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From the Editor's Desk

Please accept Diwali greetings from the office of editor with the present number of the journal.

An effort has been made in "Guest editorial" to give a shape to the the issues and challenges with reference to the discipline. Respected Dr. T. D. Dogra ,having vast experience, that is also at a premier institute in India has obliged the journal and myself personally, by accepting my humble request for the submission. I hope it will illuminate further- the challenges to the discipline and inspire all the concerned to intimate some concrete actions in proper direction.

During my tenure , once gain I wish to share *"mixed feelings"* with the learned members. It was "editor's desk" of the second number of last year, which I preferred to share my feelings. At the risk of repetition , it was my humble appeal to members for submission of manuscripts.

The overwhelming response later on in terms of quantity and quality of submission is the cause of ***"mixed feeling"*** , in a different way. At one hand I am happy that ***" contents"*** need two pages to be accommodated. At other hand , I was under compulsion since the month of September to request the contributors to spare their effort flourished submissions for editor of next tenure as they could not be accommodated this year. For various among other reasons, it is a very positive signal to all concerned with JIAFM.

I wish the diverse themes of articles in the number would impress many .

C B Jani
Editor

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Editor

Guest Editorial

Is Forensic Medicine/Science a "Junk Science" in India?

In Feb 1980, 3rd Annual conference of Indian Academy of Forensic Medicine (IAFM) was organized by AIIMS, New Delhi. I was the joint organizing secretary and the editor of the souvenir. After 20 years again, the department organized IAFM Annual meeting in Feb 1999 at AIIMS.

The souvenir of the 1980 and 1999 conferences were lying on my reading table at home. Incidentally, my son went through both these souvenirs and commented that there is hardly any difference between these two. The contents of both these souvenir are almost similar, same retrospective studies of homicide, suicide, accidental deaths, case reports and so on.

In 1978, on the insistence of my reverend teacher, Late Prof. Jagdish Chandera, the then President of IAFM, the undersigned got published the first issue of the journal, titled "Journal of Forensic Medicine & Toxicology", issued from the office of the President of IAFM. People from this department were the main contributors which somehow got discontinued after first issue. In 1984, after a gap of 6 years, since its first publication, the JFMT was again started. Many more journals have been added either published in individual capacity or other societies, which is welcomed. But when I scan the articles, I find very little information contributed to my existing knowledge. At large, quality of the publications has remained unchanged for the years. All journals are claiming that they are peer-reviewed journals, but going through the articles, I observe nothing to substantiate the claim.

India is having perhaps the largest contingent of Forensic Medicine/Science experts in the world but if we compare our academic activities, output and quality assurance, perhaps we may find ourselves last in the Que. I believe there is lot of scope for research and development in this field like any other area of the Science and Art but in spite of availability of huge number of experts and material our contribution to Forensic Medicine/Sciences at the International level is not significant.

I got an opportunity to review large number of reports from all over the country pertaining to medico-legal work being located centrally and I have no hesitation in commenting that our standard of functioning, reporting, performance and other aspects require urgent attention. It is truly disturbing when you find a person dissecting dead body in video or CD wearing undergarments only and dissecting the human organs with bare handed and a doctor standing next to him in a half folded pant, in *chaplas* peeping a dead body and writing observations on a piece of paper in a dirty and dilapidated mortuary.

I don't think in present times, excuse of lack of funds is a major constraint. I understand the lack of interest, casual approach, lack of knowledge and sensitivity are mainly responsible for this state of affair. I would not like to comment on many other aspects as it may hurt the sentiments of some people. But I find overall situation is not pleasant for one to introduce as a forensic medicine expert with pride in the Society. In spite, carrying out such onerous, important and honorable job, I have seen people hesitating while introducing themselves as forensic medicine expert. We should search our souls and storm the brain to make this specialty meaningful and of socially relevant so that we contribute to the medical Sciences and society at large, rather than becoming a "Junk Science".

Dr T. D. Dogra

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Originals and Papers

A study in minutiae of road traffic accidents and associated mortality within 72 hours of hospitalisation

Munawwar Husain, Afzal Haroon** & Mazhar Abbas****

Abstract

The term accident has been defined "as an occurrence in the sequence of events, which usually produces unintended injury, death or property damage." [1] A WHO Advisory Group defined accident as an "unpremeditated event resulting in recognizable damage." [2] Road traffic crashes are a growing problem worldwide accounting for around 1.2 million deaths and over 50 million injuries annually.[3] Currently, motor vehicle accidents ranked 9th in order of disease burden and it is expected that by the year 2020 they will rank 3rd in global burden of disease.[4] In majority of cases road traffic accidents are preventable and are usually caused by human error including alcohol drinking, over-taking and speeding, thus highlighting the importance of strict implementation of road safety measures.

This study was carried out at the casualty section of J.N Medical College Hospital, A.M.U., Aligarh, with assistance of the Department of Forensic Medicine and Orthopedic Surgery. The objective was to analyze the epidemiological features, prevalence, mortality and factors associated thereof. Aligarh is a fast developing city and has imbibed all the malaise that generally go with fast-paced development over the creaking infrastructure.

Key words: *Epidemiology, RTA morbidity, RTA mortality, RTA prevention.*

Material and method

This retrospective study was carried out in casualty section of medical college hospital. This consisted of 2139 cases of road traffic accidents that came to the casualty of the J.N Medical College Hospital, Aligarh, for treatment between the period 01/01/2006 to 31/12/2006. Out of these cases 1358 patients with serious injuries were admitted and the rest were sent back after giving treatment. The various epidemiological factors and pattern of injuries were observed. The data was collected and entered in a standardized proforma prepared for this study and were analyzed. On the basis of analysis and observation, results were drawn and discussed.

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and compared with other similar studies done elsewhere

Observations

1. Age and sex distribution in non fatal RTA

The age of the victims varied from 2 - 80 years. The peak incidence was observed in the age group 15 - 24 years comprising 29.79% of the cases. It was also observed that 19.17% belonged to the age group 25 - 34 years. Thus 48.96% of cases comprised of age group 15 - 34 years in the study. Individuals in the age group less than 5 years were the least affected 3.17%, followed by older people i.e. 65 years and above in 4.21% of total cases. The lowest age of the victim was 2 years and the highest age observed was 80 years. Out of 2139 cases 1784 (83.41%) were males while 355 (16.59%) were females. Thus a male: female ratio of 5:1 was observed.

2. Age and sex distribution in fatal RTA

The age of the victims varied from 3 - 70 years. The peak incidence was observed in the age group 15 - 24 years comprising 28.58% of the cases. It was also observed that 16.48% belonged to the age group 25 - 34 years. Thus 45.06% of cases comprised of age group of 15 - 34 years in the study. Individuals in the age group less than 5 years were the least affected 4.39% followed by older people i.e. 65 years and above in 5.49% of total cases. The lowest age of the victim was 3 years and the highest age observed was 70 years. Out of 91 cases 69 (75.82%) were males while 22 (24.17%) were females. Thus a male: female ratio of 3:1 was observed.

3. Victims of non fatal R.T.A

Distributions of different types of road users involved in non fatal road traffic accidents are shown in table (1). Majority of victims were motorized two wheelers 813 cases (38.01%) followed by pedestrian 513 cases (23.97%). Pedal-cyclists 364 (17.02%) and vehicle occupants were 298 cases (13.93%), whereas others comprised of 108 (5.05%) cases.

Table- 1: Different type of road users involved in non fatal R.T.A

S. No.	Type of road users	No. of cases	%
1	Pedestrian	513	23.97
2	Pedal cyclists	364	17.02
3	Motorized two wheeler	813	38.01
4	Vehicle occupants	298	13.93
5	Others	108	5.05
6	Unknown	43	2.02
	Total	**2139**	**100**

4. Victims of fatal R.T.A

Distributions of different types of road users involved in fatal RTA are shown in table (4). Majority of victims were pedestrians, 36 cases (39.57%), followed by motorized two wheelers, 20 cases (21.97%). Pedal-cyclists, 15 (16.49%) and vehicle occupants involved were 13 cases (14.29%), whereas others and unknown comprised of 7 cases (7.68%).

Table 4: Different type of road users involved in fatal R.T.A

S.No.	Type of road users	No. of cases	%
1	Pedestrian	36	39.57
2	Pedal–cyclists	15	16.49
3	Motorized two wheeler	20	21.97
4	Vehicle occupants	13	14.29
5	Others	5	5.49
6	Unknown	2	2.19
	Total	**91**	**100**

5. Vehicle causing death of pedestrians

Table (5) shows different types of vehicles causing death of pedestrians. Four wheelers (car, jeep, tractors) were mostly involved 15 (41.67) cases, followed by motorized two wheelers, 9 cases (25.00%). Heavy vehicles and others (tirri, jugad) were involved in 25 % cases.

Table 5: Type of vehicle involved in death of pedestrians

S. No.	Type of vehicle	Victim No.	%
1	Motorized two wheeler	9	25.00
2	Motorized three wheeler	2	5.56
3	Four wheeler	15	41.67
4	Heavy vehicles	4	11.12
5	Others	5	13.88
6	Unknown	1	2.77
	Total	**36**	**100**

6. Seasonal variation

Rainy season (July-Oct) recorded maximum number, ie., 39 cases (42.85%) followed by winter season (Nov-Feb.) 29 cases (31.87%).

7. Survival period of victims

Out of the patients who died within 72 hrs of admission maximum number of patients 23 (25.28%) died within 1-6 hrs followed by 17 (18.69%) who died with in 1 hr. Majority of patients 66 (72.53%) died within 24 hour of admission in the hospital

8. Pattern and distribution of injuries in non fatal R.T.A

Distribution of injuries. Fracture of the bones was the most common injury afflicted to the victims followed by multiple injuries like lacerations and abrasions. The site of the body mostly affected by fracture included lower limbs followed by fracture of skull bone and then upper limbs. Next type of injury was laceration over head and neck region followed by abrasion on the same regions. Maximum number of injuries sustained in lower limbs manifested as included fractures, dislocations, laceration, abrasion and crush injury followed by head and neck region which included laceration, abrasion and fractures and then upper extremities injuries in the same manner. The proportion of injuries in thorax, abdomen and spinal cord was lesser as compared to injuries on head, neck, upper and lower extremities.

9. Part of skull involved in fracture

In present study skull fracture were seen in 37 individuals out of total of 86 cases. The fracture of various skull bones was in the following descending order: temporal, 18 cases (48.65%); parietal, 6 cases (16.21%); frontal, 9 cases (24.32%); occipital, 3 cases (8.11%); and sphenoid, 1 case (2.71%).

10. Cranial-intracranial injuries

Table (10) shows that in our series there were 86 victims who sustained one or other form of head injury. All had either scalp laceration or haematoma formation. Among the intracranial injuries; subarachnoid haemorrhage was the commonest, present in 28 (54.90%) cases. Next was subdural haemorrhage in 14 (27.46%), followed by extradural haemorrhage in 9 (17.64%). Fracture of skull was present in 37 cases while contusions of the brain parenchyma were present in 34 cases

Table 10: Cranial-intracranial lesions in fatal R.T.A

Lesion	No. of Cases
Scalp haematoma and laceration	86
Skull fracture	37
Intracranial haemorrhage	51
1. Extradural	9
2. Subdural	14
3. Sub arachnoid	28
Brain contusion	34

11. Major cause of death

Table (11) shows that out of the total cases who died as a result of road traffic accidents, 61(67.03%) had head injury without any significant injury to other part of the body. 79 (86.81%) cases had head injury associated with other major injuries to other body parts. Haemorrhage and shock alone were the cause of death in 7 (7.69%) cases.

Table 11: Major cause of death

Type of injury	No. of Cases
Head injury associated with other injury	79
Head injury	61
Haemorrhagic shock	18

12. Cause of death

Table (12) shows that in present study head injury accounted for maximum number of 61 (67.03%) cases as cause of death followed by haemorrhagic shock 18 (19.79%). Haemothorax was the cause of death in 4 (4.39%) cases only.

Discussion

With exploding population, increasing registration of automobiles every month, rampant encroachment of roads, nasty tendency of violating traffic rules and chaotic traffic system have taken rapid strides in road traffic accidents. This resulted in double loss to the country. Firstly, huge expenditure is incurred in the treatment of these victims, and secondly, the victims in the most productive age group results in huge productive man-days lost.

Analysis of age and sex in our study showed males comprised a majority and constituted 69 (75.82%) compared to females who were 22 (24.17%). The male to female ratio in the study was 3:1. The peak incidence was observed in the age group 15 - 24 years comprising 28.58% of the cases. It was also observed that 16.48% belonged to the age group 25 - 34 years. More than half 57.15% of cases comprised of age group of 15 - 44 years in the study. This is in accordance with other [5, 6] which also observed the same ratio. However some authors [7, 8, 9] observed the ratio of 5:1, while others have observed ratio observed ratio of 7:1[10] ,7.3:1[11] and 9.1[12]. The reason for the above is that young adults are the prime bread earners of the family and remain outdoors during most of the day. Persons in extremes of the age usually remain indoors, whereas children are confined to the outskirts of the residential premises only.

In fatal road traffic accidents there were a total of 91 victims of vehicular accidents who died within 72 hrs of admission in hospital. Most of the victims were pedestrians, 36 (39.57%), cases followed by pillion riders of two wheelers, 20 (21.97%) cases. There were 15 (16.49%) victims travelling on non-motorized bicycles. Thus 78.03 % of cases were more prone to head injuries based on the type of conveyance they had been using. The most common offending vehicles to the pedestrians were four wheelers, in 15 (41.67%), followed by two wheelers, in 9 (25%) cases. Heavy vehicles (Bus, truck) along with other unregistered country made vehicles (tirri, jugad etc) were involved in causing death of pedestrians in 25 % cases.

This is in accordance with the studies producing similar inferences [5, 6, 11, 12, 13, 10] .Thus it can be inferred that pedestrians were most common victims than any other group. This can be explained by the fact that in Aligarh there is altogether absence of proper footpath compounded by shrunken roads due to encroachment by vendors and other commercial installations. Besides, majority of road users are pedestrians and are comparatively more exposed to the risk of accidents.

In this study we found that rainy season (July-Oct) recorded maximum number of cases: 39 (42.85%) followed by winter season (Nov.-Feb.) 29 (31.87%). The summer season recorded the least 23 (25.28%) cases. This is in accordance with a similar study which concluded that 70% of the accidents have occurred in rainy season [14]. The reason for this is that in rainy season there are poor slippery roads and poor visibility.

In the present study survival of a victim within 72 hr of admission in hospital after sustaining road traffic injury was observed. Most victims 23 (25.28%) died within 1-6 hrs followed by 17 (18.69%) who died within 1 hr. Thus majority of patients 66 (72.53%) died within 24 hours of admission in the hospital. A collaborative study sustained this deduction. [6]

In the present study skull fracture was seen in 37 (40.65%) individuals out of a total 91 cases. This figure is inconsistent with the findings in studies in which the incidence reported was 83.3% [9] and 82.3% [15]. In another study fracture of skull was found in 79.87% [15] and was the dominating entity in the whole series. In the present study fracture of temporal bone was in 18 cases (48.65%) followed by frontal bone 9 cases (24.32%). These were the main cranial bones involved in fracture. In two authoritative studies done elsewhere it was determined that temporal bone fracture was seen in 58.67% followed by 57.75% having occipital base fracture [6] study revealed and that in 40.74% of cases parietal bone had fractured and 38.88% the temporal bone. [13]

In the present study there were 91 victims having one or the other form of intracranial injury. There were 51 cases of intracranial haemorrhage. Among the intracranial injuries, subarachnoid

haemorrhage was the commonest event present in 28 (54.90%) cases. Next common was subdural haemorrhage in 14(27.46%), followed by extradural haemorrhage in 9 (17.64%) cases. Contusions of the brain parenchyma were present in 34 cases. Collaborative findings have been reported in which the incidence of subarachnoid haemorrhage has been reported as 81% while that of subdural haemorrhage as 69.3%, [9,] including brain stem haemorrhage (10.8%)[6] and that of contusions as 19.2%.[15] These findings are not consistent with our study as few other studies have reported the subdural to be commonest (67%) followed by extra dural in place in the following order: extradural in 20.37%, subdural in 14.8%, subarachanoid 7.4%, intracerebral .37%, combination 12.96% of all haemorrhages in the total cases.[16, 18]

In present study head injury accounted for maximum of 61 (67.03%) cases as a cause of death followed by haemorrhagic shock 18 (19.79%). Haemothorax was the cause of death in 4 (4.39%) only. Out of the total number who died as a result of road traffic accidents, 61 (67.03%) cases had head injury without any significant injury to other parts of the body. 79 (86.81%) cases had head injury associated with other major injuries to other body parts. Haemorrhage and shock alone were cause of death in 7 (7.69%) cases. Three researchers have reported the result of their study indicating that neurological injury caused death in 60% of patients and hemorrhagic shock in 25% of cases[17] among the 177 autopsies reviewed. [18] and that the head injuries were dominant in all road users (50.4%) as fatal injury. [12]

Conclusion

As illustrated above there are many causative factors involved in road accidents and that includes the trinity interactions by road users, vehicle and road environment.

The major challenges are:

- Mixed traffic conditions in the sense that all multiple modes of transport use the same road without any demarcation.
- The Motor Vehicles Act defines the responsibility of motorized vehicles only, leaving out the non-motorized user from its purview.
- Enforcement agencies do not work in coordination.
- Tools and systems of training are lacking.
- There is lack of political will.
- Absence of driver's training and negligent driver-testing.
- Poor road awareness.
- No standardization of traffic control devices.
- Absence of traffic engineering as a science.
- Unprecedented growth of motorized/non-motorized vehicles in the absence of a basic public transport system.
- Accident investigation - no qualitative information of causes and consequences of crashes – without which remedial measures are only hypothetical.
- Without scientific investigation, punitive measures are enforced arbitrarily.
- Enforcement in rural areas or on the highways hardly exists, whereas in the urban metropolitan areas it is treated as a means of revenue collection.
- Vehicle maintenance is a neglected area and vehicle safety enforcement is almost non-existent.
- Road encroachments are common and parking management is neglected.

For enforcement of road safety measures for the non-motorized road users the police must use

Preventive methods:

1. Control and direct the non motorized traffic to ensure their safe movement.
2. Guide and help the road users unfamiliar with the specific rules and regulations.
3. Make sure that pedestrians/cyclists use such facilities like pedestrian crossings, subways etc, and that they do not become potential hazards to safety.
4. Help the disabled road users without compromising their safety.
5. Ensure the provision of standardized control devices.

Persuasive methods:

1. Issuing verbal warnings for offences.
2. Use methods like deflating tyres of

bikes/rickshaws of those who violate basic safety laws.

3. Holding the erring road users in custody for a short duration.

Since there are many causative factors involved a multidimensional approach is needed in order to prevent the road accidents.

Road: These include maintaining existing roads, improving road surface, removing obstacles, constructing guards, rails, proper signs and widening or narrow sections of roads. There should be good road lighting and segregation of slow moving vehicles, pedestrians from highways and use of Zebra crossing, sub ways for pedestrians.

Vehicles: Vehicles design to improve visibility and protection in the event of crash; restraining devices as seat belts may be made compulsory and regular inspection to ensure proper maintenance of vehicle.

Road users: This segment of population should be properly trained by authorized centers, medically fit and mentally alert, issuing licenses after strict testing of driving skills, medical fitness, and periodic review of driving skills specially, annual medical examination of drivers above 50 years of age.

Administrative measures: Enforcing traffic rules strictly, proper legislation to avoid drunken driving and in repetitive offender license could be cancelled. Establishment of a statutory body for prevention of road traffic accidents is necessary.

Emergency medical care: There should be traffic aid posts at suitable distances on the highways to assist injured in case of accidents and quick transport of injured. Policeman at such posts should be trained in first aid procedures and ambulance with para-medical staff, oxygen, and life saving drugs at strategic points must be ready. Hospitals along major highways should be equipped with experienced surgical team, trauma centers with integrated facility of surgical, orthopaedics and neuro-surgical, anesthetic experts with modern investigative procedures as C.T. Scan and Blood Banks is best solution for treatment. Modern rehabilitation measures for injured victims form an essential part of casualty service.

The single most important thing a person can do to stay healthy and alive is to pay close attention to the way he or she drives or walks. Police training schools, colleges and academies must have a planned curriculum on all aspects of traffic management. Before being posted with the traffic police, all police personnel must undergo specialized training. Members of public should take part in planning traffic circulation and in designing living areas for benefit of residents. Schools should be located away from traffic. Attempts should be made to reduce travel and if travel is necessary public transport system should be available.

There is no panacea that will prevent road traffic accidents entirely; what is required is an organized team work by people in many disciplines like education, engineering, medical, and law enforcement agencies to achieve effective prevention of road accidents.

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Originals and Papers

A study of fatal cases of lightning strikes in Bankura district of West Bengal

Saurabh Chattopadhyay & Sobhan K. Das***

Abstract

Deaths due to lightning occur throughout the world and the incidences are more in the rural areas compared to the cities. A detailed study of the demographic profile of the victims of lightning strikes reveals that occupation and socio-economic factors are indirectly related to such deaths. Middle aged males are the most common victims specially when working in the open field during the afternoon. Though unpredictable, such deaths are preventable by following some simple precautionary measures. In spite of the fact that rapid death occurs due to anoxia and respiratory paralysis the number of fatalities can be reduced by prompt and proper basic life support like CPR.

Key words: *Lightning, incidence & death.*

Introduction

Out of all the unnatural deaths the most unpredictable is due to lightning. Incidence of lightning occurs throughout the world but with varying frequency depending upon the climatic conditions. Very few detailed study are available regarding the human fatalities due to lightning strikes. In the United States on an average 100 to 600 deaths are recorded annually due to lightning.[1] Among the average number of thunderstorm days in a year in major Indian cities Kolkata - 70 followed by Chennai- 47 and Delhi -30[2]. Though there are many ways by which lightning can induce an electric shock yet definitive diagnostic findings are minimum. Death may be either due to the direct or indirect effects of such high voltage strikes. Individuals surviving the immediate effects may develop "Lightning syndrome" [3] characterized by unconsciousness, temporary impairment of central and peripheral nervous system functions, conductive deafness and skin burns.

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Material and method

Cases for the present study included all cases of lightning deaths on which autopsy was conducted during the period 2006 to 2008 in the department of Forensic and State Medicine, Bankura Sammilani Medical College, Bankura. The retrospective study was conducted by collecting the case details from the police inquest, hospital records and autopsy reports. A total of 54 cases were recorded during the three year period of study. The data collected were analyzed and presented for discussion.

Observations

A total of 54 cases of lightning deaths were recorded during the three year period of study with maximum incidence, 31 cases in 2008. Most of the cases occurred during the months of May to September with peak incidence during June – July (29 cases, 53.70%). Only one case occurred in the month of March in 2008.

Over three fourth (75.92%) of the victims were males. Majority of the victims were in the age group of 31 – 40 years (53.18%) followed by 41- 50 years (27.77%) and 10 – 20 years (24.07%). No cases were found below the age of 10 years or above 60 years.

Age distribution among the male victims was almost similar to the overall incidence

i.e. 31–40 years – 34.16%, 41-50 years – 26.82% and 10-20 years – 24.39%. On the other hand female victims were slightly higher compared to the overall age distribution in the age group of 31 – 40 years – 38.46% and 41-50 – 30.76 %. Moreover above the age of 50 years all the victims were males.

Majority (72.23%) of the victims were farmers. Nearly half (48.14%) of the cases occurred in the afternoon hours between 12 Noon and 3 PM. 31.48% of the incidents occurred in the late afternoon and evening i.e. between 3PM and 6 PM.

Open field was the most vulnerable place for lightning strikes accounting for 57.40% cases. Persons standing beneath a tree or under a shade comprised 27.7% of the victims. Two cases were recorded where death occurred even inside the room.

Hospitalization of the victims was found only in 3 cases and in the rest either the victims died on the spot or on the way to the hospital where they were declared brought dead.

Postmortem findings were mostly non specific and majority showed evidence of severe congestion of all internal organs. In 35.18% cases ear bleeding was noted either from one or both ears and in most of these cases evidence of blast effect was also found.

Discussion

From the data collected we found 54 cases of fatalities due to lightning during the three year period of study. According to the National Crime Record Bureau, India, 2001 about 1507 persons died of lightening. In 2004 around 277 persons were killed by lightning in Orissa alone. In the United States a total of 1318 deaths from lightning were recorded from 1980 – 1995 [4] and 756 deaths from 1990 – 2003 [5]. Thus it is very much evident that the incidence of lightning and the fatalities are much higher in the sub-continent compared to the West.

In our study we found maximum cases occurring during the months of May to September with peak incidence in June – July. This is the monsoon season in this part of the country which is associated with heavy showers and lightning. A single incident was recorded in March 2008 which is the time of Norwesters (end of March and April) accompanied by thunderstorms and lightning.

Most of the victims were males. It is the males who are the bread earners of the family in our society. Hence they are engaged in outdoor activities which increase the probability of them being victims of lightning strikes. According to a study entitled "Demographics of U.S. Lightning Casualties and Damages" from 1959 – 1994 males accounted for 84% of the fatalities [6]. Out of the 1318 victims in the U.S. between 1980 - 1995, 85% were males [4].

Middle aged persons i.e. 31 – 50 years are the ones who are the most affected (62.96%). The working class people mostly belong to this age group and hence remain outdoors during the major part of the day. Similar findings were noted in the United States where 68% of the victims were in the age group of 15 -44 years [4]. No cases were found below the age of 10 years and above 60 years. This is due to the fact that children and the old are not allowed to venture outside during the rain and storms and hence are restricted indoors. Further it was noted that above the age of 50 years all the victims were males. This may be explained by the fact that though the females in the middle age group share the workload outside with their male counterparts yet at the time of rain and storms the males who are usually the head of the family take up the responsibility and may remain at work while the females specially the older ones remain at a protected place.

Our study revealed that farmers (72.23%) are the most common victims of lightning strikes. Harms[7] also reported of similar findings where farmers were 30 times more prone to lightning accidents as compared to city dwellers. The present study was conducted mostly in the rural areas where farming is the main livelihood of the people. As they are from the low socio-economic status group hence they are forced to remain at work even during the high risk period of thunderstorm and lightning. This increases their

possibility of being struck by lightning. Moreover people from other occupation are mostly engaged in indoor activities and are relatively safe. In our study we found 6 students being involved, all of whom were victims of a single incident where they were standing under a weak shade on their way back home from school.

The present study revealed that almost half 48.14% of the cases occurred in the afternoon hours between 12 Noon and 3 PM. It has been observed that during the monsoons the majority of the storms and lightning occur during this period of the day or in the late afternoon and evening. We also found 31.48% cases occurred between 3 PM and 6 PM. The afternoon hours is high time of working for the farmers and they are unable to avoid the risk of rain and lightning as this would mean a complete loss of a working day for them.

Due to very obvious reasons open field was the most vulnerable place for lightning strikes and most cases were reported from these places. It is not only due to the fact that the farmers remain in the open field but also due to the tendency of lightning striking a tall object in an open space. Harms [7] reported 53% cases being victims in the open field. A significant proportion, 27.77% cases occurred where the individuals had taken shelter under a tree or a weak shade. Thus the present study clearly points out that shelter under a tree is by no means safe nor is a weak shade. The same principle applies in these cases also where the lightning struck the towering structure, the tree or the shade, when located in a wide area of open space. In the present study two incidents were recorded where multiple fatalities occurred in a single strike. In one incident 6 school children were the victims when they were standing under a weak shade whereas in the other incident 3 individuals were killed when they took shelter under a tree. Mass accidents due to lightning are on record like the one at Ascot in 1955 where during a horse race 4 persons died and 51 were hospitalized.[8]

Majority of the victims either died on the spot or on the way to the hospital. Only 3 cases (5.56%) were able to receive some sort of medical attention after hospitalization. All of them suffered burn injuries. Out of these 3 persons two died within an hour of admission whereas the third one survived for about 10 hours. Our findings are in confirmation with Tedeschi [3] who reported instantaneous death in 44-60% cases. In majority of the deaths the cause is due to paralysis of the respiratory center. This respiratory paralysis is either due to the direct effect of the high voltage current on the respiratory center where the current passes through the head or due to cerebral anoxia following initial transient cardiac arrest. Congestion of the organs in autopsy also substantiates the theory of anoxic death. In the United States a 40% reduction in the fatalities is attributed to improved medical care and communication facilities. [6]

We also found ear bleeding from one or both ears in 35.18% cases. Most of these were due to the blast effect resulting in rupture of the tympanic membrane and hemotympanum. Ogren[9] reported 30-50% cases of otologic damage in his study. Evidence of blast effect was also noted in the wearing apparels of these cases. Shallock [10] reported a case where 4 individuals were thrown out of their bed while asleep due to blast effect.

In the present study two cases deserve special mention. In one case autopsy revealed subdural hemorrhage in a 45 years old male victim without any skull fracture. In all probability the hemorrhage was due to the mechanical trauma resulting from the blast effect and fall on the ground. In another case no definite evidence of lightning was noted but the male person aged 48 years died inside the room. On autopsy an enlarged heart weighing 550 grams with atherosclerotic changes in the vessels and narrowed coronaries was detected. In this case the sudden thunder and flash of lightning just beside the room precipitated a sudden cardiac arrest resulting in fatality. Morgan et.al. [11] in their study have revealed the possibility of cardiological manifestations as well as epidural and cerebral hemorrhage in association with lightning strikes. In such cases the typical findings of lightning deaths are missing and the actual cause of death is of cardiogenic origin

where lightning acts only as the precipitating agent.

Conclusion

Though lightning deaths are most unpredictable but they are preventable. Proper precautions taken during thunderstorms and lightning by staying indoors or under a safe and strong solid structure may reduce the incidence of such deaths. Moreover majority of these deaths are due to anoxia hence proper and prompt cardio pulmonary resuscitation (CPR) immediately after the strike till specialized medical care is available may prevent loss of life to a great extent. Thus knowledge of CPR amongst the common man is of great importance in such cases of emergency.

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Originals and Papers

Histopathological changes in skin and subcutaneous tissues at ligature site in cases of hanging and strangulation

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Abstract

94 cases of deaths due to hanging and strangulation were studied prospectively during July 2007 to December 2008 at S.M.S. Medical College, Jaipur. Autopsy was conducted in all cases encompassing a detailed external and internal examination including histopathology of skin and subcutaneous tissues from ligature site. Out of 94 cases, 91 were of hanging and 3 of strangulation. In hanging, no gross haemorrhage was detected whereas it was detected in all cases of strangulation. Congestion and Compression were present in 100% cases of strangulation whereas in 28.5% and 43.95% cases of hanging respectively. Breaking of skin was present in 35.16% cases of hanging while in 33.3% cases of strangulation. Wrinkling of skin was not observed in any case of strangulation but observed in 46.15% cases of hanging. These findings indicate the importance of histopathology of ligature mark in documenting antemortem nature of hanging and strangulation in doubtful cases.

Key words: *Subcutaneous tissue, ligature mark, neck compression.*

Introduction

Hanging is a form of ligature strangulation in which the force applied to the neck is derived from the gravitational drag of the weight of the body or the part of the body[1]. It is a common method of suicide in India. Strangulation is another entity representing death by compression of the neck from the external force by ligature, human hand or by other means like stranglehold, foot and some solid substances [2]. A great challenge rests in front of forensic experts in cases of asphyxial deaths to establish the cause and manner of death. The various features of the hanging and strangulation deaths that are available from the case history, police investigation, gross findings and internal findings lead a forensic expert to the conclusion of compression of neck as the cause of death. However, doubtful cases which test the mettle of a forensic expert do always exist. Here, lies the importance of clubbing the histopathological examination of skin and subcutaneous tissue from ligature site with the routine autopsy procedure. These findings may be helpful in elucidating the circumstances of death in conditions where the circumstances may be as yet unsolved or are later found to be fabricated.

The ligature mark itself is not necessarily the deciding factor. It is clear that the mark which is usually seen on the neck where hanging took place during life may be produced also by a ligature applied within 24 hours, or even later after death consequently. This kind of mark is not conclusive proof that the hanging took place during the life [3]. A detailed microscopic examination of the mark may confirm the presence of effusion of red cells, possibly with separation of fibrin and cellular elements, but no evidence of tissue reaction [3].

Material and Method

This study was carried out at Department of Forensic Medicine, S.M.S. Hospital, Jaipur in collaboration with the Department of Pathology, S.M.S. Medical College, Jaipur. 94 cases of asphyxial deaths were studied over the period from July 2007 to December 2008. Out of the 94 cases included in this study, in 91 cases the

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death was due to hanging while in rest three cases the death was due to strangulation (two manual and one ligature strangulation). After completing all medico legal formalities, the autopsy was conducted at the mortuary of our department with standard technique. Thorough external examination was carried out pertaining to the features such as rigor mortis, post mortem hypostasis, detailed examination of the ligature mark and other significant findings were recorded.

Dissection of thoraco-abdominal and cranial cavities was carried out following the standard technique, and lastly the dissection of neck was carried out with Y-shaped incision method i.e. two incisions, commencing on either side of neck from 2-3 cm behind the lobe of each ear which met at manubrium sterni and then continued as single incision down to the pubic symphysis, carried out in reverse manner. This incision is suitable for detailed dissection of neck. Layer by layer dissection was carried out of the neck structures beneath the ligature mark and gross findings were noted. A portion of the skin and subcutaneous tissue from the ligature site were preserved in 10% formalin for histopathological examination with microscopy under H & E stain of suitable sections.

Observations

During the period from July 2007 to December 2008, a total of 94 cases of asphyxial death due to compression of neck were autopsy at S.M.S. Hospital, Jaipur. Amongst the 94 cases of hanging and strangulation, 68 subjects were males (72.3%) and 26 were females (27.7%). This shows that the number of male cases were 2.6 times more than females. In the present study, death due to strangulation among males was not observed.

As per table-2, maximum number of death cases i.e. 42 (44.68%) cases of hanging and strangulation were reported in the age group of 21-30 years. Out of 91 cases of hanging, 68 (74.73%) were males and 23 (25.27%) were females died due to hanging. In 3 cases of strangulation, no male was reported dead in any age group. All the 3 cases of strangulation were reported in females. No case of hanging and strangulation deaths was reported in 0-10 years age group.

In our study, In 40 out of 91 cases of hanging, compression changes were observed in the skin while compression of the skin was present in all 3 cases of strangulation. The breaking of skin was present in 32 out of 91 cases of hanging and in only 1 out of 3 cases of strangulation. The wrinkling of skin was present in 42 (46.15%) out of 91 cases of hanging deaths while this histopathological feature of the skin was absent in all 3 cases of strangulation.

In 26 out of 91 cases of hanging and all the 3 cases of strangulation congestion in the skin were present. Rest other had no congestion. Cellular infiltration in the skin was present in 30 out of 91 cases of Hanging and 1 out of 3 cases

Table -1: Age and sex-wise distribution of deaths due to hanging and strangulation

S. No.	Age group	Hanging		Strangulation		Total
		Male (%)	Female (%)	Male (%)	Female (%)	No. (%)
1	0-10	0	0	0	0	0
2	11-20	14 (15.38)	4 (4.39)	0	1 (33.33)	19 (20.21)
3	21-30	27 (29.67)	14 (15.38)	0	1 (33.33)	42 (44.68)
4	31-40	22 (24.17)	3 (3.29)	0	0	25 (26.59)
5	41-50	5 (5.49)	2 (2.19)	0	0	7 (7.44)
6	51-60	0	0	0	1 (33.33)	1 (1.06)
7	**Total**	68 (74)	23 (26)	0	3 (100)	94 (100)

Table-2: Incidence and distribution of histopathological changes in skin in hanging and strangulation deaths

Type of death	Compression			Breaking			Wrinkling			Congestion			Cellular Infiltration		
	Present	Absent	Total	Present	Absent	Total	Present	Absent	Total	Present	Absent	Total	Present	Absent	Total
Hanging	40 (43.95%)	51 (56.05%)	91 100%)	32 (35.16%)	59 (64.84%)	91 100%)	42 (46.15%)	49 (53.85%)	91 (100%)	26 (28.5%)	65 (71.5%)	91 (100%)	30 (32.96%)	61 (67.04%)	91 (100%)
Strangulation	3 (100%)	0	3 100%)	1 (33.3%)	2 (66.6%)	3 100%)	0 (0%)	3 (100%)	3 (100%)	3 (100%)	0	3 (100%)	2 (66.6%)	1 (33.3%)	3 (100%)

Table-3: Incidence and distribution of histopathological changes in the underlying subcutaneous tissue in hanging and strangulation

Changes in the subcutaneous tissue	Hanging	Strangulation
Congestion	48 (52.7%)	3 (100%)
Haemorrhage	19 (20.8%)	3 (100%)
Cellular Infiltration	30 (32.9%)	0 (0%)
All above mentioned findings absent	17 (18.6%)	0 (0%)

of strangulation.

In hanging, 48 (52.7%) out of 91 cases had congestive changes in underlying subcutaneous tissue i.e. thyroid, muscles, fibrous tissue and lymphnodes, and in 19 (20.8%) cases were having haemorrhagic changes. Cellular infiltrations were present in 30 cases. None of the histopathological changes seen in 17 out of 91 cases of Hanging.

In strangulation all three cases had congestion and haemorrhagic changes, but none of the case had cellular infiltration in subcutaneous tissue.

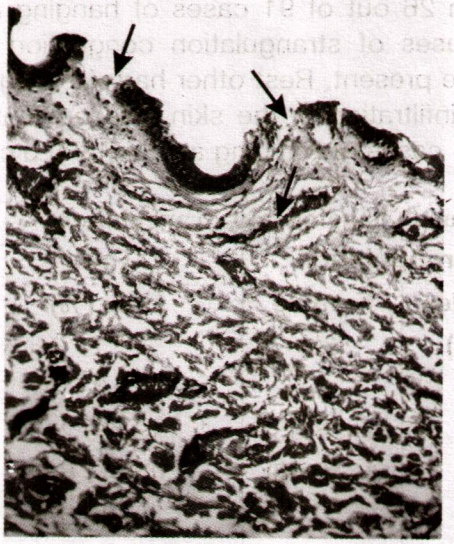

Figure-1: Section of skin from ligature site (100x) showing multiple breaks and congestion in dermal region.

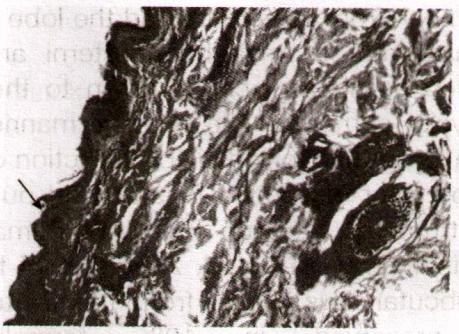

Figure- 2: Section of skin from ligature site (100x) showing in case of hanging showing wrinkling, breaking in epithelium, infiltration in sub epithelium region and congestion in dermal region.

Figure- 3: Section of skin from ligature site (100x) showing breaking, compression in epithelium, focal congestion in sub epithelial region and haemorrhage in dermal region.

Figure-4: Section of skin from ligature site (100x) in a case of strangulation showing breaking, compression with focal congestion.

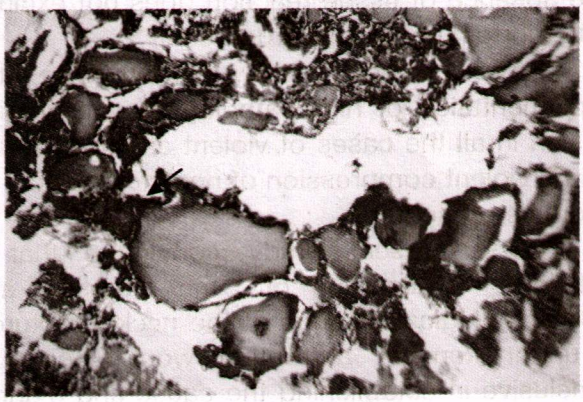

Figure- 5: Section of Subcutaneous tissue (thyroid 100x)showing dilated capillaries with congestion.

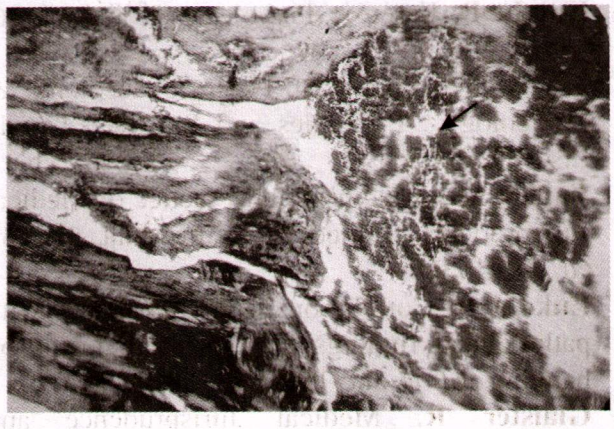

Figure- 6: Section from muscle underlying the ligature mark (100x) showing area of haemorrhages in muscle.

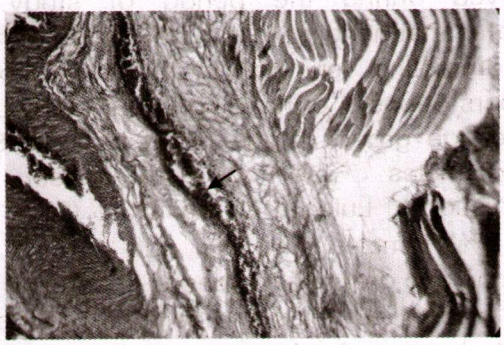

Figure- 7: Section from subcutaneous tissue (fibrous tissue 100x) showing congestion.

Figure- 8: Section of muscle (100x) in a case of strangulation showing the destroyed architecture of muscle fibres.

Discussion

In our study, we studied 10 control cases. There was no compression, breaking, wrinkling, congestion and haemorrhage on gross and microscopic studies carried out on skin and subcutaneous tissue from the neck region in cases other than hanging and strangulation, where there was no trauma to the neck region present.

Inclusion criteria were to include those cases of asphyxial deaths, where there was history of hanging or strangulation as per the investigating agency and where there was no other external injury or any other event. Out of total 91 cases of hanging, 74% cases were male as against 84% cases in study carried out by Luke et al [4]. In strangulation, all 3 cases were females and no male victim of strangulation was

observed during the period of study. This indicates that hanging is a more common method of committing suicide in males. Maximum numbers of cases of hanging in our study belong to the age group of 21- 30 years i.e. 45.05% (29.67%males and 15.38%females). The observation of Luke et al[4] was 26% (23% males and 3% females) in this age group. Least common age group in the cases of hanging in our study was 41-50 years as against 10-19 years in the study done by Luke et al[4]. In the present study, we observed that death due to hanging is more common in males as compared to females. Whereas in strangulation, all victims were females and no male was victim in our study.

A detailed dissection of the tissue of the neck should be made to detect injury of the deeper structures[5].

In strangulation the degree and character of injury to the deeper tissues of the neck are dependent on the amount of violence used in application of ligature[5]. The underlying muscles frequently show some degree of extravasation due to rupture of capillary vessels[5].

An array of characteristic changes was observed in microscopy of the skin and subcutaneous tissues of ligature site in cases of hanging and strangulation. These include compression, breaking wrinkling, congestion and hemorrhage. Compression is the decreased thickness of skin layers with increased basophilia.

The term Breaking means discontinuity of epidermal and/or dermal layers of the skin.

Wrinkling is the term which indicates increased waviness of the epidermis. The separation between the layers associated with other features i.e. compression were observed in 100% cases of strangulation deaths compared to hanging death i.e. 43.95%. Breaking was observed in 33.3% cases of strangulation death as compared to 35.10% cases of hanging death. Congestion was present in all three cases i.e. 100% of strangulation as compared to hanging where it was present in 28.5% cases. Cellular infiltration was present in 2(66.6%) out of three cases of strangulation as compared to hanging deaths (32.96%). Wrinkling was observed in 42 (46.15%) cases of hanging deaths while this particular feature was absent in all 3 cases of strangulation. in the subcutaneous tissues, congestion and hemorrhage were observed in 52.7% and 20.8% cases of hanging respectively whereas: both these features were documented in 100% cases of strangulation.

The various features of mechanical cutaneous alteration either alone or in combination are highly suggestive to determine ante mortem aspects since these histopathological features indicate that the violent compression of neck took place.

A portion of the skin and deeper tissue in relation to the ligature mark should be examined microscopically for evidence of tissue reaction, which if present indicates ante mortem hanging. The absence of tissue reaction does not exclude ante mortem hanging (Gordon et al) [6].

The present study emphasizes the implementation of histopathological examination of skin in all the cases of violent asphyxial death where violent compression of neck took place, as a routine procedure.

The present study concludes that a detailed evaluation of the gross and histopathological findings of the neck structures, if undertaken as a routine would be more conclusive in establishing the cause and manner of death to aid the administration of justice.

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Originals and Papers

Evaluation of cerebrospinal fluid cells in postmortem period to estimate death interval

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Abstract

In health, the cerebrospinal fluid is relatively acellular, although 1 to 6 cells/cmm may be considered within normal limits. The present study was aimed to evaluate the cellular changes that occurred in postmortem period to estimate death interval. 60 cases were studied comprising 36 male and 24 female of age ranging between 14 to 65 years. The cerebrospinal fluid sample was drawn by cisternal puncture. The cases were divided into 4 groups consisting 0-6 hours, 7-12 hours, 13-18 hours and 19-24 hours depending on postmortem interval. It was observed that number of cells in the cerebrospinal fluid increases after death. Up to 12 hours postmortem interval, cells could be identified and typeable cells include lymphocytes, neutrophils and monocytes. After 20 hours postmortem interval, it becomes increasingly difficult to identify and classify cells. The sequential changes occurring in the morphology of cell could be a supplementary method to estimate time since death in early postmortem period.

Key words: *Cerebrospinal fluid(CSF), cells, post mortem interval(PMI).*

Introduction

Determination of postmortem interval is essential in civil and criminal matters. In an attempt to find more reliable and precise parameter to estimate PMI, many researchers have employed a variety of physical and chemical methods but most of these methods become useful supplementary means rather than replacing the traditional triad of algor, livor and rigor mortis. Evaluation of cellular changes occurring in postmortem period is one of the methods being explored in recent times [1-6]. Experimental studies have indicated that the cellular changes such as morphological, functional or biochemical could reliably be correlated with time since death [2]. The morphological evaluation of cells in postmortem state is based on an assumption that different tissues and cells do not die at the same time or simultaneously with cardiac or respiratory arrest [7].

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With this background, the present study was undertaken to evaluate the cellular changes occurring in cerebrospinal fluid (CSF) in postmortem state to estimate death interval.

Material and method

The study was carried out at Dept. of Forensic Medicine, Indira Gandhi Govt. Medical College and Govt. Medical College Nagpur through January 2004 to December 2006. The material comprised of 60 human autopsy cadavers consisting of 36 male and 24 female. The study includes cadavers that were stored at room temperature in mortuary and whose exact postmortem interval was known. The subjects were divided into 4 categories depending on PMI as – Category no. 1: subjects from 0-6 hour PMI, Category no.2: 7-12 hour PMI, Category no. 3: 13-18 hour PMI and Category no.4: 19-24 hour PMI. In each case about 5 ml of CSF was collected using lumbar puncture needle by cisternal puncture and the sample was transferred to laboratory in polycarbonate tubes. The exclusion criteria includes – patient with head

injury, or meningitis or encephalitis or septicemia. Analysis of sample was done for total leucocyte count (TLC), differential leucocyte count (DLC) and morphological examination of cells.

TLC examination

Total leucocyte count was done using Improved Neubaur Counting Chamber. The CSF sample was drawn in white blood cell (WBC) pipette up to 0.5 mark and diluted with the diluting fluid up to 11 mark on tube and mixed well. Then the specimen was put at counting chamber and cells were counted in 4 squares. Calculations were made as – leucocyte in CSF per cubic millimeter = cells counted X 50.

DLC examination

The CSF sample was centrifuged at 3000 RPM for 20 minutes and thin smears were prepared by using sediment. The smears were stained with Leishman's stain and differential count was done.

Morphological examination

For morphological examination, thin smears were prepared by using sediment of centrifuged CSF sample. The moist smears were immediately fixed in alcohol-ether fixative. The fixation was carried out for about 30 minutes and then fixed smears were stained with haematoxylin and eosin (H & E) stain in standardized way. The smears were examined under light microscope for cell membrane, cytoplasm and nuclear features.

Results

The study consists of 60 subjects comprising 36 male and 24 female. The age related data are provided in Table- 1. The pattern that emerged with respect to CSF samples follows:

Changes in counts

Total leucocyte counts are mentioned in table 2 (figure- 1). The WBC counts of the cadaver were significantly ($p < 0.001$) higher than normal values recorded in antemortem CSF sample (8). TLC can be done up to 12 hours PMI and during this period, the white cell count remained quite steady. After this period it becomes difficult to count the cells. With reference to differential counts, in maximum number of cases no adequate results could be obtained. However, the most commonly found cells were lymphocytes and neutrophils followed by monocytes (figure- 2). The lymphocytes were observed to be more resistant to autolysis than polymorphonuclear cells.

Changes in morphology

Up to 12 hours PMI, cells could be identified and includes lymphocytes, monocytes and neutrophils. However, in this limited sample size, it becomes difficult to identify monocytes and neutrophils beyond 12 hours. The cellular changes occurring in different cells are presented in Table- 3. From 6 hours PMI onwards-cellular changes begins. Initially, cell membrane shows crenation of membrane then the margin become indistinct and then degenerates. The first observed change in cytoplasm is in form of vacuolation. In further postmortem period, cytoplasm begins to disintegrate with complete lysis of cell wall. Nuclear changes consist of initial pyknotic appearance and then fragmentation occurs (figure- 3 to 5).

Discussion

In health, the cerebrospinal fluid (CSF) is relatively acellular, although 1 to 6 cells/cu mm may be considered within normal limits. Varying numbers of white blood cells may be present. Most common are polymorphonuclear leukocytes, but lymphocytes also occur very frequently. Plasma cells and monocytes are seen much more rarely [8]. The observations of present study indicate that postmortem CSF pleocytosis do occur. The cells begin to increase from first hour of death and up to 12 hours PMI, the cells could be counted. After 12 hours PMI, it becomes difficult to count cells. The findings are in agreement with Platt et al [4] and Wyler et al [5]. The reason for this pleocytosis remains exploratory and it is not clear whether this observation represents a postmortem or a supravital phenomenon. There is speculation that some of the cells actively enter the CSF during the first hours after death and that the rest

exfoliate from the subarachnoid layer . It is known that CSF-brain barrier is not an absolute membrane phenomenon but depends on physiological mechanisms that can be altered by circulatory arrest or due to inflammatory reaction [9, 10]. Due to such insult, the cells may migrate into CSF and increase in the count may be found in postmortem state. Nevertheless, in a recent study conducted over CSF samples collected in immediate postmortem period, it was shown that WBC counts increases in patients with meningitis [11]. Similarly it has also been reported that patient who are first seen with seizures have a CSF pleocytosis as a result of the seizure itself [12]. Therefore, it may be proposed that postmortem pleocytosis could be attributed to alteration in CSF-brain barrier.

The results of microscopic examination of cells indicate that in most of the cases, the identifiable cells are lymphocytes consisting of approximately 60-70% and 30-40% neutrophils. Monocytes are infrequently noted. Considering the morphological changes occurring in WBCs, degenerative changes were early recognized in monocytes, intermediate in neutrophils and late in lymphocytes. Up to 12 hour PMI, neutrophils could be identified and up to 20 hour PMI, lymphocytes could be found. The findings are in accordance with Platt et al [4]. When comparing with blood as body fluid, cellular changes in CSF occur early. The exact reason is not known and needs further attention.

There are several limitations to the present study and includes small sample size and non-inclusion of pediatric age group. Another limitation is that the study includes corpse that were kept at room temperature only and no attempt was made to study the changes in respect to bodies kept at room temperature and stored in cold storage. Similarly no attempt had been made to study , under varying climatic conditions. In spite of these limitations, the present study has certain advantages as CSF lies in secure place with least chance of contamination. The procedure is simple and needs usual laboratory material. From these preliminary results, at present, the procedure can be utilized as useful supplementary procedure to estimate death interval.

Conclusion

The present study indicates that postmortem cerebrospinal fluid pleocytosis is a common event. The cells can be counted up to 12 hours postmortem period. Identifiable cells include monocytes, lymphocytes and neutrophils. When postmortem interval is greater than 12 hours, monocytes and neutrophils cannot be identified whereas up to 20 hours, lymphocytes can be identified.

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Table- 1: Age related distribution of cases.

Sex	Mean age (in years)	Range (in years)	Standard deviation
Male	35.05	14-65	13.68
Female	26.33	16-40	5.98
Combined	31.56	14-65	11.98

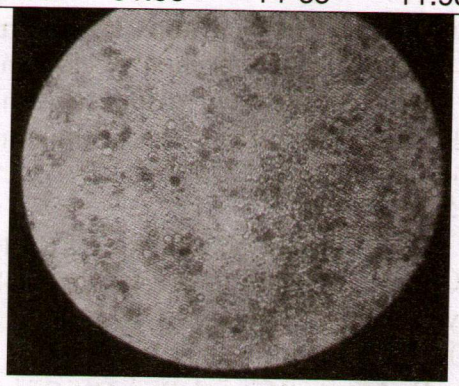

Figure-2: Differential counts showing lymphocyte and neutrophils (Leishman's X 45)

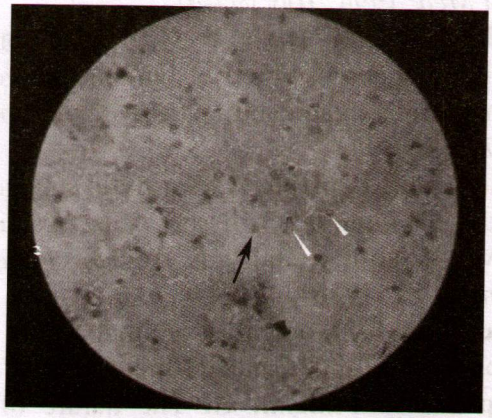

Figure-3: Degenerative changes in cytoplasm of neutrophil (white arrow) and lymphocyte (black arrow) (H & E, X 45)

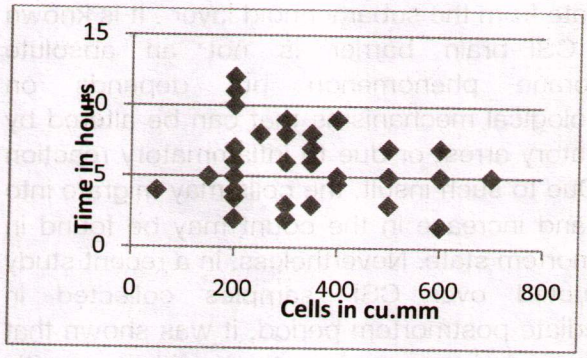

Figure- 1: Total leucocyte count against postmortem interval in hours

Table- 2: Distribution of cases as per total leucocyte count and time

WBC	0-6 hour	7-12 hour	0-12 hour
Range	50-700	200-600	50-700
Mean	335	323.07	330.30
S.E.	38.59	34.31	26.64

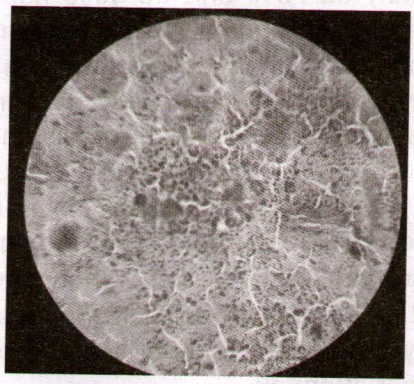

Figure-4: Llysis of cell membrane with nucleus of neutrophils appears pyknotic (H & E, X 45)

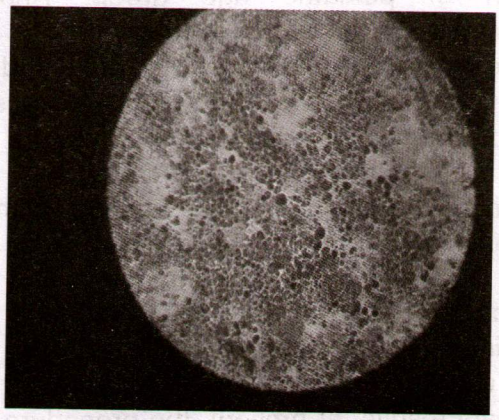

Fig ure-5: Degenerated neutrophils and lymphocyte showing vacuolation in cytoplasm (H & E, X 45)

Table- 3: Distribution of cases as per morphological features of cell against postmortem interval

PMI in hours	No. of cases	Cellular features		
		Monocytes	Neutrophils	Lymphocytes
0-6	20	In all cases monocytes shows degeneration in membrane and cytoplasm	In 3 cases (15%) neutrophils shows crenation of cell membrane and vaculoation of cytoplasm	All lymphocytes intact
7-12	13	In all cases monocytes shows degeneration, not identifiable	In 9 cases (69.23%) crenation of cell membrane,vaculoation of cytoplasm and pyknosis of nucleus In 4 cases (30.76%) cell membrane and cytoplasm degenerates with nucleus pyknotic	In 2 cases (15.38%) cell membrane shows crenation and cytoplasm appears vacuolated
13-18	15	–	Cell difficult to identify with nuclear fragmentation	In 5 cases (33.33%) cell membrane indistinct, cytoplasm vacuolated and nucleus pyknotic In 10 cases (66.66%) cell membrane and cytoplasm appears degenerated with fragmentation of nucleus begins
19-24	12	–	–	In 2 cases (16.66%) cell membrane identifiable, cytoplasm vacuolated to degenerated and nucleus appear pyknotic to fragmented In 10 cases (83.33%) lysis of cell and increasingly become difficult to identify cell

Originals and Papers

Study of some socio-etiological aspects of unnatural female deaths at government medical college , Aurangabd

Kailash U. Zine, A.Mugadlimath**, S. J. Gadge** ,V. S. Kalokhe** & R. G.Bhusale****

Abstract

Crimes against women are increasing faster than the rate of general crimes in India. The male female ration is also declining. In Maharashtra, it has declined from 934 in1991 to 922 in 2001 census. [8 districts less than 900 in 2001 as compared to none in 1991 [1]] To study the contribution of social conditions towards the main causes of unnatural female deaths this study was conducted from April 07 to March 08 at GMCH Aurangabad. Total 520 cases were studied. 65% of cases were from rural area, third decade was the most common age group involved, 68.1% victims were Hindu females followed by Buddhists 20 % and 8.26% were Muslims. 83.7% of the cases were married women, 72.35% of cases were matriculate or less studied, in 51.7% of the cases occurred within 7 years of marriage. Burns was the commonest cause (49.5% of cases) and Most of the deaths 53.7% were accidental and 40.4% were suicidal in manner.

Key words: *Unnatural female deaths, dowry deaths, bride burning, social aspects.*

Introduction

The unnatural deaths of females are not uncommon in Indian society. However, statistics reveal that crimes against women are increasing faster than the rate of general crimes in India. These are mainly due to increasing numbers of dowry deaths, suicides, accidents, female infanticides and feticides. The male female ration is declining. In Maharashtra, it has declined from 934 in1991 to 922 in 2001 census. [8 districts less than 900 in 2001 as compared to none in 1991 [1]]

The socioeconomic differences in healthy lifestyle are associated with the differences in attitudes towards life and accordingly the incidences of physical violence, suicides, etc. are encountered.[9] Understanding of the variations in social casualty, between different forms of injuries might help to explain the mechanism that conveys the effects of social disadvantage. The present study attempts to describe the association of some socio-etiological factors with unnatural female deaths at this centre.

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Aims and objectives

This study is aimed at describing the contribution of social conditions and violence against women towards the main causes of unnatural deaths among the females.

The main objectives of the study are to:

a) Ascertain the various aspects of unnatural female deaths,
b) Analyze the probable reasons for the same
c) Contribution of social conditions and violence against women towards the main causes of unnatural deaths.

Material and method

The present study was carried out from April 2007 to March 2008 in the Department of Forensic Medicine & Toxicology at Govt. Medical College and hospital, Aurangabad, Maharashtra, India, a tertiary care center. The materials of study comprised all cases of unnatural female deaths subjected to medico-legal autopsy. A standardized pro-forma specially designed for this purpose was used and filled in each case after detailed interviews with the investigating officials and the relatives/friends of the deceased & hospital records etc. to gather information regarding the age, socio-economic background,

level of education, occupation, marital status and rural/urban residence status. The relevant samples/viscera subjected to chemical analysis on autopsy to establish the poison consumed in suspected cases of poisoning. Samples are also preserved during autopsy and subjected to histopathological examination to arrive at a conclusion regarding the cause of death due to a disease process, when death occurred under suspicious conditions.

Per capita income

It was calculated by dividing the total family income by total family units. Children below one year considered as zero unit, while children between one to twelve years considered as half unit.

Socioeconomic status scale

Classification given by B.G. Prasad in 1961 adopted. It was modified as per All India Consumer Price for the month of July 2007 as below

Per capita Income (Rs) As per Prasad (July 2007)	Socio economic class Updated As per Index for (1961)	
100 & above	2534 & above	I
50 – 99	1267 – 2533	II
30 – 49	760 – 1266	III
15 – 29	380 – 759	IV
Bellow 15	Bellow 379	V

N.B. – The correction factor CCF = (The value of All India Consumer Price Index X 4.93/100). ACPI was 514 for July 2007. So CCF = (514 X 4.93/100) = 25.34. So, Rs.100 in 1961 = Rs. 2534 in July 2007. [65]

The data was compiled, analyzed and presented.

Results

The present study was carried out during 1st April 2007 to 31st March 2008 at Mortuary GMC Aurangabad. Of the total 520 cases (unnatural and suspicious female deaths) studied, 334 cases (65 %) were from rural area, 174 cases (33%) were from urban area and 12 (2%) were unknown. According to their religions, 354 (68.1%) cases belonged to Hindu, followed by Buddhist 104 cases (20%), Muslims 43 cases (8.26%), Jain and Christians 3 cases each. Remaining were unknown cases.

Table-1: Distribution of study cases according to age of the victims

Age in Yrs	Number	%
< 1	10	1.9
2- 9	21	4.0
10- 19	79	15.2
20 -29	215	41.3
30- 39	98	18.8
40- 49	51	9.8
50- 59	16	3.1
60- 70	30	5.8
Total	520	100.0

Table-2. Distribution of study cases according to marital status of the victims

Marital status	Married	Unmarried	Widowed	Separate	Unknown	Total
Number	434	56	4	1	25	**520**
%	83.7	10.8	.6	.2	4.8	**100**

Table-3: Distribution of study cases according literacy

Literacy	Illiterate	Primary	Middle	SSC	HSC	Graduate	N.A	Total
Number	65	140	152	84	36	11	32	**520**
%	12.5	26.9	29.2	16.2	6.9	2.1	6.1	**100**

Table- :4 Distribution of study cases according occupation of victim

Occupation of diseased	Number	%
Housewife	311	59.8
Agriculture/ Laborer	102	19.6
Student	34	6.5
Dependent	26	5.0
Business	6	1.2
Govt service	3	0.5
Others	6	1.4
N.A	32	5.9
Total	**520**	**100.0**

Table-5: Distribution of study cases according occupation of Husband/father/head of family

Occupation H/F/Head of Family	Number	%
Farmer/ Laborer	173	33.2
Unemployed	163	31.3
Private	80	17.1
Business	52	10
Govt. service	28	5.4
Not known / N.A	16	3.1
Total	**520**	**100.0**

Table -6 :Distribution of study cases according Socio-economic status

SE status	Number	%
V	87	16.7
IV	346	66.5
III	63	12.1
II	10	1.9
I	1	.2
N.A	13	2.5
Total	**520**	**100.0**

Out of total 520 studies, cases reasons for unhappy life leading to unnatural death (suicide/homicide) could be obtained from history for 245 cases and shown accordingly in table-8.

Table- 7: Cases according to reasons of unhappy life leading to unnatural death

Reasons	Number	%
Dowry	109	44.5
Torture by in laws & husband	41	16.7
Rash & negligent husband	25	10.2
Alcoholism of husband	24	9.8
Extra marital affair of husband	14	5.7
Emotional maladjustment	11	4.4
Marital disharmony	6	2.4
Infidelity suspicion by husband	4	1.6
Others	11	4.4
Total	**245**	**100**

Table-8: Distribution of study cases according cause of death

Cause of death	Number	%
Burns	257	49.4
Poisoning	82	15.8
RTA Injuries	63	12.1
Injuries other than RTA	23	4.4
Hanging	21	4.0
Snake bite	20	3.8
Complication following medical intervention	19	3.7
Drowning	10	1.9
Strangulation , Smothering	5	1.0
Cut throat	2	.4
Other causes	12	2.3
No exact opinion possible	6	1.2
Total	**520**	**100.0**

Table -9: Distribution of religion among study cases in relation to manner of death and dowry deaths

Religion	Manner of Death					Dowry deaths
	Accident	Homicidal	Suicidal	Undetermined	Total	
Hindu	197 (37.8)	16 (3)	137 (26.3)	4 (0.8)	354 (68.1)	74 (68)
Buddhist	55 (9.6)	3 (.6)	46 (8.8)	0 (0)	104 (20)	19 (18)
Muslim	20 (4)	2 (0.4)	21 (4)	0 (0)	43 (8.3)	15 (13.7)
Jain	2 (0.4)	0 (0)	1 (0.2)	0 (0)	3 (0.6)	1 (0.3)
Christian	0 (0)	0 (0)	3 (0.6)	0 (0)	3 (0.6)	0 (0)
Unknown	5 (1)	4 (.8)	2 (0.4)	2 (0.4)	13 (2.5)	0 (0)
Total	279 (53.7)	25 (4.8)	210 (40.4)	6 (1.2)	520 (100)	**109 (100)**

(Figures in parenthesis indicates %)

Table -10: Distribution of marital status relation to manner of death

Marital status	Manner of death				Total
	Accidental	Homicidal	Suicidal	Undetermined	
Married	231 (44.4)	12 (2.4)	190 (36.5)	1 (.2)	434 (83.7)
Unmarried	34 (6.5)	2 (.4)	17 (3.2)	3 (.6)	56 (10.8)
Widowed	3 (.6)	0 (0)	1 (.2)	0 (0)	4 (.8)
Separate	0 (0)	1 (.2)	0 (0)	0 (0)	1 (.2)
NA	11 (2.1)	10 (2)	2 (0.4)	2 (0.4)	25 (4.8)
Total	**268 (51.5)**	**25 (4.8)**	**208 (40)**	**6 (1.2)**	**520 (100)**

Figures in parenthesis are percentages (%)

Table -11: Distribution of Duration of married life (yrs) relation to Manner of death

Marriage (yrs)	Manner of Death					Dowry deaths
	Accidental	Homicidal	Suicidal	Undetermined	Total	
0 – 3	44 (8.4)	5 (1)	75 (14.4)	0 (0)	124 (23.8)	62 (57.0)
3 – 7	44 (8.4)	2 (.2)	55 (10.5)	0 (0)	101 (19.4)	36 (33)
7 – 14	53 (10.2)	0 (0)	36 (6.9)	0 (0)	89 (17.1)	10 (9.1)
14 –21	33 (6.3)	3 (.6)	14 (2.6)	0 (0)	51 (9.8)	1 (0.9)
21—28	26 (5)	1 (.2)	3 (.6)	0 (0)	30 (5.7)	0 (0)
28 – 35	10 (2)	0 (0)	2 (.4)	0 (0)	12 (2.3)	0 (0)
>35	20 (4)	1 (.2)	5 (1)	1 (.2)	27 (5.1)	0 (0)
Total	**231 (44.4)**	**12 (2.3)**	**190 (36.5)**	**1 (.2)**	**434 (100)**	**109** (100)

(Figures in parenthesis indicate percentages)

Table -12: Socio Economic statuses compared with cause of death

Cause of Death	Socio Economic Status						Total
	I	II	III	IV	V	N.A	
RTA	1 (0.2)	3 (0.6)	16 (3)	31 (5.9)	6 (1.2)	6 (1.2)	63 (12.1)
Burns	0 (0)	4 (0.8)	23 (4.4)	179 (34.4)	51 (9.8)	0 (0)	257 (49.4)
Poisoning	0 (0)	0 (0)	9 (1.7)	58 (11.1)	15 (2.9)	0 (0)	82 (15.7)
Hanging	0 (0)	1 (0.2)	2 (0.4)	16 (3)	2 (0.4)	0 (0)	21 (4)
Others	0 (0)	2 (0.4)	13 (2.5)	62 (11.9)	13 (2.5)	7 (1.3)	97 (18.6)
Total	**1 (0.2)**	**10 (2)**	**63 (12.1)**	**346 (66.5)**	**87 (16.7)**	**13 (2.5)**	**520 (100)**

Table- 13: Age groups compared with cause of death

Age (yrs)	Cause of Death					Total
	Burns	Poisoning	RTA	Hanging	Others	
<1	0 (0)	1 (0.2)	0 (0)	0 (0)	9 (1.8)	10 ()
2 – 9	4 (0.8)	1 (0.2)	7 (1.3)	0 (0)	9 (1.8)	21 (4)
10 – 19	33 (6.3)	23 (4.4)	3 (0.6)	5 (1)	15 (2.9)	79 (15.1)
20 – 29	131 (25.1)	35 (6.8)	10 (2)	14 (2.6)	25 (4.8)	215 (41.3)
30 –39	62 (11.9)	11 (2.1)	11 (2.1)	2 (0.4)	12 (2.3)	98 (18.8)
40 – 49	17 (3.2)	6 (1.2)	17 (3.2)	0 (0)	11 (2.1)	51 (9.8)
50 – 59	4 (0.8)	4 (0,8)	3 (0.6)	0 (0)	5 (1)	16 (3)
60 – 70	6 (1.2)	1 (0.2)	12 (2.3)	0 (0)	11 (2.1)	30 (5.7)
Total	257 (49.4)	82 (15.7)	63 (12.1)	21 (4)	97 (18.6)	**520 (100)**

Discussion

During the study period of one year (April 2007- March 2008) the incidence of unnatural female death was 520 cases (27.9 %) out of total 1863 medico-legal autopsies conducted. The findings of incidence of unnatural female death in present study are consistent with study by Sharma BR (2004) [2] & Bhattacharjee J et al (1991)[7].

According to present study, 334(65%) cases were from rural area. This finding is consistent with a study by Geeta S et al (2003) [5]- study of female suicide and Mohanty AK et al (2004) [12] study of female homicide, and Shrivastava AK (2004)[3] study of death in newly married. This may be due to higher incidence of violence against women in rural area as reported by INCLEN survey (2000) [17].

Table -1 shows maximum incidence of unnatural female death in 3rd decade, in present study i.e. 215 cases (41.3%). This finding in present study is consistent with findings of Kumar TS (2004).[9] Verma et al (1990) [6] observed higher incidence of unnatural female deaths in 18-30 yrs.

According to present study (Table2), most cases of unnatural female deaths were from married group 83%. This finding is consistent with study by Geeta S et al [5] (2003) 76% were married suicide victims, and by Mohanty AK et al (2004) [12] 82% were homicide victims, and, NCRB (2007), [14] reported 71% were married.

According to present study (Table3), 72.3% of victims were educated less than matric, 12% cases were illiterates. According to study by Bhullar et al (1996) [11] 90% of victims in unnatural female deaths had less than matric education, according to Shrivastava AK (2004) [3] 70% had less than matric education, and also, according to NCRB (2007) [14] 50% of suicide victims were less than high school education. The reason for this may be dependence of less educated woman on in-laws and husband and becoming victims of dowry deaths or violence against them.

According to present study (Table-4), housewives formed the maximum number of victims 59.8%. Moreover, only 0.5% cases were government servants. According to NCRB (2007) [14], maximum incidences of suicide were seen in housewives i.e. 1 in every 5 suicides. In addition, according to Geeta S et al [5] (2003) 78% of victims were housewives in female suicides. It appears that economically independent women are less affected by violence against and dowry than dependant homemakers are. According to

present study, maximum cases were from joint family 54.4% as compared with other type. According to of deaths in newly married females were from joint family. The findings of Bhullar et al (1996)[11] (60%) and Shrivastava AK (2004) [3] (73%) are consistent with present study findings.

According to present study (Table- 6) maximum numbers of husbands of the victims were farmers and unemployed (65%) and remaining were low salaried. Shrivastava AK (2004) [3] and Bhullar et al (1996) [11] have reported similar findings. Unemployment of victims' husbands leads to increased dowry demands, economic and social instability, alcoholism and disharmony in family leading to increased unnatural female deaths.

According to present, study (Table -7) maximum cases were from class IV S.E status 66.5% followed by 16% in class V. According to Shrivastava AK (2004) [3], most of the victims were from socio economic class IV 56%. According to Mohanty et al (2004) [12] 82% of victims in female homicide were from lower middle S.E status. These findings are consistent with present study. The reason for the above said findings may be due to economic instability leading to violence against women in the form of dowry deaths.

According to present study (Table- 8) reasons for unhappy life of victims leading to suicide or homicide were-alleged dowry harassments 44%, torture by in-laws 16%, alcoholism of husband 4.1%, rash and negligent husband 4%, other reasons as mentioned in Table- 9. Shrivastava A K (2004) [3] and Geeta S et al (2003) [5] reported similar findings.

According to present study (Table 9) 49.4% cases were due to burns and outnumbered all other causes of deaths followed by poisoning 15.8%, RTA 12%, drowning 10%. Study by Bhattacharjee J et al (1991) [15] and in NCRB 2007 report, burns was the most common cause of death. The reason of burns being most common cause may be easy availability of kerosene, low cost.

According to present study, (Table-10), 53.7% cases were accidental followed by 40.4% cases of suicides & homicides (5%) the least common. Bhullar et al (1996) [11] have reported similar findings. Considering duration of married life , maximum cases were seen in initial 3 years of married life i.e. 124 cases(28.5%).With maximum number of deaths in first 7 years of marriage i.e. 225(52%). Study by Bhullar et al (1996) [11] reported 75% of married victims died within 7 years, similar findings by Shrivastava AK (2004) [3] -60%. Present study findings consistent with above said studies.

According to present study (Table -11) Hindu religion showed more number of deaths in all three manner of deaths, this is consistent with most of previous Indian studies. Hindu religion showed accident suicide ratio as 1.4:1, this is related with more cases of alleged accidental burns in Hindu religion. Buddhist religion showed 20% of deaths, accident suicide ratio in this group was 1.1:1, and this suggests more cases of suicidal deaths in Buddhists than Hindu religion. Muslim religion showed 13.7% deaths, suicides slightly higher than accidental deaths. In the same table when religion was compared with incidence of dowry harassment, highest incidence was seen among Hindus 68% followed by Buddhists 18% and Muslims 13.7%. High incidence of dowry among Hindus is also reported by Shrivastava AK et al [3].

According to present study (Table- 12), suicide was most common manner of death among dowry related deaths 66%. NCRB (2007) [14] reports 35% increase in dowry related suicides. According to Shrivastava AK (2004), [3] 51% of dowry deaths were suicidal in nature. Similar observations were noted by – Satpathy DK (1995) [10]: Nagesh Kumar Rao (1997) [13], and Sharma BR et al (2006) [8]. Present study findings are consistent with these studies. However, according to Agnihotri A (1999) [16] more deaths 78% were homicidal in nature, these findings do not match with present study.

According to present study (Table- 13), maximum cases of leading causes of death (Burns, Poisoning, RTA) are commonly seen in class IV and followed by class V. These findings were consistent with previous studies relating to burns- Sharma BR et al 2006 [8], poisoning (Geeta S 2003 [5]), RTA (Kuchewar SV 2007 [15]). Burns and poisoning were commonly seen in class IV and V probably due to suicidal cases in these groups and RTA commonly seen in class IV and III due to

more vehicular accidents due to less traffic rule awareness and less number of vehicular use in class V.

According to present study (Table -14), when age group is compared to cause of death, maximum burn cases were seen in third decade - 131 cases, followed by poisoning -35 cases with ratio of burns to poisoning as 3.7/1. In adolescents (10-19), 33 burns cases followed by 23 poisoning cases with their ratio as 1.4/1.This suggests more incidences of burn cases in third decade (probably due to dowry) and nearly equal incidence of burn and poisoning cases in adolescents. In elderly group (60-70), RTA was most common, probably due to deteriorating physical senses due to old age.

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Originals and Papers

Poisoning deaths in children

Vikram Palimar & G Pradeep Kumar***

Abstract

Present study is a retrospective research undertaken at the department of Forensic Medicine, Kasturba Medical College, Manipal. Twenty six victims under the age of 18 years who died due to poisoning formed the material for the study. Age group 13-18 years was more commonly involved. Males out numbered females. Suicidal poisoning predominated. Consumption of poison was more during day time and in summer months. Organophosphorous insecticide was the involved agent in over whelming majority of the cases. Twenty six percent of the victims survived for a period of less than 12 hrs after consuming poison.

Key words: *Childhood, organophosphorous, poisoning, suicide.*

Introduction

Poisoning in children is a global health problem. Introduction of new drugs and chemicals coupled with rapid industrial growth have widened the spectrum of toxic products to which the children may get exposed.

Although pediatric poisoning is not very uncommon in this part of the country, yet there exists inadequate data regarding the pediatric fatalities due to poisons in this part of the country and the present study tries to address this problem.

The objective of the present study was to determine the various aspects of poisoning fatalities in children, like demographic data, manner, diurnal and seasonal variation, type of poison involved and the duration of survival. The present study attempts to gather epidemiological information so as to formulate recommendations that could probably help to prevent or reduce these deaths.

Materials & Methods

The present study is a retrospective research which analyses 26 pediatric victims (less than 18 years of age) of poisoning deaths from the medico legal autopsies done at the department of Forensic Medicine, Kasturba Medical College, Manipal, Karnataka State over a span of fourteen years (1993-2006). The mortuary of the Kasturba Hospital, under the department of Forensic Medicine, conducts the medico legal autopsies referred from Manipal Police Station and also those referred from adjoining police stations of Karnataka, Kerala & Goa. Data was obtained from the autopsy files, police inquest reports & hospital case records. The chemical analysis report of the viscera was perused to conclude as to the nature of poison consumed.

Results

A total of 2210 medico legal autopsies were conducted during the study period & 425 cases were deaths due to poisoning out of which 26 victims were under the age of 18 years. Age group 13-18 years were commonly involved (Figure1). Male victims out numbered females (Figure 2). More than 90% of the decedents allegedly died due to suicidal poisoning (Figure.3). Consumption of poison was more during day time (Figure 4). More than one-third of the victims (34.6%) consumed poison during the summer months (Table 1). Organophosphorous insecticide was the involved agent in over whelming majority (Table 2). Twenty six percent of the victims survived for a period of less than 12 hrs after consuming poison (Table 3).

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Discussion

Pediatric poisoning although amenable for prevention is a growing concern in the clinical practice. Unlike in adults the accidental poisoning is more common in children. Small children may accidentally swallow poisonous substances or a parent / another person may deliberately poison a child and on occasions a child may deliberately ingest a poison in a fit of rage or anger.

Present study observed that deaths due to pediatric poisoning formed 1.1% of all unnatural deaths for which autopsy was done at the morgue of Kasturba hospital, Manipal. Childhood poisoning constituted 1-2% of total deaths in other works [1,2]. Most common age group to be affected was 13-18 years. Data from Jordan indicates more involvement of children under the age of 6 years [3]. Children less than 5 years old were at the highest risk for poison-related fatalities in other study [4]. Data from South Carolina [1] observed a bimodal age distribution having two peaks, one in the teenage group (15-17 years) and the other in pre school group (9 months to 4 years). However data from England and Wales suggests more common involvement of 0-9 years [6].

There was a male preponderance in the present series of cases under study which is concurring from other works [1,3,6]. Suicidal poisoning was noted in overwhelming majority of the cases under study. Two cases of accidental and a case of homicidal poisoning were noted. Self poisoning was more common in one of the study [3]. However other report indicates accidental poisoning to be more common [1]. Study from Chandigarh observed two distinct patterns of poisoning in children; accidental poisoning was more common in less than 11 years and self poisoning in children over 11 years of age [5]. Consumption of poison was more during the day time when compared to night. It is probably because during the daytime the person would be awake and stress would be at its peak, there could be a tendency to terminate one's own life with readily available substance like poison. More than one-third of the victims (34.6%) consumed poison during the summer months. Spring had more poisoning events followed by summer in one of the reported work [3].

Organophosphorous insecticide was the involved agent in over whelming majority of the cases followed by organochlorines. A case each of homicide and suicide by sulphuric acid were also noted. Bromadiolone, an anticoagulant rodenticide was deliberately ingested in one of the case. People in this region have easy accessibility to the organophosphorous insecticides since these are commonly used for agriculture. So whenever there is a tendency to commit suicide, they are available ready in hand.

Drugs predominated in one of the study [1]. In Jordan large majority of drugs were psychotropic agents (56%) and principally diazepam's (39%) [3]. Data from England and Wales suggests most deaths occurring in fires, and is attributed to inhaling combustion products [6]. Study conducted at Malawi indicates carbonate followed by paraffin as the principal agents responsible for admission to the hospital but more than 50% of the deaths occurred due to traditional medicine intoxication [7]. The majority of deaths were due to pesticides in other work [8]. Mexican study reveals the main cause of poisoning were toxic reactions caused by venomous plants or animals, household gas or carbon monoxide and drugs [9].

More than half of the victims survived for less than a day after the consumption of poison which highlights the fact that early and energetic management holds the key in determining the prognosis in such cases. Immediate decontamination of the poison and proper first aid measures before shifting the patient to a tertiary center cannot be overemphasized.

Conclusion

Agrochemical poisons especially organophosphates are responsible for most of the poison related fatalities in children. In a developing country like India, where agriculture is the main source of income of the majority, loss of crops due to pests can't be ignored. Hence, instead of banning a particular pesticide, some measures for their safe usage and disposal could be adopted like; proper labeling, imparting awareness programmes to the general public about the hazards of pesticides and their safe and proper handling.

Extending psychiatric services to the community may help in identifying the high risk children who are likely to commit deliberate self harm. Parental education and intensified child supervision are the indicated measures of prevention for unintentional poisoning. The use of child-resistant packaging and the secure storage of household substances are the basis of preventing unintentional exposures. Poison prevention efforts should also address the appropriate role of the poison information centre.

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Table-1: Seasonal variation

Season (n=26)	No of cases	Percentage
Summer (Apr-Jun)	09	34.6
Rainy (Jul-Sep)	06	23.1
Spring (Oct-Dec)	04	15.2
Winter (Jan-Mar)	07	27.1

Table-2: Compound consumed

Compound	No of cases	Percentage
Organophosphorous	19	73.1
Organochloro	04	15.4
Sulphuric acid	02	7.7
Bromadiolone	01	3.8

Table-3: Duration of survival

Survival Period	No of cases	Percentage
0-12 hrs	07	26.9
12-24 hrs	08	30.8
> 1 day	11	42.3

Figure-1 : Age group of the victims

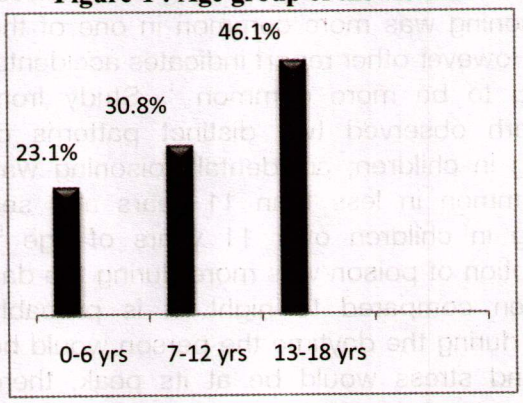


Figure-2 : Gender differences

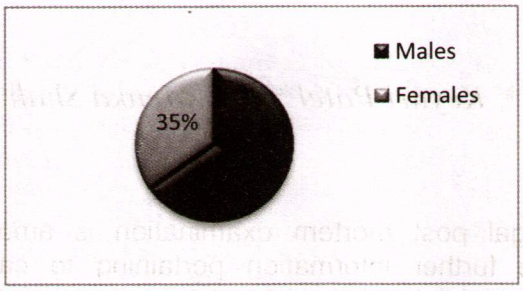


Figure- 3: Manner of poisoning

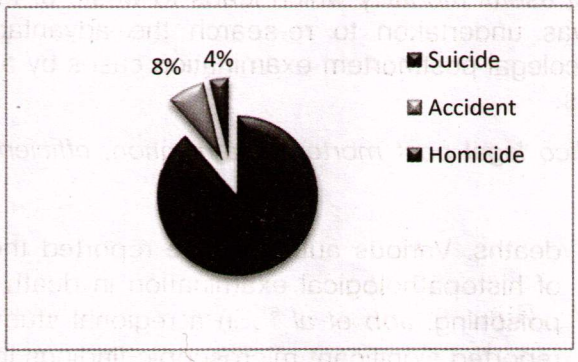
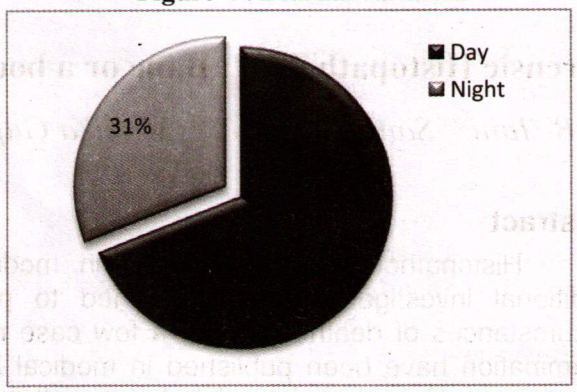


Figure-4 : Diurnal variation



Originals and Papers

Forensic Histopathology: Bane or a boon?

C. B. Jani, Sanjay Gupta**, Monika Gupta***, Keyuri Patel*** & Menka Shah*****

Abstract

Histopathological examination in medico legal post mortem examination is amongst the additional investigations that is aimed to procure further information pertaining to cause and circumstances of death. Though, a few case reports highlighting the importance of histopathological examination have been published in medical literature, there have also been some indigenous and overseas studies which have labeled it as the least useful modality which leads to waste of temporal and monitoring resources. The present study was undertaken to re-search the advantage and limitations of histopathological examination in medicolegal postmortem examination cases by applying objective parameters i.e. efficiency and effectiveness.

Key words: *Histopathological examination, medico legal post mortem examination, efficiency and effectiveness.*

Introduction

Histopathological examination is helpful when naked eye examination is inadequate to include or exclude morphological changes at the tissue level. To undertake this examination, a knowledge of histopathological techniques, laboratory setup and knowledge in the context of interpretation and reporting is necessary. Various authors have discussed in detail about gadgets, glassware, instruments, chemicals and procedures for preparing tissue sample for examination. [1,2]

Forensic applications of histopathological examination include micrometry of compact part of a long bone for age estimation[3], microscopic appreciation of the process of inflammation and repair in determining the nature of injury (whether ante mortem or post mortem), age of injuries[4], dating of deep vein thrombosis[5], in addition to concluding the cause of death in cases of sudden death and unnatural deaths. Various authors have reported the utility of histopathological examination in death due to poisoning. *Job et al* [6], in a regional study, have reported significant microscopic findings in lungs, liver and kidney in deaths due to parquet poisoning. *Sutay et al* [7] are of the opinion that histopathological examination can provide support to estimate the cause of death due to poisoning while the viscera report is still awaited and can cut short the legal proceeding which used to remain pending for evidence of poison in the laboratory.

However, there are conflicting reports regarding the benefits and utility of histopathological examination in medicolegal post mortem examination cases, which of course does not present a very encouraging scenario. In a study of 617 histopathological examination cases in medico legal post mortem examination, it was found to be useful in about 16 % of cases, to either confirm existing cause of death or to confirm existing disease or to form the basis for the cause of death [8]. The authors are of the opinion that it is very difficult for them in prevailing scientific and administrative scenario to recommend that the need of histopathological examination can be dispensed with. But they have certainly recommend that this tool should be used in a manner which is more rational and not defensive.

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Mollina et al [9] who reviewed brain, heart, liver, kidney and lung sections on 189 routine forensic cases have reported more or less similar conclusions; after comparing the results to the gross anatomic findings. Of the 189 cases, in only one case did microscopic examination alter the cause of death and in none of the cases did microscopic examinations affect the manner of death. They are also of the opinion that routine microscopic examination in forensic autopsy is unnecessary and microscopic examination should be used, as needed, in certain circumstances but is not necessary as a matter of routine [9].

However, the frequently used and applied parameters like efficiency and effectiveness of a diagnostic modality, with reference to histopathological examination in medicolegal postmortem examination have not been studied or reported so for in Indian literature. These parameters, which are of an objective nature, have been included in the present study. Generally, efficiency is defined as "achievement of goal with least expenditure of resources" and effectiveness is defined as "achievement of goal to its tallest extent" [10].

Aims and objectives

1. To determine efficiency of histopathological examination in medicolegal postmortem examination.
2. To determine effectiveness of histopathological examination in medicolegal postmortem examination.
3. To determine factors affecting efficiency and effectiveness of histopathological examination in medicolegal postmortem examination.
4. To find and suggest measures for improving efficiency and effectiveness of histopathological examination in medicolegal postmortem examination.

Material and Method

In the present retrospective study, 481 medico legal postmortem examinations that were conducted during the years 2006 and 2007 were included. Of the total cases, 419 cases in which histopathological examination was not requested were excluded. Summarily, the study comprises of 62 cases observed during the period of two years where histopathological examination was requested in medico legal postmortem examination cases. The tissue samples were collected at the autopsy room and slices were preserved in five times volume of 10% formalin with the thickness of slices of tissue not exceeding 1cm. All sections were processed using isopropyl alcohol, xylene and wax and were then embedded stained with Hematoxylin-Eosin and examined under the light microscope. General particulars (age, sex, season), time since death, type of case, aim of histopathological examination, gross findings and histopathological examination findings were entered in a proforma. Histopathological examination was considered **"not efficient"** where microscopic findings demonstrated autolytic changes. Histopathological examination was considered **"efficient but not effective"** in cases where histopathological examination sections were unremarkable (not showing evidence of relevant findings) and therefore, the aim of histopathological examination was not achieved. Histopathological examination was considered **"efficient and effective"** in cases where the aim of histopathological examination was achieved by demonstration of remarkable histopathological examination findings. The above details were entered into a master chart and relevant data were tabulated further, for the purpose of observation and discussion.

Observations

Out of total 62 cases in which histopathological examination was requested, 36 post mortems (15.79%) were performed during the year 2006 and 26 cases (10.27%) were during the year 2007, with an average of 12.89% for histopathological examination requisition. [Table-1]

As shown in table –2, there was a male preponderance. Maximum cases were observed in the age group of 41-50 followed by 61-70 and 21-30, respectively.

Table-3 depicts that postmortem examination was conducted within 0-6, 7-12 and 13-24 hours respectively in an almost similar proportion and only a small proportion of cases showed time since death of more than 24 hours.

Table-4 is a reflection of the fact that majority of the cases in which histopathological examination was requested were cases of injury and that the circumstances of death were devoid of specific history. The other categories of cases were of poisoning, non-cardiac disease, followed by asphyxial deaths and heart disease. Amongst all cases it was found that histopathological examination was effective in heart disease, unknown circumstances of death, other diseases and injury cases. At the same time histopathological examination was found less effective in cases of poisoning and asphyxia.

As per table-5, histopathological examination was more efficient and effective when the aim of histopathological examination was to confirm the cause of death and to know the cause of death. However, the efficiency and effectiveness of histopathological examination with the aim to know delayed histopathological changes and to confirm or exclude disease/ pregnancy was relatively less.

It is obvious from table-6 that in almost half of the cases gross findings were correctly diagnosed. In reasonable number of cases (n=30, 38.50%) the gross findings were under-identified. The gross findings were either not seen or over identified only in small number of cases.

As per table-7, uterus, heart and brain were the organs in which histopathological examination was more efficient as compared to kidneys, spleen, liver and lungs. However, it was both efficient and effective when tissues submitted for histopathological examination were skin, growth, lungs, spleen, kidney and stomach. The organs with relatively less effectiveness were brain, heart and uterus.

As per table-8, the duration between death and postmortem examination up to 24 hours hardly influence efficiency, effectiveness or both.

Discussion

Histopathology and forensic pathology are amongst the major subdivisions of the pathology discipline. A few studies highlight the importance of histopathological examination in medicolegal work in cases of poisoning[6, 7]. Some articles label it as the least useful modality[9] and others recommend that it should be more rational and not defensive[8].

Wright EA[11] conclude that quality control, as applied to the quantitative data of chemical pathology is not applicable to Histopathology; there would be almost no advantage in controlling either the machine product or the technical product. Technically, quality control is defined as a process, which ensures that a product meets predefined standards or that requisite action is taken when the standards are not met. Since histopathology is not carried out in quantitative terms there is an element of subjectivity, which is inherent and cannot be completely excluded completely.

Histopathological examination of any tissue in a medical or medicolegal case requires grossing and sampling, proper fixation, cutting of sections and staining of mounted section, as far as the technique is concerned (not interpretation and reporting). In contrast to previous reports, *Barr W T*[12] is of the opinion that a pilot scheme for technical quality control in histopathology is both workable and acceptable. This scheme includes the review of each slide by four assessors and independently grading and scoring of each slide using point system. With this background present study was undertaken to re-search the advantages and limitations of histopathological examination in medicolegal work at our center, of course in the context of various factors like time since death, type of case, the aim of histopathological examination, discrepancy between gross and histopathological examination findings and two important parameters of quality assurance that is to say efficiency and effectiveness. However, the interpretation of objective data and validating the histopathological diagnosis is open to the bias of inherent subjectivity in the assessment - a senior and more experience eye is expected to report in a manner which is more accurate as compared to a subordinate. For all practical purposes, in the present study the parameter of efficiency relates to factors like time since death, type of organ and technique of preparation of stained mounted section from preserved tissue. The parameter of effectiveness relates not only to efficiency but is also influenced by additional factors like aim of

histopathological examination and usefulness of histopathological diagnosis in medicolegal autopsy work.

In the present study, histopathological examination was requested in majority of cases where the time since death was less than 24 hours. This is almost similar to the distribution of cases in study conducted by *Gupta et al* [8]. Surprisingly in our study, time since death neither influenced efficiency nor effectiveness. The reason behind this may be the seasons during which these cases were observed. In three cases, even though time since death was more than 24 hours, they were observed during the months of April, July and November which are not very hot climatic months in the area.

Validation of Histopathological diagnosis and getting convinced by it depends upon correlation between gross and microscopic findings. In the present study almost half of the cases were devoid of any such discrepancy. It is obvious from table-9 that such discrepancy was far less in a study reported from the western world as compared to present study. The most striking feature in their observation was that only in a very small number of cases there was miss-identification on gross examination[9]. Under and over identification of a gross findings depends on knowledge of the autopsy surgeon with reference to macro pathological findings.

Uterus, skin, growth and stomach were more efficient as an organ as compared to lungs, spleen, brain and heart. This can be attributed to the composition of the tissue and onset and sequence of putrefaction[13] that is reflected in our observation. The effectiveness of growth, skin, lung, kidney, spleen, liver and stomach was higher than that of brain, heart and uterus. This observation cannot be explained completely on the basis of a single factor.

Firstly, it depends upon aim of histopathological examination. As shown in table-5, histopathological examination is highly effective when requested to confirm the cause of death, followed by to find out the cause of death, to find out delayed histopathological changes and to confirm or exclude disease/pregnancy. *Molina et al* [9] are of the opinion that when the cause and manner of death are determined during gross autopsy examination, microscopic examination will change the cause of death in less than 1% of cases and does not affect the determination of manner of death. Such a message from the study representing developed world is surprising, as in our study the effectiveness of histopathological examination was more as compared to their expression. Meaning there by, the aim of histopathological examination and its effectiveness are closely interrelated. Thus, the aim of requesting histopathological examination shall form the basis for any objective analysis.

As shown in table-4, histopathological examination is effective in cases of heart disease, unknown cause of death, known cardiac disease and injury cases, where there are definitive and diagnostic cytomorphological changes, as compared to poisoning and asphyxia. We feel that other factors like the number of sections submitted from an organ and staining technique have some role to play in effectiveness. As far as surgical specimens are concerned, exhaustive guidelines in the form of site and number of sections in a given organ exist in standard textbooks of surgical pathology[14].

Secondly, with reference to autopsy specimen also such guidelines exist. Nine sites have been suggested for histopathological examination of the heart and five sites for histopathological examination of brain are suggested etc[15]. Surprisingly, the number of sections selected from various organs in the present study, were far less than recommended. Thus, if inadequate numbers of sections are passed from an organ, it is possible that the non-selected site may have some positive findings, which obviously would be missed and ultimately would have the potential to adversely affect the parameter of effectiveness. It is suggested that a well-versed autopsy surgeon undertake grossing and sampling at the mortuary and then fixed specimens of small quantity shall be forwarded to pathology department instead of sending the entire organ, which requires more volume of formalin with incisions not more that 1 cm away from each other.

Thirdly, the type of stain also plays an important role as far as effectiveness is concerned. It should be clear in the mind of the

histopathologist that " Is the suspected lesion demonstrable by routine H&E stain or does it require a special stain?" In one of the cases of trauma observed in the present study, the probable autopsy diagnosis of fat embolism could not be confirmed only by H&E stained section as it required special staining technique i.e. Oil red-O, Sudan III, Scharlach R or Osmic acid[13], which were not available at our setup and hence it was not possible to confirm the autopsy diagnosis by histopathological examination.

The last but not the least aspect of the theme is subjective interpretation of objective data, that is to say independent and separate assessment of reported slides. The scheme and system of validating histopathological diagnosis by a team of senior histopathologist shall exist on periodical or even regular basis to ensure that under reporting or over reporting is avoided or minimized. The influence of such subjective interpretation and its application has not been incorporated in the present study as samples include medicolegal cases and any controversy/conflict that might arise from such a review, if any, would have the potential to invite administrative and legal controversies. But we agree with the suggestion of *Gupta et al* [8] that a senior person should supervise routine histopathological examination in medicolegal autopsy cases.

Conclusion

1. Seasonal variations and climatic conditions, are crucial factors in addition to time since death, for requesting histopathological examination. In other words, histopathological examination may be efficient with higher time since death in cold climatic conditions and may not be efficient with lesser time since death but hot climatic conditions.
2. The autopsy surgeon shall have adequate knowledge of macro pathological findings of at least the common diseases or abnormalities. This can reduce the quantum of discrepancy between the two as far as gross findings are concerned.
3. The aim of request for histopathological examination, in the mind of autopsy surgeon ,should be completely clear. Whether he is submitting tissue to know cause of death, to confirm cause of death, to know delayed histopathological changes or to confirm or exclude disease/pregnancy.
4. Even if the requested organs are preserved in appropriate volume and the concentration of preservative with its thickness not exceeding 1cm, the recommended number of sections from each organ, as per standard guidelines, shall form routine practice by the autopsy surgeon and histopathologist.
5. The histopathologist, keeping in mind the clinical history and autopsy diagnosis of the case shall adopt a suitable staining technique. In absence of facility for any such special stain, autopsy surgeon shall also consider the circumstances before completely excluding a suspected entity.
6. The scheme and system of validating histopathological diagnosis by team of senior histopathologist shall exist on a periodical or even regular basis to ensure that under reporting or over reporting is avoided or minimized.

Summary

On the basis of fruitful deductions of the present study, we are of the opinion that histopathological examination in medicolegal autopsy work is a boon, provided it is rational, technically self sufficient and interpreted in broader perspectives. Quality control, quality assurance and audit in histopathological examination can make it more scientific and near accurate. A similar or better study embodying the same theme by joint endeavourer of autopsy surgeons and the histopathologist can illuminate it further and lay down a path which can check the limitations and elaborate advantages of histopathological examination in medicolegal work.

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Table-1: Year wise distribution of cases

Year	Autopsy cases	HPE cases	
		No.	Percentage
2006	228	36	15.79
2007	253	26	10.27
Total	481	62	12.89*

* Average of both years

Table-2 :Age and sex wise distribution of cases

Age group	Sex		Total	
	Male	Female	No.	Percentage
0-10	02	02	04	06.45
11-20	03	04	07	11.29
21-30	04	05	09	14.52
31-40	04	02	06	09.68
41-50	12	04	16	25.80
51-60	07	01	08	12.90
61-70	08	01	09	14.52
Above 70	00	03	03	04.84
Total	40	22	62	100

Table- 3: Distribution of cases as per time since death

TSD (in hrs)	Cases	
	No.	Percentage
0-6	21	33.88
7-12	16	25.80
13-24	22	35.48
Above 24	03	04.84
Total	62	100

Table- 4: Distribution of cases as per type of case

Type of case	HPE requested	Effectiveness	
		Yes (%)	No (%)
Injury	19	11(57.89)	08 (42.11)
Burns	00	00 (00)	00 (00)
Poisoning	09	03 (33.33)	06 (66.67)
Asphyxia	05	01 (20)	04 (80)
Heart disease	05	05 (100)	00 (00)
Other disease	09	06 (66.67)	03 (33.33)
Not known	15	13 (86.67)	02 (13.33)

Table- 5 :Distribution of cases as per aim of HPE and its efficiency and effectiveness

Aim of HPE	Not efficient (%)	Efficient & not effective (%)	Efficient & effective (%)	Total (%)
Know COD	02 (14.29)	02 (14.29)	10(71.42)	14 (100)
Confirm COD	00 (00)	01(06.67)	14(93.33)	15 (100)
Know delayed HP changes	01 (04.35)	08 (34.78)	14 (60.87)	23 (100)
Confirm or exclude disease / pregnancy	00 (00)	05 (50.00)	05 (50.00)	10 (100)

Table- 6 :distribution of cases as per discrepancy between gross and HPE findings

Gross findings	No. (%)
Not seen	03 (03.85)
Under identified	30 (38.50)
Over identified	07 (08.97)
Correctly diagnosed	38 (48.72)
Total	78 (100)*

* In any of cases number of organ submitted for HPE is more than mathematical total of all cases, as there was an overlapping seen in 16 cases.

Table-7 :Distribution of cases as per organ wise efficiency and effectiveness in HPE

Organ	Not efficient (%)	Efficient & not effective (%)	Efficient & effective (%)	Total (%)
Brain	02 (05.26)	22 (57.89)	14 (36.85)	38 (100)
Heart	02 (04.25)	29 (61.71)	16 (34.04)	47 (100)
Lung	03 (06.52)	04 (08.70)	39 (84.78)	46 (100)
Kidney	05 (12.20)	07(17.07)	29 (70.73)	41 (100)
Liver	02 (04.76)	11 (26.19)	29 (69.05)	42 (100)
Uterus	00 (00.00)	07 (70.00)	03 (30.00)	10 (100)
Skin	00 (00.00)	00 (00.00)	03 (100)	03 (100)
Spleen	01 (14.29)	01(14.29)	05 (71.43)	07(100)
Mass/growth	00 (00.00)	00 (00.00)	01(100)	01(100)
Stomach	00 (00.00)	01(33.33)	02 (66.67)	03(100)

Table-8 :Distribution of cases as per time since death and efficiency – effectiveness of HPE

TSD (in hrs)	Not efficient (%)	Efficient & not effective (%)	Efficient & effective (%)	Total (%)
0-6	00 (00.00)	04 (18.18)	18 (81.82)	22 (100)
7-12	00 (00.00)	05 (31.25)	11 (68.75)	16 (100)
13-24	01 (04.35)	06 (26.09)	16 (69.57)	23 (100)
Above 24	00 (00.00)	00 (00.00)	03 (100)*	03 (100)

* In 3 cases even though time since death was more than 24 hours, they were observed during the months of April, July and November, which are not very hot climatic months in the area.

Table- 9 :Comparative analysis of cases with discrepancy

Type of discrepancy	*Mollina et al* [9]	Present study
Not seen grossly	44 (38.93)	03 (03.84)
Misidentified grossly	06 (05.31)	37 (47.43)
Correctly diagnosed	63 (55.75)	38 (48.71)
Total	113 (100)	78 (100)

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Originals and Papers

Comparative study of plasma and erythrocyte choline esterase level as markers of organophosphurous poisoning

Tapan J. Mehta, Kalpesh Kotariya**, S.P.Merchant*** & Pratik R. Patel*****

Abstract

Poisons are known to mankind since time immemorial. Apart from nayurally occuring substance, the rapid progress in industrial and agricultural segments has added may man-made shemicals that if not handled properly can prove a crucial factor for even mortality. Of the various substances used for suicides in India, Organophosphurous compounds (OPC) form a significant group as observed by many workers.

Since the clinical manifestaions of OPC poisoning are diverse, ranging from mild symptoms to severe symptoms, promp laboratory diagnosis helps considerably in proper management of the case. In the present study an attempt has been made to review the role of plasma and red blood cell (RBC) cholinesterase (Ch E)levels with reference to diagnosis and prognosis OPC poisoning cases.

Key words: *OPC, poisoning, plasma cholinesterase, RBC cholinesterase.*

Review of literaure

Various reports on trends of poisoning India blame the OPC as a major cuprit for death. Sutay and Tirpude[1] reported incidence of OPC as 19.38% out of total 614 case of poisoning . This report is probabely a ltest one (2008) with refence to the trends and previous reports have also reflected almost same pattern.

OPC are extremely used as pesticides for soft bodied insects in agriculture. They are classified to alkyl and aryl groups and exert pharmacological interference with the activity of enzyme acetyl cholinesterase in over activity of acetyl choline.The main effects of such accumulated acetyl choline are muscarinic, nicotinc and on nervous system.[2]

Among the qualitative confirmatory tests, RBC cholinesterases is considered more reliable than plasma cholinesterases. 25% of normal activity is indiactive of exposure, less than 50% is associated with clinical signs and symptoms of poisoning and leser than 80-90% is indicative of severe poisoning. [3]

However, RBC cholinesterase can show false positive results in pernicious anemia, hemoglobinopathies, antimalarial treatment and blood collected in oxalate bulb. Similarly, plasma cholinesterase may also show false positive results in liver cirrhosis, neoplasia, malnutrition, infections and durg therpay with succinylcholine,lidocaine,codeine and morphine.[4]

Material and method

The present study comprises of 50 casesof organophosphurous compound poisoning admitted in Sheth V. S. Geberal Hospiatal, Ahmedabad during 1999 to 2001. General particular, sign, symptoms etc were enetered into a proforma. Serial RBC and plasma cholinesterase estimations were done on day of admission(prior to commencement of treatment), 3rd day, 7th day, 2nd week,4th week and on day of discharge. The blood samples were collected in heparinised bulb and subjected to analysis by colorimetric mehod.[5] Reference range of RBC ChE was 3500 to 5000 IU/L and of plasma ChE was 2900 to 5800 IU/L. The chances of false positivity were ruled out by taking history of common diseases and drugs. The results were tabulated further to deduce significant observations.

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Observations

It is clear from table- 1 that the age group 21-30 is most vulnerable one and incidence is more or less similar in both sex. Lower and lower middle socio economic class was more commoly involved compared to ohter classes.(Table-4). In majority of the case sthe manner was suicidal one (Table-3).

Table -1: Age wise distribution of inpatients of OPC poisoning.

Age in yeaqrs	Number	Percentage
0 to 10	-	-
11 to 20	10	20
21 to30	**31**	**62**
31to 40	8	16
41 to50	1	2
51-and up	-	-
Total	**50**	**100**

Table -2: Sex incidence observed in case of OPC poisoning.

Sex	Number of cases	Percentage
Male	20	58
Female	21	42

Table-4: Motive/Intention of poisoning observed in case of OPC poisoning.

Motive/Intention	Number of patients
Suicidal	**42(84.00%)**
Accidental	6(12.00%)
Occupational	2(4.00%)
Total	50(100.00 %)

Table-5: Socio-economic status of patients

Socio-economic classs	Total	%
Lower	**10**	**20.00%**
Lower middle	**22**	**44.00%**
Upper middle	14	28.00%
Upper	4	8.00%
Total	50	100.00%

Table-6 narrates wide variety of OPCs and it is obvious that dimethoate and fenithorthion form a major chunk iwith reference to tade name.

Table-6: Trade wise distribution of cases

Techanical name of compound (Trade name)	Total
Chlopyriphos	2
Dichlorvos	1
Dimethoate (Rogor)	**8**
Diazion	1
Fenithrothion (Tik-20)	**10**
Fenthion (Baytex)	2
Malathion	5
Methyl Parathion	1
Parathion	1
Phorate	1
Unknown	8
Total	50

It is clear form Table- 7 that muscarinic and neurological manifestations are more frequent than nicotinic ones. Miosis , vomitting and respiratory distress were most constant manifestations in the muscarinic group. All most all the patients showed some neurological manifestations like convulsions, giddiness and altered sensorium. Majority of the patients showed grade II to V category and only a small portion showed grade I severity on admission. (Table-8)

Table- 8 :Clinical severity grading observed in cases of OPC poisoning (at the time of admission)

Clinical severity *	Number	Percentage
Grade I	3	6.00%
Grade II	11	22.00%
Grade III	14	28.00%
Grade IV	13	26.00%
Grade V	9	18.00%

Table-7 :Clinical presentation in cases of OPC

Signs and symptoms	No. Of patients	Percentage
A) Muscarinic		
- Vomiting	40	80%
- Miosis	33	76%
- Excessive secretion	13	36%
- Hypotention (BP<90/60 mmHg)	02	04%
- Bradycardia	08	16%
- Respiratory manifestation (significant crepts, rhonchi, pulmonary eodema)	22	44%
- Cynosis	02	04%
B) Nicotinic		
- Tachycardia	08	16%
- Hypertention	05	10%
- Fasciculation	10	20%
C) CNS manifestation		
- Altered sensorium	26	52%
- Giddiness	38	76%
- Convulsion	15	30%

Table-9:Grading of severity of OPC poisoning according to RBC ChE levels.

Grade	No. of Pt.	Percentage	Average RBC ChE levels					
			1st day	3rd day	7th day	2nd week	4th week	Recovery
Mild	26	52.00%	1420	1850	2400	3000	-	3 ± 1
Moderate	14	28.00%	475	958	1559	2858	2890	5 ± 1
Severe	10	20.00%	280	746	1375	2160	2750	10 ± 2

Table -9 depicts that the range of RBC Ch E level was consistent with grade distribution . Serial values in particular group(after treatment) shows a gradual elevation of the Ch E levels. In the mild presentations group the rise in ChE level was almost reaching normal values in a week and the case of moderate and severe poisoning took about two weeks.

Table-10 indiactes that in the group of mild severity on first day the incidence was little higher (60% as compared to 52% of RBC ChE level). Similarly the percentage in the moderate and severe group reduce as compared to RBC ChE .

Table-10 : Grading of severity of OPC poisoning according to plasma ChE levels.

Grade	No. of Pt.	Percentage	Average Plasma ChE levels					
			1st day	3rd day	7th day	2nd week	4th week	Recovery
Mild	30	60.00%	1478	1560	1500	1950	-	3 ± 1
Moderate	11	22.00%	620	728	650	970	1800	5 ± 1
Severe	9	18.00%	175	220	200	430	776	10 ± 2

Discussion

The so called" Universal phenomena" of common vulnerabilty to younger age group (21-30) stands true for poisoning by OPC. The grading of severity corelates to RBC ChE levels in untreated patients. The base line of 50% activity as accepted by majority of the workers [3,4] with reference to RBC ChE activity, is also reflected in the present study as 52% of patients even with mild symptomatology showed a mean of 1420 IU/L. There is no relation of a particular trade brand as the same pattern was observed in all of them. The RBC Ch E levels were markedly reduced in the moderate and severe poisoning categories. Thus, it is safe to conclude that RBC ChE levels are indiactors(both diagnostic and prognostic) of OPC poisoning in untreated patients.

Goldfrank et al [6] have reported that RBC ChE activity increases following first-order kinetics and it changes by approximately 1% per day and requires 5 to 7 weeks to achieve pre exposure level. In the present study, the rate of increase in the mild , moderate and severe grade groups was quite higher, that is to say within 2 to 4week in surviving victims it increased consistently to baseline levels.

The distribution of plasma Ch E levels in untreated patients showed decrease below baseline in all the three categories. Thus at this juncture it can be considered at par with RBC ChE as diagnostic parameter. Plasma Ch E levels incerases by 25-30% within first 7-10 days after exposure and then show a gradual increase over time .[6] The findings of present study with reference to rise in plasma ChE level show a deviated pattern from above observation. That is to say in all three cateories though there was rise on 3rd day , on 7th day it showed reduction and again at 2nd week it showed rise.(Table-10). Thus , it is difficult to accept plasma Ch E level as a prognostic marker of severity of OPC poisoning.

Conclusion

It is safe to conclude that both RBC ChE and plasma ChE are reliable diagnostic markers with reference to severity of OPC poisoning.

With prescribed treatment, RBC ChE levels show a gradual and steady rise on serial estimations and hence can be safely included as prognostic marker as well.

However, above conclusion does not hold true for plasma ChE, as a prognostic marker, for the reason of rise at 3rd day and decrease on 7th day followed by rise afterwards.

As the sample size of present study is small (n=50),we would prefer multicentric prospective study of larger sample size to deduce concrete conclusions with reference to applicability of RBC Ch E and Plasma ChE as markers (to be precise, prognostic) in OPC poisoning.

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Originals and Papers

Trends of aluminium phosphide poisoning in Bhopal region – A retrospective study of 10 years

Ashok Kumar Jain, B.P.Dubey**, S.P.Garg*** & Manish Nigam*****

Abstract

The study was aimed to generate a baseline data on the epidemiological factors contributing to the incidence and mortality due to Aluminium Phosphide poisoning; so as to highlight the problem which requires planned and concerntrated efforts in dealing with it on a broader horizon. Since prevention is the only logical approach there is an urgent need to take appropriate steps to prevent loss of lives. The analysis of the data revealed that 1455 cases of Aluminium Phosphide poisoning brought to the mortuary of Gandhi Medical College, Bhopal (M.P.) for medico – legal autopsy, during ten years period i.e. January 1998 to December 2007, with highest incidence in 2002. The age group ranged between 10 to 65 years, with maximum incidence between 21 to 30 years and males outnumbering females. The main mode of poisoning was suicidal. The use of poisoning Aluminium phosphide for suicidal purpose has markedly increased during the last decade contributing 7.63 % of the total mortality.

Key words: *Aluminium phosphide, poisoning & insecticides.*

Introduction

Death due to poisoning has been known since time immemorial and poisoning continues to be a major problem all over the world although its type and the associated morbidity and mortality vary from country to country or even place to place in the same country.

Aluminium phosphide, due to its low cost, easy availability and highly toxic nature, is emerging as a common self – poisoning agent in adults. Because of its highly lethal nature, depressed patients with a high risk of suicide in the rest of the world also may soon be tempted to try this agent to end their real or imaginary misery.

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The incidence of the poisoning has been increasing steadily and it is now the commonest poisoning in northern and central regions of the country.

Material and method

The materials for the present study were collected from all the cases showing confirmed Aluminium phosphide poisoning on chemical analysis of viscera in the Forensic Science laboratory which brought for medico – legal autopsy to the Mortuary of Forensic Medicine Department, Gandhi Medical College, Bhopal. (M.P.) for a period of ten years i.e. from January 1998 to December 2007. Individual victim's data was entered as deceased name, age, sex, address, marital status, occupation, type of poison consumed, amount, mode of poisoning and time of consumption. All data has been taken in a prepared proforma and analysis made from the data is analysed in various tables.

Results

The present study reveals that out of a total 19060 medico – legal autopsies conducted during Jan. 1998 to Dec. 2007. Aluminium Phosphide was responsible for 1455 (7.63 %) of

the unnatural deaths in Bhopal region with highest incidence in 2002. (Table - 1).

The poisoning was common in the age range of 21 – 30 years. Males outnumbered the females, the male: female ratio being approximately 2:1 (Table - 2).

The number of victims from the rural population was more than urban. Sixty five percent victims were from rural background and 35 % from urban background. In rural category 27 % males and 13.7 % females were married whereas among urban victims 11.6 % males and 6.1 % females were married. (Table - 3).

Though all modes of poisoning were encountered, suicidal mode was the commonest with maximum number of cases reported during 2002. (Table - 4).

The occupational status of the study was varied including predominantly students 24%, farmers 20%, housewives 32%, labourer 6%, plumber, driver, carpenter, tailor, tea shop owner 16 % and unemployed 2 %. (Table - 5).

Discussion

The retrospective 10 years study showed 1455 cases of Aluminium Phosphide poisoning brought to the mortuary of Forensic Medicine Department, Gandhi Medical College, Bhopal. (M.P.). Aluminium Phosphide is now rapidly becoming a very commonly used agent for self poisoning as revealed by the present study and also by others -Singh et.al [1] & Sepaha et.al. [2]. Aluminium Phosphide is used as a grain preservative particularly for wheat. It is easily available over the counter and is marketed in India as Celphos, Quickphos, Synfume and Phosfume tablets of 3 grams each containing 57 % Aluminium Phosphide. Apart from its easy availability, the other characteristic of Aluminium Phosphide is its highly lethal nature.

The maximum incidence (51.1 %) in the age group of 21 to 30 years noticed in our study are in confirmity with the results of Siwach et al[3]. The reason for this trend may be that this age group is most susceptible associated with frustration, failure at school, unsuccessful in love affairs, conflicts with parents etc.

It was observed in the present study that 65 % victims from rural background and 35 % victims from urban background. It is interesting to note that out of 555 females, 290 were married and 265 were unmarried. Married females outnumbered unmarried female, may be because of social and financial stresses and devil of dowry causes the loss of patience. Married males (44 %) outnumbering unmarried males in the rural population (22 %). The factor responsible for the trend observed in our study, an early marriage in rural community, along with its added familial responsibility social customs and limited resources.

Suicide was the most common mode of poisoning (76.0 %). This endorses our views that the inability to cope up with the demands put forth by the standard set by the materialistic modern society is the main factor responsible for fatal poisoning in this region. Different workers in this field have also found similar results in their studies [3,4].

In the present study majority of the victims included students, farmers and house wives (65 %). There is no such chronological study to compare this growing incidence. However short term studies conducted by various workers also indicate that high incidence. The initial explanation for increasing incidence was suggested to be the easy availability and high lethality. However despite the restriction on sale and distribution of this agent, imposed by authorities has failed to reduce its use as suicidal agent.

Conclusion

This study has brought forth the following issues that there is a need ;

1. For centralized facility to manage poisoning cases.
2. To evolve measures for checking the increasing incidence and mortality due to Aluminium Phosphide poisoning and
3. To investigate the mechanism of action of Aluminium Phosphide with aim to develop an antidote for this killer poison.

The study provides a base line epidemiological data on Aluminium Phosphide poisoning.

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Table -1: Annual Aluminium Phosphide deaths in comparison to total unnatural deaths.

Year	Total Medico-legal Autopsies	Aluminium Phosphide poisoning cases (Percentage)
1998	1998	142 (7.1 %)
1999	1755	140 (7.9 %)
2000	1796	145 (8.0 %)
2001	1850	134 (7.2 %)
2002	1815	160 (8.8 %)
2003	1862	155 (8.3 %)
2004	1790	140 (7.8 %)
2005	1898	149 (7.8 %)
2006	2018	150 (7.4 %)
2007	2278	140 (6.1 %)

Table -2:Age and Sex wise distribution of total Aluminium Phosphide poisoning cases.

Age Group	Male	Female
10 – 20 years	111	54
21 – 30 years	510	234
31 – 40 years	275	150
41 – 50 years	64	31
51 – 60 years	8	12
61 – 70 years	2	4
TOTAL	970	485

Table – 3:Marital status of rural and urban victims.

Gender	Married	Unmarried
Rural Male	400 (27 %)	200 (13.7 %)
Urban Male	170 (11.6 %)	130 (8.9 %)
Rural Female	200 (13.74 %)	145 (9.9 %)
Urban Female	90 (6.1 %)	120 (8.2 %)

Table – 4: Modes of Aluminum Phosphide poisoning encountered.

Year	Suici-dal	Accid.	Homi cidal	Un deter.	Total
1998	110	2	Nil	30	142
1999	110	13	2	15	140
2000	115	15	Nil	15	145
2001	103	10	1	20	134
2002	115	20	Nil	25	160
2003	104	11	2	38	155
2004	105	10	1	24	140
2005	111	19	Nil	19	149
2006	114	16	Nil	20	150
2007	110	10	Nil	20	140

Table – 5:Occupation wise distribution of the Aluminium Phosphide victims.

Occupation	Victims
House wives	25 %
Student	20 %
Farmer	20 %
Unskilled	16 %
Skilled	6 %
Unemployed	13 %

Originals and Papers

Psychiatric assessment of victims of sexual assault: A preliminary study from Burdwan Medical College, Burdwan, West Bengal

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Abstract

Sexual assault on female subject is a global health and human rights issue. The problem has legal as well as health related bearing. Female victims, often young girls are the worst sufferers of crimes like rape, kidnapping and trafficking. These have both short and long term effects on the mental health of the victims. In the present series psychiatric assessment of 42 victims of sexual assault was undertaken to analyze the gravity of the problem, the inherent risk factors and health related outcome of the serious offence . Epidemiological pattern, the strategy for prevention is discussed.

Key words: *Sexual assault, victims, psychiatric morbidity, depression & trauma.*

Introduction

Sexual assault is regarded as a serious health and human rights problem. Sexual assault on women, especially girls, is steadily increasing over the years. It is a global problem contributing towards increase in morbidity in those who are at a higher risk. Females in developing countries like ours have to bear the problem of violence (often physical and sexual) along with other oppressive societal evils. Regarded as a grossly underreported problem, cases of sexual assault reflect the crime scenario. It also indicated the status of women in the society. Morbidity related with sexual assault is an emerging public health problem.

According to W.H.O., about 150 million girls had experienced sexual violence with physical contact in 2002.[1] Besides HIV transmission is fallout of sexual violence, especially on minor girls.[2] Sexual assault has adverse mental and physical health consequences. It has both short and long term effects leading to morbidity in the victims [3]. Recent studies from sub Saharan Africa (2009) have documented association between sexual assault and self-report of feeling depressed among girls less than 18 years of age .[4]

The Indian scenario is even more alarming with reports of sex crimes making headlines almost every day. Rape, kidnapping and immoral trafficking are the commonly recorded crimes Reports of the National crime Records Bureau, New Delhi, substantiate the facts .[5] Studies from Kolkata a decade ago showed that immoral trafficking and child prostitution were the major forms of atrocities on minor girls. Reports from North Bengal Medical College in 2003 have shown that kidnapping as the major crime head.[6] Research from Delhi indicate that 62% of the victims were in the age group of 10-19 years.[7]

The health related effects of sexual violence are manifold. The physical factors notwithstanding, sexual assault has profound adverse effect on the mental condition of the victims. Earlier works have clearly shown the impact of sexual on health status with negative health behavior as the major finding Cases of depression, suicidal feeling, shame, guilt and self blame are noted finding in the victims, Another aspect is the anger, vengeance and the risk-taking behavior that grows in the sufferers. Posttraumatic stress disorder (DSM IV) is a well-documented entity associated with sexual violence.[8]

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It is also documented that there is wide individual variation in response to sexual assault.[9] Often victims present with mixed picture of psychological difficulties. These are also culture specific and have regional characteristics.

Aims And Objectives

The present study was designed to

(1) analyze the problem of sexual assault
(2) assess the socio-demographic determinants of the victims
(3) perform psychiatric assessment of the victims
(4) to study the response of the victims against our cultural backdrop and identify the risk factors
(5) formulate preventive measures and treatment of the victims of sexual violence

Material and method

Reported cases of sexual assault are referred by the police to the Dept. of Forensic Medicine Burdwan Medical College, Burdwan for medical examination to corroborate the allegation of assault made by the victims. The procedure also includes estimation of age from physical, odontological and radiological examination All cases are referred by the Police Stations under the jurisdiction of the Burdwan (Sadar) district Police through the order of the Ld. Court Clinical examination including genital examination is done followed by preservation of biological specimen (Vaginal swab and smear) for further laboratory confirmation.

A prospective study on 50 consecutive cases of alleged sexual assault was undertaken between 1st July 2007 and 30th June 2008. All the cases were examined as per a standard protocol, interviewed on socio-demographic profile and relevant factors using a pre-designed and pre-tested questionnaire. Examination was conducted after obtaining written informed consent from the victims (and their guardians in case of minors). Strict confidentiality was maintained. Medical examination was done in the presence of female attendant. The work was carried out in conformity with research ethics. The subjects were then asked to attend the dept. of Psychiatry of Burdwan Medical college for clinical examination and psychiatric assessment The victims were assessed on the day of the forensic examination (which was preceded by the day of the incident that varied from 3days to 2months). The psychiatric examination was optional and the subjects were free to refuse after the purpose of the study was explained to them in simple terms in vernacular. Psychiatric assessment was done and the cases were diagnosed according to I C D –10. The results were compiled pooled compared and examined at the end of the study. Statistical Analysis: Data was analyzed using statistical software (EpiCalc 2000 and Open Stat) [10,11]. For the metric variables mean Standard Deviation (S.D). Standard error of mean (S E M) was calculated. Descriptive statistics was used along with nonparametric tests. Chi square test was done. P – value of $< .05$ was considered significant.

Observations

Of the 50 cases examined initially at the department of forensic medicine 42 subjects voluntarily attended the Psychiatry O.P.D. showing an overall response rate of 84%. Only these 42 cases were included for the present study.

It was seen that the mean age of the victims of sexual assault was 19.16years with standard error of mean 1.631. Standard deviation 10.571. Median was 16. Minimum age was 3 and maximum age was 50.(Table 1 and 3)

Regarding the distribution on the basis of religion 13 were Muslims by faith and 29 were Hindu. No other denomination was found in the present series. (Table 2). Among the Hindus in the present series 18 were schedule caste (62.06%) and 5(11.9%) belonged to the scheduled Tribe category thirty victims belonged to rural areas by residency while 12 were from municipality.

Distribution on the basis of marital status showed that 8 victims were married of which one was deserted by the husband. 34 cases were unmarried constituting majority (80%) of the present series. 66.61% (n=28) of the victims were below the age of 18 years. It was also seen that 13 (30%) girls were below 14 years.

From the type of crime perpetrated against the female subjects, 19 were victims of rape while 23 (54.7%) were victims of Kidnapping

with/without coerced sexual intercourse. The distribution on some other important parameters in seen from Table 4. It was evident that of the victims of rape, 12 were subjected to violence by known person. Of the victims of kidnapping, 14 were lured away by some one known to them. There were 6 (14%) cases where the incident took place in the house of the victim.

Psychiatric assessment was done which revealed that 23of the 42 victims of sexual assault were within normal limits. 19(45.2%) subjects showed symptoms of disorder of them only one was above the age of 18 years. The said victim was married and had two children.13 of the 19 victims with psychiatric symptoms were below the age of 15 years.

Clinically depression was diagnosed in 12 (28.5%) of the victims in the present series. 5 were diagnosed as somatoform disorders and 2 were with mixed anxiety-depressive disorder. Depression with suicidal thought was observed in 4 victims all of them were below 15 years. Among the 19 cases headache and nausea were the commonest presenting complaints .One gave history of fainting after the incident. One victim who had marital discord after the sexual encounter with the known offender reported sexual difficulty. Of the subjects (n=12) with depression the mean age was 13.97yrs, median 14; S D. 2.23; standard error of mean 0.645 with 95% CI. 12.49-15.337. (table 2)

Discussion

The problem of sexual assault has reached such dimensions that it requires multidisciplinary approach for any effective study .The medico-legal importance notwithstanding; long term effects of sexual violence on the victims are well documented. [1,2,4]

The effects, most often on the minor, is devastating. It leads to increased morbidity and even mortality in the vulnerable age group. [3] Age at sexual intercourse, the societal response and after -care are culture specific. [1]

The present series showed that the mean age of the victims was 19.16 Majority were in the 12-18 years age group. This is comparable and in consonance with other studies [6,7]. It was noted that age was the single most important variable and those in the younger age group are the most vulnerable.

As with other works from India, the present series showed a distinct feature. The presenting sexual assault cases can be clearly distinguished in to two types :

a) Forcible, coerced sex against the will and without consent charged with sec 376 I PC;
b) All cases where the victim was the consenting partner and due to some reason a complaint was lodged to bring to book the alleged partner.

The second group far outnumbered the first. Majority of the cases were consenting partner s in the sexual act and the girl or her family lodged complaint only when the victims were deceived, deserted or refused on the deal of marriage. Similar reports are obtained from earlier works.[8]

Violent sexual attack by stranger leading to serious genital injury was found in only two cases. (4.76%). Medical evidence of sexual inter course was found in all the subjects except one. The study indicates that the majority of the cases were in fact true incidences of inter-personal violence with problem of sexual behavior and attitude. This asserts our contention that the study was contemplated on victims of sexual assault rather than on sex offence .The former being of broader perspective with public health implication.

The other demographic variables are important and comparable with previous works .[6] The weaker section of society is at a far greater risk of sexual violence as evidenced from the findings of the present series of the (n=42) subjects examined, 19 were diagnosed with some psychiatric problem. From among then it was seen that 13 were below the age of 15 years. The association between lower age and psychiatric morbidity in the victims of sexual assault is strongly significant as seen from **Chart 2** (chi square = 13.53; p= 0.00023; d.f = 1).

Depression is a well known and well documented after math of sexual assault.[8] Frequently patients of depression present with history of early sexual trauma. In the present series 12 victims were diagnosed as suffering

from depression. Four of them had suicidal thought. It was seen that those victims who were below 18 years were more prone to suffer from depression. (Chart 1: chi square = 6.72; p= 0.0092; DF = 1) This is statistically significant and also in consonance with other works. [5)]

Suicidal thought was noted in 4 subjects, all below the age of 18 years. There is however no statistically significant association between age below 18 and suicidal thought in the victims of sexual assault (chart 3: chi square = 2.21; p=0.137; df= 1).

Contrary to the observations of earlier workers [9] on the consequence of rape, there was no case of acute stress related disorder. Acute polymorphic psychosis, which is common with cases of sexual violence, was not found in this series. This may explained by the fact that majority of the victims were not subjected to any form of true violence (physical or sexual). The present series also showed no victim with behavioral avoidance, re-experiencing phenomena, numbing, detatchment, amnesia (dissociative experience) or panic disorder.

The following are the shortcoming of the present study:

a) the sample size was 42
b) The time interval between the incident and the examination varied widely in the sample making it difficult to comment on the temporal relationships of sexual assault and the severity of the post traumatic symptoms. Being a preliminary study our series indicates that further broad-based study is necessary and follow-up of the cases essential for greater insight.

Preventive measures include (a) more concerted effort on part of family, community and law enforcing agency to protect young girls who are more vulnerable. (b) Studies should be designed to assess the problem in our society with more sensitivity. It is recommended that (a) there must be proper arrangement and scope of routine assessment and counseling of the young victims of sexual assault. This will reduce the morbidity in the risk group and identify the subjects prone to depression. (b) Mental health assessment need to be incorporated with sexual assault related medico-legal works and research.

Table -1: Age wise distribution of the victims of sexual assault

(N = 42), Sum = 805.000, Mean = 19.167, Variance = 111.752, Std. Dev. = 10.571,Std. Error of Mean = 1.631, 0.950, Confidence Interval for mean: 15.872 to 22.461, Range = 47.000 Minimum = 3.000, Maximum = 50.000, Skewness = 1.336, Std. Error of Skew = 0.365 Kurtosis = 1.637 Std. Error Kurtosis = 0.717, Median = 16.000, Q1 = 14.000, Q3 = 20.000, Interquartile range = 6.000

Table- 2: Age wise distribution of the victims of sexual assault who were diagnosed as case of depression

(N = 12) Sum = 167.000, Mean = 13.917, Variance = 4.992 Std. Dev. = 2.234, Std. Error of Mean = 0.645,0.950, Confidence Interval for mean: 12.497 to 15.337, Range = 8.000 Minimum = 9.000 Maximum = 17.000, Skewness = -0.580, Std. Error of Skew = 0.637, Kurtosis = 1.030 Std. Error Kurtosis = 1.232, Median = 14.000, Q1 = 13.000 ,Q3 = 15.750, Interquartile range = 2.750

Table -3: Frequency analysis of age in year

FROM	UP TO	FREQ.	PCNT	CUM. FREQ.	CUM. PCNT.	%ILE RANK
3.00	13.00	7	0.17	7.00	0.00	0.08
13.00	**23.00**	**26**	**0.62**	**33.00**	**0.79**	**0.48**
23.00	33.00	3	0.07	36.00	0.86	0.82
33.00	43.00	4	0.10	40.00	0.95	0.90
43.00	53.00	2	0.05	42.00	1.00	0.98

Figure- 1:Age wise distribution of victims of sexual assault.

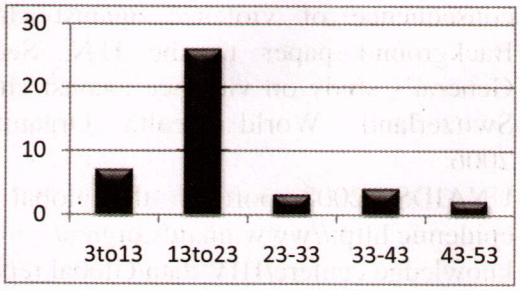


Figure -2: Religion wise distribution of the study sample .

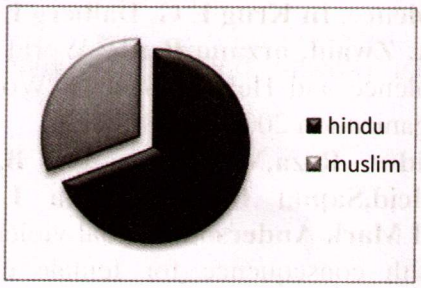


Figure -3: Caste wise distribution.

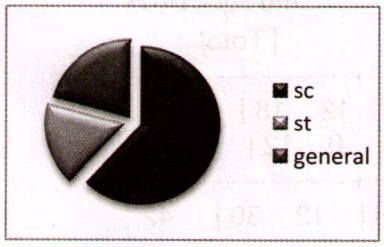
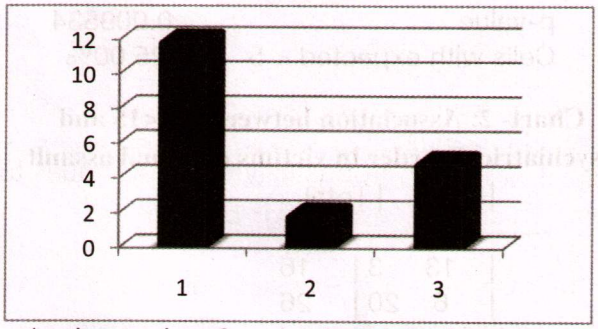


Figure -4: Psychiatric diagnoses in the victims of sexual assault .



1= depression, 2= mixed anxiety-depressive disorder 3 = somatoform disorder

Table -4:Distribution of the sample on different parameters

Parameter		Number of cases	Percentage
Education			
	Illiterate	5	11.9
	Primary	11	26.1
	Secondary	25	59.5
	Higher sec or higher	1	1.4
Residency status			
	Rural	30	71.4
	Urban (municipality)	12	28.5
Accused			
	Known to victim	38	90.4
	Unknown	4	9.52
Place of incident			
	Victim's house	14	33.33
	House of accused	4	9.53
	Unrelated place	20	47.6
	Open /deserted place	4	9.52
Time of incident			
	6am-12noon	9	21.4
	12-6pm	8	19.04
	6pm-12 mid-night	25	59.52
	12 –6am	0	

Chart- 1 : Association between depression in victims and age<18yrs

		Total
	12	18 | 30
	0	12 | 12
Total	12	30 | 42

Chi-square : 6.72
DF : 1
p-value : 0.009534
Cells with expected < 5 : 25.00%

Chart- 2: Association between age<15 and psychiatric disorder in victims of sexual assault

		Total
	13	3 | 16
	6	20 | 26
Total	19	23 | 42

Chi-square: 13.53
DF : 1
p-value : 0.000235
Cells with expected < 5 : 0.00%

Chart – 3: Suicidal thought and age of victim of sexual assault

		Total
	4	24 | 28
	0	14 | 14
Total	4	38 | 42

Chi-square : 2.21
DF : 1
p-value : 0.137072
Cells with expected < 5: 50.00%

Acknowledgment

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Originals and Papers

Identification of sex from tibia by Discriminant Function Analysis

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Abstract

Identification of sex is one of the most important steps while evaluating decomposed bodies or skeletal remains for forensic purposes. Usually availability of long bones of limbs is common. Several standards have been developed using tibia in different population. The purpose of this study was the osteometric assessment of sexual dimorphism in recent population of Varanasi area of eastern UP and the development of discriminant function standards to determine sex from tibia. 58 tibiae (40 male and 18 females) in the age range of 25 years to 58 years were collected in the department of Forensic Medicine, IMS, BHU. Anthropometric measurements of the tibia included maximum length of tibia, proximal breadth, distal breadth, transverse diameter at nutrient foramen, antero-posterior diameter at nutrient foramen, circumference at nutrient foramen and minimum girth of shaft were recorded and analyzed using discriminant function analysis. The average predictive accuracy 82.8 % (87.5 % for males and 72.2% for females).

Key words: *Sex determination, osteometry, tibia, discriminant function analysis.*

Introduction

One of the most important aims in the identification of skeletal remains is to determine the sex of the available skeletal materials. A number of literatures are available making use of different bones of a skeleton for determination of sex. Sex determination from the skeleton relies on the existence of regular and recordable differences in skeletal morphology between males and females. Not worthless mentioning that the skull and pelvis are the most dimorphic bones of the skeleton providing sexing accuracy from 92 % to 98 % respectively[1]. Standards for doing so have been developed in various populations. However in the forensic context where usually separated and fragmented bones are found, there are instances where skull and pelvis are not available. In such cases the importance of postcranial bones increases and it becomes necessary to develop standards for determination of sex from different postcranial bones. Among postcranial bones long bones of limbs have especially been utilized for the purpose of determination of sex. The sexual dimorphism in long bones is generally reflected by the larger size and bigger muscular development of the male as in overall joint size [2]. Although macroscopic sexual differences may be subtle in long bones, discriminant functions including several osteometric parameters allow a quite accurate sexing of several postcranial bones[3]. There are many studies on the metric diagnosis of sex from long bones. Studies on various long bones have included humerus[4, 5, 6], the radius[7, 8], the femur [9, 10, 11]and the tibia.[12, 13, 14] Many of these formulae are based on measurement of bony landmarks that correlate strongly to size differences between males and females, such as femoral or humeral head diameter. They are, however, like all studies in human variation, population specific [11].

As one of the major load-bearing elements in the human body, the tibia exhibits sexual dimorphism. Not only it supports the body's weight, but the proximal end is subjected

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regularly to greater stress than many other joints in the skeleton[15].

Skeletal biologists have also long recognized that each population group requires its own specific standards for accurate determination of sex, and that it is necessary to calculate discriminant functions on samples from different geographical areas. Iscan et al [16] have further shown that, over time, changes can occur in a single population, due to differences in nutrition, disease or population mobility and that specific discriminant functions must be developed to take into account temporal changes within a particular population.[17]

Several studies have been conducted to test the usefulness of tibia in identification of sex worldwide[13, 14,15,16,18]. Human tibiae from Varanasi region for the purpose of identification of sex had been studied about 3 decades ago by Singh et al [18]. They used five parameters and worked out demarking points for this region i. e. eastern part of UP. The present study focuses on evaluating various other parameters of tibia and that with the help of discriminant function analysis with the objectives to see the temporal changes that may have occurred with the passage of time and usefulness of various parameters of tibia in identification of sex.

Material and method

A total number of 58 tibiae (40 male and 18 females) in the age range of 25 years to 68 years were collected in the Department of Forensic Medicine, IMS, BHU, Varanasi, UP. All the measurements were taken from left tibia. Bones with obvious pathology were excluded from the study. The parameters of the tibia were measured as given in and are as follows:

Maximum length: It measures the straight distance from the most projecting point of the inter-condylar eminence to the tip of the medial malleolus.

Proximal epiphyseal breadth: The distance between the most laterally placed points on the tibial and fibular condyle.

Antero-posterior diameter at the level of nutrient foramen: Maximum distance between the most projecting points of the shaft at the level of nutrient foramen in antero-posterior direction.

Transverse diameter at the level of nutrient foramen: Perpendicular to the above in transverse plane of shaft at the same level.

Circumference at the level of nutrient foramen

Distal Breadth: The distance between the most laterally placed points on the tibial malleolus and the lateral surface of the lower end.

Minimum girth of shaft: Minimum circumference of shaft wherever found. Usually found at the distal third of the bone.

All the lengths and breadths were measured using Reid's osteometric board, the diameters were measured with digital sliding caliper and the circumferences were measured using the metal measuring tape. The readings were taken three times in order to minimize the intraobserver errors. The average values were used in the analysis. Discriminant function analysis was used to analyse the data. All the parameters were then analysed using SPSS statistical packages. Stepwise discriminant analysis was performed to obtain the best parameters. Univariate analysis of variance was used to measure the variation within and between the groups. A stepwise discriminant function procedure was applied to all dimensions to determine which variable provided the best discrimination between the sexes. In addition, demarking points were also worked out on the line of Jit and Singh [19]. The demarking points are defined as the mean of the variable of the opposite sex plus (male) or minus (female) three times its standard deviation.

Results

Table- 1 shows the descriptive statistics and results of discriminant function analysis. The F-ratio shows that mean difference between the study variables of the two sexes was statistically significant at 5% and 1% level of significance. In all variables males exceeded females. The wilk's lambda calculates how useful a given variable is in the stepwise analysis and determines the order of variables to enter the function.

Table -2 gives the comparison of mean values, standard deviation and demarking points of Singh & Singh [18] and present work.

Results of stepwise discriminant function analysis are shown in table 3. Of the seven measurements enter into the function, only three parameters were selected. Proximal breadth,

Table -1: Basic statistics and discriminant analysis of each variable.

Parameters	Male		Female		Wilk's lamda	F-ratio*
	Mean	SD	Mean	SD		
Maximum length	367.30	21.75	342.49	18.98	.763	17.417
Transverse diameter at NF	22.48	2.26	19.60	1.84	.714	22.416
AP diameter at NF	31.95	3.51	29.17	2.65	.862	8.962
Circumference at NF	86.61	6.58	78.95	5.90	.758	17.910
Proximal breadth	72.20	4.61	63.80	4.34	.567	42.737
Distal breadth	49.30	3.30	45.69	2.45	.765	17.239
Minimum girth of shaft	68.84	3.87	62.02	4.16	.604	36.753

*all significant at p<0.001 level

Table -2: Demarking points for three parameters of Left Tibia.

Parameters (mm)		Singh & Singh (1975)		Present study	
		Male	Female	Male	Female
Maximum length	Mean	373.0	341.5	367.30	342.49
	SD	19.5	20.9	21.75	18.98
	DP	>404.2	<314.5	>399.43	<302.05
Proximal breadth	Mean	73.3	64.4	72.20	63.80
	SD	2.73	4.10	4.61	4.34
	DP	>76.7	<65	>76.82	<58.37
Distal breadth	Mean	47.7	42.6	49.30	45.69
	SD	6.5	2.6	3.30	2.45
	DP	>50.4	<28.0	>53.04	<39.40

Table- 3 :Results of the stepwise discriminant analysis.

Step variable entered	Wilk's lambda	Equivalent f-ratio	Degrees of freedom
Proximal breadth	.567	42.737	1, 56
Distal breadth	.528	24.548	2, 55
Min girth of shaft	.492	18.579	3, 54

distal breadth and minimum girth of shaft were selected as contributing most to sex determination.

Table -4 shows the coefficients and sectioning points (average of two centroids) of all the functions of both stepwise and when direct analysis was performed in which various combination of variables were obtained in order to use in case of fragmentary tibia. The raw coefficient is used to calculate the discriminant scores for all functions. The standardized coefficients indicate how much a given variable contributes to the overall classification. The correlation between the variables and function is determined by the structure coefficient i.e. it indicates the contribution of each variable to a function. Here, proximal breadth had the highest correlation in three of the functions i. e. in functions 1, 3, 5.

The raw (unstandardized) coefficient is used to calculate the discriminant equation for all functions (Table -4). To calculate the discriminant equation from a function each dimension is multiplied with its coefficient and then all of them

Table- 4: Canonical discriminant function coefficients and sectioning points.

Function and variables	Raw coefficients	Standard coefficients	Structure coefficients	Sectioning points
1. Proximal breadth	.180	.817	.860	-0.409
Distal breadth	-.214	-.654	.546	
Min girth of shaft	.207	.822	.797	
(Constant)	-16.075			
2. AP diameter at NF	.029	.094	.576	-0.280
Transverse Diam at NF	.325	.697	.911	
Circ. at NF	.060	.382	.814	
(Constant)	-12.955			
3. Proximal breadth	.234	1.059	.998	-0.3525
Distal breadth	-.029	-.090	.634	
(Constant)	-14.847			
4. Min girth of shaft	.298	1.181	.988	-0.3305
Distal breadth	-0.81	-.247	.677	
(Constant)	-16.001			
5. Min girth of shaft	.120	.475	.857	-0.3805
Proximal breadth	.141	.641	.925	
(Constant)				
6. Proximal breadth	.221	1.000	1.000	-0.352
(Constant)	-15.353			
7. Distal breadth	.327	1.000	1.000	-0.2235
(Constant)	-15.734			
8. Min girth of shaft	.252	1.000	1.000	-0.3265
	-16.836			

Table- 5: Percentage of correct group membership.

Functions	Total	Males		Female		Average
	N	%	N	%	N	
Proximal breadth+ Distal breadth+ Min girth of shaft	58	87.5	35/40	77.8	14/18	84.5%
AP diameter at NF+ Transverse diam at NF+ Cir, at NF	58	77.5	31/40	77.8	14/18	77.6%
Proximal breadth+ Min girth of shaft	58	85	34/40	77.8	14/18	82.8%
Proximal breadth+ Distal breadth	58	77.5	31/40	88.9	16/18	81.0%
Distal breadth+ Min girth of shaft	58	82.5	33/40	77.8	14/18	81.0%
Proximal breadth	58	75	30/40	88.9	16/18	79.3%
Min girth of shaft	58	80	32/40	77.8	14/18	79.3%
Distal breadth	58	62.5	25/40	66.7	12/18	63.8%

are added together along with the constant. For example, the discriminant equation for function 1 is given as D= 0.180(Proximal breadth)-0.124 (Distal breadth) + 0.207(min girth of shaft).

Now for a given value of these parameters a discriminant score is obtained. If this value is less than the sectioning point, it is classified as female and if it is greater than the sectioning point it is classified as male.

Table- 5 gives the classification results. The classification accuracy ranged from 63.8% to 84.5%. The combination of three parameters as selected by stepwise analysis could provide an average accuracy of 84.5% (male = 87.5% & female = 77.8%). The classification accuracy was higher for males than females.

Discussion

The bones from lower extremity differ in males and females in terms of size and robusticity. This is due to differential growth pattern in males and females and these bones (femur and tibia) have been extensively studied for their utilization in identification of sex. Standards have been developed in different populations to determine sex from tibia. Demarking points have been worked out for tibia using five parameters i.e. weight max length, circumference at mid shaft, proximal breadth and distal breadth about three decades ago on the individuals from Varanasi region[18].

There is a requirement of constantly updating the existing standards in order to account for temporal changes. Moreover discriminant function analysis is also necessary which can make the technique better for determination of sex. The main advantage of discriminant function analysis is that it reduces subjective judgment as well as the level of expertise and experience needed for the determination of sex. For this reason, physical anthropologists have found discriminant function analysis to be an effective quantitative approach to sex determination[16].

The results of present study shows that tibia can be used for determination of sex up to an overall average accuracy of 82.8% using all the seven parameters with male having 87.5% accuracy and female having 72.2%. Stepwise discriminant function selected the three parameters which are proximal breadth, distal breadth and minimum girth of shaft and provided an overall accuracy of 84.5% (male-87.5%, female-77.8%). Similar results were obtained from different populations in other previous studies. Iscan et al [20] found an average prediction accuracy ranging from 80% from minimum girth of shaft to 89% with proximal epiphyseal breadth. The classification accuracy was higher in males 97% than in females 79%. In our results also the overall accuracy for females is lower than male. However, combining two variables proximal breadth and distal breadth, female accuracy increased up to 88.9%. The single best parameter for males was found to be minimum girth of shaft providing an accuracy of 80% and for females proximal epiphyseal breadth was the single best parameter with an accuracy of 88.9%.

In recent study on Japanese population, Sakaue[19] proximal epiphyseal breadth was found to be the highest discriminator with correctly classification percentage of 94%. Also in a study on prehispanic population of Canary islands, Gonza´lez-Reimersa E et al[3] obtained very high average accuracies, ranging from 94.9 to 98.3% with female accuracies of 100%. Transverse diameter at nutrient foramina, proximal breadth and min girth of shaft were the best parameters in their archaeological sample. Slaus[17] found on their archaelogical samples that complete tibiae can be sexed with 92.2% accuracy. Slightly lower accuracies (91.7 and 87.8%) were achieved using a combination of two variables, while functions employing one variable were accurate from 85.6 to 81.7%.

Proximal breadth, in almost all the studies was found to be the best discriminator of sex. As high as 95 % of prediction accuracy was found by Holland (1991).[16] Also in the study by Iscan MY (1984)[13] proximal breadth was found to be most discriminating in both black and white races. In our study also proximal breadth showed best correlation in three of the functions (1, 3 and 5) and could alone provide an average overall accuracy of 79.3% (male-75% and female-88.9%).

When different combinations were tested using the direct approach in discriminant function analysis the three parameters at the level of nutrient foramen i. e. anteroposterior diameter, transverse diameter and the circumference could correctly classified the sexes upto 77.6%. So

combination of these parameters can be used on fragmentary tibia were both of the ends are damaged. One of the noteworthy point in our study is that distal breadth was not proved to be a very good variable for determination of sex with as low accuracy as 63.8% but when combined with other variables in direct approach provide good accuracy (functions 1, 3 & 5).

Table- 2, provides the comparison of demarking points of three parameters, maximum length, proximal breadth and distal breadth of present study with the previous study conducted in the same region by Singh et al [18]. Clearly there is a decrease in the mean values of maximum length of the tibia. However proximal breadth is same for males but a decrease in female mean value. And distal breadth shows increase in mean values for females while decrease in males. Thus no uniform pattern of change was found. And the difference between the mean values of these three parameters was not statistically significant. One of the reasons behind this may be difference in the sample size of the two studies.

In conclusion, the result of this study can reasonably be used for correct determination of sex from the tibia in the inhabitants from the Varanasi region. More studies are required including greater number of samples and parameters. The paper also fulfills the need of developing new standards for identification of sex from tibia.

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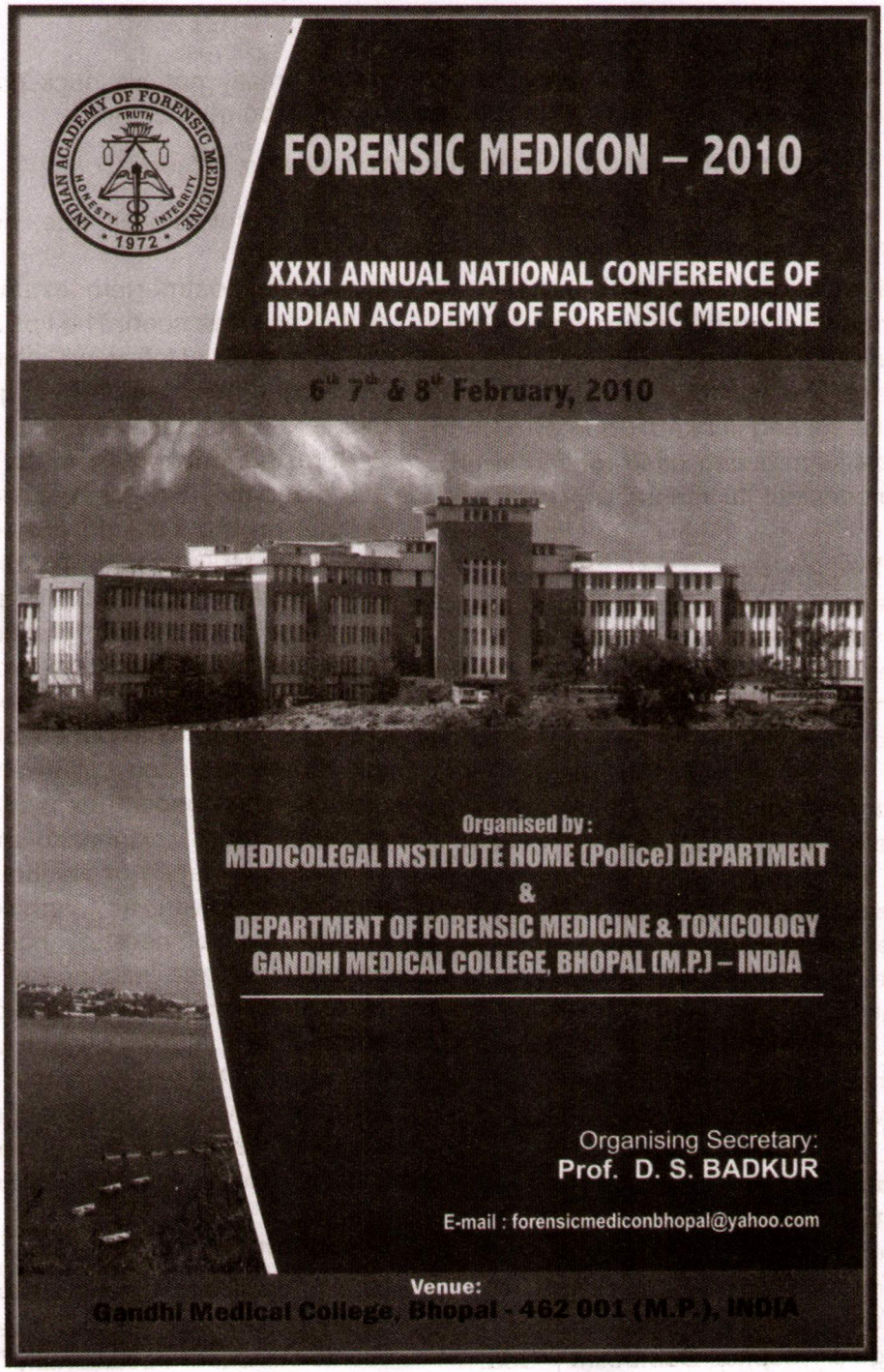
Announcement



Case Report

A rare case of fatal accidental neck compression

E.J. Rodrigues, Mandar P. Kantak**, Siddhartha S. Banaulikar*** & Girish S. Kamat*****

Abstract

A unique case where an intoxicated person accidentally got his neck compressed, wedged between a closed locked door of a room, is presented with elaborated details.

Key words: *Intoxicated, accidental, neck compression, wedge, locked door.*

Introduction

Historically some cases of neck compression have occurred from time to time. However literature search did not reveal any case of death by accidental compression of neck wedged in closed and locked door of a room. Here we report such a rare case for the forensic pathologist to consider its various aspects.

Case history

The dead body of a 28 year old male was brought for postmortem examination to the Forensic Medicine Department, Goa Medical College by the Police. The history revealed that the said person was drunk the previous night. He tried to enter the closed and locked door of his room. The room door was made of old wood which even after it was locked, on pushing its lower aspect left a small gap through which the person pushed his head through, trying to enter his room after he was unable to open the door with a key being in a drunk state. However on releasing the pressure on this partly flexible door, it came back to its original position and trapped the person's neck wedged in between the locked door and the wall of the room. Since he was unable to set himself free, he died in that very position.

On postmortem examination, congestion of the face was seen. The lips and finger nail beds were blue. The following injuries were noted: 1) An oblique abrasion on the right side of the neck, 6x2 cms,4cms below the right mastoid, brownish. 2) Abrasion, oblique along the left lower border of the mandible, 5x2 cms, brownish 3) Abrasion, oblique on the left side of neck, 6x3 cms, 3cms below the left mastoid. 4) Abrasion, oblique, 6x3 cms present on the lateral aspect of right shoulder. On neck dissection, there was extravasation of blood all around the front and lateral aspects and underneath the abrasions. However, the neck bones and cartilages were intact. The stomach cavity emitted the odour of alcohol. The concentration of alcohol was found to be 95 mg% suggesting that the person was under the influence of alcohol. The final cause of death was given as asphyxia as a result of compression of neck by hard blunt object in a person under the influence of alcohol. The scene of death photos were shown by the Police to the doctors. The injuries present over the body were consistently tallying with the compression areas around the neck and right shoulder as seen in the photographs of the scene. The manner of death was concluded as accidental by the Police.

Discussion

Accidental strangulation is unusual [1]. The death of Isadora Duncan is well known and such events still occur occasionally [2].

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It is commonly seen in:

1) Infants in cots were their neck is caught inside bars, restrainers, braces etc or strings attached to toys [3]. Sometimes the child gets entangled in ropes and swings resulting in neck compression [4]. A modern variation is found in the accidental closure of electric windows. A young child leaning out of the window or rooftop of a stationary car may operate the winding motor energizing a relay that completes the closing action without further pressure. Fatal entrapment of neck can occur if the operation is not isolated by the ignition switch or is otherwise protected[5,6].
2) Freak entanglement of scarf in the moving machinery in an adult like the *dupatta* in the moving scooter wheel [1].
3) Industrial accidents involving power driven belting [1].
4) Person under the influence of alcohol, epileptics and imbeciles may be accidentally strangled by a tight scarf, collar or neck tie or if an intoxicated person rests his neck against a bar or other hard object [3].
5) In the uterus where the movement of the foetus causes the umbilicus cord to encircle the neck [3].

If the relations of the body to the surrounding objects and the constricting agent have not been disturbed, cases of accidental strangulation are unlikely to be confused with homicide. If the body has been removed from the place in which it was first discovered, or the ligature has been removed, the presumption of accident can only be established form the description given [3].

Conclusion

1) Accidental strangulation is a rare but not an unrecognized hazard.
2) Detailed description of the scene of death or scene of death photography [as in our case] can go a long way in ruling out homicide in such cases.

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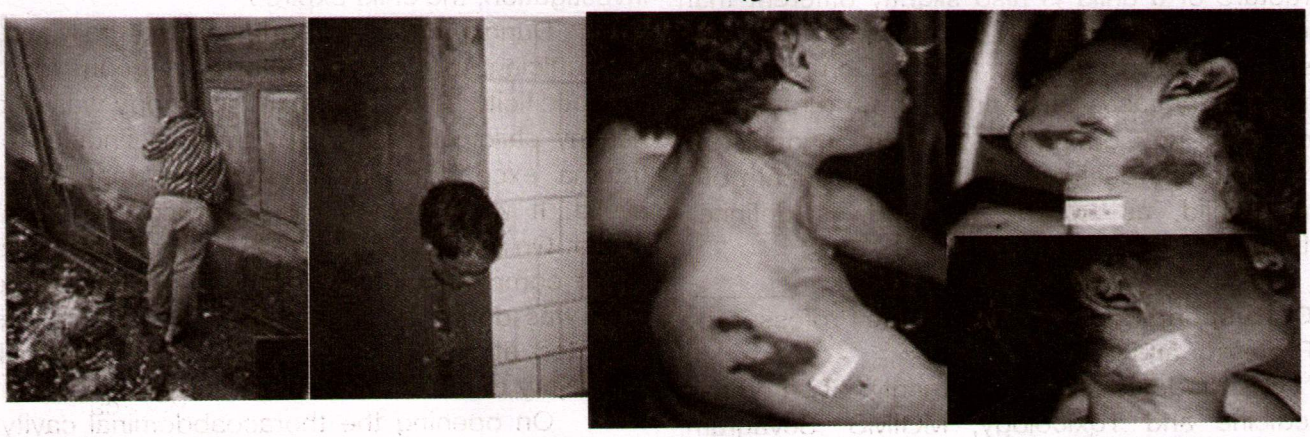

Figures- 1) Scene of death from outside the room. 2) Scene of death from inside the room 3) Injuries for right shoulder 4) Injuries for left neck 5) Injury for right neck.

Case Report

A brake decelerates the life through eye -An uncommon case report

P.N.Murkey ,B.H.Tirpude**, Aloke Mazumder*** & Sandip Bhowate****

Abstract

Head injury is supposed to be the most dangerous type of injury as it causes trauma to brain or its associated structures. A small child of about 3 yrs age expired as was injured by a bicycle at his house. The mentionable part of this injury was the way it took place. The history by the relatives was not sufficient enough to determine the cause of death. However meticulous autopsy could reveal the story. The present paper describes the findings along with a brief discussion on related part of head injury by penetrating injury through eye .

Key words: *Head Injury, penetration, eye.*

Introduction

Head injury is defined by National advisory neurological disease and stroke council,d "It is a morbid state resulting from gross and subtle structural changes in the scalp, skull, or the contents of the skull produced by mechanical forces."The concept of mechanical force restricted to those forces applied extremely to the head. Thus excluding surgical ablations and internally acting forces eg. Increased intracranial pressure resulting from, oedema, hydrocephalus or a mass occupying lesion without antecedent trauma.[1]

A study shows that about 4% cases of head injury are of age group 1-10, and death within 24 hours occurs in 51.33 %.[2] The skull structure of a child is also slightly different than the adult skull. Naturally head injury pattern is also different in children. It has been seen also heads injury cases often are more in rural areas.[2] However no documentation is enough to anticipate any destiny. The manner of death of a small child, as will be narrated, is definitely different.

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Case history

It was a shiny morning of January 2009 when a small boy of 3 yrs age was playing with his elder sister, at their own *angan.* A bicycle was kept as usual by the side of a wall. While playing, the little child unfortunately fell on the cycle and the cycle also was disbalanced. When the parents and the relatives came out hearing the shout of the elder sister, they found the child in unconscious state. They only came to know that the brake of the handle of the cycle injured the child.

The incidence took place at around 9 O'clock and the child was admitted at nearest hospital at 11 a.m. Doctor started resuscitation immediately but before arranging for any investigation, the child expired.

During autopsy, the history naturally was not sufficient to guide the autopsy surgeons to go for specificity before the start. The body was of a healthy child with no major external findings of trauma except a blue hue at the right upper eyelid. It was a contusion involving the whole eyelid. On opening the right eye, the eyeball was found completely intact .As the dissection of the orbit was done, small amount of blood clot was detected at superior aspect of the right eyeball with injury to the extraocular muscles there.

On opening the thoracoabdominal cavity, all the organs were found intact and in normal disposition. Parenchymas of the vital organs were showing a definite pattern of pallor. Testicles

were found, intact, normally placed inside the scrotal sac.

Incision of the scalp was given. The total scalp was normal, intact, showing no external or internal sign of injury. On opening the calvarium, meninges were seen tensed, no extradural haemorrhage at the vertex region. As the meninges were opened, subarachnoid haemorrhage was seen involving the whole right frontal and part of parietal lobe of right hemisphere. The brain was removed with proper precaution and with utter surprise, the inferior aspect of right frontal lobe was found lacerated with a depth of approximately 0.5 cm. The anterior cranial fossa ultimately showed a loss of bone at right orbital plate of frontal which was corresponding the injury at the brain internally and the injury superior to right eyeball externally.

At last it came out to be caused by a hard object that entered the cranial cavity passing in between the right eyelid above and right eyeball below and penetrating the roof of the orbit, causing a laceration to the brain immediately above. Probably it was the brake of the cycle as described by the elder sister of the deceased.

Discussion

It was a case of accident. But the way in which it took place was really sad and surprising. Though the child had to bear severe pain during last two hours of his life, perhaps no adventurous treatment procedures even would have been successful, to change the destiny of the small boy.

Frontal bone is one of the most important unpaired bones of the cranium that forms the anterior cranial fossa protecting mainly the frontal lobe of the brain. According to Rowbotham hypothesis [3] , the application of force to skull bones leading to fracture of skull bone may be

1) Direct application of the force.
2) Indirect application of the force, like transmission of force via spinal column.

In direct application fracture is very common, because skull bone have limited amount of elasticity. Pond fracture is common in infant skull as bones are yet not fully ossified. Anterior cranial fossa fracture occurs mainly due to an impact in front of head.

Injury to brain occurs by mainly two ways. 1. By penetrating force and 2.By application of blunt force. Laceration of brain may take place in both the cases.

Lacerations are gross solutions of continuity of brain tissue and differ from contusion merely in their severity. They are superficial but may be deep enough to open into a ventricle. Deep lacerations are generally associated with fracture of skull. They are found on the undersurface of the frontal lobe and near the tips of temporal lobe. The Pia is torn in laceration which means that ruptured cortical vessels may bleed into subarachnoid space. There may be blood and CSF leak at subdural space. [2]

The response of the skull to impact depends on the position of head on the object that strikes the head. For object larger than 2 sq inch, local skull deformation occurs immediately beneath the point of impact. [4]

In this connection it may also be mentioned that head injury, in general is becoming a social problem, as it has been seen majority of victims belong to young and productive age group in a society.[5]

In India, though mostly youngsters of 20-40 years of age group are sufferer of head injuries, with 40% population of paediatric age group, older children are susceptible to bicycle injury which contributes to around 10% of all head injuries.[4]

Conclusion

Fatal craniocerebral injuries have become very common nowadays. Rapid industrialisation and rapid life is the main cause. Study of such head injury cases will show a definite way of its prevention. And meticulous autopsy has a key role to play here.

This accidental head injury of the above mentioned cursed child may be a separate incidence, but who can say that the study of autopsy findings in such manner will not help the clinicians in some way?

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Case Report

Determined to die?

Ganesh Govekar, Dharmesh Shilajiya**, Chandresh Tailor*** & Bhaumesh M. Rajdev*****

Abstract

A 45 years old male, a happy-go-jolly kind of a person, was found hanging by neck, with a ligature to the branch of a tree, on the outskirts of the village. Beneath the ligature, on the front of the neck, a cut – throat wound with broken anterior wall of trachea was seen, after which, the relatives complained of suspected murder, claiming that he was not a person who will commit suicide. The body was sent to Valsad civil hospital for Post-mortem examination, from where it was referred to Department of Forensic Medicine and Toxicology, Government Medical College and New Civil Hospital, Surat, Gujarat. This case is being presented here for two important reasons – A tripple suicide simulating murder & social issues which compelled a person to resume to as many means as possible, to kill himself.

Key words: *Tripple suicide, hesitation cuts, bereavement, naphtha balls, volitional act.*

Introduction

Suicide i.e. killing one's own self, is the ultimate and extreme step, taken by a person, in the scenario of complete hopelessness [1]. Attempt to suicide classifies a patient into the stage of major depression [2]. Suicidal tendency is generally observed in the people who are going through a major crisis [3], which may be economical, social, familial or medical etc but mostly involving some personal relationships and which deprives the person of the capability to enjoy worldly felicities[2].

The problem is more commonly observed in males as compared to females, globally [3] and in females as compared to males, in India[4], with the rates of suicide increasing with age in males [3]. It is more commonly observed in nuclear families than in joint families, because, whereas in a joint family the number of persons with whom one can interact is more, in nuclear families, it is limited and if the head of a nuclear family is facing a problem, he may not get a proper guidance of his elders [5]. Added to that, if the person is an introvert or if the spouse is not supportive, the situation may become desperate, as might have been in this case.

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Case History

In the first week of October – 2008, a dead body of an identified male, aged about 45 years, was referred to the Dept. of Forensic Medicine and Toxicology, Govt. Medical College, Surat, Gujarat, from a peripheral hospital, which is appox. 70kms away; for Post-mortem examination. The police papers narrated that the body was hanging by neck, with the help of a nylon rope to the branch of an Acacia Arabica tree, on the outskirts of village, when it was first seen by a police official, at around 10:30 am.

As per the history given by the close relatives of the deceased, he was with them till late night (the night before the morning, his body was found) attending some bereavement ceremony of his relative. They also said that the deceased was a very joyful sort of a person, who would not commit suicide at any cost. None of the close relative or family member was aware of

any financial or social crisis, if at all, that he was going through, although it was pointed out that he, along with his wife and children, had supported from his parents and started living in a nearly home only, a few months ago. Apart from this, no significant history, which can give insight into the circumstances of death, was available and hence was the apparently genuine claim of relatives, alleging the murder of the deceased, especially after observing a cut-throat looking wound, beneath the ligature, on the front of neck.

Post mortem findings

A well built body of the deceased, wearing light yellow colored shirt, dark grey pant, and pink underwear, a black belt with metallic buckle and Tulsi-mala around the neck, was lying in the PM room, with a double rope ligature material present around the neck, in situ, with loose sliding knot. Post mortem lividity was present over back and dependant parts of body except pressure areas and it was fixed. Conjunctiva of both eyes are found to be congested together with bluish discoloration of face and nail beds. Tongue was seen to be protruding from mouth. No abnormal discharge was present from mouth, nostrils or ears. On the lower part of front of left forearm, transversally placed incised wound of size 4.5 cm × 0.8 cm × muscle deep, with tailing towards ulnar aspect, was found with several other superficial incised wounds on the both upper and lower sides of this wound. Another major incised wound was a cut throat wound 6 cm in length, 3 cm wide and going up to trachea, but not cutting the anterior wall of trachea, which was probably broken by the pressure of the ligature on the neck, as was implicated by the irregular margins of the broken anterior wall of trachea. This wound was transversely oblique, going slightly downwards from left to right and several other superficial incised wounds i.e. hesitation cuts were present on both the sides of this wound. The ligature was found to be lying in the depth of this wound, on the front of neck, making direct contact with the trachea. The sliding knot, with the knot impression was just below the right angle of mandible. On internal examination, hyoid bone fracture was found to be present on left side, at the junction of body and greater horn with extravasation of blood, along with the comminuted fracture of thyroid cartilage, present in the midline on the upper part, with extravasation of blood. On opening the stomach, 4 naphtha balls with 50 ml of clear fluid, were found to be present. (Confirmed by chemical analysis as well) The cause of death was given to be "Asphyxia due to Hanging".

Discussion

Poisoning, hanging, self-immolation and drowning are the most commonly reported methods of suicide[4, 6 &7]. The subject in discussion here, attempted to kill himself, using 3 of these methods, simultaneously or one after the other in a short succession. Finding of several hesitational cuts on both the sites i.e. wrist and neck, along with partially hanged position and the presence of naphtha balls in the stomach, leaves no queries about the suicidal intentions and deeds of the subject [8].

The incised wound on the front of the neck, removed the barriers of skin and soft tissues for the ligature and allowed it to have its impact directly on the anterior wall of trachea, no sooner the person hanged himself, although partially. This resulted in the breakage of anterior wall of trachea [9] as well as obstruction of airway, leading to asphyxia and death.

The present case was labeled a suicide based on the factors as powers of volitional act and duration of survival after a particular injury [10]. The non compressive mechanical injuries in the present case were located at wrist and neck and that to, were coupled with clear hesitation cuts in neighbouring area. The quantum of these injuries was not independently fatal and even would permit the victim to self inflict some other measure to end his life, if determined for bereavement. Maeda et al[11]reported a more or less similar case , in which it was concluded as suicidal hanging even with deep stab wounds on chest and neck in a male victim aged about 49 years.

Further more the naphthalene balls are a type of aromatic hydrocarbons [12] and volatile in nature and may loose its potency as a toxic substance on prolonged exposure. The toxic effects of napthaline are more of hemolytic type and G6PD deficiecy patients are more vulnerable to it.(which was not the case here). On the basis

of chemical analysis report it was considered a fruitless-attempt of suicide.

Conclusion

1) Adequate scientific examination and interpretation during autopsy enables autopsy surgeon to differentiate suicide from homicide in doubtful cases.
2) A thorough study and knowledge of circumstances of death may also reveal significant clues regarding mode and cause of death and hence a sincere attempt should be made to investigate not only the physical but also the social, economical and psychological parameters, surrounding death.
3) Incorporation well established fact of power of volitional act and duration of survival play an important role in ruling out injury in contribution of death and further to the manner of death.

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Case Report

Death due to electric current

Vikram Palimar, Prateek Rastogi**, G. Pradeep Kumar*** & Shankar M. Bakkannavar*****

Abstract

Proper investigation of injury and death from electrocution requires a high level of suspicion, as examination of the victim will more often prove negative. Electrical marks are produced when electric current encounters resistance from the skin. This resistance is maximum with dry skin and reduces when the body is wet. These classical features though suggestive of electrocution may not be seen in all cases. We report a case of fatal electrocution due to low-voltage current which although had features suggestive of entry wound of electric current, yet was inconclusive on histopathological examination.

Key words: *Electrocution, entry wound, low voltage current, resistance.*

Introduction

Electrocution is a relatively frequent occurrence and carries a risk of high morbidity and mortality. Electrical injuries are mainly accidental in nature and are frequently seen with low-voltage currents.[1-4] The severity of the injury depends on the amount of current flow, voltage, resistance of the body, type of current, current pathway, and duration of contact with an electric source.[5] As per Ohm's law, current is directly proportional to voltage and inversely proportional to resistance of the body. Tissues that have a higher resistance to electricity (skin, bone) tend to sustain more injuries. Whereas, tissues that have low resistance to electricity (nerves and blood vessels) sustain less demonstrable injuries. Apart from these, personal idiosyncracies of the individual also plays a pivotal role in fatality of electrocution. It is said that tolerance is more when person is expecting a shock while it is least when he is caught unaware. We report a case of fatal electrocution due to low-voltage current.

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Case History

As per the information furnished by police, an apparently healthy young male sustained electrocution at a club while dancing on a damp floor near the swimming pool and died on the spot. On external examination a pale circumscribed oval vesicle of size 0.4 x 0.3 cm surrounded by a zone of redness was seen at the tip of right middle finger (Figure 1). Internally, brain and lungs were congested and oedematous. Multiple epicardial haemorrhages were present on the posterior surfaces of heart. Stomach contained 50 ml of frank blood with an abnormal odour and hemorrhagic mucosa. Chemical analysis of the viscera revealed the presence of alcohol in viscera and blood (75.3 mg %). Histopathological examination of the skin lesion was inconclusive. Cause of death was opined as electrocution associated with alcohol consumption.

Discussion

Passage of electric current through human body is capable of producing a range of effects varying from insignificant localized muscular spasm to instantaneous death and from little or no contact burns to extremely severe burns. Skin is the part of body which offers the first and maximum line of resistance to passage of electric current through the body.

Due to this resistance the tissue fluid gets heated up, the skin gets split and a blister is raised. This blister gets collapsed producing raised edges and pale areola (due to arteriolar spasm). [6,7] These electric marks of entry are produced due to conversion of electricity into heat within the tissues and is therefore known as endogenous burn or Joule burn, which if present is diagnostic of electrocution[6]. The exit marks are variable in appearance and sometime just present as disruption of tissue.

These classical features though suggestive of electrocution may not be seen in all cases. They are produced when electric current encounters resistance from the skin. This resistance is maximum with dry skin and reduces when the body is wet. Thus, these entry and exit marks are absent in wet bodies. Something similar probably happened in the present case. The deceased allegedly was dancing barefooted on the wet floor near a swimming pool during a party. Accidentally he touched a source of current with his fingers. As he was touching the ground a circuit was set up and he suffered an electric shock. Dry fingers provided resistance to current there by developing an entry wound; on the other hand wet feet provided an easy exit to current without developing any lesion. Although, histopathological examination was inconclusive, yet negative visceral analysis, eyewitness's account and absence of any other lesion confirmed it to be a case of low voltage electrocution.

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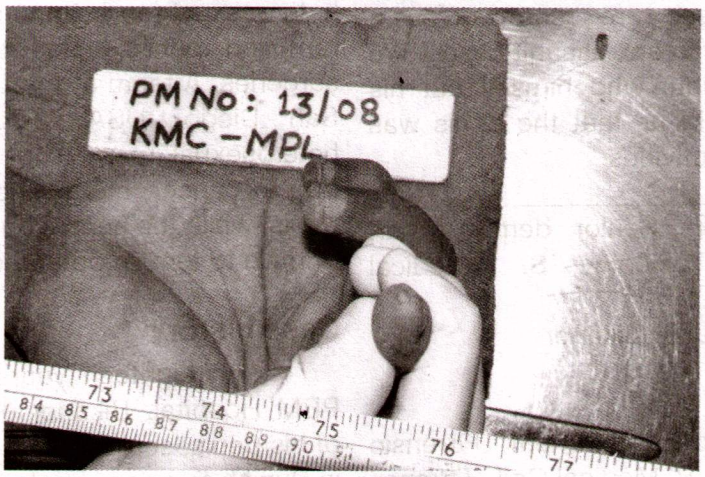
Figure-1: Entry wound on finger produced by electric current



Case Report

Phantom penis

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Abstract

Literally the word 'phantom' means something that you think, exists, but that is not real. The word phantom limb is well known as widely reported in text books & literature as compared to phantom penis. Phantom limb means that amputees still feel their missing limb. Similar are the cases of phantom penis in which penis has been removed but person feels the presence of his missing penis. We present a case of phantom penis in which penis, scrotum and testis were removed by a hijra and the victim still feels they exist.

Key words: *Phantom penis, Hijra.*

Introduction

Removal of penis has been used in past as a means of demonstrating superiority: Armies are sometimes known to sever the penises of their enemies to count the dead, as well as for trophies, although usually the foreskin is taken[1]. Some men have penile amputations known as penectomies for medical reasons. Cancer for example, sometimes necessitates removal of all or part of the penis. Genital surgical procedure for Trans women (transgender or trans-sexual women) under going sex reassignment surgery, do not usually involve the complete removal of penis. These have been incidents in which men have been assaulted, usually by their sexual partners, by having their penises severed [2]. It is well known that penises are removed as a reverenge full act mostly in sex assault cases. We have seen a case (sadhu) who himself cut his penis by a razor. He told us that the penis was disturbing his religious activities.

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Removal of penis, testes and scrotum is a religious ritual among hijras. The operation-referred to by hijras as a nirvan ("rebirth") and carried out by a dai (traditional midwife) involves in removing the penis and scrotum with a knife without anesthesia [3]. We interviewed the organizer of the conference of hijras held in Bikaner in the year 2006. She told us that the hijras are against the removal of penis, testes and scrotum as it is a heinous act. But in present case it has been done by a hijra. In past such people used to be employed as *chokidar* in *Haram/Raniwas.*

The phantom limb may sound more familiar to you. Amputees still feel their missing limb but what about the phantom penis syndrome? It characterizes post-operative heterosexual and trans-sexual men who have removed penises due to cancer or trans-sex surgeries. A team at the University of California in San Diego, USA, discovered that 60% of heterosexual men, who have lost their penises due to cancer, stated they still feel like having a penis, while the sensation persisted in just of 30% of male to female operated transsexual. [4]

Case history

An eighteen years male was admitted in PBM Hospital, Bikaner (Rajasthan) with removal of his penis, scrotum and testes (figure) by a hijra in Punjab five days back. He was working in the

past as a female dancer in marriage parties and came in contact with a hijra. The hijra assured him that he will earn more money if he remains with him. Since last three years he was living with hijra.

The parents of the victim asked him to leave the hijra and get married. The victim informed the alleged hijra that now he would marry and would not remain with them. The alleged hijra became angry and locked the victim in a room. In the night with the help of two other person this alleged hijra placed a cloth smelling of drug on the mouth & nose of the victim. The victim became unconscious and they removed his penis, scrotum and testis. This victim regained consciousness the next day evening and came to know about his condition. He managed to escape from the house after two days.

On the examination, his height was 155cms and weight was 45kg. He was having moderate, black, about 1cm long hairs on his face, condensed black hair about 3cms in axilla and condensed black hair about 3cms in pubic region. He was having 28 permanent teeth. The space for third molar was present. His penis, scrotum and testis were missing and wound was infected.

He also told us that he feels that his penis and scrotum are present and at night in dreams he feels that his missing part are erected and engorged.

Discussion

Literally the word phantom means something that you think exists, but that is not real [5]. The law of projection explains the phantom limb. Cortical stimulation experiment during neurosurgical procedures on conscious patients illustrates this phenomenon. For example, when the cortical receiving area for impulse from left hand is stimulated, the patient reports sensation in the left hand not in the head. Another dramatic example is seen in amputees. Some of these patients may complain, often bitterly of pain and proprioceptive sensation in the absent limb (phantom limb). The ends of the nerves cut at the time of amputation often forms nerve tangles called neuronal. These may discharge spontaneously or when pressure is put on them. The impulses that are generated in nerve fibers that previously came from sense organs in the amputated limbs and the sensation evoked are projected to where the receptors used to be. However, there is evidence that the plasticity in sensory system within the central nervous system is also involved in the phantom limb phenomenon[6].

The another concept in cradle now, but it is based on how we perceive our body as being determine mostly by innate hard-wiring of our brains develop, while we are in he womb. This phantom limb is another misfit between body image and reality reported by amputees who still feel their lost limb, but also by people born limbless. "Phantom limb are purported to be the result of cross wiring in the nerve of the brain responsible for the missing limb and surrounding brain regions." The phantom penis could have a similar cause and patients could still describe the organs shape and length and even the sensation of phantom erection.[4]

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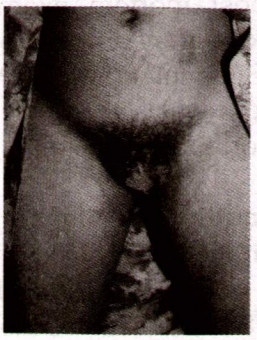

Figure:Clean cut wound with absent penis, scrotum & testes of a victim.

Case Report

A rare case of ligature strangulation with salivary staining

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Key words: *Hanging, strangulation, salivary staining & dribbling of saliva.*

Introduction

Death by hanging is due compression of the neck as a result of suspension of the body by means of a ligature in such a manner that the weight of the body or a part of the body weight acts as an endogenous constricting force. Strangulation is another entity representing death by compression of the neck from the exterior by ligature, manual strangulation, sticks, foot, some solid substances, etc. Differentiation is very important because hanging is presumptive of suicide whereas strangulation is mostly homicidal. Dribbling of saliva from the angle of mouth is often found opposite to the site of knot in hanging. This may be due to stimulation of salivary glands or congestive hypoxia. Evidence of dried marks of dribbling of saliva is suggestive of antemortem hanging, but its absence alone will not suggest that the body was suspended after death. Such dribbling is very rare in ligature strangulation. This is a rare case of ligature strangulation with salivary staining.

Case history

A 35 year old married female was brought to the Accidental Emergency of SMS Hospital, Jaipur in gasping state and was declared dead within 15 minutes. The dead body of deceased was shifted to mortuary. The police was informed immediately, on their arrival, inquest was conducted and post mortem examination was conducted the next day by a board of doctors on the requisition of Superintendent of Police, Jaipur City(East). Subject was averagely built and nourished; rigor mortis was present all over the body. Post mortem staining was present over. back, face was suffused, tongue was present inside mouth. Subconjunctival haemorrhage was present, nails and lips were blue in colour. Salivary staining almost horizontal was present over right side face extending from right side angle of mouth to right ear lobule

External examination

External examination showed injuries as follows,

- Faint pressure abrasion (ligature mark) over front and sides of neck at the thyroid cartilage level of size 29.5 cm* 1.5cm to 1cm in width, situated over thyroid cartilage and 5 cm below right ear lobule and 4.5cm below left ear lobule. Skin over ligature mark was soft and red and the mark was almost horizontal. On dissection, of neck structures, there was extravasation of blood in neck muscles over left side neck under ligature mark over an area of about 2.5cm*1 cm red colour. Hyoid bone and thyroid cartilage were intact.
- Abrasion with surrounding bruise was present just below left side of chin of size 1.5 cm * 0.8 cm, red colour.
- Bruise over front of left breast if size 2.5* 1cm red colour.
- Abrasion present over back of right elbow 5cm* 1cm red colour.
- Abrasion scratch type present over anterolateral aspect of left ankle joint of size varies from 0.5 cm * 0.5 cm to 1* 0.5 cm red in colour, four in number.
- Four scratch abrasions present over front of left ankle joint size varying from 0.5 * 0.5 cm to 1* 0.5 cm red in colour.
- Abrasion with surrounding Bruise centre of lower lip 0.5 * 0.5 cm red in colour.

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Internal examination

Larynx and trachea were congested. All viscera were congested. Brain showed petechial hemorrhages at places, stomach contained about 100 ml of brownish fluid.

Viscera were preserved for chemical analysis of common poisons and histopathological analysis. Swabs from salivary stains were preserved for detection fo salivary components. Vulvovaginal swabs were preserved. Opinion regarding cause of death was given as "asphyxia" as a result of pressure over neck structures by ligature – soft material, which is sufficient to cause death in ordinary course of nature. Post mortem findings were consistent with strangulation. The viscera sent to Forensic State Laboratory gave negative results for common poisons.

Discussion

In violent asphyxial deaths, the process of respiration i.e, the exchange of air between the atmosphere and the lungs beds is prevented by some violent and mechanical means. Violent asphyxia is of four types, hanging, strangulations, drowning and suffocation. Hanging is a form of violent asphyxial death due to the constriction of the air passage at the neck, as a result of suspension of the body by a ligature in the form of a noose, applied in such a manner, when weight of the body or other part of the body, acts as a constricting force. Strangulation is a type of violent asphyxial death caused by constriction of air passage at the neck by any means other than suspension of the body. In hanging, saliva will be found to trickle down the lower angle of the mouth, down the chin vertically on the chest in straight lines, opposite to the side of the knot in the ligature. The secretion of saliva is a vital act indicative of suspension during life, for the secretion ceases after the cessation of circulation. Salivation may not necessarily be always due to stimulation or pressure on the salivary glands by the ligature; it can be essentially be due to asphyxia and congestive hypoxia. Salivation may not occur, when death is due to vagal inhibition. Evidence of salivation should always be looked for testing the presence of mucin in it by turning blue if treated with Iodine, during autopsy examination. Evidence of dried marks of dribbling of saliva from one of the angles of mouth, though is he vital sign of antemortem hanging, but its absence alone will not suggest that the body was suspended after death.

In hanging, the ligature mark is oblique, does not completely encircle the neck, and is usually seen high up in the neck between the chin and larynx. Whereas in strangulation by ligature, it is transverse, completely encircling the neck, below the thyroid cartilage. Hence, in strangulation, the submandibular glands are not compressed and direct stimulation also avoided. This probably accounts for the rarity of dribbling of saliva in ligature strangulation. In hanging, salivary dribbling is usually vertical, whereas in the present case, it was almost horizontal; running from the right side angle of mouth, to the right ear lobule. This could be attributed to congestive hypoxia, but pressure over the glands during the course of struggle could also be a possibility. An abrasion with surrounding bruise below chin which was observed during examination could be evidence, but pressure without external injuries is not uncommon.

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Case Report

An important complication of polytrauma: Fatal gastrointestinal bleed due to duodenal ulcers

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Abstract

Acute gastritis and gastric erosions following polytrauma is a common occurrence in surgical practice. The mechanism of such ulceration is not clear, but various theories have been proposed. Perforation of the peptic ulcer is one of the most common causes of death in these cases. Two such cases are reported in this paper. The doctor conducting autopsy should be aware of such instances so that appropriate opinion regarding the cause of death can be given and the manner of death is not misinterpreted.

Key words: *Polytrauma, hematemesis, gastrointestinal bleeding, stress ulcers, duodenal ulcers, peptic perforation.*

Introduction

A peptic ulcer is defined as a disruption of the mucosal integrity of >5mm size, with depth up to the sub mucosa; of the stomach and/or the duodenum, leading to a local defect or excavation of the same due to active inflammation.[1] It can occur wherever mucosa is bathed by gastric secretion. This includes the stomach, duodenum, lower third of esophagus, margin of a gastrojejunostomy, and a Meckel's diverticulum with ectopic gastric mucosa.[2]

Stress ulcerations of the stomach accompanied by massive hemorrhage are common in cases of trauma, sepsis, shock, massive burns, traumatic/surgical injury to the central nervous system and prolonged use of steroids [3] and NSAIDs.[4] These may either occur in the stomach or in the duodenum. When in the duodenum, they usually are present in the first part (95%). They are oval to circular in shape, appear to be shallow and punched out and may vary in size from 1 – 2 mm to 1 cm in diameter, with sharply demarcated margins.[5] Ulcers situated in the anterior wall commonly perforate and the only presenting symptom may be an episode of hematemesis.[6]

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Case History

Case- 1:

An 80-year-old man was admitted to the Government Medical College & Hospital, Chandigarh (GMCH) with complaints of hematemesis following head injury that had resulted from a scuffle. History given by the police was that the person was assaulted by a few others outside his house, following which he was taken to a Civil Hospital, where he was treated as a case of head injury. There was no previous history of duodenal/gastric ulcer. Non-contrast enhanced CT scan of the head was reported to be normal. He was discharged after about 2 weeks. Four days later, he had an episode of vomiting of blood for which he was admitted to a private hospital, from where he was referred to GMCH. At GMCH, upper GI endoscopy was done which showed presence of an ulcer in D1 area (first part of duodenum). Blood transfusion was done and the person was managed conservatively. However, he died while under treatment at GMCH after 3 days stay in the hospital.

Findings on postmortem examination

Postmortem examination was done on the same day. Clotted blood was found at the anal opening and the peri-anal area. A 4 × 0.3 cm healing wound, with black scab, was present over the left parietal region, 13 cm above the mastoid process. A fracture line, 7.5 cm long, was present underneath the injury.

Peritoneal cavity showed presence of 1500 ml (approx) of blood. Lesser sac of the stomach contained about 1000 ml of fluid and clotted blood. An ulcer of 1 cm diameter was present on the posterior wall of the first part of duodenum. All organs were pale.

Death was opined to have been caused due to hemorrhage and shock as a result of perforated duodenal ulcer.

Case- 2:

A 45-year-old lady was hit by a car while crossing the road and had been hospitalized with poly-trauma in GMCH. She was operated after one week for compound fracture of the left femur. Two days later she had a bout of massive hematemesis followed by cardiac arrest. She was resuscitated and put on ventilator and inotropic support. She again had cardiac arrest on the next day and could not be revived. Postmortem examination was done on the next morning. There was a positive history of duodenal ulcer for which the lady had been taking treatment.

Findings on postmortem examination

Periorbital hematoma was present in both the eyes. A 20 × 5 cm purplish red contusion was present on the front of left forearm and hand, with fracture of the underlying radius and ulna; surgically sutured wounds were present over the right side of forehead, inner end of the right eyebrow, front of the left thigh with an surgically reduced fracture of the shaft of the left femur, outer aspect of the upper part of left thigh (site of surgical exposure for femur reaming and nailing) and on the inner aspect of the lower part of the left knee.

Internally, the dura was found to be intact, with subarachnoid hemorrhage over the parieto-occipital areas of both sides of the cerebrum. Right 3rd to 6th ribs were found fractured with hemorrhage into the surrounding tissues. The right pleural cavity contained about 1000 ml of reddish clear fluid, and the right lung was found collapsed with a laceration present in its upper lobe in its posterior aspect. Peritoneal cavity contained about 2000 ml of fluid and clotted blood. Blood clots were also present in the lesser sac and in the right side of the peritoneum, adjacent to the liver. The stomach contained about 50 ml of frank blood. The walls of the stomach were normal but the posterior wall of the first part of the duodenum showed a circular perforated duodenal ulcer of 1.5 cm diameter. Frank blood was present in the lumen of the small and large intestine. Liver showed a laceration of 6 × 0.5 cm in the right lobe; hemorrhage was present in the suprarenal glands. All other organs were pale.

Death in this case was opined to have occurred as a result of shock and hemorrhage consequent upon complications of the injuries.

Discussion

One – third of adult patients who have been seriously injured may die as a result of progressive respiratory failure, significant gastrointestinal bleed or myocardial bleed inspite of absence of direct injury to these organs. Stress ulceration of the stomach and duodenum, with massive hemorrhage is a frequent companion of trauma. Virtually all patients who have suffered severe trauma will develop stress ulcers. Characteristic pain pattern of the chronic ulcers is absent in these cases, probably because these are superficial. The onset of bleeding is usually several days after the trauma event.

Acute gastric erosions and hemorrhagic gastritis (stress ulcers), secondary to severe stressful conditions like head injury, burns, trauma, shock, etc, are common. Patients with spinal cord injury are also known to have a high rate of incidence of gastrointestinal ulcers which may be of the stress type.[7] The underlying mechanism is unknown, but may be due to an alteration in the mucosal blood flow or unopposed vagal action.[8,9] Hypersecretion of acid in these patients is not a probable determinant cause,[10] however, retention of the gastric tubes in the stomach during the last days of life may play a significant role [5] along with the breakdown of the protective barriers of the

stomach.[1] Foci of pallor and hyperemia appear in the proximal part of the body of the stomach within 24 hours of the stress, followed by petechiae and shallow erosions, which spread to the entire body except the antrum. Perforation of the peptic ulcer is the most common cause of death in these cases.[11] If the ulcer is in the posterior wall of the duodenum, massive haemorrhage may occur due to erosion of the gastroduodenal artery.[5] Treatment for the stress ulcerations varies from iced water gastric lavage to use of vasoconstrictor agents locally. Improvement in the general management of the ICU patients, maintenance of the gastric P_H>3.5 with continuous H_2 blockers or liquid antacids every 2 – 3 hours, Sucralate Slurry - 1 gm every 4 -6 hours, are the variable options available. If bleeding still persists, intra-arterial vasopressin or embolisation may be considered, failing which surgical intervention remains the only option, which in itself may prove fatal in these cases.[1] The prognosis, however, is poor irrespective of any kind of treatment.

The present cases, though not new, present the findings seen in a case of post-traumatic stress related mucosal injury of the gastro-intestinal tract. Mortality in such cases greatly depend on the quality of the intensive care available to the patients at risk. In the unfortunate event of the death of the patient, as in the cases described above, meticulous autopsy after going through the antemortem treatment records helps in coming to a conclusion regarding the cause of death in such cases which otherwise would have been misleading. Also the manner of death could be misinterpreted as 'natural,' contrary to the facts of the case (homicide and accident, respectively in the present cases).

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Review Article

An introduction to stem cells and debate surrounding them

B. D. Gupta

Abstract

Stem cells and their types are defined. From sourcing of oocytes for stem cells ethical disputes begins which remains continuous throughout. There are two schools of thoughts; one, pro choicers (those who favour stem cell research), second, pro lifers (those who think other wise). There are various areas of ethical dispute in the field of stem cell research like, consent for oocyte donation, use of stem cells, preservation of stem cell lines, destruction of ova, embryo and so on. At the same time, when does life begin? Does the primitive live organism attain personhood? Stem cell therapy is useful in some of the diseases. But the benefits versus risks must be carefully assessed. All said and done, stem cell research is still in the form of research and its therapy form would take few decades more, but there is a creation of media of hype around stem cell research as if the stem cell therapy is round the corner.

Key words: *Stem cells, research, ethics, applications and limitations, hype.*

Introduction

Stem cell research is an important new domain of biomedical research that has the potential to offer viable therapeutic options for debilitating disease and injury. However, stem cell research has proved something of a political, ethical, social and legal minefield, creating challenges for regulatory bodies, policy makers and scientists as they traverse their way through a tangled web of regulations and moral proselytising.[1]

Definition

Stem cell: One of the human body's master cells, with the ability to grow into any one of the body's more than 200 cell types.[2]

All stem cells are unspecialized (undifferentiated) cells that are characteristically of the same family type (lineage).[2]

Stem cells are cells that have the potential both for self-renewal and to differentiate into specialized cell types. Stem cells found in the early mammalian embryo, at around 5-7 days after fertilisation, are able to give rise to all the different cell types of the organism.[1]

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Types of stem cells (classification is based on source of the stem cells)

Adult stem cells Embryonic stem cells, and Amniotic stem cells.

There is another classification of stem cells based on their capacity of divisibility and differentiation- Totipotent Pluripotent , and Multipotent .

A fertilized egg is considered totipotent, meaning that its potential is total; it gives rise to all the different types of cells in the body.[3]

Pluripotent stem cells can give rise to any type of cell in the body except those needed to develop a fetus.[3]

Stem cells that can give rise to a small number of different cell types are generally called multipotent.

The adult stem cells are present in and drawn from bone marrow, brain and gut and other tissues.

Amniotic or placental stem cells

The embryo-like stem cells could be obtained from the placenta.

They are called "amniotic epithelial cells" after the amnion -- the outer membrane of the placenta's amniotic sac.

They were coaxed to differentiate] into several different tissue types, including liver cells,

neurons, heart cells, pancreatic cells with the potential to produce insulin, and glial cells which form part of the nervous system.

The adult types of stem cells have a capacity to differentiate into a limited number of different cell types, such as blood cells, muscles and neurons. That way they are multipotent rather than pluripotent.[4]

What are human embryonic stem cells?

Embryonic stem cells are a primitive type of cell that can be coaxed into developing into all of the 220 types of cells found in the human body (e.g. blood cells, heart cells, brain cells, nerve cells, etc). They are derived from human embryos in a process that causes the death of the embryos.

"In the standard method of harvesting stem cells, researchers wait five days or so after fertilization until the embryo has become a ball of up to 150 [undifferentiated] cells. They obtain stem cells from the interior of the ball, which destroys the embryo"[5]

The transformation of discarded embryos into stem cells has been referred to by one scientist as the process of turning 'garbage into gold'.[6]

Sourcing

The creation of embryos for research or (eventually) therapy, either by fertilization of an egg by sperm or by cell nuclear replacement requires a supply of oocytes. Oocyte donation entails hyper stimulation of the ovaries by hormone injection, followed by surgery to harvest the oocytes. It therefore carries significant medical risk for the donor.[1]

The dispute begins

Legally consent is required for ovum or and embryo donation.

Where consent is sought for the use of embryos in stem cell research, donors must be given 'thorough and appropriate information, including that any stem cell lines may continue indefinitely and may be used in different research projects'.[1]

Securing the trust of members of the public who are the source of the precursor tissue for the stem cell lines used in stem cell therapy may be a challenging task.[1]

In addition, a number of issues have been discussed here that arise in other fields of bio law. These include highly variable standards of consent nationally and internationally, doubts about the appropriateness of holding out financial rewards or incentives for tissue donation, insufficient attention to methods of enforcement and compliance, difficulties with sharing information without unduly interfering with individuals' privacy, and methods of compensating patients for defects with experimental treatments.[1]

Privacy of donor's information

Individuals may be concerned that information arising from their donation is kept private. Medical testing is part of the process of donating tissue for stem cell therapy in order to assess the safety and quality of the tissue before it is used for transplantation. This involves screening for certain infectious diseases and genetic traits, and blood typing, and may produce sensitive information that must be kept confidential.[1]

How are stem cells derived?

"Cloning" is defined as beginning when an embryo is implanted in a woman's womb "for the purpose of initiating a pregnancy that could result in the creation of a human fetus or the birth of a human being." [Reproductive cloning]

There is another definition also- cloning" is defined as beginning when an embryo is created with DNA that matches that of an existing person.[therapeutic purpose.[1]

Any stem cells or cell types derived from them, that are transplanted into an unrelated recipient run the risk of causing a serious immune reaction and may be rejected.

The process of cell nuclear replacement, or 'therapeutic cloning', has been suggested as a way of avoiding this problem by making it possible to derive ES cells that are genetically (and therefore immunologically) identical to the recipient.

Cell nuclear replacement involves injecting the nucleus from a normal body cell into an oocyte (egg) from which the nucleus has been

removed, creating a construct that can be induced to behave as if it were a fertilised egg, dividing and developing into an embryo. This is the same process that was used to create the first cloned mammal, Dolly the sheep.

The difference is that in 'therapeutic cloning' the aim is to use the cloned embryo to derive ES cells, not to implant it in a woman's uterus with the purpose of producing a cloned human being.[1]

Which stem cells are better?

Pluripotent stem cells have great potential but they face formidable technical and ethical challenges.

First, scientists must learn how to control their development into all the different types of cells in the body. Second, the cells now available for research are likely to be rejected by a patient's immune system.

Another serious consideration is that the idea of using stem cells from human embryos or human fetal tissue troubles many people on ethical grounds.[3] Until recently, there was little evidence that multipotent adult stem cells could change course and provide the flexibility that researchers need in order to address all the medical diseases and disorders they would like to.

New findings in animals, however, suggest that even after a stem cell has begun to specialize, it may be more flexible than previously thought.

There are currently several limitations to using adult stem cells. Although many different kinds of multipotent stem cells have been identified, adult stem cells that could give rise to all cell and tissue types have not yet been found.

Adult stem cells are often present in only minute quantities and can therefore be difficult to isolate and purify. [3]

There is also evidence that they may not have the same capacity to multiply as embryonic stem cells do.

Finally, adult stem cells may contain more DNA abnormalities—caused by sunlight, toxins, and errors in making more DNA copies during the course of a lifetime. These potential weaknesses might limit the usefulness of adult stem cells.[3]

Potential applications of stem cell therapy

Stem cells have potential in many different areas of health and medical research.

To start with, studying stem cells will help us to understand how they transform into the dazzling array of specialized cells that make us what we are.

Some of the most serious medical conditions, such as cancer and birth defects, are due to problems that occur somewhere in this process. A better understanding of normal cell development will allow us to understand and perhaps correct the errors that cause these medical conditions. [3]

Once a stem cell line is established from a cell in the body, it is essentially immortal, no matter how it was derived. That is, the researcher using the line will not have to go through the rigorous procedure necessary to isolate stem cells again.

Once established, a cell line can be grown in the laboratory indefinitely and cells may be frozen for storage or distribution to other researchers.

Stem cell lines grown in the lab provide scientists with the opportunity to "engineer" them for use in transplantation or treatment of diseases.

For example, before scientists can use any type of tissue, organ, or cell for transplantation, they must overcome attempts by a patient's immune system to reject the transplant.

In the future, scientists may be able to modify human stem cell lines in the laboratory by using gene therapy or other techniques to overcome this immune rejection. Scientists might also be able to replace damaged genes or add new genes to stem cells in order to give them characteristics that can ultimately treat diseases.

Another potential application of stem cells is making cells and tissues for medical therapies.

Today, donated organs and tissues are often used to replace those that are diseased or destroyed.

Unfortunately, the number of people needing a transplant far exceeds the number of organs available for transplantation.

Pluripotent stem cells offer the possibility of a renewable source of replacement cells and tissues to treat a myriad of diseases, conditions, and disabilities including Parkinson's and Alzheimer's diseases, spinal cord injury, stroke, burns, heart disease, diabetes, osteoarthritis and rheumatoid arthritis.[3]

However, at present Adult stem cells such as blood-forming stem cells in bone marrow (called hematopoietic stem cells, or HSCs) are currently the only type of stem cell commonly used to treat human diseases.

Doctors have been transferring HSCs in bone marrow transplants for over 40 years. More advanced techniques of collecting, or "harvesting", HSCs are now used in order to treat leukemia, lymphoma and several inherited blood disorders.[3]

Bigger ethical issues

Human life can be defined as any living entity that contains human DNA. Thus, each adult or child skin cell, spermatozoa, a woman's ovum, a just-fertilized egg, a pre-embryo which consists of a group of identical stem cells, an embryo which consists of differentiated cells, a fetus, and a newborn are all forms of human life. But human life is not necessarily considered to be a human person by everyone.

Most pro-choicers believe that the transition from human life to human personhood is achieved part way through pregnancy, or perhaps at birth.[7]

The moral status of the embryo

In order to derive ES cells, the embryo must be destroyed at around 5-7 days after fertilization (the blastocyst stage) by harvesting the cells from the part of the embryo called the inner cell mass. The question is whether it is right to do this. At one end of the spectrum of views on this issue is the belief that the embryo, from the moment of conception, is created by God and is a person in its own right with the same moral status as an adult human. Therefore, it is wrong to destroy embryos of any gestational age, for any purpose.

This absolutist view is not shared by all those with religious beliefs.[1]

An alternative stance is that the embryo acquires full personhood, and the moral rights that go with this status, by gradual stages during the process of development between conception and birth. It follows that it might be ethically acceptable, under certain circumstances, to use embryos for research. In the debate about embryo research, the formation of the primitive streak has been suggested as a key cut-off point.This event, the appearance of a surface thickening that marks the first visible organization of the embryo, occurs at around 14 days after fertilization. The term 'pre-embryo' was introduced in 1985 to describe the early embryo up to this point. [1]

They have no brain, central nervous system, mouth, heart, lungs, or other internal organs. They have no organs to see, hear, touch, taste; they lack a body, head, arms, legs; they have no self awareness, memory, thought processes, or consciousness. They are smaller than a pin-prick. They consist of a number of identical, undifferentiated cells which contain human DNA.A pre-embryo is respected because of its future potential, but is not assigned the status of a human person at that stage.

Some view it as a collection of live, human cells containing human DNA -- much like a microscopic piece of adult skin.

People are not usually concerned about the loss human DNA posed by hundreds of thousands of spermatozoa in a single male ejaculation, or the rejection by the woman's body of an unfertilized egg approximately every four weeks. [8]

The existence of hundreds of thousands of frozen pre-embryos in fertility clinics is thus of little concern to them -- at least in comparison to other moral issues such as sexism, racism, homophobia, child abuse, etc. [8]

An ova, spermatozoon, pre-embryo, embryo, fetus, and newborn are all forms of human life.They are clearly alive and contain human DNA. Everyone agrees that a newborn baby is not only human life but a human person. Pro-lifers and pro-choicers differ in their belief of when human life becomes a human person, and thus should have its life protected. [8]

The fourth criteria may appear strange. But it can reproduce itself through twinning during the first 14 days after conception. That is

how mono-zygotic (identical) twins develop. [8]

The Value of Embryo

There are different views about this moral status. The leading views speculate that embryos have the status of;

- persons, or
- potential persons, or
- divine creations, or
- subjects of moral 'harm', or
- the beginnings of human life, with intrinsic value, or
- organic material with no more moral standing than other body parts.[8]

Conflicting beliefs about when personhood starts:

- Detailed information on various beliefs about personhood:
- It happens at conception - the most common pro-life position
- It happens when blood first appears - a new interpretation based on the Bible
- It happens later in pregnancy - the most common pro-choice position
- It happens at 14 or 22 weeks gestation -
- It happens during childbirth - the traditional Jewish position.1

Alternative stem cells

"The most basic objection to embryonic stem cell research is the fact that embryos are deprived of any further potential to develop into a complete human being.

Lanza suggested that when fertility clinics perform human PGD to detect genetic diseases, they could:

- Remove the single cell as usual.
- Allow it to divide into two cells.
- Use one of the cells to test for genetic problems.[5]
- The stem cells would then be a perfect genetic match for the person into which the embryo develops.
- Lines of stem cells would then be a byproduct of existing PGD testing. No embryo would be killed in the process. The scientists hope, perhaps naively, that this technique might be acceptable to the pro-life community.

However, It's not clear it's going to work in human embryos. And in order to determine that we'll have to actually do the research on human embryos and likely destroy some in the process. [9]

Risks V/s Benefits

New therapies can carry considerable risks, and the potential complications and dangers of stem cell therapy are serious, including tumour formation, infection and immunological complications.On the other hand, a greater number of life-years would be gained from successful treatment of younger people suffering from autoimmune diseases such as Type 1 diabetes or multiple sclerosis, or from brain injury. [Where no other treatment is available, high-risk experimental treatments are easily justified but if, as in the case of Type 1 diabetes, relatively effective therapies are available, the decision to enroll children or young adults in clinical trials of stem cell therapies is a serious one.[1]

Cancer and Stem Cells

Scientists and regulators now see a narrow path for the research: designing stem cell studies bold enough to find successful treatments without overreaching and causing cancer. New discoveries suggest that stem cells in leukemia, breast, and colon cancer are at the root of many tumors. In the stem cell hypothesis, cancer is driven by specific cells that contain stem cell properties. These cells then reproduce and replenish malignant tumors.

Currently, most treatments target cancer cells, but not necessarily cancer stem cells.While the treatment may shrink the tumor and keep it in check for a while, eventually, the untreated cancer stem cells proliferate into cancer cells, leading to a return of the tumor and death.If the treatments targeted the cancer stem cells, however, the tumor would lose the ability to generate new cancer cells, eventually resulting in a cure.[3]

The two genes, PTEN and HER2/neu, that are associated with aggressive breast cancers have stem cell properties. Defects in either gene are tied to faster-growing tumors that are more likely to return. Colon cancer cells have been

sorted out by the marke CD44 which possesses a capacity to reproduce itself, regenerate, and produce tumors similar to the tumor of origin.The researchers injected cells producing various amounts of CD44 into mice. Results showed that the mice developed tumors after being injected with as few as 10 cells producing high amounts of CD44. That's not many, when we know that there are billions of cells in the body.[3]

TOURISM

Increasingly, biomedical research is a global enterprise.

Collaborations, both academic and commercial, often cross national boundaries, and both biological material and data are transferred among scientists and institutions in different parts of the world.

Differences in moral values and cultural attitudes can have an impact on the practice of global science. In South East Asia for example, where there is a great deal of biotech activity, such research seems to be subject to more relaxed ethical restraints than those that apply in western countries.

It would be a mistake to conclude from this that this research lacks any ethical sensitivity but it would be fair to say that these countries do not share the importance placed on informed consent by western countries.[1]

Such differences raise a dilemma when scientists have the option of importing material for stem cell research. The central question is whether it is ethical or legal to use imported material where the consent process meets the rules of the country of collection but not the standards of ethical sourcing that apply in the country of destination. Legal standards in the UK try to avoid the worst risks of exploitation whilst recognising that valuable imports will be stopped if European standards are strictly insisted upon.

Many people suffering from terminal or debilitating diseases, fearing that the time available to them for treatment is limited, have been travelling to other countries, such as Russia, India or China, to take advantage of untested stem cell therapies.

There are no regulatory bodies to monitor these treatments; no data is published in peer-reviewed journals to enable others to replicate any results. [1]

Social Justice

Despite their promise, stem cell based therapies are likely to remain, at least for many years, both expensive and technologically demanding. There will inevitably be opportunity costs for cash-limited healthcare systems considering making such treatments available.

These therapies would be available only to individuals wealthy enough to pay for their own treatment. The ethical questions raised by expensive new therapies are not unique to stem cells but nevertheless merit consideration.

Other questions of social justice may arise. It has been suggested, for example, that the UK Stem Cell Bank should seek to build up a collection of clinical-grade stem cell lines representing a range of different tissue types, with the aim of being able to provide immunologically-matched lines for as many patients as possible. It is possible, however, that despite good intentions such repositories may fail to include the less common tissue types, thus potentially disadvantaging minority racial and ethnic groups. [1]

Unrealistic expectations and 'hype'

ES cell research in particular has been subject to a great deal of media and scientific hype. 'Superman' actor Christopher Reeve headed one such campaign. Journalists often use extravagant language such as 'breakthrough' to dramatize a story. The complicated research indications are over simplified, creating unrealistic expectations of cures. Such hype leads to public perceptions that such cures are not only likely but 'just around the corner', which is not more than a therapeutic misconception. [1]

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Review Article

Death tourism (Sterbetourism): Destination to heaven

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Abstract

Euthanasia (Good death) refers to the practice of ending a life in a painless manner. It is called murderous by some and merciful by the others. It is a topic of debate from the beginning, so it could not be legalized but its modified form known as "Doctor Assisted Suicide" is legalized at some places like Switzerland. Death tourism is a resultant effect of 'doctor assisted suicide' as it is one step forward to it. Switzerland is the leading destination where the people are going to commit doctor assisted suicide and this city is now developing as a place of choice for "Death tourism" due to their uncertain ethical guidelines and overly helpful organizations. This is the only country where the relatives bring their incurable and hopeless patients to the hospital not for the treatment but to cause the death of the patient. Because of increasing incidences of death tourism the global spotlight has turned towards the Switzerland's liberal laws on assisted suicide and the agencies are coming forward to stop this UN-ethical act. That's why the administrative agencies of Switzerland are going to tighten the laws, making it more difficult for all but the sickest to come there in order to achieve their last breath. This paper is an attempt to know as to why Switzerland (Heaven on Earth) is developing as a destination of heaven for intended patients and also to analyze a few points about the field of 'Death tourism'.

Key words: *Death tourism, euthanasia, assisted suicide & switzerland.*

Introduction

The act of seeking death in another country by the help of physician or non physician helper is termed as suicide tourism in today's world. However, this is stated to be different from mercy death called Euthanasia. Euthanasia is till not acceptable as yet, but the assisted death is legal in Switzerland, Netherlands, Belgium, and Oregon State of USA. It is perhaps an act of buying death in legal terms where the existing law of the land permits to do so. The Swiss law that allows anyone to help patients die, as long as there are no ulterior motives, dates back to 1942[1].

'Euthanasia' (still illegal in Switzerland) is defined as administering a lethal drug to a person by a doctor or medical staff, while in "Assisted suicide" patients have to carry out the final act themselves, which is legal [2]. Now these days, Switzerland is developing as a place for 'Death tourism' and the patients are coming not only from the different areas of this country but from the other countries also. In 1998 one organization "Dignitas Swiss Assisted Suicide Group" was established by a lawyer known as Ludwing Minelli, Who is head of "Dignitas Hospital" and his work was appreciated by the others for the help of terminally ill patients[3]. That is why the suicide rate is significantly higher in Switzerland than the global average and every fifth suicide here is assisted suicide.

There are several organizations in Switzerland, such as 'Exit' and 'Dignitas', which help terminally ill patients, choose how to die. After getting admission in their hospitals, these agencies start working for the completion of the required papers for the purpose of assisted suicide. For this the patient has to bring a certificate from the panel of doctors appointed by the Swiss government, which certify that the appellant patient is a suitable case for assisted suicide. The patient has to take NOC also from the legal authorities on this matter. After getting these certificates the patient and his relatives

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have to complete the other legal and concerning formalities in hospital where he has admitted. Initially this procedure was a bit painful because of the use of poisonous gases but because of newer drugs it has improved a lot, which does not cause any anxiety or pain of death to the patient. The concerning agencies help patients to obtain a prescription for a lethal dose of the barbiturate Natrium-Pentobarbital, but the patient must ingest it himself which pushes patient into a state of deep coma never to rise again.

No validated statistics exist for assisted suicides in Switzerland. These deaths are not differentiated from unassisted suicides in official records. According to the president of one of the Swiss right to die societies, around 1800 requests for assisted suicides are made each year. Two thirds are rejected after screening. Half of the remaining people die of other causes, leaving about 300 suicides assisted by these societies annually. This constitutes around 0.45% of deaths in Switzerland [4]. Individuals outside these societies may assist additional suicides. In comparison, reported assisted suicide in Oregon represents 0.09% of deaths, and other US data showed a rate of assisted suicide and euthanasia of 0.4% among terminally ill patients. The rate of assisted suicide in the Netherlands is 0.3%, lower than the estimate for Switzerland [5].

Discussion

The issue of death tourism has been frequently discussed during the past few years in the media across the world. It is also a hot topic of discussion in Switzerland now a days. Though the doctor does not pull the trigger yet it is equivelient to murder in a common man's perception. The debate still continues weather this policy is actually inhuman or a real step for a patient to achieve "Moksha"? People from various walks of life and socialists across the globe are raising finger towards the Switzerland's liberal laws on assisted suicide, while on the other hand the numbers of patients in Switzerland are increasing day by day. Intended patients and their relatives firmly believe that such laws of optional termination of life after a prolonged incurable disease should be enforced everywhere particularly their own home land so that they can take their last breath there.

Assisted suicide is a controversial topic all around the world but data on public attitudes towards assisted suicide and euthanasia are scarce. According to one survey in Switzerland, half of 2411 army conscripts were willing to "shorten the life of a family member who suffered too much and who asked for euthanasia." In a 1999 survey of the Swiss public, 82% of 1000 respondents agreed that "a person suffering from an incurable disease and who is in intolerable physical and psychological suffering has the right to ask for death and to obtain help for this purpose." Of these, 68% considered that physicians should provide this help; 37% considered that the family, 22% that right to die societies, 9% that nurses, and 7% that religious representatives should be able to fulfill such requests. Legislation to allow euthanasia was favored by 71% of all respondents. No data are available on how well people believe the existing system is working in practice, even though this is one of the key points in the controversy [2].

In routine medicolegal practice we have also noticed that some patients were brought to us for the autopsy after certifing the brain death in an ICU. During autopsy the brain was found in such a condition from where the survival of the victim was not possible by any means and the patient was surviving with ventilator and medicinal support. In such cases secondary complications like Adult Respiratory Distress Syndrome, Acute Renal Failure, Heart failure and Septicemia with End organ failure may lead to final cause of death of the victim. In such cases only large finencial burdens with a lot of mental and physical pain to the relatives is the only end result. If we explore the history in such cases we can find out that the withdrawl of non useful and un-affordable medical treatment of ICU was the reason to stop the ventilator support in a respiratory dependent patient who has passed into a deep coma. This kind of practice of 'aid in dying' is routine behind the curtains in some countries, in which the doctors pass orders for turning off the respirator in a respiratory dependent patient or for withholding needed medication or not administrating hydration and nutritin in patients who suffer excruciating, agonizing slow and very painful deaths may be regarded as 'letting the die' or 'aid in dying'[6].

Some experts believe that it is a grey area where some curable patints may also die, as many examples of these kinds are available. Second thing is that the termination of such cases may lead to stopage of research in that area. The high literacy rate Kerala could become the first place in India to allow mercy killing if a recommendation by the state law reforms commission gets the government's nod. The proposal in favor of euthanasia is part of a report to be given to the state government on January 24 by the commission, headed by former Supreme Court judge Justice V. R. Krishna Iyer, a known civil rights activist [7].

Conclusion

In this new era of responsibilities, our aim must be to maintain the doctor patient relationship and the fate of the people in this noble profession, for which we have to keep our confidence built up and try to find out the solutions of these kinds of medical problems which still exist like a stigma in our profession. We should not try to acquire a short cut to get rid off from such problems by various Non-professional and Un-ethical means like 'Doctor assisted suicide'. Medical profession is to save life and not to terminate it.

In India, assisted suicide should not be legalized as it may provide a grey area to the opportunists in various fields related to it. It can be like a 'Legal sword in the hands of the Devils'. It will further cultivate and boost the roots of criminalization and corruption which otherwise is no less in India. Hence it doesn't seem to be possible at least in a country like India ethically as well as legally.

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Review Article

Estimation of age from ossification of clavicle: A comprehensive review

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Abstract

Age estimation in cadavers, human remains and living individuals may clarify issues with significant legal and social ramification for individuals as well as for the community. The current status of forensic age estimation in livings is mainly considered for the purpose of criminal prosecution, to determine whether a suspect without valid identity documents has reached the age of criminal responsibility (criminal liability threshold of 21years) and whether general criminal law in force for adults applies. In order to demonstrate that the proband has attained the criminal liability threshold of 21 years of age an additional X ray examination or CT scan of the clavicles is recommended along with physical examination, an x-ray of left hand and dental examination including orthopantogram to know about the dental status of the offender, because the other systems on which the development analysis is based generally matured fully by this time. The present work is a thorough review of the state of the art of estimation of age from clavicle.

Key words: *Ossification, clavicle, age.*

Introduction

The Clavicle is a long bone with a medullar cavity like the other long bones and first fetal bone to undergo ossification by membranous ossification without prior endochondrial ossification, unlike other long bones. The ossification initially starts with two primary ossification centers, one medial (sterno-mastoid pectoralis major end) and the other lateral (trapezius deltoid end) during 5th and 6th fetal week (Ogden et al. 1979 and Kumar et al. 1989). Cartilaginous growth areas (epiphyses) appear at both ends acromial as well as sternal, transforming the development pattern to combination of endochondrial longitudinal ossification and membranous ossification. Clavicle displays longest period of growth related activity than any other long bone of human skeleton, thus rendering it useful for age estimation in early years. Clavicle can be used as age indicator even at puberty as it retains its predictive value when other growth related indicators have become inactive and remain age indicator later up to the age of 30 (Black and Scheuer 1996). The relative timings of the epiphysis development and its union with clavicular shaft may be used in estimating the age of osseous remains as well as in case of living individuals. Ritz-Timme et al. (2000) has described age estimation in cadavers, human remains and living individuals. They concluded that any method to used for age estimation should essentially fulfill the following specific demands: (1) they must have been presented to the scientific community (by publication in peer-reviewed journals, (2) clear information concerning accuracy of age estimation by the method should be available, (3) methods need to be scientifically accurate and (4) principles of medial ethics and legal regulations have to be considered in case of age estimation in living individuals. The current state of forensic age estimation of living subjects is mainly considered for the purpose of criminal prosecution, to determine whether a suspect without valid identity documents has reached the age of criminal responsibility and whether general criminal law in force for adults applies (Schmeling et al. 2005). In order to increase the diagnostic

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accuracy of estimating age in criminal proceedings, physical examination of the individual, an X-ray examination of hand, as well as a dental examination including dental X-ray to find out the status of dentition should be performed in each case and if the skeletal development of the hand is complete then X-ray or CT (Computed Tomography) scan examination of clavicles should be carried out. CT scanning is rather well suitableto determine the stages of epiphyseal union of the medial clavicle for age estimation during adolescence and the 3rd decade of life (Krietner et al. 1998). Schemling et al.(2003) has described that according to the recommendation of study group for forensic age diagnostics age estimates in criminal proceedings should be based on the general physical examination, the X-Ray examination of hand and odontological examination by dentist and orthopantogram. In order to demonstrate that the proband has reached the age of 21 an additional X ray examination or CT scan of the clavicles is recommended. Future research projects should assess the combination of the above methods, impact of socio-economic status and ethnicity on the examined development systems and review the suitability of non ionizing imaging methods of age estimation.Klaus and Claus(2005) conducted a study of age estimation in adolescents and adults in crime proceedings on German population using all the examinations recommended by German study group of forensic age diagnostics, (AGFAD) which included physical examination of the suspect, a dental examination, x-ray of left hand and radiography of medial end of clavicle. Mineralization of root of wisdom teeth is finished by the age of 21, however, radiological assessment of clavicle in both the genders shows lowest age at which stage 5 (non scar of fusion) was observed is 26 years. Garamendi et al.(2005) performed following tests to confirm chronological age of 114 immigrants Moroccan males between age group of 13 to 25 years: general physical examination, corpus X-ray(Greulich and Pyle method) and dental orthopantomography (Demirjian method). Corpus X-ray (skeletal age) was most useful followed by Dermirjian's method (dental age) for chronological age of over or under 18years. They concluded that the combination of skeletal and dental age variables represented a significant improvement in the prediction of the chronological age of the subjects in this population, reducing the number of ethically unacceptable test errors to a minimum. Schmeling et al.(2008) has presented the updated recommendations of the Study Group on Age Diagnostics for criminal proceedings. In order to increase the diagnostic accuracy and to improve the age estimation examination, an X-ray examination of hand, as well as a dental examination including dental X-ray to find out the status of dentition should be performed in each case. If the skeletal development of the hand is complete, then X-ray examination of clavicles should be carried out.arty, in college campus or in a social get together.

Relative timings of the ossification of clavicle and the clavicular ossification as an age indicator

A secondary epiphyseal ossification centre appears at the medial end of clavicle during adolescence in the form of scale like epiphysis, which begins to fuse between 18 to 25 years of age and is completely fused to the rest of the bone between 25-31 years of age (Mc Kern and Steward 1957). This is the last of epiphysis of long bones to fuse. Clavicle displays longest period of growth related activity then any other long bone of human skeleton, thus rendering it useful for age estimation in early years. The slowly maturing flake like epiphysis at the medial end of the clavicle is useful in young adults. A clavicle with no evidence of fusion or fusing epiphysis is most likely to have come from an individual less than 18 years of age. A well-defined fusing flake occurs in individuals between 24-29 years. Final fusion is unlikely before 22 years and is nearly complete by 30 years. (Szilvassy, 1980; Webb and Suchey 1985; McLaughlin, 1990; Black and Scheuer, 1996). Based on large systematic studies the data shows that the relative timings of the epiphyseal development and its union with clavicular shaft may be used in estimating the age of osseous remains and data suggests that detailed knowledge of maturation of medial clavicle could be useful adjunct in forensic age diagnosis of living as well as dead, but not all epiphyses are of

equal value in estimating age. The best indicators were the epiphyses of proximal humerus, distal radius, femoral head, iliac crest and medial clavicle (McKern and Stewart 1957, Webb and Suchey1985). For a long time it was believed that the fusion of the clavicular epiphysis with the rest of the bone takes place between 20 and 25 years. McKern and Steward,(1957) showed that the fusion of the epiphysis in American males Commenced at 18 years and no case of complete union could be seen before the age of 23 years and found that the epiphyseal union of clavicle have five stages 0 to 4, and 30th year is latest age likely to show epiphyseal activity as clavicle in some individuals are still active. The complete fusion is reported as early as by 22 years (Davies and Davies 1962, Davies 1969). Warwick and William (1973) stated that secondary center of sternal end of clavicles appears in late teens and even early twenties and fusion take place quickly thereafter but reliable figures on this subject are not available. Clavicle can be used as age indicator even at puberty as it retains its predictive value when other growth related indicators have become in active and remain age indicator later up to the age of 30 (Black and Scheuer, 1996). The radiographic staging of ossification of the medial clavicular epiphyses were comparatively assessed by Schulz et al. (2008) using conventional radiographs and computed tomography for age diagnostics in 57 individuals undergoing criminal proceedings and concluded that conventional radiographic reference studies should be used for staging by conventional radiography and CT reference studies should be used for ossification staging by CT. The studies using radiation free imaging technique to estimate age from the clavicle have been introduced so far are:- 1)magnetic resonance imaging of sterno-clavicluar joints of dead bodies aged between 6 and 40 years performed by Schmidt et al.(2008) to define the ossification status of medial clavicle and the data of the study was proved to be comparable to existing data from the studies based on CT scans. 2)Ultrasound studies on the time course of clavicular ossification have been carried out in the living subjects above 18 years of age by Schulz et al.(2008) and proved that the age intervals corresponding to the ossification stages defined were consistent and comparable to the known data of CT and radiographic assessment.

Correlation of age with epiphyseal development stages using different techniques:

Age estimation has been studied by many worker based on epiphyseal union degrees or pattern, using bone specimens, radiographs, CT and MRI and have found it useful age indicator in early years.

1. Using bone specimens (Deads):

Epiphyseal union of anterior iliac crest and medial end of clavicle were studied by Webb and Suchey (1985) in 605 males and 254 females in modern Americans aged between 11 to 40 years. Analyzing the union in terms of four stages he found that epiphyseal union of medial clavicle in modern Americans sample starts earlier in females than in males and complete fusion occurs at 20 years in females and 21 years in males. Female standard can vary 1-2 years from those of males but in general epiphyseal ossification timing in both the sexes is just similar. Sternal ends of right clavicles of Japanese aged between 13 to 31 years autopsied during 1982 to 1992 were studied by Ji et al. (1994) to find out ossification stages. To define the degree of union, the 5 stages used by Mc Kern and Steward (1957) were applied to the samples and found that, in females, union appears to proceed faster than in males. Comparing the present data with that of American males by Mc Kern and Stewart (1957), they concluded that union in Japanese males' proceeds faster than that of Americans and the Clavicles are suitable for estimating age from adolescence to about 30 years old. Schaefer and Black (2005) proposed that wherever possible, appropriate standards of epiphyseal union of clavicle should be devised for more accurate aging reflecting population specific profile, as Bosnian males clavicles start and attain complete union 1 to 3 years earlier than those of Americans(Mc Kern and Stewart,1957).

2. Using Radiological techniques (Livings):-

The age intervals corresponding to different stages of ossification status defined on anatomical samples were studied later on in case of livings using radiological techniques to establish references to be used in living individuals.

i) Using Radiographic technique:- Medial ends of Clavicles examined radiologically by Jit and Kulkarni, (1976) in 684 individuals (391 males and 293 females) between the age group of 11 to 30 years from Punjab and Haryana and found that ossification centre appears between 11-19 years in females and 14 to 19 years in males, but the difference in mean age is statistically insignificant. The earliest partial fusion in both sexes occurs at 18 years of age and latest by 23 years. The earliest complete fusion was found to be at 22 years in males and 23 years in females and 100% instances show complete fusion between 24-25 years in females and 25-26 in males. Radiological assessment of the degree of ossification of the medial clavicular epiphyseal cartilage in young adults using chest radiographs of 873 patients done by Schemling et al. (2004). It was concluded that the earliest age at which stage 3 (partial fusion) was detected in either gender was 16 years, State 4 (total fusion) was first observed in women at 20 years and in men at 21 years and in both genders stage 5 (disappearance of scar) was at 26 yeas, and a lateral view should be taken to facilitate age estimation to avoid the overlapping of other bones. It was reported that the problem was faced due to the difficulty in the interpretation of staging because of the overlapping of other bones like ribs, vertebrae etc on the medial ends of the clavicles in radiographs. Olzea et al. (2006) reported that though mineralization of third molar is usually completed by the age of 19-20 years of age, this feature can not be relied upon when person attained the age beyond 21 years. Therefore, an additional X-ray examination of the medial clavicular epiphyseal cartilage is strongly recommended. ii) Using CT technique:-The ossification status of medial end of clavicles of the patients with the lack of a bone development disorder below 30 years of age was analyzed using CT retrospectively by Krietner et al (1998), to establish a reference population for the stages of epiphyseal union. He concluded that CT is well suitable to determine the stages of epiphyseal union of the medial clavicle and rather may become a generally accepted method of age identification during adolescence and the 3rd decade of life. CT images of 629 patients aged between 15 to 30 years retrospectively analyzed by Schulz et al. (2005) and reliably determined the ossification status of the medial epiphysis of clavicle in 566 cases, using classification of stages used by Schemiling et al.(2004). In both sexes stage two was first noted at age 15, stage 3 in males at age of 17 and in females at age 16, stage 4 in both the sexes at age 21 and stage 5 was first noted in female patients at 21 years and in males at 22 years of age which is 4 to 5 years early than observed using conventional radiographs. The partial volume effect in CT using thick slices could be avoided by reducing slice thickness up to 1 mm. Schulz et al. (2006) analyzed CT Scans of 100 patients (50 male & 50 female) between the age of 16 to 25 years to establish a relationship between the age and the ossification of medial epiphysis of clavicle and concluded that a reconstruction kernel suitable for osseous structure should be used and images should be viewed or presented in bone window. The results of his study has shown that a person with stage four is probably 21 years older, while a stage 3 leads to an estimated age 21 years. He concluded at the end that CT of medial epiphysis of the clavicle would only be suitable for age estimation around the age of 21.

Variables affecting the staging of ossification:

Muhler et al. (2006) has shown the influence of slice thickness in CT scan on the assessment of clavicle ossification in forensic age diagnostics. The data acquired was reconstructed into the CT scans of the slice

thickness of 1, 3, 5 and 7 mm, and the ossification stages were determined for each reconstructed slice thickness. In one case the slice thickness of 1mm lead to a different diagnosis of the ossification stage than a slice thickness of 3 mm, in three cases the diagnoses differed between the slice thickness of 3 and of 5mm, and in another three cases, between 5 to 7mm. It was concluded that for age estimation purposes, the slices thickness should be 1 mm to ensure maximum accuracy and diagnostic reliability. Paine and Brenton (2006) suggested that the measurements based on healthy cases may not be comparable in an analysis of individuals with poor diet and health. Lynn et al. (2007) combined the data on clavicle fusion from different studies and applied a binomial logistic regression analysis aiming to assess whether or not variables such as sex, socioeconomic status, and ethnicity influence the probability of having mature i.e. completely fused clavicles at a given age. It was explored whether the method of clavicle examination i.e. diagnosis from either a dry bone specimen, an examination of X-ray or an examination of CT scans, affects the accuracy of age determination from clavicular ossification and concluded that only ethnicity did not significantly affect the results.

Radiation free imaging techniques to find out ossification status:

Schmidt et al.(2007 a) conducted a study on magnetic resonance imaging of 54 sterno-clavicluar joints of the dead bodies aged between 6 to40 years for age estimation from medial clavicular ossification and proved that the data was comparable to existing data from CT scanning. All of the examined medial clavicular epiphyseal cartilages permitted the assessment of degree of classification. The observed age intervals of the respective degrees of ossification correspond to the known data from x-ray and CT scan examination. It was suggested that the achieved results should be examined with a large number of cases and a modified protocol of MR examination .

Schulz et al.(2008 a)carried out ultrasound studies on the time course of clavicular ossification for forensic age estimation in the living subjects above 18 years of age for the establishment of the radiation free imaging technique for assessment of clavicular ossification. Right clavicles of 84 test subjects between 12-30 years of age were prospectively evaluated by means of ultrasound. Ossification stage classification was possible in 80 out of 84 clavicles and was not possible in the rest of the cases due to the presence of development anomalies. The earliest ages to observe the respective ossification stages were 17.1 years for stage 2, 16.7 years for stage 3, and 22.5 for stage 4.The age interval for these stages were consistent and comparable to the known data from CT and radiographic assessment. Evaluation of medial clavicular epiphyseal ossification by ultrasound could ultimately be a rapid, economic and non-ionizing diagnostic modality for forensic age estimation.

Comparative analysis of the applicability of methods :

Schmidt et al.(2007) in a study on comparative analysis of the applicability of skeletal age determination methods of Greulich-Pyle and Thiemann-Nitz for forensic age estimation in living subjects assessed both the methods for the accuracy of age estimation and degree of acceleration in the respective reference population. For this, the skeletal age of 649 hand X-rays from German subjects aged 1-18 years was determined by both the methods. Both were reported to be equally suited for forensic age diagnostics. Accuracy of both methods was determined based on regression and measures of certainty. The degree of acceleration in the reference population of two methods was calculated as the mean difference between the estimated skeletal age and the actual age of the test subject. Compared to Greulich-Pyle population, the Thiemann-Nitz population was accelerated by 0.44 years in both male and females. The conclusion was, If the subject have come from a population with a high acceleration status, the Thiemann-Nitz method should preferably be used to prevent overestimation of age.

Schulz et al.(2008) conducted a study on radiographic staging of ossification of the medial clavicular epiphysis and comparatively assessed conventional radiographs and computed tomography scans of sternoclavicular joints used to perform forensic age diagnostics in 57 individuals undergoing criminal proceedings. With CT, it was possible to determine the ossification status of all clavicles, but in case of conventional radiography reliable assessment was not possible in 15 out of 114 clavicles studied due to the superimposition of other structures. The staging results were identical in 97 out of 99 clavicular epiphyses. In two cases, however, ossification was classified as stage 2 by CT and 3 by conventional radiography. Regarding stages 4 and 5, both methods produced identical results in all cases. In forensic age estimation practice, it is necessary that conventional radiographic reference studies should be used for ossification staging by conventional radiography and that CT reference studies should be used for ossification staging by CT.Further studies in dead bodies are required to issue recommendations as to whether conventional radiography in 3 planes or CT should be the method of choice for the assessment of clavicular ossification. Cardoso,(2008) compared the timing of epiphyseal union in the postcranial skeleton in recent sample of 121 individuals, between ages of 9-29 years with data from the scapula, clavicle, humerus, radius and ulna. Epiphyseal union was scored at 16 anatomical locations, using 3 staging schemes: 1) no union: 2) partial union: and 3) complete union. He concluded that in upper limb the epiphyses of elbow are first to fuse (11 to 15 years of age) followed by those of shoulder and wrist. In the scapular girdle coracoid's are a followed by the glenoid surface and remaining epiphyses, with medial clavicle fusing last by the age of 25-27 years.

Miscllaneous:

Cortical index which is defined as the proportion of cortical thickness to the total diameter of the bone) was calculated in adult clavicles of North-West Indians(128males and 82 females) concluding that from 15 to 30 years of age it increased in both the sexes but thereafter steadily decreased, with an initial sharp decrease in the age group of 31-40years in both the sexes. After the age of 40 years this rapid decrease in the index continued in females, but became slow and gradual in the males. Bilateral differences were insignificant but sexual difference was significant in age groups from 41years onwards being decreasing continuously in females and gradually in males. (Kaur and Jit, 1990).

The presence of rhomboid fosse evaluated as sex and age indicator for unidentified skeletal remains using a large contemporary sample (N=344:113 females, 231 males).Logistical regression found significant relationships between the presence of a rhomboid fossa and age. Fosse were common in males (36% left, 31% right) than in females (3% left, 8% right).A fossa on right clavicle is indicative of male with 81.7% probability; a fossa on left is indicative of a male with 92.2% probability. Younger individuals more commonly exhibited rhomboid fosse than older ones, and the largest fosse were most common in males' 20-30years of age. However the age effect was not conclusive and must be corroborated by other methods. A test of sex estimation method on an independent sample (26 males, 23 females) found nine males and only one female with fosse present on the left clavicle. When a clavicle exhibits a rhomboid fosse, it is likely from a male. The greater difference in fossa expression between the sexes on the left clavicle makes the use of left bone preferable (Rogers et al. 2000).

The incidence of an articular facet on the coronoid tubercle of the clavicle was studied indicating the presence of coraco-clavicular joint in the paired clavicles obtained from 1000 adult subjects aged 18 to 95 years (748 males ,252 females) and 75 children (45 males, 30 females) of known age. The paired clavicles from 50 neonates and 35 fetus were also examined. The facet was absent in the fetuses, neonates, and young children. the youngest clavicle showing facet was from a girl of 13 years(bilateral).In adults the incidence of facet was 10.1% (bilateral 5.7%, unilateral 4.4%) in males and 8.3%(bilateral 3.6%,unilateral 4.8%)in females(Kaur and Jit ,1991)

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Review Article

AIDS –A challenge to doctors and health care workers

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Abstract

Doctors and Para-medical staffs are quite prone to get HIV infection during the investigation and treatment of the patients or during post mortem examination from the injuries caused by needles, blades and various surgical & diagnostic instruments. According to Centre for Disease Control 5.05% HIV positive people are employed in the health care services[1]. This indicates that the thousands of doctors & paramedical staffs are exposed to the risk of getting HIV infection during discharge of their duties.

The chances of getting infection increase many times because the HIV status of patients/deceased is not clear in most of the cases. Practically it is also not possible to know the HIV status of each & every patient in the hospital. So there is a strong need to take all possible protective measures while discharging their duties during the treatment and/or post mortem examination.

Key words: *AIDS, HIV, Health care workers (HCWs), Gluteraldehyde, Sodium hypochlorite, incineration, post-exposure prophylaxis.*

Introduction

AIDS is one of the fastest spreading diseases. It was just discovered in 1981 but now more than 100 millions are HIV positives[1]. The causative agent Human Immunodeficiency Virus (HIV) is highly infectious, found in almost all body fluids and tissues with maximum concentration in blood, semen, CSF and vaginal secretions. It is transmitted mainly by sexual intercourse with an infected partner. It also spreads by transfusion of blood and blood products, organs transplantation, artificial insemination and from infected mothers to their children through placenta or breast milk. Use of contaminated syringes and appliances now becomes an important tool of spreading the disease [2-3].

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Health care workers (doctors, nurses, technicians etc.) are usually involved in the examination of patients, collection and examination of blood and pathological specimens, endoscopic and other investigations, and surgical procedures. During these procedures, they may get infection from accidental prick, cut or splash of blood & secretions. The risk of getting infection is much more while conducting autopsies, where the bad hygienic condition of morgue worsens the situation. The HIV status of the patient/deceased is not clear in most of the cases, which increases the risk of getting infection many times during the treatment / post mortem examination .

Duties & previllages of health care workers

The duty of a medical practitioner is to treat all the patients irrespective of their HIV status. Though a medical practitioner is free to choose his patients, but in emergency or when no other treatment facility is available, he is bound to treat such patients.

The refusal of patient on the ground of HIV

status amounts to professional misconduct and he may also be held liable for any damage until unless the doctor himself has open wounds & blood to blood contact is virtually certain.

The doctor may also be liable if he denies continuing the treatment when he finds the patient is a HIV positive during the course of treatment [4].

If the doctor is in Government service and denies the treatment of an AIDS victim, he may hold liable for damages and may also lead to disciplinary action. Likewise, a doctor posted for post-mortem duty cannot refuse to conduct autopsy of a known HIV patient.

In the larger interest of society, it is the duty of doctor to inform the fact to the spouse and paramedical staff involved in the treatment of such patient so that due precautions can be taken. But it must not be revealed to unauthorised persons.

All the cases of accidental exposure whether by needle prick or cut or by splashing to the eyes or mouth and/or when HCWs believe that they have been exposed to infection with HIV, they have every right to seek medical advice and diagnostic antibody testing. Such cases must be reported immediately to higher administrative authorities in the requisite format and post-exposure prophylaxis should be started as soon as possible preferably within few hours.

If a doctor/HCW becomes infected with HIV while discharging his duties, he should be entitled to get compensation from hospital authorities just like workers of other industries covered under Workman Compensation Act.

Precautions during the medical care and treatment

Doctors and health care workers are always on the risk of getting AIDS infection because:

- HIV is highly infectious and found in blood, secretions & in almost all the body fluids.
- Spreads also by contaminated syringe, needle, blade & other surgical and diagnostic instruments from accidental prick, cut or splash of blood & secretions and
- There is always an inherent risk of getting infection because HIV status of patient/deceased is not known prior to examination & treatment and medicolegal autopsy.

Moreover, it is quite possible that workers dealing with patients/dead bodies having HIV infection without knowing it. Therefore we should change our work culture and consider all the cases as potentially infected [5] and treat them in such a way that the risk of exposure to blood and body fluids of patients be minimal. So health care workers and hospitals are advised to take personal safety measures and stick correct hospital sterilization and disinfection protocols based on CDC(Centres for Disease Control) recommendation (Universal work precautions).

These precautions must be taken against blood, semen and vaginal secretions as well as to CSF, synovial, peritoneal, pericardial and amniotic fluid. Universal precautions do not apply to faeces, nasal secretions, sweat, tears, urine and vomits unless they contain visible blood. These precautions may be summarised as [6-7]:

a) Safety measures in handling patients
b) Disinfection of instruments & appliances before re-use and
c) Disposal of tissues and disposables

Safety measures in handling patients:

- Hands should be washed with soap and water before and after examination of patients or collection of specimens. Washing should be done with 4% chlorohexidine gluconate or povidine-iodine solution before invasive procedures
- Gloves should be used where a potential contact with blood or body fluid and discard them immediately when they are torn or punctured.
- In surgery/delivery or where splash of blood or body fluid is anticipated protective eye wear, mask and plastic apron should be used.
- Use only disposable syringe and place them immediately after use in nearby impermeable container and do not recap or manipulate needle in any way.
- Take extra care in handling scalpels to prevent accidental cut.
- In the event of needle prick or cut, allow blood to flow freely & wash the wound thoroughly with soap and water, and then

apply Lodophor / Tincture of Iodine and waterproof adhesive plastic dressings. The person should be advised rest from active work and post-exposure prophylaxis should be started at the earliest, without delay.

- Workers who have open wounds, exudative lesions or weeping dermatitis should refrain from work where blood and body fluid contact is possible until their condition resolves.
- Pregnant workers should take extra precautions to restrict the HIV transmission in foetuses.

Disinfection of instruments & appliances

- Equipments and instruments are best decontaminated with 2% gluteraldehyde for 30 minutes and then rinsed with 3-4 times with sterile water.
- Contaminated linens like mask, gown, caps etc. must be disinfected before giving for washing either by dipping in 1% sodium hypochlorite for half an hour or by boiling or autoclaving at low pressure of steam. After washing and drying, it should be autoclaved before issuing to the patients or hospital personnel
- Woollen blankets can be decontaminated by exposing them for formaldehyde vapours or autoclaving. Dry cleaning dose not inactivate or kill HIV.
- For mattress, it is advisable to cover the entire mattress with waterproof synthetic material like Rexene or plastic and wash it manually with soap a& water before reuse.
- In dental cases, Alginate impressions are disinfected by keeping for 10 minutes in cotton soaked with 1% sodium hypochloride and Zinc oxide eugenol impressions in 2% gluteraldehyde solution.
- Operation table must be carbolised each time after shifting the patient.
- Any surface which has been contaminated with blood or body fluid must be disinfected first by pouring 1% sodium hypochlorite solution and cover with paper towel or news paper for 10 minutes. These papers are removed with gloved hands and discard them in infectious waste which has to be incinerated.
- Operation theatre should be suitably fumigated with ethylene dioxide or potassium permanganate before reopen for surgery.

Disposal of tissues and disposables

- Rubber and plastic disposables like syringes, I/V bottles, catheters, rubber gloves etc. are autoclaved or treated chemically first and then shredded, cut, or mutilated to avoid recycling.
- Extra care has to be taken while handling the needles, blades and other sharps. They should be dipped in disinfectant for 1/2 to 1 hour before disposal.
- Dressings, swabs and sponges contaminated with blood, pus etc. should be collected in a separate bucket and must be disinfected by chemical before disposal by incineration.
- Tissues, organs or parts of the body removed during surgery,/delivery disposed of by deep burial with bleach.

Precautions during medicolegal autopsy

The risk of acquiring HIV infection while conducting autopsy is much more, especially in our country where autopsies are conducted in poor/unhygienic conditions. Universal work precautions should be adopted in all the cases of post mortem examination. Extra care should be taken in known HIV positive cases.

- The HIV infected body should be labelled as HIV positive before shifting to morgue.
- The autopsy surgeon and other associated staff must be properly clothed in "AIDS suit"; which comprises a disposable type of scrub suit, a plastic apron, double rubber gloves, cap, face mask, goggles and shoe covers; before entering into the post-mortem room [5]. Wire mesh gloves, even being expensive, can be used for additional safety.
- Every care must be taken to avoid any sharp injury/cut during handling the instruments. Needles and blades must be handled carefully while loading the scalpel and removing the blades. Never put one hand under the tissue/organ during cutting with other hand. However, in case of any accidental cut, bleeding should be encouraged by squeezing the part, followed

by thorough washing with soap & water and cover with waterproof dressing and post-exposure prophylaxis should be started without delay.

- After post-mortem procedure, the body should be stitched properly so that no fluid can come out and wash with tap water and then with 1% sodium hypochlorite solution. Nose and mouth should be plugged with cotton swab soaked with appropriate solution. The dead body is then put in a plastic bag and handed over to the relatives for performing last rituals.
- Cleaning and disposal of instruments, disposable apparels, autopsy table, walls and floor of morgue should be done as per the guidelines for surgery and operation theatre.
- The dead body should be disposed off at the earliest without delay. Cremation is the ideal method, but if burial is insisted upon due to social and religious belief, the dead body should be wrapped first in a cloth sheet soaked in a beaching powder solution and then cover completely with waterproof plastic or polythene sheet. Unwrapping and direct handling or mutilation of the dead body should not be allowed even for the rituals.

Conclusion

AIDS is one of the fastest spreading diseases which is believed to be incurable and deadly fatal. It is transmitted through blood, semen and other body fluids mainly by unprotected sex, transfusion of blood and blood products and perinatal circulation. Health care workers, who are involved in examination of patients, collection and investigation of blood and pathological specimens, surgical procedures and post mortem examination, handle syringes, needles, catheters, blades and various surgical and diagnostic instruments, which are soiled with blood & other body fluids and can infect them. This causes great concern and anxiety to HCWs and sometimes they refuse to provide treatment to the patients. But this is not the remedy. The only way is to treat patients with all possible bio-safety measures without considering their serological status. Hospital/health administrators should ensure adequate supply of personal protective equipments, disinfectants and should setup an effective waste disposal system.

Of course, continuous research must be on to develop the vaccine against HIV, which is by far the most appropriate way to fight this dreadful disease.

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Review Article

A guide to writing medical reports *vis- a -vis* victims of torture

Ashok Kumar Jain, B.P.Dubey**, S.P.Garg*** & Manish Nigam*****

Abstract

Numerous cases of torture have been reported in the Indian news media but these represent only a fraction of the real total and torture frequently goes unreported. The government of India has enacted the Human Rights Act, 1993, which monitors the violation of any of the rights of the individuals in this country. A systemic and meticulous examination of such victims will help in estabilishing or disproving a charge of torture. Here a scheme of hisrtory taking and physical examination is offered. The role of the medical expert in the investigation of abuse of human rights is discussed.

Key words: *Torture, medical examination, abuse of human rights.*

Introduction

These guidelines have been developed to assist doctors at the medical foundation for the care of victims of torture. The medical expert has to remain absolutely impartial and objective, avoiding any hint of bias despite the highly emotive situation which quite naturally tends to colour the doctor's attitude. Evidence in a criminal court must remain strictly within what can be demonstrated and proven in order to be credible and useful.

1) The role of the medical expert

The doctor preparing a medical report on an alleged torture victim should bear in mind that role of the expert witness, as defined by the court, is to give objective, impartial advice based upon his clinical and professional experience. The medical report should be factual, detailed and carefully worded. It is important to be aware how easily medical evidence and jargon can be challenged and the doctor should avoid making assertions that could not be defended in court. Since the report will be read mainly by non medical officials complex medical terms should be avoided.

2) History Taking

Before the history is taken, an explanation of the reason for the investigation / examination should be given to the victim of torture. The doctor should also explain that this is a medico-legal examination and say how the session will be conducted.

As is normal medical practice a full medical history should be taken, including relevant family and social history and previous medical and psychiatric history.

It is important as far as possible to avoid asking leading questions, where the forms of word or even the tone of voice may suggest a certain answer. The victim may be inhibited by a number of factors; he may consider some facts not worth mentioning because they are taken for granted in his culture, he may have forgotten details; some items may be part of cultural taboo; some symptoms may not seem relevant to him. Often the memory of torture, especially if it involves sexual abuse, may be so painful that the victim cannot bring himself to speak about it.

Details of detention include:

a) Prison conditions:- poor prison conditions

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are noted including any withholding of food and drink or forcing contaminated food and drink; withholding toilet and washing facilities; withholding or provision of medical treatment; confinement in total darkness with intermittent exposure to bright light, in extreme heat or cold, in small or crowded cell, or when the floor is wet, infested or covered in excrement.

b) Psychological torture:- testimony is recorded of details such as solitary confinement, sensory deprivation, mock execution, provocation, insult and threats during torture; enforced witnessing of the torture, rape or execution of family members or other.

c) Physical torture:- information is recorded on the frequency timing and duration of any torture sessions, number and profession of assailants e.g. police, soldiers, security guards or prison officer, and whether a doctor was involved.

The records of the torture itself includes:

1. Type of weapon used, parts of the body attacked, posture, physical restraints and suspension etc.
2. The immediate effects: whether the victim could see his assailants and the weapon they used; whether he became confused or disoriented or partially or completely unconscious; whether he could walk unaided at the end of the torture session.
3. The after effect: the presence of bruising, bleeding, open wounds or other injuries immediately after abuse, the length of the time taken for healing; other physical symptoms such as vomiting, hematuria, internal pain, dizziness or disturbance of sight or hearing; whether or not any medical assistant was offered.
4. The victims emotional reactions during and after torture and any religious and doctrinal beliefs that helped him to survive.
5. The history should be checked against any other documents which are available

Discrepancies of fact are noted and explanation sought from the victim.

3. **Present condition**

The victim is questioned and details recorded about his present general, physical and psychological condition e.g. change in weight, appetite, sleep disorder, nightmares, mood change should be recorded.

4. **Examination**

The examination should follow the usual routine, but with special emphasis on any abrasions or scars, bruises, lacerations, tenderness, abnormality or limitation of movement of joints and neurological changes such as weakness, sensory change or wasting.

Every scar and other lesion defected must be measured and its anatomical site recorded. Throughout the interview and examinations the victims emotional response and mental state should be observed closely.

5. **Opinion**

The doctor is asked to give his opinion as to whether the available medical evidence supports the victims allegation of torture or other ill-treatment.

The doctor's opinion is reached by taking into account the victim's medical history and physical examination. Sometimes reaching a definite diagnosis just as in other medico – legal work may be difficult or impossible. If no clear decision can be made, it may be helpful to call for a second opinion by a psychiatrist, neurologist or other specialist.

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Review Article

Medico-legal implications of alcohol consumption

Harish Dasari, K. H. Chavali** & Yogender S. Bansal****

"The injurious effects of alcohol must not be construed as the result of the use of a bad thing; it is actually the result of abuse of a good thing" – Abraham Lincoln.[1]

Abstract

Throughout the recorded history, alcoholic beverages have been used in many societies for many purposes - as psychoactive substances, intoxicants, liquids to quench thirst, sources of calories, etc. Whatever the social and personal valuation of the alcoholic beverage use, positive or negative or mixed; drinking alcoholic beverages carries with it some potential for social and health harm, both to the drinker and to others. Some harms are immediate, notably injuries and other harms associated with intoxication or an elevated blood alcohol level. Others are more long-term, such as cumulative damage to family or work life or social position, or chronic damage to health, etc.

A large number of medico-legal issues also arise as a result of the use/abuse of alcohol. The doctors concerned with such cases should be aware of these and their ramifications on the case, while evaluating them in their entirety. Consent is a very essential pre-requisite for every medico-legal examination, however, the fact that the patient is in an intoxicated condition at that material time leads to certain complications, which have to be borne in mind. This article describes the various medico-legal issues related to alcohol consumption, as would be encountered in the professional life of a physician.

Key words: *Alcohol consumption, medico-legal issues, blood alcohol concentration, drunkenness, breathalyser.*

Introduction

Since time immemorial, alcohol has been in use by people around the world - in the standard diet, for hygienic/ medical reasons, for its relaxant and euphoric effects, recreational purposes, artistic inspiration, as aphrodisiac, and for other reasons.2 In the form of its various beverages, alcohol is one of the most commonly consumed social drinks, in almost every nation. Of the various alcoholic beverages, beer is the world's oldest and the most consumed.3 It is the third most popular drink overall, after water and tea.4 Due to the various undesirable effects that alcohol produces on the human body, every nation has laws that regulate its production, sale and consumption, as also the maximum permissible Blood Alcohol Concentration (BAC), while driving a vehicle.

Discussion

A person may be said to be intoxicated if he not only shows the symptoms of having consumed the intoxicant (alcohol), but his actions are also affected by such intoxicant.[5] The effect of consumption of alcohol varies depending upon the amount consumed, presence of food in stomach, physical or mental fatigue/ administration of certain drugs; whether he is mentally stable/ epileptic/ suffered cerebral trauma at an earlier date, etc.[6] Water taken after absorption intensifies intoxication. Absorption rate is said to be lower with proteins and higher with carbohydrates.

Drinking of alcohol per se is not an offence in our country except in the state of Gujarat, where it is prohibited.[7] Driving, causing public

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nuisance or endangering property or life, even one's own, after consuming alcohol, is an offence.

There is no single test which itself would be sufficient to enable a medical practitioner in deciding that the amount of alcohol consumed had caused the person to lose control of his faculties to such an extent as to render him unable to execute safely the occupation in which he was engaged at that material time.

The Indian Law in relation to consumption of alcohol:

S 185 of the Motor Vehicle Act prescribes a maximum permissible BAC of 30 mg%, "in a test by a breath analyzer", while driving in India. The maximum permissible BAC in various countries is compiled in Table 1(adapted from1)

S. 510 IPC prescribes punishment for any person, who in a state of intoxication causes trespass/ annoyance to any person in a public place; or causes misconduct in a public place. Intoxication per se is not a punishable offence. However, annoyance may be caused by the mere presence of the drunken person at that place after being told to leave.[9] Voluntary/ involuntary drinking has nothing to do with causing annoyance.[6]

S. 34 Police Act empowers a police person to arrest such a person without a warrant and the punishment under the Act is imprisonment up to 8 days as opposed to **S. 510 IPC**, where

a) An arrest warrant is necessary, and
b) Imprisonment is up to 24 hrs only.

S. 85 IPC lays down the criminal responsibility of an intoxicated person. If a person is so much intoxicated at the time of doing the act that he was incapable of judging the nature of his act or that he was doing something that is either wrong or contrary to the law, then he has not committed an offence, provided, he was administered that (unwholesome) substance against his will or without his knowledge.

Voluntary drunkenness is no excuse for the commission of an offence.[10] It is no excuse to say that because of his voluntary drunkenness, he failed to resist the impulse to act in a certain way[11] or that because of it he acted like an automaton.[12] At the same time, drunkenness does not make the crime more heinous.[13]

However, voluntary drunkenness can be an excuse in 2 circumstances:

1. Where a **specific intent** is an essential element of an offence and the evidence shows that intoxication is of such an extent that the accused is not capable of forming the specific intent to constitute the crime.[14] This is applicable in cases of **Cl. 1, 2, 3 of S. 299 & 300 of the IPC**.
2. Where **habitual drinking** has resulted in such a diseased condition of mind that the accused is incapable of knowing the nature of the act or that he is doing what is either wrong or contrary to the law **(S. 84 IPC)**. In other words, insanity whether produced by alcohol or otherwise, is a defence to the crime charged.[15] This could be in cases of delirium tremens.

But in situation 1, even if the accused fails to actually form the specific intent, **S. 86 IPC**

Table- 1: Country wise permissible limits of BAC

S No	BAC (mg %)	Countries
1	00	Russia, Czechoslovakia, Hungary, Bulgaria, Romania, Turkey
2	20	Poland, Sweden
3	30	India
4	50	Finland, Norway, Netherlands, Yugoslavia, Portugal, Greece, Hong Kong [8]
5	80	Denmark, Germany, Belgium, UK, France, Switzerland, Australia, Italy, Spain.
6	100	Ireland
7	80 – 100	Different States of the USA

would impute the necessary guilty knowledge to him and he would, therefore be liable for culpable homicide not amounting to murder.[16]

S. 86 IPC: In cases where an act done is not an offence unless done with a particular knowledge or intent, a person who does the act in a state of intoxication shall be liable to be dealt with as if he had the same knowledge as he would have had if he had not been intoxicated, unless the intoxicant was administered to him against his will or without his knowledge.

As per this Section, a person who voluntarily drinks and gets intoxicated will be deemed to have the same knowledge as he would have had, had he not been intoxicated. However, this section does not presume that the accused had the same intention as he would have had, if he was sober. But it attributes the knowledge to him. Therefore, although there is a presumption as far as the knowledge is concerned, there is no such presumption with regard to intention.[17] But again, if a man has the knowledge regarding the natural consequences of his act, he must be presumed to have intended to cause them.[18] This presumption may, however, be rebutted by showing that at the time he did the act, his mind was so influenced by the drink he had taken that he was incapable of forming the requisite intention necessary to make the act an offence for which he was being charged.[19]

Drunkenness:

It was defined by the British Medical Association[20] in 1927 as "a state produced in a person, who has taken alcohol in a quantity sufficient to cause him to lose control of his faculties to such an extent, that he is unable to execute safely the occupation in which he was engaged at that particular time".

Many a times, the doctor on duty in the Emergency Department (EMO) has to perform medico-legal examination of a person alleged to have consumed alcohol, either brought by the police or by his friends/ relatives. In the later instance, treatment of the intoxication would be the main purpose of the patient's visit and this important fact must always be borne in the mind while conducting the said examination.

While certifying the accused, the examining doctor must exercise extreme caution before coming to any conclusion. The smell of alcohol in the breath, the pulse rate, dilatation of pupils, colour of the face, etc., have no bearing on the degree of intoxication. A thorough and detailed clinical examination with special attention to the state of mind, coordination of movements, visual acuity, etc., must be conducted, along with the requisite blood and urine investigations, before deducing any conclusions.

The question of consent:

Consent is essential for every medico-legal examination.[21] The consent to be taken in these cases is the written, informed one; wherein the patient is told the nature and purpose of the examination as also that the findings of the examination so performed may go against him. Consent for conducting any relevant investigations including sample collection, is also a part of the informed consent to be taken before the start of the examination.[22]

The term ***Informed Consent*** is a legal principle in medical jurisprudence that generally holds that a physician must disclose to a patient sufficient information to enable the patient to make an "informed" decision about a proposed treatment or procedure.[21] It is a person's agreement to allow something to happen, made with the full knowledge of the risks involved and the alternatives available.[23]

For a patient's consent to be informed or legally valid, it must adequately address three essential elements: information, competency and voluntariness. Each of these components must be met or any given consent will not be legally valid or informed.

In the case of a person who has consumed alcohol, taking the consent has some innate problems because of the fact that even if the accused had readily consented for the said examination and the examination completed on basis of the consent, after which the examining doctor opines that the accused "was under the influence of alcohol", the said consent, taken prior to the examination, becomes legally invalid. In these cases, the doctor should not divulge the results or the conclusions until the individual has become sober and gives a valid consent; unless there is an explicit direction from the magistrate/

court to divulge the results immediately.

However, in those circumstances where

1. the accused has been arrested by the police for a criminal offence,
2. the request for conducting the examination is from a police officer of the rank of a sub-inspector or above and
3. the doctor is of the belief, formed in good faith, that the examination of the person of the accused will provide information regarding the commission of the crime for which the person is arrested (having consumed alcohol being a part of the offence in this case), then the examining doctor can proceed with the examination without the consent of the arrested person; and even use reasonable force for the successful completion of the examination and collection of samples. **(S 53(1) Cr PC)**

Compared with the typical clinical examination, evaluation of a person in medico-legal context is different in two essential ways:[24]

a) Confidentiality is limited, because the purpose of the examination and evaluation is to form opinions that are to be communicated to a third party.
b) The purpose of the examination is also to find answers that have been asked of the doctor, or might be asked in the near future in the courts of law; and not in any therapeutic context. Thus there is no usual doctor – patient relationship in these cases.

These facts must clearly be told to the examinee before obtaining his/ her consent for the examination and consequent evaluation.

Collection of blood and urine samples in the living:

- Spirit swabbing of the area is contraindicated. However, recent studies have shown that spirit swabbing does not alter the BAC estimated much; other investigators are equally vociferous about the opposite.
- In the US and England, BAC testing is not considered legal when blood is sampled after swabbing with an ethanol antiseptic.[25]
- Dry swabbing or swabbing with 10% $HgCl_2$ is recommended. Washing the area with soap and water and then wiping it off with a sterile gauze piece is another choice.
- The blood sample is collected in universal screw capped bottles. Rubber stoppers should not be used as this may contaminate the sample with oxidisable agents.
- Sodium fluoride, 50 mg/ 10 ml blood, is used as the preservative. It prevents alcohol loss by degradation (enzyme inhibition and prevention of clotting) and bacterial action.
- Sodium fluoride and potassium oxalate mixture may also be used.
- The best alternative now-a-days would be the 'vaccutainers'. These are small rubber capped leak-proof air tight test tubes with the desired anticoagulant for various purposes and negative pressure inside. The moment the tip of the needle of a filled syringe is introduced into the cap of the vaccutainer, the blood in it would be sucked into the tube due to the negative pressure.
- 2 samples of urine should be taken, ideally. The second, half-an-hour after the first.
- First the patient is asked to empty the bladder. The samples may then be collected either by the normal process of micturition or by the use of a catheter.
- Phenyl mercuric nitrate is the preservative used.

Opinion:

After performing a complete and thorough clinical examination of the accused and collecting the requisite samples, the examining doctor can frame the following three different opinions based solely on his clinical assessment of the patient:

1. There is no smell of alcohol in the breath and all the clinical findings are normal → The individual examined has not consumed alcohol
2. There is smell of alcohol in the breath, but all the clinical findings are normal → The individual has consumed alcohol but is not under its influence
3. There is smell of alcohol in the breath and the clinical examination reveals abnormal findings → The individual has consumed alcohol and is under its influence.

As the samples have to be sent to the Forensic Science Laboratory for analysis, the opinions so formed should be based on the

clinical findings alone. The results of the analysis of the samples may be corroborated with the opinion, whenever made available to the doctor. Even if the results are not in consonance with the clinical findings, the doctor's opinion stands, if it can conclusively be proved in the court that the examination was done thoroughly and meticulously.

Autopsy precautions:

For preservation of the viscera, in addition to the routine, one hemisphere of the brain and samples of CSF and vitreous humor should also be collected and preserved for chemical analysis. Saturated salt solution is the preservative medium of choice. Blood should be collected from a peripheral vein like the femoral and never directly from the heart. However, many authorities contest this and assert that the blood from heart is the best sample.[1,6]

In cases of putrefied bodies, ethanol production may occur postmortem, by the action of the microorganisms and this may lead to a BAC of 20 – 30 mg% even when no alcohol has been consumed at all prior to death. Erroneous results may also be obtained from a blood sample that has not been properly preserved. Hence in all cases where alcohol is suspected to have been consumed, urine sample should also be preserved for alcohol estimation. If the urinary sample is negative for alcohol, the BAC can safely be termed to be as a result of postmortem production. Of course, the urine sample must itself be meticulously collected and preserved for analysis.

The relation between UAC (Urine Alcohol Concentration) and BAC is given roughly in the following equation: BAC = 0.66 x UAC. (A thumb rule)

Breathalyzer:

As described earlier, **The Motor Vehicles Act** requires that the BAC be calculated "in a test by Breath analyzer". For this purpose, most of the traffic police units are equipped with breathalyzers. A **breathalyzer** (an abbreviation of *breath analyzer*) is a device for estimating blood alcohol content (BAC) from a breath sample. "Breathalyzer" is the brand name of a series of models made originally by Smith and Wesson,(later it was sold to National Draeger), but has become a genericized trademark for all such instruments like the **Alcometer/ intoximeter**, etc.[26]

It is an 'on the spot' test for measuring BAC. If the test is positive, the driver can be taken in to custody and a detailed examination, including blood and urine analysis can be carried out. It is of many types, but in its simplest form, a person is asked to blow air in to a plastic bag containing a mixture of crystalline dichromate and sulphuric acid. If the BAC is above a certain level, the colour of the crystals will turn green up to a pre-determined distance.

Breathalyzers do not directly measure blood alcohol content or concentration, which requires analysis of a blood sample. Instead, they estimate the BAC indirectly by measuring the alcohol in one's breath. For medicolegal purposes, breath alcohol content is measured from an end expiratory volume. Measurements by this method necessarily underestimate the alveolar breath alcohol content, and thereby, under estimate the blood alcohol content.[27]

The calculation of BAC is based on Henry's Law, which states that when a volatile liquid (ethanol) is mixed in a liquid (blood) and is brought in equilibrium with the air (alveolar breath), there is a fixed ratio between the concentration of the volatile compound (alcohol) in air (alveolar) and its concentration in the liquid (blood). This is 2100 : 1 for alcohol. This ratio is constant for a given temperature, i.e., it changes with the change in temperature.

However, there is no BAC calculator that is 100% accurate, because of the number of factors that come in to play regarding the consumption, absorption and reduction (burn off rates) of different people. These factors include sex of the drinker, rates of metabolism, health issues, medications, drinking frequencies, amount of food in stomach, when eaten, etc, mints or mouth washes, also affect the breath alcohol readings.[28] Studies have shown that for every 1^0 change in temperature, the estimated BAC increases by 6.5%. Change in the temperature of the alveolar air from the alveoli to the mouth is of the order of 4^0C (31 - 35^0C). Therefore the BAC would be shown to be higher by 26% than the actual. Therefore BAC estimated

by this method should be E. BAC – 26% E. BAC.[6]

Breathing pattern can also significantly affect breath test results. One study found that the BAC readings of subjects decreased 11 to 14% after running up one flight of stairs and 22–25% after twice that effort. Another study found a 15% decrease in BAC readings after vigorous exercise or hyperventilation. Hyperventilation for 20 seconds has been shown to lower the reading by approximately 32%. On the other hand, holding your breath for 30 seconds can increase the breath test result by about 28%. Further, research also indicates that breath tests can vary at least 15% from actual blood alcohol concentration.

One of the most common causes of falsely high breathalyzer readings is the existence of *mouth alcohol*. In analyzing a subject's breath sample, the breathalyzer's internal computer is making the assumption that the alcohol in the breath sample came from *alveolar air*—that is, air exhaled from deep within the lungs. However, alcohol may have come from the mouth, throat or stomach for a number of reasons. To help guard against mouth-alcohol contamination, certified breath test operators are trained to carefully observe a test subject for at least 15-20 minutes before administering the test.

The Alcohol Test Committee of the Canadian Society of Forensic Science[29], in order to overcome this interference by mouth alcohol, has prescribed that:

1. The subject should not have consumed alcohol for at least 15 minutes prior to the collection of the breath sample.
2. 2 breath tests to be conducted, 15 minutes apart and the truncated results differ by no more than 20 mg %.

The primary objective of breath alcohol measurement has historically been the reliable and rapid estimation of pulmonary blood alcohol concentration (BAC). The process by which alcohol appears on the breath is undoubtedly complex, involving alveolar gas exchange, deposition of alcohol into the cooler airway mucosa during expiration, and some net flux of alcohol into the breath from the mucosa during inspiration.[30] The breath profile is therefore undoubtedly affected by other factors such as body and ambient air temperatures. Further, the forensic application of breath alcohol analyses faces many challenges with regard to both analytical and biological issues, including, for example, radio frequency interference (RFI), mouth alcohol bias, abnormal pre-exhalation breathing pattern, and interfering substances. Application of an appropriate model having biologically relevant parameters may assist in evaluating for the presence of these concerns in the exhalation profiles of those arrested for driving while intoxicated. The appropriate forensic protocol therefore, is to obtain at least two breath samples.

The first medico-legal application of the breath – alcohol testing was reported by Emil Bogen in 1927.[31]

Now-a-days, infra red photometry has been introduced in many countries. It measures the difference in wave lengths between the test ray and the ray reflected from the vitreous humor. The degree of difference would give the concentration of alcohol in the vitreous humor, which is equal to the BAC at that given moment.

Alcohol and Trauma:

The adverse effects of alcohol on cognitive and psychomotor skills are well documented, particularly with regard to those components of behaviour that may be related to car driving performance. While there is no international, scientific or legislative uniformity in blood- alcohol concentration (BAC) levels admissible for driving, there is substantial evidence to suggest that increases in reaction time and performance errors can be found at doses that are well within legally defined limits. The consumption of alcohol, even in relatively small amounts, increases the risk of being involved in a crash for motorists and pedestrians. Not only does alcohol impair processes critical to safe road use, such as vision and reaction time, it is also associated with impaired judgment and so is often linked to other high-risk road use behaviours such as speeding or not using seat-belts.

A survey of studies conducted in low and middle-income countries found that alcohol was present in the blood of between 4% and 69% of injured drivers, 18% to 90% of crash-injured pedestrians and 10% to 28% of injured

motorcyclists.[32] It has been estimated that 20 - 25% of all persons hospitalised for injury are alcoholics.[33] Overall, alcohol is said to contribute to 03.20% of global mortality.[34]

Alcohol has also been linked to a number of other criminal behaviours, including violation of laws such as driving under the influence. It is known to be associated with the occurrence of serious injuries and death from a wide variety of causes, including accidents, assaults, poisoning, burns, falls, drowning, etc. According to a study, 35 – 50% of trauma patients are intoxicated at the time of admission to the hospital, and of them, 85% meet the criteria of substance abuse or dependence.[35] There is also a link to public disorder, but the strength of this relationship again is dependent on culture. In almost every society, drinking behaviour is to a greater or lesser degree moralized, sometimes with positive values attached to some drinking patterns or customs, but always with negative values attached to some patterns. Where use of alcohol is religiously or culturally forbidden, the negative valuation will be attached to any pattern of drinking of alcohol. Thus, an individual's pattern of drinking is a subject of social evaluation in terms of approval or disapproval in everyday life.

Conclusion

To address legal and forensic issues involved in the clinical practice, it is essential that the doctors understand the specific legal questions that might arise in each case. They should become familiar with the relevant definitions, criteria, and legal requirements that apply in each specific area of their practice. Only then is a neutral, scientific evaluation of the examinee possible.

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Review Article

A comprehensive review of environmental exposure of Lead and its toxicity

*Prashant Agrawal * , Anugya Mittal** , Manoj Kumar *** & S. K .Tripathi *****

Abstract

The distribution of toxic heavy metals in the environment is a major concern in many industrialized countries purview of the human health. Although metals occur naturally in the environment but human activities cause more metals releases and have altered the natural cycling of the elements. Lead is used in the manufacture of batteries, metal products, paints, and ceramic glazes. Exposure to lead can occur from breathing contaminated workplace air or house dust or eating lead-based paint chips or contaminated dirt. Lead is a very toxic element, causing a variety of effects at low dose levels. Brain damage, kidney damage, and gastrointestinal distress are seen from acute (short-term) exposure to high levels of lead in humans. Chronic (long-term) exposure to lead in humans results in effects on the blood, central nervous system (CNS), blood pressure, kidneys, and Vitamin D metabolism.

Key words: *Lead, industry, health, hazards.*

Introduction

Lead is a heavy, bluish-gray metal that has a low melting point. It occurs naturally in the Earth's crust, but it is not a particularly abundant element. It is rarely found naturally as a metal, but rather in its divalent (+2) oxidative state in ore deposits widely distributed throughout the world (Wikipedia.com/lead). Lead is a naturally occurring, bluish-gray metal that is found in small quantities in the earth's crust. Lead is present in a variety of compounds such as lead acetate, lead chloride, lead chromate, lead nitrate, and lead oxide. Pure lead is insoluble in water; however, the lead compounds vary in solubility from insoluble to water soluble (ATSDR, 1992, 1997)

Discussion

The most important Lead containing ores are galena (PbS), anglesite (PbSO4), and cerussite (PbCO3). Natural Lead is a mixture of four stable isotopes: 208Pb (51%–53%), 206Pb (23.5%–27%), 207Pb (20.5%–23%), and 204Pb (1.35%–1.5%) (Wikipedia.com/lead).

Table -1: General Properties of Lead

Name, Symbol, Number	Lead, Pb, 82
Chemical series	Post-transition metals or poor metals
Group, Period, Block	14, 6, p
Appearance	bluish gray
Standard atomic weight	207.2(2) g·mol^{-1}

Sources and environmental Exposure of Lead

Lead is used in the manufacture of batteries, metal products, paints, and ceramic glazes. Exposure to lead can occur from breathing contaminated workplace air or house dust or eating lead-based paint chips or contaminated dirt. Lead is a very toxic element, causing a variety of effects at low dose levels (USEPA, 1999).

The largest source of lead in the atmosphere has been from leaded gasoline combustion, but with the phase down of lead in

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gasoline, air lead levels have decreased considerably. Other airborne sources include combustion of solid waste, coal, and oils, emissions from iron and steel production and lead smelters, and tobacco smoke. Exposure to lead can also occur from food and soil.

Children are at particular risk to lead exposure since they commonly put hands, toys, and other items in their mouths, which may come in contact with lead-containing dust and dirt. Lead-based paints were commonly used until 1978 and flaking paint, paint chips, and weathered paint powder may be a major source of lead exposure, particularly for children. Lead in drinking water is due primarily to the presence of lead in certain pipes, solder, and fixtures. Exposure to lead may also occur in the workplace, such as lead smelting and refining industries, steel and iron factories, gasoline stations, and battery manufacturing plants (ATSDR 1992, 1997). Occupational exposure to inorganic Lead occurs in coal mines and smelters as well as welding of Lead painted metal and in battery plants. Low or moderate exposure may take place in the glass industry. High levels of air emissions may pollute areas near Lead mines and coal fired TPPs. Airborne Lead can be deposited on soil and water thus reaching humans via the food chain.

Metabolism of Lead in the body

The human body contains approximately 120 mg of lead. About 10-20% of lead is absorbed by the intestines. Up to 50% of inhaled inorganic Lead may be absorbed in the lungs. Women are generally more susceptible to lead poisoning than men. Children may absorb a larger amount of lead per unit body weight than adults (up to 40%). Consequently, children are generally more susceptible for lead poisoning than adults. Symptoms include lower IQs, behavioural changes and concentration disorder. Lead accumulates in leg tissue. The most severe type of lead poisoning causes encephalopathy (www.lenntech.com).

Adults take up 10–15% of Lead in food, whereas children may absorb up to 50% via the gastrointestinal tract. Lead in blood is bound to erythrocytes, and elimination is slow and principally via urine. Lead is accumulated in the skeleton, and is only slowly released from this body compartment. Half-life of Lead in blood is about 1 month and in the skeleton 20–30 years (EHC, 1995).

Lead is excreted mainly in urine and in the faeces. Lead also appears in hair, nails, sweat, saliva and breast milk. As the body accumulates lead over many years and releases in to urine only slowly, even small can at times lead to intoxication (Vij Krishan 2005)

Mechanism of Action

Although human body contains sufficiently large amounts of lead, moderately increased Pb concentrations become toxic from health point of view. The large affinity of Pb^{+2} for thiol (-SH) and phosphate containing legands inhibits the biosynthesis of heme and thereby affects the membrane permeability of kidney, liver and brain cells. These result in either reduced functioning or a complete breakdown of these tissues since Pb is a cumulative poison (Rai et al., 2002).

Lead blocks the conversion of delta aminolaevulinic acid to porbhobilinogen by blocking the enzyme aminolaevulinic acid dehydrase. This leads to an increase in delta aminolaevulinic acid in blood and urine. Lead also inhibits ferrochelatase which results in elevated free erythrocyte protopophyrin (FEP) levels (Vij Krishan 2005)

Possible health hazards of Lead

Lead has been listed as a pollutant of concern to EPA's Great Waters Program due to its persistence in the environment, potential to bioaccumulate, and toxicity to humans and the environment (USEPA, 1994). Lead is the number one environmental poison amongst the toxic heavy metals all over the world, causing serious health hazards to humans, especially to young children. In a developing country like India, lead poisoning remains a serious problem (Rai et al., 2002). Lead adversely affects numerous body systems and causes forms of health impairment and disease that arise after periods of exposure as short as days (acute exposure) or as long as several years (chronic exposure). The frequency and severity of medical symptoms increases with the concentration of lead in the blood.

Acute Effects

Death from lead poisoning may occur in children who have blood lead levels greater than 125µg/dL and brain and kidney damage have been reported at blood lead levels of approximately 100µg/dL in adults and 80µg/dL in children. Gastrointestinal symptoms, such as colic, have also been noted in acute exposures at blood lead levels of approximately 60µg/dL in adults and children (ATSDR, 1992, 1997). Short-term (acute) animal tests in rats have shown lead to have moderate to high acute toxicity (USDHHS, 1993).

Common symptoms of acute lead poisoning are loss of appetite, nausea, vomiting, stomach cramps, constipation, difficulty in sleeping, fatique, moodiness, headache, joint or muscle aches, anemia, and decreased sexual drive. Acute health poisoning from uncontrolled occupational exposures has resulted in fatalities (http://www.osha.gov/SLTC/lead/recognition.html).

Chronic Effects

Chronic exposure to lead in humans can affect the blood. Anemia has been reported in adults at blood lead levels of 50 to 80µg/dL, and in children at blood lead levels of 40 to 70µg/dL. Lead also affects the nervous system. Neurological symptoms have been reported in workers with blood lead levels of 40 to 60µg/dL, and slowed nerve conduction in peripheral nerves in adults occurs at blood lead levels of 30 to 40µg/dL. Children are particularly sensitive to the neurotoxic effects of lead. There is evidence that blood lead levels of 10 to 30µg/dL, or lower, may affect the hearing threshold and growth in children (ATSDR, 1992, 1997).

Other effects from chronic lead exposure in humans include effects on blood pressure and kidney function, and interference with vitamin D metabolism. Animal studies have reported effects similar to those found in humans, with effects on the blood, kidneys, and nervous, immune, and cardiovascular systems noted (ATSDR, 1992, 1997 and USDHHS, 1993).

Studies on male lead workers have reported severe depression of sperm count and decreased function of the prostate and/or seminal vesicles at blood lead levels of 40 to 50µg/dL. These effects may be seen from acute as well as chronic exposures (ATSDR, 1997 and USDHHS, 1993).

Occupational exposure to high levels of lead has been associated with a high likelihood of spontaneous abortion in pregnant women. However, the lowest blood lead levels at which this occurs has not been established. These effects may be seen from acute as well as chronic exposures (ATSDR, 1997 and USDHHS, 1993).

Exposure to lead during pregnancy produces toxic effects on the human fetus, including increased risk of preterm delivery, low birthweight, and impaired mental development. These effects have been noted at maternal blood lead levels of 10 to 15µg/dL, and possibly lower. Decreased IQ scores have been noted in children at blood lead levels of approximately 10 to 50µg/dl. Human studies are inconclusive regarding the association between lead exposure and other birth defects, while animal studies have shown a relationship between high lead exposure and birth defects (ATSDR, 1992, 1997 and USDHHS, 1993).

Lead encephalopathy is characterized by sleeplessness and restlessness. Children may be affected by behavioral disturbances, learning and concentration difficulties. In severe cases of Lead encephalopathy, the affected person may suffer from acute psychosis, confusion and reduced consciousness. People who have been exposed to Lead for a long time may suffer from memory deterioration, prolonged reaction time and reduced ability to understand. Individuals with average blood Lead levels under 3µmol/l may show signs of peripheral nerve symptoms with reduced nerve conduction velocity and reduced dermal sensibility. If the neuropathy is severe the lesion may be permanent. The classical picture includes a dark blue Lead sulphide line at the gingival margin. In less serious cases, the most obvious sign of Lead poisoning is disturbance of haemoglobin synthesis and long-term Lead exposure may lead to anaemia (ATSDR, 1999).

Recent research has shown that long-term low-level Lead exposure in children may Lead to diminished intellectual capacity. The combined evidence suggests a weighted mean decrease in IQ of 2 points for a 0.48 µmol/l (10 µg/dl) increase

in blood Lead level (95% confidence interval from –0.3 points to –3.6 points) (EHC,1995).

Acute exposure to Lead is known to cause proximal renal tubular damage. Long-term Lead exposure may also give rise to kidney damage and in a recent study of Egyptian policemen, urinary excretion of NAG (N-Acetyl-β-D-glucosaminidase) was positively correlated with duration of exposure to Lead from automobile exhaust, blood Lead and nail Lead (Mortada et al., 2001).

Blood Lead levels in children below 10µg/dl have so far been considered acceptable, but recent data indicate that there may be toxicological effects of Lead at lower levels of exposure than previously anticipated. There is also evidence that certain genetic and environmental factors can increase the detrimental effects of Lead on neural development, thereby rendering certain children more vulnerable to Lead neurotoxicity (Lidsky et al., 2003).

Lead as Carcinogenic agent

The Department of Health and Human Services has determined that Lead acetate and Lead phosphate may reasonably be anticipated to be carcinogens based on studies in animals. There is inadequate evidence to clearly determine Lead's carcinogenicity in people.

IARC (1987) classified Lead as a 'possible human carcinogen' based on sufficient animal data and insufficient human. Since then a few studies have been published, the overall evidence for Lead as a carcinogen being only weak, the most likely candidates are lung cancer and stomach cancer (Steenland et al., 2000). Animal studies have reported kidney tumors in rats and mice exposed to lead via the oral route. EPA considers lead to be a Group B2, probable human carcinogen (ATSDR, 1992, 1997; USDHHS, 1993 and USEPA, 1999).

Maximum allowable concentration of Lead

The Centers for Disease Control and Prevention recommends that children ages 1 and 2 must be screened for Lead poisoning. Children who are 3 to 6 years old should be tested for Lead if they have never been tested for Lead. CDC considers children to have an elevated level of Lead if the amount in the blood is 10µg/dL. The USEPA (1994) requires Lead in air not to exceed 1.5 micrograms per cubic meter (1.5µg/m3) averaged over 3 months. EPA limits Lead in drinking water to 15 µg per liter.

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Letter to Editor

Professional indemnity insurance: Can insured medical establishments immunize working professionals ?

Rajiv Mahajan& Kapil Gupta***

Sir,

We read the review article **"Professional indemnity insurance *vis -a -vis* Medical professionals"** published in Jan-Mar issue of Journal of Indian Academy of Forensic Medicine with great interest. [1] In this article the growing need for having an insurance cover for medical negligence has been clearly highlighted. We will like to further elaborate the discussion on the point of insurance cover purchased by medical establishments and vicarious liability .

Insurance by medical establishment covers legal liability falling on the medical establishment such as hospitals and nursing homes, as a result of error or omission committed by any named professional or qualified assistants engaged by the medical establishment.[1] This is very healthy trend; but in recent times two negative impacts have been seen.

Firstly, this has given negative sense of relief to the doctors that they are well protected against individual lawsuits, so they have started buying individual policies with lower limits of insurances because medical malpractice premiums have become more expensive.

Second thing is that now more than previously, lawyers sue the individual physician and the corporation, both. [2] This is because, unlike non-physician business, in medical field plaintiff generally sue the individual physician than the establishment. Therefore, physicians should also buy medical malpractice policies in their own name, rather than in the name of the practice [2] and should not rely solely on the one purchased by establishment.

In many countries, physicians have created legal entities, such as limited liability companies (LLCs) and professional associations, to limit their liability. Although this legal structure does protect physicians in case of claims, but new litigation trends suggest that this can now *increase* liability in medical negligence cases, simply because in these cases also, individual physicians are also being sued. [2]

Vicarious liability is based on the theory known as respondent *superior*, which translates literally to "let the master answer," to hold entities liable. Under respondent *superior*, the master is the establishment or other legal entity that a physician's group may practice under. This causes trouble when the individual doctor responsible for an act of negligence does not have enough insurance to cover a claim. The corporation can become jointly and severally liable for paying the remainder of the judgment. Even if physicians have insurance coverage for themselves and their entities, they must still be aware of the "vicarious" liability that can emerge from using independent contractors, sharing office space, or even using "covering doctors." [3]

Buying additional insurance for the entity is not an answer to this problem as high insurance limits often result in higher settlements. The more money available, the more money plaintiffs' attorneys may demand. [4]

Thirdly,when a practice is sued, it may need to hire its own lawyers to represent it, thus increasing pressure of legal fees associated with defending an entity and giving plaintiffs' attorneys yet additional leverage to facilitate a settlement. This "double jeopardy" -- suing both the physician and the entity -- can have a devastating effect on medical practices. [3]

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