used for the age estimation was derived based on earlier study digital translucency measurements.
- 3. This study has adapted a 2D computer based Adobe Photoshop image editing software which is less precise when compared to 3D view. (Dentin translucency in buccolingual plane is only viewed and is considered.)

Conflict of interest: None Financial Assistance: None

References:

- Ring ME. Paul Revere- dentist, and our country's symbol of freedom. NY State Dent J. 1976;42(10):598-601.
- Helen M. Liversidge. Accuracy of age estimation from developing teeth of a population of known age (0. 5.4 years). Int J Osteoarchaeology. 1994;4(1):37-45.
- Moorrees CF, Fanning EA, Hunt E. Age variation of formation stages for ten permanent teeth. J Dent Res. 1963;42:1490-502.
- 4. Gustafson G. Age determination on teeth. J Am Dent Assoc. 1950;41:45-54.
- Demirjian A, Goldstein H, Tanner JM. A new system of dental age assessment. Hum Biol. 1973;45: 211-27.
- 6. Johanson G. Age determination from teeth. Odontol Revy 1971;22:1-126.
- S Jyotsna. Dental age estimation using Willems method: A digital orthopantomographic study. Contemporary Clinical Dentistry. 2014;5(3):371-6.
- Acharya AB, Sivapathasundharam B. Forensic Odontology. In: Rajendran R, Sivapathasundharam B, Ed. Shaferos Textbook of Oral Pathology. 6th ed. Noida, India: Elsevier; 2009. p. 871-99.
- 9. Bang G, Ramm E. Determination of age in humans from root dentin transparency. Acta Odontol Scand. 1970;28:3-35.
- 10. Miles AE. Dentition in the estimation of age. J Dent Res. 1963;42:255-63.
- 11. Acharya A B. A new digital approach for measuring dentin translucency in forensic age

estimation. Am J Forensic Med Pathol. 2010;31:133-7.

- Drusini A, Calliari I, Volpe A. Root dentine transparency: Age determination of human teeth using computerized densitometric analysis. Am J Phys Anthropol 1991;85:25-30.
- Valenzuela A, Martin-De Las Heras S, Mandojana JM, De Dios Luna J, Valenzuela M, Villanueva E. Multiple regression models for age estimation by assessment of morphologic dental changes according to teeth source. Am J Forensic Med Pathol 2002;23:386-9.
- Simranjit Singh, Ramesh Venkatapathy, PD Balamurali, NSC Charles, R Suganya. Digital approach for measuring dentin translucency in forensic age estimation. J Fore Dent Sci. 2013;5(1):47-51.
- Bajpai M, Mishra N, Sharma P. A Comparison of the Accuracy of Maples & Rice & newly derived Formula for Age Estimation: A Forensic study.: J Orofacial Res. 2012:2(1):1-4.
- Vasiliadis L, Stavrianos C, Dagkalis P, Parisi K S, Stavrianou I, Tatsis D. Translucent root dentine in relationship to increasing age: review of the literature. Res J Biol Sci. 2011;6(2):92-5.
- Azaz B, Michaeli Y, Nitzan D. Aging tissues of the roots of nonfunctional human teeth (Impacted Canines). Oral Surg Oral Med Oral Pathol. 1977;43:572-8.
- Solheim T. Dental root translucency as an indicator of age. Scand J Dent Res 1989;97:189-97.
- Singhal A, Ramesh V, Balamurali PD. A Comparative analysis of root dentin translucency with known age. J Foernsic Dent Sci 2010;2:18-21.
- 20. Nalabandian J, Gonzales F, Sognnaes RF. Sclerotic age changes in root dentin of human teeth as observed by optical, electron and X-ray microscopy. J Dent Res. 1960;39:598-607.

Figure 1: ABFO No.2 Scale



Figure 2: Scanned image of the tooth in the scanner



Figure 3: Measuring the length of translucency using Adobe Photoshop



Figure 4: Correlation between age and length of



Table 1: The actual age and estimated age of the study

	patients					
Patient	Actual	Length	Calculated	Rounded	Discrep	
No	Age		age	off age	ancy	
1.	47	4.8	50.14934	50	3	
2.	25	1	42.1454	42	17	
3.	30	1.2	42.56666	43	13	
4.	40	4.5	49.51745	49	9	
5.	34	3	46.358	46	12	
6.	25	0.6	41.30288	41	16	
7.	35	3	46.358	46	11	
8.	35	3.2	46.77926	47	12	
9.	53	5.4	51.41312	51	2	
10.	50	4.8	50.14934	50	2	
11.	48	4.7	49.93871	50	1	
12.	55	5.5	51.62375	52	-3	
13.	35	3.1	46.56863	47	12	
14.	42	4.7	49.93871	50	8	
15.	44	4.8	50.14934	50	6	
16.	39	2.6	45.51548	46	7	
17.	38	2.4	45.09422	45	7	
18.	42	4.2	48.88556	49	7	
19.	40	3.8	48.04304	48	8	
20.	37	2.6	45.51548	46	9	

Sexual Dimorphism by Mastoid Length in Bhopal Region of Central India

¹ Murli Lalwani, ²Jayanthi Yadav, ³Arneet Arora, ⁴B. P. Dubey

Abstract:

As a Forensic expert we receive, examine and opine on skeletons which may be either as whole skeleton or skeletal remains. Most reliable bone for sex determination is pelvis, followed by skull. Glabella, Supraciliary arches and mastoid processes are the important morphological parameters for determination of sex. Gross subjective examination of the mastoid process has for long been used as an important landmark for differentiating male and female skulls by anthropologists and forensic experts. But craniometric studies measuring mastoid length for sexual differentiation have not been undertaken to that extent. Thus, a study was conducted to determine the significance and practical feasibility of the length of mastoid process for assessment of sex by examination of human skull. 100 male and 60 female skulls were examined for the present study. Mastoid length was found to vary between 2.22 - 3.87 cm (mean 3.04 cm) for males and 2.08 - 3.07 cm (mean 2.62 cm) for females. Z test was 9.88 (p < 0.01), indicating significant difference between male and female mastoid lengths.

Key Words: Human skulls, Mastoid Process, Sex determination

Introduction:

Human identification is one of the most challenging subjects for medicolegal experts. The concept of identity, with few significant variations is a set of physical characteristics, functional or psychic, normal or pathological that defines an individual.¹ Krogman and Iscan state that determination of sex, age and race in a collection of 750 skeletons was possible, with levels of reliability of 100% when whole the skeleton was present, with 95% reliability when using the pelvis alone, 92% using the skull alone, and 98% using the pelvis and the skull,

Corresponding Author:

¹Associate Professor,

Department of Forensic Medicine, Gandhi Medical College, Bhopal

²Additional Professor, ³Professor & Head, Department of Forensic Medicine, AIIMS, Bhopal

⁴Dean, LN Medical College & Hospital, Bhopal E-mail: murliinfmt@gmail.com L. M. No: LM/IAFM/709

DOR: 25/07/2017 DOA: 09/09/2017 DOI: 10.5958/0974-0848.2017.00052.5 thus clearly demonstrating the importance of skeleton, pelvis, and skull for sex determination examinations.² forensic anthropological in Various bones are used as tools in sexual dimorphism, most commonly pelvis and skull.³ The skull is probably the second best region of the skeleton to determine the sex.⁴ Human skeleton is comprised of calcified hard tissue that may sustain severe conditions yet retain important features that may lead to valuable information. The dimorphic variations of gender develop during the intrauterine life and later manifest as differences in bone weight, length, size, and mineral density.⁵ These changes emerge at adolescence are seen earlier and for a shorter period in girls compared to boys who undergo pubertal changes 2-3 years later, but sustain them for a longer period.⁶ Males have both a longer and more intense growth bouts than females, therefore this extended growth pattern creates difference in size, classically seen in skull, where the growth spurts affect most structures.⁷ There are certain factors such as the role of growth bouts and their pattern, and the attachments of muscles to bones could play a significant role in dimorphic features and have

a direct bearing on gender differentiation.⁵ The secondary sexual changes are influenced by hormones, which play role in development of musculoskeletal system.⁸

Subsequent to drastic events such as natural disasters, outbreak of wars or air traffic accidents, positive identification of victimsq gender becomes, perhaps, the most difficult task to encounter.⁹ Extreme burns, disfigurement, and severe decomposition of bodies render the determination of gender by examination of remains and their radiographs extremely difficult, if not impossible. A major role in gender identification, however, could be played by the osteological criteria that may set the foundation for full identification.^{2,10}

Application of some existing methods of study occurs through two main approaches: by comment and description of the morphology of the bones in question, and by the values obtained using morphometry, or in other words, the measurement of these bones.¹¹ It has been reported that morphological characters such as mastoid processes, among others, give valuable idea of gender.¹² Employing supraorbital margin, glabella, mastoid process, crista supramastoid and mandible in sexual dimorphism. Graw et. al., in 1999¹³ and Graw in 2004¹⁴ reported reliable results related to sex. Broca¹⁵ and Hoshi¹⁶ have already suggested that when skulls were placed on flat surface, the male skulls rest on the mastoid processes, while the female skulls rest on the occipital condyles or other portions of the skull.

Williams and Rogers in 2006 assessed the mastoid size in addition to some other cranial structures, for sex determination, and considered these morphological features as high-quality gender identifiers.¹⁷ Kranioti, et al, carried out osteometric measurements on cranio-facial skeletons, including mastoid height, of 90 males and 88 females. Their results indicated that males were statistically significantly greater than females in all dimensions.¹⁸ Other researchers, among them Pavia and Segre, in 2003, Patil and Modi, in 2005, evaluated the role of mastoid process, however, craniometric studies measuring mastoid length for sexual differentiation were not taken in general.^{19,20} Thus, this study was undertaken to determine the significance and utility of mastoid process length in differentiation of adult male and female skulls.

Materials and Methodology:

The study was carried out in the department of Forensic Medicine, Gandhi Medical College, Bhopal, during the year 2006-2007. A total of 160 skulls were studied, of which 100 were male and 60 were female. All the skulls used for the study were of adults. Length of the mastoid was measured using a sliding caliper. [The length of the mastoid is the length of the projection of the mastoid process below and perpendicular to the eye ear plane in the vertical plane.] The criteria to decide that the skull was of an adult was dental examination and suture closure between basi-occiput and basi-sphenoid. Damaged skulls were excluded from the study. Elderly skulls, in which the vault sutures were showing complete closure, were not included.

Results and Observations:

Mastoid length varied from 2.22 to 3.87 cm (mean 3.04 cm) for males and from 2.08 to 3.07 cm (mean 2.62 cm) for females. \angle qtest was 9.88 with a p value of <0.01. This reveals a significant difference between male and female mastoid length.(**Table 1, Fig 1**)

Discussion:

The mastoid region used in this study, being a part of the temporal bone, is recognized as being the most protected and resistant to damage, due to its anatomical position at the base of the skull.²¹ Sumati and Patnaik worked on mastoid process of North Indian skulls, 30 of either sex, and observed the mean and SD of mastoid length to be 28.3cm for males and 23.18 cm for females, indicating that the mastoid lengths of people of North India are shorter than those of central India in both sexes. The sexual dimorphism in their study is statistically significant (p value < 0.001), similar to the present study.²² Dasgupta, et al, studied 70 adult macerated human skulls (35 of either sex) of South Indian origin to determine the accuracy of mastoid process in sex determination. They observed that the mean length of mastoid process for male was 29.233 mm and 22.442 mm for females, with p-value < 0.001, that is statistically significant in south Indian population for sex determination. In a study by Gupta et.al, the mean length of mastoid process of female skulls was shorter than the male skulls in comparison to the study by Sumati & Patnaik on North Indian skulls and the present study in central India.²³ In a study by Virupaxi, et al, done on 50 male and 50 female skulls in North Karnataka, they observed that the mean length of mastoid process in male skulls was 30.2 mm (range- 25.2 to 36.65) and in female skulls, 26.2mm on the right side. (range- 21.04 to 33.3). The male left side mastoid mean length was 30.7mm (range 24.02 to 36.7) with the standard deviation of 3.09. Whereas, the left side female mastoid mean length was 26.2 mm with the range of 21.03 to 33.30. Their observation and results are almost similar to the present study.²⁴ (Table 2)

Klaatsch observed that female skulls generally preserve infantile type of small mastoid process, while the male present great variability.²⁵ Hoshi classified the mastoid processes into three main types, viz. M, N and F type (M- male, N- neutral, F- female type), based on the direction of the mastoid process in relation to a vertical plane as assessed visually. He also suggested that when skulls were placed on flat surface, the male skulls rest on the mastoid processes while female skulls on occipital condyles or other portions of the skull.¹⁶

Larnach and Macintosh^{26,27} calculated the size of mastoid process and divided it into five grades (very small, small, medium, large or very large). They concluded from their consecutive studies that females have predominantly very small to small sized mastoids in comparison to males who have predominantly medium to large sized mastoids.

Williams and Rogers identified mastoid size as one of the high quality trait (>=80% accuracy and =<10% intraobserver error) for sex determination.¹⁷ Keen,²⁸ and Giles and Elliot²⁹ observed that the mean mastoid length was more in skulls of male individuals as compared to skulls of female individuals irrespective of race or region. De Moulin³⁰ and Sarangi, et al³¹ concluded subsequent to their study on French and Indian sample that the value of mastoid module was extremely significant for sex determination.

Hoshi¹⁶ stated that male skulls, when placed on flat surface, rest on mastoid processes where as females on occipital condyles. This observation indirectly indicates that males skulls have more mastoid length as compared to female skulls, that is why, male skulls rest on mastoid processes but not female skulls.^{26, 27} The present study's results affirm that the size of mastoid process is important for sexual diagnosis, stated that females have very small to small sized mastoids and males have medium to large sized mastoids.

Conclusion:

The present study was done on 100 male and 60 female dry adult human skulls in Bhopal region of central India. The bisexual difference between mastoid length of male and female skulls is highly significant in the present study. Mastoid length was found to be most significant as the bisexual variable and hence can be used with reasonable accuracy to determine the sex of an individual in the unidentified decomposed and burnt bodies.

Conflict of interest: None Financial Assistance: None

References:

- Alves Es. Medicina legal e deontologia. Curitiba, Ed. do Autor. 1965. Cited in Pooja Gangrade, Rajeev Yadav, LK Jain. Sexing the human skull using mastoid process measurements. Research and Reviews: J Medical and Health Sciences. 2013;1(2):35-9.
- Krogman W M. The human skeleton in forensic medicine. C.C. Thomas Publications: 1st ed. Springfield, IL. 1962. pp 112
- Mall G. Sex determination and estimation of stature from the long bones of the arm. Forensic Science International. 2001;117:23-30.
- 4. Bass WM. Human Osteology: A laboratory and field manual of the human skeleton. Special Publications of the Missouri Archaeological Society, Columbia. 1971. Cited in A. Das Gupta, Arindom Banerjee, Anil Kumar et al. Discriminant

Function Analysis of Mastoid Measurements in Sex Determination, J Life Sci 2012;4(1):1-5

- Biggerstaff RH. Craniofacial characteristics as determination of age sex & race in forensic dentistry. Dent Clin North Am. 1977;21(1):85-97.
- Kalmey JK, Rathbun TA. Sex determination by discriminant function analysis of the petrous portion of temporal bone. J Forensic Sci. 1996;41(5):865-7.
- 7. Scheuer L. Application of osteology to forensic medicine. Clin Anat. 2002;15(4):297-312.
- Iscan MY. Forensic anthropology of sex and body size. Forensic Science International. 2005;147:107-12.
- 9. Balci Y, Yavuz M F, Cagdir S. Predictive accuracy of sexing the mandible by ramus flexure. Homo. 2005;55:229-37.
- Novotony V, Iscan M Y, Loth S R. Morphologic and osteometric assessment of age, sex and race from the skull. In Iscan M Y and Helmer (eds.): Forensic analysis of the skull. New York; Willy Liss, 1993; pp.71-88.
- Reichs KJ. Forensic osteology: Advances in the identification of human remains in Forensic implications of skeletal pathology: sex. Charles C Thomas Publishers, Springfield Illinois, USA, 1986;. pp 112
- Krogman WM. The human skeleton in forensic medicine. Springfield. Illinois, USA. Charles C. Thomas Pub Ltd. 1st ed. 1962.114-22.
- Graw M, Czarnetzki A, Haffner HT. The form of the supraorbital margin as a criterion in identification of sex from the skull: investigations based on modern human skulls. Am J Phy Anthropol. 1999;108(1):91-6.
- Graw M. Significance of the classical morphological criteria for identifying gender using recent skulls. Forensic Sci Communications.2001;3(1):1-8.
- Broca P. Instruction craniologique. In: Dechambere D. Dictionaire encyclopédique des sciences médicales. Paris, Asselin/Masson. 1879; t.22, p.642. Cited in Paiva Las et al. . Sexing the human skull through the mastoid process. Rev. Hosp. Clín. Fac. Med. S. Paulo 58(1):15-20, 2003.
- Hoshi H. Sex difference in the shape of the mastoid process in norma occipitalis and its importance to sex determination of the human skull. Okajimac Folia Anat Jpn. 1962; 38: 309-

317. Cited in Sumati, Patnaik VVG, Pathak A. Determination of sex from mastoid process by discriminant function analysis. J Anat Soc India. 2010;59(2):222-8.

- Williams BA, Rogers T. Evaluating the accuracy and precision of cranial morphological traits for sex determination. J Forensic Sci. 2006;51(4):729-35.
- Kranioti EF, Iscan MY, Michalodimitrakis M. Craniometric analysis of the modern Cretan population. Forensic Science International. 2008;180:110. e1-e5.
- Saavedra de Paiva LA, Segre M. Sexing the human skulls through human skulls through the mastoid process. Rev Hosp Clin Fac Med S Palo. 2003;58(1):15-20.
- Patil KR, Mody RN. Determination of sex by discriminant function analysis and stature by regression analysis: a lateral cephalometric study. Forensic Sci Int. 2005;147(2-3):175-80.
- Whall J, Henke W. Die pars petrosa als diagnostikum für die multivariat-biometrisch geschlechtsbestimmung von leichenbrandmaterial. Z Morphol Anthropol. 1980; 70: 258- 68. Cited in Paiva Las et al. . Sexing the human skull through the mastoid process. Rev. Hosp. Clín. Fac. Med. S. Paulo 58(1):15-20, 2003.
- Sumati, Patnaik VVG, Pathak A. Determination of sex from mastoid process by discriminant function analysis. J Anat Soc India. 2010;59(2):222-8.
- Das Gupta RD, Banerjee A, Kumar A, Rao SR, Jose J. Discriminant Function Analysis of Mastoid Measurements in Sex Determination. J Life Sci. 2012;4(1):1-5.
- 24. Virupaxi RD, Yadav SK, Desai SP, Shirol VK. Sexual dimorphism of mastoid process in dried skulls of north karnataka population Int J Cur Res Rev. 2016;8(4):51-3.
- 25. Klaatsch H. Skulls of the Australian Aboriginal. Rep Path Lab Lunacy Dept. N.S.W. Govt. 1908;1(3):43-167. Cited in Larnach SL, Macintosh NWG. The craniology of the aborigines of Coastal New South Wales. The Oceania Monographs No. 13. 1966; 44. Cited in A. Das Gupta, Arindom Banerjee, Anil Kumar et al. Discriminant Function Analysis of Mastoid Measurements in Sex Determination, J Life Sci, 4(1): 1-5 (2012)

Anat

Soc

India.

26. Laranch SL, Macintosh NWG. The craniology of

the aborigines of Coastal New South Wales. The

Oceania Monographs No. 13. 1966; 43-4. Cited

in Sumati, Patnaik VVG, Pathak A. Determination

of sex from mastoid process by discriminant

J

1950; 8(1): 65-79. Cited in Paiva Las et al. .

Sexing the human skull through the mastoid process. Rev. Hosp. Clín. Fac. Med. S. Paulo

 Giles E, Elliot O. Sex determination by discriminant function analysis of crania. Am J Phys Anthropol. 1963; 21: 53-68. Cited in Sumati, Patnaik VVG, Pathak A. Determination of sex from mastoid process by discriminant function analysis. J Anat Soc India. 2010;59(2):222-8.
 De Moulin F. Importance de certaines mesures cranienes (en particulier de la longueur sagittale de la mastoid) dans la determination sexuelle des cranes. Bull et Mem de la Soc D' anthropol de Paris. 1972; 9 (Series 12): 259-264. Cited in Swati Shah, Pratik Patel, Sexing the human skull

 Laranch SL, Macintosh NWG. The craniology of the aborigines of Queensland. The Oceania Monographs No. 15. 1970; 34. Cited in Sumati, Patnaik VVG, Pathak A. Determination of sex from mastoid process by discriminant function analysis. J Anat Soc India. 2010;59(2):222-8.
 Keen JA. A study of the differences between male and female skulls. Am J Phys Anthropol.

analysis.

function

2010;59(2):222-8.

58(1):15-20, 2003.

- using the mastoid process. NHL Journal of
 - Medical Sciences. July 2013, 2(2):75-78 31. Sarangi MP, Das S, Sharma GK. Mastoid module
 - a clue to sex determination. Indian Anthropologist. 1992;22(2):91-3.

Table 1: Range,	Mean,	Standard	deviation	of Mastoid
L	enath	in present	studv	

S. No	Parameter	Male (100)	Female (60)
1.	Range	2.22- 3.87 cm	2.08-3.07 cm
2.	Mean	3.04 cm	2.62 cm
3.	Standard Deviation	0.294	0.238
4.	Mean +/- 3S D	2.16-3.92	1.91-3.33

Table.2: Mean Length of mastoid process in various published studies (length in mm)

Author		Male	Female	Region of study
Keen (1950)		29.3	26.5	Cape coloured
				population
Giles and	Elliot	28.067	25.213	Whites
(1963)		30.320	26.347	Negroes
Sumati, Pa	Itnaik	28.3	23.18	North India
(2010)				
Dasgupta A. et al		29.233	22.442	South India
(2012))			
Virupaxi	Rt.	30.2	26.2	North Karnataka
R.D. et al	side			
(2016)	Lt.	30.7	26.2	
	side			
Present study		30.4	26.2	Central India
(2005-20	07)			

Figure 1



Sterilization Methods on Extracted Human Teeth -A Comparative Study on Evaluation of Efficacy

¹Vidya G Doddowad, ²Mohamad Ayas, ³Premalatha B. R, ⁴Madhuri Kulkarin

Abstract:

Aim: To evaluate the efficacy of various methods of sterilization on extracted human teeth.

Materials & Methodology: 100 non carious teeth were collected and sterilized using physical and chemical methods. Ten samples each were placed in seven different chemical disinfectants for a period of 7 days, at room temperature. The disinfectants used were 10% formalin, 3% hydrogen peroxide, 5.25% sodium hypochlorite, 70% alcohol, vinegar, thymol and Normal saline.10 teeth each were treated with three physical methods namely: microwave irradiation at 650 W for 3 min, boiling water at 100^oC and autoclaving at 121^oC for 20 minutes at 16 lbs pressure.

Result: It was found that autoclaving at 121^oC for 20 minutes at 16 lbs pressure, 5.25% sodium hypochlorite solution and10% formalin were 100% effective sterilization methods for extracted human teeth.

Conclusion: Autoclaving, 5.25% sodium hypochlorite and 10% formalin are the best methods for sterilization of extracted human teeth for research and preservation purposes.

Key Words: Disinfection, Extracted Teeth, Preservation, Sterilization.

Introduction:

Extracted teeth are routinely used in dentistry as well as in forensic odontology. They are used in dental schools to teach and build the technical and preclinical skills of the students in the beginning of their course and before entry to the clinics. In forensic odontology, the extracted human teeth are used for identification of the age, sex, blood group of the dead person or victim. They are also used for various other purposes such as preparing ground sections for histopathological evaluation and research.

Corresponding Author: ¹Reader,

³Reader,

²P G Student,

Department of Oral Pathology & Microbiology, JSS Dental College and Hospital, Mysuru.

⁴Prof. & Head, Dept. of Microbilogy, JSS Medical College, Mysuru..

E- Mail: drvidyagd@gmail.com. L. M. No: Not a Member DOR: 24/11/2016 DOA: 09/09/2017 DOI: 10.5958/0974-0848.2017.00053.7 There are numerous well documented hazards of cross contamination that occur while performing dental procedures. In recent years, infection control guidelines in dental institutions have been revised due to the possibility of cross contamination from extracted teeth. American Dental Association (ADA) and the Centre for Disease Control (CDC) have recommended decontamination of extracted teeth for use in the dental educational settings to minimize the risk of transmission of blood borne pathogens.¹

Sterilization is the process by which an article, surface or a medium is made free from microorganisms, excluding bacterial spores.² Several physical and chemical methods of sterilization have been tried for sterilization of extracted human teeth with varying results. At present, there is no particular recommended method of sterilization for extracted human teeth. Hence, the purpose of this study was to compare the efficacy of different sterilization methods for extracted human teeth and to determine the best method among them.

Materials & Methodology:

Official approval was obtained from the Institutional Ethics Committee to conduct this study. 100 freshly extracted human teeth were obtained from the Department of Oral and Maxillofacial surgery and the study was carried out in the Department of Microbiology. The teeth were stored in sterile saline until the commencement of study. The teeth samples included were intact, non-carious and extracted due to periodontal diseases or for orthodontic purposes. The teeth were randomly divided into one of the 10 groups consisting of 10 teeth in each group. **(Table I)**

All the teeth were immersed in separate bottles containing 10 ml of the disinfectant for 7 days at room temperature $(25^{\circ}C)$. Following the assigned treatment period, teeth from each group were placed individually in separate test tubes containing 10 ml of tryptic soy broth at $37^{\circ}C$ for 48 hours. Any evidence of microbial growth was observed after 48 hours. Data were collected and statistical analysis was performed by using descriptive statistics.

Results:

Among the various methods of sterilization of extracted teeth, autoclaving at 121_C for 20 minutes (10/10), 5.25% sodium hypochlorite solution (10/10) and 10 % formalin (10/10) were found to be 100% effective. Thymol (4/10) and hydrogen peroxide (5/10) showed 50% effectiveness while 70% alcohol (0/10), vinegar (0/10), saline (0/10), boiling water (0/10), and microwave radiation (2/10) are considered as ineffective methods in the disinfection of extracted teeth. **(Table II)**

Discussion:

Extracted human teeth may harbour potential pathogens for which sterilizing them is essential for researchers, students, as well as educators.³ Various pathogenic microorganisms like HIV, HBV, HCV, aerobic and anaerobic bacteria are present in pulp, radicular and periradicular tissues of extracted teeth.^{1,4} Hence, sterilization is very important for health care delivery systems in educational institutes and hospitals.

Our study documents that autoclaving, 5.25% sodium hypochlorite solution and 10 % formalin are very effective sterilization methods for extracted human teeth. Several other studies are consistent with our results.^{1-3,5} These methods are simple, cheap and suitable for routine use in preclinical courses, exercises and research purposes. But, these methods have their own drawbacks like: formalin is a hazardous irritant and carcinogen, sodium hypochlorite may alter protein structure of teeth especially enamel and dentin, autoclaving affects the amalgam restored teeth by release of mercury vapours. Hence we recommend that amalgam restored teeth should be sterilized by formalin or sodium hypochlorite and nonamalgamated teeth to be sterilized by autoclaving. In contrast to our results, few studies show that sodium hypochlorite is not an effective disinfectant.^{3,6}

In the present study, thymol and hydrogen peroxide have shown partial efficacy in the sterilization of extracted human teeth. Similar results were obtained in few other studies.^{1,3,7} In contrast to our study, Lolayekar, et al stated that thymol does not have effect of disinfection/ sterilization on extracted teeth¹ and Tijare opined that hydogen peroxide is a good disinfectant.⁶

70% alcohol, vinegar, Normal saline, boiling water and microwave radiations are considered as ineffective methods in disinfection of extracted teeth as per our study and it is in agreement with few similar studies.^{1,6} But, Tijare, et al have stated that vinegar is totally effective disinfectant medium for extracted human teeth³ and Rahaman, et al explained that the use of the microwave for three or six minutes was effective in disinfecting the extracted human teeth.⁸ Based on our study, we found that there may be difference in the effectiveness of sterilization in different methods due to inactivation of the agents or poor penetration of the agents.

Conclusion:

We recommend that amalgam restored teeth should be sterilized by formalin or sodium hypochlorite and non-amalgamated teeth by autoclaving methods. Whenever extracted teeth are handled by dental students/ educators / researchers for teaching and research purposes, they should follow the infection control guidelines as the extracted teeth may harbour potentially harmful organisms.

Conflict of interest: None Financial Assistance: None References:

- 1. Lolayekar NV, Vidya BS, Sham SB. Disinfection methods of extracted human teeth. J Oral Health Community Dentistry. 2007;1(2):27-29.
- Arun G, Shouvik C. Sterilization and disinfection of extracted human teeth for institutional use. Int J Clinical Dental Science. 2013;4(1):9-12.
- Kumar M, Sequeira SP, Peter S, Bhat GK. Sterlization of extracted human teeth for educational use. Ind J Medical Microbiology. 2005;23(4):256-.8.
- Dominici JT, Eleazer PD, Clark SJ, Staat RH, Scheetz JP. Disinfection / sterilization of extracted teeth for dental student use. J Dental Education. 2001;65:1278 -80.
- Simarjeet VS, Rajiv T, Raman PK, Bhullar, Himanta B. Sterilization of extracted human teeth-Comparative analysis for dental researcher. J Oral Biol and Craniofacial Research. 2012;2:170-5.
- Tijare M, Smitha D, Sowmya K, Shreenivas K, Sandeep G, Amith HV. Vinegar as a disinfectant of extracted human teeth for dental educational use. J Oral and Maxillofacial Pathol. 2014;18(1):14-8.
- Chandki R, Maru R, Gunwal M, Garg A, Mishra A. A Comparison of different methods for disinfection or sterilization of extracted human

teeth to be used for dental education purpose. World J Dentistry. 2013;4(1):29-31.

 Abdul Rahaman GY, Wiaam MOA, Shukur AM. Disinfection of extracted teeth for dental researcher. Al-Rafidain Dental Journal 2010;10(1):158-61.

Table I:	Various	methods	of	sterilization used
	Various	memous	v	Stermzation used

Group	Sterilization Method Used
1	10% Formalin
2	3% Hydrogen Peroxide
3	5.25% Sodium Hypochlorite
4	70% Alcohol
5	0.1% Thymol in distilled water
6	Boiling water for 20 minutes
7	Autoclave at 121ºC, 15lbs psi for 30 minutes
8	Control, Normal saline
9	Vinegar
10	Microwave radiation

Table II:	Effectiveness of various sterilization methods
	on human extracted teeth

Sterilization method	Number of teeth samples	Number of teeth Sterilized
10% Formalin	10	10
3% Hydrogen	10	05
peroxide		
5.25% Sodium	10	10
hypochlorite		
0.1% Thymol	10	04
70% Alcohol	10	0
Vinegar	10	0
Normal Saline	10	0
Boiling water	10	0
Microwave radiation	10	2
Autoclave	10	10

Level of MBBS Student's Perception – Tested in Advance Before Start of Autopsy Demonstration

¹Madhusudhana Reddy D

Abstract:

Autopsy continues to be an integral part of the undergraduate medical education. The present study was conducted to assess the attitude and knowledge of medical students and to know how important it is as a part of under graduate curriculum from students point of view, before actual demonstration of the autopsy.

Methodology: The study design was a descriptive study; the students of 2nd MBBS 4th term, who were yet to attend autopsy demonstration, were asked to participate voluntarily and were asked not to disclose their identity on a specially designed questionnaire, regarding the necessity, purpose, and knowledge of the procedure about how useful and necessary was the autopsy in medical education. Their comments were analysed and tabulated.

Results: 25 (18%) felt that they would have to perform independently, once they finish MBBS. 128 (92.1%) felt that it was to know the cause of death, 100 (71.9%) felt that lectures in the department would be helpful in preparing prior to autopsy, 121(87.5%) felt that dead bodies should be handled properly, silence should be maintained and cleaning of the body should be done after autopsy. 128 (92.8%) opined that inquest papers, mortuary, Forensic Pathologist and instruments are basic requirements for autopsy.

Conclusion: Considering the role played by the medical practitioners in India in rural set up, mastering the autopsy skills is required for conducting the autopsy independently, this factor can be important for us to understand and to rectify the present scenario. Steps are required to be taken by the teachers/ staff associated with students to bring out the desired change in the attitude of the medical students towards autopsy so that the overall standard of autopsy and the medico legal work improves

Key Words: Autopsy, Medical education, Attitude of Medical students

Introduction:

"You may takes notes for twenty years, from morning to night at the bedside of the sick, upon the diseases of the viscera, and all will be to you only a confusion of symptoms — a train of incoherent phenomena, Open a few bodies and this obscurity will disappear"

Xavier Bichat¹

Corresponding Author:

¹Senior Resident,

Dept. of Forensic Medicine & Toxicology, Sri Venkateswara Medical College, Tirupathi.

Email: dr_maddydwarasila@yahoo.co.in L.M.No: Not a Member. DOR: 01/12/2016 DOA: 14/09/2017 DOI: 10.5958/0974-0848.2017.00054.9

Autopsy as a tool for finding out more about pathogenesis and subsequently establishing the actual cause and manner of death is age old.²⁻⁵ Virchow and Osler previously used autopsy in 19th century for understanding the pathological conditions of fatal diseases like pulmonary embolism by correlating the clinical findings with that of findings at autopsy.² Following an age old practice among attaining many of the skills, MBBS students are required to gradually master the ability of actual autopsy work during their postingt in the department of Forensic Medicine and Toxicology.^{2,4.6}

Before the students start their demonstration sessions in autopsy, utility of knowing in advance their perception towards autopsy is an useful indicator to make autopsy sessions more effective, interesting and interactive. Many studies on the other professions like embalmers, funeral directors, etc have been carried out, however studies in the medical student groups are very few and some believe that such study occupies a unique postion.⁶ In India, the overall standard of medico- legal work is variable. Due to lack of forensic pathologists, most of the forensic autopsies are conducted by general medical practitioners in rural areas. As a result, the quality of the postmortem work and the report is substandard.^{2,7-9} Value of the present study lie in improving these, when used in appropriate way.

Aim:

To know the students perception, in advance, towards the autopsy with an aim to use the results for more effective learning.

Materials and Methodology:

Institutional Ethical Committee clearance was obtained duly as required. A feedback was taken by providing a questionnaire (annexure 1) with five questions to the MBBS students in their 2nd year, before the start of the autopsy demonstration classes. Questions given were regarding the necessity, purpose, preparing for, knowledge of the procedure, and a feeling of respect towards the dead. This was conducted at Vydehi Institute of Sciences & Research Centre, Medical Bengaluru, during the year 2015. The class consisted of 157 students out of which 139 students participated in the study. Clear verbal instructions were given to all the students in class. Consent was taken from the students before the start of the questionnaire.

Inclusion criteria:

All students who had not attended autopsy demonstration.

Exclusion criteria:

Students who answered with more than one option.

Results:

All responses of the students, who were included in the study were analysed. Thus the actual no. of responses further analysed &

tabulated were 134 out of a total of 139 students.

Observations:

Relating to the first question regarding why attaining autopsy skills is a must, 64 (46%) felt that autopsy is necessary to determine the architecture of the organs and learn many things useful in medical practice, 34 (24.5%) felt it will be useful in future medical activity, 25 (18%) felt that they should be able to perform independently once they finish MBBS and 11 (7.9%) felt that it as a part of medical curriculum.

Answers to second question on the purpose of autopsy: 128 (92.1%) students felt that it is to know the cause of death, 4 (2.87%) felt it as a mere formality, 1 (0.7%) felt that it is to trouble the relatives of the deceased, and useful in future medical practice, respectively.

Responses on how to prepare themselves for a demonstration of autopsy: 100 (71.9%) felt that it is by lectures in the department, 20 (14.3%) by internet and 11 (7.9%) by books and 3(2.5%) by seniors.

Response to fourth question on how best to show respect to the dead body: 121 (87.5%) felt proper handling of the body, maintaining silence and cleaning the body after autopsy is the way to respect the dead body. An %all of the above+ response was provided. 5 (3.59%) felt that maintaining silence, 1(0.7%) by cleaning the body after autopsy and 7(5.03%) felt handling the body properly, respect could be shown.

For the fifth question on requirement for conducting the autopsy, 129 (92.8%) felt inquest papers, mortuary, forensic pathologist, instruments are required - an %all of the above+ response was provided. 1(0.7%) felt forensic pathologist and instruments respectively, and 2.2% felt inquest papers alone.

Discussion:

To understand the student's perception towards autopsy before starting the demonstration to the students (4th or 5th term), this study was conducted, based on five multiple choice questions. As regards responses for necessity in skill attainment, 25 (18%) felt that they should be able to perform independently. This is contrary to the study done by Pervaz, et al, as cited in Qasim AP, et al, 50% participantos opined that they will be competent to conduct the autopsy during their future carieer.¹⁰

Study done by SinghVP and Biswas G opined that 88%, 84% & 87% (Students - 3rd,4th, & interns respectively) felt incapable of performing autopsy,⁴ similarly, in the current study 109 (81%) students were not aware that mastering the skill of autopsy is to perform independently once they finish the course.

For the question the purpose of autopsy, 121(92.1%) in the current study stated main criteria is for knowing the cause of death. Similarly, in the study done by Jadav CJ, et al, 198 (99%) students opined that main criteria for autopsy is to know the cause of death.²

For the question on preparing beforehand, it was difficult to find similar studies. However, cited in the study done by Qasim AP, et al. some authors indicated that the students felt uncomfortable after watching first autopsy, as student were not prepared psychologically for demonstration of an autopsy, like dissecting the corpse is frightening, having nightmares, this to avoid such things.¹⁰ In a study done by De Villiers and Ruhaya, they had the opportunity for frank discussion with the teachers about their feelings and thoughts about autopsy. This opportunity was used by 15 (9%).¹¹ In the current study, 100 (71.9%) students opined that lectures in the department will be helpful in order to avoid discomfort, nightmares and giddiness and can help them in preparing themselves prior to autopsy demonstration better.

For the fourth question on showing respect to the dead body, 121 (87.5%) responded %all of the above+. In the study by Qasim, et al, 85 (40.7%) student's observation on various activities related to handling, cleaning, comments and organ removal procedure were highlighted¹⁰ and the study done by Khoo.J.J¹² has shown similar response on student's observation. In our current study, students were aware that dead body should be given proper respect by maintain silence, proper handling of the body and cleaning the body after autopsy.

Finally on the fifth question on necessary basic requirement for autopsy work, 129 (92.8%) responded with % all of the above+ (inquest papers, mortuary, forensic pathologist & instruments). In the study done by Khoo.J.J, 89 (69%) students understood the procedure of inquest papers for medico-legal autopsy.¹²

To conclude, 25 (18%) students felt that mastering autopsy skills is required for conducting the autopsy independently. This factor can be important for us to understand and attempts should be made to rectify the present scenario. Further, the teachers/ staff associated with students should take necessary steps to bring out the change in attitude of the medical students towards autopsy and also help in improving the overall standard of autopsy, medico legal work.⁸

Conclusion:

Attainment of autopsy skill is required for a medical officer or physician in India. The present study has clearly demonstrated that this particular group of respondents require more attendance to modify their thinking based upon the responses in question . 1, on other responses of the questionnaire, majority were aware of the information in advance. Considering the role played by medical practitioners in India in rural set up,² various authors stated that every effort must be made to communicate the importance of autopsy to medical students during their placements in Forensic Medicine & Toxicology, every student should be aware about the medico-legal responsibilities in the practice of Medicine, as it was introduced by Government Medical College, Chandigarh, along with some other institutions. Fifteen days compulsory and 15 days optional training in Casualty and Forensic Medicine, respectively, is imparted during Internship, where in the student is expected to acquire the knowledge of various medico-legal responsibilities and learn to identify medico-legal problems, prepare medicolegal reports, conduct meticulous post-mortem examinations, diagnose and treat common poison conditions, etc., through supervised observation.¹³ By regular demonstration of autopsies⁷ and video interaction with the students by the lectures

during the procedure and encouraging the students to assist in the procedure can bring the change in their attitude, thoughts towards autopsy.^{4,13,14}

Conflict of interest: None Financial Assistance: None

References:

- Waheed G, Mengal MA, Sapry ZZ, Sheik AW. Autopsy as a part of curriculum: studentos perceptive. J Ayub Med Coll Abbottabad 2011;23(3). Available from http://www.ayubmed.edu.pk/JAMC/23-3/Gulfreen.pdf. Accessed on 18/09/2015.
- Jadav JC, Paten BN, Shah KA, Tandon RN. Knowledge & attitude of medical students on rensic autopsy in ahmedabad city. J Ind Acad Forensic Med. 2013;35(1):26-8.
- Ioan B, Neagu M, Monoilescu I, Plaiesu T, Damian S. Utility of autopsy in medical education- students opinion and attitude. Rev, Med, chir, soc med nat iasi -2014;18(3). Available from: https://www.ncbi.nlm.nih.gov/pubmed/25341304.

Accessed on 06/11/2015

- Singh VP, Biswas G. Knowledge and attitude of medical students and interns towards forensic autopsy. J Indian Acad Forensic Med. 2014;36(1):9-11.
- Kosemehmetoglu K, Tumer AR, Usubutun A. Autopsy status and pathologist attitude towards autopsy in turkey. Turkey J Med Sci. 2007;37(6):351-8.
- Verma SK. Knowledge & attitude of medical students in delhi on post mortem examination. Available from: http://www.indianjmedsci.org/text.asp?199/53/8/3 52/12215. Accessed on 18/9/2015.
- 7. Nemetz PN, Ludwig J, Kurland LT. Assessing the autopsy. Amer J Pathol. 1987;128:362-79.
- Rautji R, Kumar A, Behera C. Attitude of medical students towards medico legal/ clinical autopsy. J Ind Acad Forensic Med. 2013;35(4):358-61.
- 9. Yadwad BS. Medico-legal autopsy-what, why and how. J Ind Med Assoc. 2002;100(12):703-5.
- Qasim AP, Hashmi KUR, Ahemed M, Naheed.K. The value of autopsy in medical education . students attitude and opinion. Journal University Medical & Dental College.2015;6(3):17-25.

- De Villiers FPR, Ruhaya M. Students opinion on autopsy and death. South African Family Practice. Available from: http://dx.doi.org/10.1080/20786204.2005.108731 7. Accessed on 18/9/2015.
- Khoo JJ. Perception of medical students towards autopsy as an educational tool. J Contemp Med Edu. 2014:2(1):57-62.
- Sharma BR, Harish D, Chavali KH. Teaching, training and practice of forensic medicine in indiaan overview, J Ind Acad Forensic Med. 2005;27(4):213-7.
- Ekanen VJ, Akhigbe KO. Attitude of nigerian medical students towards autopsy. Turk J Med Sci 2006;36:51-6.

Figure 1 Response to Q. 1

1. What is the necessity of mastering the skill of Autopsy?



A.medical curicculum-11(7.91%)

- B. To be able to perform independently once we finish MBBS-25(17.98%)
- C. To determine the architecture of the organs/ learn many things useful in medical practice-64(46.04%)
- D. useful in future medical activity-34(24.46%)

Figure 2 Response to Q. 2

2. What is the purpose of Autopsy?



282

Pattern of Filling up of Medical Certification of Cause of Death (MCCD) at a Tertiary Care Hospital: Pitfalls and Suggestions

¹B. L. Bamboria,²Vishal B. Surwade, ³B. D. Gupta

Abstract:

The statistics provided by the Medical Certification of Cause of Death - MCCD, plays an important role in deciding the direction of public health programs, provide a feedback system for future implementation of health policies, health planning and management of epidemiological studies, vital statistics, medicolegal investigations, census studies, health research, assessment of effectiveness of public health programs. Our study focuses on the analysis of MCCD proformas filled up by residents and faculty members and common mistakes committed while filling it. This was a retrospective, cross sectional study carried out at an 800 bedded hospital associated with a medical college situated in Madhya Pradesh. The period of this study is one calendar year in 2015 in which a total of 459 deaths were reported.We could study a total of 106 certificates (23 %) as in rest of the cases, the MCCD was not attached. The analytical outcome of the study revealed some major errors like wrong proforma of MCCD and some minor errors. The conclusion of our study highlights an urgent need for imparting extra efforts towards awareness, importance to undergraduates as well as postgraduate training and regarding complete and accurate filling of the Medical Certification of Cause of Death proforma.

Key Words: Hospital deaths, MCCD, Mistakes, Awareness

Introduction:

The mortality statistics are good indicators of demographic health trends and are provided on scientific basis of the system of MCCD - Medical Certification of Cause of Death.1 The statistics regarding cause of death is a very useful entity, as it helps in deciding the direction of public health programs, provide a feedback system for future implementation of health policies, health planning and management of epidemiological studies, vital statistics, medicolegal investigations, census studies, health research, assessment of effectiveness of public health programs.

Corresponding Author:

¹Assistant Professor, Department of Medicine,

²Asst. Professor, ³Professor & Head, Department of Forensic Medicine,

R.D. Gardi Medical College, Ujjain, M.P. E Mail: dr.vishalsurwade@gmail.com L.M.No: Not a member DOR: 13/04/2017 DOA: 19/09/2017 DOI: 10.5958/0974-0848.2017.00055.0

It is also very important in insurance sector as the Government of India has launched various schemes which promote life insurance for each and every one. In that scenario, the number of insurance claims will increase many folds. For attending physicians, it is of paramount importance as they often find themselves at the centre of various litigations.² Standard cause of death report in India follows the recommendations of the WHO. The causes of death are classified according to the International Classification of Diseases (ICD) and the MCCD is as per the format presented in volume II of ICD-10.³ It originally came in to the existence in 1960 and India started to follow the system in 1969 along with incorporation in RBDA- Registration of Birth and Death Act, 1969 in subsection 3 of Sec.10 of the Act in the form of 4 or 4A.4,5 This document should be 100% correct & fool proof. But in reality, the MCCD proformas which are being filled up by most of the Registered Medical Practitioners are not correct.6

This study was undertaken to analyse the MCCD proformas filled up by residents and faculty members in death occurred in our hospital in the year 2015.

Aims & Objectives:

- 1. To know if the MCCD format was used or not.
- 2. If used was it filled up correctly?
- 3. If not what were the columns filled wrongly or left blank
- 4. To know the causes behind these lacunae.
- 5. To point out the commoner mistake committed by RMPs while filling up the MCCD
- 6. To suggest ways to rectify the mistakes.

Materials & Methodology:

It is a retrospective study carried out at an 800 bedded hospital associated with a medical college, situated in Madhya Pradesh The period of this study was one calendar year in 2015. A total of 459 deaths were reported during this period. A proforma was prepared and relevant data was entered into it, consistent with the objectives of the study from the MCCD proformas from the case papers. But only 106 case files had the MCCD attached with it. After proformas on the basis of the filling the information obtained from the case records for all deaths, these were analyzed and conclusions drawn. Windows word 2016 & SPSS software have been used for this purpose. Strict confidentiality of the case papers was maintained and no medical condition was revealed, nor the identity of the deceased disclosed. Various aspects of MCCD proforma were classified into sub headings like major errors and minor errors.6

Inclusion and exclusion criteria:

All brought in dead cases and the cases which were referred for post mortem examination were excluded.

Study Type:

Cross sectional study.

Ethical issues:

No ethical issues are involved. However due permission was taken from Institutional Ethics Committee- IEC, was taken.

Results:

We studied a total of 106 certificates. It showed a big lacuna, as there were 459 deaths but only 106 cases (23 %) had MCCD attached. The analytical outcome of the study revealed that preliminary components of the certificate viz. full name, age, sex, address were correctly entered in all the cases. Immediate cause of death was mentioned as CRA (Cardio Respiratory Arrest) in 103 cases which was not correct. Terms used to describe modes of death like cardiac arrest, cardiac shock, sudden cardiac failure, respiratory failure, respiratory paralysis, respiratory arrest etc., were mentioned in these cases.³ It was mentioned in only 3 cases. The physician certifying death is required to put his signature, mention his/her full name & designation along with date and preferably should use his/her seal bearing registration number, at the bottom of the certificate.

Whereas the other errors were:

- Immediate cause of death: In most of the certificates, it was cardio-respiratory arrest (often used as abbreviation - CRA) in spite of written instructions regarding immediate cause of death.
- 2) Abbreviations were also frequently (92) used, which should not be there.
- Significant condition contributing to death was kept vacant in 89 cases
- Time interval between onset of the symptoms & death was missing in 104 cases.
- 5) Signature of the hospital authority was there but the name was not there in 103 cases.
- Improper sequencing of onset of symptoms to event causing death was not proper in 80 cases.
- ICD-10 coding was missing from almost every MCCD
- 8) Date of verification was missing from every MCCD.

Discussion:

The government is supplying the wrong proforma of MCCD form (Form 4-A), as it is for non - institutional deaths. The errors resulting in: there is no information regarding the name of the institution., Department, ward no., unit, unit head, consultant in-charge, IPD & OPD No. manner of death & name & signature of the Medical Superintendent etc.

Physicians are finding it difficult to correctly fill the immediate cause of death. Only in 3 (2.8%) cases, doctors could correctly fill this column. Astonishingly, 97.2% of the doctors were confused between the terms %ause of death+and %aode of death+. The differences are explicitly mentioned in textbooks and literature and are covered extensively in the 2nd MBBS curriculum. Although the MCCD guidelines specifically mentions that, %be cause of death should not be confused with the modes of death+; the dilemma still persists.

One of the reasons may be that the treating physicians refer the textbooks on Medicine, Surgery and the allied subjects that do not mention the difference. The text books that mention these differences are mostly Forensic Medicine Textbooks, that are taught in the 2nd phase of MBBS curriculum. Another reason may be the indifferent attitude towards filling up of these forms, which the treating physicians feel, is unnecessary. This may also be the reason why the doctors ignore or omit to put their seal with registration number in the death certificate. Guidelines of the MCCD as well as Indian Medical Council (Professional conduct, etiquette, and ethics) Regulation 2002,⁴ insist that every medical certificate including the cause of death certificate should bear the seal of the doctor which should bear the registration number. It will not be correct to argue that the doctors in a teaching hospital are ignorant of these basic guidelines.

On the contrary, it may be concluded that there are some general in differences among the physicians towards certain guidelines that are imposed upon them against their wishes. Another area of concern is failure to mention the interval between onset and terminal event of death. The MCCD guidelines do not mention what is exactly meant by onset of the illness. Furthermore, as the tertiary health centres mostly deal with the cases which are either referred from some primary health centres or treated at other hospitals, the onset of terminal illnesses, sometimes becomes blurred. Many times, the patients are admitted in their terminal stage of the disease.⁸ Therefore, it is very difficult to pinpoint this interval. Hence the guidelines should explicitly define this interval, and for different hospitals as well as different disease conditions.

Other minor areas that need to be addressed are the manners of death, which again is sometimes confused with modes of death or causes of death. In case of female deaths, if the lady is not in the child bearing age, the importance loses its ground. However, as a part of the routine the doctors should meticulously fill all the columns as per the guidelines.

MCCD being a medical and legal document, should be cent-percent correct, but contrary to that, our study reveals that, not a single MCCD form filled can be called perfect. The main reason behind the lacunae are lack of proper orientation and training of those who are immediately responsible for it and the lack of supervision of unit heads.

Cause of the mistakes:

1) lack of proper knowledge

2) lack of understanding of importance to MCCD.

Conclusion:

The MCCD scheme is an important step in regularizing and maintaining uniformity of issuing the cause of death certificate by medical practitioners. However, our study revealed that there is a conflict of opinion as to the meaning of the terms ‰auses of death+, ‰odes of death+, and manners of death+. The section on Interval between onset and terminal events needs to be redefined for different settings to ensure a proper and genuine filling up of these certificates. Extra effort needs to be put forth towards awareness regarding complete and accurate filling of the forms. If it is not done, it wond serve the purpose of being an important tool to obtain scientific and reliable information in terms of causes of mortality. Also, the lacunae in the scheme that exist need to be addressed.

Recommendations:

The following guidelines are recommended:

1) After death, the attending doctor will become the pronouncing physician and hand over

the death slip to the attendant of the deceased.

- 2) The lower part of form 4 (death slip) should be signed by the concerned hospital authority with hospital seal.
- The attending physician should seek the academic guidance from the concerned seniors
- It recommended that the undergraduates be highlighted the importance of MCCD during their training.
- 5) Interns posted in the wards dealing with the cases should be properly trained.

Conflict of Interest: None.

Financial Assistance: None. References:

- Patel AB, Rathod H, Rana H, Patel V. Assessment of Medical Certificate of Cause of Death at a New Teaching Hospital in Vadodara. National J. Of Community Med. Vol 2, Issue 3, Oct-Dec-2011, pg 349-353.
- 2. Office of the Registrar General of India, Vital Statistics Division. PhysiciansqManual on Medical Certification of Cause of Death. 4thedi. New Delhi: Ministry of Home Affairs, Govt. Of India; 2000.Available from http://www.censusindia.gov.in/2011Documents/m ccd_Report1/Physician's_Manual_MCCD.pdf
- World Health Organisation. International statistical classification of diseases and related health problems, tenth revision (ICD-10), Vov.1,2 and 3; 2ndedi. Geneva: WHO;2004. Available from http://www.who.int/classifications/icd/docs/en/WH OFICPrinciples.pdf
- Gupta BD, Trangadia MM, Mehta RA, Vadgama DK. Death Certificate: Ignorance and Facts; J Indian Acad Forensic Med. July- Sept 2013, Vol.35, No.3 pg 259-261.
- Govt. Of India, Ministry of Home Affairs; The Registration of Birth and Deaths Act, 1969. Section 10(3). Available from http://mha.nic.in/sites/upload_files/mha/files/pdf/r bd_act_1969.pdf
- Pandya H, Bose N, Shah R. Chaudhury N, Phatak A. Educational intervention to improve death certification at a Teaching hospital. The National Medical Journal of India, Vol. 22, No.6, 2009. pg 317-319.
- 7. Kotabagi RB, Chaturvedi RK, Benerjee A. Medical certification of cause of death. Medical

Journal Armed Forces India 2004;60: 261-272. Available from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC49 23180

 Degani AT, Patel RM, Smith BE, Grimsley E. The effects of students training on accuracy of completion of death certificates. Med Edu online 2009; 14:17. Available from http://med-edonline.net/index.php/meo.2009.Res00315.

Chart 1: Distribution of male and female in total deaths



Table 1: Type and frequency of errors in MCCD filling (N= 106)

Type of Error	No.	%	
Major e	rrors		
Wrong form of MCCD	106	100	
Wrong immediate cause of	103	97.16	
death			
Significant condition	89	83.96	
contributing to death			
Improper sequencing	80	75.47	
Lack of ICD -10 coding	106	100	
At least one major error	106	100	
Minor errors			
Absence of time intervals	104	98.11	
Use of abbreviations	92	86.79	
Illegible handwriting	43	40.56	
At least one minor error	106	100	

Pattern of Unnatural Female Deaths at Mortuary of Civil Hospital, Ahmedabad

¹Rakesh Kumar Mori, ²SandipRaloti, ³Kalpesh Shah, ⁴Sadikhusen Momin, ⁵Jigesh V Shah, ⁶Dharmesh S Patel

Abstract:

The present, prospective study of unnatural female deaths was carried out at the mortuary of Civil Hospital, Ahmedabad, during the year 2012. A total of 3930 corpses were received for autopsy during that period. Of them, 1238 were female corpses, of which 816 had died because unnatural causes. While looking at different criteria, age group 21-30 years (35.3 %), class III (middle class) of modified Prasad classification (42.4 %), housewives (51.5 %) and married females (66.2 %) were the majority in their category. Among the married women, 73.2% were of above 7 years of married life, necessitating magistrate inquest. Burns (46.7 %) was most common cause of death, followed by multiple injuries/ head injury(27.9 %), hanging (14.3 %) and poisoning (8.5 %). Manner of death was concluded to be accidental in 58.8 % of cases, followed by suicidal (37.5 %) and homicidal (3.7 %).

Key Words: Autopsy cases, Unnatural female death

Introduction:

Unnatural deaths are not uncommon in the present century. They may be accidental, suicidal or homicidal. Among all unnatural deaths, female deaths are common from the known human history. Indian women have suffered violence at the hands of men, including family members, from conception to death. Women are dying within four walls of house due to domestic torture and dowry death, being the heinous amongst them.

Corresponding Author:

¹Assistant Professor,
 ⁵Associate Professor,
 ⁶Prof. & Head,
 Dept. of Forensic Medicine, GMERS Medical College, Sola, Ahmedabad

²Assistant Professor, Dept. of Forensic Medicine, SMIMER, Surat

³Professor, ⁴Assisstant Prof. Dept. of Forensic Medicine, BJ Medical College, Ahmedabad E-mail: rakeshmoree@gmail.com, L.M. No. 1105, DOR: 02/02/2017 DOA: 21/09/2017 DOI: 10.5958/0974-0848.2017.00056.2 The violence against women includes not only physical aggression but sexual, psychological and emotional abuse, as well. Now a days, since last two decades, women from different sections of societies are coming out of the confines of their homes for studies, jobs and for social work so there is a phenomenal spurt in crime against women, becoming a concern of contemporary society, law enforcing agencies and judiciary of this country.

Crime Rate Analysis against women in India shows clearly sharp increase in crime rate, 8.8% in 2007 and 9.4% in 2011, which is a serious matter from safety and security point of Indian woman.¹ This shows increase in nature and extent of violence directed at women and which vary according to class, region, culture and the strata of the society across the country. The 'cause of death' profile is an important set of public health information and forms the cornerstone of the health information system. At state level, it is needed for health planning and deciding on intervention strategies. By this study, we can know the various socio-etiological aspects of un-natural causes of female death which will be useful for awareness of society and improve the situation.

Materials and Methodology:

The present prospective study of unnatural female deaths was carried out at mortuary of Forensic Medicine Department, B.J. Medical College & Associated Civil Hospital,Asarwa, Ahmedabad, during the year 2012. During the period under study, a total of 3930 corpses were received for autopsy. Of them, 1238were females (31.5 %).

Of the 1238 female victims, in 422 cases (34.1 %), the cause of death was opined to be because of some pathology found in one or more the organs of the body. So, the manner of death was classified as natural. These cases were excluded from the study. In the remaining 816 cases (65.9 %), the victims had died because of some of violence over the body, which was either accidental, suicidal or homicidal in nature. These fatalities were part of the study and constituted 20.8 % of the total autopsy cases during the calendar year.

These cases were studied by applying different criteria like month and season wise distribution of cases, age groups of the victims, marital status and marriage duration, education and occupation of the victim, socio-economic status,cause manner of death. The data so received was recorded on a specially designed Performa, tabulated on a sheet and analyzed.

Observations & Discussion:

As can be seen from **Table no. 1**, of the 3930 autopsy cases during the calendar year 2012, in 816 cases (20.8%), the female bodies showed some kind of violence over the body. These cases were classified as unnatural deaths.

In the present study, as can be seen from **Table no. 2**, maximum cases (35.3%) were seen in age group of 21 - 30 years, followed by 20.3% cases in age group of 11 - 20 years. Least cases (3.5%) were seen in 0-10 years of age. This finding was consistent with the findings of Sharma BR, et al,⁶ Mohan Kumar,⁷ Geeta, et al,⁸ Kailash, et al,⁹, Muhammad, et al^{10,} Mostaque, et al,¹¹ Rajesh, et al,¹² Pankaj, et al,¹³ Verma, et al.¹⁴

In this study, as can be seen from **Table no. 3**, the highest number of cases (15.2%) was seen in September and lowest (2.57%) in November. According to season wise distribution, there were maximum cases (39.8%) in Monsoon, followed by summer (31%) and winter (29.2%). Geeta, et al,⁸ in their study, had also observed maximum cases in Monsoon.

As can be seen from **Table no. 4**, housewives (420) constituted the largest single occupation category, amounting to 51.5% cases. There were 20.2% students, 7.4% laborers, while 2.21% victims had their own business. 24 cases (2.9%) were not applicable, which included children < 5 years and unknown, while non-worker (old age) comprised 30 cases (3.7%).This finding was consistent with the findings of Srivastava, et al,¹⁵ Geeta, et al,⁸ Kailash, et al,⁹ Statistics of NCBI,¹ Pankaj, et al.¹³

As can be seen from Table no. 5, single largest class was found to be of literate women, comprising of about 82% of the total cases, in which 20.2% victims studied up to primary, 25.7% victims up to secondary, 25.7% victims up to higher secondary, 10.3% were graduate, while 15.4% were illiterate. This was consistent with the findings of Kailash, et al,⁹ in which 72.4% of cases were educated less than metric and 12% were illiterate and also with that of NCBI,¹ in which the maximum number of suicide victims were educated up to Primary level (25.3%); and Pankaj, et al,¹³ in which most of females were literate (89.1%), of whom 30.4 % studied up to secondary school, 25.4% up to higher secondary, 25.4% up to graduation.

As can be seen from **Table no. 6** Socio-economic status wise, highest number of cases 42.4% were seen in class III (Middle) followed by 31.6% cases in class IV (Lower middle) and only 20 cases (2.5%) were present in class V (Lower). Our observations are consistent with those of Srivastava, et al¹⁵ and Pankaj, et al,¹³ where in majority of the victims were from class III (middle) or class IV (lowermiddle) socio-economic groups. Kulshrestha, et al¹⁷ and Kailash, et al,⁹ in their study however
observed that class IV (lower . middle) socioeconomic class was most vulnerable, while in the study by Mohanty, et al,⁵ Sharma BR, et al,⁶ and Geeta, et al,⁸ class V (lower) socioeconomic class were mostly involved, which is in disagreement with our study.

As can be seen from **Table no.7**, of the total number of cases, more than half of victims were married, 66.2%, and 5.9% were widows. This was consistent with the observations of Mohanty, et al,⁵ Geeta, et al,⁸ Kailash, et al,⁹ NCBI¹ and Pankaj et al.¹³

As can be seen from **Table no.7** out of the 816 cases, maximum, 73.2% were above 7 years of married life. The 48 widows were also included in the total cases. This finding was consistent with the findings of Kailash, et al.⁹

As can be seen from Table no. 8 highest number of cases, 58.8% were accidental in nature, while 37.5% cases were suicidal. Homicidal cases constituted only 3.7% cases. This finding was consistent with those of Singh D² Sharma BR et al,⁶ Mohan Kumar, et al.⁷ As can be seen from **Table no. 8**, burns (46.7 %) was the most common cause of death. Of the burns cases, burns shock and septicemia constituted 24.6% and 22.1%, respectively. Multiple injuries (20.2%), hanging (14.3%), poisoning (8.5%), head injury (7.7%) were the other main causes of death. This finding was consistent with the findings of others.^{2,7.9.13.19} The reason of burns being the most common cause may be the easy availability of kerosene, low cost.

As can be seen from **Table no. 9**, most common poison which caused the deaths (39.1%) was corrosives, followed by insecticides (21.7%), Organo phospates(17.4%), Aluminium Phosphide (13%). Chloroquine and Zinc Phosphide (4.3%, each). This finding was consistent with the findings of Virendra Kumar, et al,⁴ Singh D, et al,² Sharma BR, et al⁶ and Singh AK, et al,³ who, in their study had observed that the most common poison was ALP.

Conclusion:

The present study of autopsy cases of unnatural female deaths Maximum cases were

seen in age group of 21. 30 years. Housewives ,illiterate, married belongs to lower /middle class family. Among the married women, maximum suicidal cases were seen above 7 years of marriage life . According to manner and cause of death maximum cases were accidental burns. Suicidal deaths . Most common poison which causes was Corrosive poisoning.

Suggestions and Recommendations: Social and economic measures:

- Safety precautions to be adopted to prevent domestic accidents should be issued to the families through government and nongovernment agencies.
- An effective coordination should be sought between the non-government, voluntary and law enforcing agencies to prevent and contour crime against women.
- Costly and ostentatious marriage rituals should be discouraged with an economical ban on such marriages.
- Promoting literacy among the women to make them economically independent and free by providing job opportunities.

B) Legal measures:

- Early marriage should be discouraged and punitive measures to be strictly implemented in case of default.
- Women protection cell working in the State should be given to deal with deaths resulting from burns with adequate and sufficient facilities.
- Enact more stringent laws taking care of the torture of housewives by their husbands and In-laws.
- Inquest by a magistrate or a senior police officer should be made in all cases of females deaths especially of burns cases and the existing laws to be strictly adhere to.
- Doctor should arrange/record dying declaration in dowry deaths cases particularly when he is of the opinion that the life was fast ebbing out of dying women.
- Visit to the crime scene should be made compulsory to the autopsy surgeon along with the expert in Forensic Science with a well-equipped team.

There should be transparency and accountability in the judicial system.

Conflict of interest: None Financial Assistance: None References:

- National Crime Records Bureau; Crime in India 2011 Compendium. Government of India, Minister of Home Affairs, New Delhi, 2012: 2. Available from http://ncrb.nic.in/CDCII2011/ compendium2011.pdf
- Singh D, Dewan I, Pandey AN, Tyagi S. Spectrum of unnatural fatalities in the Chandigarh zone of north-west India - a 25 year autopsy study from a tertiary care hospital, J Clin Foren Med.2003;10(3):145-52.
- Singh AK, Verma AK, Singh K, Singh M, Kumar S. Pattern of un-natural deaths in lucknow, capital of uttar pradesh. Paper presented in Scientific Session of Forensic Medicon 2010, XXX Annual conference of Indian Academy of Forensic Medicine (IAFM) on January 2010 at Nagpur.
- 4. Kumar V. Poisoning deaths in married women. J Clin Foren Med.2003;11(1):2-5.
- Mohanty MK, Panigrahi MK, Mohanty S, Das SK. Victimiologic study of female homicide. J Legal Medicine. 2004;6(3):151-6.
- Sharma BR. Social etiology of violence against women in India. The Social Science Journal. 2005;42(3):375-89.
- Mohan Kumar T, Kanchan T, Yoganarasimha K, Pradeep Kumar G. Profile of unnatural deaths in Manipal, Southern India 1994. 2004, J Clin Foren Med.2006;13(3):117-20.
- Geeta S, Sachidananda M, Sekhar TC, Manju P. Victimiologic study of female suicide. Medico-Legal Update. 2008;8(1):14-18.
- Kailash UZ, Mugadlimath A, Gadge SJ, Kalokhe VS, Bhusale RG. Study of some socio-etiological aspects of unnatural female deaths at Government Medical College, Aurangabad. J Ind Acad Foren Med. 2009;31(3):210-7.
- Muhammad S, Ali A, Bashir MZ. Unnatural female deaths in Peshawar. J College of Physicians and Surgeons--Pakistan. 2003;13(4):198-200.
- 11. Rahim M, Das TC. Profile of unnatural deaths at forensic medicine department of dhaka medical

college. Bangladesh Medical Journal. 2009;38(2):44-7.

- Dere RC, Rajoo KM. Study of unnatural deaths in females. J Indian Acad Forensic Med. 2011;33(3):124-27
- Prajapati P, Prajapat S, Pandey A, Joshi V, Prajapati N. Pattern of suicidal deaths in females of South
- 14. Gujarat Region. National J Med Res. 2012;2(1):31-4.
- Kumar S, Verma AK, Ali W, Pandey A, Ahmad I, Singh US. A study of unnatural female deaths profile in Lucknow, India. American J Foren Med Pathol. 2013;34(4):352-6.
- Srivastava AK, Arora P. Suspicious deaths in newly married females . a medicolegal analysis. J Ind Acad Foren Med. 2007;29(4):62-66.

Table No. 1: Cases of Unnatural Death in Females
--

	No. of cases	(%)
Unnatural female deaths	816	20.8
Total Autopsies	3930	100
Table No. 2: Age Wise Distribution of Cases		

Table No. 2: Age Wise Distribution of Cases

Age group (Years)	No. of cases	%
0 – 10	29	03.5
11 – 20	166	20.34
21 – 30	288	35.29
31 – 40	148	18.40
41 – 50	76	09.31
51 – 60	67	08.21
> 60	42	05.15
Total	816	100

Table No 3 Month & Season Wise Distribution of Cases

Month	Season	No. of Cases	%
November'12	Winter	21	02.57
December'12	(238	41	05.02
Jan'12	cases,	80	09.80
Feb'12	29.18 %)	96	11.76
March'12	Summer	40	04.90
April'12	(253	34	04.16
May'12	cases,	91	11.15
June'12	31.00 %)	88	10.78
July'12	Monsoon	71	08.70
August'12	(325	93	11.39
September'12	cases,	124	15.19
October'12	39.82 %)	37	04.53
Total		816	100

Table No. 4: Classification of Cases According to the Occupation of the Victim

Occupation	No. of cases	%
Domestic Work	48	05.88
House wife	420	51.47
Student	165	20.22
Labourer	60	07.35
Employed (job)	51	06.25
Business	18	02.21
Non worker (old age)	30	03.68
Not applicable (Children < 5	24	02.94
years & Unknown)		
Total	816	100

Table No. 5: Classification of Cases According to the Education of the Victim

Educational Status	No. of cases	(%)
Primary	165	20.22
Secondary	210	25.74
Higher Secondary	210	25.74
Graduate	84	10.29
Illiterate	126	15.44
Not applicable (Children < 5 years)	21	02.57
Total	816	100

According to Modified Prasad Classification -AICPI as per December 2012

Class	No. of cases	%
I (Upper)	15	01.84
II (Upper - middle)	177	21.69
III (Middle)	346	42.40
IV (Lower – middle)	258	31.62
V (Lower)	20	02.45
Total	816	100

Table No. 7: Distribution of Cases According to Marital Status

Marital Status	Duration of marriage	No. of cases	(%)
Married	> 7 years	321	39.34
	< 7 years	219	26.84
Unmarried		195	23.90
Divorce		09	1.10
Widow		48	05.88
Not Applicable		24	02.94
Total		816	100

Table No. 6: Distribution of Cases According to Socio-Economic Status of the Victim

Table No. 8: Classification of Cases According to Cause and Manner of Death

Cause of Death	Accidental	Suicidal	Homicidal	Total
Burns –septicemia	135	36	9	180 (22.06 %)
Burns – shock	105	93	3	201 (24.63 %)
Multiple injuries	147	6	12	165 (20.22 %)
Hanging	0	117	0	117 (14.34 %)
Poisoning	18	51	0	69 (8.46 %)
Head injury	60	3	0	63 (7.72 %)
Electrocution	09	0	0	09 (1.10 %)
Drowning	06	0	0	06 (0.74 %)
Strangulation/Throttling	0	0	6	04 (0.74 %)
Total	480 (58.82 %)	306 (37.50 %)	30 (3.68 %)	816 (100 %)

Table No.9: Distribution of Cases According to Type Of Poisoning

Type of Poisoning	No. of cases	Percentage (%)
OP	12	17.39
ALP	09	13.04
Corrosive	27	39.13
Insect bite	15	21.73
Zinc Phosphide	03	04.34
Chloroquine	03	04.34
Total	69	100

Original Research Paper

Profiling of Cases Brought to Causality for Alcohol Examination: A Two Year Study

¹Amandeep Singh, ²Gagandeep Kaur Kalsi, ³Ajay Kumar, ⁴Dasari Harish, ⁵Tanya Singh

Abstract:

Introduction: The hazardous and harmful use of alcohol is a major global contributing factor to death, disease and injury: to the drinker through health impacts, such as alcohol dependence, liver cirrhosis, cancers and injuries; and to others through the dangerous actions of intoxicated people, such as 'drunk driving' and violence or through the impact of drinking on fetus and child development.

Materials and Methodology: A two year retrospective study was conducted of the cases brought for alcohol examination to emergency of GMCH Chandigarh from 15th June 2015 to 14th June 2017, after obtaining clearance from the Institutional Ethics Committee. Details regarding demographic profiling, reason for examination, delay in examination and outcome of their examination, etc. was studied.

Observations: Of the 12984 total medico-legal cases registered in GMCH during these two years, 676 (2.3%) cases were cases brought for alcohol examination. All these cases were brought by police and were examined after receiving request from the police official. Of the 676 cases, only 2 were females. Majority of the cases belonged to the 21 to 40 years age group with 41.6% belonging to 21 to 30 years and 33.8% cases to 31 to 40 years group. 477 (70.6%) of the cases were from urban area. As per their occupation; 580 were doing private jobs/ labourer, 24 cases were government servants, while 72 were unemployed. Smell of alcohol was present in 619 (91.5%) of cases. Abnormality of behavior was found in 8.4% cases and muscle in-coordination was reported in only 6.9% cases. Injuries were also present in 35 (5.2%) cases, which were in the form of simple abrasions, swelling, contusion and lacerated wounds. Commonest reason for arrest of the person and bringing for alcohol examination was found to be drinking at public places, (63.1%) followed by quarrel (26.6%), involved in road side accident (5.7%), causing nuisance after drinking (3.5%) and drinking on duty as well as 'drink and drive' cases (0.04%).

Key Words: Alcohol Examination, Medicolegal cases, Motor Vehicle act, Liquor Prohibition Act

Introduction:

Although little data on alcohol consumption and drinking patterns is available from the developing world, increasing alcohol

Corresponding Author:

³Associate Professor, ¹Associate Professor, ^{2.5} PG 1st Year, ⁴Prof. & Head, Dept. of Forensic Medicine, Government Medical College& Hospital Chandigarh E-mail: iamdrajay@gmail.com, L.M. No. 752 DOR: 12/08/2017 DOA: 21/09/2017 DOI: 10.5958/0974-0848.2017.00057.4 is observed in developing countries, which may relate, among other factors, to economic growth, stress, conflict, availability and aggressive advertising.¹

Alcohol harm is experienced not only by drinkers but by those around them including families, friends, colleagues and strangers.² The abuse of alcohol is a major global contributing factor to death, disease and injury: to the drinker through health impact, such as alcohol dependence, liver cirrhosis, cancers and injuries; and to others through the dangerous actions of intoxicated people, such as driving after drinking and quarrel or through the impact of drinking on fetus and disturbed family environment leading to poor child development.

Fifteen people die every day . or one every 96 minutes . from the effects of drinking alcohol, reveals an India Spend analysis of 2013 National Crime Records Bureau (NCRB) data. The per capita consumption of alcohol in India increased 38 percent, from 1.6 litres in 2003-05 to 2.2 litres in 2010-12, according to a World Health Organisation (WHO) report, which also revealed that more than 11 percent of Indians were binge drinkers, against the global average of 16 percent.³

There is a strong relationship between alcohol and domestic abuse, violence and sexual assault.² Strong links have been found between alcohol use and the occurrence of intimate partner violence in many countries. Evidence suggests that alcohol use increases the occurrence and severity of domestic violence.⁴⁻⁶

Aims and Objectives:

- 1) Analysis of the cases brought to the emergency for alcohol examination.
- 2) Compare the results so obtained with those of the others.
- 3) Suggest remedial measures for the same.

Materials and Methodology:

A two year retrospective study was conducted of the cases brought for alcohol examination to emergency of GMCH Chandigarh from 15th June 2015 to 14th June 2017, after obtaining clearance from the Institutional Ethics Committee. Details regarding demographic profiling, reasons for examination, delay in examination and outcome of their examination, etc. were studied.

Observations:

Of the total 12984 medico-legal cases registered in GMCH during these two years, 676 (2.3%) cases were cases brought for alcohol examination (**Table1**). All of these cases were brought by police and were examined after receiving request from police official.

Of the 676 cases, only 2 were females **(Table 2)**. Most of the cases brought for alcohol examination came during the night time i.e. 8 PM to 8 AM, followed by evening and morning (69%, 21% & 10%, respectively) **(Table 3)**. Majority of the cases were from the 21 to 40

years of age group, with 41.6% belonging to 21 to 30 years and 33.8% cases from 31 to 40 years of age (**Table 4**). 477 (70.6%) belonged to the urban area (**Fig. 1**). According to their occupation; 272 (40.2%) were doing private jobs, 176 (26.1%) were labourers, 132 (19.5%) were students, 24 (3.5%) were government servants, while 72 (10.7%) were unemployed (**Fig. 2**). Commonest reason for arrest of the person and bringing for alcohol examination was found to be drinking at public place (63.1%), followed by quarrel (26.6%), involved in road side accident (5.7%), creating nuisance after drinking (3.5%) and drinking on duty as well as 'drink and drive' cases (0.04%) (**Fig. 3**).

Delay in bringing the person for examination has major effect on the outcome of the result of the examination. It was noted that majority of the cases (396) were brought with about 2 to 6 hours of delay while 88 cases were brought for examination within 2 hours of incident or arrest and 192 cases were brought after a delay of more than 6 hours (Table 5). On examination, smell of alcohol was seen in 619 (91.6%) cases (Table 6). Abnormality of behavior was found in 8.4% cases and muscle in-coordination was reported in only 6.9% cases (Table 7). Injuries were also associated in 35 (5.2%) cases which were in form simple abrasions, swelling, contusions and lacerated wounds (Table 8).

Based on the examination, final opinion was given either as person had not consumed alcohol, as in 60 cases; or the person has consumed alcohol but not under its influence, as in 569 cases; and in 47 case the opinion was given as person had consumed alcohol and is under its influence **(Table 9)**.

Discussion:

Alcohol is one of the commonest used intoxicant, being legally and easily available in almost every region of India, leaving aside few states which have banned the sale and use of alcohol. This alcohol menace is not limited to the national boundaries, but problems involves almost all parts of the world. Public drinking can often be a nuisance to local communities and can greatly hamper the quality of life for residents in a particular area. Strict laws are existing to guard against the misuse of the alcohol and even punishments are prescribed if the person is caught flouting these laws.⁷⁻⁹ All the local authorities have alcohol byelaws in force and are tackling the problem of reducing the nuisance and disorder commonly associated with public drinking.¹⁰

Our study showed that most of the offenders (more than 70%) were from age group 21 to 40 years which is similar to many studies.¹¹⁻¹⁴ This age group is the most active group, thus involved in incidents of accidents as well as other crimes like guarrel. We found that among the patients brought for alcohol examination, the most common reason was drinking at public places. Reason for this is that, with increasing cost of liquor and taxation by the hotels, etc, the cost of drinking has gone up and to reduce this, people prefer to drink in their vehicles. There are certain IPC Sections which also prescribe punishment related to problem arising from alcohol consumption. Section 268 of Indian Penal Code, broadly defines and prohibits causing nuisance to public.^{15,16}

Driving after drinking is another problem which not only endangers the life of the accused himself but also other commuters plying on the road. Section 185 of Motor vehicle act prohibits driving of any vehicle after consumption of any drugs, including alcohol, if the blood alcohol level is more than 30 mg%. As per this section, any person who is caught breaking this law shall be punished for the first offence with imprisonment for a term which may extend to six months, or with fine which may extend to two thousand rupees, or with both; and for a second or subsequent offence, if committed within three years of the commission of the previous similar offence, with imprisonment for a term which may extend to two years, or with fine which may extend to three thousand rupees, or with both.¹⁷ Only three cases of driving under influence of alcohol were brought for examination, as in Chandigarh, the traffic police is equipped with Alco-meters and they, on finding alcohol above the permissible limit, Challan the offenders there and then, and impound the vehicle, which is released only after appearing in the court and fulfilling all related formalities.¹⁸

Increasing taxation on alcoholic beverages is another powerful means of decreasing both average consumption in the population and the number of alcohol abusers, provided it applies to all alcoholic beverages^{19,20}. Lower legal blood alcohol content limits for drivers in India as compared to some western countries i.e. 0.03 grams of alcohol per deciliter of blood (g/dL) and increasing license suspension periods for offenders is another deterrent for the alcohol abusers. Administrative records show a significant decrease of 32% in alcohol-related car accidents right after the law was approved but the effects moderate over time (15% after three years). There is also a significant reduction in injuries (31% right after the approval and 11% after three years) but no statistically significant effects on deaths.²¹

Several authors²²⁻²⁵ have suggested that increasing alcohol prices by raising alcohol excise taxes is among the most effective means of reducing excessive drinking and alcoholrelated harms. Increasing alcohol excise taxes has been specif²cally recommended as a public health intervention by the IOM, Partnership for Prevention, the WHO, and the expert panel convened for the Surgeon Generals Workshop on Drunk Driving.²⁶⁻²⁹

Non-motor-vehicle mortality outcomes are also studied by many authors. Six different studies evaluated the effects of alcohol price or taxes on non-traff²c deaths. Despite of substantial variability in these studies, all six studies found that higher alcohol prices were associated with decreased mortality.³⁰⁻³³

An increased risk of arrest along with one-year suspension of a driver's license can significantly reduce drunk driving Various 'drunk driving' studies have proved that this increased risk of arrest does deter drunk driving.³⁴ The National Research Council panel on alcohol abuse concludes that "some moderately persuasive evidence exists suggesting that effectively enforced drunken driving laws will deter drunken driving and reduce accidents and fatalities associated with it."34 Even many studies have proved that there is strong direct correlation between density of alcohol shops in an area with number of violent crimes reported from those areas.³⁴

In our study, it was found that most of the cases brought to the emergency were delayed and due to this the outcome of the examination in this group was that they were found to have taken alcohol but not under the influence of it. It is on record that 0.015 BAC of the alcohol in the body is being metabolized and disappearing from the body. So, if person**\$** BAC was 0.08 (legally impaired), it would take about 5.33 hours for the alcohol to be eliminated from your body.³⁵ Alcohol <u>burns off at a rate of .016</u> <u>BAC</u> per hour, or about one average drink per hour. This rate is pretty standard regardless of one's weight. Thus examination has to be done as early as possible to get the exact outcome of the results of examination.³⁶

Conclusion:

- Increased police surveillance is especially important at night, when most alcohol-induced crime and traffic fatalities occur.
- Speedy disposal of cases involving drinking and drunk driving by court can substantially influence the effectiveness.
- Price-induced decreases in consumption have in turn been linked to declines in the incidence of drunk driving and cirrhosis of the liver.
- Preventing drunk driving is through educational campaigns employing the mass media or local organizations such as hospitals, churches, and schools and
- Tougher penalties for drunk drivers are the two approaches that must be part of the solution.³⁷
- Earlier reporting for alcohol examination will yields more positive and accurate results.

Conflict of interest: None

Financial Assistance: None References:

- Perdrix J, Bovet P, Larue D, Yersin B, Fred Paccaud BB. Patterns of alcohol consumption in the seychelles islands (indian ocean). Alcohol and Alcoholism. 1999;34(5):773-85.
- 2. Available at http://www.ias.org.uk/uploads/IAS%20report%20 Alcohol%20domestic%20abuse%20and%20sexu al%20assault.pdf. Accessed on 5th Jul 2017.
- 3. Available at http://indianexpress.com/article/lifestyle/lifestyle/one-indian-dies-every-96-minutes-due-toalcohol-consumption-2818493/) date 30/6/2017 Accessed on 8th Jul 2017.
- Leonard KE, Quigley BM. Drinking and marital aggression in newlyweds: an event- based analysis of drinking and the occurrence of husband marital aggression. J Studies on Alcohol. 1999;60:537-45.

- Testa M, Quigley BM, Leonard KE. Does alcohol make a difference? Within- participants comparison of incidents of partner violence. J Interpersonal Violence, 2003;18:735-43.
- Brecklin LR. The role of perpetrator alcohol use in the injury outcomes of intimate assaults. J Famib Violence. 2002;17:185-97.
- 7. Available at https://www.alcoholwebindia.in/content/regulation -legislation-www.timesnow.tv/india/article/goapolice-ban-drinking-in-public-places.../60434 Accessed on 15th Jul 2017
- Available at https://en.wikipedia.org/wiki/Alcohol_laws_of_Indi a. Accessed on 15th Jul 2017
- 9. Available at https://www.quora.com/In-Indiawhat-is-the-penalty-for-consuming-alcohol-onthe-road. Accessed on 16th Jul 2017.
- 10. Available at www.gov.scot/Topics/Justice/law/Licensing/Byela ws. Accessed on 4th Jul 2017.
- Ruma Dutta, Sruthy Gnanasekaran, S Suchithra, V Srilalitha, R Sujitha, S. Sowmya Sivaranjani, S Subitha, Lawrence Dcruze. A Population based Study on Alcoholism among Adult Males in a Rural Area, Tamil Nadu, IndiaJ Clin Diagn Res. 2014 Jun; 8(6): JC01. JC03.
- Pradeep R. Johnson, Saira Banu, M. V. Ashok. Severity of alcoholism in Indian males: Correlation with age of onset and family history of alcoholismIndian J Psychiatry. 2010 Jul-Sep; 52(3): 243. 249.
- Manjunatha N, Saddichha S, Sinha BN, Khess CR, Isaac MK. Chronology of alcohol dependence: Implications in prevention. Indian J Community Med. 2008;33:233. 7
- 14. Available at https://www.collegedrinkingprevention.gov/media/ Journal/023_039.pdf accessed on 20th Aug 2017
- 15. Available at https://en.wikipedia.org/wiki /Indian_Penal_Code. Accessed on 16th Jul 2017.
- 16. Available at https://indiankanoon.org/doc /209076/. Accessed on 16th Jul 2017.
- 17. Available at https://indiankanoon.org/doc /139481594/ Accessed on 1st Aug 2017
- Available at http://indianexpress.com/article /cities/chandigarh/drunk-drivers-claim-ignoranceof-law-use-sifarishes-to-dodge-alcometer/ accessed on 15th July 2017

- 19. Levy D, Sheflin N. New evidence on controlling alcohol use through price. J Stud Alcohol. 1983;44(6):929-37.
- Baltagi BH, Goel RK. Quasi-experimental price elasticity of liquor demand in the U.S.: 1960.
 83. Am J Agric Econ. 1990;72(2):451-454.
- 21. Otero S, Rau T. The effects of drinking and driving laws on car crashes, injuries, and deaths: evidence from chile. Accid Anal Prev. 2017;106:262-74.
- 22. Babor TF, Caetano R. Evidence-based alcohol policy in the Americas: strengths, weaknesses, and future challenges. Pan Am J Public Health. 2005;18:327-37.
- Chisolm D, Rehm J, Van Omeren M, Monteiro M. Reducing the global burden of hazardous alcohol use: a comparative costeffectiveness analysis. J Stud Alcohol. 2004;65:782-93.
- Holder HD, Treno AJ. Moving toward a common evidence base for alcohol and other drug prevention policy. In: Stockwell T, Gruenwald PJ, Toumbourou JW, Loxley W, editors. Preventing harmful substance use: the evidence base for policy and practice. New York: John Wiley and Sons; 2005:351-66.
- 25. Toomey TL, Wagenaar AC. Policy options for prevention: the case of alcohol. J Public Health Policy. 1999;20(2):192-213.
- 26. Babor TF, Caetano R, Casswell S, Griffith Edwards, Norman Giesbrecht, Kathryn Graham, Joel W. Grube, Linda Hill, Harold Holder, Ross Homel, Michael Livingston, Esa Österberg, Jürgen Rehm, Robin Room, and Ingeborg Rossow. Alcohol: no ordinary commodity: research and public policy.New York: Oxford University Press; 2003.
- 27. Available at http://www.oxfordscholarship.com/view/10.1093/a cprof:oso/9780199551149.001.0001/acprof-9780199551149 accessed on 20th Aug 2017
- 28. Chaloupka FJ, Grossman M, Saffer H. The effects of price on alcohol consumption and alcohol-related problems. Alcohol Res Health. 2002;26:22-34.
- 29. Bonnie RJ, O'Connell ME. Reducing underage drinking: a collective responsibility. Washington DC: National Academies Press; 2004. Available at

https://www.ncbi.nlm.nih.gov/pubmed/20669473 accessed on 30th Aug 2017.

- Surgeon Generals workshop on drunk driving: proceedings. Rockville MD: USDHHS; 1989. Available at https://profiles.nlm.nih.gov/ps/retrieve/ResourceM etadata/NNBBBW accessed on 30th Aug 2017.
- Cook PJ, Tauchen G. The effect of liquor taxes on heavy drinking. Bell J Econ. 1982;13(2):379-90.
- Heien D, Pompelli G. Stress, ethnic, and distribution factors in a dichotomous response model of alcohol abuse. J Stud Alcohol. 1987;48(5):450-5.
- Sloan FA, Reilly BA, Schenzler C. Effects of prices, civil and criminal sanctions, and law enforcement on alcohol-related mortality. J Stud Alcohol. 1994;55:454-65.
- 34. Rush B, Steinberg M, Brook R. Relationships among alcohol availability, alcohol consumption and alcohol-related damage in the province of Ontario and the State of Michigan. Adv Alcohol Subst Abuse. 1986;5(4):33-45.
- Speer PW, Gorman DM, Labouvie EW, Ontkush MJ. Violent crime and alcohol availability: relationships in an urban community. J Public Health Policy. 1998;19(3):303-18.
- Available at https://www.homehealthtesting.com /how-long-does-alcohol-stay-in-your-system.html. Accessed on 15th Jul 2017.
- 37. Available at http://dui.findlaw.com/duiarrests/alcohol-metabolism-rate-and-yourdui.html. Accessed on 15th Jul 2017.

Table 1 : Showing total MLC cases and Cases examined for alcohol intoxication

Total MLC Cases	12984
Alcohol Examination cases	676 (2.3%)

Table 2 : Showing distribution of cases according to sex of the patient

Sex	No. of cases	%age
Males	674	99.7
Females	02	0.3
Total	676	100

Table 3 : Showing distribution of cases according to time of examination

Time of examination	No. of cases	%age
Morning duty (8AM to 2 PM)	69	10.2
Evening Duty (2 PM to 8 PM	141	20.8
Night Duty (8 PM to 8 AM)	466	68.9
Total	676	100

Fig 1: Showing distribution of cases according to residence of the patient



Fig 2 : Showing distribution of cases according to occupation of the patient



Occupation

Fig 3: Showing distribution of cases according to reason for the examination

Reasons for examination



Table 4 : Showing distribution of cases according to age group of the patient

Age group	No. of cases	%age
<10 yrs	0	0
11-20 yrs	55	8.1
21-30 yrs	281	41.7
31-40 yrs	229	33.8
41-50 yrs	89	13.2
51-60 yrs	13	1.9
>61yrs	9	1.3
Total	676	100

Table 5: Showing distribution of cases according to delay in bringing for examination

Time since Incident / Arrest	No. of cases	%age
Within 2 hours	88	13
2 to 6 hours	396	57.6
More than 6 hours	192	28.4
Total	676	100

Table 6: Showing distribution of cases according to smell of alcohol

Smell of alcohol on examination	No. of cases	%age
Present	619	91.6
Absent	57	8.4

Table 7: Showing distribution of cases according to examination findings

		-	
Findings		No.of cases	%age
Bobayior	Normal	619	91.6
Dellaviol	Abnormal	57	8.4
Muscle	Normal	629	93.1
coordination	Abnormal	47	6.9

Table 8: Showing distribution of cases according to injuries associated

Injuries	No. of	%age	Injuries	No. of
	cases	•	sustained	cases
			Abrasions	33
Procont	35	5.2%	Contusions	10
Flesent	55	J.Z /0	Swelling	27
			Laceration	5
Absent	641	94.8%		

Table 9: Showing distribution of cases according to opinion given

• •		
Opinion	No. of cases	%age
Has not consumed alcohol	60	8.9
Consumed alcohol by not under influence	569	84.2
Consumed alcohol and is under the influence of alcohol	47	6.9

Original Research Paper

Analysis of Deaths Due to Poisoning: A Two Year Retrospective Study

¹Chanpreet Kaur Pawar, ²Gurmanjeet Rai, ³Ashok Chanana, ⁴Gaurav Pawar, ⁵Kuldeep Kumar, ⁶Manpreet Kaul, ⁷Swati Tyagi, ⁸Kamaljeet Singh

Abstract:

India is an agriculture based country with Punjab as one of the leading food grain producing states. There is an ever increasing burden to feed the growing population. This has led to over-usage of pesticides, which on one hand has contributed significantly to increase the crop yield, while on the other hand has led to sharp increase in the poisoning cases in the region. The present study was undertaken to study the deaths related to poisoning in Amritsar, Punjab, with a view to assess the pattern, trends and incidence of poisoning in relation to age, sex, area, season , effect of poison on internal organs and type of poison used. Of a total of 2000 autopsies, 201 cases of death due to fatal poisoning were selected for this study, which were brought to us for postmortem examination, during the span of two years (from January 2003 to December 2004). These constituted 10.1% of all the unnatural deaths. In this study, higher number of fatal poisonings episodes were ascribed to Chlorocompounds, followed by Aluminum Phosphide, but on the basis of WHO classification of poisons, Aluminium Phosphide is the most common fatal poison.

Key Words: Poisoning, Deaths, Toxicology, Incidence.

Introduction:

Poisoning is as old as our society. Of late, the incidence of poisoning cases is increasing steadily with each passing year. By definition, anything which when used internally or on the body surface in a dose or in repeated doses, if acts chemically and physiologically, causing disturbances of body functions and leads to disease or death, is a poison.¹

Corresponding Author:

²Addl. Professor & Head,

¹Senior Resident,
³Associate Professor,
⁴Junior Resident
⁵Assistant Professor,
⁶Lecturar,
^{7,8}Junior Resident,
Dept. of Forensic Medicine & Toxicology,
Dept. of Pathology, Govt. Medical College, Amritsar,
Punjab.

E Mail: drmaan0079@rocketmail.com L M no.: LM/238/Punjab/1989 DOR: 31/03/2017 DOA: 21/09/2017 DOI: 10.5958/0974-0848.2017.00058.6

As per law, poison is a substance which when administered is injurious to health or life.² Of these, 90% of fatal poisoning occurs in developing countries, particularly amongst the agricultural workers. Acute poisoning forms one of the commonest causes of emergency hospital admissions. Pattern of poisoning in a region depends on variety of factors, such as availability of poisons, socioeconomic status of population, religious and cultural influence. The exact incidence of poisoning in India is uncertain due to lack of data at central level as most cases are not reported, also, mortality data is a poor indicator of incidence of poisoning. It has been estimated that about 5-6 persons per lakh of population die due to poisoning every year.³

In the United States, deaths due to poisoning number more than 775 per year. Most of the people who die from poisoning are adults and deaths often results from intentional, rather than accidental exposure.⁴

Both homicidal and suicidal cases of poisoning are more common in India than in western countries, owing to easy availability of poison in the Indian markets. Insecticides and pesticides account for majority of these poisoning cases. More recently, aluminum phosphide, because it is cheap, easily available, highly toxic, and has no antidote, has emerged as the most common suicidal agent.⁵ The toxic effects of aluminum phosphide are due to the deadly phosphine gas liberated when it reacts with water or hydrochloric acid in the stomach. Organophosphorus compounds are the other more common cause of insecticide poisoning in India.⁶

Poisoning is a major epidemic of noncommunicable diseases in the present century. Among the unnatural deaths, deaths due to poisoning come next only to road traffic accident deaths.⁷ In the earlier times, poisoning deaths from pesticides were mainly accidental but easy availability, low cost and unrestricted sale have led to an increase in suicidal and homicidal cases as well. Pesticides, which were invented to protect crops from rodents, insects and humans from starvation, have themselves become an important contributor to unnatural deaths. In the developed world, poisoning due to narcotics and drug over dosage is far more common than due to pesticides. World Health Organization (WHO) estimated that 0.3 million people die every year due to various poisoning agents. The death rate due to poisoning is much higher in the low- and middle-income countries of Europe than in any other region of the world.⁸

Materials and Methodology:

This retrospective study was conducted in the department of Forensic Medicine and Toxicology, Government Medical College, Amritsar. This study comprised of hospital deaths and deaths in the jurisdiction of Amritsar district, alleged to have died due to poisoning during the period of January 2003 to December 2004. Total 2000 autopsies were conducted during the study period and of these. 201 were alleged poisoning deaths. The data required was collected from the police inquest papers, autopsy reports and toxicological examination reports. The data was entered into MS - Excel spread sheet, statistically and critically analysed, tabulated and compared with other various studies to analyse the trends .Trends in distribution of poisoning cases were observed in relation to age, gender, type of poison, survival period and seasonal distribution. The study was approved by the Institutional Ethics Committee.

Observations:

A total of 2000 post-mortems were conducted in the year 2003 and 2004, of which 201were positive for poisoning, on analysis. This constituted 10.1% of all the unnatural deaths. From **Table 1**, it is clear that the maximum number victims were males (158, 78.6%). The Male: Female ratio was found to be 3.67:1. The incidence was highest in the age group 21-30 years (53.7%), followed by the age group 31- 40 years (31.8%). The age group 61 to 70 years showed minimum (1.5%) cases. **Table 2** Our study revealed that most of the victims of fatal poisoning were of Sikh Religion (78.6%). **Table 3**

The incidence of poisoning cases was more in the urban areas (46.8%), as compared to the rural (43.3%). Table 4 Most of the victims (24.9%) were from the labour class, followed by housewives (17.9%), and there were 4 students also among the victims. Table 5 Of the 43 females, only 15 (34.9%) could get treatment and of the 158 males, 100 of them could get treatment in hospital, before they expired. Table 6 Chloro compounds were responsible for majority of cases to the extent of 48.3% while Aluminium phosphide (50), Organophosphorus (22), Dextropropoxyphene (3), etc, constituted the rest. Table 7 In the year 2003, total deaths due to poisoning were 126 and in 2004 they were 76. In 2003, August (25) recorded the highest number of cases, followed by June (12), while January (5) recorded the least number of cases. In 2004, July (16) had highest number of and minimum number of cases were cases seen in November (5). Table 8 Gross examination of various organs, that is, stomach, brain, lungs, liver, kidney and spleen, revealed congestion. Table 9

The study highlights the following points:

In one case the cause of death came out to be asphyxia as a result of strangulation, and along with that, chemical analysis report showed alcohol in blood. Of the total, injuries which included abrasions (40), bruises (20), lacerated wounds (20), incised wound (1), ligature mark (1) and burns (2), were found on the body of 49 victims during autopsy. These injuries were antemortem in nature. Among them, two were prisoners and two were from mental hospital, Amritsar. Four of them were recovered from forest areas and bodies were putrefied and chemical analysis report showed Organophosphorus in three of them and Chlorocompound in one. Two victims were pregnant.

Discussion:

In the present study, 21-30 years of age group showing higher incidence of poisoning accounted 53.7% which is similar with observations of other workers,⁹⁻¹³ which can be explained by the fact that the persons of this age group are suffering from stress of the modern life style, failure or less percentage in the exams, scolding from parents or teachers, failure in love, family problems etc. Change over from the concept of joint family to nuclear family has forced modern youth to face the problem of day to day living, both at home and outside, on their own without the much needed advice from the elders. When these problems and tensions become unbearable, ending ones life seems to be the only solution of them. Sharma, et al¹⁴ said that people in the extremes of the age groups i.e. below 15 years and above 60 years, were least prone to poisoning and the higher incidence of poisoning found in the age group of 15-30 years. Singh, et al¹⁵ have also observed that younger age group is most susceptible to the lure of riches, the modern society s hard stick of success and frustrations caused by the inability to cope with the highly competitive, indifferent and materialistic society have resulted in increased poisoning in younger generations.

No significant seasonal trend is observed in the present study, which is also supported by the other authors.^{11,15} In the present study, males (42.3%) showed higher incidence of poisoning than the females (11.4%). On comparison with other authors,^{10,12-} ^{14,15} our study showed similarity. Though all the studies were conducted in different parts of India, male predominance was a common and constant feature in all, which suggests that male are more active in various social activities and customs and hence they are vulnerable from stress and tension.

Maximum number of poisoning deaths occurred in the urban areas (52.7%), as compared to the rural. On comparison with other authors, ^{10,14,16,17} our study showed contradiction because now-a-days, due to globalization and urbanization, people are migrating from other areas, which causes increase of population of the city, the urban people have lot of business failure and social problems so these factors contributing.

In the present study, higher number of fatal poisonings episodes can be ascribed to Chlorocompounds, but on the basis of WHO classification of poisons, aluminium phosphide is the most common fatal poison. The data presented in the literature indicates that organophosphate are pesticides the predominant problem worldwide, being responsible for many cases of self-poisoning and the majority of deaths and a rural preponderance for pesticide poisoning are observed. Maximum number of victims were treated in hospitals but could not survive. Similar was observed in study done in Shimla.¹⁸

Suggestions:

- Punitive and stringent legislation should be made for offenders of free sellers of Scheduled E: poisons and Schedule H drugs.
- 2. At household level, the drugs and poisons should be kept safely and away from reach of children and adolescents.
- 3. At root level of health services, medical and paramedical staff should be educated and made aware of various poisonings with house hold remedial measures keeping in view hilly terrain of Himachal Pradesh, which can reduce the mortality that is enhanced in the shifting of patients to higher level of health institutions.
- 4. At primary health center level, it has been observed that unjustified referrals are made to secondary level health centers before making the patient fully stabilized which can result in avoidable or preventable death of the patient on way.
- 5. At higher institutions or tertiary level, centers casualty/emergency medical officers must be trained thoroughly to deal with all kind of

poisoning cases swiftly and accurately. Ready charts of different symptoms and signs should be present in emergency wards with specific antidotes. The specific antidotes and other life saving drugs should be readily available at all levels of health institutions.

- 6. It is always advisable to consult a toxicologist at the earliest while treating non-specific poisoning emergencies.
- 7. Toxicological units should be established at tertiary care centers to expedite the diagnosis as well as treatment of various poisonings.
- 8. Forensic Science Laboratories should be equipped with chemical analyzers, which can report both quantitatively as well as qualitatively.

Conflict of interest: None Financial Assistance: None References:

- 1. Nandy A. Forensic toxicology Principles of Forensic Medicine. 2nd Ed: 438-54.
- 2. Glaister. Law relating to poisoning:Med Juris Toxicol. 1957; 10: 466-67.
- Reddy KSN: The Essentials of Forensic Medicine and Toxicology, 29th Ed. K. Saguna Devi, Hyderabad;2010:449.
- Klaassen CD. Principles of toxicology and treatment of poisoning. Quoted in: Goodman & Gilman. The pharmacological basis of therapeutics. 10th International Ed, McGraw Hill, New York: 67-80.
- 5. Jay Ram KS. Death pills from pesticides. Nature 1991;353:177.
- Parikh CK. Parikhos textbook of medical jurisprudence, forensic medicine and toxicology. 6th Ed., New Delhi 2000:10.41-10.49
- Mathers, C., Fat, D.M., Organization, W.H., and Boerma, J.T. The global burden of disease: 2004 update. World Health Organization, ; 2008.
- Singh SP, Aggarwal AD, Oberoi SS, Aggarwal KK, Thind AS, DS Bhullar, et al. Study of poisoning trends in north India . A perspective in relation to world statistics. J Foren Legal Med. 2013;20(1):14-18.
- Aggarwal NK, Aggarwal BBL. Trends of poisoning in Delhi. J Ind Acad Forensic Med.1998;20(2):32-6.

- Dalal JS, Gorea RK, Aggarwal AK, Thind AS, Sandhu SS. Poisoning trends- a post mortem study. J Ind Acad Forensic Med.1998;20(2):27-31.
- 11. Dhattarwal SK, Dalal SS. Profile of deaths due to poisoning in rohtak, haryana. J Forensic Med Toxicol.1995;14(1):51.
- Gargi J, Rai H, Chanana A, Raj G, Sharma G, Bagga IJS. Current trends of poisoning - a hospital profile. J Punjab Acad Forensic Med Toxicol. 2003;3:41-5.
- Murari A, Sharma GK. A comparative study of poisoning cases autopsied in LHMC New Delhi and Jipmer, Pondicherry. J Forensic Med Toxicol.2009;19(1):18-20.
- Sharma BR, Harish D, Sharma V, Vij K. The epidemiology of poisoning - An Indian view point. J Forensic Med Toxicol.2000;19(2): 5-11.
- 15. Shingh K, Oberoi SS, Bhullar DS. Poisoning trends in the malwa region of punjab. J Punjab Acad Forensic Med Toxicol.2003;3:26-29.
- Shingh VP, Sharma BR, Harish D, Vij K. A ten year study of poisoning cases in a tertiary care hospital. Ind Internet J For Med Toxicol.2004;1:2.
- 17. Dhattarwal SK, Singh H. Profile of death due to poisoning in rohtak, haryana. J Forensic Med Toxicol.2001;18(2):28-29.
- Kapila P, Sekhon HS, Mishra VK. Study of poisoning deaths in and around shimla.Deptt. of Forensic Medicine, IGMC Shimla. Ind Internet J For Med Toxicol. 2003;1:2.

Table 1.	Sex wise	distribution	of deaths	due to
		poisonina		

	<u> </u>
Sex	Total
Male	158(78.60%)
Female	43(21.39%)
Total	201

Table 2. Age and sex wise distribution of deaths due to poisoning

Age (Yrs)	Male	Female	Total
0-10	-	-	0
11-20	9(4.47%)	1(0.49%)	10(4.97%)
21-30	85(42.28%)	23(11.44%)	108(53.73%)
31-40	56(27.86%)	8(3.98%)	64(31.84%)
41-50	4(1.99%)	5(2.48%)	9(4.47%)
51-60	2(0.99%)	4(1.99%)	6(2.98%)
61-70	1(0.49%)	2(0.99%)	3(1.49%)
71-80	1(0.49%)	-	1(0.49%)
Total	158	43	201

Table 3. Religion wise distribution of deaths due to poisoning

1		
Religion	No. of cases	
Hindu	52(25.87%)	
Sikh	125(62.18%)	
Muslim	4(11.99%)	
Not known	20(9.95%)	
Total	201	

Table 4. Area wise distribution of deaths due to poisoning

Area	Total
Rural	75(37.3%)
Urban	106(52.73%)
Not known	20(9.95%)
Total	201

Table 5. Occupation wise distribution

Occupation	No. of cases
Govt. service	21(10.44%)
Private service	36(17.91%)
Farmer	22(10.94%)
Labour	54(26.86%)
Housewife	36(17.91%)
Unemployed	28(13.93%)
Student	4(1.99%)
Total	201

Table 6. Treatment Wise Analysis

Treatment	Male	Female	Total
Treated	100(63.2 %)	15(34.88%)	115(57.21%)
Not treated	58(36.70 %)	28(65.11%)	86(42.78%)
Total	158	43	201

Table 7. Type of poison

Type of poison	Male	Female	Total
Chlorocompounds	76(37.8%)	21(10.4%)	97
Aluminium phosphide	50(24.8%)	11(5.4%)	61
Organophosphorus	22(10.9%)	8(3.9%)	30
Dextropropoxyphene	3(1.4%)	1(0.4%)	4
Corrosive poison	1(0.4%)	1(0.4%)	2
Alcohol	4(1.9%)	0	4
Zinc phosphide	2(0.9%)	1(0.4%)	3
Total	158	43	201

Table.8 Month wise distribution

Month	Year 2003	Year 2004
January	5	10
February	10	6
March	11	4
April	9	12
May	9	9
June	12	4
July	11	16
August	23	6
September	10	4
October	6	2
November	10	1
December	9	2
Total	125	76

Table 9. Internal examination

Mucosal findings (stomach)	No. of cases
Congestion	55
Congestion and Hemorrhages	144
Corroded	2
Softening	20
Ulceration	12
Sub mucosal hemorrhage	135
Perforation	1

Table 10. Poison wise distribution

Tune of noison	Most common	Se	ex		u/r/uk	(Relig	ion		Treat	ment
Type of poison	age gp	М	F	U	R	UK	Н	S	m	UK	Т	NT
Chlorocompound	21-30yrs	74	24	52	45	10	23	62	2	10	57	40
Aluminium phosphide	21-30yrs	50	11	35	19	7	10	43	1	7	31	30
Organophosphorus	21-30yrs	27	3	11	6	3	14	15	1	0	16	14
Alcohol	31-40yrs	4	0	2	2	0	2	1	0	1	3	1
Dextroporopoxyphene	21-30yrs	2	1	4	0	0	1	3	0	0	3	1
Zinc phosphide	11-20yrs	1	2	1	2	0	1	1	0	1	3	0
Corrosive	21-30yrs	0	2	1	1	0	1	0	0	1	2	0

Abbrevations: M - Male, F - Female, U - Urban, R - Rural, UK - Unknown, H - Hindu, S - Sikh, m - Muslim

Original Research Paper

Evaluation of Foramen Magnum Dimensions for Sex Determination

¹Madhusudan R. Petkar, ²Sandesh B. Datir, ³Chandeep Singh Makhani, ⁴Jamebaseer Farooqui, ⁵Rajendra S. Bangal, ⁶Kalidas D. Chavan

Abstract:

This retrospective observational study was undertaken to study the sexual dimorphism in 108 adult human skulls (58 Male and 50 Female skulls) of known sex of population of Maharashtra from Foramen Magnum dimensions. Foramen Magnum Length (FML) and Foramen Magnum Breadth (FMB) were measured in millimeters with sliding vernier calipers. The values of range, mean, standard deviation, calculated range (mean±3SD), were obtained in univariate analysis. Subsequently Demarking point and Identification point were derived. The mean and range of FML of males (Mean - 34.34 mm, Range 26-41 mm) was higher than that of females (Mean - 33.64 mm, Range 29-38 mm) with significant difference. Also the mean and range of FMB of males (Mean - 28.59 mm, Range 25-35 mm) was higher than that of females (Mean - 28.59 mm, Range 25-35 mm) was higher than that of females (Mean - 27.56 mm, Range 22-32 mm) with significant difference. On comparing with other studies, the findings of the present study were found to be almost similar. The methods of demarking point (DP) and identification point (IP) were not found helpful in determining the sex of skull. FML and FMB were not found to be very reliable indicator in estimation of sex of an unknown skull and thus, these should only be used as a supportive finding in estimation of sex of fragmentary remains of skull.

Key Words: Foramen Magnum Length, Foramen Magnum Breadth, Skull, Sexual dimorphism, Demarking point, Identification point

Introduction:

Identity of a person is a set of physical

Corresponding Author:

²Associate Professor,

⁵Dean,

Department of Forensic Medicine and Toxicology, Smt. Kashibai Navale Medical College and General Hospital. Narhe, Pune.

¹Associate Professor,

Department of Forensic Medicine and Toxicology, Dr. D. Y. Patil Medical College, Hospital & Research Centre, Pimpri, Pune.

³Associate Professor,

Department of Forensic Medicine and Toxicology, Army College of Medical Sciences, New Delhi.

⁴Associate Professor,

Department of Forensic Medicine and Toxicology, Rural Medical College, Loni.

⁶Registrar,

Maharashtra University of Health Sciences, Nashik. Email id: sandeshdatir@gmail.com. L. M. No: 714/2009 DOR: 07/07/2017 DOA: 21/09/2017 DOI: 10.5958/0974-0848.2017.00059.8

characteristics, functional or psychic, normal or pathological that facilitates the %adividualization" of a person. Each individual has unique and distinguishing characteristics, which on adequate inspection and examination ensure that he/she cannot be mistaken for another.¹ Establishment of a personos individuality is important, both for legal as well as humanitarian purposes. Correct identification of a deceased also allows for accurate documentation of death (i.e. filing of the death certificate) and permits the deceased's financial and legal issues to be addressed, including the settling of the estate, filing life insurance claims and probating a Last Will and Testament.

To identify the deceased person from bone is the most common and critical problem faced by Anatomists, Forensic Experts and Anthropologists. Skeletal remains have been used for sexing the individual as bones of the body are last to perish after death next to enamel.² Determination of sex is an important initial step in the development of the biological profile in human osteology, whether analyzing a forensic case or an archaeological population. Without an accurate determination of sex, we cannot accurately estimate age at death, as rates of growth, development, and degeneration vary by sex as well as population. Additionally, stature is estimated with different regression formulae for males and females.

There are many sex estimation methods which can be applied to human remains. These methods vary from visual assessments to metric analysis of sexually dimorphic traits. The general anatomical regions used for sex determination are the pelvic girdle, the skull and long bones, although other bones have also been utilized and show some degree of sexual dimorphism.³ Traditionally, skull is most studied bone in physical anthropology. As evident from the past studies, skull is the most dimorphic and easily sexed portion of skeleton after pelvis, providing accuracy up to 94%.⁴⁻⁷

There is no denial of the fact that a skull can be sexually differentiated very well. But, analyzing the gender of a skull by foramen magnum examination has an undisputed advantage during instances like mass disasters, where, even a small piece of base of a skull having foramen magnum can aid in determining sex.⁸⁻⁹ Therefore, the authors of the present study felt the need and have made an attempt to contribute a little more with relation to sex determination of skeletal remains by measuring foramen magnum dimensions of a dry skull.

Materials and Methodology:

The present retrospective observational study was carried out on 108 adult human skulls (58 male and 50 female) of known sex of population of Maharashtra, available in the Department of Anatomy, in tertiary health care centers, with prior approval from the Ethics Committee. Dry skulls of individuals of age group 18 years to 55 years of known sex, free of damage and deformity were included in the study.

Following dimensions of Foramen Magnum were measured for each skull.¹⁰⁻¹²

1. Foramen Magnum Length (FML): The distance between basion (most anterior

point on anterior margin of foramen magnum) and opisthion (most posterior point on the posterior margin of the foramen magnum). It was recorded with the help of sliding vernier caliper. (**Figure 1**)

 Foramen Magnum Breadth (FMB): Maximum breadth of Foramen magnum was measured at broadest part of Foramen magnum with the help of sliding vernier caliper. (Figure 2)

Data Analysis: Statistical Analysis: ¹³⁻¹⁴

All the values were tabulated and analyzed statistically by routine statistical methods with SPSS software. The values of range, mean, standard deviation, calculated range (mean±3SD), were obtained in univariate analysis. Subsequently Demarking point and Identification point were derived. For FML with male range of a . b and female range of c . d, values and and and were the identification point (I.P) for females and males respectively. FML reading less than ±aq was regarded as female skull and greater than ±lqwas regarded as male skull and in case where female range was more than male then by and by were identification point (I.P) for female and male respectively. Similarly Demarking Point (D.P) was calculated from calculated range i.e. Mean ± 3 S.D (a = minimum value in male range, b = maximumvalue in male range, c = minimum value in female range and d = maximum value in female range). Similarly values of range, mean, standard deviation, calculated range (mean±3SD), were obtained and IP and DP were derived for FMB. Subsequently ± qtest was applied. Results were tabulated, analyzed and compared with other studies.

Results:

Foramen Magnum Length:

The mean FML of male skulls was 34.34 mm ranging between 26-41 mm. The mean FML of female skulls was 33.64 mm with the values ranging between 29-38 mm. The identification point of male skulls was more than 38 mm and of female skulls was less than 26 mm and percentage of skulls identified by I.P alone was 5.17% of males and 0% of females. The SD for male and female 2.89 were and 2.24 range of respectively. The calculated

mean±3SD in males and females was 25.68-43.01 mm and 26.92-40.36 mm respectively. The demarking point for males was more than 40.36 mm and for female it was less than 25.68 mm. The percentage of skull identified by DP alone was 1.72% for males and 0% for female. (**Table 1**)

Foramen Magnum Breadth:

The mean FMB of male skulls was 28.59 mm ranging between 25-35 mm. The mean FMB of female skulls was 27.56 mm with the values ranging between 22-32 mm. The identification point of male skulls was more than 32 mm and of female skulls was less than 25 mm and percentage of skulls identified by I.P alone was 5.17% of males and 08% of females. The SD for male and female were 2.18 and 2.20 respectively. The calculated range of mean±3SD in males and females was 22.06-35.12 mm and 20.97-34.15 mm respectively. The demarking point for males was more than 34.15 mm and for females it was less than 22.06 mm and the percentage of skull identified by DP alone was 1.72% for males and 02% for females. (Table 1)

Discussion:

All the previous researchers have reported a larger FML and FMB in males than females.¹⁵⁻¹⁹ Our findings in this regard are consistent with that reported in the earlier studies. The mean and range of FML and FMB of male skulls was higher than that of female skulls significantly, showing sexual dimorphism.

On comparing the mean and range of FML and FMB of skulls, of the present study with other studies, the findings of the present study were found to be similar with findings of Deshmukh,² Keen,²⁰ Hong Wei Song,²¹and Kanchan.²² (**Table 2 and 3**)

The methods of DP and IP were not found helpful in determining the sex of skull. Though the differences in the observations of various researchers are attributed to the variations in the study samples, methodology, and statistical analysis employed, ²³ most of the researchers are of the opinion that the dimensions of the foramen magnum are not a very reliable indicator in estimation of sex of an unknown skull and thus, these should only be used as a supportive finding in estimation of sex of fragmentary remains of skull.

Conflict of interest: None

Financial Assistance: None

References:

- Gangrade P, Saini R, Yadav R, Vyas A. Evaluation of New Morphometric Parameters for Sex Determination of Human Skull. RRJMHS. 2013;2(3):81-84.
- Deshmukh AG, Devershi DB. Comparison of cranial sex determination by univariate and multivariate analysis. J Anat Society of India. 2006;55(2):48-51.
- 3. Giles E, Elliot O. Race identification from cranial measurements. J Forensic Sci. 1962;7(2):147-57.
- Krogman WM, Iscan MY. The human skeleton in forensic medicine. 2nd sub ed. Illinois: Charles C. Thomas Pub Ltd; 1986.
- Veyre-Goulet SA, Mercier C, Robin O, Guérin C. Recent human sexual dimorphism study using cephalometric plots on lateral teleradiography and discriminant function analysis. J Forensic Sci. 2008;53(4):786-9.
- 6. Luo L, Wang M, Tian Y, Duan F, Wu Z, Zhou M, et al. Automatic Sex Determination of skulls model. based on а statistical shape Computational and Mathematical Methods in Medicine. 2013; 2013. Available from: http://dx.doi.org/10.1155/2013/251628
- 7. Garvin HM, Sholts SB, Mosca LA. Sexual dimorphism in human cranial trait scores: effects of population, age, and body size. Am J of Phys Anthropol. 2014;154(2):259-69.
- Manoel C, Prado FB, Caria PHF, Groppo FC. Morphometric analysis of the foramen magnum in human skills of Brazilian individuals: its relation to gender. Brazilian Journal of Morphologic sciences. 2009;26(2):104-108.
- Holland TD. Use of the cranial base in the identification of fire victims. J Forensic Sci 1984;29:1087. 1093.
- Moore-Jansen PH, Ousley SD, Jantz RL. Data Collection Procedures for Forensic Skeletal Material. Report of Investigations no. 48. The University of Tennessee, Knoxville, Forensic Anthropology Center, 1994;56. 57.
- 11. Routal RR, Pal GP, Bhagwat SS, Tamankar BP. Material studies with sexual dimorphism in

foramen magnum of human crania. J. Anat Soc. India. 1984; 33(2):85-89.

- Günay Y, Altinkök M, Çagdir S, Kirangil B. Gender determination with skull measurements (in Turkish). J Forensic Med 1997;13:13. 19.
- Jit I, Singh: Sexing of adult clavicles. Ind. J. Med. Res. 1966;54:551-571.
- 14. Cleaves, Juliet Allen, Sex and Race Determination From The Base Of The Skull. Master's Thesis, University of Tennessee, 1993. Available from:

http://trace.tennessee.edu/utk_gradthes/4132

- Catalina-Hercera CJ. Study of the Anatomical matrix values of the foramen magnum and its relationship with sex. Acta Anat. 1987;130(4):344-347.
- Burdan F, Umÿawska W, Dworza ski W, Klepacz R, Szumiÿo J, Starosÿawska E, et al. Anatomical variances and dimensions of the superior orbital fissure and foramen ovale in adults. Folia Morphol. 2011;70:263. 71.
- 17. Zaidi SH, Dayal SS. Variations in the shape of foramen magnum in Indian skulls. Anat Anz. 1988;167(4):338-40.
- Mukherjee JB. Forensic Medicine and Toxicology. In: Karmakar RN, editor. Personal Identification. 4th ed. Kolkata. Academic Publishers; 2011. P.86-175.
- Uysal S, Gokharman D, Kacar M, Tuncbilek I, Kosa U; Estimation of sex by 3D CT measurements of the foramen magnum. J Forensic Sci. 2005; 50:1310. 14.
- 20. Keen JA. A study of the differences between male and female skulls. Am J Phys Anthropol.1950;8(1):65-80. Available from: [http://dx.doi.org/10.1002/ajpa.1330080113
- 21. Hong Wei Song, Zi Qing Lin and Jing Tao Jia. Sex diagnosis of Chinese skulls using multiple

stepwise discriminant functional analysis. Foren Sci Inter. 1992;54:135-40.

- Kanchan T, Gupta A, Krishan K. Craniometric Analysis of foramen magnum for estimation of sex. Intern J Med Health, Biomed, Bioeng Pharmaceutical Eng. 2013;7(7):378-380.
- Raghavendra Babu YP, Kanchan T, Attiku Y, Dixit PN, Kotian MS. Sex estimation from foramen magnum dimensions in an Indian population. J Forensic Leg Med 2012;19(3):162-7.

Figure 1: Foramen Magnum Length (FML)



Figure 2: Foramen Magnum Breadth (FMB)



Details of measurement	FML	in mm	FMB in mm		
Details of measurement	Male n=58	Female n=50	Male n=58	Female n=50	
Mean	34.34	33.64	28.59	27.56	
SD	2.89	2.24	2.18	2.20	
Range	26-41	29-38	25-35	22-32	
Identification point (IP)	>38	<26	>32	<25	
Percentage of skull Sexed by IP	5.17%	0%	5.17%	08%	
Calculated range (mean±3SD)	25.68-43.01	26.92-40.36	22.06-35.12	20.97-34.15	
Demarking point (DP)	>40.36	<25.68	>34.15	<22.06	
Percentage of skull Sexed by DP	1.72%	0%	1.72%	02%	
Standard error	0.37	0.31	0.28	0.31	

Table 1: Statistical analysis of Foramen Magnum dimensions

S. No.	Name of workers			Male			Fe	male		SS
		Ν	М	R	SD	Ν	М	R	SD	р
1	Keen (1950) ²⁰	50	36.3	30-44	2.9	50	34.8	30-40	2.4	
2	Hong Wei Song (1992) ²¹	30	34.1		2.6	30	32.1		2.1	< 0.001
3	Deshmukh (2006) ²	40	34	26-40	3.09	34	34	30-38	2.05	>0.05
4	Kanchan (2013) ²²	69	34.51	27–41	2.77	49	33.60	27–39	2.63	0.073
5	Present study	58	34.34	26-41	2.89	50	33.64	29-38	2.24	>0.05

Table 2: Comparison of Foramen Magnum Length (FML)

Where N – no. of skull, M – Mean, SD – Standard deviation, R – Range, SS – Statistical significant, FML in mm.

	Table 3: Comparison of Foramen Magnum Breadth (FMB)										
		Ν		SS							
3. NO.	Name of workers	Ν	М	SD	Ν	М	SD	р			
1	Hong Wei Song (1992) ²¹	30	27.5	2.4	30	25.8	1.8	<0.001			
2	Deshmukh (2006) ²	40	29	1.97	34	28	2.09	>0.05			
3	Kanchan (2013) ²²	69	27.36	2.09	49	26.74	2.36	0.131			
4	Present study	58	28.59	2.18	50	27.56	2.20	<0.01			
	Where N – no of skull, M – Mean, SD – Standard deviation, SS – Statistical, significant										

MB in mm.

**Contd. from page no.234

Fatal injury(s)	Pedestrians	Cyclist	Occupants of motorized two wheeler	Occupants of light of Medium vehicles vehicles		Occupants of heavy vehicles	Others	Total
Isolated Head injury	73(56.6)	19(59.4)	69(66.3)	32(27.6)	6(31.6)	9(45)	19(64.6)	227(50.4)
Isolated Cervical spine injury	2(1.6)	1(3.1)	6(5.8)	9(7.8)	2(10.5)	1(5)	0(0)	21((4.7)
Isolated Chest injury	3(2.3)	1(3.1)	3(2.9)	7(6.0)	3(15.8)	0(0)	2(5.9)	19(4.2)
Isolated Abdomino pelvic injury	9(6.9)	3(9.4)	4(3.8)	7(6.0)	0(0)	1(5)	0(0)	24(5.3)
Head & chest injury	8(6.2)	2(6.3)	3(2.9)	8(6.9)	0(0)	1(5)	3(11.8)	25(5.6)
Thoraco abdominal injury	11(8.5)	1(3.1)	6(5.8)	12(10.3)	1(5.3)	1(5)	2(0)	34(7.6)
Head & abdominal injury	3(2.3)	1(3.1)	6(5.8)	3(2.6)	0(0)	0(0)	0(0)	13(2.9)
Limb and other fracture	10(7.8)	0(0)	3(2.9)	1(0,9)	0(0)	1(5)	1(5.9)	16(3.5)
Multiple injuries	10(7.8)	4(12.5)	4(3.8)	37(31.9)	7(36.8)	6(30)	3(11.8)	71 (15.8)
injury Head & abdominal injury Limb and other fracture Multiple injuries Total cases	3(2.3) 10(7.8) 10(7.8) 129	1(3.1) 0(0) 4(12.5) 32	6(5.8) 3(2.9) 4(3.8) 104	3(2.6) 1(0,9) 37(31.9) 116	0(0) 0(0) 7(36.8) 19	0(0) 1(5) 6(30) 20	0(0) 1(5.9) 3(11.8) 30	13(2.) 16(3.) 71 (15 450

Table 8- Distribution of cases according to fatal injury(s) in different road users

(Figures in brackets shows % of cases in each group of road user)

Original Research Paper

Thoracic Artefacts Due to Resuscitative Procedures Encountered During Autopsy

¹Shailesh Vasantrao Parate, ²S. Harish, ³Girish Chandra Y. P, ⁴Ashok Kumar Samanta.

Abstract:

This prospective study was conducted at M.S. Ramaiah Medical College, Bangalore, from October 2008 to March 2010, for a period of 18 months with aim to study the pattern of thoracic resuscitative artefacts and to ascertain the causal relationship of thoracic resuscitative artefact to age and sex. Data was collected by detailed questionnaire, focusing on the history furnished by the police in inquest and requisition form, by the relatives and hospital records.

Thoracic artefacts were present in 15 % cases. Rib fracture artefact was found in 15% cases. Most commonly fractured ribs were 3rd, 4th and 5th at midclavicular line, either unilateral or bilateral. 2nd, 6th and 7th ribs were less commonly involved and there was no involvement of 1st and 8th to 12th ribs. Most common site of rib fracture was midclavicular line. Sternum was most commonly fractured at middle 1/3rd due to CPR. In cases above 50 years, percentage of rib and sternal fracture was more in females. Positive correlation was found between thoracic artefact and age. Incidence of artefact was less in cases when CPR was given by doctor than in cases in which it was given by a paramedical person followed by doctor and percentage of incidence of artefact was further more in cases where CPR was given by doctor.

Key Words: Artefact, Resuscitation, Autopsy

Introduction:

Artefact is defined as any change caused or feature introduced in the natural state of the body that is likely to be misinterpreted at autopsy.¹ Thoracic artefact are the artefacts observed in the thoracic region. The term resuscitation means to revive from unconsciousness or apparent death.²

Corresponding Author:

¹Assistant Professor,

⁴Professor & HOD Dept. of Forensic Medicine, ESIC Medical College, Joka, Kolkata.

^{2,3}Professor,Dept. of Forensic Medicine,M. S. Ramaiah Medical College, Bangalore.

Email: drshaileshparate@gmail.com

Email: drayad_in@yahoo.com L. M. No: Not A Member DOR: 30/05/2017 DOA: 19/06/2017 DOI: 10.5958/0974-0848.2017.00060.4

The resuscitative measures include cardiopulmonary resuscitation (CPR), defibrillation, endotracheal tracheostomy, intubation, puncture of veins, pericardiocentesis and decompression of tension pneumothorax or mediastinal emphysema. Such procedures sometimes can cause injury which is likely to be misinterpreted at autopsy as injuries due to accidental intentional or trauma. Cardiopulmonary resuscitation (CPR) is a basic life support method intended to maintain perfusion of internal organs in cases of sudden apparent cardiac arrest until advance life support (ALS) can be instituted.²

Cardiopulmonary resuscitation (CPR) is a lifesaving procedure but it can also cause various injuries to patients. Unanticipated complications have been observed and described in the medical literature. These include skeletal fractures. upper airway complications, pulmonary barotrauma,

hemothorax, and lacerations of internal organs.³ Since forensic pathologists often encounter different types of CPR-related injuries during autopsies, they must be able to distinguish between CPR-related injuries and those caused by other factors such as assaults and accidents. Even therapeutically unimportant injuries can be important for forensic pathologists. Main factors influencing frequency and severity of injuries resulting from resuscitation procedures include length of resuscitation time, age of the patient, degree of qualification and skill of the medical personnel.⁴

It is important to determine whether any rib fractures discovered in infants and young children are secondary to accidental injury, inflicted injury, or cardiopulmonary resuscitation (CPR) efforts. The interpretation of such fractures may have important medico-legal implications.⁵ Emergency care providers who are knowledgeable about CPR-related injuries may be able to recognize and limit iatrogenic injuries during the critical moments of resuscitation. This information is also crucial to enable medical and legal professionals to assess the significance of injuries in children suspected of being abused.⁶

While lungs can be ruptured by direct force of chest compression or punctured by tips of broken ribs during intensive and prolonged CPR, these injuries rarely occur when proper chest compression is used. Lacerations of the lungs can cause hemothorax with ante-mortem and/or postmortem bleeding during chest compression.⁷

Objectives of the study:

1) To study the pattern of thoracic resuscitative artefacts.

2) To ascertain the causal relationship of thoracic resuscitative artefact to age and sex.

Materials and Methodology:

The present prospective study was conducted in the department of Forensic Medicine, M.S Ramaiah Medical College Bangalore from October 2008 to March 2010 for a period of 18 months. Ethical clearance was obtained priorly. Study included cases subjected for autopsy having history of resuscitative measure instituted. Cases with history of thoracoabdominal trauma by road traffic accident or any form of accident were excluded from study. Postmortem examination of the case was carried out as per the standard procedure mentioned in the % utopsy diagnosis and technique+by Otto Saphire.⁸ After removal of the thoracic viscera, the parietal pleura was stripped and the internal surface of the ribs carefully examined for fracture, first by visualization and then by palpation.⁸ Blood and viscera were sent for chemical analysis in suspected cases of poisoning.

Data was collected by detailed questionnaire, focusing on the history furnished by the police in inquest and requisition forms, by the relatives and hospital records. Additional information with respect to age of patient, time of death, place of death, time interval between death and postmortem examination& person giving CPR were collected. Descriptive statistics was applied for various thoracic artefacts encountered and their interpretation.

Results:

Please refer table number 1to 5.

Discussion:

During the study period, in 160 autopsy cases, resuscitative measures were iniated. Of these, 128 (80%) were males and 32 (20%) were females. Rib fracture was found in 24 (15%) cases, rib fracture among males was found in 16 out of 128 (12.5%) cases, whereas among females, it is found in 8 out of 32 (25%) cases. In 16 cases, it was bilateral and in 8, it was unilateral, of which in 7 cases it was on left side and in one case it was on the right side. Most commonly fractured ribs were 3rd, 4th and 5th at midclavicular line, whether fracture was unilateral or bilateral. 2nd, 6th and 7th ribs were less commonly involved and there was no involvement of 1st and 8th to 12th ribs. In 19 cases, ribs were fractured at midclavicular line, in 4 cases, they were fractured at anterior axillary line and in 1 case it was fractured at midaxillary line. Sternal fracture was present in 10 (6.3%) cases, sternal fracture among males was found in 5 out of 128 (3.9%) cases, whereas among females, it was found in 5 out of 32 (15.6%) cases. In 9 cases, it was at middle 1/3rd and in one case it was at lower 1/3rd.

In a study of 70 autopsy cases by Powner J, et al, rib fracture artefact was present in 19% cases, sternal fracture artefact in 9% and mediastinal bleeding was present in 4% cases.⁹ In a prospective study of the complications of cardiac resuscitation by JP Krischer, et al, rib fracture artefact was present in 31.6% cases; sternal fracture in 21.1% cases and anterior mediastinal haemorrhage was present in 18.3% cases.¹⁰ In a study of 268 autopsy cases by Paaske F, et al, rib fracture was found in 44% cases and sternal fracture in 22% cases.¹¹

Percentage of rib fracture in subjects above 50 years was found to be 24.3%. It was 06 out of 31(19.4%) in males and 3 out of 06 (50%) in females. Percentage of sternal fracture in subjects above 50 years was found to be 16.2%. It was 3 out of 31 (9.7%) in males and 3 out of 6 (50%) in females. It shows that percentage of rib and sternal fracture is more in females. This is because they are more prone to fracture after 50 years due to post menopausal osteoporosis. In a prospective study of the complications of cardiac resuscitation by JP Krischer, et al, incidence of contusion/puncture of lungs was found to be 0.8%,¹⁰ whereas in this study, it was 1.9%, in combination and individually incidence of contusion, puncture and collapse were 1.3%, 0.6%, 0.6% respectively. It can be either by direct force of chest compression or punctured by tips of broken ribs during intensive and prolonged CPR. 6 cases were associated with anterior mediastinal haemorrhage.

Table 4 shows that thoracic skeletal artefact and thoracic soft tissue artefact (in lung) are increasing as age increases. Hence, there is positive correlation between thoracic artefact and age. **Table 5** shows that percentage of incidence of artefact is less in cases when CPR was given by doctor than in cases in which it was given by paramedical person followed by doctor and percentage of incidence of artefact is further more when CPR was given by layperson followed by doctor. This is because of decrease in the level of skills and experience.

Conclusion

 3^{rd} , 4^{th} and 5^{th} ribs are most commonly fractured due to cardiopulmonary resuscitation whether fracture is unilateral or bilateral. 2^{nd} , 6^{th}

and 7th ribs are less commonly involved and 1st and 8th to 12th ribs are usually not involved. Most common site of rib fracture is midclavicular line. Sternum is most commonly fractured at middle 1/3rd due to CPR. In cases above 50 years percentage of rib and sternal fracture is more in females due to post menopausal osteoporosis. There is positive correlation between thoracic artefact and age.

Incidence of artefact is less in cases when CPR is given by doctor than in cases in which it is given by paramedical person followed by doctor and percentage of incidence of artefact is further more when CPR is given by layperson followed by doctor.

Recommendations:

A. To the autopsy surgeon -

- Autopsy surgeon should be aware of complications arising from different resuscitative procedures and artefacts introduced by them
- 2. Detailed history from police and relatives should be collected regarding circumstances of death and treatment given in hospital or accident and emergency department.
- 3. Autopsy surgeon should go through hospital case sheet particularly emergency room records and may have to talk with treating doctor whenever he/she is in dilemma about nature of infliction of injuries, whether caused by trauma/assault or by resuscitative procedures.

B. To the treating doctor -

- Since CPR is a lifesaving procedure it cannot be withhold due to fear of complications but it should be performed as correctly as possible particularly application of appropriate pressure at the proper anatomical site and should make note of the same in the hospital case sheet and death summary.
- 2. All successfully resuscitated patients should be screened for potential complications of CPR to improve prognosis.

Acknowledgement:

Department of Forensic Medicine and Toxicology, M.S. Ramaiah Medical College, Bangalore, Karnataka.

Conflict of interest: None Financial Assistance: None References:

- Vij K. Textbook of forensic medicine and toxicology. 5th ed. New Delhi: Elsevier; 2011. 31 pp.
- Hart AP, Azar VJ, Hart KR, Stephens BG. Autopsy artefact created by the revivant AutoPulseTM resuscitation device. J Forensic Sci 2005;50(1):164-8.
- Jones J, Flatter B. Complications after cardiopulmonary resuscitation. Am J Emerg Med. 1994;12:687-8.
- Darok Mario. Injuries resulting from resuscitation procedure. In: Tsokos M. Ed. Forensic pathology review Vol- 1. Totowa (NJ): Humana Press Inc; 2004. 293-303.
- Dolinak David. Rib fractures in infants due to cardiopulmonary resuscitation efforts. American J Forensic Med Pathol. 2007;28(2):107-10.
- Bush Colleen M, Jones Jeffrey S, Cohle Stephen D, Johnson Harrison. Paediatric injuries from cardiopulmonary resuscitation. Annals of Emerg Med. 1996;28:40-4.
- 7. Saukko Pekka, Knight Bernard. Knightos forensic pathology. 3rd ed. London: Arnold; 2004. 41 pp.
- 8. Otto Saphire. Autopsy diagnosis and technic. 4th ed. Illinois: Hoeber Harper; 1965. 17-30 pp.
- 9. PownerJ, Holcombe PA, Mello LA. Cardiopulmonary resuscitation related injuries. Crit Care Med. 1984;12:54.
- Krischer JP, Fine EG, Davis JH and Nagel EL. Complications of cardiac resuscitation. Chest. 1987;92:287-91.
- 11. Paaske F, Hart Hansen JP, Koudahl G, Olsen J. Complications of closed-chest cardiac massage in a forensic autopsy material. Dan Med Bull. 1968;15:225 Available from: https://www.ncbi.nlm.nih.gov/pubmed/5708589

Table no-1	Thoracic skelet	al artefacts
------------	-----------------	--------------

Sr. No	Artefact	No. of cases having particular artefact	%age (n = 160)	Male (128)	Female (32)
1	Rib fracture	24	15.00	16 (12.5 %)	08 (25%)
2	Sternal fracture	10	06.25	05 (03.9 %)	05 (15.6%)

Table no-2, Rib fracture & sternal fracture artefact above 50 years age

Parameter	>50 years	Rib fracture	Sternal fracture
Male	31	06 (19.4%)	03 (9.7%)
Female	06	03 (50%)	03 (50%)
Total	37	09 (24.3%)	06 (16.2%)

Table no-3, Thoracic soft tissue artefacts in lungs

Sr. No.	Artefact	No. of cases having particular artefact	%
1	Contusion	02	01.25
2	Puncture	01	00.63
3	Collapse	01	00.63
4	Contusion+Puncture	03	01.88
5	Anterior mediastinal haemorrhage	06	03.75

Table no-4, Relation between artefacts and age group

Age group in years	Thoracic skeletal artefact	Thoracic soft tissue artefact (lung)
0-20	00	00
20-30	04	00
30-40	05	00
40-50	06	01
>50	09	03

Table No-5, Relation between artefact and CPR given			
by different persons			

CPR given by	Number of cases	No of cases having thoracic artefact	Percentage of cases having artefact
Doctor only	141	14	09.93
Paramedical person followed by doctor	13	06	46.15
Layperson followed by doctor	06	04	66.67

Review Research Paper

Legal Perspectives in Negligence Cases

¹Rajesh Sangram

Abstract:

Power and prerogatives of doctors have grown due to new technologies. The responsibility of medical doctor has grown due to rising patient demands for medical help. Patients are better informed about their health and expect their doctors to make decisions with them and not for them. Days of % doctors knows best+are over. On the other hand, simple matters of yesterday enter the arena of serious and acrimonious debate today, obscure and unknown matters till yesterday, have suddenly come to light today.

Key Words: Negligence Cases, Legal Aspects.

Introduction:

Power and prerogatives of doctors have technologies.The grown due to new responsibility of medical doctor has grown due to rising patient demands for medical help. Patients are better informed about their health and expect their doctors to make decisions with them and not for them. Days of % doctors knows best+are over. On the other hand, simple matters of vesterday enter the arena of serious and acrimonious debate today. obscure and unknown matters till yesterday, have suddenly come to light today.

A doctor is required to make clear decisions based on an unambiguous estimate of the problem. Patients usually seek and physicians often provide a definitive diagnosis and this works well in practice. However, often, clinical picture is ambiguous, making it difficult for physicians to reach a definitive conclusion. In such situations, the possibility of a mistake is real and is a common professional hazard.

Corresponding Author:

¹Professor & Head,

Dept. of Forensic Medicine & Toxicology, E S I Medical College, Kalaburagi, Karnataka.

E mail: - dr.rajesh.sangram@gmail.com. L. M. No: Not a Member

DOR:01/10/2016 DOA: 19/06/2017 DOI: 10.5958/0974-0848.2017.00061.6 Rather than accepting the ambiguity of certain clinical situations and explaining it to patient, doctors are often pressured to make definitive decision in unclear circumstances, situations, which actually demand a probabilistic inference due to incomplete and fragmentary nature of information, are often discussed in terms of clinical certainty, forcing errors.

No human being is infallible, and in the present state of science, even the most eminent specialist may be at fault in detecting the true nature of the disease. A practitioner can only be held liable in this respect if diagnosis is so palpably wrong as to prove negligence, i.e., if his mistake is of such a nature as to imply an absence of reasonable skill and care on his part. Reasonable skill is equated with ordinary or average level of skill in the profession.

In medico-legal cases, however, part of the problem lies in the legal connotation of the word % begligence+. The failure of a doctor and hospital to discharge their obligation is a civil wrong, called tort in law, a breach of which attracts judicial intervention by way of awarding damages.

Protection to Doctors:

In this era of crass commercialization of the profession, pontifications about % oble+ profession and % acred+ doctor-patient relationship being vitiated by being taken to court ring hollow. The only protection available under the IPC to doctors for acts which may result in death or hurt is for acts done in % Good faith+ However, Good faith+has been defined in section 52 in with Gue care and attention+¹

Medical malpractice is not merely the negligence on the part of the care giver; but also a conscious decision of the care giver; with an offer and/ or force a product, along witha procedure or investigation upon a patient for monetary gain either personally or for the institution comes under the definition under malpracticeq²

There could always be deficiency of service inherent in every profession and the nature and extent of deficiency or efficiency is governed by the circumstances, qualifications and experience of the dispensing professional as well as the availability of gadgets and convenience at hand to the attending doctor.¹

The court observed³ that the service which medical profession renders is probably the noblest of all and hence there is a need to protect doctors from unjust prosecution. Even a minor lapse on the part of doctor is blown out of proportion, cancelling out the enormous amount of good work the doctor might have done while underlying the component silently. negligence-of-duty and resulting damage, the court repeatedly observed that it is not necessary for every professional to possess the highest level of expertise in that branch which he practices. It is also quoted that in an acceptable standard of conduct; the competence of the dependant is to be judged by the lowest standard that would be regarded as acceptable. %The test in the standard of the ordinary skilled man exercising and professing to have that special skill.... and it is sufficient if he exercises the ordinary skill of an ordinary competent man exercising that particular art+. The court also observed that the standard is that of the reasonable average and the law does not require of a professional man that he be a paragon combining the qualities of polymath and prophet.

Bolam Test⁴

The classical statement of law in Bolam case (1957) has been widely accepted as decisive of the standard of care require both of professional men generally and medical practitioners in particular and holds good in its applicability in India.

А medical professional to he prosecuted for negligence under criminal law there should be evidence that he did something or failed to do something, which a medical professional, % his ordinary senses and prudence would have done or failed to do+⁴ The apex court has observed that % simple lack of care, an error of judgment or an accident is no proof of negligence+⁴ A private complaint against a doctor will be entertained only if the complainant is able to furnish prima facie evidence before the court.

Civil Cases of Negligence:

Civil cases pertain to disputes between two or more persons regarding wrong or inadequate treatment, wrong diagnosis and failure to keep professional secrecy. When a patient sues a doctor in civil courts, it is mainly for compensation.

- Due to the injury or death of the patient or as the case may be, caused because of the negligence of the doctor, OR
- When a doctor files a civil suit for realization of his professional fees from the patient or his relatives who refuse the same on the grounds of malpractice.

Examples of civil negligence:

- \rightarrow Unnecessary treatment
- \rightarrow Wrong diagnosis
- \rightarrow Prolonged treatment
- → Duty(to warn in possible side-effects) not discharged
- \rightarrow Treatment leading to further complications.

A Causation means **%** bring about+⁵ In order to obtain compensation in a case of medical negligence, it is not only sufficient to prove that negligence occurred, but also that the negligence was the cause of the damage which occurred. The more proximate the causation (proximate cause) to the damage, the greater is the chance of succeeding in a claim for compensation. The more remote the causation (remote cause), the lesser is the chance of success in getting compensation.⁵

In order to succeed in a medical negligence case, the claimant must prove, on a balance of probabilities, that the doctors breach of duty to care, i.e., negligence, caused the damage, he has to show that:⁶

- The damage would not have occurred, but for the doctor negligence OR
- The doctorop negligence materially contributed to, or materially increased the risk of injury.
- Further, if the claim is that the doctor failed to disclose the risk involved in the treatment or surgery, and the risk actually occur, the claimant can raise a plea that had such risk been disclosed he would not have agreed to such treatment or surgery

The great problem of alleged medical negligence lies in the continuum of *s*tandard of careqbetween actions that are accepted medical practice and those that constitute a lack of care.⁷ At the junction of these two extremes is a grey area of debatable clinical judgment where some doctors would act in one way where as others would act, quite legitimately, in a different way.⁷

Claimants(patients) in clinical negligence actions have to demonstrate first that they were owed a duty of care by their health care provider, second that there was a breach of the duty, and third, that they suffered harm as a result.²

The following actions comes under the purview of negligence;

- → Inadequate notes, lost records, failing or muddled memories may all lead to an inability to rebut the claimant case.
- \rightarrow Operation without consent
- → Issuing wrong certificates or reports. [What does the author want to say?]

It is important to note that <u>damageq</u> in the sense of injury or harm, is quite different from <u>damagesq</u> which is the financial compensation awarded to a successful litigant (here it is a patientor side).

What the court says:

Supreme Court held that the Damoclesq sword of criminal prosecution should not be hanging constantly over medical practitionercs head by making them liable for every instance of negligence.⁵

- A simple lack of care, error of judgment or accident is not a negligence
- Error must be gross in nature
- Doctor cand be arrested in routine manner

• Complaint wond be entertained when there is credible opinion from another competent doctor, preferably from Government doctor in that branch of medicine.

A Doctor can be prosecuted for causing death due to \pm ash and negligent actq(304A)⁴ if his patient dies, but the doctor cannot be prosecuted for \pm ulpable homicide not amounting to murderq (304) IPC,⁴ which entails a higher punishment. While punishment for rash and negligence act is two years, a life sentence can be imposed for an offence under culpable homicide not amounting to murder.

Criminal Cases of Negligence:

Criminal cases are related to violation of laws. In such cases, the guilty doctor is awarded with a punishment. It may be fine, imprisonment or even death sentence. In case of serious injury, the doctor may be charged under various sections of IPC;³

- → Section 304A of IPC: causing death of any person by doing any rash or negligent act which does not amount to culpable homicide, which is punishable with imprisonment for a term which may extend to 2 years.
- → Section 336 of IPC: rash or negligent act endangering human life.
- → Section 337 of IPC: causing hurt to any person by doing any rash or negligent act as would endanger human life.
- → Section 338 of IPC: causing grievous hurt to any person by doing any rash or negligent act so as to endanger human life.

Examples of criminal negligence

- → Injecting anesthetic in fatal dosage or in wrong tissues.
- \rightarrow Transfusing wrong blood.
- \rightarrow Performing a criminal abortion.
- → Leaving instruments or sponges inside the part of body operated upon.
- \rightarrow Operation on wrong patient.

Highly personalized skilled professional services of a doctor cannot be equalled to that of a rash driver. In a way doctor is neither a warrantor nor a guarantor. Further, there are many loopholes, variations and deficiencies in the knowledge and outcome of a treatment. It is unwise to expect that everything will go well in medicine according to the plan in every case. It is also true that the knowledge in medicine and its application is advancing so fast that every doctor cannot be an expert and be expected to offer the best expertise in every situation.

The profession had earlier tried to imply that it cannot be called to account by the law on the ground that it is technically inadequate. However, medicine is not some arcane art. It is a highly codified body of knowledge and procedures of treatment are meticulously standardized. With this level of procedural consistency, the profession cannot claim that the law does not have the expertise to evaluate its performance. The evaluation consists only in seeing whether the doctor in the dock has gone by the book. The law is as competent to rule on a medical case as in the case of financial irregularity. Most malpractice cases are selfevident anyway, and the principle of res ipsaloquitor(literally, the issue shall speak for itself) may safely be applied. It is usually a case of a surgical oversight- the ubiquitous forceps the maladministration problemor of anaesthesia. The law does not need technical skills to come to adequately comprehend such matters.

Elements of Negligence:

The necessary elements of an action founded on negligence were held to be;

- A duty or obligation recognized by law requiring the person to conform to a certain standard of conduct for the profession of others against unreasonable acts.
- A failure on the part of the defendant (doctor) to conform to the standard required.
- A reasonable close casual correction between the conduct and the resulting injury.
- Actual loss or damage resulting to the plaintiff (patient).

Right to Life -

The problem before the society is that it does not want to challenge the integrity, dignity and morality of the medical professionals. It still believes that it is very uncommon for a doctor to go against his soul and oath taken by him on the entrance of his profession. Further the patient is now become conscious of the fact that right to life is his fundamental right as quoted in article 21 of the constitution. As the right to life which means and implies healthy life is a constitutional right guaranteed to citizens under Article 21 of the Constitution is actionable right against state under article 32 and 226 of the constitution of India.⁵ It is therefore desirable that the state should take the responsibility of its citizen¢ health.

The only way to resolve the problem of whether an act is truly negligent is by peer judgmentqand this is the means by which most medical disputes are settled. The facts of the case are placed before experts in that particular specialty and their views sought. It is sufficient in this context to show only that a substantial number of doctors agree with the actions of the defendant (here it is a doctoros side); there is no need for unanimity of either condemnation or support.

Tact, sympathy and understanding are expected of the physician, for the patient is no more collection of symptoms, signs, disordered functions, damaged organs and distorted emotions. He is human, fearful and hopeful, seeking relief, help and reassurance.

Conflict of Interest: None Financial Assistance: None

References:

- 1. Aggarwal KK. IJCPos Medi Law, Vol . 1, 2005; p-6.
- 2. Paresh K. Ichhaporia, MrunalPatil, Neha Shah, Legal First Aid, Published by Oxygen Healthcare Communications, Edition 2009, p 15-17.
- Tyagi SP. Law relating to Medical Negligence, Doctor in the Court,Issue-19(Oct-Dec) 2008, p 9-10.
- Richard Shepherd, Medical Malpracticeq Simpsonos; Forensic Medicine, Published by Oxford University Press Inc.,12th Ed 2003, p no-16
- 5. Murthy KKSR. Medical Negligence and the Law Indian journal of medical Ethics. 2007;4(3):116-8.
- Panting G, How to avoid being Sued in Clinical Practiceq Post Graduate Medical Journal 2004;80:165-8.
- 7. IJCPc MedinewsVol-7 no.9 Sept 2007.

Review Research Paper

The Intriguing Section of 307 IPC – Dangerous to life . . . is it?

¹Ashish Tyagi, ²Shashank Tyagi, ¹Hitesh Chawla, ⁴Nishtha Malik, ⁵PK Paliwal

Abstract:

Medical documentary evidences like medicolegal reports on injuries prepared by the medical practitioners are very important for the courts in making their legal judgments. A medical officer has to prepare the MLR in all cases brought in the emergency by the police, those coming of their own for medico legal examination or any other case in which foul play is suspected. The type of wounds and weapons, legal categories of hurts and their ages are specifically noted in these reports. Now a days, most of criminal cases, more in particular, in the District Sessions Courts in India, are Hurtgcases such as offences punishable under section 323, 324, 326 & 307 of Indian Penal Code, 1860. There is no criminal Court in India without these cases. Section 307 IPC . attempt to murder is defined as an act which is done with knowledge or intention that it is likely to cause death. The line of demarcation between an offence punishable under Section 326 IPC and under Section 307 IPC is that to fall within Section 307 IPC, the act must be done with such mens-rea as would have formed the act of murder if death had occurred. However, the law enforcement agencies instead of enquiring about the other elements of Section 307 IPC is mainly looking for the comment injury dangerous to lifeqin the MLR report prepared by doctor. As the definition of injury ±langerous to lifeq is not very precise because of which there are subjective variations present in each case as compared to grievous injuries and thus, the chances of making errors by the doctor increases. In this article wege going to discuss in detail about different court judgments and practical hurdles faced by doctors with regard to this section.

Key Words: Dangerous to life, attempt to murder, Section 307 IPC, grievous hurt, medico-legal report

Introduction:

In India wounds are graded not only by their physical nature, but also by the perceived risk to life or health of the victim. Medical practitioners very commonly need to examine, treat victims and issue medicolegal reports in day to day working of their line of work dealing with wounded persons.

Corresponding Author:

¹Assistant professor,

⁵Professor, Deptt. of Forensic Medicine, Shaheed Hasan Khan Mewati Govt. Medical College, Nalhar, Nuh

²Assistant Professor, H.B.T Medical College & Dr. R.N. Cooper Hopital, Vile Parle, Juhu, Mumbai

⁴PG Resident, Dept. of Microbiology, Govt. Medical College, Amritsar

Email i.d.: djashtag96@gmail.com. L.M.No: LM/IAFM/919/HR/12 DOR: 25/10/2016 DOA: 04/09/2017 DOI: 10.5958/0974-0848.2017.00062.8

Law enforcing officers generally brought the wounded victims for routine treatment and essentially for medicolegal reports of the cases. Occasionally the victims from their own selves request the attending medical practitioners to issue medical certificates and reports which will be needed to start a legal action against the accused persons. Most of the times medico legal evidence or reports are critical to the success of investigation of crimes against person. There are many circumstances which doctors in sometimes become involved with the law simply they have professional skills since or experience. It is necessary that the medical professional examines all wounds carefully and describes them in detail completely and correctly. This examination and description of wounds can have important medico-legal implications, which may be civil or criminal and may not become apparent for many days. Examination of the site, orientation and pattern(s) of the wounds will frequently reveal useful indications about the nature of the injury.

Section 307 relates to attempt to murder. It reads as follows:

"Whoever does any act with such intention or knowledge, and under such circumstances that, if he by that act caused death, he would be guilty of murder, shall be punished with imprisonment of either description for a term which may extend to ten years, and shall also be liable to fine; and, if hurt is caused to any person by such act, the offender shall be liable either to (imprisonment for life), or to such punishment as is hereinbefore mentioned."¹

Attempt to murder . Essentials for the criminal attempt: (i) an existence of an intent on the part of the accused to commit a particular offence (ii) some steps were taken towards it after completion of preparation (iii) steps must be apparently adopted to the purpose destined (iv) it must come dangerously near to success (v) it must fall short of completion of ultimate design i.e. death.² It must have both the necessary mens rea and actus reus.³ Section 307 is a cognisable offence with issue of warrant took place in the first occurrence only.³ Also it is non-bailable and non- compoundable and is exclusively triable by the Sessions Court.³

'Dangerous to life' definition & review of literature

The concept of injury dangerous to life is not a precise one. Danger to life should be imminent before the injuries are designated -dangerous to lifeq Such injuries are extensive, and implicate important structures or organs, so that they may prove fatal in the absence of any surgical aid ⁴⁻⁷. Some of the examples listed in different texts of injuries dangerous to life are: all head injuries showing signs of compression, compound fracture of skull, burns involving $>1/3^{rd}$ of total body surface area, haemorrhage >1litre, injury to a large blood vessel, laceration of any visceral organ, penetrating wound to any of the body cavity, any neck wound, injury to spinal cord at the upper cervical cord level, combined effects of number of injuries, none of which by itself and alone may be sufficient to cause death, but may cause it by their cumulative effects rupture of internal viscus, thrusting of lathi into the anus, injuries which cause vasovagal shock etc.⁸ Apart from these injuries described, for declaring the injury -dangerous to lifeq, the doctor may take into

consideration, the nature and extent of injury, the kind of weapon used, the part of the body struck and the condition of the patient or victim including nature and extent of medication during the hospital stay.⁶

There is no precise definition of injuries ±langerous to lifeq in law as compared to grievous injuries or hurt. The main stress is given on the word imminent or direct impending danger to life of the person. The confusion also prevails with the definition of injuries which are ±ikely to cause deathqand the injuries which are ±ufficient to cause death in ordinary course of natureq

Hurt which endangers life is an injury which has a 50% chance to end in a fatality.⁸ Endangerment may be for a short duration only.⁸ Difference between % ulpable homicide not amounting to murder % and % grievous hurt+ (i) in former the injuries must be such as are % ikkely to cause death+; in the latter the injuries must be % dangerous to life+. The difference lies in % chances of death+. Chances of death are more in the former, which is purely a subjective consideration (ii) in the former; there must be intention and knowledge. No such requirement in latter i.e. in grievous hurt.^{68,9}

Different court judgements and the confusion...

In Criminal Misc. Application 2014, the Honople Gujarat High Court held, an offence under section 307 has the following essential ingredients; % irstly, That the accused did an act; Secondly, That the act was done with intention or knowledge and under such circumstances to cause a bodily injury as the accused knew to be likely to cause death or that such bodily injury was in the ordinary course of nature to cause death, or that the accused attempted to cause such death by doing an act known to him to be so imminently dangerous that it must in all probability cause death or such bodily injury as is likely to cause death; and lastly that the accused had no excuse for incurring the risk of causing such death or injury.+¹⁰

For liability under section 307, the prosecution has to prove the following facts:

%1) That the accused did an act, and (2) that the act was done with such intention or knowledge and under such circumstances that if he by that act caused death he would be guilty of murder. If

hurt is caused by such act, the offender becomes liable to imprisonment for life, otherwise the maximum term of imprisonment prescribed is 10 years. Thus the section itself does not take into consideration the effect of the act of the accused except as a measure of sentence to be imposed upon him.+¹¹

% State of Maharashtra v. Balram m Patil it was observed that to justify a conviction under Section 307, it is not essential that bodily injury capable of causing death should have been inflicted. Although the nature of injury actually caused may often give considerable assistance in coming to a finding as to the intention of the accused, such intention may also be deduced from other circumstances, and may even, in some cases, be ascertained without any reference at all to actual wounds.¹²

Whe Section makes a distinction between an act of the accused and its result, if any. Such an act may not be attended by any result so far as the person assaulted is concerned, but still there may be cases in which the culprit would be liable under this Section. It is not necessary that the injury actually caused to the victim of the assault should be sufficient under ordinary circumstances to cause the death of the person assaulted. What the Court has to see is whether the act, irrespective of its result, was done with the intention or knowledge and under circumstances mentioned in the Section. An attempt in order to be criminal need not be the penultimate act. It is sufficient in law, if there is present an intent coupled with some overt act in execution thereof. Therefore, an accused charged under Section 307 IPC cannot be acquitted merely because the injuries inflicted on the victim were in the nature of a simple hurt."¹²

This position was highlighted in Girija Shanker v. State of Uttar Pradesh (2004 (3) SCC 793), R. Parkash v. State of Karnataka (JT 2004 (2) SC 348) and State of M.P. v. Saleem @ Chamaru and Anr. (2005 (5) SCC 554) and, State of Madhya Pradesh v. Imrat and Anr. 2008 (11) SCC 523.¹²

In Sarju Prasad v. State of Bihar it was observed in para 6 that the mere fact that the injury actually inflicted by the accused did not cut any vital organ of the victim, is not by itself sufficient to take the act out of the purview of Section 307.¹³

In case Tej Ram vs. state of Punjab and State of Punjab v. Tara Singh, that the injury described by the doctor as 'dangerous to life' and if not treated i.e. to say that but for timely and medical aid the injured was likely to die. Such type of injury/opinion is not the type of the injury as would attract the provisions of Section 307 Indian Penal Code, which envisages an injury sufficient in the ordinary course of nature to cause death, such injury would fall within the ambit of clause Eighthly of Section 320 Indian Penal Code, would be punishable under Section 326 Indian Penal Code and in view of such opinion, charge under Section 307 Indian Penal Code cannot be sustained." To bring an offence under Section 307 Indian Penal Code, the prosecution is required to prove that the accused had an intention to commit murder of injured. This intention could be gathered either from the act of the accused or from the impact of the injuries. 14, 15

An identical question and the distinction between the words "dangerous to life" and "endangering life" came to be determined by a Division Bench of the Court in Atma Singh v. The State of Punjab and it was held as under:-"Held that the expression 'dangerous' is an adjective and the expression 'endanger' is verb. An iniurv which can put life in immediate danger of death would be an injury which can be termed as 'dangerous to life' and, therefore, when a doctor describes an injury as 'dangerous to life', he means an injury which endangers life in term of clause 8 of Section 320IPC, for, it describes the injury 'dangerous to life' only for the purpose of the said clause. He instead of using the expression that this was an injury which 'endangered life' described it as 'dangerous to life', meaning both the time the same thing+¹⁶

Even the Courts at times have considered an injury described as dangerous to life as an injury envisage in clause Eighthly of Section 320 of the Indian Penal Code. In this regard, reference can be made to Muhammad Rafi Versus Emperor and Jai Narain Mishra & Others Versus State of Bihar.^{17, 18}

In Ganga Ram vs State of Rajasthan and Roopa v. State of Rajasthan the court clearly defines the injury ±dangerous to lifeqand the responsibilities of a doctor and court in this matter.^{19, 20}

% Hardev Singh @ Deba Son Of Assa ... vs State Of Punjab the court relied on the judgement of Atma Ram's case that the Court is not absolved of the responsibility, while deciding a criminal case to form its own conclusion regarding the nature of the injury, Expert's opinion notwithstanding. The Court has to see the nature and dimension of the injury, its location and the damage that it has caused. Even when an injury is described as to be one which endangers the life, the court has to apply its own mind and form its own opinion in regard to the nature of injury, having regard to the factors that should weigh with the Court, already mentioned. It was also held that wherever a doctor describes an injury as 'dangerous to life' and the nature of the injuries is such which could merit such a conclusion, then such an injury has to be treated as 'grievous hurt' of the description mentioned in first portion of clause (8) of Section 320 of the IPC. $+^{21}$

Whatever might have been the judicial conflict on this subject, it has been set at rest by the two decisions of the Supreme Court, namely; Sarju Prasad v. State of Bihar and Om Prakash v. State of Punjab. In both these cases the observations made by Beaumont C.J. were quoted in extenso and were approved. In these circumstances, it is not necessary for a conviction under Section 307, Penal Code, that the injury actually inflicted should be sufficient in the ordinary course of nature to cause death or that it should be on any vital organ.^{13, 22}

% Atma Singh v. The State of Punjab, 1982 Division Bench of the Court held that when the doctor is required to carry out medico-legal examination of the injury suffered in a criminal assault, he is required to examine the injury from two stand points i.e. 1) for the purpose of opining the kind of weapon used to inflict the injury in question and (2ndly) to form an opinion regarding the degree of seriousness of the injury in question. The Indian Penal Code recognises from the stand point of seriousness only four types of injuries (1) simple injuries (2) grievous injuries (3) injuries of the kind inflicted with intent to commit murder described in clause Firstly and 2ndly of Section 300 IPC (4) injury sufficient to cause death in the ordinary course

of nature envisaged by clause Thirdly of Section 300 IPC. When a doctor describes an injury as "dangerous to life", one has to see what had the doctor intended to convey thereby. Is it one to hold that since injury has not been described by the doctor as one which "endangered life", so the concerned injury cannot be held to be grievous on the specious ground that an injury described as "dangerous to life" is not as serious an injury which "endagers life". Therefore, in order to appreciate whether in the circumstances, offence under Section 307 IPC is made out; the injuries are to be of kind as mentioned in Section 300 IPC except that death has not occurred. $+^{23}$

The question of intention to kill or the knowledge of death in terms of section 307 is a question of fact and not one of law. It would all depend on the facts of a given case and secondly, the important thing to be borne in mind in determining the question whether an offence under section 307, is made out is the intention and not the injury (even if simple or minor); Vasant Virthu Jadhav v. State of Maharashtra.²⁴

Discussion & Conclusion:

The main question arise is why we want to discuss this section in such a detail. The answer lies in its complexity and practical problems which arise in day to day opinion formation regarding nature of injury. The medical practitioners have to use their medical knowledge and skill to identify and classify these injuries, different causative weapons or means for making very useful medicolegal reports and on a later date to act as competent expert witness in the courts of law.

Earlier the question asked by the I.O. is to give opinion regarding nature of injuries but now a days, the I.O. specifically asked whether the injuries are dangerous to life or not. This is due to the fact that after certifying the injuries dangerous to life the I.O. can apply Section 307 to the accused party without any hesitation. Neither the IPC or CrPC or the IEA or police manual insists that there should be the opinion of a medical officer as a condition precedent to convicting a person for an offence U/S 307 IPC. Thus, the police official is saved from charges of partiality as they say the doctor gave the particular opinion because of which this section is applied. However, after through perusal of the above section in detail and different court judgements wege of the opinion that nature of injury is of less importance in deciding the culpability of this offence, it mainly depends upon the facts and circumstances of each case whether the accused had the intention to cause death or knew in the circumstances that his act was going to cause death. The nature and type of the weapon used, the intention showed by the accused at the time of the act, the purpose for the commission of the offence, the nature and size of the injuries and the parts of the body of the victim on which the injuries inflicted are important factors which may be taken into thought in coming to a finding whether in a particular case the accused can be convicted of an attempt to murder or not. An offence under Section 307 IPC is a grave offence and it requires same very factors as an offence under Section 302 IPC except that it just falls short of death of the victim.

Most of the medical board cases which are coming to the Deptt. of forensic medicine in State of Haryana for second opinion or remedical examination belongs to such category i.e. to opine whether the injuries are dangerous to life or not. As the primary opinion is given by the Medical officer sitting in the periphery, these cases (section 307, 323 to 326) amounts to bulk of the cases which are brought forwarded for reopinion in the court of law and in police station. The concept of injury dangerous to life being not very precise, it is necessary that the medical witness should not remain content with making bald statement that the injury in a particular case is dangerous to human life.¹⁹ Because of this there are subjective variations present in each case as compared to grievous injuries and thus, the chances of making errors by the doctor increases.¹⁹ While there may be cases which can be easily placed cither in the category of injury dangerous to life or in the other category, there may be marginal and border line eases where it may be very difficult to categorise the injuries as dangerous to life or not and in such cases the medical experts may also differ. Also, because of complexity and gruesome nature of this section wrongful detention is quite common and many a times accused and complainant parties used to offer large sum of money to doctor and police official to comment about ±dangerous to lifeq If one of the parties gets the required comment on the particular MLR, the other party soon ask for re-opinion by board of doctors or by medical college experts. Thus, this vicious cycle continues.

As it has been already been mentioned in this article in detail about the definition and consequences of the section 307 and nature and complication of the comment *±*langerous to lifeg so in the end, we can concur that it would be prudent to give opinion as grievous injury (endanger to life) rather than dangerous to life which is far more critical, confusing and less specific. There was no provision in the Indian Penal Code which envisages or refers to an injury described as "dangerous to life". As a medical practitioner and forensic expert we owe a duty towards the society, when we know that our opinion has far reaching consequence on a personos life and any mistake could jeopardise personos future. So, instead of giving rash opinion we should stick to better one so that in the court of law better judgement prevails and be sure to know your words before you write them down. Ending this article remembering the words of Buddha, #f you truly loved yourself, you could never hurt anyone.q

Conflict of Interest: None Financial Assistance: None References:

- 1. Indian Penal Code, Act No. 45 of Year 1860.
- Dikshit P C. Textbook of forensic medicine and toxicology. 2nd ed. Pee Pee publishers and distributors (P) Ltd: Delhi; 2007. p. 275
- http://www.shareyouressays.com/119089/punish ment-for-attempt-to-commit-murder-section-307of-ipc
- Kannan K, Mathiharan K, Eds. Modi A textbook of medical jurisprudence and toxicology. 24th ed. Lexis Nexis: Nagpur; 2012. p.559.
- Karmakar RN, editor. J.B. Mukherjee s forensic medicine and toxicology. 3rd ed. Academic publishers: Kolkata; 2007.p.285.
- 6. Vij K. Forensic Medicine and Toxicology. 4th ed. Elsevier publication: New Delhi; 2005. p. 209.
- Biswas G. Review of forensic medicine and toxicology. 3rd ed. Jaypee brothers medical publishers: New Delhi; 2015.p.297-8.

J Indian Acad Forensic Med. July - Sept. 2017, Vol. 39, No. 3

- Aggrawal A. Textbook of forensic medicine and toxicology. 1st ed. Avichal publishing company: New Delhi; 2014.p.211-2.
- 9. Empress of India v. Idu Beg ILR (1881) 3 All 776.
- 10. Criminal Misc.Application (for quashing & set aside FIR/order) no. 3120 of 2014, Gujarat High Court.
- 11. https://articlesonlaw.wordpress.com/2015/03/27/t he-theory-of-hurt-and-grievous-hurt/27.03.2015.
- State of Maharashtra v. Balram m Pate [AIR 1983 SC 305]
- 13. Sarju Prasad v. State of Bihar (AIR 1965 SC 843)
- 14. Tej Ram vs. The state of Punjab, 1987 (1) RCR (Criminal) 611: 1978 (6) CLR, 76
- 15. State of Punjab v. Tara Singh, 1987 (1) Recent Criminal Reports (Criminal) 184
- Atma Singh v. The State of Punjab, 1982 (2) CLR 496

- Muhammad Rafi Versus Emperor, AIR 1930 Lahore 305
- Jai Narain Mishra & Others Versus State of Bihar, 1972 Criminal Appeal Reporter 19(S.C.)
- 19. Ganga Ram vs State of Rajasthan on 17 March, 1966, 1968 CriLJ 134 (1)
- 20. Roopa v. State of Rajasthan AIR 1966 Raj 68
- 21. Hardev Singh @ Deba Son of Assa ... vs State Of Punjab on 1 April, 2013 CRA No.942-SB OF 2001.
- 22. Om Prakash v. State of Punjab 1961 AIR 1782, 1962 SCR (2) 254
- 23. Surinder Kumar vs Sunil Kumar and Others on 22 February, 2012 CRM No.16008 of 2011 and CRM No. A-289-MA of 2011 (O&M)
- 24. Vasant Virthu Jadhav v. State of Maharashtra, (1997) 2 Crimes 539 (Bom)



Case Report

Metal Implant - A Hidden Clue to Identification -A Case Report

¹Arun Kumar Jaiswani, ²Rajesh Dere, ³Hemant Kukde, ⁴Mahesh Sabale, ⁵R. R. Savardekar

Abstract:

Identity is the recognition of individuality of a person, live or dead and is important for both legal and humanitarian reasons. In the present case, a completely charred unclaimed body was brought to the department of Forensic Medicine for medico-legal autopsy with the manner of death unknown. On autopsy, a metal implant with lot number mentioned over it was found in the right femur which led to positive identification of the human remains and the cause of death was established. With the advances in modern medicine, the use of surgically implanted devices has become increasingly common in human skeleton system. The presence of an orthopedic device is an individual characteristic which not only differentiates one set of remains with the other but also provides investigator a useful piece of information about the deceased. The case highlights the importance of meticulous autopsy and utility of multiple lot numbers of body implantable devices in cases where the identification remains obscure.

Key Words: Identification, Metal Implant, Charred, Radiography, Lot Numbers, Serial Numbers.

Introduction:

Identity is the recognition of individuality of a person, live or dead and is important for both legal and humanitarian reasons. The establishment of certain broad groupings, such as sex, stature, ancestry and age may be determined solely from the available bodily remains, though corroboration may be obtained from other evidence.

Corresponding Author:

¹Assistant Professor,

Department of Forensic Medicine & Toxicology, Govt. Medical College, Nagpur.

³Associate Prof, Department of Forensic Medicine, LTMMC & GH, Sion, Mumbai,

⁴Assistant Professor, Department of Forensic Medicine, Govt. Medical College, Akola,

⁵Professor, Department of Forensic Medicine & Toxicology, Lokmanya Tilak Municipal Medical College and General Hospital, Mumbai

²Professor, Department of Forensic Medicine & Toxicology, Seth GS and KEM Hospital, Mumbai

E Mail: arunjaiswani@gmail.com L. M. No: 1275/2016 DOR: 01/03/2017 DOA: 18/09/2017 DOI: 10.5958/0974-0848.2017.00063.X An obvious example would be sex determination from clothing and jewellery, though even this may not be absolutely reliable.¹ When establishing the identity of an unidentified corpse, fingerprints, dental findings, and DNA polymorphism are generally used. However, these findings are of no use when no antemortem data are available for comparison, such as registered fingerprints, dental records or DNA samples from individuals presumed to be close relatives.²

Establishing positive identification in cases involving extensive thermal alteration is often difficult given the fragmentary condition of the remains and the fragile nature of the material which may hamper the use of standard identification techniques.³ Prosthetic implants can survive a variety of situations like decomposition, mutilation, burial and cremation and their use for identification has been established in various studies so far.⁴⁻⁹

Medical devices play a role not only in screening, diagnosing and treating patients but also in restoring patients to normal lives and in regularly monitoring health indicators to prevent diseases. From a forensic perspective, the growing prevalence of these devices in the humans requires understanding the circumstances leading to device implantation and how these devices can aid in the identification of an unknown decedent.

Case History:

A charred body was found in the bushes at a secluded spot with manner of death not known. As the deceased could not be identified, the police demanded to perform the identification procedures on the deceased. Crime scene examination showed charred body with evidence of decomposition & burnt leaves and stems on and around the deceased (**Fig. 1**). No evidence of container having inflammable petrochemical product or other weapon was found at and around the crime scene. It was concluded that the manner of death was homicidal. Body was brought to Sion hospital for post-mortem examination to establish the identity and cause of death.

Postmortem Examination:

Body was lying in prone position with limbs flexed at joints and evidence of charring and decomposition with foul smelling present (Fig. 2). Features were unrecognizable & orbits were empty. Evidence of skeletonization was present with bones from skull, limbs and trunk exposed. Evidence of larvae of maggots and flies were present on the buttock region. Scalp was burnt leaving a patch of unburnt area of grey scalp hair. Fingerprints were damaged on both hands, all teeth in both jaws were intact. Rigor mortis had passed off, joints were stiff due to heat stiffening. On dissection, skull bones were intact; brain matter was liquefied, grey coloured. Hyoid bone & laryngeal cartilages were intact, with no evidence of any haemorrhage in the soft tissues of neck. Remains of visceral organs were present in the form of black decomposed mass. On dissection of right hip, a metallic femur implant was found at the upper end of right femur (Fig. 3 & 4). On examination of skull and pelvis bones, it was concluded that the deceased was of an adult female. Implant prosthesis was dissected out & measured: shaft length -14cm and diameter of head (ball) - 4.5cm. The implant prosthesis bore LOT and serial numbers (Fig. 5) over different areas of implant. Piece of decomposed muscle and viscera that was preserved for chemical analysis came out negative for any intoxicant or poison. Tuft of unburnt scalp hairs and tooth were preserved for DNA analysis.

Discussion:

The requirement to establish the identity of the deceased tends to fall into three wide categories:⁵

1. Criminal investigations resulting from an unexplained natural death, homicide, or suicide. It is virtually impossible to satisfactorily investigate a situation where one is confronted with a corpse to which no identity can be assigned. The investigating authority can carry the inquiries no further, as they cannot know whom to interview · family, friends, or colleagues. Most unidentified deceased in this situation result in an open case investigation with no resolution until identity can be secured. 2. Accidents and mass disaster incidents, whether as a result of forces of nature or human intervention, either accidental or intentional.

3. War crimes and genocide.

When minimal thermal changes are present on human remains, normal procedures for identification can be carried out. Extensive heat related alterations can severely disrupt normal procedures but frequently, sufficient evidence survives to facilitate identification.¹⁰ Orthopaedic or medical implants may be potentially useful in such cases as they are relatively uncommon and usually contain individual identifying features, such as the type of device used and its anatomical location.⁴

The use of serial numbers and lot numbers on the implant devices can allow identification if histories of serial and lot numbers are retained by manufacturers, distributors, or hospitals. Serial numbers can allow identification of a body implantable device in an individual, even in the case of a single serial number, whereas lot numbers can narrow identification to a group of individuals.¹¹

Currently, the Indian medical device and pharmaceutical market is largely unregulated and medical devices can be freely imported into the country. In India about 75% of the device market comes from imports. Registration ensures that the government can (i) have a record/listing of the vendor; (ii) lay emphasis on after-sale obligations; (iii) enforce orders on defaulters like suspension of licenses, and (iv) have a renewal system in place for registration thereby maintaining updated information.¹² In the present case, the femur implant bearing LOT & serial numbers was shown to a local distributer who identified the manufacturer. The manufacturer maintained a database allowing rapid tracing of the LOT and serial number. With the LOT and serial number the company provided the name of the doctor to whom it was sold and on further investigation the doctor provided the details of the patient in which the device was implanted. After identifying the deceased, the investigating authorities nabbed the perpetrators of crime who revealed that they first strangulated her and later burnt the body to obscure identification.

Recommendations:

The use of radiological techniques must be encouraged among autopsy surgeons in unidentified bodies.

- Use of radiological techniques in screening for prosthetic implants must be encouraged amongst autopsy surgeons where the identity of the deceased is obscure. This can be of great help so as to prevent invasive autopsies which often leads to maiming of the deceased.
- 2. A separate radiological unit attached to the mortuary must be set up for the convenience.
- 3. Regulatory body or act should be introduced to achieve quality control of devices after implantation into the body, requiring recording of the use history of body implantable devices. The introduction of such an act/regulatory body in India will be of great help to judicial system especially in cases where identification of a person remains obscure.

References:

- Saukko P, Knight B. Knight's forensic pathology. 3rd ed. London: Arnold. 2004:98-135.
- Wilson RJ, Bethard JD, Di Gangi EA. The use of orthopaedic surgical devices for forensic identification. J Forensic Sci. 2011;56(2):460-9.
- Bennett J, Benedix D. Positive identification of cremains recovered from an automobile based on presence of an internal fixation device. J Forensic Sci. 1999;44(6):1296-8.
- Simpson EK, James RA, Eitzen DA, Byard RW. Role of orthopedic implants and bone morphology in the identification of human remains. J Forensic Sci. 2007;52(2):442-8.

- Thompson T, Black S. Forensic human identification, An introduction. New York: CRC Press; 2007:11.
- Dedouit F, Telmon N, Guilbeau-Frugier C, Gainza D, Otal P, Joffre F, Rougé D. Virtual autopsy and forensic identification – practical application: a report of one case. J Forensic Sci. 2007;52:960-4.
- Pushparani C, Ravichandran CP, Sivakumari K. Radiography superimposition in personal identification - a case study involving surgical implants. J Forensic Res. 2012;3:140.
- Steadman DW, Sperry K, Snow F, Fulginiti L, Craig E. Anthroplogical investigations of the tri-state crematorium incident. In: Adams B, Byrd J, editors. Recovery, analysis, and identification of commingled remains. Humana Press: Totowa, NJ. 2008. p 81-96.
- Blau S, Robertson S, Johnstone M. Disaster victim identification: New applications for postmortem computed tomography. J Forensic Sci. 2008;53(4):956-61.
- 10. Ubelaker DH. The forensic evaluation of burned skeletal remains: a synthesis, Forensic Sci. Int. 2009;183:1-5.
- Takeshita H, Nagai T, Sagi M, Chiba S, Kanno S, Takada M, Mukai T. Forensic identification using multiple lot numbers of an implantable device. Med Sci & Law. 2014;54(1):51-3.
- Radhadevi N, Balamuralidhara V, Pramod Kumar TM, Ravi V. Regulatory guidelines for medical devices in India: An overview. Asian J Pharm. 2012;6:10-7.









**Contd on Page no. 327 (Fig 3, 4 and 5)
Case Report

Multidisciplinary Approach in a Case of Cinderella Syndrome: A Case Report

¹H. K. Khartade, ²H. M. Pathak

Abstract:

A two years old female child, youngest of three siblings, was brought to the Dept. of Paediatrics with alleged history of loss of consciousness following an episode of seizure two days back. CT scan revealed subdural hematoma over right fronto-parietal convexity. Call was sent to Dept. of Forensic Medicine as pediatrician suspected foul play based on history given by parents. After detailed history we found inconsistency of the parentsqexplanation with the extent of injury and delay in seeking medical advice. On external examination, no injuries were found over body surface. Whole body X ray was advised which revealed multiple fractures at different sites in different stages of healing which is a classical finding in a case of Cinderella syndrome. This case emphasizes the importance of multidisciplinary approach and taking whole body X-ray in every suspected case of child battering as % be skin and bones tell a story which the child is too young or too frightened to tell.+

Key Words: Battered Baby, Subdural Hematoma, Multidisciplinary Approach

Introduction:

A battered child refers to a child who suffers repeated non-accidental injuries, sometimes fatal, caused through episodes of violence by parent or guardian. One child of a family, almost invariably the youngest, may be the scapegoat, receives most of the battering. This tendency led to the term % inderella Syndrome+¹ Most of the fatal victims are young, more than two thirds being under three years of age.² The typical form of this condition is very rare in India.³

This case is being presented due to the extreme rarity of such cases in India. It also emphasizes the importance of having high index of suspicion and taking whole body X-ray in every suspected case of child battering for diagnosis of such cases and significance of multidisciplinary approach in their treatment.

Corresponding Author: ¹Assistant Professor,

²Professor,

Department of Forensic Medicine and Toxicology, Seth Gordhandas Sunderdas Medical College & King Edward Memorial Hospital, Parel, Mumbai.

Email ID: harshwardhan.khartade@gmail.com L. M. No - LM/IAFM/1333/2017 DOR: 03/03/2017 DOA: 18/09/2017 DOI: 10.5958/0974-0848.2017.00064.1

Case history:

A two years old female child, youngest of three siblings was brought to the Dept. of Paediatrics with alleged history of loss of consciousness following episode of seizure two days back. Pediatrician advised CT scan which revealed subdural hematoma along right fronto-parietal convexity. Call was sent to Dept. of Forensic Medicine as pediatrician suspected foul play based on history given by parents. We again took detailed history from mother and father separately.

The explanations offered by them regarding the injury were different from one another. While mother said that the child fell from tricycle, father reported that she fell while walking on a slippery surface. In the second interview with mother, she stated that the child has been injured by sibling. They also failed to offer reasonable explanation for delay in seeking medical advice as they have brought the child after 2 days of episode of seizure. They also did not seek the advice of local practitioners. While taking family history, it was revealed that the mother of the child died three months back and within three months from her death, father of the child married again and the alleged mother was in fact the stepmother of the child. The family belonged to lower socioeconomic class.

On external examination, no injuries were found over body surface. Whole body X ray was advised which revealed-

- Fracture of distal shaft of left radius which was old as there was appearance of hard callus (Age of fracture >/= 36 days).
- 2) Fracture of mid shaft of right radius of recent origin (Age of fracture 8-35 days).
- Acute fracture of mid shaft of right humerus.(Age of fracture < 8 days)
- 4) Malunited fracture of mid shaft of right clavicle.

Thus, from history and clinical findings we observed that-

- 1) There is inconsistency of the parentsq explanations with the extent of injuries.
- 2) There is delay in seeking medical advice.
- Whole body X-ray revealed multiple fractures at different sites in different stages of healing.

From above observations, it was concluded that it is a case of Cinderella Syndrome, a type of battered baby syndrome in which the youngest female child receives most of the battering.

Interventions taken-

- 1) Police were informed.
- NGO Sneha Foundation, which works for prevention of violence against women and children was informed.
- 3) Dept. of pediatric surgery was consulted for management of head injury.
- 4) Department of orthopedics was consulted for management of fractures.
- 5) Opinion of Department of Ophthalmology was taken to rule out retinal haemorrheges or other ocular damages.

Discussion:

Cinderella syndrome was first described by Peter Lewin in 1976. In some families, a single child, particularly female child, is chosen for battering. The child is usually the youngest in the family. The child is repeatedly abused while other children of same family are spared. In another variety of syndrome, few adopted female children accuse their step-parents of maltreatment.⁴

Lower socio-economic status is one of the predisposing factor for child abuse.⁵ In present case, the parents belonged to lower socio-economic status. Age of the parents is also a significant factor in child abuse cases.⁵ In the present case, the father was 40 years of age whereas the age of step mother was 18 years. The commonest history in true child abuse cases is that of fall or minor accident. Abusive parents sometimes state that a child has been injured by sibling.⁵ Similar history was given in our case.

Battering tends to be noninstrumental, peculiar injuries being bruising of upper lips, rupture of frenulum of lips, bruises on the skin of armpits and lower ribs, multiple bruising over forearms, upper arms and legs often in bilateral fashion and bite marks.¹ Even after extensive search, no injury was detected on external surface in present case.

Characteristic radiographic lesions in Cinderella syndrome include multiple fractures at different sites in different stages of healing, separation of epiphyses, subperiosteal calcification in periosteal haemorrhages, fractures of the ribs producing beading effects and chipping of the corners of epiphyses at large joints.¹ Of these typical radiological features, we observed multiple fractures at different sites in different stages of healing. (**Image 1**)

Head injury is the most common cause of death, most common lesion being subdural hematoma.¹ In the present case, CT scan revealed subdural hematoma along right fronto-parietal convexity.

Differential diagnosis of non-accidental injuries in child includes osteogenesis imperfecta, haemorrhagic diathesis and subclinical scurvy. All these differential diagnoses were ruled out first based on clinical features and laboratory investigations.

From above case presentation and discussion it can be concluded that-

1) Detailed history must be taken in every suspected case of child abuse.

2) Whole body X-ray must be done in every suspected case of child battering as % the skin and bones tell a story which the child is two young or too frightened to tell.+

3) Multidisciplinary approach is immensely helpful in detection and successful treatment of cases of child abuse.

Conflict of Interest: None. Financial Assistance: None.

References:

- Knight B. The battered child. in: Tedeschi CG, Eckert WG, Tedeschi LG. Editors. Forensic Medicine. Volume 1, Mechanical Trauma. Philadelphia: W. B. Saunders Company; 1977: 500-9
- 2. Saukko P, Knight B. Knightos forensic pathology. 3rd ed. London: Arnold; 2004: 461.
- 3. Reddy KSN, Murty OP. The essentials of forensic medicine and toxicology. 33rd ed. New

Delhi: Jaypee Brotherqs Medical Publishers(P) Ltd; 2014:445-6.

- Bardale R. Principles of forensic medicine and toxicology. 1st ed. New Delhi: Jaypee Brotherc Medical Publishers(P) Ltd. 2011:361.
- Mason JK. Paediatric forensic medicine and pathology. 1st ed. London: Chapman and Hall Medical; 1989:205-19.

Image 1- X Ray showing 1) fracture of distal shaft of left radius which was old as there was appearance of hard callus (Age of fracture >/= 36 days). 2) Fracture of mid shaft of right radius of recent origin (Age of fracture - 8-35 days). 3) Acute fracture of mid shaft of right humerus.(Age of fracture < 8 days). 4) Malunited fracture of mid shaft of right clavicle.





Case Report

A Case of Sudden Death Due To Non Traumatic Acute Subdural Haemorrhage

¹Manas Ranjan Sahu, ²Manoj Kumar Mahanty, ³Sudipta Ranjan Singh, ⁴Sasank Shekhar Maharik

Abstract:

Disease of the cardio vascular system (CVS) is the most common cause (45-50 %) of sudden death in an apparently healthy adult followed by respiratory system and central nervous system (CNS). The suspicion of CVS involvement is more intense, if the deceased is obese and the death is immediate. We, in this case report, present a case which had similar pattern of death and thus cardiovascular disease was suspected by both the clinician and the forensic expert. However, on meticulous autopsy, it was concluded to be a case of spontaneous subdural haemorrhage. CNS conditions are the third leading cause of sudden death. The conditions are mostly attributed to cerebral/cerebellar haemorrhage, pontine haemorrhage, subarachnoid haemorrhage and thrombotic or embolic or other causes. Spontaneous subdural haemorrhage is a rare condition of sudden death. Subdural haemorrhage (SDH) is mostly traumatic in origin and is a very frequent observation at autopsy centres. This frequent observation may bias the autopsy surgeon, leading to over diagnosis of traumatic SDH, when in actual, it is a spontaneous SDH. This wrong diagnosis can grossly change the further course of events. So, in such suspicious cases, very meticulous observation and careful derivation of opinion is required to avoid confusion and error of diagnosis.

Key Words: Sudden death, Spontaneous subdural haemorrhage, medico legal autopsy

Introduction:

Subdural haemorrhage (SDH) is common in extreme age groups and is usually traumatic in origin.¹ SDH is as a result of bleeding of the subdural portion of bridging veins, which have been identified as more fragile than the subarachnoid portion of the veins.² The commonest site is over the convexity of the cerebral hemispheres where the freedom of movement is greatest.² Approximately 72% of all SDH are due to fall and assault, followed by motor vehicle accidents.³

Corresponding Author: ¹Associate Professor,

²Prof. & Head, ³Assistant Professor, ⁴Senior Resident,

Department of Forensic Medicine & toxicology, AIIMS, Bhubaneswar.

Email: drmanas.sahu@gmail.com. L.M.No.: Not a Member DOR: 24/01/2017 DOA: 03/04/2017 DOI: 10.5958/0974-0848.2017.00065.3 Spontaneous SDH is rare and there is always an underlying contributing disease condition. We conducted medicolegal autopsy on a case of sudden death where there was no history or signs of trauma. Based upon the post-mortem findings, the cause of death was concluded to be spontaneous SDH. Though rare, spontaneous SDH do happen. We have discussed the approach and various risk factors in detail.

Case history:

A case of sudden death of an obese male (Height-178 cm, Weight- 109 Kg) of age about 35 years working in the railway department was brought for post mortem (PM) examination.

The patient was apparently fine on previous day but on the fateful night, shortly after returning from his official duty, he felt uneasiness and was subsequently admitted in the emergency department. He collapsed in the emergency department before initiation of any intervention or investigations. Immediate resuscitation measures were started but the patient could not be revived and was declared dead. Subsequently the body of the deceased was forwarded for police inquest and postmortem examination. The patient had past history of jaundice about 3 months back and had an uneventful recovery.

There were external injuries over the body. The face and conjunctivas were congested and nail beds were cyanosed. Post mortem lividity was present at the back, except over the pressure points and rigor mortis was present all over the body. There were no other significant external findings.

For dissection, an ±q incision was made and the thoracoabdominal cavity was opened. No features of mechanical injuries were observed from neck to pelvic cavity. Heart (Wt. 310 gm.) was removed and was examined thoroughly. There were no gross pathological changes. Both lungs were intact and were deeply congested. Liver was enlarged (Wt.2150 gm.), hard in consistency and showed the gross features of macro nodular cirrhosis [Fig-2. 3]. The spleen was also grossly enlarged (Wt.1450 gm) [Fig-4]. There was no fluid in pleural and peritoneal cavities. Stomach was intact and contained brownish coloured fluid of about 100 ml and the mucosa appeared healthy. Both kidneys were intact and congested. Scalp and skull were found intact and were devoid of any signs of blunt external force impact. On opening the skull cap, an organised SDH was observed on entire left tempero-parietal region extending to the base of left middle cranial The cause of death was fossa [Fig-1]. concluded to be coma consequent upon SDH.

Discussion:

Non traumatic spontaneous acute SDH is a rare condition. Multiple underlying etiological factors like hypertension, arterial bleeding from an aneurysm, coagulation disorders and anticoagulant therapy predispose to acute SDH.⁴ Chronic liver dysfunction in the context of a long term infection with Hepatitis B & C viruses is also a risk factor for SDH.⁵ Though the deceased had a clinically uneventful recovery from jaundice a few months back, we observed macro nodular cirrhosis of liver. Along with it, there was huge splenomegaly. These observations,

considered together, point towards the non-traumatic spontaneous predisposition for SDH.

Acute SDH following trauma is commonly bilateral.⁶ In our case, the haemorrhage was unilateral and moreover, there was no corroborative sign of injury on scalp nor was there any history of trauma. These observations, along with pathological findings like macronodular cirrhosis and huge splenomegaly, favour more towards the origin of spontaneous the SDH. А spontaneous subdural haemorrhage commonly originates over the area where the freedom of movement is the greatest, that is over the convexities of the cerebral hemispheres.² SDH that have obviously originated high on the parietal area commonly drain down under gravity and, with a large accumulation in the middle and anterior cranial fossa.7

Unlike chronic SDH. rapidly developing acute SDH becomes life threatening even when the bleeding is less. An acute SDH of approximately 50 ml in size could also be fatal.³ Death is usually due to compression of the brain stem. In the present case, the SDH was acute and was large enough to cause the pressure effects, leading to sudden death.

The other risk factors of acute SDH are haematological malignancies causing tumour solid thrombocytopenia, dural metastasis, and hypervitaminosis.⁸ Sudden increase of intravenous pressure can also be a risk factor for acute sub dural haemorrhage which can occur when forcible exhalation occurs against a closed glottis (Valsalva manoeuvre), during coughing or defecation.⁹ Intra cranial hypotension is also a risk factor for spontaneous subdural haemorrhage, which can occur following exercise, resulting in systemic vascular hypotension.8 Acute SDH is also observed in anabolic steroid dependant weight lifters as a result of vascular remodelling caused by steroid, leading to weakness of vessel wall and increased susceptibility to bleeding.8

Conclusion:

When a case of SDH is come across and the signs of trauma over the scalp and other parts of body are absent, then various contributing etiological factors of spontaneous SDH should be looked for and evaluated thoroughly. Though commonly traumatic, SDH may not be exclusively due to trauma. A high level of suspicion and knowledge of possibility of spontaneous SDH will definitely help arriving at a logical opinion in such confounding cases.

Conflict of Interest: None. Financial Assistance: None.

References:

- Reddy KSN. The essentials of forensic medicine & toxicology. Jaypee Brothers Medical Publisher; 33rd Ed. 2014. p259 -61.
- Dikshit PC. A textbook of forensic medicine and toxicology. Peepee Publishers; 1st Ed. 2007. p207-8.
- 3. DiMaio DJ, DiMaio VJM. Forensic pathology. Boca Raton: CRC Press; 1993.p166-7.
- Agrawal D, Mahapatra AK. Spontaneous subdural hematoma in a young adult with haemophilia. Neurology India. 2003;51(1):114-5.
- Petraru C, Buburuzan VB, Balan Gh. Cerebral haematoma and diffuse cerebral hemorrhage in the context of chronic viral liver disease with severe metabolic disorder of hemostasis. Observations on a series of 7 cases. Romanian Neurosurgery. 2012;19(3):234-8.
- Mukherjee JB. Forensic medicine and toxicology. Academic Publishers; 3rd Ed. 2007 p 458-9.
- 7. Knight B. Forensic pathology. Arnold Associates; 3rd Ed. 1996 p190-1.
- Salazar LRM, Miranda HRA, Miranda WC, Cerra GA, Rubiano AM. Spontaneous chronic subdural hematoma in a young male patient: case report. Romanian Neurosurgery. 2014; 21(2): 230 - 5.
- Brennan PM, Fuller E, Shanmuganathan M, Keston P, Fouyas I. Spontaneous subdural haematoma in a healthy young male. BMJ Case Reports. 2011; doi:10.1136/bcr.01.2011.3694

Fig 1: Subdural haemorrhage present over left temporo-parietal and middle cranial fossa



Fig 2: Hepatomegaly with surface shows macro nodular forms of cirrhotic changes



Fig 3: On cut section of liver – macro nodular forms of cirrhotic changes



Fig 4: Huge splenomegaly



The Reviewers of the JIAFM

Abhishek Das Demonstrator, Medical College & Hospital Kolkata, W Bengal Abhishek Yadav Assistant Professor, AIIMS, New Delhi Aiav Kumar Associate Professor, GMCH, Chandigarh Akashdeep Aqqarwal Associate Professor, GMC, Patiala, Puniab Amandeep Singh Associate Professor, GMCH, Chandigarh Antara Deb Barma Senior Resident, AIIMS, New Delhi **Anand P Rayamne** Assistant Professor, Mysore Medical College &Research Institute, Mysore Arneet Arora Prof & Head, AIIMS Bhopal Ashok Chanana Associate Professor, Government Medical College, Amritsar **B** Suresh Kumar Shetty Prof.& Head, State Medicolegal Consultant, Govt of Karnataka. Kasturba Medical College, Mangaluru C B Jani Prof. & Head, GCS Medical College Ahmedabad Chittranjan Behera Assistant Professor, AIIMS, New Delhi Cyriac Job Vice Principal & Head, Govt. Medical College, Manjeri, Malappuram, Kerala **Deepa Durga Roy** Senior Resident, V.M.M.C & Safdarjung Hospital, New Delhi Hemant Bhardwaj [Lt. Colonel] Army Medical Corps Kewal Krishan. Associate Professor, Department of Anthropology, Punjab University, Chandigarh Luv Sharma Professor, PGIMS, Rohtak, Haryana Mandar Ramchandra Sane Assistant Professor, Sri Aurobindo Medical College & PG Institute, Indore Manish Kumat Professor, V.M.M.C & Safdarjung Hospital, New Delhi

Manish Nigam Prof. & Head, Sri Aurobindo Medical College & PG Institute, Indore Manoj Kumar Mohanty Prof. & Head, AIIMS, Bhubaneswar **Mukesh Sharma** In-Charge, Assistant Director Regional Forensic Science Laboratory, Rajasthan N K Aqqarwal Dir. Prof & Head, UCMS & GTB Hospital, New Delhi N. Srinivasaraqavan Prof & Head, ESIC Medical College & PGIMSR, KK Nagar, Chennai Pankaj Gupta Professor, SGRD Medical College, Amritsar, Punjab Prateek Rastogi Associate Professor, Kasturba Medical College, Mangalore Pratik Vijay Tarvadi Associate Professor, Pacific Institute of Medical Sciences, Umarda, Udaipur Putul Mahanta Associate Professor, Tezpur Medical College, Tezpur, Assam Raiiv Joshi Prof. & Head, Guru Gobind Singh Medical College, Faridkot, Punjab Rambarapu Sudha Associate Professor. Osmania Medical College & General Hospital, Koti, Hyderabad, Telangana Rashmi Kulkarni Sr. Research Associate, SAIMS Indore Satinder Pal Singh Assistant Professor, GMCH, Chandigarh Shilekh Mittal Associate Professor, Guru Gobind Singh Medical College, Faridkot, Punjab Tanuj Kanchan Associate Professor, AIIMS, Jodhpur Tapas Kumar Bose Prof. & Head, N R S Medical College, Kolkata Virendar Pal Singh Associate Professor, Dayanand Medical College, Ludhiana Dasari Harish Prof. & Head Government Medical College & Hospital, Chandigarh