

Medico-Legal Update

An International Journal



Medico-Legal Update

EDITOR-IN-CHIEF

Prof (Dr) R K Sharma

Former Head, Department of Forensic Medicine & Toxicology
All-India Institute of Medical Sciences, New Delhi-110029
E-mail: medicolegalupdate@gmail.com

ASSOCIATE EDITOR

1. **S.K. Dhatarwal** (*Professor*)
Forensic Medicine, PGIMS, Rohtak, Haryana
2. **Dr. Adarsh Kumar** (*Additional Professor*)
Forensic Medicine, AIIMS, New Delhi
3. **Dr. Vijaynath V** (*Associate Professor*)
Forensic Medicine, Vinayaka Mission Medical college, Tamil Nadu

INTERNATIONAL EDITORIAL ADVISORY BOARD

1. **B. N. Yadav** (*Professor*)
Forensic Medicine, BP Koirala Institute of Medical Sciences, Nepal
2. **Dr. Vasudeva Murthy Challakere Ramaswam** (*Senior Lecturer*)
Department of Pathology, International Medical University, Bukit Jalil, Kuala Lumpur. Malaysia
3. **Babak Mostafazadeh** (*Associate Professor*)
Department of Forensic Medicine & Toxicology, Shahid Beheshti University of Medical Sciences, Tehran-Iran
4. **Dr. Sarathchandra Kodikara** (*Lecturer*)
Forensic Medicine Department of Forensic Medicine, Faculty of Medicine, University of Peradeniya, Sri Lanka

NATIONAL EDITORIAL ADVISORY BOARD

1. **Prof. N.K. Agarwal** (*Professor*) Forensic Medicine, UCMS, Delhi
2. **P.K. Chattopadhyay**, (*Professor*)
Forensic Sciences, Amity University, Noida
3. **Dalbir Singh** (*Professor*) Forensic Medicine, PGIMER, Chandigarh
4. **Dr. Harish Pathak**, Mumbai
5. **J. Gargi** (*Professor*) GGS Medical College, Faridkot
6. **P.C. Dikshit** (*Professor*)
Forensic Medicine, Jamia Hamdard Medical College, New Delhi
7. **Anil Mittal** (*Professor*)
Forensic Medicine, Vardhman Mahavir Medical college, New Delhi
8. **Balbir Kaur** (*Professor*)
Forensic Medicine, MM institute of Medical Sciences, Ambala
9. **Mukesh Yadav** (*Professor*) Forensic Medicine, School of Medical Sciences and research, Greater Noida

Medico Legal Update is a scientific journal which brings latest knowledge regarding changing medico legal scenario to its readers. The journal caters to specialties of Forensic Medicine, Forensic Science, DNA fingerprinting, Toxicology, Environmental hazards, Sexual Medicine etc. The journal has been assigned international standard serial number (ISSN) 0971-720X. The journal is registered with Registrar of Newspaper for India vide registration numbers 63757/96 under Press and Registration of Books act, 1867. The journal is also covered by EMBASE (Excerpta Medica Database) from 1997 and by INDEX COPERNICUS, POLAND. Medico legal update is a half yearly peer reviewed journal. The journal has also been assigned E-ISSN 0974-1283 (Electronic version). The first issue of the journal was published in 1996.

Website: www.medicolegalupdate.org

© All Rights reserved The views and opinions expressed are of the authors and not of the **Medico Legal Update**. The Medico Legal Update does not guarantee directly or indirectly the quality or efficacy of any products or service featured in the advertisement in the journal, which are purely commercial.

ASSOCIATE EDITOR

4. **Ms. Roma Khan**, Forensic Sciences, INSAAF Mumbai
5. **Dr. Imran Sabri** (*Assistant Professor*)
Department of Bio-Medical Sciences. College of Medicine, King Faisal University, Saudi Arabia

NATIONAL EDITORIAL ADVISORY BOARD

10. **T.K.K. Naidu** (*Professor*) Forensic Medicine, Prathima Institute of Medical Sciences Andhra Pradesh
11. **S. Das** (*Professor*) Forensic Medicine, Himalayan Institute of Medical Sciences Dehradun
12. **Col Ravi Rautji**, Forensic Medicine, Armed Forces Medical College, Pune
13. **Dr. Manish Nigam** (*Professor and Head*)
Department of Forensic Medicine & Toxicology Sri Aurobindo Institute of Medical Sciences, INDORE (M.P.)
14. **Dr. Shailesh Kudva** (*Principal*)
Rajasthan Dental College and Hospital Jaipur-302026
15. **Usmanganishah Makandar** (*Associate Professor*)
Anatomy, AIMS, Bhatinda
16. **Dr. Pratik Patel** (*Professor and Head*) Forensic Medicine, Smt NHL Municipal Medical College Ahmedabad
17. **Basappa S. Hugur** (*Associate Professor*)
Forensic Medicine, Ramaiah Medical College, Bangalore
18. **Dr. Vandana Mudda (Awati)** (*Associate Prof*)
Dept of FMT, M.R. Medical College, Gulbarga, Karnataka, India
19. **Dr. Harish Kumar. N.** (*Associate Professor*)
Dept. of Forensic Medicine, Sri Siddhartha Medical College, Tumkur
20. **Dr. Gowri Shankar** (*Associate Professor*)
Forensic Medicine, SNMC, Bagalkot
21. **Dr. Manjunath Badni** (*Reader*) Dept of Oral pathology Maharana Pratap college of Dentistry and Research Centre, Gwalior
22. **Dr. L. Ananda Kumar** (*Associate Professor*) Forensic Medicine, Rajiv Gandhi Institute of Medical Sciences, (RIMS), Kadapa
23. **Dr. Ramesh Nanaji Wasnik** (*Associate Professor and Head*)
Forensic Medicine Late B.R.K.M. Govt. Medical college, Jagdalpur

Editor

Dr. R.K. Sharma
Institute of Medico-legal Publications
4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Printed, published and owned by

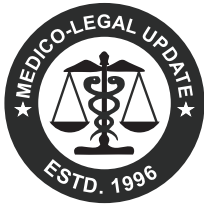
Dr. R.K. Sharma
Institute of Medico-legal Publications
4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001

Printed at

Devtech Publishers & Printers Pvt. Ltd., Faridabad

Published at

Institute of Medico-legal Publications
4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001



Volume 13 Number 02

July-December 2013

1. A Study on Socio-Demographic Profile of Post Mortem Cases in the Morgue of a 01
District Hospital in West Bengal
Aditya Prasad Sarkar, Ranjana Mandal, Supriti Ghorai, Pushpendu Sengupta
2. Estimation of Stature from Percutaneous Measurement of Tibia in Living 05
Dhurve Alka S, Dhurve Sharad A
3. A Rare Case of Homicidal Gagging Concealed by Fire 08
Yadav A, Alam F, Kothari N S, Gahlot R K
4. Electron Microscope: A Review 12
Arun Singh, Renuka Verma, Aditi Murari, Ashutosh Agrawal, Shalini Singh, Vertika Singh
5. A Prospective Roentgenological Study in Mewar Region of 17
Rajasthan to Establish Age Group 16 to 18 Years
Sharma Yogesh, Bohra Bhavesh, Buri Sanjeev
6. Radiological Study of Appearance and Fusion of Lesser and Greater Trochanter and Head of the 21
Femur in Bikaner Region in 12-20 Years Age Group
Sharma Yogesh, Mathur Indubala, Bohra Bhavesh
7. Pattern and Distribution of Cranio-cerebral Injuries in Fatal Road Traffic 24
Accidents - A Cross Sectional Study
Chaitanya R, Sunil S Kadam, Viswanathan K G
8. A Study of Bilateral Asymmetry of Tibia in Living 29
Dhurve Alka S, Dhurve Sharad A
9. Socio-demographic Profiles of Post Mortem Cases in a Sub-district, West Bengal, India 32
Dilip Kr Biswas, Achintya Biswas, Dulal K Das, Rama Bhunia, Dipankar Ghosh

II

10. Profile of Traumatic Brain Stem Injury: An Autopsy Study of 41 Cases 38
Hemalatha N, Gambhir Singh O, Vallinayagam R
11. Medico Legal Aspects of Prescription Writing- A Cross Sectional Study 41
K Srinivasulu
12. An Overview of Cervical Vertebrae Fractures in Road Traffic Accident Cases-A 5 47
Year Study at Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka
Kumar U, Vijay Kumar A G, Shivaramu M G, Hemanth Raj M N, Suresh J, Ajay Kumar S
13. Accidental Degloving of Penile Skin - A Case Report 50
Mohd Kaleem Khan, Manzoor Ahmad, Shaukat A Hanif, Manoj Kumar
14. Study of Patterns of Homicidal Deaths Autopsied at 53
District and Medical College Hospitals of North Karnataka
Mohsenul Haq, Ayesha Farheen, S K Goli
15. Study of Pattern of Deaths due to Acute Pancreatitis 57
N T Satish, S Harish, Girish Chandra Y P, Udaya Shankar B S
16. A Comparative Study of the Emerging Trends in the Use of Electronic Gadgets in the Youth 62
Navpreet Kaur, Priyanka Devgan, R K Chaudhary, Baljeet Singh, Pankaj Gupta
17. A Study of Correlation of Time Since Death with Vitreous Potassium and Sodium-Potassium Ratio 66
Nitin S Barmate, Manish B Shrigiriwar, Anil K Batra, Preeti Puppalwar
18. Correlation of Clinical History with Analysis of Poison Consumed by Patients 72
Done in MGIMS Toxicology Laboratory
Pushperndra Singh, B H Tirpude, P N Murkey, Ninad Nagrale, Swapnil Patond
19. Demographic Profile of Fatal Burns in Bagalkot, North Karnataka 75
Pallavi V Raikar, Ashutosh B Potdar
20. Identification of Sex of Sacrum of Chennai Region 79
Prakash Babladi, Shreekrishna H K, Vijaykumari
21. A Study of Association between Alcohol Consumption and 83
Road Traffic Accidents at Jaipur, Rajasthan
Solanki A, Punia R K, Pathak D

22. A Statistical Analysis of Poisoning Cases in Medico Legal Autopsy-A Retrospective Study	88
<i>Ved Prakash Gupta, Putul Mahanta</i>	
23. Mortality Pattern in Poisoning Cases Analysed in MGIMS Toxicology Laboratory	94
<i>Pushperndra Singh, B H Tirpude, P N Murkey, Ninad Nagrale, Swapnil Patond</i>	
24. A Statistical Analysis of Death Victims brought for Medico-legal Autopsy	97
<i>Biswadeep Paul, Putul Mahanta, Raktim Pratim Tamuli</i>	
25. A Comparative Study of Symphyseal Surface of Pubic Bone at Autopsy for	102
Age Estimation Using Mckern- Stewart Criteria	
<i>Bajrang Kumar Singh, Anil Aggrawal, Anil Kumar Mittal</i>	
26. Post Mortem Study for Distribution of Intracranial Haemorrhages in	107
Fatal Road Traffic Accidents	
<i>Singh BK, Ramanuj A, Bhise RS</i>	
27. An Unusual Internal Ricocheting of Bullet in a Case of Firearm Injury Over Chest	109
without Significant Damage to Vital Structures: A Case Report	
<i>Ravindra Baliram Deokar, Sachin Sudarshan Patil, Kshitija Rajiv Patil</i>	
28. Profile of Unnatural Deaths- A Study of Autopsies at Mortuary of King George's	113
Medical University, Lucknow, India	
<i>Sachil Kumar, Anoop K Verma, Irfan Ahmad, Wahid Ali, Uma S Singh</i>	
29. Detection and Characterization of Children's Soft Toy for Phthalate Esters	119
<i>Abdul Rahim Yacob, Aminah Mohamed Ayub, Nazirah Binti Said</i>	
30. Assessment of Subcarinal Angle and Factors Determining it by using CT Scan	124
<i>Salahuddin Azeemuddin, Mehera Bhoir</i>	
31. Cross Sectional Study of Road Traffic Accidents with Forensic Autopsy	130
View at Davangere Karnataka	
<i>Satish Babu B S, Raju G M, Vijayanath V</i>	
32. Derivation of Multiplication Factor for Stature Estimation from Tibia in Living	134
<i>Dhurve Alka S, Dhurve Sharad A</i>	

IV

33. Estimation of Stature from Upper Fragment of Tibia in Living 137
Dhurve Alka S, Dhurve Sharad A
34. Estimation of Personal Height from the Head Length in North Chennai Region 140
Shreekrishna H K, Vinoth, Vijaykumari
35. Multidisciplinary Approach in a Case of Fall from Bridge: A Case Report 143
Tekade P R, Sharma H, Tekade C R, Salgare M B
36. Plastination : An Attempt to Estimate Size and Volume of Maxillary 147
Sinus of Dry Crania to Determine Gender
Vidya C S, N M Shamasundar, Manjunatha B
37. Dental and Skeletal Fluorosis: A Review 151
Rohit Sharma, Pradeep Kumar, Neha Bhargava, Amit Kumar Sharma, Shalabh Srivastava, Shweta Jain, Vijay Agrawal

A Study on Socio-Demographic Profile of Post Mortem Cases in the Morgue of a District Hospital in West Bengal

Aditya Prasad Sarkar¹, Ranjana Mandal², Supriti Ghorai³, Pushpendu Sengupta⁴

¹Associate Professor, Dept. of Community Medicine, Burdwan Medical College, ²Assistant Professor, Dept. of Physiology, Burdwan Medical College, ³Senior Medical Officer (Medico-legal), North 24 Parganas District Hospital, Barasat, ⁴Superintendent, North 24 Parganas District Hospital, Barasat, West Bengal

ABSTRACT

Objectives: i) To assess the socio-demographic profile of post mortem cases in that morgue and ii) to determine the cause of death in those cases.

Materials & method: A record-based cross-sectional descriptive study was undertaken in the mortuary of North 24 Parganas district hospital Barasat in West Bengal. Data were collected using a pre-designed schedule from Post mortem registers and reports from January 2008 to December 2010 maintaining confidentiality.

Results: Out of Post-mortem examination of 3381 cases conducted during that period 9.3% cases died of natural cause. Difference between mean age of males and females was statistically significant ($p=0.000$). Overall poisoning was the commonest cause followed by hanging and traffic accident. Poisoning was the major cause of death among females and in rural area. The cause of death was significantly associated with age, sex, religion and residence ($p=0.000$).

Conclusion: To prevent such huge socioeconomic loss, intensive campaign for awareness on traffic rules and strict enforcement of traffic rules should be undertaken. Proper counseling for depression cases are to be done. Insecticides should be kept secured in houses.

Keywords: Socio-Demographic Profile, Post Mortem

INTRODUCTION

An autopsy—also known as a post-mortem examination, is a highly specialized surgical procedure that consists of a thorough examination of a corpse to determine the cause and manner of death and to evaluate any disease or injury that may be present. The term “Autopsy” is derived from Ancient Greek word “*autopsia*” which means “to see for oneself”. The necessity of this procedure was evident to our ancestors. Records from Roman times narrate the examination of the wounds of Julius Caesar¹. There are generally two types of autopsies i) The Clinical or Academic and ii) The Medico-legal or Forensic. The later is undertaken in all cases of unnatural deaths.

Road traffic injuries are a leading cause of death, killing nearly 1.3 million people annually. Approximately 90% of these deaths occur in low- and middle-income countries. If current trends continue unabated, road traffic injuries are predicted to rise from

their current position as the ninth leading cause of death to become the fifth leading cause of death by 2030².

Section 174 of Criminal Procedure Code of 1973 deals with unnatural deaths and relates to post mortem. National Crime Records Bureau, Ministry of Home affairs reported 3,57,121 accidental deaths in 2009 in India³. West Bengal contributed to 4.4% of such deaths having rate of accidental deaths of 17.5 per lakh population. Out of causes of accidental deaths in India in 2009, 42.7% were road traffic and railway accidents, 7.5% were poisoning and 7.3% were drowning 6.5% by fire while 6.2% by natural causes³. There is dearth of information regarding different variables of post-mortem cases in the morgue of a district hospital of West Bengal. Under these circumstances the present study was undertaken to assess the socio-demographic profile of post mortem cases in the morgue of a district hospital in West Bengal and to determine the cause of death in those cases.

MATERIAL & METHOD

It was a record-based cross-sectional descriptive study. The study was undertaken in the morgue situated at North 24 Parganas District Hospital Barasat situated at Barasat of district in West Bengal during July 2011 to September 2011. Data were collected using a pre-designed schedule from Post mortem registers and Post mortem reports regarding post mortem examinations done from January 2008 to December 2010. Total 3381 cases were studied. Strict confidentiality was maintained during the whole study period. Data were tabulated using a Microsoft excel worksheet and analysis was done using proportion and Chi square test with the help of SPSS software version 19.0.

FINDINGS

Out of 3381 post mortems done at the mortuary, 35 were decomposed fetus and 6 were only limbs. Remaining 3340 cases were studied further. In 310 cases (9.3%) the cause of death was found to be natural cause. Out of which majority were due to heart cause

(169, 54.5%) followed by lung cause (94, 30.3%), brain cause (35, 11.3%) and pregnancy related cause (12, 3.9%). Rest 3030 cases of unnatural death were analyzed further based on age, sex, religion and residence.

Most common cause of unnatural death was hanging (24.1%) followed by poisoning (23.6%). Remaining causes being traffic accident (21.6%), injury (14.5%), burn (6.4%), drowning (5.2%) and other causes (4.7%). Out of total 3030 cases 1944 (64.2%) were male and 1086 were female (35.8%).

Regarding age-wise distribution, majority of cases (24.9%) were in 20-29 years age group while only 3.3% was contributed by 0-9 year's age group. Mean age of the males (37.59 years \pm 16.98) was more than females (33.51 Years \pm 18.8) and the difference was statistically significant ($p=0.000$). Religion and place of residence of 167 cases were not available as they were brought as unknown cases, however their age had been approximated. However majority of the cases had rural residence (64.5%) and majority (78.2%) belonged to Hindu religion.

Table 1: Distribution of cases according to age and cause of death. (n=3030)

Age in years		Cause of death							Total
		Burn	Drowning	Hanging	Injury	Poisoning	Traffic accident	Others	
0-9	No	3	32	1	15	9	22	17	99
	%	3	32.3	1	15.2	9.1	22.2	17.2	100
19-Oct	No	16	30	104	46	140	53	21	410
	%	3.9	7.3	25.4	11.2	34.1	12.9	5.1	100
20-29	No	48	19	229	92	209	124	34	755
	%	6.4	2.5	30.3	12.2	27.7	16.4	4.5	100
30-39	No	47	24	127	77	117	126	29	547
	%	8.6	4.4	23.2	14.1	21.4	23	5.3	100
40-49	No	27	21	118	75	109	128	26	504
	%	5.4	4.2	23.4	14.9	21.6	25.4	5.2	100
50-59	No	12	17	66	65	66	99	9	334
	%	3.6	5.1	19.8	19.5	19.8	29.6	2.7	100
60-69	No	15	9	43	38	43	56	1	205
	%	7.3	4.4	21	18.5	21	27.3	0.5	100
≥ 70	No	25	6	43	31	21	45	5	176
	%	14.2	3.4	24.4	17.6	11.9	25.6	2.8	100
Total	No	193	158	731	439	714	653	142	3030
	%	6.4	5.2	24.1	14.5	23.6	21.6	4.7	100

Table no 1 reveals that there is statistically significant association between age and cause of death ($\chi^2=377.879$, d.f.=42, $p=0.000$). Drowning was commonest cause of death (32.3%) in 0-9 year's age group and hanging being the rarest cause. Poisoning

was commonest among adolescents and burn was rarest. Hanging was commonest cause in 20-39 years age group while drowning was least common. Road traffic accident contributed maximum in more than 40 year's age group.

Table 2: Distribution of cases according to sex and cause of death. (n=3030)

Sex		Cause of death							Total
		Burn	Drowning	Hanging	Injury	Poisoning	Traffic accident	Others	
Male	No	24	112	430	354	412	518	94	1944
	%	1.2	5.8	22.1	18.2	21.2	26.6	4.8	100
Female	No	169	46	301	85	302	135	48	1086
	%	15.6	4.2	27.7	7.8	27.8	12.4	4.4	100
Total	No	193	158	731	439	714	653	142	3030
	%	6.4	5.2	24.1	14.5	23.6	21.6	4.7	100

Table no 2 reveals that sex is significantly associated with the cause of death ($\chi^2=367.065$, d.f.=6, p=0.000). Most of the male died from traffic accident (26.6%) while least common cause was burn (1.2%) as

compared to females (15.6% burn cases). The major cause of death in females is poisoning (27.8%) closely followed by hanging (27.7%). Drowning was least common cause in females (4.2%).

Table 3: Distribution of cases according to religion and cause of death. (n= 2863)

Cause of death							Total
Burn	Drowning	Hanging	Injury	Poisoning	Traffic accident	Others	
162	124	658	292	477	437	89	2239
7.2	5.5	29.4	13	21.3	19.5	4	100
26	24	68	106	219	137	40	620
4.2	3.9	11	17.1	35.3	22.1	6.5	100
1	1	1	0	0	1	0	4
25	25	25	0	0	25	0	100
189	149	727	398	696	575	129	2863
6.6	5.2	25.4	13.9	24.3	20.1	4.5	100

Table no 3 shows that religion is significantly associated with cause of death ($\chi^2=134.193$, d.f.= 12, p=0.000). It is revealed that commonest cause of death was hanging among Hindus (29.4%) while other

causes was least common (4.0%). Among Muslims poisoning was the commonest cause of death (35.3%) but only 3.9% died of drowning.

Table 4: Distribution of cases according to place of residence and cause of death. (n=2863)

Cause of death							Total
Burn	Drowning	Hanging	Injury	Poisoning	Traffic accident	Others	
106	69	381	259	558	370	103	1846
5.7	3.7	20.6	14	30.2	20	5.6	100
83	80	346	139	138	205	26	1017
8.2	7.9	34	13.7	13.6	20.2	2.6	100
189	149	727	398	696	575	129	2863
6.6	5.2	25.4	13.9	24.3	20.1	4.5	100

Table no 4 shows that poisoning was the commonest cause of death (30.2%) while drowning was least common cause (3.7%) among cases coming from rural area. Hanging was most common cause of death among cases from urban area (34.0%) while other causes contributed least (2.6%).

The difference in cause of death according to residence is statistically significant. ($\chi^2= 161.754$, d.f.= 6, p=0.0

DISCUSSION

The study on post mortem cases revealed many features. Most of the cases were in 20-29 years age group which is the most productive period of life which is similar to the findings of a study at Kolkata⁴, another at northern India⁵ and another at Dhaka, Bangladesh⁶. Male predominance is seen among the cases in present study, Kolkata study as well as a study at northern India and Dhaka, Bangladesh. Such loss

of people in productive age group bears a significant effect on the socioeconomic status of the country.

Out of the post-mortem cases 10.2% were found to be due to natural causes which are more than the national figure 6.2% in 2009³ and slightly more than result in Chandigarh study⁵. Among the cases of death due to natural cause majority were due to heart disease (54.5%) as compared to the study at Kolkata where majority of cases of natural death were due to lung cause (57.2%)⁴. Proportion of deaths due to brain cause are almost similar in present study and Kolkata study.

Among the deaths due to unnatural causes, hanging was the leading cause (24.1%) closely followed by poisoning (23.6%) and then by traffic accident (21.6%). 5014 deaths occurred due to traffic accident in West Bengal in 2009³. Least common cause was other causes. Whereas road traffic accident was most common cause in Chandigarh study followed by poisoning⁵. Similar picture is revealed by national figure in this respect³.

Drowning is the commonest cause in 0-9 year's age group probably because of ignorance about swimming whereas drowning is least common in 20-39 years probably due to knowledge in swimming. Poisoning was the commonest cause among adolescents while it was commonest in 21-30 year's age group in the study at Warangal, Andhra Pradesh⁷.

Males outnumbered females in traffic accident because of more mobility of males outside. Traffic accident contributed about six times as cause of death in males as compared to females in study by P Shrivastava et al⁴. Similar finding was reported in a study at Nepal⁸. Commonest cause of death in females was poisoning which may be due to easy availability of insecticides at home in rural areas. Poisoning was most frequent cause in 20-29 years age group and in males which corroborates with the study at Andhra Pradesh by Kumar S V et al⁷. Similar findings was stated by Dash S K et al in a study in Orissa⁹.

Hindus outnumbered other religions in all types of cause of death by virtue of their majority among study population. Commonest cause of death was poisoning in rural areas due to easy availability of insecticides at home. This corroborates with a study at Orissa⁹. Surprisingly victims of traffic accident were

more from rural areas like the Nepal study⁸. Burn was more common in rural areas probably due to kutcha houses.

To reduce the deaths due to unnatural causes an in-depth study on the causes are to be undertaken. However some immediate measures can be taken. Traffic accidents should be prevented by safety education starting at school age and strict enforcement of traffic rules. Insecticides should be kept in secured places in houses. Counseling of all people showing symptoms of depression should be done. Thus a multi-sectoral approach may help in minimizing the problem in future.

Conflict of Interest: None

Source of Funding: Nil

REFERENCES

1. Vij K, Textbook of Forensic Medicine and Toxicology Principles and Practice 2nd edition. B.I.Churchill Livingstone. New Delhi, 2002.
2. 2nd Global Status Report on Road safety, World Health Organization, Geneva, 2011.
3. Accidental deaths and suicides in India 2009, National Crime Records Bureau, Ministry of Home Affairs, Government of India, New Delhi-110066.
4. Shrivastava P, Som D, Nandy S, Saha I, Pal P B, Guha Roy T et al Profile of post mortem cases conducted at a morgue of a tertiary care hospital in Kolkata. *J Indian Med Assoc* 2010; 108(11): 730-733.
5. Sharma, B R, Singh V P, Sharma R, Sumedha Unnatural deaths in northern India a profile. 2004; *JIAFM*, 26(4):140-146
6. Khan H B M, Hossain M M Study on Unnatural Death Patterns in Dhaka City AKMMC *J* 2011; 2(2): 18-20.
7. Kumar S V, Venkateswarlu B, Sasikala M, Kumar V G A study on poisoning cases in a tertiary care hospital. *J Nat Sc Biol Med* 2010 ; 1 (1) :35-39.
8. Mishra B, Sinha N D, Shukla S, Sinha A K Epidemiological study of road traffic accident cases from Western Nepal *Ind J Com Med* 2010 ; 35 (1) : 115-121.
9. Dash S K, Raju S A, Mohanty M K, Patnaik K K, Mohanty S Socio-demographic profile of poisoning cases. *JIAFM*, 2005 ; 27 (3): 133-138.

Estimation of Stature from Percutaneous Measurement of Tibia in Living

Dhurve Alka S¹, Dhurve Sharad A²

¹Assistant Professor, Department of Anatomy, Indira Gandhi Government Medical College, Nagpur, Maharashtra,

²Assistant Professor, Department of Medicine, NKPSIMSR, Nagpur, Maharashtra

ABSTRACT

Determination of stature from different body part still retains an utmost importance in the identification of criminal and victim. The objective of the study was to find out correlation and to derive regression formula between length of right and left tibia and height of an individual in India. The material consisted of 440 individual in which male and female constituted the equal number between the age group of 18 to 24 years. This group comprises the admixture of students admitted from all over the country.

Measurements were taken at a fixed time to avoid diurnal variations. The height was recorded with the help of an anthropometer and length of both sided tibia was recorded with spreading caliper. The observed data was subjected to statistical analysis. The result obtained indicated there were positive correlation between right and left tibia and height of an individual.

Regression equation derived can be used to estimate stature of an individual when it is not definitely known as to which part of the country the he/she belongs.

Keywords: Stature Estimation, Percutaneous Tibial Length

INTRODUCTION

Stature or body height is one of the most important and useful anthropometric parameter, which determines the physical identity of an individual. Therefore determination of stature from different body parts and skeleton still retain an utmost importance in the identification of criminal and victim. Long bone length is known to be the best indicator of stature. Next to femur, the tibial length measurement gives better estimation of stature than any other long bone because it is technically easier and tibial length itself is a part of stature. Similarly percutaneous measurement of tibia in the living gives better degree of accuracy (D.Allbrook, 1961)^[1]. Many of the previous workers had done this study on cadavers. But cadavers cannot represent a population and cadavers are largely of persons who are aged, and might have suffered from chronic debilitating diseases. According to Trotter and Glesser (1952)^[2] there is increase in height by 2.5cm after death when measurement is taken in recumbent posture. All these short comings in cadaveric material can be overcome by analyzing it in living. Pearson in 1899^[3] determined regression formula for calculation

of stature from length of long bone. Trotter and Glesser (1952)^[2] established regression equation for stature calculation and concluded that increase in stature after 18yrs is insignificant even though the mean value indicate a maximum attained at age 24 years, there is no statistical significant change after age 18years. So the present study is done on person belonging to 18-25yrs age group.

MATERIAL AND METHOD

The project "Estimation of Stature from PCTL in living" was carried out in Government Medical College, Nagpur, Maharashtra. The subjects taken for study were medical students of Govt. Medical College and Indira Gandhi Govt. Medical College, Nagpur. In them 220 students were male and 220 were female. This age group comprises the admixture of the students admitted from all over country i.e. 15% on all India basis and remaining 30% on state basis and 55% on Zonal level basis. The age group of 18- 24yrs was selected and their height and length of right and left tibia were recorded. Measurement was taken for stature from crown to heel in standing erect posture

with an Anthropometer and length of tibia was measured with the help of spreading caliper from medial most superficial point on upper border of medial condyle to tip of medial malleolus. For measuring the tibial length subject was asked to stand and keep his/her foot on a wooden stool to maintain the angle between flexor surface of leg and that of thigh at 90° and great toe was touching the vertical plate.

After collection of data, the measurements were subjected to statistical analysis which has given some important analysis.

OBSERVATION

The statistical data was tabulated to show the different parameters at a glance.

Table No. 1. Showing the average living height in male and female

No. of sample	Male (220)	Female (220)
Range in cms.	Max=182.5 Min=155.2	Max-165 Min - 142.5
Mean	168.52	153.24
S.D.	5.46	4.61
C.V.	0.0324	0.0300
S.E.M.	0.3681	0.3108

In male height varied from 155.2cm to 182.5cm. the average height being 168.2cm and the coefficient of variation-0.0324. In female the height varied from 142.5cm-165.0cm with an average 153.24cm and the

coefficient of variation was 0.0300. Small values of coefficient of variation indicate that sample observation can be considered as homogenous.

Table No. 2. Showing the Range, Mean, S.D. C.V. and SEM of length of tibia in male and female

Tibia	Right		Left	
	Male	Female	Male	Female
No. of sample	220	220	220	220
Range in cms.	26.1 to 43.5	24.5 to 37.9	26.6 to 43.8	24.5 to 38.9
Mean	34.92	30.71	35.32	30.67
S.D.	2.54	2.27	2.49	2.27
C.V.	0.0727	0.071	0.0704	0.074
S.E.M.	0.1211	0.1082	0.1187	0.1082

Table No.3. Showing formulation of Regression Formula for calculating the living Stature from the length of tibia in male and female

Tibia	Right	Left		
	Male	Female	Male	Female
Independent variable (x)	Length of Tibia (x_1)	Right tibial length (x_1)	Length of Tibia (x_2)	Left tibial length (x_2)
Intercept (a)	111.37	104.01	109.59	108.16
Regression coefficient (b)	1.6409	1.6011	1.6683	1.4695
Correlation coefficient (r)	0.7408 (r_1)	0.7625 (r_1)	0.7626 (r_2)	0.7324 (r_2)
Coefficient of determination (R^2)	0.5489	0.5815	0.5817	0.5365
Chi-square (χ^2)	15.19	12.47	16.20	13.86
Significance	NS	NS	NS	NS

: NS – Not significant

The correlation coefficient (r) of height and length of right tibia was 0.74 and left tibia was 0.76 in male. For female correlation coefficient was 0.76 for right side and 0.73 for left side. Chi-square test for regression

coefficient was found to be statistically significant. Statistically there was no significant difference in the length of tibia of right and left side in both male and female. ($p > 0.05$)

On the basis of present observation regression formulae were derived separately for both sides in male and female for calculating the living stature.

In male,	Right side	$y_1 = 111.37 + 1.6409 x_1$
	Left side	$y_2 = 109.59 + 1.6683 x_2$
In Female,	Right side	$y_1 = 104.01 + 1.6011 x_1$
	Left side	$y_2 = 108.16 + 1.4695 x_2$
	Where,	y = substituting measured height.
		x = percutaneous tibial length.

DISCUSSION

Allbrook D. (1961)^[1] compared both the estimated stature derived from length of dried tibia and from the average percutaneous tibial length. He derived regression formulae for stature estimation from the length of tibia as S (Stature) = 83.78 (Tibial Length) + 2.30 (Standard error) Kate and Muzumdar in 1976^[4] also expressed the same kind of view after comparing the derived regression equation for Maharashtrian and Punjabis (Indian) with that of Pearson regression derived from English bone (which are commonly used in India for Forensic opinion).

Mukta Rani, et al (2004)^[5] estimated the stature of Delhi students between 18 to 22 years age group. They have also calculated the stature after substituting the percutaneous tibial length in their own formulated regression equation. Their findings are found to be at par with our findings. The average stature comes out in our study for male is 168.28cms. and 153.54cms. for female and the average stature calculated by Mukta Rani, et al (2004)^[5] for male is 169.5cms. and 159.5cms. for female. While substituting the average percutaneous tibial length of our study in the regression equation derived by Mukta Rani, et al (2004)^[5], the stature was found to be 168.85 cms. for male and 153.53 cms. for female which exactly correlated with estimated stature of present study. Whereas after substituting the average percutaneous tibial length derived by Mukta Rani, et al (2004)^[5] formulated regression equation, the average stature comes to be 169.51cms. for male and 159.46cms. for female of the Delhi students. This also coincides with stature derived by Mukta Rani, et al (2004)^[5] for Delhi students.

RESULT

Study showed that regression equation differs in both sexes for both side of tibia. By using this regression equation the stature was calculated 168.28cm in males and 153.8cm in females. Whereas average measured height in living males comes out to be 168.53cm and that of females 153.2 cm. In the present study average error is less than 1 cm in both sexes when compared between estimated stature and actual stature in living.

INFERENCE

Thus height of a person can be estimated with fair accuracy and the study will definitely be useful to the anatomist and forensic expert where the mutilated leg is available for medico legal examination.

ACKNOWLEDGEMENT

The authors are thankful to Professor D.S. Pimpalkar, Government Medical College, Nagpur and Associate Professor J.V. Deshpande, Government Medical College, Nagpur for their guidance to carry out this work.

REFERENCES

1. Allbrook David (1961): Estimation of stature in British and East African Males. Based on tibial and ulnar bone length. *J. Forensic Med.* Vol. 8(1): 15 -28.
2. Trotter Mildred and Gleser G. C. (1952): Estimation of stature from long of bones of American White and Negroes *Am. J. Phys. Anthropol.*, vol.10: 436 -514.
3. Pearson K. (1899): IV. Mathematical contribution to the theory of evolution on the reconstruction of the stature of prehistoric races. *Philos. Trans. R. Soc. series A* 192:169 – 241.
4. Kate B. R. and Muzumdar R. D. (1974-76): Stature estimation from femur and humerus by regression and autometry. *Acta Anatomica*, 311-320.
5. Mukta Rani., Tyagi A. K., Verma S. K., Kohli A. (2004): Estimation of stature from, percutaneous measurements of legs (1999 – 2000). *Journal of Forensic Medicine and Toxicology*, vol. 21 (1): 12 – 14.

A Rare Case of Homicidal Gagging Concealed by Fire

Yadav A¹, Alam F², Kothari N S³, Gahlot R K⁴

¹Assistant Professor, Department of Forensic Medicine, ²Postgraduate Resident, Department of Forensic Medicine, ³Professor, Department of Forensic Medicine, ⁴Professor and Head, Department of Forensic Medicine, NIMS Medical College, Jaipur, Rajasthan

ABSTRACT

Fire is a good means of attempting to conceal the injuries and other marks that may indicate that the deceased was a victim of homicide. We reported a case of 37 years old female who was brought dead to emergency department in almost 95 % burn condition. On autopsy a gag material (piece of red cloth) was found in mouth up to root of tongue. The cause of death is gagging in this case which was attempted to conceal by fire. Fire will almost certainly cause some destruction of forensically useful evidence. As a result, all burnt bodies must be viewed with particular care and possibility that the death might have occurred before the fire began must be considered. The finding of the soot particles in the airways and carbon monoxide in the blood indicate that person was breathing after the fire began. However, it must be strongly emphasized that the converse is not true: the absence of soot and carbon monoxide certainly does not mean that the victim must have been dead before the fire started.

Keywords: Gag Material, Homicide, Fire, Soot Particles

INTRODUCTION

Gagging is a type of asphyxia in which a cloth is forced into the mouth or and the nose may be closed by tying a cloth or a similar material around them. This rolled up cloth is called a gag. The gag is introduced so as to block the pharynx and cause asphyxia. This is almost always homicidal mode of death and is commonly employed in children. Usually the gag is inserted to prevent the victim from shouting but death occurs unintentionally due to insertion of the gag inside the pharynx and causing obstruction and asphyxia.¹ The gag is commonly composed of handkerchief, sari or dhoti. It is usually stuffed tightly into position. It thus not only fills the mouth but also obstructs breathing through the back of throat. Taylor points out that in clinical stage two of asphyxia, the victims of gagging may be in danger of death, owing to saliva and mucus moistening and rendering impassable to air the gag or cloth bindings that have

so far only made breathing more difficult.² The sequence of physiological events is bradycardia, decrease in respiration with agonal gasps with eventual cessation of respiration, slowing and finally flattening of EEG.³ In such cases, typical asphyxial signs may or may not be present as it depends upon the struggle to breathe.⁴ It is very difficult, if not impossible, to differentiate antemortem and postmortem burns. Cases of homicides by this method are rarely reported.

CASE REPORT

We are reporting a case of female 37 years old that was killed by her husband. A 37 years old female was brought dead in NIMS hospital with about 95% burn on 10/05/12.. The police was informed immediately, on their arrival, inquest was conducted and postmortem examination was conducted on the next day. As per information furnished by police and her attendants she was married and having three children and belonged to economically weak class. She was acutely ill and completely on bed for last 3 months. She had a paralytic attack. Due to poor economic condition and health of victim, day to day quarrel had been started between husband and wife. One day he killed his wife by homicidal gagging and after that burn the whole body with kerosene.

Corresponding author:

Anil Yadav

Assistant Professor

Department of Forensic Medicine

Nims Medical College, Jaipur

Email id: yaduvanshi1@gmail.com

Autopsy examination

After receiving panchayatnama, Postmortem was done on 11/05/12 at 11.30A.M. by a panel of three doctors vide PMR No.23 dated 11/05/12. The subject was averagely built and averagely nourished. She was in state of pugilistic attitude (Fig.1). Postmortem staining was not evident due to extensive burn over back and dependent parts of the body. Decomposition of body not started yet. Both eye balls are damaged due to excessive heat exposure.



Fig. 1. Showing case of homicidal gagging (insitu gag material) concealed by fire in pugilistic attitude.

External examination

Superficial to deep (3rd and 4th degree) burns with sooty blackening of skin, singeing and burning of scalp hairs, eye brows and eyelashes with peeling of skin at places involving the following parts of the body- skull and face as a whole, neck as a whole, chest and abdomen as a whole, both upper limb as a whole except at places at dorsum of left hand, genitalia as a whole and both lower extremities as a whole except at places on front of left thigh and dorsum of left foot. Smell of kerosene oil is present on the body. Burnt area is about 95% of the surface area of the body.

Internal examination

On examination red colored 2-3 cm burnt part of cloth is present outside of mouth (Fig.2) and unburnt part was present upto the root of tongue which is removed and sealed and sends to forensic science laboratory for further chemical analysis. On further examination there is absence of soot over the palate (Fig.5). Also soot particles were absent in trachea, larynx and lower respiratory tract. The stomach contains about 200 ml of semi digested food. All other viscera's (lung, liver, spleen and kidneys) were congested and edematous. On examination of skull, charring of skull is present. On opening the cranial cavity, brain is firm and yellow and dura was leathery in appearance with the extravasation (heat hematoma) of blood on the upper surface of duramater below the

charring of skull on Rt. side of size 2x1 cm which is soft, friable and pink in color. The burns were postmortem in nature. The cause of death was given suffocation due to "gagging" by foreign material (cloth).



Fig 2. Showing completely burnt body of female with sooting, blackening of skin, peeling of skin at places with singeing of scalp hairs with gag material in semiopen mouth.



Fig 3. Showing postmortem burning case with in situ gag material.



Fig 4. Showing recovery of gag material (piece of red cloth) during autopsy examination.



Fig. 5. Showing examination of victim revealed no soot on the palate.

Material Sent For Chemical Examination

1. One Sealed Glass bottle containing stomach as a whole, piece of small intestine with their contents in super saturated solution of common salt.
2. One sealed bottle containing pieces of liver spleen and kidney in supersaturate solution of common salt.
3. One sealed glass bottle containing piece of cloth and burnt hairs
4. One sealed glass vial containing plain blood.

DISCUSSION

Postmortem burning after homicidal gagging to conceal crime is not commonly seen. Differentiation of ante mortem from postmortem burns is very important especially in charred bodies. Burning of the body to try to conceal the homicide may complicate the situation by making it difficult to interpret the findings⁵. A careful search must be made for any antemortem injuries that may have caused or contributed to death. Pugilistic attitude is not an antemortem phenomenon and can be produced after death. In the reported case burnt areas were accompanied with blackening that is characteristic of burns from kerosene or petrol. It is very difficult to kill an active conscious person by burning. Either the victim is first made unconscious or semiconscious by way of intoxicating or assault and then burned after pouring fuel on the body; or at first hands and feet of the victim are tied and mouth gagged or tied and then burned.⁶ In above case victim had an attack of paralysis three months back and she was hemiplegic since then. So relative inability of the victim due to hemiplegia

makes assailant job quite easy. In such cases, the reduced capacity of the person to swallow oral secretions likely plays a role in the mechanism of death. Extremes of ages, adults incapacitated with drugs, drinks, diseases etc are mainly the victims of homicidal gagging. It may be difficult or impossible for the forensic pathologist to determine the extent of ante mortem damage if the ensuing fire later reaches the body and causes postmortem burning. The exposed skin surface may be reddened in both antemortem and postmortem burns, the classical distinction of a red flare or vital reaction being unsafe as an index of infliction before death.⁷ It is important to know that when severe heat is applied to the cranium a mass of blood resembling a true extradural hematoma may form between the skull and dura. In this phenomenon the diploic veins and longitudinal sinus is involved. Heat hematoma should be differentiated from extradural hematoma. Extradural hematoma is always traumatic in origin and does not have a cherry red color or honey comb appearance. In gagging facial findings are prominent such as congestion of face and fine petechial hemorrhages over the face, sclera and conjunctiva. These findings were masked or not evident due to extensive postmortem burning. Although they are usually associated with homicides (e.g elderly robbery victims, neonaticidal, gags have also been used to stifle screams by victims using a painful method of suicide (self immolation).⁸ Postmortem burning is an attempt to disfigure or destroy a body that resulted from another method of homicide, such as gagging, strangulation, gunshot wound etc before the fire. This case report aims to draw attention to postmortem burning following homicide by careful and detailed autopsy of the victim.

ACKNOWLEDGEMENT

The authors are thankful to Dr Rakesh Sharma medical officer Government Hospital Chandwaji Jaipur for kindly help to carry out this work.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearance: Taken

REFERENCES

1. Dikshit PC. Textbook of Forensic Medicine and Toxicology. New Delhi: Peepee publishers and distributors (P) Ltd; 2010.

2. Taylor's Principles and Practice of Medical Jurisprudence, 12th edn, 1965, vol 1, p 357.
3. Di Maio VJ, Di Maio DJ. Asphyxia. In: Forensic Pathology. 2nd ed. London: CRC Press, 2001: 230-278.
4. Vij K. Asphyxial deaths. In: Text Book of Forensic Medicine and Toxicology. 3rd Ed. New Delhi: Elsevier, 2005: 165-221.
5. Suárez-Peñaranda JM, Muñoz JI, López de Abajo B, Vieira DN, Rico R, Alvarez T, Concheiro L. Concealed homicidal strangulation by burning. Am J Forensic Med Pathol. 1999 Jun; 20(2):141-4.
6. Nandy A. Principles of Forensic Medicine including Toxicology. 3rd edn. Kolkata: New central book agency(P) ltd ; 2010
7. Saukko P, Knight B. Knight's Forensic Pathology. 3rd edn, London, Edward Arnold (publishers) ltd. 2004.
8. Shkrum, M., Johnston, K.A. Fire & Suicide: a three year study of self immolation death. J. forensic sci. 37:208-221, 1992.

Electron Microscope: A Review

Arun Singh¹, Renuka Verma², Aditi Murari³, Ashutosh Agrawal³, Shalini Singh⁴, Vertika Singh⁵

¹Senior Lecturer, Department of Oral Pathology and Microbiology, Kothiwal Dental College and Research Centre, Moradabad, Uttar Pradesh, India, ²Lecturer, Department of Oral Pathology & Microbiology, Career Post Graduate Institute of Dental Sciences and Hospital, Lucknow, Uttar Pradesh, India, ³Sr. Lecturer, Department of Oral Pathology and Microbiology, Institute of Dental Sciences, Bareilly, Uttar Pradesh, India, ⁴Medical Officer, Female Ward, Bilgram, Hardi, Uttar Pradesh, India, ⁵P.G. Student, Department of Anesthesia, Rohilkhand Medical College, Bareilly, Uttar Pradesh, India

ABSTRACT

Electron microscopy is an important viewing technique for the study of microorganisms. More specifically, scanning electron microscopy and transmission electron microscopy are extremely useful tools for the ultrastructural examination of prokaryotic cells as well as for the study of the interaction between bacterial pathogens and host cells

Keywords: *Electron Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy*

INTRODUCTION

The word microscope is derived from the Greek mikros (small) and skopeo (look at). From the dawn of science there has been an interest in being able to look at smaller and smaller details of the world around us. Biologists have wanted to examine the structure of cells, bacteria, viruses, and colloidal particles.¹

Electron Microscopes are scientific instruments that use a beam of highly energetic electrons to examine objects on a very fine scale.² Because of the limited resolution of the light microscope, analysis of the details of cell structure has required the use of more powerful microscopic techniques-namely electron microscopy.³ Light microscopy which uses visible light as a source of illumination and optical lenses to magnify specimens in the range between 10 to 1,000 times their origin sizes. EM is operated in the vacuum and focuses the electron beam and magnifies images with the help of electromagnetic lenses. The electron microscope takes advantage of the much shorter

wavelength of the electron (e.g., $\lambda = 0.005$ nm at an accelerating voltage of 50 kV) when compared to the wavelengths of visible light ($\lambda = 400$ nm to 700 nm). When the accelerating voltage is increased in EM, the wavelength decreases and resolution decreases. In other words, increasing the velocity of electrons results in a shorter wavelength and increased resolving power.⁴

HISTORY

The history of electron microscopy began with the development of electron optics. In 1926, Busch studied the trajectories of charged particles in axially symmetric electric and magnetic fields and showed that such fields could act as particle lenses, laying the foundations of geometrical electron optics.⁵ Nearly at the same time, the French physicist Broglie D introduced the concept of corpuscule waves. A frequency and hence a wavelength was associated with charged particles: wave electron optics began. Following these two discoveries in electron optics, the idea of an electron microscope began to take shape.⁶

The Transmission Electron Microscope (TEM) was the first type of Electron Microscope to be developed and is patterned exactly on the Light Transmission Microscope except that a focused beam of electrons is used instead of light to "see through" the specimen. It was developed by Max Knoll and Ernst Ruska in Germany in 1931.

Corresponding author:

Arun Singh

Senior Lecturer

Department of Oral Pathology and Microbiology,
Kothiwal Dental College and Research Centre,
Moradabad, Pin-244001, Uttar Pradesh,
India. Mob. No:- 09520994444

The first Scanning Electron Microscope (SEM) debuted in 1942 with the first commercial instruments around 1965. Its late development was due to the electronics involved in "scanning" the beam of electrons across the sample.²

Type of Electron Microscope

There are three basic type of electron microscope:

1. Transmission Electron Microscope (Tem)
2. Scanning Electron Microscope (Sem)
3. Scanning Transmission Electron Microscope (Stem)

Transmission Electron Microscope (Tem)

Transmission electron microscopy is the direct counterpart of conventional light microscopy and involves the passage of a high velocity, homogeneous electron beam through a specimen that is thin enough to transmit at least 50 percent of the incident electrons. The emergent beam of transmitted electrons is then focused by a system of lenses to form a magnified, two-dimensional image of the specimen.⁷ The transmission electron microscope (TEM) has been widely used in routine histopathology in recent years, particularly in the fields of renal disease, tumour pathology and virus infections.⁸ TEM is almost always the first method used to determine the size and size distribution of nanoparticle samples.⁹ With this greater resolving power, the transmission electron microscope is able to reveal the substructure or ultra structure of individual cells. The physical basis for this benefit lies in the formula:

$$R = \frac{0.61\lambda}{NA}$$

Where R - Resolution represents the capacity of the optical system to produce separate images of objects close together.

λ - Wavelength of the incident illumination.

NA - Numerical aperture of the lens.³

Analogy Between Light And Transmission Electron Microscopes

Light and TEMs are similar so far as the arrangement and function of their components are concerned. They both consist of three major system; an illuminating system, an imaging system and an image translating system.

The illuminating system comprises a source of radiation and the condenser lens assembly, which focuses the 'illuminating beam' onto the plane of the specimen. After passing through the specimen, the beam enters the imaging system, which consists of a number of lenses that produce the final, magnified image of the specimen. The lenses involved are the objective lens, which produces an intermediate image of the specimen and the projector lens, which magnifies the intermediate image to produce the final image. The final image can then be viewed on a fluorescent screen and recorded photographically or on a monitor and recorded digitally; these correspond to the image translating system.

The analogy between light and TEMs is not strict as the two instruments differ in certain essential respects. The three most obvious differences are the 'light' source, the form of the lenses and the manner in which the image is formed.⁷

The electron microscope uses a *beam of electron* instead of a beam of light and electromagnets rather than glass lenses are used to focus the beam.¹⁰ The beam of electrons, which is most commonly generated by thermionic emission from a tungsten filament using an electron gun.¹¹ *Electromagnetic lenses*, lenses in an electron microscope are electromagnetic coils. Passing a current through the coils creates a magnetic field, which is able to deflect electrons.¹³ The most common defects associated with electromagnetic lenses are spherical aberration, chromatic aberration and astigmatism.⁷

Image formation

In the electron microscope, the absorption of electrons by a specimen usable thickness is very small and the image is formed partly from electrons that have passed through the specimen and partly by electrons being scattered by the specimen. The majority of electrons pass through the specimen without deviation, but some are deflected by interaction with electrons orbiting the atoms in the specimen (inelastic scatter) and some by interaction with the atomic nucleus itself (elastic scatter). This form the pattern of emergent beam, which is translated into an image on the fluorescent viewing screen as electrons impinging on the fluorescent viewing screen as electrons impinging on the screen produce a visible fluorescence, whilst the areas where the scattered electrons would have hit the screen, had they not been deflected, remain dark.⁷

Instrumentation of the Transmission Electron Microscope

The vacuum system

It is necessary to maintain the microscope column under vacuum for three reasons.

Firstly, electrons will travel only a few micrometers in air before they are stopped by collisions with gas molecules. As the distance between the electron gun and image translating systems in most modern microscopes is at least 1 metre, the column must be evacuated. The majority of microscopes operate with a vacuum greater than 1.33×10^{-4} Pa (1×10^{-4} mm Hg) and in this vacuum an electron can theoretically travel about 2.5 metres before colliding with a gas molecule.

Secondly, gas molecules present between the filament and anode plate will be converted into positively charged ions when bombarded with electrons. A build-up of positive ions in this area will produce a continuous electrical discharge between the filament and anode, rather than beam of electrons.

Finally in a poor vacuum the tungsten atoms in the filament are oxidised; this decreases the efficiency with which the filament can emit electrons and reduces filament life.

To attain and maintain, a high vacuum within the microscope column, a series of pumps employed. The types of pumps installed are dependent on the sophistication and cost of the microscope.⁷

The electrical system

The electrical system consists of a high tension unit, a lens current supply unit and voltage and lens current stabiliser units. The high tension unit usually operates between -20 kV and -100 Kv and generates the high voltage needed to accelerate the electron so that the beam has a sufficiently short wavelength. The lens current supply unit provides power to the various electromagnetic lenses.⁷

The specimen stage

An electron microscope specimen may be in the form of a very thin disc or more generally, be mounted upon an electroformed mesh (usually copper) of 3 mm diameter. This is known as the specimen grid. The specimen stage requirements are very stringent. Any part of the specimen grid should be available for survey at high magnification.⁷

The microscope column

The microscope column consists of an evacuated metal tube in which are aligned, one under another, the tungsten filament enclosed in the cathode shield, the anode plate, a number of electromagnetic lenses, a viewing screen and a photographic film.⁷

Scanning Electron Microscope

The scanning electron microscope (SEM) has become a powerful tool for microstructural geologists due to rapid development in the last 20 years.¹⁴ This type of microscope differs from TEM in that the beam of electrons is made to scan the specimen in a raster. The secondary electrons 'reflected' from the surface of the specimen are collected by a secondary electron detector, passed through a photomultiplier tube and onto a cathode ray tube where the image is displayed.

As it is necessary to section solid specimens for TEM, three-dimensional representations can be obtained only by making reconstructions using numerous two-dimensional images taken at different levels throughout the depth of the specimen. With the scanning electron microscope (SEM), the great depth of field obtainable with electromagnetic lenses is used to the full to directly visualise the surface topography of solid, unsectioned specimens. The images obtained are similar to those given by a dissecting microscope, out the depth of field at an equivalent magnification is approximately 500 times greater. The name of the instrument derives from the fact that the image, unlike that in TEM which is formed by irradiating the whole specimen at once with transmitted the whole specimen at once with transmitted electrons, is built up point by point and line by line from secondary electrons. These electrons are emitted as the specimen reacts with the incident electron beam (the probe), which scans the specimen in a square raster pattern.⁷

SEMs can be classified into two groups: thermionic and field emission. A field emission SEM has the highest magnification capability and is widely used in industries and research. Field emission SEMs are extremely expensive and require a high level of precautions, including an ultra high vacuum and a clean room, compared to thermionic SEMs.¹⁴

Instrumentation of the Scanning Electron Microscope

The scanning electron microscope may be divided into four major components

The microscope column

As in the TEM, this is an evacuated metal tube in which are aligned, one under another, a tungsten filament enclosed in a cathode shield, an anode plate and a number of electromagnetic lenses. Unlike a TEM, only three electromagnetic lenses are present. The first two act as condenser lenses and serve to progressively demagnify the incident electron beam into a probe. The third lens, which is often referred as the objective lens, further decreases the diameter of the probe and then focuses it onto the surface of the specimen.

Display units

As three-dimensional images in the SEM are formed from secondary electrons that do not have sufficient inherent energy to excite a fluorescent screen, these electrons cannot be used directly to form the image as transmitted electrons are in TEM. In a SEM, therefore, the secondary electrons are first collected and then, following amplification, used to form an image on the phosphor screen of a cathode ray tube (CRT).

The scan assembly

The image in an SEM is built up point by point and line by line as the probe scans the surface of the specimen in a square raster pattern. This scanning action is under the control of a scan generator, which sends sweep signals to a pair of deflection coils that are placed between the last two lenses or within the final lens. These coils deflect the probe in a regular pattern over the surface of the specimen.

The detector system

When the probe impinges on the specimen, the resultant collisions of primary electrons with atoms in the specimen give rise to several types of radiation. SEMs are fitted with a variety of different detectors that collect and process these various signals. It is

principally the secondary electrons that are used for normal i.e. topographical imaging.⁷

Image Formation in the Emissive Mode

Electron gun produces a beam of electrons that is accelerated down the microscope column. As this beam travels through the condenser lenses, it is progressively demagnified to form a small diameter probe. The diameter of this probe is further reduced by the objective lens, which also focuses the probe onto the specimen surface. As the deflection coils move the focused probe across the specimen in a square raster pattern, the interaction of the primary electrons of the probe with atoms in the top 5-10 nm layer of the specimen results in the emission of secondary electrons. These emitted electrons are drawn towards the positively biased detector, where they produce light. This light is led by a fibre optic light guide to a photomultiplier, which changes the light back to an electrical signal and then amplifies this signal. The output from the amplifier is then fed to a CRT grid where it modulates the brightness of a spot produced by the electron beam of the CRT, which is scanning in synchrony with the incident electron beam. As the number of secondary electrons emitted from each point on the specimen surface is characteristic of the surface at the point, the current the detector feeds to the CRT grid from any one point is determined by the characteristics of the surface. The image, therefore, is built up from spots of differing light intensity, in much the same way that a monochrome television picture is compiled. Due to their low energy, not as many secondary electrons are detected from depressions as from peaks. Thus, the depression gives rise to dark spots on the CRT and the peaks to bright spots. The magnification of the image is controlled by varying the current applied to deflection coils associated with the probe, as magnification is simply the ratio of the length of the scan across the specimen to the length of the scan across the CRT display.⁷

Differences Between Sem and Tem ⁶

TEM	SEM
Electron beam passes through thin sample.	Electron beam scans over surface of sample.
Specially prepared thin samples or particulate material are supported on TEM grids.	Sample can be any thickness and is mounted on an aluminum stub.
Specimen stage halfway down column.	Specimen stage in the chamber at the bottom of the column.
Image shown on fluorescent screen.	Image shown on TV monitor.
Image is a two dimensional projection of the sample.	Image is of the surface of the sample.

Scanning Transmission Electron Microscope (Stem)

The best known development in electron microscopy in recent years has been the STEM, combines TEM and SEM by collecting a transmission image by the scanning method and is ideally suited to a multi-signal approach. In a scanning transmission electron microscope (STEM), a high-resolution image can be formed by scanning an electron beam (which can be less than 3 Å in diameter) across a specimen in a raster fashion while collecting the transmitted elastically scattered electrons with an annular detector located beneath the specimen.¹⁶ Specimens to be examined with this form of microscope have to be treated in the same way as those for dedicated SEM.⁸

CONCLUSION

To investigate the structure and the function of cells it is necessary to integrate the imaging techniques of a variety of microscope, from optical microscopes to electron microscopes to cover a wide range of resolutions. The integration of microscopes, specimen preparation techniques and digital image processing can yield the 3D structure of a cell and its molecular components. The implementation of these interdisciplinary approaches to cell imaging should result in new advances in our understanding of cell biology.

Source of Support: Nil

Acknowledgements: Nil

Ethical Clearance: Nil

Conflict of Interest: Nil

REFERENCES

1. An introduction to electron microscope. FEI Company (2010).
2. Voutou B, Stefanaki EC. Electron Microscopy: The Basics. Physics of Advanced Materials Winter School (2008): 1-11.
3. Cooper GM. The cell: a molecular approach 2nd Edition. Sinauer Associates, Inc. Sunderland, Massachusetts (1997)
4. Stadlander CTKH. Scanning electron microscopy and transmission electron microscopy of mollicutes: challenges and opportunities. *Modern Research and Educational Topics in Microscopy* (2007); 28: 122-131.
5. Oatley CW. The early history of the scanning electron microscope. *J Appl Phys* (1982); 53(2): 1-13.
6. Hawkes P. Recent advances in electron optics and electron microscopy. *Ann Fondation Louis de Broglie* (2004); 29(1): 837-855.
7. Robinson G, Gray T. *Electron microscope: Instrumentation and image formation*. 3rd edition (1990).
8. Culling CFA, Barr WT, Allison RT. *Cellular pathology technique*. 4th Edition. Butterworth and Co. Ltd (1985).
9. Cockayne D, Kirkland AI, Nellist PD, Bleloch A. New possibilities with aberration-corrected electron microscopy. *Phil Trans R Soc A* (2009); 367: 3633-3635.
10. Black JG. *Microbiology: principles and explorations*. 5th Edition. Wiley (2005).
11. Zworykin VK, Morton GA, Ramberg EG, Hillier J, Vance AW. *Electron optics and the electron microscope*. John Willy and Sons, Inc. (1948).
12. Wyckoff RWG. *The world of the electron microscope*. New Haven: Yale University (1958).
13. Trimby PW, Prior DJ. Microstructural imaging techniques: a comparison between light and scanning electron microscopy. *Tectonophysics* (1999); 303: 71-81.
14. Park MJ, Kim DH, Park K, Jang DY, Han DC. Design and fabrication of a scanning electron microscope using a finite element analysis for electron optical system. *J Mech Sci Tech* (2008); 22: 1734-1746..
15. Goodhew PJ, Humphreys J, Beanland R. *Electron microscopy and analysis*. 3rd Edition. Taylor and Francis Group (2001).
16. Ohtsuki M, Isaacson MS, Crewe AV. Dark field imaging of biological macromolecules with the scanning transmission electron microscope. *Proc Natl Acad Sci* (1979); 76(3): 1228-1232.

A Prospective Roentgenological Study in Mewar Region of Rajasthan to Establish Age Group 16 to 18 Years

Sharma Yogesh¹, Bohra Bhavesh², Buri Sanjeev³

¹Associate Professor and Head, Department of Forensic Medicine & Toxicology S.P. Medical College, Bikaner, ²Demonstrator, Department of Forensic Medicine and Toxicology S.P. Medical College, Bikaner, ³Resident, Forensic Medicine & Toxicology, S.P. Medical College, Bikaner, Rajasthan, India

ABSTRACT

Extensive work on the determination of age of epiphyseal union has been carried out in different states of India as well as abroad, and from the findings of different workers, it is evident that there are not only differences in the age of epiphyseal union in India and abroad but also in the different states of India. The present study has been conducted on 100 candidates of Mewar region of Rajasthan who were in the age group of 14-20 years of either sex. They were clinically examined and their wrist, elbow & Pelvis were x-rayed to know the different stages of epiphyseal union according to their actual age which was verified by birth certificate or school records. The study showed that epiphyseal union takes place almost at the same age in females and little later in males. The union in females occur earlier by about 1 year to two years as a whole. No difference in the socio-economic denominator has been found.

Keywords: Age, Epiphyseal union, Radio-logical age, Epiphyseal fusion

INTRODUCTION

Age estimation is a common problem in forensic practice, not only in India, but all over the world. Various sections of the Indian penal codes (Sec. 320, 375, 376, 377, 302 etc.), Railway's Act, Employment rules and laws relating to child labour definitely require the proof of age for accused and sometimes victim also. Estimation of age isn't an easy task and sometimes inaccurate due to wide variations in different physical characteristics. In India, especially in Mewar region of Rajasthan, a large number of population belongs to tribes and is severely affected by illiteracy, which results in less regard to birth registration and documentation.

The time of appearance and fusion of ossification centres, as observed by roentgenographic methods was the subject of a comprehensive survey by Flecker (1942). This, together with his earlier survey of the times of appearance of epiphyses and their fusion with diaphyses (Flecker, 1932) are standard references.⁽⁵⁾

Age of a person depends upon various denominations like racial and provincial differences, religion and caste differences, gender bias, socio-economic and geographical conditions as revealed by

studies carried out by different workers all over the world including India. Those who have worked in India are Hepworth (1929) in Punjab, Lall & Nat (1934) in U.P. Pillai (1936) in Madras, Galastaun (1937) in Bengal, Basu and Basu (1938) in Bengal, Lall & Townsend (1939) in U.P. Ledger and Wargon (1941), Narisimhan and Bhaskarmurti (1942), Mittal (1952) in U.P., Bajaj (1957), Loomba SD⁴ (1958) (4), Gupta (1961), Sharma (1962) in U.P., Franklin (1962) in Maharashtra, Hassan and Narayan Dharau (1964), Ram Ji Das and Grewal (1965) in Punjab, Saxena (1969) in M.P.⁶, Gupta BP. (1969) in Sikar Rajasthan, Yadav SD & Suri P.R. (1971) in UP⁷, Das Gupta (1974) in UP², Kothari DR (1974) in Mewar region of Rajasthan³. A survey committee in 1964 while reporting on medico-legal practice in India had recommended to the government that zone wise study of problem of determination of age may be encouraged. The state of Rajasthan is the biggest state of the country and has different sub-divisions depending upon various geographical and socio-economic conditions like Shekhawati, Hadoti, Mewar, Rajputana region etc.

On review of literature none of the study is found in this regard in Mewar region, except Kothari DR in Rajasthan for wrist & Elbow joint only³.

Thus, legally and medico-legally, age group of 14-20 is chosen to study radiologically, to find out the variation of epiphyseal union around elbow and wrist joints in addition to pelvis in boys and girls with following aims and objectives-

1. The range of fusion with relation to each epiphysis covering the upper and lower ages.
2. To compare the age of union of ossification centres of Joints with those of people of different states of India.
3. To compare the age of union of ossification centres of Joints with those people of different parts of the world.

So as to provide a medico-legal list with reliable figures with either genders, especially applicable to residents of Mewar region of Rajasthan, in many medico-legal cases where the question of age frequently comes up when the date of birth is not known.

MATERIAL AND METHOD

This study has been conducted on 100 subjects of Mewar Region of Rajasthan at RNT Medical college Udaipur. The person chosen for the study were in the age group of 14, 15, 16, 17, 18, 19 and 20 years of either sex and belonging to different socio-economical, religious and educational status. Their ages as stated by them was further confirmed either from birth certificate or school record duly certified by the head of the school. After clinical examination , each person

was x-rayed of his/her elbow, wrist, and pelvis AP views.

The following points has been noted with reference to each of the epiphyses in both sexes separately

- (A) Age of the youngest subject showing fusion of epiphysis with diaphysis.
- (B) Age of the oldest subject not showing fusion of epiphysis with diaphysis.
- (C) Age at which at least 75% or more of the cases have shown fusion.
- (D) The range of fusion with relation to each epiphysis covering the upper and lower ages.

The findings are recorded chronologically in the form of master chart and subjected to computer assisted statistical analysis observations.

OBSERVATION

Table No. 1. Age and Sex wise Distribution of the Cases

Age(in years)	No. of cases		Total	Percentage
	Female	Male		
14-15	4	-	4	4
15-16	23	8	31	31
16-17	12	14	26	26
17-18	11	13	24	24
18-19	06	7	13	13
19-20	-	2	2	2
TOTAL	56	44	100	100

Table No. 2. Progress of Union of Epiphyses in Females

Epiphyses	Age in years				
	14-15% Union	15-16% Union	16-17% union	17-18% Union	18-19% Union
Lateral Epicondyle	100	100	100	100	100
Medial Epicondyle	100	95.65	100	100	100
Head of Radius	100	100	100	100	100
Lower end of Ulna	25	56.52	75	100	100
Lower end of Radius	00	34.78	41.66	100	100
Iliac crestAppearanceFusion	0000	10000	10000	10000	10066.66
Ischial TuberosityAppearanceFusion	0000	5000	90.900	10000	10050
Head of Femur	00	100	100	100	100
GreaterTrochanter	00	100	100	100	100
Lesser Trochanter	00	66.66	72.72	90	100

Table No. 3. Progress of Union of Epiphyses in Males

Epiphyses	Age in years				
	15-16% Union	16-17% Union	17-18% union	18-19% Union	19-20% Union
Lateral Epicondyle	87.5	92.8	100	100	100
Medial Epicondyle	00	21.4	84.6	100	100
Head of Radius	62.5	50	92.3	100	100
Lower end of Ulna	00	00	38.5	85.7	100
Lower end of Radius	00	00	15.4	57.1	100
Iliac Crest Appearance Fusion	87.500	78.500	10015.4	10000	10000
Ischial Tuberosity Appearance Fusion	5000	28.500	76.220	10000	10000
Head of Femur	87.5	78.6	100	100	100
Greater Trochanter	37.5	14.3	84.6	83.3	100
Lesser Trochanter	12.5	14.3	61.5	83.3	100

Table No. 4. Showing Ages of Boys And Girls According To Different Workers¹

Workers	Subjects	Lateral epicondyle		Trochlea epiphysis		Conjoint epicondyle		Medical		Olecranon		Head of Radius		Distal end of radius		Distal end of ulna	
		F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
		Foreign															
Paterson	English	14-15	17-18	14-15	14-15	14-15	18	14	19-21	14	19	14	19	20	21	20	21
Sidhom and Derry	Egyptian	-	-	-	-	17	17	16-18	-	-	-	16	-	-	18-19	-	19-20
Hepworth	Punjabi	-	-	-	-	14	15	14.5	14.5	-	-	14	15	16	17	16	17
Pillai	Madrasi	14	14	-	-	14	14	17	17	16	16	17	17	18	18	18	18
Galstaun	Bengali	10-12	11-16	9-13	11-15	9-13	11-15	14	17	15	17	14	16	16-17	18	17	18
Lall and Nut	U.P	-	-	-	-	-	16-17	-	16-17	-	16	-	17	-	19	-	18-19
Basu and Basu	Bengali	12-13	-	12-13	-	12-13	-	14	-	13-14	-	13-14	-	16-17	-	16-17	-
Lomba		-	-	-	-	-	-	-	-	-	-	-	-	18-19	20-21	18-19	-
Franklin	Maharashtrian	13-14	-	13-14	-	13-14	-	14-15	-	13-14	-	13-14	-	14-15	-	17-18	-

Table No. 5. Average Age of Epiphyseal Union in Females and Males
(The figures below represent the average of 75% classes)

Epiphyses	Average age of union (in years)	
	Females	Males
Lateral Epicondyle	14-15	15-16
Medical Epicondyle	14-15	17-18
Head of radius	14-15	17-18
Lower end of Ulna	16-17	18-19
Lower end of radius	17-18	19-20
Iliac crest appearance fusion	15-16 8-19(in 66.66%)	15-16 -
Ischial tuberosity appearance fusion	16-17 18-19(in 50%)	17-18 -
Head of femur	15-16	15-16
Greater trochanter	15-16	17-18
Lesser trochanter	16-17	18-19

CONCLUSION

On the basis of the observations the following is the average age of union of epiphyses in years around the elbow, wrist and pelvis joints in either of the genders in Mewar region of Rajasthan.

	Female	Male
Lateral epicondyle of humerus (fusion)	14-15	15-16
Medial epicondyle of humerus (fusion)	14-15	17-18
Head of Radius (fusion)	14-15	17-18
Lower end of Ulna (fusion)	16-17	18-19
Lower end of radius (fusion)	17-18	19-20
Head of femur (fusion)	15-16	15-16
Greater trochanter (fusion)	15-16	17-18
Lesser trochanter (fusion)	16-17	18-19
Iliac-crest (appearance)	15-16	15-16
Ischial tuberosity (appearance)	16-17	17-18

Relation Of Epiphyseal Union To Other Factors

Racial differences

The epiphyseal union under study in India especially Bengalis, South Indians and Punjabis takes place considerably earlier than in other races. The epiphyseal union in subjects of Mewar region of Rajasthan occurs earlier than in English people. It also occurs either at the same age or little earlier than in other countries like Australia, Egypt and Burma.

Provincial Differences In India

In people of Mewar region of Rajasthan, epiphyseal union takes place almost at the same age in females and little later in males than observed by the different workers in Bengalis, Punjabis and Madrasis but earlier than UP. Further the figures of Kothari on the subjects of Mewar region of Rajasthan on the age of union are similar to the present study.³

Religion And Caste

No difference of any appreciable extent was seen in process of union of epiphyses.

SEX

The ages of union of epiphyses in females are found to be earlier by one year to two year on the whole. This is in accordance with the findings of other workers on the subject and is quite understandable taking into consideration the earlier onset of puberty in the females.

REFERENCES

1. Franklin, C.A(ed.).(1988); *Modi's Jurisprudence and Toxicology*, 23rd ed.; Tripathy Pvt. Ltd. Bombay; 37-51
2. Gupta S.M.D & Prasad V. (1974); A roentgenologic study of epiphyseal union around elbow wrist and knee joints and pelvis in boys and girls of U.P; *J. Indian M.Ass.* 62; 10-12.
3. Kothari D.R.(1974); Age of Epiphyseal union at elbow and wrist joint in Mewar region of Rajasthan; *J. Indian M.Ass.* 63; 252-256.
4. Loomba S.D. (1958); Age of Epiphyseal union at wrist joint in U.P; *J. Indian M. Ass*; 30; 380-395.
5. Polson C.J. & Goe D.J.: *The Essentials of Forensic medicine* " Pergamon press, Oxford, 3rd Ed. 55.
6. Saxena J.S & Vyas S.K (1969); Epiphyseal union at wrist, knee, and iliac crest in residents of Madhya Pradesh; *J. Indian M. Ass*; 53; 67-68.
7. Yadav S.D. and Suri P.R. , Age of fusion of Basisphenoid and Basisocciput in Males and Females of Uttar Pradesh ", *Journal of the Indian Academy of Forensic Science* , 10,11-13, 1971.

Radiological Study of Appearance and Fusion of Lesser and Greater Trochanter and Head of the Femur in Bikaner Region in 12-20 Years Age Group

Sharma Yogesh¹, Mathur Indubala², Bohra Bhavesh²

¹Asso. Professor & Head, ²Resident, Department of Forensic Medicine and Toxicology, S.P. Medical College, Bikaner, Rajasthan, India

ABSTRACT

Estimation of age of an individual is a necessity for the law enforcement agencies in both civil and criminal matters more so in country like ours, since illiteracy is a common feature findings. Various workers suggest that there is variation in age estimation, not only in country to country but also in different states of India. Survey Committee appointed by Central Government recommended for a Zone wise study⁷. Appearance and fusion of different ossification centres with their corresponding bones has been proved to be a very good and reliable tool for this purpose.

This study involves radiological examination of hip joint (AP view) of 165 individuals for the study of age related appearances and fusion of ossification centres of lesser and greater trochanter and the head of the femur in the age group of 12-20 years of both male and female in S.P. Medical College, Bikaner, Rajasthan.

Keywords: Age Estimation, Lesser Trochanter, Greater Trochanter, Head of the Femur

INTRODUCTION

Estimation of reasonably accurate age, plays a pivotal role in civil/criminal cases like personal identification, fixing of criminal responsibility, judicial punishment i.e. in cases of rape, kidnapping, criminal abortion, attempted or evident murder, theft, burglary, dacoity, offence of railway property, provision of motor vehicle Act, NDPS Act, custom and excise Act etc., and in various schemes of Social Welfare department i.e. Employment, attainment of majority, marriage contract etc. The age estimation is more often required in developing countries where birth records are not well maintained.

There are countable differences noticed in the appearance and fusion activities of ossification centres depending on race, geographic distribution and sex. The process of ossification may also be influenced by food habit, nutritional status, infectious diseases, hormonal and metabolic disorders, and physical activities. Ossification activities occur earlier in Indian

population than in western population. The activities are generally earlier in females than in males.

MATERIAL AND METHOD

This study is carried out in the Department of Forensic-Medicine and Toxicology of S.P. Medical College and Hospital, Bikaner. The subjects selected are residents of Bikaner region, of age group 12-20 years, both male and female belonging to different socio-economical status, religion and educational status.

Each person is x-rayed for pelvis AP view and subsequently the skiagrams are studied in detail in reference to various ossification centers, their appearance, process of fusion and post fusion scarring in upper part of femur on both side, namely for Lesser Trochanter, Greater Trochanter and Head of the Femur. The age at which 75% cases showing appearance of centre or complete union was accepted as average age for each event.

OBSERVATION**Table 1. Appearance and Fusion of the Centre of Lesser Trochanter**

S. No.	Age (yrs)	Male					Female				
		No. of Cases	Appearance		Fusion		No. of Cases	Appearance		Fusion	
			No.	%	No.	%		No.	%	No.	%
1	12-14	21	6	28.57	-	-	10	2	20	-	-
2	14-16	17	14	82.35	8	47.05	6	6	100	4	66.67
3	16-18	42	42	100	34	80.95	25	23	92	23	92
4	18-20	29	29	100	28	96.55	15	15	100	15	100

In this study, appearance of ossification centre of lesser trochanter in female was found in 20% of cases in 12-14 years, in 100% of cases in 14-16 years, in 92% of cases in 16-18 years, in 100% of cases in 18-20 years of age, and in male, it was found in 28.57% of cases in 12-14 years, in 82.35% of cases in 14-16 years, in 100% of cases in 16-18 years of age. Complete fusion of lesser trochanter in female was found in 66.67% of cases in

14-16 years, in 92% of cases in 16-18 years and in 100% of cases in 18-20 years age group and in male it was found in 47.05% of cases in 14-16 years, in 80.95% of cases in 16-18 years and in 96.55% of cases in 18-20 years age group. Average age of appearance of lesser trochanter in both male and female is 14-16 years, and age of fusion is 16-18 years found in present study.

Table 2. Fusion of the Centre of Greater Trochanter

S. No.	Age (yrs)	Male			Female		
		No. of Cases	Fusion		No. of Cases	Fusion	
			No.	%		No.	%
1	12-14	21	-	-	10	-	-
2	14-16	17	7	41	6	4	66.67
3	16-18	42	27	64	25	25	100
4	18-20	29	27	93	15	15	100

Complete fusion of greater trochanter in female was found in 66.67% of cases in 14-16 years, in 100% of cases in 16-18 years and in 100% of cases in 18-20 years age group and in male it was found in 41% of cases in

14-16 years, in 64% of cases in 16-18 years and in 93% of cases in 18-20 years age group. Average age of fusion of greater trochanter found in male is 18-20 years and in female it is 16-18 years in present study .

Table 3. Fusion of the Centre of Head of the Femur

S. No.	Age (yrs)	Male			Female		
		No. of Cases	Fusion		No. of Cases	Fusion	
			No.	%		No.	%
1	12-14	21	-	-	10	-	-
2	14-16	17	10	58.82	6	4	66.67
3	16-18	42	29	69.04	25	25	100
4	18-20	29	27	93.10	15	15	100

Complete fusion of the head of the femur in female was found in 66.67% of cases in 14-16 years, in 100% of cases in 16-18 years and in 100% of cases in 18-20 years age group and in male it was found in 58.82% of cases in 14-16 years, in 69.04% of cases in 16-18 years and in 93.10% of cases in 18-20 years age group. Average age of fusion of the head of the femur found in male is 18-20 years and in female it is 16-18 years in present study.

DISCUSSION**Appearance And Fusion Of The Centre Of Lesser Trochanter**

The findings in our study of appearance of ossification centre is not consistent with N.Reddy⁶, RK Sharma⁸ and VV Pillay⁴ those stated that it is 12-14 years of age.

The findings in our study of fusion is consistent with N.Reddy⁶ and Nagesh Kumar Rao⁵, RK Sharma⁸, VV Pillay⁴ and found it is 17-18 years of age.

The findings in our study of fusion is very much accordance with BD Chaurasia¹ who stated that it is 18 years of age.

The findings in our study of fusion is very much accordance with Mckern and Stewart (cited from Bernard Knight²) who found that it is 16-19 years of age.

The findings in our study of fusion is not consistent with Galstaun, who studied Bengali population (cited from JP Modi³) and found it is 15-17 years.

Fusion of the Centre of Greater Trochanter

The findings in our study of fusion is very much accordance with N.Reddy⁶ and Nagesh Kumar Rao⁵, RK Sharma⁸, VV Pillay⁴ those stated that it is 17-18 years of age.

The findings in our study of fusion is very much accordance with Mckern and Stewart (cited from Bernard Knight²) and found that it is 16-19 years of age.

The findings in our study of fusion is very much accordance with BD Chaurasia¹ and stated that it is 18 years of age.

The findings in our study of fusion is not consistent with Galstaun, who studied Bengali population (cited from JP Modi³) and found it is 17 years in male and 14 years in female.

Fusion of the Centre of Head of the Femur

The findings in our study of fusion is very much accordance with N.Reddy⁶, Nagesh Kumar Rao⁵, RK Sharma⁸ and VV Pillay⁴ those stated that it is 17-18 years of age.

The findings in our study of fusion is very much accordance with Mckern and Stewart (cited from Bernard Knight²) and found that it is 16-19 years of age.

The findings in our study of fusion is very much accordance with BD Chaurasia¹ and stated that it is 18 years of age.

The findings in our study of fusion is not consistent with Galstaun, who studied Bengali population (cited from JP Modi³) and found it is 16-19 years in male and 14-15 years in female.

CONCLUSION

According to present study the average age of appearance and fusion of lesser trochanter and fusion of greater trochanter and head of the femur in Bikaner region as follows:

S. No.	Ossification Centre / Epiphysis	Appearance / Fusion	Age(yrs)	
			Male	Female
1	Lesser Trochanter	Appearance	14-16	14-16
		Fusion	16-18	16-18
2	Greater Trochanter	Fusion	18-20	16-18
3	Head of The Femur	Fusion	18-20	16-18

REFERENCES

1. Chaurasia BD. Bones of the lower limb. Human Anatomy Vol 2. 3rd ed: CBS Publisher; 2005. 5-29.
2. Knight Bernard. The establishment of identity of human remains. Forensic Pathology. 1st ed: Edward arnold; 1991. 109-11.
3. Modi JP. Personal identity. Medical Jurisprudence and Toxicology. 22nd ed: Lexis Nexis Tripathi; 2007.
4. Pillay VV. Identification. Textbook of Forensic Medicine and Toxicology. 16th ed: Paras Medical Publisher; 2011. 67
5. Rao Nageshkumar. Forensic identity. Textbook of Forensic Medicine and Toxicology. 1st ed: Lordson Publishers; 2000. 84.
6. Reddy KS Narayan. Identification. The essentials of Forensic Medicine and Toxicology.
7. Saini OP. Fixation of age 16 years of age by radiological study of shoulder joint. *JIAFM* 2006; 28 (2) ISSN: 0971-0973: 60-62
8. Sharma RK. Identification. Concise Textbook of Forensic Medicine and Toxicology. 1st ed: Elsevier; 2005. 15

Pattern and Distribution of Cranio-cerebral Injuries in Fatal Road Traffic Accidents - A Cross Sectional Study

Chaitanya R¹, Sunil S Kadam², Viswanathan K G³

¹Associate Professor, Department of Forensic Medicine, Vijayanagar Institute of Medical Sciences, Bellary, Karnataka,

²Associate Professor, Department of Forensic Medicine, S S Institute of Medical Sciences and Research Centre Davangere, Karnataka, ³Professor and Head, Department of Forensic Medicine, J J M Medical College, Davangere, Karnataka

ABSTRACT

Background and objectives: The mortality and morbidity related with road traffic accidents(RTA's) are increasing at an alarming rate throughout the world as a result of rapid industrialization and increase of fast moving vehicles combined with lack of traffic sense among road users and India is no exception for this. Thereby RTA's itself pose as a major epidemiological and medicolegal problem. Of all the regional injuries, those of the head are most common and account for 60% of fatal RTA's.

Methodology: The present cross-sectional study was carried out on the victims of fatal RTA, to know the profile, sex and age wise distribution of victims, vehicles involved and pattern of cranio-cerebral injuries who were autopsied at Chigateri General Hospital Mortuary, Davangere, for a period of two years from 1st Aug 2006 to 31st July 2008.

Results: RTA fatalities constituted 22.2% of total unnatural deaths. Most of the victims were males (85.1%). Deaths were maximum in the age group of 21-40 years (52.27%). External injuries were predominantly found over the head (71.2%) and extremities (70.7%). Linear skull fracture (37.1%) was the commonest type located over the temporal bone (26.5%) and Sub dural hemorrhage SDH (39.1%) was the commonest intra cranial hemorrhage (ICH).

Conclusions: RTA's have become one of the major killers in recent times due to increase in the number of high speed vehicles along with congested roads, rash and negligent driving, violation of traffic rules, intoxicating influence of alcohol / drugs, inexperienced drivers and usage of mobile phones while driving. An attempt may be made to prevent these deaths by strict implementation of traffic rules, educating the public about road safety measures, usage of helmets, seat belts and airbag restraint system and by establishing trauma centers to treat the aggrieved swiftly and by referring them to nearest specialized centers without delay.

Keywords: Unnatural Deaths, Road Traffic Accidents, Cranio-cerebral Injuries, Safety Measures

INTRODUCTION

A WHO advisory group in 1956 defined accident as an "unpremeditated event resulting in recognizable damage" and represents a major epidemic of non-communicable disease in the present century. During 1990's traffic injuries ranked 9th among the leading

causes of deaths in the world and projected to become 2nd leading cause by the year 2020. Road traffic injuries alone are ranked as the primary cause of disease among children in the age group of 5-14 years and the third leading cause in the age of 15-29 years in year 2000.¹

According to an estimate, one RTA occurs every four minutes in India, claiming at least 25,000 lives every year. The 4B's-bad roads, badly maintained vehicles, bad driver, bad traffic sense along with drunken drivers are to be squarely blamed for accidents in India.²

There was a steady increase in RTA from 88,474 in 1997 to 98,038 in 2000. It comprised of 41% all unnatural

Corresponding author:

Chaitanya R

Associate Professor

Department of Forensic Medicine

Vijayanagar Institute of Medical Sciences,
Bellary, Karnataka

Mob : 09008735628

Email : chaitanyanaik06@gmail.com

deaths in 2000. Deaths from RTA's being highest in the city of Delhi (2499) followed by Mumbai (1405) and lowest in Hyderabad (445) and Calcutta (452). RTA not only affects the primary victims but also affects secondary victims in the form of family and relatives who suffer financially, psychologically and socially, though morbidity does not reckon with these social aspects of this problem.³

The injuries and disability resulting from RTA's put a significant drain on economy, consuming between 1-3% of country's gross national product per annum. Globally estimates suggest that the economic costs of road traffic injuries amount to 518 billion per annum. In developing countries, the cost is estimated to be 100 billion which is twice the annual amount of development assistance provided to developing countries. Recent estimates shows that RTA's amounts to at least 1-2% GDP loss to the nations around the world.⁴

With the above background, an effort has been made to study the various types of cranio-cerebral injuries, the age and the sex wise distribution, survival period, profile of victims and offending vehicles that occur in the RTA.

METHODOLOGY

A cross sectional study of "Pattern and distribution of Cranio-Cerebral injuries in fatal road traffic accidents" was undertaken at the mortuary of Chigateri General Hospital, Davangere during two year period from 1st August 2006 to 31st July 2008.

A detailed information of the deceased and circumstances leading to the death was gathered from all possible sources like police records, hospital records and from relatives. Cases were selected based on following criteria.

Inclusion criteria : All fatal RTA's occurring on the road between two or more variants, one of which had to be any kind of a moving vehicle were included.

Exclusion criteria: Any fatalities on the road without involvement of a moving vehicle (eg : A person slipping and falling on the road and persons getting injuries and dies while washing or loading a vehicle) were excluded.

All the victims of RTA autopsied at Chigateri General Hospital, Davangere were included in the study. The age and sex wise distribution of cases were analysed, victims were categorized into pedestrians,

motorcyclists and occupants of heavy motor vehicles and light motor vehicles. The offending vehicles were divided into HMV's, LMV's, motorcycles and others. Pattern and distribution of injuries over the head were studied in detail and cause of death noted in the proforma. The data collected was analysed statistically.

RESULTS

Out of 1782 cases of unnatural deaths autopsied, death due to RTA's were 396 (22.2%) accounting for the second most common cause of unnatural deaths. Among 396 cases of RTA's, 337 (85.1%) were males and 59 (14.9%) females indicating preponderance of males over females in the ratio 5.7 : 1. The maximum number of deaths occurred in the age group of 21-30 years i.e., 123 (31.1%), 84 (21.2%) in 31-40 years, of total cases.

Pedestrians 174(43.4%) formed the major part of victims followed by motorcyclists 126 (31.8%), occupants of LMV 72 (18.2%) and HMV 26 (6.6%) cases involved in RTA's. HMV's were the commonest offending vehicle in 237 (59.8%) of total cases, LMV 81 (20.5%) and motor cycles 22 (5.6%) cases. Others 56 (14.1%) cases include those vehicles which hit an immovable object like rock, wall, tree etc., hit and run cases, fall from moving vehicle and rollover crashes resulting in death of the victim.

The study shows that, 192 (48.5%) cases survived for more than 6 hours and 115 (29.1%) cases died within 6 hours and 89 (22.5%) died on the spot. Majority of the cases had injuries over the head region and extremities in 282 (71.2%) cases and 280 (70.7%) cases respectively. Superficial injuries to the head involved in 282 (71.2%) of total cases. The commonest injury was laceration 198 (50%), followed by abrasions 130 (32.8%) and contusions 79 (19.9%). In 114 (28.8%) cases no injuries were found over the head.

In among the internal injuries to the head, intracranial hemorrhages were commonly seen in 224 (56.5%) followed by skull fracture in 208(52.5%) of cases. Cerebral injuries in the form of contusions and lacerations were found in 201 (50.75%) and scalp haematoma in 88 (22.2%) of cases. In the fractures of the skull, most commonly involved was temporal bone in 105 (26.5%), parietal bone in 103 (26%), frontal bone in 67 (16.9%), occipital in 66 (16.7%) and basal bone in 58 (14.6%) of cases. No fractures were seen in 188 (47.5%) cases. Linear (fissure) fractures in 147 (37.1%) of cases was the commonest followed by basal fracture 76 (19.2%), comminuted fracture 49 (12.4%) and depressed skull fracture in 25 (6.3%) cases and least

being sutural fractures in 20 (5.1%) cases. In 188 (47.5%) of cases fracture of skull was not seen.

The commonest intracranial hemorrhage observed was SDH in 155 (39.1%) cases, SAH in 71 (17.9%), and EDH in 38 (9.6%). Intracerebral haemorrhage(ICrH) was observed in 20 (5.1%) of cases. In 172 (43.4%) cases, no intracranial haemorrhage was seen. Cerebral injuries in the form of contusions and lacerations were found in 201 (50.75%) cases and temporal and parietal lobes of brain were involved in 120 (30.3%) and 116 (29.2%) of cases respectively followed by frontal lobe 83 (21%) and occipital lobe 81 (20.4%). In 195 (49.2%) of cases cerebral injuries were not seen.

Out of 396 cases autopsied, skull fracture was associated with ICH in 157 (75%) of cases and is significant with the $p < 0.001$ (chi-square test = 63.8). 67 (36%) of cases had only ICH without skull fracture and 51 (25%) had only skull fracture without ICH. Both the skull fracture and ICH were not found in 121 (64%) of total cases. Injuries to the head in 208 (52.5%) cases contributed to the major cause of death among the victims.

DISCUSSION

The results of our study on the pattern and distribution of cranio cerebral injuries due to RTA were analyzed and compared with the previous studies in India and other countries. RTA constitutes a complex phenomenon of multiple causation. The rise in number of RTA's is due to urbanization and tremendous growth in road transport sector. Population explosion, congested roads, inadequate traffic planning, consumption of alcohol, drug abuse and disregard to traffic rules has contributed for increase in number of RTA's. In the present study, unnatural deaths due to RTA's were 396 (22.2%) which were similar with the study conducted by Kachre RV⁵, Singh H⁶, Singh YN⁷, Dhillon S⁸.

Our study showed, 337 victims were males and 59 females. Similar results were observed by Patel NS⁹, Sharma BR¹⁰, Biswas G¹¹, Kachre RV⁵, Singh H⁶, Chaudhary BL¹², Singh YN⁷, Gupta S¹³, Kochar S¹⁴, Khajuria B¹⁵. The predominance of males over females may be attributed to the male dominance in the society who work outside to earn their daily bread are more vulnerable, while females usually stay at home and look after the house hold work.

In the present study, maximum number of deaths occurred in the age group of 21-30 years followed by

31-40 years which is similar to that observed by Patel NS⁹, Chandra J¹⁶, Sharma BR¹⁰, Kachre RV⁵, Singh H⁶, Chaudhary BL¹², Singh YN⁷, Kochar S¹⁴, Dhillon S⁸.

The present study showed that, pedestrians (43.4%) were the most common victims, followed by motorcyclists (31.8%), occupants of LMV (18.2%) and HMV (6.6%) which is similar to that observed by Gissane W¹⁷, Tonge JI¹⁸, Chandra J¹⁶, Salgado MSL¹⁹, Ghosh PK²⁰, Sharma BR¹⁰, Biswas G¹¹, Singh YN⁷, Chavali KH²¹, Gupta S¹³. Pedestrians being the most common victims of RTA, reflects their carelessness, ignorance towards traffic rules and rash driving of heavy vehicles. Motorcycles being more economical and suitable to Indian roads are used maximum by middle class people. Whether hit by the moving vehicle or skidding or colliding against a stationary object, it is the motorcyclist who is in danger.

Our results were consistent with the studies done by Chandra J¹⁶, Ghosh PK²⁰, Sharma BR¹⁰, Biswas G¹¹, Kachre RV⁵, Chavali KH²¹ and Dhillon S⁸ where it was observed that HMV's (59.8%) were the commonest involved in RTA's followed by LMV (20.5%) and motorcycles (5.6%). And their involvement can be attributed to their tremendous increase in number, congested narrow roads and recklessness.

In our study we observed that the external injuries were present in 93.4% of total cases, among them head region was most commonly involved in 71.2% cases. Laceration (50%) was the commonest injury seen in the head region followed by abrasion (32.8%) and contusion (19.9%). Dhillon S⁸ showed scalp lacerations were seen in 24% and scalp abrasions seen in 8.8% cases which differs from our result.

Present study showed that the intracranial hemorrhages (56.5%) was the commonest injury followed by skull fractures (52.5%), cerebral injuries (50.7%) and scalp haematoma (22.2%) which is similar to the study conducted by Tonge JI¹⁸, Chandra J¹⁶, Toro K²², Dhillon S⁸. We also observed that the fracture of temporal bone (26.5%) was the commonest, followed by parietal bone (26%), frontal bone (16.9%), occipital bone (16.7%) and basal bone (14.6%). These results were similar to that of Chaudhary BL¹², Gupta S¹³ but differed with that of Chandra J¹⁶ where the fractures of occipital bone (33.2%) were commonest.

It was observed that, the linear fracture (37.1%) was the commonest type followed by basal fracture (19.2%), comminuted fracture (12.4%), depressed fracture (6.3%) and the sutural fracture (5.1%) being least

common variety. Similar results were seen by Chandra J¹⁶ and Gupta S¹³ where fissure fracture was the commonest followed by depressed and comminuted fracture.

In our study we observed that SDH seen in 39.1% cases was most common followed by SAH in 17.9% cases, EDH in 9.6% cases and ICrH in 5.1% of total cases. Similar results were observed by Chaudhary BL¹² but differed from the study done by Chandra J¹⁶ and Dhillon S⁸, where the SAH was the commonest ICH.

The cerebral injuries in the form of contusions and lacerations were more commonly seen in temporal lobe (30.3%), parietal lobe (29.2%), frontal lobe (21%) and occipital lobe (20.4%). In our study out of 396 cases, injuries to the head region 208 (52.5%) contributed to maximum number of fatalities which is similar to study conducted by Salgado MSL¹⁹. Majority of victims died of head injury followed by haemorrhagic shock and combination of head injury and haemorrhagic shock. Our findings were consistent with the study conducted by Chandra J¹⁶, Sharma BR¹⁰, Chaudhary BL¹² and Chavali KH.²¹

CONCLUSION

RTA's are the penalty paid by us for rapid transportation and have become the commonest cause of unnatural deaths. The rise in the number of fast moving vehicles, semi-skilled drivers, drunken drivers, congested and ill-maintained roads has led to the increase in the number of RTA's. If not prevent them, an effort may be made to decrease the incidence of RTA's by strict implementation of road safety measures and educating the public.

Majority of the victims were males, and more than 50% of the victims were between the age group of 21 to 40 years who are at the most active phase of life both physically and socially. The young college students with their fast lifestyle, craze for speed and disregard for traffic rules, have accentuated the mortality further. Involvement of pedestrians in large number reflects the poor management of roads and lack of knowledge regarding traffic rules among them.

Head injury comprised of the lion share in causing deaths due to RTA's, which is to be blamed for the region itself. The brain and its coverings are vulnerable to that degree of trauma as would rarely prove fatal, if applied to other parts of the body. Vulnerability to fatal injuries is much more with helmet less motorcyclists

than the helmeted ones. Most of the victims survived for more than 6 hours and these deaths can be prevented by establishing 'Trauma teams' to indicate rapid assessment and resuscitation of victims. Primary health centers need to be equipped with life supportive measures and proper transportation facility for referral of cases to the nearest specialized centers and thus decrease the mortality.

ACKNOWLEDGEMENT

The authors are thankful to the Principal, J J M Medical College for providing necessary facilities to carry out this work and also to all the departmental staff who helped during the study period.

Conflict of Interest: None

Source of Funding: Self funding

Ethical Clearance: Yes

REFERENCES

1. Park K. Accidents and Injuries. In : Text book of preventive and social medicine, 19th ed, Jabalpur, India, Banarsidas Bhanot Publishers 2007; 340-342.
2. Jirli PS, Shetty AK, Mestri SC. A rear footrest lay to rest an innocent – A road traffic accident case report. JFMT 2007 July-Dec;24(2):30-31.
3. Nath NC. Road traffic accident – The present scenario and how to prevent it. JIMA 2004 April;102(04):190.
4. Kiran ER, Saralaya KM. Road safety at cross roads. JIAFM 2004;26(4):147-152.
5. Kachre RV, Kachre VH, Asawa SS. Pattern of vehicular accidents in Pravara region : A rural region of Ahamadnagar District of Maharashtra. JFMT 2003 July-Dec;20(2):29-32.
6. Singh H, Dhatarwal SK. Pattern and distribution of injuries in fatal road traffic accidents in Rohtak (Haryana). JIAFM 2004;26(1):20-23.
7. Singh YN, Bairagi K, Das K. An epidemiological study of Road traffic accident victims in Medico-legal autopsies. JIAFM 2005;27(3):166-169.
8. Dhillon S, Kapila P, Sekhon HS. Pattern of injuries present in road traffic accident in shimla hills. J Punjab Acad Foren Med Toxicol, 2007;7(2):50-53.
9. Patel NS. Traffic fatalities in Lusaka, Zambia, Med Sci Law 1979;19(1):61-65.
10. Sharma BR, Harish D, Sharma V, Vij K. Road traffic accidents – a demographic and topographic analysis. Med Sci Law 2001;41(3):266-274.
11. Biswas G, Verma SK, Sharma JJ, Aggarwal NK.

- Pattern of road traffic accidents in North-East Delhi. *JFMT* 2003 Jan-June;20(1):27-32.
12. Chaudhary BL, Singh D, Tirpude BH, Sharma RK, Meel V. Profile of road traffic accident cases in Kasturba hospital of M.G.I.M.S., Sevagram, Wardha. *Medico Legal Update* 2005;5(4):1-10.
 13. Gupta S, Kumar P, Moitra R, Chhetri D. Demographic study of fatal craniocerebral road traffic injuries in North Bengal region. *JIAFM* 2007;29(1):25-27.
 14. Kochar S, Rastogi P. Mode of death shifting from coma to syncope sports utility vehicle (SUV) accidents. *JIAFM* 2007;29(3):13-17.
 15. Khajuria B, Sharma R, Verma A. A profile of the autopsies of road traffic accident victims in Jammu. *J Clin Diag Res*, 2008 Feb;2(1):639-642.
 16. Chandra J, Dogra TD, Dikshit PC. Pattern of cranio-intracranial injuries in fatal vehicular accidents in Delhi 1966-76. *Med Sci Law* 1979;19(3):186-194.
 17. Gissane W, Bull J. A study of 183 road deaths in and around Birmingham in 1960. *Br Med J* 1961 June;1:1716-20.
 18. Tonge JJ, O'Reilly MJ, Davidson A, Johnston NG, Wilkey IS. Traffic-crash fatalities (1968-73): Injury Patterns and other factors. *Med Sci Law* 1977;17(1):9-24.
 19. Solgado MSL, Colombage SM. Analysis of fatalities in road accidents. *FSI* 1988;36:91-96.
 20. Ghosh PK. Epidemiological study of the victims of vehicular accidents in Delhi. *JAMA* 1992 Dec;90(12):309-312.
 21. Chavali KH, Sharma BR, Harish D, Sharma A. Head Injury: The principal killer in road traffic accidents. *JIAFM* 2006;28(4):121-124.
 22. Toro K, Hubay M, Sotonyi P, Keller E. Fatal traffic injuries among pedestrians, Bicyclists and Motor Vehicle occupants. *FSI* 2005;151-156.

A Study of Bilateral Asymmetry of Tibia in Living

Dhurve Alka S¹, Dhurve Sharad A²

¹Assistant Professor, Department of Anatomy, Indira Gandhi Government Medical College, Nagpur, Maharashtra,

²Assistant Professor, Department of Medicine, NKPSIMSR, Nagpur, Maharashtra

ABSTRACT

There have been many studies of asymmetry both morphological and physiological. In the study of human bones, the result appears to be more definite and all of the reports seem to indicate at least a degree of predictable asymmetry. The objective of the study was to find out the bilateral asymmetry of lower limb by measuring the percutaneous length of tibia in living. The material consisted of 440 individual in which male and female constituted the equal number between the age group of 18 to 24 years. This group comprises the admixture of students admitted from all over the country. Measurements were taken at a fixed time to avoid diurnal variations. Length of both side of tibia was recorded with vernier caliper. The observed data was subjected to statistical analysis. The result obtained indicated the left tibia found to be longer than the right tibia when both sexes considered together. When considered the both sexes separately, left tibial length was more than right in male and right tibial length was more than left tibial length in female.

Keywords: *Bilateral asymmetry, Tibia*

INTRODUCTION

Bilateral asymmetry and its manifestation have long been interesting but baffling problem. Asymmetry of paired dimension has been recognized as a methodological problem in anthropometry and more recently as an indicator of environment stress. Schaeffer A. A. (1928)^[1] first upon opined and felt that the bilateral differences are too small to cause bilateralism of movements or its spiral movements. Prives M.G. (1960)^[2] observed that physical work favors growth in length. Certain occupations and sports tend to have an unequal development of extremities. In the present study sincere and humble attempt was made to rule out bilateral asymmetry of lower limb by measuring the percutaneous tibial length in living. Trotter and Glesser (1952)^[3] concluded that increase in stature after 18yrs is insignificant even though the mean value indicate a maximum attained at age 24 years, there is no statistical significant change

after age 18years. So the present study was done on person belonging to 18-25yrs age group.

MATERIAL AND METHOD

The project "A Study of Bilateral Asymmetry of Tibia in living" was carried out in Government Medical College, Nagpur, Maharashtra. The subjects taken for study were medical students of Govt. Medical College and Indira Gandhi Govt. Medical College, Nagpur. In them 220 students were male and 220 were female. This age group comprises the admixture of the students admitted from all over country i.e. 15% on all India basis and remaining 30% on state basis and 55% on Zonal level basis. The age group of 18- 24yrs was selected and lengths of right and left tibia were recorded. For measuring the length of tibia subject was asked to stand and keep his/her foot on a wooden stool to maintain the angle between flexor surface of leg and that of thigh at 90° and great toe was touching the vertical plate. Two points were marked with skin marking pencil (1) Upper point – The medial most superficial point on upper border of medial condyle, and (2) Lower point- Tip of medial malleolus. Distance between two points was measured with the help of spreading caliper. After collection of data, the measurements were subjected to statistical analysis which has given some important analysis.

Corresponding author:

Alka Sharad Dhurve

Department of Anatomy,
Indira Gandhi Government Medical College, Nagpur,
Maharashtra

Email- dr_dhurve2623@rediffmail.com

OBSERVATION

The statistical data was tabulated to show the different parameters at a glance.

Table No. 1. Showing the distribution of Tibial side according to the range of their length in male and female

Length of Tibia in cm	Male		Female	
	Right	Left	Right	Left
20 – 25	-	-	2	2
25 – 30	1	3	78	73
30 – 35	114	89	130	135
35 – 40	96	118	10	10
40 - 45	9	10	-	-
Total	220	220	220	2220

Table No. 2. Showing the Range, Mean, S.D. C.V. and SEM of length of tibia in male and female

Tibia	Male		Female	
	Right	Left	Right	Left
No. of sample	220	220	220	220
Range in cm.	26.1 to 43.5	24.5 to 37.9	26.6 to 43.8	24.5 to 38.9
Mean	34.92	30.71	35.32	30.67
S.D.	2.54	2.27	2.49	2.27
C.V.	0.0727	0.071	0.0704	0.074
S.E.M.	0.1211	0.1082	0.1187	0.1082

It was observed that in male the left tibia averages 0.4cm longer than the right tibia. In female right tibia on an average 0.04cm longer than the left tibia.

Table No. 3. Showing linear measurement of each pair of tibia in both sexes

Measurement	Right tibia	Left tibia
No. of sample	440	440
Range in cm	21.5 to 43.5	21.6 to 43.8
Mean	32.5	32.7
Standard deviation	3.20	3.02
Coefficient of variation	9.15%	9.02%
Standard error	0.1526	0.1440

In the combined study of both sexes the average tibial length was 32.5cm, the coefficient of variation was 9.15% and standard error was calculated to be 0.1526 for right tibia. On the left side the average tibial length was 32.7cm, coefficient of variation was 9.02% and standard error was 0.1440.

DISCUSSION

From the above observation it was seen that the left tibial length on an average 0.2cm longer than the right. Schultz (1937)^[4] and Dupertuis C. Wesley (1951)^[5]

mentioned that the right side average value was more than the left side. Whereas Trotter and Glesser (1952)^[3] and Lowrance E.W. and Latimer H.B.(1957)^[6] found that all of the bones of the lower extremity were longer and heavier than the right side. Regarding bilateral asymmetry our findings statistically correlated with Trotter and Glesser (1952)^[3] and Lowrance E.W. and Latimer H.B.(1957)^[6] and not match with the result of Schultz(1937)^[4] and Dupertuis C. Wesley(1951)^[5]. But these authors derived asymmetry from cadaveric bones and we were concerned with living subject. Mukta Rani, et al (2004)^[7] studied the bilateral comparison from percutaneous measurement of tibia and expressed that left tibia was longer than the right tibia in both sexes. The finding in the present study exactly coincide with the finding of Mukta Rani for male. But female they were not correlated.

RESULT

In the present study left tibia found to be longer than the right tibia when both sexes considered together. When considered the both sexes separately, left tibial length was more than right in male and right tibial length was more than left tibial length in female.

INFERENCE

Thus there exists left sided dominance in measurement of leg length, though statistically it was insignificant.

ACKNOWLEDGEMENT

Medico legal Update Journal invites article, case report, newspaper clippings, and report to update the knowledge of reader. The authors are thankful to Professor D.S. Pimpalkar, Government Medical College, Nagpur and Associate Professor J.V. Deshpande, Government Medical College, Nagpur for their guidance to carry out this work.

REFERENCES

1. Schaeffer A. A. (1928): Spiral movement in man. *J. Morph and Physiol.*, 45:293-298.
2. Prives M. G. (1960): Influence of labor and sport upon skeleton structure in man. *Anatomical Record*, 136 : 216.

3. Trotter Mildred and Glesser G. C. (1952): Estimation of stature from long of bones of American White and Negroes Am. J. Phys. Anthrop., vol.10: 436 -514.
4. Schultz A. H. (1937): Proportion and variability and asymmetry of the long bones of the limbs and the clavicles in man and apes. Human Biol., 9: 281-328.
5. Dupertuis Wesley C. S. : On the reconstruction of stature from long bones. Am. J. Phys. Anthrop., 9: 15-54.
6. Latimer H. B. and Lowrance E. W. (1965): Bilateral asymmetry in weight and in length of human bones. Anat. Record, 152: 217-224.
7. Mukta Rani., Tyagi A. K., Verma S. K., Kohli A. (2004):
8. Estimation of stature from percutaneous measurements of legs (1999 – 2000). Journal of Forensic Medicine and Toxicology, vol. 21 (1): 12 – 14.

Socio-demographic Profiles of Post Mortem Cases in a Sub-district, West Bengal, India

Dilip Kr Biswas¹, Achintya Biswas², Dulal K Das³, Rama Bhunia⁴, Dipankar Ghosh⁵

¹Dy. Chief Medical Officer of Health-II, Dist: Purba Medinipur, West Bengal, India, ²Medical Teacher (Trainee Reserve, MD Forensic Medicine), Burdwan Medical College & Hospital, Burdwan, West Bengal, India, ³Medical Officer (Medico-Legal), Police Case Hospital, Barrackpore, North 24 Parganas district, West Bengal, India, ⁴District Tuberculosis Officer, Hooghly district, West Bengal, India, ⁵Prof & Head of Department (FSM), Burdwan Medical College & Hospital, Burdwan, West Bengal, India

ABSTRACT

Background: There was limited information in postmortem data. We described distribution of unnatural deaths, to find out factors associated with these deaths and generated hypothesis regarding un-natural deaths in a sub-district, West Bengal, India.

Method: It was a cross sectional study of postmortem data performed at Police Case Hospital Barrackpore, district North 24 Parganas; West Bengal, India during January 2008 to October 2010. We collected data in a data collecting format from the inquest and autopsy surgeon's reports. We analyzed data in epi-info and excel soft were.

Results: Among the total 2581 un-natural deaths during the period of 33 months, the maximum numbers of unnatural deaths cases attended for post mortem were men 70% (1799). The highest death observed in 19 - 28 years 21% (550), followed by 29 - 38 years 20% (504). The sub-district catered 18 police station (PS) and maximum cases rushed for postmortem from Titagar PS 20% (515), followed by Jagaddal PS 15% (393). The majority of these deaths were Hindu 82.7% (2108) and Muslim 9% (231), and 48% (1245) of them were married, 24% (631) unmarried, 16% (407) unemployed and 19% (499) were housewife by profession.

Of total post mortem cases, highest numbers were suicidal death 45% (1159) followed by accidental 35% (908) and 6% (156) homicidal. Psychiatric illness and family conflict were related to suicidal deaths [OR 36, 95% CI 25-52 and OR 15, 95% CI 13-19].

Conclusion: Young men were main victim of unnatural deaths. Psychiatric problems were associated with suicidal death. We recommended social counseling and convergent activities with different sectors and further studies for prevention of unnatural deaths.

Keywords: Un-natural Death, Postmortem, Suicide, Psychiatric Illness, West Bengal, India

INTRODUCTION

Unnatural deaths includes suicidal, homicidal and accidental deaths for which medico-legal autopsy is required for ascertaining the cause of this deaths.¹ Globally, World Health Organization (WHO)

estimated that one million people committed suicide in the year 2000². 2.5 million People died due to accidents, burns, drowning, poisoning and disaster each year³. Worldwide, suicide was one of the leading causes of un-natural deaths, with a rate of suicide was 18/100000 population and 1.4% of all deaths were attributed due to suicide in the year 2005.^{2,4}

Corresponding author:

Dilip Kumar Biswas

Deputy Chief Medical Officer of Health- II
Office of the Chief Medical Officer of Health
Post: Tamruk, Dist: Purba Medinipur, Pin: 721636
West Bengal, India
Phone: +919433200804, Fax: 03228-266489
Email: dilipbiswas29@gmail.com

In India, the number of suicides were increased by 25% in the 1998 (in 1997, number of suicide was 96,000 and in 1998, the number was 1,04,000).⁵ The suicide rate in India was 11/100,000, and in West Bengal was 19/100,000 in the year 1998.⁵ Studies showed that different socio-cultural and environmental factors were

related to un-natural deaths in India.^{6,7,8} These deaths can be prevented by taking timely intervention measures. We conducted to study the post mortem (PM) data with the objectives to describe the distribution of PM cases in term of time, place and person, and socio-demographic status of unnatural deaths in a sub-district, West Bengal, India.

METHOD

The total population of the sub-district was 35, 56,045.⁹ Populations were mostly urban and were mixed ethnic.

Study design & source of data

It was a cross sectional study. We collected the post mortem data from the inquest reports and autopsy surgeon’s reports of cases attended for postmortem at the Police Case Hospital, Barrackpore; North 24 Parganas district, West Bengal, India between January 2008 and October 2010. We reviewed the inquest reports and post mortem reports of the cases rushed for post mortem in the police case hospital morgue. We included all cases for study of unnatural death cases attended for post mortem examination in the police morgue within the stipulated time.

Operational case definitions

Un-natural deaths: A death that is caused by external causes–injury or poisoning which includes death... due to intentional injury such as homicide or suicide, and death caused by unintentional injury in an accidental manner”.¹⁰

Suicide: Suicide is a process of purposeful ending of one’s own life.¹¹

Clothes used for suicide: The following clothing materials used for hanging such as Dhuti: It is made

of cotton with a length of 8-10 feet long and four feet width, usually adult male and widowers use as a garment.

Sari: It is also made of cotton, fine silk, etc with a length of 8-10 feet and width of 4 feet, usually use by the women as their garments.

Orna/dopatta: It is also made of clothes, silk length of 4-6 feet and width of 3-4 feet, generally use by the young, adult as well as older women as a garment.

DATA COLLECTION

We collected data from the inquest report made by police as well as post mortem reports prepared by the autopsy surgeon of the deceased in data collection format. We collected information of deceased like age, sex, religion, marital status, educational qualification, occupation, date of death, date of holding post mortem and some factors related to cause of death.

Analysis

We analyzed data by Excel & Epi-Info software (version 3.5.1, 2008).

RESULTS

A total 2584 cases were brought to police morgue for holding post mortem, out of them, 2581 postmortem were done, rest three cases referred to medical college police morgue for expert opinion.

Demographic profile

Among the total, the majority of unnatural deaths were men 70% (1799). The majority of them were young and active age group 19-38 year 41% (1054) and 39-58 years were 31% respectively (Table 1). Mean age for men was 40 years, and for women mean age was 37 years.

Table 1: Distribution of post mortem cases by age and sex, at Police Case hospital, Barrackpore, North 24 Parganas district, West Bengal, India

Age	Male	%	Female	%	Total	%
Age group	n=1799	70	n=782	30	n=2581	100
0 - 18	164	55	133	45	297	12
19 - 38	716	68	338	32	1054	41
39 - 58	625	80	161	20	786	30
> 59	291	66	147	34	438	17
Not known	3	50	3	50	6	0

Of the total, 82% (2107) of the post mortem cases were Hindu and 9% (231) were Muslim by religion.

Forty eight percent (1244) of them were married; among the men were maximum 67 % (831/1244).

Ninety two percent (2369) of cases their literacy level could not be ascertained. Among the total PM cases, 19% (497) were house wife, 16% (407) had no jobs, 10% (257) were businessmen. (Table 2)

Table 2: Socio-demographic status of post mortem cases at Police Case hospital, Barrackpore, North 24 Parganas district, West Bengal, India

Characteristics	Male	%	Female	%	Total(n=2581)	%
Religion						
Hindu	1455	69	652	31	2107	82
Muslim	160	69	71	31	231	9
Christian	7	87	1	13	8	0
Others	4	80	1	20	5	0
Not known	174	76	56	24	230	9
Marital status						
Married	831	67	413	33	1244	48
Unmarried	423	67	208	33	631	24
Widow	0	0	97	100	97	4
Divorce/separated	17	59	12	41	29	1
Not Known	528	91	52	9	580	22
Literacy level						
Illiterate	38	59	26	41	64	2
Primary	23	61	15	39	38	1
Secondary	18	39	28	61	46	2
Higher secondary	13	59	9	41	22	1
Graduate	23	70	10	30	33	1
Postgraduate	4	44	5	56	9	0
Not Known	1680	71	689	29	2369	92
Occupation						
Service	128	90	15	10	143	6
Unemployed	331	81	76	19	407	16
Student	52	47	59	53	111	4
Labour	276	93	20	7	296	11
Farmer	10	100	0	0	10	0
Housewife	0	0	497	100	497	19
Business	247	96	10	4	257	10
Not Known	755	88	105	12	860	33

Time and Place Distribution

Average 76 cases per month of unnatural deaths attended for post mortem at this police morgue and maximum cases reported in the month of April 11% (273), followed by May 10% (250) and September 10% (248). Cases were distributed according to police stations (PS). Maximum 20% (515) of unnatural death cases attended from the Titagar PS, followed by Jagadal PS 15% (393), Ghola PS 14% (358), Khardah PS 13% (328) (Figure 1). It is indicated that 78% (2015) of cases were rushed for PM from different hospitals and 22% (566) were other than hospital (dead body was found on the street, ponds, river or patient died on the way to hospital etc.).

Manner of Death

(a) Suicidal death: Suicidal death cases were attended for PM was 45% (1159). Suicidal deaths among the men were maximum 57% (662). Among the suicidal deaths 31% (793/1159) of the individual committed suicide by hanging. Clothes such as sari, orna, dhuti etc were used as a material for hanging 64% (509/793), followed by nylon rope 19% (153/793). Women used cloths maximum 79% (229/291) than men 55% (280/502) for hanging.

Nine percent (222/1159) of people consumed poison for committing suicide. Insecticidal substances were used 55% (121/222) of the cases

among the poisonous substances and followed by pesticides substances 13% (28/222).

Six percent (144/1159) of them committed suicide by burning, where 88% (127/144) were women and 12% (17/144) were men. (Table 3, 4)

Table 3: Nature of death of post mortem cases at Police Case hospital, Barrackpore, North 24 Parganas district, West Bengal, India

Manner of death	Male	%	Female	%	Total(n=2581)	%
Accidental	n=672	74	n=241	26	n=913	35
Road Traffic Accident	238	88	32	12	270	10
Train Accident	116	49	119	51	235	9
Drowning	219	77	66	23	285	11
Others accidents	99	80	24	20	123	5
Suicidal	n=662	57	n=497	43	n=1159	45
Hanging	508	64	285	36	793	31
Poisoning	137	62	85	38	222	9
Burning	17	12	127	88	144	6
Homicidal	n=118	76	n=37	24	n=155	6
Firm Arm injuries	44	94	3	6	47	2
Physical Assault	74	69	34	31	108	4
Natural death	252	77	23	328	13	
Not Known	18	69	8	31	26	1

Table 4: Materials used for hanging and poisoning of post mortem cases at Police Case hospital, Barrackpore, North 24 Parganas district, West Bengal, India

Events	Material used	Male	%	Female	%	Total(n=2581)	%
Hanging		n=502		n=291		n=793	
	Cloths	280	55	229	45	509	64
	Plastic/ nylon rope	132	86	21	14	153	19
	Others	41	61	26	39	67	8
	Jute rope	26	87	4	13	30	4
	Cotton rope	13	76	4	24	17	2
	Coconut rope	10	59	7	41	17	2
Poisoning		n=140		n=82		n=222	
	Insecticides	81	67	40	33	121	55
	Others	29	55	24	45	53	24
	Pesticides	13	46	15	54	28	13
	Gas/ asphyxiates	13	87	2	13	15	7
	Herbal	3	75	1	25	4	2
	Food poisoning	1	100	0	0	1	0

(b) **Accidental death:** A number of accidental deaths required postmortem, it was 35% (913). Among the accidental deaths, 10% (270) were road traffic accident, 9% (235) were train track accident and 11% (285) were drowning. Maximum numbers of accidental deaths were among men 74% (672/913) than women 26% (241/913). (Table 3)

(c) **Homicidal death:** Six percent (155) homicidal cases were reported. Among them, maximum homicidal deaths were due to physical assault and fire arms injury. (Table 3)

(d) **Natural death:** Thirteen percent (328) of cases, deaths were natural. Deaths were due to ageing process and some chronic disease conditions (Table 3).

Factors associated with the cause of deaths

A large number of cases were documented as a psychiatric illness [23% (605)] and men suffered more than the women [63% (384)]. 18% (461) deaths were caused by chronic illness (tuberculosis, cancer, leprosy, chronic lung diseases etc).

Psychiatric illness and family problems were associated with the suicidal death, odd ratio are (OR 35.64 95% CI 25.03 – 52.82 and OR 15.2 95% CI 12.50 – 18.54) respectively.

DISCUSSION

Young and active age groups were the main victim of unnatural deaths. Suicidal deaths especially among the men were predominant. Maximum cases were from the Titagar PS followed by Jagadal PS. Psychiatric illness and conflicts in the family were associated with suicidal death. Women committed suicide by burning and they were married and house wife. RTA accidents were maximum among the men.

Hanging was the most common method to commit suicide in the study. Similar findings reported in a study in the neighbor country Bangladesh.¹² Materials used for suicide were clothes for hanging such as shari, orna (dopatta), dhuti which are easily available. It was also observed that insecticidal substances used maximally as a substance for suicide in case of poisoning. It was two times more in men than women. But women committed suicide by burning was more than men.

Mental illness, marital disharmony, conflict in family, chronic illness, rivalry, conflications were observed as causes behind un-natural deaths. Married people, as well as married women showed maximum unnatural deaths. People moved outside for work and unfortunately, this young and active age group faced accidental death which had a large number in this study, and it was road traffic accident, railway tract accident and drowning who ended lives. Women had been killed in large number by physical assault than men, but fire arm injuries were more among men.

In this study, suicidal deaths were the commonest deaths among the total un-natural deaths. This finding was similar with other study done in Chandigarh in the Northwest India.¹³ Suicidal deaths are related with the psychiatric illness such as depression. Similar finding was seen in study in USA.¹⁴ Effective treatment of depressive disorder will cure 60-80% of illness, which will reduce suicidal deaths also. Suicidal deaths accounted in West Bengal among the total unnatural death are 12% during the year 2007, a study in rural Tamil Nadu, where suicidal death was 9%.¹⁵ But in this study, suicidal deaths were 45%. Hanging was the common mode of committing suicide (68%), which

was higher than the national average [(48.4%, National Crime Bureau (India)].¹⁶ Cotton and cotton products (Dhuti, Dopatta, Sari etc) were easily available materials used for hanging. Women used fire (burning) method more than the men to commit suicide but poisoning and hanging was being used maximum by men. Psychiatric illness was the major contributor of suicide which could be reducing by timely and properly treatment and counseling. But conflict in the family, marital disharmony and failure in result were some reason of unnatural deaths and were higher in women than men. Due to repeated physical and mental torture they lose their level of control and commit suicide by easily accessible methods. Similar finding was seen in other study at Ludhiana in the Panjab province.¹⁷

Men were the maximum victim of accident because they have to move more in the street than women because of their livelihood. A study in the tertiary care hospital, Kolkata revealed that accidental death was maximum in comparison to suicidal and other death, and men were chief victim of accident.¹⁸

Suicidal deaths need to be addressed by social security, education, psychiatric counseling and employment. Proper mental counseling, special focus on female and young require careful attention by early detection of psychiatric illnesses at peripheral health care facilities. Accidental death especially road traffic and train track injuries need to be prevented as they are responsible for most of the death in case of young and active group which directly influencing social and economic development of the country.

Traffic rules to be introduced in the school curriculum. Proper implementation of traffic acts will be reduced the accidental death. Unnatural deaths especially suicidal death and accidental death are increasing gradually. An integrated community based mental health program may reduce the unnatural deaths. From these findings further study could be conducted to minimize the unnatural deaths.

ACKNOWLEDGEMENT

The authors would like to acknowledge Dr Sukanta Sil, Chief Medical Officer of Health, North 24 Parganas district, West Bengal, India, Health personnel of Police case hospital, Barrackpore, Dr Prabhdeep Kaur, Scientist- C, National Institute of Epidemiology, Chennai, India for their kind co-operation and help.

Conflict of Interest: There is no conflict of interest.

Source of Funding: None

Ethical Committee Permission: Not required

REFERENCES

1. Lindqvist P, Gustafsson L. Suicide, Classification-Clues and their use, A Study of 122 Cases of Suicide and Undetermined Manner of Death. *Forensic Science International* 128 (2002), 136-4. Available at www.elsevier.com/locate/forensic
2. WHO. Mental and Behavior Disorders, Department of Mental Health, World Health Organization. Geneva; 2000. Available at www.who.org/WHO/MNH/MBD/00.1
3. Essam M. Ali, Amal A. Embakry, Mahamad A. Ali. A study of early unnatural death in medicolegal autopsies at Dhakalia locality. Mansoura J. *Forensic Med. Clin. Toxicol.* Vol. XV, No. 1, Jan. 2007
4. Louise B Andrew. Depression and Suicide. Updated: Oct 21, 2010. Available at <http://emedicine.medscape.com>.
5. World Health Organization. Fact and Figure, Suicide Prevention: Emerging from Darkness. SEARO: <http://search.who.int/>
6. Latha KS, Bhat SM, D'Souza P. Suicide attempters in a general hospital unit in India: Their socio-demographic and clinical profile—emphasis on cross-cultural aspects. *Acta Psychiatr Scand* 1996; 94:26-4.
7. Kumar SPN. Age and gender related analysis of psychosocial factors in attempted suicide. *Indian J Psychiatry* 1998;40:338-7.
8. Nandi DN, Banerjee G, Boral GC. Suicide in West Bengal: A century apart. *Indian J Psychiatry* 1978; 20:155-5
9. Census of India 2001. available at www.censusindia.gov.in
10. McGraw-Hill Concise Dictionary of Modern Medicine. © 2002 by The McGraw Hill Companies, Inc. Available at <http://medicaldictionary.thefreedictionary.com/Unnatural+Death>
11. Roxanne Dryden-Edwards. Available at www.medicinenet.com/suicide/article.htm
12. Ahmad M, Hossain M Z. Hanging as a method of suicide retrospective analysis of postmortem cases. *JAFMC Bangladesh.* Vol 6, No 2 (December) 2010.
13. Singh D, Dewan I, Pandey AN, Tyagi I. Spectrum of Unnatural Fatalities in Chandigarh Zone of Northwest India- a 25 year autopsy study from a tertiary care hospital. medint@pgi.chd.nic.in
14. American Association of Suicidology, 5221 Wisconsin Avenue, Washington, D.C. 20015, (202) 237. 2280, (202) 237.2282 (Fax). Available at www.suicidology.org
15. Gajalakshmi V, Petro R. Suicide rate in rural Tamil Nadu, South India: verbal autopsy of 39000 deaths, 1997-98. *Int J Epidemiol* 2007; 36: 203-7.
16. National Crime Bureau, Ministry of Home Affairs, Accidental Death and Suicide in India. New Delhi: Government of India, 2007.
17. Narang RL, Mishra BP, Nitesh M. 2000 Attempted suicide in Ludhiana. *Ind J Psychiatry* 2000; 42(1): 83-84.
18. Srivastava P, Som D, Nandy S, Saha I, Pal PB, Roy TG et al. Profile of Postmortem cases conducted at a morgue of a tertiary hospital in Kolkata. *J Indian Med Assoc* 2010; 108: 730-733

Profile of Traumatic Brain Stem Injury: An Autopsy Study of 41 Cases

Hemalatha N¹, Gambhir Singh O², Vallinayagam R³

¹Assistant Professor, Forensic Medicine, ²Associate Professor, Forensic Medicine, S.R.M. Medical College, Kattankulathur, Tamil Nadu, ³Professor, Department of Forensic Medicine, Govt. Mohan Kumaramangalam Medical College, Salem, Tamil Nadu

ABSTRACT

It is a prospective study of 41 cases of traumatic brain stem injury cases whose medico legal autopsy was done in the Institute of Forensic Medicine, at the Madras Medical College and Government General Hospital, Chennai from December 2007 to June 2008. In the 41 cases, 16 cases, (39.02%) were primary brain stem injury and 25 cases, (60.98) were secondary brain stem injury. The mean ages of cases with primary and secondary brainstem injuries were respectively 55.7 and 36.2. Male victims outnumbered the female victims with male female sex ratio of 13:1. Road traffic accidents involving mainly pedestrians and two wheelers were the most common cause for traumatic brain injury.

Keywords: Brain stem, Traumatic brain stem injury, Primary brain stem injury, Secondary brain stem injury, Road Traffic Accident

INTRODUCTION

Brain stem, a small part of the Brain which constitutes portions of mid brain and hind brain, is well protected in terms of rest of Brain¹. However, it is subjected to a disproportionate degree of trauma compared to other areas of brain and injury to the brainstem carries a poor prognosis both as regard to the life and neurological recovery and also the financial constraints.^{2,3,4,5} With increasing severity of head injuries especially due to road traffic accidents the incidence of brainstem injury is also increasing.^{6,7} The aim of the present study is not only to examine the patterns of traumatic brain stem injury (TBSI) case but also to compare them with the findings of other workers.

MATERIAL AND METHOD

The present study was conducted in the Institute of Forensic Medicine, at the Madras Medical College

Corresponding author:

Hemalatha

Assistant Professor

S.R.M. Medical College, Kattankulathur, Tamil Nadu

Mobile No. : +91 90035 02802

E-mail ID: drfm_mmc@yahoo.co.in

and Government General Hospital, Chennai from December 2007 to June 2008

During the present study period there were fifty Medico legal cases of fatal Head injury that died in the hospital. Out of these fifty cases brain stem injury was found in 41 cases, the remaining 9 cases were excluded from the present study. Detailed information such as post mortem number, name, age, sex, date and time of injury, mode of injury, site of impact and other relevant data were noted. Other relevant information was also collected from the hospital records, police papers and relatives. These data were tabulated for easy study and comparison with previous available studies.

OBSERVATION

Out of the 50 cases of fatal head injury there were 41 cases of traumatic brain stem injury (TBSI). In the 41 cases 16 cases (39.02%) were primary brainstem injury and 25 cases (60.98%) were secondary brainstem injury. The Table No.1 shows the distribution of cases according to age of the victim.

Table No.1: Cases Distribution According to Age Group

Age in Years	Primary Brain Stem Injury	Secondary Brain Stem Injury
0-10	-	01
11-20	-	05
21-30	-	04
31-40	03	04
41-50	05	05
51-60	04	04
61-70	01	02
71-80	01	-
Above 80	02	-
Total	16	25

Majority of the victims were males 38 cases, (92.68%). Only 3 female patients had TBSI (Table NO.2).

Table No. 2: Cases Distribution According to Sex

Sex	No. of Cases	%
Male	38	92.68
Female	03	07.32
Total	41	100

Road traffic accident (RTA) was responsible for 35 cases of TBSI. In one case it was due to assault (as shown in Table No.3).

Table No.3: Cases Distribution According to Mode of Injury

Mode of Injury	Primary Brain Stem Injury	Secondary Brain Stem Injury	Total
RTA	14	21	35
Fall from height	02	03	05
Assault	-	01	01
Total	16	25	41

Brain stem hematoma was seen in 19 cases. Bleeding was commonly seen in Pons, 12 cases. (Table No.4).

Table No. 4: Cases Distribution According To Brain Stem Hematoma

Site	Primary Brain Stem Injury	Secondary Brain Stem Injury
Midbrain	02	02
Pons	05	07
Medulla	01	02
Total	08	11

TBSI was more common with side to side force, 30 cases. It was least common with force on vertex, seen in 1 case (as shown in Table No.5).

Table No. 5: Cases Distribution According to Direction of Impact

Direction of Impact	No. of Cases	%
Antero posterior	10	24%
Lateral	30	73%
Vertex	01	2%
Total	41	100

Out of 41 cases we observe skull bone fracture in 26 cases. Only in one case there was fracture of occipital bone (Table No. 6).

Table No. 6: Cases Distribution According To Skull Bone Fracture

Brain Stem Injury	Base	Frontal	Parietal	Temporal	Occipital	Total
Primary Brain Stem Injury	04	02	01	03	01	11
Secondary Brain Stem Injury	01	01	06	07	-	15
Total	05	03	07	10	01	26

DISCUSSION

Majority of the victims were middle aged people, the mean age of patients with primary and secondary brainstem injuries were respectively 55.7 and 36.2. Male victims predominated over female victims. Similar age and sex pattern was also reported by Rongchao S et al⁸ and Patil A M and Walter F V⁹. However, Shukla D et al¹⁰ reported that young adults to be the common victims and there was no gross difference between the mean age of primary (31.1%) and secondary (37%) brainstem injury.

Road traffic accident was the prime cause for fatal head injury but unlike the western countries where the majority of the victims are car occupants; in the present study majority of the victims were pedestrians and two wheeler users. In the present study 87.5% of primary brainstem injury and 84% of secondary brainstem injury were due to RTA. In this respect our findings are consistent with those reported by Tyagi A K et al¹¹, Patil A M and Walter F V⁹, Chandra J et al¹² and Shukla D et al¹⁰.

Among the patients who had brainstem injuries 10 had impact in the anteroposterior direction and 30 patients had impact on lateral aspect. One patient had impact on vertex. In those patients who had impact in the anteroposterior direction 4 patients had primary brainstem injury and 6 patients had secondary brainstem injury.

Of the 30 cases that had impact on lateral aspect 11 had primary brainstem injury and 19 had secondary brainstem injury. The patient who had impact on vertex had primary brainstem injury. Brainstem injuries were often associated with lateral impact in this study.

Totally 26 cases of TBSI were associated with skull fractures. Among these 26 cases, 11 were primary brainstem injury and 15 were secondary brainstem injury. In these 11 cases of primary brainstem injury that had skull fractures, 4 cases had skull base fracture, 2 cases had frontal bone fracture, 3 cases had temporal bone fracture, one patient had parietal bone fracture and one patient had occipital bone fracture. In those 15 cases of secondary brainstem injury, 6 cases had parietal bone fracture, 7 cases had temporal bone fracture, one patient had skull base fracture and one patient had frontal bone fracture. Skull base fracture was seen more with primary brainstem injury and lateral skull fractures were seen more with secondary brainstem injury in this study.

Haemorrhagic contusions were seen in midbrain in 6 cases, pons in 12 cases and medulla in one case. Common involvement of pons and medulla was also observed by Ohshima et al¹³. However, Meyer CA et al¹⁴ reported midbrain as the most common site for bleeding.

ACKNOWLEDGEMENT

I most humbly express my sincere thanks and gratitude to the then Professor Dr.R.Vallinayagam M.D., Director and Professor, Institute of Forensic Medicine, Madras Medical College, Chennai-03 for helping me throughout this study. I am also thankful to all teaching and nonteaching staffs especially the morticians of the Institute for their tremendous support.

REFERENCES

1. Carpenter's Human Neuroanatomy, Williams & Wilkins, 9th Ed. 1996. 45-50.
2. Firshcing R, Woischneck D, et al., Brain stem lesions after head injury, Neurological Research, Vol.24 (2), March 2002. 145 – 146.

3. Pekka Saukko, Bernard Knight, Cerebral Injuries, Knight's Forensic Pathology, 207-214.
4. Rajkamal, Biomechanics of Head injury, A text book of head injury, A.K.Mahapatra and Rajkamal, 2nd Edition, 2001. 13 - 16.
5. Spitz Fischer's Medico legal investigation of Death, 4th Edition. 1021-1048.
6. Kalyanaraman S, Ramamurthi B. Analysis of 2000 cases of head injury, Neurology India,1970.18:3.
7. Mitchell DE, Adam JH. Primary focal damage to the brainstem in blunt head injuries does it exist? Lancet 1973,2. 215-18.
8. Rongchao, S., Shudong, Y., Zhiyi, Z.: Pathological and immune histochemical study of lethal primary brain stem injuries. Diagn Pathol. 2012 May 21;7:54.
9. Patil, A.M., Walter, F.V.: Pattern of Fatal Blunt Head Injury: A Two Year Retrospective / Prospective Medico Legal Autopsy Study, J Indian Acad Forensic Med, 32(2)
10. Shukla, D., Mahadevan, A., Sastry, K.V., and Shankar, S.K. : Pathology of post traumatic brainstem and hypothalamic injuries. Clin Neuropathol. 2007 Sep-Oct;26 (5):197-209.
11. Tyagi, A. K., Sharma, G. K. and Bishnu, K.: Cranio cerebral damage by blunt force impact; J Indian Academy of Forensic medicine, 1986, Vol.1, 24-39.
12. Chandra, J., Dogra, T. D. And Dikshit, P. C. : Patterns of cranio- intracranial injuries in fatal vehicular accidents in Delhi, (1966-1976), Medicine Science Law, 1979. 19:3. 186-194.
13. Ohshima, T. and Kondo, T. : Forensic pathological observations on fatal injuries to the brain stem and/or upper cervical spinal cord in traffic accidents. J Clin Forensic Med 1998; 5(3):129-34.
14. Meyer, C.A, Mirvis, S.E, Wolf, A.L, Thompson, R.K, and Gutierrez, M.A.: Acute traumatic midbrain hemorrhage: experimental and clinical observations with CT. Radiology. 1991; 179: 813-818.

Medico Legal Aspects of Prescription Writing- A Cross Sectional Study

K Srinivasulu

Associate Professor, Department of Forensic Medicine, Medciti Institute of Medical Sciences, Ghanpur, Medchal, RR, Andhra Pradesh

ABSTRACT

Prescription is one of the important Medico legal documents, the art of prescription writing has an ancient inheritance, commonly the prescription considered as a written order by the physician to the pharmacist to prepare and dispense the drugs. The term prescription means an order to take certain medications. Prescriptions have legal implications, prescriber is responsible for clinical care of the patient.

Doctors are facing charges of medical negligence due to wrong prescriptions and illegible prescriptions, the number of cases filed in the courts are increasing day by day since from the inception of Consumer protection act in medical practise.

A cross sectional study was done with an objective to appraise the importance and various medico legal aspects in prescription writing. The study was conducted at Ranga reddy Dist area in duration of one year, prescriptions were collected randomly from the patients and analysed for errors and deficiencies, in my study I observed too many lacunas in the prescriptions which can lead to medico legal problems.

Keywords: *Prescription Writing, Medico Legal Aspects*

INTRODUCTION

The prescription is one of the most important therapeutic transactions between a physician and a patient. Commonly the term prescription means an order to take certain medications. In ancient days a universal standard language Latin was used, present days for better understanding prescriptions are written in English language and metric system is used to write the dose of the drug.

The medical practise has become more complex as a result the definition of prescription has broadened

and includes not only prescribing medications but also clinical assessment and diagnostic information.

The main Aim of this study is to create awareness in medical practitioners about various legal aspects arising in prescription writing, Most of the doctors learn the art of prescription writing from their seniors. Doctors are facing medico legal problems due to improper documentation. In this study Prescriptions are analysed for errors, and explained how they may lead to medico legal problems.

REVIEW OF LITERATURE

A prescription traditionally composed of four parts, Superscription, Inscription, Subscription, Signature and refills.

Superscription: The superscription contains the date of the prescription, Patient information such as Name, age, sex, Weight, address and contact number. Prescriber Name, Qualification, registration number, address and contact number. In modern prescription

Corresponding author:

K Srinivasulu

Associate Professor

H.NO: 8-7-69/P1/60, IndraPrastha Colony,

Hasthinapuram Central

Hyderabad-50079

Mobile no: 09030715569

Email: drksrinu1968@gmail.com

in addition to the above details prescriber is supposed to write additional information such as patient's complaints, examination findings, provisional diagnosis or final diagnosis and any investigations suggested.

Symbol Rx is derived from the major lines in the symbol of the eye of Horus. Horus was an Egyptian God, A God of sky, A God of Light and A God of Goodness. It is also considered as the sign of the planet Jupiter, another theory Rx is an abbreviation for the Latin word "recipere" which means take or take thus.

Inscription: The body of the prescription containing the name of the drug, the strength of the drug and schedule, the drug name to be written in capital letters only, it is advisable to write the drug generic name, do not use any abbreviations in the prescription.

Subscription: Directions to the pharmacist for preparation of the drug and its strength. In modern Prescription the subscription part is not much important as the drugs are manufacturing by Pharmaceutical companies as per the standards and required strength under the directions of Drug control authorities,

Signatura: From Latin word "signa" meaning "Write" or "Label". This section contains the directions to the patient these should be always written in English. Physician better avoid any abbreviations.

Refills; The Physician should specify the number of refills he wishes the patient to have.

Who can write Prescription: A registered Medical practitioner is authorized to issue prescription. Prescriptions do not order by telephone, there are possibilities of wrong prescription, which can lead to dangerous consequences.

LEGIBILITY

Prescription when hand written are notorious for being often illegible, there is every possibility that a wrong drug may be issued by the pharmacist due to illegible prescription. A physician is supposed to write

a prescription in capital letters. He can also issue a computerized prescription.

The German news magazine DER SPIEGEL reports that about 7000 people die unnecessarily annually in the USA because pharmacists cannot read the illegible handwriting on doctor's prescriptions.

ABBREVIATIONS

An abbreviation carries an increased risk of confusion and misrepresentation and should be used cautiously, as far as possible avoid using abbreviations.

Conventions for avoiding ambiguity: Careful use of decimal points and Units to avoid ambiguity:

1. Avoid unnecessary decimal points: A prescription can be written as 4 ml instead as 4.0ml, avoid possible misinterpretation of 4.0 as 40ml.
2. Always use zero prefix for decimal. Eg: 0.4 instead of .4 to avoid misinterpretation as 4.
3. Avoid decimals altogether by changing the unit. Eg; 0.5gr is less easily confused when written as 500 mg.
4. ml is used instead of cc to avoid misinterpretation of c as o. Further cc can be misinterpreted as "cum cibum" a latin word meaning take with meal.
5. Insulin injection, dose is mentioned in Units, majority of nurses and jr doctors confused units as ml, resulting in several fatal incidents in hospitals.
6. Avoid using units such as teaspoon or table spoon.
7. Avoid using symbols of measure. Eg: Pint (0), drams (3), grains(g), they are most commonly misinterpreted.

Directions to the Patient: Directions to the patient must be written clearly, never use abbreviations.

Most Commonly used abbreviations in Medical Practice.

IM: in the muscle.	pc: take after meal.	po: orally.
IV: intravenous.	pr: suppository.	bid: take twice a day.
sc:sub cutaneous.	sl: under the tongue.	tid: take thrice a day
qid: take 4 times a day.	od: once in day.	sos whenever necessary.
qhs: take at bed time.	qqh: every four hours.	stat: Immediately.

Legal aspects: (courts judgements)

Case -1 (MLCD journal, July 2010)

Case of Medical negligence of Dr Aravind Shah v/s Kamalaben Ramsingh Kushwala, the Mumbai High Court given judgment in favour of the patient.

The court held the doctor negligent on two counts:

1. Failure to record even a provisional diagnosis of the patient ailment before prescribing treatment, this amounted to absence of proper disclosures and hence absence of consent as the patient was not even informed about ailment before starting treatment.
2. No proper prescription was written for the patient's treatment.

Hence the court awarded punishment against the doctor with a compensation of Rs 2.5 lakh. The doctor was held negligent.

Case-2 (Information from MLCD journal) Euglucon case tragedy.

Findings of the court

The court relying on medical literature produced by the patient concluded that Euglucon a specific anti diabetic drug is required to be administered only after testing blood sugar levels. The dosage needs to be adjusted periodically depending on the blood sugar levels and it is required to be administered immediately after intake of food. Literature further shows that intolerance of alcohol may occur in patient treated with such drugs and therefore the patient must be strictly advised to avoid alcohol while taking this drug. The general physician himself admitted in his cross examination that he was aware that the patient was an alcoholic.

The court found that none of these precautions were advised to the patient in his prescription and hence the general practitioner was held negligent.

Case-3 Family compensated for death after illegible prescription

A Texas jury has attributed the death of a 42 year old patient to an illegible prescription and has ordered the doctor who wrote it to pay \$225000, compensation to the patient's family. The total judgment of \$450000 included an equal award against the dispensing pharmacist.

The doctor, cardiologist wrote a prescription for 20 mg Isordil (isosorbide dinitrate) for angina, every six hours. But, because of the illegibility of the prescription, the pharmacist dispensed the same dosage of Plendil (felodipine), a calcium channel blocker used in the treatment of hypertension.

MATERIALS AND METHOD

About 200 prescriptions were collected randomly from the patients of different doctors from different hospitals and clinics, after obtaining consent. Hospital name, Patients names and the doctor's names were kept anonymous

The contents of the prescription are divided into the following headings and analysed for any errors.

Superscription

1. Name, Age, Sex of the patient
2. Weight of the patient especially in paediatric and elderly age group.
3. Name of the Doctor.
4. Registration Number.
5. Contact address and Phone number.
6. Symbol Rx used or not.
7. Patient complaints mentioned or not.
8. Examination findings mentioned or not.
9. Provisional or Final diagnosis mentioned or not.
10. Any relevant investigations recommended or not.

Inscription

1. Drug name whether the brand or Generic Name.
2. Dose of the drug mentioned correctly or not.
3. Prescribed drugs are Legible or not.
4. Any decimals or abbreviations are used.

Subscription: Any directions to the pharmacist.

Signature or Refills

1. Directions to the Patient mentioned or not,
2. Possible drug intolerance or dangers.
3. Number of refills.

4. Signature of the Medical practitioner.

Prescriptions are also verified regarding provisional diagnosis and treatment given is relevant or not. Suggested Investigations are relevant or not.

Observation and Discussion

The study conducted In Hyderabad and RR Dist area for a period of 1 year from 1stDec 2011 to 30th Nov 2012. 200 prescriptions were collected randomly from the patients and analysed for errors. In my study I observed that none of the practitioners is giving computerised prescription, nobody is maintaining the patient information, Medical records for OP patients are almost nil,

The following observations were made, when the prescriptions are analysed as per the standards of existing rules and regulations.

1. Age of the patient not mentioned in 50 percent of the prescriptions, age is very important for prescribing the drugs, some drugs cannot be given to particular age group, age also important for calculating the dose of the drug.
2. 70 percent of the practitioners did not write the weight of the patient, majority of the drugs dose is calculated on the basis of weight of the patient,
3. None of the prescriptions mentioned the address of the patient or contact number of the patient,
4. In 80 percent of the prescriptions the doctor registration number is not mentioned,
5. Symbol Rx is used before prescribing the drugs, it is a symbol meaning "take thus" practised since ancient days. In my study I observed 30 percent of the doctors did not use the symbol, this is not important Medico legally, but it is an ancient practise and respect to the prescription, every doctor is supposed to use this symbol.
6. In 40 percent of the prescriptions patient complaints were not mentioned, in modern prescription doctor is supposed to write the patient complaints in the prescription.
7. In 90 percent of the prescriptions examination findings are not mentioned, not even simple vital parameters like pulse, BP are recorded. This shows incomplete examination and absence of care.
8. In 40 percent of cases the doctors did not mention

the Provisional or final diagnosis, this is very important aspect in the prescription, doctor must write the diagnosis of the patient condition, failure to record is negligence on the part of the medical practitioner, this amounts to absence of proper disclosure and hence absence of consent as the patient is not even informed about ailment before starting treatment.

9. In none of the prescriptions the prescriber used generic name of the drug, every doctor prescribing the drugs using the brand name of the drug.
10. I also observed in my study 80 percent of the doctors are not prescribing the drugs in capital letters, everyone is writing in cursive handwriting, 10 percent of the prescriptions were illegible. Illegible prescriptions are notorious and danger to the patient, there are possibilities that wrong drug may be issued to the patient.
11. Doctor should not use any abbreviations in the prescription, in my study it was observed that 20 percent of the doctors are using abbreviations, patient cannot understand the medical abbreviations,
12. In 80 percent of the prescriptions the dose of the drug is not mentioned, and in 70 percent of the prescriptions the schedule of the drug like how many times to be taken is not mentioned, majority of doctors are using the abbreviations or code words like -0- for once in a day, -0-0- twice in a day and -0-0-0- for thrice in a day.
13. Subscription part of the prescription contain any directions to the pharmacist, in my study none of the prescriptions contained directions to the pharmacist. Doctor can give directions like do not change the brand or do not substitute the drug.
14. Prescriptions should also contain directions to the patient about possible adverse reactions of the drug and drug intolerance. In my study none of the prescriptions contain these directions to the patients. Failure to inform the possible side effects of the drug amounts to negligence.
15. Refills is very important for every prescription, physician must specify the number of refills he wishes, otherwise there are possibilities of reuse of the same prescription for many number of times, in my study I observed that none of the practitioners mentioned about refills.

16. In 90 percent of the prescriptions, I observed that doctors were not signing in a proper way.
17. I also observed in 10 percent of prescriptions the investigations prescribed were not relevant to the provisional diagnosis.
18. In 5 percent of the prescriptions the treatment did not tally with the diagnosis, Eg: doctor mentioned the diagnosis as myalgia and he prescribed Vitamin B complex.
8. Always write the drug generic name, and write in capital letters to avoid illegibility.
9. Please inform the possible side effects of the drug, and explain if any possible drug intolerance.
10. Specify how to take the drug, how many times in a day and how many days to be taken very clearly without any ambiguity.
11. Please specify the number of refills, otherwise patient may continue the same prescription for many number of times without taking the doctor consultation.

Conclusions and Recommendations

Prescription is an important Medico legal document, Majority of the doctors are not following the standard guidelines for prescription writing, due to which many doctors are facing medico legal problems, Proper documentation is very important, if any litigation arises the only proof between the doctor and the patient is a medical document.

Doctors should follow the prescription writing like a format, superscription, Inscription, subscription, signature and refills. All these columns must be fulfilled in every prescription.

1. Never order prescription by telephone.
2. Computerised prescriptions are always better, they are legible, we can also record the patient data including the complaints, examination findings and the investigations and treatment advised to the patient in the computer, and it is easy to retrieve the information whenever required.
3. Use simple English language while writing the prescription, do not use the Medical terminology, patient cannot understand the medical terminology.
4. Record the complete information of the patient including the weight, age. Sex and contact address,
5. Record the patient complaints, examination findings and required investigations in the prescription,
6. Record the Diagnosis of the patient condition whether provisional or final, failure to record can be treated as lack of full disclosure and absence of informed consent.
7. Do not use any abbreviations in the prescription, this may confuse and mislead the patient.

12. Do not use the prescription for the sake of advertisement, like "the above medicines are available in so and so shop". This amount to be an association with the firm or industry can be treated as infamous conduct.
13. Do not prescribe unnecessary drugs or investigations, for vested interest.
14. Registration number is compulsory on the prescription, as per MCI guidelines.
15. Do not erase or make any corrections in the prescription, if there is a mistake while writing it is better to give it in another prescription.

Conflict of Interest: Nil

Source of Support: Self

ACKNOWLEDGEMENT

I thanks to my senior professor's, colleague doctors in the department and I thanks to my principal and Medical superintendent of MIMS hospital who constantly encouraged me to conduct research work.

Ethical Clearance: Not applicable, (no ethical issues in this study, name of the patients, doctors names kept anonymous).

REFERENCE

1. Text book of Medical jurisprudence and Toxicology by MODI, 24th edition, code of medical ethics.
2. Text book Essentials of Forensic medicine by K.S.N reddy, 2012 edition.
3. Guidelines from Medical Council of India code of ethics Regulations 2002(amended up to 2010).

4. A journal of Medical Law Cases for Doctors published by Medknow publications in July 2010.
5. Journal List >BMJ >v.319(7223); Dec 4, 1999 >PMC1117199.
6. The pharmacological basis of of therapeutics by Goodman and Gillmans 10th edition.
7. Basic and clinical pharmacology, Mc grew hill, Lange international edition, 10th edition.
8. Pharmacological practise by AJ winfeld, RME Richards, chrchill livingstone, 2nd edition.
9. Signatura definition, MW.com,2007-04-25.
10. Davis-T (August 20,2005) Prescription writing and the PDR.
11. Institute of safe medication practices, Medication safety alerts 1999-12-07.
12. High court orders strict following of guidelines of Mci, Bhaskar news oct16 2011.
13. University of florida college of medicine Jackson ville resident manual.
14. Safe prescribing work book section1 by Andy Fox principal pharmacist.

An Overview of Cervical Vertebrae Fractures in Road Traffic Accident Cases-A 5 Year Study at Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka

Kumar U¹, Vijay Kumar A G¹, Shivaramu M G², Hemanth Raj M N³, Suresh J⁴, Ajay Kumar S⁵

¹Assistant Professor, Department of Forensic Medicine & Toxicology, ²Professor, Department of Forensic Medicine & Toxicology, Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka State, India, ³Assistant Professor, Department of Forensic Medicine & Toxicology, S S Institute of Medical Sciences & Research Centre, Davangere, India, ⁴Assistant Professor, Department of Forensic Medicine & Toxicology, Chettinad Hospital & Research Institute, Chettinad, Tamil nadu, India, ⁵Post Graduate, Dept. of Forensic Medicine & Toxicology KLE University's J.N.Medical College, Belgaum, Karnataka, India

ABSTRACT

The WHO has revealed in its first ever global status report on road safety, that more people die in road accidents in India than anywhere else in the world. In this retrospective study, 39 fatal cases of cervical vertebrae fracture autopsied were analyzed. Maximum number of victims belonged to the age group 31-40 years. Male - female ratio is 2.6:1. Overall 13 victims involved in road traffic accidents were motorcycle riders. The fracture of anterior arch of atlas was seen in 4 cases and fracture of posterior arch of atlas in 8 cases. The atlanto-axial dislocation was seen in 1 case and atlanto-axial subluxation in 2 cases. The fracture of the pedicles of C2 was seen in 3 cases and fracture of dens process in 4 cases. The fracture of C3, C4, and C5 vertebrae was seen in 9 cases and fracture of spinous process of C6 and C7 was seen in 5 cases.

Keywords: Road Traffic Accidents, Cervical Vertebrae Fractures

INTRODUCTION

The WHO report, based on 2006 and 2007 statistics collected from 178 participating countries, said globally over 1.2 million people die in road accidents every year and 20-25 million people suffer non-fatal injuries. Every hour, 40 people under the age of 25 die in road accidents around the globe. According to it, this is the second most important cause of death for 5 to 29 year olds. In India alone, the death toll raised to 14 per hour in 2009 as opposed to 13 the previous year.¹

The World Health Organization has revealed in its first ever global status report on road safety that more people die in road accidents in India than anywhere else in the world including the more populous China. At least 13 people die every hour in road accidents in the country, the latest report of the National Crime Records Bureau reveals. In 2007, 1.14 lakh people in India lost their lives in road mishaps—that's significantly higher than the 2006 road death figures in China. 89,455 Road deaths in India registered a sharp 6.1% rise between 2006 and 2007

The United States Major Trauma Outcome Study estimated the incidence of acute spinal-cord injury to be 2.6% of blunt trauma patients.^{2,3} The average life time costs of treating an individual with traumatic spinal-cord injury are estimated to be between US\$500 000 and US\$2 million. The total direct costs of caring for the spinally-injured each year exceed US\$7 billion in America.⁴

Corresponding author:

Kumar U

Assistant Professor

Department of Forensic Medicine & Toxicology,
Adichunchanagiri Institute of Medical Sciences,
Mandya, Karnataka State, India

Email- kumarugrappa@yahoo.co.in

Phone No. 9742220084

MATERIAL AND METHOD

In this retrospective study, 39 fatal cases of cervical vertebrae fracture autopsied during the period 1st January 2006 to 31st December 2010 were analyzed at the Department of Forensic Medicine & Toxicology, Adichunchanagiri Institute of Medical Sciences, Mandya District, Karnataka, India.

RESULTS

Totally, 39 fatal cases of Cervical vertebrae fractures were autopsied during the study period.

Table 1: In the present study, majority of victims belonged to 31-40 year age group (14 cases). Male-to-female ratio is 2.6:1.

Table 2: Overall 13 victims involved in road traffic accidents were motorcycle riders.

Table 3: In the present study, Fracture of anterior arch of atlas was seen in 4 cases and Fracture of posterior arch of atlas in 8 cases. Atlanto-axial dislocation was seen in 1 case and Atlanto-axial subluxation in 2 cases. Fracture of the pedicles of C2 was seen in 3 cases and Fracture of Dens process in 4 cases. Fracture of C3, C4, C5 vertebrae was seen in 9 cases. Fracture of spinous process of C6 and C7 was seen in 5 cases.

Table No 1. Distribution of cases according to age and sex wise.

Age group	Male	Female	No. of cases	Percentage
1-10	00	00	00	00
11-20	10	02	12	30.8
31-40	11	03	14	35.9
41-50	04	03	07	17.9
>50	04	03	06	15.4
Total	29	11	39	100

Table No 2. Distribution of cases according to type of road users

Type of road users	No. of cases	Percentage
Pedestrian	02	5.1
Cyclist	01	2.6
Scooterist	03	7.7
Motorcyclist	13	33.3
Three wheelers	04	10.3
Light motor vehicle	08	20.5
Heavy motor vehicle	08	20.5
Total	39	100

Table No 3. Distribution of cases according to type of fractures

Fracture site	No. of cases	Percentage
Fracture of anterior arch of atlas	04	10.3
Fracture of posterior arch of atlas	08	20.5
Combined fracture	03	7.7
Total number of cases	15	38.5
Atlanto-axial dislocation	01	2.6
Atlanto-axial subluxation	02	5.1
Total number of cases	03	7.7
Fracture of the pedicles of C2	03	7.7
Fracture of Dens process		
Tip of dens	00	00
Base of dens	02	5.1
Sub-dentate	02	5.1
Total number of cases	07	17.9
C3, C4, C5	09	23.1
Fracture of spinous process of C6	02	5.1
Fracture of spinous process of C7	03	7.7
Total number of cases	05	12.8

DISCUSSIONS

In United States, Cervical spine injuries cause an estimated 6000 deaths and 5000 new cases of quadriplegia each year. Approximately 80% of patients are aged 18-25 years. Male-to-female ratio is 4:1.⁵

Jumbelic reported that motor cycle accidents were responsible for approximately 42 – 46,000 deaths per year in the USA.⁶

Levine AM and Edwards CC had done a study on thirty-four patients who had fractures of the atlas (the first cervical vertebra) and they were reviewed at an average follow-up of 4.5 years. Seventeen patients had bilateral fracture of the posterior arch of the first cervical vertebra. A third group of eleven patients sustained a Jefferson, or burst fracture of the first cervical vertebra. These patients had either four fractures (two in the anterior arch and two in the posterior arch) or three fractures (one in the anterior arch and two in the posterior arch).⁷

Fractures of the Atlas compromise 25% of atlantoaxial complex bony injuries, 10% of cervical spine injuries, and 2% of all spine injuries. Injury to the cervical spine occurs infrequently in pediatric populations, and although C1 represents only 1-2% of pediatric trauma and 2-10% of all cervical injuries in this population, the associated mortality is 16%.⁸

According to a case report by McSweeney T, An 18-month-old child was rendered tetraplegic below C6 in a road traffic accident. There was an associated fracture-dislocation of the atlanto-axial joint.⁹

Ehlinger M et al. they report a rare case of atlanto-occipital dislocation (AOD) in a surviving patient with more than one-year follow-up.¹⁰

James Demetrious reported a single case of cervical subluxation on MRI examination.¹¹

Linton LY reported a case report in which, a lateral neck of radiograph shows an unstable fracture of the C2 pedicles, with forward displacement of C1 and the body of C2 on C3.¹²

In the study done by Sait N et al., 12 cases with odontoid fractures were treated. The radiological investigations revealed no type I fracture, nine type II fractures and three type III fractures.¹³

Fractures of C5 and C6 are most common because most injuries are due to hyperflexion, with the maximum force being focused upon the vertebral bodies of C4-C7.¹⁴

Spinous process avulsion fractures occur as a result of forced flexion against the opposing action of the interspinous and supraspinous ligaments. The injury occurs most frequently at C7, followed by C6 and then T1.¹⁵

CONCLUSION

Overall, our study proves that major injuries of the cervical spine are usually caused by indirect violence, such as road traffic accidents, falling on the head or violent movements transmitted from the skull. The mechanism may be an excessive movement in any direction – flexion, extension, lateral flexion, or rotation or vertical compression force acting upon a straight spine, and the nature of injury bears a fairly constant relationship to the mechanism of its causation. Fatalities are more commonly seen in injuries to the atlas and axis than with similar lesions in the lower cervical vertebrae, because of possible paralysis of the respiratory centre. Forward dislocation of the odontoid process can cause fatalities due to crushing of the cord demonstrated at autopsy. Whiplash injury, more commonly sustained by the

front seat occupants of 4 wheeler vehicles results in fatal contusion or laceration of the spinal cord involving the cervical vertebrae without fracture of the spinal column.

Competing interest: Authors declare that they have no competing interest. All the authors have read and approved the final manuscript.

REFERENCES

1. India leads world in road deaths: WHO. The Times of India. [cited 2012 Feb. 5]. Available from <http://www.articles.timesofindia.indiatimes.com>.
2. Roaf RA. A Study of the mechanics of spinal injuries. *J. Bone Joint Surg.* 1964; 42(B):810–823.
3. Burney RE, Maio RF, Maynard F, Karunas R. Incidence, characteristics, and outcome of spinal cord injury at trauma centers in North America. *Arch Surg* 1993; 128(5): 596-99.
4. McDonald JW, Sadowsky C. Spinal-cord injury. *Lancet* 2002; 359(9304): 417-25.
5. Cervical Spine Fracture in Emergency Medicine. [Updated 2011 Aug 15; cited 2012 Feb. 5]. Available from <http://emedicine.medscape.com>.
6. Jummbelic MI. Fatal injuries in a minor trafıc collision. *J Forensic Sci* 1995; 40:492 –94.
7. Levine AM, Edwards CC. Fractures of the atlas. *J Bone Joint Surg Am.* 1991 Jun; 73(5):680-91.
8. C1 Fractures Author: [Updated 2011 Jul 22; cited 2012 Feb. 5]. [cited 2012 Feb. 5]. Available from <http://emedicine.medscape.com>.
9. McSweeney T. Traumatic atlanto-axial fracture dislocation in a child. *Paraplegia.* 1979; 17: 372–376.
10. Ehlinger M, Charles YP, Adam P et al. Survivor of a traumatic atlanto-occipital dislocation. *Orthopaedics & Traumatology: Surgery & Research.* 2011; 97(3):335-340.
11. James D. Post-traumatic upper cervical subluxation visualized by MRI: a case report. *Chiropractic & Osteopathy.* 2007; 15:20.
12. The Hangman's Fracture. *Radiology Cases in Pediatric Emergency.* [cited 2012 Feb. 5]. Available from <http://www.hawaii.edu>.
13. Sait N, Özgür A, Feridun A, Tansu M, Nuri A. Odontoid Fractures. *Turkish Neurosurgery* 2006; 16(2): 81-84
14. The Cervical Spine. [cited 2012 Feb. 5]. Available from <http://www.imageinterpretation.co>.
15. Harris JH and Mirvis SE. *The Radiology of Acute Cervical Spine Trauma.* 1996; 3.

Accidental Degloving of Penile Skin - A Case Report

Mohd Kaleem Khan¹, Manzoor Ahmad², Shaukat A Hanif³, Manoj Kumar⁴

¹Senior Resident, Department of Forensic Medicine and Toxicology, ²Senior Resident, Department of Surgery, ³Associate Professor, Department of Forensic Medicine and Toxicology, ⁴Junior Resident, Department of Forensic Medicine and Toxicology, J.N.Medical College, Aligarh Muslim University, Aligarh, U.P., India

ABSTRACT

Degloving of the penis is reported rarely in forensic medicine as it has often been a topic of discussion in the surgical discipline. The first clause of Sec 320 IPC stands for emasculation discussed in legal medicine. Degloving of the penis may occur as a result of road traffic accidents, or direct injuries from assault, violent sexual activity specially sexual asphyxia; the ill effect of the tools in agricultural and and other machines which a person closely handles.

Here is a case of accidental degloving of the penis which resulted from the dragging force derived from the body itself. The entire force that led to degloving was due to the contact of the abdominal area below the umbilicus and the road after falling flat from a moving vehicle. There was no history of being run over by another vehicle.

Keywords: Penis, Degloving, Accidental

INTRODUCTION

Injury to the male external genitalia is often reported, reasons being due to direct assault, violent sexual act, sports, road traffic accidents or industrial machines. Injury to the penis may be classified as a strangulation, cutaneous injuries, circumcision injury, penile skin avulsions, penile fracture and penile amputation.

The anatomy of the male external genitalia includes the penis and scrotum enclosing the testes. Being an external organ it is quite susceptible to injury but at the same time it is protected by the nature of the skin of the scrotum which is tough due to its thickness and elasticity. Penis having mobile skin supported by fascia may often get injured by strong external force. This may lead to various cutaneous injuries of the penis and in extreme cases total avulsion of the skin may occur. Penile skin avulsion is a usual outcome of power takeoff injuries. Garments such as trouser, dhoti or lungi worn by worker are caught in the power takeoff of an industrial or agricultural machine. The skin of the glans is spared most of the time due to its strong adherence to the subcutaneous structure of the penis but in uncircumcised penis the foreskin adhering to the glans may be involved. Avulsion of the complete scrotal skin is rare but may occur in car accidents.

Sometimes, degloving injuries of the penis occur along with the injuries of the abdomen either in road traffic accidents or industrial and farming procedures. Most of the penile degloving occur when pedestrian run over by heavy vehicles in road traffic accidents.

CASE REPORT

A 40 year old male resident of Mahamaya Nagar, Uttar Pradesh reported to the emergency department of the J.N. Medical College, AMU Aligarh at around 8 PM on the 3rd of April 2012 with degloving injury of the penis with bleeding

History as narrated by the patient; He was travelling by public transport a four wheeler, locally made vehicle commonly known as jugad. It was overloaded with passengers therefore he was standing on the platform attached at the rear end. Due to a sudden jerk, he fell from the vehicle and was dragged on the road in the prone position. Before the vehicle came to a halt so that he could be rescued he sustained injury to the penis; clothes corresponding to the injury were also torn. No time was wasted in bringing him to JNMC, Aligarh. On examination, it was found that there was no urethral injury, the scrotum and testes were also spared. There was degloving of the skin of the penis but the buck's fascia remained intact and no

other structure of the penis was damaged. The skin of the glans remained intact. A radiograph of the abdomen excluded pelvic injuries and all the structure adjoining were also found to be normal. The case was taken up by the department of surgery where necessary treatment was given. The patient was kept for observation for two days and then discharged and further course of the case was uneventful.

DISCUSSION

Injury to the external genitalia in males has been reported earlier the commonest cause being a road traffic accident. The injury being a result of heavy vehicles running over the abdominal region which not only damages the abdominal structures but also includes the genitals.

The various other causes as reported earlier pointed out similar injuries caused by assaults, gunshot wounds, violent sexual activities, sports etc. in the males.

Ahmed et al in a Nigerian study came to a conclusion that 68% of the injuries to the male external genitalia were caused by road traffic accidents followed by 16% by gunshot and 10.7% by grinding machines.³ External genitalia were avulsed in 11 of road traffic accidents out of 89 cases. Complete loss of penile skin occurred in 2 cases and 4 cases sustained partial loss of penile skin. In 3 cases there was a partial scrotal skin loss and 2 had sustained avulsion of penis, scrotum and testes.³

Lee et al in his studies on 156 male patients, 33% of assault constitutes the major cause of injury to the external genital organs. 20% , 16% and 9% of the injuries were respectively caused by coitus, sports and road traffic accidents.⁷

Shetty et al. reported a case of run over accident by a lorry, the rear tyre causing degloving injury of the penis along with its partial amputation and sparing both testicles.⁴

Paraskevas et al. reported a case in which penile skin was completely degloved and scrotal skin was partially avulsed, exposing corpora cavernosa and corpus spongiosum, by a thresher machine.⁸

Still earlier it had been reported that most of the injuries of the external genitalia in the developed countries were due to agricultural machines¹² whereas in developing countries it was due to road traffic

accidents. But at present road traffic accidents and firearm injuries took the prime place.¹³



Fig. 1. showing degloving injury of the penis



Fig. 2. Showings stitched and approximated injured penis

CONCLUSION

A proper approach involving a multidisciplinary team should be involved in treating such cases that may include debridement of the wound, decontamination and if needed reconstruction of the genitalia. Psychological trauma associated with any of the deformities that have been the outcome of such injuries should also be tackled in terms of multidisciplinary approaches.

In the present case since the degloving included only the skin and not the deeper tissues, therefore the intensity of the injury was not severe but it was unique in its type since the dragging force of the victim's own body helped in achieving it. It may be categorized under road traffic accident but not under run over by heavy vehicles. Fall on the road in a prone position

leading to degloving of the penis on the dorsal aspect by being dragged.

As far as the injury is concerned if as a result proper erection or potency is affected, then, as per the IPC (1860), the injury is included in grievous hurt (emasculatio-clause 1 of IPC-320)

The psychological trauma of low self esteem due to injury to the private part is an additional factor with the existing grievous hurt that needs proper placing in terms of legality, psychological and social support.

All the local or poorly devised vehicles in developing countries should be either banned or should be brought under the supervision of the government with the proper directives of road safety .

Definite number of passengers should be prescribed by the government penalized if the number found in such vehicles is over and above.

Trauma center should take up such cases on priority basis to save the person from permanent damage due to delay. It should also include the treatment for psychological trauma as well as counseling. Physiotherapy may also be required if the adjoining members or joints are involved. Compensation and monetary benefits should also be looked into. Welfare funds should be created for such victims.

REFERENCES

- Ahmed A, Mbibu NH. Etiology and management of injuries to male external genitalia in Nigeria. *Injury* 2008;39:128–33.
- Wessells H, Long L. Penile & genital injuries. *Urol Clin N Am* 2006;33:117e26.
- Ahmed A, Mbibu NH. Etiology & management of injuries to male external genitalia in Nigeria. *Injury* 2008;39:128e33.
- Shetty BSK, Rao PPJ, Menezes RG. Traumatic degloving lesion of male external genitalia. *J Forensic Leg MED* 2008;15:535e7.
- Armenakas NA, McAninch JW, Lue TF, Dixon CM, Hricak H. Post-traumatic impotence: magnetic resonance imaging & duplex ultrasound in diagnosis & management. *J Urol* 1993;149(5 pt 2):1272e5.
- Menon A, Pai VK, Rajeev A. Pattern of fatal head injuries due to vehicular accidents in Mangalore. *J Forensic Leg MED* 2008;15:75–7.
- Lee SH, Bak CW, Choi MH, Lee HS, Lee MS, Yoon SJ. Trauma to male genital organs: a 10-year review of 156 patients, including 118 treated by surgery. *BJU Int* 2008;101:211e5
- Paraskevas KI, Anagnostou D, Bouris C. An extensive traumatic degloving lesion of the penis. A case report & review of the literature. *Int Urol Nephrol* 2003;35:523e7.
- Selvan SS, Alagu GS, Gunasekaran R. Use of a hypogastric flap & split-thickness skin grafting for a degloving injury of the penis & scrotum: a different approach. *Indian J Plast Surg* 2009;42:258e60.
- Kanchan T. Traumatic degloving of male external genitalia. *J Forensic Leg MED* 2009;16:362.
- Gomes CM, Ribeiro-Filho L, Giron AM, Mitre AI, Figueira ERR, Arap S. Genital trauma due to animal bites. *J Urol* 2000;165:80e3.
- McAninch JW. Management of genital skin loss. *Urol Clin N Am* 1989;16:387e97.
- Cline KJ, Mata JA, Venable DD, Eastham JA. Penetrating trauma to the male external genitalia. *J Trauma* 1998;44:492e4.
- Jordan GH, Whelan TV, Horstman WG, et al. Urology/urinary system. In: O'Leary JP, Capote LR, editors. *The physiologic basis of surgery*. 2nd Ed. Maryland: Williams & Wilkins; 1996. P. 581–601.
- Jordan GH, Schlossberg SM. Surgery of the penis and urethra. 9th Ed. In: Wein, Kavoussi, Novick, et al., Editors. *Campbell–Walsh urology*, vol. 1. Philadelphia: Saunders Elsevier; 2007. p. 1023–1097.
- Werthman P, Alter GJ. Treatment of penile and testicle amputation. In: Ehrlich, Alter GJ, editors. *Reconstructive and plastic surgery of the external genitalia – adult and pediatric*. Philadelphia: WB Saunders Co; 1999. p. 441–444.

Study of Patterns of Homicidal Deaths Autopsied at District and Medical College Hospitals of North Karnataka

Mohsenul Haq¹, Ayesha Farheen², S K Goli³

¹Assistant Professor, Department of Forensic Medicine, ²Assistant Professor, Department of Pathology, ³Professor & Head, Department of Forensic Medicine, K.B.N.I.M.S, Gulbarga, Karnataka

ABSTRACT

Homicide is the most serious crime committed against persons, and its grave implications make its detections, solutions & adjudication matters of vital importance to every citizen & to the entire community as well as to the law enforcement authorities & judiciary.

The present study is a perspective study conducted at Khaja Banda nawaz institute of medical science of, Gulbarga (North-Karnataka) during 2010-2012. Total 39 alleged homicidal deaths were studied in a systematic manner. All these cases were analyzed with an objective of knowing age & sex distribution of victims, types of fatal injuries & their probable weapons, victims' location (urban or rural), literacy, socio-economic status and motives involved.

Among 39 cases autopsied 26 deaths (66.64%) were due to mechanical violence, the commonest type (Table No 1) of weapon used was mixed (sharp+blunt) in 11 cases(28.20%), in 9 cases(23.06%) it was by sharp cutting weapon, in 6 cases (15.38%) it was blunt weapon, in 2 cases(5.12%) it was firearm, 2 cases(5.12%) were asphyxial deaths, out of which one case (2.56%) was due to hanging & one case (2.56%) was due to strangulation. Among the remaining 9 cases 8cases (20.51%) were of burns & one case (2.56%) was of poisoning.

Males 28 (71.77%) predominated females 11 (28.20%) and majority of cases 11 (28.20%) belonged to 21-30 yrs age group. The commonest weapons used were the mixed weapons (sharp + blunt) causing 11 (28.20%) deaths.

Most of the victims belonged to the low socioeconomic status i.e. [36(92.29%)] & majority of them were from rural areas i.e. [25 (64.10%)].

Keywords: Homicide, Weapons, Autopsy, Fatal Injuries

INTRODUCTION

Homicide forms a major problem all over the world, though the motive for homicide & the type of weapon vary from place to place and change over a period of time. About 80-100 cases of homicides take place every day in India¹. This crime is unacceptable to all types of society.

Violence is an integral part of human nature & every individual on this planet has a certain degree of the 'wild man' in him/her irrespective of the

nationality, race, sex & social bearing. Homicide is extreme manifestation of interpersonal conflict with minimal reporting bias & can thus be used as a conflict "Assay"². Homicides in related persons are comparatively easy to investigate, because of their inter-human connections³.

During the last three decades with growth in the population and modern needs, the incidence of homicide in India is on the increase. The enhancing number of homicides may be attributed to increasing population, unemployment, industrialization, easy

availability of weapons, fast changing life-styles and stressful living conditions.

The aim of the present study was to collect authenticated data of the homicidal deaths & analyze them in all respects. It is very essential to know the profile of these unfortunate victims so as to enable the concerned authorities to resolve the glitches in the medical, medico-legal & preventive aspects of homicide.

MATERIALS AND METHOD

Study design- Descriptive

Study period- 02-11-2010 to 30-04-2012

Study Method- A total of 519 homicidal injuries cases were admitted, in all 39 cases resulted into deaths which were autopsied at District hospital & Khaja Banda Nawaz institute of medical science, Gulbarga (North Karnataka) and these deaths were analyzed.

The victims were studied from the time of OPD admission to wards and followed up till recovery or death. Data were collected in a proforma, from the history given by the victims & their relatives, hospital records, police-inquest reports, post-mortem reports and FSL reports. An attempt was made to collect information particularly regarding the age, sex, motive, types of injuries & their probable weapons, & also whether he/she belongs to rural or urban area, their socio-economic status and literacy. All data was documented and statistically analyzed.

RESULTS

The present study revealed that, the total number of homicidal deaths was 39, which were autopsied, and it was found that 26 cases (66.64%) were due to mechanical violence, which comprised of 9 cases (23.06%) by sharp cutting weapons, 6 cases (15.38%) by blunt weapons, 11 cases (28.20%) by mixed types of weapons (sharp & blunt). There were 2 cases due to firearm injuries (5.12%). Deaths due to asphyxia constituted 2 in number (5.12%) viz one case by hanging & the other one being strangulation. In all there were 8 deaths due to burns (20.50%). There was only one case due to poisoning (2.56%) in the present study.

Majority of the victims belonged to age group 21-30 yrs (28.20%) (Table No.02).

And they were found to be residents of in and around Bijapur, comprising of 14 (64.10%) urban & 25 (35.89%) rural citizens (Table no 6). Majority of the victims were males 28 (77.19%) (Table No.03).

Motive for homicide in present study was Quarrel/ Rivalry, which topped the list i.e. 13 (33.33%) (Table no 06). The Commonest type of weapon used was mixed (sharp+blunt) 11(28.20%) (Table No 05). Most of the victims belonged to rural area i.e. 25(64.10%) as compared to urban area (Table No 06). 36 victims (92.29%) were from low socioeconomic status (Table No 07). 25 victims (64.10%) were illiterate, forming the most common category. (Table No 08)

Table No. 1: Pattern of Homicide

Types of deaths	Type of weapons with resulting injuries	Male	Female	Total	Percentage	Total %	
Mechanical violence	Sharp	Stab wounds	5	1	6	15.38	66.64%
		Incised wounds	2	0	2	5.12	
		Chop wounds	1	0	1	2.56	
	Blunt	Fractures	5	1	6	15.38	
		Non-fractures	0	0	0	0	
		Mixed (blunt&Sharp)	11	0	11	28.20	
Firearms	Firearms	2	0	2	5.12	5.12%	
Asphyxial deaths	Hanging	1	0	1	2.56	5.12%	
	Strangulation	0	1	1	2.56		
Burns	Burns	0	8	8	20.50	20.50%	
Poisoning	Poisoning	1	0	1	2.56	2.56%	
	Total	28	11	39	100.00	100.00%	

Table No. 2. Age wise distribution of victims

Age	No of homicides	Percentage
0-10	0	0
11-20	1	2.56
21-30	18	46.14
31-40	10	25.63
41-50	7	17.94
51-60	2	5.12
61 and Above	1	2.56
Total	39	100

Table No. 3. Sex wise Distribution of victims

Age	Males		Females	
	No	%	No	%
0-10	0	0.00	0	0.00
11-20	1	2.56	0	0.00
21-30	11	28.20	7	17.94
31-40	8	20.51	2	5.12
41-50	6	15.38	1	2.56
51-60	1	2.56	1	2.56
61 and Above	1	2.56	0	0.00
Total	28	71.80	11	28.20

Table No. 4. Motive for homicide

Motive	No of Cases	Percentage
Quarrel/Rivalry	13	33.33
Robbery	3	7.69
Dowry harassment	8	20.51
Previous enmity	6	15.38
Property dispute	5	12.82
Un known	4	10.25

DISCUSSION

The present scenario of globalization, urbanization and industrialization is creating lot of stress on individuals in particular, as well as on the society in common. The incidence of homicides has been increasing probably due to increase in population, illiteracy, poverty and frustration in life.

A similar study was conducted by Virendra Kumar & Gordon K. Murphy^{4&5}, in which sharp & blunt weapons were responsible for majority of homicidal cases, which is consistent with the present study.

It was observed in the present study that 28.20% of the total homicidal cases were due to mixed weapons (sharp+blunt), while 12.82% of the cases were due to blunt weapons. This is consistent with the studies conducted by U.S.Sinha, A.K.Kapoor & S.K.Pandey⁶. The incidence and type of weapon may vary in different regions of the country.

Maximum number of victims belonged to the age group 21-30 years (38.46%) followed by age group 31-40 years (33.33%). In our study male female ratio was observed to be 3:1. Similar observations were found in the study conducted by A.L.Ghangale, S.G.Dhawane, and A.A.Mukherjee⁷.

Males (71.77%) were more affected than the females (28.18%). A similar observation was made by U.S.Sinha, A.K. Kapoor & S.K. Pandey⁶. The occurrence of more number of homicidal deaths in age group 21-30 years seems to be because of reasons like sudden provocation resulting into violent & emotional out burst, which seems to be the common and obvious factor in this age group.

25 cases (64.10%) of alleged homicides involved in the present study were from rural areas and 14 cases (35.89%) belonged to urban areas. This may be attributed to increasing population, illiteracy, unemployment and easy availability of weapons. 92.29% of the victims in the present study were from the low socio-economic status i.e. agricultural workers & manual labourers. These findings are consistent with the study of U.S.Sinha, A.K. Kapoor & S.K.Pandey⁶

8 cases (20.50%) were of homicidal burns which were dowry deaths, most women were from undivided families and the homicides occurred within the initial 7 years of their marriages. The majority of the affected wives belonged to 16-25 years of age group at the time of the incident and sustained more than 70% burns. This is consistent with the study made by Virendra Kumar, C.B. Tripathi⁸.

2 victims (5.12%) died due to firearms. One case of homicidal hanging (2.56%) was reported which almost correlates with the study by E.J. Rodrigues & S.D. Sapeco¹⁰.

One case of strangulation (2.56%) found in present study is almost consistent with the study of U.S.Sinha, A.K.Kapoor & S.K. Pandey⁶.

The present study revealed a single death due to homicidal poisoning. This low occurrence is found to be similar with the study by Jones w, Barbara M.D, Gerber, John M.D Biggs & Gary when compared¹¹.

CONCLUSION

The present study revealed that out of 39 total homicidal deaths 26 deaths were due to mechanical violence. Weapons which caused these injuries were

sharp cutting weapons, blunt weapons & mixed type of weapons (sharp & blunt). There were 2 cases of firearm injuries. The study also revealed that maximum victims were from rural area and majority of the victims were males.

The study clearly highlights the profile of homicidal deaths in North Karnataka area, showing that the males of age group 21-30 yrs were the major victims. It also clearly indicated that the commonest victims were agricultural workers & manual labourers belonging to lower socio-economic status.

As the population and number of immigrants continued to increase, preventive measures need to be taken, based on the risk factors that had been identified. Therefore the present laws should be amended to have a non-violent & peaceful community if possible by the following means:

- Strict enforcement of law on possession of dangerous weapons like sharp, heavy cutting weapons/firearms.
- Promoting the literacy among the general public.
- Promoting self-employment schemes, improving the financial status of every civilian by providing bank loans to needy.
- Public awareness against homicide can be created through media like television, newspapers etc.
- Educating the people about bad habits like consumption of alcohol etc & their hazards & also about socio-pathological impacts.

ACKNOWLEDGEMENTS

The authors are thankful to Principal, Prof Nazeer Ahmed Bendigeri, Khaja Banda Nawaz institute of Medical sciences, Gulbarga for kindly providing laboratory and necessary facilities to carry out this research work.

Conflict of Interest

The findings in this research work found to be similar to most of the research work conducted in India.

Source of Funding: Self Funding.

Ethical Clearance: Not Applicable.

REFERENCES

1. Victims of homicidal deaths-An analysis of variables, Manoj Kumar Mohanty, T.S. Mohan Kumar, Arun Mohamram an Vikram Palimar. *JCFM* 2005;12(6):302-304
2. Daly M. and Wilson M. *Evolutionary Social Psychology and family Homicide Sciences*. 1998;242:519-24
3. Skyes, G.M. and Cullen, F.T., *Criminology*. 2nd edition. Fort Worth, Philadelphia, San Diego, New York, 1992.
4. Virendra kumar, Adeline khaw mae li, Ahmad zaid zaniel, Ding, Ailee & Syahrul Anuar Salleh. A Study of Homicidal Deaths in Medico-legal Autopsies at UMMC, Kuala Lumpur. *JCFM* 2005;12(5):254-59
5. Gordon K. Murphy. Beaten to Death. An autopsy series of Homicidal Blunt force injuries. *AJFMP* 1991;2:98-101
6. Sinha U.S, Kapoor A.K, Pandey S.K. Pattern of homicidal deaths in SRN hospital mortuary at Allahabad. *JFMT* 2003;20(2):33-6
7. A.L. Ghangale, S.G. Dhawane, A.A.Mukherjee. Study of homicidal deaths at Indira Gandhi Medical College Nagpur. *JFMT* 2003;20(1):47-51
8. Virendra Kumar, C.B. Tripathi. Burnt Wives: A study of homicides. *Med.Sci.Law* 2004; 44(1): 55-60
9. Antonio Preti, Paola Miotto. Death by homicide in Italy, 1980-94, Age & Gender differences among victims. *Med.Sci.Law*. 2000; 40(3): 233-39
10. Rodrigues E.J. & Sapeco S.D. Statutory rape & Homicidal Hanging A Case report *JIAFM* 2001, 23(5): 73-74.
11. Jones w, Barbara M.D, Gerber, John M.D, Biggs, Gary. *AJFMP* 2001, 22 (2): 203-6

Study of Pattern of Deaths due to Acute Pancreatitis

N T Satish¹, S Harish², Girish Chandra Y P³, Udaya Shankar B S⁴

¹Associate professor, Dept. of Forensic Medicine and Toxicology, Adichunchanagiri Institute of Medical Sciences B G Nagar Mandya, Karnataka, ²Professor, Dept. of Forensic Medicine, ³Professor and Head, Dept. of Forensic Medicine,

⁴Post Graduate, Dept. of Forensic Medicine, M S Ramaiah Medical College Bangalore, Karnataka

ABSTRACT

Acute pancreatitis is a protean disease which is usually mild and self limiting in most cases. The disease is severe and is associated with a high mortality in 5-20% of cases due to systemic complications culminating in multi-organ failure and shock. Acute pancreatitis in a subset of patients presents as sudden unexpected death and is diagnosed for the first time during autopsy. The majority of cases of sudden unexpected death can usually be attributed to a past history of illness, clinical features or characteristic findings on postmortem examination. The forensic pathologist or the medical examiner faces the daunting task of determining the cause of death in those cases without any antecedent causes, suspected violence, suicide or homicide and with no clinical history of illness.¹ In this article, we are discussing series of cases with varied history where the sudden death was due to pancreatitis.

Keywords: Sudden Death, Acute Haemorrhagic Pancreatitis, Autopsy

INTRODUCTION

Acute Pancreatitis in the United States is approximately 17 new cases per 100,000. It results in 100,000 hospitalizations per year. Eighty percent of cases are interstitial and mild; the remaining 20% are necrotizing and severe. Approximately 2000 patients per year die from complications related to Acute Pancreatitis.

Acute Pancreatitis is a disorder that has numerous causes, an obscure pathogenesis, few effective remedies, and often unpredictable out come. It is a condition peculiar to the pancreas in which there is destruction of the gland by enzymes escaping into its substance, characterized pathologically by hemorrhagic necrosis and inflammation of the pancreatic tissue and clinically by abdominal pain, vomiting and shock, which may cause death. The clinical diagnosis is usually based on the history, examination and investigations including serum and urinary amylase and ultrasonic and CT scans. In many cases, the diagnosis of acute pancreatitis was unsuspected until postmortem examination.²

CASE SERIES

Case 1

A 28 year old male was subjected for autopsy with alleged history of consumption of unknown poison in-between 9:30 p.m on 27/07/11 and 9:30 a.m on 28/07/11 in his room.

External examination

Dead body that of a male aged 28 years measuring 5 feet and 6 inches in length, moderately built and nourished, wheatish in complexion. Eyes partially opened, cornea was hazy, pupils dilated and fixed. Post mortem staining present over back of chest and abdomen and fixed. Rigor mortis well appreciated all over the body. Froth present over nostrils.

Internal Examination

1. Skull was intact, brain & meninges were intact & congested.
2. Both lungs were intact & congested.
3. Heart & aorta were intact.

4. Stomach contains 60 ml of cream coloured fluid, smells peculiar, mucosa haemorrhagic.
5. Liver & spleen were intact & congested.
6. Pancreas shows haemorrhages. Figure 1 and 2
7. Intestinal coils contain gas & its contents.
8. Both kidneys were intact & congested.
9. Pancreas sent for Histopathological examination.

HPE Impression: Acute necrotizing and haemorrhagic pancreatitis-poison/drug induced. Figure 3

10. Viscera sent for forensic science laboratory

Opinion of forensic science laboratory: Colour tests and TLC methods have responded for presence of Organophosphorus insecticide in viscera and blood.

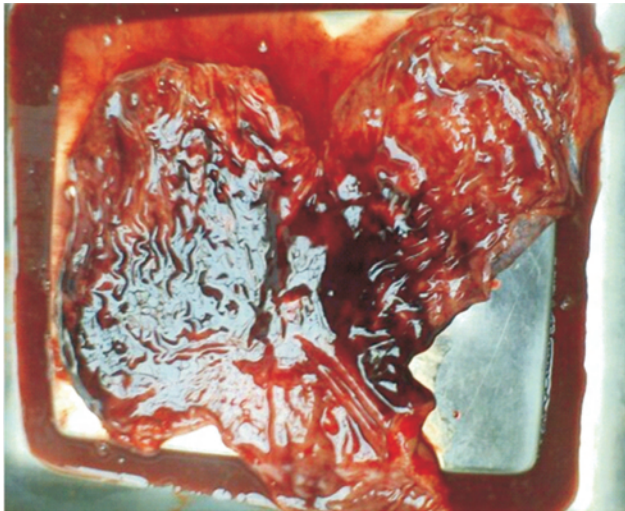


Fig. 1. Stomach on opening shows its mucosa haemorrhagic



Fig. 2. Haemorrhage over the surface of pancreas

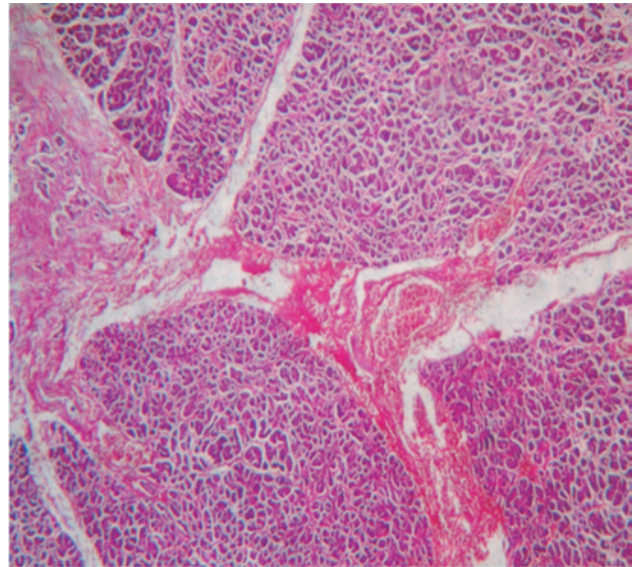


Fig. 3. HPE of Pancreas showing haemorrhages in duct and substance of Pancreas

Cause of death: Death is due to acute necrotizing and haemorrhagic pancreatitis as a result of consumption of Organophosphorus insecticide.

Case 2

A 20 year old female was brought for autopsy at 5 p.m on 29/11/10, with alleged history of consumption of unknown poison at 10 p.m on 28/11/10 in her room, and was shifted to M.S. Ramaiah hospital, Bangalore where she died

On external examination

Dead body that of a female aged 20 years measuring 5 feet and 5 inches in length, moderately built and nourished, fair in complexion. Eyes closed, pupils dilated and fixed. Post mortem staining present over back of chest and abdomen and fixed. Rigor mortis well appreciated all over the body. Nail beds show bluish discoloration.

Internal Examination

1. Skull was intact, brain & meninges were intact & congested.
2. Both lungs were intact & congested.
3. Heart & aorta were intact.
4. Stomach contains 100 ml of reddish brown coloured partially digested food particles, smells peculiar, mucosa oedematous and shows petechial haemorrhages.

5. Liver & spleen were intact & congested.
6. Pancreas-Neck and body shows extravasation of blood over anterior surface and in its substance.
7. Intestinal coils contain gas & its contents.
8. Both kidneys were intact & congested.
9. Uterus-normal in size, cavity contains menstrual blood.
10. Pancreas was sent for Histo pathological examination

Impression: Pancreas-consistent with haemorrhagic infarction. Figure 4

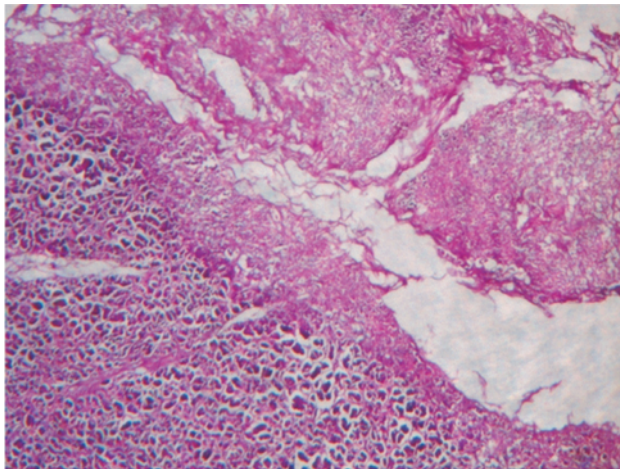


Fig. 4. HPE of Pancreas showing haemorrhagic infarction

Viscera was sent for forensic science laboratory

Opinion of forensic science laboratory: Colour tests and Thin Layer Chromotography methods have responded for presence of Organo phosphorus insecticide in viscera and blood

Cause of death: Death is due to acute haemorrhagic infarction of pancreas as a result of consumption of Organophosphorus insecticide.

Case 3

A 39 year old male was brought for autopsy at 11 a.m on 29/11/10, with alleged history of brought dead to a hospital at 5 p.m on 25/10/11. He was shifted from his residence to hospital as he was suffering from headache and pain abdomen.

External examination

Dead body that of a male aged 39 years measuring 5 feet and 2 inches in length, moderately built and

nourished, wheatish in complexion. Eyes closed, pupils dilated and fixed. Post mortem staining present over back of body and fixed. Rigor mortis well appreciated all over the body.

Intravenous injection marks present over back of right hand.

Internal Examination

1. Skull was intact, brain & meninges were intact & congested.
2. Pleural cavity contains 200 ml of straw coloured fluid on both sides.
3. Both lungs were intact & congested Heart & aorta were intact.
4. Peritoneal cavity contains 1000 ml of straw coloured fluid and shows frank pus at places.
5. Stomach contains 50 ml of cream coloured fluid, no unusual smell, mucosa normal.
6. Liver & spleen were intact & congested.
7. Pancreas-congested and oedematous. On dissection, parenchyma and duct shows multiple calcified calculi of varying sizes of 0.5 to 1 cm. Figure 5 Parenchyma shows areas of grey-white pancreatic necrosis and haemorrhagic areas. Figure 6
8. Intestinal coils contain gas & its contents.
9. Both kidneys were intact & congested.

Cause of death: Death is due to peritonitis consequent upon acute on chronic pancreatitis.



Fig. 5. Pancreatic calculi removed from duct

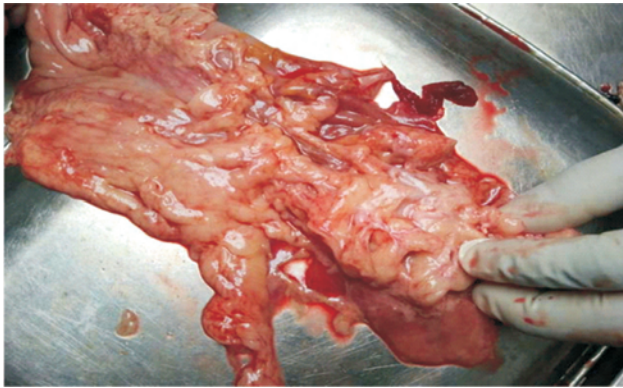


Fig. 6. Pancreas oedematous and shows necrotic and haemorrhagic areas

RESULTS

In these study cases of acute hemorrhagic pancreatitis. Two patients presented as sudden deaths at home, while one died within 24 hours of hospitalization. All three patients had similar findings of acute hemorrhagic pancreatitis on post mortem examination. Pancreatitis associated organ failure was one of the most important determinants of mortality. While biliary etiology represents the main cause in various clinical studies, it had an insignificant role in our case study. Etiological factors usually are alcohol and gall stones, but in our study two cases had history of consumption of some unknown substance which revealed to be organophosphorus insecticide which was confirmed by chemical analysis and idiopathic cause in one. The males in their 2nd and 3rd decade were common victims

DISCUSSION

From mild disease to Multiorgan failure and sepsis, acute pancreatitis is a disorder that has numerous causes, an obscure pathogenesis, few effective remedies, and an often unpredictable outcome. The suddenness of its onset, its illimitable agony which accompanies it, and the mortality attendant upon it render it the most formidable of catastrophes.

Pancreatitis associated organ failure was one of the most important determinants of mortality features of organ failure included respiratory distress, hypotension and anuria. Autopsy based studies provide valuable information and a holistic approach to the study of acute pancreatitis.

The underlying cause of the pancreatitis in cases included alcohol abuse, biliary tract disease, trauma, hypothermia and hyperparathyroidism.³

It has been recognized for many years that in 30 - 40 per cent of fatal cases the diagnosis is not made until autopsy. Since a postmortem examination is not carried out on everyone who dies, it would be reasonable to assume that there are additional cases of acute pancreatitis where the condition is not suspected clinically, and where the diagnosis is never made. If these fatalities were included the mortality rate expressed in terms of the population at risk would be even more⁴

Sudden death in young individuals is relatively uncommon and acute hemorrhagic pancreatitis as a cause of sudden and unexpected death is a rare phenomenon. A case of sudden death due to acute hemorrhagic pancreatitis is reported in a young doctor who ignored the radiating pain of acute pancreatitis for gastritis, and resorted to self-medication. The condition was discovered only at autopsy.⁵

Causes of Acute Pancreatitis

Gallstones and alcohol are the two most common causes of Acute Pancreatitis in western countries, accounting for 80% of cases. Gallstone pancreatitis results from transient obstruction of the ampulla of Vater by small stones or edema. Alcohol is the second leading cause of Acute Pancreatitis, which typically occurs after episodes of binge drinking. After recurrent episodes, most alcoholics go on to develop chronic pancreatitis.

Hypertriglyceridemia produces acute pancreatitis if triglyceride levels are above 1000 mg/dL. Hypercalcemia produces Acute Pancreatitis through calcium-mediated activation of trypsinogen and subsequent glandular autodigestion. In recent years, numerous genetic mutations have been associated with the development of pancreatitis.

These include mutations of cationic trypsinogen (hereditary pancreatitis), serine protease inhibitor Kazal type 1 (SPINK1), and the cystic fibrosis transmembrane regulator (CFTR) gene. Numerous case reports and case series have implicated specific medications (e.g., sulfa drugs, 6-mercaptopurine, didanosine, furosemide, valproate) as causes of acute pancreatitis; however, the strength of these associations is variable.

Acute pancreatitis is difficult to diagnose during pregnancy. It presents as a systemic inflammatory response syndrome (SIRS) resulting in hemodynamic changes and may lead to abruptio placentae.

Pathophysiology

The pathogenesis of Acute Pancreatitis has been studied extensively using animal models. Although various causes produce distinct inciting events, the final common pathway is premature activation of digestive enzymes within the acinar cells. Ordinarily, pancreatic proenzymes become activated on release within the duodenum. Pancreatitis results from early activation of pancreatic enzymes, producing autodigestion of the pancreas and surrounding tissues. Exposure of trypsinogen to lysosomal enzymes such as cathepsin B has recently been elucidated as a mechanism for early trypsin activation. Digestive enzyme release is amplified as acinar cells lyse, leading to a vicious cycle of inflammation and necrosis.

CONCLUSION

Sudden unexpected deaths form the subject of medicolegal investigation if they occur in apparently healthy individuals, wherein an autopsy would shed light regarding the cause of death. Etiology in an attack of acute pancreatitis is highly variable and hence it is very important to identify the causative factor as it can have an effect on the specific treatment and can prevent the relapses. Incidence of acute pancreatitis seems to be increasing, the difference in the incidence and

etiology between and within the countries reflect the difference in risk factor prevalence. Case fatality rate, but not the population based mortality rate has decreased over a time.⁶

Conflict of Interest: Nil

REFERENCES

1. Murty O. P, Agarwal Anshoo, Krishnan Radha; Sudden death due to acute pancreatitis: Autopsy observations, *Journal of Forensic Medicine and Toxicology*, 2008; 25(2).
2. M K Heatley, J Crane; Acute pancreatitis as a cause of sudden or unexpected death in Northern Ireland, *The Ulster Medical Journal*, April 1989; 58(1): 51- 55.
3. Acute pancreatitis, *The Ulster Medical Journal*, Volume 58(1), 54-55.
4. Acute pancreatitis as a cause of sudden or unexpected death in Northern Ireland, *The Ulster Medical Journal*, *The Ulster Medical Society*, April 1989; 58(1): 51- 55.
5. Tanuj Kanchan, *Journal of Forensic and Legal Medicine* February 2009; 16(2): 101-103
6. Steinberg William, Tenner Scott. *Acute Pancreatitis*, *The New England Journal of Medicine*. Washington DC, 1994,1198-1200.

A Comparative Study of the Emerging Trends in the Use of Electronic Gadgets in the Youth

Navpreet Kaur¹, Priyanka Devgan², R K Chaudhary³, Baljeet Singh⁴, Pankaj Gupta⁵

¹Associate Prof, Department of Forensic Medicine, ²Associate Prof, Department of Community Medicine,

³Assist. Prof. Department of Forensic Medicine, ⁴Prof & Head, Department of Forensic Medicine,

⁵Prof. Department of Forensic Medicine, SGRDIMSAR, Amritsar, Punjab

ABSTRACT

Technology is ruling the modern world. Electronic world wide web has spread its tentacles far and wide and there is hardly anybody who has been left untouched by it. The modern youth is so driven by it that the day is not far when problem of drug abuse will be replaced by electronic abuse. These devices are the boon and the bane of society. Outdoor activity has been replaced with obsession to be accessible to all and sundry with frequent updating of statuses and fidgety fingers looking for keypads to work on. The study was undertaken to study the trend and influence of these modern gadgets in the life of young adults of Amritsar city.

Keywords: Electronics, Abuse, Youth

INTRODUCTION

Technology & electronic gadgets have revolutionized common man's life. It has become an integral part of our day to day activity & has literally become the fuel that drives our lives. The whole world is accepting & adopting the ways of technology & the youth are playing a vital role in this. Cell phones, computers, internet, i pads, PSP's, TV, have become a staple of modern society. From children to adults, every single one of them is hooked to these devices like life support system. The current study was undertaken to analyse the dependence of man especially young adults in the age group of 17-21 years on these electronic devices & how it influences their mental & physical health by the amount of time these young adults spend using these gadgets.

MATERIAL & METHOD

A pretested proforma adjudging the average amount of time the young adults of Amritsar region spend on using electronic gadgets & physical exercise was administered to 300 students who were freshly enrolled into courses in Sri Guru Ram Dass Institute of Medical Sciences & research, Engineering college running under the aegis of Global Institute & DAV College Amritsar. The students were informed about the purpose of study & their consent was taken after assuring them full confidentiality.

RESULTS

Table 1: Distribution of students according to age & sex

Age Group	Male	Female	Total
<17	0	0	0
17-19	151(53%)	134(47%)	285(95%)
>19	5(33%)	10(66%)	15(5%)
Total	156(52%)	144(48%)	300

In the present study, 156(52%) males & 144(48%) females participated out of which 151 males & 134 females were in the age group of 17-19 years. In this 100% of the medical & engineering students owned a cell phone while 96 % of the humanities students possessed mobile.

Table 2: Percentage distribution of students according to average time they spend using cell phones

Average time spent	Medical	Engineering	Humanities
2-3 hrs or more	23	16	13
2-1 hrs	35	38	29
1-½ hr	42	46	54
Total	100%	100%	96%

In the medical stream, 23% students spent 2-3 hrs or more using cell phone, 35% used it for 1-2 hrs & 42% used it for only 1-1/2 hr per day. 16% Engineering students used mobiles for 2-3 hrs, 38% for 1-2 hrs & 42% restricted their use to 1-1/2 hr daily. Meanwhile 54% of the arts students spent ½ to 1 hour talking on

cell phones, 29% for 1-2 hrs & only 13% used it for more than 3 hrs.

In the present study, out of the total 300 students who participated, 255 (85%) had access to internet while 45(15%) did not have access to internet.

Table 3. Distribution of students according to average time they spend surfing on internet

Average time spent	Medical	Engineering	Humanities	Total
More than 2 hrs	2	9	2	13(0.3%)
2-1 hrs	44	48	52	144(57%)
1-1/2 hr	37	33	28	98(38%)
No access	17	10	18	45(15%)

Majority 57% of the student spent 1-2 hrs daily surfing on the net with 52% contribution from the humanities section. 38% students spent only 1- ½ hr surfing with medical students taking the lead in this category with 37%. Only 0.3% spent more than 2 hours surfing the net with engineering students taking lead in this section.

Table 4: Distribution of students according to purpose of surfing

Purpose	Medical	Engineering	Humanities	Total
Social networking	8	25	24	57(22%)
Research	14	35	11	60(23%)
Chat	34	24	20	78(30%)
Videos/games	27	4	23	52(20%)
Not specific	7	12	4	23(0.9%)
No access	17	10	18	45(15%)

Out of the total 255 who had access to internet, 22% spent time on social network sites, 23% did academic research, 30% chatted on chat sites, 20% played games or watched videos & 0.9% surfed a little bit of everything.

Table 5: Distribution of students according to time spent watching TV

Average time spent	Medical	Engineering	Humanities	total
More than 3 hrs	7	13	12	32(14%)
2-3 hrs	0	0	0	0
2-1 hr	90	85	88	263(88%)
1-1/2 hr	3	2	0	5(1%)

88% (263) of the total young adults watched TV daily for an average period of 1-2 hrs while 14% watched it for more than 3 hrs & 1% (5) students watched TV for less than an hour. Majority 112 (38%) of these students liked to watch reality shows followed by 30% liking movies ,22% family drama & only 9%

spent their time watching educational programmes as seen in the results of table 6.

Table 6: Distribution of students according to preference of programmes watched on TV

Programme	Medical	Engineering	Humanities	Total
Educational	3	15	11	29(9%)
Reality shows	43	24	45	112(38%)
Movies	38	32	19	89(30%)
Drama	16	26	25	67(22%)
Non specific	0	3	0	3(1%)

184(61%) of the total students participated in some kind of physical activity while 116(39%) refrained from doing any exercise.

Table 7: Distribution of student according to physical activity indulged in.

Activity	Medical	Engineering	Humanities	Total
Sport	20	30	14	64(34.7%)
Walk	23	17	27	67(36.4%)
Gym	12	17	23	52(28%)
yoga	1	0	0	1(0.05%)

Majority of the professional students played some sport (50) while humanities students (50) were more inclined towards walk & going to a gymnasium.

DISCUSSION

In the present study 100% of the medical & engineering students & 96% of the students from humanities owned a cell phone. Regarding the average time spent by students using a cell phone, majority (48%) restricted their time limit to ½ hour to 1 hour daily. Hargittai (2007), in a study of all incoming students at the University of Illinois-Chicago, found that almost 97 percent had a cell phone.^[1] Junco and Mastrodicasa (2007) found in their multicollge study that 94 percent of respondents reported owning cell phones.^[2] Salaway, Caruso, and Nelson(2007) report that among college students in their study, 86 percent own cell phones (without Internet access) while 12 percent own smartphones (which often include personal digital assistants, Internet, gaming, and cell functions in one device).^[3]In a small-scale study of college students at one university in the South, Auter (2007) found that students reported around ten and a half hours of cell phone use per week, with the majority of use related to interpersonal communication with social network members.^[4] 255(85%) students out of the total 300 who participated in the study had access to internet through desktops (106)42%, laptops (72)28%, cyber café (34)13% , phones(35)14% or in their colleges(6)0.2%. 57% of these young adults spent on

an average 1-2 hours surfing the internet while 38% spent only half an hour. The percentage of students surfing net for more than 2 hrs was only 5% which was observed in engineering students who spent maximum time in academic research. 23% of the students used internet for academic research in which both medical & engineering students took the lead. 30% of the young adults chatted on internet daily while 22% spent their time on social networking sites. 20% liked to play games or watch videos & 0.9% liked to surf little bit of everything on the internet. In the United States, 68 percent of Americans own a desktop computer, 30 percent have a laptop computer, and 73 percent live in a household with an Internet connection (Fox,2005; Horrigan, 2007).^[5] According to recent Pew Internet Studies reports,73 percent of U.S. adults are Internet users, and on average, about 70 millionU.S. adults use the Internet on a given day (Pew Research Center, 2006;Madden and Rainie, 2003).^[6] The highest rates of Internet use are among those eighteen to twenty-nine years old (88 percent), with declines in rates as age increases (Pew Research Center, 2006). Other research shows that communication is the main use of the Internet (Fox, 2004; Cotten and Bowman,2005; Hoffman, Novak, and Venkatesh, 2004; Kraut and others, 1998).^[5,8,9] Quan-Haase (2007) found that 65 percent of the 268 students in her study spent more than three hours per day online, 62 percent used e-mail weekly, 67 percent used IM daily, and most students had been using IM for four years or more.^[10] Morgan and Cotten (2003), in a sample of 287 college first-year students, found that students spent an average of 3.9 hours using e-mail, 16.3 hours of chatroom and IM use, and almost 12 hours using the Internet for non communication-related activities per week, such as surfing or playing games.^[11] Hargittai (2007) found that 82 percent of students reported using chat features of digital media, and almost 84 percent went online more than once a day. Gordon, Juang, and Syed (2007) report that the top five uses of the Internet in their convenience sample of undergraduate psychology students were e-mailing friends, getting help with school work, talking with friends, e-mailing family, and IM.^[12] The average time spent by them was 1-2 hrs (88%) watching TV while 14% watched TV for more than 3 hrs & hardly 1% reported watching TV for less than half an hour. The preference for watching reality programmes was shown by 38% students, followed by preference for movies (30%) while 22% liked to watch family drama. Educational programmes were viewed by only 9%. 184 (61%) of the generation X indulged in some sort of physical activity with

professional students showing preponderance towards sports & humanities population tilting towards walking & going to a gym. No study has been reported to know the time young adults spend watching TV & doing some sort of physical exercise.

CONCLUSION

Technology has no doubt revolutionized our lives but at the same time it has overpowered us by spreading its tentacles towards all sparing none from children to adults. The research clearly shows that the new generation likes to spend whatever time they have glued to their computers or hooked to internet updating their status. Mothers like to sing a lullaby to their infants through an iphone & quality time these days is not spending time with your family but addicted to ipads, laptops or phones. The desire to stay connected has in fact made man so dependent on these gadgets that life without them seems as if one has been un hooked from ventilatory support . Restlessness, irritability, fidgeting fingers ready to press buttons & zero tolerance towards relationships are some of the behavioural changes observed in the new tech savvy generation. This new addiction of the electronic gadgets is producing zombies who talk & breathe only through these devices.

REFERENCES

1. Hargittai, E. "A Framework for Studying Differences in People's Digital Media Uses." In N. Kutscher and H.-U. Otto (eds.), *Cyberworld Unlimited*. VS Verlag für Sozialwissenschaften/ GWV Fachverlage GmbH, 2007. Retrieved Oct. 10, 2007, from <http://eszter.com/research/c10-digitalmediausesframework.html>.
2. Junco, R., and Mastrodicasa, J. *Connecting to the Net Generation*. Washington, D.C.:National Association of Student Personnel Administrators, 2007.
3. Salaway, G., Caruso, J. B., and Nelson, M. R. *The ECAR Study of Undergraduate Students and Information Technology, 2007*. Boulder, Colo.: EDUCAUSE, 2007. Retrieved Oct. 12, 2007, from <http://connect.educause.edu/library/abstract/TheECARStudyofUnderg/45075>.
4. Auter, P. J. "Portable Social Groups: Willingness to Communicate, Interpersonal Communication Gratifications, and Cell Phone Use Among Young Adults." *International Journal of Mobile Communications*, 2007, 5(2), 139-156.
5. Fox, S. "Older Americans and the Internet." Pew Internet and American Life Project, 2004.

- Retrieved Sept. 23, 2006, from http://www.pewinternet.org/pdfs/PIP_Seniors_Online_2004.pdf.
6. Pew Research Center. *Who's Online*. 2006. Retrieved Aug. 5, 2006, from http://www.pewinternet.org/trends/User_Demo_4.26.06.htm.
 7. Madden, M., and Rainie, L. "The Changing Picture of who's Online and What They Do." 2003. Retrieved Jan. 5, 2004, from http://www.pewinternet.org/pdfs/pip_online_pursuits_final.pdf.
 8. Cotten, S. R., and Bowman, S. "Using Symbolic Interactionism to Delineate the Process Through Which Internet Usage May Impact Well-Being Among College Students." Paper presented at the American Sociological Association annual meeting, Philadelphia, 2005.
 9. Hoffman, D. L., Novak, T. P., and Venkatesh, A. "Has the Internet Become Indispensable?" *Communications of the ACM*, 2004, 47(7), 37-42.
 10. Quan-Haase, A. "College Students' Local and Distant Communication: Blending Online and Offline Media." *Information, Communication and Society*, 2007, 10, 671-693.
 11. Morgan, C., and Cotten, S. R. "The Relationship Between Internet Activities and Depressive Symptoms in a Sample of College Freshmen." *CyberPsychology and Behavior*, 2003, 6(2), 133-142.
 12. Gordon, C. F., Juang, L. P., and Syed, M. "Internet Use and Well-Being Among College Students: Beyond Frequency of Use." *Journal of College Student Development*, 2007, 48, 674-688

A Study of Correlation of Time Since Death with Vitreous Potassium and Sodium-Potassium Ratio

Nitin S Barmate¹, Manish B Shrigiriwar², Anil K Batra³, Preeti Puppalwar⁴

¹Assistant Professor, Dept. of Forensic Medicine & Toxicology, Govt. Medical College, Nagpur, Maharashtra, ²Professor & Head, Dept. of Forensic Medicine & Toxicology, Shri V. N. Govt. Medical College, Yavatmal, ³Associate Professor, Dept. of Forensic Medicine & Toxicology, Shri V. N. Govt. Medical College, Yavatmal, ⁴Assistant Professor, Dept. of Biochemistry, Shri V. N. Govt. Medical College, Yavatmal

ABSTRACT

The interval between the death and the time of the examination of the body is known as postmortem interval. The exact time of death cannot be fixed by any method but only approximate range of time since death can be given because there are considerable biological variation in the individual cases. The present study was carried out in the Morgue and the Department of Forensic Medicine and Toxicology, of Shri V. N. Government Medical College, Yavatmal from Maharashtra. The vitreous humor was sampled from about 201 cases subjected to autopsy.

The results of the present study lead to the following conclusions:

- 1) There is linear relationship between vitreous potassium concentration and postmortem interval.
- 2) The Vitreous Potassium based formula for the estimation of Postmortem interval is $PMI = 11.63 (K+) - 70.90$.
- 3) For first 12 hours with increase PMI sodium/potassium ratio also increases. Then it is suddenly decreases from 12.1 hours onwards up to 24 hours.
- 4) Age, sex, cause of death and environmental condition have no appreciable effect in determining the correlation of potassium in vitreous humor with postmortem interval.

Keywords: *Vitreous Potassium, Sodium, Postmortem Interval/ Time Since Death*

INTRODUCTION

The interval between the death and the time of the examination of the body is known as postmortem interval. The exact time of death cannot be fixed by any method but only approximate range of time since death can be given because there are considerable biological variation in the individual cases¹.

The routine methods to estimate postmortem interval are changes in eye, cooling of body, postmortem staining, rigor mortis, decomposition changes, contents of stomach and bowels, contents of urinary bladder and circumstantial evidence. From these methods only the approximate time of death can be estimated. ².

Following death, there is cessation of metabolism and energy production. Autolysis starts leading to dissolution of the chemical, physical and morphological integrity of the vitreous body, cessation of active membrane transport and loss of selective membrane permeability. Therefore, this leads to diffusion of ions from intracellular fluid to extracellular fluid according to their concentration gradients till the equilibrium is reached³.

Thus in the present study an effort is made to derive a formula to estimate near accurate PMI in this Central India region from vitreous potassium and also find the correlation of the ratio of sodium/potassium to the postmortem interval. An effort will be made to know if the postmortem vitreous potassium concentration

has any relationship with different age group, with male and female sex along with seasonal variation.

MATERIAL AND CASES

The study was carried out in the Morgue and the Department of Forensic Medicine and Toxicology, of Shri V. N. Government Medical College, Yavatmal from Maharashtra.

The vitreous humor was sampled from about 201 cases subjected to autopsy at Mortuary of this Department.

Inclusion criteria: Case with known time of death, only the clear vitreous humor samples taken.

Exclusion criteria: Cases, where time of death on enquiry from different sources are differ by more than ± 30 min, vitreous humor samples either turbid or having any particulate matter or blood is discarded

The vitreous samples was drawn from the eyes of deceased at the beginning of postmortem examination

of dead body to the mortuary. The sample was collected and needs to be immediately centrifuged.

The sample was analyzed for sodium and potassium, the analysis for these constituents will be carried out using Flame Photometer Mediflame 129 (Systronics). The statistical analyses for the data were carried out using the Graph Pad Prism Version 5.01 software.

RESULT & OBSERVATION

A total 201 samples in which 145 subjects were males and 56 were females ranging from age group of 09 to 75 years with an average value of 35.52 years used in present study.

In this study the minimum value of known postmortem interval was 1 hours and the maximum of known postmortem interval was 26 hours with an average value of 10.99 hours.

Vitreous Humor Biochemical Concentrations

Table No. 1:

PMI in hours	No. of cases	Range of K ⁺	Range of Na ⁺	MEAN \pm SD K ⁺	MEAN \pm SD Na ⁺	MEAN \pm SD Na/K Ratio
0 - 6	65	6.1 - 7.4	91.2 - 118	6.49 \pm 0.44	114.10 \pm 3.80	17.63 \pm 1.05
6.1 - 12.0	44	6.4 - 7.2	120 - 130	6.82 \pm 0.19	126.81 \pm 2.87	18.5 \pm 0.35
12.1 - 18.0	70	6.3 - 8.2	126 - 140	7.44 \pm 0.28	135.05 \pm 2.98	18.16 \pm 0.42
18.1 - 24.0	21	7.7 - 8.2	138 - 144	7.90 \pm 0.11	140.19 \pm 2.08	17.73 \pm 0.28
24.1 - 36.0	01	8	144	-	-	-
Total (0-36 hrs)	201	6.1 - 8.2	91.2 - 144	7.05 \pm 0.58	127.1 \pm 10.31	18.04 \pm 0.76

Thus for first 12 hours with increase PMI sodium/potassium ratio also increases. Then it suddenly decrease from 12.1 hours onwards up to 24 hours.

The observed linear regression analyses correlation of the vitreous potassium and sodium/potassium ratio with PMI

Vitreous potassium and PMI

The linear regression correlation of vitreous potassium and PMI The linear rise of vitreous potassium against increasing PMI is represented in Fig. 1 (n: 201; r: 0.8911; P<0.0001).

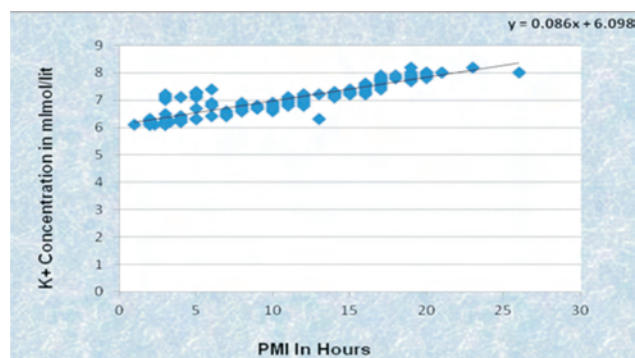


Fig.1. The regression plot of vitreous humor potassium concentration plotted against the postmortem interval (PMI) in hours

Vitreous sodium/potassium ratio and PMI The linear regression correlation of vitreous sodium/potassium ratio and PMI (n:201; r: 0.09953; P: 0.1598)

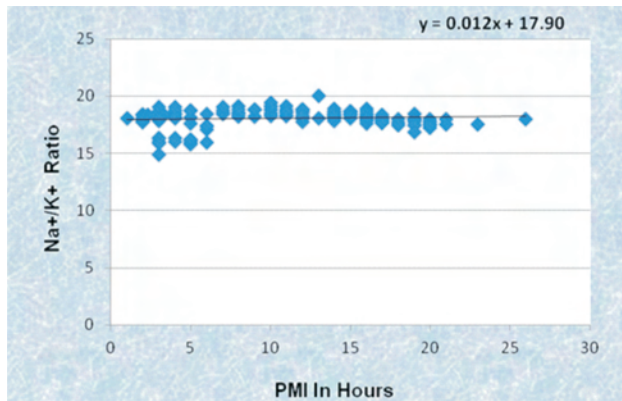


Fig.2. The regression plot of vitreous sodium/potassium ratio plotted against the postmortem interval (PMI) in hours.

Correlation between Postmortem Interval and Vitreous Humor Potassium For Proposed Formulae

The vitreous potassium concentrations were used as the dependent variable to calculate the estimated PMI. The resulting linear regression equation in the form of

$$y = ax + b$$

Where,

'y' is vitreous potassium concentration;

'x' is actual PMI in hours;

'a' is the slope of regression line and

$$a = 0.086,$$

'b' is the intercept of the regression (Y-intercept when X=0.0):

$$b = 6.098$$

Thus the resulting linear regression equation is

$$y = 0.086x + 6.098 \text{ ie..}$$

$$x = (y - 6.098) / 0.086$$

$$x = 11.63y - 70.90$$

Thus Postmortem interval estimated by resulting linear regression formula.

$$PMI = 11.63 (K^+) - 70.90$$

$$95\% \text{ confidence limit of } x = \text{Mean} \pm 2SD \text{ of } x$$

$$= \text{Mean} \pm 2 \times 6.06$$

$$= \text{Mean} \pm 12.12$$

SD of x

$$\text{Regression coefficient} = r$$

SD of y

$$= 0.8911(6.06 / 0.58)$$

$$= 9.30$$

This means that an increase of potassium values of 1mmol/L will indicate an increase of 9.30 hrs in the postmortem interval and 95% confidence limit for all cases will be ± 12.12 hrs.

Thus average rate of increase of vitreous potassium was calculated as 0.1075mmol/L per hours.

Comparison of Actual PMI and Estimated PMI by Derived Formula:

Statistical analysis By using Paired t test

Comparison	P value	Significance
Actual PMI with Estimated PMI	0.6444	NS

NS - Not significant.

As the potassium based formula derived from the data of the present study to estimate PMI is: $PMI = 11.63 (K^+) - 70.90$

No significant difference(NS) find between actual PMI and estimated PMI from derived potassium based formula (P 0.6444)

Comparison of Potassium (K⁺) and Sodium (Na⁺) concentration in different age group with post-mortem interval:

Table No. 2

Sr. No.	Age Group (Years)	No. of cases	Range of PMI(Hours)	Range of K ⁺	Range of Na ⁺	MEAN \pm SD K ⁺	MEAN \pm SD Na ⁺
1	0-20	34	02 - 26	6.1- 8	112 - 144	7.076 \pm 0.61	128.52 \pm 9.77
2	21-40	103	02 - 23	6.1- 8.2	91 - 144	7.084 \pm 0.55	127.31 \pm 10.54
3	41-60	54	01 - 21	6.1- 8	110 - 144	6.99 \pm 0.64	126.59 \pm 10.25
4	61-80	10	02 - 17	6.1- 7.7	112 - 136	6.94 \pm 0.55	122 \pm 9.79

Statistical analysis (By using Kruskal-Wallis Dunn's post hoc test)

Comparison of each age group reveal P values not less than 0.05 ie. Not significant.

Table 2 and statistical analysis shows no significant effect of age on vitreous potassium and sodium with same PMI in different age group.

Comparison of Potassium (K⁺) and Sodium (Na⁺) concentration in different sex post-mortem interval.:

Table No. 3

SEX	No. of cases	Range of PMI(Hours)	Range of K ⁺	Range of Na ⁺	MEAN ± SD K ⁺	MEAN ± SD Na ⁺
Male	145	01 - 26	6.1 – 8.2	91 - 144	7.05± 0.60	127.19± 10.57
Female	56	02 - 20	6.1 - 8	110 - 142	7.035± 0.56	126.71± 9.69

Statistical analysis (By using Mann Whitney test test)

Comparison of male and female shows P values not less than 0.05 ie. Not significant.

Table 3 and statistical analysis shows no significant correlation of vitreous potassium and sodium

with same PMI in different sex ie. male and female.

Comparison of Potassium (K⁺) and Sodium (Na⁺) concentration in different season with same post-mortem interval

Table No. 4

Season	PMI(hrs)	No. of cases	Range of PMI (hrs)	Range of K ⁺	Range of Na ⁺	MEAN ± SD K ⁺	MEAN ± SD Na ⁺	Mean ± SD Na ⁺ /K ⁺
Winter	0-6.0	36	1 - 6	6.1– 7.3	91- 118	6.43± 0.41	113.08 ± 4.58	17.70±1.04
	6.1-12.0	16	7 - 12	6.4 – 7.1	120 - 130	6.89 ± 0.17	127.5 ± 2.37	18.50±0.359
	12.1-18.0	43	13 - 18	7.1 – 7.9	130 - 138	7.44 ± 0.22	134 ± 2.77	18.13±0.308
	18.1-24.0	12	19 – 21	7.7 – 8	138 – 144	7.89 ± 0.11	139.83 ± 1.99	17.72±0.265
	24.1-36.0	1	26	8	144	-	-	-
Rainy	0-6.0	16	2- 5	6.1 – 7.3	112 - 118	6.62 ± 0.51	115.38 ± 1.89	17.49 ± 1.18
	6.1-12.0	4	7 - 9	6.5 - 6.7	120 - 122	6.6 ± 0.08	121.5 ± 1	18.41±0.13
	12.1-18.0	11	14 - 17	7.1 – 7.7	130 - 136	7.31 ± 0.18	134.36 ± 2.50	18.36 ±0.31
	18.1-24.0	4	19 - 20	7.8 – 7.9	140 – 144	7.85 ± 0.057	141.5 ± 1.91	18.02 ±0.31
Summer	0-6.0	13	2 - 6	6.1 – 7.2	112 - 118	6.47 ± 0.44	115.38 ± 2.06	17.88±1.11
	6.1-12.0	24	7 - 12	6.6 – 7.2	120 -130	6.78 ± 0.18	127.12 ± 2.58	18.75±0.32
	12.1-18.0	16	13 - 17	6.3 – 8.2	126 - 140	7.50 ± 0.44	135. ± 3.78	18.12±0.67
	18.1-24.0	5	20 - 23	7.9 – 8.2	138 – 144	7.98 ± 0.13	140 ± 2.44	17.54±0.106

Statistical analysis (By using Kruskal-Wallis Dunn's post hoc test)

Comparison of each season within PMI group reveal P values not less than 0.05 ie. Not significant.

From table 4 and statistical analysis it is observed that environmental condition have no effect on

vitreous potassium and sodium with same post mortem interval.

Comparison of Vitreous Potassium (K⁺) and Sodium (Na⁺) concentration with post-mortem interval in different cause of death

Table No. 5

Sr. No	Cause of death	No. of cases	Range of PMI (hrs)	Range of K ⁺	Range of Na ⁺	MEAN ± SD K ⁺	MEAN ± SD Na ⁺
1	Shock due to burn	15	03- 17	6.9 – 7.9	112 - 140	7.32±0.30	126.4±10.25
2	Septicaemic shock due to burn	21	03 - 20	6.8 – 8.2	114 - 142	7.3±0.37	126.09±10.26
3	Poisoning	94	02 - 26	6.1 – 8.0	91 - 144	6.99±0.59	127.20±10.46
4	Trauma	27	02 - 19	6.1 – 8.0	110 - 142	7.02±0.62	128±10.18
5	Natural	13	01 - 23	6.1 – 8.2	110 - 144	6.70±0.73	123.23±12.18
6	Opinion reserved	9	12 - 21	7.0 – 8.0	128 - 144	7.5±0.33	136±4.47
7	Other	22	02 - 20	6.1 – 7.9	112 - 138	6.92±0.63	125.27±9.35

Statistical analysis (By using Kruskal-Wallis Dunn's post hoc test)

Comparison of different cause of death with each other reveal P values not less than 0.05 i.e. Not significant.

From table no. 5 and statistical analysis it is observed that no significant correlation between vitreous potassium and sodium with different cause of death found in same PMI.

DISCUSSION

During lifetime, potassium is almost intracellular. High intracellular concentration of potassium is maintained by $\text{Na}^+\text{-K}^+$ pump. After death this $\text{Na}^+\text{-K}^+$ pump does not operate, therefore K^+ is leaked out of cell, leading to high postmortem levels. It is postulated that normal antemortem entry route of potassium into vitreous humor is through ciliary body. After death, autolysis of the vascular choroids and retinal cells are responsible for its rise³.

The levels of sodium in vitreous remained constant for prolonged postmortem intervals. Later, their level decreases at a rate of 1mmol/L per hour³.

The normal vitreous concentration of potassium is 2.6 - 4.2mmol/L² and sodium is 118 - 154 mmol/L.⁴

Vitreous Potassium

The present study of potassium in the vitreous humor and sodium/potassium ratio shows that there is considerable rise in the levels of potassium with increasing postmortem interval and this is one of the most accurate methods of estimating time since death.

The Postmortem interval ranges from 1 - 26 hours with mean postmortem interval 10.99 hours. Vitreous potassium concentration ranges from 6.1 - 8.2 with mean±SD 7.05 ± 0.58.

This observation is authenticated by many workers including Agrawal et al (1983)², Yogiraj et al (2008)³, Prasad et al (2003)⁷, Garg et al (2004)⁸, Dalbir Sing et al (2005)⁹, Jashnani et al (2010)¹⁰

Vitreous Sodium

It is evident from Table no. 1 that with the increase in the postmortem interval, the mean levels of sodium in the vitreous humor 127.1 mmol/L which is within

the normal range. This observation consistent with Yogiraj et al (2008)³, Jaffe FA (1962)⁵ and Lie JT (1967)⁶.

From Table no. 1 it is observed that the sodium/potassium ratio of 201 cases ranges from 14.91 - 20 with mean±SD 18.04 ± 0.76.

Thus for first 12 hours with increase PMI sodium/potassium ratio also increases. Then it is suddenly decreases from 12.1 hours onwards up to 24 hours.

This observation partly correlated with Dalbir Sing et al (2005)⁹,

While inverse relationship between vitreous sodium/potassium ratio and postmortem interval was noted by Jashnani et al (2010)¹⁰

From table 2 and statistical analysis show that age has no appreciable role in the changes in the levels of vitreous potassium and sodium. This observation evident by many worker including Agrawal et al (1983)², Garg et al (2004)⁸, Jashnani et al (2010)¹⁰.

Table 3 and statistical analysis shows that there are no appreciable change in the levels of vitreous potassium and sodium in male and female cases. This is authenticated by many workers including Agrawal et al (1983)², Garg et al (2004)⁸, Jashnani et al (2010)¹⁰.

From table 4 and statistical analysis it is observed that environmental condition have no effect on vitreous potassium and sodium with same PMI. This observation consistent with many worker including Garg et al (2004)⁸, Jashnani et al (2010)¹⁰.

Table no. 5 and statistical analysis, which shows that no effect of cause of death found on vitreous potassium and sodium with same PMI. This observation authenticated by various worker including Prasad et al (2003)⁷ and Jashnani et al (2010)¹⁰.

Comparison of Actual PMI and estimated PMI by Derived formula

Postmortem interval estimated by resulting linear regression formula.

$$\text{PMI} = 11.63 (\text{K}^+) - 70.90.$$

By using Paired t test

No significant difference found between actual PMI and estimated PMI from derived potassium based formula (P 0.6444).

CONCLUSION

The results of the present study lead to the following conclusions:

- 1) There is linear relationship between vitreous potassium concentration and postmortem interval.
- 2) The Vitreous Potassium based formula for the estimation of Postmortem interval is $PMI = 11.63 (K^+) - 70.90$.
- 3) Thus average rate of increase of vitreous potassium was calculated as 0.1075mmol/L per hours.
- 4) Age, sex, cause of death and environmental condition have no appreciable effect in determining the correlation of potassium in vitreous humor with postmortem interval.
- 5) For first 12 hours with increase PMI sodium/potassium ratio also increases. Then it is suddenly decreases from 12.1 hours onwards up to 24 hours.

ACKNOWLEDGEMENT

I could not find the words to express my thanks with a deep sense of gratitude to my respected teacher Dr. S.G. Dhawane, & Dr. S V Kuchewar

No conflict of interest and no source of support.

Ethical Approval. No: 15466-67/2009 Date 24/12/2009.

REFERENCES

1. Reddy KSN. The Essentials of Forensic Medicine and Toxicology. 29th ed. Hyderabad, India; Om Sai graphics: 2010. p. 2010; 158

2. Agrawal RL, Gupta PC, Bhasin S, Nagar CK. Determination of the time of death by estimating potassium level in the cadaver vitreous humor. Indian Journal of Ophthalmology. 1983 Sep; 31(5): 528-31.
3. Yogiraj V, Indumati V, Kodliwadmth MV. Study of vitreous humour electrolytes to assess the postmortem interval and cause of death. Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicology; 2008 July - December; Vol. 9(2).
4. Khurana AK. Anatomy and Physiology of Eye. 2nd ed. New Delhi: CBS Publishers and Distributors India; 2006. p. 128 -138.
5. Jaffe FA. Chemical Postmortem changes in intra-ocular fluid. Journal of Forensic science. 1962. Vol. 7 (2): 231- 237.
6. Lie JT. Changes of potassium concentration in the vitreous humor after death. The American Journal of Medical Sciences. 1967. vol. 254. 2:136-143.
7. Prasad BK, Choudhary A, Sinha JN. A study of correlation between vitreous potassium level and postmortem interval. Kathmandu University Medical Journal. 2003. vol 1. 2: 132-134.
8. Garg V, Oberoi SS, Gorea RK, Kaur K. Changes in the levels of vitreous potassium with increasing time since death. Journal of Indian Academy of Forensic Medicine. 2004; 26(4): 136-139.
9. Singh D, Prashad R, Sharma SK, Pandey AN. Double logarithmic, linear relationship between postmortem vitreous sodium/potassium electrolytes concentration ratio and time since death in subjects of Chandigarh zone of north west India. Journal of Indian Academy of Forensic Medicine. 2005. 27(3): 159-168.
10. Jashnani KD, Kale SA, Rupani AB. Vitreous humor: biochemical constituents in estimation of postmortem interval. Journal of Forensic Sciences. 2010 November. vol 55 (6): 523 -527.

Correlation of Clinical History with Analysis of Poison Consumed by Patients Done in MGIMS Toxicology Laboratory

Pushperndra Singh¹, B H Tirpude², P N Murkey³, Ninad Nagrale⁴, Swapnil Patond⁴

¹Associate Professor, Forensic Medicine & Toxicology, Veer Chandra Singh Garhwali, Government Institute of Medical Sciences & Research, Srinagar, Pauri Garhwal, ²Professor & Head, ³Professor, ⁴Postgraduate Students, Forensic Medicine & Toxicology, MGIMS, Sewagram Wardha, Maharashtra

ABSTRACT

For the diagnosis of a case of poisoning, judgement is based on history obtained and signs and symptoms prevailed by a particular consumed poison. But sometimes poisoning may not be suspected ordinarily, because symptoms and signs are not present, specifically and it may even resemble natural disease. Besides it, the history is not available most of the time or if it is available is not correct. Diagnosis of poisoning based on wrong information by exclusion technique has hazardous clinical and legal implications.

Keywords: Poisoning, Clinical Toxicology, Toxicology Laboratory

INTRODUCTION

Toxicology is a science dealing with properties, actions, toxicity, fatal dose, detection & estimation of and of treatment of poisons and medico legal importance of poisoning. Forensic toxicology deals with medical & legal aspects of harmful effects of chemicals on human beings. Clinical toxicology deals with human diseases caused by or associated with abnormal exposure to chemical substances.

In research work, toxicology laboratory can play a vital role in determining the epidemiological aspect of poisoning and to find out the incidences of various poisons. Such knowledge can be utilized by public health authorities in proper planning of preventive measures and public education.

MATERIALS AND METHOD

This study was carried out at Kasturba Hospital in the Department of Forensic Medicine & Toxicology of MGIMS, Sewagram, dist. Wardha (Maharashtra), consisting of 375 cases of poisoning admitted which were analysed in the departmental toxicology laboratory during the period from January 2000 to December 2001.

Each case was followed from the time of admission till the discharge or death and autopsy conducted at the mortuary of department of Forensic Medicine of this institute.

RESULTS

Table 1. Distribution of cases in relation to individual poisons according to history & clinical diagnosis.

Sr. No	Name of poison	No. of cases	Percentage
1.	Inorganic irritants Non metallic-Insecticide, organophosphorus, organochlorous, pyrethroid iodine Metallic- zinc phosphide	19530	52%8%
2.	Inebriant cerebral poisons Ethyl alcohol, kerosene	59	15.73%
3	Organic cerebral poisons/ pharmaceutical agents- diazepam, alprazolam, carbamazepine, dilantin, naphthelene	12	3.2%
4	Organic irritant vegetable poisons- croton seeds, abrus precatorius, neem oil	5	1.33%
5	Somniferous cerebral poison Heroin	3	0.8%
6	Deliriant cerebral poisons- Camphor, cannabis indica	4	1.07%

Table 1. Distribution of cases in relation to individual poisons according to history & clinical diagnosis.

Sr. No	Name of poison	No. of cases	Percentage
7	Corrosive poisons Inorganic- sulphuric acid, hydrochloric acid Organic- phenol, Dettol	10	2.67%
	Single poison subtotal	318	84.8%
8	Ethyl alcohol + organophosphorus Ethyl + methyl alcohol Organophosphorus + organochlorus	4542	12% 1.07% 0.53%
	Mixed poison subtotal	51	13.6%
9	Unknown	6	1.6%
	Grand total	375	100%

Out of 375 cases of poisoning analysed, single cases of poisoning were found as follows-

Inorganic irritants- non-metallic were reported in 195(52%) cases, metallic zinc phosphide 30(8%) cases, inebriant cerebral poisons, ethyl alcohol, kerosene 59(15.73%) cases, organic cerebral poisons, diazepam, alprazolam, carbamazepine, dilantin, naphthalene 12(3.2%) cases, organic irritant vegetable poisons, croton seeds, abrus precatorious, neem oil 5 (1.33%) cases, somniferous cerebral poisons- heroin 3 (0.8%) cases, deliriant cerebral poison camphor, cannabis indica 4 (1.07%) cases, corrosive poisons sulphuric acid, hydrochloric acid, phenol, Dettol 10 (2.67%) cases. Incidence of mixed poisons were found as ethyl alcohol+ organophosphorus 45 (12%), ethyl + methyl alcohol 4(1.07%), organophosphorus + organochlorous 2(0.53%) and unknown in 6(1.6%) cases respectively.

Thus it was observed that the incidence of single poison in 318(84.8%) cases was more in comparison to the mixed poisons i.e. 51 (13.6%) cases.

Table 2. Distribution of cases according to estimation of poison after departmental toxicology laboratory analysis report

Sr. No	Name of poison	No. of cases	Percentage
1	Inorganic irritants Non metallic Metallic	19923	53.066.13
2	Inebriant cerebral	55	14.67
3	Organic cerebral/ pharmaceutical agents	11	2.93
4	Somniferous cerebral	02	0.53
5	Deliriant cerebral	04	1.06
6	Organic irritant vegetable	05	1.33
7	Corrosive poisons	10	2.67
8	Mixed poisons Ethyl alcohol + organophosphorus Ethyl + methyl alcohol	4804	12.81.06
9	No recognizable poison detected	14	3.73
	Total	375	100

In the above study, after estimation of poisons in departmental toxicology laboratory, it was seen that inorganic irritant i.e non metallic poisons were found in 199(53.06%) cases, metallic poison in 23(6.13%) cases, inebriant cerebral poisons in 55(14.67%) cases, organic cerebral poison/ pharmaceutical agents in 11(2.93%) cases, somniferous cerebral poison in 2(0.53%) cases and mixed poison ethyl alcohol + organophosphorus in 48(12.8%) cases, whereas no recognizable poison was detected in 14(3.73%) cases.

Table 3. Discrimination between diagnosis made before and after estimation of poison in departmental toxicology laboratory

Clinical diagnosis in total number of poisoning cases admitted in KHS since Jan 2000- Dec 2001	375
Provisional diagnosis supported in number of cases	336 (89.6)
Provisional diagnosis not supported	25 (6.67)
1. Changed in number of cases	
2. No poison detected in number of cases	14 (3.73)

Out of total 375 cases, 11(2.93%) cases were provisionally diagnosed by clinician in the hospital at the time of admission as insecticides, categorically changed as 10 cases of organophosphorus and 1 case of organochlorous poisoning after the departmental toxicology analysis. Out of 157(41.87%) cases, of organophosphorus poisoning, provisional clinical diagnosis was consistent with laboratory diagnosis in 156(41.6%) cases and changed in 1(0.27%) as organochlorous. Out of 22(5.87%) cases, clinical provisional diagnosis was consistent with laboratory diagnosis in 16(4.27%) cases while it was changed in 6(1.6%) cases, which were reported as organophosphorus after analysis. Out of 30 (8%) zinc phosphide cases, clinical diagnosis was consistent with laboratory diagnosis in 23(6.13%) cases and in 7(1.87%) cases, no recognizable poison was detected after chemical analysis. Out of 53(14.13%) cases of ethyl alcohol, the clinical diagnosis was consistent with the laboratory diagnosis in 50 (13.33%) cases and provisional diagnosis has changed in 3(0.8%) cases. Out of 3(0.8%) cases of heroin, clinical diagnosis was consistent with laboratory diagnosis in 2(0.53%) cases and no recognizable poison was detected in 1(0.27%) case. Out of 2(0.53%) cases of organophosphorus + organochlorous, clinical diagnosis was found inconsistent with laboratory diagnosis after poison estimation in the toxicology laboratory. Out of 6(1.6%) cases of unknown poison diagnosis has established in 1(0.27%) case and no recognizable poison was detected in 5(1.33%) cases.

DISCUSSION

In the present study, from the above table it was observed that the provisional diagnosis was supported by departmental toxicology laboratory after analysis of samples in 336(89.6%) cases. Whereas in 25 (6.67%) cases, laboratory diagnosis changed from provisional clinical diagnosis made by clinician in the hospital at the time of admission. Whereas in 14(3.73%) cases, no recognizable poison was detected in departmental toxicology laboratory after analysis of samples.

Thus it can be concluded that in the present study, the toxicology laboratory has played major role in the confirmation and specification of the clinical diagnosis.

CONCLUSION

1. History was consistent with laboratory findings in 336(89.7%) cases only.
2. In 25(6.67%) cases the provisional clinical diagnosis was changed after the samples were analysed in departmental toxicology laboratory, and in 14(3.73%) cases, no recognizable poison was detected.
3. Thus departmental toxicology laboratory was found to be contributing directly in establishing diagnosis of 39 (10.4%) cases of poisoning and in 25(6.67%) cases suggested suitable antidote for treatment and management in hospital.

REFERENCES

1. Dewan A. (1997); "role and relevance of poison information centres in India", *ICMR bulletin*; Vol. 27(5):P.43-47
2. Dogra TD, Singh B.(1996); "present status of poisoning in India"; *Indian Medical Gazette*; Nov. 1996, P.364-368
3. Fernando R. (1995), "pesticide poisoning in Asia-pacific region and role of a regional information network (1995); *J. Toxicol. Clin. Toxicol* 33; P. 6-11.
4. Jain R. Agarwal P.(1996); "role of Toxicology laboratory in acute poisoning and drug overdose", *Medicolegal update* Vol. No. 1, Jan-Jun, 1996, P. 14-17
5. Malley M. (1997); "clinical evaluation of pesticide exposure and poisoning"; *the Lancet* 1997; 349, P. 1161-66
6. Naik RS, Tirpude BH, Sarwey GN, Agarwal S, Bhati A. (1999); "role and relevance of Toxicology laboratory in department of Forensic Medicine of Medical college", *Journal of Forensic Medicine and Toxicology*; 1999, Vol. 16, No.1; Jan-Jun 1999; P. 70-72
7. Parikh CK. (1990); "Parikh's textbook of Medical jurisprudence and Toxicology", 1990 5th edition, Toxicology section, P. 694.

Demographic Profile of Fatal Burns in Bagalkot, North Karnataka

Pallavi V Raikar¹, Ashutosh B Potdar²

¹Assistant Professor, Department of Community Medicine, ²Assistant Professor, Department of Forensic Medicine, Aarupadai Veedu Medical College & Hospital, Puducherry

ABSTRACT

A retrospective study was conducted on the autopsy cases of death due to burns brought to the morgue of HSK Hospital, Bagalkot & District Civil Hospital, Bagalkot between period from October 2007 to September 2010. Out of 255 cases of burn injuries admitted to these hospitals in this 3-year's period, 115 cases of death were recorded. All these 115 cases were studied in relation with age, sex, marital status & occupation. Observations were also made in relation to total body surface area involved & cause of death. An attempt was made to analyze the manner of death.

Keywords: Burns, Autopsy, Demography, Cause of Death

INTRODUCTION

Fire has been very useful in evolution of human beings. It is also an evil that has caused numerous mass disasters and casualties. Burns is a serious health problem that is associated with high mortality and morbidity in developing countries like India.

Burn injury is defined as an area of tissue damage caused by the effects of heat. It may result directly from the transfer of thermal energy or indirectly when some other form of energy is converted into thermal energy. Examples of the latter are the skin burn seen in electrocution (electrical energy), burns occurring as a result of friction (physical energy) and thermal energy resulting from a chemical reaction (chemical burns). And traditionally injuries resulting from wet heat sources, such as hot water and steam, are known as scalds¹. Here we have studied cases of deaths caused by direct transfer of thermal energy.

As per the NCRB statistics, the number of deaths due to fire in India in year 2008 were 22,454 (6.5% of all accidental deaths) while in year 2009 those were 23,268 (6.5% of all accidental deaths). It included burns due to firework/crackers, short-circuits, explosion of domestic LPG cylinder or stove bursts & other fire accidents causing flame burns. The number of suicides

by burns in year 2008 were 10,986 and the number of suicidal burns in year 2009 were 11,650².

The problem of burning brides for dowry is also at its peak hence, the present study was conducted with aims & objectives of analyzing the demographic features and mortality of burn victims in Bagalkot district.

MATERIAL & METHOD

During the three years period from 1st October 2007 to 31st September 2010, total of 561 medico-legal autopsies were conducted in the mortuaries of S. N. Medical College, Bagalkot and Civil Hospital, Bagalkot. Out of 561 autopsies, 115 deaths resulted due to burns injury. Demographic data about all these 115 cases were collected from the hospital records, police inquests and post mortem notes and were analyzed statistically using percentages & Chi-square test.

OBSERVATIONS

Out of total 561 autopsy cases, 115 (20.49%) were due to burns & rest i.e. 79.51% of medico-legal autopsies were due to other causes. (Table 1)

Table 1. Year wise incidence of Burns cases

Year	No. of burns autopsy cases	Other ML autopsy cases	Total no. of P.M.
2007	05	23	28
2008	43	162	205
2009	35	141	176
2010	32	120	152
Total	115	446	561

Age & sex wise distribution is depicted in Figure 1, indicating females of age group 21-30 years (36.52%) were predominant victims. Male cases were 28 in number i.e. 24.34% & female cases were 87 (75.66%) in number, making a M:F ratio of 1:3. Maximum number of victims belonged to age group of 21-30 years i.e. 53 (46%) cases while minimum cases were reported in age groups of < 10 years & 51-60 years with 2 (1.73%) cases in each age group.

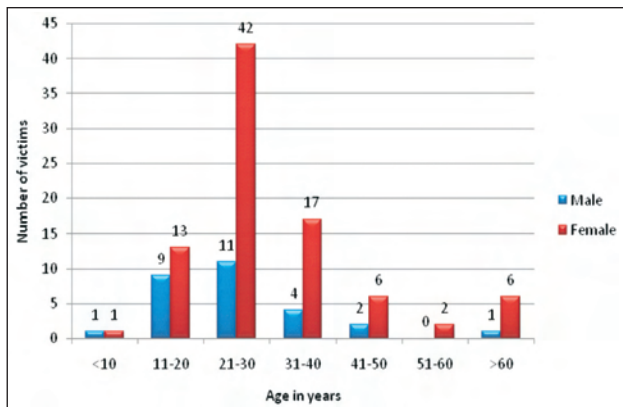


Fig. 1. Age & Sex distribution

Incidence of burns was higher among married women and it was statistically significant. (Table 2: $\chi^2 = 17.37, p < 0.001$)

Table 2: Distribution of cases as per Marital Status and Sex

Marital status	No. of cases		
	Male	Female	Total
Single	14	11	25
Married	14	76	90
Total	28	87	115

Chi square test: $\chi^2 = 17.37, p < 0.001$

With regards to occupation (Figure 2), 71.3% victims who suffered burns were housewives, followed by 16.52% victims being students and 10.43% were farmers.

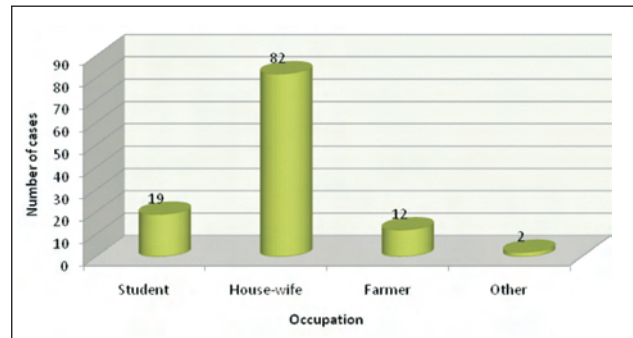


Fig. 2. Occupation wise distribution of cases

Among the study population, majority i.e. 91.3% of victims were residents of rural area surrounding Bagalkot City, while rest 8.7% cases were from urban population. (Table 3)

Table 3: Distribution of cases as per place of residence

Place	No. of cases		
	Male	Female	Total
Rural	26	79	105
Urban	02	08	10
Total	28	87	115

The commonest cause of death was septicemia, which was observed in 51(44.36%) victims. Second common cause of death was neurogenic shock with toll of 36(31.3%) cases and the rest 28(24.34%) cases succumbed to hypovolaemia. (Figure 3)

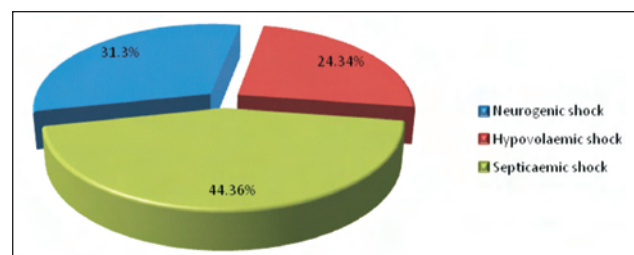


Fig.e 3. Cause of death

Most of the cases i.e. 102(88.69%) were reported as accidental while 10(8.7%) cases were suicidal & only 3 being homicidal in manner of death. (Table 4)

Table 4: Distribution of cases as per Manner of death

Manner of death	No. of cases		
	Male	Female	Total
Suicidal	04	06	10
Homicidal	00	03	03
Accidental	24	78	102
Total	28	87	115

Distribution of burns cases as per the total body surface area (TBSA) involved reveals that, maximum victims i.e. 26 (22.63%) had burn injury involving more than 90% of TBSA, followed by 24 (20.86%) cases, which had 81-90% of TBSA involved. (Figure 4)

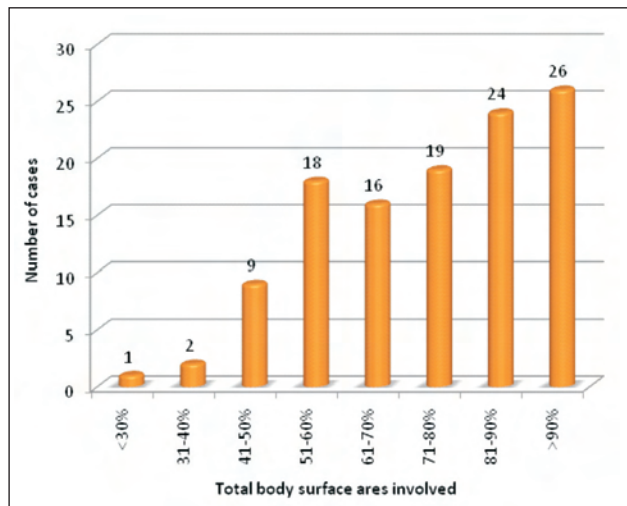


Fig. 4. Total body surface area involved

DISCUSSION

Babladi PI³ and his associates, in their five years (1998–2002) study of burns at Gulbarga, Karnataka, found 25% cases, out of all unnatural deaths, were due to burns (i.e. 525) and out of them 381(72.5%) were females and 450(85.17%) cases were accidental in nature, findings similar to our study. Similar study was conducted on the burns autopsy cases by Tirpude et al⁴ at MGIMS, Sewagram (2006 to 2007). The study showed that the male:female ratio was 1:3 coincident with present study.

In a study done in Rajkot from Nov.2004 to Oct.2005, Sharma B⁵ observed that female victims were 219 (73.0%) in number, making a M: F ratio of 1:2.7, & most victims i.e. 120 (40.0%) were of younger age group between 21-30 years. These findings are consistent with our study.

Mangal HM⁶ in Chandigarh found that 19% of the total medico-legal autopsies conducted during the study period were, deaths due to burns. The most common cause of death in these cases was septicemia, same as the finding in present study.

In a study done in Imphal, Manipur, the age group most commonly involved was 21-30 yrs with an incidence of 38.46%, which was more in females,

similar to our study but overall male preponderance was more as opposed to female preponderance in our study⁷.

CONCLUSION

Demographic features of burns in present study are almost similar to the pattern found in most of the other Indian studies with similarity in almost all parameters used.

Most of the burn victims were married females of younger age group from rural area, who died due to septicemia because of accidental burns involving more than 70% of total body surface area.

Though it is said that the accidental burns are more common at extremes of age, i.e. among children and elderly, but it is contradictory to the findings in our study as majority of victims were adult married women. So question that arises here is “Are these really accidental cases?” Or these could be homicidal Dowry deaths, manipulated & reported to be accidental deaths..... And if truly, these are accidental then attempts should be made to prevent occurrence of such cases in future by educating the population at risk regarding safety education.

Septicemia was the commonest cause of death, even though victims were treated in tertiary care units; hence more emphasis should be given on proper management of the burns injury victims to avoid the fatal outcome.

Conflict of Interest: None

Acknowledgement: Nil

Ethical Clearance: None

Source of Funding: Self

REFERENCES

1. Cooper NJ. Burn Injury in Essentials of Autopsy Practice-Current Methods and Modern Trends. London: Springer-Verlag London Limited; 2006. p. 215-32.
2. www.ncrb.nic.in
3. Babladi PI, Vijaynath V, Vijayamahantesh SN. A five year (1998–2002) study of burns at Gulbarga, Karnatak., Medico-Legal Update 2010;10(2): 121-123.

4. Tirpude BH, Murkey PN, Pawar VG, Keche AS, Borkar JL, Singh KS, et al. Autopsy study of burn cases in MGIMS, Sewagram, Wardha. *Int J Med Toxicol Leg Med* 2008;10(2): 23-25.
5. Sharma BR, Harish D, Sharma AR, Sharma S, Singh H. Accidental burns in Indian kitchens: Are they really accidental? *Journal of Indian Academy of Forensic Medicine* 2006;28(1):14-7.
6. Mangal HM, Pathak A, Rathod JS. The Fire is Both "A Blessing & Scourge to the Mankind". *Journal of Indian Academy of Forensic Medicine* 2007;29(4):75-7.
7. Dr. Memchoubi Ph. A Study of Burn Deaths in Imphal. *Journal of Indian Academy of Forensic Medicine* 2007;29(4):131-4.

Identification of Sex of Sacrum of Chennai Region

Prakash Babladi¹, Shreekrishna H K², Vijaykumari³

¹Professor, Dept. of Forensic Medicine and Toxicology, Mahadevappa Rampure, Medical College, Sedam Road, Mahadevappa Rampure, Marg, Gulbarga, ²Assistant Professor, Department of Forensic Medicine and Toxicology, Madha Medical College, Chennai, ³Assistant Professor, Department of Forensic Medicine and Toxicology, Madha Medical College, Chennai

ABSTRACT

Various measurements of sacra of Chennai region, available in the Department of Anatomy, Madha medical college Chennai were taken and the various indices of sacrum were calculated. The demarking points of various parameters were calculated and the percentage of bones identified by D.P. was also recorded. The results were compared with the available literature. It was found that the demarking points of length of sacrum and the sacral index were most reliable in sexing of sacra. Though, the Demarking Point (D.P) of a single parameter may not identify sex in all the bones but the accuracy is 100% in the bones, which are identified.

Keywords: Sacral Index, Corpobasal Index, Demarking Point

INTRODUCTION

Determination of sex from the skeletal remains is of tremendous medico legal importance for establishing the identity of an individual. Sacrum has always attracted the attention of medico legal experts for establishing sex, possibly because of its contribution to pelvic girdle and associated functional sex differences. It has long been customary among forensic experts, anatomists and anthropologist to judge the sex of skeletal material by non-metric observations. Lately, Sexual divergence has been based upon actual measurement in different regions. The determination of deceased sex is first step in skeletal analysis since estimation of age at death, race and stature depends on sex of deceased.

Metrical study of sacrum has been done by various authors (wilder¹, 1920, Fawcet², 1938, Davivongs³, 1963). Singh and Gangrade⁴ (1968) have reported that even within the same general population, mean value may be significantly different in bones from different zones. Jit and Singh⁵ (1966) advocated the demarking point, which identify the sex with 100% accuracy. Singh and Singh⁶ (1972) have shown that D.P. should be calculated separately for different regions of population because the mean of a parameter differs in values in different regions.

The available literature shows that the Indian sacra have not been studied widely except Singh & Raju⁷ (1977) and Jana et al⁸ (1988). The materials studied by them are from Varanasi region and Burdwan regions respectively. Hence present study was undertaken with a view to study the sex differences in sacra of Chennai region of Tamilnadu state.

MATERIAL AND METHOD

The material for the present study consisted of 60 adult sacra (30 males and 30 females) of known sex available in the Department of Anatomy, Madha Medical College, Chennai. These sacra were selected after rejecting the bones, having any fractures, pathology or wear and tear. With the help of a stainless steel sliding caliper and flexible steel tape, the following measurements were taken (each linear measurement was recorded to the nearest millimeter):

1. Maximum length of sacrum (Wilder's mid-ventral Straight length) – measured along the mid-line of sacrum with the sliding caliper from middle of antero-superior margin of the last sacral vertebra.
2. Maximum breadth of sacrum – measured with the sliding caliper by taking points at the upper part of auricular surface anteriorly (or lateral most part of alae of sacrum), thus maximum breadth is measured on anterior aspect of sacrum.

3. Curved length of sacrum (Mid-ventral curved length) – measured along with mid line of the anterior surface of the sacrum (from middle of antero-superior margin of promontory to middle of antero-inferior margin of the last sacral vertebra) by the flexible steel tape.
4. Antero-posterior diameter of the body of 1st sacral vertebra – It is the maximum possible diameter of 1st sacral vertebra measured with the sliding caliper by taking one point on antero-superior border and another point on the postero-superior border of 1st sacral vertebral body.
5. Transverse diameter of the body of 1st sacral vertebra – It is the maximum transverse diameter of 1st sacral vertebra measured with the sliding caliper by taking one point on each side of the lateral most point on the superior surface of body of 1st sacral vertebra.
6. Length of alae – It is measured on both sides with the sliding caliper by taking one point on lateral most point of superior surface of body of 1st sacral vertebra and another point of the two sides is taken as length of alae.

By using the above measurements, the following indices were calculated:

1. Sacral index

$$\frac{\text{Width} \times 100}{\text{Straight Length}}$$

2. Curvature index

$$\frac{\text{Straight Length} \times 100}{\text{Mid-ventral curved length}}$$

3. Index of body 1st Sacral vertebra

$$\frac{\text{AP diameter of body of } S_1 \times 100}{\text{Transverse, dia of body of } S_1}$$

4. Corpo-basal index

$$\frac{\text{Transverse diameter of body of } S_1 \times 100}{\text{Width of sacrum}}$$

5. Alar index

$$\frac{\text{Length of ala} \times 100}{\text{Transverse diameter of body of } S_1}$$

Table 1: Showing various parameters of Sacrum and their statistical analysis

Sr. No.	Parameters	Sex	Range	Mean	S.D.	't' value	'p' value	Calculated range Mean + 3 S.D.	D.P.	% of bone identified by D.P.
1	Length of Sacrum (mm)	M	93-121	107.56	8.59	8.437	<0.001	81.78-133.34	>108.6	70.30%
		F	82-100	90.86	5.91					
2	Width of Sacrum (mm)	M	93-119	107.03	7.98	3.68	<0.001	83.07-124.00	<83.47	2.1
		F	84-117	96.8	10.4					
3	Curved length of sacrum (mm)	M	96-134	110.6	11.39	4.19	<0.001	76.42-144.77	>120.68	13
		F	91-115	99.98	7.13					
4	Tr. Dia of body of 1st sacral vertebra (mm)	M	41-55	48.12	4.23	2.57	<0.001	35.46-60.87	>53.89	21
		F	41-50	45.56	2.77					
5	A-P dia. of body of 1st sacral vertebra (mm)	M	27-36	29.94	2.91	1.9	<0.01	21.19-38.66	>38.33	6
		F	25-33	28.96	3.12					
6	Length of ala of sacrum (mm)	M	26-33	29.4	2.19	0.72	<0.01	22.82-35.97	<20.64	4
		F	26-39	30.67	3.01					
7	Sacral Index	M	93-108	99.21	4.1	9.3	<0.001	90.07-114.72	<93.98	56
		F	104-130.25	119.84	8.66					
8	Curvature index	M	90.47-98.33	94.72	1.91	3.51	<0.001	88.95-107.44	>106.57	4
		F	83.2-97.77	91.2	5.19					
9	Corpobasal index	M	40-53.06	47.76	3.93	6.73	<0.001	35.95-59.57	>53.81	15
		F	33.2-46.9	40.9	4.3					
10	Alar Index	M	44.2-59.5	51.57	5.23	12.47	<0.001	35.85-67.29	<44.15	8
		F	62.0-97.5	76.93	7.69					
11	Index of body of 1st sacral vertebra	M	56-72	64.33	6.43	3.68	<0.001	49.97-78.69	<54.06	0
		F	60-76	69.4	6.9					

The demarking points (DP) of all the above parameters were calculated on the line of the work of *Jit and Singh⁵ (1966)* and percentage of bones identified by each parameter were worked out.

OBSERVATIONS

The range, mean, calculated range (mean \pm 3 S.D.) demarking points (DP) of various parameters and the

percentage of bones in which sex could be identified by them, are given in table -1.

Table shows that the length of sacrum and sacral index are important parameters as far as the sex determination of sacrum is concerned because 70.3% of male bones and 78% of female bones could be identified by using the D.P. for the above parameters.

DISCUSSION

The value of determining the sex of sacra is mostly medico legal where 100% accuracy is required, Jit & Singh⁵ (1966) found that the max & minimum units of parameter values which is determined on the basis of mean + 3 S.D. and which they have named D.P. would be of great value of determining the sex of sacrum with almost 100% accuracy.

The mean length of male sacra of Chennai region (107.56mm) is higher than that of Varanasi region (104.96mm) studies by Raju et al¹¹. (1981) However, the female sacra of Chennai region are shorter than the Varanasi region. Comas & Charles⁹ (1960) reported a wide variation between the male and female in the Chinese, Negroes and Bushmen. Davivongs³ (1963) in his study of Australian aboriginal sacra has reported mean length of sacrum to the 96.52mm and 88.12 mm in the male and female respectively, which is much less than the Indian sacra studied so far. Thus there exists a regional and racial difference in the length of sacrum.

The mean width of the male sacra of Chennai region (107.03mm) is almost similar to observation made by Raju et al.¹¹ (1981) in the Varanasi region (105.33mm). However, in the females the Varanasi region showed a lesser value than that of Chennai region. In the Australian aboriginal females, the maximum width of sacrum was 101.24 mm) of the same race Davivongs³ 1963

The range of the midventral curved length of female sacra falls within the male range in the present study. This is true in the case of Australian aboriginal studies by Davivongs³ (1963). In the present study in all the cases the mean transverse diameter of body of S₁ of male was higher than that of females, supporting the general rule, that the size of the body of first sacral vertebra should be larger in males than in females. The male bones of the present series showed a higher measurement than the males of Varanasi region Raju et al¹¹., (1981) and the Australian aborigines Davivongs³, (1963)

The female ranges of anteroposterior & transverse diameters of body of S₁ are narrower than that of males and fall within the corresponding male ranges. The result is that the separation of any female sacrum from the males by the above measurement alone is impossible.

The mean sacral index of the male sacra of the present series (99.4) falls under dolichohieric group (narrow sacrum with sacral index up to 99.9). Similar observation was reported by Jana et al⁸. (1988) in their study of sacra of Budhwan region (West Bengal) (mean sacral index of male being 95.7) and Singh et al¹⁰. (1988) in Jammu region. However, Davivongs³ (1963) and the Raju et al¹¹ (1981) reported that the male sacra of their study fall under sub-plathieric group.

The mean sacral index of the female bone of the present series (119.62) falls under plathyhieric group, which is similar to the observations of Raju et al¹¹ (1981) and Davivongs³ (1963). Martin¹² (1928) reported that in the European sacrum both male and female means fall into the plathyhieric group, being 112.4 in the male and 114.8 in the female. Any way an attempt to use the sacral index for ethnic discrimination is very doubtful Davivongs³, (1963) However, its importance in sex determination cannot be denied since the differences between the males and females are highly significant, statistically.

The male curvature index of male sacra of the present study (94.72) is slightly higher than that of the observations of Raju et al¹¹ (1981) and Davivongs³ (1963). The same trend was observed in the female bones also.

The mean corpobasal index of the males (47.54) in the present series is slightly higher than that of the Varanasi region (44.94) studies by Raju et al¹¹ (1981), while in the case of females the observations are similar in both the regions. The same trend was observed in both the regions as far as the alar index is concerned also.

SUMMARY & CONCLUSIONS

The present study shows that certain parameters are insignificant as far as the sex determination of sacrum is concerned while certain other parameters are much useful. However, not a single parameter could identify 100% of the bones. Hence, it can be concluded that for the determination of sex of sacrum, maximum number of parameters should be taken to attain 100% accuracy.

Continuance of such studies in a defined geographic area over a period of time will definitely help in establishing anthropometric standards. Such studies will also be useful to observe the changing trends if any, in the metric measurements which is influenced by environmental socioeconomic factors, physical stress and genetic factors.

ACKNOWLEDGEMENT

The authors are thankful to Principal, Prof. Dr. Ganjendran, for permitting to carry out the work and students who participated and cooperated with the study.

Conflict of Interest: We the authors hereby declare that authors or the institution have no financial or the other relationship with other people or organisation.

Source of Funding: This study has not been funded by any organization or the institution.

Ethical Clearance: Ethical clearance has been obtained from ethical committee of the college.

REFERENCES

1. Wilder, H.H. A laboratory manual of anthropometry. P. Blakistons sons & Co. Philadelphia. p. 193 (1920)
2. Faweet, E. (138) : The sexing of the human sacrum. *Journal of Anatomy London*. 72 : 638
3. Davivongs : V, (1963): The peivic girdle of the Australian aborigines; Sex difference and sex determination, *American Journal of Physical Anthropology*, 21:443-455.
4. Singh S, and Gangrade, K.C. (1968) : Sexing of adult clavicle verification and applicability of demarking point. *Journal of Indian Academy of Forensic Science*. 7 : 20-30.
5. Jit I and Singh S. (1966) : Sexing of the adult clavicle, *Indian Journal of Medical Research*, 54:551-571.
6. Singh, S.P. and Singh, S. (1972) : Identification of sex from the humerus. *Indian Journal of Medical Research*, 60:1061-1066.
7. Singh, S. and Raju P.B. (1977) : Identification of sex from the hip bone-demarking points, *Journal of Anatomical Society of India* 26: 111-17.
8. Jana, T.K. Koley, T.K. Saha, S.B. Basu, D., and Basu, S.K. (1988) : Variation and sexing of adult human sacrum. *Journal of Anatomical Society of India (Processing of the Anatomical Society of India)* 37: pp II-III.
9. Comas J, Charles C, *Manual of physical anthropology (revised and enlarged English edition)* Thomas Springfield, Illinois, USA, pp 415-416(1961)
10. Singh H., Singh J. and Bargoitra R.N (1988): Sacral index as observed anthropometrically in region of Jammu. *Journal of anatomical Society of India*.30:13-15
11. Raju, P. B., Singh, Sand Padamnabhaban, R. (1981): Sex determination and Sacrum. *Journal of anatomical Society of India*. 30: 13-15
12. Martin (1928) : Cited by Comas, J. *Manual of Physical Anthropology*, 2nd Edn. Charles, C. Thomas Springfield, Illinois U.S.A. : p 415 (1960)

A Study of Association between Alcohol Consumption and Road Traffic Accidents at Jaipur, Rajasthan

Solanki A¹, Punia R K², Pathak D³

¹Senior Demonstrator, ²Associate Professor and Head of Deptt, ³Assistant Professor, Deptt of Forensic Medicine, SMS Medical College, Jaipur, Rajasthan

ABSTRACT

Introduction: Worldwide motor vehicle collisions lead to death and disability as well as financial costs to both society and individuals involved. There is much evidence to indicate that alcohol consumption by a road user is a major factor in road traffic accident causation.

Objectives: To assess the difference in pattern of injuries among the road traffic accident cases with and without consumption of alcohol. 2. To study the socio-demographic profile of alcohol and non alcohol related road traffic accidents.

Material and Method: This prospective observational cross-sectional study was carried out over a one year period between September 2009 and September 2010 at SMS Hospital, Jaipur. Examination of admitted road traffic accident cases was performed after selection of cases for injuries and consumption of alcohol along with autopsies for cases resulting in death of the subject. All findings were recorded and statistically evaluated.

Result: Out of the 121 cases, a total of 83% of the victims from study population suffered fatal injuries. Of these, 9% were cases of exclusive head injuries; 20% cases had injuries other than head injury and 71% cases had head injury along with injuries to other parts of the body. About 50% of victims suffered head injury along with other bodily injury and 50% had injuries other than head injuries.

Conclusion: Clinically this study shows higher association of RTA's with alcohol. This study also reported a significant correlation between use of safety measures and survival rate which is a well established fact. Hence, it can be concluded that road traffic accidents are a major cause of morbidity and mortality in this region of Rajasthan, India with a higher risk to the productive age group of the society who are predominantly motorcyclists.

Keywords: Road Traffic Accident, Alcohol

INTRODUCTION

A traffic collision also known as a traffic accident, motor vehicle collision, motor vehicle accident, car accident, automobile accident, road traffic collision or car crash, occurs when a vehicle collides with another vehicle, pedestrian, animal, road debris, or other stationary obstruction, such as a tree or utility pole. A number of factors contribute to the risk of collision including; vehicle design, speed of operation, road design, road environment, driver skill and/or impairment and driver behaviour.

Human factors in vehicle collisions include all factors related to drivers that may contribute to a

collision, example include driver behaviour visual and auditory acuity decision making ability, use of cell-phones during driving and reaction speed.¹ Driver impairment may be due to various factors involving physical and mental factors as well as drug use.

The contribution of alcohol to increased risk of traffic accidents has been well established and has received international attention for many years². There is much evidence to indicate that alcohol consumption by a road user is a major factor in road traffic accident causation³. Consuming alcohol impairs performance of a wide variety of tasks during driving i.e. ranging from slowing the reaction time, hampering the eye

hand co-ordination and judgment of distance, the liability to perform several tasks simultaneously⁴.

A person who is severely affected by alcohol may be physically incapable of driving motor vehicle or may refuse to drive; one who is less affected but is still obviously under the influence of alcohol constitutes a danger as a driver. Further, in sub clinical intoxication, in which a person has consumed alcohol but shows no clinical signs whatever, his judgment as a driver may be impaired⁵.

Hence, this study was undertaken at a tertiary care centre in the capital metropolitan city of Rajasthan, to generate alcohol related statistics of road traffic accidents with special concern to the pattern of injury for this region of a developing country, so as to make a contribution to the measures related to combating an emerging public health problem of developing countries.

OBJECTIVES

1. To assess the difference in pattern of injuries among the road traffic accident cases with and without consumption of alcohol.
2. To study the socio-demographic profile of alcohol and non alcohol related road traffic accidents.

MATERIAL AND METHOD

This prospective observational cross-sectional study was carried out over a one year period between September 2009 and September 2010 at SMS Hospital, Jaipur on indoor cases.

After locating the cases, history taking and clinical medico-legal examination for details of injuries inflicted upon were performed along with detailed medico-legal examination for consumption of alcohol, if any. The presence or absence of consumption of alcohol in cases was assessed by clinical examination which was further confirmed using rapid tests on blood and urine samples of the patient collected at the time of examination. In cases where the patient succumbed to the injuries resulting in death of patient, a meticulous medico-legal autopsy was conducted as per rules to determine the cause of death.

OBSERVATIONS

The present study was conducted at the Department of Forensic Medicine of SMS Medical

College, Jaipur between 21st September, 2009 to 5th September, 2010 including 121 cases of road traffic accident which included only male patients out of which maximum number of victims belonged to the 25-34 years of age with about half i.e. majority of victim population belonging to the productive age group i.e. 25 to 44 years of age.

Out of the 121 cases, a total of 83% of the victims from study population suffered fatal injuries. Of these, 9% were cases of exclusive head injuries; 20% cases had injuries other than head injury and 71% cases had head injury along with injuries to other parts of the body. About 50% of victims suffered head injury along with other bodily injury and 50% had injuries other than head injuries.

The victims of road accidents suffering head injuries showed significant correlation with the outcome i.e. mortality of the patients.

Table No. 1. Distribution of injury & outcome of the subjects

Head injury	Outcome		Total
	Survived	Expired	
Occurred	10(11.11)	80(88.89)	90(100.00)
Not occurred	11(35.48)	20(64.52)	31(100.00)
Total	21(17.36)	100(82.64)	121(100.00)

$\chi^2 = 9.550$

d.f.=1

$P < .01$

Sig

Clinical Assessment of consumption of alcohol revealed that 34.7% victim had consumed alcohol prior to the episode of road accident. However it was confirmed in only 28.6% of clinically suspected cases.

Table No. 2 Distribution of subjects according to age & alcoholic condition

Age group(In Yrs)	Alcohol		Total
	Detected	No detected	
15-24	1(0.83)	32(13.22)	33(27.27)
25-34	1(0.83)	41(33.88)	42(34.71)
35-44	2(1.65)	20(16.53)	22(18.18)
45-54	0(0.00)	19(15.70)	19(15.70)
55 +	0(0.00)	5(4.13)	5(4.13)
Total	4(3.31)	117(96.69)	121(100.00)

Maximum cases with presence of alcohol belonged to 25-34 years of age followed by 15-24 years age group. Majority of cases of road accident with alcohol suffered multiple injuries to head as well as other parts of the body.

Table No. 3. Distribution of pattern of injury & alcoholic condition of the subjects

Injury on Body part	Alcohol		Total
	Detected	Not detected	
Only Head	1(11.11)	8(88.89)	9(100.00)
Head & other part	2(2.47)	79(97.53)	81(100.00)
Except Head	1(3.22)	30(96.77)	31(100.00)
Total	4(3.31)	117(96.69)	121(100.00)

Table No. 4. Distribution according to head injury & alcoholic condition of the subjects

Head Injury	Alcohol		Total
	Detected	Not detected	
Occurred	3(2.48)	87(71.90)	90(74.38)
Not occurred	1(0.83)	30(24.79)	31(25.62)
Total	4(3.31)	117(96.69)	121(100.00)

$\chi^2 = 0.306$ d.f. =1 P > .05 NS

Table No. 5. Distribution of injured subjects & injury on part of body

Injured person	Injury on Body part			Total
	Only Head	Head & other part	Except Head	
Driver	2(1.65)	43(35.54)	11(9.09)	56(46.28)
Occupant	1(0.83)	15(12.40)	6(4.96)	22(18.18)
Pedestrian	6(4.96)	23(19.01)	14(11.57)	43(35.54)
Total	9(7.44)	81(66.94)	31(25.62)	121(100.00)

Table No. 6. Distribution of injured subjects & outcome

Injured subject	Out come		Total
	Survived	Expired	
Driver	13(10.74)	43(35.54)	56(46.28)
Occupant	1(0.83)	21(17.36)	22(18.18)
Pedestrian	7(5.78)	36(29.75)	43(35.54)
Total	21(17.36)	100(82.64)	121(100.00)

Table No. 7. Distribution of Safety measures used by injured subjects according to outcome

Injured Person	Survived			Expired		
	Safety measures			Safety measures		
	Used	Not used	Total	Used	Not used	Total
Driver	7(53.85)	6(46.15)	13(100.00)	8(12.50)	35(81.39)	43(100.00)
Occupant	0(0.00)	1(100.00)	1(100.00)	9(42.86)	12(57.14)	21(100.00)
Total	7(50.00)	7(50.00)	14(100.00)	17(26.56)	47(73.44)	64(100.00)

$\chi^2 = 4.429$ d.f.=1 P< .05 Sig

DISCUSSION

In the present study, 121 cases of victims of RTA's were included in study group and followed during the course of treatment to report 100 fatalities. The sample size is highly variable in all the different studies involved as 451, 552 and 577 cases by Kaye, Puerto Rico (1970, 1972 & 1973)^{6,7,8}; 217 cases by Patel⁹; 1296 cases by Asogwa¹⁰, 32 cases by Aguwa¹¹; 48 cases by Fosseus¹², 275 cases by Vande Spuy¹³, 198 cases by Wu¹⁴; 752 victims by Nilambar¹⁵, 500 cases by Millo T¹⁶ and 360 cases by B Mishra¹⁷ et al. Age was also presented in different groupings in various studies.

In our study, highest number of cases was reported in 25-34 years age group followed by 15-24 years age group. Most studies reported that the people of most active and productive age group are involved in RTA's which adds a serious economic loss to the country. Similar to other studies, our study group comprised of only males. 52% victims in our study were motorcyclists followed by 36% pedestrians, about 12% four wheelers and less than 1% bicyclists probably because of changing trend of modern traffic. Averagely

there were 60% drivers and 40% occupants in most studies being compared.

Fatal outcome was observed in 65% victims suffering injuries to body parts other than the head region. It is a well documented fact that head injury is the commonest injury in fatal cases and also the commonest injured suffered by two wheelers users meeting with accidents. In our study the predominance of two wheelers is probably the reason for it. Similar results have been reported according to B Mishra et al¹⁷. The association of fatality was very significantly associated with the presence of head injury at the time of accident (P<0.001) similar to our study.

In the present study, clinically alcohol consumption was detected in 34.71% cases; however alcohol was confirmed in 9.91% only. The probable reason for poor confirmation remained the lag period between the Consumption of alcohol and the collection of blood samples. Also only qualitative testing was conducted which must have missed traceable amounts of alcohol levels in blood.

Maximum number of such cases suffered injuries to multiple body parts along with head injury. 32.23% of head injury victims of RTA cases showed presence of alcohol. 93% cases of RTA with alcohol suffered head injuries, fatal or non fatal. Alcohol prevalence in drivers ranged between 30 and 53% in 5 studies undertaken in South Africa (Myers et al. 1977)¹⁸, Zambia (Patel and Bhagwatt 1977)⁹ and Papua New Guinea (Wyatt 1980¹⁹; Lourie and Sinha 1983²⁰; Sinha and Sengupta 1989²¹) where a cut-off point of 80mg/100 ml. was applied, while it ranged from 48 to 69% in 36 studies in Puerto Rico (Kaye 1971; 1973; 1974)^{6,7,8} that applied a lower cut-off 20 mg/100ml.

Our study revealed that 9.91% (12) of the cases were positive for blood alcohol out of the 121 cases. Of these, majority belonged to the productive age group cases. 93% cases of RTA with alcohol suffered head injuries, fatal or non fatal. However, majority of the fatal casualties were reported in overtaking cases. Maximum number of cases suffered injuries to multiple body parts along with head injury. 34.71% of such cases showed presence of alcohol.

In our study, a significant correlation was obtained between use of safety measures and survival rate which is a well established fact. However, no such comparable citations were available. In the past 15 years there have been major advances in the design of vehicles and in their ability of protect occupants in crash. The introductions of airbags, side-impact protection, crumple zones and other engineering advances, to both vehicle and road design, presents opportunities for further improvement if widely adopted. Of concern is the fact that such developments are not automatically and widely available in low and middle income countries like ours.

74% victims suffered head injuries, 72% abdominal trauma, 23% thoracic injuries and about 40% victims had injuries to the extremities. Most of them were poly trauma patients suffering injuries at multiple sites. 83% victims suffered fatal injuries with 100% fatality in victims having only head injury. The victims of road accidents suffering from head injuries showed significant correlation with the outcome i.e mortality of the patients. Almost 90% study subjects suffering head injuries during the episode of traffic collision succumbed to it.

CONCLUSION

The present study was conducted to assess the difference in pattern of injuries among the road traffic

accident cases with and without consumption of alcohol and to study their socio-demographic profile.

In this study, all cases were males most of them belonging to the productive age group of society. Out of the 121 cases, 83% suffered fatal injuries. Clinically, about 35% of the victims were detected to have suffered the episode of road accident while driving after consuming alcohol. The fatality was significantly related to infliction of head injury during the episode. Also, most fatalities were encountered in accidents resulting from right angle collisions. 34.71% of cases with multiple injuries showed consumption of alcohol. 40% of patients with head injury had also consumed alcohol prior to the accident. The mortality was higher in cases of alcohol related road accidents.

This study also reported a significant correlation between use of safety measures and survival rate which is a well established fact. Hence, it can be concluded that road traffic accidents are a major cause of morbidity and mortality in this region of Rajasthan, India with a higher risk to the productive age group of the society who are predominantly motorcyclists. Also the changing trends of the society is involving this age group into addictive behavior especially alcohol. Though not confirmed chemically, clinically this study shows higher association of RTA's with alcohol.

ACKNOWLEDGEMENT

The authors are thankful to Dr. Subhash Nepalia, Principal, S. M. S. Medical College, Jaipur along with sincere regards to Lt. Prof. Dr. Sheetal Jain for permission and guidance to pursue the work.

Conflict of Interest

To draw attention to the increasing effect of change of culture of metropolitan cities on the magnitude of road traffic casualties.

Source of Funding: Self

Ethical Clearance from Administration

This study was pursued as dissertation work after obtaining due clearance from the ethical committee of the Institution.

REFERENCES

1. Hingson R, Howland J. Use of laws to deter drinking and driving. *Alcohol health & res.* 1990; 14:36-43.

2. Jadaan KS (1989a) Road accident costs in Jordan. *Journal of Royal Society of health* 109, 141-44.
3. abc harry Lum & Jerry A. Reagan (Winter 1995). "Interactive Highway safety design model: accident predictive module". Public Roads Magazine. <http://www.tfhr.gov/pubrds/winter95/p95wi14.htm>.
4. ABC of Alcohol, BMA Publications, 1994
5. abc (PDF) The good, The Bad and the talented: Young Driver's Perspectives on Good Driving and Learning to drive 9Road safety Research Report No. 74ed.). *Transport Research Laboratory*. January, 2007.
6. Kaye S. (1971) The drunk pedestrian and driver on our highways in Puerto Rico (1970). *Bulletin of Association of Medicine of Puerto Rico*;63 (7), 170-177.
7. Kaye S. (1973) Influence of alcohol on traffic deaths in Puerto Rico (1972). *Bulletin of Association of Medicine of Puerto Rico*;65 (6), 135-9.
8. Kaye S. (1974) Sudden drop in alcohol and drug-related traffic accidents in Puerto Rico (1974). *Bulletin of Association of Medicine of Puerto Rico*;67 (12), 369-71.
9. Patel NS & Bhagwatt PP (1977) Road traffic accidents in Lusaka and blood alcohol. *Medical Journal of Zambia*; 11, 46-69.
10. Asogwa SE (1980) Some characteristics of drivers and riders in road accidents in Nigeria. *East African Medical Journal*; 57 (6), 399-404.
11. Aguwa Cn, Anosike EO, Akubue PI (1982) Road accidents in Nigeria: Level of alcohol in the blood of automobile drivers. *Central African Journal of Medicine*; 28, 171-4.
12. Fosseus CG (1983). Motorcycle and alcohol. A survey of fatalities in Cape Peninsula. *South Africa Medical Journal*; 64(5), 159-60.
13. Van de spuy JW. (1989) More about trauma continuing medical education VMO.7; 6, 721-6.
14. Wu SI, Yang, Chou, TauCC, Chen KT. (19991) An analysis of traffic injuries in Taiwan in relation to alcohol use and economic loss. *Injury*; 22(5), 357-361.
15. Nilambar J, Srinivasa DK, Roy G, Jagdish S. Epidemiological Study of road traffic accident cases: A study from South India. *Indian Journal of Community Medicine*. Vol. XXIX, No. 1, Jan- Mar, 2004.
16. Millo T, Sharma RK, Murty op, Bhardwaj DN, Murmu LR, Aggarwal P. Study of incidence of alcohol use in road traffic accidents in South Delhi in fatal cases. *Ind Journ of For Med and Toxicol*. 2008;2(1).
17. Mishra B, Sinha ND, Shukla SK, Sinha AK. Epidemiological study of road traffic accident cases from Western Nepal. *Indian J Community Med*. 2010;35:111-21.
18. Myers RA, Taljaard JJ, Penman KM (1977) Alcohol and road traffic injury. *South African Medical Journal*. 52, 328-30.
19. Wyatt GB (1980) Epidemiology of road accidents in Papua New Guinea. *Papua New Guinea Medical Journal*. 23, 60-5.
20. Lourie J, Sinha S (1983) Port Moresby road traffic accident survey. *Papua New Guinea Medical Journal*. 26, 126-89.
21. Sinha SN, Sengupta SK (1989) Road traffic accident fatalities in Port Moreby: A 10 year survey. *Accident Analysis and Prevention*. 21, 297-301.

A Statistical Analysis of Poisoning Cases in Medico Legal Autopsy-A Retrospective Study

Ved Prakash Gupta¹, Putul Mahanta²

¹Post Graduate Trainee, ²Faculty, Department of Forensic Medicine, Gauhati Medical College, Guwahati, Assam

ABSTRACT

Poison and deaths due to poisoning are perhaps as old as the human civilization. With the increase in population and development of society human beings became more complicated in their thinking and approach towards life and started taking one's own life (suicide) or other's lives (homicide) using some of these substances. In this study at the Gauhati Medical College, Guwahati, Assam during the period from 1st January to 31st December 2010, a total number of 2476 Medico legal autopsies were carried out of which 5.25% of the deaths were due to poisoning, the male to female ratio being 1.8:1. 31.52% of the victims belonged to the age group of 20 -29 years followed by 30 - 39 years (25.37%). 71.50% of victims belonged to the lower class and 11.53% were unemployed. The others epidemiological data, i.e. occupation, motive and circumstances of the death, name and availability of poison, etc. were discussed to know the pattern of poisoning as well as way of preventions by keeping potentially dangerous substances out of vulnerable hands is a sure way to prevent unintentional poisoning.

Keywords: *Poisoning, Suicide, Unemployment, Organ phosphorus*

INTRODUCTION

Poison is a substance solid, liquid or gaseous which if introduced in living body, or brought into contact with any part thereof will produce ill-health or death, by its constitutional or local effects or both¹. With advancement of time in order to keep pace with other nations in terms of production and quality in the agricultural industry chemical insecticides/pesticides entered the Indian market along with indigenous production resulting in easy availability in all corners of the country. Like a coin having two sides, these pesticides apart from their use in agricultural industry for killing and repelling pests which harbor the crops for food, shelter and propagation became a social menace resulting in tragic loss of human life in form of accidental, suicidal and rarely homicidal poisoning deaths. The global statistics shows poisoning death rates of 4.35 % in males and 2.41% in females amongst all causes of unnatural deaths during 2002. In India 21172 poisoning deaths were reported during the year 2003, the most common agents responsible for poisoning being pesticides, kerosene, prescription drugs and household chemicals².

MATERIALS AND METHOD

Material for the present study consists of 130 cases of suspected poisoning drawn from the medico-legal autopsies performed in the department of forensic medicine, Gauhati medical College, Guwahati, Assam during the period from 1st January to 31st December 2010. During this period a total of 2476 medico-legal autopsies were carried out in the department. Thus suspected poisoning cases constituted 5.25% of the total cases. The various epidemiological data, i.e. age, sex, occupation, motive and circumstances of death, name and availability of the poison, etc. were gathered from the police papers like inquest report, dead body challan, etc. and thorough detailed interviews of the friends, relatives, neighbors and police officials accompanying the dead bodies taken separately. In the cases where victims were hospitalized and treated for poisoning and died later on, the available hospital papers were consulted and data collected. A detailed, careful and thorough postmortem examination was done on every case. Viscera and other relevant materials were collected, preserved using proper preservative and sent for chemical analysis to the

forensic science laboratory and results of the analyses were collected.

OBSERVATION AND RESULT

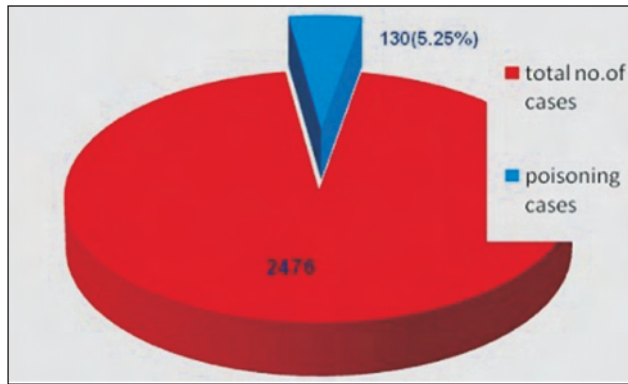


Fig. 1. Total Number of Suspected Poisoning

A total of 2476 medico-legal autopsies were performed in the department during the period from

1st January to 31st December 2010. Out of these, 130 cases were death due to suspected poisoning, constituting 5.25% of total autopsies performed (Figure1).

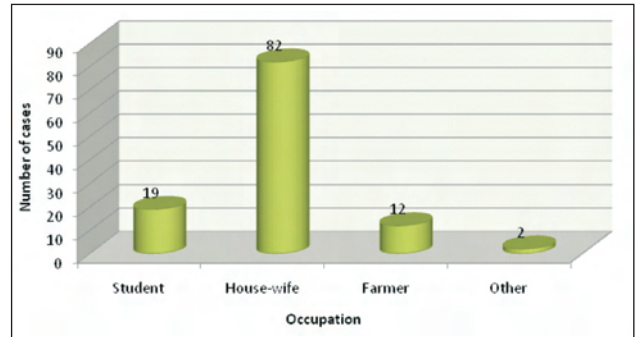


Fig. 2. Sex Wise Distributions

It is observed that the male victims outnumbered the female victims, the number being 85 (65.39%) in the male and that in the female 45 (34.61%). The male and female ratio being 1.8:1 (Figure 2).

Table 1. Age and Sex Wise Distribution

Age group in Years	Male		Female		Total	
	No.	%	No.	%	No.	%
0-9	5	3.75	3	2.31	8	6.14
10-19	8	6.06	4	3.17	12	9.22
20-29	25	19.14	16	12.40	41	31.52
30-39	21	16.05	12	9.33	33	25.37
40-49	13	10	3	2.31	16	12.30
50-59	3	2.31	3	2.31	6	4.70
60-69	7	5.38	4	3.17	11	8.45
70 & above	3	2.31	0	00	3	2.30
Total	85	65	45	35	130	100

The numbers of victims of poisoning were maximum in the age group of 20–29 years (31.52%) and that in the age group between 30–39 years were

the second (25.37%). Lowest number of cases was reported in the age group above 70 years (Table 1).

Table 2. Educational Status

Educational status	Male		Female		Total	
	No.	%	No.	%	No.	%
Illiterate	7	5.37	10	7.69	17	13.07
Primary	11	8.35	10	7.69	21	16.07
High School	25	19.13	15	11.53	40	30.77
Higher Secondary	27	20.65	8	6.36	35	26.93
Graduate & Above	14	10.75	2	1.73	16	12.40
Not Known	1	0.75	0	00	1	0.76
Total	85	65	45	35	130	100

It is observed that maximum numbers of victims were educated up to High School level (30.77%)

followed by group that educated up to Higher Secondary level (26.93%) as shown in Table 2.

Table 3. Occupational Status

Occupation of the victim	Male		Female		Total	
	No.	%	No.	%	No.	%
Student	21	16.15	14	10.96	35	26.93
Business	11	8.45	0	00	11	8.47
Servicer	13	10	2	1.54	15	11.53
Laborer	9	6.92	4	3.27	13	10.00
Domestic worker & Housewife	0	00	25	19.23	25	19.25
Cultivation	15	11.53	0	00	15	11.53
Unemployed	15	11.53	0	00	15	11.53
Not known	1	0.76	0	00	1	0.76
Total	85	65	45	35	130	100

It was observed that maximum number of victims of fatal poisoning cases belonged to students with 26.93 % cases followed by domestic worker and housewife cases from the female community (19.25%) as shown

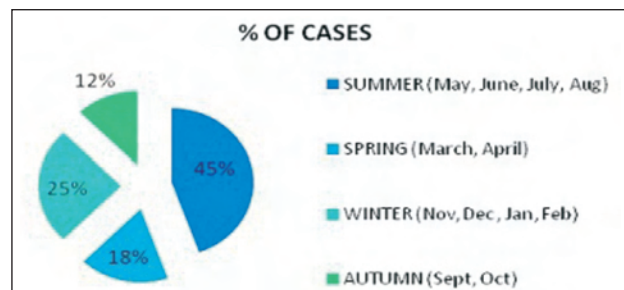
in Table 3. It is also observed that the lower economic class topped the list with 71.50% followed by middle class (26.90%).

Table 4. Nature of Death

Nature of Death	Male		Female		Total	
	No.	%	No.	%	No.	%
Suicide	84	64.6	43	33.07	127	97.69
Homicide	0	0	0	0	0	0
Accidental	1	0.76	2	1.53	3.00	2.31
Total	85	65	45	35	130	100

The suicidal poisoning cases were the maximum for 97.69 % cases followed by accidental cases (2.31%) as shown in Table 4.

Incidence of poisoning was maximum during the summer season, the percentage being 45%, followed by winter (25%) (Figure 3).

**Fig. 3. Seasonal Variation****Table 5. Motive behind Suicide**

Nature of Death	Male		Female		Total	
	No.	%	No.	%	No.	%
Poverty	19	14.6	9	6.92	28	21.5
Unemployment	13	10	0	00	13	10
Failure In Love	6	4.61	6	4.61	12	9.23
Failure In Examination	7	5.38	3	2.30	10	7.69
Family Quarrel	30	23.0	21	16.1	51	39.2
Chronic Disease	3	2.30	2	1.53	5	3.84
Not Known	7	5.38	4	3.07	11	8.45
Total	85	65	45	35	130	100

39.23 % of victims committed suicide due to family quarrel. The next common motive of suicide was the poverty having 28 cases (21.5%) as shown in Table 5.

It is observed that organophosphorus compounds were the most common agents with 30% cases, followed by Organochlorine compounds 11%,

Carbamate 5%, alcohol 2% and zinc phosphide 1% as shown in Figure 4.

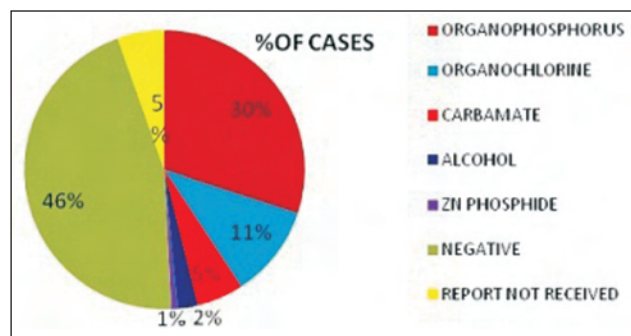


Fig. 4. Poisons Detected

DISCUSSION

Incidence: In the present study 5.25% of the total autopsies performed were due to suspected poisoning. This percentage of poisoning deaths is slightly lower than the one estimated by WHO which put poisoning in the fifth position of all the causes of unnatural deaths with 4.35% in males and 2.41% in females².

Sex: Regarding the sex distribution of cases out of total 130 cases 65.39% were males and 34.61% were females. The findings are almost similar to the study of Pang et al (1997) who found that males constituted 68.2% and females 31.8% of poisoning³. The present study is also consistent with the findings of Siwach and Gupta (1995) who found that the number of male was almost double 67.98% the female 32.02%⁴. The male preponderance of poisoning is may be attributed to the fact that males outnumber females in the general population in our state and also males lead a more stressful life than females carrying the responsibilities of the family and social lives and thereby make themselves more vulnerable to acts such as suicidal and other forms of poisoning.

Age and sex distribution: The number of victims of poisoning was maximum in the age group of 20–29 years for 31.53% and that in the age group between 30–39 years was second for 25.37%. Lowest number of cases was reported in the age group above 70 years for 2.30%.

The findings of the present study are almost consistent with the findings of Hitchens and Graham (1968) who found a peak incidence for males at age 25–35 years and for females at age 15–25 years⁵.

The present study are similar with those of Thomas, Y.K. Chan et al (1994) who found that poisoning

occurred mostly in the relatively young age group, 86.3% below the age of 40 years, the highest number of cases being in the age group of 21–30 years (27.5%) followed by 14–20 years (19.5%) and 31–40 years (13%)⁶.

The higher incidence of poisoning in the young adult stage may be due to the fact that this is the period when they are by nature, tend to be more emotional, irrational and more aggressive and intolerant, thus making themselves more vulnerable to quarrels, commotion and instabilities of life.

Educational status: It is also observed that the maximum number of victims were educated up to High School 40 cases (30.77%) followed by Higher Secondary level for 35 cases (26.93%).

The findings of the present study to a major extent is similar to the findings of Siwach and Gupta (1995) who found that 24.3% cases were illiterate, 10.4% cases educated up to the level of 5th class, 27.1% in the 6–9th class, 27% in the 10th – graduation and 11.1 % educated up to the level of graduation and above in their study⁴. The cause of the higher percentage of people with higher level of educational status of the poisoning victims may be attributed to the better rate of literacy and active responsible part taken by the educated people in the family as well as social life, thereby putting themselves under more stresses of life.

Occupation: It is observed that the maximum number of victims of fatal poisoning cases belonged to students with 26.93% cases followed by domestic worker and housewife cases from the female community (19.25%).

The present study is at variance with a study by Siwach and Gupta (1995) who found that 12.7% cases were unemployed at the time of ingestion of poison without any source of income⁴. The higher incidence of poisoning among students may be due to the fact that they are by nature, tend to be more emotional, irrational, intolerant and loss exposed to life with worries of studies, future employment and love affairs, etc.

Economical status: The above Table-4 shows that the Lower class topped the list with 71.50 % cases followed by middle class (26.90%).

The findings of the present study consistent with the Haryana-Rohtak study of Siwach and Gupta (1995) who observed that majority of cases came from the

lower socio-economic group 71.9% followed by the middle socio-economic group with 25.4% cases and followed lastly by upper socio-economic group with 2.7 % cases⁴.

The representation of the lower income group with a higher number of cases may be due to the facts that this group constitutes the highest percentage of population in the study region; poverty by itself is a motive in the suicidal cases.

Seasonal variation: Incidence of poisoning was maximum during the summer season, the percentage being 45%, followed by winter (25%).

The study is in proximity with the study by Khadgawat et al (1994) who recorded the highest incidence in summer 41.7%, 33.6% in rainy and 24.7% in winter seasons⁷. The higher number of cases during summer and winter may be explained on the basis that the poisons used by most of the victims of this study are available easily at their residence and retail stores because of rich agricultural activities during these seasons.

Nature of deaths: It is observed that 97.69% cases of deaths due to poisoning were suicidal in nature. Only three cases (2.31%) were accidental. The findings of the present study to a major extent is similar to the findings of the study by Herald Gormsen (1960) who found 85.2% suicidal, 12.8% accidental and 2.1% homicidal cases in his study of 2044 fatal poisoning cases⁸. The study is almost similar with the Hong Kong study of Chan et al (1994) who reported 96% suicidal and 4% accidental cases⁹. The high rate of suicides may be attributed to the increasing number of population resulting in all round deficiencies of food, shelter, educational and health facilities, job opportunities which put the population of the present society at risk of all sorts and poisoning is no exception.

Motives of the victims: It is also observed that, 39.23% of victims committed suicide due to family quarrel. The next common motive of suicide was poverty having 28 cases (21.5%).

The findings of the present study are similar to some extent to the study by Siwach and Gupta (1995) in Rohtak who found marital conflict in 32.7% cases followed by economic hardship in 15.3% while failure in love were responsible for 6.8% cases and academic worries for 5.5% cases⁴. The study differs from the study by Chan et al (1994) in Hong Kong who found

emotional upset, social crisis and physical illness to be responsible for 80% of the cases⁹. The days of the present generation of people are harder with an ever increasing population, economic hardships with the problems of employment, health etc. which gets reflected on the family life.

Chemical analysis report of viscera: It is also seen that organophosphorus compounds were the most common agents with 30% cases, followed by organochlorine compounds 11%, carbamate 5%, alcohol 2% and zinc phosphide 1%.

The findings of the present study are almost similar to the findings of the Rohtak study of Dhattarwal and Dalal (1997) who reported the insecticides and pesticides as the main agents. They reported aluminium phosphide, organophosphorus, organochlorine and alcohol as the agents responsible for poisoning¹⁰.

The findings of the present study are also somewhat similar to the findings of Siwach and Gupta (1995) who found the insecticide aluminium phosphide in 67.7% and organophosphorus in 13.9% cases⁴.

Being highly toxic, these substances are preferred by the victims of suicide. As to the negative results of the viscera analysis, the treatment received, time interval between entry of poison and death of the victims, collection and time of analysis of the viscera are the probable drawbacks and errors in the process of chemical analysis which are to be considered.

CONCLUSION

Poisoning as a means of suicide is a horrifying trend existing in our society and needs to be considered seriously from all its aspects. Measures should be implemented to improve the socio-economic conditions to lessen the existing stress and strain of the society. Proper education of the common people, preventive measures and overall improvement of the infrastructure comprising of the most modern treatment modalities and the drugs for the management of the same will go a long way in strengthening the whole setup. Rendering of social support and psychiatric advice through suicide prevention and crisis intervention centers managed by social workers and psychiatrists in aid with the Government may be the answer to the problem plaguing the society.

REFERENCES

1. Reddy, K.S.Narayan: The Essentials of Forensic Medicine and Toxicology: 29th Edn.2011. K.Suguna Devi Hyderabad, India 446.
2. Park, K: Parks Textbook of Preventive and Social Medicine 19th Edn.2007 M/S Banarasidas Bhanot Publisher, Jabalpur.
3. Pang C.W. et al; Epidemiology of Poisoning in the new Territories South of Hongkong: Human & Experimental Toxicology 16:204-207, 1997.
4. Siwach SB., Gupta, A. The Profile in Acute Poisoning in Haryana Rohtak Study: Journal of Association of Physician, 1995;43(11):756-759.
5. Hitchens, R.A.N., Graham, J.D.P. Acute Poisoning and its Prevention: British Journal of Preventive & Social Medicine, 21, 108-114, July 1967.
6. Thomas YK. Chan et al. Drugoverdose and other Poisoning in Hongkong- The Prince of Wales Hospital (Shatin) Experience: Human and Experimental Toxicology (1994) 13512-515. Macmillan Press Ltd.1994.
7. Khadgawat r. et al. Accidental Poisoning: Indian Pediatrics Vol-31 1555-57, 1994.
8. Herald Gormsen. Association Proceeding, 1960, 2044 Consecutive Fatal Poisoning Cases 1953-59: Medicine Science and Law, Vol-1, 1960-61, 1946.
9. Chan TYK. et al Childhood Poisoning in Hongkong: Experience of the Drug Poisons Information Bureau from 1988 to 1992: J. Paediatric Child Health 1994;30 ;681 – 682.
10. Dhattarwal SK, Dalal SS. Profile of Deaths due to Poisoning in Rohtak, Haryana in the year 1995. JFMT 1997;XIV(1):51.

Mortality Pattern in Poisoning Cases Analysed in MGIMS Toxicology Laboratory

Pushperndra Singh¹, B H Tirpude², P N Murkey³, Ninad Nagrale⁴, Swapnil Patond⁴

¹Associate Professor, Forensic Medicine & Toxicology, Veer Chandra Singh Garhwali, Government Institute of Medical Sciences & Research, Srinagar, Pauri Garhwal, ²Professor & Head, ³Professor, ⁴Postgraduate Students, Forensic Medicine & Toxicology, MGIMS, Sewagram Wardha, Maharashtra

ABSTRACT

Poisoning is a medical emergency and is one of the major causes of hospitalization through emergency and is a major public health problem in the country. It is important to know the nature, severity and outcome of acute poisoning cases in order to take up appropriate planning, prevention and management techniques. This study aimed to assess the mortality pattern of poisoning cases in a tertiary care hospital in Maharashtra.

Keywords: Poisoning, Case Fatality Rate, Mortality Pattern

INTRODUCTION

Acute poisoning is an important medical emergency. The nature of poison used varies in different parts of the world and may vary even in different parts of the same country depending on the socioeconomic factors and cultural diversity. Management of these critically ill patients will greatly improve if the common causes of poisoning are properly defined.

With the progress in the industrial and agricultural field and advances in medical sciences a vast number of insecticides have become available, which on exposure may produce severe toxicity. In general, accidental poisoning is more common in children, whereas suicidal poisoning is more common in young adults. Studies of this nature will be a useful tool in planning and management of critically ill acute poisoning cases. In this context the present study was carried out with the objective to investigate the mortality pattern of poisoning cases in a tertiary care hospital in Maharashtra.

MATERIALS AND METHOD

this study was carried out at Kasturba Hospital in the Department of Forensic Medicine & Toxicology of MGIMS, Sewagram, dist. Wardha (Maharashtra), consisting of 375 cases of poisoning admitted which were analysed in the departmental toxicology

laboratory during the period from January 2000 to December 2001.

Each case was followed from the time of admission till the discharge or death and autopsy conducted at the mortuary of department of Forensic Medicine of this institute.

RESULTS

Table 1. Sex wise case fatality rate. (CFR)

Sex	Total number	No. of deaths	C.FR
Male	257	25	62.5%
Female	118	15	37.5%
Total	375	40	10.67%

Out of total 40 deaths in present study, 25(62.5%) were male & 15(37.5%) cases were female. Male to female ratio is 1.0:0.6. in present study, out of total 375 cases, 40 were expired, thus case fatality rate was 10.67%, whereas case fatality rate among males was 62.5% and among female it was 37.5%.

Table 2. Showing sex wise death according to manner of poisoning (n=40)

Manner of poisoning	No. of deaths in male (%)	No. of deaths in females (%)	Total (%)
Suicidal	23(92)	14(93.93)	37(92.5)
Accidental	2(8)	1(6.66)	3(7.5)
Total	25(100)	15(100)	40(100)

Out of total 40 deaths, maximum were suicidal in 37 (92.5%) cases and accidental deaths were in 3(7.5%) cases.

Out of all suicidal cases, deaths in male were seen in 23(92%) and in female 14(93.93%) cases, whereas poison responsible for accidental death in male was in 2(8%) cases and amongst female was in 1(6.665%) case.

Table 3. Case fatality rate in various types of poisons.

Type of poison	Total cases	No. of deaths	C.F.R (%)
Organophosphorus	175	29	16.57
Pyrethroid	4	1	25
Zinc phosphide	23	1	4.35
Phenol	7	1	14.28
Kerosene	5	1	20
Ethyl alcohol + Organophosphorus	48	6	12.5
Ethyl+ methyl alcohol	48	6	12.5
Organochlorus	19	0	0
Iodine	1	0	0
Ethyl alcohol	50	0	0
Diazepam Alprazolam Nitrazepam Carbamazepine Dilantin	11	0	0
Croton seeds Abrusprecatorius Neem oil	5	0	0
Heroin Camphor Cannabis indica	6	0	0
Sulphuric acid Hydrochloric acid Dettol	3	0	0
No recognizable poison	14	0	0
Total	375	40	10.67

Overall case fatality rate in present study was 10.67% whereas case fatality rate among mixed poison group was maximum in ethyl+ methyl alcohol poisoning amounting to 25% cases whereas ethyl alcohol + organophosphorus insecticide had 12.5% case fatality rate.

Among single poison, fatality rate due to pyrethroid poisoning amounts to 25%, followed by kerosene 20%, organophosphorus 16.57% cases and in phenol it was 14.28%. whereas zinc phosphide had case fatality rate of 4.35%.

DISCUSSION

1. Case fatality rate of poisoning cases in present study was 10.67% with male to female ratio being

1:0.6. results of present study are different from those by other authors like Sinha et al(1999) who reported case fatality rate as 33.69 % and Agarwal et al (1998) reported mortality rate of 58 %, which was significantly higher than the fatality rate found in present study.

2. Out of total deaths, maximum were suicidal 92.5% and accidental in about 7.5%. Hence here deaths due to poisoning are most commonly suicidal.
3. Case fatality rate was maximum in mixed poison group. C.F.R was 25% in combination of ethyl + methyl alcohol type whereas case fatality rate seen in single poison like organophosphorus insecticide was 16.57% and in pyrethroids it was 25%. Agarwal et al (1998) from New Delhi reported fatality rate due to aluminium phosphide was 23.12%, Dalal et al (1998) from Punjab reported, fatality pattern of various poisons like organophosphorus 53.3%, aluminium phosphide 25.15%, alcohol in about 7% and unknown as 6%. Zine et al (1998) from Ngapur reported organophosphorus 45%, organochlorus 14% and alcohol 38%. Sharma BR et al (1996) from Jammu reported insecticide fatality to be 50% and alcohol 9.3%.

CONCLUSION

1. Overall case fatality rate in present study was in 40(10.67%) cases with male to female ratio of expired cases being 1:0.6. Male deaths accounted for 25 (62.5%) cases & female deaths 15(37.5%) cases.
2. Out of total deaths, suicidal, was most common in 37(92.5%) cases whereas due to accidental poisoning, it was found in 3(7.5%) cases.
3. Case fatality rate of various poisons
 - a. Ethyl +ethyl alcohol poisoning in 1(25%)
 - b. Ethyl alcohol + organophosphorus in 6 (12.5%) cases
 - c. Pyrethroid in 1 (25%) case.
 - d. Kerosene in 1 (20%) case.
 - e. Organophosphorus insecticide in 29 (16.57%) cases.
 - f. Phenol in 1 (14.28%) cases.
 - g. Zinc phosphide in 1 (4.35%) case

REFERENCES

1. Agarwal NK, Agarwal BBL. (1998); "trends of poisoning in New Delhi", *JIAFM*, Vol 20 (2); P. 30-36
2. Agarwal Praveen, Handarohini, Wali JP (1998); "common poisoning in India; *Journal of Forensic Medicine & Toxicology* Vol XV (1); Jan-Jun 1998; P 73-79
3. Dalal JS, Goria RK, Agarwal KK, Thind AS, Sandhu SS. (1998) "poisoning trends- A post-mortem Study. *JIAFM*, 1998, Vol 20(2); P 27-31
4. Sharma BR (1996); "Trends of poison/ Drugs abused in Jammu"; *Journal of Forensic Medicine & Toxicology*; Vol XIII, No. 1; Jan-Jun 1996; P 7-9.
5. Sinha US, Kapoor AK, Agnihotri AK, Srivastava PC; "A profile of poisoning cases admitted in SRN hospital, Allahabad with special reference to Aluminium phosphide poisoning" (1999); *Journal of Forensic Medicine & Toxicology*; Vol 16, No. 1; Jan-Jun; P 40-43
6. Zine KU, Mohanty AC (1998); " pattern of Acute poisoning at Indira Gandhi Medicalcollege& hospital Nagpur", *JIAFM*, 1998, Vol. 20, No. 2 :P 37-39

A Statistical Analysis of Death Victims brought for Medico-legal Autopsy

Biswadeep Paul¹, Putul Mahanta², Raktim Pratim Tamuli¹

¹Post Graduate Trainee, ²Faculty of Forensic Medicine, Gauhati Medical College, Guwahati, Assam, India

ABSTRACT

This retrospective study was conducted over 2,476 death victims brought to the mortuary of Gauhati Medical College during the year 2010, to know the pattern, trend, causes and other aspects relating to death. The highest incidence, i.e. 32.16% of death occurred in road traffic incidents, followed by hanging (13.68%). The male and female ratios were 3:1. The urban victims outnumbered the rural with a ratio of 1.7:1. A very few cases (3.99%) opined as a negative autopsies. The age group, 21-30 years topped the list of involved cases in all section followed by 30-40 years. Head injury was the single most common injury that ultimately led to coma resulting in death in RTA section. Based on the outcome from this study, preventive measures can be formulated for better management of the cases and homogenous social sustenance, etc. However a thorough multi-disciplinary study is much needed, relating to each section for an excellent outcome.

Keywords: Road Traffic Incident, Hanging, Head Injury, Coma

INTRODUCTION

Man is mortal and like all living beings, he cannot escape from the ultimate truth called "Death". In the present era of prosperity, accelerated modernization and sophistication, when man is fanatically running after worldly pleasures, he has diligently acquired the means and measures to achieve them, to harness the forces of nature to fulfill his demands, to supersede his fellow beings at all cost and while doing so he has also devised evil means to wipe out not only competitors but also his own life, being faced with the utter despair of failure and rejection.

An unprecedented increase in crime and violence, deaths due to unnatural causes and damages to the human resource and property, has become medico-legal problem for the society with epidemiological proportions. The progress so far humanity has made in matters of intellect and values have set certain norms for us who regard any cruel and disrespectful approach to our fellow beings as heinous, eccentric and uncultured. To enrich the human values and to ascertain their smooth onward journey to the stage of complete attainment, human society has formulated various rules and regulations as per laws of the land and any deviation from the mainstream catapults the skyrocketing graph of morbidity and mortality. It is here that the role of the autopsy surgeon gets

emphasized. With proper elucidation of risk factors, means and modes applied, the correct diagnosis and energetic association with physicians and law enforcing directorates, he can reduce the ever-increasing toll of unnatural and sudden deaths, although may not completely extinguish the phenomenon.

A quantitative and qualitative descriptive study of autopsy cases has become the backbone of understanding the trends and pattern of deaths prevalent in an existing society, hence it was carried out.

MATERIALS AND METHOD

A retrospective study was conducted on 2,476 victims subjected to medico-legal autopsy at mortuary of Department of Forensic Medicine, Gauhati Medical College, Guwahati over a period of one year from January 2010 to December 2010. The study design comprised of thoroughly scrutinized information gathered from autopsy related documents, proforma, history of relatives of the deceased, hospital records, concerned investigating agencies and laboratory report of viscera and their contents, fluids, diseased tissues and organs and other relevant suspicious samples, available in our department.

OBSERVATION AND RESULTS

A. General findings

Month wise distribution

The month of October recorded the maximum number of cases with 223 (9.01%) cases followed by June with 222(9%) cases and minimum recorded in December with 189(7.63%) cases, with an average of 206.33 cases per month.

AGE

The age group 21-30 years recorded the highest number of cases 747(30%) followed by 31-40 years with 601(24%) cases and least in the age group 81 years and above (0.2%).

PATTERN OF DEATH

Road traffic incidents accounted for the highest number of cases 796(32.15%), followed by hanging 338(13.7%), natural death 278(11.23%), burn 267(10.8%) and poisoning 130(5.25%). The least number of cases were registered for attack by wild animals, still births, snake bites, bomb blasts and suffocation with 2 cases each (0.08%).

SEX

Males outnumbered the females with a ratio of 3:1. In cases of RTA, males were 71.6% and females 28.4%, in hanging cases, males were 69.02% and females 30.7%, in natural deaths, males were 74.82% and females were 25.17%, out of 267 burn cases, 58.42% were females who outnumbered 41.6% cases of males, out of 130 poisoning cases 65.4% were males and 34.6% were females. Out of 103 drowning cases males were 62.1% and females 37.9%. In homicide cases males were higher for 76.06%, females 22.2% and children 1.7%.

LOCATION

The urban and rural ratio being 1.7:1. Maximum numbers of deaths due to RTA were in urban areas for

85.9% followed by 14% in rural cases. In hanging cases 59.9% were urban cases and 40.7% were rural the cases. Out of 223 natural cases 80.2% were in urban and only 19.8% in rural areas. 53.9% cases of burn were of urban areas followed rural by 46.06%. Poisoning cases were maximum in rural for 74.6% followed by urban for 25.4%. Drowning cases were also maximum in rural areas for 54.4% and 45.6% in urban areas.

ECONOMICAL STATUS

The middle class people were the majority of affected victims with 1436 (58%) cases followed by the lower class 684(27.6%) and last by the upper class people-356(14.3%).

OCCUPATION

The table headed by services group for 34%, followed by business (24.2%), students (12.2%), cultivators (11.3%), domestic workers/housewives (8.03%), unemployed persons (4.6%) and others (5.6%).

Fatal regional injuries

Fatal injuries found during post mortem examination could be ascertained maximum to head and neck (43%), followed by abdominal injuries both penetrating/perforating or blunt trauma (34%), chest injuries (16%), injuries to extremities 6% and others 1%.

Final Opinion

The final opinion that could be reached after thorough post-mortem examination, histopathological, microbiological examination and chemical analysis of victims and viscera were attributed to coma (28%), followed by asphyxia (22%), shock and haemorrhage (18%), shock (12%), instantaneous deaths in 8% cases, exhaustion resulted in 5% of cases, septicemia /syncope(3%) and others (1%).

Table 1. Different Statistical data of death cases attending autopsy

Pattern of Death	Total No. of Cases	M: F Ratio	Age Group	U:R Ratio	Occupation	Mode of Death
Road Traffic Incidents	32.15%	2.5:1	21-30 yrs(30.2%)	6.1:1	Services(58%)	Coma (49.74%)
Hanging	13.68%	1.6:1	21-30 yrs(42.6%)	2:1	Domestic Workers(28%)	Asphyxia (99%)
Natural Death	11.22%	2:1	>50 yrs(71%)	8:1	Businessmen(73%)	Syncope (43%)
Burn	10.8%	1:2.8	31-40yrs(35.2%)	1:2	Housewife(91.7%)	Shock (56%)
Poisoning	5.25%	1.9:1	21-30yrs(31.5%)	1:2	Students(27%)	Organophosphorus Poisoning (30%)
Drowning	4.16%	1.6:1	21-30yrs(46.6%)	1:7	Students(36%)	Asphyxia (97.2%)
Railway Incidents	3.7%	91:1	31-40yrs(41.3%)	1.3:1	Businessmen(42%)	Instantaneous(77%)

N.B.: M-Male, F-female, U- Urban, R-Rural

DISCUSSION

The present study, encompassing such a wider perspective of death and its aspects, reveals some facts which are both in affirmation and negation to very few available studies, carried out on such a magnanimous proportion by authors previously. In the present study male: female ratio was 3:1, i.e. 75.84% males to 24.15% females, which is similar to NCRB data 3.5:1. It is also similar to the study conducted at PGI Chandigarh which shows 73.32% males and 26.58% females¹ and also similar to that study conducted at Dhaka Medical College, Dhaka which shows 73.32% males and 26.68% female victims².

The age group of 21-30 years comprised of 30% victims which is less than that found at Govt. Medical College and Hospital with 47.33% victims³.

In our study urban victims comprised of 63.5% and rural comprised of 36.51% which is similar to Govt. Medical College and Hospital, Chandigarh which showed 63.14% urban victims and 36.86% rural victims³.

In the present study, road traffic incidents claimed the major share of victims 32.15% which is similar to both NCRB data for 2010, 37.9% and the study conducted at Govt. Medical College and Hospital, Chandigarh with 36% cases³ but varies to 79.3% in the study at PGI Chandigarh¹ and 61.67% victims found in study conducted at KLES's Hospital and MRC, Belgaum⁴.

The males comprised of 71.6% cases and females 28.4% and 21-30 age group consisted of the highest victims 30.2% followed by 31-40 yrs age group-24.2% which is similar to study at KLES's Hospital with males 70.10% and females 26.08% and 21-30 yrs comprising 27.02% followed by 31-40yrs age group with 24.32% cases⁴ but varies to the study with 66% males and 34% females⁵. A total of 13.68% hanging cases were registered in this study which varies to 3.8% found at Govt. Medical College and Hospital, Chandigarh³ and 31.4% according to the NCRB data⁶.

Burn cases consisted of 10.8% in our study which is similar to 15% in the study of KLES's Hospital & MRC, Belgaum⁴ but less than 18.30% of total victims at Govt. Medical College and Hospital, Chandigarh³.

During the study we found that females who maintain kitchen and daily prepare meals were the most affected with 73.4% cases and males with 26.6% cases which is similar to that found in a study at

Kasturba Medical College, Manipal with 75% females and 25% males⁷, and M. R. Medical College, Gulbarga with 75.68% females and 24.32% males⁸, 80.2% female:19.8% male deaths in the study conducted by V.C.S.Verma and Praful Kumar Das⁹ and 66.6% females and 33.4% males according to NCRB data for 2010⁶.

The maximum victims belonged to the 31-40years age range-35.2%. poisoning cases in our study constituted 4.16% cases which is similar to 6.67% found in the study at KLES's Hospital and MRC, Belgaum⁴ but varies greatly to 21% found in the study at Govt. Medical College and Hospital, Chandigarh³. Organophosphorus poisoning (used as fertilizer) was the most common in our study 30% which is in contrast to aluminium phosphide poisoning (used as grain preservative) 55% found in the study at Govt. Medical College and Hospital, Chandigarh³. Drowning cases found were 4.16%, similar to NCRB, 2010 data with 7.7% cases⁶.

Males constituted 62.1% cases and females-37.8% which shows higher male trend similar to study conducted at Isfahan, centre of Iran with 87% males and 13% females and 85% were accidental in nature and occurred in the months of June, July, August and September¹⁰ compared to our 20.4% accidental nature and June being in rainy season claiming the highest drowning victims in our study 54.4%.

A natural death in our study was relatively higher with 11.22% as compared to 7.4% in Govt. Medical College and Hospital, Chandigarh³ and NCRB data-7.6%⁶.

The total suicidal cases in our study was 24.2% which is in contrast to 13.9% at PGIMER, Chandigarh¹, 38.55% in Govt. Medical College and Hospital, Chandigarh³ and 10% at KLES's Hospital and MRC, Belgaum⁴,

Hanging was the most common means applied for committing suicide in our study with 56%, similar to the study at Manipur¹¹, Behrampur¹² and Ireland¹³ but is in contrast to poisoning as the most common means found in the study at Northern India 48.49%^{3,14} and Belgaum 58.33%⁴. Suicide by self immolation grabbed the second spot in many studies including 18.4% in present study, 39.79% in Northern India². and 16.67% at Belgaum⁴.

A suicidal death by males was higher in our study 57% and females 43%, similar to 65% males and 35%

females in Northern India³ but varies to 83% males and 17% females in Belgaum⁴. The age group of 21-30 years comprised of the maximum victims 53.5% in our study which is similar to 51.7% in Northern India^{3,15}.

Homicidal cases registered in our present study was 4.72% which is similar to 6% in PGIMER, Chandigarh¹, 4.44% in Northern India³, but less in Belgaum-2.5%⁴. Males were the main victims and violence resulted in most cases of homicide similar to study of North India³. Stab injuries were the most common similar to the findings in North-east Delhi¹⁶.

SUGGESTIONS

1. Research should be continued with a specific trend of death involving larger group.
2. Multi-disciplinary study would yield far reaching results and would be better informative.
3. A detailed prospective/cross-sectional study would prove vital in corroborative outcomes.
4. Crime scene investigation should be implemented in suspicious cases.
5. Stringent rules, fines and punishments should be implemented by the Government in collaboration with NGOs, local bodies and other social organisations, for citizens to abide by, for a better homogenous and fruitful environment within the country in general and society in particular.
6. Proper education of individuals through print and electronic media is essential to minimize the premature loss of human resource of the country.
7. A more sensible and well thought out redressed system of the problems faced by the adolescents and youths of this country, especially those belonging to the 21-30 years age group, would help in reducing the stress of the modern society and peer pressure at the grass root level and prevent premature termination of promising lives.
8. Improvement of literacy rate, designing of job oriented vocational courses and creation of more avenues of jobs both in Government and private sectors should be done to allay the fear of unemployment. Socio-economic, unemployment factors accounts for the higher incidence of suicide by younger section of people which requires the attention of policy makers for suitable and sincere framing of the strategies and policies, and

implementing the same in such a way that the benefits reach the deprived.

9. Proper storage and sale of insecticides and agrochemicals, monitoring of arbitrary sale of drugs and alcohol, adoption of measures to control trafficking of contrabands and framing of policies and regulation of laws in the strictest way possible should be done to wipe off the evils of the society and curb the menace.
10. Active involvement of women's organisations regarding dowry demands and deaths, marriage counselling, implementation of an interlinked interpersonal swift network between the Government and private run hospitals, physicians and paramedical staff and proper stratification of treatment process to reach the unreached, up-gradation of existing medical facilities, proper channelization and utilization of funds and natural resources etc., would prove a boon in reducing the burden of mortality and provide the much needed impetus to the society in the right direction in the coming years.

CONCLUSION

This retrospective study conducted for a period of one year over 2,476 autopsied cases revealed some valuable and overwhelming facts regarding the existing pattern and trends of deaths prevalent in our society, their modes of execution, availability of treatment to the victims and subsequent corroborative findings discovered during autopsies.

REFERENCES

1. 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 of Clin Forensic Medicine* 2003; 10(3):145-152.
2. Islam MN, Islam MN. Pattern of unnatural death in a city mortuary: A 10 year retrospective study. *Legal Medicine* 2003 (Selected papers from the 5th International Symposium on Advances in Legal medicine 2002); 5(1):354-356.
3. Sharma BR, Singh VP, Sharma R, Sumedha. Unnatural deaths in Northern India – A profile. *J of Indian Academy of Forensic Medicine* 2004; 26(4):140-146.
4. Santhosh CS, Vishwanathan KG, Satish Babu BS – Pattern of Unnatural Deaths-A cross-sectional study of autopsies at Mortuary of KLES's Hospital and MRC, Belgaum. *J of Indian*

- Academy of Forensic Medicine. Jan-Mar 2011; 33(1):18-20.
5. Ghosh PK. Epidemiological study of the victims of vehicular accidents in Delhi. *J of Indian Medical Association* 1992; 90(12):309-312.
 6. url <http://ncrb.nic.in/CII2010/Compendium2010.pdf>[cited on 01.01.2012 at 08.33am]
 7. Rao NG. Study of fatal female burns in Manipal. *J of Forensic Medicine & Toxicology* 1997; 14(2):57-59.
 8. Babladi PIP, Sangram R. The post mortem study of thermal deaths with reference to dowry deaths. *J of Forensic Medicine and Toxicology* 2005; 22(1):23-25.
 9. Verma V C S and Das P: Burns and its medico-legal aspect, *IAFM*, Jan 1990, 7-9.
 10. Sheikhzadi A, Ghadyani M H: Epidemiology of drowning in Isfahan province, Center of Iran. *Journal of Research in Medical Sciences*. 2009 Mar-Apr; 14(2):9-87.
 11. Fimate L, Meera TH. A study of suicides in Manipur. *International J of Medical Toxicology and Legal Medicine* 2001; 3(2):27-29.
 12. Sahoo PC, Das BK, Mohanty MK, Acharya S. Trends in suicide. A study in M.K.C.G. Medical College, P.M. Centre. *Journal of Forensic Medicine and Toxicology* 1999; 16(1):34-35.
 13. Davidson A, Marshall TK. Hanging in Northern Ireland A survey. *Medicine, Science and the Law* 1986; 26(1):23-28.
 14. Sharma BR, Harish D, Sharma V et al. Poisoning in Northern India - Changing trends, Causes and Prevention thereof; *Med. Sci. Law* 2002; 42(3): 251-257.
 15. Sharma BR, Sharma V, Harish D, Vij K. Suicides in Northern India: Causes methods used and prevention. *Medicine, Science and the Law* 2003; 43(3):221-229.
 16. Kohli A, Aggarwal BBL. Pattern of murder cases in North East Delhi. *Journal of Forensic Medicine and Toxicology* 1996; 13(1 & 2):36-38.
 17. Sharma BR Harish D. Sharma V. et al. Road Traffic Accidents- a demographic and topographic analysis; *Med. Sci Law* 2001, 41(3):266-274.

A Comparative Study of Symphyseal Surface of Pubic Bone at Autopsy for Age Estimation Using Mckern- Stewart Criteria

Bajrang Kumar Singh¹, Anil Aggrawal², Anil Kumar Mittal³

¹Assistant Professor, C.U. Shah Medical College, Gujarat, India, ²Director & Professor, Maulana Azad Medical College, Lok Nayak and Associated Hospitals Delhi, ³Director, Professor & H.O.D., Forensic Medicine, Vardhman Mahavir Medical College and Safdarjung Hospital Delhi

ABSTRACT

Determination of age after 25 years becomes very difficult as all teeth will be erupted and ossification Centre of the bone will be fused till 25 years of the age. In all available bony changes, change in morphological surface of symphysis pubis is the most reliable between 20 to 40 years of the age. Bony changes depend on climate, nutrition, geographical region, races etc. So we had done a comparative study between Mckern- Stewart study and our study using Mckern- Stewart criteria for scoring.

Keywords: Age Estimation, Forensic Medicine, Pubic Bone, Anthropology

INTRODUCTION

Question of identification arises in every day medico-legal practice both in civil cases such as marriage, disputed sex, missing persons insurance claims, person and inheritance claims as well as in criminal cases such as persons accused of assault, rape, murder, absconding prisoners etc. The methods of identification depend upon, Available ante mortem records and the degree of preservation of body remains i.e. whether intact, decomposed, burned, fragmented, semi skeletonized or skeletonized.

Since the bones resist putrefaction and destruction by animals, skeletal remains contain an abundance of information, which can lead to the reliable determination of age, sex, race, stature of the individual.

Use of ossification centers and dentition for estimation of age is possible up to the age of about 25. After the age of 25 years, skeletal age can be assessed to within + 5 years by the state of cranial sutures and of the bony surfaces of symphysis pubis. Sutures tend to obliterate after mid-twenties onwards to old age but the process begins from within and shows wide individual variations.

It has been observed by various works that developmental and regressive changes of bones in the body are affected by various factors such as climatic, dietetic, hereditary, nutritional, sociological, racial, environmental and geographical etc. since most of these factors are different in different countries and also in different parts of India, no universal standard can be devised for estimation of age from bones. The same is true for pubic symphysis. Observation made in western countries will not be same as observation made in Indian population so we are presenting comparative study. Delhi being a cosmopolitan city, study of its population has, therefore, included all important ethnic groups of the country. Anatomical characters of symphysis pubis and pubic bone have been studied for the above purpose.

REVIEW OF LITERATURE

Todd (1920) has made a substantial contribution in evaluating the role of pubic symphysis as an age indicator². He called the symphyseal surface of pubis as a modified diaphyso-epiphyseal plane and expected it to show a metamorphosis as an ageing feature.

He evolved a system of assessing age from 10 stages of pubic metamorphosis. Fundamentally, he

considered each pubic symphysis to have an oval outline with supero-inferior long axis. Five main features were studied:

- 1) A ventral (outer) border or “rampart”.
- 2) A dorsal (inner) border or “rampart”.
- 3) A superior extremity.
- 4) An inferior extremity.

Other features, seen mainly on the surface were ridging billowing and ossific nodules. Varying and

progressive combination of these osteological features was seen and this led to the establishment of 10 phases of pubic symphysis ranging in age from 18-19 years to 50 + years.

In 1957, Mckern and Stewart worked on 450 pairs of pubic symphysis for estimation of age in males covering the age range (17-50 years)³. This study was based on Todd’s scoring method but they selected three components, i.e. dorsal plateau, ventral rampart and symphyseal rim. Five development stages were described for each component.

Table 1. (Mckern-Stewart component with their respective scoring)

Component I	Score	Component II	Score	Component III	Score
Dorsal margin Absent	0	Ventral Beveling Absent	0	Symphyseal rim Absent	0
Middle third	1	At superior extremity	1	Partial dorsal rim	1
Entire border	2	Extend inferiorly	2	Complete dorsal rim	2
Dorsal plateau Middle third	3	Ventral rampart Begins	3	Complete rim formation	3
Present Most of demiface	4	Extensive	4	Breakdown of rim begins	4
Complete	5	Complete	5	Rarefaction of symphyseal face	5

Mckern and Stewart noted that their system was more reliable for age period between 17 and 30 years. This method was easier and more accurate than the Todd’s method because the scoring eliminated a subjective bias in interpretation of bone metamorphosis.

Glibert at al. in 1973 conducted studies on female pubic symphysis based on the formula of Mckern and Stewart⁴. This work was devoted to the development of a standard for aging female pubic symphysis for the age range 17-55 years. 120 samples were collected from female individuals of known ages and parity. Besides, 60 more bones from Stewart collection were also studied. The age of samples ranged between 17 and 55 years. He established 3 components namely the dorsal demi-face, the ventral rampart and the symphyseal rim. Each component was further divided into six (0-5) stages of metamorphic change

It was observed that morphological development of females is different from that of males, and females are subject to trauma of child-birth. This may cause an individual female os pubis to appear older than it actually is. The dorsal surface of female symphysis was seen to undergo flattening at faster rate as compared to males. It was further noted that in females, the ventral (demiface) is beveled away from dorsal demiface whereas an imaginary line separated the two demi-faces in males.

They concluded that female of the same age may appear to be ten years younger based upon the ventral rampart and ten years older based upon the dorsal plateau.

Glibert in 1973 carried out the comparison of age estimates of female pelvis obtained by the new female standard with those obtained by the male standard⁵. 15 females pelvis were aged by both the male standard and a newly developed female standard. It was found that the male standard significantly under aged females 40 years or older in the test sample, although it worked out very well for pubic between 17-40 years of age. The female standard, however, yielded results within useful limits in all age groups.

In 1979, J.M.Suchey carried out work to assess the reliability of the Glibert Mckern method for aging the female os pubis⁶. He designed a study in which 23 forensic anthropologist were asked to an age & set of 11 female pubis of known age. There was a great deal of variability in the responses of these 23 participants.

There, four and five different responses (out of a 6 scale system) were given for each component of each pubic bone. Only 51% of the assessment showed age ranges which included the known age of specimens. It was concluded that it is difficult for an observer to select the exact stage of development which is present in any of the three components using the Glibert-Mckern method. Analysis of the errors showed that

one of the main problems of the Glibert-Mckern system was the difficulty in judging whether the ventral rampart was building up or breaking down. Same difficulty was experienced while assessing component III (the symphyseal rim).

A study by Gaurav Sharma⁶ demonstrated that various stages of symphyseal rim were found at a later age in Indians as compared with American pubic bones examined by Mckern and Stewart⁷. This study confirms pubic symphysis as useful age indicator especially for adult male. There were no differences in the urban and rural populations to the metamorphic changes in the symphyseal surface of pubic bone.

MATERIALS AND METHOD

The study was conducted on 50 cases coming for medico-legal postmortem examination to the Department of Forensic medicine, Maulana Azad Medical College, New Delhi.

Study design: Descriptive cross-sectional study.

MATERIALS

Human pubic symphysis (body, part of superior ramus and part of inferior ramus of pubis) belonging to different known age groups and sexes had been used for the study. The specimens were collected from autopsies conducted by the Department of Forensic Medicine at Maulana Azad Medical College New Delhi.

Inclusion Criteria

1. The cases of known age coming for medico legal postmortem examination. Age was confirmed by documentary evidences.
2. Subjects above 12 years of age. According to existing literature changes in symphyseal surface of pubic bone starts at 17 years of age, so we had taken 12 years of the age for baseline morphology of symphyseal surface of pubic bone and to detect changes before 17 years of the age in our study population if any.

Exclusion Criteria

1. Unknown, unclaimed bodies.
2. Cases showing fracture of limb, pelvic degenerative disease or fracture of pelvis.

Method of Removal of Pubic Symphysis At Autopsy

The soft tissue in the suprapubic region was displaced and cleared in order to have workable space. Soft tissue overlying pubic symphysis was retracted as far as possible. Electric bone cutting saw was used for cutting the bone. Two lateral cuts were made on the superior pubic rami about 2 inches from midlines, inferior pubic rami was cut in similar manner. Then soft tissue was separated and the specimen had been taken out from body. The specimens were further dissected to remove soft tissue without damaging underlying bone.

PROCESSING

The specimens were processed by chemical method. After proper tagging with patient's details, the specimens were placed in bath of antiformin (150 grams of sodium bicarbonate and 100 grams of bleaching powder with 1 litre of water mixed with 1 liter of 15% solution of sodium hydroxide) solution using sufficient solution to cover the specimens. For fresh tissue 1 part of antiformin to 8 to 10 parts of water was used. The solution was heated just short of boiling and was maintained at this temperature. The specimens were examined from time to time to see how quickly it is being denuded. In most of the specimens additional method like burying in sand was needed to clean the soft tissue.

When the specimens were totally free of soft tissue then the symphyseal surface was studied for morphological changes using a hand lens. Age was precisely recorded from police records (inquest papers). The age was further verified from municipal corporation records, i.e. birth certificate, election card etc.

The Study materials were scored on the pattern as described by Mckern – Stewart.

Statistical Evaluation

Assessment of age was made by study of various morphological features of pubic symphysis. We had used mean and correlation test.

OBSERVATION AND RESULT

The present study comprises a total of 53 individuals in the age group of 12-75 years, residence of Delhi. All the individuals had never suffered from

any disease or deformity affecting the bone during their life.

Table 2. (Mean age comparison for component I)

Score	Mckern- Stewart Study (Mean Age In Years)	Present Study (Mean Age In Years)
0	19.3	15.67
1	20.1	21.25
2	22.5	23.75
3	23.6	27
4	26.1	34.42
5	32.9	51.875

Table 3. (Mean age comparison for component II)

Score	Mckern- Stewart Study (Mean Age In Years)	Present Study (Mean Age In Years)
0	17.5	16.875
1	18.9	23
2	19.8	23.14
3	20.1	27.43
4	23.3	32.2
5	31.9	49.84

Table 4. (Mean age comparison for component III)

Score	Mckern- Stewart Study (Mean Age In Years)	Present Study (Mean Age In Years)
0	19.2	16.43
1	23.8	21.67
2	27	25
3	28.1	28.08
4	35.9	38.2
5	41.1	53.57

DISCUSSION

In present study the examination of symphyseal surface of os-pubis by Mckern-Stewart criteria in delhi (India) population to determine the age showed significant difference in all the 3 components as well as in total scoring in both the sexes when compared Mckern-Stewart study (study).

The dorsal margin appears late in the present study. It begins at the mean age of 23 years in both sexes, while in Mckern-Stewart study it begins at the mean age of 18.9 years and it completes at the mean age of 23.14 in our study while it completed at the mean age of 19.8 years in Mckern-Stewart study.

Dorsal plateau formation starts at the mean age of 27.43 years in our study, and it completes at the mean age of 49.84, while in Mckern-Stewart study it started

at the mean age of 20.1 years and completed at the mean age of 31.9 years.

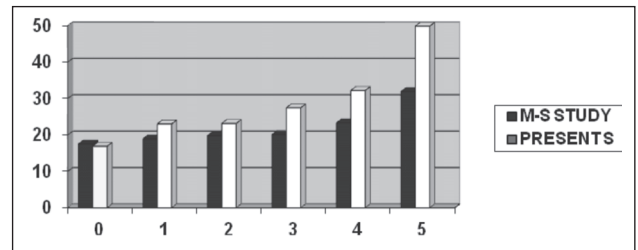


CHART 1. (Showing comparison of mean age for component-I)

Ventral bevelling appears late in the present study. It begins at the mean age of 21.25 years in both sexes, while in Mckern-Stewart study it begins at the mean age of 20.1 years and it completes at the mean age of 23.75 in our study while it completed at the mean age of 22.5 years in Mckern-Stewart study.

Ventral rampart formation starts at the mean age of 27 years in our study, and it completes at the mean age of 51.875, while in Mckern-Stewart study it started at the mean age of 23.6 years and completed at the mean age of 32.9 years.

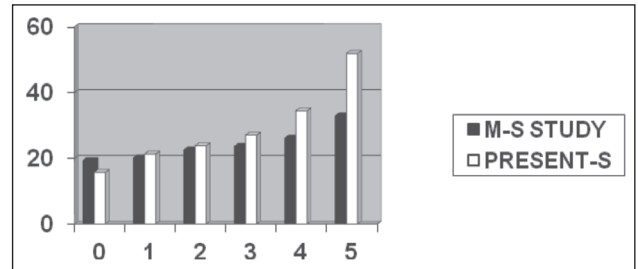


CHART 2. (Showing comparison of mean age for component-II)

Symphyseal rim formation appears early in the present study. It begins at the mean age of 21.67 years in both sexes, while in Mckern-Stewart study it begins at the mean age of 23.8 years and it completes at the mean age of 28.08 in our study while it completed at the mean age of 28.1 years in Mckern-Stewart study.

The rarefaction of symphyseal rim starts at the mean age of 38.2 years in our study, while in Mckern-Stewart study it started at the mean age of 35.9 years.

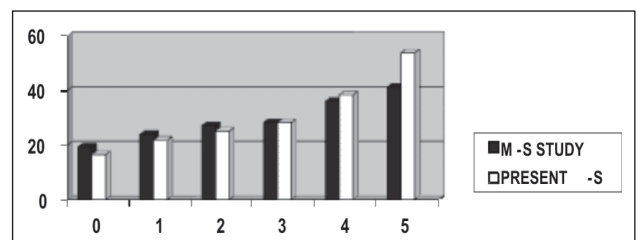


CHART 3. (Showing comparison of mean age for component-III)

CONCLUSION

For component I, II and III correlation between Mckern-stewart study and present study is 0.99, 0.99 and 0.98. Correlation for all 3 components is statically significant, so in our study there was not much differences in comparison to study done by Mckern and Stewart in 1957.

REFERENCES

1. Martrille L, Douglas H, Cattaneo C, Fabienne S, Tremblay M, Baccino E . Comparison of 4 skeletal methods for estimation of age on white and black adults J Forensic Sci 2007 ch;52(2):302-5
2. Todd, T.W. Age changes in pubic bone. Am J Phys Anthrop 1920, 3(3):285-334
3. Mckern,T.W. & Stewart,T.D. Changes in Young American Males: Analysis from the Standpoint of Age Identification. Technical Report EP-45, Quartermaster Research & Development Center, Environmental Protection Research Division.) Natick, Massachusetts: Headquarters Quartermaster Research & Development Command, 1957. viii, 179 pp., 87 figures, 52 tables.
4. Gilbert,B.M. and Mckern T.W. A method for aging the female os pubis. Am J Phys Anthrop 1973;38:31-8
5. Gilbert,B.M- Misapplication to females of the standard for aging the male os pubis. Am J Phys Anthrop 1973;38:39-40
6. Suchey,J.M. Problem in the aging of females using the os pubis. Am J Phys Anthrop 1979;51:467-70
7. Sharma G. Determination of age from pubic symphysis: an study. Med Sci and Law 2008;48(2):163-9

Post Mortem Study for Distribution of Intracranial Haemorrhages in Fatal Road Traffic Accidents

Singh BK¹, Ramanuj A², Bhise RS³

¹Assistant Professor, Forensic Medicine, ²Professor, Pathology, ³Professor, Forensic Medicine, C.U. Shah Medical College, Gujarat, India

ABSTRACT

This study was conducted in Maulana Azad Medical college, New Delhi Mortuary among the 102 post mortem cases of road traffic accident victims over the period of three years from 2008-2011. Objective of this study was to find out distribution of intracranial haemorrhages in fatal road traffic accident. Most common type of haemorrhage was subarachnoid followed by subdural haemorrhage.

Keywords: Road Traffic Accident, Intracranial Haemorrhages, Post Mortem

INTRODUCTION

Most of the injuries and fatalities worldwide are caused by road traffic accident. Road traffic accidents are leading cause of death globally among 15 to 19 years old while for those in the 10 to 14 and 20 to 24 years age brackets they are second leading cause of death¹. In 2009 1.27 lakh people in India lost their lives in road mishaps². Road traffic accident represents 45 to 50 % causes of head injuries and young adult were the most common victim³. Ten per cent of all new admission in emergency OPD came with head injuries due to Road traffic accident⁴. Intracranial haemorrhages commonly occur in road traffic accidents and these haemorrhages with brain parenchymal damage are cause of death in most of the head injuries cases. Intracranial bleeding (IB) is a common and serious consequence of traumatic brain injury (TBI). Intracranial bleeding can be classified according to the location into: epidural haemorrhage (EDH) subdural haemorrhage (SDH) intraparenchymal haemorrhage (IPH) and subarachnoid haemorrhage (SAH). Subdural haemorrhages mostly occur in old age and children due to fall on ground by accidents, while subarachnoid haemorrhages are most common pattern of intracranial haemorrhages in road traffic accidents^{5,6,7}.

MATERIALS AND METHOD

This study was conducted in Maulana Azad Medical college, New Delhi Mortuary among the 102 post mortem cases of road traffic accident victims over the period of three years from 2008-2011. Intracranial

haemorrhages and brain parenchymal injuries were noted at the time of autopsy.

OBSERVATION

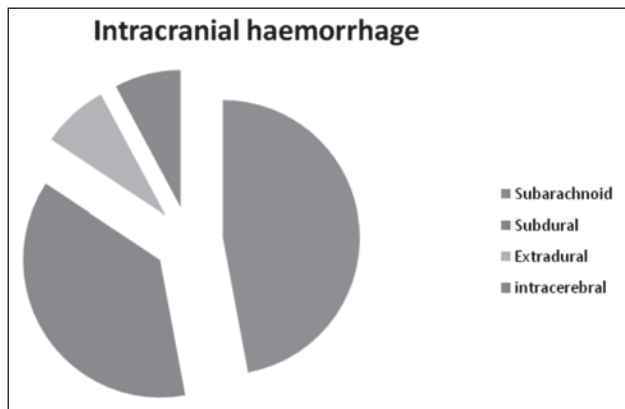
A total of 102 cases were studied. Out of 102 cases cerebral damage was present in 82 cases in the form of intracranial haemorrhages and parenchymal injuries. In the present study out of 82 cerebral damage cases, intracranial haemorrhages were found in 78 cases.

Table 1 Distribution of intracranial haemorrhages in road traffic accident victims

Injury type	Total number of cases	Percentage
Only extradural haemorrhage	4	5.13
Extradural & Subarachnoid haemorrhage	2	2.56
Extradural & Subdural haemorrhage	2	2.56
Total extradural haemorrhage	8	10.26
Only subarachnoid haemorrhage	26	33.33
Total subarachnoid haemorrhage	48	61.54
Only subdural haemorrhage	16	20.51
Total subdural haemorrhage	38	48.72
Subarachnoid & Subdural haemorrhages	20	25.64
Intra parenchymal haemorrhages	8	10.26
Total	78	100

DISCUSSION

Most common type of haemorrhages was subarachnoid followed by subdural and extradural haemorrhage was least common in the present study.



(Chart 1: Showing distribution of intracranial haemorrhages in fatal road traffic accident victims)

Subarachnoid haemorrhages were responsible for 61.54 % of all internal haemorrhages in our study as mentioned in most of the study⁸. Subdural haemorrhages were responsible for 48.72 % of all internal haemorrhages in our study. Out of 78 cases of cerebral damage in 13 cases brain parenchymal injuries were present in the form of contusions, haematoma and lacerations. In the present study in 30.77 % cases more than one type of haemorrhages were found. In the study conducted in Maharashtra⁹ combination of subarachnoid and subdural haemorrhage was most commonly observed in 61.95 % cases, followed by combination of extradural, subdural and subarachnoid haemorrhage in 20.35 % cases. Finding in present study differ from that study, as only subarachnoid haemorrhage was most common in 33.33 % cases followed by combination of subdural and subarachnoid haemorrhage in 25.64 % cases. In the present study combination of extradural, subdural and subarachnoid haemorrhage was not present in contrast to study in Maharashtra where it was present in 20.35 % cases. In the study conducted in Nepal¹⁰ subdural haemorrhage was found in 50.6%, extradural in 48% and subarachnoid haemorrhage in 35% of the cases. So finding in study conducted in Nepal differ from present study. A study conducted in Bengaluru¹¹ showed that most common intracranial haemorrhage was subdural in 98 % cases followed by subarachnoid haemorrhage in 96 % of cases. A study conducted by Gupta et al¹² showed that subdural haemorrhage was most common in 68 % cases followed by extradural haemorrhage in 28 % case and intracerebral haemorrhage was least common in 8 % of cases. Intracerebral haemorrhage was least in our study also but other finding of Gupta et al study is contrary to our study. Chandra et al¹³ study showed that subarachnoid haemorrhage is most common type of

haemorrhage followed by subdural haemorrhage coincide with our study.

CONCLUSION

In the present study subarachnoid haemorrhage was most common followed by subdural haemorrhage. There is a lot of variation in the distribution of intracranial haemorrhage in fatal road traffic accident victims. Combination of haemorrhages were common so careful brain examination should done to find all type of intracranial haemorrhages.

REFERENCES

1. WHO- World health organization 2007b. World health statistic 2007. 1-87.
2. Mondal P, Sharma N, Kumar AK, Bhangale UD, Tyagi UD, Singh R. Effect of rainfall and wet road condition on road crashes: A critical analysis. SAE paper number 2011-26-0104
3. Youngerman S. Head injury, age 4 and older. *J Neurosurgery* 2004;100(3): 381-85
4. Brookes M, Macmillan R, Cully S, et al. Head injuries in accident and emergency departments. How different are children from adults? *J Epidemiol Comm Health* 1990;44:147-151.
5. Knight B, Saukko P. Knight's forensic pathology. 3rd ed London:Arnold. 2004, p 174-222
6. Singh D, Dewan I, Sharma AK, Shodhi A. A retrospective study of death due to head injuries in Chandigarh. *J Ind For Med* 1998 ;18:1-4.
7. Tirpude BH, Naik RS, Anjankar AJ, Khajuria BK. A study of pattern of craniocerebral injuries in road traffic accident. *J Ind Ac Fo Med* 1998; 20(1):3-9.
8. Pillay VV. Textbook of Forensic Medicine and toxicology. 15th ed New Delhi:Paras medical publisher. 2010,p227
9. Tandle RM, Keoliya AN. *J Indian Acad Forensic Med.* 2011; 33(3):228-31.
10. Jha S, Yadav BN, Agrawal A, Thakur D. The pattern of fatal head injury in a teaching hospital in eastern Nepal. 2011; 5(3):592-6
11. Shivakumar BC, Srivastava PC, Shantakumar HP. Pattern of head injuries in mortality due to road traffic accidents involving two-wheelers. *J Indian Acad Forensic Med;* 32(3):239-42
12. Gupta S, Roychowdhury UB, Deb PK, Moitra R et al. Demographic study of fatal cranio-cerebral road traffic injuries in North Bengal region. *Medico-legal update* (2007-01 - 2007-03);7(1).
13. Chandra J, Dogra TD, Dikshit PC. Pattern of craniocerebral injuries in fatal vehicular accidents in Delhi. 1966-1976. *Med Sci Law.* 1979;19(3):186-94

An Unusual Internal Ricocheting of Bullet in a Case of Firearm Injury Over Chest without Significant Damage to Vital Structures: A Case Report

Ravindra Baliram Deokar¹, Sachin Sudarshan Patil², Kshitija Rajiv Patil³

¹Assistant Professor & Medicolegal In-charge, Department of Forensic Medicine, ²Assistant Professor, Department of Forensic Medicine, Seth G S Medical College and KEM Hospital, Mumbai, ³House Officer, Department of Forensic Medicine, Seth G S Medical College and KEM Hospital, Mumbai

ABSTRACT

Usually a penetrating firearm injury to the chest wall turns out to be fatal as it tends to damage the vital organs or great vessels. However a medicolegal case was brought in front of us where a patient's vital organs were not damaged as he survived for 5 days before succumbing. An autopsy was conducted and the bullet track dissected. It was found to be an unusual case of ricocheting of bullet within the body and the patient was found to have died due to late complications.

Keywords: Medicolegal Autopsy, Firearm Injury, Ricocheting of Bullet, Bronchopneumonia

INTRODUCTION

Murders by gunshot account for 12.2 percent of all murders committed in India.¹ Unlicensed Firearms account for 86 to 92 percent of all gunshot murders.¹ Compared to firearm fatality rates in much of the world, India's are not particularly high due to strict rules of licensing for possession of firearms². However they are on the rise due to manufacturing of illegal firearms- desi kattas, as they are commonly called- especially in the states of Uttar Pradesh and Bihar.³

CASE REPORT

The deceased was a 38years old male who was shot in the anterior chest wall on the left side with a country made Firearm. The entry wound was present but there was no exit wound. He was brought to KEM hospital, Mumbai and survived for 5 days before succumbing.

Corresponding author:

Ravindra Baliram Deokar

Assistant Professor & Medicolegal In-charge,
Department of Forensic Medicine, Seth G S Medical
College and KEM Hospital, Acharya Donde Marg,
Parel, Mumbai

Email id: ravideo80@gmail.com,

sachinpatilmdfm@gmail.com

Contact No. 09869741117, 09757179483

Clinical Summary: He was admitted with complaints of breathlessness and pain at site of entry wound and on right side of chest wall. On examination he was found to have tachypnea, decreased air entry on right side of chest wall, bilateral crepitation and rhonchi, subcutaneous emphysema over right neck and chest wall anteriorly and posteriorly.

Investigations: Radiograph showed the bullet lodged at the level of 3rd rib on the right side with its nose distorted and directed upward and laterally. CT chest showed signs of hemopneumothorax on right side and collapse of right lung. Bullet was lodged in right subscapularis muscle. CT chest repeated 5 days later showed signs of opacification of lobes of both lungs suggestive of bilateral bronchopneumonia.

Treatment: An intercostal drain was inserted in 4th intercostal space to drain the hemopneumothorax. He was intubated and kept under observation. He was administered antibiotics and hemostatic drugs. For initial 3 days he showed improvement before his condition deteriorated. He was declared dead after 5 days of hospital stay.

AUTOPSY FINDINGS

Relevant Surface Injury Description: The Entry wound was present over anterior chest wall on left

side, roughly oval in shape 04cm below the midpoint of clavicle, diameter was 0.7cm at its minimum and 0.8cm at its maximum with inverted, clean punched margins with abraded collar in lower left quadrant measuring 0.3cm. The surrounding skin showed blackening, scorching and tattooing over 03cm to 05cm area.



Fig. 1. Showing firearm entry wound.

Track dissection: The track was directed upward, inward and backward through the muscles of anterior chest wall up to the left clavicle.



Fig. 2. Entry pathway of bullet within anterior thoracic wall.

The left clavicle was found to have a fracture on its inferomedial aspect and splintered fragments of the bone were seen scattered, largest of which measured 01 cm x 0.5 cm x 0.5 cm. On further dissection at the root of neck, the other structures were found intact whereas there was a dent on the anterior aspect of first thoracic vertebra. On dissecting to the right, the scapula had a dent over the glenoid angle anteromedially.

Final lodging of bullet: The fired bullet was finally sagged into the right subscapularis muscle in front of right scapula against 3rd rib posterolaterally. The bullet's nose was broken and directed upward,

outward and backward with it's base directed downwards, inwards & forwards.

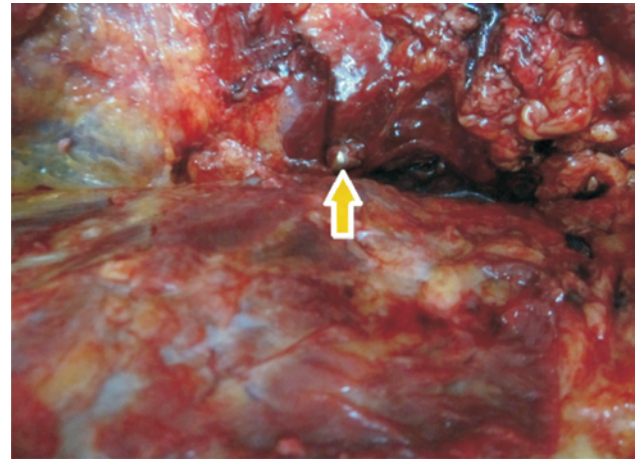


Fig. 3 . Final enlodgement of Bullet in subscapularis muscle.

Description of bullet: The fired bullet was 03 cm in length and 0.7cm in diameter. The nose was damaged due to impact with bones in the body. Cannellure was seen near the base. Markings on the surface of the bullet were straight in direction suggestive of being fired through an improvised smooth bored shotgun. The bullet was sent to ballistics expert for further detailed report.

Other Findings: The laryngotracheal tract was dissected and found to be intact with congested mucosa. Both the lungs were found to have firm consistency suggestive of consolidation. On cut section changes of red hepatisation were seen at places. The other organs including the heart, liver, spleen, stomach, pancreas, small and large intestines, both kidneys along with adrenals, testes and brain were examined and found to be intact.

DISCUSSION

This is very unique case showing ricocheting of bullet within the thoracic cavity without causing any significant damage to underlying vital structures⁴.

Distance of Firing: According to the appearance of the entry wound that showed tattooing, burning and blackening the distance must have been approximately between 30cm to 60 cm from the body.

Direction of Firing: This was deduced by drawing a straight line between the Entry wound and the first point of deflection by ricocheting. It must have been from the left anterior side of the victim directed upward and to the right hand side of the victim.



Fig. 4. Black line showing direction of ricocheting of bullet within chest cavity.

This was a case of ricocheting of bullet inside the body. It entered at the left anterior chest wall going upward, backward and inward to hit the left clavicle inferomedially and onward to anterior surface of first thoracic vertebra. At this point it is found to have changed its direction and travelled towards the right scapula hitting it at glenoid angle anteromedially where, losing its velocity and reversing its direction, it dropped down and lodged in right subscapularis muscle with its nose upwards and base downwards.

Penetrating trauma to the chest or around the root of neck is often fatal because of the complicated anatomy of the area where there is a dense concentration of vital vascular, aero digestive and nervous system structures located within a very small space. The bullet, in its course, is found to have traversed through the root of neck dodging all the vital structures including the common carotid artery, internal jugular vein, vagus, vertebral artery, inferior thyroid artery, thyroid gland, apices of lungs, trachea and oesophagus.

In richer countries firearms are used most commonly for committing suicides while with lower income countries like India firearms are usually used for assaults and homicides. In addition, elderly people are commonly experiencing self-inflicted wounds

using firearms⁵, while younger men are commonly injured by homicide attempts⁶. Gunshot violence in addition to medical importance has an enormous economic impact, third most costly etiology of injury and the fourth most expensive form of hospitalization⁷. Therefore, treatment protocols for emergency treatment of firearm injuries have to be established in trauma departments worldwide. Having good knowledge of general ballistic principles will be of great help to guide clinical management of patients with firearm injuries⁸.

CONCLUSION

This is a rare case of fire arm injury at a vital site where the important structures were not damaged. However the patient succumbed due to late complications. The cause of death was Bronchopneumonia as consequence and complication of Gunshot injury. As the saying goes, "The best armour is to keep out of gunshot." However, in certain rare cases, the gunshot may be kept out by the natural armour of our body.

ACKNOWLEDGEMENT

We gratefully acknowledge to Dr H.M.Pathak , Professor and head for his valuable guidance for conductance of medicolegal autopsy and we are extremely thankful to Dr R B Sukhadeve , Associate Professor for his unrelenting help and Dr. (Mrs.) Deokar Priya & Miss. Dhriti for being a continuous source of encouragement and support.

Ethical Approval: Not applicable.

Conflict of Interest: None declared.

Source of Support: Nil.

REFERENCES

1. Small Arms Survey Issue Brief of September 2011
2. Singh V.P. , Sharma, B.R. Dasari H, Vij K., Multiple Wounds By A Single Bullet: A Case Report. JIAFM, 2004; 26(1),Pg no 30-31.
3. Sharma R.K, Concise Textbook of Forensic Medicine and Toxicology, Elsevier.Publishers 2nd.edition,2008, Pg no 82.

4. Agrawal A, Pratap A, Rauniar RK, Kumar A, Nepal U. Intracranial ricocheting of bullet from anterior clinoid process. *JNMA J Nepal Med Assoc.* 2008 Jul-Sep;47(171):145-6.
5. Lustenberger T, I.K., Schnüriger B, Barmparas G, Eberle BM, Lam L, Talving P, Demetriades D, Gunshot injuries in the elderly: patterns and outcomes. A national trauma databank analysis. *World J Surg*, 2011. 35(3): p. 528-34.
6. Davies MJ, W.C., Squires PA, Hodgetts TJ, Lecky FE, Civilian firearm injury and death in England and Wales. *Emerg Med J*, 2012. 29(1): p. 10-4.
7. Philipp Lichte, R.O., Marcel Binnebösel, Rene Wildenauer, Hans-Christoph Pape, Philipp Kobbe, A civilian perspective on ballistic trauma and gunshot injuries. *Scand J Trauma Resusc Emerg Med.*, 2010. 18(35).
8. Athanasios G., Firearm Injuries And Their Management In The Context Of A Metropolitan Emergency Department ; crisis.med.uoa.gr/elibrary/5.pdf; Pg no 1-13.

Profile of Unnatural Deaths- A Study of Autopsies at Mortuary of King George's Medical University, Lucknow, India

Sachil Kumar¹, Anoop K Verma², Irfan Ahmad³, Wahid Ali⁴, Uma S Singh⁵

¹Junior Research Fellow (UGC), Department of Pathology, ²Associate Professor & Head, Department of Forensic Medicine & Toxicology, ³Senior Research Assistant, Department of Pulmonary Medicine, ⁴Assistant Professor, Department of Pathology, ⁵Professor, Department of Pathology, King George's Medical University UP, Lucknow

ABSTRACT

Unnatural deaths claim a substantial number of lives in developing countries like India. Among the various types of deaths RTAs (road traffic accidents) account for majority of deaths followed by poisoning, hanging, burns, snake bite and electrocution. The ratio between homicidal, suicidal and accidental deaths was 5:2:1. Males 2636 (59.6%) were commonly involved as compared to females 1785 (40.3%). The type of unnatural deaths encountered in our study were RTAs 2486 (56.23%), burns 289 (6.53%), poisoning 616 (13.93%), hanging 502 (11.35%), snake bite 69 (1.56%), electrocution 38 (0.85%). Poisoning and hanging is the most common method of self destruction followed by burns, drowning. In homicidal deaths multiple injuries were the most common type of death followed by burns. Preventive measures should be adopted wherever possible and prompt steps should be taken to decrease the incidence of road traffic accidents which takes a lion share among the unnatural deaths. The study suggests different measures to check unnatural death to improve the situation.

Keywords: *Unnatural Deaths, Suicide, Autopsy, Urban-Rural Population, Accident*

INTRODUCTION

Everyday around the world thousands of people die from unnatural deaths and for every person that dies, several thousands more are affected. Unnatural deaths occur in all regions and countries and affect people in all age and income group. Unnatural death is one of the indicators of the level of social and mental health.¹³ The unnatural causes of death are many with accidents being the most common amongst others. Over the decades there has been a steady increase in the transportation deaths and injuries, on road, rail and in the air. Accidental burns, poisoning, drowning, electrocution, are also on the rise. Suicidal and homicidal fatalities are common among both rural and urban population. The present study deals with epidemiological and medico-legal aspects of unnatural deaths in district Lucknow in the state of Uttar-Pradesh. The result have been analyzed and presented. The various socioeconomic factors and their bearing on the unnatural deaths have been also correlated.

MATERIAL AND METHOD

Materials for the present study comprised 4756 cases of unnatural deaths received in the mortuary of the Department of Forensic Medicine and Toxicology, King George's Medical University U.P., Lucknow, INDIA for medico-legal autopsy examination during the period May 2, 2011 to May 1, 2012. The various epidemiological characteristics of the cases and their medico-legal aspects were collected from the perusal of police papers, postmortem reports of the cases and through interrogation of the parents, relatives, friends and neighbours and the police officers accompanying the dead body. In selected cases histopathological examination, x-ray examination and chemical analysis were also taken into consideration. The unnatural deaths are broadly classified as accidental, suicidal and homicidal depending upon the manner of death. Next, as per the various pattern of modes of deaths encountered during this study, the unnatural deaths were classified as RTAs, burns, poisoning, asphyxia deaths, and deaths due to electrocution.

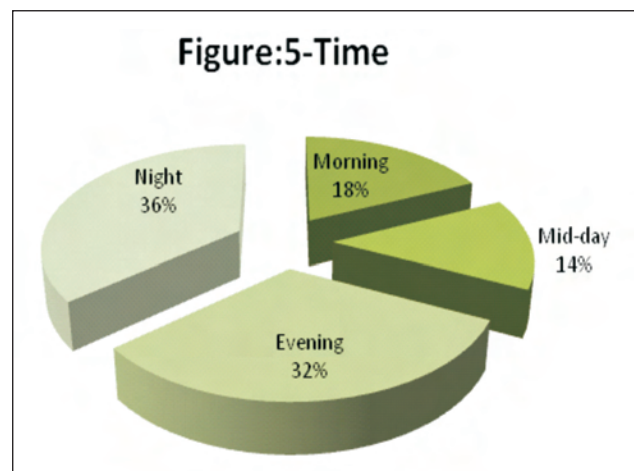
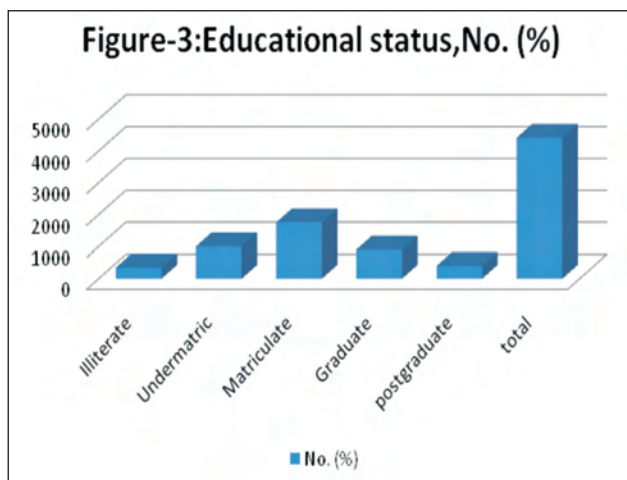
RESULTS

A total of 4756 cases of unnatural deaths of all ages were reported for postmortem in the Morgue of the hospital during the study period, of which 1550 (35.05%) were in the age group of 16-30 years i.e. comprising more than 1/3 of the total number of cases. 335 cases were excluded from the study which were either unknown cases and were exempted from postmortem examination. The table -1 shows the distribution of cases under various categories. The

majority of the victims (91.55%) were either illiterate, under metric or education up to matriculation level or graduation level and only (8.45%) victims had got higher education (Fig-3). Although the number of rural (51.48%) and urban (48.51%) victims was almost equal, yet keeping in mind the urban to rural ratio of population of Lucknow district, the incidence was obviously higher in urban community. The incidence most commonly happened during night (36%) and evening hours (31.93%) (Fig-5).

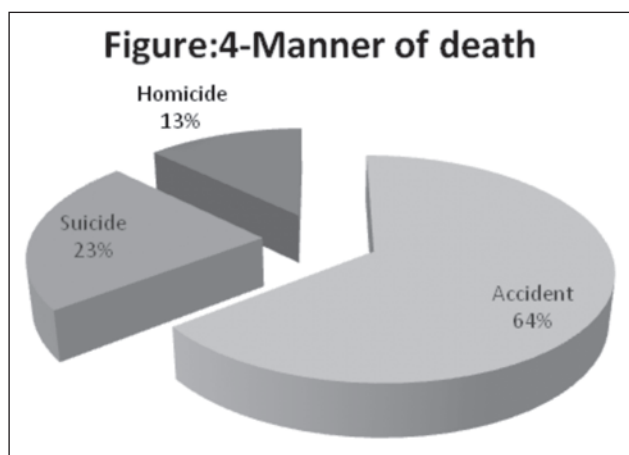
Table 1: Profile of unnatural deaths.

Gender Dimorphism	No. (%)	Age group	No. (%)	Marital status	No. (%)	Educational status	No. (%)	Nature of death	No. (%)
Male	2636(59.6%)	0-15	360	Married	3225	Illiterate	353	Homicidal	
Female	1785(40.3%)	16-30	1550	Unmarried	1196	Undermatric	1006	Multiple injuries	244
Total	4421(100%)	31-45	1179	Total	4421	Matriculate	1755	Poison	92
community	No. (%)	46-60	908	Causative agents	No. (%)	Graduate	905	Burns	190
Rural	2276	61-above	423	Vehicular accidents	2486	postgraduate	402	Others	39
Urban	2145	Total	4421	Poison	616	total	4421	Total	565
Total	4421	Time	No. (%)	Hanging	502			Suicidal	
Manner of death	No. (%)	Morning	806	Burns	289			Drowning	105
Accident	2850	Mid-day	611	Drowning	135			Hanging	502
Suicide	1006	Evening	1412	Homicidal injuries	244			Poison	359
Homicide	565	Night	1592	Snake bite	69			Burns	40
Total	4421			Electrocution	38			Total	1006
		Total	4421	others	42			accidental	
				Total	4421			Vehicular acci-	2486
								Poison	165
								Burns	59
								snakebite	69
								electrocution	38
								drowning	30
								others	3
								Total	2850
								Grand total	4421



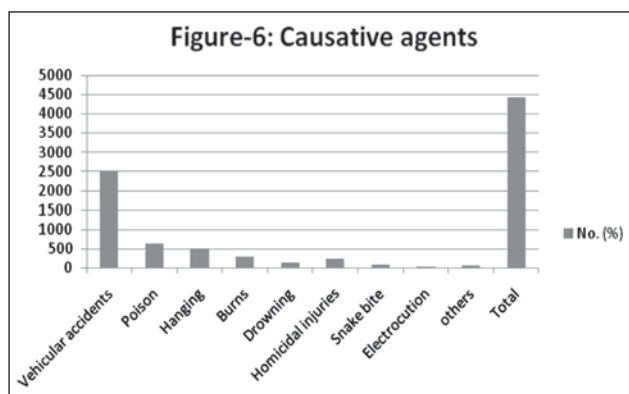
1. Profile of unnatural deaths

The present study included 4421 cases of unnatural deaths during a period of 1 year, out of which 2850(64.46%) were due to accident, 565 (12.77%) cases were homicide and 1006 (22.75%) cases were suicide (Table-1) (Fig-4).



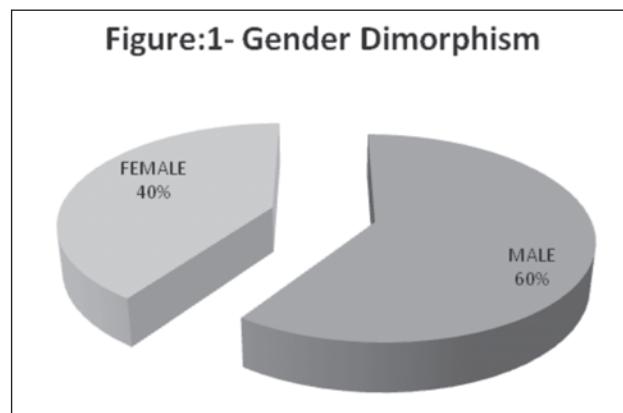
2. Types of unnatural deaths

During the study period, out of 4421 cases depending on the mode of deaths encountered during the study period, there was RTAs 2486 (56.23%), burns 289 (6.53%), homicidal injuries 244 (5.51%), poisoning 616 (13.93%), drowning 135 (3.05%), hanging 502 (11.35%), electrocution 38 (0.85%), snake bite 69 (1.56%) and others 42 (0.95%) (Fig-6).



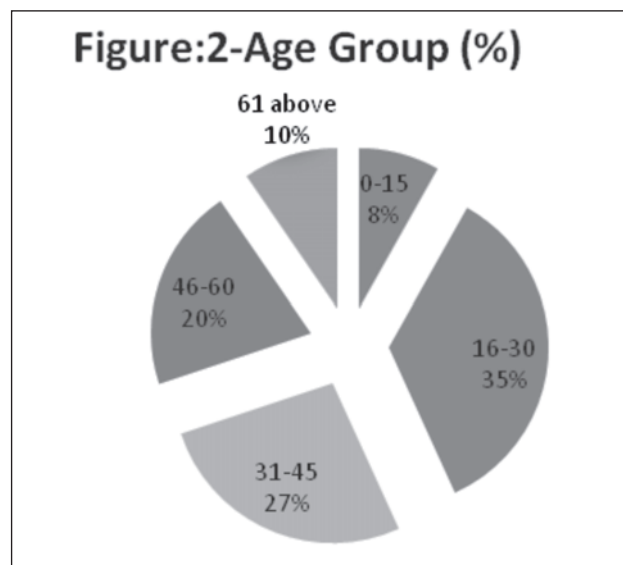
3. Sex profile of unnatural deaths

Among 4421 cases of unnatural deaths, 2636 (59.6%) were males and 1785 (40.3%) were of female sex. (Table-1) (Fig-1).



4. Age wise distribution of the presenting type of unnatural deaths

Maximum number of cases were seen in the age group of 16-30 years 1550 (35.05%) followed by 31-45 years 1179 (26.66%) (Fig-2).



5. Type of accidental, suicidal and homicidal deaths with sex wise distribution.

The pattern of accidental deaths were, RTAs 2486 (87.22%), burns 59 (2.07%), poisoning 165 (5.78%), snake bite 69 (2.42%), Electrocution 38 (1.33%), Drowning 30 (1.05%) and others 3 (0.10%). Out of 2850 cases of accidental deaths, 2040 were males and 810 were females. Among them RTAs top the list where out of 2486 cases an overwhelming 1826 (73.45%) cases were males and 660 (29.54%) were females. There were 16 (5.53%) cases of males and 43 cases of (14.87%) females among the accidental burns. In poisoning cases of accidental poisoning

were male 98 (15.90%) and 67(10.87%) were females.

Out of 1006 cases of suicidal deaths 451 were males and 555 were females. Among 359 cases of suicidal poisoning 158 (24.65%) were males and 201(33.62%) were females. Among the 40 (3.97%)

cases of burns 1 was male and rest was females. There were 502 cases of suicidal hanging among which 206 (41.03%) were males and 296 (58.96%) were females. 105 cases of suicidal drowning among them 86 were males and 19 were females (Table-2).

Table 2: Types of accidental, suicidal and homicidal deaths with sex wise distribution.

Accidental deaths	Male No (%)	Female No (%)	Suicidal deaths	Male No (%)	Female No (%)	Homicidal deaths	Male No (%)	Female No (%)
Vehicular acci-	1826	660	Drowning	86	19	Multiple injuries	136	108
Poison	98	67	Hanging	206	296	Poison	56	36
Burns	16	43	Poison	158	201	Burns	8	182
snakebite	38	31	Burns	1	39	Others	7	32
electrocution	30	8	Total	451	555	Total	207	358
drowning	29	1						
others	3	0						
Total	2040	810						
Grand total	4421							

In homicidal deaths 565 (12.77%), Multiple injuries 244 (55.73%) were the most common type of death followed by burns 190 (16.28%) and poisoning 92 (16.28%) (Fig-7-12).

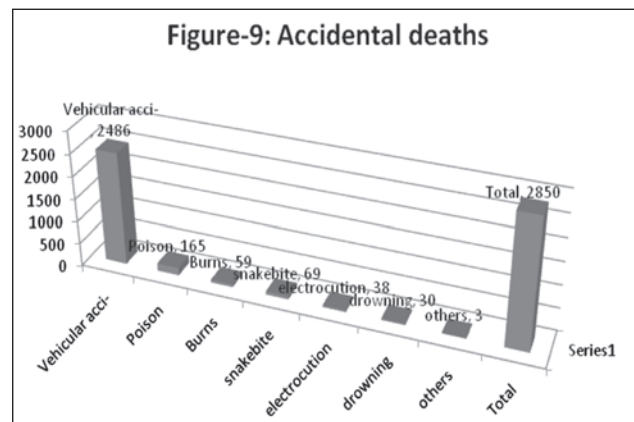
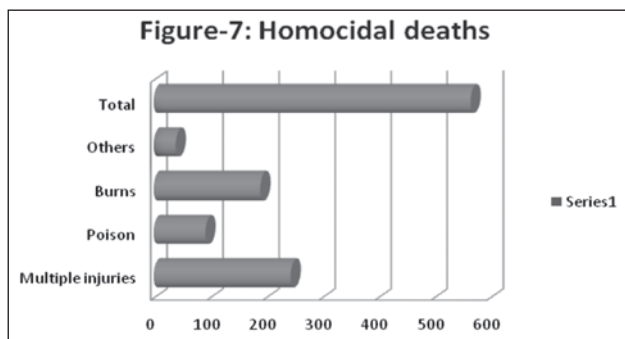


Figure 10. Sexwise distribution of accidental deaths.

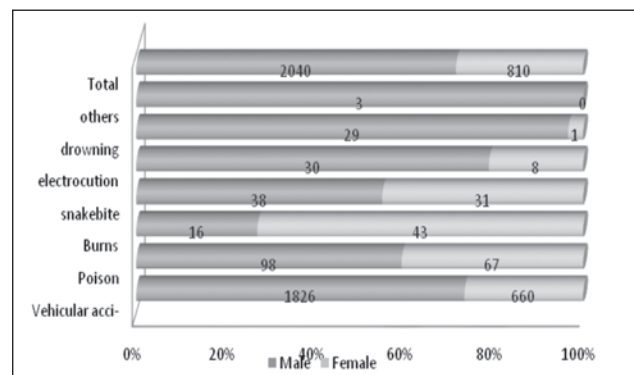
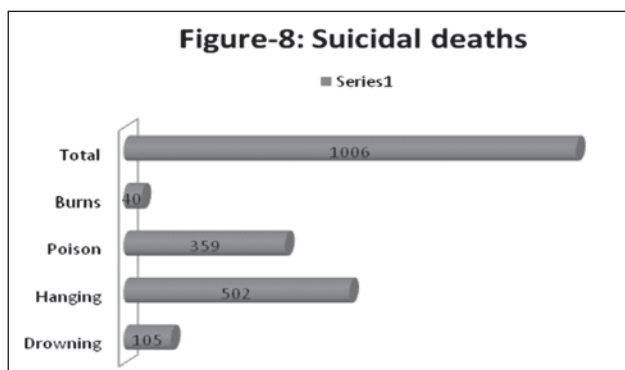


Figure 11. Sexwise distribution of suicidal deaths.

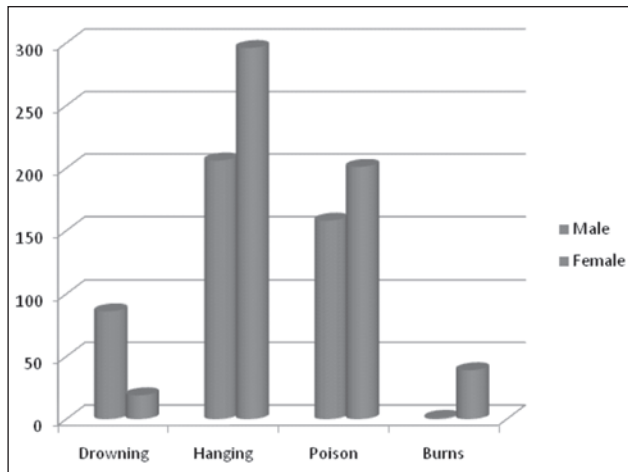
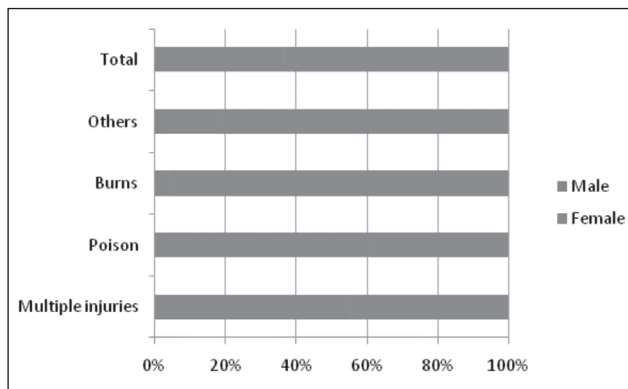


Figure 12-Sexwise distribution of homicidal deaths.



DISCUSSION

In our study, unnatural deaths due to accidents were 64.46%, suicide 22.75% and homicide 12.77%. Our findings differ from the study conducted at PGIMER, Chandigarh, where 79.3% of deaths were due to accidents, 13.95% due to suicide and 6% of deaths were due to homicide.¹ Our findings also differ from to the result of the study conducted at government medical college hospital, Chandigarh where deaths due to accidents were 49.56%; deaths due to suicide were 38.55% and homicide were 4.44 % .²

Sex profile of unnatural deaths shows 59.6%of the cases were males and 40.3% cases were females. Our findings are different to study conducted at PGIMER, Chandigarh where 73.42%were males and 26.58% were females.¹ our findings also differ to the study at Dhaka medical college, Dhaka, Bangladesh where 73.32% were males and 26.68% were females.³

The type of unnatural deaths in our study, 56.23% were RTAs, 6.53% cases were burns, 13.93% cases were

poisoning, 11.35% were death due to hanging, 5.51% for homicidal injuries and rest deaths due to drowning, snakebite, electrocution. These deaths were attributed to be the leading cause of death in our study. Mortality rate for poisoning deaths in various studies^{14,15} is reported between 11% to 34%, which is 13.93% (616/4421) in the present study.

Maximum number of RTAs in our study is due to the close proximity of highways traversing the city which account for many highways accidents. Apart from this, congested and overcrowded roads and increase in the number of vehicles have resulted in more number of accidents even within the city.

The numbers of deaths due to poisoning, burns are influenced by a number of factors like the geographic area of the study, cultural and traditional background of the people.

Our findings differ from the study conducted at Kasturba Medical College, Manipal, where 75% were females and 25% were males. The age group of 19-25 years involved 26.7% followed by the age group 26-32 years which involved 21.7% which also differ from our study. Our results also differ from the study at M.R Medical College, Gulbarga where 75.68% were females and 24.32% were male victims of burns. Here also the maximum number of deaths involved in the age group 21-30 years.

The types of accidental deaths in our study were RTAs (87.22%), poison (5.78%), burns (2.07%), snakebite (2.42%), electrocution (1.33%) and drowning (1.05%). Our findings are differ with respect to RTAs (65.72%) and burns (14.09%), in the study conducted at government medical college and hospital Chandigarh but also differ from our result in case of poisoning(9.87%).⁷ In our study among all the accidental deaths RTAs were maximally involved. This may be explained due to the close proximity of the national highway no.24 and increases in the number of vehicles within the city which has resulted in many accidents. Likewise accidental burns, poisoning included a small percentage of cases in our study.

In the type of suicidal deaths the maximum number of suicidal deaths occurred as a result of hanging (49.90%) followed by poisoning (35.68%), drowning (10.43%)and burns (3.97%). our findings are not consistent in case of suicidal deaths due to poisoning (48.49%) and hanging (9.88%) at the study conducted at government medical college and hospital Chandigarh.² our findings are consistent from the study at Ireland,⁸ Epirus in north west Greece,⁹

Manipur^{5,10} and Behrampur¹¹ where hanging was the most common method of self destruction followed by either poisoning or drowning in water and burns.

In the present study deaths due to multiple injuries (43.18%) were the most common types of homicidal deaths encountered followed by burns and poisoning. Our findings are consistent with the study conducted at GTB hospital, Shadhara, Delhi where death due to multiple injuries was the most common cause.^{4,12}

CONCLUSION

Unnatural deaths are known to claim a substantial number of lives especially in developing countries like India. Analysis of unnatural deaths in society not only gives an idea of the manner of death but also it reflects the socio-economic status of the society. The increase in the pace of mechanization, rise in the number of fast moving vehicles, semi skilled drivers, drunken drivers, inadequate, congested and ill maintained roads in our society has lead to the increase in the number of RTAs. Self destruction by poisoning is commonly adopted by farmers as insecticides and agrochemicals are easily available in every rural house. In unmarried girls, failures in love, failure in examination, scolding by the parents or many children in the family were the reason behind such deaths. By improving the illiteracy rate and providing employment to youth, crime rate and more so the number of homicidal deaths can be brought down. Responsibility for prevention of violence in our society does not rest only on the law enforcement personal. Public health and other human service agencies should assist in preventing primary violence as they have helped to prevent other major causes of morbidity and mortality. Apart from medical efforts, social effort in the form of governmental, NGO and other social group's helps through sincere and severe work at many levels like economy, poverty, education, irrigation and markets is the need of the hour. Preventive measures should be adopted promptly wherever possible to avoid all unnatural deaths. If not preventable, prompt and immediate care should be provided in order to save the life of the victim.

Ethical Clearance: Not declared.

Source of Funding: None.

ACKNOWLEDGEMENTS

We sincerely thanks to faculty of Department of Forensic Medicine & Toxicology and staff of Post-mortem house, King George's Medical University UP, Lucknow.

Conflict of Interest: None

REFERENCES

1. Singh D, Devan 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. *Journal of clinical forensic medicine* 2003; 10(3):145-152.
2. Sharma BR, Singh VP, Sharma R, Sumedha. Unnatural deaths in northern India- a profile. *Journal of Indian academy of forensic medicine* 2004; 26(4):140-146.
3. Islam MN, Islam MN. Pattern of unnatural deaths in a city mortuary: a 10 year retrospective study. *Legal medicine* 2003; 5(1):354-356.
4. Ghosh PK. Epidemiological study of the victims of vehicular accidents in Delhi. *Journal of Indian medical association* 1992; 90(12):309-312.
5. Rao NG. Study of fatal female burns in Manipur. *Journal of forensic medicine and toxicology* 1997; 14(20):57-59.
6. Babladi PIP, Sangram R. The postmortem study of thermal deaths with reference to dowry deaths. *Journal of forensic medicine and toxicology* 2005; 22(1):23-25.
7. Sharma BR, Sharma V, Harish D, Vij K. Suicides in northern India: causes methods used and prevention. *Medicine, science and the law* 2003; 43(3):221-229.
8. Davidsan A, Marshal TK. Hanging in Northern Ireland a survey. *Medicine, science and the law*; 1986; 26(1):23-28.
9. Vouglouklakis, Voumba VA, Mitsclou A, Peschos D, Gerontopoulos K. Trends in suicide mortality in the deprived region of Epirus during the period 1998-2002. *medicine, science and the law* 2005; 45(1):39-46.
10. Fimate I, Meera TH. A study of suicides in Manipur. *International journal of medical toxicology and legal medicine* 22001; 3(2):27-29.
11. Sahoo PC, Das BK, Mohanty MK, Acharya S. Trends in suicide. A study in M.K.C.G College, P.M. centre. *Journal of forensic medicine and toxicology* 1999; 16(1):34-35.
12. Kohli A, Agarwal BBL. Pattern of murder case in north east Delhi. *Journal of forensic medicine and toxicology* 1996; 13(1&2):36-38.
13. Shamsue A.K.M. Study of pattern of unnatural deaths in morgue of Dhaka medical college, Bangladesh (1989 to 1994)
14. Zine KU, Mohanty AC. Pattern of acute poisoning at Indira Gandhi medical college and hospital, Nagpur. *j ind aca for med* 1998; 20:37-39.
15. Dewan A. Role and relevance of poison information centers in India. *ICMR bulletin* 1997; 27:43-47.

Detection and Characterization of Children's Soft Toy for Phthalate Esters

Abdul Rahim Yacob¹, Aminah Mohamed Ayub², Nazirah Binti Said³

¹Professor Doctor, Chemistry Department, Faculty of Science, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia, ²Rubber Research Institute of Malaysia, Sungai Buluh, 47000, Selangor Darul Ehsan, Malaysia, ³Postgraduate Student, Chemistry Department, Faculty of Science, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia

ABSTRACT

On November 19, 2009, the European Union regulated three phthalates esters; Benzyl Butyl Phthalate (BBP), DiButyl Phthalate (DBP), and DiEthylHexyl Phthalate (DEHP) to a limit of less than 0.1% in all imported toys and articles. However, the U.S regulation strongly prohibited BBP, DBP and DEHP and at any concentrations more than 0.1%. These regulations thus indicate how serious phthalate esters and their effect on health. In the current study, five (5) imported samples of soft toys were obtained from local markets and analyzed for six (6) types of phthalate esters of BBP, DBP, DEHP, Di-n-Octyl Phthalate (DnOP), DiIsoNonyl Phthalate (DINP) and DiIsoDecyl Phthalate (DIDP) respectively. The method used was established by Consumer Product Safety Commission (CPSC) Malaysia while characterization performed by Fourier Transform Infrared (FT-IR) spectroscopy, Thin Layer Chromatography (TLC), Thermogravimetric Analysis (TGA) and Gas Chromatography-Mass Spectrometry (GC-MS). This study found all the samples to contain high percentage of DEHP while two (2) contained acceptable levels of DBP. Other phthalate esters were however not detected or below the detection limit of GC-MS.

Keywords: *Phthalate Esters, Soft Toy, Safety Regulation, Health Effects*

INTRODUCTION

Phthalate esters (PAES) are the most common chemical widely used to modify the physical properties of plastics products to increase flexibility, transparency, softness, durability and longevity ^{1,2}. It also provides plasticity to otherwise rigid materials such as polyvinyl chloride and other polymers. Phthalates thus are widely used in toys, childcare items and other household products.

Chemically there is no bond between phthalates and the polymeric material, thus phthalates are expected to leach out to the surrounding. The main concern is the migration of phthalates to human

especially children. Infants have a tendency of mouthing toys and leaching of phthalates via saliva is one of the routes of administration into children ^{3,4}.

On December 14, 2005 The European regulations specifically limit three phthalates – DiEthylHexyl Phthalate (DEHP), DiButyl Phthalate (DBP), and Benzyl Butyl Phthalate (BBP) – to a level of less than 0.1 % in all toys and articles designed to be put in a child's mouth. This regulation also limits DiIsoNonyl Phthalate (DINP), DiIsoDecyl Phthalate (DIDP), and Di-n-Octyl Phthalate (DnOP) to less than 0.1 % in articles that are designed to be quenched or put in a child's mouth ⁵. The U.S. regulations are slightly different – DEHP, DBP, and BBP, have been permanently prohibited at concentration of more than 0.1% in "children's toys" or "child care articles." Three additional phthalates – DINP, DIDP, and DnOP – have been conditionally prohibited at a concentration of more than 0.1 %, in "children's toys" or "child care articles" ^{6,7}.

Corresponding author:

Nazirah Said

Postgraduate Student

Chemistry Department, Faculty of Science, Universiti Teknologi Malaysia,
81310 Skudai, Johor, Malaysia

Existing method for the detection of phthalates requires large volume of hazardous solvents, time consuming, costly and labor intensive. Hence, this study will develop a new simple and reliable test method with regards to the measurement of the content and identification of six regulated PAES in toys and children products in order to fulfill the regulations requirements for exporting Malaysian rubber toys products in the EU and USA. The developed is expected to be fully implemented by Malaysian Rubber Board (MRB) as a standard regulation for exporting toys products from rubber.

MATERIALS AND METHOD

The analysis involved analyzing five types of imported rubber toys that has been purchased from the market to measure the phthalates esters and the polymer type in the toys. The compounds of interest in this study are, Dibutyl phthalate ($C_{16}H_{22}O_4$, DBP), Diethylhexyl phthalate ($C_{24}H_{38}O_4$, DEHP), Benzyl butyl phthalate ($C_{19}H_{20}O_4$, BBP), Di-n-octyl phthalate ($C_{24}H_{38}O_4$, DnOP), Diisononyl phthalate ($C_{26}H_{42}O_4$, DINP) and Diisodecyl phthalate ($C_{28}H_{46}O_4$, DIDP) respectively. Benzyl benzoate ($C_{14}H_{20}O_2$, BB) was used as internal standard (IS). $\hat{\alpha}$ -sitosterol were used as authentic standard in TLC analysis. All standard were analytical grade or higher and was obtained from AccuStandard. The reagents used in this study are Methanol, Nitric Acid, Tetrahydrofuran (THF), n-Hexane, Acetone, Petroleum ether, Diethyl ether phosphomolybdic acid and Cyclohexane purchased from Merck, Germany. All reagents used were of GC grade or higher unless stated otherwise.

A. Determination of the Polymer Type

Samples were Soxhlet extracted using acetone for 16 hours. The extracted was subjected to Fourier Transform Infrared (FTIR) and Thermogravimetric Analyzer to determine the polymer type. The polymer absorption band and the polymer type was identified and classified.

B. Extraction of Phthalate Esters

Sample was prepared in the laboratory using method established by Consumer Product Safety Commission (CPSC) Malaysia, which used tetrahydrofuran solvents as extraction medium. Prior to analysis, each component part was cut into small pieces (no dimension larger than 2 mm), or milled/ground into a representative powder. 0.05 ± 0.005 g of the sample was dissolved

completely in THF. For sample larger than 0.05g, 10mL of THF was added for every 0.1g of sample. The sample was shook, and stirred for at least 30 minutes to allow dissolution. Any PVC polymer occurred was subjected to precipitation with 10mL of n-hexane for every 5mL of THF used. The sample was continuously shaken. This step was remained for 5 minutes in order for the polymer to settle (longer times may be necessary to minimize clogging of filters in subsequent step). A mixture of THF/n-hexane solution was filtered through a 0.45 μ m PTFE filter. 0.3 ml of the THF/hexane solution was combined with 0.2 ml of internal standard (BB, $150 \mu\text{gml}^{-1}$) in a GC vial, and was diluted to 1.5 ml with cyclohexane. The sample was subjected to Gas Chromatography-Mass Spectrometry (GC-MS).

C. GC-MS Analysis

Table 2.1 shows parameter used in GC-MS analysis of phthalates. Phthalate analysis was performed on Agilent model series 6890 with a 5975C Mass Spectrometer Detector.

Table 2.1: GC-MS Operating Procedures and Quality Control Measures

Parameter	
Column	DB-5MS; 30 m x 0.25 mm ID x 0.25 μ m
Flow Mode	1 ml/min, constant flow (He gas)
Inlet Mode	20:1 Split or Splitless
Injection Amount	1 μ l
Inlet Temperature	290° C
Solvent Delay	5 min
Initial Oven Temp, Hold Time	50° C, 1 min
Ramp 1	30° C/min, 280° C
Ramp 2	15° C/min, 310° C
Final Hold Time	4 min or longer

OBSERVATION AND RESULTS:

A. Analysis of Thermal Stability using Thermogravimetric Analyzer (TGA)

In this study a preliminary analysis was done and no $\hat{\alpha}$ -sitosterol was detected indicating the absence of natural rubber in the samples. The toys were then characterized accordingly. Materials that exhibit weight loss or gain due to decomposition, oxidation, or dehydration of PVC were investigated. Results showed that thermal degradation of PVC proceeds in two steps. First, elimination of Hydrogen Chloride (HCl) at 262°C leads to formation of polyene sequences with then

rearrange and decompose to aromatic and aliphatic hydrocarbons at 472°C⁹.

TGA results showed a second rapid loss of weight observed between 350-480°C. This was due to material decomposition of the dehydrochlorinated product of PVC. Final weight loss was observed starting from 500°C. It corresponded to carbonization of the dehydrochlorinated residue. Corresponding to the HCl loss, unsaturation formation resulting in discolouration of the polymer was observed. Hence, S-shaped curves were observed on all the samples. This is similar to report by Druedow and Gibbs which reflected the activation of weak links in the polymer⁹.

From the results, it was found that only slightly different in the percentage weight loss for each toys sample were obtained by TGA analysis. Toys samples 1, 2, 3, 4 and 5 had weight loss percentage of 87.32%, 89.87%, 91.94%, 90.53% and 87.88% respectively.

B. Identification of polymer type using FTIR

Identification of the polymer material was carried out using FTIR before the quantification of PAES was initiated. PVC spectrum confirmed the usage of synthetic rubber in the present study of toys samples.

Result from FTIR shows that similar significance peak was present for all samples. FTIR absorbance spectra of the samples obtained were similar to each other. The doublet peak corresponds exclusively to the plasticizer and served as the best indicator for phthalate groups. The bands corresponding to the carbonyl and ester group, as well as those corresponding to the aromatic and aliphatic C-H bonds can also be observed in the spectrum¹¹. Spectrum of the plasticizer shows the typical doublet of the phthalates at 1580 and 1600 cm⁻¹^{11,10}. The doublet peaks of phthalates are present at 1601.29 and 1579.66 cm⁻¹.

Further investigation showed the IR absorption spectra of PVC plasticized with phthalates exhibit a strong band at 1710-1750 cm⁻¹ range due to the ester carbonyl groups (-O-C(=O)-) of the phthalate¹². The absorption of carbonyl band occurs at 1721.66cm⁻¹. This band however had undergone significant changes. The decrease in the intensity of this band is accompanied by a simultaneous broadening, indicating the conversion of phthalate, and simultaneous formation of bands of new

groups or compounds that contain differently substituted keto- groups. The existence of the ester carbonyl peak at 1722 cm⁻¹ signalizes the attachment of phthalate fragments to the polymer and showed indication of an indirect effect involving chemical reactions of reactive species formed by the photolysis of the plasticizer with PVC¹². Instead, the methylene asymmetric stretch peaks at 2,925cm⁻¹ with a methine C-H stretch peaking at 2,958cm⁻¹. The methylene scissors deformation split at 1,435cm⁻¹ and 1426cm⁻¹. PVC is sometimes heavily plasticized with phthalates or phosphate and its infrared spectrum can be obscured until the plasticizer had been extracted.

C. Analysis of Phthalates Esters via GC-MS

Peaks for interfering ions in excess of 25% of the base peak are absent; the relative responses of the qualifier ions to the quantifying ion are within an acceptable range of 10%. The most abundant ion formed in the mass spectrometer is called the base peak. In the mass spectra of phthalates the base peak is indicated m/z value 149, for this determination this is referred to as the target ion for quantification^{13,14}.

Typical chromatograms for internal standards and 6 Phthalate esters standard solution in cyclohexane were collected. The elution order in retention time is BB, DBP, BBP, DEHP, DnOP, DINP and DIDP. It clearly shows that the analytical method proposed in this work completely separates all the analyte within 14 minutes of GC-MS analysis. The confirmation of presence was monitored by the following qualifier ions are m/z 206 (BBP), m/z 223 (DBP), m/z 279 (DEHP and DnOP), m/z 293 (DINP) and m/z 307 (DIDP)¹⁰. Internal calibration standard was prepared by spiking Benzyl benzoate (BB) with known amount concentration of 20ppm. The calibration curves for all of the phthalate esters were linear in the investigated concentration range, coefficient of correlation more than 0.9983.

From previous study, the fragmentation pattern of DEHP, two hydrogen atoms are transferred from the parent ion to the m/z 279 fragment. This ion is two mass units heavier than the cleaved fragment would be if unmodified¹⁵. Prior work has documented that the molecular ion peak for phthalate compounds is usually weak and not always present in the mass spectra, but the (M-R)⁺ and (M-OR)⁺ (R=alkyl group) fragments can be secondary form of identification¹⁶.

Table 3.3: Phthalate esters content in toy samples

Sample	Phthalate esters content %, w/w					
	DBP(%)	DnOP(%)	BBP(%)	DEHP(%)	DINP(%)	DIDP(%)
1	ND	ND	ND	0.65±0.02	ND	ND
2	0.06±0.01	ND	ND	0.76±0.02	ND	ND
3	ND	ND	ND	0.68±0.02	ND	ND
4	0.05±0.01	ND	ND	0.56±0.02	ND	ND
5	ND	ND	ND	0.09±0.02	ND	ND

The total areas of each analytes were processed from the ion abundance of the quantifying ion followed by confirmation using the qualifier ions summarized in Table 3.2. All of the analyses were repeated three times with the error of analysis of each samples calculated as shown in table 3.3. From table 3.3, the phthalates identified and their contents in the investigated products are described. Investigation of phthalates in five toys sample showed high percentage content of DEHP ranging 0.09% up to 0.76%. Only small amounts of other phthalates, DBP, with maximum of 0.05% were found in these products. Other phthalates were not detected either not present or beyond the detection limit of GC-MS used. Four (4) out of 5 toys samples failed to fulfill the regulations as prescribed by EU or US respectively.

CONCLUSION

In this study, none of the soft toys analyzed were found made from natural rubber. High concentration of DEHP was detected in all the samples, and 4 out of 5 failed to fulfill neither the EU nor US regulations limits. This method is found to be simple, and reliable for detection of phthalates esters in children's toys.

ACKNOWLEDGEMENT

The authors are thankful to Universiti Teknologi Malaysia Rubber Research Institute of Malaysia for their co-operation and hospitality throughout the study.

Conflict of Interest: None

Ethical Clearance: None needed.

REFERENCES

1. Wilkinson, C. F., and Lamb, J. C., The Potential Health Effects of Phthalate Esters in Children's Toys: A Review and risk Assessment. *Regulatory Toxicology and Pharmacology* 1999; 30;140-155.
2. Biedemann-Brem, S., Biedermann, M., Pfenninger, S., Bauer, M., Altkofer, W., Rieger, K., Hauri, U., Droz, C., and Grob, K., Plasticizers in PVC Toys and Childcare Products: What Succeeds the Phthalates? *Market Survey 2007 J. Chromatographia* 2008; 68; 227-234.
3. Biedemann-Brem, S., Biedermann, M., Pfenninger, S., Bauer, M., Altkofer, W., Rieger, K., Hauri, U., Droz, C., and Grob, K., Plasticizers in PVC Toys and Childcare Products: What Succeeds the Phthalates? *Market Survey 2007. J. Chromatographia* 2008; 68; 227-234.
4. Babich, M. A., Chen, S.B., Greene, M.A., Kiss, C.T., Porter, W.K., Smith, T.P., Wind, M.L. and Zamula, W.W., Risk Assessment of Oral Exposure to Diisononyl phthalate from Children's Products. *Regulatory Toxicology and Pharmacology*. 2004; 40;151-167.
5. Directive 2005/84/EC of The European Parliament and of the council of 14 December 2005. *Official Journal of the European Union*.
6. Assembly Bill 319, California Legislature-2005-06 Regular Session, 10 February 2005.
7. CPSC. 2002. U.S. Consumer Product Safety Commission. Memorandum to Marilyn L. Wind from S.B. Chen. Screening of Toys for PVC and Phthalates Migration.
8. Allsopp, M., Santillo, D., Kallee, U. and Hojsik, M., Our reproductive health and chemical exposure: a review of the evidence for links between declines in human reproductive health and our exposure to hazardous chemicals. *Greenpeace Research Laboratories, Greenpeace International Technical Note* 2006; 2;1-27.
9. Zulfiqar, S. and Ahmad, S., Thermal degradation of blends of PVC with polysiloxane-1. *Journal of Polymer Degradation and Stability* 1999; 65;243-247.
10. CPSC. 2002. U.S. Consumer Product Safety Commission. Memorandum to Marilyn L. Wind from S.B. Chen. Screening of Toys for PVC and Phthalates Migration.

11. Beltran, M., Garcia, J.C., and Marcilla, A., Infrared spectral changes in PVC and plasticized PVC during gelation and fusion. *J. Eur. Polym.* 1996; 33;453-462.
12. Denizligil, S. and Schnabel, W., Photooxidation of poly (vinyl chloride) at 254 nm in the absence and presence of phthalate plasticizers. *Journal of Applied Polymer Science.* 1995; 229;73-92.
13. Rastogi, S. C., Gas Chromatographic Analysis of Phthalate Esters in Plastic Toys. *J. Chromatographia.* 1998; 784;724-726.
14. A.O. Earls, I.P. Axford and J.H. Braybrook, Gas chromatography-mass spectrometry determination of the migration of phthalate plasticisers from polyvinyl chloride toys and childcare. *Journal of Chromatography A* 2002; 983;237-246.
15. Assembly Bill 319, California Legislature-2005-06 Regular Session, 10 February 2005.
16. Soudais, Y., Moga, L., Bazek, J. and Lemor, F., Coupled DTA—TGA—FT-IR investigation of pyrolytic decomposition of EVA, PVC and cellulose. *J. Anal. Appl. Pyrolysis.* 2007; 78;46-57.

Assessment of Subcarinal Angle and Factors Determining it by using CT Scan

Salahuddin Azeemuddin¹, Mehera Bhoir²

¹Medical Officer, Rural Hospital Murud, District Raigad-402401, ²Professor, Department of Anatomy, TNMC, Mumbai

ABSTRACT

The present study entitled "Assessment of subcarinal angle and factors determining it by using CT scan" was done at General Municipal Hospital, Mumbai.

The present study entitled "CT assessment of subcarinal angle and its determinants" was done at General Municipal Hospital, Mumbai.

Subcarinal angle is the angle between first few centimeters of the lines drawn along inferior margins of two main bronchi. Carcinoma of the subcarinal lymph nodes is a challenge for the radiologist and pulmonologist as the subcarinal lymph nodes are among the most difficult to detect on chest radiographs. Presence of a widened and distorted subcarinal angle enables the detection of subcarinal mass.

In the present study 64 adult individuals in the age group of 18-60 years of age of either sex (34 males and 30 females) attending the department of Radio diagnosis at General municipal Hospital, Mumbai for chest CT scan in whom CT scan images were normal as diagnosed by senior radiologist were studied. Subcarinal angle was measured and correlated with age, sex, body mass index, Presternal fat thickness, retro vertebral fat thickness, anteroposterior diameter and transverse diameter of thorax separately.

Normal range of subcarinal angle was 47 to 98 degrees (Mean \pm standard deviation = 78.54 ± 12.07 degrees)

Subcarinal angle in male (Mean \pm standard deviation = 72.69 ± 12.16 degrees, range=47-90 degrees), female (Mean \pm standard deviation = 84.96 ± 7.72 degrees, range=61-98 degrees), in obese (Mean \pm standard deviation = 84.9 ± 7.76 degrees, range=62-98 degrees) and in persons with normal body mass index (Mean \pm standard deviation = 72.63 ± 12.60 degrees, range=47-92 degrees) were obtained. It was wider in females and in obese.

Fat deposited in subcarinal space enlarges the subcarinal angle. This is supported by strong positive correlation of subcarinal angle with body mass index.

Subcarinal angle shows significant positive correlation with presternal fat thickness and retro vertebral fat thickness and has no correlation with age, anteroposterior diameter of thorax and transverse diameter of thorax.

This set of standards can be used to determine the pathology in mediastinum.

Keywords: Subcarinal Angle, 4 Slice Helical CT Scan, Carcinoma Of Subcarinal Lymph Nodes

INTRODUCTION

Subcarinal angle is the angle between first few centimeters of the lines drawn along inferior margins of two main bronchi⁸.

Widening and distortion of the carina is a serious sign because it usually indicates carcinoma of the lymph nodes⁶.

Widening of the subcarinal angle may be observed in left atrial enlargement¹¹, subcarinal masses including lymphadenopathy⁷, tumor and bronchogenic cyst, lobar collapse, lobectomy, Pericarditis, pericardial effusion², generalized cardiomegaly, mediastinitis, achalasia cardia, etc

There are various controversies regarding the determinants of subcarinal angle. Many different normal values exist for subcarinal angle in the literature and several factors account for the discrepancies found in the various studies. Normal subcarinal angle is subject to considerable variation due to factors⁸ like age, gender, body habitus, and dimensions of thoracic cavity, position of carina, left atrial size and with different phases of respiration².

Most published measurements have been obtained from cadavers or specimens of dissected tracheas. Carina is a dynamic structure as it moves with extension of head⁴. So subcarinal angle derived from nonliving specimens are of little value when applied to a patient in a clinical practice.

Some previous studies assessed the subcarinal angle on radiographs using goniometer which gives two dimensional data only which may give a misleading impression. Rotation of angle in sagittal plane results in appearance of widening on frontal radiographs which may be produced by superior or inferior angulations of X-ray beam⁹.

Computed tomography is a cross-sectional imaging modality enables the acquisition of volumetric images of the chest which can be reconstructed on a work station. By using appropriate window we can bring one plane of interest into focus to display the position of major bronchi relative to the rest of the mediastinal shadow and the airways are better seen than in the PA radiograph.

As 4 slice helical CT scan gives a volumetric data set and more accurate measurement, our study has used it to assess the correlation of subcarinal angle with age, sex, body mass index, presternal and retro

vertebral fat thickness and anteroposterior and transverse diameter of thorax.

By doing this study with the above mentioned parameters the expected value of subcarinal angle can be predicted for a given patient and a useful set of standards established that can be applied in clinical practice.

AIMS AND OBJECTIVES

- To find out the normal range of subcarinal angle.
- To study the gender variation in subcarinal angle.
- To estimate the correlation of subcarinal angle with age, body mass index, anteroposterior diameter of thoracic cavity, transverse diameter of thoracic cavity, presternal fat thickness and retro vertebral fat thickness.
- To provide a useful set of standards in Indian population.

MATERIALS AND METHOD

- "Assessment of subcarinal angle and factors determining it by using CT scan" was a prospective study of 12 months duration in which CT images of 64 adult individuals in the age group of 18-60 years of age of either sex (34 males and 30 females) attending the department of Radio diagnosis at a General municipal

Hospital Mumbai for chest CT scan and in whom CT scan were normal as diagnosed by senior radiologist were studied..

- The permission of the Head of Department of Radio diagnosis was taken
- Sample size was taken as per advice of Biostatistician.

Inclusion Criteria

- Cases of either sex with in age group of 18-60 years of age.

Exclusion Criteria

1. Cases below 18 and above 60 years of age.
2. Patients with history of prior cardio thoracic surgery.
3. Patients in whom CT scan shows

- Moderate to severe pulmonary fibrosis
- Moderate to severe pulmonary emphysema
- Atelectasis
- An intrathoracic mass or lymphadenopathy
- Pericardial or pleural effusion
- Left atrial enlargement and
- Patients who fail to hold breath during examination

MATERIALS

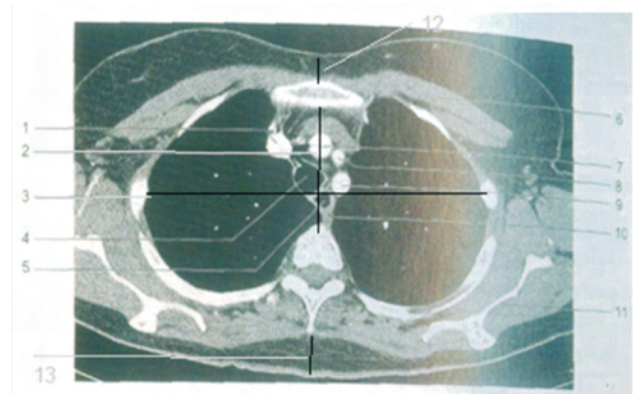
- Siemens Somatom Volume Zoom Multi Slice (4 Slice) Multi Detector Spiral Ct Scanner
- Weighing machine
- Sliding wall scale for height measurements.

METHOD

- Height and Weight of the patients were carefully measured and body mass index was calculated using the formula, $BMI = \text{Weight in Kg} / (\text{Height in m})^2$

Analysis of image

- As chest CT scan was being performed, all the images were transferred to a dedicated workstation.
1. Subcarinal angle was measured electronically on 5 millimeters thick reformatted coronal images using wider window setting. Subcarinal angle is the angle between first few centimeters of the lines drawn along inferior margins of two main bronchi
 2. Transverse diameter of thoracic cavity was measured at the level of the carina as the greatest distance between the inner sides of the two ribs.
 3. Anteroposterior diameter of thoracic cavity was measured at the level of carina as the distance between posterior surface of sternum and the anterior surface of vertebra.
 4. Presternal fat thickness from skin to sternum was measured.
 5. Retro vertebral fat thickness from tip of the spinous process to the skin was measured.



1. Brachiocephalic vein. 2. Anteroposterior diameter. 3. Transverse diameter. 4 carina. 5. Oesophagus. 6. Pectoralis major. 7. Right brachiocephalic artery. 8. Left common carotid artery. 9. Left subclavian artery. 10. Posterior junction. 11. Scapula. 12. Presternal fat thickness. 13. Retrovertebral fat thickness.

OBSERVATIONS AND RESULTS

Normal range of subcarinal angle

Normal range of subcarinal angle was 47 to 98 degrees, mean: 78.54 degrees and Standard deviation was 12.073.

Table 1: Normal range of subcarinal angle

Group (n=64)	Minimum	Maximum	Mean	S.D.
Subcarinal angle	47	98	78.54	12.07

Correlation of subcarinal angle with gender

There were 34 Male patients and 30 Female patients in the study group.

Subcarinal angle in male was mean \pm standard deviation = 72.69 ± 12.16 degrees (range=47-90 degrees) and in female was mean \pm standard deviation = 84.96 ± 7.72 degrees (range=61-98 degrees).

Table 2: Subcarinal angle in male and female

Sex	Sample size	Subcarinal angle (degrees)		
		Mean	S.D.	Range
Female	30	84.96	7.72	61 to 98
Male	34	72.69	12.16	47 to 90

Subcarinal angle was larger in females and it was statistically significant ($P < 0.001$).

Correlation of subcarinal angle with age

Youngest patient of study group was 18 years and the oldest patient was of 60 years. The mean age of the group was 42 years with a standard deviation of 13.86. There was no correlation between subcarinal angle and age.

Correlation of subcarinal angle with body mass index

The body mass index (BMI) of each patient was calculated by dividing the body weight (in kg) by the square of body height (in meter) and patient with body mass index greater than 25 kg/m² were classified as obese.

In the present study there were 32 cases having normal body mass index and 32 cases that were obese (16 females and 16 males). The range of subcarinal angle in obese was 62 to 98 degrees ((Mean ± standard deviation = 84.9 ± 7.66 degrees) and in normal body mass index it was 47 to 92 degrees (Mean ± standard deviation = 72.63 ± 12.60 degrees).

Table 3: Subcarinal angle Vs body mass index

Body mass index	Subcarinal angle (degrees)		
	Mean	Range	S.D.
Normal n=32	72.63	47 to 92	12.60
Obese n=32	84.9	62 to 98	7.66

There was positive correlation between subcarinal angle and body mass index and it was statistically significant (r=0.651, p-value = 0.0001).

Correlation of subcarinal angle with presternal fat thickness

There was positive correlation between subcarinal angle and presternal fat thickness and it was statistically significant (r=0.542, p<0.001).

Correlation of subcarinal angle with retro vertebral fat thickness

There was a positive correlation between subcarinal angle and retro vertebral fat thickness and it was statistically significant (r=0.3, p=0.016).

Correlation of subcarinal angle with anteroposterior and transverse diameter of thorax

There was no correlation of subcarinal angle with anteroposterior and transverse diameter of thorax.

DISCUSSION

Table 4: Normal range of subcarinal angle (degrees)

Sr. No.	Study done by	S sample S size	Age group	Range	Mean	S.D.
1.	Alavi et al ¹	87	3wks-83yrs	45 – 70	57.16	6.06
2.	Haskin et al ⁵	100	21 -80 yrs	35 - 90.5	60.8	11.8
3.	Murray et al ⁷	122	27-85 yrs	36-114	62.4	14.8
4.	Kirollos Salah Kamel et al	70	22-101 yrs	36-121	78	20
5.	N Karabulat ⁸	120	17-85 yrs	34 – 105	73	16
6.	Saowanit Choorat et al ¹⁰	163	21-63 yrs	31-95	62	12.62
7.	Present study	64	18 -60 yrs	47 – 98	78.54	12..07

In the present study mean value of subcarinal angle was about 78.54 degrees with a standard deviation of 12.073 and the range was 47 to 98 degrees.

From the table it is observed that the present study also shows a wide range of subcarinal angle as that of previous studies.

Correlation of subcarinal angle with gender

Murray et al⁷ 1995 [pub] reported larger subcarinal angle in females but did not assess its statistical significance.

Coppola V et al³ 1998 [pub] and PH Haskin et al⁵ found that the mean value of subcarinal angle was independent of patient’s gender.

N Karabulat⁸ 2003 studied subcarinal angle in 120 normal persons and found that female gender was

associated with greater subcarinal angle (p= 0.007 and r= 0.25).

Saowanit Choorat et al¹⁰ 2007 [pub] studied the chest radiographs of 163 healthy patient (75 men and 88 women: age range 21-63 years: mean age 44 years) in the adult Thai population and found that the mean subcarinal angle for males and females was 60.42 degrees and 63.46 degrees respectively. There was no relationship of the subcarinal angle to gender (r = 0.12).

Kirollos Salah Kamel et al 2009 [pub] studied 60 high-resolution chest CT scans (aged 22-88 years, 40 males, 20 females) and 10 cadaver tracheas (aged 68-101 years, 7 males, 3 females) and found that there was no correlation of subcarinal angle with gender.

In the present study the subcarinal angle in male was 72.69 ± 12.16 degrees (range=47-90 degrees) and

in female it was 84.96 ± 7.72 degrees (range=61-98 degrees). Subcarinal angle was larger in females and statistically significant ($p < 0.001$).

Present study results support the findings of N Karabulat⁸.

Correlation of subcarinal angle with age

There was no relationship of the subcarinal angle to age in the study done by PH Haskin et al⁵ 1982 [pub], Coppola V et al³ 1998 [pub], N Karabulat⁸ 2003, Saowanit Choorat et al¹⁰ 2007 [pub] and Kirollos Salah Kamel et al 2009.

In the present study youngest patient of study sample was 18 years and the oldest patient was of 60 years. The mean age of the sample was 42 years with a standard deviation of 13.87. There was no statistically significant correlation between subcarinal angle and age as in other studies ($r = 0.11$ and $p = 0.384$).

Correlation of subcarinal angle with body mass index

In the present study the range of subcarinal angle in obese was 62 to 98 degrees (mean =84.9 degrees, standard deviation = 7.66) and in normal it was 47 to 92 degrees (mean=72.63, standard deviation=12.60). It was larger in obese.

N Karabulat⁸ 2003 demonstrated that body mass index was weakly correlated with subcarinal angle($r=0.28$, $p=0.002$).

In the present study there was a positive correlation between subcarinal angle and body mass index ($r=0.652$, $p<0.001$) and it was statistically significant.

Correlation of subcarinal angle with presternal fat thickness

N Karabulat⁸ 2003 reported statistically significant positive correlation of subcarinal angle with presternal fat thickness ($r=0.40$, $p=0.001$).

In the present study there was positive correlation between subcarinal angle and presternal fat thickness and it was statistically significant ($r=0.542$, $p<0.001$).

Correlation of subcarinal angle with retro vertebral fat thickness

N Karabulat⁸ 2003 reported statistically significant positive correlation of subcarinal angle with retro vertebral fat thickness ($r=0.31$, $p=0.001$).

In the present study there was positive correlation between subcarinal angle and retro vertebral fat thickness and it was statistically significant ($r=0.3$, $p=0.016$).

Presternal fat thickness and retro vertebral fat thickness are the manifestations of increased body weight. Body mass index was positively correlated with Presternal fat thickness ($r=0.541$, $p<0.001$) and retro vertebral fat thickness ($r=0.3$, $p<0.016$). Therefore increase in body fat is associated with accumulation of fat in presternal, retro vertebral and subcarinal spaces that enlarges these spaces.

Correlation of subcarinal angle with anteroposterior and transverse diameter of thorax

N Karabulat⁸ 2003 reported statistically significant weak negative correlation of subcarinal angle with transverse diameter of thorax and no correlation with anteroposterior diameter.

In the present study there was no correlation between subcarinal angle and anteroposterior and transverse diameter of thorax.

CONCLUSION

Normal range of subcarinal angle is 47 to 98 degrees (Mean \pm standard deviation = 78.54 ± 12.07 degrees)

Subcarinal angle in male is Mean \pm standard deviation = 72.69 ± 12.16 degrees (range=47-90 degrees) and in female is Mean \pm standard deviation = 84.96 ± 7.72 degrees (range=61-98 degrees).

It is wider in females.

The range of subcarinal angle in obese is 62 to 98 degrees (mean =84.9 degrees, standard deviation = 7.76) and in persons with normal body mass index is 47 to 92 degrees (mean=72.63 degrees, standard deviation=12.60).

Fat deposited in subcarinal space enlarges the subcarinal angle. This is supported by strong positive correlation of subcarinal angle with body mass index.

Subcarinal angle shows significant positive correlation with presternal fat thickness and retro vertebral fat thickness and no correlation with age and anteroposterior and transverse diameter of thorax.

This set of standards can be used in clinical practice to determine the pathology in mediastinum.

REFERENCES

1. Alavi et al. The angle of tracheal bifurcation: Its normal measurement. *Am J Roentgenol* 1970; 108:546-9.
2. Chen JT et al. widening of the subcarinal angle by pericardial effusion. *Am J Roentgenol* 1982; 139:883-87.
3. Coppola V et al. Normal value of the tracheal bifurcation angle and correlation with left atrial volume; *Radiol med* 1998 May; 95(5):461-5.
4. Harris RS. Tracheal extension in respiration. *Thorax* 1954, 14:201-10.
5. Haskin PH, Goodman LR. Normal tracheal bifurcation angle: a reassessment. *Am J Roentgenol* 1982; 139:879-82.
6. Muller NL et al. Subcarinal lymph node enlargement: radiographic findings and CT correlation *American Journal of Roentgenology*, Vol 145, Issue 1, 15-19
7. Murray et al. widening of the tracheal bifurcation on chest radiographs: value as a sign of left atrial enlargement. *Am J Roentgenol* 1995; 164:1089-92.
8. N Karabulat. CT assessment of tracheal carinal angle and its determinants, *Br. J. Radiol.*, September 1, 2005; 78(933): 787 – 790
9. Rosenthal et al. pseudo widening of carinal angle; *American Journal of Roentgenology* 1997; Vol 128;866-868,1997
10. Saowanit Choorat et al. Assessment of Normal Subcarinal Angle on Chest Radiographs in Adult Thai Population, *Siriraj Med J* 2008; 60:264-266
11. Taskin V et al. Tracheal carinal angle and left atrial size. *Arch Intern Med* 1991; 151:307-8.
12. Turner RS. A note on the geometry of the tracheal bifurcation. *Anat Rec* 1962; 143:189-93.

Cross Sectional Study of Road Traffic Accidents with Forensic Autopsy View at Davangere Karnataka

Satish Babu B S¹, Raju G M², Vijayanath V³

¹Assistant Professor, Department of Forensic Medicine & Toxicology, J.J.M. Medical College, P.J. Extension, Davangere, ²Associate Professor, Department of Forensic Medicine & Toxicology, S.S.I.M.S & R.C, NH-4 Bypass Road, Davangere, ³Associate Professor, Department of Forensic Medicine & Toxicology, Vinayaka mission, Salem, Tamil Nadu

ABSTRACT

Road Traffic Accident (RTA) is any vehicular accident occurring on the roadway this includes collision of an automobile with a pedestrian, another automobile or with a non-automobile on the roadway/ fall from a moving vehicle causing injuries or death of involved individuals.

The objective is to describe injuries of road traffic deaths in Davangere, Karnataka, India. A cross-sectional study includes road traffic accidents death during the period of 2009-2010. Those Patients who died in the J.J.M. Medical College, and subsequently postmortem examination conducted. Hundred cases of RTA deaths were included in the study. Deaths due to Road Traffic Accidents (RTA) are increasing at an alarming rate throughout the world. Thereby it poses itself as a major epidemiological and medico legal problem. Victims in RTAs sustain large varieties of injuries, which are fatal or dangerous to life. The study of injuries associated with fatal outcome that helps in implementation of measures to prevent fatalities due to RTAs.

Keywords: Fatal RTA, Types of Injury, Skull fracture, Cause of Death

INTRODUCTION

An increased incidence of RTA has direct repercussion on increased fatalities observed in RTA. Road traffic injuries are one of the leading causes of death in the world ¹. World wide the number of people killed in road traffic accidents each year is estimated at almost 1.2 million, while the number of injured could be as high as 50 million.² In India over 80,000 Victims die in traffic accidents annually, over 1.2 million are injured seriously and about 30,000 disabled permanently³. Road Traffic Accident (i.e. originating on, terminating on, or involving a vehicle partially on the roadway)⁴

Objectives: To know

1. The pattern of injuries in victims.
2. The age and sex wise distribution of fatal RTAs.
3. Pattern of Cause of Death.

METHODOLOGY

The present study was a cross-sectional study. The study material comprised of victims of RTA who succumbed and subsequently autopsied at the J.J.M. Medical College, Davangere, Karnataka, during the 1-year period from 31st January 2009 to 30th January 2010. The sample size was estimated to be 100 cases.

In the present study information regarding the bio-data of the deceased and various characters regarding the circumstances of the accident and time of accident were gathered from all possible sources like police records, hospital records and by direct interrogation with investigating officer, eyewitnesses and Psychological autopsy of the deceased accompanying dead bodies. In addition to these X-ray, report of each case was reviewed and the radiograph was examined for the presence of fracture before commencing the autopsy. In each case, a thorough external and internal examination was done for the injuries and opinion as to the cause of death was made

after the examination. The data thus obtained was recorded in the predesigned and pretested Proforma, which comprised relevant data that is concerned with the objectives of the study and analyzed. Controversial road traffic accidents cases were excluded from the study. Photographs of each case were taken during postmortem examination, by prior obtained consent from the legally authorized & autopsy surgeon. Age of the deceased was calculated as to the nearest completed years. The age groups of victims were categorized in an interval of 10 years.

RESULTS

Table I: Age wise distribution of cases.

Sl. No.	Age group (years)	Male	Female	Total No.	%
1	21-30	63	4	67	67
2	31-40	32	1	33	33
	Total	95	5	100	100

Males outnumbered females in ratio of 9: 1. More than half (67 percent) of the cases were in the age group of 21-30 years in males.

Table II: Sex wise distribution of cases.

Sex	No. of cases	%age
Male	95	95
Female	5	5
Total	100	100

Above table shows, that in fatal road traffic accidents males comprised a majority and constituted 95% compared to females who were only 5%. The male to female ratio in the study was 9:1.

DISCUSSION

RTA related deaths accounted for 67% of total medico legal autopsies conducted during the study period. Males outnumbered females in the ratio 9:1. Age group most commonly involved was 21 – 40 years. Injuries of head were present in maximum number of victims (90%). More than half of victims (50%) died between 24 hours and 1 week of sustaining injuries. Intra Cranial injuries alone were responsible for death in 99%.

In present study, brain haemorrhages are classified as extradural haemorrhage, subdural haemorrhage, subarachnoid haemorrhage, intracerebral/cerebellar haemorrhage and brain stem haemorrhage. Subarachnoid haemorrhage was most commonly seen (59%), followed by subdural haemorrhage (26%).

Extradural haemorrhage was seen in only 10%. Extradural haemorrhage and intra cerebral/cerebellar haemorrhage (each in 4%). Least seen was brain stem haemorrhage (1%). Subarachnoid haemorrhage was associated with subdural haemorrhage in 75 %. Subarachnoid haemorrhage was associated with extradural haemorrhage in 10%. Subarachnoid haemorrhage was associated with intra cerebral haemorrhage in four cases.

All the 10 % of extradural haemorrhage had fracture of the skull. Among the 26 % of subdural haemorrhage, 15% had fracture of skull. Among the 59% of subarachnoid haemorrhage, 42 % had fracture of the skull. Among the 4% intra cerebral/cerebellar haemorrhage, 2% had fracture of the skull. In the 1% of brain stem haemorrhage, there was fracture of skull. Significant association was seen between subarachnoid and subdural haemorrhage in present study.

RTAs are as common as nice roads. They must have started taking place since the vehicle started playing on roads. The first death due to a motor vehicle was registered in 1896 in the United Kingdom⁵. This is due to the tremendous increase in the number of vehicles, high-speed technology along with other contributing factors like, intoxicating influence of alcohol or drugs, inexperienced drivers without proper driving license, ignorance or intentional violation of traffic rules etc. Victims in RTAs sustain large varieties of injuries, external as well as internal. External injuries may be abrasions, lacerations, contusions etc. Internal injuries may be fractures, rupture of viscera, destruction of major arteries etc. Fatality in RTAs can be due to immediate causes like haemorrhage, injury to vital organs, vagal inhibition, neurogenic shock, embolism etc. and late causes like infection, complications of injuries, mismatched blood transfusion etc⁶.

In 2002, global rate of death from Road Traffic Injuries was 19.2 per 10,000 population⁷. In India, more than 3 lakhs accidents and more than 90,000 deaths were reported during 2004⁸. According to an expert study group appointed by Government of India⁹ "RTAs have come to be considered as the third deadly killer, next to heart disease and cancer." Every year the World Health Organisation (WHO) hosts an event, usually on 7th April, to celebrate the anniversary of its founding in 1946. Each year the event focuses on one health issue. In response to a growing concern about RTAs the WHO Director-General, Dr. Lee Jong Wook has for the first time in the history of WHO devoted 7th April 2004 specifically to road safety and the slogan

was "Road Safety Is No Accident". Early detection of the injury and prompt treatment are necessary in saving the lives of many of these victims¹⁰. A careful and detail study of injuries is one of the important contributors in the reconstruction of RTAs, especially in hit and run cases, which will in turn help the investigating authority in identification and prosecution of those responsible for the accident. In addition, the study of injuries associated with fatal outcome helps in implementation of measures to prevent fatalities due to RTAs.

There is a step rise in the vehicular accidents in the present era due to urbanization and tremendous growth in road transport sector. Population explosion is a catalysing factor for increased number of accidents. Accidents just do not happen but it occurs. The causes may vary from case to case. Since accidents are multi-factorial, hence, call for an inter-sectoral approach to both prevention of accidents and taking care of the injured person. Since accidents are multi-factorial, epidemiological techniques are especially useful for their study and control.

The most common age group involved in fatal road traffic accidents was 21-30 years. Two-third of all the cases was in the age group of 31-40 years in both sexes. The maximum number of victims was young adults as they are more ambulatory hence exposed to greater risk as compared to persons belonging to other age groups^{11,12,13}. Present study and its results are in concurrence with the studies conducted by various studies, males outnumbered females in the ratio of 9:1. Male victim deaths in accidents were 95% as compared to 5% deaths of female victims. Singh H et al¹⁴ showed that male female ratio was 9:1, Chaudhary et al¹⁵ showed that male female ratio was 4.9: 1 Menon A et al¹⁶ also showed marked male preponderance in road accidents. Arvind K et al¹⁷ showed that male female ratio was 7.49: 1. The reason of male predominance could probably be due to the tendency of males not following the traffic rules and regulations. Moreover, females in our region have minimal outdoor activities as compared to males.

CONCLUSION

Road traffic accident is a complex phenomenon. Constant rise in the number of motor vehicles, rampant encroachment of roads, easy to avail the vehicle because of loan facility, nasty tendency of violating traffic rules and anarchic traffic systems have greatly contributed to rapid increase in RTAs. The rise of road

traffic accidents has become a major public health problem. RTAs cost a lot not only to the individuals affected and their families but also to the nation. The injuries, disability and fatality resulting from unexpected RTAs put a significant drain on the economy of the nation. In case of accident, severity and fatalities due to lapse of time can be prevented by establishing traffic aid post at suitable distances on the highways and establishment of mobile trauma clinics by the government as well as by NGO. This also helps to assist injured and transport of injured to the hospital for further management. Hence, an organized teamwork by personals of many disciplines like education, engineering, medical, law enforcement agencies are required for effective prevention of RTAs and in turn prevention or minimization of fatality by road traffic accidents.

REFERENCES

1. Peden M, McGee K, Krug E (eds). Injury: A leading cause of the global burden of disease, 2000. Geneva Switzerland: WHO; 2002.
2. World Health Organization. World Report on Road Traffic injury prevention 2009.
3. Ganveer GB, Tiwari RR. Injury pattern among non-fatal Road traffic accident cases: A cross-sectional study in central India. *Ind J Med Sci* 2005; 59:9-12.
4. WHO. ICD-10 'International Statistical Classification of Diseases and Related Problem'. 10th revision. Volume 1. Geneva: World Health Organization; 891-94.
5. Patel NS. Traffic fatalities in Lusaka, Zambia. *Med Sci Law* 1979; 19(1):61-65.
6. Nandy A. Principles of forensic medicine. 2nd ed. Calcutta: New Central Book.
7. Kiran ER, Saralaya KM. Road safety at cross-roads. *Journal of Indian Academy of Forensic Medicine* 2004; 26(4): 147-152.
8. India tops in road accident deaths. *Deccan Herald*. 2005; 1. 15.
9. District Statistician. A view on statistics of Belgaum district 2003-04. Belgaum: Zilla Panchayat; 2005.
10. Meera Th, Nabachandra H. A Study of Pattern and Injury Severity Score in Blunt Thoraco-abdominal Trauma cases in Manipal. *Medico-Legal Update* 2005-06: 5(2).
11. Srivastava AK, Gupta RK. A study of fatal road accidents in Kanpur. *JIAFM* 1989; 11(1): 24-8.

12. Tirpude BH, Naik RS, Anjankar AJ, Khajuria BK. A study of pattern of cranio-cerebral injuries in road traffic accidents. *JIAFM* 1998; 20(1):9-12.
13. Hingston R and Winter M. Epidemiology and consequences of drinking and driving. *Alcohol Res Health*. 2003; 27(1): 63-78.
14. Singh H, Dhatarwal SK, Pattern and Distribution of injuries in fatal road traffic accidents in Rohtak (Haryana) *JIAFM* 2004; 26(1): 20-23.
15. Choudhary BL, Singh Deepak, Tirpude BH, Sharma RK, Meel Veena, profile of road traffic accidents cases in kesturba Hospital of MGIMS, Sevagram, Wardha, Maharashtra, *Ind medica medico legal update* 2005; 5(4): 1-12.
16. Menon A, Pai VK and Rajeev A' Pattern of fatal head injuries due to vehicular accidents in Mangalore. *J Forensic Leg Med*. 2008; 15(2): 75-7.
17. 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 journal of neurotrauma* 2008; 5(2): 63,-67

Derivation of Multiplication Factor for Stature Estimation from Tibia in Living

Dhurve Alka S¹, Dhurve Sharad A²

¹Assistant Professor, Department of Anatomy, Indira Gandhi Government Medical College, Nagpur, Maharashtra,

²Associate Professor, Department of Medicine, LN Medical College, Bhopal

ABSTRACT

Determination of stature from different body part still retains an utmost importance in the identification of criminal and victim. The objective of the study was to derive multiplication factor for stature estimation from tibia in living. The material consisted of 440 individual in which male and female constituted the equal number between the age group of 18 to 24 years. This group comprises the admixture of students admitted from all over the country.

Measurements were taken at a fixed time to avoid diurnal variations. The height was recorded with the help of an Anthropometer and length of both sided tibia was recorded with spreading caliper. The observed data was subjected to statistical analysis. The Multiplication Factor found to be the second most commonly used method for estimation of stature next to the regression formulae. The accuracy of Multiplication Factor was estimated and compared result with actually measured stature and the stature calculated by using regression formula. Positive correlation obtained in the present study.

Keywords: Stature Estimation, Percutaneous Tibial Length, Multiplication Factor

INTRODUCTION

Stature or body height is one of the most important and useful anthropometric parameter, which determines the physical identity of an individual. Therefore determination of stature from different body parts and skeleton still retain an utmost importance in the identification of criminal and victim. The tibial length measurement gives better estimation of stature than any other long bone because it is technically easier and tibial length itself is a part of stature. Similarly percutaneous measurement of tibia in the living gives better degree of accuracy (D.Allbrook, 1961)^[1]. Many authors derived regression equation for stature estimation. After regression formulae 2nd most common method in practice for reconstruction of stature is 'MULTIPLICATION FACTOR'. In India it was the Pan in 1924^[2], which introduced the multiplication factor by way of measuring the length of various bone and thereby established the multiplication factor followed by calculation of stature of the body as follows.

Average stature

$$\text{M.F.} = \frac{\text{Average stature}}{\text{Average length of bone}}$$

Average length of bone

$$\text{Body Stature} = \text{M.F.} \times \text{Length of bone}$$

Trotter and Glesser (1952)^[3] concluded that increase in stature after 18yrs is insignificant even though the mean value indicate a maximum attained at age 24 years, there is no statistical significant change after age 18years. So the present study is done on person belonging to 18-25yrs age group.

MATERIAL AND METHOD

The project "Derivation of Multiplication Factor for Stature Estimation from Tibia in Living" was carried out in Government Medical College, Nagpur, Maharashtra. The subjects taken for study were medical students of Govt. Medical College and Indira Gandhi Govt. Medical College, Nagpur. In them 220 students were male and 220 were female. This age

group comprises the admixture of the students admitted from all over country i.e. 15% on all India basis and remaining 30% on state basis and 55% on Zonal level basis. The age group of 18- 24yrs was selected and their height and length of right and left tibia were recorded. Measurement was taken for stature from crown to heel in standing erect posture with an Anthropometer and length of tibia was measured with the help of spreading caliper from medial most superficial point on upper border of medial condyle to tip of medial malleolus. For measuring the tibial length subject was asked to stand and keep his/her foot on a wooden stool to maintain the angle between flexor surface of leg and that of thigh at 90° and great toe was touching the vertical plate. After collection of data, the measurements were subjected to statistical analysis which has given some important analysis.

OBSERVATION

The statistical data was tabulated to show the different parameters at a glance.

Table No. 1. Showing the average living height in male and female

No. of sample	Male (220)	Female(220)
Range in cms.	Max=182.5 Min=155.2	Max-165 Min - 142.5
Mean	168.52	153.24
S.D.	5.46	4.61
C.V.	0.0324	0.0300
S.E.M.	0.3681	0.3108

In male height varied from 155.2cm to 182.5cm. the average height being 168.2cm and the coefficient of variation-0.0324. In female the height varied from 142.5cm-165.0cm with an average 153.24cm and the coefficient of variation was 0.0300. Small values of coefficient of variation indicate that sample observation can be considered as homogenous.

Table No. 2 Showing the Range, Mean, S.D. C.V. and SEM of length of tibia in male and female

Tibia	Right		Left	
	Male	Female	Male	Female
No. of sample	220	220	220	220
Range in cms.	26.1 to 43.5	24.5 to 37.9	26.6 to 43.8	24.5 to 38.9
Mean	34.92	30.71	35.32	30.67
S.D.	2.54	2.27	2.49	2.27
C.V.	0.0727	0.071	0.0704	0.074
S.E.M.	0.1211	0.1082	0.1187	0.1082

Table No.3. Showing the multiplication factor in both sexes for tibial length

Sex	Right		Left	
	Right	Left	Right	Left
No. of sample	220	220	220	220
M.F.	4.84	4.78	5.02	5.02
Mean		4.81	5.02	

The multiplication factor in males for right side tibia was 4.84 and for left tibia was 4.78. In female it was 5.02 for both right and left tibia. It was observed that in female multiplication factor for both side was same and further observed that the multiplication factor was near about same in both sexes for right and left tibia.

DISCUSSION

Being the second most common method in practice, the stature so estimated from percutaneous tibial length with the help of formulated multiplication factor compared with earlier calculated average living stature and stature estimated by regression formula. Pan in 1924 [2] carried out the study separately in male and female and also both together. During this he observed the different data for both sexes. In case of the tibia the average length for male found to be 14.2 inches and that of the female was 13.2 inches (Length varies from 12 inches to 16 inches with an average length is 13.8 inches for combined). But there was no statistically significant difference in proportion to body length in separate study. Hrdlicka in 1931 [4], estimated the stature from long bones in American White and Negroes. He had also calculated multiplication factor and percentage proportions. While doing so he observed that his finding was found to be exactly same like that of the INDIAN, which was worked out by Pan in 1924 [2]. B.S. Nat (1930) [5] calculated the multiplication factor for each long bone. At the same time he noticed some differences between the length of bones of right and left sides and stated that, "The length of the given bones is to be multiplied by its multiplication factor to estimate the stature". Siddiqui and Shah in 1944 [6] measured the length of the long bones of Punjabis to test the accuracy of the multiplication factor. They concluded that the stature can be estimated with the help of multiplication factor and showed the average error about 1 1/2" or 2 % for tibia. The findings of Siddiqui and Shah of 1944 [6] also once confirmed by Singh B. and Sohal H.S. in 1952 [7]. The work of Lal C.S. and Lala J.K. (1972) [8] was in relation with age group. They calculated Multiplication Factor of tibia and ulna and analyzed

that- 1) The Multiplication Factor varies inversely with age. 2) The Multiplication Factor remains more or less constant in the age group of 18 to 21 years. Similarly, they compared their data with that of previous workers (B.S. Nat, 1931^[5]; Siddiqui and Shah, 1944^[6]; Singh and Sohal, 1952^[7]) and showed that there was no difference in multiplication factor. The findings and views expressed by Lal C.S. and Lala J.K. (1972)^[8] partially confirmed in this study. (i) The multiplication factor varies inversely with age could not confirm as age group selected in this study was 18 to 24 years. (ii) The multiplication factor remains more or less constant in this age group of 18 to 21 years. In our study also we found multiplication factor more or less same in the 18 to 24 years age group.

RESULT

The average multiplication factor calculated in this study as per the method proposed by Pan in 1924^[2]. The value comes out to be 4.81 for male and 5.02 for female. It was observed that in female multiplication factor for both side was same and further observed that the multiplication factor was near about same in both sexes for right and left tibia. The average stature estimated from percutaneous tibial length with the help of derived multiplication factor was 169.40 cms. for male and 154.06 cms. for female. These values compared with the earlier values as follows:

Sex	Average stature estimated by M.F.	Average stature estimated by R.F.	Measured average living stature
Male	169.40 cms.	168.28 cms.	168.52 cms.
Female	154.06 cms.	153.84 cms.	153.24 cms.

(i) The average error found to be 0.88cm in female when average stature estimated by multiplication factor compared with estimated living stature. Whereas (ii) when the same is compared with the average stature estimated by regression formula the average error is 1.12 cm. in male and 0.2cm in female. Overall the average error is just around 1cm; hence multiplication factor can be use as a second line formula for estimation of stature.

ACKNOWLEDGEMENT

Medicolegal Update Journal invites article, case report, newspaper clippings, report to update the

knowledge of reader. The authors are thankful to Professor D.S. Pimpalkar, Government Medical College, Nagpur and Associate Professor J.V. Deshpande, Government Medical College, Nagpur for their guidance to carry out this work.

Conflict and Sources of funding

The study was carried out during my post graduation degree course under the guidance of senior teachers. We took extra efforts to complete this study with the help of given authors references.

Study was approved by the Anatomist in the department of Anatomy and Ethical Committee of Govt. Medical College, Nagpur.

REFERENCES

- Allbrook David (1961): Estimation of stature in British and East African Males. Based on tibial and ulnar bone length. *J. Forensic Med.* Vol. 8(1): 15 -28.
- Pan N. (1924): Length of long bones and their proportions to body height in Hindus. *Journal of Anatomy*, 58: 347 – 378.
- Trotter Mildred and Glesser G. C. (1952): Estimation of stature from long of Bones of American White and Negroes *Am. J. Phys. Anthropol.*, vol.10: 436 -514.
- Hrdlicka (1931): The principle dimensions, absolute and relative of the humerus in the white race. *Am. J. Phys. Anthropol.*, 16: 431 – 450
- Nat Captain B.S. (1930): Estimation of stature from long bones in Indians of the united Provinces; A medicolegal enquiry in Anthropometry. *Indian J. Medd. Res.* 18; 1245 – 1253.
- Siddiqui M.A.H. and Shah M.A. (19 44): Estimation of stature from long bones of Punjabis. *Indian J. Med. Res.*, 32(1): 105 – 108.
- Singh B. and Sohal H. S. (1952): Estimation of stature from the length of Clavicle in Punjabis. A preliminary report. *Indian J. Med. Res.*, 40; 67-71.
- Lal C. S. and Lala J. K. (1972) : Estimation of height from tibial and ulnar lengths in North Bihar. *J. Indian Med. Asso.*, vol. 58 (4) : (120-121.

Estimation of Stature from Upper Fragment of Tibia in Living

Dhurve Alka S¹, Dhurve Sharad A²

¹Department of Anatomy, Indira Gandhi Government Medical College, Nagpur, Maharashtra, ²Assistant Professor, Department of Medicine, NKPSIMSR, Nagpur, Maharashtra

ABSTRACT

Among the various factors used to establish individuality of an unidentified dead body or any mutilated part of such dead body the 'Height' is one of them as human has an erect posture. The objective of the study was to find out correlation and to derive regression formula between length of right and left upper fragment of tibia and height of an individual in India. The material consisted of 440 individual in which male and female constituted the equal number between the age group of 18 to 24 years. This group comprises the admixture of students admitted from all over the country.

Measurements were taken at a fixed time to avoid diurnal variations. The height was recorded with the help of an anthropometer and length of both sided upper fragment of tibia was recorded with vernier caliper. The observed data was subjected to statistical analysis. The result obtained indicated there were positive correlation between right and left tibia and height of an individual.

Regression equation derived can be used to estimate the stature of an individual when it is not definitely known as to which part of the country he/she belongs.

Keywords: Stature Estimation, Percutaneous Length of Upper Fragment of Tibia

INTRODUCTION

Establishment of identity of an unknown human dead body or the mutilated part of the dead body is difficult work in forensic medicine. Lower limb bone had greater contribution for measuring the height of the individual than the bone of the upper limb (N.K.Mohanty, 1998)^[1]. Similarly landmark on other long bones are more difficult to identify and more variable than that of tibia, hence percutaneous measurement of tibia was taken as subject matter. Muller (1935)^[2] followed by Steel and Mckern (1969)^[3] established the techniques and methods to estimate the stature if fragment of long bone is available. Stature reconstruction from fragmentary remains of long bone is essential in medico legal practice, as material provide may only be a fragment of bone. Therefore the sincere and humble attempt had been made to estimate the stature from fragmentary measurement of bone in living and derived regression formulae for that. Trotter

and Glesser (1952)^[4] established regression equation for stature calculation and concluded that increase in stature after 18yrs is insignificant even though the mean value indicate a maximum attained at age 24 years, there is no statistical significant change after age 18years. So the present study was done on person belonging to 18-25yrs age group.

MATERIAL AND METHOD

The project "Estimation of Stature from upper Fragment of Tibia in living" was carried out in Government Medical College, Nagpur, Maharashtra. The subjects taken for study were medical students of Govt. Medical College and Indira Gandhi Govt. Medical College, Nagpur. In them 220 students were male and 220 were female. This age group comprises the admixture of the students admitted from all over country i.e. 15% on all India basis and remaining 30% on state basis and 55% on Zonal level basis. The age

group of 18- 24yrs was selected and their height and length of right and left upper fragment of tibia were recorded. Measurement was taken for stature from crown to heel in standing erect posture with an Anthropometer. For measuring the length of upper fragment of tibia subject was asked to stand and keep his/her foot on a wooden stool to maintain the angle between flexor surface of leg and that of thigh at 90%. The two landmarks were taken (1) Upper point- the lateral most superficial point on upper border of medial condyle, and (2) Lower point was taken on a vertical line from the upper point at the level of most prominent point of tibial tuberosity. For that set-square was used and vertical distance was measured with the help of a vernier caliper. After collection of data, the measurements were subjected to statistical analysis which has given some important analysis.

OBSERVATION

The statistical data was tabulated to show the different parameters at a glance.

Table No. 1. Showing the average living height in male and female

Range in cms.	Max=182.5 Min=155.2	Max-165 Min - 142.5
Mean	168.52	153.24
S.D.	5.46	4.61
C.V.	0.0324	0.0300
S.E.M.	0.3681	0.3108

In male height varied from 155.2cm to 182.5cm. The average height being 168.2cm and the coefficient of variation-0.0324. In female the height varied from 142.5cm-165.0cm with an average 153.24cm and the coefficient of variation was 0.0300. Small values of coefficient of variation indicate that sample observation can be considered as homogenous.

Table No. 2. Showing the Range, Mean, S.D. C.V. and SEM of length of upper fragment of tibia in male and female

Tibia	Right		Left	
	Male	Female	Male	Female
No. of sample	220	220	220	220
Range in cm.	2.4 to 6.0	2.2 to 5.6	2.4 to 5.9	2.2 to 5.5
Mean	4.1	3.7	4.1	3.7
S.D.	0.77	0.70	0.73	0.67
C.V.	0.18	0.1891	0.17	0.1815
S.E.M.	0.0367	0.0333	0.0348	0.0319

Table No.3. Showing formulation of Regression Formula for calculating the living Stature from the length upper fragment of tibia in male and female

Tibia	Right		Left	
	Male	Female	Male	Female
Independent variable (x)	Length of UFT (x ₁)	Right UFT length (x ₁)	Length of UFT (x ₂)	Left UFT length (x ₂)
Intercept (a)	146.23	137.97	145.69	138.16
Regression coefficient (b)	5.4137	4.1244	5.5457	4.0816
Correlation coefficient (r)	0.7681 (r ₁)	0.6486 (r ₁)	0.7457 (r ₂)	0.6014 (r ₂)
Coefficient of determination (R ²)	0.5901	0.4207	0.5561	0.3617
Chi-square (x ²)	15.94	17.23	17.24	18.976
Significance	NS	NS	NS	NS

NS – Not significant, UFT- Upper fragment of Tibia

The correlation coefficient (r) of height and length of upper fragment of right tibia was 0.76 and left tibia was 0.74 in male. For female correlation coefficient was 0.64 for right side and 0.60 for left side. Chi-square test for regression coefficient was found to be statistically significant. Statistically there were no significant difference in the length of tibia of right and left side in both male and female. (p > 0.05)

On the basis of present observation regression formulae were derived separately for both sides in male and female for calculating the living stature.

In male, Right side $y_1 = 146.23 + 5.4137 x_1$

Left side $y_2 = 145.69 + 5.5457 x_2$

In Female, Right side $y_1 = 137.97 + 4.1244 x_1$

Left side $y_2 = 138.16 + 4.0816 x_2$

Where, y = substituting measured height.

x = percutaneous length of upper fragment of tibia.

DISCUSSION

Steele and Mckern (1969) [3] worked on estimating the stature from fragmentary portion of long bone. They selected the femur, tibia and humerus to tackle the same problem. Also Das, Jena C.S. and Sahu S.C.(1979)[5] observed that smaller the segment greater the accuracy for the stature reconstruction of bone in medico legal cases. Present study compare with the

stature estimated from total percutaneous length of tibia on same individuals. The average stature comes out in our study for male was 168.25cm and 153.2cm for female from the upper fragmentary tibial length. While using the regression equation derived from total tibial length the stature was found to be 168.28cm for male and 153.8cm for female which exactly correlated with estimated stature of present study. Whereas average measured height in living males comes out to be 168.53cm and that of females 153.2cm. Thus there were no significant difference between the stature estimated from the tibial length and stature estimated from upper fragment length of tibia. In our own study the attempt was made to estimate the stature from percutaneous fragmentary length of tibia in living. To compare our finding with others the literature was not available. But the final result that we got regarding estimated stature was similar to that of our stature estimated from total percutaneous length of tibia.

RESULT

Study showed that regression equation differs in both sexes for both side of tibia. By using this regression equation the stature was calculated 168.25cm in males and 153.2cm in females. Whereas average measured height in living males comes out to be 168.53cm and that of females 153.2 cm. In the present study average error was less than 1 cm in both sexes when compared between estimated stature and actual stature in living.

INFERENCE

Thus height of a person can be estimated with fair accuracy and the study will definitely be useful to the anatomist and forensic expert where the mutilated leg is available for medico legal examination.

ACKNOWLEDGEMENT

Medico legal Update Journal invites article, case report, newspaper clippings, and report to update the knowledge of reader. The authors are thankful to Professor D.S. Pimpalkar, Government Medical College, Nagpur and Associate Professor J.V. Deshpande, Government Medical College, Nagpur for their guidance to carry out this work.

REFERENCES

1. Mohanty N.K. (1998): Prediction of height from percutaneous tibial length amongst Oriya population. *Forensic Sci. Int.*, 98: 137-141.
2. Muller (1935): quoted by Krogman (1986): *The human skeleton in Forensic Medicine*, 2nd Ed. Springfield Charles C.Thomas. *Acta Anatomica*, 311-320.
3. Steel D.G. and Mckern T.W. (1969): A method for assessment of maximum bone length and living stature from fragmentary long bone. *Am. J. Phys. Anthropol.*, 31: 215-227.
4. Trotter Mildred and Glessner G. C. (1952): Estimation of stature from long of bones of American White and Negroes *Am. J. Phys. Anthropol.*, vol.10: 436 -514.
5. Das R., Jena. C.S. and Sahu S.C. (1979): reconstruction of total bone length from fragmentary remains of tibia. Paper presented at 1st Annual conference Jan. 1979 of Indian Association of Forensic Medicine. M. K. C. C. Medical College, Barhampur.

Estimation of Personal Height from the Head Length in North Chennai Region

Shreekrishna H K¹, Vinoth², Vijaykumari³

¹Assistant Professor, Department of Forensic Medicine and Toxicology, Madah Medical College, Chennai, ²Assistant Professor, Department of Anatomy, Madha Medical College, Chennai, ³Assistant Professor, Department of Forensic Medicine and Toxicology, Annapoorna Medical College, Salem

ABSTRACT

Estimation of stature is a prime work of forensic expert, which helps in identification. In this study 100 students (50 male and 50 female) of age group 17-22years of Madha Medical College, Chennai hailing from Chennai region are included for the study. Spreading caliper is used to measure head length and height of subject was measured with standard height measuring instrument. The result obtained were analysed and attempt was made to derive a formula between head length and height of an individual.

Keywords: Head Length, Correlation, Stature Estimation

INTRODUCTION

Identification of individuality is a prime work of forensic experts. In identification estimation of the stature is a primary characteristic along with age and sex. Assessment of the body height from different parts of body by anthropometric study of skeleton is an area of interest of forensic experts, anatomist and anthropologists. In ancient time physician and surgeon like Charaka and Sushruta were well acquainted with the relation of different parts of the body and height. According to Charaka, the height of an average man should be 84 anguls, thigh-21 anguls, leg-19 anguls, forearm-15 anguls and arm 16 anguls¹In past many authors have studied on stature estimation based on measurements long bones. Several authors have offered regression equations based on the length of long bones, however it is well known that formula that apply to one population do not always give accurate results for other population. Pearson stated that a

regression formula derived for one population should be applied to other groups with caution². In 1929, Stevenson confirmed the existence of inter population differences with respect to stature estimation³. Most of the studies have stressed that regression formula for stature estimation should be population specific. So there is a need to develop a separate regression formula for estimation from head length measurement for a particular population. Since glabella and external occipital protuberance are easily felt through skin, it is easy to measure the head length.

MATERIALS AND METHOD

The present study is carried out in Madha Medical College, Chennai, Tamilnadu. Total 100 students (male 50 and female 50) in the age group of 17-22years belonging to Chennai region are selected. Before taking the measurement the procedure was explained to the student and consent was obtained from individual. The height and length of skull is measured by the same observer and with the same instrument. Head length is measured with the help of spreading caliper from glabella to prominent point of external occipital protuberance (inion). Height of the students is measured in standing position with barefoot. After collection of data, it is subjected to statistical analysis. Mean S.D, range for height calculated separately for

Corresponding author:

Shreekrishna H K

Assistant Professor

Department of Forensic Medicine and Toxicology,
Madah Medical College, Chennai

Email: krishnashree61@yahoo.com

Ph. No.: 7200278293

male and female. Correlation of head length with height is calculated.

RESULTS

The statistical data which are extracted from calculation are tabulated in table 1 and table 2 & 3.

Table 1

Parameters	Age (yrs)	Head length (cm)	Height (cm)
Range	17-22	11.5-20.5	142-188.5
Mean	18-36	17.62	165.83
S.D	0.82	0.96	8.95

Table 2

Correlation co-efficients	
Parameters	Coefficient value
Age and height	+0.08
Age and length	+0.09
Sex and height	-0.73
Sex and head length	-0.55
Height and head length	+0.53

Table.3

Age v/s height and head length				
Age	Height mean (cm)		Head length mean (cm)	
	Male	female	Male	female
17	170.03	153.8	17.93	16.85
18	170.32	154.2	18.07	16.80
19	171.04	154.20	18.2	17.2
20	172.4	157.71	18.03	17.23
21	166.58	159.9	17.53	17.10
22	167.2	159.8	17.40	17.21

Regression formula for estimation of height

For male

$$Y = 138.74 + (1.77) x$$

For female

$$Y = 128.02 + (1.72)x$$

Y=total height

X=head length

DISCUSSION

No two individuals are exactly alike in all their measures traits, even genetically identical twins differ in some respects. These traits tend to and undergo change in varying degrees from birth to death in health and disease and since skeletal development is influenced by a number of factors producing differences in skeletal proportions between different geographical areas. Table 1 shows that age ranges from

17-22 yrs head length from 11.5-20.5cm and total height form 142- 188.5cm. Table 2 shows correlation coefficient between various parameters. Between age and height, between age and head length and between height and head length. It is positive suggesting that it is significant. Various workers have shown significant correlation between height and different parts of boy Singh and sonal (1951) ⁴ have shown a significant correlation between height and length of clavicle. Charhalia (1961) ⁵, showed that significant correlation between height and foot length where correlation coefficient was 0.46. Atharwalw (1963)⁶, derived a regression equation between total height and forearm bones. Shroof and vare (1979)⁷, have also derived height from the length of superior extremity and its segments. Lal and lala ⁸ estimated height from surface anatomy of long bones like tibia and ulna. Saxena et al (1981) ⁹, also derived a regression equation between head length and height in Agra population (U.P). Their correlation coefficient between head length and height was +0.2048. Glaistea (1957)¹⁰, nasion –inion length (head length) is 1/8 of total height of an individual. Telekka (1950)¹¹ worked on bones of Finns expressed the opinion that each racial group needs a separate formula for estimation of stature. In this study we have derived separate regression equations for both male and female to estimate accurate height of an individual.

CONCLUSION

The result of the present study indicates that head length can be efficiently used for estimation of stature. Most authors have underlined the need for population specific stature estimation formulae. The main reason for this is, the ratio of various body parts differ from one population to another. In addition ethnic difference, secular trend and even environmental factors such as socioeconomic and nutritional status can influence body proportion. So in this present study we have derived a separate regression equation to estimate stature form head length for the students of north Chennai region and also there is a need to develop separate population specific stature estimation formulae for other regions.

ACKNOWLEDGEMENT:

The authors are thankful to principal, prof. Dr. Ganjendran, for permitting to carry out the work and students who participated and cooperated with the study.

Conflict of Interest: We the authors here by declare that authors or the institution have no financial or the other relationship with other people or organisation.

Source of Funding: This study has not been funded by any organization or the institution.

Ethical Clearance: Ethical clearance has been obtained from ethical committee of the college.

REFERENCES

1. Mondal MK, Jana TK, Das J et al. Use of length of ulna for estimation of stature in living adult male in Burdwan district and adjacent areas of west Bengal. *J. Anat. soc. India* 2009; 58(1): 16-18
2. Pearson K. Mathematical contribution to the theory of evolutions on reconstruction of stature of prehistoric races. London: Philos. Trans. R. Soc. 1898. Series A 192: P169-244.
3. Lundy JK. The mathematical versus anatomical methods of stature estimation from long bones. *American journal of forensic medicine and pathology* 1983; 6(1): p. 73-76
4. Singh B and Sohal HS. Estimation of stature from clavicle in Punjabis: A preliminary report. *Indian Journal of medical research* 1951; 40: 67-71
5. Charnalia VM. Anthropological study of the foot and its relationship to stature in different castes and tribes of Pondichery state. *Journal of anatomical society of India* 1961; 10: 26-30
6. Athawale MC. Anthropological study of height from length of forearm bones. A study of one hundred Maharashtrian male adults of ages between twenty five and thirty years. *American journal of physical anthropology* 1963; 21: 105-112
7. Shroff AG and Varghese AM. Determination of height from length of superior extremity and its segments. *Journal of anatomical society of India* 1979; 28: 53
8. Lal and Lal JK. Estimation of height from tibial and ulnar length in north Bihar. *Journal of Indian medical essentials* 1972; 1972: 58: 4
9. Saxena SK, Jeyasingh P, Gupta CD. The estimation of stature from head length. *Journal of anatomical society India* 1979; 28: 53
10. Glaister John. In *Medical jurisprudence and toxicology*. 10th edition E & S, Livingstone Ltd. Edinburgh and London 1957: 79.
11. Telekka, A. On prediction of human stature from the long bones. *Acta Anatomica* 1950; Volume 9 pp 103-11.

Multidisciplinary Approach in a Case of Fall from Bridge: A Case Report

Tekade P R¹, Sharma H², Tekade C R³, Salgare M B³

¹Assistant Professor, Department of Forensic Medicine & Toxicology, Late Shree B.R. Kashyap Memorial Medical College, Jagdalpur (C.G.), ²PhD Student in Entomology (M.Sc. Forensic Science), Scene of Crime Unit, Jagdalpur (C.G.), ³Practitioner, Bhandara (M.S.)

ABSTRACT

Determination of manner of death by the forensic persons is vital for dispensing justice. At times, even meticulous enquiry and legal proceedings are not able to form a conclusive opinion, mostly due to an error committed at some point of investigation and lack of eyewitness. A careful postmortem examination and critical crime scene investigation are the tools which can explain the crime in most satisfactory manner in such cases.

In the present case manner of death given by doctor was questioned by the investigating agencies. The non availability of eyewitness and inability to trace any offender also contributed to the puzzle. The pattern of injuries, the condition of vehicle, crime scene report and the physics of fall were considered to point out or rule out the possibilities.

Keywords: *Manner of Death, Physics of Fall, Fall From Height*

INTRODUCTION

Dead person leaves us with several questions to answer. At the end of postmortem examination cause of death is obvious in majority of cases, but manner of death is a tiresome job to accomplish, as it routinely involves crime scene investigation. Even after clear autopsy report and crime scene report we need to reconstruct the crime in most acceptable and scientifically explainable way. Investigation of death needs application of all disciplines of science. In country like India, development demands more critical investigation of death. A mistake of investigator at any step can burden the already stressed system, and cause pain to society.

In present case cause of death was obvious, but manner of death was disputed. Difference of opinions brought the case for expert opinion. Opinion was given by considering pattern of injuries, crime scene report, condition of vehicle, physics of fall and required information provided by investigating officer.

CASE REPORT

A 19 years old male was reported to be dead under a bridge, in dry basin of river at around 11.00 am. Police officers inspected the spot and had the autopsy done. The autopsy surgeon reported 'head injury' as cause of death. Manner of death was given to be 'homicidal'. In autopsy report five external injuries in form of abrasions and lacerations (all horizontal) were mentioned over left side of face. An area of redness was reported over left side of chest. Internally under scalp haematoma was found on back side and occipital bone was reported to have compound fracture. Meninges contained clotted blood. Contusions were present over brain bilaterally. Fracture of left 4th rib with blood in surrounding zone was seen. Visceral organs were congested.

Corresponding author:

Pawan Tekade

Assistant Professor

Department of Forensic Medicine & Toxicology, Late Shree B.R. Kashyap Memorial Medical College, Jagdalpur, District- Bastar, Chhattisgarh- 494001

E mail: tekade_pawan@yahoo.co.in

As per police history, the person was last seen going in that way on previous afternoon. As per the crime scene report his bicycle had its rare wheel ring bent. The surface where the body was found was hard and rough covered with a thin layer of sand (Fig. 1).

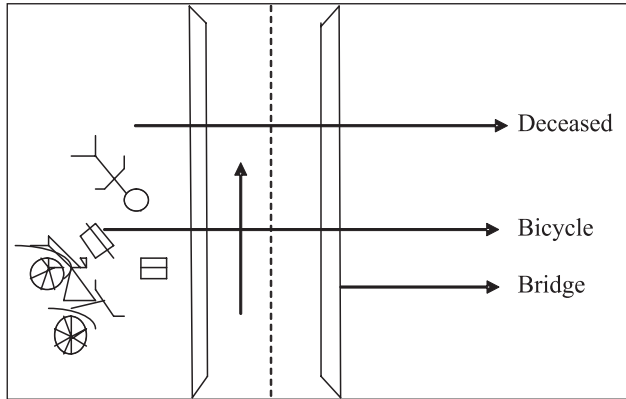


Fig. 1. Diagrammatic representation of scene as seen from above the bridge.



Fig. 2. Photograph of crime scene.

The investigating officer tried his best but couldn't trace the unknown accused. All the interrogations were futile. At this stage the police suspected that the autopsy surgeon has given the manner of death (homicide) on insufficient grounds, so it can be questioned. The case reports were forwarded for expert opinion. The photographs depicted a young male lying on sandy surface in left lateral position. A bicycle was found lying about a meter away from him. A bag near a seat and another about a meter away were seen. Below his head a pool of reddish fluid (reported to be blood) was visible (Fig. 2). The visible part of clothes appears normal. A bridge and its column were seen away from body.

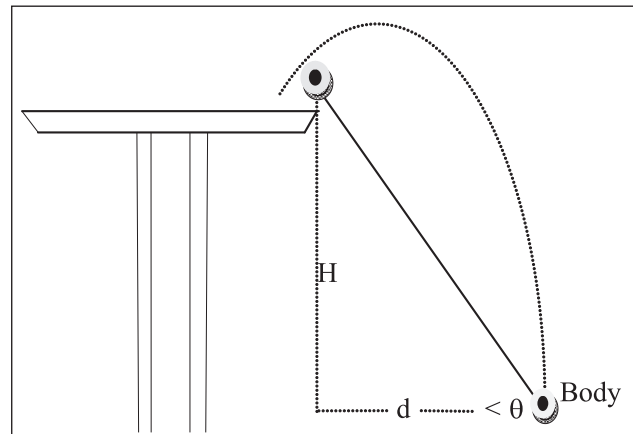


Fig. 3. Diagrammatic representation of fall.

Physics of fall

Horizontal distance of the deceased from the bridge $d=2.2$ m. Height of the bridge $h1=3.9$ m. Height of the centre of mass (*c.of.m*) of the deceased along with bicycle = .56 m. Total height $ht= h1+c.of.m =4.46$ m. (Fig. 2).

In this case, the center of mass of a person has fallen through a vertical height ht and has travelled a horizontal distance d through the air, as shown in figure 3. If we ignore the effects of air resistance or wind, then h and d are related to the launch speed $v0$ (average speed of bicycle at launch time) and the fall angle θ can be determined by

The fall angle θ of the deceased person, $\theta = \tan^{-1} ht/d$ 60.57°

$$d = \frac{v_0^2 \sin(2\theta)}{g}$$

$$v_0 = \sqrt{\frac{d * g}{\sin(2\theta)}} \quad 5 \text{ m/s} = 18 \text{ km/hr}$$

Average speed of bicycle was found to be between 14 to 23 kmph by direct experimentation on similar road. Thus calculated speed falls between the possible limits in this case. Also it indicates a lateral fall, which forms a small angle with the direction of motion. If higher speed of bicycle is presumed then this fall remains a possibility. It, along with other parameters, also helps to rule out the push from behind or side by a heavy vehicle moving with higher speed.

DISCUSSION

Given information, leads us to consideration of possibilities, as follows. Homicide needed a special consideration as it was claimed in autopsy report.

Suicide: It is least likely to commit suicide with bicycle because height of bridge from river bed is only 3.90 meters, and river bed is dry. It's very unusual for a person of normal intelligence to commit suicide in such an atypical manner. In case of suicide by fall without bicycle, bicycle will be found on the bridge. Also no previous history of attempted suicide and no possible reason for such unfortunate step as per family members, preclude this theory.

Homicide: In case of homicide with push by a moving vehicle from bridge while person is on bicycle, evidence of double impact on bicycle, one due to impact of pushing vehicle and another due to fall in river bed, are expected. Primary impact injuries are highly possible in such cases. The likelihood of this manner is thus ruled out. Homicide due to gentle push, though a possibility, is less likely, because it would have formed bigger angle with the direction of motion of the rider and so would have reduced the horizontal distance of fall. Some defects over the most prominent part of the vehicle will be evident in such cases.

In case of homicide, when person is off the bicycle (bicycle thrown afterwards), the person will have the fatal or near fatal injuries over the bridge and other antemortem injuries due to fall from height will be seen. While two different patterns of injuries over different contours of body or parts of body along with signs of struggle are also expected. The horizontal distance of fall is much more than expected or possible in such a case. This much distance indicates body in motion with significant speed and thus rules out this possibility.

In case of homicide with mechanical trauma followed by post-mortem fall, post-mortem injuries are expected due to fall from height. Also two different patterns of injuries over other parts of body along with blood stains and signs of struggle over bridge are expected. The actual horizontal distance of fall is much more than expected or possible in such a case.

In case of mechanical trauma in the river bed, tracks of bicycle up to and around the scene, signs of struggle over body or sand, blood stains at places are expected. Pool of blood is seen only under the head, no stains of blood are observed on the other places which indicate that the person bled through the injury in face that is on dependant part of body. No much disturbance around body, no signs of dragging or foot prints indicate that person didn't move much after fall.

Accident: In case of accidental fall while person is

on bicycle, with push by a moving vehicle, signs of double impact over body and bicycle are expected. Signs of application of brakes over the bridge are also possible. Absence of both these things, on a quite busy road, disqualifies this possibility.

In case of accidental fall from bridge while person is riding bicycle without push, the damage to vehicle and injuries over body can occur as in present case. So explain this theory of accidental fall without any push.

The accident or homicide by head on collision is out of consideration as front of bicycle and deceased were unhurt.

Combination of head and thorax injuries are highly possible⁷. As per observations of Ramos S.M and Delany H.M. skeletal fractures are commoner than skull fractures due to fall from such height⁵. Mortality is infrequent due to fall from such heights, but in this case it may be explained by a head first fall. Reynolds B.M and others reported that skeletal fractures along with visceral injuries especially that of head and chest in most of the fatal falls⁶. Head injuries, along with skeletal trauma was the common occurrence in cases as well as fatalities due to low falls, while thoracic cage was relatively spared. The disparity from the present case is possible due to, the difference in manner of death and part touching the ground first.

To summarise, accidental fall from bridge while person is riding bicycle without push or with gentle push remains the possibilities. Coupe and counter coupe injuries to brain are consistent with the head injuries (which resulted in death) due to fall. The findings over the bridge, on and around the body under the bridge, extent of damage to vehicle, pattern of injuries over body, distance of fall, all support the above two theories. So the opinion was given that 'The possibility of homicide, as mentioned in autopsy report, cannot be ruled out, but in high probability it appears to be a case of accidental fall while person is riding the bicycle.'

ETHICAL AND LEGAL ISSUES

Can the opinion given by the doctor be challenged or changed in these cases? Should it be changed? As a forensic person, one should not decide the case before the court. Law does not uphold the opinion of doctor without cross examination, it being corroborative evidence¹. This should not be a question on integrity of the doctor who conducted postmortem examination.

Conclusion: The application of forensic medicine along with allied branches can be promoted for the better acceptance of opinions in court of law.

REFERENCES

1. Modi's Medical Jurisprudence and Toxicology- 23 edition; Lexis Nexis Butterworths Publications; 387-391.
2. McLean S.F, Tyroch A.H.- Injuries sustained after falls from bridges across the United States– Mexico border at El Paso; *Rev Panam Salud Publica* 31 (5), 2012; 427-433.
3. Helling TS, Watkins M, Evans LL, Nelson PW, Shook JW, Van Way CW.- Low falls: an underappreciated mechanism of injury ; *J Trauma*. 1999 Mar; 46 (3); 453-456.
4. Atanasijevic TC, Savic SN, Nikolic SD, Djoki VM.- Frequency and severity of injuries in correlation with the height of fall; *J Forensic Sci*. 2005 May; 50 (3); 608-612.
5. Ramos S.M, Delany H.M.- Free Falls From Heights: A Persistent Urbakn Problem; *Journal Of The National Medical Association*, Vol. 78, No. 2, 1986; 111-115.
6. Reynolds B.M, Balsano N.A, Reynolds F.X.- Falls From Heights: A Surgical Experience Of 200 Consecutive Cases; *Ann. Surg. Aug*. 1971; Vol. 174; No. 2; 304-308.
7. James J.P, Byard R.W, Corey T.S, Henderson C: *Encyclopedia Of Forensic And Legal Medicine*. First Edition; 2005; Elsevier Academic Press; 307-319.

Plastination : An Attempt to Estimate Size and Volume of Maxillary Sinus of Dry Crania to Determine Gender

Vidya C S¹, N M Shamasundar², Manjunatha B³

¹Assistant Professor, ²Professor and Head Department of Anatomy ³Professor Department of Forensic Medicine & Toxicology, JSS Medical College , JSS University Mysore-15

ABSTRACT

Plastination is a process of preservation of anatomical specimens by a delicate method of forced impregnation with curable polymers like silicone, epoxy or polyester resins with vast applications in medical fields of study. This technique of tissue preservation was developed by Dr.gunther von hagens in 1977. Luminal cast plastination is useful to study the dimensions and architecture of different cavities of organs and to study the tubular -arterial, venous, ductal branches and their variation. Gender has long been determined from the skull, the pelvis and the long bones with an epiphysis and metaphysis in unknown skeletons. The aim of the present study is to estimate the size and volume of maxillary sinus by luminal cast plastination to determine gender of dry crania.

The skulls of known sex were obtained from recently buried bodies. Skulls were subjected to plastination method by injecting silicone gel. The casts of maxillary sinus obtained were measured by digital calipers and corel draw software.

The preliminary discriminative analysis of data by plastination method have been tabulated. The volume of maxillary sinuses of both sides was significantly greater in male skulls compared to female skulls. By plastination method using digital calipers showed statistically significant p values, left width - 0.037, right width - 0.019 and right volume - 0.027. By plastination method using corel draw software showed statistically significant p values, left width - 0.041, right width - 0.032.

The silicone cast is a real replica of the lumen of the maxillary sinus and can be produced as an evidence in the court of law.

Keywords: Maxillary Sinus, Plastination, Crania, Gender

INTRODUCTION

Plastination is a technique used in anatomy to preserve bodies or body parts. The water and fat are replaced by certain plastics, yielding specimens that can be touched, do not smell/decay and even retain

most of the properties of the original sample. The silicone s10 is the standard technique in plastination. Specimen impregnation with s10 results in opaque, more or less flexible and natural looking specimens.¹ It has been reported that maxillary sinuses remain intact although the skull and other bones may be disfigured in victims who are incinerated and, therefore that maxillary sinuses can be used for identification.² Plastinated or embalmed specimens could be an excellent tool in defending cases involving medicolegal issues.³ The aim of the present study is to estimate the size and volume of maxillary sinus by

Corresponding author:

Vidya C S

Assistant Professor,

Department of Anatomy,

JSS Medical College, JSS University Mysore-15,

9449679386

vidyasatish@rediffmail.com

luminal cast plastination to determine gender of dry crania. The luminal cast plastination method is first of its kind to determine the volume of maxillary sinus for forensic importance.

MATERIAL AND METHOD

The skulls of known sex were procured from the department of anatomy for the study. Sample size for the complete project was 80 skulls and at present 30 skulls were studied. Macerated skulls were taken , cleaned thoroughly and subjected to plastination method. . Air present within the sinus is taken out making a hole in the floor of the orbit. The skulls were cut into halves sagittally. A hole was drilled on the anterior wall of maxillary sinus below the infra orbital foramen. Silicone gel was injected slowly into the sinus by using gun injector. 48 hrs later the casts from both the sides were removed carefully and dimensions of maxillary sinus casts were measured using digital slide calipers. The casts were immersed in graduated measuring jar filled with water and the volume by displacement method for both sides was calculated. The dimensions of the casts were also measured using corel draw software (image 2,3). the data was subjected to statistical analysis.



Fig. 1. Materials used for plastination method

TABLE 1. Shows female: male distribution of the mean value, sd and p value of maxillary sinus parameters by plastination method - as measured by digital calipers, volume by immersion method

PARAMETERS	FEMALES (N=12)		MALES (18)		P value
	MEAN	SD	MEAN	SD	
Left height	3.158	0.396	3.244	0.458	0.589
Left A-P	2.892	0.378	3.183	0.597	0.113
Left width	1.892	0.309	2.239	0.555	0.037
Left volume	10.225	3.482	13.150	7.035	0.194
Right height	3.017	0.295	3.156	0.427	0.301
Right A-P	2.733	0.401	3.067	0.582	0.074
Right width	1.800	0.316	2.206	0.500	0.019
Right volume	9.117	2.815	13.683	6.362	0.027

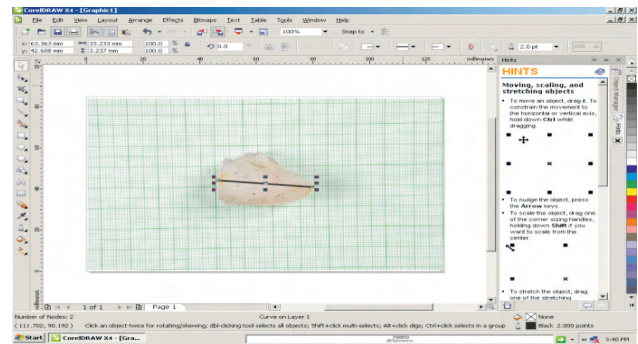


Fig. 2. Measurement of width of maxillary sinus cast by using corel draw software

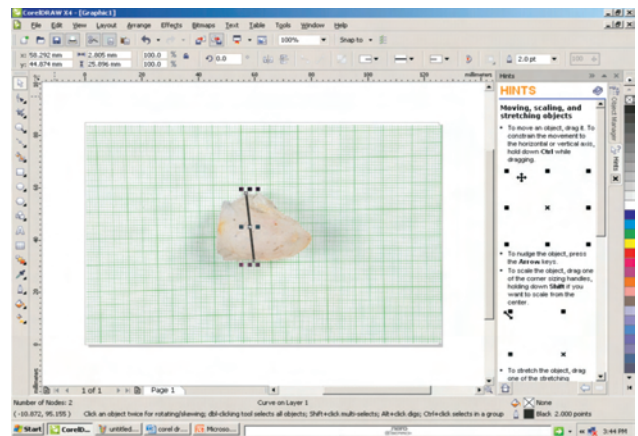


Fig. 3. Measurement of A-P length of maxillary sinus cast by using corel draw software

Statistical analysis

Statistical analysis was performed with Systat 13 package. mean and SD to assess the level of the parameters in males and females were determined. Independent sample t – test. Differences with a p value $p < 0.05$ were considered significant.

RESULTS

The preliminary discriminative analysis of data by plastination method have been tabulated. The discriminative analysis will be done when 80 skulls are studied. The dimensions and volume of maxillary air sinuses are shown in Table 1, 2

The volume of maxillary sinuses of both sides was significantly greater in male skulls compared to female skulls. By plastination method using digital calipers

showed statistically significant p values, left width - 0.037, right width - 0.019 and right volume - 0.027.

TABLE 2. Shows female: male distribution of the mean value, sd and p value of maxillary sinus parameters by plastination method- measurements taken using corel draw software

PARAMETERS	FEMALES (N=12)		MALES (18)		
	MEAN	SD	MEAN	SD	P value
Left height	3.183	0.361	3.211	0.376	0.841
Left A-P	2.875	0.362	3.117	0.527	0.148
Left width	1.942	0.326	2.172	0.478	0.041
Right height	3.067	0.323	3.200	0.433	0.343
Right A-P	2.700	0.359	2.983	0.546	0.125
Right width	1.833	0.271	2.156	0.441	0.032

The volume of maxillary sinuses of both sides was significantly greater in male skulls compared to female skulls. By plastination method using corel draw software showed statistically significant p values, left width - 0.041, right width - 0.032.

Discussion : in the present study all the dimensions and volume of maxillary sinuses were larger in males compared to females. By plastination method using digital calipers showed statistically significant p values, left width - 0.037, right width - 0.019 and right volume - 0.027. . By plastination method using corel draw software showed statistically significant p values, left width - 0.041, right width - 0.032.

In 1997, Nel PCP has elaborated the research applications of plastination. Use of plastinated specimens in teaching of forensic pathology, odontology and anthropology was discussed. They identified that plastination method could be used as a research tool.⁴

Tientip W studied traumatic and normal brains by preservation. 10% formal fixed brains were processed through Biodure S-10 plastination method. All pre-and post plastinated specimens were measured in several reference points on the surface, and degree of shrinkage determined. The finished plastinated brains were dry to touchable, odorless, nontoxic and remain original shape, reasonably close in color and consistency. The study demonstrated that plastination in traumatic brain is most likely a suitable method and superior to those preserved in formalin for medicolegal evidence and teaching purpose.⁵

Vandana Mehta in 2007 has explained the use of plastination in forensic medicine. Plastination of soft tissues, organs, bones, and teeth has proved valuable

in preserving delicate, friable and calcined specimens. In medicolegal cases, these specimens may be used for accurate identification and preservation of important material.⁶

Ravi SB in 2011 has explained how the plastination method can be used as teaching adjunct in oral pathology. The advantages of plastination such as nontoxic, noninfectious and preparation of tissue sample for use as evidence was discussed.⁷

Pashari in 2010 has briefed the applications of plastination. The potential of plastination lies in its ability to preserve delicate structure and their interconnections, enabling them to be traced microscopically. Even ultrathin plastinated slices can be obtained and have been used to construct precise 3-dimensional computed models of anatomical structures.⁸

Durand M et al studied deposition of aerosol in the maxillary sinuses using a plastinated model. The study revealed scintigraphic images of the specimen, whatever the incidence of the views, were not accurate enough to differentiate the aerosol deposition in the maxillary sinus from that in the nasal cavity. These techniques may be useful for invitro characterization of aerosol penetration into the maxillary sinuses.⁹

Musumeci E and others studied ethmoidal regions by plastination using the standard S10 technique. A CT scan of each ethmoidal block was performed before and after preparation of the block to assess shrinkage. The specimens were well suited for comparative radiographic and endoscopic studies.¹⁰

It is observed that the accuracy by plastination is beyond 95% even minor surfaces, depressions,

projections and recesses can be perfectly cast by this method, which cannot be delineated by CT. Since this is a direct method it has more value than the 3D CT analysis.

CONCLUSION

The plastination produces a unique specimen at very low cost almost equivalent to the plastinated specimens of international quality. Plastinated or embalmed specimens could be an excellent tool in defending cases involving medicolegal issues. The luminal cast plastination method is first of its kind to determine the volume of maxillary sinus to determine gender for forensic importance.

ACKNOWLEDGEMENT

I sincerely thank the support of my institution and ICMR funding for my research work. IRIS ID NO.2010-02580 Ethical clearance from the institution to start the project has been obtained. No conflict of interest from co-authors either financially or personally to publish the paper.

REFERENCES

1. Von Hagens G. Heidelberg plastination folder. Collection of all technical leaflets for plastination. Collection of all technical leaflets for plastination. 2nd edn. Heidelberg, . 1986; pp:245-457.
2. Teke HY , Duran S, Canturk N and Canturk G. determination of gender by measuring the size of the maxillary sinuses of computerized tomography scans. *Surg radiol anat* . 2007 ; 29 : 9-13.
3. Vidya M., Nandaprasad, Karkera Bhavana V., Hemant M., Shakil M. Plastination: an attempt for oral specimen. *Indian journal of forensic medicine and toxicology*. 2009;3(2) : 39-40.
4. Nel PCP. Research applications of plastination. *J Int Soc plastination*. 1997;12(1): 9-12.
5. Tiengtip W. plastination preserves in traumatic brains for medicolegal evidence. Mahidol university. 2004.
6. Vandana Mehta. A review on plastination process, uses and ethical issues. *Medicolegal update*, 2007 ; 7(2): 1-5.
7. Ravi SB, Bhat VM. Plastination: A novel , innovative teaching adjunct in oral pathology. *J Oral Maxillofac Pathol*. 2011;15:133-7.
8. Pashaei S. A brief review on the history, methods and applications of plastination. *Int.J.Morphol*. 2010 ; 28(4):1075-1079.
9. Marc D and et al .preliminary study of the deposition of aerosol in the maxillary sinuses using a plastinated model . *journal of aerosol medicine* 2001;14(1):83-93.
10. Musumeci M, Lang FJW., duvoisin B., Riederer B.M. Plastinated ethmoidal region: preparation and applications in clinical teaching. *journal of the international society for plastination*. 2003 ; 18 : 23-28.

Dental and Skeletal Fluorosis: A Review

Rohit Sharma¹, Pradeep Kumar², Neha Bhargava³, Amit Kumar Sharma⁴, Shalabh Srivastava⁵, Shweta Jain⁶, Vijay Agrawal⁷

¹Senior Lecturer, Department of Oral Medicine & Radiology, NIMS Dental College, Jaipur, ²Senior Lecturer, Department of Periodontics, Rajasthan Dental College, Jaipur, ³Senior Lecturer, Department of Pedodontics, NIMS Dental College, Jaipur, ⁴Senior Lecturer, Department of Oral Surgery, Jaipur Dental College, Jaipur, ⁵Senior Lecturer, Department of Oral Pathology, Jaipur Dental College Jaipur, ⁶Senior Lecturer, Department of Conservative Dentistry, ⁷Senior Lecturer, Department of Orthodontics, NIMS Dental College, Jaipur, Rajasthan

ABSTRACT

Dental fluorosis which is characterized by discolored, blackened, mottled or chalky-white teeth is a clear indication of overexposure to fluoride during childhood when the teeth were developing. These effects are not apparent if the teeth were fully grown prior to the fluoride overexposure, therefore the fact that an adult may show no signs of dental fluorosis does not necessarily mean that his or her fluoride intake is within the safety limit.

Chronic intake of excessive fluoride can lead to severe and permanent bone and joint deformations of skeletal fluorosis. Early symptoms include sporadic pain and stiffness of joints, headache, stomach-ache and muscle weakness can also be warning signs. The next stage is osteo-sclerosis (hardening and calcifying of the bones) and finally the spine, major joints, muscles and nervous system are damaged.

Dental and skeletal fluorosis is irreversible and no treatment exists for these conditions, hence only remedy is prevention by keeping fluoride intake within safe limits.

Keywords: Fluoride, Dental Fluorosis, Skeletal Fluorosis, Rajasthan

INTRODUCTION

Fluorosis is an endemic disease resulting from excess intake of fluoride either through drinking water, food or dentrifices. The safest minimum daily intake of fluoride is not known. Chronic fluorine intoxication through drinking water containing above 10 ppm of fluorine results in pathological changes of bone leading to skeletal fluorosis.¹ While dental fluorosis can be easily recognized, the skeletal involvement is not clinically obvious until the advanced stage of crippling is reached.²

The beneficial and the detrimental effects of fluoride naturally present in water were well established by the early 1940s. High levels of fluoride present in concentrations up to 10 mg/l were associated with dental fluorosis (yellowish or brownish striations or mottling of the enamel) while low levels of fluoride i.e. less than 0.1 mg/l were associated with high levels of dental decay, although poor nutritional status is also an important contributory factor.³

In endemic areas, poor nutritional status coupled with prolonged exposure to fluoride tend to aggravate the fluoride toxicity lowering the safe level of fluoride intake even further.³

The effects of fluoride intoxication are related to the total amount of fluoride ingested. Earlier, fluoride intoxication was accounted to be only through water however food like fish, barley, rice, turmeric, tea etc. also contain good amount of fluoride which can lead to dental or skeletal fluorosis.^{3,4}

The severity of fluorosis has a direct proportional relationship with factors² like fluoride concentration in drinking water, period of exposure, climatic factors (for example temperature), fluoride ingestion through other sources, nutritional status, chemical constituent of drinking water other than fluoride and occupation.⁵

DENTAL FLUOROSIS

Excessive ingestion of fluoride during the early childhood years may damage the tooth forming cells,

leading to a defect in the enamel known as dental fluorosis. Both sexes are equally affected. It is the permanent teeth that are affected and they lose their normal creamy white translucent color and become rough, opaque and chalky white. Teeth with fluorosis

also have increased porosity of the enamel. In the milder forms, the porosity remains to the sub-surface enamel whereas in more advanced stage the porosity affects the surface enamel as well resulting in extensive pits.^{5,6,7}

Table 1. Concentration of fluoride in drinking water and its effects on human health^{6,8,9}

Concentration (mg/l)	Effect
<1.0	<1.0 Safe limit
1.0-3.0	1.0-3.0 Dental fluorosis (discoloration, mottling and pitting of teeth)
3.0-4.0	Stiffened and brittle bones and joints
4.0-6.0 and above	Deformities in knee and hip bones and finally paralysis making the person unable to walk or stand in straight posture, crippling fluorosis

Pitting and chipping are other marks of fluorosis. Brown or black pigment gets deposited on the defective enamel and once established tends to remain there permanently.^{10,11} Incidence of dental fluorosis in endemic areas exhibits a linear relationship to the fluoride content of water but it may also vary with other factors. Dental fluorosis does not obviously occur when there has been no exposure to fluoride in the first decade of life.^{12,13,14,15}

Fluoride and Periodontal Diseases

Periodontitis is a multifactorial disease that is related to age. Although periodontitis was present in all the age groups, the steady increase in periodontitis is seen as the age advances to 55 years.¹⁵ Studies conducted by Murray and Vandana et al^{16,17} compared gingivitis, gingival recession and periodontitis of aged between 15 and 65 years and found gingivitis and gingival recession to be more prevalent in high-fluoride areas than low-fluoride areas. However, a study on the contrary showed that prevalence and severity of periodontitis in adults residing in a high-fluoride area (2-3 ppm) had a little evidence of periodontal destruction.¹⁸

No effort has been made in the literature to quote reasons for association of periodontal disease in high-fluoride areas apart from blaming oral hygiene and plaque levels. The risk factors such as age, sex and oral hygiene status for periodontal disease may not differ from high to low fluoride areas. The regular pathway of gingivitis progressing to periodontitis through an inflammatory process is well established. In addition to inflammatory process which remains common to high and low fluoride areas, the fluorosis induced changes in hard and soft tissues of periodontium requires attention to suspect fluoride as an etiological (environmental) agent for periodontal disease.¹⁷

Fluoride and Skeletal Fluorosis

In regions with very high fluoride content, skeletal fluorosis may affect younger age groups including children. The longer the exposure to fluoride, higher will be its incidence. In tropical countries, skeletal fluorosis occurs even while drinking low levels of fluoride. It is the farm laborers who are prone to develop fluorosis rather than those engaged in sedentary occupations. Epidemiological observations revealed that nutritional status might influence chronic fluoride toxicity.^{19,20}

The factors which govern the development of skeletal fluorosis are prevalence of high levels of fluoride intake, continual exposure to fluoride, strenuous manual labors, poor nutrition and impaired renal function due to systemic disease.^{19,20}

The stage at which skeletal fluorosis becomes crippling usually occurs between 30 and 50 years of age in the endemic regions. Newcomers to a hyper endemic region may sometimes develop symptoms of skeletal involvement within 4 years of their arrival. Men suffer more than women from severe affects of the skeletal fluorosis presumably because their work is usually more strenuous than that of women.^{19,21}

Pre-skeletal stage

This stage ranges from 10 to 30 years or even longer in endemic areas and from 10 to 15 years or longer in cases of industrial fluorosis. The duration of this stage may vary with the amount of fluoride daily ingested. It is usually free of any signs or symptoms in its early stages in endemic regions. The persons concerned may occasionally complain of pains in the small joints of the limbs and back, which are often mistaken for rheumatoid arthritis or ankylosing spondylitis. However, various reports from Europe and America

suggest that there would be symptoms corresponding to gastrointestinal, musculoskeletal, respiratory and visceral systems during this stage. The majority of these visceral symptoms may be due to allergy to fluoride in susceptible individuals or the effect of fluoride on the various target organs and these are nonspecific.^{19,22, 23}

Skeletal fluorosis

Early in the development of fluorotic changes in the skeleton, the patients often complain of a vague discomfort and paresthesiae in the limbs and the trunk. Pain and stiffness in the back appear next, especially in the lumbar region, followed by dorsal and cervical spines. Restriction of the spine movements is the earliest clinical sign of fluorosis. The stiffness increases steadily until the entire spine becomes one continuous column of bone manifesting a condition referred to as 'poker back'. In man the spine is most likely to be affected first and severely because of its being required to sustain the erect posture^{19, 21, 24, 25}

The involvement of the ribs gradually reduces the movement of the chest during breathing, which finally becomes mainly abdominal. When that happens the chest assumes a barrel shape. With the increasing immobilization of the joints due to contractures, flexion deformities may develop at hips, knees and other joints which make the patient bedridden. Bony exostosis may also appear over the limb bones especially around the knee, the elbow and on the surface of tibia and ulna. Despite the fact that the entire bone structure has become affected the mental faculties remain unimpaired till the last stage is reached.^{19, 22, 24, 26}

Neurological manifestation of fluorosis

Neurological squeal in skeletal fluorosis manifesting usually as radiculo- myelopathy arising principally because of the mechanical compression of the spinal cord and nerve roots brought about by osteophytosis and sclerosis of the vertebral column. However, it is only in later stages owing to pressure on the radicular vessels in the intervertebral foramina that vascular complications may supervene, but the neural toxicity attributable to fluorides is yet to be established. Neurological complications arise at a late stage of the disease in about a tenth of the total number of skeletal fluorosis cases.^{27, 28}

The largest number of cases with neurological manifestations was reported from two endemic belts of Punjab, Harayana, Rajasthan and adjacent Uttar

Pradesh in northern India belt. However, Andhra Pradesh in southern India belt have reported few cases of fluorosis with neurological complications.²⁰

CRANIAL LESIONS

Nerve in the skull is not much affected in fluorosis and basal cranial nerve foraminae are not usually encroached upon except at advanced stages of the disease. Of the cranial nerves, the most frequently affected in a quarter of the cases investigated has been the eighth nerve. In all such cases calvarial changes caused by fluorosis are discernible. A progressive high frequency perceptive deafness is observed; moreover the bone conduction is affected more than air conduction. Nevertheless total deafness rarely occurs. It is perhaps the compression of the nerve in the sclerosed and narrowed auditory canal that accounts for the deafness in fluorosis.^{20, 27, 28}

Peripheral neuropathies

Exostosis, which mainly develops around the knee, elbow and ankle, may press upon the median, ulnar or lateral popliteal nerves. Pain and paraesthesia followed by weakness in the limbs may be caused by such bony growth.^{19, 20}

Acute toxicity

Acute oral exposure to fluoride may produce effects including nausea, vomiting, abdominal pain, diarrhoea, fatigue, drowsiness, coma, convulsions, cardiac arrest and death. Severe tissue damage, respiratory effects, cardiac arrest and deaths have been noted individuals exposed accidentally to hydrofluoric acid through dermal contact. The lethal dose of sodium fluoride to the average adult has been estimated to be between 5 and 10 g (32–64 mg fluoride/kg body weight), an acute dose of 5 mg fluoride/kg body weight has been considered to be the maximum that might lead to adverse health effects. Death due to acute fluoride poisoning resulting from improperly fluoridated drinking-water, the individual was estimated to have ingested approximately 17.9 mg fluoride/kg body weight prior to death. The toxicity of fluoride is dependent upon the type or species of the compound ingested. Generally, the more soluble salts of inorganic fluorides (e.g. sodium fluoride) are more toxic than those that are either weakly soluble or insoluble (e.g. calcium fluoride).^{19, 20}

Gastrointestinal effects produced following the acute ingestion of toxic amounts of fluoride arise from

the corrosive action of hydrofluoric acid, which is produced within the acidic environment of the stomach. Damage to the gastric mucosa (e.g. hemorrhage, loss of epithelium) has also been observed in human volunteers administered acidulated phosphate fluoride gels or sodium fluoride solutions.²⁰ Some individuals may be unusually hypersensitive to stannous fluoride and manifested by ulcerations in the oral cavity after topical treatment.^{29, 30}

Cardiac arrest following accidental exposure to high levels of fluoride has been attributed to the development of hypocalcaemia or hyperkalaemia. The acute effects of fluoride upon the central nervous system may be due to fluoride induced hypocalcaemia and the inhibition of cellular enzymes. Respiratory effects (e.g. hemorrhage, pulmonary oedema, tracheobronchitis and shortness of breath) have been observed in individuals following inhalation of hydrogen fluoride.²⁰

Fluorosis in Rajasthan

In Rajasthan, all the 32 Districts are affected with high fluoride levels in water. 11909 villages and 11388 other habitations are having fluoride level in their ground water in concentration of over 1.5 mg/l. Similarly 4250 villages and 3449 habitations are having fluoride concentration more than 3.0 mg/l, thus the fluoride affected villages and habitations constitutes of nearly 24.79% of the total number of villages and habitations.^{31, 32}

In the state habitations of all the 32 districts are endemic to fluoride problem but the districts of Jaipur, Nagaur, Barmer, Bhilwara, Rajsamand, Dausa Jodhpur, Alwar, Tonk, Churu, Pali and Ajmer are worst affected, while Baran and Bundi are least affected. The mostly badly affected areas in the state are the rural areas where lack of education, poverty, limited sources of water and cost of defluoridation are important factors in these areas.^{31, 32}

PHED, UNICEF, and Non-Governmental Organizations (NGO's) are working in various fields. And from being medicinal professionals it is our duty to work in preventing this endemic disease by educating our patients and people in affected areas.³²

CONCLUSION

The problem of Fluorosis is world wide affecting many countries and in India especially Rajasthan which is the largest state of India. The cause of problem

is high fluoride content of water more than 1 ppm and chronic long term ingestion as stated by the different studies around the world and World Health Organization (WHO). Fluorosis not only affect oral cavity but has more severe and generalized effect on the body resulting in hard tissue and soft tissue irreversible damage in form of dental fluorosis, increased chances of caries and periodontal diseases, skeletal and non-skeletal fluorosis and acute toxicity which is lethal.

REFERENCES

1. Pareek A: A study on skeletal deformities due to fluorosis. *The Indian Journal of Nutrition and Dietetics*. 1994. 31: 121-125.
2. Pushpa Bharati, Annapoorna Kubakaddi, .Clinical symptoms of dental and skeletal fluorosis in Gadag and Bagalkot district, Karnataka. *J Hum E col* 2005; 18(2):105-107.
3. J. Fawell, K. Bailey, J. Chilton, E. Dahi, L. Fewtrell and Y Magara. Fluoride in Drinking-water. World Health Organization (WHO). 2006.
4. Yadav JP, Lata S. Urinary fluoride levels and prevalence of dental fluorosis in children of Jhajjar District, Haryana. *Indian J Med Sci*. 2003; 57:394-9.
5. Soben Peter, Fluoride in dentistry, Essential of preventive and community dentistry: first edition, Arya publishing house, New Delhi, India. April 1999;193-306
6. Meenakshi.R.C, Maheshwari .Fluoride in drinking water and its removal. Centre for Rural Development and Technology, Indian Institute of Technology 2006. 456-463.
7. Dean, H.T. and Elvove, E. "Studies on the Minimal Threshold of the Dental Sign of Chronic Endemic Fluorosis" (mottled enamel)*Public Health Rep*.1935, 50:1719.
8. T. Aoba, O. Fejerskov. Dental Fluorosis Chemistry and Biology. *Crit Rev Oral Biol Med*. 2002; 13(2):155-170.
9. Fejerskov O, Larsen M J, Richards A, Baelum V. Dental tissue effects of fluoride. *Adv Dent Res*. 1994; 8(1):15-31.
10. D.Chakraborti, C.R.Chandra, G.Samanta, U.K Chowdhury, S.C Mukherjee, A.B.PAL. Pal, et al. Fluorosis in Assam-India. *Current Sciences*. 2000; 78(12):1421-1423.
11. Endemic fluorosis in Mexico, Fluoride, World Health Organization, Geneva. 2000; 30(4).
12. Fluorides and oral health. Report of a WHO Expert Committee on Oral Health Status and Fluoride Use. WHO Technical Report Series, Geneva WHO: 1994. 846.

13. UNICEF" Fluoride in water: An overview". <http://www.unicef.org/wes/fluoride.pdf>.
14. Dean H.Trendley. Endemic Fluorosis and Its Relation to Dental Caries. The Challenge of Epidemiology: Issues and Selected Readings, Pan America Health Organization (PAHO).2007; 271-278.
15. Haikel Y, Tiirlot JC, Cahen PM, Frank R. Periodontal treatment needs in populations of high-and low-fluoride areas of Morocco. J Clin Periodontol. 1989; 16:596-600.
16. Murray JJ. Gingivitis and gingival recession in adults from high-fluoride and low fluoride areas. Arch Oral Biol 1972; 17:1269-77.
17. Vandana KL, Sessa Reddy M. Assessment of periodontal status in dental fluorosis subjects using community periodontal index of treatment needs. Indian Journal of Dental Research 2007; 18(2): 67-71.
18. Reddey J, Parker JP, Africa CW, Stephen LX. Prevalence and severity of periodontitis in a high fluoride area in South Africa. Community Dent Oral Epidemiol 1985; 13:108-12.
19. D. RajaReddy, Srikanth R.Deme. Skeletal Fluorosis. www.medvarsity.com/vmu1.2/dmr/dmrdata/cme/fluorosis/Fluorosis.htm.
20. Fluorine and fluorides. Environmental Health Criteria 36, IPCS International Programme on Chemical Safety, WHO, 1984.
21. Grynypas MD, Fluoride effects on bone crystals. J Bone Miner Res 1990 Mar; 5 (1):169-175.
22. Mithal A, Trivedi N, Gupta SK, Kumar S, Gupta RK. Radiological spectrum of endemic fluorosis: relationship with calcium intake. Skeletal-Radiol. 1993, 22(4): 257-61.
23. Gupta SK, Gambhir S, Mithal A, Das BK. Skeletal scintigraphic findings in endemic skeletal fluorosis. Nucl-Med-Commun. 1993 May, 14(5): 384-90.
24. Wang Y, Yin Y, Gilula LA, Wilson AJ. Endemic fluorosis of the skeleton: radiographic features in 127 patients. AJR-Am-JRoentgenol. 1994 Jan, 162(1): 93-8.
25. Krishnamachri KA. Skeletal fluorosis in humans: a review of recent progress in the understanding of the disease. Prog Food Nutr Sci. 1986; 10(3-4):279-314.
26. S.S.Jolly, BUM. Singh, O.K. Mathur, and S.C Malhotra. Epidemiological clinical and biochemical study of endemic dental and skeletal fluorosis in Punjab. Br Med J.1968 November 16; 4(5628):427-429.
27. Sesikeran B, Krishnamurthy D, Harinarayana Rao S, Ramachandran EP, Raja Reddy D. Studies on skeletal muscle biopsies in endemic skeletal fluorosis. Neurol India 2000 April-June; 48(2): 187-188.
28. Reddy DR. Neurology of endemic skeletal fluorosis. Neurol India 2009; 57:7-12.
29. Gupta IP, Das TK, Susheela AK, Dasarathy S and Tandon RK (1992). Fluoride as a possible etiological factor in non-ulcer dyspepsia. J. Gastroenterol. Hepatol. 7:355-359.
30. Siddiqui AH (1970). Fluorosis in areas of India with a high natural content of water fluoride. Fluorides and human health. WHO Monograph No. 59,284-94.
31. Rohit Sharma, Anil Pandey, Shweta Jain, Abhilasha Walia. A review on water fluoride level in Rajasthan State. Dentalraj JIDA Rajasthan Branch. Issue 2; Sept. 2011:4-8.
32. Public Health Engineering Department, Rajasthan, Water Quality Survey Report (2000-01)

Call for Papers / Article Submission

Medico-Legal Update invites articles, case reports, newspaper clippings, report medico legal activities to update the knowledge of readers in scientific disciplines such as Forensic Medicine, Forensic Sciences, Environmental Hazards, Toxicology, odontology, Anatomy and law etc.

The following guidelines should be noted:

- The article must be submitted by e-mail only. Hard copy not needed. Send article as attachment in e-mail.
- The article should be accompanied by a declaration from all authors that it is an original work and has not been sent to any other journal for publication.
- As a policy matter, journal encourages articles regarding new concepts and new information.
- Article should have a Title
- Names of authors
- Your Affiliation (designations with college address)
- Abstract
- Key words
- Introduction or back ground
- Material and Methods
- Findings
- Conclusion
- Acknowledgements
- Interest of conflict
- References in Vancouver style.
- Please quote references in text by superscripting
- Word limit 2500-3000 words, MSWORD Format, single file

All articles should be sent to: **medicolegalupdate@gmail.com**

Our Contact Info:

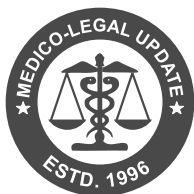
MEDICO-LEGAL UPDATE

Prof. R. K. Sharma Editor

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001
Mobile: 91-9971888542, Fax No: +91 11 3044 6500

Email: medicolegalupdate@gmail.com

Website: www.medicolegalupdate.org



MEDICO-LEGAL UPDATE

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001
Mobile: 91-9971888542, Fax No: +91 11 3044 6500

Email: medicolegalupdate@hotmail.com

Website: www.medicolegalupdate.org

CALL FOR SUBSCRIPTIONS FOR 2013

About The Journal

Print-ISSN: 0971-720X, Electronic - ISSN: 0974-1283, Frequency: Six monthly (2 issues per volume).

Medico Legal Update is a journal which brings latest knowledge regarding changing medico legal scenario to its readers. The journal caters to specialties of Forensic Medicine, Forensic Science, D. N. A. fingerprinting, Toxicology, Environmental hazards, Sexual Medicine etc. The journal has been assigned international standard serial number (ISSN) 0971-720X. The journal is registered with Registrar of Newspapers for India vide registration numbers 63757/96 under Press and Registration of Books act, 1867. The journal is also covered by EMBASE (Excerpta Medica Database) from 1997 and by INDEX COPERNICUS, POLAND.

Medico-Legal Update is a quarterly peer reviewed journal. The journal has also been assigned E- ISSN 0974-1283 (Electronic version). The first issue of the journal was published in 1996.

Journal Title	Pricing of Journals		
Medico-Legal Update	Print Only	Print+Online	Online Only
Indian	INR 7000	INR 9000	INR 5500
Foreign	USD 450	USD 550	USD 350

Note for Subscribers

Advance payment required by Cheque/demand draft in the name of "Medico-Legal Update" payable at New Delhi.

Cancellation not allowed except for duplicate payment.

Claim must be made within six months from issue date.

A free copy can be forwarded on request.

SEND REMITTANCE TO :
Prof. RK Sharma, Editor

MEDICO-LEGAL UPDATE

4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001
Mobile: 91-9971888542, Fax No: +91 11 3044 6500

Email: medicolegalupdate@gmail.com

Website: www.medicolegalupdate.org

Published, Printed and Owned : Dr. R.K. Sharma
Designed and Printed : Devtech Publishers & Printers Pvt. Ltd., Faridabad
Published at : 4th Floor, Statesman House Building, Barakhamba Road,
Connaught Place, New Delhi-110 001
Editor: Dr. R.K. Sharma, Mobile:91-9971888542, Fax No: +911130446500