Journal of Indian Academy of Forensic Medicine (JIAFM)

Printed and published by C. B. Jani and P. Harikrishna on behalf of Indian Academy of Forensic Medicine at Graphica Printers, GIDC Estate, VV Nagar388121, Gujarat.

ISSN 0971-0973 *J Indian Acad Forensic Med, 30(4)*

Journal of Indian Academy of Forensic Medicine

Volume 30 • Number 4 • October-December 2008

: Contents:

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ISSN 0971-0973 *J Indian Acad Forensic Med, 30(4)*

Journal of Indian Academy of Forensic Medicine

Volume 30 • Number 4 • October-December 2008

From the Editor's Desk

The last issue of present calendar year has been published timely as a result of continuous and collective efforts of contributors, review group and advisory board. The diverse themes in different articles are the result of vigor, interest and proactive approach of the contributors.

I have tried my level best to include majority of submissions of this year in the issue but a small number have been spared for subsequent issue.

I hope, many of the members must be eager to participate in academic feast- **" Forensic Medicon-2009"** at Nagpur. I request all the learned members to come forward with their valuable suggestions in context of the journal in the forum, in addition to academic deliberations.

C B. Jani
Editor

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Editor

Editorial

Indigenous "Reference Atlas cum Database" for age estimation

Age of individual is of paramount significance in many civil and criminal matters. Among the various age groups, most common age groups in question are age 16 and 18 years. Under the circumstance, investigating agency seek opinion of medical man, preferably a medicolegal expert, in the matter pertaining to the determination of age of individual. In many cases opinion about age of individual forms a pirate around which move the fate of the case. The scientific data pertaining to growth and development, especially, eruption and calcifications of teeth and process of ossification and fusion in various bones, cited in various text books forms basis of such exercise. However, in the case of *Ram Deo Chauhan v State of Assam*, Hon'ble court has observed that "***Too much reliance could not be placed upon textbooks of medical jurisprudence and toxicology while determining the age of accused***".[1]

As the data documented in any standard textbook of Forensic Medicine are procured from original work of different individuals and hence observations involving different population reflect variation in age group for fusion of a particular bone. Such variation has been attributed to environment, nutrition, health status and so on, which of course will vary from one person to another and in turn medico legal opinion can't be in form of a value, but a range. Under the circumstances the Honorable courts apply the ratio of "***Even other wise there can always be a difference of a year or two in assessment of age***..." laid down in case of *Natthal V. State of UP* [2]. In case of discrepancy between medico legal opinion and other evidences (School leaving certificate etc) , the later is considered more trustworthy (of course after a scrutiny and cross examination). Thus, practically there are restricted applications of medical knowledge in justice delivery system, as far as Forensic age estimation is concerned.

The prevailing scenario in context of reliability of age estimation parameters clearly demands some contemplation for all concerned. In other words, without excluding other scientific factors, such variation seems to be casually attributed to biological variations as stated above. The other possibility of such variations observed by different workers can be due to difference in the design of the research work. May be the criteria applied for fusion and or non-fusion may be different and subsequently subjective. For example, in a given case, where same x-ray film observed by different examiners, one may interpret recent union and another as complete union. The stage of recent union and complete union offers at times some difficulty even to the most experienced observer.[3] Subsequently, inference drawn about age may vary. In addition, the earlier work may be devoid of statistically significant tests for want of reorganization of Statistics as a well developed science then. But, the recent work by many scientists, have mention of such parameters like intra and inter class coefficient, coefficient of determination etc. and are safer to apply, if the statistically significant data of a populations in question is available.

Many eminent experts would agree that statically significant populations specific data is need of hour to include/ exclude the influence of factors like nutrition, hormonal status, geographical area, food habits etc. A reasonable number of scientists in the western world have started studying the applicability of Greulich-Pyle Atlas, Tanner and Whitehouse method and Thiemann- Nitz method [4]. Such reference atlas is compiled by serial radiological images of wrist with statistical back up. The observer compares the radiological image in question with that in the atlas and forms the opinion about age.

Furthermore, today, majority of tertiary care centers are equipped with digital imaging systems i.e. Digital X-ray techniques. It has many advantages over pre existing X-ray modality. It allows the observer to view a small area with magnification, measure the areas of interest, view bone window in "Invert Image" with altered contrast and brightness and also store an image in digital format. Such radiological images of trauma patients with known chronological age and other parameters can be utilized for any such research work. To begin with, such data can be of great help to evaluate applicability of a particular reference atlas (GP method etc). If, we come across some improvement in accuracy and precision for age estimation, the uphill task of developing an indigenous reference atlas for various Indian populations can be thought of. Thus, availability of digital imaging techniques coupled with statistically significant population specific database can help us in overcoming the hindrance in form of subjective factors and in turn, we can increase the objectiveness and uniformity in the exercise of age estimation.

Ending with hopes that the discipline of Forensic Medicine will bestow an excellent compilation of vital information useful to all the concerned involved in the exercise of age estimation and earn kudos of melioration.

I am sincerely thankful to **Dr. S.K. Roy Chaudhary** , Professor and Head, Department of Forensic Medicine, U.H.F.T. Medical College, Haldwani (Utranchal), who inspired me to share the theme of article with learned members.

References

1. Ram Deo Chauhan v State of Assam, AIR 2001 SC 2231.
2. Natthal v State of U.P., 1993 JIC, 696 [A I I]
3. **Krogman W M and Iscan Y M.** The Human Skeleton in Forensic Medicine. 2nd Ed. Charles C. Thomas, USA, 1986, pp.59-60.
4. **Schmidt S, Koch B, Schulz R, Reisinger W and Schmeling A.** Comparative analysis of the applicability of the Skeletal age determination methods of Greulich-Pyle and Thiemann- Nitz for Forensic age estimation in living subjects. *Int J Leg Med.* 2007;121(4):293-296.

C. B. Jani

Editor

Original and Paper

Analysis of vaginal swab examination vis-a-vis magnitude of rape in Punjab

D.C. Sharma, K.K. Aggarwal** & D.S. Bhullar****

Abstract

From analysis of data from vaginal swab examination of cases with alleged / suspected sexual assault received in Chemical Examination Laboratory of state of Punjab, it was observed that the pattern of crime of rape in the state was almost similar to that at the national level with maximum number of victims as unmarried girls and younger age children but with no age exemption. The prevention of crime must involve multi-pronged approach giving due weightage to the testimony of the victim as well as corroboration with medical evidence including vaginal swab examination and circumstantial evidence. The law needs further amendment by addition of a separate sub-clause for the elderly women. The chemical / forensic laboratories must be updated with latest techniques and equipment for elaborate analysis of the evidentiary exhibits sent for examination by trained personal in sexual assault cases.

Key Words: *Vaginal swabs, rape, spermatozoa, DNA fingerprinting, sexual assault, crime, semen, choline.*

Introduction

Sexual assault whether natural or unnatural, has been labelled to be the most condemned crime since time immemorial. Rape, the most common sexual assault on women is not a medical diagnosis as commonly known but a legally well-defined crime and usually occurring un-witnessed with testimony of the victim and assailant carrying more weightage. In spite of stringent measures taken against sexual crime, incidence of rape continuous to rise unabated all over the globe. Fifty one of every 1, 00,000 females in America were raped with one woman being raped every nine minutes[1]. Forensic scientists are often required to examine the vaginal swabs of the victim or seminal stains on the belongings of the victim as well as accused. Microscopic detection of spermatozoa in the stains is usually used as to confirm the presence of semen and thus scientifically corroborate an alleged sexual assault. But it is not always possible to demonstrate the presence of intact spermatozoa with certainty, not only in case of oligospermic or aspermic semen but also in cases of sterilisation for family planning and time lapse between occurrence of crime and laboratory examination[2]. The forensic medicine experts have a definite role to play in the investigations of sexual assault cases in establishing chain of evidence by corroborative medical evidence and analysis of the trace evidence results from forensic science laboratory, thus making conclusions more easy and possible by investigating authorities.

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Material & Method

Vaginal swabs of a total of 1118 cases / victims of alleged / suspected rape cases were received for examination for presence of sperms / spermatozoa in the Chemical Examination Laboratory of Punjab Government in the year 2005 and 2006. Out of these, a total of 1000 cases have been included in the present study for analyzing the same under various parameters.

Table -1 : Marital status

Marital Status	Number of cases	%
Married	165	16.5
Un-Married	823	82.3
Un Known	12	1.2
Total	1000	100

Table – 2 : District wise number of cases

Sr.No.	District	Number of cases	%	Population (% of state)	Incidence per lac of population
1	Amritsar	102	10.2	8.86	4.48
2	Bathinda	59	5.9	5.81	4.97
3	Faridkot	24	2.4	2.26	4.35
4	Fatehgarh Sahib	13	1.3	2.21	2.41
5	Ferozepur	67	6.7	7.17	3.23
6	Gurdaspur	91	9.1	8.64	4.37
7	Hoshiarpur	53	5.3	6.08	3.57
8	Jalandhar	103	10.3	8.06	5.30
9	Kapurthla	43	4.3	3.10	5.70
10	Ludhiana	182	18.2	12.45	6.03
11	Mansa	27	2.7	2.83	3.92
12	Moga	18	1.8	3.67	2.01
13	Muktsar	26	2.6	3.20	3.34
14	Nawan Shahar	23	2.3	2.40	3.91
15	Patiala	50	5.0	6.71	2.81
16	Ropar	31	3.1	2.58	3.97
17	Sangrur+Barnala	40	4.0	8.21	2.71
18	SAS Nagar	30	3.0	2.87	5.16
19	Tarn Taran	19	1.9	3.85	2.30
---	**TOTAL**	**1000**	**100**	-----	**3.85**

Total Population of Punjab state (as projected for 2006): 2, 59, 76000.

Table - 3: Age wise details of samples of vaginal swabs

Age Group	Number of cases	%
0 – 5 years	25	2.5
6 – 10 years	44	4.4
11 – 14 years	87	8.7
15 – 18 years	**415**	**41.5**
19 – 22 years	**232**	**23.2**
23 – 26 years	76	7.6
27 – 30 years	34	3.4
31 – 40 years	59	5.9
Above 40 years	28	2.8
TOTAL	**1000**	**100**

Table- 4 : District wise rate for spermatozoa positive cases

Sr.No	District	Total Number of samples sent	Number of sperm positive cases.	%
1	Amritsar	102	30	29.8
2	Bathinda	59	35	59.3
3	Faridkot	24	10	41.7
4	Fatehgarh Sahib	13	6	46
5	Ferozepur	67	30	44.8
6	Gurdaspur	91	25	27.5
7	Hoshiarpur	53	9	17
8	Jalandhar	103	32	31
9	Kapurthla	43	16	37.2
10	Ludhiana	182	79	43.4
11	Mansa	27	11	40.7
12	Moga	18	7	38.9
13	Muktsar	26	14	53.8
14	Nawan Shahar	23	10	43.5
15	Patiala	50	16	32
16	Ropar	31	9	29
17	Sangrur+Barnala	40	16	40
18	SAS Nagar	30	10	33
19	Tarn Taran	19	5	28
---	**TOTAL**	**1000**	**370**	**37**

Table- 5 : Age wise percentage of sperm positive cases

Age Group	% of positive cases.
0 – 5 years	39
6 – 10 years	26
11 – 14 years	21
15 – 18 years	42
19 – 30 years	35
31 – 40 years	**53**
Above 40 years	34

In the current study of samples from 1000 cases, 65 samples were received from cases of dead bodies where some kind of sexual offences against them were not ruled out. The vaginal swabs taken from dead bodies confirmed this in over 20% cases for the presence of spermatozoa (13 samples).

Observations

1. The number of cases of receiving vaginal swabs for examination was about FIVE times more in unmarried girls compared to married women indicating the incidence of alleged /suspected rape much more in unmarried female victims.
2. The highest incidence per lac population of receiving vaginal swabs was from district Ludhiana (6.03) followed by adjoining district of Kapurthla (5.70) and the lowest incidence was from district Moga (2.01) pointing some pockets reporting crime of rape with higher incidence compared to other parts in a given geographic area of human population in the state of Punjab.
3. Maximum number of vaginal swabs were received from the age group of 15-18 years

Table-6 : District wise details of samples in dead bodies

Sr.No	District	Number of cases	% of cases of sexual assault in the District.
1	Amritsar	9	8.9
2	Bathinda	2	3.4
3	Faridkot	6	25
4	Fatehgarh Sahib	1	7.7
5	Ferozepur	2	3
6	Gurdaspur	8	8.8
7	Hoshiarpur	2	3.8
8	Jalandhar	4	3.8
9	Kapurthla	00	0
10	Ludhiana	8	4.4
11	Mansa	2	7.4
12	Moga	1	5.6
13	Muktsar	2	7.7
14	Nawan Shahar	5	21.7
15	Patiala	8	16
16	Ropar	3	9.7
17	Sangrur+Barnala	1	2.5
18	SAS Nagar	00	0
19	Tarn Taran	1	5.3
---	**TOTAL**	**65**	**6.5**

Table-7: Age wise details of samples of vaginal swabs in dead bodies.

Age Group	Number of cases	%
0 – 5 years	02	3.07
6 – 10 years	01	1.53
11 – 14 years	03	4.61
15 – 18 years	05	7.69
19 – 22 years	11	16.92
23 – 26 years	11	16.92
27 – 30 years	05	7.69
31 – 40 years	**18**	**27.69**
Above 40 years	09	13.84
TOTAL	**65**	**100**

(41.5 %) followed by age group of 19-22 years (23.2%) and minimum samples were from age group of 0-5 years (2.5%).Thus, girls just before and during the age of marriage were most prone to the crime of rape.

4. The lowest age of the alleged rape victim in the current series was a female child of six months from district Ludhiana in the year 2005. Another female child of 8 months allegedly kidnapped for committing the crime (FIR U/S 366 IPC) was again from district Ludhiana. The lowest age of the female child who was allegedly raped and swabs were found positive for spermatozoa, was again from Ludhiana district.
5. The oldest female allegedly raped was a 70 years old woman from Kapurthla district and

on examination of the swabs in the laboratory it was found positive for the presence of spermatozoa. Another married woman of 70 years from District Mansa was allegedly murdered and rape was not ruled out before murder. But the swabs in this case were found to be negative in the laboratory.

6. No age seemed to be exempt to the alleged incidence of the crime of rape. The prevalence of the incidence in very extremes of the age i.e. minors and the old women when they are physical incapable to counter the alleged accused, indicates their tendency to make misuse of the helplessness of the victims.
7. Out of the total number of vaginal swabs examined, the incidence of positivity of the samples for presence of spermatozoa / sperm was 37 percent. The incidence of sperm positive samples was recorded as maximum from district Bathinda (59.3%) followed by district Mukatsar (53.8 %) and minimum incidence from district Hoshiarpur (17%). Out of the 19 districts in the state of Punjab, the incidence of sperm positive samples was reported above the average incidence from 11 districts.
8. Out of 1000 samples received, 65 (6.5%) were of dead bodies of which 13 samples (20%) were found positive for the presence of spermatozoa.
9. Out of the 65 samples from dead bodies, 18 samples (27.69%) were from the age group of 31-40 years followed by 11 samples (16.92%) each from age group of 19-22 & 23-26 years and minimum 1(1.53%) from group aged 6-10 years.
10. The Amritsar district reported highest percentage in the state i.e. 13.9% of total number of these victims (9 out of 65) whereas the highest proportional incidence has been reported in the Nawan Shahar district (5 out of 23 cases of sexual offences)
11. All the samples received for examination in the age group above 40 years in 65 dead bodies, were found negative for sperms.

Discussion

According to Crime Clock-2005 report of National Crime Records Bureau, one crime every three minutes against women, one case of molestation • every 15 minutes, one sexual harassment case every 53 minutes and one rape every 29 minutes were reported in the country. Out of all crimes, rape is the most heinous one against women. National capital is the least safe city for women, which accounted for 30% rapes recorded in the country's 35 major cities [3]. According to Government of India reports "Crime in India" rape cases rose from 9150 in year 1989 to 11242 in the year 1993 [4]. According to The Hindustan Times News agency (1988) 447 rape cases were reported from 12 metropolitan cities, during the year 1987, out of which Delhi alone accounted for 103 cases [5].

In a six year study of the pattern of injuries on the child victims of rape cases, it was observed that children of age group of 12-14 years are the most vulnerable to rape followed by age group of 7-9 years and number of child victims is increasing day by day in an alarming rate. Further, physical & genital examination of child victims of rape cases constitute the main bulk of medico-legal evaluation of assault victim, which has marked impact for legal proceeding against offenders. In a series of study, Kindermann G., Corsten P.M. and Massen V. in a Swiss Survey in 1996, found that about 40% of total victims of rape belonged to age group of 0-14 years amongst them lowest injury rate was found in the age 0-5 years and 6-10 year [6]. Sixty-nine victims of alleged rape in and around Imphal examined during the period of 1998-2003 indicated maximum percentage of the cases in the age group 12-20 years and unmarried with child victims constituting 29%. No age was free from this crime and opportunity and apathetic attitude of public are the most important contributing factors of the crime [7]. An analysis of 38 victims of rape, showed the incidence on decline in Manipur but increasing in children (44.7%). The incidence of rape was higher in rural areas (63.2%) compared to urban areas and 68.5% were the acquaintances as alleged or

accused [8]. Of all the violent acts, rape is the least reported one especially amongst child victims, as it has very bad repercussion to the family, to the victim and also due to the prevailing social stigma for rape victims. Even in Western countries only 10-15 % of rape incidents were reported to the police [9]. In 1991, 96% of female rape victims younger than 12 years old, knew their attackers. 20% were victimised by their fathers or stepfathers as per US Department of justice. Modern cultures condemn underage sex and regard it as a serious crime, based on the idea that children are not sufficiently mature to consent for sex and that sex with children is therefore rape[10]. Though all sexual offences on female children are not reported and do not come to light, yet there is an alarming and shocking increase in sexual offences committed on children. The conviction rate in rape cases is at its pitiable low of only 4-5% in India. Though rupture of hymen is not essential to confirm sexual intercourse in a case of rape, the courts are cautious in accepting every story of penetration without rupture as amounting to rape [11]. Rape is not a medical term, but a crime legally defined under Section 375 IPC with punishment for rape under Section 376 IPC with sub-Sections (A) to (D) prescribing penal punishment under various situations of commitment of crime including age of the victim if she is less than 16 years when sexual intercourse with or without consent amounts to the offence of rape. The victims of rape age between a child to an old woman indicating there is no specificity for the rapist of the age except for the opposite sex. Although law specifies lower age of crime for woman and for wife with quantum of punishment separately under its sub-sections, there is no mention of additional punishment for old women considered as senior citizens thus necessitating further amendment in Section 376 IPC. [12]

Microscopic detection of spermatozoa in the stains is usually used to confirm the presence of semen and thus scientifically corroborate an alleged sexual assault. But it is not always possible to demonstrate the presence of intact spermatozoa with certainty in case of oligospermic or aspermic semen, sterilisation for family planning or time lapse between occurrence of crime and laboratory examination. Spermatozoa can be identified and choline can be detected for a relatively longer duration when the stains are subjected to cold climate in closed environment. In any environmental condition, the spermatozoa and choline are found for a longer duration in seminal stains on natural fabrics as compared to synthetic fabrics [13]. The period of staining and immersion play a great role in the detection of spermatozoa in an immersed semen stain cloth. As spermatozoa could be detected in cotton clothes even up to 32 days of immersion, rape can be easily confirmed even in those cases where the victim is killed and thrown into water to avoid detection, provided semen was deposited on the clothing worn by victim. But when the stains are dry and fixed, they could be detected up to 3 days [14].

Conviction in rape cases depends solely on the basis of the credibility of the evidence of the victim; the other evidences are merely corroborative. [15]. Presence of spermatozoa in the vaginal secretion from the posterior fornix is a positive sign of rape in case of children and growing up virgins [16]. In one case of examination of the victim of sexual assault, in spite of delay in examination of the vaginal swabs taken from the posterior fornix of vagina of the victim, were found to be positive for spermatozoa by CSFL Hydrabad. Pollak (1943) reported presence of spermatozoa in the vagina from 30 minutes to 17 days and Morrison (1972) up to 9 days in vagina & 12 days in cervix. Motile spermatozoa can be found as long as 100 hours and non-motile for as long as 17 days [17].

Since its discovery in 1985, the DNA Fingertyping technique has been extensively used in many medico legal cases including sexual offences and rape. In most of the forensic cases the main goal is to assign positive identification of the evidentiary material with those of the putative suspects. It may not prove guilt but might throw more light on the evidence, which is the basic requirement in the court. It also needs to be remembered that DNA fingertyping only provides the proof of identity and not the proof of guilt – as was clearly observed in the famous trial of O.J. Simpson[18]. Since December 1993, the National Human Rights Commission has required

all District Magistrate / Superintendents of Police to report any instance of rape directly to it, within 24 hours of its occurrence, failing which, it will be presumed that an effort was being made to suppress the occurrence [19].

It is the spurt in the number of unmerited acquittals, recorded by the criminal courts, which give rise to the demand for death sentence to the rapists. The courts have to display a greater sense of responsibility and be more sensitive while dealing with charges of sexual assault on women. In the case State of Punjab V. Gurmit Singh, it has been held that a conviction can be founded on the testimony of the victim alone unless there are compelling reasons for seeking corroboration and the evidence of the victim of a sexual offence is entitled to great weight. Corroboration as a matter of prudence can be arrived at through circumstantial and or medical testimony. However there is no rule of law that corroboration is essential before there can be conviction on the evidence of the victim alone. Refusal to act on the testimony of a victim of rape and seeking corroboration as a precondition amounts to adding salt to injury. In another case of Shiekh Zakir V. State of Bihar, it was held that non production of the medical report would not be of much consequence if the other evidence on record is believable. In case of State of Karnatka V. Revannaiah, of rape on child, the court held that failure of the investigating officer to get the accused medically examined is not of significance when he was found to be a married man having two children. There was no need to get him medically examined to ascertain his potency. But that is not to say that medical evidence is unnecessary or irrelevant. Even where medical evidence is absent, the court has to arrive at a conclusion on an appreciation of all the relevant circumstances [20].The effects of rape are both physical & psychological. To help prevent the crime, girls must learn behaviour patterns of potential attackers, educate oneself about aspects of one's appearance and behaviour that might make one vulnerable to attack and learn self-defence techniques to help defend against an attack. [20]

Conclusion

1. By analysis of data from vaginal swab examination cases, it may be concluded that the pattern of crime of rape in the state of Punjab is almost similar to that at the national level with maximum number of victims as unmarried girls and younger age children but with no age exemption.
2. The prevention of crime must involve multi-pronged approach giving due weightage to the testimony of the victim as well as corroboration with medical evidence including vaginal swab examination and circumstantial evidence.
3. The law needs further amendment by addition of a separate sub-clause for the elderly women.
4. Special measures are needed be taken to check the crime in the pockets with higher prevalence in every population group.
5. The child and younger age victims need training for self-protection and identification of potential attackers. The increasing incidence of crime, less reporting rate of the same to the authorities and the pitiable low conviction rate, must be a cause of grave concern in the civilized society.
6. The chemical / forensic laboratories must be updated with latest techniques and equipment for elaborate analysis of the evidentiary exhibits sent for examination by trained personal in sexual assault cases.

References

1. **Tedeschi CG, Edeart WG & Tedeschi LG.** Forensic Medicine Vol. II, Physical Trauma: Rape, W.B. Saunders, 1977. p.939.
2. **Naik R S et al.** Factors governing detection of spermatozoa and choline in seminal stains. *J Forensic Med Toxicol*; 16(1): 11.
3. **Naidu TKK et al.** Study of Crime against Women: Role of Forensic Medicine; *J Indian Acad Forensic Med.* 2007; 29(1): 38.
4. **Chakarbarti N K.** Domestic Violence and crime against Women in India. *Indian J Criminol.*1998;27(1&2):17
5. Hindustan Times Nov. 4, 1988: Highest Dowry deaths in Delhi.

6. **Acharya S.** Pattern of injuries on Child Victims of Rape cases. *J Indian Acad Forensic Med.* 2000;22(2):29-32.
7. **Momonchand A et al**. Alleged Rape in and Around Imphal; *J Indian Acad Forensic Med.* 2003; 25(4): 147-149.
8. **Fimate L. et al**. Changing pattern of Rape in Manipur. *J Indian Acad Forensic Med.* 2001:23(1-6): 49.
9. **Denny Quadagno**. Human Sexuality. 2nd ed. St. Louis Mosby Year book Inc. 1992; p. 597.
10. **Kumar M P**. Sexual abuse over children; *J Karnataka Med Leg Soc.* 11(2): 34-35.
11. **Rodrigues E J**. Vulval Rape. *J Karnataka Med Leg Soc.9* (2): 24.
12. Indian Penal Code Act 1860.
13. **Fimate L.** Detection of spermatozoa from seminal stains immersed in water. *J Indian Acad Forensic Med.* 23(1-6) : 25-26.
14. In re Karichiappia Govindan, AIR 1942, Med.385; 33 Cr. L.J. 576; 199 IC 742.
15. **Gupta R L**. Medico Legal Aspect of Sexual Offences, 3rd edition Eastern Book Company p. 74.
16. **Knight B and Cox H W V.** Medical Jurisprudence and Toxicology, 5th edition 1987, the Law Book Company Pvt. Ltd. P. 371.
17. **Singh J R.** DNA fingerprinting in forensic and medico legal applications. *J Punjab Acad Forensic Med Toxicol.* 2001; 1(1): 22-29.
18. **Vij K**. Textbook of Forensic Medicine; 1st edition; p.p. 690-691.
19. **Aggarwal O P**. Evidence of doctor in Rape Cases not mandatory: Supreme Court. *J Indian Acad Forensic Med.* 2006;28(4): 170-171.
20. Doctor NDTV Newsletter, December 06, 2004.

Original and Paper

Cheiloscopy- Everything in nature is unique

P.N.Murkey, Seema Sutay**, I.L.Khandekar***, B.H.Tirpude**** & V.G.Pawar******

Abstract

The study of lip print pattern i.e. cheiloscopy which is done for the identification of an individual in the present trend of criminology where newer technologies are adopted by people including criminals, like using hand gloves to hide their finger prints. They may leave other clues viz. lip prints at the scene especially in a case of sexual assault over the body of the accused and victims, over cigarette butts and glasses etc. that cannot be hidden by the means. So, we have studied lip print pattern, the relationship of sex, fingerprints and blood group with lip print in 204 individuals of Sewagram of Maharashtra including 10 groups of twins.

Key Words: *Lip print, identification, finger print.*

Introduction

From childhood we have been ingrained with the concept that everything is different. Every person, every snow flake, in fact EVERYTHING in nature is unique. Every portion of friction of skin is unique, and every portion of non-friction ridge skin is unique. The processe of fetal formation dictate that detail within the patterns present on all human skin are formed under random and chaotic forces, and are therefore individual. How we apply that individually is the reason we say the answer IN PART is biological uniqueness. In criminal investigations the material evidence left at the scene of crime frequently useful data for investigation and identification materials such as blood, body fluids and hair and prints of finger, palms and soles have led to the solutions of many difficult cases Lip print on wine bottles, glasses or on the love letters have in some occasion helped identification of concerned persons. Lip print identification methodology, although seldom used, is very similar to finger print comparison and is a known and accepted from of scientific comparison. Le Moyne Snyder (1950) pointed out wrinkles and cracks of lips have certain individualistic characteristics like fingerprints. Santosh (1967) classified wrinkles and grooves of lips into simple and compound types and then subdivided them in 8 types for the purpose of personal identification.[1]

Kazuo Suzuki and Y Tsuchihashi [2,4] termed lip prints containing grooves as "*Figural linerom labiorum rubrorum*" and classifies them as:

Type I	Vertical, comprising of complete(end to end) longitudinal fissures/ patterns
Type I'	Partial length grooves of type I variety
Type II	Branching Y-shaped pattern
Type III	Intersecting pattern
Type IV	Reticular, chequred, fence like pattern.

Objectives Of The Study

1) To check whether there was any change in the lip print pattern of the same individual over a period of time.

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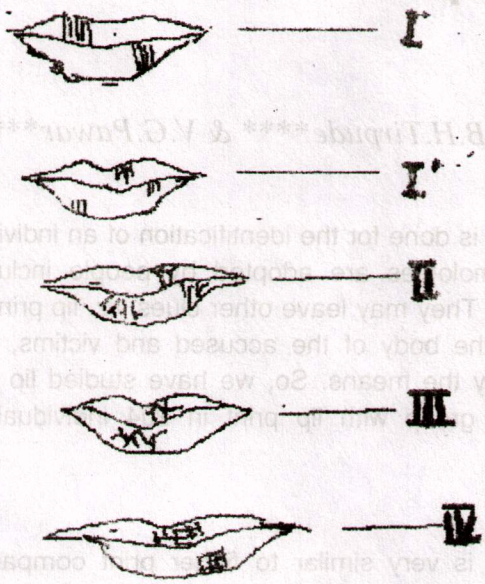

Figure-1 : Types of lip prints

2) To check whether there are any peculiar pattern in relation to sex of the individual.
3) To discover the most common pattern in the Indian (regional) population.
4) Relationship between fingerprint and lip print.

Material And Method

204 subjects of Sewagram and Wardha region were studied aged between 5-60 years. Diseased lips or lips with any abnormality were excluded because of their unsuitability for investigation. 10 groups of twins were examined. We followed 2 male and 2 female every 2 months for one year to see any change of pattern.

Dark red coloured frosted lipstick was used for printing on photo copy papers and it was observed and studied by magnifying lens and linen tester.

The lipstick was applied with single motion, evenly on the lips of each individual.

The subject was then asked to rub his/ her lips together to spread the lipsticks uniformly.

Prints were taken on a paper with center portion of lips dabbed first and then pressing it uniformly to the left and right corner of lips. Care was taken to avoid sliding of the lips to prevent smudging of the prints.

After acquiring the patterns of the subjects each of them was assigned then a number and studied carefully with a magnifying lens to analyze quadrant-wise denoting the type according to Suzuki classification.

Out of total 204 individuals (Male 100, females 104) including all age groups, we had classified the lip prints pattern as mentioned earlier by dividing each lip print into 4 quadrant by a horizontal line distinguishing the upper lip from lower lip (X-X') and median vertical line which divide the left and right sides of the lip(Y-Y'). These two lines were intersected at the right angle and each quadrant was further subdivided into 3 sub quadrants-a,b,c at 30°angels.That means each lip print was divided into 12 quadrants and in the same way total 2448 quadrants were studied in 204 cases represented as follows;

Observations

Table-1: Age and sex distribution of subjects

Age(Years)	Sex		Total
	Male	Female	
5-10	10	12	22
10-20	17	15	32
20-30	40	55	95
30-40	23	18	41
40-50	4	2	6
51-60	6	2	8
Total	100	104	204

Pattern of lip print:

We found each lip print on its own pattern, No two lip prints were identical.

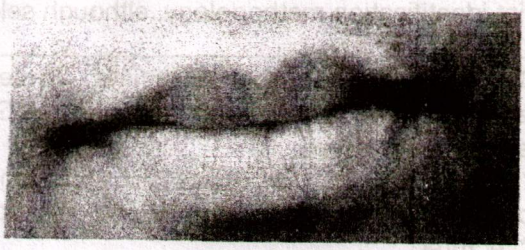

Figure – 2: Lipprint of an individual

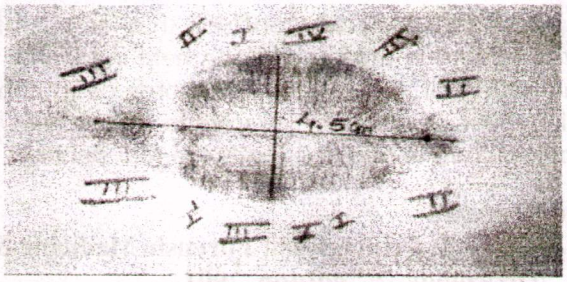

Figure-3 : Pattern of lipprint

quadrants it was different altogether. It was similar to their parents in few quadrants, but one or the other give different pattern. This was different from study by Y Tsuchihashi [2,4] in which they found similar lip prints in twins and their parents. Though size of samples for twins in our study was small but even one case of uniovular showing different pattern creates doubts for hereditary in lip prints identification.

Table-2: Pattern of lip print

Types	Type I	Type I'	Type II	Type III	Type IV	Total
Male	210(8.75%)	334(13.64%)	500(20.42%)	100(4.08%)	132(5.39%)	1276
Female	150(6.12%)	264(10.78%)	440(17.97%)	140(5.71%)	178(7.27%)	1172
Total	360(14.70%)	598(24.42%)	940(38.39%)	240(9.80%)	310(12.66%)	2448

We have found that Type II pattern is most common giving 940(38.39%) followed by Type I' i.e. 598 (24.42%) followed by Type I, IV and III having 360(14.70%), 310(12.66%) and 240(9.80%).

Finger prints of both hands and blood groups of individual were studied to detect any correlation with lip prints but we were unable to establish the same.

Discussion

"NO TWO LIP PRINTS WERE IDENTICAL. EACH HAS ITS OWN LIP PRINT PATTERN."- was the result observed in our study which was identical studies by others [2,3&4].

We found that Type II pattern is the most common (38.39%) followed by Type I' (24.42%) which is different from the study by Y Tsuchihashi[2,4] where type III pattern was most common. It may be because of racial variation in Indian population that is different from Japanese population.

Hereditary of lip print

Here, out of 6 pairs of twins 2 pairs were of uniovular type that was initially appeared same when we divided lip prints into 4 quadrants, but when they were studied in details in all 12

Prevalence of lip prints

The lip print of 4 adults (2 male & 2 female) were recorded routinely every month for one year for comparative study. No change was observed during this time. One of the individual out of this sustained trauma on upper lip. His lip prints were disturbed for one month while in healing phase. But after total recovery, pattern to its normal previous state, as similar coincidently with study of Y Tsuchihashi [2,4].

Differentiation between male and female lip prints

Differentiation between sexes with the help of lip print pattern was not be possible as opposed to study by Vahanwala [3] where they found Type Ii dominant in males in 2nd quadrant whereas Type I pattern is predominant in females in 3rd and 4th quadrant. In our study there was no such correlation, Type Ii and I was equally distributed in each quadrant. However, horizontal length of lip print from one angle to another showed average length in females 3.9-4.8cm while in males 4.5-5.7cm.

In study by Vahanwala [3] Type III was not found in 3rd and 4th quadrant at all, but we found Type III pattern in every quadrant in varying percentage.

Relation with blood group and fingerprints

We also tried to establish correlation of lip print with blood group and finger print but no positive conclusive opinion was found.

Conclusion

Type II pattern was most common in this population followed by Type I.

In cases of twins when we divided the pattern in 4 quadrants they appeared to show similar pattern among siblings and also one of their parents. But after dividing them into 12 quadrants they showed different patterns from each other. Hence it is necessary to study lip prints in details for proper identification.

Thus, lastly we conclude that, as each lip print pattern is unique and can help in identity of the individual. If, police keep records of lip prints with them along with fingerprints, it will help to solve the crime and can justify the real sinner.

References

1. Nandy A. **Principles of Forensic Medicine & Toxicology, 2nd edition, 2001.**
2. **Tsuchihashi Y.** Personal identification by means of lip prints. *Int J Forensic Sci.* 1974 ; 3: 233-248.
3. **Vahanwala S and Parekh B.K.** Study of lip prints as an aid to forensic methodology. *J Forensic Med Toxicol.* 2000;17(1) : 12-18.
4. **Suzuki H and Tsuchihashi Y.** Personal identification by means of lip prints. *Int J Forensic Sci.* 1970 ; 17: 52-57.

Corrigendum (For Vol.30, No.3)

1. Page- 130: 1st column, para-3, line-2: 0.80 mg% shall be read as 0-80 mg%.
2. Page-137: 2nd column- line-2- " I " shall be treated as deleted.
3. Page-137: 2nd column- line-4- "lega" shall be read as " legal ".
4. Page-137: 2nd column- line-5- " . " after and shall be treated as deleted.
5. Page-152: Illustration of second figure shall be read as " Figure-2".
6. Page- 155: Illustration for first figure- **" Figure-1: Hemopericardium visible before opening chest cavity"**
7. Page- 155: Illustration for second figure- **" Figure-2: Hemopericardium visible on opening pericardial cavity "**
8. Page- 156: Illustration for third figure- **" Figure-3: Hemopericardium layering anterior surface of heart"**

Original and Paper

Gender differentiation from sternal width

*D.K. Atal * A. Murari ** & S. K. Naik ****

Abstract

A post-mortem study was conducted to differentiate male and female sternum. A total of 100 sternums of adult individuals (56 males & 44 females) were obtained from the cases brought for autopsy to the Department of Forensic Medicine & Toxicology, Lady Hardinge Medical College, New Delhi between the periods August 2005 to March 2007. Our study concluded that the widths of manubrium and width of third sternebrae were not found useful for determining sex from sternum. However, by using width of first sternebrae, 71.42% male and 95.45% female sternums could be sexed correctly.

Key Words: *Strenal width, gender differentiation*

Introduction

Determination of sex from skeletal remains is important for identification of an individual in medico-legal cases. Determination of sex by examination of the skeletal remains is based upon the morphological and morph-metrical features present in the pelvis, skull, sternum and long bones. Studies for determination of sex from the various dimensions of adult sternum are rather limited. According to several workers, the dimensions of the sternum are definitely influenced by sex. However, some workers are of the opinion that it is of no practical value. The present study is an attempt to differentiate gender, on the basis of width of the sternum at different level.

Materials & Methods

The present study was carried upon 100 sternums obtained from known male and female (56 Male and 44 Female) dead bodies brought for medico-legal autopsy. As sex differentiating features in the bones are well marked only after puberty and pieces of mesosternum complete fusion by the age of 25 years, sternums of individuals above 25 years of age were taken for the present study. The various dimensions were measured using Helio's Dial Caliper, which gives more accurate reading, up to 1/100 of mm. The following dimensions of sternum were measured in millimeters & evaluated.

1. Width of manubrium (W)
2. Width of first sternebrae (W_1)
3. Width of third sternebrae (W_3)

The data obtained was analysed statistically to find out the range, the mean and standard deviation. The p value was determined to find out whether the sexual differences between means were significant or not. The data was also analysed statistically to find out the number of cases lying in overlapping zones and to find out the reliability of each and every parameter separately.

Observations and results

The results of various measurements of sternum of the present study are shown in Table No. I & II.

Width of manubrium

The mean widths of manubrium were found 40.718 and 35.80 for males and females respectively. The level of significance of the difference between the means was statistically highly significant ($p< 0.001$) for the width of manubrium (Table I, Graph-I).

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Table –1: Measurement of the sternal width in two sexes

Parameters	Sex	Range (mm)	Mean (mm)	S.D.	Level of significance for the difference between the means
Width of Manubrium (W)	M	34-45	40.718	2.68	P < 0.001
	F	29-45	35.800	4.07	
Width of first sternebrae (W_1)	M	22-33	25.877	2.01	P < 0.001
	F	18-25	21.928	1.64	
Width of third sternebrae (W_3)	M	25-40	28.518	2.64	P < 0.001
	F	21-29	24.664	1.95	

Table –2: Number and percentage of cases falling in overlapping zone

Parameters	Sex	Number of cases in overlapping zone	Percentage of cases in overlapping zone
Width of Manubrium (W)	M	55	98.21
	F	8	18.18
Width of first sternebrae (W_1)	M	16	28.57
	F	2	4.54
Width of third sternebrae (W_3)	M	45	77.58
	F	16	36.36

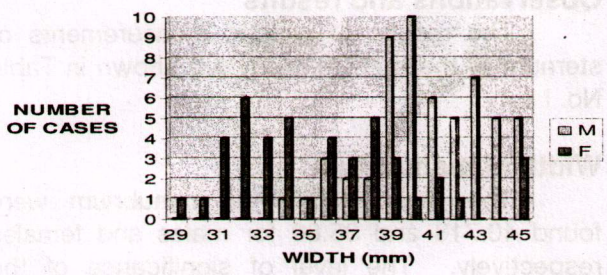

Figure-1: Width of manubrium

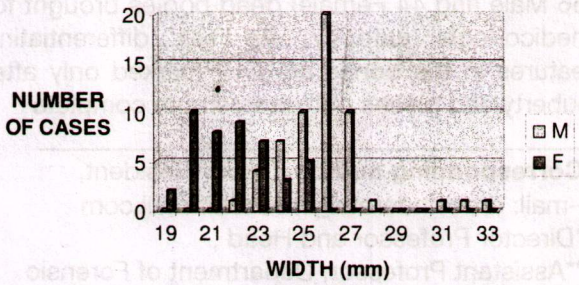

Figure-2 : Width of first sternebrae

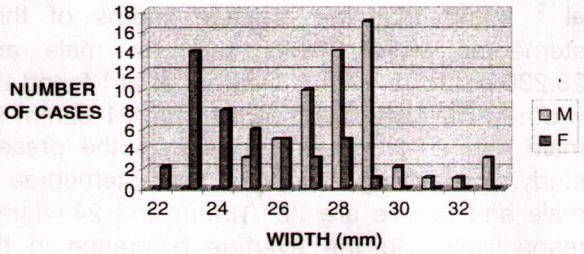

Figure-3 : Width of third sternebrae

Out of 56 male cases, 55 male cases (98.21%) were lying in overlapping zone. Also out of 44 female cases, 8 cases (18.18%) were lying in overlapping zone. Only 1 male and 36 female cases were present outside this overlapping zone (Table II, Graph-I).

In spite of significant p value ($p<0.001$), due to considerable overlapping, the width of manubrium could not be considered as a reliable parameter for sternal sex determination.

Width of first sternebrae:

The mean widths of first sternebrae were 25.877 and 21.928 for males and females respectively. The level of significance of the difference between the means is statistically highly significant ($p<0.001$) for width of first sternebrae (Table I, Graph-II).

In 40 male sternums, the width of first sternebrae was more than 24.91mm which was the maximum width of fist sternebrae recorded in the female specimens. While in case of 23 female sternums, it was less than 22.12 mm which was the smallest width of first sternebrae in a male sternum (Table II, Graph-II).

So, it was found that the width of first sternebrae was a reliable parameter in determining sex of the sternum.

Width of third sternebrae:

The mean widths of third sternebrae were 29.518 and 24.664 for males and females respectively. The level of significance of the difference between the means is statistically highly significant ($p< 0.001$) for width of first sternebrae (Table I, Graph-III).

Out of 56 male cases, 45 male cases (77.58%) were lying in overlapping zone. Also out of 44 female cases, 16 cases (36.36%) were lying female cases were present outside this overlapping zone (Table II, Graph-III).

So, it was found that the width of third sternebrae could not be considered as a reliable parameter for sternal sex determination.

Discussion

The observations of various workers regarding the gender differences in width of manubrium and mesosternum are given in the Table No. III.

Table -3: Observations of various workers in comparison to present study

Parameters	Sex	Jit et al (1980)[2]	Dahiphale et al (2002)[3]	Gautam et al (2003)[1]	Present study
Width of Manubrium (W)	M	--	--	38-72	40.718
	F	--	--	41-68	35.800
Width of first sternebrae (W_1)	M	27.45	27.166	21-62 (width of body of sternum)	25.877
	F	24.32	24.444	24-51 (width of body of sternum)	21.928
Width of third sternebrae (W_3)	M	32.58	31.947	--	28.518
	F	29.19	28.236	--	24.664

Width of manubrium

According to Gautam et al [1], the width of manubrium ranges from 38-72 mm for male and 41-68mm for female. In the present study, the average width of manubrium in male and female are 40.718 mm and 35.800 mm respectively. So the average difference in the width of manubrium is 4.910mm, which is statistically highly significant ($p<0.001$). For this parameter, 55 (98.21%) males and 8(18.18%) females lie in overlapping zone (Table-II, Graph-I). Hence, it is a not useful parameter in determining the sex of sternum. This is in accordance with the observations of Gautam et al [1].

Width of first sternebrae:

According to Jit et al [2], the mean widthof first sternebrae were 27.45mm for male and 24.32mm for female respecitively. Dahiphale et al found that the average widths of first sternebrae were 27.166mm for male and 24.444mm for female, Gautam et al[1] found the width of mesosternum ranges from 21-62mm for male and 24-518mm for female. In the present study, the average width of first sternebrae in male and female are 25.877mm and 21.928mm respectively. So the average difference in the width of first sternebrae is 3.949mm which is statistically highly significant ($p<0.001$). For this parameter, 16 (28.57%) males and 2 (4.54%) females only lie in overlapping zone (Table-II, Graph-II) whereas rest 40 (71.42%) male cases and 42 (95.45%) female cases lie outside the overlapping zone. Therefore, this parameter can be used for determining sex of the individual from sternum. This is not in concordance with the observations of Jit et al[2], Dahiphale et al [3]and Gautam et al[1].

Width of third sternebrae:

According to Jit et al [2], the mean widths of third sternebrae were 32.58mm for male and 29.19mm for female respecitively. Dahiphale et al [3] found that the average widths of third sternebrae were 31.947 mm for male and 28.236mm for female. Gautam et al [1] found the width of mesosternum ranges from 21-62mm for male and 24-51mm for female. In the present study, the average width of third sternebrae in male and female are 28.518mm and 24.644mm respectively. So the average difference in the width of first sternebrae is 3.874mm which is statistically highly significant ($p<0.001$). For this parameter, 45(80.35%) males and 16(36.36%) females lie in overlapping zone (Table- II, Graph-III). Hence, it is not a useful parameter in determining the sex of sternum. This is in accordance with the observations of Jit et al [2], Dahiphale et al [3]and Gautam et al [1].

Conclusions

1. Width of first sternebrae could be used in gender differentiation from sternum. The average width of first sternebrae in male and female are 25.877mm and 21.928mm respectively.
2. Width of manubrium and width of third sternebrae were found to be unreliable in sex determination.

References

1. **Gautum RS, Shah GV, Jadav HR and Gohil BJ.** The Human Sternum –As an Index of Age and Sex. *J Anatomical Soc India.* 2003; 52(1):20-3.
2. **Jit I, Jhingan V and Kulkarni M.** Sexing the human sternum. *Am J Phys Anthropol.* 1980; 53(2): 217-24.
3. **Dahiphale VP, Baheete BH and Kamkhedkar SG.** Sexing the Human Sternum in Marathwada Region. *J Anatomical Soc India.* 2002; 51(2): 162-7.

Original and Paper

Day, week and month of suicide by hanging

Tanuj Kanchan

Abstract

Seasonal asymmetry in suicide is a long observed phenomenon. Seasonal vulnerability to suicides that is suggested to be biologically determined is often related to climatic factors. Weather conditions are fairly uniform throughout the year in the southern west coastal region of India. This retrospective review was aimed at finding an association of suicide by hanging with day, week and month of the year. The study revealed that suicides by hanging in males and females are more common in the latter half of the month. In males, hanging was predominantly observed during mid - week days, and second quarter of the year. Pattern of hanging in females was however uniform.

Key Words: *Suicide, hanging, seasonal variations.*

Introduction

Hanging is one of the most popular methods of suicide worldwide and one of the preferred methods of suicide among males and females in southern India [1]. It has been shown that the latitude and climatic factors, such as day length, daily temperature, daylight, and humidity may influence mood [2,3]. Seasonal asymmetry in suicide is a long observed phenomenon and possible association of the seasonal distribution in completed and attempted suicides have long been studied [4-6]. It has been suggested that seasonal vulnerability is biologically determined and associated with the circannual rhythm of central serotonin neurotransmission [7]. Weather conditions in coastal regions differ from other regions; the predominant seasons' being summers and monsoons, and climate is hot and humid during most part of the year. This retrospective review is done in the west coastal part of southern India to study the possible association of suicidal hanging with day, week, and month of the year to elaborate on a very valid research question; when do people commit suicide by hanging? The aim of this preliminary study is to find the high-risk periods of suicide by hanging.

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Material and Method

This study is a registry based descriptive research on suicidal hanging mortalities during the year 2007. The study was carried out at the Government District Wenlock Hospital (GDWH), Mangalore, India. The GWDH caters to more than 90 % of all medigolegal autopsies conducted in cases of unnatural deaths in Mangalore Taluk of southern west coast of India[8]. All medicolegal autopsy case records from January 2007 to December 2007 were retrospectively reviewed and deaths from suicidal hanging were analysed. Gender differences in suicides have been reported earlier [9,10] hence trends were studied separately for males and females.

Results and discussion

A total of 628 autopsies were conducted at the Government District Wenlock Hospital (GDWH), Mangalore, India during the year 2007. A total of 70 cases of suicides by hanging were autopsied at the aforementioned centre during the study period. Suicide by hanging amounted to 11.1% of the total autopsies and suicide rate by hanging in the region was approximately 12.9 per lakh population. Majority of the victims were males (n=53,75.7%). Male-female ratio was 3.1:1.

The age of the victims ranged from 17 to 82 years, mean age of the victims being 38.9 years. Peak incidence was seen in the 4th decade of life. Third to 5th decades were the most affected age groups, together accounting for 75.7% (n=53) of the total hanging deaths (Table 1).

Maximum male and female suicides were reported in the latter half of the month (54.7% and 58.8% in males and females respectively). When each month was subdivided into four quarters a gradual rise in suicides was evident with maximum suicides occurring in the last quarter (Figure 1). Among males, maximum suicides (n=14, 32.5%) were interestingly reported on mid weekday (Wednesday) that was followed by a gradual decline with minimum suicides being committed on Tuesdays. A relatively uniform pattern was however evident for female suicides (Figure 2). Peak in suicides on Wednesdays observed in our study is in contrast to other studies from the western part of the globe that report predominance of weekend suicides. Burns observed 38.33% suicides during the weekend days, Saturday and Sunday[11] ,while Bradvik observed that 31% of all suicides occurred on Sundays[12]. The weekend suicides have been associated with employment status and alcohol misuse[13]. In another study Bradvik et al. noted a suicide peak after weekends and holidays in patients with alcohol dependence [14]. Weinberg et al.[15] reported an increase in suicide rate on the first working day following the weekend among Israel Defense Force soldiers. No such factor could be established and reasons for peak of suicidal hangings on Wednesdays in our study remain a mystery. Ours is mostly a monthly remuneration system with salary distribution occurring in the first week of every month. Suicides by hanging in our study increased as the month progressed and maximum suicides were reported during latter part of the month. Although employment status of the victims in our study could not be studied owing to the retrospective nature of the research, financial crisis during the month end appears to be a possible precipitating factor in suicidal hanging.

Month wise distribution of hanging fatalities is shown in figure-3. Peak incidence of suicidal hanging among males in June (n=8, 15.1%) and females in September (n=5, 29.4%) is reported. Overall 55.7% of the hanging deaths (n= 39) occurred during first half of the year (January to June). Maximum suicides (n=18, 34%) are reported during the second quarter of the year (April- June) in males, whereas pattern of suicidal hangings was fairly uniform in females. Findings of earlier studies on month wise distribution of suicides are inconclusive. Burns [11] reports a peak in the number of suicides during the month of July, and a cluster occurring during the months September to December while Bradvik[12] demonstrated maximum male suicides during October and November. A study from South Africa reports maximum hangings in November and minimum during September[16]. Based on time-honored classification of seasons in the region (October to January- Winters; February to May- Summers; June to September- Monsoons) no seasonal variations in suicidal hangings were observed. Findings of studies done to relate season and suicides vary from region to region[17,18]. Preti et al highlighted that a more definite pattern of seasonal variation was associated with the more violent methods of suicide [7]. No seasonal variations were evident for suicidal hanging, a violent method of suicide among males and females in our study, probably because of more or less uniform climatic conditions throughout the year.

Pattern of female suicides was fairly uniform for the examined variables that could be due to a significantly lesser number of female suicides by hanging during the study period. This is a preliminary one-year retrospective study from a west coastal region of southern India that figures out the vulnerability of males to suicides on Wednesdays, end of the month and second quarter of the year. Authors even suggest that weekly remuneration system can bring down suicides. Hence more prospective studies with analysis of other cofactors viz. employment status, financial burden at the end of the month,

disease and depression need to be elaborated from different regions to confirm the findings of the study. Similar studies for other methods of suicide are also proposed.

References

1. **Kumar TS, Kanchan T, Yoganarasimha K and Kumar GP.** Profile of unnatural deaths in Manipal, Southern India 1994- 2004. *J Clin Forensic Med.* 2006; 13: 117-120.
2. **Potkin SG, Zetin M, Stamenkovic V, Kripke D and Bunney WE.** Seasonal affective disorder: prevalence varies with latitude and climate. *Clin Neuropharmacol.* 1986; 9: 181-183.
3. **Lambert GW, Reid C, Kaye DM, Jennings GL and Esler MD.** Effect of sunlight and season on serotonin turnover in brain. *Lancet.* 2002; 360: 1840-2.
4. **Chew KS and McCleary R.** The spring peak in suicides: A cross-national analysis. *Soc Sci Med* .1995; 40: 223-230.
5. **Preti A.** Seasonal variation and meteotropism in suicide. *Curr Opin Psychiatry.* 2000; 13: 655-660.
6. **Preti A and Miotto P.** Seasonality in suicides: the influence of suicide method, gender and age on suicide distribution in Italy. *Psychiatry Res.* 1998; 81: 219-231.
7. **Preti A, Miotto P and De Coppi M.** Season and suicide: recent findings from Italy. *Crisis.* 2000; 21: 59-70.
8. **Shetty BSK and Shetty M.** Epidemiology of drowning in Mangalore, a coastal Taluk of South India. *J Forensic Leg Med.* 2007; 14: 410-415.
9. **Kanchan T and Menezes RG.** Suicidal poisoning mortalities in Southern India: gender differences. *J Forensic Leg Med.* 2008; 15: 7-14.
10. **Kanchan T and Menezes RG.** Suicidal hanging in Manipal, South India - Victim profile and gender differences. *J Forensic Leg Med.* 2008. (In press).
11. **Burns A, Goodall E and Moore T.** A study of suicides in Londonderry, Northern Ireland, for the year period spanning 2000–2005. *J Forensic Leg Med.* 2008; 15: 148-157.
12. **Bradvik L.** The occurrence of suicide in severe depression related to the months of the year and the days of the week. Eur Arch Psych Clin Neurosci 2002; 252: 28-32.
13. **Pirkola S, Isomatsa E, Heikkinen M and Lonnqvist J.** Employment status influences the weekly patterns of suicide among alcohol misusers. *Alcohol Clin Exp Res.* 1997; 21: 1704-1706.
14. **Bradvik L and Berglund M.** A suicide peak after weekends and holidays in patients with alcohol dependence. *Curr Opin Psychiatry.* 2003; 33:186-191.
15. **Weinberg I, Lubin G, Shmushkevich M and Kaplan Z.** Elevated suicide rates on the first workday: a replication in Israel. *Death Stud.* 2002; 26: 681-688.
16. **Meel BL.** A study on incidence of suicide by hanging in the sub-region of Transkei, South Africa. *J Clin Forensic Med.* 2003; 10: 153-157.
17. **Kalediene R, Starkuviene S and Petrauskiene J.** Seasonal patterns of suicides over the period of socio-economic transition in Lithuania. *BMC Pub Health.* 2006; 6: 40.
18. **Mohanty S, Sahu G, Mohanty MK and Patnaik M.** Suicide in India- A four year retrospective study. *J Forensic Leg Med.* 2007; 14: 185-189.

Table- 1: Age distribution of victims

Age (years)	Male (n, %)	Female (n, %)	Total (n, %)	M: F
< 19	01, 01.9%	03, 17.6%	04, 5.7%	1: 3
20-29	11, 20.8%	05, 29.4%	16, 22.9%	2.2: 1
30-39	15, 28.3%	04, 23.5%	19, 27.1%	3.8: 1
40-49	15, 28.3%	03, 17.6%	18, 25.7%	5: 1
50-59	08, 15.1%	--, --	08, 11.4%	--
>60	03, 5.7%	02, 11.8%	05, 7.1%	1.5: 1
Total	53, 100%	17, 100%	70, 100%	3.1: 1

Figure- 1: Distribution of suicidal hangings in a month

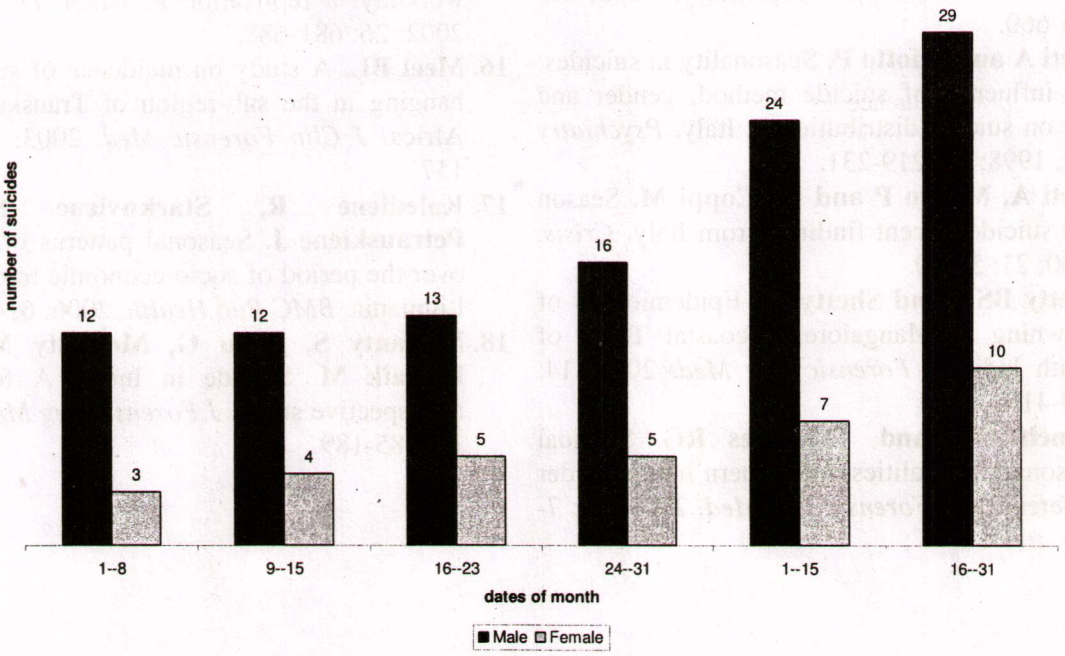


Figure -2: Distribution of suicidal hangings in a week

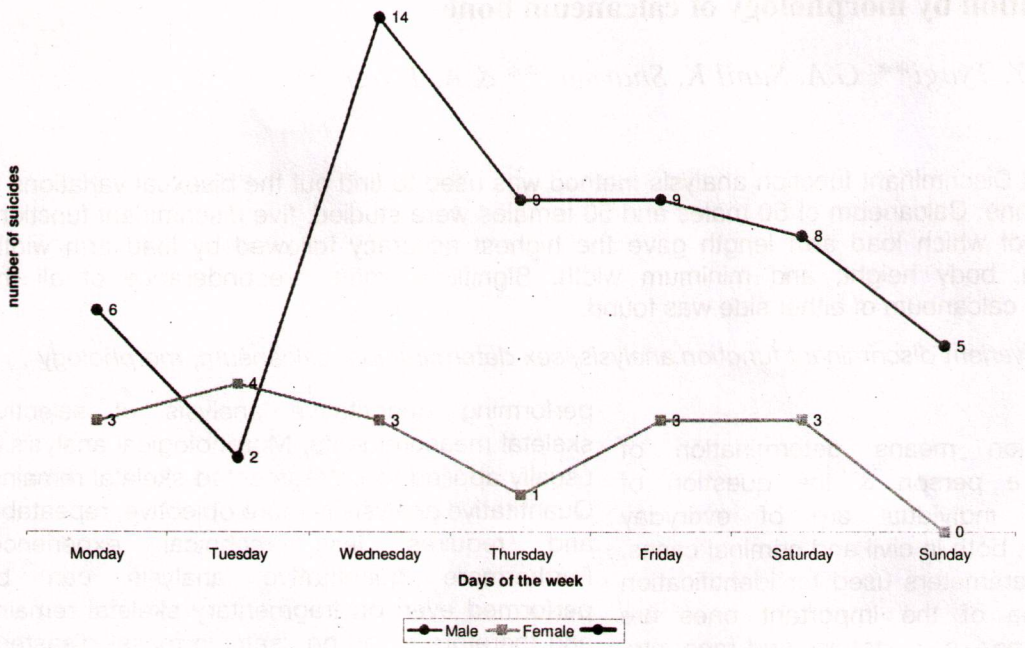
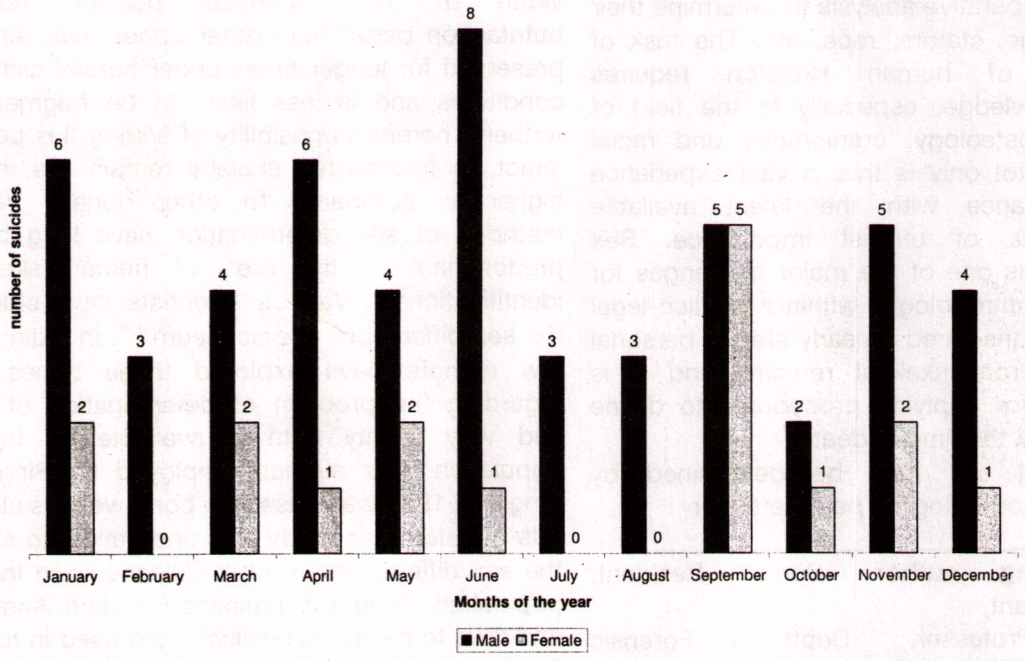


Figure- 3: Distribution of suicidal hangings throughout the year 2007



J Indian Acad Forensic Med, 30(4)

Original and Paper

Sex determination by morphology of calcaneum bone

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Abstract

Univarient Discriminant function analysis method was used to find out the bisexual variations in the calcaneum bone. Calcaneum of 50 males and 50 females were studied, five discriminant functions were generated of which load arm length gave the highest accuracy followed by load arm width, maximum length, body height, and minimum width. Significant male preponderance of all the measurements in calcaneum of either side was found.

Key words: *Univarient discriminant function analysis, sex determination, calcaneum, morphology .*

Introduction

Identification means determination of individuality of a person & the question of identification of individual are of everyday occurrence in life, both in civil and criminal cases. Out of various parameters used for identification of person, some of the important ones are determination of age, sex, stature, and race, etc. Human bones have long been explored all over the world, mainly by anatomists, physical anthropologists and physicians, all of them having interest in comparative analysis to determine their origin, sex, age, stature, race, etc. The task of identification of human skeleton requires thorough knowledge, especially in the field of comparative osteology, craniometry and racial morphology. Not only is this, a vast experience and acquaintance with the latest available statistical data of utmost importance. Sex determination is one of the major challenges for the forensic anthropologist within a medico-legal context; it is considered an early step in personal identification from skeletal remains and it is indispensible for applying procedures to define race and age at the time of death [1].

Skeletal sex may be determined by studying the morphological parameters or performing quantitative analysis of selective skeletal measurements. Morphological analysis is usually applied to unfragmented skeletal remains. Quantitative analysis is more objective, repeatable and requires less technical experience. Furthermore quantitative analysis can be performed even on fragmentary skeletal remains and therefore it can be useful in mass- disasters, natural calamities, charred bodies and criminal cases.

Calcaneum is a small, stout bone, and by virtue of its anatomical position resists putrifaction better than other bones, can remain preserved for longer times under natural climatic conditions and is less likely to be fragmented further. Therefore possibility of finding this bones intact, in fragmented skeletal remains, is much higher as compared to other bones. Visual methods of sex determination have long been predominant in the area of human skeletal identification[2,3,4]. Various scientists have studied the sex differences in calcaneum [5-9]. In India very few authors have explored these bones, as regarding the problem of determination of sex and very scanty data is available for Indian population. The method employed by Singh & Singh[6] in 1975 was based on bone weights alone. It is therefore this study was undertaken to study the sex differences in adult Calcaneum in Indian population using Discriminant Function Analysis and thus to be made available and used in future for determination of sex.

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Material & method

The study was conducted in the Department of Forensic Medicine, University College of Medical Sciences and Guru Teg Bahadur Hospital, New Delhi. The material was collected from the dead bodies coming for medico-legal autopsies in the mortuary of Guru Teg Bahadur Hospital during year 2002 to 2004.The informed consent, was taken from the relatives before taking out the bones from the dead bodies. The Calcaneum of 100 persons (50 males and 50 females), all adults, were taken out of the dead bodies. Deceased having any deformity or pathology of bone were not included in the study. Immediately after removal, permanent and indestructible tags were put on the bones. The bones were first cleaned by blunt dissection taking utmost care, so that no injury is caused to the bone. The bones were then buried under the soil for 6-8 weeks to separate the remaining soft tissues attached to the bone, in natural climatic conditions in which bones are usually found. After 6-8 weeks the bones were removed from the soil, washed with tap water and then air- dried. All measurements of calcaneum bone were taken by standardized anthropometric caliper graduated to 0.1mm on anthropometric board.

Measurements of calcaneum

Five measurements of calcaneum were taken [7].

1. Maximum Length (Max.L): The fixed arm of the sliding caliper was applied to the most posterior point of the calcaneum tuberosity. The movable arm was brought into contact with the most antero-superior point of the calcaneum over its articular surface for the cuboid. The caliper was rotated from side to side to achieve maximum length.
2. Body Height (BH): The fixed arm of the sliding caliper was applied to the most inferior point of the calcaneum tuberosity. The movable arm was brought into contact with the most superior point of its posterior talar articular surface. The caliper was rotated from side to side to achieve maximum height.
3. Minimum Width (Min.W): The arms of the sliding caliper were applied to the medial and lateral surfaces of the calcaneum. The caliper was rotated from side to side to achieve maximum transverse diameter.
4. Load Arm Length (LAL): The fixed arm of the sliding caliper was applied to the most posterior point of calcaneum over posterior talar articular surface. The movable arm was brought into contact with the most antero-superior point of its articular surface for the cuboid.
5. Load Arm Width (LAW): The arms of the sliding caliper were applied to the most medial point on the sustentaculum tali and the most lateral point on its posterior talar articular surface.

In the present study Univarient Discriminant function analysis(DFA) was used where the individual measurement taken is used as one function.

The DFA equation **Y =MX +C**, where Y is the Discriminant function score, M is the coefficient, X is the magnitude of the variable in millimeters, and C is the constant. The sectioning point in each equation is taken as 0 (zero). The positive values of Y indicate bone to be male and negative values of Y indicates a female bone.

Table-1: Range, mean, S.D of parameter maximum length of calcaneum bone

Male			**n=50**	**Female**		**n=50**
Side	Range	Mean	S.D.	Range	Mean	S.D.
Right	71.50-86.00	79.34	3.87	66.10-75.60	71.31	2.23
Left	71.00-86.00	79.21	3.89	66.40-75.40	71.21	2.34

Table-2: Range, mean, S.D of Parameter body height of calcaneum bone

Male			n=50	Female		n=50
Side	Range	Mean	S.D.	Range	Mean	S.D.
Right	42.10-65.00	50.24	4.54	40.00-50.80	44.20	2.68
Left	45.00-56.00	49.40	6.37	39.00-51.60	43.80	3.81

Table-3: Range, mean, S.D of parameter minimum width of calcaneum bone

Male			n=50	Female		n=50
Side	Range	Mean	S.D.	Range	Mean	S.D.
Right	21.00-30.00	26.43	3.74	19.10-26.90	24.23	1.92
Left	19.50-30.00	27.18	5.90	19.00-26.70	24.46	3.19

Table-4: Range, Mean, S.D of Parameter Load Arm Length of calcaneum bone

Male			n=50	Female		n=50
Side	Range	Mean	S.D.	Range	Mean	S.D.
Right	44.30-52.50	48.62	2.22	38.00-48.00	41.89	2.37
Left	43.00-53.40	48.23	2.43	37.40-48.10	41.99	2.30

Table-5: Range, mean, S.D of parameter load arm width of calcaneum bone

Male			N=50	Female		N=50
Side	Range	Mean	S.D.	Range	Mean	S.D.
Right	36.70-45.60	41.36	1.97	28.00-39.00	35.10	2.95
Left	36.80-47.00	41.17	2.17	28.10-39.10	35.40	3.07

Table-6: Equation of univarient discriminant function analysis

Bone	S. No.	Parameter	Coefficient	Constant	Sectioning Point	Accuracy
RT. CALCANEUM	1. LAL	Y=(LAL) X	0.436 +	-19.707	0	93%
	2. LAW	Y=(LAW) X	0.399 +	-15.236	0	90%
	3. Max. L	Y=(Max. L) X	0.317 +	-23.869	0	90%
	4. BH	Y=(BH) X	0.268 +	-12.664	0	87%
	5. Min. W	Y=(Min.W) X	0.337 +	-8.534	0	65%
LT. CALCANEUM	1. LAL	Y=(LAL) X	0.422 +	-19.058	0	93%
	2. Max. L	Y=(Max. L) X	0.311 +	-23.418	0	91%
	3. BH	Y=(BH) X	0.191 +	-8.882	0	89%
	4. LAW	Y=(LAW) X	0.376 +	-14.389	0	86%
	5. Min. W	Y=(Min.W) X	0.211 +	-5.445	0	66%
LT. CALCANEUM	1. LAL	Y=(LAL) X	0.422 +	-19.058	0	93%

Observation and discussion

It is observed that Maximum length is more on right side in males, ranging from 71.50 mm to 86.00 mm with a mean of 79.34 mm, as compared to left side having a range of 71.00 mm to 86.00 mm with a mean of 79.21 mm. The same was found to be more on left side in females with range of 66.40 mm to 75.40 mm with a mean of 71.21 mm as compared to right side having a range of 66.10 mm to 75.60 mm with a mean of 71.31 mm. The measurement is significantly more on either side, in males as compared to females.

Univarient Discriminant function equation derived for Maximum Length is

For right side Y = (Maximum Length) (0.317) + (-23.869)

For left side Y = (Maximum Length) (0.311) + (-23.418)

Sex could be ascertained with 90% accuracy from the right side and with 91% accuracy from the left side.

The range (42.10 mm to 56.00 mm) as well as the mean (50.24) for right side of males was greater as compared to left side, the range being 45.00 mm to 56.00 mm and the mean 49.40 mm. In the females the right side predominated with a mean of 44.20 mm and a range of 40.00 mm to 50.80 mm. The mean for left side is 43.80 mm and a range of 39.00 mm to 51.60 mm. The measurement is significantly more on either side, in males as compared to females.

Univarient Discriminant function equation derived for Body Height is

For right side Y = (Body Height)(0.317) +(-23.869)

For left side Y = (Body Height)(0.311) +(-23.418)

Sex could be ascertained with 87% accuracy from the right side and with 89% accuracy from the left side.

It is observed that minimum width is more on left side in males, ranging from 19.50 mm to 30.00 mm with a mean of27.18 mm, as compared to right side having a range of 21.00 mm to 30.00 mm with a mean of 26.43 mm. The same was found to be more on left side in females with range of 19.00 mm to 26.70 mm with a mean of 24.46 mm as compared to right side having a range of 19.10 mm to26.90 mm with a mean of 24.23 mm. The measurement is significantly more on either side, in males as compared to females.

Univarient Discriminant function equation derived for Minimum Width is

For right side Y = (Minimum Width)(0.337) +(8.534)

For left side Y = (Minimum Width)(0.311) +(-5.445)

Sex could be ascertained with 65% accuracy from the right side and with 66% accuracy from the left side.

The range (44.30 mm to 52.50 mm) of right side was smaller than left side (range varied from 43.00 mm to 53.40 mm) but the mean of right side 48.62 mm was greater than the mean 48.23 mm of left side. In females also the left side predominated with a mean of 41.99 mm and a range of 37.40 mm to 48.10 mm. The mean for right side is 41.89 mm and a range of 38.00 mm to 48.00 mm. The measurement is significantly more on either side, in males as compared to females.

Univarient Discriminant function equation derived for Load Arm Length is

For right side Y = (Load Arm Length)(0.436) +(-19.707)

For left side Y = (Load Arm Length)(0.422) +(-19.058)

Sex could be ascertained with 93% accuracy from the right side and the left side.

In males the range is 36.70-45.60 mm for the right side with a mean of 41.36 mm whereas the mean of left side is 41.17 mm with a range of 36.80 to 47.00 mm. In females the range is 28.00 to 39.00 mm for the right side with a mean of 35.10 mm whereas the mean of left side is 35.40 mm with a range of 28.10 -39.10 mm The measurement is significantly more on either side, in males as compared to females.

Univarient Discriminant function equation derived for Load Arm Width

For right side Y = (Load Arm Width)(0.399) +(-15.236)

For left side Y = (Load Arm Width)(0.376) +(-14.389)

Sex could be ascertained with 90% accuracy from the right side and with 86% accuracy from the left side respectively.

In the present study using Univarient Discriminant function out of the five parameters measured on the calcaneum bone,

Load arm length achieved the highest percentage accuracy of 93% in both the right side and the left calcaneum. Minimum width achieved the lowest accuracy of 65% and 66% for the right side and the left calcaneum. The accuracy of the other three variables lied in between 65% and 93%.

Conclusion

The maximum accuracy given by a single parameter in Univarient Discriminant function analysis was from Load arm length (93%).

Sex could be ascertained with 93% accuracy for both the sides from the parameter Load arm length of the calcaneum.

Sex could be ascertained with 91% accuracy for the left side and with 90% accuracy for the right side respectively by the parameter Maximum length.

Sex could be ascertained with 90% accuracy for the right side and with 86% accuracy for the left side from the parameter Load arm width.

Sex could be ascertained with 87% accuracy for the right side and with 89% accuracy for the left side from the parameter Body height.

Sex could be ascertained with 65% accuracy for the right side and with 66% accuracy for the left side from the parameter Minimum width.

The results are in contravention to the common belief that bigger parameters form better Discriminant functions with the body for the purpose of identification. Load arm length of the calcaneum being comparatively smaller parameter achieved higher accuracy percentage as compared to other parameters.

The present study is conducted on a cosmopolitan population, and the Discriminant function equation thus derived in this study, can be routinely used all over the country for sex determination from the calcaneum bone and will be of immense forensic value in the field of crime detection.

References

1. **Introna Jr F, Di Vella G, Campobasso CP and Dragone M.** Sex determination by discriminant analysis of calcanei measurements. *J Forensic Sci* .1997; 42(4): 725-8.
2. **Srewart TD.** Medico-legal aspects of the skeleton, I. Age, Sex, race and stature. *Am J Physical Anthropol* .1948; 6: 315-21.
3. **Krogman WM.** The human skeleton in legal medicine: medical aspects. In levinson SA ed. Symposium on medico-legal problems, Series 2. Philadelphia : JB Lippincot Co; 1949 .
4. **Hrdlicka A .**Practical Anthropology, 3rd ed. Philadelphia: Wistar Institute, 1947.
5. **Olivier G .**Practical Anthropology. Springfield , Thomas 1969.
6. **Singh and Singh SP.** Identification of sex from the tarsal bones. *Acta Anat.* 1975; 93: 568-73.
7. **Steele DG.** The estimation of sex on the basis of talus and calcaneum. *Am J Physcial Anthropol.* 1976; 45:581-88.
8. **Murphy A M C .**The calcaneum: sex assessment of prehistoric New Zealand Polynesian skeletal remains. *Forensic Sci Int.* 2002; 129:205-8.
9. **Bidmos MA, and Asala SA.** Discriminant function sexing of the calcaneum of the South African Whites. *J Forensic Sci* .2003; 48(6): 1213-8.

Table-7: Comparision of percentage accuracy of calcaneum bone of various authors

Function	Variable	Introna[1]	Murphy[8]	Bidmos[9]	Present(Rt)	Present(Lt)
Univariate	Max. L	83.75%	94%	84.90%	90%	91.00%
	BH	71.25%		73.50%	87%	89.00%
	Min. W	68.75%		74.80%	65%	66.00%
	LAL				93%	93.00%
	LAW	77.50%			90%	86.00%

Original and Paper

Termination of pregnancy in adolescents

U. B. Roychowdhury, D. Guharoy **, A. Roy*** & S. Basak*****

Abstract

A study was conducted at the Dept. of Gynaecology & Obstretics, Medical College, Kolkata in collaboration with the Dept. of FSM on adolescent girls who have undergone Medical Termination of Pregnancy (MTP) for the period Sept.06 to May 07. Highest incidence (48.89%) was found in low-income group. 80% of the girls were married and a large number of them (60%) did not use any contraceptive. Social cause was the commonest indication (75.57%) for MTP.

Key Words: *Adolescent girls, MTP.*

Introduction

Despite MTP Act which is being enforced in our country in the year April 1972 and the apparent liberalization of attitude in recent years, unwanted pregnancy for a variety of social, cultural and economic reasons, continues to be a source of stress on adolescent girl and her immediate family. In India 6 million abortions take place every year of which 4 million are induced and 2 million are spontaneous [1]. The practice of child marriage is still widely followed in rural India and the expectation that after marriage a woman will become pregnant as soon as possible encourages early onset of maternity and high adolescent fertility [2].

Morbidity and mortality rates are significantly higher for teenage mothers and their infants of our country. Though the abortion laws are getting liberalized worldwide and even with the presence of national priorities of family planning, the adolescent population still records a huge number of pregnancies ending in MTP. Changing values of life, greater permissiveness among young generation and their sexual inquisitiveness and promiscuity are the reason in a significant number of cases.

Information about abortion among teenagers is limited and inaccurate especially in the developing world. Induced abortion-both legal and illegal-has important public health and demographic implications that are often overlooked. A rise in the prevalence of abortion reflects a deterioration of reproductive health of the adolescent girls. The study is important for epidemiologist, health planners concerned with maternal health, demographers, and family planning programme specialists and for the law enforcing agencies.

Materials and methods

The study was conducted at Medical College Hospital, Kolkata, Dept. of G&O, in collaboration with Dept. of Forensic & State Medicine. The study population comprised of adolescent girls aged between 15-18 years who had undergone MTP. Total 90 cases were studied from Sept.06 to May 07. It was a hospital based cross-sectional study and the sample population was selected by purposive sampling method. 90 adolescent girls were interviewed as per a standard designed questionnaire and the result after meticulous evaluation was recorded.

Results

The findings are summarized below:

1. Incidence of teenage MTP- it was 13.75% of the total MTP-s conducted during the said period.

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2. Age- Most of the adolescent girls (95.56%) belonged to the age group16-18years. 4 girls who were aged 15yrs were victims of rape and sought abortion on humanitarian ground.
3. Place of residence- 46.67% had an urban background while the majority (53.33%) came from rural and semi-urban region.
4. Per capita income of the family- highest incidence (48.89%) was recorded in low-income group, the number of cases gradually declining with increasing income. Lowest incidence of MTP (11.11%) was recorded in the higher income group (Rs.1000-1500 per capita monthly income)[Table I].
5. Education- Majority of subjects were either illiterate (22 cases) or studied up to primary level (40 cases) [Table II].
6. Occupation- Most of the adolescent girls (52) were housewives. 26 girls were engaged as manual laborers in the field for cultivation or were fruit-sellers or house-maids [Table III].
7. Religion- 52 girls (57.78%) were Hindu whereas a significant number 32(35.56%) were Muslim.
8. Marital status- 80% were married and 20% unmarried.
9. Age of marriage- Among the married girls, 25% were married at the age of 18yrs, 44.44% at 17yrs and 16.67% at 16yrs.
10. Parity- 46.67% of the girls under study had 1 child, 20% had 2 children and 33.33%(mostly unmarried) had no child.
11. Use of contraceptives- A large number (60%) did not use any contraceptive while 35.56% used them irregularly.
12. History of previous abortion- 62 of them (68.89%) had their first abortion whereas 14 of them (15.56%) had a previous history.
13. Cause of MTP- Social cause was the commonest (75.57%). 4 girls were victim of rape and sought abortion on humanitarian ground (4.44%) [Table IV].
14. Weeks of pregnancy at MTP- Most of the MTPs were done within the first 6 weeks (53.33%) while 42.22% of the adolescents were aborted between 7-12 weeks.
15. Methods employed for MTP- 20% had D/E or S/E with Copper T and 80% had D/E or S/E only.

Discussion

Though teenage pregnancy and abortion forms a sizeable bulk of the Gynaecology and Obstretics cases in most of the countries, our study revealed that adolescent MTP constituted only 13.75% of the total number of MTP conducted in the hospital. This can be explained by the fact that the present study is based on government hospital whereas adolescent girls for their privacy prefer private nursing home.

A large number of cases (53.33%) were from rural and suburban area though the study was done in the city of Kolkata. This reveals lack of infrastructure in many rural hospitals to terminate such adolescent pregnancies. Moreover, people of urban area being better off may also choose private nursing home to terminate their unwanted pregnancies.

Highest incidence of MTP was found in lower socio-economic group (48.89%) that does not match with the observation by Spitz and Fishers, who observed lower rate of abortion in poor classes, probably people in this class desire larger families [3]. But it reflects that with the change in the social outlook and with the liberalization of abortion, poor people also want to restrict their family. It corroborates with the study by State Bureau of Health Intelligence, Govt. of W.B. that shows that 46% of the teenagers aged 15-17 yrs with family income below poverty level are at risk of unintended pregnancy [4].

Majority of girls studied upto primary level (44.44%). This is due to the practice of early marriage still widely followed in the country and the expectation in the present socio-cultural milieu that a girl after marriage will become pregnant as soon as possible.

57.78% of the subjects were housewife, which corresponds with a similar study carried out in Kerala[2]. Majority of the employed adolescents were maid-servants, sweeper, ayahs or fruit-sellers. Hindus (mostly scheduled caste) constituted a major bulk (57.58%) of the girls under study. This can be explained by the fact that majority of the teenagers belonging to the lower socio-economic class who reside in Kolkata come under this category.

Highest incidence of abortion was found among married girls (80%) which is also in

accordance with the findings of Tietze and Lewit[5].This is probably due to the fact that married people are more accessible to the hospital and unmarried girls to conceal their pregnancy mostly resort to criminal abortion. In the present study, the unmarried women who underwent MTP gave history of sexual promiscuity (8.89%), illicit cohabitation and false assurance of marriage (4.45%) and one unmarried girl was a sex-worker.

Regarding the age of marriage, 75% of the married subjects in the study were married below 18yrs of age, which is in accordance with the survey which stated that that early marriage is still widely followed in India[2]. 46.67% were primi-parous and they resorted to MTP for spacing between their pregnancies. But 16.67% of married nulli-parous women underwent MTP as they were unwilling to expand their family at an early stage of marriage. This reflected the fact that they relied more on abortion as a family planning measure rather than on temporary contraceptive methods.

A significant number of girls under study (60%) did not use contraceptive at all while 35.56% used them irregularly. The result closely resembles a Norwegian study [6] which showed that 57% of the women were not using contraception at the time of conception. In the present study, among those who used them irregularly, few commented that it was due to non-cooperation of their male companion and 24.44% expressed their ignorance. 8.89% were intolerant of IUCD and OC pills.

As to the cause of MTP, majority (75.57%) were due to social reason which indicates the success of liberalization of MTP (MTP Act, 1971). 35.6% of women did abortion to postpone child bearing and for spacing between pregnancies. This corresponds with the study by Bankole A. et al who found 25.5% women underwent abortion to postpone child bearing [7]. 95.55% cases underwent MTP in first trimester to avoid complications of late abortion. A study conducted on women of New Zealand revealed similar result [8].

Conclusion

A rise in the prevalence of abortion indicates reproductive ill health of the adolescent girls. The present study clearly indicated that child marriage is still widely practiced in our country. Early pregnancy in a stage when they are not prepared both physically and mentally results in early onset of maternity and high adolescent fertility. During the present study it was felt that it is of utmost importance for the girls to achieve higher level of education. It is essential to recognize that unwanted pregnancy in teenagers is a specific health risk for them and their families. Thus it is highly important to conduct classes and seminars for teenage girls particularly in school atmosphere so that they are well informed about various aspects of contraception and abortion. This is probably the high time to introduce sex education in school curriculum. In rural areas anganwadi workers can play an important role in educating adolescents about healthy human reproduction. Mass media can also do a lot in this regard by boosting their social sensitivity and their legal rights.

References

1. WHO(1978) Techn. Rep. Ser. No.623:p.76-77.
2. **Jagnayak S S.** Study of Abortion Practices in Kerala. Southern Institute for Social Science Research ,Trivandrum. June 2005, p.11-57.
3. **Spitz & Fisher.** Med. Legal Investigation of Death.C.C.Thomas,1969: 23-25.
4. Health on March 2006, State Bureau of Health Intelligence, Govt. of West Bengal, Swasthya Bhawan, p-205.
5. **Tietze S and Lewitt T.** Adolescent pregnancy and induced abortion. *Abortion Sc American.* 1969; 220(21): 126-41
6. **Skjeldestad F E.** Using induced abortion to measure contraceptive efficacy. *Fam Plann Prospect.* 1995 Mar-Apr; 27(2):71-96.
7. **Bankole Akinrinola, Singh Susheela and Hass Taylor**. Reasons why women have induced abortion: evidence from 27 countries. *Int Fam Plann Prospect.* 1998;24(3) :321-6.
8. **Goodyear A , Knowles L and Masters J.** First Trimester Medical Termination of Pregnancy- an alternative for New Zealand women. *Aust N Z J of Obs Gynaecol.* 2006, Jun; 46(3):193-8.

Table-1: Per capita monthly income

Amount(Rs/capita/month)	Number	Percentage
<500	44	48.89
501-1000	36	40.00
1001-1500	10	11.11
Total	90	100

Table-2: Educational level

Educational level	Number	Percentage
Illiterate	22	24.44
Primary(I-V)	40	44.44
Secondary (VI-X)	28	31.12
Total	90	100

Table-3: Occupation

Occupation	Number	Percentage
Student	6	6.67
House wife	52	57.78
Worker	26	28.89
Un employed	6	6.67
Total	90	100

Table-4: Cause of MTP

Cause	Number	Percentage
Social	68	75.57
Humanitarian	4	4.44
Therapeutic	8	8.88
Eugenic	2	2.22
Did not reveal	8	8.88
Total	90	100

Case Report

Plastic bag asphyxia with LPG (butane–propane) inhalation -Fatal Asphyxiphilia or Suicide?

O.P.Murty

Abstract

One case of unusual suicide by plastic bag and domestic gas is discussed in this report. One unemployed youth in his late-twenties was found dead in his apartment with plastic beg covered face which also had live connection with cooking gas .He was a known substances abuser and was under de-addiction therapy. Plastic bag suffocation is not uncommon but its combination with cooking gas LPG (butane–propane) inhalation makes it unique method of ending life. Either he ended his life by a mere accident or planned suicide was a mystery. Whether manner of death was accidental, or suicidal, or it was purely autoerotic, death is discussed in detail. As the deceased was unemployed, known drug abuser and there was frequent mood variations with feeling of worthlessness. All these questions with critical analysis are answered in this report.

Keywords : *Suicide, autoerotic asphyxiation, plastic bag and suffocation, domestic gas asphyxia, LPG Fatality, accidental death, suffocation.*

Introduction

Asphyxial deaths utilizing plastic bags have increased in last two decades. Suicide is defined as the deliberate taking of one's own life. [1, 2] It is one of the leading causes of death in world. Every year, there are cases of suicide that involves different age groups and people of different ethnicity.

Asphyxia due to plastic bags or plastic wrappings may be caused by variety of mechanisms including obstruction of the upper airways and oxygen deprivation. The manner of death may be accidental, suicidal or homicidal.[3-7]

Auto asphyxiation is used to produce cerebral asphyxia and hyper capnia in an effort to get enhanced sexual pleasure. The method includes neck constriction[8], plastic bags[9] , inhalation of gases, anesthetic agents , propellants and propane[10] , chest compression, body compression by wrapping one in a series of rubbing leather , rough towels or blankets [11] , abdominal ligature. [12]

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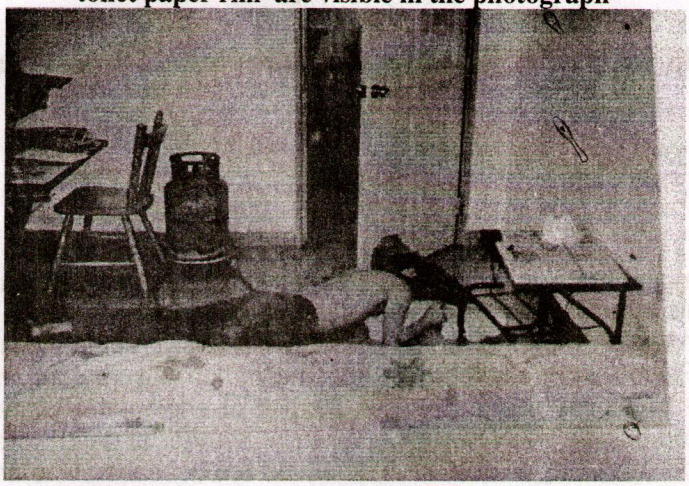
Case summary

The deceased in his late twenties was living away from his parents in one rented flat. He was a school drop out and was doing odd jobs for his livelihood. He had no regular source of income. He was a known addict for heroin, Ice (Amphetamine), or like other designer drugs for last few years. He was attending de-addiction centre. He had frequent mood variations with suicidal thoughts. He also quarreled with his mother, as he wanted to discontinue the de-addiction treatment.

On crime scene, he was found dead in a fully furnished flat; door was bolted and was broken to make entry. There were initial attempts to resuscitate, cooking gas cylinder was on, and there was strong smell in the whole flat. Gas was put off by removing its attachment, plastic bag was slightly torn, and belt was loosened. At the time of recovery of his body, his personal computer was found on; CD -ROM was projecting out side, and is also visible in picture one [figure 1]. By the time crime scene team reached the spot, initial attempt for revival by his family and other rescuers in form of tearing plastic bag and stopping gas supply was already attempted. Crime team found him dead on the spot and photograph at that time is shown in figure 1.

Figure-1: Position of the deceased , with projecting CD drive, towel , red plastic bag , gas cylinder , tissue toilet paper rim are visible in the photograph



Body was lying near computer, and there was mirror near to the bed. He was lying on floor, with chair on bedside, one rough towel was below the body, and hands were extended as trying or making an attempt to escape. Blue Jean's zip was open, semen present; tissue paper was lying on table. A complete autopsy was conducted at PPUM Hospital Kuala Lumpur.

The body was that of a well-nourished, muscular adult male, 182cm in length and 61 kg in weight. The body was topless, dressed in a blue jeans pant with open zip and semen stains were present inside. Both hands clenched, nail bed marked bluish.

In this case one impervious plastic super market carry plastic bag of red color was used to cover head and neck with insertion of live cooking gas pipe from a near by gas cylinder (figure 1). The bag could be opened with slightly loose free ends of the bag. There was lot of moisture with wet nasal and salivary secretions.

One red color super market carry plastic bag was present around the head and neck , tied at the level of middle neck with black color belt [figure 2] , belt circumference 37.5cm , neck circumference 38 cm , horizontally placed and tightened over plastic ,belt was loose in action not bolted to make a fix one.

The belt was placed 10 cm above the supra eternal notch , 5 cm below chin , 10cm from occipital protuberance , 3.5 cm above neck vertebral prominence. It was placed over the head down to neck level, closed end above vault and open end in neck the bag was still on the body, there was moisture with wet nasal, salivary secretions. In nasal, oral area tenacious secretions with saliva mixed present over face. Area above neck intensely suffused with marked congestion of eyes, postural hypostasis effect also present. Asphyxia findings were more prominent in cover area in comparison to other parts. Nasal secretions were dribbling, and had gathered around face and nostrils and made the plastic more adherent to facial skin. The lips, mouth and tongue were marked bluish. Weight of passive head with hypostasis on face area had produced marked purplish discoloration so asphyxia effects are added effect in this case.

The external genitalia was normal, penis was non-circumcised., in semi erect position, recent semen discharge present. There were no hardened veins, recent or old injection marks over elbow, thighs, and groin or leg areas giving any indication of main lining.

The brain (1705 g) showed congestion. The trachea and bronchi lumen contained a small amount of mucus. The lungs (right -720 g, left - 670 g) showed sub pleural small hemorrhages, more so in inter –lobar fissures. Cut sections showed intense congestion and edema, cut surface exude dirty fluid.

The stomach contained 900 gram of partially digested food with identifying material of rice, beans etc. material. No unusual smell of alcohol or any peculiar substance was not noted in the gastric contents. The mucosa was normal. The external surfaces of the small and large bowel were unremarkable.

Histology examination of the rest of tissue samples confirmed the macroscopic findings and did not reveal any additional pathology. There was no foreign material in lungs, spleen, liver, or kidney Death was due to suffocation produced by means of self-suffocation by covering head and neck and inhalation of domestic gas.

Discussion

Deaths from plastic wrappings or bags usually result from suffocation and obstruction from plastic sheets, which prevents air entry into lungs. An additional factor may be suffocation by oxygen replacing gases such propane –butane or nitrous oxide. The manner of death in plastic bag / wrapping asphyxia is variable, with most cases representing suicides.[12,13]

Accidental asphyxia from plastic bag or sheet may not be frequent with autoerotic activities. At times safety device may fail in time to rescue the person, which may result in loss of consciousness with subsequent death from suffocation. Accidental deaths may also occur in individuals who are sniffing volatile substances from plastic bags.

Homicidal deaths by plastic bagging is rare and usually occurs if the victim has been sedated or incapacitated prior to the fatal attack, or if there is gross disparity in the size and strength of the perpetrator and victim.[12]

Autoerotic deaths have been defined as accidental deaths occurring during individual, usually solitary, sexual activity in which a device, apparatus, or prop used to enhance the sexual stimulation of the deceased in some way caused unintended death.[14]

In autoerotic practice by putting plastic bag and adding up LPG (cooking gas) is bound to produce intense asphyxia. This plastic seal over external air passage ceases the aeration and may give to sexual erotic pleasure due to hypoxia.[15]

Mann and Strauss[16] offered one of the first investigative checklists - a young solitary male, with some contrivance of ropes, belts or other binding material arranged so that compression of the neck may be produced voluntarily; neck is protected by padding material; the clothing removed or arranged to allow access to the genitalia; possibly photographs or literature of a pornographic nature or looking into mirror. In this case person is young, half nude, genitalia is accessed, padding is there near the neck area and near to belt, computer was on with CD-ROM was projecting outside.

Most of the cases, the victim's body was found indoors. Further analysis revealed the following main location; the bedroom (53 cases out of 187), the bathroom (19 cases out of 187 cases), the basement (13 cases out of 187 cases) an so on.[17]

In view of these information, scene was analyzed on the following points. Some points in favor of auto-erotic practice in this case were as -

1. Private or secluded location or close room where privacy is there, in this case living separately, away from parents, room was closed.
2. Body position on bed, ground, or sitting or support of cushions – body was lying on ground.
3. Operating agents to produce asphyxia like rope, belt, gas etc. – He used gas, belt, and polythene bag .
4. Safety devices – towel, loose belt, loosely tied ends of plastic bag near mouth.
5. Sexual erotic literature / scene/ - computer was on but CD was removed / disturbed, sexual fancy aids were not there in this case.
6. Padding material- towel .
7. Cleaning material – tissue paper and towel were there.
8. Some sort of masturbatory activity – Jeans' zip was down, there was no underwear, and semen stains were there.
9. Suicide note - absent in this case .
10. Previous suicidal attempt or threat, not clear but had argument with mother on previous day on his treatment on following day.
11. Social circle and type of job – odd jobs .

12. Single technique /multiple techniques - two techniques.

The points like isolation, use of drugs, combined with instability in life make these people more vulnerable for obsessive and compulsive acts and such accidental happenings do happen. In such a death usual disturbance of scene by removing pornographic or adult material from scene , altering position , covering of sex organs is quite common as no one want to present their members in offensive or socially objectionable / doubtful position . It is also possible, as there could be genuine attempt to revive the person. Scene may be inadvertently get disturbed as others may not understand the investigative importance of positions and items there.

In one review by Byard R W and et. al [7] in four cases propane , natural gas and helium had been introduced into a plastic bag to further reduce oxygen. Death from oxygen deprivation associated with this type of inert gas exposure is well-reported event in the suicides and accidents.[18-20]

Toxic and lethal levels of prescription medication were found in 17 cases; benzodiazepines drugs were present in 10 cases and alcohol in eight; chloroform and ether had been used in one case each and in four cases, plastic bags over victims' head had been filled with gases such as helium, propane and natural gas. In a total number of 45 cases, 17 had depression and were found to have antidepressant drugs on toxicological screening.[5]

In two earlier cases reported from this mortuary, both were married and were above 50 years of age. Incidentally both of them were also Chinese by ethnicity as in this case.[20] In one major study in USA, a Haddix TL et al [4], analyzed 53 cases of suicide by plastic bags. Plastic bag in situ is the most important crime scene observation otherwise autopsy findings remain non-specific. Thus, if the plastic bag were removed after death, the cause and manner of death would be obscure.

In this case, sense of worthlessness was prevailing due to unemployment, mood variations were also reported, and he was taking de-addiction therapy. He was living alone though his parents were living in the same city so wanted isolation and freedom probably to satisfy his needs or fantasies. He was unstable in his behavior and actions. There were equal possibilities of suicide in this case. This case was also closed by police as a case of suicide and there was nothing much to counter it. Whether he committed suicide? In absolute terms, it is not possible to rule it out completely as circumstances also in conformity of suicidal act.

References

1. **Bennett AT and Collins KA**. Suicide: a ten year retrospective study. *J Forensic Sci.* 2000; 45:1256-8.
2. **Klitte A, Gilbert JD, Lokan R and Byard RW**. Adolescent suicide due to inhalation of insect spray. *J Clin Forensic Med.* 2002;9:22-4.
3. **Martinez ALP, Chui P and CameronJM**. Plastic bag suffocation. *Med Sci Law* .1993;33:71-5.
4. **Haddix TL, Harruff RC, Reay DT and Haglund WD.** Asphyxial suicides using plastic bags. *Am J Forensic Med Pathol.*1996;17:308-11.
5. **Jones L S, Wyatt J P and Bususttil A**. Plastic bag asphyxia , in South –eastern Scotland. *Am J Forensic Med Pathol* .2000;21:401-5.
6. **Bullock M J and Diniz D.** Suffocation using plastic bags: a retrospective study of suicides in Ontario, *Canada J Forensic Sci.* 2000; 45:608-13.
7. **Byrad Roger W, Simpson Ellie and Gilbert John D**. Temporal trends over the past decades in asphyxial deaths in South Australia involving plastic bags or wrapping. *J Clinical Forensic Medicine.* 2006; 13:9-14.
8. **Emerson HE.** Accidental hanging in autoerotic death. *Am J Forensic Med Pathol.1983*; 4:337-40.
9. **Johnstone JM, Hunt AC, Ward and Ward EM.** Plastic-bag asphyxia in adult. *Brit Med J* .1960; 2:1714-6.

10. **McLennan JJ, Sekula – PerlmanA, Lippstone MB and Callery RT**. Propane-associated autoerotic fatalities. *Am J Forensic Med Pathol.1998*; 19(4):381-6.
11. **Tough SC, Buttt JC and Sanders GL.** Autoerotic asphyxial deaths: analysis of nineteenth fatalities in Alberta, 1978 to 1989. *Can J Psychiatry.* 1994:39:157-160.
12. **Byard RW and Wilson GW**. Death scene gas analysis in suspected methane asphyxia. *Am J Forensic Med Pathol.* 1992:13:69-71.
13. **Peter ME Cummings, Karen Naves and John Butt.**Autoeroticasphyxia. http://www.geocities.com/pathologypete/ autocase1.html.
14. **Byard RW and Bramwell NH..**Autoerotic death-a definition. *Am J Forensic Med Pathol* .1991;12(1):74-615.
15. **Resnik HL.** Erotized Repetitive hangings. A form of self destructive behavior, *American Journal of Psychotherapy*. 7: 4-21 .
16. Literature of Autoerotic asphyxia.In: www.Law.forensic.com/autoerotic_2htm accessed on 1/7/2006.
17. **Sauvageau Anny and Stephanie Racette**. Autoerotic deaths in the literature from 1954 to 2004: A Review . *J Forensic Sci*. January 2006;51(1):140-144.
18. **Avis SP and Archbald JT**. Asphyxial suicide by propane inhalation and plastic bag suffocation. *J Forensic Sci* .1994:39:253-6.
19. **Wagner SA, Clark MA , Wesche DL, Doedens DJ and Lloyd AW.** Asphyxial deaths from recreational use of nitrous oxude. *J Forensic Sci*.1992:37:108-15.
20. **Wantabe T and Morita M.** Asphyxia due to oxygen deficiency by gaseous substances. *Forensic Sci Int* . 1998;98:47-59.
21. **Nadesan K and Beng OB**. Two cases of death due to plastic bag suffocation. *Med Sci law* . 2001 Jan; 41(1):78-82.

Figure- 2. Plastic bag with loose ends in front part; belt used to tighten at neck level.

Case Report

Unusual carbon monoxide poisoning

Mohammed Iliyas Sheikh, Pranav Prajapati & Rajesh Patel

Abstract

Two cases of group accidental death due to carbon monoxide poisoning were brought to Government Medical College & New Civil Hospital, Surat in 1997 & 2004. Accidental carbon monoxide poisoning is now increasing. Details of these cases have been discussed in this paper.

Keywords : *Carbon monoxide, group accidental death, generator, carboxyhemoglobin.*

Introduction

Carbon monoxide (CO) is a colorless, odorless, tasteless and non irritant toxic gas with no warning properties. That is usually produced by incomplete combustion of hydrocarbons. In India, accidents occur in connection with incomplete combustion of wood, charcoal and coal in ill ventilated room.[1]

Carbon monoxide toxicity appears to result from a combination of tissue hypoxia and direct carbon monoxide mediated damage at cellular level. Carbon monoxide competes with oxygen for binding to hemoglobin. The affinity of hemoglobin for carbon monoxide is 200 to 250 times as great as its affinity for oxygen, because of this; oxygen hemoglobin dissociation curve is shifted to the left leading to impaired release of oxygen at the tissue level and cellular hypoxia.[2]

Symptoms in carbon monoxide poisoning range from mild (constitutional symptoms) to severe (coma, respiratory depression and hypotension).[3] The classical findings of carbon monoxide poisoning are cherry red finger nail beds, cyanosis and retinal hemorrhage.[4] Some times delayed neuro psychiatric syndrome in form of cognitive and personality changes, dementia, psychosis and Parkinsonism etc. were seen after apparent recovery from acute intoxication.[5,6]

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Case history

Case no: 1

Five teenagers friends (aged: 18, 16, 16, 15, 13 yrs) arranged VCR to see movie in one room on 04/08/97 in night but because of rainy season electric supply was not there. They had arranged generator with petrol tank for electric supply. All windows and door were closed by them. On the next day their relatives went to the house and knocked the door to arouse them. But none of them was responded. On breaking the door, all five friends were found dead and generator was in "ON" position. They informed to police. Post mortem examination was conducted at Government Medical College, Surat on 05/08/97.

Case no: 2

A family of four member, father, mother and their two male children were residing in an area of Surat. They purchased a new house. They had been organized a function for celebrating their new house on 17/11/2004 in evening. They invited their relatives, friends and their neighbors on that day evening, a day before the post mortem examination. Electric supply was not there on that day .They arranged branded generator with petrol and kerosene tank in it. All invited persons and family members were enjoyed function till late night. After completion of function, four members of family decided to sleep in their new house.

Due to winter season, they closed all doors and windows of house. The generator was "ON". On next day morning, relatives came to meet around 11.00am but no one was responding on knocking the door. Some foul play and suspicioun came in their mind. They broke the window and noticed that all four were in sleeping condition. They tried to arouse them from sleep. No one could give any respond .They informed to police. Police entered in the house and found that all four members were dead. Post mortem examination was conducted to Government Medical College & New Civil Hospital, Surat on 18/11/2004. Findings of both the cases were more or less similar as mentioned below:

External examination revealed:

- Cherry red color postmortem lividity seen and fix at certain places.
- Conjunctiva congested.
- Petechial hemorrhage seen in conjunctiva. (in three cases)

Internal examination revealed:

- Chest and abdominal muscles were bright red in color.
- Blood was cherry red in color.
- Both lungs were congested and bright red in color.
- Few scattered petechial hemorrhage were present over surfaces of both lungs.
- Intestines were congested.
- All organs were congested.

Histopathological examination:

Lungs revealed pulmonary edema. Cerebrum revealed congestion and cherry red color. Liver, kidneys, spleen did not reveal any significant pathology.

Chemical analysis report:

Viscera were sent for chemical analysis to Forensic Science Laboratory, Surat. Blood was sent with special precaution in air tight container with layer of liquid paraffin. Viscera did not reveal any common poison except pieces of lungs and blood was saturated with carboxyhaemoglobin.

Opinion:

Considering the postmortem findings, histopathological findings & chemical analysis report, the final cause of death was given as **"Carbon Monoxide poisoning"**.

Discussion

Carbon monoxide (CO) is the leading cause of death from poisoning in United State. In a review of death certificate data from 1979 to 1988, there were over 5000 deaths each year from CO poisoning.[7] Although they appears to be increased public awareness of CO problem there were still 2581 United States deaths (14% of total poisoning deaths) attributed to known CO exposure in 1995 of which 436 were unintentional.[8] Carbon monoxide poisoning is one of the most common causes of morbidity and mortality in western countries.[9]

Natural production of carbon monoxide is estimated to be about 10 times the amount produced by man made sources. Oxidation of methane is the largest source of CO in the atmosphere. Other natural sources include volcanoes, forest and grass fires, marsh gases, electrical sources, oxidation and the destruction of chlorophyll in autum. [10]

Tremendous amount of carbon monoxide are released in the atmosphere as a result of human activities. The largest source of CO is the combustion of petroleum products. Motor vehicles have accounted for about 55% to 60% of global man made emissions of carbon dioxide. Another 20% of man made CO emissions comes from stationary sources such as space and water heater and furnaces and from industrial processes, coal mine explosions and solid waste disposal procedures.[11]

It can be classed toxicological as a chemical asphyxiant. Amongst five major pollutants which accounts 85% of all most pollution, carbon monoxide alone account about 52%.[12] The upper limit of safety is 0.01% carbon monoxide in the air. If a person breathes carbon monoxide in a considerable length of time, especially during sleep, he will be poisoned just as effectively as though he was exposed to high

concentration for a low period.[13]

Growth in the industries has increased industrial hazards in the developing countries.[7]Carbon monoxide poisoning is not very common in India and few cases those are reported are due to use of inappropriate room heating appliances kept in bed room which may be ill ventilated with all windows and doors closed and in factories.

In both cases of carbon monoxide poisoning, electric supply was not there. All family members and five friends were used generator for electric supply which was operated by petrol in the room with all closed windows and doors. This incidence was due to unawareness of consequences of using petrol operated generator in air tight close space. With a density of 0.968 relative to air, it quickly diffuses to equilibrate with any indoor air space.[14] An open ventilated area does not guarantee against CO poisoning, as cases were also observed in boats and tractors.[15]

An unexpected case of carbon monoxide poisoning found in tyre manufacturing factory at North Goa district.[16] Another case of carbon monoxide poisoning found at Essar Company, Hazira in Surat, which was industrial accident.

Conclusion

In both cases, death of nine persons was due to unawareness of safely using petrol / kerosene generator. All petrol/kerosene operated generator should be used in open space and in case of closed space, generator should be kept outside or at least two ventilation should be there.

The company manual or users' guide should mention about safety measures and where the set should be started or kept in running condition etc.

References

1. **S R Mehta, M Niyogi** et al. Carbon monoxide poisoning. *J Assoc Physicians India.* 2001;49:622.
2. **Rodkey FL, O'Neal JD, Collission HA and Uddin DE**. Relative affinity of hemoglobin S and Hemoglobin A for carbon monoxide and oxygen. *Clin Chem.* 1974;20:83-84.
3. **Erst A and Zibark Jd.** Carbon Monoxide poisoning. *New Eng J Med.* 1998;339:1603-1608.
4. **Hardy kr and Thom Sr**. Pathophysiology and treatment of carbon monoxide poisoning. *J Toxicol Clin Toxicology.* 1994;32:613-629.
5. **Chois Is**. Delayed neurological sequelae in Carbon Monoxide intoxication. *Arch Neurol.* 1983;40:433-435.
6. **Min SK.** A brain syndrome associated with delayed Nero psychiatric sequelae following acute carbon monoxide intoxication. *Acta Psychiatric Scand.* 1986;73:80-86.
7. **Venkateshan A and Karunanidhi G**. Heath Hazards at work place. *J Social welfare.* May 1998:10-11.
8. **Fingerhut LA and Cox CS**. Poisoning mortality: 1985-1095. *Public health Rep.* 1998;113:218-233.
9. National centre for Health statistics. Vital statics of United States: 1988, 1991. Washington, D.C. Government priuting office. (DHHS Publication No. (PHS) 89-1102)
10. **Pickwell GV.** The physiology of Carbon Monoxide production by deep-sea coelenterates: causes and consequences. *Ann NY Acad sci.* 1970;174:102-115,.
11. **Hamilton & Hardy**. Industrial Toxicology: Carbon Monoxide.1998, pg: 165-170.
12. **Krishnan Vij.** Toxicology of air pollutants. Journal of Indian academy of Forensic Medicine. 1996: vol: 18, nol-4.Pg. 12-14.
13. **Reddy KS Narayan.** The essentials of Forensic Medicine and Toxicology, Asphyxiant 2005: pg 537-540.
14. **Louders D.** Unsuccessful suicidal by carbon monoxide: A secondary benefit of emissions control. *West J Med.* 1981; 135: 360-363.
15. **Jumbelic MI**. Open air Carbon Monoxide Poisoning. *J Forensic Sci.* 1998; 43:228-230.
16. **Madhu S G Ghodkirekar** et at. Carbon Monoxide Poisoning- An unexpected suspect-A Case Report. *J Indian Acad Forensic Med.2005;*25 (4): 157-160.

Case Report

Establishment of identity: a challenge in mass disaster

Sanjay Gupta , Hitesh Vaishnav** & Jaydip Gadhavi***

Abstract

Mass disasters are inevitable for many natural and human factors. The rescue of living is of course the first priority of the administrative authorities. How ever, the establishment of identity of dead is the subsequent challenge. This uphill task is of immense importance to inform the relatives about demise of their near and dear one and also for disbursement of claim and compensation. DNA typing remains the most advanced and available modality evening developed countries. We present the case with evaluation of forensic application of DNA typing in context of identity of victims of mass disaster.

Keywords : *Identity, charred remains, DNA analysis.*

Case History

On late evening of 14-05-07 vehicular collision at National highway No.8 [Reconstructed and illustrated in (figure 1 & 2)] **involved three HMV** (Heavy Motor Vehicle) with passengers within and **three by passers** by the **jet of fire generated** from the hole made in LPG tanker which extended **in an area of about 120 meter diameter**.

After prolonged and difficult rescue operation dead bodies retrieved from the scene were submitted for autopsy examination to the institute(a tertiary care center in the nearest vicinity). All autopsy were conducted by a board (panel) of two doctors- one Forensic faculty and another being Government Medical Officer from the team sent by the state authorities.

The case was registered u/s 279, 304-A, 337, 338 of IPC and u/s 177, 184,134 of M V Act.

The unfortunate event left **9 people injured** and was responsible for **demise of 34 victims. Autopsy examination of 31 victims** was conducted at this center and 3 victims died at higher centers. As the majority of the bodied were severely charred(Figure-3),the most important objective of PME was to establish of identity and hence meticulous documentation of parameters for age & sex and belongings was undertaken. In all the case examined, best possible sample (burnt tooth/ burnt bone) for DNA analysis was collected in presence of Forensic Scientific Officials and preserved.

Awaiting the DNA analysis report, primary & interim opinion of age and sex (solely based on autopsy examination) were submitted to investigating agency.

Reference samples for match were available in 15 cases only and rest eight cases were without any relative claiming the dead body. (probably none from the family left behind)

At the Forensic Science Laboratory, DNA was isolated by organic extraction method and subjected to multiplex PCR reaction for 16 STR loci and amelogenin using AmpFℓ STR PowerPlex16 System kit. The amplified products along with controls were run on Automated sequence and analysis was carried out using Gene Scan and Genotyper soft wear with respect to standard ladder.

The report of DNA analysis issued after approximately two months was incorporated for final opinion about the identity of victims.

Observations

Table – 1 : Distribution of cases according to degree of burns & identity status

Cases of burns	Identified - no(%)	Unidentified - no(%)	Total - no(%)
Superficial	07(22.58)	00(0)	07(22.58)
Deep	18(58.06)	06(19.36)	24(77.42)
Total	25(80.64)	06(19.36)	31(100)

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Table – 2 : Distribution of identified cases according to discrepancy in age-sex opinion & age group

Age group (in years)	Cases without Discrepancy- no(%)	Cases with Discrepancy- no(%)	Total no(%)
0-5	1(4)	1(4)	2(8)
6-10	3(12)	0(0)	3(12)
11-60	20(80)	0(0)	20(80)
Total	24(96)	01(4)	25(100)

Table – 3: Distribution of cases according to manner by which identity was established

Manner of identity	Cases- no(%)
Site of recovery	07 (28)
Visual	07(28)
Belongings	03(12)
DNA typing	11* (44)
Total	25(100)

* Out of 24 cases of deep burns, typing was possible in 11 cases only.

However, in 6 cases there is no claimant / reference sample.

Table – 4: Distribution of cases with deep burns according to futility of DNA analysis

DNA status	Cases-no(%)
DNA amenable	11 (39.13)**
DNA not amenable	14(60.87)
Total	24(100)

** In one case DNA was amenable, but no match sample was available.

Discussion

Disaster can be defined as **"Any emergency that requires the implementation of special arrangements by one or more of the emergency services".** The recommended methods for identification include finger prints, DNA profiling, dental examination, physical characteristics, radiological examination, clothing, documents recovered from the body, jwellary/ ornaments and visual identification.[1]

The identification of the body from a fatal fire may at first appear a daunting task, especially if large areas of it have been consumed during the fire.[1] The conventional methods adopted for identification may not help much due to extensive burns in which majority of the parameters are destroyed due to fire and in such case DNA typing from burnt tooth or bone may the only and best possible tool left for objective and scientific opinion on identity. And hence, bone and tooth are considered as conclusive samples in decomposed or skeletonised corpses.[2]

It is obvious from Table -1 that 77.42% cases had deep burns and superficial burns cases were only 22.58%. In cases with superficial burns identity was possible to be established in all cases. Contrary to that, it was possible to establish identity in only 75%. Thus, the higher degree of burns is an adversely affecting factor, which influence the success of such exercise.

Discrepancy between primary (interim) and of final opinion about age and sex of an individual was confined to age group 0-5 only. In other age groups, both opinions were almost similar[Table-2]. The discrepancy in early age group can be attributed to fact that in this age group skeletal features are less reliable as compared to adults.[3]

Table – 3 depicts that in 7(28%) cases persons identified based on site of recovery such as bus driver, conductor of the bus, tanker's driver, truck cleaner and 3 by passers. In 7(28%) cases of superficial burns facial features were intact, enabling the relative for visual identification. In 4(16%) cases presence of belonging on the body like "*MANGAL SUTRA*", "*MALA*", "*SIMCARD*", *DENTAL BRIDGE* played vital role for purpose of primary identification. In 44% cases identity was confirmed only on the basis of DNA typing.

Though reference sample for DNA typing were available in 24 cases, only in 11(39.13 %) cases; DNA was amenable. Where as in 14 (60.87%) cases, DNA was not amenable.

All these cases showed 6th degree burns (Dupuytren's classification) and severe charring leading to mutilation. [Table-4]Teeth and bone are " marginal sample"(may work but not best choice) [2] and the utility is further reduced if those are also charred . Thus, restricted utility of DNA typing in the present case can be safely attributed to availability of only marginal samples and that is also in charred condition, in the present case.

Conclusion

From the observations and discussion as above it can be safely concluded that:

1. The primary challenge in cases of autopsy of mass disaster victims is the establishment of identity. The uphill task becomes more challenging when there is severe mutilation of dead body due to extensive burns and charring.
2. Meticulous documentation of site of recovery of dead body and belongings thereon do help in primary exercise of establishment of identity to certain extent.
3. Determination of age and sex in pre-pubertal phase of human life, on the basis of skeletal characteristics does experience some flaw.
4. Retrieving the DNA from extremely charred dead body samples is still a challenge even with recent analytical methods.
5. In all such cases, collective and combined endeavor by police, Forensic Pathologists and Forensic Science expert in context of examination of scene, dead bodies and analysis of evidence may help to resolve the issues related and minimize the discrepancies in context of such mass disasters.

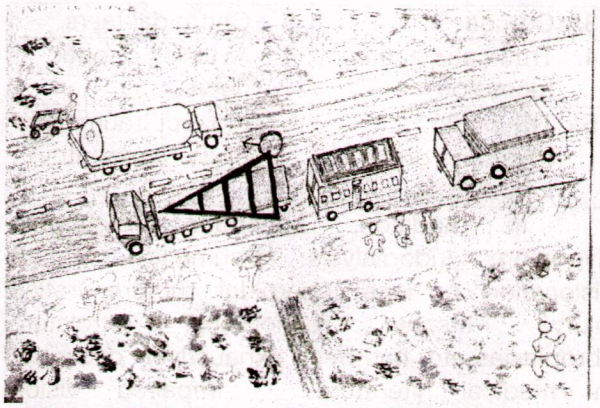

Figure-1:Relative position of LPG tanker on one side of road and trailer, bus and truck on the other side of road just before the accident. Three by passers in near vicinity and a person at the distance of 100 meter, working in the field.

References

1. **James J P , Busutil A and Smock W.** (2003) Forensic Medicine- Clinical and Pathological aspects, GMM London, pp.565-578
2. Understanding and collecting Forensic DNA Evidence- A Guide for Doctors, CFSL, Chandigarh.
3. **Krogman W M and Iscan M Y.** (1986): The Human Skeleton in Forensic Medicine, 2nd Edition, Charles C, Thomas ,USA, p.190.

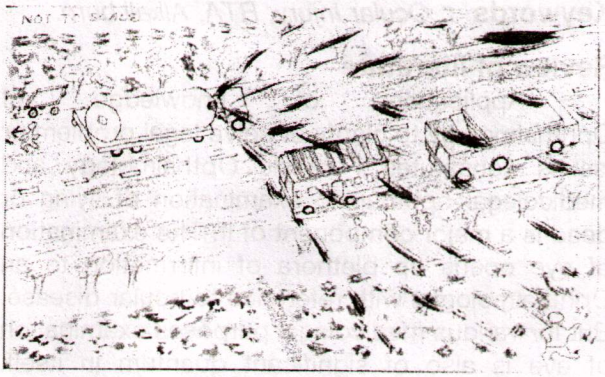

Figure-2:The damage to upper front part of LPG tanker ejaculating jet of fire involving cabin of the tanker, bus, truck, three by passers and a person at the distance of 100 meter working in the field.

Figure-3: Mutilated and charred remains of passenger of bus.

Case Report

Ocular Injury & its medico legal implications

*Dinesh Sharma *, P.N. Mathur ** & O.P. Saini ****

Abstract

Forensic Medicine is fast growing and important branch of medicine. Some sub division of this subject like Thanatology , Toxicology are taking their shape separately. Forensic Opthalmology is one of the newly emerging dimension of the subject. A series of four case reports of medicolegal implication are presented herewith.

Keywords : *Ocular Injury, RTA, Alkali burn.*

Review of literature

Application of knowledge of Ophthalmology to clarify or solve legal problem or issues constitutes Forensic Opthalmology and medicolegal ophthalmic examination of living or dead is a major component of it. The examination of eye opens up plethora of information to an Ophthalmologist with reference to ocular disease. But for various medicolegal purposes examination of eye is also of significant quantum in itself. Condition of pupils, Strabismus, Nystagmus, play important role in case of poisoning and help the treating physician in excluding or including various differential diagnosis.[1]

Postmortem changes in cornea and retinal vessels are also relied upon for determining time since death, of course it is limited to few hours after death.[2] Many of the recent work include analysis vitreous humor in estimating time since death. One such recent work comprising of 492 samples indicates that in 153 cases the prescribed value was found and in 339 cases there was over estimation.[3]

Behra et al in the study of 120 cases has drawn useful conclusion that for estimation of age detail examination of the eyes is helpful, postmortem time interval can be estimated from IOT, reaction to meiotic and mydriasis in the early periods and SGOT level of the vitreous in the late periods after death and eye injuries can predict different types of head injuries.[4]

Broadly the ocular injuries can be divided on the basis of type of structure involved as below.[5]

ANTERIOR SEGMANT INJURY	POSTERIOR SEGMANT INJURY
1. Lid	1. Traumatic macular mole/macular cyst
2. Conjunctiva	2. Traumatic retinal dialysis or detachment
3. Cornea	3. Choroidal tears
4. Traumatic angle recession	4. Avulsion of optic nerve
5. Traumatic mydriasis and iridodialysis	5. Indirect traumatic optic Neuropathy

In addition, secondary glaucoma, Hypopion, Iridodialysis, traumatic cataract, dislocation of lens, choroidal rupture, retinal injury, Putscher retinopathy, retrolateral fibroplasias etc. has been exhaustively described in medical literature.[6] Impaired vision, abnormality of ocular muscle, impaired sensation over forehead due to sharp force, known as orbital apex syndrome has also been reported.[7] The victims of RTA also show a reasonable number of variety of ocular trauma in form of abrasion, laceration, black eye associated with maxillo-facial trauma.[8]

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Case History

Case –1

This is the case of 13 years boy who met with a road traffic accident and suffered transient loss of consciousness. On examination subconjuctival hemorrhage and haematoma or orbit (black eye) was present. CT scan and vision was normal. Black eye is the commonest of all eye injuries (42.22%) without visual disturbance, in road traffic accidents. It takes up to one and half to two months to resolve Haematoma. They usually do not cause visual disturbances (simple injury) but it must be thoroughly examined. Even in slightest doubt, x-ray and / or CT scan to be done to look into any under lying fracture of orbital wall or compression of optic nerve etc. This changes category of the injury to grievous one.

Case -2

A 10 years old boy while playing with his brother with bow and arrow, accidentally sustained arrow inpact at sclera-corneal and caused perforation of globe (Figure-1). Perforated wound was sutured and in spite of intra vitreal broad spectrum antibiotics, endophthalmitis ensued. Perforated wound on the globe, it this gets infected may lead endopthalmitis or panopthalmitis.(Figure-2) This further may lead to meningitis which may be dangerous to life . Perforation of globe if not treated properly and well in time eventually leads to phthisis bulbi (shrunken eye).

Case –3

A 15 years old boy met with fireworks (crackers) injury during the Diwali festival (Figure-3). On examination multiple foreign bodies (carbon particles) were present on the cornea, sclera and fornix and corneal epithelial burn with edema. In due course of time even with treatment cornea got infected, ulcerated then sloughed out. There was no vision hence patient's eye was enucleated.

Case –4

A 16 years old boy splashed fused calcium carbonate paste intentionally contained in squeezable plastic tube to an 11 years old girl. On examination there was severe burning , redness profuse watering.(Figure-4) There was corneal epithelial erosion, edema and more than half limbal necrosis. Eventually patient's eye became practically blind due to corneal opacity and secondary glaucoma following Alkali burn by *Jurda* and *Chuna* (tobacco powder and fused calcium carbonate paste) . Intoxication by chewing of powdered tobacco mixed with *chuna* is very common in North India specifically in Rajasthan . *Chuna* (semisolid fused calcium carbonate paste which is available in soft plastic tube) and *jurda* is freely available in every smallest shop of North India and are kept in the house within the reach of children. (Figure-5) While playing children may squeeze the tube and it comes out of all sudden and gets splushed into the eye. This lead to severe alkali burn leading to blindness and eventually phthisis bulbi.

Discussion

The therapeutic modality in case of ocular trauma depends on the type and extent of structure damaged in either anterior or posterior segment and hence is domain of ophthalmologist. However, any ocular injury can be categorized in three groups namely 1. Simple eye injuries, 2. Grievous eye injuries & 3. Eye injuries those are dangerous to life for all medicolegal purposes. In case of assault the severity of ocular injury contribute in the exercise of application of section of IPC. If the ocular injury in question false within ambit of subsection 2 of Section 320 IPC and in turn depending on type of weapon section 325 or section 326 is applied in a case. All injuries that cause privation of any part of the eyes (with exception, the eye lashes) and joints for example dislocation of lens and breaking of zonules and stripping away of lid or small part of it. Permanent disfigurement of face, for example, injuries that cause residual defect after healing, i.e. ptosis, entropion and squint etc even if the vision is normal (6/6) & amounts to grievous injury.

Here, it may be important to note that we should give opinion after complete healing which may take 6 weeks or 6 months or more on an average, then only we can judge whether the disability or disfigurement is permanent or not because anatomical healing usually never correlate with physiological healing (i.e. vision).

Any ophthalmic injury can be considered grievous which cause suffer to be, during the space of 20 days in serve body pain or unable to follow his ordinary pursuits.

Certain ocular injuries involving the cranium may prove fatal immediately and few delayed complications like meningitis, endopathalmitis, pan-opthalmitis and sympathetic opthalmitis have been reported to cause death of injured. Thus by using medical knowledge especially in case of homicide opinion about possibility of death under ordinary cause of nature, bears importance, when ocular injuries extend deeper.

In case of visual disability the Snellen's chart forms a basis to assess loss of vision and loss of earning capacity.[9] Such exercise is necessary in civil matters where the patient claims compensation under Motor Vehicle Accident and the Workmen's Compensation Act.

Conclusion

Though eye is a bilateral member; its involvement by injury has medico-legal implication, both of civil and criminal nature. Basic knowledge of Opthalmology and available medical literature are important dimensions in offering a medicolegal opinion. Further similar or better work by various scientists who practically deal with such cases will definitely enrich the relevant literature.

References

1. **Pillay V V** . Comprehensive Medical Toxicology, Chapter 2, Paras Publishing 2003, pp. 8-10.
2. **Narayan Reddy K S.** The Essential of Forensic Medicine and Toxicology, Chapter 7, 26th Edition 2007, K Shagona devi, pp..131-132.
3. **Madea B and Rodig A**. Time of death dependent Criteria in vitreous humer: academy of estimating time since death. *Forensic Science Int.* 2006; 16(2-3):87-92.
4. **Behra A, Das G S, Pandey S N and Mohapatra S C**. Eye is the Spy of Forensic Medicine. *J Indian Acad Forensic Med.* 2003; 25(4):165-167.
5. **Sihota R and Tandon R**. Parson's Diseases of the Eye. 20th Edition, Elsevier 2007.
6. **Tadechi C G, Edeart W G and Tedechi L G.** Forensic Medicine: A Study in trauma & environmental hozzards, Vol.1, Ch.3, B Sanadems Co.1977, pp. 88-131.
7. E. Medicine. Orbital Fracture of Apex. By Bhupendra Patel.
8. **Sharma D, Mathur P N and Saini O P.** Incidence of Ocular trauma is RTA during 2003. A Staststics evaluation. *J Forensic Med Toxicol.* 2005; 22(1) :33.
9. **Parmar SPS and Desai S S.** Law of Disability (Medical and Non Medical). Dwivedi and Co., Allahabad, (India),2004.

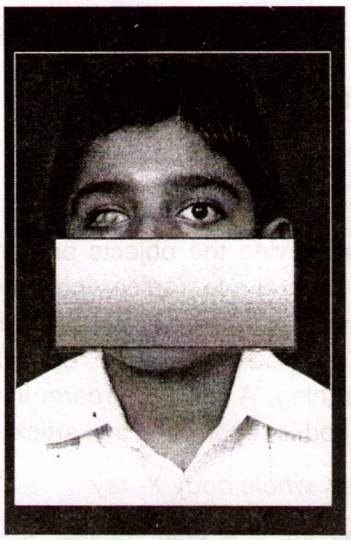

Figure –1: Perforation of globe by bow and arrow injury, followed by endophthalmitis

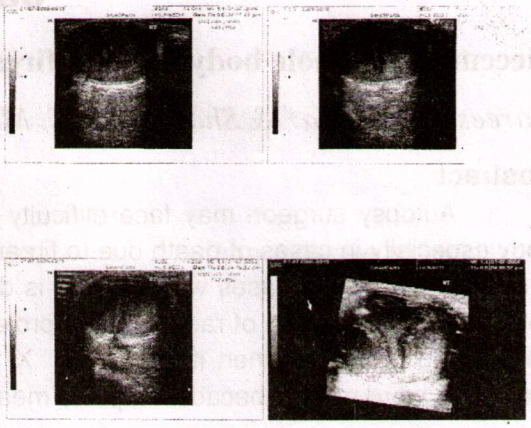

Figure-2: Collection of thick fluid (pus) with retinal detachment in B-scan USG of figure-1 patient.(Case No.2)

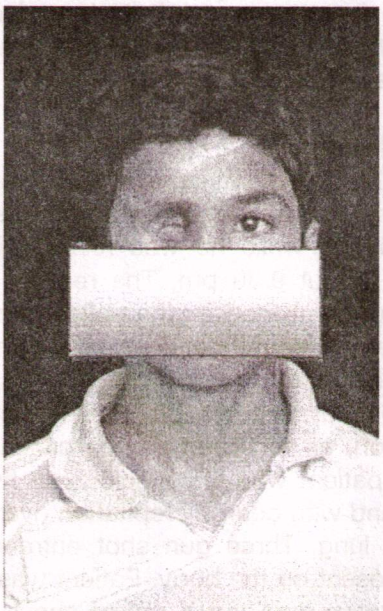

Figure –3: Enucleation of eye after perforation of globe due to corneal sloughing in fireworks (Crackers) injury. (Case No.3)

Figure-4: Alkali burn with corneal opacity and secondary glaucoma (Case No.4)

Figure –5: Calcium carbonate Paste-Real hazard to vision through alkali burn. (Case No.4)

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Case Report

Piecemeal or whole body x ray in firearm injuries -a case report

Hareesh S. Gouda & Shashidhar C. Mestri***

Abstract

Autopsy surgeon may face difficulty in locating and retrieving the objects present inside the body especially in cases of death due to firearm injuries. As a general rule, radiograph should be taken in all gunshot wound cases whether one is dealing with a routine or a special situation since it is the sole means of detection of radio opaque projectiles within the body before autopsy. But X rays have to be taken in proper manner; if not, even X- rays will fetch nothing. A case of firearm injury in which projectiles were missed because of piece meal radiograph method is reported in this article.

Keywords : *Gunshot injury, missing pellets, pecemeal X --ray, whole body X- ray*

Introduction

One of the objectives of Medico Legal autopsy is to collect evidence in order to identify the object causing death and to identify the criminal.[1] Exhibits include that are present inside the body of the deceased as well as outside. Occasionally autopsy surgeon may face difficulty in locating and retrieving the objects present inside the body especially in cases of death due to firearm injuries. This is because, projectiles after piercing the skin may change their pathway due to internal ricocheting and may be lodged anywhere inside the body. In such cases knowing the specific location of the bullet will save valuable time at autopsy and also avoid needless effort in searching for bullets that are inaccessible. Radiological methods have been used to detect foreign material in human body since the discovery of X ray by Sir Wilhelm Conrad Roentgen on 8th November 1895 [2] and still is the preferred method of detecting and localizing bullets. On 7th February 1896 X- ray was used for the first time to locate bullet in the body. [3]As a general rule, radiograph should be taken in all gunshot wound cases whether one is dealing with a routine or a special situation.[4]

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Since they are the sole means of detection of projectiles within the body before autopsy. But they have to be taken in proper manner; if not, even X -rays will fetch nothing. In this article a case of firearm injury in which projectiles were missed because of piece meal radiograph method is discussed.

Case History

Deceased was an elderly male aged about 60 years. He was shot by his adopted son and his three friends while he was relaxing in an easy chair at about 9.30 pm. The reason behind the shoot out as alleged by the police personnel was a property dispute between them and the gun used was a country made one. He was brought to KLE Hospital at 10.05 pm on the same day. At admission, as recorded by the casualty medical officer, patient was unconscious, in hypovolemic shock and with coarse crepitation over the region of right lung. Three gun shot entrance wounds were present on the body. Patient was treated on conservative line and X ray of chest, pelvis and left upper arm was taken and was shifted to the operation theatre for an emergency exploration. But unfortunately he succumbed to the injuries even before commencement of surgery and body was shifted to mortuary for Medico Legal formalities.

Salient autopsy findings

Autopsy was conducted on the next day morning. Apart from the routine findings,

concentrating exclusively on gun shot wounds, the following findings were observed. Three penetrating wounds with features of entry wound were present on the body. One was situated on the back of left upper arm in the middle one third measuring 1cm x 0.8 cm bone deep (Figure 1). Projectile corresponding to this wound was traced and retrieved by dissecting the wound track. Second wound of 1.3 cm x 1 cm size cavity deep, was present over front of upper abdomen on left side and the third one, of 1 cm x 0.7 cm size cavity deep, over the front of chest on right side (Figure 2). Apart from these, an abrasion of 3 cm x 1 cm size was present over front of chest on left side. There were no exit wounds on the body (Figure 3). Projectile corresponding to wound number two was traced and retrieved by dissecting the wound track. Projectile was present near 10th rib of right side in the back armpit line. This indicates that the projectile has traveled below upwards from left to right side. Projectile corresponding to wound number three which was present near second lumbar vertebral body also retrieved by dissecting the wound track. Projectile has traveled from above downwards towards midline. All the three projectiles were globular metal mass having rough surface (Figure 4). 1200 ml of blood was present in abdominal cavity and 900 ml in thoracic cavity. All viscera were pale.

From above findings cause of death was opined as haemorrhagic shock as a result of multiple injuries sustained.

Discussion

This particular case is reported because, the three X- rays which were taken at casualty surprisingly revealed the presence of only one projectile i.e in the left arm (Figure-5). Where as X -rays of chest (Figure-6) and pelvis (Figure 7) did not show any projectile. But interestingly X-rays taken prior to autopsy revealed the presence of two more projectiles (Figure 8) apart from the one in the arm.

In the X- rays taken at casualty, part of the chest up to 9th rib and pelvis with upper part of both thighs are exposed, but part of the body from 9th rib to 5th lumbar vertebra is not exposed. And, this was the area where the remaining two projectiles were lodged, which are visible in X-rays taken prior to autopsy (Figure 9). Thus, these projectiles would not have been missed if the full body was subjected for X -ray at casualty. However, in this particular case missing of these projectiles did not affect the final outcome as the victim died before surgery. But this may not be same in every case.

Conclusion

. In all cases of firearm injuries, it is very much essential to take X- ray (Antero Posterior & Lateral view) of whole body rather than taking the X -ray of only that particular region where external wounds are present. And, even though the antemortem X -rays show the presence of projectiles, it is better to take one more X -ray prior to autopsy. During medical intervention like Cardio Pulmonary Resuscitation or while shifting the body to mortuary, the projectiles may also shift their position inside the body. For these reasons it is always preferable to take X -ray of the whole body, region-by-region or full body scan if facilities are available. This will save the patient by taking prompt remedial measures, treating doctor as well as autopsy surgeon from litigations.

Acknowledgement

We profoundly thank Dr (Late). F.S. Kuligod, Professor, Dept. of Forensic Medicine, KLE University's J N Medical College, Belgaum, who was instrumental in solving the mystery.

References

1. **Reddy KSN**. The essential of Forensic Medicine and Toxicology . 24th ed. Hyderabad: Sugunadevi K; 2003. p.84.
2. Who discovered the x-ray? [Cited 2008 August 07]. Available from: www.essortment.com/all/wilhelmroentgen_rght.htm - 13k -
3. **Brogdon BG and Lichtenstein JE.** Forensic Radiology in Historical Perspective. In: Brogdon BG, editor. Forensic Radiology. New York: CRC Press; 1998. p.13-34.
4. **Dimaio VJM.** Gunshot Wounds: Practical aspects of Firearms, Ballistics and Forensic Techniques. 2nd ed. New York: CRC Press; 1999. p.315.

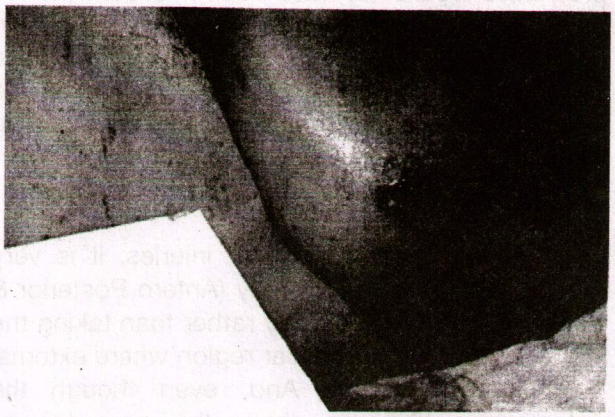

Figure-1: Entry wound of arm

Figure –2: Chest showing entry wounds (white arrows) and abrasion (black arrow)

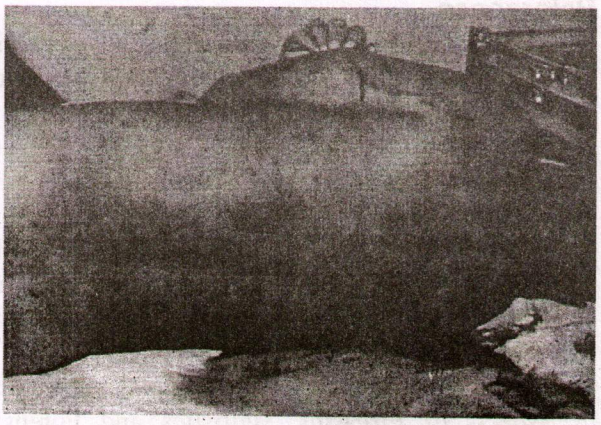

Figure-3: No wound over the back

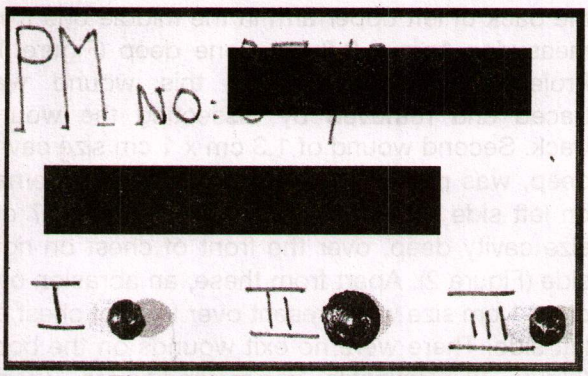

Figure -4: Retrieved projectiles

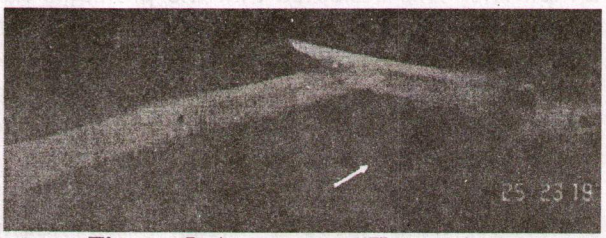

Figure -5: Antemortem X ray - Arm

Figure- 6: Antemortem X ray – Chest

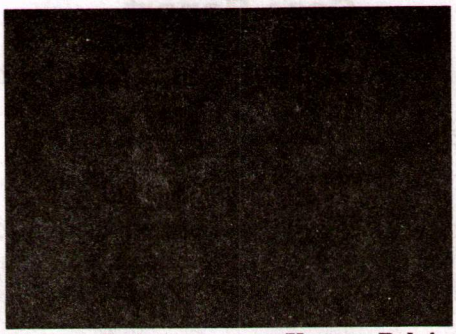

Figure -7: Antemortem X ray – Pelvis

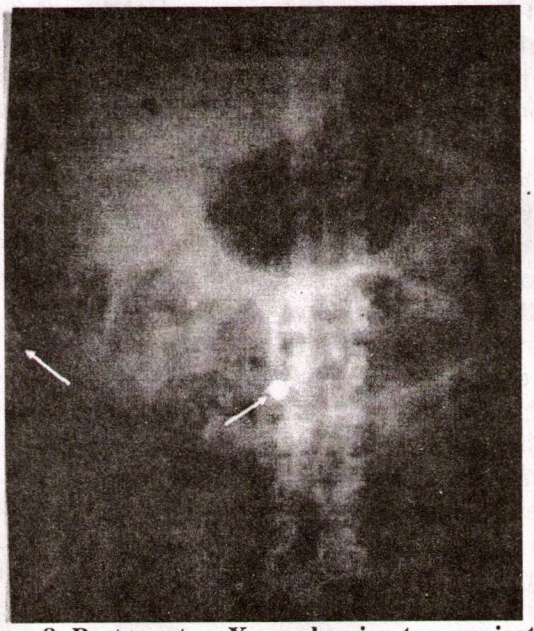

Figure -8: Post mortem X ray showing two projectiles

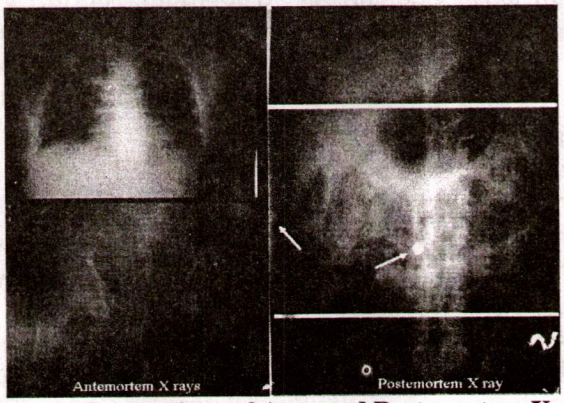

Figure -9: Comparison of Ante and Post mortem X rays

Case Report

Abdominal transection and egg shelling of skull in a road traffic accident

Prateek Rastogi & Y.P. Raghavendra Babu***

Abstract

Fatalities occur in all forms of transportation, but numerically, road-traffic accidents account for the great majority worldwide. Here we present a case of run over injury with egg shelling of the skull and near complete transection of the trunk at the level of umbilicus.

Keywords : *Road traffic accident, run over, egg shelling, transection of abdomen.*

Introduction

Fatalities occur in all forms of transportation, but numerically, road-traffic accidents claim largest toll of human life and tend to be the most common problem around the world. In India, nearly 1 lakh persons die, 1.2 million are seriously injured and around 3 lakh get permanently disabled annually due to road traffic accidents.[1] Incidents can range from pedestrian hit or run over by a vehicle, collision between two vehicles, vehicle colliding with an obstruction, a person collapsing due to a natural disease and subsequently been run over etc. The determination of manner of infliction of these injuries is mainly circumstantial, but the Forensic expert has a definite role in circumstances where there is a degree of doubt as to the manner of infliction of injuries and as to antemortem nature of these injuries. Recording of injuries at post mortem may facilitate not only in the award of compensation but also in apprehending the defaulting drivers. A case of road traffic accident is presented where the victim while sleeping on the footpath was run over by a heavy vehicle.

Case History

As per the information furnished by the police an unknown male aged about 40-45 years was sleeping on the footpath. He was run over by a heavy vehicle in the early hours of morning and autopsy was performed in the forenoon.

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External Examination

Dead body was of a male, weighing 32 Kg, having dark complexion. Body was disfigured & was in state of rigor mortis. Skull & face were crushed with opened empty cranial cavity- side-to-side compression. (Fig.1). Abdomen was transected at the level of umbilicus (joined only with vertebral bodies) (Fig.2) with complete extravasation of abdominal viscera (Fig.3). Left arm & right thigh were crushed. Left arm, right forearm, left thigh, right leg & hipbone were fractured.

Internal Examination

Brain matter was absent. Multiple rib fractures and fractures of tracheal rings were present. Right pleural cavity contained 300 ml & left pleural cavity contained 250 ml of blood. Abdominal walls were lacerated with crushing of lumbar vertebrae and genital organs. Lungs, oesophagus, stomach and intestines showed multiple contusions and lacerations. Peritoneum, diaphragm, aorta, liver, spleen, kidneys and urinary bladder were ruptured.

Opinion- Cause of death was opined as crush injury to skull and abdomen.

Discussion

Motor vehicle accidents rank first among all accidents in the world. Pedestrians are the commonest group of victims involved followed by motorcyclists further followed by occupants of cabs and jeeps.[2] Injuries may range from minute abrasions to imminently fatal ones. Traumatic amputation of extremities and complete severance of the trunk have been reported in

collisions between passenger cars and pedestrians at collision speeds of > 80-100 km/h (50-62 mi/h).[3] Most of the injuries are self evident as to the nature and manner of infliction.

There is little that the autopsy surgeon can contribute to the elucidation of factors leading to the accident as it is largely the circumstantial and forensic laboratory evidence which is likely to reveal a non-accidental cause. However, the doctor's role in detecting the compatibility/incompatibility of the injuries with those usually sustained in traffic accidents, distinguishing antemortem from postmortem injuries, demonstrating the presence of any disease capable of creating sudden incapacity and analysing samples for alcohol/drugs, etc., can go a long way in assigning roles to the human and to some extent vehicular and environmental factors [4]

In the present case there was near total transection of the body at the level of the umbilicus and egg shelling of the skull. Complete severance or transection of the trunk, a known entity in road traffic accident, is an imminently fatal one. Egg shelling of the skull (rarely reported finding) was present in this case along with complete loss of brain tissue.[5]

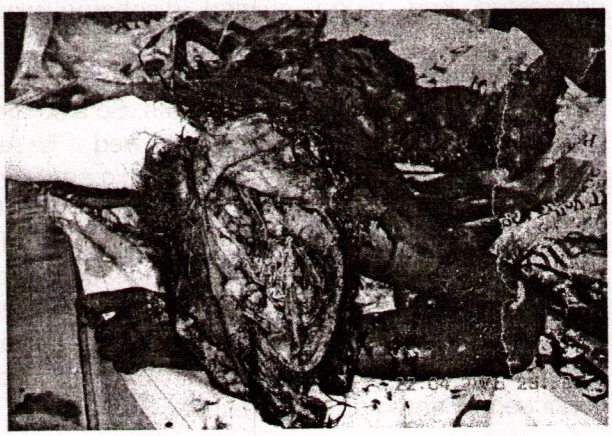

Figure-1: Egg Shelling of the skull

Figure- 2: Complete transection of the trunk

References

1. **Kaul A, Sinha US, Pathak YK** et al. Fatal road traffic accidents, study of distribution, nature and type of injury. *J Indian Acad Forensic Med.* 2005; 27(2): 71-76.
2. **Mohan D.** Road traffic deaths and injuries in India: Time for action. *National Med J India.* 2004; 17: 63-6.
3. **Nadjem H and Ropohl D.** Complete transaction of the trunk of passengers in car accidents. *Am J Forensic Med Pathol.* 1996; 17(2): 167-71.
4. **Sharma BR, Harish D, Sharma V and Vij K.** Road traffic accidents – a demographic and topographic analysis. *Med Sci Law.* 2001; 41(3): 266-74.
5. **Behera C, Rautji R and Dogra TD.** Decapitation with egg shelling of the skull in a road traffic accident: a case report. *Med Sci Law..*2008; 48(1): 87-8.

Case Report

Toxic epidermal necrolysis and medical negligence: A case report

Kiran G T &T. K. Bose***

Abstract

A 21 year old lady was admitted to a tertiary care hospital for treatment of seizure disorder. She was administered Phenytoin Sodium intravenously and developed Toxic epidermal necrolysis. She succumbed to the same subsequently. The patient's relatives filed a complaint of medical negligence against hospital authorities. Autopsy was conducted, which showed vesicles, blisters and epidermal detachment over extensive body surface. Several dilemmas arise out of this situation regarding what is the role of doctor in preventing, anticipating or treating such a rare and unpredictable syndrome. What would be the role of a forensic expert in assessing such a situation?

Keywords : *Toxic epidermal necrolysis (TEN), medical negligence, dilemmas, solution*

Case History

A 21 yr lady was admitted to a major hospital for treatment of seizure disorder on 13/06/08. She was treated with IV phenytoin and developed painful blisters all over the body with fever of 103 F. She was diagnosed as a case of Stevens Johnson syndrome and admitted to ICCU. Later, the patient progressed to develop Toxic epidermal necrolysis. She was ventilated. All vital parameters were continuously monitored and treated symptomatically. Antibiotics and corticosteroids were also part of the treatment. Inspite of all efforts she succumbed on 24/06/08. Her relatives against the hospital filed a case of medical negligence.

Post-mortem examination revealed multiple raindrop pattern of necrosis of epidermis(most extending upto dermis)s all over the body including back, whole of face, anterolateral and posterior aspect of neck , anterolateral aspect of thoracoabdominal wall, both superior extremities including both gluteal region and perineum. Margins of the necrosed epidermis were reddish in color, inflamed and showed signs of infection. Other important findings were skin test mark over the right thigh, one white area present showing pus-like substance on anterior aspect of left forearm. There was also evidence of femoral venepuncture and ECG lead in left lateral chest wall.

Post-mortem staining was present all over the back, cornea was hazy, conjunctiva congested and blood stained discharge was present per mouth and nostril.

Internal examination showed congested brain with multiple hemorrhagic spots. So also the pleura and lungs. Lungs showed basal consolidation and petechial hemorrhagic spots in the sub-pleural region. Mucous lining of the GIT from mouth to small intestine was congested. Liver and kidney also showed congestion and hemorrhagic spots. It was opined that death was due to the effect of widespread epidermal necrosis associated with infection and septicaemia, antemortem in nature.

Discussion

From the above case many differential diagnosis can be arrived. Mainly, Toxic epidermal necrolysis, Staphylococcal scalded skin syndrome(here only stratum corneum is lost)[1], Bullous pemphigoid and pemphigus vulgaris(onset very slow and lesions more localized), Graft versus host disease(no such history) and anticonvulsant hypersensitivity

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Syndrome (pustulated lesions are main findings here)[2]. Considering the .history and autopsy examination a diagnosis of toxic epidermal necrolysis can be arrived.

Toxic epidermal necrolysis is a drug induced disorder which is characterized by blisters and epidermal detachment(more than 30% body surface area) resulting epidermal necrosis in the absence of substantial dermal inflammation. Patient presents wih acute symptoms, painful skin lesions, fever > 102.2 F, sore throat and visual impairment resulting from mucous membrane and ocular lesions. Intestinal and pulmonary involvement associated with a poor prognosis, as are greater extent of epidermal detachment (almost many of features found in this case).

Drugs most commonly implicated in this condition are sulfonamide drugs, phenytoin, carbamazepine, phenobarbitol, penicillins, Allopurinol and NSAIDs. Best results come from early diagnosis, immediate discontinuation of any suspected drug and supportive therapy, paying close attention to ocular complications, often in burn units or intensive care units. Readministration or future skin testing with offending drug is absolutely contraindicated. Administration of corticosteroids is controversial[3].

Finally, there is no prevention for TEN[4]. No reliable test can indicate that a specific drug may cause TEN in a specific patient[5]. Question arises as to what is the role of doctor in preventing, anticipating or treating such a rare and unpredictable syndrome.

Here there is no role of the doctor preventing such a syndrome except if such similar history is available. The role of doctor is limited only in speedy and intensive treatment of the patient once the syndrome has occurred. In case of controversial treatment protocols such as corticosteroid usage in this case, the doctor has to get informed consent from the patient or his kin for treatment after explaining them all the pros and cons of such a protocol and alternative protocols ,if any[6].

Conclusion

In the above case, since the onset was sudden and appearance of the patient was unpleasant to the relatives of the patient, important thing for prevention of litigation is proper counseling of the patient's relatives. Normally, in any treatment common adverse effects are explained to the patient but for better sake, informed consent of the patient should touch Stevens Johnson syndrome/Toxic epidermal necrolysis as a rare possible sequelae.

References

1. **John Hunter, John Savin and Mark Dahl**. Clinical Dermatology, 3rd Ed,2003: p115-116.
2. **David J Gawkrodger**. Dermatology, Illustrated color text, 3rd Ed,2003: p83.
3. **Kasper, Braunwald, Fauci, Hauser, Longo, Jameson**. Harrison's principles of internal medicine,16th Ed, 2005, p321-322.
4. **Kumar & Clark**. Clinical Medicine, 6th Ed, p1341-1342.
5. **Jacqueline L Longe et al.** The Gale Encyclopedia of Medicine, 3rd Ed, 2006, p3740-3741.
6. Electronic file, http://www.thindabhin.com/iafm/mlmanual.htm, Prof K S Narayan. Reddy, Malpraxis prevention, Ch 6.

Case Report

Post-mortem diagnosis of "Battered women syndrome"

Akhilesh Pathak & H. M. Mangal ***

Abstract

Over the last two decades, awareness in the community has significantly increased towards the domestic violence and due to that various legal and other agencies are coming forward to help the victims of domestic violence by means of legislation and other social means. Since the inception of the various laws to protect the women, a great deal of controversy and confusion has surrounded the term "Battered women syndrome," that how it is used and on what basis the action can be taken to minimize the problem furthers. Battering of women is one of the well-recognized crimes in India, and most of the cases are settled in the home surroundings as rarely they reach to the police station or courts. Detection of such cases during the post-mortem examination is very unusual. One such case was brought to the mortuary of Medical College , Rajkot, in which we could conclude that the deceased was a victim of "Battered women syndrome," with findings of consistent and repetitive physical torture in the form of different types of injuries of different duration, ultimately terminating into the death. This case-report is an attempt to provide an overview of Battered women syndrome, which makes a question that are we really advancing and our laws are really safeguarding or protecting the interest of the women in India?

Keywords : *Battered women syndrome, domestic violence & abuse*

Introduction

Battered women syndrome is a psychological condition used to describe some one who has been the victim of consistent and severe domestic violence. A cycle of abuse occurs in a repeating pattern with in the context of at least two individuals with in a family system in which woman is the victim. To understand Battered women syndrome, one must first understand how someone becomes a "Battered women". According to Dr. Lenove E. Walker (Psychologist & Faminist) a woman must experience at least two complete battering cycles before she can be labeled as a "Battered women". This cycle of abuse has three distinct phases-First is the 'Tension building phase', followed by second phase of 'Explosion or Acute battering incident' and lastly 'Calm and loving phase'-often referred to as the Honeymoon-phase. [1]

Battered woman syndrome describes a pattern of psychological and behavioral symptoms found in women living in battering relationships. There are four general characteristics of this syndrome:

1. The woman believes that the violence was her fault.
2. The woman has inability to place the responsibility for the violence elsewhere.
3. The woman fears for her life and or her children's lives.
4. The woman has an irrational belief that the abuser is omnipresent and omniscient.

Most of the women in India experience some form of physical violence from their partners during their married life. Wife beating is found in every class at every income level. A woman is most at risk of serious injury or even homicide when she attempts to leave an abusive partner and it may take her a long time before she can do

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so.[2] In the Era, where we are celebrating the "Women's Day," it is very unfortunate that such cases of death due to battering of wife are still being reported. Government is also trying to protect the women from all such violence and for that recently the "Domestic Violence Act 2005" was brought into the force by Indian government from October 26, 2006. Domestic violence under this act includes actual abuse or the threat of abuse weather physical, sexual, verbal, emotional or economic. Harassment by way of unlawful dowry demands to the women or her relatives would also be covered under this definition.[3]

Case history

In September 2007, a dead body of an identified female aged about 24 years was referred to us for the pot-mortem examination from a rural hospital about 80 Km from the Department of Forensic Medicine, Rajkot .The police had alleged the cause of death due to head injury by some hard and blunt object. During the postmortem examination we found that the contusions of varying size, shape and color from red to green were present over the different parts of the body. Infected lacerated wounds and burns of different duration were also present over the different parts of the body of the victim. The antemortem changes in contusions and lacerations were consistent with the duration of 1-2 days. The healing burn injuries of dermo-pidermal degree over the inner aspect of both thighs near genitals and on front of right thigh in typical "S" shape pattern were also consistent with their old duration of about 2-6 months. Superficial scars of scald burns over inaccessible area of inter-scapular region and over left forearm in the right-handed victim might be because of some past violence. Contusion over left side forehead and underlying depressed fracture of left frontal bone with large sub-dural hemorrhage was sufficient to cause the death of the victim.

Discussion

Violence within the family has received increasing attention in recent years. Family violence is strongly associated with excessive drinking, aggressive personality of men, or sometimes with some psychiatric illness. Some people are violent only within the family, whilst others are also violent outside the family. Violence in the family can have long term detrimental effects on the psychological and social development of the children as well as on the mental health of the spouse. Violence by men towards their wives is much more conspicuous than violence to husbands. The latter is less frequent, physically less serious, and much less often reported.[4] Most battered women will make up excuses for why their partners have an abusive incident and usually they believe that the abuse will never happen again. Her passivity will most often reinforce the abusers violent tendencies and the tension in the relationship will continue to build until it culminates either in the suicide by the victim or sometimes a homicidal act by the abuser.[1] Agnihotri & Sinha have also observed in their three-year study that in various crimes against women, majority of the cases was of dowry harassment followed by eve teasing. [5]

It is important to understand that why battered women stay in abusive relationship. She may tend to stay in abusive relationships for a number of reasons like- women are still positively reinforce during the honeymoon phase; women tend to be the peacekeepers in family to maintain the relationship. She thinks that it is more dangerous to leave than to stay and sometimes because of the prior threats given by abuser to kill self or her children. Finally she losses her self-esteem and no psychological energy to leave the home resulting in a learned helplessness or psychological paralysis.[6] Children who witness parental violence are also effected indirectly as they think that such behavior is acceptable and approved off by their most important role models e.g. parents. A child, who witnesses his parents engaging in abusive behaviors towards one another, will very likely subject his or her spouse to the same abusive patterns.

This type of cases are only a tip of ice-berg for drawing the attention of the administrative agencies and women social activist that we have to still go far to protect the women in society, as it shows that the women are still not in a position to save themselves or to escape from such intolerable environment.

References

1. **Walker L.** The Battered Woman Syndrome, 1984, New York: Springer, pp.95-97.
2. **Sadock BJ and Sadock VA.** Comprehensive Textbook of Psychiatry, 7th Edition, 2000, Lippincott Williams & Wilkins; USA, pp. 2003-04.
3. Protection of Women from Domestic Violence Rules, 2005: Implementing rules issued by the Indian Central Government.
4. **Gelder M, Gath D and Cowen P.** Oxford Textbook of Psychiatry, 3rd Edition, 1996, pp.763-64.
5. **Agnihotri AK and Sinha US.** Atrocities against women in Utter Pradesh, *Int J Med Toxicol Legal Med.* 1999; 2(1): 09-11.
6. What is Battered Woman's Syndrome? By Lori S. Rubenstein, Attorney - Mediator Published: July 17, 2004.

Case Report

Unusual fatal accidental femoral vessel injury: A case report

(Lt Col) Ravi Rautji , C. Behera** & T. D. Dogra****

Abstract

A young male was accidentally injured when he was hit by a reversing school bus on the upper part of his left lower limb. A mobile phone which was kept in the left pocket of his trouser got crushed and sharp fragments of the mobile pierced his left inguinal region injuring femoral vessels. He bled profusely before he could be shifted to a hospital. In the hospital he was treated with wound exploration, stitching of vessels, transfusion of blood and local dressing. Throughout the period of hospitalization his condition remained critical, and he succumbed to multi organ failure due to septicemia consequent upon the injury sustained.

Keywords : *Mobile phone, femoral vessels, inguinal region, septicemic shock*

Case history

A 24-yrs old male was accidentally injured by a reversing school bus, when it hit the individual on the upper part of lower limb including inguinal region on the left side. The mobile phone which the individual was carrying in his left pant pocket got damaged during the accident and sharp fragments of the mobile phone pierced the left inguinal region damaging the blood vessels. He lost considerable amount of blood before being shifted to a hospital where, after a preliminary examination and first aid, CT examination was conducted. Plain CT scan revealed bulky and enlarged left pectineus, iliopsoas, rectus femoris, obturatur externus and gluteal musculature with blurred myofascial fat planes, measuring approximately 68.6 x 58.6 mm in size and encompassing the left external iliac and the femoral vasculature. Post traumatic organised haematoma, myofascial contusions and thin undisplaced fractures of left anterior and posterior acetabullar pillars and the left pubic ramus was seen. Active bleeding was stopped by suturing the vessels.

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Autopsy Findings

The body was that of a 24-year-old male with rigor mortis present all over the body. Faint postmortem lividity was present on the back and dependent part of the body except pressure points. No signs of decomposition were present. Partially healed wound of size 4x3 cm with granulation tissue on its surface was present over the left inguinal region, 1 cm lateral to the root of penis, and 1cm below the inguinal line (Fig.1). On exploration, wound was filled with purulent material. Sutures were seen around left femoral vessels. (Fig.2) Purulent material was present in lungs, and medulla of kidney. Fatty changes were seen in liver. Death was due to multi organ failure due to septicemia consequent upon the injury sustained during the accident.

Discussion

Vascular injuries to the groin are common and often life-threatening. Injuries above the inguinal ligament, to the iliac system, are associated with 37% mortality. Associated intra abdominal injuries are common. Injuries below the inguinal ligament are usually to the femoral vessels and are rarely fatal. Associated intra-bdominal injuries are unusual, but disability from femoral fractures and nerve injuries are common.[1]

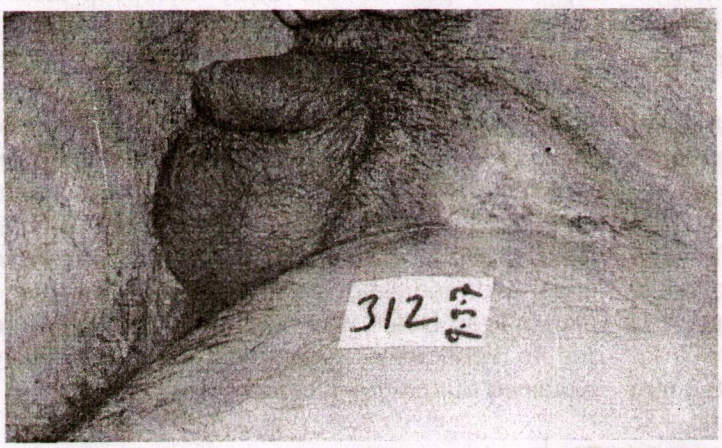
In a retrospective study of 106 patients, with penetrating injuries to the femoral artery by [2], the cause of injury was gunshot in 82 per cent,

stabbing in 13 per cent and pellets in 5 per cent. Injury to femoral vessels due to blunt force trauma has been reported by many authors.[3 & 4]. Bicycle handle and scooter-motor handle bar are the other common offending agents, causing injuries to femoral vessels. [5,6 & 7]

The case is presented for its uniqueness and to the best of authors' knowledge has not been reported in the literature.

References

1. **Millikan JS, Moore EE, Van Way CW 3rd and Kelly GL.** Vascular trauma in the groin: contrast between iliac and femoral injuries. *Am J Surg.* 1981 Dec;142 (6):695-8.
2. **Degiannis E, Levy RD, Velmahos GC, Potokar T and Saadia R.** Penetrating injuries of the femoral artery. Br J Surg. 1995 Apr;82 (4):492-5.
3. **Scott C M, Pinson W and Inahara T.** Common femoral artery injury by blunt trauma: a case report. *Surg.* 1984 Jul;96 (1):122-5.
4. **Madan AK, Raafat A and Hewitt RL.** Complete femoral artery transection from blunt trauma. *J La State Med Soc.* 2003 Jul-Aug;155 (4):215-6 .
5. **Baker WE, Bilimoria MM and Victor MG.** Motor-scooter handlebar syndrome: blunt traumatic injury of the femoral artery. *J Trauma.* 1996 Jun;40 (6):1017-20.
6. **Hadeed JG, Albaugh GK, Alexander JB, Ross SE and Ierardi RP.** Blunt handlebar injury of the common femoral artery: a case report. *Ann Vasc Surg.* 2005 May;19 (3):414-7.
7. **Sarfati MR, Galt SW, Treiman GS and Kraiss LW.** Common femoral artery injury secondary to bicycle handlebar trauma. *J Vasc Surg.* 2002 Mar;35(3):589-91.



← **Figure-1: External wound on left inguinal region in stage of healing**

Figure-2: Dissection reveals extravasation at and around left femoral vessels. ⟶

Review Article

Motorized two-wheeler crash injuries and the role of helmet-use in their prevention: an overview

B. R. Sharma

Abstract

Road-traffic accidents are a major cause of premature death and disability all over the world and motorized two wheelers (motorcycles/scooters/ mopeds) account for the majority of such cases, particularly, in the developing countries like India where they are one of the most important means of transportation, unlike the developed countries where they are used for recreation. Head injuries are a leading cause of death from motorcycle crashes, with many deaths occurring despite optimal use of the available treatment facilities. On the other hand, there is substantial evidence that safety helmets are effective in reducing the incidence and severity of head injuries due to motorcycle crashes. In recent years, mandatory helmet use for motorcyclists has received a considerable attention all over India. Strict implementation of the helmet laws, presently limited to bigger cities only, if extended to smaller cities and towns may help restrict the ever-increasing workload of emergency management services engaged in trauma care.

Keywords : *Motorized two wheelers, crash, head injury, chest injury, abdominal injury, mandatory helmet-use, law.*

Introduction

Nonuse of safety helmets has been shown to result in a shift in the spectrum of injuries, not only to more fatalities but also to more severe nonfatal injuries[1]. It has also been documented that disability related to the nonfatal injuries is extensive, and much of the cost is borne by the society[2]. Although there have been recent advances in access to sophisticated trauma systems and in the treatment of head injuries, much of the morbidity and mortality of head injuries persists despite optimal use of such treatment[3]. Injury prevention efforts are, thus, vital to decrease the impact of such injuries.

The Seattle bicycle helmet campaign[4] has been considered a model program in health promotion and injury prevention. It utilized a multidimensional approach, emphasizing broad-based community coalition building and focusing on elementary school-age children. Another study demonstrated that injury prevention strategies targeting helmet use could increase utilization of this safety device and thus decrease the occurrence of severe head injuries in victims of bicycle crash and motorcycle crash admitted to a level I trauma center[5].

It has been reported that helmets reduce the probability of the occurrence of head injuries, the severity of head injuries when they occur, and the probability of death in both bicycle and motorcycle crashes[6-8]. Statistics have shown an 8% decrease in bicycle crash-related mortality and a 21% decrease in motorcycle crash-related mortality[5]. States introducing mandatory helmet use laws have experienced a decrease in the number of both fatal and nonfatal motorcycle crashes, and States repealing helmet laws have experienced subsequent increases in motorcycle trauma[9,10]. Proponents of the law have pointed out that the costs of head injuries to motorcyclists are in fact, a societal issue, because the tremendous costs of treating and caring for severely head-injured patients are usually borne by the society[2].

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A study by Chiu et al [11], demonstrated the effectiveness of the motorcycle helmet use law, as shown by several trends: a 33% decrease in motorcycle-related injuries; decreases in severity of injury, associated injuries, and length of hospital stay; and better outcome. According to this study, data provided by the Taiwan Department of Health showed that after implementation of the helmet law, the number of motorcycle-related injuries decreased by 14%, length of hospital stay decreased by 14.5%, and costs of hospitalizations from motorcycle-related injuries decreased by an average of US $3.93 million per month.

The medical and public health literature on motorcycle crash injuries of the past two decades has focused predominantly on head trauma and the role of helmets in reducing fatal and non-fatal brain injuries[12-14]. Although this emphasis is well justified, since head injuries are the leading anatomic site involved in fatalities, a substantial proportion of those injured in motorized two wheeler crashes have severe, life-threatening or fatal injuries to the chest and abdominal regions. Studies have reported that 7% to 23% of all fatal injuries sustained in motorcycle crashes were to the trunk region[15, 16]. It has also been reported that among fatally injured helmeted riders, 36% died from severe trunk injuries whereas among the non-helmeted riders 19% died from trunk injuries[17]. This finding might suggest that non-use of helmets will substantially reduce the occurrence of fatal injuries to the trunk. However, this interpretation is incorrect, since there is only a proportional shift from one anatomic region to another with the change from unhelmeted to helmet use. In other words, as the percentage of fatal or severe head injuries decreases with helmet use, the proportion of fatal or severe injuries in other anatomic regions must increase.

This anomaly was observed in a finding from California[18] where, in the year before mandatory helmet law, 61% of the most severe fatal injuries were to the head; whereas in the year after the implementation of the helmet law the percentage declined to 43%. Likewise the shift in fatal trunk injuries was from 34% to 46% respectively. As more states and countries adopt mandatory helmet use laws the number of fatal and sever head injuries from motorcycle crashes will decline as a result, but the fatalities and severe injuries that will continue to occur will involve other anatomic regions.

Motorcyclists constitute a large segment of the patient population with head injury associated with other multiple organ injuries treated at Trauma centers / tertiary care centers all over the world [19]. However, certain aspects of motorized two wheeler driving are peculiar to Indian conditions and need to be mentioned: 1) Roads and driving conditions are such that a large number of accidents occur without actual collision. 2) Motorized two-wheeler in India is a family vehicle and the number of pillion riders may be more than one. 3) At some places, helmet is compulsory for the driver as well as the pillion rider, whereas at some, it is compulsory for drivers only and still not mandatory at many places. Some riders wear turbans (a substitute for the helmet) whose efficacy in protecting against head injury is not known. 4) Nearly all female pillion riders sit sideways with both legs to the left of the vehicle because the common mode of dress, the sari, prevents them from sitting astride and they do not wear safety helmets. Majority of the female motorcycle drivers also does not wear helmets.

Head injury is a common outcome among motorcyclists who crash, and the helmet has been the principal countermeasure for decreasing head injury in crashes [1, 11, 20]. Many studies of helmet effectiveness have concluded that helmets decrease the severity of injury, the likelihood of death, and the overall cost of medical care [21]. Data from the United States as a whole, from various states, from other countries, and from individual cities and hospitals have demonstrated that motorcycle helmets provide protection during motorcycle crashes [22].

Arguments by the organizations that object to motorcycle helmet legislation include: 1) Reduction of the peripheral vision, 2) restricted hearing, 3) production of neck injuries by the extra weight of helmet and 4) religious grounds for wearing turban in a particular Indian community. However, it has been shown that even the full facial helmet coverage allows almost complete peripheral vision of 180^0. This may be slightly

reduced from the normal 200^0, but is not functionally significant impairment. The question of hearing is a bit different. The sound of an approaching vehicle from the side or rear must compete with the sound of the motorcycle engine and wind across the biker's ears in a non-helmeted mode. Both the wind and motorcycle engine, however, are louder than that of an approaching car. Use of the helmet reduces all sound levels equally. It does not differentially reduce the sound of approaching vehicles, and therefore, the ability to detect the approaching vehicles is not impaired. The question of injuries induced by the extra weight of the helmet to the cervical spine has been answered by the studies that demonstrated decreased cervical spine injury on account of energy attenuation from the absorbing capabilities of the helmet that reduces cervical vertebral loading [22].

Motorcycle crashes are associated with a wide spectrum of injuries, which are often in multiple anatomic regions [23, 24]. Therefore, when a severe injury is present in one anatomic region, there is a high likelihood that severe injuries also are present in other anatomic regions. Furthermore, there is a strong association between severe injuries in one anatomic region and severe injury both within the same anatomic region and in other anatomic regions in fatally and non-fatally injured motorcyclists. This finding has obvious important implications for the clinical evaluation and management of the injured motorcyclist and the future design of injury prevention strategies for the motorized two wheeler drivers. Clearly, it is not enough to design a better helmet to decrease brain injury severity without also providing better protection for vital organs in the chest, abdomen and spine. In addition, extremity injuries although, usually non-fatal, but they are most common and may result in tremendous long-term morbidity.

The financial burden of helmet non-use has been reported to be tremendous. Rivara et al. [2] studied 105 motorcycle patients from Seattle admitted to a level – I trauma center and reported that the average cost per patient was $25.764. Only 60% of the costs were for the initial hospitalization and 63.4% of the medical costs were borne by the public. Muller [25] reported on the medical cost of motorcycle repeal and found that $61 million could have been saved in 1979 had the helmet law not been repealed. Converted to 2005, this figure might cross $250 million per year on account of increased cost of medical care and rehabilitation. Increase in medical costs may be attributed to the severity of a greater number of head injuries, which increased hospital days, Intensive Care Unit days, and days of disability. According to yet another study [26], the medical cost for non-helmeted riders was 189.3% higher than for the helmeted riders. The hospital cost difference in 1977, for helmeted vs. non-helmeted riders, was 199.2% while in 1978 the increase was 201%. The portion of injured motorcyclists who required hospitalization with and without mandatory helmet use legislation was 25.5 per 100 accidents vs. 41.6 per 100 accidents respectively. The days of disability for helmeted riders was 26.7 vs. 51.1 for non-helmeted.

The follow-up question, then, is how to increase safety helmet use. The two most obvious methods are education and mandatory helmet legislation. To improve voluntary helmet use in the absence of mandatory helmet-use laws, motorcyclists need an increased awareness of their vulnerability. According to a study, most injured motorcyclists who do not wear helmets report that they did not expect to be injured; yet 40% of the head injury-associated deaths have been ascribed to the motorcyclist's loss of control, not, apparently, to some action of the driver of another motor vehicle [27]. Thus comprehensive motorcycle helmet-use legislation appears to be a viable and scientifically sound component of those efforts. Strategies to design protective gears for the trunk, spine, limbs etc should be our next priority. But then, in the absence of strict implementation of the rules, can we expect the motorcyclists who avoid wearing even the safety helmets, to wear the trunk guard, spine guard, limb guard etc.

Yet another alternative is to impose speed restrictions (limits) for the two-wheeler motorized vehicles associated with their classification into different categories depending upon their use as for example for sporting events – high speed, and personal / family vehicle - low speed. It has been reported that the risks of fatal injuries in

motorcycle crashes are related to the engine capacity of the motorcycle, the size of the vehicle collided against and the direction of collision [28]. Structural modifications in the motorized two wheelers for this purpose need to be worked out by the experts in designing and manufacturing segment with special reference to road stability of the vehicle and provisions of protection to, at least, the limbs. Complete protective gear, for the motorcyclist riding a high-speed vehicle and the safety-helmets for those using a low speed vehicle should be made mandatory by legislation.

Conclusion

Helmets reduce head injuries and fatalities. Mandatory helmet legislation increases helmet use and is effective in reducing injuries, death and medical costs. To improve voluntary helmet use in the absence of mandatory helmet-use laws, motorcyclists need an increased awareness of their vulnerability. The study further indicates a need for improved safety devices for motorized two wheeler drivers from a prevention perspective. Current laws and technology stress the importance of brain injury attenuation secondary to motorcycle crash prevention, and much has been done to minimize the severity of brain injury with current helmet technology and the helmet laws. However, improvements in protective devices to minimize thoracic, abdominal, spinal and extremity injuries are just as important, since severe injuries in one anatomic region are frequently associated with severe injury in other anatomic regions. Introduction of the overall protective gear for motorcyclists may help to prevent fatal injuries as well as reduce the workload on emergency departments providing trauma care.

References

1. **Sosin DM, Sacks JJ and Holmgreen P.** Head injury associated deaths from motorcycle crashes. *J Am Med Assoc.* 1990; 264:2395-2399.
2. **Rivara FP, Dicker BG, Bergman AB, Dacey R, and Herman C.** The public cost of motorcycle trauma. *J Am Med Assoc* . 1988; 260: 221-223.
3. **LaHaye PA, Gade GF and Becker DP.** Injury to the cranium. In Moore EE, Mattox KL, Feliciano DV, (eds). Trauma. East Norwalk,Conn., Appleton & Lange. 1991: 237-251.
4. **Rivara FP, Rogers LW and Thompson DC,** et al. The Seattle children's bicycle helmet campaign: Effects on helmet use and head injury admissions. Pediatrics. 1994; 93: 567.
5. **Mock CN, Maier RV, Boyle E, Pilcher S and Rivara FP.** Injury prevention strategies to promote helmet use decrease severe head injuries at a level I trauma center. *J Trauma.* 1995; 39(1): 29-33.
6. **Offner PJ, Rivara FP and Maier R.** The impact of motorcycle helmet use. *J Trauma.* 1992; 32:636.
7. **Sosin DM and Sacks JJ.** Motorcycle helmet use laws and head injury prevention. *J Am Med Assoc.* 1992; 267:1649.
8. **Thomas S, Acton C, Nixon J, et al.** Effectiveness of bicycle helmets in preventing head injury in children: Case-control study. *Br Med J.* 1994; 308: 173.
9. **Chenier TC and Evans L.** Motorcyclist fatalities and the repeal of mandatory helmet wearing laws. *Accid Anal Prev.* 1987; 19: 133-139.
10. **Watson GS, Zador PL and Wilks A.** The repeal of helmet use laws and increased motorcyclist mortality in the United States, 1975-1978. *Am J Public Health.* 1980; 70: 579-585.
11. **Chiu WT, Kuo CY, Hung CC, and Chen M.** The effect of the Taiwan motorcycle helmet use law on head injuries. *Am J Public Health.* 2000. 90(5): 793-96.
12. **Rowland J, Rivara F, Salzberg P, Soderberg R, Maier R and Keepell T.** Motorcycle helmet use and injury outcome and hospitalization costs from crashes in Washington state. *Am J Public Health* .1996; 86: 41 – 45.
13. **Murdock M and Waxman K.** Helmet use improves outcomes after motorcycle accidents. West *J Med.* 1991; 155: 370 – 372.

14. **Wagle V, Perkins C and Vallera A**. Is helmet use beneficial to motorcyclists? *J Trauma*. 1993; 34: 120 – 122.
15. **Wick M, Muller E, Ekkernkamp A and Mubr G**. The motorcyclist: easy rider or easy victim? An analysis of motorcycle accidents in Germany. *Am J Emerg Med*. 1998; 16:320 – 323.
16. **Matzsch T and Karlsson B.** Moped and motorcycle accidents: similarities and discrepancies. *J Trauma* .1986; 26: 538 – 543.
17. **Sarkar S, Peek C and Kraus J**. Fatal injuries in motorcycle riders according to helmet use. *J Trauma*. 1995; 38: 242 – 245.
18. **Kraus JF, Peek C, McArthur DL and Williams A**. The effect of the 1992 California motorcycle helmet use law on motorcycle crash fatalities and injuries. *J Am Med Assoc*. 1994; 272(19): 1506-1511.
19. **Sharma BR, Harish D and Singh G**. Pattern of Fatal Head Injury in Road Traffic Accidents. *Bahrain Med Bull*. 2003; 25 (1): 22 - 25
20. **Krantz KPG**. Head and neck injuries to motorcycle and moped riders with special regard to the effect of protective helmets. Injury. 1985; 16: 253-258.
21. **Fleming NS and Becker ER.** The impact of the Texas 1989 motorcycle helmet law on total and head-related fatalities, severe injuries, and overall injuries. *Med Care*. 1992; 30: 832-845.
22. **McSwain NE Jr and Belles A.** Motorcycle helmets: medical costs and the law. *J Trauma*. 1990; 30:1189-1197.
23. **Mackenzie EJ, Cushing BM and Jurkovich GJ**, et al. Physical impairment and functional outcomes six months after severe lower extremity fractures. *J Trauma* .1993; 34: 528 – 539.
24. **Peck C, Braver E, Shen H and Kraus J**. Lower extremity injuries from motorcycle crashes: a common cause of preventable injury. *J trauma*. 1994; 37: 358 – 364.
25. **Muller A**. Evaluation of the costs and benefits of motorcycle helmet laws. *Am J Public Health* .1980; 70: 586 – 592.
26. **Lummis ML and Dugger C**. Impact of the repeal of the Kansas mandatory motorcycle helmet law, 1975 – 1978: an executive summary *EMTJ*. 1981; 5: 254 – 259.
27. **Lin MR, Hwang HF and Kuo NW**. Crash severity injury patterns, and helmet use in adolescent motorcycle riders. *J Trauma*. 2001; 50: 24 – 30.
28. **Pang TY, Umar RS, Azhar AA, Ahmad MM, Nasir MT and Harwant S**. Accident characteristics of injured motorcyclists in Malaysia. *Med J Malaysia*. 2000; 55 (1): 45 – 50.

J Indian Acad Forensic Med, 30(4)

Review Article

Medical certification of cause of death

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Abstract

Medical certification of cause of death [MCCD] scheme is an important tool to obtain scientific and reliable information in terms of causes of mortality. It is basically a part of International Statistical Classification of Diseases and health related problems formulated by WHO. Because of this importance, a provision has been made in Registration of Births and Deaths Act, 1969 for certification by a medical practitioner who has attended the deceased during his last illness. Till now this scheme is not uniformly covered and implemented in India. An overview of this scheme is presented herewith.

Keywords : *Medical certification of cause of death, WHO*

Introduction

Medical certification of cause of death [MCCD] scheme is an important tool to obtain scientific and reliable information in terms of causes of mortality. Mortality statistics are quite essential for the welfare of the community, health planning, management of health programme, for control measures in preventing spread of epidemic, to build up scientific data base for medical research, in knowing the impact of health services, to evaluate health indicators like infant mortality rate [IMR], maternal mortality rate [MMR] etc. and to find out magnitude of emerging and re-emerging diseases. It is because of this importance, a provision has been made in Registration of Births and Deaths Act, 1969 for certification by a medical practitioner who has attended the deceased during his last illness. It is basically a part of International Statistical Classification of Diseases [ICD] and health related problems formulated by WHO. The purpose of ICD is to permit systematic recording, analysis, interpretation and comparison of morbidity and mortality data collected in different countries or areas at different times.

Rules as per Registration of Birth and Deaths Act, 1969

Certain sections of the act are relevant to every medical practitioner. As per **Section 8(1-b)**, a medical practitioner in charge of a hospital, maternity home, health centre, nursing home or other like institutions has to notify births as well as deaths within 21 days of occurrence. As per **Section 10(2)**, every State Government has made a provision to obtain cause of death certificate from a medical practitioner. As per **Section 10 (3)**, with regards to section 10 (2), in case of death of a person, a certificate of cause of death has to be issued by a medical practitioner who attended the deceased in his last illness without charging any fee in the prescribed form stating to the best of his knowledge and belief, the cause of death and the same has to be delivered to Registrar of Births and Deaths at the time of notifying death. As per **Section 17 (1-b)**, any person on payment of required fees and postal charges subject to any rules made by respective State Governments, can obtain an extract from the register relating to any birth or death, without disclosing confidentiality of the cause of death. If a medical practitioner neglects or refuses to issue a cause of death certificate as per Section 10 (3), he is liable to be punished with fine up to Rs. 50/- as per **Section 23 (3)** of this act [1].

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Responsibilities of medical practitioner

All hospital deaths including medico-legal case deaths are to be covered under MCCD. As per the MCCD scheme, any medical practitioner attending the deceased in his/ her last illness, after death of the person shall fill in **Form No. 4** [for institutional deaths] and **Form No. 4A** [for non-institutional deaths] [The forms are given at the end]. Medical practitioners are instructed not to fill and submit form 4/ 4A for still births. For still births, separate Form 3 is made available. He has to send the completed form to the respective District Registrar of Birth and Deaths by 5th of every month that in turn has to send it to the Chief Registrar of the State who shall send it to the Registrar General, India [2].

Instructions on how to fill the certificate

Name of the deceased should be in full – not in initials. In case of infants not yet named at the time of death, write S/o or D/o followed by names of father and mother. If the deceased is above the age of 1 year, give the age in completed years, if below 1 year, give age in months, if below 1 month, give age in completed number of days and if below 1 day, give it in completed hours. Sex of the deceased should be noted.

The column for cause of death is divided into two parts: Part I and Part II. Part I has three parts (a), (b) and (c). The cause of death includes any disease or injury responsible to initiate a chain of events incompatible with life resulting in death of a person[3]. In single morbid condition, it should be written on line (a) of Part I. Nothing else needs to be written. Immediate cause is reported in line(a). It is the disease/injury/ complication that preceded death. It may be the sole entry. But there must be an entry. Mode of dying (heart failure/ espiratory failure/ cardiorespiratory arrest) should never be entered. Mode or mechanism of death is the physiological disturbance or derangement resulting from cause of death being incompatible with life [3]. It serves no purpose. If condition on line (a) is due to another condition, record that in line (b). It is antecedent to the immediate cause of death. If condition on line (b) is due to another underlying condition, mention it in line (c). It is the condition antecedent to condition on line (b). If condition on line (b) is underlying condition then nothing more should be entered. When many conditions are involved, write full sequence. There should only be one condition per line with most recent condition at the top; example: [a] Perforation – [b] intestinal obstruction – [c] inguinal hernia; Septicemia - [b] gangrene foot - [c] diabetes.

In part II, other conditions/diseases that unfavorably influenced the course/ modified/ contributed to the fatal outcome should be written. It may even not relate to the disease causing death.

Next column is for interval between onset of diseased condition & death. Write exact period, when it is known. When unknown, approximate period should be written. It provides useful check on the sequence of events. Last column is for ICD code. That is not to be filled by the certifying medical practitioner. It shall be filled at the Registrar's office after consulting the International Statistical Classification of Diseases 10 and National List prepared from ICD 10. The list is available at the District Registrar. The list being exhaustive is not given here.

Below the cause of death column, there is provision for indicating the manner of death; being natural, accidental, suicidal, homicidal or if pending investigation. Manner of death is the fashion in which the death occurred [3]. The certifying practitioner is expected to clearly write how the injuries occurred, as the case may be. Then for female deaths, one has to mention whether the death was associated with pregnancy. If yes, whether there was delivery or not?

Below the certificate, every medical practitioner is expected to sign and write his full name and designation along with date [preferably use seal].

Last part is detachable portion of the certificate, which has to be duly filled and given to the next of kin of the deceased along with the body. In this part, confidentiality regarding the cause of death is to be maintained. The purpose of giving the last portion is to enable the relative register the death of the deceased.

Lacunae regarding medicolegal cases in certification of cause of death

Firstly, in case of deaths from violence, not admitted in hospital, interval between onset of terminal events and cause of death cannot be mentioned. The column is to be left blank. **Secondly**, in case of spot deaths and dead bodies being brought to the hospital, it is not possible to find out and write the chain of events leading to death. Here only immediate cause of death is to be given after postmortem examination. **Thirdly**, it is not always possible to correctly comment on manner of death as many cases turn out other way after police investigation. A case being brought as natural death may turn out to be homicidal after police investigation. Here one should comment on manner of death only when there is surety about it, otherwise leave the column blank. **Fourthly**, in medicolegal cases, being treated at hospital and having subsequent death, it is expected that the treating doctor should not write cause of death certificate. Instead the doctor performing the autopsy should issue the Form 4/ 4A after conducting the autopsy along with the autopsy report mentioning the same cause of death. This 4/ 4A certificate is to be given to police or to hospital authorities for subsequent submission to registrar is yet not clear. At one training session a reference has been quoted that the Form 4 should be given to the police and the respective registrars should collect from the police stations. This seems impractical. **Fifthly**, if at postmortem, cause of death is kept pending for some investigation like chemical analysis, histopathological examination etc., then MCCD should not be filled and sent. Instead it has to be filled and submitted mentioning the cause of death after obtaining the reports of investigation. The certificate should bear the MLC no. and PM no. along with other particulars to help identify the case [4].

Conclusion

The MCCD scheme is an important step in regularizing and maintaining uniformity of issuing the cause of death certificate by medical practitioners. It's a Herculean task to cover all the entities dealing with medical services with regards to MCCD. Therefore, its implementation has been put forth in phased manner in all the States. But, as the data reveals, the efforts of State Governments have met little success or rightly speaking with no success. There can be many reasons for it as stated:

1. The scheme and its importance have not been brought to the notice of all the medical practitioners.
2. Even those practitioners covered are not following it either because they don't find time from their busy schedule to follow this important but less emphasized work.
3. The fine kept for defaulters is very meager. May be increase in fine would force the medical practitioners to take this work seriously.
4. There are certain lacunae in the scheme that have not been dealt with properly, especially with regards to medicolegal cases.
5. Non medical person, Statistical Officer, at the helm of affairs are not able to analyze the MCCD scheme effectively and efficiently.

The authors have undergone training in the MCCD scheme and have quite a few suggestions to make it a success. The suggestions are stated as follows:

1. The scheme though being covered in the medical curriculum at some places needs to be made compulsorily taught at undergraduate level.
2. The training in phased manner has been slow which needs to be quickened.
3. All major hospitals in a district should be covered first and then private medical practitioners. At places where there are medical colleges, Forensic Medicine & Toxicology/ Preventive and Social Medicine Department can take responsibility in covering the major private hospitals under this scheme.
4. A "Physician's Manual on Medical Certification of Cause of Death" has been brought out by Registrar General of India. It can be made available at all the major hospitals.
5. With regards to medicolegal cases, as all the medicolegal cases go for postmortem after death, it should be made clear that the treating physician should not issue cause of

death certificate. Instead the autopsy surgeon, after postmortem should issue Form 4 along with postmortem report. The postmortem report as per rule should be handed over to the investigating officer. While Form No. 4 should be submitted to the medical record department in district hospitals and to Chief District Health Officer where postmortem was done in a primary or secondary health centre.

6. There should be a medical personal appointed at the Registrar level to correctly interpret the certificates issued by different medical practitioners.
7. The implementation of MCCD scheme should be supervised by a medical body like Indian Medical Association/ District Health Officer/ District Surgeon of a locality so as to make it a success.

References

1. The Registration of Birth and Deaths Act, 1969 [Act No. 18 of 1969].
2. Physicians' Manual on Medical Certification of Cause of Death, Vital Statistics Division, Office of the Registrar General, India, Ministry of Home Affairs, New Delhi, 4th Edition.
3. **Mathiharan K and Patnaik A K.** Modi's Medical Jurisprudence and Toxicology, 23rd Edition, Lexis Nexis, New Delhi, 2005:357.
4. Manual on Medical Certification of Cause of Death [MCCD Scheme], State Bureau of Health Intelligence, Commissionerate of Health, Medical Services and Medical Education, Gujarat State, Gandhinagar, 2002.

MEDICAL CERTIFICATION OF CAUSE OF DEATH

(FORM NO. 4)

(For hospital in-patient deaths; not to be used for stillbirths)

TO
THE REGISTRAR OF BIRTH & DEATHS
_____ CITY.

Name of the hospital _____I hereby certify that the person whose particulars are given below died in the hospital in Ward No. _____ on _____at _____AM/PM.

NAME OF THE DECEASED					For use of statistical office
SEX	Age at death				
	If 1 year or more, age in years	If less than 1 year, age in months	If less than 1 month, age in days	If less than on day, age in hours	
1. Male 2. Female					
Cause of death 1. Immediate cause (a) _____ State the diseases, injury or complication which caused death, not the mode of dying such as heart failure, asthenia etc. (Due to/ as consequence of) Antecedent cause (b) _____ morbid conditions, if any, giving rise to the above cause stating underlying conditions last (Due to/ as consequence of) (c) _____ 2. Other significant conditions contributing to the death but not relating to the disease or conditions causing it				**Interval between onset & death**	

Manner of death
1. Natural 2. Accident 3. Suicide 4. Homicide 5. Pending investigation

How did the injury occur?

If the deceased was female, was the death associated with pregnancy? 1. Yes 2. No

If yes, was there a delivery? 1. Yes 2. No

Name and signature of the Medical Practitioner certifying the cause of death

Date of verification

(To be detached and handed over to the relatives of the deceased)

Certified that Shri/Smt./Kum. _____ S/W/D of Shri _____ R/o _____was admitted to this hospital on _____ and expired on _____ at _____ AM/PM.

Doctor _____
(Medical Superintendent & Name of the hospital)

MEDICAL CERTIFICATION OF CAUSE OF DEATH

(FORM NO. 4A)

(For non-institutional deaths; not to be used for stillbirths)

TO
THE REGISTRAR OF BIRTH & DEATHS
_____ CITY.

I hereby certify that the deceased Shri/ Smt./ Kum. _____
S/W/D of _____ , resident of _____ was under
My treatment from _____ to _____ and he/ she died on _____ at _____ AM/PM

NAME OF THE DECEASED					For use of statistical office
SEX	Age at death				
	If 1 year or more, age in years	If less than 1 year, age in months	If less than 1 month, age in days	If less than on day, age in hours	
1. Male 2. Female					
Cause of death 1. Immediate cause (a) _____ State the diseases, injury or complication which caused death, not the mode of dying such as heart failure, asthenia etc. (Due to/ as consequence of) Antecedent cause (b) _____ morbid conditions, if any, giving rise to the above cause stating underlying conditions last (Due to/ as consequence of) (c) _____ 2. Other significant conditions contributing to the death but not relating to the disease or conditions causing it				**Interval between onset & death**	

Manner of death — How did the injury occur?
1. Natural 2. Accident 3. Suicide 4. Homicide 5. Pending investigation

If the deceased was female, was the death associated with pregnancy? 1. Yes 2. No
If yes, was there a delivery? 1. Yes 2. No

Name and signature of the Medical Practitioner certifying the cause of death
Date of verification

(To be detached and handed over to the relatives of the deceased)

Certified that Shri/Smt./Kum. _ _____ S/W/D of Shri
_____ R/o _____ was admitted to this hospital on
_____ and expired on _____ at _____ AM/PM.

Doctor _____
(Medical Superintendent & Name of the hospital)

J Indian Acad Forensic Med, 30(4)

Review Article

Medico legal aspects of crime against women

T.K.K. Naidu

Abstract

Due to rise in crowds, naturally there is fall in cultural values and escalation in crimes. Crime against women is on the rise especially sexual crimes. Though crime is prevalent in every country and society, most of them either goes undetected or unreported. As per National Crime records bureau, New Delhi, a crime takes places every 17 seconds, among them one dowry death every 77 mins, one crime against women every 3 mins and finally one rape or sexual assault every 27 mins. With above crime scenario, forensic medicine plays a important role in helping to prevent, early detection, providing expert medico legal and scientific reports at earliest, which will result in quick trial and instant administration of justice to victims. Due to lack of legal or medico legal, scientific awareness and knowledge among victims, investigating agencies, medical and para medical staff, the end result is either (justice hurried is justice buried' or ' justice delayed is justice denied' to the victims. There is need to give importance to forensic nursing, impart medico legal knowledge to para medical and health workers in rural and semi urban levels as to how to handle cases of crimes committed against women and report them. One accused aquitted means breeding of hundred criminals. Prevention and detection is better than conviction.

Keywords : *Torture sexual, assault, dowry deaths.*

Introduction

Crime Against Women (CAW) is centuries old even in mythology *Ramayana* and *Mahabharata* stories of *Sita* being fire tested to prove her chastity after being kidnapped by *Ravana*, striping of *Daupadi* by *Dushasana* in *open darbar*. Still this social crime CAW is continuing even today. *Ramas, Ravanas and Dushasana* are born and behave like them. Goddess like : *Lakshmi, Saraswati, Sita, Radha and Kali* are worshiped and cores are spent in building their temples, but in real life CAW is a every day tragedy to be read in every possible newspaper. Majority of the case either go undetected or unconvinced due to lack of dedication, devotion, cooperation and co-ordination of different department involved in CAW investigation. Extra effort or interest on part of forensic pathologist can only solve these cases. CAW starts from cradle to cremation and birth to burial ground. Women suffer the most because they're naturally, biologically and physically less stronger and less aggressive than men.

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Medico legal aspects

Its role is crucial and critical in prevention, awareness detection and conviction of perpetrators of this crime. A well – established medico legal system only can act as deterrent to this menace.

Prevention: CAW is a preventable crime.

a) If forensically trained nurses as in west, sexual assault nurse examiners SANE are employed.
b) The special organization with coordination of services of sexual assault resource tea SART is helpful.
c) To appoint forensic experts at district level hospital.
d) To train, organize seminars and workshops for lawyers, police officers, para medical staff and NGOs as how to handle cases of CAW, medico legally.

e) To bring about awareness among women in particular and public in general as to how where and when to bring to the notice of police in cases of CAW.
f) Introduce one year PG diploma course in forensic medicine after MBBS course, so as to deal with cases in rural and semi urban areas.
g) Use of safe kit in case of rape or sexual assaults as designed by NGO's CEHAT of MUMBAI.
h) To incorporate forensic nursing in nursing courses.

Common case of caw

1. Sexual assault
2. Rape
3. Dowry death
4. Molestation
5. Cruelty by in-laws
6. Eveteasing alleged love with homicidal ending.

Nahni Shani tandoori case, Jessica lal case, Priyadarshini Matto case, Miss Bhatnagar murder cased and many more, cases go undetected or unconvinced due to improper medico legal investigation either justice is hurried and buried or delayed and denied. Medico legal experts should always give prompt, scientific and accurate report in case of CAW for fast trial instant justice to the victims. One rapist convicted 100 rapes can be prevented.

Examples

Collecting minute trace evidences, Recording proper and exact history of the crime from investigating agencies. Conduct scientific postmortem with proper instruments and collect different samples of blood, viscera in poisoning cases of CAW followed by prompt sending and obtaining result from forensic science laboratory.

DNA finger printing or profiling from sources to identify suspects from hair, blood, and semen other biological fluids from scene of violent crime especially in rape cases.

Instances

If soot is present in dowry death due burns ante mortem death.

Postmortem straining, dribbling of saliva, and ligature mark if properly examined gives clues of ante or post mortem hanging, strangulation or hanging.

Positive diatom test is sign of ante mortem drowning. Female infanticide hydrostatic test indicates still or dead born Proper collection and preservation of clothes and undergarments helps in rape and assault cases Proper documentation of ante and postmortem injuries on private part in sexual assault and cases of torture.

Medicolegal examination of ante mortem and post mortem burns.

Above are some common instances, which need detail and meticulous examination for administration of justice to the victim in CAW cases.

1. **Violence in the Family**
   - Domestic violence
   - Traditional practices *like satipratha*, forced *purdah* (veil) system, witch hunt, etc.
   - Female infanticide
   - Female child abuse
   - Abandonment of female child
   - Dowry related crimes
   - Neglect and starvation
2. **Violence in the community**
   - Sexual offences e.g. rape, molestation, harassment etc.
   - Commercialised violence such as trafficking of women, forced prostitution, labour exploitation, pornography, kidnapping and abduction, and the exploitation of women migrant workers.
3. **Violence by the State**
   - Sexual abuse in remand homes
   - Custodial rape
   - Women in armed conflict and refuge situations.

Table -1: Crime head –wise incidents of crime against women during 2001 – 2005 and percentage variation in 2005-2004.

Crime Head	Year					Percentage variation in 2005 over 2004
	2001	2002	2003	2004	2005	
Rape (Sec. 376 IPC)	16075	16373	15847	18233	18359	0.7
Kidnapping & Abduction (Sec. 363 to 373 IPC)	14645	14506	13296	15578	15750	1.1
Dowry Death (Sec. 302/304B IPC)	6851	6822	6208	7026	6787	-3.4
Torture (Sec. 498A IPC)	49170	49237	50703	58121	58319	0.3
Molestation (Sec. 354 IPC)	34124	33943	32939	34567	34175	-1.1
Sexual Harrassment (Sec. 509 IPC)	9746	10155	12325	10001	9984	-0.2
Importation of Girls (Sec. 366-B IPC)	114	76	46	89	149	67.4
Sati Prevention Act. 1987	0	0	0	0	1	100.0
Immoral Traffic (P) Act. 1956	8796	6598	5510	5748	5908	2.8
Indecent Rep. Of Women (P) Act. 1986	1052	2508	1043	1378	2917	111.7
Dowry Prohibition Act. 1961	3222	2816	2684	3592	3204	-10.8
	143795	**143034**	**140601**	**154333**	**155553**	**0.8**

Table -2: Proportion of crime against (IPC) towards total IPC crime

Sl. No.	Year	Total IPC crimes	Crime against women (IPC cases)	Percentage to total IPC crimes
1	2001	17,69,308	1,30,725	7.4
2	2002	18,80,330	1,31,112	7.4
3	2003	17,16,120	1,31,365	7.6
4	2004	18,32,015	1,43,615	7.8
5	2005	18,22,602	1,43,523	7.9

Conclusion

In our vast country to prevent CAW Medico legal service have to be improved and upgraded. Communications gaps and hiccups between different investigation agencies to be narrowed or plugged. CAW is preventable and can be eradicated if it can be tackled in multiphase efforts. However forensic medicine has a critical role in striking a balance between law, public and police properly. Though many laws have been enacted fro prevention of CAW ground realty is different, due illiteracy, ignorance of law and neglected medico legal services in rural areas cases go unreported or unconvinced. If advanced technology like brain mapping, narco-analysis DNA profiling polygraph methods are used CAW cases can be solved. In modern day society pre and post marital affairs, influence of electronic media, films, books, TV serials, alcohol and drugs have resulted in raise in CAW cases all over the country.

Crime against women has been increasing all over the world. Indian women are victim of various kinds of crime and abuses including customs and traditional suppression. Various legislations have been passed, including the latest domestic violence Act 2005. There is a need for strict implementation of the always, good education to bring awareness in the society. The health professional can play big role in detection, treatment and rehabilitation of these victims.

Last but not the least, prevention and detection of CAW is better than conviction.

Legal dictums

Justice delayed is justice denied.
Justice hurried is justice buried
Justice protected will protect.
Ignorance of law excuses no one.
By you ever so high, the law is always above you.
Condemn control and prevent crime against women.

References

1. **Knight B**. In: Forensic Pathology, Arnold, London 191.
2. **Forrest D, Knight B, Hinshelwood G, Anand J and Tonge V**. A guide to writing medical report on survivors of torture. *Forensic Sci Int*. 1995; 76:69-75.
3. **Rainio J, Lalu K and Penttila A.** Independent forensic autopsies in an armed conflict: investigation of the victims from Racak, Kosovo. *Forensic Sci Int*. 2001;116:171-185.
4. **Hans Draminsky Peterson and Olav Minor Vedel.** Assessment of human rights violations in Kashmir. *Forensic Sci Int*. 1994;68:103-115.
5. **A K Agnithotri et al.** Atrocities against women in Uttar Pradesh. *Int J Med Toxicol Leg Med*. 1999; 2(1):9-11.
6. **Anil Kohli et al**. Medicolegal aspects of female forticide. *J Forensic Med Toxicol*. 13(3&4):12-14.
7. National Crime Record Bureau, 2005.
8. Times of India, News Delhi, 27th October 2006 : 13
9. Times of India, New Delhi, 12th November, 2006:15
10. Hindustan Times, New Delhi, 12th November, 2006 : 1,4.
11. Hindustan Times, New Delhi, 30th November, 2006 ; 16.
12. The protection of women from Domestic violence Act, 2005

J Indian Acad Forensic Med, 30(4)

Review Article

Recent amendments in the Laws pertaining to crimes against women: An overview

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Abstract

The National Crime Records Bureau has reported a steep rise in the number of crimes against women and children in recent times, despite many laws in our country pertaining to crimes against women, thus demanding for the amendments from time to time.

The Protection of Women from Domestic Violence Act, 2006, is a step towards safeguarding women against ill treatment at the hands of their husbands and in-laws and other male members of the family. Compulsory registration of marriage is another step to improve the status of women in the society. Hindu Succession (Amendment) Act, 2005 removes the gender discriminatory provision in the original Act of 1956 and gives equal right to daughters with respect to inheritance claims. The Medical Termination of Pregnancy Act, 1971 now incorporates changes regarding the place where the termination of pregnancy can be done, and punishments for violation of the given provisions. The Pre-Natal Diagnostic Techniques Act, 1994, was amended in 2002 to prohibit any kind of tests for detection of sex before or after conception.

Many amendments have also been made in the laws relating to sexual offences, especially regarding detailed procedure of examination of victim and accused to include examination of blood, blood stains, semen and swabs in addition to physical examination and to provide for inquest by Judicial Magistrate in cases of murder following rape. Sexual harassment at work place has been made punishable by the Vishaka Guidelines. Cyber crime, sending objectionable messages (SMS), etc are also being brought in to the ambit of law.

Keywords : *Laws, Acts, Amendments, crimes against women*

Introduction

Crimes and violence against women were being perpetuated right from time immemorial. Female-foeticide, *Satipratha*, child marriage, dowry, social boycott of the widows, etc are just a few examples of these atrocities. Women are made to pay dearly for their womanhood, right from the womb to the tomb. Discrimination against women begins even before birth, by selective abortion of the female fetuses, diagnosed by the prenatal sex determination tests. This continues throughout life in the form of less nutritious food, household responsibilities right from childhood, minimum level of education, exclusion from family property; and violence, in its various forms and degrees. It is no wonder then that girls grow up without any self worth and self respect, molded into prisoners of their gender and considering themselves as a burden to be handed down from father to husband to the son(s).

Many steps have been taken through the years for the benefit of women. Government and NGOs have been working towards this cause, and to some extent have been successful too. Many such Acts and Laws have under gone amendments, from time to time according to the changing times and patterns of crimes, so that women in the modern world can lead a life of respect and dignity, without any discriminations in a society which may be considered safe for them.

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The Hindu Succession Act, 1956 [1]

The Hindu Society's main pillar of

strength is the joint and undivided family, which traces its origin to the ancient patriarchal system. The laws of inheritance governing the devolution of property on the death of the head of the family followed the doctrine "He who inherits the property, also offers the *pinda* ", laid down by the Mitakshara law.[2] Hence, only the male members of the family had a right on the property and the female members were completely left out. Their share was confined to the dowry and *streedhan* that were handed over to the bridegroom and his family members at the time of her marriage. In essence, therefore, the woman did not get any thing for herself as the dowry and *streedhan* become the property of the groom and his family.

The hardships that the Hindu women had to face because of these laws were officially recognized way back in 1937, when the Hindu women's Right to Property Act, 1937[2] was introduced with the aim of improving the legal position of women regarding inheritance of property. Nothing much came out of it. Finally, the Hindu Succession Act, 1956 was passed after preparing a comprehensive Hindu Code under the chairmanship of Sir Benegal Narsing Rau (between1944 – 48). Act 39 of 2005.3 brought in major amendments to this Act.

The most important amendment was the removal of gender discriminatory clause debarring daughters from inheriting property in a joint Hindu family[4] and giving her equal status as a coparcener in her own right in the same manner as the son, right from her birth.

Section 23 of the original Act, which disentitled a female heir from demanding partition and her share of the ancestral home wholly occupied by her joint family till the male heirs chose to do so, was repealed by Act 39 of 2005, so as to further empower the women and free them from their dependence on the male members of the family for their survival. Further, by repealing S.24 of the Act of 1956, the new amendment protects the right of the widows of the pre-deceased sons of a Hindu joint family to inherit her share of the family property, even after remarriage.

The Pre-Conception and Pre-Natal Diagnostic Techniques (Prohibition of Sex Selection) Act,1994 [5]

Female-Infanticide has been prevalent in India even as early as 1500 BC (Vedic Aryan Period: 1500-500 BC). It has been hypothesized that the early nomads of that period felt that female children were of little use and hence undesirable. This continued during the period of Aryan consolidation (BC 500-AD 200).The British discovered the practice of female infanticide around 1789 among the Rajputs of the Eastern Uttar Pradesh, Rajasthan, and Bihar.[6] Female feticide is now more wide spread in the country than ever before. From a few states, a few years ago, this barbaric practice had spread to the whole of the country. The 2001 census showed that the sex ratio had plunged to an all time low in Punjab (798), Haryana (819), Chandigarh (845), and Delhi (868). Even Dadar and Nagar Haveli, which had 1013 girls/1000 boys in the 1991 census, showed 979 girls in the 2001 census.[7] This inequality is more pronounced in the Urban than in the Rural communities in the whole of the country.[8]

The most important factor responsible for this is, paradoxically, advancement in technology, in the form of Ultrasound Scanning facility, introduced to identify fetal abnormalities. Gross abuse of the technique, in the form of Pre-Natal Diagnostic Centers using this facility for determination of the sex of the fetus, rose rapidly. Such centers became very popular and their growth was tremendous, as the female child is not welcomed in most of the Indian families. The result was that such centers became centers of female feticide.

Finally, the government considered it necessary to bring out a legislation to regulate the use of and to provide deterrent punishment to stop the misuse of such techniques, resulting in the passing of The Pre-Natal Diagnostic Techniques (Regulation and Prevention of Misuse) Act, 1994[9].

Later on, the nomenclature of the Act was amended to its present.[10] Section 3A, which prohibits sex selection on a woman or a man or

on both or on any tissue, embryo, conceptus, fluid or gametes derived from either or both of them and S.3B, which prohibits the sale of any ultrasound machine or imaging device or any equipment capable of detecting sex to any centre or person not registered under the Act, were both inserted by the 2002 Amendment Act. However, the Act does not ban the use of these techniques for detecting genetic or metabolic disorders.

Clauses 3, 4 and 5 were inserted to S. 4 of the original Act with the specific aim of safeguarding the health of the pregnant woman, and to ensure that no one coerce her in to submitting herself for the purpose of sex determination and female feticide. They specify that pre-natal diagnostic tests can be conducted on a pregnant woman only when: a) she is above thirty-five years, b) undergone two or more spontaneous abortions or foetal loss, c) exposed to potentially teratogenic agents such as, drugs, radiation, infection or chemicals, and d) she or her husband has a family history of mental retardation or physical or any other genetic abnormalities. The person conducting the tests should maintain complete records of the tests and to certify that such tests were not performed for sex selection. Clause 2 of S. 5 further prohibits any person from communicating the sex of the fetus to the pregnant woman concerned or any of her relatives by any means, thereby safeguarding the very survival of the Unborn female fetus from an untimely death. Similarly, subsection C of S.6 again prohibits the selection of sex before or after conception.

No person who was in any way associated with the use or promotion of sex-selection tests could be a member of the Central Supervisory Board under the Act.[11] The Appropriate Authority constituted by the Central and State Governments, as per the Act, has been empowered to take appropriate legal action against any person/institute involved in any sex selection techniques either suo moto or when brought to their notice by any means.[12]

Section 22 prohibits any advertisement relating to pre-conception and pre-natal determination of sex or sex selection. Contravention is punishable with imprisonment up to 3 years and with fine up to Rs 10000. The name of such registered medical practitioner may be erased from the State Medical Register for a period up to 5 years for the first offence and permanently for the subsequent offence. Any person who coerces the pregnant woman to undergo such tests is punishable with imprisonment up to 3 years and with fine up to Rs 50,000 for the first offence and imprisonment up to 5 years and with fine up to Rs 100,000 for the subsequent offence[13] Giving further fillip to the pregnant woman, the Act provides that unless proved otherwise, the Courts shall presume that such a pregnant woman was compelled by her husband/relatives to undergo the pre natal diagnostic tests[14].

The Hindu Marriage Act, 1955 [15]

Marriage, according to the Hindu Law, is a holy *"Sanskar"* with *"Kanyadan"* and *"Saptpadi"* or the *"Saat Feras"* being the basic and important components of the same. Legislation of the laws relating to the Hindu marriage began from the Year 1829, the same year, when *"Sati"* was abolished by law and was declared a punishable offence.[16] Marriage of the Hindu widows was legalized in 1856 by The Hindu Widows Remarriage Act. The Child Marriage Restraint Act was passed in 1929. Many Acts were passed to legalise inter-caste marriages, inter-marriages between sub-divisions of the same caste and those within the same *"Gotra"*, inter-religious marriages, etc. In 1947, the Hindu Code, drafted by the Rau Committee, was introduced in the Legislative Assembly and was referred to a Select Committee of the Constituent Assembly of India. The Code was then split in to separate parts for facilitating drafting of the laws. The Hindu Marriage Act, 1955 was the first of the series. It underwent several amendments, the major amendment of which was The Amendment Act, 1976.[17] However, the change in the age of the bridegroom and the bride from the previous 18 and 15 years to the present 21 and 18 years was effected by the Amendment Act of 1978.[18] The Punishment for contraventions of this clause was enhanced to rigorous imprisonment which may extend to 2 years or with fine which may

extend to Rs.100000, or with both.[19]

The jurisdiction of any case of marital discord would be of the Court under which the area, in which the complainant wife resides, falls.20 The Hon'ble Supreme Court on October 25, 2007 directed all States and Union Territories to bring in suitable legislation within three months to make the registration of marriage compulsory. A bench headed by Justice Arijit Pasayat asked the States and Union Territories to file a compliance report along with an affidavit after the three months deadline. The Hon'ble apex court passed the order after noting that several states had made registration of marriage compulsory only for the members of the Hindu community. But by the Supreme Court order, registration of marriage will be mandatory for all religions.

The Protection of Women from Domestic Violence Act, 2005 [21]

Domestic Violence, particularly against women, is widely prevalent throughout the country, but owing to the patriarchal form of a "male dominated" society has been invisible in the public domain, and wife-beating is professed more as a norm than as an aberration. According to a 1999 survey, 56% women said it was OK if their husbands hit them, while 40% agreed that it was justified if they did not care for their children or take care of the household. Even women, who are educated, independent and belong to well-to-do families, continue to be silent victims.[22]

Till 2005, The Indian Penal Code [23] dealt with persons inflicting cruelty to a married woman U/S 498-A or 304-B. The law, therefore, was thought not to be addressing this phenomenon in its entirety as it dealt only with crimes committed against a married woman, and that too, for dowry. Other women – like sisters, mothers, aunts, daughters etc, though are subjected to violence, have no way of redressal of their grievances, even though domestic violence is a human rights issue and a serious deterrent to the development of the individual concerned. Hence the said Act was passed, keeping in view the rights guaranteed under Articles 14, 15 and 21 of the Constitution of India.

The Act covers all women who are or have parties have lived together in a shared household and are related by consanguinity, marriage or through a relationship in the nature of marriage or adoption, as well as relationships with family members living together as a joint family. This includes sisters, mothers, widows, single women or living with the accused. "Domestic Violence" has been defined to include actual abuse or threat or abuse that may be physical, sexual, verbal, emotional, or economic.

It provides for rights of women to "secure housing". It also gives the woman a right to reside in her matrimonial home or shared household, irrespective of the fact that she may have any rights on such a household or not. Such a right can be secured by the woman in form of a "residence order" passed by a Magistrate.

The Act empowers a Magistrate to pass protection orders in favour of the aggrieved woman to prevent the accused from aiding or committing any act of domestic violence, entering the work place or any place frequented by the said woman, isolating any assets used by both the parties or causing violence to any of her relatives who are providing assistance to her.

It further provides for appointment of "Protection Officers" for providing assistance to the aggrieved woman with respect to her medical examination, obtaining legal aid, safe shelter etc. Registration of non-governmental organizations as service providers for the said purpose has also been provided for, by this Act.

The Medical Termination of Pregnancy Act, 1971 [24]

The Indian Penal Code provided for abortion U/S 312-318, wherein abortion was a crime, for which the mother as well as the abortionist could be punished except where it had to be induced to save the life of the mother. This strict law was being observed in the breach all over the country, resulting in the untimely death of many young pregnant women. The said Act was therefore passed in order to liberalise the existing provisions relating to the termination of pregnancy so as to save the pregnant women's life, health and strength. It underwent two amendments: in 2002 and in 2005.

In the original Act, a person who was not a qualified, registered medical practitioner, as per the Act, prescribed no punishment for the offence of termination of pregnancy. It only stated that the offence was punishable.[25] However the Amendment of 2002 prescribes the punishments for such offences to be not less than 2 yrs, which can be extended to 7 yrs if the termination is carried out by a person who is not a registered medical practitioner under the Act, or if the place where it was carried out was not an Approved Center. The owner of such an establishment is also liable for punishment.[26] The MTP Regulations, 2003[27] provide for the maintenance of an Admission Register for the said purpose; giving full particulars of the women coming for MTPs and that such Registers are secret documents and have to be preserved for a period of 5 yrs.

The Indian Evidence Act, 1872 [28]

With the introduction of the Judicial System in India by the British, it became necessary to bring about a law relating to presentation of the evidence in courts and upon which they could come to some conclusion about the facts of the case and then pronounce judgments based on them. This led to the enacting of the said Act. It underwent many amendments through the years to safeguard the interests of the women and help in restoring their dignity and self-respect.

The Hon'ble Supreme Court, in Sakshi Vs Union of India[29]had recognized the inadequacies in the law relating to rape and had suggested that the legislature should bring about the required changes. The Law Commission, after examining the entire law relating to rape and sexual assault and suggested an overhauling of the entire law. Based on these recommendations, national consultations organized by the National Commission for Women, a new Bill was drafted by Ms Kirti Singh. It recommends various changes in the Evidence Act, listed below:

1. The character of the victim or her previous sexual experience has no bearing on the "issue of consent" in offences under sections 376A, 376B, 376C or 376D (sexual intercourse not amounting to rape). been in a relationship with the abuser and both
2. The general character of the women cannot be impeached and no one can try to prove in any court of law that the woman was of generally immoral character—omission of clause 4 of S.155.
3. In a prosecution for an offence U/S 376A, 376B, 376C or 376D, where the question of consent is in issue, it shall not be permissible to adduce evidence or to put questions in the cross-examination of the victim as to her general immoral character, or as to her previous sexual experience with any person for proving such consent or the quality of consent—insertion of clause 4 to S.146.

The Code of Criminal Procedure, 1973 [30]

Consolidation of the various laws and Acts governing criminal procedure in various provinces and presidency towns, so as to have a uniform law for the whole country, started in 1852 in stages. Thereafter, the Code of Criminal Procedure of 1898 was the consolidated Code applicable to the whole of India. This underwent various amendments, of which the amendments of 1955 were the most extensive. In 1968, the Law Commission was asked to undertake a detailed examination of the 1898 Code and this ultimately culminated in The Code of Criminal Procedure, 1973[31] .

Certain sections were added and some amended in Criminal Procedure Code for the betterment of women, especially those who are victims of sexual abuse.

To facilitate the examination of a person charged of rape as early as possible, after his arrest, S. 53A was added to the original Code to provide for his examination by any registered medical practitioner of the area authorized for the said purpose by a police officer not below the rank of a sub-inspector, in the absence of an RMP within the radius of 16 Kms from the place where the offence has been committed.

Sub-Section 2 of S. 53A makes it mandatory to collect material for DNA profiling from the accused. The same has also been included in the Explanation of S. 53A and S. 54: "examination shall include the examination of blood, blood stains, semen, swabs in case of

sexual offences, sputum, sweat, hair samples and finger-nail clippings by the use of modern and scientific techniques including DNA profiling and such other tests which the medical practitioner thinks necessary in a particular case."

Section 164A provides for the examination of the person of the victim within 24 hours of receiving the information or commission of the crime by an RMP employed by the government or any local authority or any RMP of the area, with the consent of such woman or by any person competent to give consent on her behalf. The detailed examination shall include collection of material for DNA profiling (sub-Section 2).

Section 176 has been amended to provide that in the case of death or disappearance of a person, or rape of a woman while in the custody of police there shall be a mandatory judicial inquiry, both by a Judicial Magistrate or a Metropolitan Magistrate, and in case of death, examination of the body shall be conducted within twenty-four hours.

Sexual Harassment at Work Place

Women, now-a-days, are working hand in hand with their male counterparts in almost all spheres of life. Even the once all-male combat forces have now opened their doors wide open for the women, thereby acknowledging their equal status. However, like in other areas, at work places too, women face harassment and indignity at the hands of the men, particularly of the sexual kind. Sexual harassment at workplaces is not an isolated phenomenon, but a manifestation of the larger gender discrimination in society. But not all such incidents are reported, though there may be many reasons for the same. The victims of sexual harassment are reluctant to even admit to this because of social stigma, ridicule, ostracism and fear of reprisals. Considering the increase in such incidents, the Hon'ble Supreme Court laid down the Vishakha Guidelines in 1997.[32] They define Sexual Harassment as any unwelcome sexually determined behavior such as:

1. Physical contact and advances;
2. Demand or request for sexual favors;
3. Sexually coloured remarks;
4. Showing pornography;
5. Any other unwelcome physical, verbal or non-verbal conduct of sexual nature.

The Supreme Court ruled that sexual harassment includes harassment not only in work situations but also harassment in public or social situations, for example on the roads, in buses etc. Hostile and anti women environment like pornography in public places, use of foul language etc. also constitutes sexual harassment. Although these may not be directed against any particular woman, but the effect is of discomfort, which puts her in a disadvantaged position.

The Indian Penal Code under Sections covers acts of sexual harassment:

1. 292-294: Obscenity (sale of books, pornography; obscene songs, etc)
2. 354: Assault or Criminal Force to a woman with intent to outrage her modesty
3. 375: Rape
4. 509: Word, gesture or act intended to outrage the modesty of a woman
5. Protection of Human Rights Act, 1993 (as amended in 2006)

The Hon'ble Court ruled that it shall be the duty of the employer or any other responsible person in work places or other institutions to prevent or detect the commission of acts of sexual harassment and to provide for the resolution of acts of sexual harassment by taking all steps required. The employer shall also create awareness, constitute complaints mechanism, initiate disciplinary action against perpetrators, initiate criminal action where required and provide for support mechanisms to victims wherever required.

It was emphasized that complaint mechanism should be created in the organization for redressal of the complaint made by the victim. Such mechanism should ensure time-bound treatment of complaints. A woman should head such a "Complaints Committee" and not less than half of its members should be women. It should include a member from NGO or other body familiar with the issue of sexual harassment. The complaints committee must make an annual report to the government with the action taken report. Confidentiality in the proceedings is to be ensured. The victim has the option to seek transfer of the perpetrator or her own transfer.

The Ministry of Women and Child Development has come up with a "Protection of Women Against Sexual Harassment at Workplace Bill, 2007" [33] which has now been placed before the Select Committee to be debated. It states that "No woman employee at a work place shall be subjected to sexual harassment including unwelcome sexually determined behavior, physical contact, advances, sexually coloured remarks, showing pornography, sexual demand, request for sexual favours or any other unwelcome conduct of sexual nature whether verbal, textual, physical, graphic or electronic or by any other actions, which may include, -

1. Implied or overt promise of preferential treatment in employment; or
2. Implied or overt threat of detrimental treatment in employment; or
3. Implied or overt threat about the present or future employment status; or
4. Conduct which interferes with work or creates an intimidating or offensive or hostile work environment; or
5. Humiliating conduct constituting health and safety problems."

For the purpose of this Act, every employer of a work place shall constitute, by an Office Order in writing, an Internal Complaints Committee that shall consist of:

1. A Chairperson, from amongst employees, who shall be a senior level woman, committed to the cause of women. In case a senior level woman employee is not available, the Chairperson shall be appointed from a sister organization or a non-governmental organization;
2. At least two members from amongst employees committed to the cause of women or who have had experience in social work; and
3. One member from amongst such non-governmental organisations or associations or other interests committed to the cause of women.

At least fifty per cent of these members shall be women.

The duties of the employer that have been proposed are:

1. Provide a safe working environment at the workplace;
2. Undertake workshops and training programmes at regular intervals for sensitizing the members;
3. Provide necessary facilities to the Committee or the Local Committee, as the case may be, to deal with the complaint and conduct enquiry;
4. Ensure the attendance of respondent and witnesses before the Committee or the Local Committee.

On the completion of an enquiry under this Act, the said Committee shall provide a report of its findings to the employer, or as the case may be, District officer. If it arrives at the conclusion that the allegation against the respondent has not been proved, it shall recommend to the employer that no action is required to be taken in the matter. But if it is of the opinion that the allegation against the respondent has been proved, it shall recommend to the employer -

1. To take action for misconduct in accordance with the provisions of the service rules applicable to the respondent or where no such service rules have been made, in such manner as may be prescribed; or
2. To deduct from the salary or wages of the respondent such sum of compensation to be paid to the aggrieved woman or to legal heirs, as it may determine, in accordance with the provisions of the Act.

Cyber-Crime against Females

With advancement of technology, the type and methods of crime are also changing. One such offensive is the increase in cyber-crime in India. One such crime is known as 'Cyber-stalking'.

The Delhi Police had recently registered India's First Case of Cyber-stalking.[34] One Mrs. Ritu Kohli complained to the police against a person who was using her identity to chat over the Internet at the website. Mrs. Kohli further

complained that the person was chatting on the Net, using her name and giving her address and was talking obscene language. The same person was also deliberately giving her telephone number to other chatters encouraging them to call Ritu Kohli at odd hours. Consequently, Mrs. Kohli received almost 40 calls in three days mostly at odd hours from as far away as Kuwait, Cochin, Bombay and Ahmedabad. The said calls created havoc in the personal life and mental peace of Ritu Kohli who decided to report the matter. Consequently, the IP addresses were traced and the police investigated the entire matter and ultimately arrested Manish Kathuria on the said complaint. Manish apparently pleaded guilty and was arrested. A case was registered under section 509, of the Indian Penal Code (IPC).

Cyber-stalking does not have any one definition but it can be defined to mean threatening, unwarranted behavior or advances directed by one net user to another user using the medium of Internet and other forms of online communication. It is a recent phenomenon and women generally are the main targets of this crime.

Conclusion

Girls and women face inequality everywhere, but in India, they usually do not get even a fighting chance to lead a healthy and productive life. According to Manu, the law giver, a woman cannot attain *'moksha'* and has to be reborn a man for redemption. Further more, a man attains *'moksha'* only when his son performs the sacred *'pind-daan'*. In such a male-oriented and a male-dominated world, it is no surprise that women are subjected to ridicule, harassment, and violence in all phases of life, right from conception. Worldwide data reveals 105 women for every 100 men. Even the sub-Saharan Africa has a sex ratio of 102 women per 100 men. However, according to the 2001 census, India had less than 93 women for 100 men.[35] No amount of legislations can put an end to this deep rooted evil. As has been proved time and again, education of the victim or the perpetrator, has not much bearing on the correction of this menace. What is required is an attitudinal change in the whole society.

According to a UNDAF sponsored report,[22] released by the UN Resident Coordinator in New Delhi in 2002, a study conducted amongst 109 judges regarding the issue of wife-beating reveals certain astounding facts! Forty-nine percent of the respondents felt that there are certain situations when it becomes mandatory for the husband to slap his wife; while 79% believed that a woman's first priority should be to save her marriage even if she had to face domestic violence.

Enacting laws is not enough. The women's organizations, police and the legal framework may continue to provide assistance to the victims. But, ultimately, it is up to the woman herself to stand up for her rights and safe-guard her self-respect, rather than live in an abusive relationship in the futile hope that some-how, sometime later, things may change for the better.

References

1. Act 30 of 1956, as amended by Act 39 of 2005.
2. Universal's Hindu Laws. Universal Law Publishing Co. Pvt Ltd. 2008:27.
3. The Hindu Succession (Amendment) Act, 2005.
4. Section 6. Substituted by S. 3, Act 39 of 2005.
5. Act 57 of 1994.
6. **Giriraj R**. Changing attitude to female infanticide in Salem. *Social Welfare*. February 2004: 13-14 & 34-35.
7. **Suguna B**. Female foeticide: 21st Century gender violence. *Social Welfare*. March 2007:14-16.
8. **Nagarajan R**. Rich don't want daughters, blamed for adverse sex ratio.. The Hindustan Times, April 12, 2004: 13.
9. Act 57 of 1994, before the amendment.
10. Section 3. Act 14 of 2003.
11. Clause (f) S.14 of Act 57, 1994. Substituted by S.11, Act 14 of 2003.
12. Sub-clauses (e) - (i) inserted by S.15, Act 14 of 2003 to clause 4, S.17 of Act 57 of 1994.
13. Sub-sections 2&3 S.23 substituted by S.19, Act 14 of 2003.
14. Section 24 substituted by S.20, Act 14 of 2003.
15. Act 25 of 1955, as amended by The Prohibition of Child Marriage Act, 2006 (6 of 2007).

16. Universal's Hindu Laws. Universal Law Publishing Co. Pvt Ltd. 2008:1.

17. The Marriage Laws (Amendment) Act, 1976 (68 of 1976).

18. Clause iii S.5 substituted by S.6 of The Child Marriage Restraint (Amendment) Act, 1978 (2 of 1978).

19. Sub-sections a & b S.18 substituted by S.20, Act 6 of 2007.

20. Clause iii a S.19 substituted by S.12, Act 68 of 1976.

21. Act 43 of 2005.

22. Seth A. Of battered wives and chauvinistic men..... The Hindustan Times 21 October 2003:6.

23. Indian Penal Code, 1860. Act 45 of 1860.

24. Act 34 of 1971, as amended by The Delegated Legalisation Provisions (Amendment) Act, 2004 (4 of 2005).

25. Sub-section 2, S.5, Act 34 of 1971.

26. Sub-section 2, 3 & 4, S.5, Act 34 of 1971 substituted by S.5 of The Medical Termination of Pregnancy (Amendment) Act, 2002 (64 of 2002).

27. Vide G.S.R. 486(E), dated 13th June 2003, published in the Gazette of India, Extra, Pt II. Sec 3(i).

28. Act 1 of 1872.

29. http://new.nic.in/Amendments%20to-%20laws%20relating%20to%20women.pdf. Accessed 30.08.2008

30. Act 2 of 1974, as amended by The Code of Criminal Procedure (Amendment) Act, 2005 (25 of 2005).

31. Universal's The Code of Criminal Procedure, 1973. Universal Law Publishing Co. Pvt Ltd. 2008:1.

32. Vishaka and Othrs Vs The State of Rajasthan and Othrs (1197) 6 SC C241.

33. http://www.nic.in/protshbill2007.htm. Accessed 30.08.2008.

34. http://www.caslon.com.au/stalkingnote4.htm. Accessed30.08.2008.

35. Pannu GK. Prevention of femicide and relevant legislations. *Social Welfare.* July 2004: 11-15.

Review Article

Examination of victims of child trafficking - Why & how?

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Abstract

Child trafficking is a big social problem. It affects millions of children and families in many countries. The conviction rate of child trafficking cases in India is very low. Delays in filing the FIR, delay in medical examination and/or deficiencies in medical examination are found to be some important causes of the low rate of conviction. The deficiencies in medical examination can mislead the justice. To remove this deficiency the registered medical practitioners should have, awareness about child trafficking and should know their role in the investigation of the cases. Important information about child trafficking, the role of medical practitioner in the investigation of such cases and examination procedure are discussed in this paper.

Keywords : *Child, Trafficking, Examination.*

Introduction

Child trafficking may be defined as moving, selling or buying of children for some illegal acts within and outside a country with or without the consent of the child. The main purpose of trafficking of children is commercial sexual exploitation/ prostitution and other purposes are forced / bonded labour, begging, organ trade, camel jockeying, adoption, etc.

There are several factors that lead to trafficking of children. These factors can broadly be classified into two categories i.e. Supply factors and Demand factors. Supply factors are *Poverty, Debt bondage and slavery,* Abandoned children, *Dysfunctional/ broken Families, Natural calamities and poor rehabilitation, Traditional practices like Devadasis*, *Child marriage, Urban opportunity* i.e. migrate to urban areas looking for work, *Illiteracy, Weak law enforcement, etc.* Demand factors are *raising male migration, Growth of tourism, Misconception of the treatment of STDs*, etc.

Child trafficking is a big social problem. It affects millions of children and families in many countries around the world. It can occur within one country, across national borders or between regions. While trafficking patterns vary, it is relatively common for children from rural areas to be trafficked for exploitation in urban centres, and for children from poor countries to be trafficked to wealthier neighboring countries and beyond[1]. The victims suffered physical, sexual, psychological and/or emotional abuse and also medical neglect. Maximum percent of the victims suffered more than one type of abuse. Trafficking of a person is an offence. Laws have been enacted to deal with this crime. But, proper administration of justice can be done only when the crime has been investigated properly.

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Observations of study team

The trafficking of women and children had drawn a serious attention of the National Human Rights Commission (NHRC), the Department of Women and Child Development (DWCD) and the UNICEF[1]. They have undertaken several activities to study the problem in greater depth, so that more effective steps can be taken to prevent and curb it at source, protect the victims more meaningfully, and provide them sustainable rehabilitation. The team found very low conviction rate in child trafficking cases. It observed that the low rate of conviction is due to *delays in filing the FIR, delay in medical examination and/or deficiencies in medical examination,* etc. According to them the current lacunae in the

medical examination system are (i) *Lack of standardised* protocols for medical examination, (ii) Lack of trained medical personnel for the age determination tests, (iii) Lack of ossification data of the different groups/ regions, (iv) Not considering the age determination tests as mandatory by the medical officer, (v) Conducting the medical examination only by one doctor (makes easy for the traffickers to influence), and (vi) No time stipulation for submitting the report to the investigating agency/court.[2]

Role of RMP in the investigation

The important role of a Registered Medical Practitioner in the investigation and management of child trafficking cases are -

- To examine the victims and collect the evidences.
- To form opinion from the facts observed by him and help in the administration of justice.
- To offer treatment and primary level counseling.
- To refer the patient to the concern specialist when necessary.

Objectives of medical examination

- To determine the age of the victim,
- To find out signs of torture/assault (physical, mental, sexual),
- To find out the time of assault,
- To collect evidences.
- To detect trauma and offer the treatment.

Importance of age estimation

Most of the victims of trafficking are poor and illiterate and do not have any record of birth such as birth certificates to prove his/her age. In sexual exploitation cases the victim is under tremendous pressure from the traffickers to insist that her age is above 18 if she is ever questioned about it by the police or judicial authorities, and that she is a prostitute of her own free will. Thus, it is necessary to estimate the age of the victims by the medical practitioners in all cases of child trafficking.

The meaning of a child is given in different Acts of India. According to Child Labour Act, 1986 - "child" means a person who has not completed 14 years of age 3. According to Immoral Traffic Act, 1956 - it means a person who has not completed 16 years of age 4. According to Juvenile Justice Act, 2000 -"juvenile" or "child" means a person who has not completed 18 year of age 5. According to Child Marriage Act, 1929 - "child" means a person who, if a male, has not completed 21 years of age, and if a female, has not completed 18 year of age 6. The meaning may be different but in all the question of age of the victim may arise.

Age estimation of trafficked victim is mandatory under Section 15(5A) of the ITPA. According to JJA if a trafficked victim is a child (below 18 years of age), then the child would be treated as a victim in need of care and protection and sent to a protective home.

Examination & reporting

The medical practitioner must remember that he is a helper and the victim is the person who can help the helper [7]. Due to the trauma, the victim may be suffering from inability to trust others. It may not be so easy to get their trust and confidence. Therefore, the medical practitioner must create a sensitive environment in which victim feels comfort and has encouraged expressing his/her feeling, concern and needs related to the assault. The victim needs to be informed about his/her right as victim, as guaranteed by law. The victim also needs to be informed about the services available to address his/her needs.

The medical practitioner needs to obtain requisition with FIR number from police officer for the medical examination of the victim. In case, where the victim is brought directly by parent/guardian/NGO/individual to the hospital, the medical practitioner needs to obtain the proper history, inform the police, and conduct a proper and complete medical examination of the victim.

A child who has been sexually assaulted requires examination by the most competent medical provider so that repeated examinations can be avoided and trauma to the patient can be

reduced. For age determination no single method alone should be adopted. A combination of examination of physical, dental and radiological should be taken into consideration before recording the final opinion.

It is better to have a uniform prescribed format for preparing the examination report. It will be helpful not only to the examiners but also to the Investigating Officers and Court. The format may be prepared as follow:

Examination of Injuries:

It is most likely that victims of child trafficking may show injuries over the body. Photograph of injuries should be taken, wherever possible and facilities are available.

The medical practitioner should look for recent physical assault injuries, like grip marks, bite marks, pinpricks, ligature impression, broken pieces of hair.

EXAMINATION & REPORT OF VICTIM OF CHILD TRAFFICKING

MLC No..... *Date* .....
Requisition from ..... *of* .....
FIR/ST case no..... *P.S/Court* .....
Date & time of examination ..... *Place of examination* .....
Name ..... *Sex* ..... *Caste* .....
S/o,D/o,W/o ..... *Address* .....
Age ..... *(as stated by Police) and* ..... *(as stated by victim)*
Educational qualification ..... *Occupation* .....
Marital status .....
Date of menarche ..... *. Last menstrual period*.....
Name & No. of police who brought and identified .....
Examination in presence of (name of Female attendant) .....
Consent of examination& report .....
Marks of identification (a) .....
(b).....
History of the case as given by Police (including date & time of complaint):.....
History of the case as given by the victim: present incidence, pain-discomfort, family, marital, etc.....
Whether she/he was conscious or under the influence of any intoxicant prior and at the time of alleged assault .....
Any complaint of pain, discomfort during walking, urination and defecation .....
Clothing – changed or not (if changed –when) .....
Any sign of struggle .....
Any stain/hair/fiber/grass etc.....
Whether bath was taken or not (if taken- when) .....
Whether motions and urine passed or not (if yes- when) .....
Height ..... *Weight* .....
Body build ..... ***Nutrition***—poor/ satisfactory/healthy
Personal hygiene—poor/good
Look- vacant /starry / fearful
Mental status - cool/calm/excited/depressed /anxious/aggressive hostile/ trustless, Hopelessness/ confused/clear

Teeth:

Rt U	87654321 | 12345678	Lt U
Rt L	87654321 | 12345678	Lt L

T = Temporary
P = Permanent
S = Space after tooth

Hairs: Scalp .....
Bread .....
Moustach .....
Axillary .....
Pubic-.....

Development of breast.....
Milk yes/no.....

Development of genitals & other findings:

Labia majora	➢	hypertrophy/not, gap/appose each other, any swelling, adhesions, lubricant, injury, infection etc.
Labia minora	➢	protruded out in between majoras or not, any swelling, adhesions, lubricant, injury, infection etc.
Clitoris	➢	Mucous plug, erosions, growth, bleeding, dilation.
Fourchette	➢	any injury and infection,
Vulva	➢	any injury, infection, discharge etc.
Hymen	➢	Type, intact/elastic/torn (fresh/old) at ..... O'clock.
Vagina	➢	admit one/two/three fingers, discharge
Vaginal wall	➢	distinct/not distinct/lacerated
Uterus	➢	Size shape, position, any other
Anus	➢	bleeding/ injuries/semen/lubricants, Dilated/not, Normal/thickened skin, Skin folds-distinct/not, Anal fistula/ Chondylomata/ warts/ chancre, Scarring, skin tags, Venous congestion, anal infection and dribbling etc., Anal sphincter-normal/hypotoinic/ increase laxness/elastic, admits 2/3/4 fingers

Report of radiological examination with No. & Date of X-ray:

1. Shoulder Jt .....
2. Elbow Jt .....
3 Wrist Jt & Hand.....
4 Knee jt.....
5. Pelvic .....

Report of Laboratory examination:.....

Opinion:

Opinion must have components of injury, sexual activity, and age estimation.

While recording an opinion in medico-legal cases the following four criteria must be incorporated:

i. Evidence of recent sexual activity – Yes/No
ii. Accustomed to sexual intercourse – Yes/No
iii. Sign of struggle / use of force - Yes/No
iv. Presence of Sexually Transmitted Diseases - Yes/No

While giving opinion about the injuries, the R.M.P. must specify whether injures are:

Fresh / ...Hr/ ...days old,
Caused by sharp weapon/ blunt weapon/ burning object like cigarette,
Simple /Grievous /Dangerous,
Self inflicted (Suicidal) /Assault (Homicidal) / Accidental

While writing a description of injuries, follow a sequence and the whole body should be examined so no part is left out. The description should contain the type of injury, exact location, dimension of injury, shape, stage of healing and other important characters (if any). The description should also contain the nature of injury (simple/grievous), and its causation (Blunt /force/sharp instruments/cigarette burns, etc).

The R.M.P. should consider all findings collectively while giving his opinion about age. He should narrow down the range of the age of the victim as far as possible. It is said that the range should not be more than ± 6 months. This range of ± is given only when opinion is expressed as a whole number for example, 14.6 years ± 6 months.

It will be more convenient for the I.O./Court, if the R.M.P. can give the age as "above ..... years but below ..... years" e.g. "above 14 years but below 16 years".

The medico-legal report is not substantive evidence and it has to be proved by the maker of it. Opinion of an expert is not accepted by the court as a GOSPEL TRUTH without reason. Therefore, the reasons should be recorded in the report. The report must be self explanatory and should be prepared in such away that the reader can visualize the victim along with the findings.

Collection of samples for laboratory investigations:

The following samples must be collected in cases of sexual exploitation or abuse.

- Blood (for grouping, DNA Finger printing, drugs)
- Urine (for suspected pregnancy, drugs)
- Seminal stain (for blood grouping, DNA Finger printing)
- Nail scrapings (for epithelium of the assailant)
- Hairs (for identification, nature of crime, seminal stain)
- Vaginal swabs (for semen &identification)
- Vaginal swabs (for motile and immotile sperm)
- Urethral swab (for STD).
- Swabs from suspected areas (for seminal and saliva stains)

In addition, the examiner may also collect the following items if he/she feels necessary-

A. Clothing

Save torn, blood/semen-stained clothing for further examination. Describe in detail about tears, stained areas. These stained and torn areas in the clothing may be encircled, made into a proper layer and kept in a paper packet. Dry the wet clothing at least for one hour in fresh air before preserving. Otherwise candida growth will spoil the semen and blood stains.

B. Foreign material

- The medical officer may look for
- Foreign hair from the pubic or chest areas
- Cloth fibres from foreign clothing
- Foreign skin fragments in nail, and over the abraded areas.

C. Sample from Mouth

Swab from under the tongue and buccal area near molars. Take one swab from each area and prepare the smear.

D. Sample from Rectum

Take one sample from the external parts and another from the 2- 5-cm area from external orifice.

According to the National Plan of Action formulated by Government of India the report should be submitted to the Investigating Officer/ Court within 48-72 hours of conducting the examination. In cases where laboratory investigations and test results are awaited, the same should be mentioned in the report.

If the victim requires medical treatment, it must be given and if necessary, the case should refer to the respective specialist for further examination and management.

References

1. International Labour Organization: Child trafficking and action to eliminate it; International Labour Office, CH-1211 Geneva 22, Switzerland, 2002, xi.
2. Manual for medical officers dealing with medico-legal cases of victims of trafficking for commercial sexual exploitation and child sexual abuse, Department of Women & Child Development, UNICEF, 19.
3. The Child Labour (Prohibition and Regulation) Act-1986, Universal law Publishing Co. PVT. LTD. Delhi, 2007, 2.
4. The Immoral Traffic (Prevention) Act-1956, Universal law Publishing Co. PVT. LTD. Delhi, 2007, 3.
5. The Juvenile Justice (Care and Protection of Children) Act- 2000, Universal law Publishing Co. PVT. LTD. Delhi, 2007, 5.
6. The Child Marriage Restraint Act- 1929, Universal law Publishing Co. PVT. LTD. Delhi, 2005, 2.
7. **Olshaker Jonathan S, Jackson M, Christine Smock & William S.** Forensic Emergency Medicine, 2nd Edition, Lippincott Williams & Wilkins, 2007, 21.

J Indian Acad Forensic Med, 30(4)

Review Article

Biodegradation of dead bodies including human cadavers and their safe disposal with reference to mortuary practice

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Keywords : *Biodegradation ,cadaver, carcass, decomposition and putrefaction*

Introduction

The biodegradation is the breakdown of complex organic materials into simpler chemicals by biochemical process[1]. Basically it is oxidative breakdown of synthetic or natural substances by microbial activity[2]. After death this natural process takes place in all biological waste and residue, which may otherwise cause environmental pollution at large. Biodegradation of body is the final process of the biological destruction of body and is commonly termed as decomposition or putrefaction. This process reduces the tissues to simple compounds like water, carbon-dioxide, hydrogen sulphide, ammonia etc. The temporal changes in the composition of the carrion take place in all animals but it is well described for human being. In this article a review of various changes that take place in biological wastes with special reference to human cadaver during its biodegradation have been discussed and measures for safe-disposal of such material in mortuary are suggested.

Composition of organic bodies and growth process

Proteins, carbohydrates and fats are the three main ingredients of all the organic bodies. Nitrogen and sulphur are consider as the essential elements for biological growth process. Nitrogen is required for the synthesis of amino acids and nucleic acids while sulphur is needed for synthesis of sulphydryl (-SH) containing amino acids viz. cystine and methionine and also for Vitamin B. These elements also from a source of energy. All above mentioned transformations can occure in the process of decomposition of the dead bodies, so it is said that the cycle of life continues to survive on the dead and decomposed remains of previous generation.

Biogeochemical cycles

Nitrogen and sulphur cycles are termed as biogeochemical cycles and are energy-yielding process. Both these cycles are the processes by which nitrogen and sulphur are brought into a cycle by plants and animals including human. Basically biogeochemical cycles are more or less circular pathways through which the chemical elements, including all the essential elements of the protoplasm, circulate in the biosphere from environment to organism and back to the environment. Nitrogen and sulphur cycles consists of four parts (Table – 1)[3].

Decomposition of bioligical wastes

Ecosystem mainly comprises of three types of organisms viz. Producers, Consumers and Decomposers.

Producers:- synthesize organic matter from (i) Inorganic compounds by the chemo synthesis of bacteria and (ii) Photosynthesis by green plants.

Consumers :- utilize the organic matter synthesized by the producers and they may be: (i) Primary consumers – those who feed directly on producer (herbivores); (ii) Secondary consumers- those who feed on the herbivores (carnivores) and (iii) Tertiary consumers- those who feed on the carnivores and so on[2]. Decomposers are the group of largely saprophytic or sporozoic organisms who feed on the dead and decaying corpses of the producers and the consumers and

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cause break down the organic materials incorporated into the bodies which are returned to the ecosystem as raw material for fresh synthesis. In this process the decay of carrions (including the human cadavers) provide habitat and resources for a host of specialized organisms adopted to colonize and exploit such materials.

The degradation (decomposition) process is brought about by two different groups of organisms i.e. the scavengers and the true decomposers. Both these organisms are complimentary to each other in the decay system. The scavengers usually remove the fragments of courpse during fresh state while the decomposers reduce it in situ. The scavengers may be invertebrates (e.g. flies, ants, mites, dermestids, cockroaches etc.) or vertebrates (e.g. fish, reptiles, big birds like vultures or mammals like jackals, rodents etc.)

Invertebrates Scavengers:- The various species of the invertebrates which contribute in decaying are not all found upon the dead body at any time. The invertebrates colonizing the corpse depends on the stage of decomposition e.g. larvae are found during the active stage of decomposition whereas the mites and dermestids colonize the "remains" state [1].

The entomology of the cadaver was first reported by Bergeret (1855) [4]. Foul odour from the decomposing body attracts the houseflies and blow flies[5]. The flies usually arrive at the cadaver within an hour or two after death [4] in day light [1] and lay eggs in clusters at the base of the hair but their distribution is not even over the cadaver. Generally the eggs are concentrated in the natural orifices and ulcerated areas[4] or the areas of softer skin. The eggs are found in the skin folds of the armpit, groin, neck bare skin around the eyes, ears, nose and the perineal area. The eggs hatch into larvae (maggots). Maggots secrete digestive fluids containing proteolytic enzymes, which help in softening the tissues and making their way to creep into the interior of the body. It also helps in providing easy access to the external micro-organisms [4].

The development of the maggots is very rapid and complete in three moultings and instar states in five or six days. At third instar stage the "fat maggots" also known as "fisherman's maggots" (because they are used as bait by the Anglers) stop feeding and migrate from the to pupate in the soil. Some large flies are viviparous which may deposit their larvae on the surface of the dead body [1]. It is said that the maggots consume over 80 % of the putrefying flesh of a cadaver.

Vertebrate scavengers:- There are few vertebrate scavengers which are exclusive carrion feeders. Most of the vertebrate are a predator, which consume fleshy dead corpses. Crows, kites, African cranes, Storks, Hyenas and Jackals are more scavengers than predator. Vultures and condors are adopted for eating putrefying flesh alone. Cadavers may be eaten by dogs, jackals and birds of prey if found unprotected and in lonely place.

The invertebrates can consume little portion of the available material while the vertebrates can consume large portion of corpse but they cannot cope with large cadavers like man or elephant because of their superabundance and hence their major proteins are left for micro-fauna which are dealt with by the true decomposers.

True decomposers

The bacteria are the principal agents which ultimately bring about the final reduction of the biological refuse. The maggots by enzymatic action liquefies the carcass and increases the microbial activity. Both aerobic and anaerobic micro-organisms contribute in decomposition but the body undergoes mainly true anaerobic decomposition and the PH for the microbial action varies between 6 and 8. It is claimed that there are about 10X14 number of microorganism both inside and outside the human body. The environmental factors in the human body vary from site to site and only particular type of micro-organism can multiply at particular site. Such native (resident) microflora which have conditions congenial for a commensal existensce are called microbiota of the region (Table –2)[7-8].

A systemic study of the cadaveric bacteriology was undertaken by Burn [9] and he found two groups of bacteria on cadavers. The

group includes anaerobic spore-bearing bacilli (e.g. Cl. Welchii), coliform organisms micrococci diptheroids and proteus organisms which are normally present in the respiratory or instestinal tracts and they penetrate the muscosal and rapidly invade the tissue shortly after death[10]. The second group of bacteria includes a variety pathogenic and non-pathogenic strains. The marked increase in hydrogen ion concentration and the rapid loss of oxygen in the tissue after death favours the growth of anaerobic organisms. The blood is the most natural nutrient medium for microbial growth.

In addition to bacterial action autolysis also contribute in decomposition process. Autolysis results in softening and liquification from autodigestion and disintegration of soft body tissue under sterile condition. This is due to proteolytic, lipolytic and glycolytic action of enzymes and ferments released from body cells [9]. Decay is the general desomposition of organic matter through bacterial and fungal actions[1]. In the final phase of decomposition the anerobes become active putrefying agents, releasing foul-smelling byproducts.

The proteins which consists of carbon, hydrogen. Oxygen, phosphorus, sulphur and iron undergo putrefaction by the activities of colon bacilli (microbiota of the large intenstine). Escheria coli are the coliform bacteria found in the gut which act in anaerobic conditions and produce incomplete oxidized products namely abblumoses polypetides, peptones, amino acids, ammonia etc. An amino acid- "Cystine" which contain sulphur produce malodourous and poisonous products such as ethyl and methyl mecaptans (C^2 H^5SH and CH^3SH);and hydrogen sulphide. The other amino acids hydrolyse to amines[1](Table-3) by replacing one or more of the hydrogen of ammonia by one or more hydrocarbons which contribute to characteristic odours of putrefaction. On the scale of offensive osmogens known to the human sense of smell;the mercaptans have $10^{-6}$to 10^{-5} threshold in comparison to Amines(10^{-1}) [3].

The amines formed during decomposition are strongly alkaline and depending upon the molecular weight they may be in gaseous, liquid or solid form. Some of the amines e.g. cadverine, neutrine, choline etc.are highly toxic and are known as ptomaines. Finally the amines are reduced to ammonia, carbondioxide and water[1].

$$NH_2(CH_2)_5NH_2=70_2->2\ NH_3+5CO_2+4H_2O$$

The other bacteria which is considered as the chief instrument behind decomposition is Clostridium welchii (Cl. perfringens)[4] which is also known as gas bacillus .Other clostridia like Cl.septicum, Cl sporogenes, Cl tetanus, Cihitolyticum etc. and bacterial species e.g. Salmonella, Shigella, B. subtilis, B,Faecalis, B.bifidus, Staphylococci, and Fungi (Yeast) etc. also grow on the dead bodies and help in acceleration of biodegradation of corpes.

Bacteria produce a large varieties of enzymes or fragments which act on different body tissue and cause proteolytic, liolytic or hydrolytic action [5].One of the most important enzyme; known as "Lecithinase" is produced by Cl.welchii[6] cause hydrolysis of the lecithin present in the cell membranes including blood cells[5]. This enzyme is also responsible for postmortem hydrolysis and hydrogenation of body fat.

Due to decomposition there occur colour changes, liberation of gases and liquification of tissues of carpse. Hydrolysis of red blood cells librate iron pigment (haeme) and protein fraction (globin). The pigment stains the tissu reddish-brown and further splitting of it gives to greenish. Greenish –blue or greenish-black discolouration of the tissues[1]. According to others[11,12] the discolouration is due to the conversion of haemoglobin into sulphur-containing compounds by the action of H_2S diffusing from the intestine into the tissues.

During putrefaction a number of gases are formed in the tissues e.g. hydrogen sulphide, marsh, methane, carbon-dioxide, ammonia and hydrogen Phosphide etc.[11-12]. Out of various developed gases methane, carbon-dioxide and hydrogen are non-odourous while the other gases have a characteristic offensive odour of their own e.g. hydrogen sulphide- rooten egg; hydrogen Phosphide – garlicky and ammonia – ruinous [1].

The offensive odour from cadavers under biodegradation is mainely by these gases and by some quantities of mercaptans.

All the tissues of the body except bones (which are immutable) gradually undergo a process of softening and liquefy ultimately. Glaister , J[13], states that the rate of softening depends, to some extent, upon the amount of muscles and fibrous tissue. The muscles in the initial stages of all death from lactic acid under anaerobic conditions, followed by coagulation of muscle proteins with partial resolution of proteins into soluble compounds of less molecular weight. This decay of proteins is initiated by enzymes at two points of the protein molecule i.e. the amino-group (NH2) and the carboxy 1- group (ÇOOH) or both.

Order of biodegradation

i) cells → Tissues → Organs
ii) Liquid tissues (e.g. blood, Lymph) → Soft tissues (parenchymatous tissues) →Firm tissues (e.g. muscles) Hard tissues (e.g. cartilage, bone).
iii) (Organ decay → Muscus lining → Parenchymatus organs → Fibromuscular organs.
iv) Decay of body compounds:
Carbohydrate (Glycogen) → Water and CO_2.
Proteins → Water, CO_2,NH_3,H_2s,PH_3, Mercaptans, CH_4,H_2,N_2 and Amines
Fat (Fatty acids, glycerol, ketone bodies) → Water and CO_2

Biodegradation of bones is a slow process which converts their organic complex constituents into simpler inorganic ones.

Environmental factors influencing rate of biodegradtion

As a general rule, organic compounds are readily degraded in warm climates and less so in the cold [14]. When the onset of decomposition is rapid th progress is accelerated and the time of onset nainly depends upon (i) the atmospheric temp (ii) the humidity of the atmosphere and the mov ment of air in the atmosphere and (iii) the stat of hydration on the tissues[11]. The rate of dec mposition is different in air, water and buried bodies [5]. Casper's dictum is that the time and rate decomposition in air, if denominated as 1, it will be 2 in case of submerged ones, and incase of bodies buried in deep graves. Decomposition is said to be optimum between 21^0 to 38^0 C, retarded between 0^0-20^0C and stop if the temperature is around 45^0C and the body will get mummified[5]. Humidity above 75% is conductive for decomposition. Moisture and warm air enhance the decay by interfering with evaporation and also by raising the body temperature optimum for bacterial growth, whereas the constant wafting of dry air retard in decay due to dehydration.

The rate of decomposition of a body immerged in fluid medium depends upon the temperature of the medium, nature of the medium and the movement of the fluid. It is rapid in warm water and rapid in polluted water e.g. sewage effluent than in fresh water. It is more rapid in fresh water than in salt water. Decomposition proceeds more rapidly in stagnant water than in running water. The rate of decomposition is often accelerated after removal of body from water[11].

There is considerable variation in the rate of decomposition of bodies after burial. If a body is buried immediately after death its biodegradation is slower than in air or water, due to anaerobic conditions but if it is buried after decomposition has set in, it is rapid. The biodegradation is early if burial is shallow than deep burial. Burial is the method adopted by Australopithecus, in the early Pleistocene period for human beings1. The other methods of disposal of dead are shown in Table-4.

In modern era the human cadavers are mostly disposed off according to the customs and culture of the society depending upon the natural environmental conditions1. but most of the times the dead bodies of animals are not properly disposed off and are allowed to decompose here and there. Decomposition causes environmental pollution with offensive odour in the air. So it is always better to burial the corpses of animals at an earliest, rather than to allow them to decay in the air or by throwing them in water.

On 20th July, 1998, Ministry of Environmental and Forest, Government of India notified, "Biomedical Waste(Management and Handling) Rules" in Gazette 15-16.According to schedule I (rule 5) of these rules, human anatomical waste which include human tissues, organs, body parts etc. and animal waste including animal tissues, organs, body parts, carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals, colleges, discharge from hospitals and animal houses are considered as category 1 and 2 of Bio-medical waste. They may cause environmental pollution by offensive odour due to their decomposition and also by providing habitat for various micro-organisms. Hence their proper disposal is essential to protect the environment. Legally incineration and deep burial are consider as the best methods for their disposal.

Summary

Biodegradation of the bodies (human and animals) is a natural process mainly brings about by the micro fauna of true decomposers, which are both aerobic and anaerobic in nature but mainly anaerobic micro-organisms play their role in it. Due to decomposition a number of products are formed which also include a number of gases having a characteristic offensive odour along with mercaptans. The offensive odour in the air gives rise to a great environmental problem, hence to protect the environment disposal of the dead bodies and bio-medical waste shall strictly adhere to the laws framed in the current years[15].

Following measures are suggested to ensure compliance with the provisions of Bio Medical Waste (Management and Handling)Rules 1998[15] in relation to mortuary practice.

→ S.6 of the Act- "Segregation, packaging, transportation and storage":

1) Bio medical waste shall not be mixed with other waste.
2) Bio medical waste shall be segregated into containers/bags at the point of generation in accordance with schedule II prior to storage, transportation, treatment and disposal. The containers shall be labeled according to schedule II.

→ With reference to mortuary practice, following category of bio medical waste shall be dealt accordingly. (Table – 5)

Table – 1:Biogeochemical Cycles

Nitrogen Cycle		Sulphur Cycle	
[A]	**Assimilation and Fixation** (a) Many Bacteria assimilate organic nitrogen (b) Axobacter, some clostridia and certain enterobacter fix the atmospheric nitrogen	[A]	**Assimilation** Sulphates are assimilated by many micro-organisms and converted into the sulphydryl (-SH) group.
[B]	**Deamination** Lysis of dead cells release organic nitrogen which is converted into ammonia either directly by proteolytic enzymes or indirectly by decarboxylation.	[B]	**Desulphydration** Most bacteria produce H_2S from partly decomposed proteins which is subsequently oxidized to sulphate.
[C]	**Nitrification** In this process nitrates are produced from NH_3 in two steps: (a) Nitrosomonas convert NH_3 into nitrite: $2NH_3+3O_2 \rightarrow 2HNO_2+2H_2O+$energy (b) Nitrobacter convert nitrite into nitrate: $3HNO_2+3O_2 \rightarrow HNO_3\ H_2O$ + energy	[C]	**Sulphur oxidation** In the presence of free oxygen H_2S is oxidized to sulphur. $2H_2S + O_2 \rightarrow 3S + 2H_2O$
[D]	**Dissimoilation** Organisms use only the oxidized from of nitrogen and release the energy. The released nitrogen is not usable in cell synthesis.	[D]	**Reduction** In this process energy is released by sulphur reducing bacteria.

Table – 2:Resident microbial flora of human body

Region	Microflora
Nasopharynx and oral cavity	Staphylococcus aureus and S. epidernidis. Neisseria catarrhalis, Haemophilus influenzoe Candida albicans.
Oropharynx	Viridans streptococci, Beta-haemolytic streptococci Streptococcus pneumoniae, S. aureus, S.Epidermidis, Diptheroids, B. Catarrhalis.
Eyes, Ears and Sinuses	S.Epidermidis, Lactobacillus, S. aureus, Haemophilus, liMoraxella cattarrhalis, Entrobacteriaceae, Str. Pyogenes, Str. Fluenzoe pneumoniae etc.
Gastrointestinal tract	Bacteroids, Clostridium, Fusobacterium, Lactobacillus, Escherichia, Proteus, Klebsiella, Entrobacter, Bifidobacteria, Eubacterium and Peptostreptococcus etc.
Urinary tract	Entrobacteriaceal, Yeast etc.
Genital tract	Staphylococci, Corynebacteria, Myconacterium smegmatis, Enterbacteriaceae, Streptococci, Lactobacilli and Candida albicans etc.
Skin	Diptheroids, S. epidermidos, S. aureus, Propionibacterium acnes, Lipophilic and Nonlipophilic Yeasts, Wart virus and Ringworm fungl etc.

Table – 3:Amines of amino acids emiting smell of putrefaction

	Amines	Chemical formula
[A]	**Amines of monoamino acids**	$CH_3 - NH_2$
	Methylamine	$(CH_3)_2 - CH - (CH_2) - NH_2$
	Iso-amylammine	$C_6H_5 - (CH_2)_2 - NH_2$
	B- Phenylethylamine	$HOC_6H_4 - CH_2 - (CH_2)_2 NH_2$
	Tyramine	$NH_2-(CH_2)_2$
[B]	**Amines of diamino acids**	
	Putrescine	$NH_2 - (CH_4)_4 - NH_2$
	Cadaverine	$NH_2 - (CH_2)_5 - NH_2$
	Histamine	$C_3H_3N_2 - (CH_2)_2 - NH_2$
[C]	**Amines not directly derived from amino acids**	
	Dimethylamine	$(CH_2)_2 - NH$
	Trimethylamine	$(CH_3)_3 - N$
	Indol	C_8H_7N
	Propylamine	$CH_3 -- (CH_2)_2 - NH_2$
	Neurine	$(CH_3)_3 - NCH - CH_2OH$
	Choline	$HO - CH_2 - CH_2 - N(CH_3)_3\ OH$
	Skatol	C_9H_9N

Table – 4: Various methods of disposal of dead

	Method	Popular in
1	Left exposed either as whole or dismembered in a scheduled area to be fed by carrion birds and beasts	Zoroastrians and Tibetans
2	Hidden in a mound of stones	Megaliths
3	Hidden in a cave with or without preservation	Incas of Peru
4	Buried in a pit in the earth, with or without some from of wrapping	Predynastic Egyptians
5	Elaborately embalmed, mummified, draped and jeweled, casketed and entombed in massive vaults with funeral gifts	Kings and nobles of Egypt of China
6	Thrown into a lake, river or sea	Scottish, Irish and Danish peat bogs
7	Burming	Cremation of India
8	Burial	Christians and Mommdons etc.

References

1. **Jayovelu T.** Embalming 1st Ed. 1991; B. I. Churchil Livingstone Pvt. Ltd., New Delhi.
2. **Sharma P D.** Ecology and Environment 7th Ed.2003; Rastogi Publication, Meerut.
3. **Charles E Kupchella and Margaret C Hyland.** Environmental Science 2nd Ed., Allyn and Bacon.
4. **Vij K.** Text Book of Forensic Medicine and Toxicology 2nd Ed.2002, B I Churchill Livingstone Pvt. Ltd., New Delhi
5. **Mukherjee J B** .Forensic Medicine and Toxicology, Vol.1, 2nd Ed. 1981, Academic Publishers, Calcutta.
6. **Subrahmanyam B V.** Modis Medical Jurisprudence and Toxicology 22nd Ed.,1999: Butterworths India, New Delhi.
7. **Subrahmanyam A.** Body's invisible soldiers – Science Spectrum, Science Reporter, Vol.26 – CSIR, New Delhi, 1988, pp 650-652.
8. **Betty A Forbes, Daniel F Sahm and Alice S Weissfeld.** Bailey and Scott's Diagnostic Microbiology 10th Ed.1998, Mosby, USA.
9. **Burn C G.** Postmortem Bacteriology J Infect. Dis. Vol.54 1934, pg. 395-403.
10. **Burn C G.** Eexperimental studies of postmortem bacterial invasion in animals, J Infect.Dis: Vol.54 1934, pg.388-394.
11. **Gordon I and Shapiro H A** .Forensic Medicine – A Guide to principles; 2nd Ed. 1982, Churchill Livingstone, Edinburth.
12. **Franklin C A.** Modi's Text Book of Medical Jurisprudence and Toxicology 21st Ed.1988, N M Tripathy Pvt.Ltd.,Bombay.
13. **Glaister J.** Medical Jurisprudence and Toxicology 9th Ed.,1950, Livingstone, Edinburgh, pg.135 –136.
14. **Sim G K.** Advance in Soil Science Vol.11, 1990, pg.289-330.
15. **Bio-medical Waste (Management & Handling) Rules ,1998.** Published by Ministry of Environment and Forest, Govt. of India. Gazette Notification dated 20th July 1998.
16. **Santra S C.** Environmental Science 1st Ed.2004 New Central Book Agency (P) Ltd. Calcutta.

Table-5 : Measures to deal with Bio-medical waste in mortuary practice

Option	Waste category	Type of container	Colour code	Treatment and disposal
Category-1	**Human Anatomical Waste(Human tissues, Organs, body parts)**	Puncture proof container/plastic bag	Yellow / Blue respectively	Incineration / deep burial
Category-3	**Microbiology & Bio technology waste (laboratory cultures, body part carcasses, bleeding parts, vaccines)**	Plastic bag/ disinfected container	Yellow/ Red respectively	autoclaving/micro waving/ incineration
Category-4	**Waste sharps (Needles, syringes, scalpels ,blades ,glass)**	Shredding	Not applicable	Chemical disinfection & shredding
Category-6	**Solid waste (Items contaminated with blood, any body fluids including cotton, solid paper casts, linens, beddings)**	Plastic bag/ disinfected container	Red	Local autoclaving/micro waving/ chemical disinfection/ incineration
Category-7	**Solid waste (waste generated from dispossible items other than waste sharp such as tubings, catheters, IV sets etc.)**	Plastic bag/ disinfected container/ puncture proof container	Red/ Blue respectively	Chemical dis-infection/ autoclaving/shredding
Category-8	**Liquid waste (generated from laboratory and washing, cleaning, house keeping and disinfecting activities)**	Not required	Not applicable	Dis-infection by chemical treatment with 1% hypochlorite solution or equivalent chemical reagent

Brief Communication

Individuality of Footprints- Forensic Implications

Tanuj Kanchan

Footprint analysis forms a simple and cost effective method of identification in medicolegal investigations. Footprints have been used in estimation of sex[1], stature[2,3], and weight of an individual[4,5]. Footprint patterns are not determined genetically and vary even in monozygotic twins. A change in foot shape has also been reported under different weight bearing conditions [6]. Thus, foot prints are not only important evidence in crime scene investigations to establish identity of a criminal but also in identification of dismembered human remains in cases of criminal mutilation and mass disasters.

Footprint morphology shows the individuality of each person's footprints[6]. Combined effects of heredity and life experiences are said to determine the size and shape of the feet. It is a well established fact that individual characters of footprints can help in identification. The acquired characteristics such as scars, pits, corns, and callosities etc. on the planter surface however, depend on occupation and habits like barefoot walking[7]. Footprint patterns obtained from the crime scene or from dismembered remains along with peculiarities such as scars, corns and callosities etc. are highly individualistic and can be compared to confirm identity of an accused or deceased. Similarly occupation and interests of an individual may also influence footprint appearances. Krishan in his research did not find phalange marks of 2nd to 5th toes in most of the footprint impressions in the study group and rightly mentions that absence of a toe stem may be considered as importance as its presence[7]. Kulthanan et al studied and compared footprints in athletes and non-athletes. In their research percentage of fifth toe contacting the ground was found to be significantly higher among athlete males than non-athletes [8]. Thus the predominant occupation, habits and interests of the subjects can have a bearing on the individual characteristics of footprints.

This report possibly will be significant in defining forensic implications of the studies on foot prints, and for future researchers in associating individualistic footprint characteristics to occupation and habits of an individual.

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References

1. **Rao NG and Kotian MS**. Foot print ratio (FPR) - a clue for establishing sex identity. *J Indian Acad Forensic Med.* 1990;12:51-56.
2. **Giles E and Vallandigham P H.** Height estimation from foot and shoeprint length. *J Forensic Sci.* 1991;36:1134-1151.
3. **Krishan K.** Estimation of stature from footprint and foot outline dimensions in Gujjars of North India. *Forensic Sci Int.* (2007) In Press.
4. **Robbins LM.** Estimating height and weight from size of footprints. *J Forensic Sci.* 1986;31:143-152.
5. **Robbins LM**. The individuality of human foot prints. *J Forensic Sci.* 1978;23:778-785.
6. **Tsung BYS, Zhang M, Fan YB and Boone DA.** Quantitative comparison of planter foot shapes under different weight bearing conditions. *J Rehabil Res Dev.* 2003;40:517-526.
7. **Krishan K.** Individualizing characteristics of footprints in Gujjars of North India- Forensic aspects. *Forensic Sci Int.* 2007;169:137-144.
8. **Kulthanan T, Techakampuch S and Bed ND**. A study of foot prints in athletes and non-athletic people. *J Med Assoc Thai.* 2004;87:788-793.

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