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Role of Coronary Thrombosis in Sudden Deaths- Autopsy based Study

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ABSTRACT

Death occurring instantaneously or within one hour of the onset of the morbid symptoms. As per the World Health Organization 24 hours is the limitation period.⁽⁹⁾ Sudden death is within 24 hours of the onset of the symptoms, but in forensic practice most of the deaths occur within minutes or even in seconds of onset of the symptoms.⁽¹⁶⁾ Or Sudden cardiac death is usually from cardiac cause, heralded by abrupt loss of consciousness within one hour of the onset of acute symptoms. Sudden death is important from medico legal point of view, as it raises a suspicion of foul play. When a natural death is very rapid, the cause is almost inevitably Cardiovascular. ⁽¹⁶⁾ Acute occlusion of coronary artery results from thrombosis or haemorrhage within the walls of the artery leads to ischemia. Death of foam cells by necrosis/apoptosis leading to necrotic lipidcore formation. Finally rupture of fibrous cap or endothelial erosion, exposure to thrombogenic substrate and arterial thrombosis. An improved understanding of the patho physiology of atherosclerosis providing novel direction for its prevention and treatment. The Study is prospective and one hundred hearts are examined from the different age groups of males and females, during the medico legal Autopsies to know the severity of Atherosclerosis, among them three cases are reported as sudden deaths, though the sample size is minimum, significant results are obtained and the results are statistically analysed.

Keywords: - Sudden deaths, Thrombosis, Coronary Artery Disease.

INTRODUCTION

Determination of cause of death in natural deaths, particularly when the death occurred suddenly, unexpectedly is an important part of forensic autopsy practice for reasons. Performance of a complete and thorough autopsy on apparent natural deaths can provide invaluable information. sudden death is within 24 hours of the onset of the symptoms, but in forensic practice most of the deaths occur within minutes or even in seconds of onset of the symptoms.⁽¹⁶⁾ Diseases of the heart account for approximately 90% of all sudden deaths

due to natural disease with atherosclerotic coronary artery disease with being underlying cause ⁽⁶⁾. Death due to atherosclerotic coronary artery disease is of greatest incidence in the 35 to 64 year range. ⁽⁶⁾ Sudden death is the first and only symptom the underlying atherosclerotic coronary artery disease in approximately 25 to 40% of individuals who die on the way to hospitals. However there are a Variety of non atherosclerotic diseases and congenital abnormalities of the coronary arteries that are potential cause of sudden death.eg abnormal location of coronary ostia and arteries, ostial stenosis/ ostial ridges and acute angle take-off of the proximal portion of the coronary artery. ⁽⁶⁾ Coronary atherosclerosis is by far the most frequent cause of ischemic heart disease and plaque disruption with superimposed thrombosis is the main cause of the acute coronary syndromes of unstable angina, myocardial infarction and sudden coronary death. Arteriosclerotic vascular disease is a

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specific form of arteriosclerosis in which artery wall thickens as a result of invasion and accumulation of white blood cells and termed as “Fatty Streaks” and contains both living, active WBC cells producing inflammation and remnants of dead cells includes Cholesterol and Triglycerides. The remnants eventually include calcium and other crystalloid material within the outermost and old plaque. The fatty streaks reduces the elasticity of the arterial blood wall, but however they do not effects the blood flow for the decades, because the artery muscular wall enlarges at the location of plaque and further multiple plaques will be formed with in the arteries. The plaques are divided in to 3 distinct components. 1. Atheroma- Nodular accumulation of soft, flaky, yellowish material at the centre of the large plaque, composed of macrophages nearest the lumen of the artery. 2. Underlying area of the cholesterol crystals, 3. Calcification at the outer base of the older or more advanced lesions. And these plaques may be stable and unstable. Stable plaques are asymptomatic and rich in extracellular matrix and smooth cells, unstable plaques are symptomatic and rich in macrophages and foam cells and prone for rupture. Many changes occur in the lipid core due to Atherosclerosis, macrophages not only proliferate but also die and as macrophages undergo programmed cell death (apoptosis). Lesional macrophages in response to proinflammatory mediators such as CD154. The apoptotic bodies bear this intrinsic membrane protein on their surface, thus providing a ready store of trigger for thrombus formation in the heart of the lesion.⁽³⁾ Rupture of fibrous cap expose thrombogenic material such as collagen to the circulation and eventually induce thrombus formation and slowly progressive and cumulative and leads to rapidly slow or stop the blood flow leading to death of a tissue. The disrupted plaque triggers thrombosis by exposing platelets to collagen, thereby promoting their aggregation and degranulation. After rupture the tissue factor derived predominantly from lipid-laden macrophages in response to proinflammatory mediators such as CD154, can contact factors VII and X in the blood compartment and causes coagulation that cumulates in thrombin formation.⁽³⁾ Complications of Atheromatous plaques may worsen the coronary stenosis and subsequent myocardial ischemia. Bleeding may occur in to a plaque and this can be seen as sub intimal haemorrhage at autopsy. The simple stenosis and the complications of Atheromas are sufficient to cause death and much more common.⁽¹⁶⁾ Zones of

occlusion are usually less than 5mm in length and the area of the severest involvement is about 3-4 cms from coronary ostia, more often at or near the bifurcation of the arteries suggesting the role of hemodynamic forces in Atherogenesis. The mechanism of death in the majority of patients dying of sudden cardiac death is ventricular fibrillation. Also sudden cardiac death could be the consequence of electric-mechanical dysfunction and bradycardia.

MATERIAL & METHOD

To study the grading and severity of Atherosclerosis in autopsy cases, Specimen 100 hearts were collected from the post mortem cases among them three cases are reported as sudden deaths. In every case the heart is separated after applying double ligatures at the base of the heart over each large vessel and then dissecting them in between the ligatures of each vessel. Size and weight of the heart is noted. The coronary arteries are examined by making serial cross-sectional incisions about 3-5mm apart, in order to evaluate for atherosclerotic narrowing. The narrowest segments and any areas containing thrombi are selected for microscopic examination. Then they were washed and representative sections were given and fixed in 10% formalin solution and studied with histopathological examination. Tissues thus selected were subjected to automatic processing, blocks were made out of 6-8 microns and stained with haematoxylin, Eosin and Special stains were employed- Elastic stain, Toluidine blue, Sudan III stain. The grossing and automatic processing, block making and reporting was done in the Dept of Pathology, S.V. Medical College, Tirupati. The results were statistically analysed.

FINDINGS

One hundred cases of random fresh bodies, those which came for post mortem examination during the period of one year are taken for the study. The study is prospective and has included the deceased who have been autopsied in the S.V. Medical College, Mortuary, Tirupati. Among the one hundred cases 3 deaths are reported as sudden deaths. The results are statistically analysed. The age, sex and disease distribution of patients were evaluated by means of the Chi-square (χ^2) and Fisher exact probability tests, both of which compare the proportions of cases falling into various categories in one group with the proportions of cases falling into the same categories in another group. The Chi-square (χ^2) test was applied to those groups, which

contained more than 40 patients, and Fisher test was employed when smaller groups were involved.

statistical test was arbitrarily set as P=0.01. The results are shown in various tables and discussed.

The probability level of significance for these entire

Table 1: Atherosclerosis changes in Sudden death group

Group	Atherosclerosis		Total	Statistical Significance
	Present (%)	Absent (%)		
Sudden death	3 (100.0)	0 (0.0)	3 (100.0)	$\chi^2= 0.10$; P=0.75; NS
Other group	86 (88.7)	11 (11.3)	97 (100.0)	
Total	89 (89.0)	11 (11.0)	100 (100.0)	

Table 2: Atherosclerosis by selected variables in Sudden death group

S.No.	Variable	No. of subjects with atherosclerosis (%)			Statistical significance
		Sudden Death (%)	Other group (%)	Total (%)	
1.	Mean Age	55.0±8.66	37.54±16.14	38.07±16.22	t=4.76; p<0.001; S
2.	Sex				
	Male	3 (4.3)	18 (95.7)	21(100.0)	$\chi^2=0.26$; P=0.60;NS
	Female	0(0.0)	79 (100.0)	79 (100.0)	
3.	Diet				
	Non-vegetarian	3 (3.9)	74(96.1)	77(100.0)	$\chi^2=0.07$; P=0.79, NS
	Vegetarian	0 (0.0)	23 (100.0)	23 (100.0)	
4.	Smoking				
	Yes	3 (12.5)	21 (87.5)	24 (100.0)	$\chi^2=5.97$; P=0.79, NS
	No	0 (0.0)	76 (100.0)	76 (100.0)	
5.	Alcoholism				
	Yes	3 (14.3)	18 (85.7)	21 (100.0)	$\chi^2=7.24$; P=0.07; S
	No	0 (0.0)	79 (100.0)	79 (100.0)	

Table 3: Level of Atherosclerosis in various arteries in Sudden death group compared to the rest of the group.

Artery examined	Mean Level of atherosclerosis		Statistical Significance
	Sudden death group	Other group	
RCA	6.00±1.00	2.14±2.23	t=7.89; p<0.001; S
LCA	6.66±0.57	2.37±2.56	t=8.17; p<0.001; S
Circumflex	6.00±1.73	1.67±2.25	t=7.62; p<0.001; S
TA	5.66±1.15	2.29±0.37	t=6.88; p<0.001; S
AA	5.66±1.15	2.88±2.33	t=5.34; p<0.001; S
Mean Level	6.00±1.03	2.27±1.87	t=8.73; p<0.001; S

CONCLUSION

In the present study total one hundred samples were collected among 70 males and 30 females. In addition to age factor, diet and behavioural characters, diseases like hypertension, diabetes are taken into consideration to know the grades of Atherosclerosis and thrombosis resulting sudden deaths. Behavioural characters like smoking and alcoholism which can contribute to sudden death. In Sudden deaths 100% of the study group were affected. Though the statistically it is not significant but significant lesions were found in all arteries examined. Complicated lesions were found in the sudden deaths when compared to other group study. As age advances, the severity of Atherosclerosis is also increased and this may lead to sudden deaths as the results coronary Thrombosis, and study is correlating with previous study of P.A.Walford⁽¹⁵⁾ and Giorgio Baroldi⁽¹⁰⁾ studies and other related studies.

All the reports are statistically calculated and reported in the tables and reports are as follows.

Table 1: It can be seen that all the 3 cases with sudden death had atherosclerotic changes in the arteries compared to 88.7% among the rest of the group. However, the difference in the proportion of atherosclerosis between the sudden death group and the other group is not found to be statistically significant.

Table 2:-The mean age of the sudden death group is significantly higher than that of the other group of subjects. Higher proportion of sudden death group were males and non-vegetarian compared to other group but the differences were however not statistically significant. Higher proportions of sudden death group were smokers and alcoholism and the differences were also statistically significant. Higher proportions of sudden death group were smokers and alcoholism and the differences were also statistically significant.

Table 3: In all the arteries examined, the level of atherosclerosis is found to be significantly higher in sudden death group compared to the other group. The overall level of atherosclerosis was also found to be significantly higher in the sudden death group compared to the other group of study subjects.

Before the conclusion there is still a need for autopsy studies in the Investigation of risk factors and atherosclerotic lesions and to know the role of

Coronary thrombus in rustling the sudden deaths. The study comprises only three cases among the one hundred cases. It may be taken as a sample study for further research work. Recommendations- To prevent Coronary Vessel Disease, DASH Diet and certain vegetarian diets are recommended which are low in SFA, TFA and dietary cholesterol and high dietary fibre. DASH diet recommends increased intake of fruits, vegetables, low -fat dairy foods while limiting intake of red meat and added sugars. Whole grains, poultry, fish and nuts also emphasized. Omega 3 fatty acids from fish and fish oils can protect against coronary heart disease and reduces triglyceride concentration in a dose dependent manner, which intakes of about 4 grams per day lowering serum triglycerides by 25to 30%. These dietary characteristics typically impart favourable effects on CVD risk factors. Niacin is the most effective HDL-C-raising pharmacological agent, reduces apo B secretion, thereby lowering both VLDL and LDL, increasing apoA-1 and lowering Lipoprotein (a).⁽³⁾ Complex carbohydrates obtained from cereals, pulses, which are rich in fibre contents and reduces risk of atherosclerosis and hyperlipemia. Fish oils can produce modest reductions in blood pressure, possibly through their effect on endothelial function.⁽⁷⁾ Lifestyle change modification, adequate exercise, eating a diet rich in fruits and vegetables and low in saturated fat, weight loss if obese. Diabetes, high blood pressure, abnormal cholesterol, obesity, elevated homocysteine and elevated risk of blood clots should be under control and periodical health checkups are recommended.

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Fatal Accidents in Industrial Sector- A Study in Odisha

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ABSTRACT

It is needless to say that industrialization is necessary for progress and prosperity of a nation. Not only have modern gadgets produced by industrialization made the life of people fast, enlightened and easy but also various industrial sectors give employment to thousands of people. But the hazards of this modern industry are many. This can be physical, chemical, biological, electrical or ergonomical. To prevent these there are inbuilt safety measures in each equipment and there are let down standards and procedures for work. However, deviation in desirable procedure of operation or error made by the employee leads to accidents which are sometimes fatal. The objective of this study is to find out important causes of these accidents and necessary prevention. In this study, the data of fatal accidents in industrial sectors for the year 2011,2012 and 2013 were collected with the help of department of factories and boilers of the government of Odisha and was analyzed. Out of all these accidents, it was observed that fall from height is the major cause of fatality in all these years. The data was compared with the national data and possible preventive measures are discussed in this article. The important points of existing legislation were also highlighted in this article.

Keywords:- Industrialization, Fatal accidents, Safety Measures, legislation.

INTRODUCTION

Accidents represent a major epidemic of non-communicable diseases of present day. A WHO advisory group in 1956 defined accidents as “an unpremeditated event resulting in recognizable damages”. Global estimates of injury related deaths (2002) was 2.1% of all deaths^[6]. It includes road traffic accident, occupational accidents, burns, drowning etc. Three major consequences of accidents like mortality, morbidity and disability cause immense loss to the family as well to the nation.

It's beyond doubt that industrialization is one of the keys to improve the economic health of a nation, but breach in the safety standards in industrial establishments give rise to hazards like accidents which are sometimes fatal. Injuries caused by these accidents may be minor, moderate, serious, severe, critical and

non-survival as per the Injury Severity Scale (ISS)^[2].

Main Causes of Accidents in Industrial Sector:

The main causes of accidents are either due to unsafe act or unsafe condition. Unsafe acts may be intentional(violation) or unintentional (lapse or slips). Persons doing unsafe act are known as risk-takers. A study Human Safety and Environment (H.S.E.) that out of 330 risk-takers there are no injuries in 300 cases. 29 case will have minor injuries and one case will have fatal injuries.

Unsafe condition in working place is another cause of accident which can be prevented. Physical and Physiological condition – like poor vision, deafness, under age, over age, sickness or intoxication are also causes of these accidents.

The general hazards like electricity fire, heat, height, high pressure gas or liquid, powerful sharp moving machinery and toxic materials may be the cause of these accidents. The exact causes of accidents as per national survey is fall from height (45%), fall of material on the body (14%), road traffic accidents inside the factory premises (14%), lifting of instruments (7%),

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excavator – 7%, electrocution – 6% and miscellaneous causes – 7%.

OBJECTIVES

The objective of this study is to know the magnitude and important causes of fatal accidents of industrial sectors in Odisha and to derive certain preventive measures to reduce such accidents which cause loss of skilled manpower. Law regarding support and protection of the employees and their families is also highlighted to create awareness.

MATERIAL & METHOD

The data relating to fatal accidents that occurred in 3 consecutive years (2011, 2012, 2013) in 3756 factories in the state was collected with the help

of department of Factories and Boilers of the state of Odisha. The history of their occurrence and direct cause of fatal accidents were collected, analyzed and presented in a tabular format.

FINDINGS

The total number of fatal accidents in 2011, 2012 & 2013 –were 60, 73 and 58 respectively. In majority of cases, direct cause of accidents is fall from height in each of these three years. Vehicular accidents inside factory premises, burn (flame & chemical) & electrocution, getting hit by objects (cement bag, anchor plate, iron rod) and entanglement between objects like conveyer belt, dumper & body etc. are other important causes of fatality. Miscellaneous causes are explosion by gas like acetylene cylinder, drowning in water reservoir inside the factory etc.

Table 1 : Cause wise fatal accidents in year 2011, 2012, 2013*

Cause	Year 2011 (60)	2012 (73)	2013(58)
Fall from height	14	17	18
Vehicular Accident inside factory premises	10	11	10
Electrocution	8	11	8
Burn	3	7	7
Hit by object	5	4	7
Pressed or entangled	5	5	5
Fall of object on victim	4	8	2
Miscellaneous	11	10	1
TOTAL	60	73	58

Source:- Dept. of Factories & Boilers, Govt. of Odisha

DISCUSSION

Victims of fall from height generally exhibits severe injuries like single or combined head injury (80%), thoracic cage injuries, intra-abdominal injuries, cardiovascular & pulmonary injuries and fractures. In head injuries, 1/3rd cases show cerebral lacerations. Facial fracture, ring fracture of the skull and transection of brain stem are commonly seen. In thoracic injuries, multiple rib fractures and sternum fracture is seen when fall form height is more than 40 feet^[2]. Cardiac rupture is observed which is more common in right atrium (post wall) ^{[1],[2]}. Contusion of lungs is seen in almost all fatal cases^[1]. In intra-abdominal injuries, rupture of liver is seen in 60% cases^[2]. Right lobe of liver is more often

involved than the left^[1]. It is observed that renal injuries are rare. Cause of death in most of victims are due to multiple trauma, head injuries and blood loss. Majority of victims die instantaneously at the scene.

Inside a factory, flame burns and chemical burn injuries are often found. Electrical burn injuries are also common where the cause of death is ventricular fibrillation if current is more than 60-100 mA^{[4],[5]}.

Important preventive measures are imparting proper training to educate employees, issuing proper instructions by the authorities, use of personal protective instruments like belt, shoes, masks and goggles and observing safety norms inside factory are

other measures which can prevent accidents to a great extent. The employees should believe that all accidents are preventable.

Accidents due to electricity can be prevented by taking care of defective tools, poor insulation or engagement of unskilled persons. Care should be taken to prevent accidents due to gases like Carbon monoxide, Carbon dioxide, Hydrogen Sulphide (H₂S) and Methane^[5]. Accidents due to gas occur when a person work in closed drains, sewers etc. Proper first-aid, immediate skilled assistance should be rendered at the accident site to prevent fatality. It includes – life saving measures like cardiopulmonary resuscitation (CPR), expired air resuscitation (EAR), external cardiac compression, controlling blood loss and prevention of shock. Removal of the victim from the source of danger like toxic gas, fire and electricity is important.

LEGISLATION

With the growing complexity of industry in the country with increasing machinery and consequent danger to workmen, it is advisable that they should be protected by law.

Important legislation for employees to prevent accidents are :

I **Factories Act, 1948**^{[3],[7],[8],[9]} :-

The Act defines what a factory is and there is provision for health and safety of workers, restriction on employment of young persons and specified hours of work. Hazardous process and hazardous operation has been defined in this Act in 1st Schedule and rule 96 respectively. The Act provides a child under 14 years cannot be employed in a hazardous job in a factory. A child above 14 years but below 18 years can be employed in a hazardous job only if he is found medically fit for the job.

II **ESI Act, 1948(Amended in 1975,1984,1989)**^{[3],[7]} :-

This Act provides certain cash and medical benefits to employees in case of sickness or injury. Under this Act workers of certain establishments are compulsorily insured and protected with health care programmes . The insured worker is entitled to get treatment under ESI physician.

III **Workmen's Compensation Act,1923**^{[6],[9],[10]} :

In this Act, there is a provision of compensation for workers who are injured at work. Compensation varies as per death or disablement vide Section 2 (1) and 4 of part 1 and 2 of schedule 1 of the Act. The Act provides payment of compensation by the employer to the employee for suffering any injury or disability or disease resulting from accident or occupational hazard. Compensation is paid on the basis of nature and extent of disability – whether it is permanent or temporary, total or partial ; if partial then its percentage of loss of earning capacity. In case of death of the worker due to occupational hazard his dependent (Legal heir) is paid the compensation. The role of doctor is important in connection with assessment of degree of disability.

CONCLUSION

Rapid industrialization with use of various modern technologies has posed greater challenges to general safety, at the same time research provides sufficient methods to many of these challenges.

Various methods to prevent these accidents include – data collection (local and national), analysis of data, proper strategies to prevent accidents ,good communication system on safe working practice, promotion of safety measures inside factory and prevention of intoxication are important. Enforcement of law and proper rehabilitation services will provide financial and psychological support.

Research on evaluating accidents more precisely is known as accidentology. Information about extent, type and characteristics of accidents and seeking better methods to alter human behavior are important facets of this study.

Conflict of Interest:- None To Declare

Source of Support:- Self

Ethical Clearance:- Nil

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Comprehensive Study of Suicidal Deaths due to Insecticidal Poisons in Females

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ABSTRACT

Suicide is nothing but self-killing which is a growing problem in developing as well as developed countries. Developing countries are suffering with suicide by agricultural poison whereas in developed countries it is by drugs. To analyze the situation of suicides by insecticide in females the present study is conducted in Hyderabad in department of forensic medicine, Osmania Medical College, Hyderabad. 25 female cases of suicide by insecticides are observed. In this most of the deaths are in the age group of 21-30 years with health related problems. 80% of female are committed suicide by consuming organophosphorus compounds in this study.

Keywords- Suicide, Insecticide, Female.

INTRODUCTION

Suicide is widely prevalent and no nation and culture has escaped from it, though the number varies from area to area. The prevalence of suicide in today's world is quite alarming. In the year of 2000 about 8 lakh people have died due to suicide in the world wide. According to the World Health Organization (WHO), suicide in 2004 was the 8th leading cause of potential years of life lost worldwide among persons aged 15-44 years¹. Suicide means self-murder. Schneidman defined it as 'the human act of self-inflicted, self-intentional cessation of life 'it is an act committed out of constricted thinking, tunneled logic and acute anguish².

Deliberate self-poisoning has become an increasingly common response to emotional distress in young adults³. In industrialized countries, the drugs that people commonly take in overdose to commit suicide are analgesics, tranquillisers, antidepressants are relatively non-toxic⁴. In developing countries the situation is quite different. The substances most commonly used

for self-poisoning are agricultural pesticides⁵⁻¹⁰. Overall case fatality ranges from 10% to 20%¹¹. For this reason, deaths from pesticide poisoning make a major contribution to patterns of suicide in developing nations, particularly in rural areas⁵. Insecticides are compounds which kill or repel insects and related species. For example, organophosphates, organochlorines, carbamates, pyrethrum and its derivatives (pyrethroids)¹².

AIMS AND OBJECTIVES

To analyze the deaths occurring due to insecticidal Poisons in female sex in Hyderabad area.

MATERIAL AND METHOD

The present study was done on suicidal deaths by insecticidal poisons in female sex which are autopsied in Department of Forensic Medicine, Osmania Medical College Hyderabad In 2013. Regarding manner of death information collected from Inquest report and with personal discussion of family members of deceased. Only death due to inorganic insecticide poisons are taken into consideration for this study which are conformed by RFSL reports. Victims who are died due to organic insecticide are excluded.

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RESULTS

The number of Post mortem examinations conducted by the Department of Forensic Medicine Osmania Medical College, Hyderabad are 1440 in 2013. The total number of suicides committed by poisoning is coming to 186(12.9%) in the study period. Female deaths are 25(1.7%) by insecticidal poisons.

The age distribution of the victims is showing increased incidence between 21 years to 40 years in both sexes. There are no deaths seen in the age group less than 10 years of age group who committed suicides. Between 11 years and 20 years 3(12%) in number, the youngest girl who committed suicide is 12 years. 10(40%) females are in between 21- 30 years, 6(24%) females are in between 31- 40 years, 3(12%) are in 41 years and 50 years, 1(4%) female belongs to 51- 60 years, 2 (8%) female are belongs to 61 - 70 years.

In this study of 25, married women are 20(80%) and unmarried women are 5(20%). Out of 25 deaths 6(24%) females are illiterates; 14(56%) females completed primary education; 2(8%) completed secondary education; 2(8%) were graduates and 1(4%) was professional. When hormonal status is taken into consideration 15 (60%) are in non-menstrual state, 3(12%) are in menstrual state, 5(20%) are in menopausal stage, 1(4%) in lactating and 1(4%) in pre pubertal stage.

As many as 19 (76%) deaths are occurred in hospital; 3(12%) females died in their own houses; 2 (8%) females died in others houses and 1(4%) female died in open areas. Most of the deaths are committed by consuming Organo Phosphate compounds. They accounted for 20(80%) deaths of total 25. 3(12%) females consumed Organo Chlorine compounds; 2(8%) females consumed Carbamate.

Health problems are the leading precipitating factors for committing suicides in the present study and 11(44%) females died for this. Which are varying from pain abdomen in the young female to incurable disease in elderly female. The next leading factor is marital disharmony, 6 (24%) persons committed suicide by poisoning for their marital disharmony. Maladjustment with the family members is also another leading cause and 3 (12%) females are died for this reason. Failure in love causes 2 (8%) females and failure in education 1 (4%) female death. Infertility is reason in 1 (4%) female

to commit suicide.

DISCUSSION AND CONCLUSION

Suicide is one of the leading manner of deaths all over the globe and that is true even in Hyderabad area. It is found that the total number of deaths occurring due to suicidal poisoning are coming to 186 in the calendar year 2013. In this female suicidal deaths by insecticidal poison are 25.

The vulnerable age group found to be 21 years to 40 years with peaks in 21 years to 30 years then 31 years to 40 years. Because at this age group females have to face many problems like health, family and financial problems etc. This correlates with one western study¹³.

Most of the victims have primary education. It indicates that not only education, emotional stability is required which protect the female from their impulsive act of suicide. No place is safe for consuming poison. 6(24%) female are not seen immediately after they consumed the poison. They died on the spot. Majority of the victims are shifted to the nearest hospital soon they witnessed the act. Even after that the deaths in the hospital are more because, they crossed critical life saving time due to delay in transportation.

The commonest poison consumed is Organo Phosphate compound. This is because these compounds are commonly used in agricultural work so there is a easy access to this insecticide, when compared with other insecticide like Organo Chlorines and carbamates. Financial problems are the leading precipitating factors, followed by the health problems are the leading precipitating factors, which include pain abdomen in young females and incurable diseases in elderly females. The precipitating factors expressed as pain abdomen either in the inquest or elicited on personal enquiry appears to be untrue. Because it was expressed in many women that she had menstrual pain. But on dissection of uterus except in 3 women who showed menstrual phase of cycle, rest of all others who complained of pain abdomen are in non-menstrual cycle. Next precipitating cause is marital disharmony which is related to dowry or lack of care from husband or his family members. Marital disharmony and maladjustment with family members is one of the important aspect to be addressed, as because these are all preventable deaths. Failure in education and failure

in love should not become causes for committing suicide if proper counseling is given to the victims in time.

SUGGESTIONS

1. Counseling should be arranged for all victims who are at risk and proper care should be taken by their family members. Counseling is to be extended to the girls in pubertal age and there should be proper health care provision to reduce their physical pain, induced by onset of menstruation. Sec. 309 of I.P.C should be kept in to action and the persons making para-suicide attempts should be penalized under this section, which sends a message to the community that, committing suicide is a punishable crime. (Attempted suicide is an unlawful act and the person is held responsible for the immediate consequence of the act in India¹⁴.)

2. Approach to the insecticide is one factor which makes somebody to commit suicide because of its accessibility. So they should be kept in safe custody. Stringent actions should be adopted in selling and handling of such harmful insecticides.

3. Every PHC should be equipped with the first aid treatment, as a stomach wash tube, atropine, PAM, IV fluids etc. All the staff in the PHC should be trained to manage the poisoning cases effectively. Preferably the victims should be shifted to the nearest tertiary care hospital as early as possible. There should be enough transport facility to transit these victims to the tertiary care hospital. Telemedicine facility should be extended to all hospital dealing with poisoning cases. Poison information center should be established at least one in each state.

Conflict of Interest- No

Ethical Comity Clearance: Taken

Source of Funding- Self

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Awareness of Medical Students Towards Medicolegal Autopsy in Barabanki, U.P.

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ABSTRACT

Autopsy implies examination of the dead body with a view to searching primarily for the cause of death. It is divided into Medico-legal autopsy and Academic autopsies. The autopsy can make an important contribution to medical education. Present study is carried out to determine the awareness of medical students towards autopsy. Two hundred sixteen medical students of 2nd and 3rd year MBBS were randomly selected for the study. The students were asked to respond anonymously to a set of 12 questions. 85.2% of the students agreed that autopsy is necessary in medical education. (92.6%) respondents suggested that medical students should actively participate in performing autopsies. The majority of the students (202, 93.5%) felt that autopsy should not be scrapped from the medical curriculum. 56.5% of students do not want to specialise in forensic medicine. The study showed that exposure of students to autopsy is important to their medical education.

Keywords: Medico legal autopsy, Academic autopsy, Medical students, Forensic Medicine.

INTRODUCTION

The word autopsy is derived from the Greek word autopsia- “to see with one’s own eyes”. The medico-legal autopsy plays an important role in the administration of justice. The use of autopsy in medical education has been declining, just as autopsy rate has been falling worldwide. ^[1, 2]

It is only when students attend an autopsy section that they can appreciate the large number of pathological conditions in different patients. ^[3]

It is obvious that knowledge of autopsy will broaden the students’ mind and enhance a more accurate diagnosis during the subsequent years of their clinical practice as doctors. Various reasons given for the decline in autopsy-based teaching include insufficient hospital autopsies, competing departmental duties and limited curriculum time. ^[4]

A complete autopsy is necessary to substantiate the truth of the evidence of eyewitnesses. A poor autopsy is worse than no autopsy at all, as it is more likely lead to a miscarriage of justice. ^[5]

Many medical students graduate without seeing an autopsy ^[6], but in some countries they may be the only medically qualified person to undertake the task.

In India, according to the curriculum of the Medical Council of India, a medical student should witness a minimum 10 in number of medico legal autopsies in the second year so that they can observe and interpret various findings .An intern is supposed to acquire the skill of doing a medico-legal autopsy. Thus, every medical graduate is presumed to be capable of doing a medico-legal autopsy. ^[7]

The autopsy sessions provide opportunities to discuss subjects like death certification, forensic pathology, appropriate attitudes towards deaths and communication skills essential for giving bad news or seeking consent for autopsy. ^[8]

We therefore decided to carry out this study to determine the attitudes of medical students toward

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autopsy practice in Barabanki.

AIMS AND OBJECTIVES

To study the awareness of medical students towards autopsy, specifically, medico-legal autopsy

MATERIALS AND METHOD

This study was conducted among medical students of a Mayo Institute of medical sciences Barabanki, lucknow. Comments of the students of 2nd and 3rd year were obtained by asking them to answer a questionnaire on the subject. Questionnaires were prepared, after going through literature and day today interactions with students during autopsy. The questionnaires were distributed to the students and participation in the study was voluntary. The students were asked not to disclose their identity. The survey consisted in several questions relating to the autopsy practice, the knowledge of the procedure and attitude and perception towards post-mortem examination.

OBSERVATIONS

Out of the 250 questionnaires distributed, 216 were returned duly filled. The age range was 19-24yrs, 134 (62%) of them were male while 82 (38%) were females. All these students witnessed 10 medico-legal autopsies each during 2nd and 3rd year of medical graduation in the subject of Forensic Medicine and Toxicology, which is a mandatory requirement as per the syllabus prescribed by Medical Council of India.

In our study 160(74.1%) students were aware of aims and objective of medico-legal autopsy and only 60(27.8%) is aware of prerequisite of performing medico-legal autopsies.

In the evaluation of response, 85 (39.4%) of the students stated that the number of autopsies they witnessed was enough, while 131 (60.6%) said that number was not enough. However, a total of 170(78.7%) students would recommend medical students to watch more autopsies.

The majority, 200(92.6%), suggested that medical students should actively participate in performing autopsies.

Majority, 160 (74%) of the students is aware of types of incisions while performing medico-legal autopsy.

Most of the students 184 (85.2%) agreed that autopsy is necessary and they learnt something from watching and participating in an autopsy.

Most of the students (202) 93.5% felt that autopsy should not be scrapped from the medical curriculum. (Table 1)

In our study only 44% agreed to an autopsy being performed on them or their relatives.

Majority of the students 122(56.5%) were not interested in specializing in Forensic Medicine because it deals with death, while 63% of them had made up their mind to specialize in other specialties. In our study 16.7% students were not interested in forensic medicine, 63% interested in other specialties, 8.3% felt that Forensic medicine as a profession is not lucrative because there is very little scope at present in India for this speciality. (Table -2)

12 % students are having no reasons for specialising in forensic medicine.

DISCUSSION

The age range of the students was 19-24 yrs in this study. This is because the common age of admission into the medical college in India falls between 17-20 yrs. This compares favourably with the findings of Brieger WR ^[9] in 1980 and Ekanem and Akhibe ^[10] in 2006.

In the present study, all the students witnessed a minimum of 10 autopsies each. Although (39.4%) of the students said that the number of autopsies they witnessed were enough, 170 (78.7) students recommended that medical students should watch more autopsies. This is similar to the study by Ekanem and Akhibe ^[9] where the figure was 57% and 74% respectively. Most of the students, 184 (85.2%), agreed that autopsy is necessary and they learnt something from watching and participating in an autopsy.

This compares favourably with the studies of other authors. ^[10-12] In Nigeria several students commented that attendance at autopsy may have fundamental psychological benefits, “---aiding students to come to terms with the death of a patient,” and “attending one or more autopsies is good for medical students in that it is one way in which we can come to terms with mortality”.^[13]

In our study 44.4% of the student answered positive

on wished to have post-mortem examination on self/relative when required is favoured by study of Ekanem and Akhibe [10] and it is in contrast to the studies by Sanner [14] in Sweden, and Jadav CJ et al [12] in which 90% and 82.5% of the students respectively agreed for autopsy to be performed on themselves, though most of them felt uncomfortable at the thought of it.

92.6%, 200 participants suggested that students should actively participate in performing autopsy rather watching and standing as spectators is similar to study(76%) conducted by Ekanem and Akhibe [10].

In present study 93.5% of the students agreed that autopsy is necessary in medical education. This compares favourably with the study of Botega et al [15] in Brazil and a study by Conran et al [11] in Ohio, USA, where 85% of the students also said that autopsy should be mandatory for all medical students. Joon Joon in Malaysiya

Indicated 77.5% of the students recommended making autopsy session compulsory during undergraduate medical training. [16]

The majority of the students (88%) were not interested in specializing Forensic Medicine because it deals with death, while 63% of them had made up their mind to specialize in other specialties. 8.3 % of them felt that forensic medicine as a profession is not lucrative ,

because there is very little scope at present in India for this speciality. Though no other has been exclusively done on this subject i.e. medico legal autopsy, a similar study by Ekanem and Akhibe [10] on the clinical autopsy compares favourably with the present study, where students have shown the same response for the subject of pathology. [Table-2]

In present study majority of students (74%) were aware about aims and objectives of performing medico-legal autopsy and incisions given during performing Medicolegal autopsy and only (27.8%) know about prerequisite of performing medico-legal autopsy.

Most of the students suggested (57.4%) that use of primitive instruments such as chisel hammer should be replaced with the more modern equipment like oscillating saw and care should be taken to keep the autopsy room clean and odour free this is similar with the study done by Rautji R et al[17]

Very few students (8.3%) were of opinion that post-mortem examination is disrespect to human body, which is favoured by study of Jadav et al and Khoo Joon Joon [12, 16]

2.8% students were of the view of starting virtual autopsy and (2.8%) emphasised increased requirement of forensic expert at places of medico-legal autopsy.

Table 1: Response to question in relation to gender

S. No.	Questions	Male		Female		Total	
		Yes(%)	No(%)	Yes(%)	No(%)	Yes(%)	No (%)
1.	Have you any knowledge about aims and objectives of performing medico-legal autopsy?	94(70.1)	40(29.9)	66(80.5%)	16(19.5%)	160(74.1)	56(25.9)
2.	Do you know about prerequisite of performing medico-legal autopsy?	38(28.4)	96(71.6)	22(26.8)	60(73.2)	60(27.8)	156(72.2)
3.	Do you know think the number of autopsies you watched were enough?	53(39.6)	67(60.4)	32(39)	50(61)	85(39.4)	131(60.6)
4.	Would you recommend that medical students should watch more autopsies?	104(77.6)	30(22.7)	66(80.5)	16(19.5)	170(78.7)	46(21.3)
5.	Should medical students actively participate in performing autopsies?	124(92.5)	10(7.5)	7.6(92.7)	6(7.3)	200(92.6)	16(7.4)
6.	Do you know type of incisions given during performing Medico-legal autopsy?	96(71.6)	38(28.4)	64(78)	18(22)	160(74)	56(26)
7.	Did you learn anything from the autopsies you watched?	106(79.1)	28(20.9)	78(95)	4(5)	184(85.2)	32(14.8)
8.	Should witnessing autopsy be scrapped from the UG curriculum?	6(4.5)	128(95.5)	8(10)	74(90)	14(6.5)	202(93.5)
9.	At death would you like autopsy to be performed on you or any of your near relatives	68(50.7)	66(49.3)	28(34.1)	54(65.9)	96(44.4)	120(55.6)
10.	Would you like to specialize in Forensic Medicine?	56(41.8)	78(58.2)	38(46.3)	44(53.7)	94(43.5)	122(56.5)

Table 2: Reasons for not specialising in forensic medicine

S. No.	Reasons	%
1.	Not interested in forensic medicine	16.7%
2.	Interested in other specialities	63%
3.	Not lucrative , scope in India is minimal	8.3%
4.	No reasons	12%

Table 3: Suggestions for improvement in Autopsy procedure

Suggestions	%
Improvement in hygiene and sanitation in autopsy room	28.7
Replacement of primitive instruments with modern ones in the autopsy room	57.4
Show more respect towards dead body	8.3
Starting of virtual autopsy	2.8
Increased requirement of Forensic Expert at place of Medico-legal Autopsy	2.8

CONCLUSION

Autopsy promote research; help in administration of justice; they provide reliable statistics on morbidity and mortality; they produce useful genetic information; they facilitate interdisciplinary discussion and knowledge exchange; and they can serve as an indicator of the quality of medical care. ^[18] The exposure of students to autopsy is important to their medical education since those who are not exposed will not be able to order one in their subsequent years of clinical practice^[10] the authors therefore recommend that the attitude of medical teachers should be such as will encourage the students to become more interested in observing autopsies. The use of innovative technology in teaching autopsies to medical students, for example, starting of virtual autopsy should be considered.

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Analysis of Electrocardiographic Changes in Patients with Scorpion Sting

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ABSTRACT

Scorpion stings are a major health problem in tropical countries like Africa, India where the incidence of serious envenomations are very high. Among the different species of scorpions available, the Indian red scorpion, *Mesobuthus tamulus* is of medical importance in India as it constitute cardiotoxins. So the Aim of this study is to examine the electrocardiographic changes of patient stung by scorpions. Forty six patients stung by scorpions for the period June 2013 to July 2015 were selected. 12 lead derivations electrocardiography (ECGs) was performed to all patients. The determined parameters were: PR segment and QRS duration, QTmin, QTmax, QTc, QT dispersion (QTd) intervals, minimum P wave duration (PWmin), maximum P wave duration (PWmax) and P wave dispersion (PWd). Thirty six patients (17 males and 19 females, mean age: 36.7±13.7 years) were included in this analysis. Heart rate (84,5±13,8 beat/min), QRS (98,8±11,8 msn), QTc (412±27,4 msn), QTd (412±27,4 msn), PWmin (412±27,4msn) and PWd (41,4±19,7 msn) were found. Scorpion sting lead to changes in the ECG with most common changes were ST changes, sinus tachycardia, atrial ectopic beat, bradycardia, and ventricular ectopic beat.

Keywords: *Electrocardiographic variability; Heart rate; Scorpion sting.*

INTRODUCTION

Scorpion envenomation is an occupational hazard for farmers, farm labourers, villagers, migrating population and hunters. They are generally found in dry, hot environments, although some species are also present in forest and wet savannahs. All species are nocturnal, hiding during the day under stones, wood or tree barks, loose tiles of hut, inside empty shoes, pockets of trousers and shirt, crevices of doors and windows^{1,2}

Electrocardiographic abnormalities are frequently recorded on admission or several hours later³. Sinus tachycardia is initially recorded in the majority; however sinus bradycardia may be present in 24% of the victims. Bizarre, broad notched, biphasic T wave

changes with additional ST elevation or depression in the limb and precordial leads are recorded, sometimes accompanied by beat-to-beat T wave abnormalities³ followed by the appearance of tiny Q waves in the limb leads, consistent with acute myocardial infarction like pattern; occasionally electrical alternant of the QRS was recorded; the QTc was prolonged in the majority of patients and a transient deviation of the QRS frontal axis to the left or right accompanied by incomplete RBBB was also observed⁴.

India is the most affected, with a reported incidence of 0.6%.¹ A retrospective analysis of the calls received by the national poison information center (NPIC) between April 1999 and March 2002 showed that, out of 995 calls, 6 involved scorpion sting.¹⁴ During hot months March to June and September to October daily cases of sever scorpion sting are received at endemic areas western Maharashtra, Karnataka, Andhra Pradesh, Saurashtra and Tamil Nadu.

The aim of this study was to examine the electrocardiographic changes in patients presenting with envenoming following a scorpion sting.

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METHOD

This was a retrospective study of 46 consecutive patients with scorpion stings admitted to Gandhi Medical College Hospital, Secunderabad from June 2013 to July 2015. The protocol was approved by the institutional ethics committee. Repeat 12 derivation electrocardiography (ECGs) were obtained per 6 h during admission from all patients. Only the ECG that was obtained from the patients when their pain was at the highest level was recorded for determination. Minimum QT duration, maximum QT duration and QT dispersion were measured. QT dispersion was calculated as the difference between maximum QT duration and minimum QT duration (QT dispersion = maximum QT duration – minimum QT duration). Increased QT dispersion (QTd) is an indicator of heterogeneous ventricular repolarization and is useful for prediction of lethal arrhythmia such as ventricular tachycardia⁵. Minimum P wave duration, maximum P wave duration and

P wave dispersion was calculated. P wave dispersion was calculated as the difference between maximum P wave duration and minimum P wave duration (P wave dispersion = maximum P wave duration - minimum P wave duration). The P wave of the electrocardiogram may show alterations that can be associated with atrial arrhythmias⁶. Prolonged P wave duration and increased P wave dispersion have been reported to an increased risk for atrial fibrillation⁷. Corrected values (QTc, QpTc) were calculated from these values according to the Bazett formula: (QTc = QT/QR-R, Q peakTc = QpT/R-R (sec). Additionally, Q peakT values were found by measuring the interval between the initial point of the QRS complex and the highest point (peak) of the T wave.

STATISTICAL ANALYSIS

SPSS software package (SPSS 16; SPSS Inc., Chicago, IL, USA) was used for statistical analyses. The data were analyzed using Student's t-test and the numeric data were expressed as the mean ± standard deviation. Chi-square test and the results were expressed in percentages.

RESULTS

The mean values and statistical comparisons of 46 patients are presented in Table 1. Forty six patients

(24 males and 22 females, mean age; 33,7±14,7 years) were included in this analysis. The ECG which were performed when the patients had maximum (grade 3) pain were obtained for determination.

Heart rate (84,5±13,8 beat/min), QRS (98,8±11,8 msn), QTc (412±27,4 msn), QTd (412±27,4 msn), PWmin (412±27,4msn) and PWd (41,4±19,7 msn) were found. In patients, sinus tachycardia, atrial ectopic beat, ventricular ectopic beat, sinus arrhythmia, ST changes, LBBB, RBBB, first-degree AV block, LAHB, LPHA that were not needed treatment were 17,1%, 2,6%, 13,2%, 2,6%, 7,9%, 13,2%, 1,3%, 2,6%, 6,6%, 6,6%, and 2,6% respectively.

DISCUSSION

The scorpionism and its consequences are an actual public health problem in several parts of the world; especially in north-Saharan Africa, Sahelian Africa, South Africa, Near and Middle-East, South India, Mexico and South Latin America, east of the Andes⁹. Approximately 1500 species of scorpions are described. About thirty of them are recognized as potentially dangerous for humans⁹. Approximately 94% of the accidents occur during the night at homes especially in rural areas, and 88% do not require any hospitalization⁸.

Climatic conditions, dryness and heat, are also important risk factors¹⁰. The effects of the stings depend on the delivery dose of the scorpion, the age of the offender, the season, and the size of the victim¹¹.

Adults and among them males are most frequently stung by scorpions. However, envenomations are more severe in children in whom mortality is dramatically higher than in adults³. The death can occur early due to cardiovascular collapse. The incidence is underestimated resulting in the absence of exhaustive report of the cases; mortality is probably better known. More than 1,200,000 scorpion stings occur annually while the number of deaths could exceed 3250⁹. Average case fatality rate is 0.27%⁹. Soker et al¹² reported a higher mortality rate (12.5%) from west and southeastern part of Anatolia among 64 children patients with scorpion stings. In contrast, in our study no deaths were recorded among the 36 cases from our region.

The pathogenesis of cardiac dysfunction and myocardial damage secondary to scorpion envenomation

had largely been the subject of debate in the past. The most accepted hypothesis was the increased catecholamine circulating secondary to a direct stimulatory effect of the venom on the adrenals and on sympathetic nerve endings. This hypothesis was confirmed by some clinical and experimental¹³ studies. In effect, it is possible that the venom affected the myocardial cell membranes directly, altering its permeability as well as electrical properties, and through abnormal electrolytes fluxes and shifts, causes functional damages¹. However the myocardial dysfunction may be due to myocardial ischemia¹⁴. This hypothesis was advanced on some clinical, electrocardiographic, echocardiographic¹⁵, and radionuclide²⁰ studies.

It was reported in this study that, the incidence of pulmonary edema ranged from 7% to 46% and cardiac arrest rate was 7%³. It is reported in many studies¹⁷ that, the clinical signs of involvement of cardiovascular system are tachycardia (rarely bradycardia with hypotension) with hypertension, in a large number of the victims. Alpay et al¹⁸ evaluated the ECG findings in two cases; in first case they had shown sinus rhythm with normal PR and QT intervals, presented 1 mm ST depression on precordial and extremity derivations where 2 mm ST elevation was found on aWR. Sinus tachycardia, U wave and mild QTc elongation (QTc=0.46 sn) was found in ECG of the second case.

QTd is related to serious arrhythmia and sudden cardiac death¹⁹. In many studies, it is accepted that regional differences in repolarization (QTd) of the heart triggers these events²⁰. QT disturbed regional repolarization of ventricle²⁰, namely, it reflects homogeneity disturbance (inhomogeneity) in the repolarization process²¹ Alan et al¹⁹ thought that, persons who have been bitten by scorpions, myocarditis could develop, homogeneity of myocardium could be disturbed due to inflammation or toxic effects in myocardium, and arrhythmias may occur through QTd. Therefore they examined QTd in patients. They did not detect a significant difference in QT and QTd value patients and control group. In our study QRS, QTd, and PwD were found to be statistically significant.

There were no cases of hypersensitivity reactions, cardiogenic shock and pulmonary edema in present study. All patients were discharged with recovery. Cheema et al²² reported that epinephrine

and norepinephrine extended the maximum period of P wave. It was reported by Tukek et al²³ that, the increase in sympathetic activity causes increasing in P dispersion. The P wave of the electrocardiogram may show alterations that can be associated with atrial arrhythmias⁶. The P wave dispersion was not determined in previous studies due to scorpion stings. Our study is the first in this subject. We think that, the significant difference between P wave dispersion and minimum P wave period is related to both increased early atrial beat number and also increased sinus arrhythmia. This condition is related to the sympathetic activity that caused by scorpion venom.

Bouaziz et al²⁴, reported that, the most observed abnormalities in electrocardiogram were sinus tachycardia (84.8%) (>120/min in children and 90/min in adult patients) and T-Wave changes (17.8%). Other ECG abnormalities were also observed including ST segment depression or elevation (15%), and sinus bradycardia (0.4%). Also, it was determined in this study that, of patients, 61.5% had a pulmonary edema, while 20.5% had a cardiogenic shock²⁴.

Bahloul and his colleagues¹⁴ made a study to determine the myocardial ischemia in six patients with severe scorpion envenomation. In this study the most common abnormality observed in ECG was tachycardia (>110 beat/min) (100%). 1/3 of patients improved cardiogenic shock. Other ECG abnormalities were also observed, including ST segment depression or elevation observed in two patients, T-wave change was observed in four patients and right bundle branch block in one. In our study, the most common ECG abnormality was sinus tachycardia. The rate of patients with bradycardia and ST-T changes were similar to the literature.

In Blum and his colleagues's⁴ study the ECG demonstrated a normal sinus rhythm. There were deep large inverted T waves in leads II, III, and AVF, with huge U waves in precordial leads V1-V4⁴. In another study that was made by Bentar et al.²⁵, cardiac problems rate and ECG abnormalities was reported as 23,1% and 13,7% respectively.

Table 1. Comparison of ECGs findings of the patients

Sinus tachycardia (n/%)	13/ %17,1
Heart (Rate beat/min)	84.1±13,8
Atrial ectopic beat (n/%)	10/ %13,2
Ventricular ectopic beat (n/%)	2 /%2,6
Bradycardia (n/%)	2 /%2,6
Sinus arrhythmia (n/%)	6 /%7,9
ST changes (n/%)	10 /%13,2
LBBB (n/%)	1/ %1,3
RBBB (n/%)	2 /%2,6
1. AV block (n/%)	5 /%6,6
LAHB (n/%)	5/ %6,6
LPHB (n/%)	2/ %2,6
PR duration(msn)	159,1±34,1
QRS duration(msn)	98,8±11,8
QTmin (msn)	342,4±32,8
QTmax(msn)	377,1±33,4
QTc(msn)	412±27,4
QTd(msn)	36,3±21,5
Pmin wave duration (msn)	68,4±19,3
Pmax wave duration (msn)	105,9±21,1
PWd (msn)	41,4±19,7
QpeakT (msn)	87,1±20,1

QTd:QT dispersion, PWd:P wave dispersion

CONCLUSION

Most common ECG abnormality was sinus tachycardia. Other ECG abnormalities were ST segment changes, bradycardia, AV block, LBBB, and RBBB. QRS, QTd, and PWd which was statistically significant.

Conflict of Interest: We declare that there is no conflict of interest

Source of Funding: None

Ethical Clearance : Institutional ethics committee.

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Ligature Mark in Hanging – Gross and Histopathological Examination with Evaluation and Review

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ABSTRACT

Background: Hanging is one of the most common methods of suicidal deaths in India. Virtually all hangings are suicides until otherwise it is proved contrary. The ligature mark plays a major role in deriving the important findings to lead investigation. The correlation of external, internal findings help to establishing the crucial facts in cases of hanging.

Aims & Objectives: To study various patterns of ligature mark. To differentiate cases of antemortem hanging with postmortem.

Materials & Method: A study carried out in Departments of Forensic Medicine and Pathology, S. V. Medical College, Tirupati from January 2010 to December 2013 with 83 cases of asphyxial deaths due to hanging. A thorough external and internal examination of ligature mark was performed in all the cases.

Results: Majority, 37(44.5%) of cases belong to 3rd decade (21-30 yrs). Males are common victims – 52 (62.6%). Complete hanging was commonest type – 76(91.56%). Chunnis were commonest material – 25 (31.12%). Single ligature mark was common – 80(96.3%). Gross examination revealed soft tissue changes in 23(27.71%) cases. Microscopic examination - breaking, wrinkling and compression of skin along with micro hemorrhages and inflammatory changes in subcutaneous tissues were notified.

Conclusion: The correlation of external, internal and microscopic findings leads to easy formulation of final opinion in these cases. It also, to some extent helps to delineate antemortem cases of hanging with postmortem cases.

Keywords: Hanging, Ligature Material, Microscopic Examination, Suicidal Deaths.

INTRODUCTION

Hanging was found out to be second most common cause of suicidal death in India in the year 2012. The

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most common cause being death by pesticide intake¹. Virtually all hangings are suicides until otherwise it is proved contrary². The ligature strangulation is one in which force applied to the neck is derived from the gravitational pull of the weight of the body or the part of the body³. The factor of suspension differentiates hanging from strangulation by ligature⁴. A single knot with a running noose, fixed knot by a granny or reef knot or a simple loop is found⁵. The nature of ligature mark depends upon the material and position of ligature

used and the time of suspension of body after death. Hence, examination of ligature material and mark becomes an indispensable part of autopsy. The ligature mark is more detectable in cases where the ligature is narrow and material is hard. The suspension time is directly proportional to the detectability of ligature mark. Multiple pictures are taken at different times till autopsy is completed – this technique is called as “bracketing” or “color saturation”⁶.

Usually single line or mark is found. But, multiple marks may also be seen in cases of spiral turns, multiple turns around neck or upward displacement of material after application due to fall.⁷

The line of congestion may be seen along course of a furrow, which is considered significant and is interpreted as a vital reaction by Polson⁸. Here exists another challenge in front of forensic experts to qualify the case of hanging as ante mortem or post mortem i.e., fabricated scene of hanging in case of homicides. The diagnosis of ante mortem hanging is only a measure of probability when only gross features are observed that too in the absence of strong proof to the contrary⁹. Hence, a detailed internal examination of neck structures (soft tissue, bones & cartilages) and histopathological examination of the mark and internal neck structures gives additional and necessary information in these cases. The histopathological examination reveals presence of effusion of red cells, congested blood vessels, hemorrhages, tissue reaction etc., in cases of ante mortem hanging. Though absence of the above findings does not exclude ante mortem hanging, its presence plays a major role in establishing the facts in cases of hanging¹⁰.

In the present study the authors have tried to make an attempt to study various patterns and variations in ligature marks in cases of hanging and to study external, internal, gross features of neck, correlating these findings with histomorphological observations in respective cases to establish the exact mode and nature of death of the individual.

MATERIALS AND METHOD

The present study was carried out in the Department of Forensic medicine and Toxicology in collaboration with Department of Pathology, S. V. Medical College, Tirupati. A total of 83 cases of asphyxial deaths due to hanging were enumerated and an extensive study

was performed over a period of four years from January – 2010 to December – 2013. Emphasis was over ligature mark and material. A meticulous local external examination of neck was done with naked eye and hand lens to quantify and correlate ligature mark with its appearance in relation to material, impression, pattern, color, course, type of knot, level of ligature, skin changes etc. . A note was also made regarding other external injuries if any. Thus, after completing external examination autopsy was performed with dissection of thoraco-abdominal and cranial cavities followed by dissection of neck with ‘Y’ shaped incision. Two incisions were given over either side of neck 2-3cms behind lobe of each ear converging diagonally at manubrium sterni. The incision was continued down as a single line up to pubic symphysis. The neck dissection was completed by layer wise inspection starting with subcutaneous tissue and proceeding with muscle layers, vital vessels and other deeper structures in the neck beneath ligature mark. All gross findings were noted and a portion of skin and subcutaneous tissue from the site of ligature mark was excised. The excised specimen was preserved in 10% formalin and subjected for histopathological examination. The sections were stained with hematoxylin and eosin and slides were examined by a panel of pathologists. The final opinion was recorded and findings were correlated in all the cases for further evaluation.

RESULTS

Majority of cases observed were young adults in third decade i.e., 21-30 years – 37 (44.5%) followed by individuals in fourth decade i.e., 31-40 years – 18 (21.6%). In present study 52 (62.6%) male victims and 31 (37.3%) female victims were found.

Amongst 83 cases of hanging 33 (39.75%) males were married and 11 (13.25%) were unmarried. In 8 (9.63%) the marital status was not known. Whereas, 19 (22.89%) female victims were married, 10(12.04%) unmarried and the status was not known in 2 (2.4%) cases. Most of the victims belong to middle and lower socio economic strata - 37(45%) and 36 (43%) respectively. The status was not known in 10 (12%) cases and there were no cases from upper social status. As far as the type of hanging was considered, complete hanging was observed in 76 (91.56%) cases. Partial hanging was seen in 7 (8.43%) cases and in 5 (6.02%) cases feet was seen touching the ground. In 2 (2.40%)

cases knees were touching the ground. Chunni was the most common ligature material used by victims in present study – 25 (31.12%), followed by nylon rope in 15 (18.07%) and other materials like Saree, bed sheet etc., were also used. An unusual plastic tape like material was observed in one case (Figure:1).



Figure: 1 Plastic tape material and pattern of ligature material over the neck

The pattern of ligature mark was present in 12 (14.45%) cases. A single ligature mark was found in 80 (96.38%) and multiple rows in 3 (3.61%) cases. Slip knot was found in 15 (18.07%) and fixed knot in 9 (10.84%) cases. There was no particular knot in 59 (71.08%) cases, where a simple loop, encircled ligature material etc., were observed. The ligature mark was situated above thyroid cartilage in 76 (91.56%) cases, at the level of thyroid cartilage in 5 (6.02%) cases and below thyroid cartilage in 2 (2.40%) cases. Complete encirclement of mark around the neck was observed in 12 (14.45%) cases and partial encirclement of neck in 71 (85.54%) cases. Grooving of the ligature mark (Figure: 2) over the skin of neck was present in 19 (22.89%). It was absent in 64 (77.10%) cases. A single case showed fractured hyoid bone (1.20%).



Figure:2 Grooving and brownish discoloration of the skin over the neck

In present study it was observed that in 3 (3.61%) cases external injuries other than ligature mark were present. Soft tissue injuries were observed in 23 (27.71%) cases, which show pale, white and glistening structures with focal engorged capillaries and small

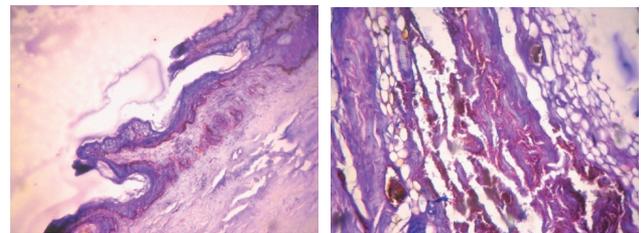
areas of hemorrhagic collections in the muscle plane and fibro fatty tissue (Figure:3).



Figure: 3: Internal examination of neck structures beneath the ligature mark showing large hemorrhage

In rest of the 60 (72.28%) cases, the internal examination was normal without any gross abnormalities. Histopathological evaluation was performed in all 83 cases.

Discontinuity of epidermal and dermal layers of skin (breaking) was noticed in 21 (25.30%) cases. Increased waviness of epidermal and dermal layers of skin (wrinkling) was noticed in 30 (36.14%) cases. There was decreased skin thickness with increased basophilia (compression) in 28(33.73%) cases. All the three features were noted in 4 (4.81%) cases. Only congestion of underlying tissues was observed in 35 (42.16%) cases; hemorrhagic collection in 18 (21.68%); congestion of tissues and frank areas of hemorrhages in 6 (7.22%) cases and congestion along with frank hemorrhages and cellular infiltrates in 8 (9.63%) cases. All the above findings were absent in 16 (19.27%) cases (Figures4 & 5).



Figures: 4 & 5 Microscopic examination (10 xs). Wrinkling and breaking of skin Subcutaneous hemorrhages at the plane of ligature (10 xs)

DISCUSSION

In present study 2.26% of cases of hanging were recorded in a period of four years (January 2010 to December 2013). There was gradual raise in number of cases from 2010 with dipping in 2012 and further increase in 2013. The above statement clearly depicts

that, the number of cases of hanging are increasing and there is a definite need for formulation of necessary steps to control this social evil. Young adults in third decade accounted for maximum number of cases – 44.5% followed by fourth decade – 21.6%. Similar findings were observed by various research workers and authors^{2, 6, 7, 11-14}.

Majority of cases were males – 62.6% and 36.3% of cases were females. More number of male victims were in their third decade - 28.91% and majority of female victims also were in their third decade – 15.6%. The present findings are consistent with studies done by other authors^{6, 7, 11-13, 15}.

The incidence of hanging was found to be more common in married individuals, 37.75% of males and 22.89% of females were married individuals. Similar findings were observed in study done by Sai Sudheer and Nagaraja². The possible element of stress and increasing responsibilities after marriage can be attributed to increase in number of married males. 45% of cases belong to middle socioeconomic strata and 43% of cases were from lower socioeconomic strata. The observations correlated with the findings of Sai sudheer and Nagaraja². Family related issues, financial derailments and other miscellaneous reasons play a pivotal role leading to psychological breakdown and increased suicidal tendencies in the people of middle and lower socioeconomic strata.

In present study, maximum number of cases showed complete hanging (91.56%) which is equivalent to observations by Sai sudheer and Nagaraja². Death by complete hanging might be ascribed to firm motive of individual to commit suicide. The authors studied in detail regarding ligature material used and comparative study was done in order to assess the common material used during hanging by the victims in Indian subcontinent. In all the studies done by various researchers, cloth material – Chunni was found to be the commonest ligature material followed by nylon rope and Saree^{6, 7}.

Single ligature marks was most commonly found in 96.38% of cases. Identical results were recorded by Sadik husen et al⁷. In majority of cases there was not particular kind of knot (71.08%), which is contradictory to Sadik husen et al.,⁷ where fixed knot was observed in maximum number of cases - 58%. Thus, the fact is once again strengthened, that in majority of individuals

suicide by hanging is being practiced under extreme psychological stress where individual was not able to device a knot at that instance. In present study maximum number of cases (91.56%) showed ligature mark above thyroid cartilage which is similar to Sai sudheer and Nagaraja (88%), Sharma et al., (85%), Mohammed Musaib et al., (72.09%) and others^{2, 6, 7, 16}. All the above facts are correlating with the observations in present study. In most of the cases grooving of the ligature over neck was absent (77.10%). Contradicting feature was appreciated by Sai sudheer and Nagaraja², where grooving was present in 54% of cases. In present study, incidence of fracture of hyoid bone was observed in only one case (1.20%). In other studies also the percentage of cases showing hyoid bone fracture was very less.^{2, 13, 16}.

In present study, very few cases showed external injuries other than ligature mark (3.61%) and internal injuries like congestion of neck structures, internal capillary hemorrhages and frank hemorrhagic areas were observed in 27.71% cases which were found out to be consistent with the findings of Sai sudheer and Nagaraja². It is said that ligature mark is mainly a postmortem phenomenon, any inner neck structure injury indicating ligature mark intravitality is to be identified to establish the ante mortem hanging⁴.

An array of microscopic characteristic changes was studied. Skin changes—breaking (25.30%), wrinkling (36.14%) and compression (33.73%) were recorded which were in correlation with study done by Anil Yadav and Gupta¹¹. Congestion of blood vessels (42.16%), hemorrhages (21.68%), cellular infiltration (9.63%) was observed in present study which were in correlation to studies done by Anil Yadav and Gupta¹¹. The microscopic features were uneventful in 19.27% cases and a similar observation was made by Anil Yadav and Gupta¹¹ where 18.6% cases were uneventful.

Thus, various features of external injuries, internal injuries with assisted microscopic examination were studied and all findings were correlated.

CONCLUSION

The present study tries to emphasize that, examination of corpse in cases of hanging is made easy by correlating every single observation with ligature material, other external features, internal findings and histopathological features. Thus, if this procedure of

linking all the findings is followed as a routine practice in cases of death due to hanging, the formulation of final opinion in doubtful cases also will become easy; this in turn helps to distinguish ante mortem ligature mark with post mortem ligature mark and to establishing the cause and mode of death.

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Ethical Clearance: S V Medical College, Tirupati.

Conflict of Interest: None

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Medico-legal Study on the Poisoning Cases of Ajmer Region

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ABSTRACT

Background:-poisoning cases are increasing as epidemiological, social and medicolegal problem in all over the world. **Aims & objective:-** our aim of the study is to develop the statistical profile of poisoning cases in relation to their medico-legal aspect. **Method:-** this is a retrospective and cross-sectional study on the 142 poisoning cases noted in the Department of Forensic Medicine & Toxicology, J.L.N. Medical College, Ajmer, in the period starts from Jan. 2013 to December 2015. **Result:-** The incidence of poisoning, males being common victim and male : female ratio of 2.1:1. Maximum cases were observed in Hindu community. Evening time encountered maximum cases with common place of exposure being home. Maximum involvement of married males with Present study shows, married people (100 cases, 70.43%) are commonly involved as compared to unmarried (41 cases, 28.87%). Majority of victims (112 cases, 78.88%) consumed the poisons to commit suicide as per history followed by Accidental nature (22 cases, 15.49%). Aluminium phosphide is most commonly encountered poison (28 cases, 19.71%) leading to maximum fatalities, very closely followed by Organophosphorus compounds (25 cases, 17.61%) and corrosive substance (18 cases, 12.68%). **Conclusion:-** male cases predominant in poisoning cases and suicidal nature most commonly found.

Keywords:- Aluminium phosphide, suicide, summer

INTRODUCTION

In almost all unnatural deaths, poisoning is and likely to remain one of the commonest cause of death. Atharva Veda (1500 BC) describes poisons, Shastras and Upanishads gave details of symptoms produces by various poisons and their antidotes,

Poison is a substance (Solid, liquid or gaseous), which if introduced in the living body, or brought into contact with any part thereof, will produce ill-health or death, by its constitutional or local effects or both¹. The word poison has been evolved from the Latin word "potion" means to drink for health and that by the time, the definition has been changed to its present form as any substance which when administered, inhaled or

ingested is capable of acting deleteriously on the human body².

Deaths in homicidal or suicidal cases, poisoning appear an important cause³. Poisons are silent weapons, which can be easily used without arousing suspicion and often without violence in expert hands.

Since the origin of the mankind, poisoning always remains associated with it, though it was mostly accidental in nature in the earlier times⁴.. The incidence of poisoning is increasing because of its low cost, easy availability without any restrictions, comparatively small fatal dose and almost sure death. In India, there is no strict control over the sale and storage of poisons.

As trends of poisoning varies from place to place, but the incidences ever increasing epidemiological, social and medicolegal problem. This knowledge is need for restriction of particular poisonous compounds or there is need for improvement in emergency medical services or there is need for an awareness regarding the mortality due to poisoning cases.

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An attempt has made to find out incidence, socio demographic profile, various poisonous compounds, their fatalities, diagnostic difficulties, influence of treatment and analytical facilities and other significant features of poisoning.

MATERIALS AND METHOD

The present retrospective cross sectional study was conducted in department of Forensic and Toxicology, JLN Medical College, Ajmer, Rajasthan during the period of January 2013 to December 2015.

All the alleged human poisoning cases was bring for medico-legal autopsy and cases that was diagnose as poisoning after autopsy will be selected.

Detailed information of the deceased concerned to the case was collect from the relatives or attendants of the deceased, from concerned police officers and hospital case papers. All cases with the alleged history of poisoning and those cases which were diagnosed as poisoning after complete Post Mortem examination were included in our study. Confirmation of poisoning was done from chemical analysis reports. The data obtained were entered in charts and tables.

REVIEW OF LITERATURE

Paracelsus, in the 16th century, was the first to relate poisoning to the dosage of the toxic substance. To him is attributed the historic comment:

An autopsy study covering 25 years (1972-1997) conducted as Postgraduate Institute of Medical Education and Research, Chandigarh showed maximum

fatalities in the age group of 14 to 30 years (68%) with male dominance (69%). Suicidal poisoning was most common. Barbiturates (37%) and copper sulphate (22%) were most common poison consumed initially with changeover to aluminium phosphate (65%) and organophosphates (46%) due to agrochemicals that appeared to be a by-product of the “green revolution” when compared to the first and last 5 years of the study respectively⁶.

Out of 340 case of poisoning studied at Guru Nanak Dev Hospital, Amritsar, showed that males (72.94%) outnumbered females (27.06%) with the ratio of 3:1 with maximum cases in the age group of 21-30 years (45.59%) of which 69.12% were married, reasons being various related aspects of married life and influences of social customs and various stresses. Suicidal (76.46%) poisoning was most common followed by accidental (20.91%) and homicidal (1.76%), 3 cases (0.88%) were of undetermined origin. Aluminium phosphide (38.23%) was the most common poison consumed followed by organophosphorus compounds (17.64%) and alcohol (8.23%)⁷.

According to report of WHO, 2,20,000 people die each year and more than 90% of fatal poisoning occurs in developing countries. As per the rough estimate, more than 50,000 people die, that is about 5 to 6 persons per lakh of population die due to poisoning every year in India The commonest types of poisoning in India are insecticides and pesticides, the reason being agriculture based economics, poverty and easy availability of highly toxic pesticides. Among children, the manner of death was accidental while in adults it was mainly suicidal⁸.

OBSERVATIONS & DISCUSSION

Table – I: Distribution of poisoning cases in relation between age group and sex.

Sr. No.	Age group	Male	Percentage (%)	Female	Percentage (%)	Total	Percentage (%)
1	0-10 years	5	5.21	1	2.17	6	4.23
2	11-20years	14	14.58	14	30.43	28	19.72
3	21-30-years	29	30.22	12	26.09	41	28.87
4	31-40 years	14	14.58	7	15.22	21	14.79
5	41-50 years	19	19.79	7	15.22	26	18.30
6	51-60 years	12	12.5	2	4.35	14	9.86
7	61-70 years	2	2.08	2	4.35	4	2.82
8	>70 years	1	1.04	1	2.17	2	1.41
	Total	96	100	46	100	142	100

In present study, maximum cases noted in age group of 21 to 30 years (41 cases, 28.87%) with more males followed by age group of 11 to 20 years (28 cases, 19.72%) with equal involvement of both sexes. Minimum cases were observed in both extremes of age that is children and older people.

This can be due to factors like unemployment, stress, tension, failures in love, family problems, marital disharmony, harassment related to dowry in cases of females and scolding from parents in young brigade.

Table – II: Distribution of poisoning cases in relation to marital status of victims.

Marital Status	Year			Total
	2013	2014	2015	
Married	18 (75%)	49 (72.06%)	33 (66%)	100 (70.43%)
Unmarried	6 (25%)	18 (26.47%)	17 (34%)	41 (28.87%)
Not Known	0 (0%)	1 (1.47%)	0 (0%)	1 (0.70%)
Total	24 (16.90%)	68 (47.89%)	50 (35.21%)	142

Present study shows, married people (100 cases, 70.43%) are commonly involved as compared to unmarried (41 cases, 28.87%) . only 1 case of unknown was encountered where marital status remains unascertained.

In case of married males, family problems, unemployment , inability to fulfill requirements of family, marital disharmony and financial problems may be the cause whereas in married females harassment in context of dowry, dominance of husband, dependent life, change of social environment after marriage family conflicts may contribute.

Table – III: Distribution of poisoning cases according to alleged manner of death in relation to year.

Year	Alleged Manner of death				Total
	Accidental	Homicidal	Suicidal	Not Known	
2013	3 (12.5%)	0 (0%)	21 (87.5%)	0 (0%)	24 (16.90%)
2014	11 (16.18%)	0 (0%)	53 (77.94%)	4 (5.88%)	68 (47.89%)
2015	8 (16)	3 (6%)	38 (76%)	1 (2%)	50 (35.21%)
Total	22 (15.49%)	3 (2.11%)	112 (78.88%)	5 (3.52%)	142

Majority of victims (112 cases, 78.88%) consumed the poisons to commit suicide as per history followed by Accidental nature (22 cases, 15.49%). 5 cases (3.52%) were noticed where manner of death was not known.

This can be due to increased stress, tension and strain in life and inability to copy up with modern standards of life and society. Easy availability of poison, economical problems and low educational level can contribute as other responsible factors for suicide.

Table - IV

Year	Ingestion	Inhalation	IV	Skin contact	Unascertained	Total
2013	21 (87.5%)	2 (8.33%)	0 (0.0%)	1 (4.17%)	0 (0.0%)	24 (16.90%)
2014	59 (86.77%)	1 (1.47%)	0 (0.0%)	5 (7.35%)	3 (4.41%)	68 (47.89%)
2015	46 (92%)	0 (0.0%)	1 (2%)	2 (4%)	1 (2%)	50 (35.21%)
Total	126 (88.74%)	3 (2.11%)	1 (0.70%)	8 (5.63%)	4 (2.82%)	142

Year-wise distribution of cases according to route of exposure of poisoning cases.

In almost all cases, route of exposure selected by victims was oral (126 cases, 88.74%).

This is because majority of victims were laymen and being universal phenomena oral administration was route of choice.

Table – V: Distribution of poisoning cases according to season.

Season	Cases	Percentage
Winter	39	27.47%
Summer	55	38.73%
Monsoon	48	33.80%
Total	142	100%

In present study, majority of cases noted in summer season (March, April, May, June) (55 cases, 38.73%) with reason unknown, very closely followed by Monsoon (July, August, September, October) (48 cases, 33.80%) and then winter (November, December, January, February) (39 cases, 27.47%). Again the study period involves maximum months of summer, so that may have lead to maximum fatalities in summer season.

Table – VI: Year-wise distribution of cases according to post mortem reports and cause of death.

Mode	Compound/Agent	Year			Total (Out of 142 cases)
		2013	2014	2015	
Cardio- respiratory failure	Aluminium Phosphide	4	11	13	28 (19.71%)
	OP	8	14	3	25 (17.61%)
	Corrosion	0	9	9	18 (12.68%)
	Suggestive of poisoning	2	9	6	17 (11.97%)
	Organo chlorine	0	1	0	1 (0.70%)
	CuSO ₄	0	0	2	2 (1.41%)
	Carbamate	0	1	0	1 (0.70%)
	HCl acid	0	1	0	1 (0.70%)
	Snake bite	0	3	0	3 (2.11%)
	Scorpion sting	0	2	0	2 (1.41%)
Shock	Stomach perforation	0	1	1	2 (1.41%)
Respiratory Failure	Kerosene	0	1	1	2 (1.41%)

In present study, Aluminium phosphide is most commonly encountered poison (28 cases, 19.71%) leading to maximum fatalities, very closely followed by Organophosphorus compounds (25 cases, 17.61%) and corrosive substance (18 cases, 12.68%). According to history of alleged poisoning, corrosive substance were most common but after detailed post mortem examination and chemical analysis reports, it is concluded that majority of victims died of aluminium phosphide poisoning. 17 cases (11.97%) were encountered where death was attributed to poisoning on the basis of post-mortem findings, exclusion of other pathology and history of poisoning as per inquest and case papers though chemical analysis revealed no poison in viscera.

Aluminium phosphide poisoning deaths were most common because of easy availability without restrictions in market, minimal fatal dose, cheap, useful in agricultural work, domestic usage for preserving grains, minimal fatal dose and non-availability of antidote leads to more fatalities.

Organophosphorus poisoning were second most common cause for fatalities as India being an agricultural bases country with increasing use of insecticide and pesticide day by day and maximum people were from rural areas having farming background are most exposed to them with lack of education and lack of knowledge how to handle these poisonous compounds.

SUMMARY AND CONCLUSION

The present study includes 142 cases of alleged poisoning during the study period of January 2013 to December 2015, conducted in the Department of Forensic Medicine and Toxicology, J.L.N. Medical College, Ajmer. Detailed information of the deceased pertaining to the case was collected from the relatives or attendants of the deceased, from concerned police officers and hospital case papers. Detailed and complete post mortem examination including chemical analysis of viscera was done to reach cause of death.

1. The incidence of poisoning was 5.23% with slight increase in proportion of poisoning cases during last two years (2012 and 2013) with males being common victim and male : female ratio of 2.1:1. Hectic life, familial and social responsibilities and inability to cope up with modern life styles and demands leading to

frustration making males more commonly involved.

2. 3rd decade of life accounting for maximum cases with male dominance with reason behind like unemployment, stress, tension, romantic, failures, family problems, financial and family responsibilities in young age showing need to increase opportunities for employment.

3. Maximum cases were observed in Hindu community as maximum percentage of population in Ajmer is comprised of it. Evening time encountered maximum cases with common place of exposure being home.

4. Maximum involvement of married males with probable reason behind marital conflicts, family problems, unemployment and economical low level and in case of married females, dowry, dependency over husband and change of social environment may contribute.

5. Rural areas, having increased farming activities, agricultural and domestic use of insecticidal compounds, lack of knowledge of using them with easy access and low cost provided maximum cases of poisoning from it.

6. Suicidal poisoning was most common with male predominance with reason behind can be increased burden to cope up with modern life style and demands for survival and selecting to surrender.

7. Commonest route of exposure was oral as it is a universal phenomenon and majority of them were laymen preferred administering it orally.

8. Season of summer accounted maximum cases of poisoning as the study period includes maximum months of summer may be the reason behind or the hot weather making people miserable with frustration leading to peak level contributing more fatalities in summer.

9. Maximum cases were reported where exact poison being unknown, proper antidote cannot be given contributing to more fatality. In such case with absence of history of particular poison, diagnosis become more difficult which can be lessened by bedside analytical test and toxicological analysis set up.

10. Maximum deaths were reported within 24 hours of intake of poison with first 9 hours being more

lethal suggesting severity of deadly poison and need for an improvement of facilities for emergency case in hospital set up.

11. Aluminium phosphide poisoning was the leading cause of death with easy availability without restrictions, cheap, minimal fatal dose, no antidote, agricultural usefulness and domestic use for preservation of grains making easy access. Organophosphorus poisoning were second most common causing fatalities as India being an agricultural bases country and maximum cases from areas having farming back ground and usage of insecticides.

12. There should be restriction of poisonous compound from being easily available from market and prior approval for use should be taken from authorized centres and proper records of their sale should be maintained by the retailers.

13. Education regarding proper storage and use of household products and medicines should be given with strict supervision at home keeping away from the reach of children and young adults. Proper psychological counseling with importance of valuable human life given by God should be carried out among the entire group of people and not to waste in such a way.

14. A toxicology lab should be established at the level of community health centre and all teaching medical institute for analyzing common prevailing poison like aluminium phosphide and insecticides.

15. The problem of poisoning has been and is going to exist with human society, so more studies are required for stoppage of this developing threat.

16. I would like to mention some limitations of the study that it is confined to particular area, some chemical analysis reports were still awaited so there is a need for improvement whether there is delay by police to deliver viscera on time or delay in issuing report from forensic science laboratory. The information of the deceased is

based on the history given by the police and relatives of the deceased and among treated cases by hospital case papers.

Conflict of Interest:- Differentiation of Homicide and suicide are always a debatable issue in poisoning cases

Source of Funding- Self

Ethical Approval:- Consent obtained

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Study of Cases of Hanging and Strangulation by Ligature with Special Reference to Morphological Changes in Lungs, Thyroid and Adrenal Glands

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ABSTRACT

A retrospective study was conducted at North Bengal Medical College, Siliguri during a span of 2 years (2013-2014). In this study 183 cases of hanging and 16 cases of strangulation by ligature was included to know the epidemiological pattern like age, sex, religion, marital status, socio-economic status and other predisposing factors in fast changing socio-economic scenario, to study the ligature material and to analyze the morphological changes in the lungs, thyroid and adrenal glands in cases of death due to hanging and strangulation by ligature. It was concluded that highest number of hanging deaths were in the age group of 21-30 years while deaths due to strangulation by ligature was highest in 31-40 years age group. Among the age highest number of hanging death is reported in males while no such difference regarding gender was noticed in deaths due to strangulation by ligature. Our study shows on histopathological examination, hemorrhagic spots found inside the parenchyma of lungs, thyroid and adrenal glands in majority of cases of hanging deaths and death due to strangulation by ligature.

Keywords – Hanging, Strangulation by ligature, Hyoid bone, Thyroid cartilage.

INTRODUCTION

Suicide is a self-directed act having a fatal outcome. Death is certain for all living beings, but only humans end their lives prematurely by committing suicide. Among various methods opted, hanging is one of the most common, as materials necessary are easily available and of high success rate. Reasons may be the availability of ligature material, easy accessibility to the suspension point in domestic set up and deaths by hanging are considered as painless deaths when compared to other modes. Most of the victims are middle aged and post-marital deaths are more common than premarital deaths [1].

In India, hanging is second common method of committing suicide after poisoning. Over the past 30 years the incidence of suicide by hanging is on increase, especially among young adults^[2]. The fact that 71% of suicides in India are by persons below the age of 44 years imposes a huge social, emotional and economic burden on our society^[3]. According to National Crime Records Bureau report 2012, in India on an average, more than one lakh persons committing suicides every year in the country during the decadal periods (2003

– 2013).

Suicide rate increases with age and at all ages males predominate the females. Suicide is low among Jews. Marriage is a protective factor and married persons have lowest suicide rate than single, divorced or separated. Risk factors for suicide are psychiatric disorders, social factors, immediate psychological factors and physical disorders [4].

Strangulation is one of the common forms of homicide where most of the victims are adult women, children and old persons. Ligature mark depends upon composition of ligature, width and multiplicity of ligature, weight of the body suspended, degree of suspension, tightening of the encircling ligature, duration of suspension, position and type of knot, slipping of the ligature during suspension and height of suspension.

The present study was an attempt to analyze the socio-demographic pattern, causes and precipitating events for persons who commit suicide by hanging and death due to strangulation by ligature along with to find out the correlation between autopsy findings and

pathological changes in various organs specially lungs, thyroid and adrenal glands.

MATERIAL & METHOD

After obtaining approval from Institutional Ethics Committee, a descriptive type of study with cross sectional was carried out at North Bengal Medical College, Siliguri, from January 2013 to December 2014. All Cases of fresh dead bodies with the history of antemortem hanging and strangulation by ligature brought to mortuary of Department of Forensic Medicine, North Bengal Medical College, and Darjeeling was included in this study.

Study materials were the relevant reports and records like autopsy reports, inquest papers, case sheet and suicidal notes. Data were collected in a pre-designed case record form. Obtained data were analyzed by descriptive and inferential statistical methods by using appropriate software.

RESULTS

1. AGE DISTRIBUTION –

Hanging - The most vulnerable age for hanging is found to be between 21-30 years, wherein 52 deaths (28.41%) occurred. The next vulnerable age group is 11-20 years in which 43 deaths (23.49%) occurred. In 31-40 years age group, 34 deaths (18.57%) have occurred. In 41-60 years age group, 38 deaths occurred. In old age, i.e. after 60 years, incidence came down to 8.19%. Only 1 case of death reported in this study between 0-10 years age group.

Strangulation by ligature – 8 cases (50%) of death recorded in the age group of 31-40 years of age, 4 cases (25%) of death occurred in 21-30 years age group and 1 case each in 0-10 years, 10-20 years, 41-50 years and more than 60 years age group.

2. SEX DISTRIBUTION –

Hanging - For the present study, 183 cases of hanging are selected from May 2013 to April 2014. Of them 65.03% (119 death) were males and 34.97% (64 death) were females. The male to female ratio is about 2: 1. Males outnumbered the females in the present study.

Strangulation by ligature – 16 cases of death due to strangulation by ligature was included in this study of which 50% were males and 50% were females.

3. MARITAL STATUS –

Hanging - In the present study, married couples (101) were more prone to hang themselves, when compared to unmarried persons (68). Even in the case of death of either partner, males (8 cases) outnumbered the females (6 cases).

Strangulation by ligature – 11cases (68.75%) of deaths due to strangulation by ligature were married and 5 cases (31.25%) were unmarried.

4. TYPE OF FAMILY –

Hanging - People living in nuclear families (72.14%) outnumbered those in joint families (27.86%).

Strangulation by ligature – It is found that 14 cases (87.5%) belongs from nuclear family and only 2 cases (12.5%) belongs to joint family.

5. OCCUPATION –

Hanging - When we compare the occupational status of the deceased; majority were self-employed persons (46.99%). House wives accounted for 31 deaths (16.93%) and service persons accounted for 24 deaths (13.11%). Unemployed persons also accounted for 42 deaths (22.95%).

Strangulation by ligature – In this study it was found that 10 cases (62.5%) were self-employed and 3 cases (18.75%) were unemployed, 2 (12.5%) cases were housewife and 1 case (6.25%) was employed in service.

6. CAUSE OF HANGING –

In the present study, family problems claimed 76 lives (41.53%). Chronic physical illness accounted for 24 deaths (13.11%) and mental illness is the cause behind 7 (3.82%) deaths. Other motives behind hanging were love failure (6.55%); unemployment (2.18%); exam failure (3.27%), Money loss (1.63%) and drug abuse (1.09%). In 49 (26.77%) deaths cause of death were not known.

7. SUICIDAL NOTE –

In the present study population, 17 (9.28%) people left behind the suicide notes depicting their problems and cause for suicide. Remaining 166 (90.71%) had not

written any suicide note.

8. SALIVARY STAINS –

Hanging - Dried salivary stains over the angle of mouth was observed in 171 cases (93.44%) and depending on the position of knot, dried salivary stains were present on right angle of mouth in 76 (41.54%) cases, on left angle of mouth in 92 (50.27%) cases and over both angle of mouth in 3 cases (1.63%) out of 171 cases. No salivary stain was present in 12 cases (6.56%) of death due to hanging.

Strangulation by ligature - Blood stain mixed with saliva and mucus found over the face in all cases of death due to strangulation by ligature.

9. TYPE OF HANGING –

In the present study complete hanging is seen in 117 deaths (63.93%). Partial hanging accounted for 18 deaths (9.94%) and in 48 cases (26.23%) proper history was not given by relatives regarding exact position of body whether leg or any other body part was in touch with the ground or not.

10. POSITION OF LIGATURE MARK OVER NECK –

Hanging - In the present study, it is observed that in 152 (83.06 %) cases, the level of ligature mark was above the thyroid cartilage, below the thyroid cartilage in 12 (6.56 %) cases and overriding the thyroid cartilage in 19 (10.38 %) cases.

Strangulation by ligature - In cases of death due to strangulation by ligature, level of ligature mark overriding the thyroid cartilage was seen in 14 cases (87.5%) and below the thyroid cartilage was seen in 2 cases (12.5%).

11. POSITION OF KNOT -

Hanging - In cases of death due to Hanging, Knot was present in right side of neck in 97 (53.02 %) cases, over left side of neck in 52(28.41%) cases and over suboccipital region in 31(16.94%) cases. In only 3 (1.63%) cases knot was present over submental position.

Strangulation by ligature - In cases of death due to strangulation by ligature, knot was present over right side of neck in 8 cases (50%), over left side of neck in

2 cases (12.5%) and over submental position in 6 cases (37.5%).

12. PERILIGATURE INJURIES –

Hanging - In the present study, 157 cases (85.79%) did not show any changes around the ligature mark, but in 26 cases (14.21%), peri-ligature injuries in the form of rope burns, contusions and abrasions were seen. The reasons of the production of peri-ligature injuries are knot mark contusions, fibers projecting from ligature material and the nail scratch marks inflicted by the struggling victim to free himself at the moment of death.

Strangulation by ligature – All 16 cases had presence of nail scratch abrasion and contusion around the ligature mark over neck reflecting the evidence of forceful struggle between assailant and victim.

13. FRACTURE OF THE HYOID BONE –

Hanging - In the present study, no fracture was noted in 177 cases (96.72%). Fracture of great cornue of hyoid bone was observed in 6 cases (3.28%). The reason being the fracture increases with age, high level of ligature mark on the neck, increased duration of suspension and with a thin hard ligature material.

Strangulation by ligature – Fracture of greater cornue of hyoid bone was present in 7 cases (43.75%) and no fracture was found in 9 cases (56.25%) of death due to strangulation by ligature.

14. FRACTURE OF THYROID CARTILAGE –

Hanging – In the present study, no fracture was noted in 180 cases. Fracture of superior horn of thyroid cartilage was observed in 3 cases (18.75%). The reasons being pressure over the horns exerted due to traction and complete suspension of the victim.

Strangulation by ligature – Fracture of superior horn of thyroid cartilage was present in 13 cases (81.25%) and no fracture was found in 3 cases of death due to strangulation by ligature.

15. TYPE OF LIGATURE MATERIAL –

Hanging – All ligature material was examined during this study and found that in maximum 62 cases (22.88%) nylon rope was present, next to that in 36

cases (19.67%) sari was present, in 26 cases (14.21%) dupatta was used, in 18 cases (9.83%) lungi & dhoti was used, in 15 cases (8.19%) towel and gamcha was used, in 14 cases (7.66%) jute rope was used, in 9 cases (4.93%) bed sheet was used, in 1 case telephone wire and in 2 cases electric wire was used by deceased for the purpose of hanging.

Strangulation by ligature – During study of deaths due to strangulation by ligature it was found that in 7 cases (43.75%) nylon rope was present, in 4 cases (25%) sari was present, in 2 cases (12.5%) each towel & gamcha and jute rope was present and in only 1 case (6.25%) dupatta was used by accused.

16. MORPHOLOGICAL CHANGES IN LUNGS –

Gross appearance – In all cases of hanging deaths and death due to strangulation by ligature lung tissues were found to be congested.

Microscopic findings – On histopathological examination majority of the cases of hanging deaths and death due to strangulation by ligature showed features of congestion and alveolar hemorrhages. Dilated and fibrosed blood vessels with emphysematous changes of lung parenchyma was present in some cases. In few cases carbon particles with hemosiderin laden macrophages was present reflecting long standing exposure to smoking and air pollution.

17. MORPHOLOGICAL CHANGES IN ADRENAL GLANDS –

Gross appearance – In most of the cases of hanging deaths and death due to strangulation by ligature adrenal glands were congested.

Microscopic findings – On histopathological examination majority of the cases of hanging deaths and death due to strangulation by ligature showed presence of hemorrhagic spots inside the parenchyma.

18. MORPHOLOGICAL CHANGES IN THYROID GLAND –

Gross appearance – In most of the cases of hanging deaths and death due to strangulation by ligature thyroid glands were found to be congested.

Microscopic findings – Majority of the cases

of hanging deaths and death due to strangulation by ligature showed petechial hemorrhagic spots during histopathological examination. Few cases showed colloid filled with dilated follicles lined by follicular cells and few cases showed foci of calcification.

DISCUSSION

Morphological changes in lungs –

Majority of the cases of hanging deaths and death due to strangulation by ligature showed features of congestion and alveolar hemorrhages during histopathological examination.

Dilated and fibrosed blood vessels with emphysematous changes of lung parenchyma was present in some cases. Our findings are consistent with the findings of various authors.

Grellner W. and Madea B. also observed that in cases of hanging and strangulation by ligature, intra-alveolar edema of different degree and strong hyperemia could be regularly observed in lung parenchyma, especially in fatal hanging. Further frequent histological patterns were perivascular and intra-alveolar hemorrhages, local dystelectasis and focal emphysema. Alterations of the lung vessel contents could be detected in a varying extent ^[5]. Delmonte C, Capelozzi VL observed that the extension of the area occupied by alveolar hemorrhage was significantly higher in lungs associated with strangulation. ^[6].

Morphological changes in adrenal glands –

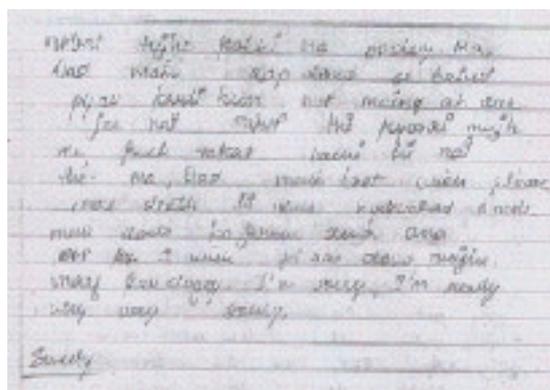
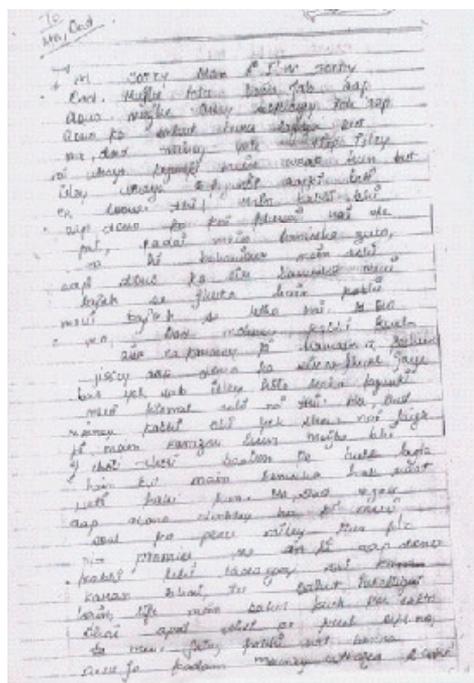
In gross appearance most of the cases of hanging deaths and death due to strangulation by ligature adrenal glands was congested. In microscopic examination, majority of the cases of hanging deaths and death due to strangulation by ligature showed presence of hemorrhagic spots inside the parenchyma. This findings is not in accordance with the findings of various authors. Herbert Braunstein and Ben T. Yamaguchi suggested that the histological characteristics of adrenal glands shows nodularity of the Zona fasciculate and irregular thinning of the Zona glomerulosa were found in persons dying rapidly of trauma ^[7]. Rogers and Williams described alterations in adrenal sterol content in patients exposed to protracted noxious stimuli. Authors also emphasized enlargement and lipoid depletion as manifestations of stress ^[8].

Morphological changes in thyroid gland –

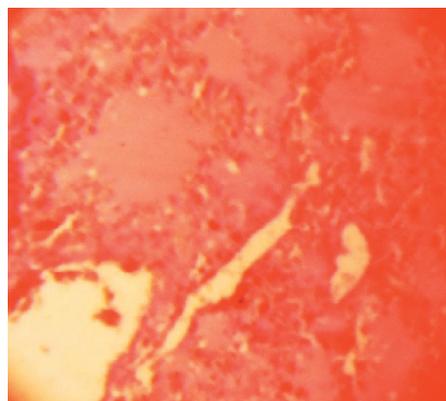
Thyroid gland were found to be congested in most of the cases of hanging deaths and death due to strangulation by ligature. In microscopic examination most of the cases showed petechial hemorrhagic spots, few cases showed colloid filled with dilated follicles lined by follicular cells and few cases showed foci of calcification. Our finding is consistent with the findings Okłota M, Niemcunowicz-Janica A, Dziecioł J, Ptaszyńska-Sarosiek I, Klim B, Sackiewicz A, Załuski J, Szeremeta M (2011) who also observed that petechiae were observed in the thyroid gland and hyperemia of the thyroid was observed with segmental expansion of blood vessels and observed petechial hemorrhagic spots in 33% cases of hanging deaths.^[9]

Pictures –

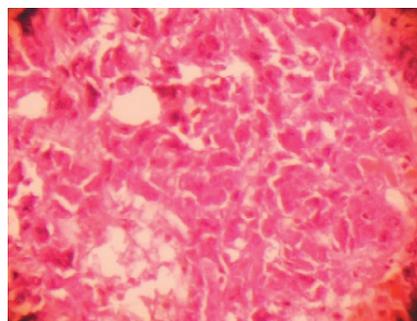
1) Suicidal notes –



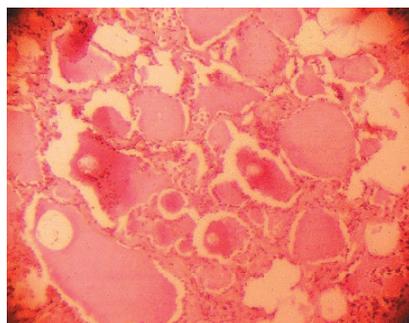
2) Microscopic appearance of lung showing multiple hemorrhagic spots –



3) Microscopic appearance of adrenal gland showing multiple hemorrhagic spots –



Spots –



4) Microscopic appearance of thyroid gland showing multiple hemorrhagic spots –

CONCLUSION

The number of suicidal hanging cases is increasing day by day. A well designed and comprehensive program is needed to identify the causative factors and prevention of suicidal behaviors. Appropriate education, influencing the media in their portrayal of suicidal news, reporting method, involvement of young generations in encouraging activities may reduce the rate of suicidal death by hanging in future. Psychological counselling program should be organized for the school going

children especially for those who are going to appear in examination.

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Ethical Clearance – Ethical clearance was obtained from Ethics committee, North Bengal Medical College, Siliguri,

Conflict of Interest – No Conflict of interest.

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A Case of Sudden Death due to Neurocysticercosis (NCC) in a Chronic Alcoholic

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ABSTRACT

NCC or Neurocysticercosis is one of the clinical syndromes produced by infection with larval stage of tapeworm *Taenia Solium* (Pork tapeworm). It is the commonest parasitic infection affecting the central nervous system in human beings. Though seizure disorders are common in NCC in adults, sudden death is rarely reported. In our present case study one young male footpath dweller of 35 years of age and known to be a chronic alcoholic, died suddenly after a drinking bout. The dead body was sent to Kolkata police morgue for autopsy examination as a medico-legal case. Save a minor degree of cirrhotic changes in the liver, abdominal and thoracic viscera were unremarkable. Unexpectedly the brain parenchyma was found to be studded with numerous cystic lesions, which on Histopathological examination was confirmed to be the lesions of Neurocysticercosis. Cardiovascular events originating from coronary atherosclerosis are regarded worldwide as commonest cause of sudden death, more so in alcoholics. Neurological causes, particularly vascular events are not rare too. Meticulous autopsy, supported by ancillary investigations, occasionally leads an autopsy surgeon to such surprising outcomes.

Keywords: Sudden death, Chronic Alcoholic, Neurocysticercosis, Autopsy, Histopathology.

INTRODUCTION

A death is said to be “sudden” or “unexpected” when a person, not known to have been suffering from any disease incompatible for his/her continuation of normal life, injury or poisoning, is found dead or dies within 24 hours after onset of terminal illness (W.H.O.). But this time period is considered to be too long for many clinicians and pathologists; some only accept death to be sudden if it occurs within one hour from the onset of symptoms/illness. Sudden deaths include deaths due to natural causes of which most are due to pathology in the cardiovascular system (45-55% according to different authors). Pathologies of Central nervous system constitute about 15% cases, which include mostly the cerebrovascular accidents, infections and so-

far undetected intracranial space occupying lesions. Helminthic infections of central nervous systems are rarely detected at autopsy, particularly in cases of sudden deaths. Neurocysticercosis is the commonest of all parasitic infections affecting the central nervous system, though sudden death in these cases is rare. In the present case also we expected to detect some common cardiovascular pathology as a cause of sudden death of the deceased on the background of history, obtained from the patient party and inquest report send by the police.

THE CASE

A case of sudden death when brought dead to the emergency department of any hospital are usually booked as medicolegal case and the investigating agency (police) after conducting inquest upon the deceased use to send the dead body for autopsy examination to the mortuary for determination of cause of death. It was such a case; a 35 years old healthy male, a slum (footpath) dweller, used to earn a living by doing

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stale jobs starting from car washing to garbage picking. He was addicted to alcohol and tobacco and there was history of occasional spells of unconsciousness. On that eventful day he became unconscious following a heavy bout of drinking and was taken to nearby hospital where he was declared as brought dead.

The autopsy:

External Findings:

Athletic built well-nourished body of a 5ft 7inches male subject, *Rigor Mortis* all over, faint bluish discoloration of finger tips of both hands, purplish *PM stain* over dependent parts of the body, no external injury could be detected.

Salient Internal Findings:

1) Intense congestion of Brain

2) Multiple cystic lesions, containing clear fluid and some whitish opaque fleshy substance within, of different sizes varying from 3mm to 1.2cm in diameter, detected on the surface and also deep into the brain parenchyma (on section). [fig.1 & 2]

3) Other thoracic and abdominal viscera were unremarkable except grade-II atheromatous plaques at the root of aorta and mild cirrhotic changes in the liver.



Fig. 1 a cyst in section of brain



Fig. 2 another cyst, containing. (After Formalin fixation) clear fluid and fleshy mass within in section of formalin fixed brain

Investigations referred for:

1) Histopathological examination of portions of Brain, containing cystic lesions.

Reports on Investigation:

Histopathology:

1) Brain-Sections examined reveal brain parenchyma with minimal chronic inflammatory infiltrate and gliosis. Several sections reveal cystic structure with invaginated scolex and proglottid surrounded by chitinous wall. (Fig 3 & 4) Meningeal vessels are congested and mild stromal oedema is noted. Histological features consistent with Neurocysticercosis.

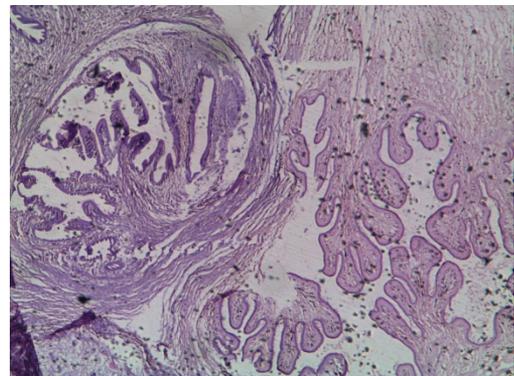


Fig 3: Cysticercosis with invaginated scolex

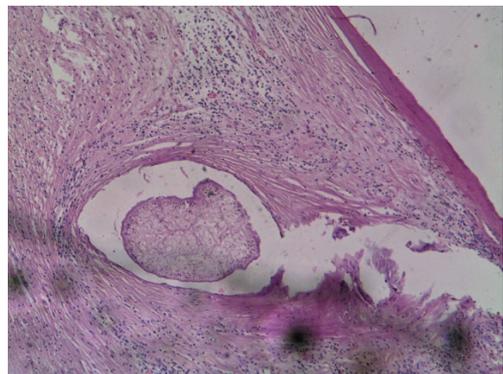


Fig 4: brain parenchyma showing cystic structure with within brain parenchyma (x40, H&E) degenerated proglottid floating in cyst fluid (x40, H&E)

DISCUSSION

The pork tape worm, *Taenia solium*, can cause two distinct types of infections in human being. Adult tapeworms in the intestine and larval stage of the helminth in the tissues, known as cysticercosis-caused by larvae that hatched up following ingestion of eggs. *T. solium* is found worldwide, where pigs are raised and have access to human faeces. It is a disease of poverty and underdevelopment which are closely

associated with poor standard of living in terms of hygiene. Approximately 50 million people worldwide are estimated to have cysticercosis infection, although estimates are probably low since many infections are subclinical and there are relatively few populationbased data on prevalence. It is most prevalent in Latin America, sub-Saharan Africa, China, India and Southeast Asia. ^(1, 2, 3)

The tapeworms have a complex lifecycle requiring two mammalian hosts for their development; an intermediate host, in which it does not reach sexual maturity and a definitive host in which the worm reaches sexual maturity. Humans are the only definitive hosts for *T. solium*; pigs are the usual intermediate hosts, although other animals may harbor the larval forms. *T. solium* can be transmitted to humans in two ways. Either by ingestion of undercooked pork containing larval cysts which leads to development of adult tapeworm in the intestine; or through ingestion of eggs in food or water contaminated with human (containing mature adult tapeworm in the intestine releasing eggs) faeces. As the ingested larvae hatch they penetrate the gut wall, disseminate through haematogenous route and encyst (thus causing cysticercosis) in many organs including the brain, muscles, skin and heart. ^(1, 2)

Neurocysticercosis is the commonest parasitic infection affecting the central nervous system, worldwide. Convulsions, increased intracranial tension and neurologic disturbances are the common symptoms. However the cerebral symptoms depend upon the precise location of the cysts, which may be intra-parenchymal, attached to the arachnoid, or freely floating in the ventricular system. The cysts are ovoid and white to opalescent, containing invaginated scolex with hooklets (seen as white fleshy mass on naked eye examination) that are bathed in clear fluid of the cyst. The cyst wall, which is rich in glycoproteins, evokes little host reaction when it is intact. As they degenerate, however, there is inflammation, followed by scarring and focal calcification. ^(1, 2)

Sudden death is rare in Neurocysticercosis. Few cases of sudden death due to Neurocysticercosis have been reported, although sporadically, in literature. Increased intracranial tension, acute meningoencephalitis or acute reaction to trauma (and subsequent rupture of cyst) or antilarval drugs have been speculated as precipitating event in such references. ^(3, 4, 5, 6)

By definition sudden deaths are mostly natural deaths where deaths occur immediately or within 24 hours of the onset of the terminal symptoms. The definition does not essentially exclude deaths due to means other than natural diseases but no unnatural cause is apparent. The commonest cause of sudden and unexpected death in apparently healthy adults is cardiac diseases and commonest cause of such disease is coronary atherosclerosis. In sudden death, the immediate cause is almost always to be found in the cardiovascular system, even though topographically the lesion is not in the heart or great vessels. Coronary atherosclerosis, sometimes called the 'The Captain of men of death', was certainly the most frequent cause of sudden death in the Western societies. In the pathology of sudden death, overt infarcts are the exception, rather than the rule. ^(7, 8)

This is truer in cases of chronic alcoholics. Chronic misuse of alcohol, predisposes to certain cardiovascular pathological conditions like cardiomyopathy, ventricular arrhythmias and dilatation of the left heart which can themselves cause sudden death. Reporting of few cases are there in the literature where incidences of sudden deaths in chronic alcoholics are attributed to acute haemorrhagic pancreatitis or seizure disorders. But there is hardly, if any, established causal relationship between sudden death due to Neurocysticercosis and chronic alcoholism. Hence the association of sudden death, due to Neurocysticercosis and chronic alcoholism is purely sociological. ⁽⁹⁾

CONCLUSION

From the autopsy findings, supported by the ancillary investigations, it is evident that the unfortunate young patient might have been suffering from Neurocysticercosis for a long time but the condition remained undiagnosed. The helminthic infection in the young slum dweller might have resulted through unhygienic living habits, which is an offshoot of poverty and social underdevelopment. Autopsy of such case of sudden, unexplained natural death is basically a challenge for the autopsy surgeon, for the surprising and unexpected outcomes they sometimes produce, which may lead to elucidation of the pathological explanation of the cause of death, as happened in the present case.

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Ethical Clearance:Not applicable.

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A Simple and Cogent Forensic Technique to Trap and Nab a Bribe-Seeking Corrupt Public Servant ‘Blue-Handed’

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ABSTRACT

For strengthening the legal system of justice against the menace of bribery, a highly cogent and sensitive forensic technique has been developed using an indicator dye of triphenylmethane group---Bromocresol green (BCG)---as corruption marker. By means of BCG, a bribe-seeker can be so firmly trapped that not only his / her hand or finger(s) get colored blue upon treatment with water, that even the shirt's pocket as well as some of the coercively-received currency notes also get tainted with deep blue color. The new technique replaces the age-old use of phenolphthalein for trapping the bribe-seeker wherein, when bribe-taker's hand is dipped in sodium carbonate solution a pink color is produced. The necessity for a new and cogent technique has become desirable because owing to several procedural deficiencies and techno-legal lacunae as pointed out in various High Courts' and Supreme Court's judgments, and also because of the instability of the pink color generated by phenolphthalein and alkali, the trapped-and-convicted persons are quite often set free upon appeals. But the sturdy blue color produced by BCG is of highly stable in nature which firmly and truly ratifies the "Locard's Exchange Principle" of forensic science. The strong blue spots specially on the hand or fingers and the blue-spotted shirt pocket along with the blue-tinted currency notes, can all act collectively as strong incriminating legal evidence(s) against the trapped person. Unlike phenolphthalein, sodium carbonate is not required in the BCG method to generate the color (blue) either in water or on other (hard) objects. Moreover, any additional stabilizer like hydroquinone, etc., is also not required either for storing the blue solution, or for safekeeping the blue-spotted hard materials like shirt, handkerchief, or currency notes for showing them in the court of law at appropriate stage. Since the BCG-produced blue color on the currency notes is of utmost stability and can not be wiped away by ordinary means, a special method has also been reported to safely remove (conceal) the blue spots from the currency notes used in the 'Operation BCG'. Having all these (hard) bluish objects in the hands of anti-corruption bureau (ACB) as irrefutable evidences against the accused, there is hardly left any need for safekeeping the blue-colored water solution (the liquid obtained after dipping trapped person's hand in water).

Keywords : Bromocresol green (BCG), corruption marker, blue-handed, Locard's Exchange Principle, justice against bribery, trapping the bribe-seeker, anti corruption bureau (ACB).

INTRODUCTION AND BACKGROUND

The menace of corruption and bribery is taking the toll of billions of brighter futures in most parts of the world including India¹---hence, now it's time for bringing justice in action against bribery via the path of forensic chemistry. As per Transparency

International's Corruption Perception Index, more than six billion people are living in countries with serious and unabated corruption problems. The scourge of bribery has overshadowed the normal work culture of many of the South Asian countries (including India, Pakistan and Bangladesh) and South-East-Asian nations (including Philippines, Indonesia and Thailand), and also of many other nations of the world including those of Europe (e.g., Romania, Bulgaria, Croatia, etc.). Soliciting or receiving by coercion the

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green currency notes from gullible common citizens in lieu of getting some duty-related job done, by the low to high ranking personnel of rogue nature, has become a virtual vogue rather than an exception. These corrupt elements deployed on official, public, or legal duty have downgraded the democratic values of their concerned country. Hence, their apprehension at the earliest has become highly desirable in order to cleanse the corrupt and vicious atmosphere in the Government sector. As a curious example, the rise of bribery in the East European nation of Romania has become the inspiration for setting up of a new virtual art gallery named as “Museum of Corruption”. This museum is exhibiting (since May 30, 2016)² virtual paintings of the most incredible bribery cases that have happened in Romania. The state of corruption in Romania now ranks third from the bottom among European Union member states on the Transparency International’s Corruption Perception Index. However, the authors’ own country, India, is at the ranking of 76 out of 177 countries in Corruption Perception Index-2015. Hence, the state of corruption in India (down at rank 76) is far worse than that of Romania (at rank 58). Denmark being the most honest country in the world (with rank 1, the highest). About the current state of corruption in India, the true perspective can be effectively and truly illustrated hereunder, based on the poetically modified statement of the famous 17th century English soldier (an army Captain-cum-miscellaneous writer, Barnabe Rich [1540-1617] :

“Honesty waits at the gate knocking,

Bribery barges in everyone shocking.”

A Government survey, sponsored by the Central Board of Direct Taxes (CBDT) of India, and conducted in 2015 by the National Council of Applied Economic Research (NCAER), New Delhi, showed that an average urban household in India pays about Rs. 4400/family/year as bribe for general work. For rural sector, the figure of bribe is Rs. 2900/family/year.

Thus, for fighting corruption effectively there is a dire need to introduce a juggernaut type of cogent as well as internationally acceptable forensic technique for trapping and nabbing the corrupt Government servants anywhere in the world for rooting out the squalid graft.

Current Modes of Trapping the Corrupt: For the purpose of trapping the bribe-seekers in India, an

old traditional method, using *phenolphthalein* powder, is being used at present^{3, 4, 5}, but whose guarantee of success has never been absolute during legal battles. This is because in one particular case, for example, the High Court had accepted the defense version made under Section 313 of Code of Criminal Procedure, 1973 and recorded the findings that the possibility of Phenolphthalein powder appearing on the hands of the respondent-accused when he shook hands with the complainant cannot be ruled out. Occasionally, the *anthracene*⁶ powder method is also used (wherein a person’s hand, fingers, etc., when come in to contact with invisible traces of anthracene powder, it would emit blue fluorescence when exposed to ultraviolet light). Anthracene is a polycyclic aromatic hydrocarbon (in powder form) whose molecule is made up of three fused benzene rings.

The New Research (Bromocresol Green versus Phenolphthalein): This research paper astoundingly introduces the use of Bromocresol green (BCG)---a member of triphenylmethane group of indicator dyes--- as corruption marker in anti-corruption forensic operations for trapping and nabbing the corrupt public servants demanding bribe. Thus, the age-old use of phenolphthalein has been replaced by BCG because in many of the trap cases phenolphthalein has failed⁷⁻¹⁰ to get the accused bribe-taker convicted on account of several procedural deficiencies and legal controversies involved therein. The complete fading out (decolorization) of pink colored solution (from hand washings of the accused during trapping), etc. is one of the problems afflicted with the use of this old dye. Further, whereas in trap cases using phenolphthalein the accused is asked to dip his fingers or hand in sodium carbonate solution, but when BCG is used, no sodium carbonate solution or any other chemical is required. Only plain water fulfills the requisite job. When hand or fingers of the accused bribe-taker are dipped in plain water, it almost immediately or within a few seconds turns bluish-green to deep blue in color. Alternatively, a white colored wet piece of a cloth or handkerchief when pressed or slightly rubbed on the hand of the accused, it turns bluish-green or even dark blue at various spots. Unlike phenolphthalein’s pink color, the blue color of BCG is highly stable and may be stored for a longer time without using any preservative. As an additional alternative, when water is sprayed or sprinkled (with the help of a needle-fitted medical syringe) on the pocket

of the accused where he had kept BCG-laced currency notes, the pocket also turns (spotted) blue in color very strongly ; at the same time, one or more, or all of the currency notes also get colored blue upon wetting. This multidimensional bluing effect of BCG leaves no scope for any alibi left with the accused to deny having received the bribe money. Further, since unlike phenolphthalein, BCG is not used as an oral medicine or as an ingredient of any pharmaceutical formulation, the accused gets no reason to claim having either consumed or coming in to contact with this material before being caught ‘blue handed.’

Bromocresol Green Superseding Phenolphthalein

: Thus far, the choice of phenolphthalein powder^f has been the most common trapping practice against the corrupt public servants because of its simple color-change chemistry---from colorless (in acidic or neutral medium) to pink (in alkaline medium), and also because of its easy availability. However, the pink coloration fails to remain intact during the course of time (that is during pendency of the case in the court), unless otherwise it is made stable by adding some stabilizer like hydroquinone, etc. During court proceedings also, the defense counsel poses a major issue by asking for a proof regarding the actual use of phenolphthalein at the time of trapping of the accused client. Thus, the phenolphthalein technique faces a stumbling block when the cunning and corrupt accused person, on the advise of his/her counsel, projects his/her plea of having handled and /or used a laxative at the time of being trapped. The alibi of laxative is presented because some of the common laxatives sold in the market contain phenolphthalein as the main ingredient. But for successfully thwarting the ‘laxative’ alibi of the accused, the proof of addition of yet another chemical substance in the form of a stabilizer like hydroquinone is essential for court trials. This is because firstly, the color of phenolphthalein can only be maintained for a long period of time by the pre-addition of hydroquinone, and secondly hydroquinone is never used as an ingredient of a laxative. Thus the false ‘laxative-based’ plea of the culprit can be easily dismissed by the court if the prosecution proves the presence of hydroquinone in the colored pink solution. But this is not an easy task to be achieved by the prosecution.

Phenolphthalein is a white-colored, light weight powder, used as an acid-base indicator in analytical chemistry. It is only very slightly soluble in water, but

becomes soluble in the presence of some alkali, and with instant change of color also, from white to pink^{3, 4,6,7}.

- A. Phenolphthalein + acidic solution = colorless
- B. Phenolphthalein + neutral solution = colorless
- C. Phenolphthalein + alkaline/basic solution = pink color.

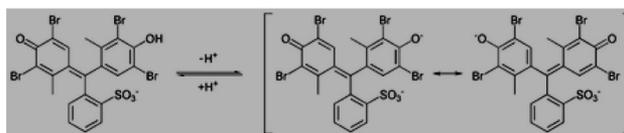
Like phenolphthalein, bromocresol green (BCG) [CAS No. : 76-60-8] is also used as a pH indicator in titrations, and its availability, from the laboratory grade chemical dealers, is almost as easy as phenolphthalein. BCG exhibits three different colors depending on the pH of the liquid to which it comes in contact with. Within the moderately acidic pH range, from 3.8 to around 5.4, BCG exhibits green color. But below the 3.8 pH (at much acidic conditions), its green form of the liquid turns to yellow. However, above the pH 5.4 mark the dye turns to blue or even ink blue in color. Thus, the property of broad range exhibition of color variations, below and above pH 7, makes BCG a highly useful chemical for very effectively and astoundingly substituting the role of phenolphthalein dye in forensic science chemistry in anti-corruption operations. Because of having the capability of generating BLUE coloration also, besides GREEN, (of course, at different pH ranges), BCG is also known as bromocresol blue¹¹.

Bromocresol green + Water = Blue color



Fig. 1

Bromocresol green (Bromocresol Blue)
(Showing pH-Based Color Changes)



YELLOW **BLUE**
CHEMICAL STRUCTURES OF BROMOCRESOL GREEN (BCG)
(3,3',5,5'-tetrabromo-*m*-cresolsulfonphthalein)

EXPERIMENTAL

Materials : Bromocresol Green (BCG) powder ; baking soda (NaHCO₃) ; dilute acetic acid (~ 10%)

or vinegar; an half or one-inch sized long-handled painter's brush; a white piece of cloth or a white-colored handkerchief ; a 2- or 5-ml capacity medical syringe (new or previously used) ; and a bowl or beaker made of glass or plastic.

Procedure for coating the currency notes with BCG : With absolutely dry hands, put a small quantity (about 2 - 3 gm) of BCG powder, on to a piece of white paper put on a dry surface, and with the help of a small sized (but long-handled) painters' brush, apply the powder on both the sides of a few or desired number of currency notes lying spread on another sheet of a white paper, as shown in **Fig. 2 and Fig. 3**. Touch the brush hairs with BCG powder and then smoothly spread the powder on the entire surface area of the notes, covering both sides. Finger should never be used for spreading the powder on the notes. The pale yellowish-brown-colored BCG powder spread on the currency notes remains virtually invisible to the naked eye.



Fig. 2



Fig. 3

Generally there is no need to apply the BCG powder on all the currency notes, but one can do so if thought necessary. Generally, only two or three notes on the upper side and similar number of last notes of the wad of currency only need to be treated with the powder. In case only one single note of any denomination is to be given to the bribe-seeker, then the matter becomes too simple. The unused quantity of BCG powder should be transferred back to the original packing. Preferably, but not necessarily, the person performing the BCG-coating of note(s) should wear the gloves.

If, instead of cash, the corrupt public servant demands some material goods as gift, in the form of bribe, then such goods like a laptop, a smart phone, iPad or tablet, etc., can also be coated with BCG powder using a brush. As soon as the corrupt official accepts the currency notes or an electronic gadget (of course by touching), then any one or all of the below described procedures are to be followed by the personnel of anti corruption bureau (ACB) :

Methods for trapping the bribe-seeker: The BCG-coated currency notes are to be handed over to the person demanding the bribe. As soon as the corrupt person takes the notes into his/her hand, traces of bribe-marker (BCG) get adhered to his/her hand or fingers. Although these traces are sufficient to trap the person in the next step, but for making the detection of the crime under the Prevention of Corruption Act visibly more stronger, the bribe-seeker should be encouraged to count the given notes so that more particles of BCG unnoticeably reach on the hand of the corrupt (**Fig. 4 & Fig. 5**). Whether the bribe-taker counts the notes or not, he/she will most probably keep the ill gotten money into his pocket (or into her blouse, in the case of a lady). In the next few moments the hidden raiding party of anti-corruption department will take the corrupt into its custody.



Currency notes being given to corrupt

Fig. 4



The bribe-taker counting the currency notes

Fig. 5

Now, for busting the crime of corruption of the person under detention, either one or all of the undernoted steps are to be performed, preferably by video-graphing, if possible or desirable :

(A) Dipping the bribe-taker's hand or fingers into plain water : This may be referred to as '*hand-dipping-in-water method*' for 'Operation BCG'. Ask the bribe-taker to dip his/her hand or fingers into a glass beaker or porcelain bowl filled with about 100 to 150

ml of plain water, preferably borewell water. (which generally possesses high pH, above 7) ; but water from any source will do. The water will turn light blue to intense blue in color depending upon the quantity of the BCG powder traces getting transferred on to the hand or fingers of the person under examination (**Fig. 6 & Fig. 7**). At this stage, not only water in the bowl turns blue, even light blue to deep-blue colored spots may also appear on the hand and / or fingers of the suspect of corruption [**Fig. 8 (A) & Fig. 8 (B)**].



A beaker containing some plain water

Fig. 6



Beaker water turns blue on hand-dipping

Fig. 7



Traces of BCG left on the fingers turn them blue upon wetting with water

(Protein of the human hand reacting strongly with BCG)

Fig. 8 (A)



Fig. 8 (B)

(B) Treating the bribe-taker's pocket with plain water : Take a 2- or 5 ml capacity medical syringe (for injection, etc.), remove the needle, fill it with plain water, replace the needle, and slowly sprinkle a torrent of water on the pocket (or blouse) wherein the bribe-taker has kept the bribe money. In

case the trapped suspect had accepted and pocketed the BCG coated currency notes, either strong blue colored spots will appear on the pocket, or even the entire pocket (or blouse area) will turn blue in color upon wetting with water (**Fig. 9 - Fig. 12**). This will irrefutably confirm the act of bribery.



Bribe-taker is pocketing the currency notes

Fig. 9



Bribe-taker's pocket being made wet with water, using a syringe

Fig. 10



Bribe-taker's pocket turns blue after wetting

Fig. 11



Some bribe money also turns bluish after wetting

Fig. 12

(C) Examining the wet notes recovered from pocket of the accused: When ACB or vigilance bureau team recovers the pocketed currency from the bluish-turned wet pocket of the trapped accused, at least one or two (or even more) of the notes would also be found tainted and tinted with blue color (**Fig. 12**). These notes, along with their Serial Numbers, can be preserved as such (after drying in air) for showing in the court as a very strong evidence against the person under trial.

(D) Wiping the bribe-taker's hands with a wet piece of white cloth or white handkerchief : This is an alternative of the '*hand-dipping-in-water method*' of 'Operation BCG'. (as shown above in Step A : **Fig. 6 - Fig. 8**).

'Hand-wiping with a wet cloth method': After the corrupt having accepted, counted, and has kept the BCG-treated currency notes into the pocket (or blouse, in case of a lady), the raiding party of ACB should give a wet piece of white cloth or white handkerchief to the targeted person and ask him/her to strongly wipe the hands with it for a few seconds. The white piece of wet cloth or the handkerchief will get spotted with light blue or deep blue stains at several places or even the entire cloth will turn bluish-colored (**Fig. 13 & Fig. 14**), thus further confirming the act of corruption. The wet cloth method is also recommended if the bribe-seeker has accepted BCG-laced material gift(s) instead of cash.

colorization process. If blue spots repeatedly reappear after dipping in HCl followed by washing with water, then finally dip the notes in dilute HCl only, and without washing with water, dry them by pressing between the folds of an old newspaper. There will be no blue coloration now. The low strength of HCl used in the decolorization process is unlikely to harm the user's hand or damage the currency note's paper because the paper used in making currency notes is different from ordinary paper, and is much more resilient, resistant to wear and tear, as well as to the effect of mild-powered chemicals.

(H) How to effectively remove the blue spots from the hand and / or fingers of a member of the ACB team ? If somehow the hands or fingers of a person of ACB team turn blue in color at any stage during 'operation BCG', the bluish colored spots can be cleared, firstly by repeated washing with tap water, then with vinegar, and then several times with soap, and finally again applying a little vinegar. The hands can also be de-stained by dipping then in very dilute HCl of about 5 to 6 % strength ; this is quite safer for hands and then washing them immediately with soap and plain water (several times). For availing dilute HCl, help of the chemistry laboratory of any nearby school or college can be taken. Since the cost of a 5 – 6 % dilute HCl is very meager, the job can likely be got done gratis, in public interest.

(I) How to confirm that the blue-colored hand-wash solution of the trapped accused contains BCG : Take about 10 to 12 ml of the blue solution in a test tube and add to it a few drops of dilute acetic acid or vinegar. The blue color of the solution immediately disappears and a pale yellow to clear yellow-colored solution is formed. Now add a pinch of baking soda (sodium bicarbonate) and shake. The original blue color of the solution is restored instantly.

RESULTS AND DISCUSSIONS

The Cogency of BCG Technique: As illustrated in the experimental section of this research paper, the bribe-seeking corrupt person can be truly, firmly, and inexcusably caught 'blue handed' through 'Operation BCG'. Gone are the days of a corrupt bribe-taker being caught 'red handed', but very weakly, hence acquitted later on, as has been happening since decades in the phenolphthalein trap cases. This is because in the case of phenolphthalein, wherein the aqueous solution of

sodium carbonate turns pink upon hand-dipping, but the hands of the suspect are not strongly stained with pink or red color. In fact, the color on the hand or fingers can be immediately cleared merely by washing with water. But, on the other hand, the effect of BCG is so immense that it causes such a strong staining of the hand and / or fingers with bluish coloration that it becomes very difficult to wash out the color even by repeatedly using soap or synthetic detergent. The state of water present in the beaker also turning permanently blue upon hand-dipping comes out to be an additional advantage, or so to say 'an additional evidence'. Thus, the latest terminology for apprehending a corrupt should be like catching a corrupt *blue-handed* instead of *red-handed*. The supreme court of India ruling, dated 29 January 2015, also stressed that the hands of the bribe-taker must be found strongly colored, otherwise no case of bribery would be made out^{9,10}.

Whereas in the phenolphthalein method the suspect's hand or fingers are to be dipped in quite high pH water (containing sodium carbonate, Na₂CO₃), but in the present technique involving BCG, even plain municipal water, borewell water, or even R. O. water alone will give remarkable results. However, sodium carbonate water may also be used, if one desires, as its use may give slightly more stronger blue-colored aqueous solution or deeper bluish spots on the hand, but this is just a minor option, but not an essentiality. Although, the resultant blue-colored water can be stored for long in a transparent bottle for showing it in the court as a proof of corruption, during the trial, but in the wake of other highly incriminating hard-state (or solid-state) blue-colored evidences, the practice of keeping a liquid in safe custody for months or years may be done away with.

The weakness of the phenolphthalein method^{4,5,7} in legal arena: *Recently, yet another case of the weakness of the phenolphthalein method came to the fore when on January 29, 2015, a two judge bench of the Supreme Court of India (SC), comprising justices V. Gopala Gowda and R. Bhanumathi, in their judgment, ordered for the immediate release of an accused policeman who was jailed after being trapped by the phenolphthalein powder method^{9,10}. The judges also said that the phenolphthalein test could not be said to be a conclusive proof against the accused appellant, as the color of the solution had faded out. Passing their judgment, the SC*

judges said : “Since, the charge against the appellant is not proved, the conviction and sentence imposed upon the accused-appellant by the High Court (of Kerala, at Thiruvananthapuram) under Section 13(1)(d) read with Section 13(2) of the Prevention of Corruption Act-1988 is set aside. The jail authorities are directed to release the appellant forthwith”. Earlier, the reason assigned by the Trial Court was that the color of the phenolphthalein solution could have faded by the lapse of time. But the Supreme Court judges said that this explanation could not be accepted by them in view of the fact that the color of the other samples taken by the Investigation Officer after the completion of the trap laid against the appellant had continued to retain the pink color. Moreover, the sample of the shirt worn by the accused appellant which was produced before the Trial Court also did not show any color change on the shirt’s pocket section, where the bribe money was allegedly kept by him after receiving the same from the complainant.

What, if BCG had been used in place of phenolphthalein : This is just an assumption that BCG were used in place of phenolphthalein in the January 15, 2015 Supreme Court verdict case^{9, 10}. In that case the blue colors of the hand-dipped solution as well as the bluish pocket of the shirt or the pant of the accused would have firmly remained as such with full intensity. Moreover, the Supreme Court also wants that when a person is trapped for bribe, his/her hands must be found in colored state^{9, 10}. Although phenolphthalein exhibits some color on the hand, but only temporarily ; but quality of the red color is too poor because it can be wiped out immediately by washing the hand with water. But, on the other hand, the blue coloration on the hand or fingers generated by BCG is so strong that it can not be wiped out fully even after two or three washings with soap or detergent cake. This happens due to the fact the BCG interacts with the protein molecules of the hand to form a strong BCG-Protein complex^{12, 13, 15, 16}. Thus, the bluish color appearing on the human hand is formed by the interaction of BCG with protein of the hand. This complex can be transformed to very pale yellow (almost colorless), green, or blue, depending upon bringing the same under different pH conditions (from <3.8 to upwards), using dilute HCl and water. The intensity of the final blue color can, however, be further enhanced to intense blue in color by using water containing sodium bicarbonate or sodium carbonate. But the latter step is by no means essential because pH

of the common water (pH ~ 6.5 to 8.5) itself is enough. Since phenolphthalein does not form any stable pink complex with the proteins, hence its existence does not last longer. However, when BCG interacts with the cellulosic or other ingredients of a currency note, it gets so deeply embedded in to the intermolecular fabric, probably without forming any molecular complex, that it becomes extremely difficult to extract it out. The blue color generated within this area, upon treatment with water, also acquires high stability there, making it virtually impossible to eliminate it. This complex can be turned colorless or very pale yellow only upon treatment with dilute acetic acid or HCl, and again blue upon treatment only with water, or with sodium bicarbonate or sodium carbonate solution. All these extraordinary properties of BCG make it an ideal and ‘honestly’ incriminating candidate for trapping the bribe-seekers, and giving no chance in favor of the corrupt to win the case at any stage of legal battle.

The task of forensic lab for confirming the use of BCG becomes too easy and rapid : In the phenolphthalein method, sending of the pink-red-colored hand-wash solution to forensic science laboratory is mandatory where the presence of dissolved phenolphthalein has to be confirmed by extracting it out in solid state by solvent extraction (preceded by acidification), and then identifying the same through the use of some costly instruments like, thin layer chromatography (TLC), high performance thin layer Chromatography (HPTLC), high performance liquid chromatography (HPLC), UV Spectroscopy, etc. However, under certain adverse physico-chemical or atmospheric conditions phenolphthalein present in the ‘safely kept’ pink-red solution gets decomposed, before being analyzed, into two colorless moieties---phenol and 2(4-hydroxybenzoyl)benzoic acid¹⁴. In that case the entire anti-corruption operation faces failure, and the trapped accused gets the full benefit sooner or later. But in the BCG technique every legal confirmation of the used corruption marker (BCG) remains fully established in advance (even before sending of the test samples to the forensic lab, and the case matter to the court). This is all due to the fact that the presiding judge, hearing the case, would also have full opportunity to perform by himself/herself or through the state counsel the simplest confirmatory tests for BCG within the court room itself by adopting very simple experimental procedures that involve the use of most inexpensive and safe chemicals,

like vinegar, baking soda and water only (as explained and illustrated in the Experimental section of this research paper). No instrument would be required at any stage to confirm the guilt of the trapped accused. Given the easiness of the forensic examination task, the forensic lab can also send its report quickly.

The chemistry of BCG-protein and BGG-cellulose reaction involved in anti-graft operation

: Although no deep-rooted or complicated chemistry is involved in the title subject, but the astonishingly bright color-transition reactions (yellow \longrightarrow green \longrightarrow blue) become visible even at a very narrow range of pH, exhibited by the BCG by reacting with human protein (i.e., skin of the palm and fingers, and also with the cellulosic material of the currency notes, upon wetting with water). This set of reactions has created a cogent and quintessential forensic technique that can create consternation in to the heart and mind-set of the corrupt public servants.

It was Rodkey (1964-1965)^{12, 13} who had first observed Intense binding power of bromocresol green with human protein (mercaptalbumin) with the help of spectrophotometry and ultrafiltration, at pH values below 5. At this pH both nonspecific electrostatic as well as specific anionic binding between BCG and protein was found to be involved. Binding of the bivalent anion of bromocresol green was also measured at pH = 6.95, and the data were interpreted in terms of two classes of binding sites. Three molecules of BCG were found to be bound per molecule of albumin with an association constant $k' = 7.0 \times 10^5$. Five additional molecules were also found bonded but less tightly (association constant $k'' = 2.0 \times 10^4$). Rodkey's work on BCG-albumin interaction catalyzed further research work in the same field¹⁵⁻¹⁸. The authors of the current research paper are of the opinion that similar kind of interaction probably takes place between BCG and protein molecules of human hand, finger, etc., with the generation of deep blue coloration on the palm and/or finger skin that helps in nabbing a bribe-seeker. The blue color in beaker water (**FIG. 7**) comes from low association constant ($k'' = 2.0 \times 10^4$) reaction product of BCG with the palm's tissue protein. But the strong blue-color (difficult to remove) of the fingers comes from high association constant $k'' = 7 \times 10^5$) interaction (**FIG. 8**). The intensity of the bluish finger color depends upon the number of BCG molecules

strongly bonded to each molecule of protein (with high association constant). Similarly, the number of binding molecules of BCG with each molecule of cellulosic matter of currency notes is most probably much higher further because of the intensity and immense stability of the blue coloration created upon the paper ; hence, the association constant in this case is also expected to be far beyond $k'' = 7 \times 10^5$. Thus, because of these physio-chemical marvels of BCG, there is no fear of any legal fiasco as has happened several times in the anti-corruption legal history when phenolphthalein was used by ACB or vigilance teams. Of late, the interaction of BCG with human protein has come out to be of such high forensic value that even the precise estimation of postmortem interval after death has been made possible by the scientists of the Department of Forensic Science, School of Sciences, Gujarat University, Ahmedabad, India¹⁸.

CONCLUSION

Due to very weak and limited coloring effect, the common and age-old phenolphthalein method for trapping the bribe-seekers is now passé. Hence, for strengthening the legal system of justice against menace of bribery, the newly reported technique using BCG as corruption marker not only can supersede phenolphthalein method in many ways, it is indeed quintessential. The BCG effect is so sturdy and permanent that not only bribe-seeker's hand(s) or finger(s) get colored blue upon subsequent treatment merely with water, that even his/her shirt's pocket (or blouse) as well as some of the coercively-received currency notes also get tainted almost permanently with deep blue in color. The new technique can also effectively eliminate several procedural deficiencies and techno-legal lacunae that have been pointed out in various High Courts' and Supreme Court's judgments, wherein phenolphthalein was used to trap-and-convict the bribe-seekers, but later on they were acquitted upon appeals. The BCG method also ratifies the "Locard's Exchange Principle" of forensic science very firmly and truly. The strong blue spots specially on the hand or fingers, and the blue-spotted shirt pocket (or blouse of a corrupt lady) along with the blue-tinted currency notes, can all act collectively to create a bunch of strong incriminating legal evidences against the trapped person that his / her conviction becomes virtually assured. Unlike phenolphthalein, no other chemical like sodium carbonate, etc., is required in the BCG method to

generate the color either in water or on other (hard) objects. Moreover, any stabilizer like hydroquinone, etc., is also not required either for safekeeping the blue-colored hand-dip solution or blue-spotted hard material evidences like shirt, handkerchief, or currency notes. Besides phenolphthalein, the quintessence of the new technique also replaces the rarely used anthracene method as well.

Conflict of Interest : Because of the uniqueness and novelties of this quintessential forensic technique prescribed against the bribe takers, there can not be any scope for arising any conflict of interest whatsoever. Thus, the techniques reported herein rule out the raising of any artificial situation in which a person or organization can use the techniques in self-interests to falsely trap or defame any other individual or organization. In the older phenolphthalein method, which now essentially has been left with only modicum legal value, because following its use many cases of conflict of interest have come up before the High Courts and Supreme Court of India. But, on the other hand, because of the multidimensional and juggernaut quality of proofs and evidences genuinely cropping up following the use of BCG, no person can falsely implicate any honest person in corruption. The current piece of research is just a foolproof scientific advancement in true favor of crimino-legal procedure against graft that also vindicates the “Locard’s Exchange Principle” of forensic science wherein a corrupt person certainly and invariably leaves behind some scientifically-proven evidence of graft, and unknowingly takes away a whiff of incrimination that becomes nemesis for him/her later on.

Ethical Clearance: Not applicable, because no animal sacrifice or religious matter is involved in the research work done.

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Pulmonary Candidiasis: A Rare Diagnosis on Autopsy- A 5 Year Study in a Tertiary Care Hospital

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ABSTRACT

There is an upward trend in the incidence of various mycotic infections. Deaths from HIV-associated opportunistic mycoses and other immuno-compromised patients (malignancies like leukemia, solid cancers, organ transplants, bone marrow transplant associated nosocomial infections) are becoming one of the major cause of mortality. However, the definitive diagnosis of invasive mycotic diseases is can be made on routine histopathology biopsy of the lung and post-mortem histopathological examination of the viscera for the cause of death. We conducted the present study on 271 medicolegal cases in which viscera was received in the department of Pathology at GGS medical college, Faridkot in last 5 years (2010-2016). Of the total, 143 cases having both the lungs as the part of viscera we encountered only two cases (1.3%) of pulmonary candidiasis. This study highlights the utility and indispensability of histopathological autopsies for complete and accurate diagnosis at demonstration of rare diagnosis.

Keywords: Pulmonary candidiasis, cryptococcosis, PAS, Mucicarmine

INTRODUCTION

Mycoses is defined as infections caused by eumycotic organisms such as Candida, Aspergillus, Cryptococcus, Zygomycetes and other fungal species excluding infections caused by filamentous bacteria such as Actinomycetes, Pneumocystis carinii along with superficial infections such as dermatophytosis.^{1,2,3} Mycoses detailed in autopsy records were defined as severe if they were direct cause of death and caused severe pulmonary infection involving both lobes of lungs.² In the United states, of deaths in which an infectious disease was the underlying cause, those due to mycoses increased from the tenth most common in 1980 to the seventh most common in 1997.⁴ The purpose of this article is to highlight that in presence of fungal spores in both lungs in an immunocompromised patient differential diagnosis of candida and cryptococcus

should be. In our study we have highlighted two cases of pulmonary candidiasis using special stains like PAS (Periodic Acid Schiff) and mucicarmine.

AIMS & OBJECTIVES

1. To highlight the rare diagnosis of pulmonary candidiasis in the lung autopsies.

MATERIALS & METHOD

The present study is a prospective study done between period of 2010-2016 in Department of Pathology, during which a total of 271 medicolegal cases were received for histopathological examination to ascertain the cause of death. Of the total, 143 cases in which lung specimen (both sides) were send are included in the study. The viscera was received in 10% formalin solution; haematoxylin and eosin staining was done after the routine tissue processing. Special stains including PAS (periodic acid Schiff) and mucicarmine were done, wherever necessary. All the histopathology slides were subjected to light microscopic examination.

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RESULTS

Of the 143 cases over a 5 year period, we made an incidental diagnosis of pulmonary candidiasis in only two cases (1.3%) made. Here in, we describe the details of the individual cases.

Case I

A 30 year old female patient suffering from lower limb paralysis since 10 years was admitted to emergency with high grade fever, dyspnoea and wide spread bed sores. She died within an hour of admission to the hospital. The autopsy was conducted and viscera consisting of parts of lungs, kidneys, liver, spleen and heart were sent to our department for histopathological examination. The cause of death was ascertained on autopsy and histopathological examination of lungs. On gross examination the lungs were solid [Fig.1].

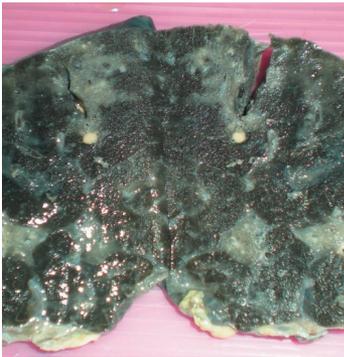


Fig-1 Gross appearance of lungs

Microscopic examination on haematoxylin and eosin [H&E] stain revealed presence of round to ovoid spores of fungus along with presence of chronic inflammatory infiltrate and thickening of alveolar septa [Fig.2]. On the basis of H&E stain, two differential diagnosis of Candida and Cryptococcus were kept.

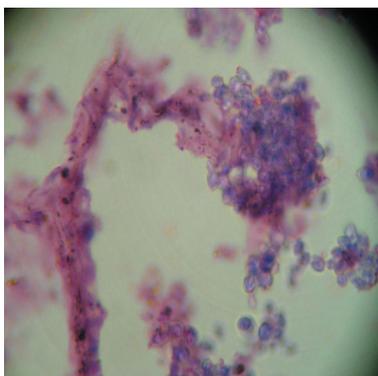


Fig-2 Sections from lungs show numerous colonies of round to ovoid fungal spores (H&E, x400)

Special stains including PAS and mucicarmine

stains confirmed the diagnosis of candida was confirmed by demonstrating budding spores of candida [Fig.3]. Mucicarmine stain was negative as it did not highlight any capsule ruling out Cryptococcus. Microscopic examination of other organs was unremarkable.



Fig-3 Sections from lungs shows spores of Candida showing budding (PAS x400)

CASE II

A 65 year old Hepatitis C positive male, a diagnosed case of chronic liver disease and portal hypertension was admitted with high grade fever, bleeding per rectum and dyspnoea. He died within 2 days of admission to the hospital. Autopsy was conducted and viscera including both lungs, heart, liver and kidneys were send for histopathological examination. On gross examination the lungs were solid and bulky [Fig.4]. Microscopic examination [H&E] stain demonstrated the presence of round to ovoid spores of fungus alongwith presence of congestion [Fig.5]. We kept the differential diagnosis of candida and Cryptococcus, for which special stains like PAS and mucicarmine were done. The stain demonstrated the presence of PAS positive budding spores which were mucicarmine negative. Whereas, the rest of the viscera was normal, the liver showed the presence of cirrhosis, bile duct proliferation and lymphocytic inflammatory infiltrate in the portal tracts.

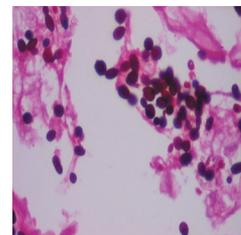


Fig-4 Gross appearance of lungs

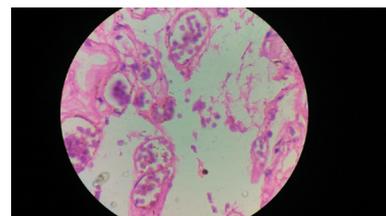


Fig-5 Sections from lungs show numerous colonies of round to ovoid fungal spores (H&E, x400)

DISCUSSION

Pulmonary infections are the most common form of documented tissue invasive infections observed in immunocompromised hosts.^{1,2,3,4,5,6} Immunocompromised hosts are defined by susceptibility to infection with organism of little native virulence in normal individual.

Yamazaki T, Kume HS et al defined mycoses as infections caused by eumycotic organisms such as *Candida*, *Aspergillus*, *Cryptococcus*, *zygomycetes*, *trichosporon* and other fungal infections excluding infections caused by actinomycetes, *Pneumocystis carinii* and superficial infections such as dermatophytoses.²

McNeil MM et al studied the trends in mortality due to invasive mycosis in the United States from year 1980-1997 and found a 3.4-fold rate increase, from 0.7 to 2.4 deaths per 100,000 population. The two major factors responsible for the emergence of fungal infections have been the HIV disease epidemic and many advances of modern medicine (including solid organ and bone marrow transplantation) that prolong the survival of critically ill patients. Another factor is the increase in the number of aged/ aging population.^{1,4,7,8,9}

Although there is spurt in the newer diagnostic fungal blood culture methods, there is possibility of false-negative results in patients with invasive candidiasis. So, the definitive diagnosis of mycosis is demonstrated on histopathological examination.^{4,8,10,11,12}

In a post-mortem histological study on 25 non-neutropenic patients, fungal infections account for nearly 8% of all nosocomial infections; *Candida* is the responsible agent in 80% of the cases. This microorganism once considered a minor pathogen is now among the most commonly cultured microorganisms in intensive care units (ICU).¹⁰

Yamazaki T, Kume HS et al documented that mycoses detailed in autopsy records were defined as severe if they (i) were direct cause of death, (ii) caused severe pulmonary infection involving both lobes of the lung, (iii) caused severe visceral infections of two or more organ systems including those involving the CNS, which were not regarded as the direct cause of death, (iv) caused multi organ system infections of three or more organ system excluding the CNS (v) caused

fungemia.² The two cases fulfill the first two enlisted criteria so making it as severe mycoses.

Banerjee SN, Emori TG, Culver DH et al and Kume H, Yamazaki T et al observed that the lung and bronchial system was involved most frequently, regardless of pathogen species. This suggests that the lungs and bronchi are at the highest risk of being exposed not only to exogenous pathogens such as *aspergillus*, *cryptococcus* but also to *candida* species. Although *candida* species is commensal of digestive tract, it is possible for them to be a major causative agent of systemic infection in immunocompromised patients.^{2,13,14}

The purpose of this study is to highlight a rare diagnosis in an immunocompromised patient pulmonary candidiasis involving both lobes of lungs qualifies as severe mycoses and is direct cause of death.

Ethical Clearance: Taken from Departmental Ethical Committee

Conflict of interest: None

Source of Funding: None

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A Study on Coronary Atherosclerosis- An Autopsy based Study

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ABSTRACT

Atherosclerosis is an endothelial dysfunction of the arteries and the leading cause of death and disability in the developed world and usually involves the aorta, large and medium sized elastic and muscular arteries of the heart, brain, kidneys and extremities, predisposing such organs to ischemic injury. In coronary arteries it causes myocardial infarction and angina pectoris, in central nervous system it provokes strokes and transient cerebral ischemia, in kidneys renal artery stenosis, in peripheral circulation it causes intermittent claudication and gangrene and can jeopardize limb viability.⁽¹⁴⁾ Atherosclerosis involves the development of a plaque composed of variable amounts of connective tissue matrix, vascular smooth muscle cells, lipoproteins, calcium, inflammatory cells, chiefly monocyte-derived macrophages, T lymphocytes and mast cells and new blood vessels (neovascularization). The Study is prospective and one Hundred hearts are examined from the different age groups of males and females, during the medico legal Autopsies. The study showed significantly the higher proportion of atherosclerosis in males than females and prevalence rate is increased as the age is increased and significant lesions are seen in chronic smokers, alcoholics and in non vegetarians.

Keywords: - Atherosclerosis, Atheromas, Arteriosclerosis, Arteriosclerotic Vascular disease.

INTRODUCTION

Atherosclerosis is a slowly progressing arterial disease in which the intima of the arteries are thickened by fibrous deposits that gradually narrow the lumen and gradually become the site of bleeding and thrombus formation.⁽¹⁶⁾ Fatty streaks are the earliest visible sign consists of sub endothelial accumulation of large lipid containing cells and leads to fibrous plaques or atheroma formation which causes the clinical manifestations. The plaques consist of accumulation of monocytes, macrophages, foam cells, T lymphocytes, connective tissue, tissue debris and cholesterol crystals and causes vascular remodelling leads to acute and chronic luminal

obstruction, abnormalities of blood flow and diminished oxygen supply to target organs. Plaques are often infected with Herpesviridae, including cytomegalovirus, Chlamydia Pneumonia infection.⁽¹⁴⁾ In order of frequency the commonest sites are Abdominal Aorta, Coronary arteries, popliteal arteries and the cerebral circulus arteriosus.

Five important risk factors influences the Atherosclerosis namely Hyperlipidemia, Hypertension, Smoking, Diabetes mellitus and Hyperhomocysteinemia and subordinate factors are overweight and a sedentary or stress full lifestyle⁽¹⁶⁾.

The vascular endothelium plays a critical role in maintaining the vascular health, by secreting vasodilators, inhibitors of smooth muscle growth and thrombolytic factors. Normally healthy endothelium produces nitric oxide and it acts as a local vasodilator by increasing smooth muscle cell cyclic GMP levels and inhibiting platelets aggregation and smooth cells

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proliferation.⁽⁷⁾ In conditions such as hypertension, diabetes, dyslipidemia and smoking cause the physiologic and structural changes in the vessel that leads to vascular disease. One of the earliest changes to occur in each of these conditions is an alteration of the oxidative metabolism of the endothelium with increased oxidative stress and causes dysfunction, manifested by a decrease in vasodilators, inhibitors of growth and thrombolytic factors and an increase in the synthesis and releases vasoconstrictive substances in turn promotes the smooth muscle growth, adhesion molecules and prothrombotic factors. In particular there is a decrease in NO formation and activation of vascular ACE and endothelin and results in vasoconstriction, vascular hypertrophy or hyperplasia (Vascular Remodelling) due to Ang II, endothelin and other growth factors and also inflammatory changes including monocyte adhesion and infiltration due to adhesion molecules, cytokines and plaque ruptures due to proteolysis and thrombosis is caused by tissue factor and excessive plasminogen activator inhibitor-1(PAI 1) release from the Atherosclerotic plaque.⁽⁷⁾ The endothelial injury suggests that the plaque formations are 2 types. (1) Positive remodeling (2) Negative remodelling.

When plaque ruptures the cells that accumulate at site and thrombosis produces the cytokine interferon gamma, which inhibits collagen synthesis, already formed collagen is degraded by macrophages that produce proteolytic enzymes and by matrix metalloproteinase (MMPS), particularly MMP-1, MMP-13, MMP-3 and MMP-9. The MMPS are induced by macrophages and SMC- derived cytokines such as IL-1, tumor necrosis factor (TNF), and CD154 or TNF-alpha.

Histopathology of atherosclerotic lesions - New concept⁽¹⁹⁾

1. Stary I Lesion: The endothelium surface adhesion molecules E selectin and P selectin, attracting more polymorphonuclear cells and monocytes in the sub endothelial space.

2. Stary II Lesion: Macrophages begin to make up large amounts of LDL (fatty streak).

3. Stary III Lesion: As the process continues, macrophages eventually become foam cells.

4. Stary IV Lesion: Lipid exudes into the extra

cellular space and begins to coalesce to form the lipid core.

5. Stary V Lesion: SMCs and fibroblasts migrate in, forming fibro atheromas with soft inner lipid cores and outer fibrous caps.

6. Stary VI Lesion: Rupture of the fibrous cap with resultant thrombosis causes ACS.

7. Stary VII and VIII Lesions: As lesions stabilize may become fibro calcific (Stary VII lesion) and ultimately, fibrotic with extensive collagen content (Stary VIII lesion).

MATERIAL & METHOD

To study the Atherosclerosis in autopsy cases, Specimen (hearts) were collected from 100 medico legal autopsies, fixed in 10% formalin solution and dissected with enterotome as per standard procedure i.e. in the direction of blood flow. Coronary arteries were dissected transversely by sharp knife as well as longitudinally up to its Ostia, and the morphological lesions were plotted in proforma. Left coronary artery and its branch such as circumflex, right coronary artery are sectioned and studied with histopathological examination. Tissues thus selected were subjected to automatic processing: blocks were made out of 6-8 microns and stained with haematoxylin, Eosin and Special stains were employed- Elastic stain, Toluidine blue, Sudan III stain. The bits are subjected for Histopathology examination. The grossing and automatic processing, block making and reporting was done in the Dept of Pathology, S.V. Medical College, Tirupati.

FINDINGS

One hundred cases of random fresh bodies, those which came for post mortem examination during the period of one year are taken for the study. The study is prospective and has included the deceased who have been autopsied in the S.V. Medical College, Mortuary, Tirupati. It has included proximal part of right coronary artery, left coronary artery, circumflex artery and subjected for histopathological examination. The results are statistically analysed. The age, sex and disease distribution of patients were evaluated by means of the Chi-square (χ^2) and Fisher exact probability tests, both of which compare the proportions of cases falling into various categories in one group with the proportions of cases falling into the same categories in another group.

The Chi-square (χ^2) test was applied to those groups, which contained more than 40 patients, and Fisher test was employed when smaller groups were involved.

The probability level of significance for these entire statistical test was arbitrarily set as P=0.01. In the present study it was observed that overall there are 70% males and 30% of females groups are present.

Higher proportional of males belonged to higher age groups are compared to that of females. The proportion of atherosclerosis is found to increase with age being lowest in 10-19 years of age group (78.6%) and highest in 60 and above age group were 100%.

The results are shown in various tables and discussed.

Table 1: Age and Sex distribution, their Percentages and Statistical Significance:

Age group (years)	Male (70) (%)	Female (30)(%)	Total (100)	Statistical significance
10-19	4 (5.7)	10 (33.3)	14 (14.0)	$\chi^2= 17.31$ df=5 p=0.00395
20-29	14 (20.0)	4 (13.3)	18 (18.0)	
30-39	18 (25.8)	8 (26.8)	26 (26.0)	
40-49	12 (17.1)	4 (13.3)	16 (16.0)	
50-59	12 (17.1)	0 (0)	12 (12.0)	
60& above	10 (14.3)	4 (13.3)	14 (14.0)	
Total	70 (100.0)	30 (100.0)	100 (100.0)	
Mean Age	40.67±15.22	33.43±18.05	38.50±16.52	T=2.32, p=0.022; S

Table 2: Atherosclerotic changes in RCA by selected variables

S.No.	Variable	Total Subjects	Mean Level of atherosclerosis	Statistical Significance
1.	Age Group			
	10-19	14	0.64±1.44	F ratio=11.2 P<0.001; S
	20-29	18	1.33±1.94	
	30-39	26	1.88±2.25	
	40-49	16	1.81±1.37	
	50-59	12	3.58±2.31	
	60 & above	14	5.14±1.29	
	Total	100	2.26±2.29	
2.	Sex			
	Male	70	2.65±2.22	t=2.72
	Female	30	1.33±2.21	P=0.007,S
3.	Diet			
	Vegetarian	23	1.43±1.99	T=1.99
	Non-Vegetarian	77	2.50±2.33	P=0.048,S
4.	Smoking			
	Yes	24	4.37±2.12	T=6.03
	No	76	1.59±1.92	P<0.001, S
5.	Alcoholism			
	Yes	21	4.52±2.04	T=5.89
	No	79	1.65±1.97	P<0.001,S

Table 3: Atherosclerosis changes in LCA by selected variables

S.No.	Variable	Total Subjects	Mean Level of atherosclerosis	Statistical Significance
1.	Age Group			
	10-19	14	0.64±1.44	F ratio=5.21 P<0.01; S
	20-29	18	1.72±2.32	
	30-39	26	1.76±2.32	
	40-49	16	2.31±1.66	
	50-59	12	3.91±2.33	
	60 & above	14	5.71±2.05	
	Total	100	2.50±2.63	
2.	Sex			
	Male	70	2.95±2.63	t=2.73
	Female	30	1.43±2.32	P=0.007,S
3.	Diet			
	Vegetarian	23	1.30±2.18	t=2.54
	Non-Vegetarian	77	2.85±2.66	P=0.012,S
4.	Smoking			
	Yes	24	5.33±2.14	t=7.57
	No	76	1.60±2.09	P<0.001, S
5.	Alcoholism			
	Yes	21	5.09±2.11	t=5.88
	No	79	1.81±2.31	P<0.001,S

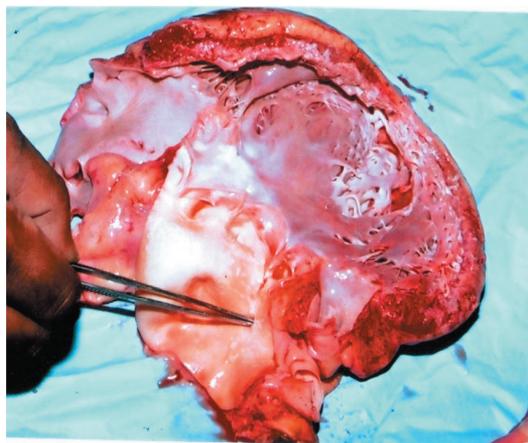
**Fig 1: Atherosclerotic plaque around the coronary ostio**

Table 4: Atherosclerosis changes in Circumflex Artery by selected variables

S.No.	Variable	Total Subjects	Mean Level of atherosclerosis	Statistical Significance
1.	Age Group			
	10-19	14	0.50±1.40	F ratio=4.87 P<0.01; S
	20-29	18	1.05±1.92	
	30-39	26	5.03±2.24	
	40-49	16	1.18±1.60	
	50-59	12	2.66±3.08	
	60 & above	14	4.21±2.05	
	Total	100	1.80±2.35	
2.	Sex			
	Male	70	2.10±2.45	t=1.98
	Female	30	1.10±1.97	P=0.049,S
3.	Diet			
	Vegetarian	23	0.69±1.52	t=2.63
	Non-Vegetarian	77	2.12±2.46	P=0.009,S
4.	Smoking			
	Yes	24	3.95±2.25	t=6.03
	No	76	1.11±1.94	P<0.001, S
5.	Alcoholism			
	Yes	21	3.95±2.35	t=5.35
	No	79	1.22±2.00	P<0.001,S

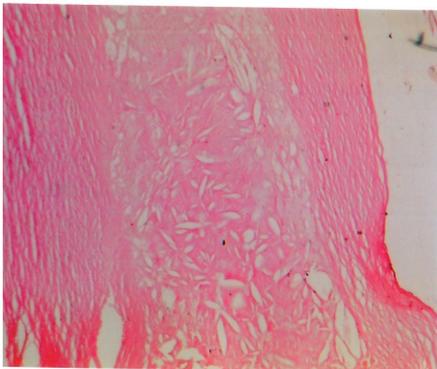


Fig 2: Atherosclerotic Plaque with cholesterol clefts (H&E Stain 10X)

CONCLUSION

For the study total one hundred samples are collected, out of hundred 70 are males and 30 are females. In addition to age factor, diet and behavioural characters, diseases like hypertension, diabetes are taken into consideration to know the grades of Atherosclerosis. In the study, among females, in 3rd decade 3.3% are having advanced lesions, who had habit of eating beef regularly. But there was significant involvement of Arteries with Atherosclerosis in the males than the females. In 60 and above age group the lesions were almost equal in both

sex. As the age advanced the severity of Atherosclerosis increased correlating with the study of Autopsy studies in Atherosclerosis. Higher proportion of males belonged to higher age groups compared to that in females. The mean age of male subjects is comparatively higher than females. The age differences by sex are also statistically significant (Table1). Dr. James and C. Robert ⁽¹²⁾ suggested that Arteriosclerosis increases with age and involves primarily in the larger arteries. The present study correlates with their study.

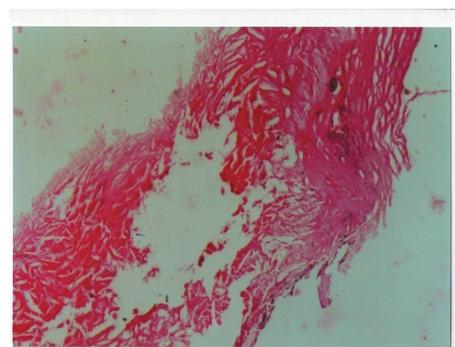


Fig3: Atheromatous plaque with multiple calcifications (H&E Stain 10X)

The study by Roberts, Moses Wilkins ⁽¹²⁾ on men

and women the right coronary artery and the anterior descending coronary artery generally contained the most severe coronary atherosclerosis and present study correlates with above study. As age advances, the severity of Atherosclerosis is also increased and this may lead to sudden death if the total artery is involved when the lumen is blocked. It is suggested that as age advances both the sexes are equally affected by atherosclerosis. As age advances Atheromas and complicated lesions are present in the middle and older age groups. Significant lesions are seen in those had history of Diabetes mellitus and Hypertension.

Sex has no difference. Both sex were affected by Atherosclerosis from 2nd decade onwards.

All the reports are statistically calculated and reported in the tables and reports are as follows.

Table 1: Higher proportion of males belonged to higher age groups compared to that in females. The mean age of male subjects is comparatively higher than females. The age differences by sex are also statistically significant.

As the age advances the complicated lesions were seen in the arteries 60 and above age groups in both sexes correlates with the study by Dr. M. K. S.Reddy⁽¹³⁾.

Table 2: It can be inferred that the degree of atherosclerosis shown a consistently rising trend with age being highest in 60 & above age group (5.14) and lowest in 10-19 years age group (0.64). Significantly higher level of atherosclerosis is found with male sex (2.65) Non-vegetarian diet (2.50), smokers (4.37) and Alcoholics (4.52).

Table 3: The mean level of atherosclerosis in LCA has shown a rising trend with age being highest in 60 & above age group (5.71) and lowest in 10-19 years' age group (0.64). The differences were also statistically significant. Significantly higher level of atherosclerosis is found in males (2.95), Non-Vegetarian diet (2.85), Smokers (5.33) and Alcoholics (5.09).

Table 4: The mean level of atherosclerosis in circumflex artery has shown a rising trend with age. It is highest in higher age groups like 6.8 above age group (4.21) and lowest in the lower age group like 10-19 age groups (0.50) and the differences are also statistically significant.

Significantly higher level of atherosclerosis is found in males (2.10), Non-vegetarian diet (2.12), smokers (3.95) and Alcoholics (3.95).

In the present study positive lesions are seen at the age 14 in the females and at the age 18 in the males. As age advanced there was gradual raise of Atherosclerotic lesions. 60 and above age group had advanced complicated lesions in the present study. The study correlates with Dr.Sahoo's Study⁽⁹⁾. In addition, the males and the females are equally affected by atherosclerosis when the age advanced. The Males and the females more or less were affected below 50 years of age group and females were not exempted from Atherosclerosis. But there was significant involvement of Arteries with Atherosclerosis in the males than the females. Before the conclusion there is still a need for autopsy studies in the Investigation of risk factors and atherosclerotic lesions. The study comprises only one hundred cases, it reveals that much of the prevalence rate of atherosclerosis in this region. It may be taken as a sample study for further research work. Recommendations are lifestyle change Modification, adequate exercise, eating a diet rich in fruits and vegetables and low in saturated fat, weight loss if obese. Diabetes, high blood pressure, abnormal cholesterol, obesity, elevated homocysteine and elevated risk of blood clots should be under control and periodical health checkups are recommended.

Conflict of Interest: - Nil

Source of Funding: - Self funding with Govt Assistance

Ethical Committee Clearance: - Taken from S.V.Medical College Ethical Committee, Tirupati, Andhra Pradesh.

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A Judicial Autopsy Case of a Craniopharyngioma Patient Who Experienced Three Times Local Recurrences and Died on the Forth Postoperative Days

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ABSTRACT

In this case, a 70 - year - old male craniopharyngioma patient experienced three times to local recurrences. On the forth postoperative days after the fourth surgery, the patient died of acute renal failure and decreased blood pressure. The judicial autopsy, conducted 15 hours later, found multiple small bleeding ulcers in the gaster, and a large amount of blood had filled in the gaster and small intestine. The cause of death was considered to be respiratory failure due to congestive edema seen in the lungs, and hemorrhagic shock due to multiple gastric ulcers (Cushing ulcer).

Keywords: Craniopharyngioma, Local recurrence, Postoperation, Judicial autopsy, Pulmonary edema, Multiple gastric ulcers (Cushing ulcer).

INTRODUCTION

Craniopharyngioma is a typical brain tumor derived from pituitary gland embryonic tissue. It is usually a mixture of both solid mass and fluid - filled cysts, and is most commonly found in young people aged five to 10 years old, though it can occur and is easy to recur in adults, too. It does not involve cancerous tumors, and does not spread to other parts of the body. Although histologically craniopharyngioma are benign tumors, they tend to locally invade the surrounding neurovascular structures, making complete excision challenging^{1,2}. Local recurrence, as high as 25%-70 %, has been reported³. Most recurrences occur locally in the sellar region, but ectopic recurrences, both cranial and spinal, have also been reported. An ectopic recurrence of a craniopharyngioma is very rare and, in most reported cases, occurs via direct seeding along the course of the previously utilized surgical approach⁴. We

report this case as a rare case, and one in which there were three recurrence, and the patient died suddenly after surgery.

CASE HISTORY

In April. 1999, a tumor in the upper part of the sella turcica was discovered by examination of visual field abnormality. The tumor was diagnosed as craniopharyngioma on pathological examination. There was a relapse in June. 2000, and the patient underwent resection and stereotactic radiotherapy.

In March. 2005, an increase in the tumor was observed and, surgery was done.

Pituitary dysfunction and diabetes insipidus emerged from the surgery. In March.

2011, a 10 x 10 x 7 mm - sized hung tumor was seen, and rapid visual impairment was observed in the patient.

On March. 11,. 2011, emergency surgery was performed. But, the patient died of acute renal failure and a sharp decrease in blood pressure on March. 15,. 2011.

Because a medical accident was suspected, a

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judicial autopsy was done 15 hours later.

AUTOPSY FINDINGS

The judicial autopsy was done 15 hours later. The findings were as follows.

A 70 - years old male cadaver of good nutritional status, body height 166 cm, body weight 80 kg (Figure 1). Brain (1340 g): a 10 x 10 x 7 mm - sized tumor was seen in contact with the optic chiasm (Figure 2).

Lungs (Left = 1025 g / Right = 1200 g): both lungs were slightly enlarged (Figure 3), and a small amount of yellowish pleural effusion was observed into both thoracic cavities. Gaster: the contents of a large amount of tarry had been stored, and multiple ulcers were seen with clot adhesion to the gastric mucosa (Figure 4). Small intestine: a large amount of blood had been stored; the bleeding site was not seen in the mucosa.

Oesophagus: varices were not seen in the oesophageal mucosa.

Kidneys: (Left = 230 g / Right = 210 g): both kidneys were enlarged, bleeding was seen in the renal pelvis mucosa. Heart (490 g): although left ventricular concentric hypertrophy was seen, acute myocardial infarction was not seen.

Histopathological findings:

The brain tumor was diagnosed as a craniopharyngioma adamantinomatous type in pathological examination (Figure 5). In both lungs, pulmonary edema and hemorrhaging were seen in strong diffusion within the alveoli (Figure 6). Multiple gastric ulcers were seen U1 -II from U1 - I (Figure 7). In both kidneys, no significant glomerular or tubular changes were observed.

DISCUSSION

Sometimes hemorrhagic shock is observed postoperatively in patients who have undergone brain tumor surgery ^{5,6,7,8,9}. In such a case of sudden death, it is considered difficult to judge whether or not bleeding was overlooked, and whether or not the medication administered resulted into exacerbation of the ulcer. It is also difficult to judge the propriety of the decisions made, and the validity of the medical actions undertaken. When a Cushing ulcer complicated with a head injury and a craniotomy surgery, and a Curling

ulcer complicated with a burn, are exacerbated by stress ^{10,11,12,13,14,15}, it is generally considered difficult to judge of the degree of exogenous contribution. In our patient, recurrence of craniopharyngioma occurred three times, and the patient died in a state of shock after the fourth surgery.

In the autopsy, multifocal small bleeding ulcers were seen in the gaster. Because a large amount of blood had filled the gaster and small intestine, the direct cause of death was thought to be due to hemorrhagic shock. As a cause of multiple gastric ulcers, Cushing ulcers were observed in postoperative central nervous system disease. As organ changes associated with shock, congestive edema due to hemorrhagic shock were observed in the lungs.

We considered one of the factors in the patient's death of respiratory failure to be congestive edema. We surmised that the patient, who had had repeated surgery and recurrences, had a experienced strong stress.

Because postoperative renal failure was not substantial in the kidney lesions, the renal lesions were considered as pre-renal failure due to the large amount of bleeding.

But Cushing ulcers are often seen after surgery, and this case showed that there is a concern as to whether or not it is possible to avoid multiple gastric ulcers after surgery.

The administration of Histamine H2-receptor Antagonist (H2RA) ¹⁵ in patients with acute gastric mucosal lesions (AGML) is expected, and the risk of major bleeding is said to be reduced to 58 % (relative risk reduction) ¹⁶. Metiamide of H2RA was discovered in 1972 ¹⁵, and the prevention of stress ulcers and the effectiveness of treatment in regard to Metiamide were reported in 1976 ¹⁷.

However, the administration of H2RA to patients was not done at the time. In this case, we thought it desirable to administer H2RA to the patient for the prevention of stress ulcers.



Figure 1- A 70- year- old male cadaver with good nutritional status, body height 166 cm, body weight 80 kg.

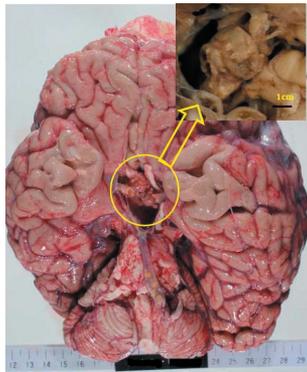


Figure 2- Brain (1340g): a 10 x 10 x 7 mm- sized tumor (arrow) was seen in contact with the optic chiasm. The upper right is a close-up photograph in the brain tumor. Bar = 1cm.

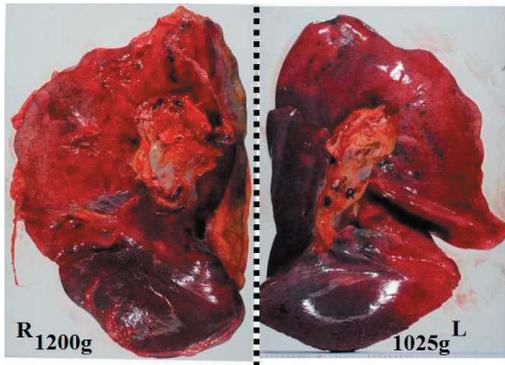


Figure 3- Lungs (Left = 1025 g/ Right = 1200 g): both lungs were slightly enlarged.

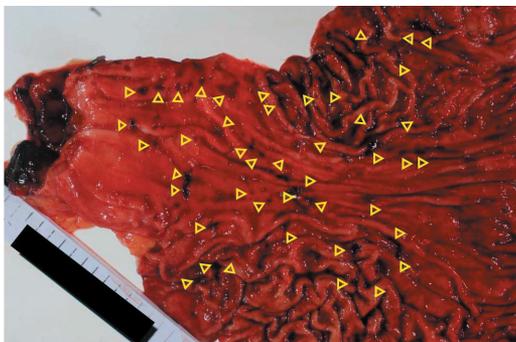


Figure 4- Gaster: the contents of a large amount of tarry had been stored, and multiple gastric ulcers were seen with clot adhesion to the gastric mucous.

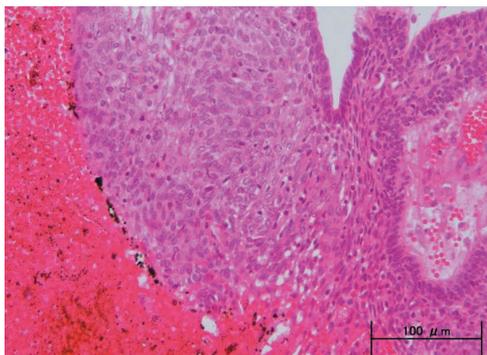


Figure 5- Adamantinomatous craniopharyngioma invading brain tissue (HE stain, bar = 100µm).

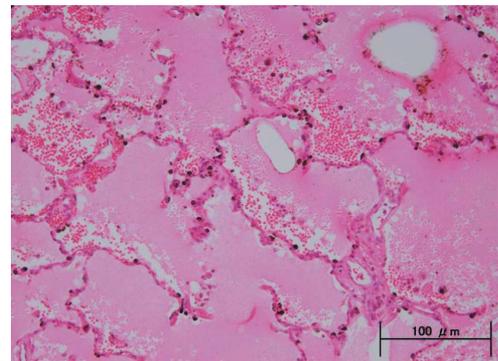


Figure 6- Pulmonary edema and hemorrhaging were seen in strong diffusion within the alveoli. (HE stain, bar = 100µm).

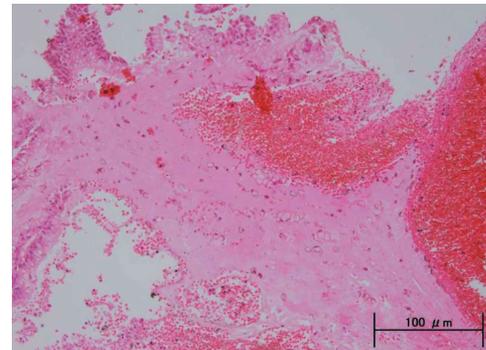


Figure 7- Multiple gastric ulcers were seen UI -II from UI - I (HE stain, bar = 100µm).

CONCLUSION

The local recurrence of craniopharyngioma with three times was seen to this case.

An emergency surgery was done by the sudden change of the symptom of this patient, but this patient died on the forth postoperative days.

In the Judicial autopsy, multifocal small bleeding ulcers were seen in the gaster.

Because a large amount of blood had filled the aster and small intestine, the direct cause of death was thought to be due to hemorrhagic shock. As a cause of multiple gastric ulcers, Cushing ulcers were observed in postoperative central nervous system disease.

As organ changes associated with shock, congestive edema due to hemorrhagic shock were observed in the lungs. We considered one of the factors in the patient's death of respiratory failure to be congestive edema.

Ethical Clearance- Taken from ``Guidelines for notification of unnatural death`` of Japanese Society of Legal Medicine

Source of Funding- Self

Conflict of Interest- Nil

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A Study on Stressful Life Events and Farmers Suicide

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ABSTRACT

Suicide is a fatal act which represents the individuals wish to die. The latin word suicide denotes “self murder”. India is an agrarian country with around 60% of its population depends directly or indirectly upon agriculture. Farmer suicide account for 11.2% of all suicides in India. Activists and scholars have cited a number of conflicting reasons for farmer suicide; such as high debt burdens, genetically modified crops, government policies etc. The current study aims at understanding the various stressful life events that lead to suicide of the farmers in Kamrup district, Assam.

Keywords: *Farmer Suicide, Self Murder, Stressful Life Event.*

INTRODUCTION

Suicide is a fatal act which represents the individuals wish to die⁵. The latin word suicide denotes “self murder”³. Most of the victims plans it for days, weeks, months even years; but for some it is an impulsive act⁵.

India is an agrarian country with around 60% of its population depends directly or indirectly upon agriculture. Farmer suicide account for 11.2% of all suicides in India. Various reports suggests that suicide by farmers touched a grim high in 2015. There has been a big debate and blame game in socio-political and economic fronts.

Activists and scholars have cited a number of conflicting reasons for farmer suicide; such as monsoon failure, high debt burdens, genetically modified crops, government policies, public mental health, personal issues and family problems.

The current study aims at understanding the various stressful life events that lead to suicide of the farmers in Kamrup district, Assam.

OBJECTIVES: To find the

- Socio demographic data of the victims.

- Different type of stressors that might have influenced the farmers to commit suicide.
- To formulate strategy to prevent further suicide.

MATERIALS AND METHOD

The material of the study consists of 50 suicide victims of farmers brought for medico-legal autopsy in the department of Forensic medicine GMCH, Assam, during the period of Jan 1st 2015 to dec 31st 2015.

The various data in relation to socio-demographic profile were obtained from the history, relatives, police documents and investigating officers.

Presumptive life event scale^{1,6} (PSLE SCALE) as proposed by Dr Gurmeet Singh, Ms Dalbir Kaur and Mrs Harsharan Kaur were applied to the reliable informant including spouse, sons and daughters or near relatives of the victims, who expressed suicidal thoughts or attempted suicides during the past 6 months. This study has no control group and as the sample design was amongst the non living only number of stressors experienced by the victims which was expressed to the family members during the past 6 months were counted and analysed. The informants who were not reliable were excluded from the study.

OBSERVATIONS AND RESULTS

In the current study all the samples were male, whose profession depended solely on agricultural

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activities.

Among the cases most of the victims were between 31-40 years (19 cases).

Family wise most of the victims were from nuclear family and all of them were married. Most of the victims were having primary level of education.

Analyzing the stressful life events experienced by the farmers during the past 6 months which was often recognized by the family members and expressed by the victims were “major personal illness or injury”(13 number of cases). This was followed by “excessive alcohol or drug use by family members” (11 cases). For another cases “large loan” was a major stressor. “Property or crops damage”, “death of spouse”, and “Family conflict” were other major stressors. Few experienced “death of close family member” and “sexual problems” as a stress factor. In 2 cases no stressor was expressed by the informants.

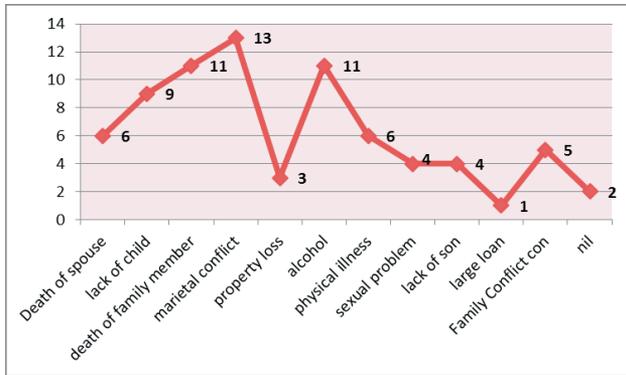


Figure1: Showing the underlying cause in suicide cases.

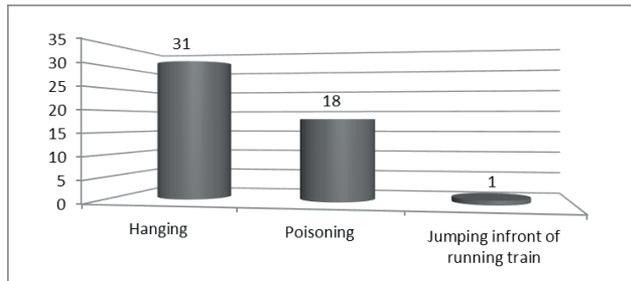


Figure2: showing the various methods adopted for suicide

DISCUSSION

A total of suicidal deaths were autopsied during the period of 1st Jan 2015 – 31st Dec 2015, of which 56 were farmers, whose livelihood dependent solely on agricultural work. 50 cases of farmers were selected for the study since information on stressor of the other 6 was not reliable and adequate.

Considering the core issue of stressful life event and its influence upon suicide, most of the victims experienced multiple stressors during the last six months before death. Suicidal thoughts and preoccupation with the stressors were expressed to close family members and relatives. Based upon information gathered from the informant “major personal illness” topped the list which was experienced by a total 13 numbers of the victims. This was quickly followed by- “excessive alcohol or drug use by family members” and “Large loan”. Dongre and Deshmukh, 2012 in their study on farmers suicide in rural Vidarbha (Maharashtra) opined reasons behind farmers suicide were – debt, alcohol addiction, environment, stress and family responsibility and crops failure etc⁴.

Behere and Bhise 2009 opined indebtedness (87%) and deterioration in the economic status (74%) were a major risk factor for farmer suicide². In our study 9 were preoccupied with the stress of property or crops damage, 6 were concerned “death of spouse” and “family conflict”. Alit Ghosh 1982 in his study also opined about persona issues and family problems amongst the various causes of farmers suicide. In the current study “marital conflict” was a major stressor for 5 numbers of victims. Out of the total 50 victims, 3 expressed “lack of a son” as a major stressor amongst other stressors, which again reflects social preoccupation with a male child.

SUMMARY AND CONCLUSION

This study was an attempt to find out the influence of “stressful life events” amongst the victims of suicide who were farmers by profession. In our study “major personal illness” emerged as the most commonly experienced stressor. A sizable number also experienced “excessive use of alcohol or drug by family members” as a major stress. “Indebtedness” and “large loan” was also a significant stressor amongst the victims. Most of the victims reported multiple stressors before the final act of suicide.

Proper psycho-social research requires close attention to how stress is defined, how the victim’s history is obtained and control subjects are selected. Governments’ responses to farmers’ suicide, agricultural debt waiver and debt relief scheme, mass awareness with regional initiatives might address this burning issue. In summary, it may be concluded that stressful life events may be an important factor amongst farmers

who commit suicide.

Conflict of Interest : Nil

Source of Funding: Self

Ethical Clearance: Taken from institutional ethical committee.

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Forensic Odontology – Awareness among Dental Practitioners in and around Tirupati - A Knowledge, Awareness and Practice Study

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ABSTRACT

Background: Forensic odontology though learned in the undergraduate curriculum but there is no separate postgraduate specialty in this area. In need of forensic expert advice, the law and enforcement department depends on the opinion of broad specialty dental practitioners. This study was designed to analyze the knowledge, attitude and awareness of forensic odontology among dental practitioners in Tirupati. **Method:** A cross-sectional study was conducted in a sample of 126 dental practitioners in Tirupati and data was collected by means of a questionnaire survey. Answers to a set of 15 relevant questions with demographic and clinical data were recorded. **Results:** 10% of the dental practitioners did not maintain dental records in their clinic/workplace and out of the 90% who maintained records, 60% were not aware of child abuse and the actions to be taken for it. Estimation of dental age and gender was known to 63 % of them. 65% dentists knew the role of forensic odontology in mass disasters. About 81 % knew the significance of teeth bite mark patterns and 59 % knew that they can testify as an expert witness in the court of law while 41% lacked formal training in collecting, evaluating and presenting dental evidence. **Conclusion:** Our study revealed that the knowledge level was inadequate among dentists and lack of practice pertaining to clinical knowledge of forensic odontology is prevailing among the dental post graduates.

Keywords: Forensic odontology, Dentists, Knowledge, Mass disaster.

INTRODUCTION

The Application of dental Knowledge in identification of deceased individuals is a challenging and fascinating branch of forensic science. The knowledge of Forensic odontology in giving expert opinion in the court of law is in practice since 1849¹. Dr. Oscar Amoeda who did enormous work in the field of forensic odontology is even considered as Father of Forensic Odontology². In the past three decades though this science has developed as specialized

branch of forensic odontology in forensic medicine, but when it comes to actual awareness, knowledge and application in our setup it's still in budding stage. As an expert in forensic odontology one may provide information regarding human remains at a crime scene or mass disaster and even about bite marks and inference regarding the age, gender etc in the court of law. Though there are many dental colleges providing various postgraduate courses in India, very few offer training courses in forensic odontology and more over dentists may not prefer to take it as a specialty because of lack of job opportunities in the field³.

Forensic odontology is becoming important tool of forensic medicine and in coming decades due to upraise of crime rate and mass disasters due to population explosion there will be many references to dentists regarding their opinion. Hence the question

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is how dentists are equipped with the knowledge and application of this science. Under conditions like natural disasters, the bodies of the victims become mutilated beyond recognition. The vital role of dental surgeons comes into the picture in the identification of such individuals⁴.

The current study is designed to evaluate the awareness, knowledge and application skills among dentists in the field of forensic odontology.

MATERIALS AND METHOD

The present study was conducted in and around Tirupati in 126 dentists of various dental specialties other than forensic odontology. The participants were given a questionnaire and asked to choose the answer which they found appropriate. The participants were informed that mentioning the names is not mandatory to fill up the questionnaire, consisting of 15 questions all related to the field of forensic odontology. Data was collected from dentists in and around Tirupati over a period of 5 months from October 2015 to February 2016. The data was meticulously tabulated for each question analyzed using MS-Excel. Description statistics were used and the findings are presented as number and percentage.

FINDINGS

After collecting answers to the questionnaire from the 126 dentists, the data was analyzed and the findings are as follows ;

1. What is the terminology given for forensic study of teeth?

- 120 (95%) of dental clinicians knew the terminology of forensic odontology

2. Teeth examination can provide information on

- 44 (35%) answered as person's age,
- 2 (2%) as person's ethnic background
- 80 (63%) answered as the above all

3. Are you comfortable providing expert opinion in case of forensic dentistry?

- 68 (54%) don't know about expert opinion
- 50 (40%) are not comfortable
- 8 (6%) are comfortable

4. Where did you learn about forensic odontology?

- 64 (51%) got the information by listening to

lectures

- 26 (20%) by TV serials such as crime patrol and CID.

- 12 (10%) by reading news papers.

- 24 (19%) got the information by other sources.

5. Your confidence level about forensic dentistry?

- 58 (46%) have average confidence levels

- 56 (44%) have inadequate confidence levels.

- 12 (10%) have adequate confidence levels about forensic dentistry.

6. Do you update your knowledge on forensic dentistry?

- 64 (51%) of them are not updating.

- 40 (32%) are occasionally updating

- 22 (17%) are updating

7. Can you interpret patterns of teeth bite marks and its relevance?

- 102 (81%) of dental clinicians can interpret

- 24 (19%) cannot.

8. Do you know you can testify as a professional expert witness in court of law?

- 74 (59%) knew

- 52 (41%) didn't know

9. Do you maintain dental records.

- 114 (90%) are maintaining

- 12 (10%) are not maintaining.

10. If yes, which of the following are maintained

- 54 (43%) in the form of radiograph

- 36 (28%) as casts

- 12 (10%) in the form of photograph of patients

- 24 (19%) in the form of all the three methods.

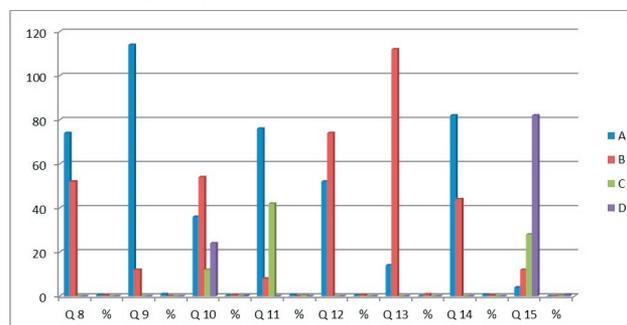


Figure – 1 Response to Questions 1 to 7

Q-Question, ABCD-Options in questionnaire

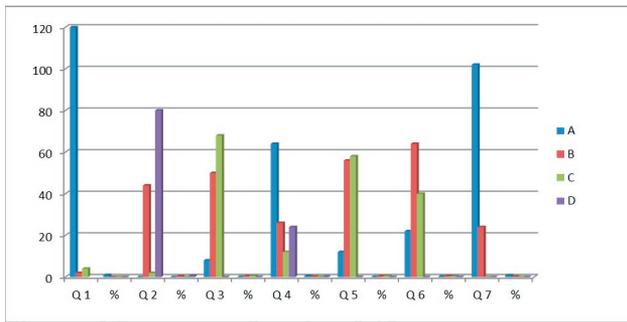


Figure – 2 Response to Questions 8-15

Q-Question, ABCD-Options in questionnaire

11. What steps are to be taken while detecting child abuse signs and symptoms?

- 76 (60%) have informed to the police.
- 42 (33%) informed the parents.
- 8 (7%) informed the NGO.

12. Are you aware of any forensic odontology courses available in India? If available name them?

- 52 (41.27%) were aware
- 74 (58.73%) were not aware

13. Are you interested in learning more about forensic odontology

- 112 (89%) were not interested
- 14 (11%) were interested.

14. As a dentist do you know the role of forensic odontology in mass disasters

- 82 (65%) know the role
- 44 (35%) didn't know.

15. Most appropriate method to identify the age from teeth, among deceased in mass disaster?

- 28 (22%) by method of deposits of secondary dentin.
- 12 (10%) by cementum annulations,
- 4 (3%) by enamel translucency,
- 82 (65%) by above all the methods.

DISCUSSION

The Latin word forum stands for Forensic, which means “court of law”. Odontology refers to study of teeth. Therefore the Federation Dentaire Internationale (FDI) defined Forensic odontology as a branch of dentistry which, in the interest of justice, deals with the proper handling and examination of dental evidence, and with the proper evaluation and preservation of

dental findings⁵. This study was conducted among the individuals from the field of dentistry to assess their awareness about forensic odontology. More than 90% of dental practitioners are aware about the terminology, the reason may be its dealt in their undergraduate curriculum. Similarly 80% are comfortable in that through dental examination they can identify person’s age and ethnic background. Very few (6%) are confident enough to provide expert opinion and more than 54% don’t know about expert opinion in case of forensic dentistry.

The major source of information about forensic odontology was lectures (51 %) which they attended only during their undergraduate period as there is no scope of updates later for practitioners⁶. Among participants, only 10% were confident about forensic dentistry and 90% were not confident. Very few (17 %) were updating their knowledge, probably academicians who were in access to continue dental education in colleges. 81% clinicians were comfortable inferring about teeth bite marks and its relevance⁷. About awareness as a professional expert in the court of law, 59% were aware and 41% were not. 60% of dentists were aware about their duty to inform police on detecting a child abuse case. 58% of study participants were not aware about the availability of forensic odontology course in India. 89% of dentists were not interested in studying forensic odontology. In identification of human remains in major disasters 65% were aware of the key role involved on scientific application of forensic odontology knowledge^{8,9}. The results clearly show that there is awareness about forensic odontology among most of the dental practitioners who participated in the survey. When it comes to knowledge aspect around 50% were confident in executing their knowledge and around 50% do not have sufficient knowledge and hence lack of confidence. More than 59% of the respondents were aware that they could testify as an expert witness in court to present forensic evidence¹⁰. But they were not willing to participate as an expert because of poor knowledge. The reason for such low confidence level among dental practitioners may be poor formal training in the forensic odontology as it was not included as a part of our academic curriculum. Most of the practitioners had no formal training and were not interested in studying because of poor career growth and due to lack of fully equipped labs accessible for forensic odontology.

CONCLUSION

This study reveals that there is acceptable percentage of dentists with adequate knowledge and awareness towards the branch of forensic odontology but with poor skills and confidence. This study conducted in and around Tirupathi reflects the current situation in the field of forensic odontology. This situation can be improved by conducting regular guest lectures, workshops and CME/CDE with inculcating the importance of forensic odontology as part of undergraduate and Postgraduate curriculum in dentistry.

Conflict of Interest: None declared.

Source of Funding: Self

Ethical Clearance: Prior clearance and approval was taken.

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Epidemiological Study of Road Traffic Accidents and Role of Alcohol in Road Traffic Accidents

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ABSTRACT

The objective of the study was to assess the epidemiological factors of road traffic accident victims, which will give a clue on the risk factor in road traffic accidents. As per the report from Transport Research Wing, Ministry of Road Transport and Highways, Government of India approximately 400 people die per day because of road traffic accidents, in 1 hour 57 accidents occur in which 17 victims die of which 54% victims are between 15 to 34 years¹⁹. The study involves 100 victims of Road Traffic Accidents reported to Government Sivagangai Medical College and Hospitals. About 64% victims are in productive age group. About 64% victims are due to accidents caused by driver under alcoholism, of which >60% suffer from greivious injury. 40% of road traffic accidents are due to over speeding. Hence, Alcohol places an important role in occurring of road traffic accidents and in determining the nature of accident and injuries. Proper education and alcohol abstinence can reduce the RTA and prevent excess load on health care system and reduce the economic loss of the family and the country as whole.

Keywords: Road traffic accident, Alcoholism, nature of injury.

INTRODUCTION OR BACKGROUND

A Road traffic accident (RTA) can be defined as, an event that occurs on a way or street open to public traffic; resulting in one or more persons being injured or killed, where at least one moving vehicle is involved. Thus RTA is a collision between vehicles, between vehicle and pedestrians; between vehicles and animals; between vehicle and a architectural or geographical obstacles.¹

Each year the lives of almost 1.24 million peoples are cut short as a result of road traffic accidents. Between 20 to 50 million more people suffer non-fatal injuries, with many incurring a disability as a result of their injury.²

Road traffic accidents cause considerable economic losses to victims, their families, and to nation as a whole. These losses arise due to the cost of treatment as well as reduced productivity for those killed or disabled by their injuries, and for family who need to take time off the work to care for the injured.

There are only few global estimates of the costs of injury, but an estimate carried out in 2000 suggest

that the economic cost of road traffic accidents was approximately US\$ 518 billion. National estimates have illustrated that road traffic accidents cost countries between 1-3% of their gross national product, while the financial impact on individual families has been shown to result in increased financial borrowing and debt, and even a decline in food consumption.

Road traffic accidents have been neglected from the global health agenda for many years, despite being predictable and largely preventable. Evidence from many countries show that dramatic successes in preventing road traffic accidents can be achieved through concerned effects that involve, but are not limited to health sector.² during 2008, Road Traffic Accidents ranked fourth among the leading causes of death in the world.³

Like any other disease, accidents follow same epidemiological pattern and majority are preventable. For every death due to Road Traffic Accident, there are as many as 50-100 minor injuries and 10-20 serious injuries requiring long periods of expensive treatment.¹⁸

Road traffic injuries also place a huge burden on the health sector in terms of pre-hospital and acute care and rehabilitation⁷

While the casualties in road accidents in the country have increased by 1.3% during 2012; as compared to 2011.⁹ if no action is taken, road traffic accidents are predicted to result in the deaths of around 1.9 million people annually by 2020.²

Hence, the goal of the United Nations' Decade of Action for Road Safety 2011-2020 is to save 5 million lives.⁴

MATERIALS AND METHOD

STUDY POPULATION:

100 victims of Road Traffic Accidents who reported to Government Sivagangai Medical College and hospital.

INCLUSION CRITERIA:

- **Victims of Road traffic accidents reporting to Government Sivagangai Medical College hospital.**

EXCLUSION CRITERIA:

- **Victims who are unwilling to participate in the study are excluded.**

VARIABLES TO BE COLLECTED:

Demographic, human, vehicular, environmental and time factors

ETHICAL CONSIDERATION:

ETHICAL COMMITTEE APPROVAL: The institutional ethical committee approval is obtained before starting the study.

INFORMED CONSENT: The informed consent is obtained from the study population individually after explaining the nature of the study to the study population in their own language.

CONFIDENTIALITY: The data collected from the patients will be maintained confidentially.

FINDINGS

Among the 100 victims of Road traffic accidents, 64% of victims are in productive age group. A detailed

breakup classification of the age of the victims is given in Figure 1. Among them, 8% were illiterate, 10% were uneducated, 14% had their elementary schooling education, 30% had completed their high education, 14% had their higher secondary education and 24% had their college education. Of the accidents occurred, 38% of RTA are from urban places, 62% of RTA are from rural places. Also among the 100, 46% of reported RTA was accidental bike skid, 38% of the reported RTA was collision in nature, 10% of reported RTA was due to the crossing of animal or human in roads, 6% of reported RTA was due to the technical problems. Alcohol is considered as a major preventable reason for road traffic accidents. Among the 100 RTA victims included in the study more than 64% are due to the Road Traffic Accidents due to driving by alcohol consumed drivers. Among the victims of road traffic accidents caused by drivers under the influence of alcohol, 62% (40 victims) of victims suffer from grievous injury, 38% (24 victims) of victims suffer from simple injuries (Figure 2). In the road traffic accident caused by non-alcoholic drivers about 50% of victims suffer from grievous injury. 56% of road traffic accident victims are due to bike skidding. Hence, bike skidding is common in driver who consumed. In case of non-alcoholic victims are 44% are due collision with other vehicle or objects. So, collision is common in non-alcoholics. About 40% of the road traffic accidents are due over speeding vehicles. Of the 40% of over speeding vehicles 26% are alcoholics and 14% were non-alcoholics. Alcohol is one of the primary cause for over speeding proved in Figure 3. 52 % of road traffic accidents took place in roads that were in poor condition. Around 64% of road traffic accidents occur within 3.00pm to 9.00pm.

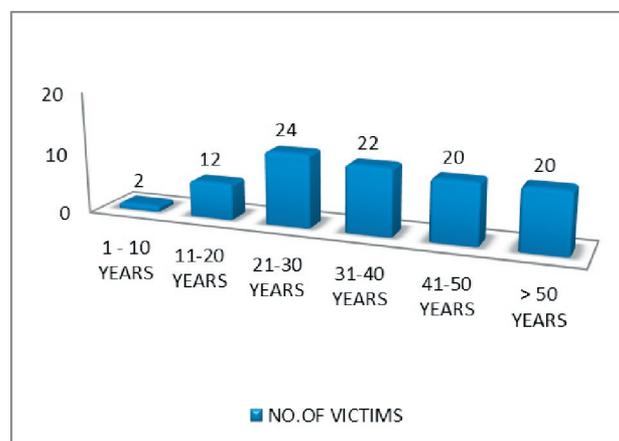


Figure 1: Age distribution

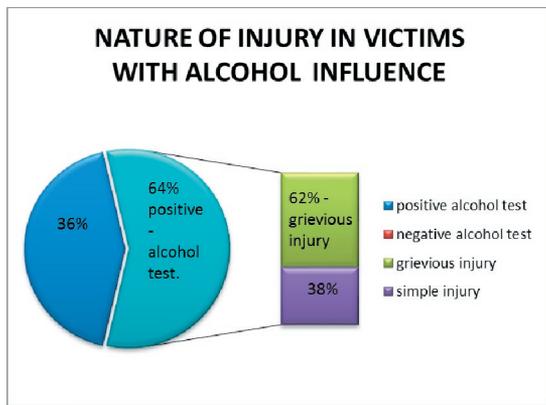


Figure 2: Nature of injury in case of victims with alcohol influence

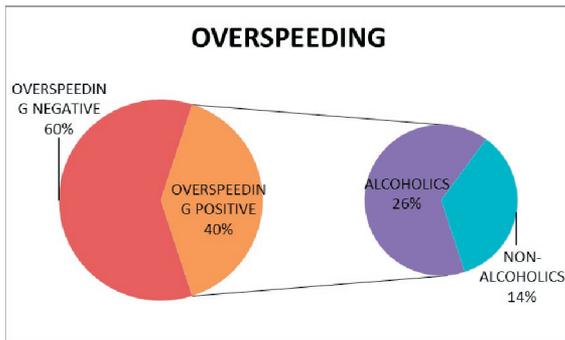


Figure 3: Over speeding

DISCUSSION

In our study, about 64% of victims are in productive age group. According to the research paper titled “An Epidemiological Survey of Fatal Road Traffic Accidents and their Relationship with Head injuries.”¹⁶ The majority of victims belonged to the age group of 21-40 years and females are less involved than men. It is due to the great male exposure to the urban streets and similar higher incidence of road traffic accidents among males has been found in other researches too.^{10,11,12,13} Poor education and lack of awareness may be considered as a factor in RTA. “Epidemiological study of road traffic accident cases from Western Nepal”, states that high prevalence of RTA was reported in school educated peoples around 49.16% and graduates around 39.15%. This is similar to that in our research study. From the data collected it is evident that most of the victims of RTA are from rural place about 62% are from rural area and 38% were from urban place. In the study named as “Epidemiological study of Road Traffic Accident cases from Western Nepal, done by Badrinarayan Mishra, Nidhi D Sinha et al”,¹⁴ about 65.83% of victims are from rural area and 34.17% of the victims are from urban. This is similar to that in our research study. Thus, rural road condition, facilities available

in their place plays an important role. In the research paper “A study of Pattern of Injuries in Road Traffic Collisions by Dr.D.Rao and Dr.S.Mukerjee”¹⁵ the majority of accidents are collisions which is similar to our study where we say that collision is common among the non-alcoholic drivers caused road traffic accidents. Among the road traffic accidents involving non-alcoholic drivers 28% of victims are due to bike skidding, 44% are due collision with other vehicle or objects, 17% of victims are due to the RTA involving cattle in road, 11% are victims of RTA due to vehicle factors. Among the drivers under the influence of alcohol 56% are due to bike skidding. Alcohol is considered as a major preventable reason for road traffic accidents. For the 100 RTA victims included in the study 64% are due to the Road Traffic Accidents due to driving by alcohol consumed drivers, 32% are victims of Road traffic accidents caused by non-alcoholics. This is similar to the findings in the research paper done in Maharishi Markandeshwar Institute of Medical sciences and Research.¹⁷ In the research paper titled as “Epidemiological Study of Road Traffic Accident cases from Western Nepal by Badrinarayan mishra, Nidhi D sinha and AK Sinha et al.”¹⁴ ‘Alcohol – the killer on road’ is a well documented fact, where 46.37% were found to have evidence of alcohol consumption. This is similar to that in our finding, that alcohol consumption by drivers in road is the major preventable cause of majority of road traffic accidents. Of the road traffic accidents 40% of victims are due to the road traffic accidents involving over speeding vehicles, 60% of the victims are due to the road traffic accidents involving vehicles not over speeding. Of the 40% of over speeding vehicles 26 are alcoholics and 14 were non-alcoholics. In the research paper titled as “Epidemiological Study of Road Traffic Accident cases from Western Nepal by Badrinarayan mishra, Nidhi D sinha and AK Sinha et al”¹⁴ it was observed that 50% of cases were due to high speeding vehicles (40-60 km/h). Speeding vehicles were responsible for an alarmingly high percentage of fatalities 63.63%. This is similar to the result of our research. To the addition most of the drivers of speeding vehicles are alcoholics in 40 speeding vehicles 26 were driven by drivers under influence of alcohol. In our study among the 100 RTA 48% occurred in poor condition and non-familiar roads and 52% occurred in the normal roads. This in accordance to the results of the research paper titled as “Epidemiological Study of Road Traffic Accident cases from Western Nepal by Badrinarayan

mishra, Nidhi D sinha and AK Sinha et all"¹⁴, defective roads are responsible for 39% of Road Traffic Accidents & remaining 61% occurred in the wide roads. Thus, wide roads are suitable for over speeding which may be the reason for the road traffic accidents.

CONCLUSION

Alcoholism is considered to be an important cause for road traffic accidents. Alcoholism also determines the nature of accident and nature of injuries too. Awareness and lack of education also places a role in road traffic accidents.

Conflict of Interest: Conflict of interest declared none.

Source of Funding: Self

Ethical Clearance: Ethical clearance is taken from "The Institutional Ethical Committee, Government Sivagangai Medical College and Hospitals, Sivaganga". (Certificate attached below, certificate no: 03072015)

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Profile of Poisoning Cases and Related Medicolegal Time Frame

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ABSTRACT

Poisoning is one of the global public health problems. Considerable number of cases form part of Emergency department and far many cases succumb to it. This study aims to know the profile of fatal poisoning cases at a tertiary care center in North Karnataka and the related time taken for various steps of medicolegal work before arriving at final opinion. This retrospective study involved fatal poisoning cases autopsied during a two year period (2013-14). The available information was documented in the prestructured proforma and analysed. Males outnumbered the females, majority belonged to age group of 21-30 years, organophosphorus was the most common poison detected and self ingestion was the commonest manner. The average time taken for various steps of medicolegal work are as follows- viscera collection by police from Forensic medicine department: 25 days; deposition of viscera at Forensic science laboratory (FSL): 30 days; reporting from FSL: 33 days; submission of report to Forensic medicine department:63 days. The result of this study will be useful in taking steps to reduce the various time frames, thus facilitating early finalisation of reports.

Keywords: Forensic science laboratory, Organophosphorus, Poisoning.

INTRODUCTION

Poison is any substance which when introduced into the living body or brought in contact with any part thereof will produce ill effects or death by its local or systemic action or both.¹ Poisoning is one of the global public health problems. Considerable number of cases form part of emergency department and far many cases succumb to it. Next to road traffic accidents they are commonest cases we encounter at autopsy. We know that certification of cause of death of the deceased in any case becomes an important issue as it is needed for

obtaining death certificate which is a vital document for the survivors to make life insurance claims, settle property disputes, and to obtain other death benefits. But usually in a case of poisoning the final opinion will be reserved till an opinion is obtained regarding the type of poison from the Forensic science laboratory (FSL). Many a time's the deceased's survivors would be apprehended because of delay in getting the final opinion. For this reason the study is carried out to know the various medicolegal time frames before arriving at the final opinion thus finding out answer for queries such as where is the time lag? Can it be prevented? If yes, what steps to be taken? The study also aims to know the pattern of poisoning deaths in relation to age group, sex, occupation, manner of poisoning and type of poison.

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MATERIAL AND METHOD

The study was conducted at SDM Medical College,

Dharwad, Karnataka. The study is a retrospective study. It included all fatal poisoning cases which were autopsied during a two year period from January 2013 to December 2014. Snake bite, bee sting cases which formed part of fatal poisoning cases were excluded from the study. Details of the case with respect to age, sex, type of poison detected at FSL and various medico-legal time frames like time taken for collection of the viscera by police from the department of Forensic medicine, time taken for viscera deposition by the police at FSL (date of collection of sample was mentioned in FSL report), time taken for reporting by FSL authority, time taken for submitting the FSL report by police to doctor were noted down.

RESULTS

A total of 58 fatal poisoning cases were autopsied during the period of January 2013 - December 2014, out of which 32 (55%) were males marginally outnumbering the females 26 (45%) (Table 1). Majority belonged to age group of 21-30 years followed by people in 4th and 3rd decade (Table 2). Organophosphorus (48.28%) was the most common poison detected at the FSL, followed by phosphide (12.10%). Pyrethroid, organochlorine, and phenol compounds were detected in equal number of cases and in 12.07% cases the poison was not detected (Table 3). Self ingestion was the commonest manner (83%), few were accidental (17%) and none of them were homicidal (Table 4). The average time taken for viscera collection from Forensic medicine department by police was 25 days, the average time taken by police to deposit the viscera at FSL was 30 days, the average time taken for reporting by FSL 33 days, the average time taken for submission of FSL report to Forensic medicine department 63 days (Table 5).

Table 1: Sex wise distribution of victims

Sex	Number of cases	percentage
Male	32	55%
Female	26	45%
Total	58	100%

Table 2: Age wise distribution of victims

Age range	Number of cases	Percentage
0-10	2	03.45%
11-20	6	10.34%
21-30	23	39.66%
31-40	9	15.52%
41-50	10	17.24%
51-60	7	12.07%
>60	1	01.72%
TOTAL	58	100%

Table 3: Type of poison ingested

Type of poison detected at FSL	Number of cases	Percentage
Organophosphorus	28	48.28%
Phenol	4	06.90%
Phosphide	7	12.10%
Pyrethroid	4	06.90%
Organochlorine	4	06.90%
Carbamate	1	01.72%
Paraquat	2	03.45%
OTHERS	1	01.72%
Undetected	7	12.07%
TOTAL	58	100%

Table 4: Manner of death

Manner	Number of cases	Percentage
Suicide	48	82.75%
Accident	10	17.24%
Homicide	0	0
Total	58	100%

Table 5: Various medicolegal time frame

Time frame	Average number of days	Maximum number of days	Minimum number of days
Time taken for viscera collection from Forensic medicine Department	25	88	1

Cont... Table 5: Various medicolegal time frame

Time taken for viscera deposition at FSL after collection from Forensic Medicine department	30	125	1
Time taken by FSL to report	33	143	3
Time take by police to submit the report from FSL to forensic medicine department	63	222	1

DISCUSSION

According to the present study the major chunk of time wasted is in submitting the report from FSL to the Forensic medicine department followed by reporting from FSL, deposition of viscera to the FSL from the police, viscera collection from the department by the police.

In the state of Karnataka the FSL report is submitted to the doctor through the police therefore the Forensic medicine expert should depend on the police for the chemical analysis report. This time gap can be reduced by FSL directly submitting an additional copy of their report to autopsy surgeon as practiced in Maharashtra so that the final opinion can be given at the earliest.

Time delay in viscera collection from the department by the police for chemical analysis can be obviated by handing over the viscera and the postmortem report along with the body as already practiced by many autopsy surgeons. Time constraint of autopsy surgeon due to work load might be a hindering factor for the preparation of the report and dispatch of the viscera on the same day. If that is the reason we can make sure that it is at least dispatched at the earliest.

Delay in deposition of viscera to the FSL from the police after collecting the samples was also noticed the delay might be due to many reasons including priority of case, staff deficiency, and distance of FSL from police station.

Time delay was also noted in reporting from FSL which depend upon workload and the priority of the case. If the delay is due to the work load number of regional forensic science laboratory can be increased.

Once the FSL report is received from the police, final opinion is drafted on same day at our institute.

The common agents responsible for fatalities were similar to other studies with organophosphorous leading the list.^{2, 3} The age range of the victims also matches other study.^{4, 5}

CONCLUSION

This study helps to take steps to mitigate the time lag at different levels thus reducing delay in delivery of justice. Further studies can be taken up to analyse the various local factors influencing each of the above time frame.

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Ethical Clearance: Permission for the study obtained from the institutional Ethical committee.

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Socio-Etiological Aspects of Dowry Deaths: An Autopsy based Study

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ABSTRACT

Violence affects lives of millions of woman worldwide in all societies. One of the most heinous and shocking forms among them is dowry death, is one among the various reasons for suicidal (i.e., abetted suicide) and homicidal deaths of women in India. The evil of dowry system is a matter of serious concern to everyone in view of its ever increasing and disturbing proportions. The present study was conducted in Department of Forensic Medicine and Toxicology, S V Medical College, Tirupati, Andhra Pradesh, during the period January 2010 to December 2014, to evaluate the magnitude and study various socio-etiological factors of dowry deaths. The most common age group to be affected was 18 – 25 years with 84 cases (66.14%) and first three years of marital life were more prone to dowry deaths with 96 cases (75.59%). Burns was the cause of death in majority of cases 65 (51.18%) and majority of victims being less educated (85.03%) and unemployed (81.10%). Education of females, awareness about laws and strict and timely punishment of offenders will help in controlling dowry deaths.

Keywords: Dowry deaths, Newly married, Social aspects, Awareness and Education.

INTRODUCTION

Violence affects lives of millions of woman worldwide in all societies. One of the most heinous and shocking forms among them is dowry death, is one among the various reasons for suicidal (i.e., abetted suicide) and homicidal deaths of women in India.

On initiative of various social and women welfare organizations, both legal and administrative steps have been taken by government to give protection to young married women against violence and cruelty at the hands of their husbands and in laws.

'Dowry' means any property or valuable security given or agreed to be given either directly or indirectly

(a) by one party to a marriage to the other party to the marriage; or (b) by the parents of either party to a marriage or by any other person, to either party to the marriage or to any other person; at or before or any time after the marriage in connection with the marriage of said parties¹.

The dowry related harassment and deaths are increasing day by day due to prevailing socioeconomic life style. The dowry is closely interlinked to many crimes committed against women viz female infanticide, domestic violence, neglect of girl child, denial of educational and career opportunities to daughters, rape, and extortion, homicide and discrimination women.

The evil of dowry system is a matter of serious concern to everyone in view of its ever increasing and disturbing proportions. Dowry deaths are well planned crimes executed within the four walls of a house by the family members. Most of the victims die on the spot and those who survive hesitate to make a statement before magistrate either due to fear psychosis on account of lack of support or traditional respect of husband or

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family members and many a times they are threatened or persuaded to give their statement in favour of their husband and in laws.

National crime records bureau (NCRB) reports that there were about 8455 dowry death cases registered in India in 2014 with 8501 victims and an average of 1.4. India reports about 10050 cases under Dowry prohibition Act with an incidence rate of 1.7 per 100000 women². The high incidence of unnatural deaths in newly married female within first few years of their marriage is a dark spot on the noble tradition of our society. The most obvious reason behind such deaths are unending demands of dowry (cash / kinds) by their husbands &/or in laws, for which they sometimes kill or torture the bride in such a way that she commits suicide³.

Sadly, awareness and education, particularly of young people and women, has not helped to ease the situation. In fact, families of people who are better educated and more qualified with foreign degrees etc have often demanded or given more dowries. Even after years of campaigning by government and other organizations the menace of dowry deaths and dowry harassment cases is on the rise. Unless the perpetrators of the crime are punished, the incidence of dowry related deaths will not decrease or be prevented.

The present study in undertaken to evaluate the magnitude and study various socio-etiological factors of dowry deaths affecting the alarming rise in incidence of dowry deaths.

MATERIALS AND METHOD

The present study was conducted in Department of Forensic Medicine and Toxicology, S V Medical College, Tirupati, Andhra Pradesh, during the period January 2010 to December 2014.

All the dead bodies of married women dying within 7 years of married life brought to mortuary of S V Medical College, cases being booked under section 176 Cr P C, 174 Cr P C, 304 (B) IPC, 498 (A) IPC, where inquest is conducted by Executive Magistrate were the inclusive criteria. Death of women within 7 years of marriage due to road traffic accidents, natural cases and homicide victims, unrelated to dowry were excluded from the study.

Proforma is filled in each case regarding the history given by relatives, inpatient case sheets in case of

admission, information obtained during magistrate’s inquest and by the investigating officer, postmortem finding with particularly reference to manner of death, histopathology and chemical analysis reports to establish the cause of death.

RESULTS

A total number of 127 cases of dowry deaths were recorded during the study period. The most common age group to be affected was 18 – 25 years with 84 cases followed by 26 – 30 years age group (28), 31-35 years (13) and 36 – 40 years age group (2). (Table 1)

With reference to the duration of married life, first three years of marital life were much more prone to dowry deaths with 96 cases (75.59%), among these 33 cases within 1 year, 42 between 1 - 2 years and 21 between 2 – 3 years. (Table 2)

More number of dowry deaths (55.90%) were reported in nuclear type of families when compared to joint families (44.09%). Majority of dowry deaths were reported among lower socioeconomic strata 95 (74.80%), followed by middle socioeconomic strata 29 (22.83%). Incidence of dowry death was very rare in higher socioeconomic groups. (Figure 1)

Burns was the cause of death in majority of cases 65 (51.18%) followed by hanging 32 (25.19%), Poisoning 15 (11.81%), Strangulation 03 (2.36%) and Others 12 (9.44). Manner of death was suicidal in majority of cases 90 (70.85%), followed by homicidal 25 (19.67%). In 12 (9.43%) of cases the manner of death was inconclusive. (Table 3)

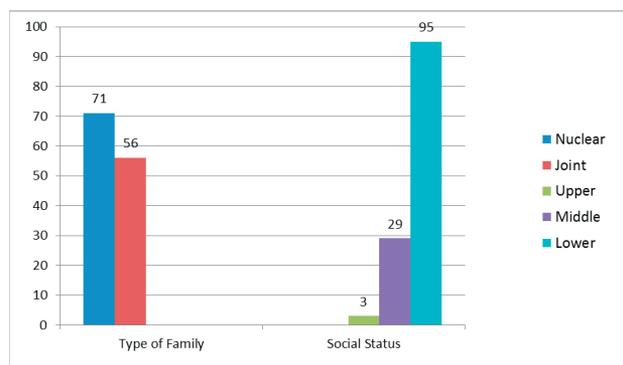
Majority of the victims were either illiterate 21 (16.53%) or poorly educated 87 (68.50%), only 15 (11.81%) of the victims were graduates and 4 (3.14%) were post graduates. Most of the victims were unemployed/housewife’s 103 (81.10%). Less educated and unemployed females were more prone to dowry deaths than their literate and employed counterparts. (Figure 2)

Table 1: Age groups wise distribution of Victims

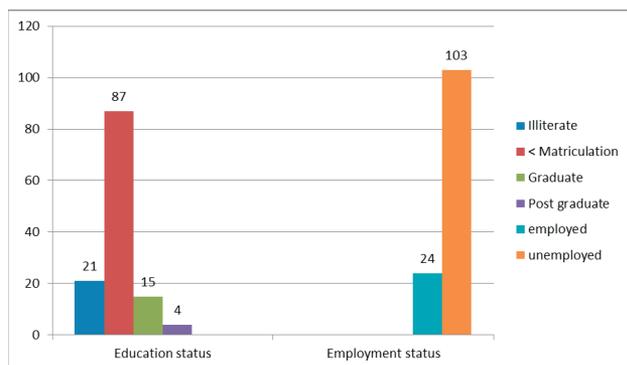
Age group	No of cases	Percentage
18-25	84	66.14
26-30	28	22.04
31-45	13	10.23
36-40	2	1.57

Table 2: Duration of Marital life

Years	No of cases	Percentage
< 1	33	25.98
1 –2	42	33.07
2-3	21	16.53
3-4	15	11.81
4-5	9	7.08
5-6	5	3.93
6-7	2	1.57

**Figure 1: Chart showing Type of Family and Social Status of Victims****Table 3: Method and Manner of Dowry Deaths**

Method/Manner	Suicidal		Homicidal		Inconclusive		Total	
	No of Cases	%	No of Cases	%	No of Cases	%	No of Cases	%
Hanging	30	23.62	--	-	02	1.57	32	25.19
Burns	45	35.43	13	10.23	07	5.51	65	51.18
Poisoning	11	8.66	02	1.57	02	1.57	15	11.81
Strangulation	-	-	03	2.36	-	-	03	2.36
Injuries	04	3.14	07	5.51	01	0.78	12	9.44
Total	90	70.85	25	19.67	12	9.43	127	100

**Figure 2: Chart showing Educational and Employment status**

DISCUSSION

Unnatural deaths of married women amongst the total female deaths have been an increasing trend in Indian society during the recent past years; which may be suicide, homicide or even accidents. But the suicides and homicides are currently more commonly associated with dowry dispute.

Most of dowry deaths occur where the young women, unable to bear the harassment and torture commits suicide. Most of the suicides are by burns,

hanging or by poisoning. Sometimes the woman is killed by setting her on fire; known as “bride burning” and sometimes disguised as suicide or accident. Death by burning of Indian women has been more frequently attributed to dowry conflicts⁴. In dowry deaths, the groom’s family is the perpetrator of murder or suicide⁵.

Incidence of dowry deaths in each year of the study period shows increase i.e., cases in 2010, cases in 2011, cases in 2012, cases in 2013 and cases in 2014. This is similar to the data given by NCRB which shows a total of 24771 deaths in three years i.e., 8233 in 2012, 8083 in 2013 and 8455 in 2014². This is also similar to the study conducted by Anil Agnihotri⁶. The rising incidence indicates the prevalence of social evil of dowry and ineffectiveness of anti dowry laws and the awareness campaigns. The laws should be made more stringent, take up and disposal of dowry death cases should be fast tracked and other means should also be tried apart from these to control and eradicate this social evil.

Most of victims are aged between 18 – 25 years (84), followed by 26 – 30 years (28), 31 – 35 years (13)

and 36 – 40 years (2). These findings are similar to the studies of Radhika et al⁷, Sharma B R et al⁸, Naresh et al⁹, Kusa Kumar Saha et al¹⁰ and Virendra Kumar et al¹¹.

With reference to duration of marital life, during the first three years of marital life, women were much more prone to dowry deaths. In the present study 33.07% of cases were reported between 1 – 2 years, followed by 25.98% in less than 1 year, 16.53% cases reported between 2 – 3 years. These findings are similar with Radhika et al⁷, Naresh et al⁹, A K Srivastava¹². More number of victims in the early marital life can be explained by the stress the females face during adaptation in the laws house which gets aggravated by the harassment for dowry or any demand for extra money after marriage and a drunkard husband.

More number of victims (55.90%) were from nuclear families. This may be due to rapid urbanisation and the fact that staying alone leads to repeated thinking about the arguments and quarrels that occurred for the sake of dowry. Absence of third person to share the grievances and to pacify the excited partners leads to more quarrels and ultimately to a bid to commit suicide / homicide. Similar results were seen in studies by Kusa Kumar Saha et al¹⁰ and Virendra Kumar et al¹¹.

Regarding the social status in case of dowry deaths, women of lower socioeconomic status (74.80%) died more when compared to middle (22.83%) and upper (2.36%) socioeconomic status. Similar results were seen by Zine Kailash et al¹³. Economic instability leading to violence against women, unemployment, illiteracy and lack of support and awareness about government policies and NGO's support are the main reasons for more number of deaths in lower socioeconomic strata.

Burns was preferred choice of death (51.18%), followed by hanging (5.19%), poisoning (11.81%), injuries (9.44%) and strangulation (2.36%). Easy access to inflammable materials for burns and ligature material for hanging are the main reasons for their predominance. Similar results were seen in studies by Naresh et al⁹, Zine Kailash et al¹³ whereas contrasting results were seen in studies by B R Sharma et al⁸ and A K Srivastava¹².

Manner of death was suicidal in majority of cases (73.22%), followed by homicidal (19.68%) and inconclusive (7.08%). Similar results were seen in

studies by Naresh et al⁹. Staying in nuclear families separated from family members with no one to pacify or bring about a compromise to the situation is the cause for increased suicides and homicides. Females being more sensitive and staying alone at home after heated arguments commit suicide out of anger and depression.

Less educated and unemployed women are more prone when compared to their counterparts. Similar results were seen in studies by Naresh et al⁹, Zine Kailash et al¹³. these findings indicate the importance of female education and employment, which could help to cope up with the pre and post marital stress, economic burden thereby helping the family. Moreover education and employment also brings about the awareness about the government policies, different NGO's providing the support in such situations, which will decrease the number of dowry harassment cases and thereby dowry deaths.

CONCLUSION

Even though the Government of India has passed different legislations like the Dowry Prohibition Act, 1961, Sec 498 (A) IPC, Sec 304 (B) IPC, Sec 113 (A) and Sec 113 (B) of IEA, Domestic Violence Bill 2001, till toady this social evil is not totally eradicated from our society and has become a major issue of unnatural female deaths.

The present study highlights the risk factors associated with dowry deaths like literacy, low socioeconomic status, first few years of marriage and staying in a nuclear family with a drunkard husband.

Thus, education of females, employment opportunities for females and financial independence play a vital role in saving the lives of female. Promoting literacy and professional courses and encouraging employment among girls to make them economically independent at the time of marriage ill surely bring about a decrease in incidence of dowry deaths. Discouraging dowry demands and costly and ostentatious marriage rituals through education and awareness will be very helpful. Pre and post marital counseling regarding the different aspects of marital life helps to bring down the death rate. Timely and adequate response from the family members, friends, counselors, women help groups, police and other law enforcement agencies is the most important step to avoid dowry deaths.

Awareness programs about Dowry Prohibition Act and other legislations, along with punishments rewarded for violence and crime against women on large scale can reduce dowry deaths and violence against women in the society. Moreover early trial and disposal of dowry death cases with strict punishments can instill fear in the minds of the perpetrators before committing the crime.

Conflict of Interest: The authors declare that there is no conflict of interests regarding the publication of this paper.

Source of Funding: Self

Ethical Clearance: Not Applicable

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Epidemiological Study of Patterns of Head Injuries in Fatal Road Traffic Accidents in Tripura

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ABSTRACT

Road traffic accidents have become significantly responsible for loss of life, economic and social resources even in our small state of Tripura. With the sudden rise in the number of vehicles in the past ten years the chances of traffic accidents also has risen. The present study has been carried out in the Mortuary of Department of Forensic Medicine and Toxicology, AGMC & GBP Hospital on all the autopsies performed in fatal Road traffic accident cases during the period of 1st July 2011 to 30th June 2013 to highlight the patterns of head injuries among road traffic accident victims in this part of the state. Most of the victims in the present study were males and belong to the age group of 21 to 30 years. Most commonly affected victims were the pedestrians with a total number of 84(42.85%) cases. Majority of the victims died within 24 hours of the incident with a total number of 135 (68.87%) cases. Mechanized four wheelers were the most common offending vehicles with a total number of 102 (52.04%) cases. Commonest external injury sustained was contusion with a total number of 180 (91.83%) cases. Skull bone fracture was found in total 96 cases. Subdural haemorrhage was the most common type of intracranial haemorrhage with a total number of 181(92.34%) cases followed by subarachnoid haemorrhage with a total number of 149 (76.02%) cases. Brain contusion is the most common injury encountered by the victims. This study will help in improving data linkages between police, transport and health services.

Keywords: Head injury, road traffic accident, victims, intracranial haemorrhage.

INTRODUCTION

Road traffic accidents contribute 30.2% of all kinds of natural and unnatural accidental death and are one of the major causes of disability and death all over the world (WHO-1980)¹. India accounts for 10% of road traffic fatalities worldwide.² According to a study conducted by National Transportation Planning Research Centre, every 4 minutes a person is killed or injured in Road Traffic Accidents in India. Even in our small State Tripura there is an alarming 10 fold increase in the number of both two wheeler and four wheeler accidents in the last 10 years which was published by the State road transport department in a local daily on 1st

January 2012.³ Of all the regional injuries sustained in such road traffic accident cases, those of head and neck are most common and are important in our Forensic practice. Dominance of head injuries may be attributed to the fact that when a person falls on the ground he or she often strikes his head first.⁴ The present study has been undertaken to know the pattern of such head injuries sustained in road traffic accidents in Tripura in relation to the demographic profile of the victims.

MATERIALS AND METHOD

The study has been carried out in the Mortuary of Department of Forensic Medicine and Toxicology, Agartala Government Medical College & GBP Hospital on all the autopsies performed in fatal Road traffic accident cases during the period of 1st July 2011 to 30th June 2013. Total 327 fatal road traffic accidents were autopsied during the period. Out of 327 cases, head injury was the cause of death in 196 cases which were

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taken up for the study.

OBSERVATION AND RESULTS

During the study period head injury was the cause of death in 196 (59.93%) cases of road traffic accidents, 155(79.08%) cases were male victims and remaining 41(20.92%) cases were female victims.

Table 1. Age group of the victims

Age	Number	Percentage (%)
0-10	10	5.10
11--20	19	9.69
21-30	41	20.92
31-40	39	19.89
41-50	38	19.39
51-60	28	14.29
>60	21	10.71

Table 2. Distribution of the type of victims

Type of victim	Number (196)	Percentage (%)
Pedestrian	84	42.85
Driver	57	29.08
Occupant	55	28.06

Table 3. Period of survival of the victims of the incidence

Period of survival	Number (196)	Percentage (%)
Spot dead	14	7.14
Within 24 hours	135	68.87
>24 hours	47	23.97

Table 4. Distribution of external scalp injuries.

Type of scalp Injury	Number(196)	Percentage (%)
Abrasion	19	9.69
Contusion	180	91.83
Laceration	87	44.38
Incised wound	08	4.08
Combination	88	44.89

Table 5. Distribution of skull bone fractures

Cranium involvement	Number (196)	Percentage (%)
Vault of skull	96	48.97
Anterior cranial fossa	11	5.61
Middle cranial fossa	15	7.65
Posterior cranial fossa	3	1.53

Table 6. Type of intracranial haemorrhages.

Type of haemorrhage	Number (196)	Percentage (%)
Extra dural (EDH)	32	16.32
Sub dural (SDH)	181	92.34
Sub Arachnoid (SAH)	149	76.02
Intra cerebral (ICH)	19	9.69

DISCUSSION

In the present study male predominance was found in the head injury cases of road traffic accidents. The findings are similar to the studies conducted by Kaul A et al ⁵, Emejulu JKC ⁶, Ahmed et al ⁷. 21 to 30 years age group is the most vulnerable since they are the productive age group who stay outdoor in search of income. The findings are similar to the studies conducted by Momonchand A and Fimate L (1988) ⁸, Pillay⁹ who also found the commonest age group is 21 to 30 years. Pedestrians are the most common type of victims. The findings of the study are similar to those conducted by Sevitt S (1968)¹⁰, Chandra J et al (1979)¹¹, Most of the victims who sustained fatal head injuries survived for 24 hours which reflects that timely intervention and proper transportation of the victims to higher referral centres can save the life of such victims and focuses on the need for mobile medical units. Data analysis revealed that contusions comprise the maximum number of external injury. The findings are consistent with the study conducted by Sharma BR et al¹².Skull fractures were sustained in 46.97% cases. Out of the intracranial haemorrhages subdural haemorrhage was found to be the most common variety of haemorrhage present in 181(92.34%) cases. The findings are consistent with the studies conducted by Tyagi AK et al (1986)¹³, Baker CC et al¹⁴. In the present study brain was found

to be contused in 159 (81.12%) cases, lacerated in 20(10.20%)cases and crushed in 17(8.67%)cases.

CONCLUSION

The present study revealed that male persons of the productive age group are maximally involved in the fatal road traffic accident cases. Pedestrians being the most common type of victims reflect the poor condition of roads in our state. Subdural haemorrhage is the most common type of intracranial haemorrhage found in the fatal road traffic accidents. Timely intervention, transportation along with up gradation of the emergency services is the need of the hour in our state for saving the precious lives lost in road traffic accidents.

Ethical Clearance: Taken from Institutional Ethical Committee

Source of Funding: Self

Conflict of Interest: Nil

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Study of Identification of Sex of Adult Human Skull by Cranial Circumference

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ABSTRACT

Introduction: in medicolegal cases bones form the important evidence in establishing the identity of the deceased. Traditionally the skull is most studied bone in physical anthropology.¹ traditional studies by non metric methods were not reliable. So morphometry and stastical methods were introduced. Purpose of this study is to establish standards and to know the reliability of sex determination from cranial circumference.

Objective: to measure the cranial circumference of available skulls and to know its sexual dimorphism and to study the utility and limitation of cranial circumference in sexing of skull and to compare with earlier studies. This may be helpful to establish the sex of a person from skeletal remains.

Materials and method: 100 Dry human skulls (50 males & 50 females) available in the department of forensic medicine and anatomy M.R medical college, Gulbarga were used for study. Maximum cranial circumference was measured with the help of thread and steel tape. Adult skulls, intact and undamaged were included and while those which were broken or damaged and having ambiguity of sex, were excluded.

Results: mean maximum cranial circumference of male was 497.66 mm and those of female were 483.76mm. The SD for male and female were 13.8 and 17.07 respectively. Percentage of skull identified by I.P alone was 04% of males and 36% of females. The percentage of skull identified by D.P alone was 0 % for males and 0% of female.

Conclusion: in present study, significant difference was found in the maximum cranial circumference of male and female skulls. The mean maximum cranial circumference of males is higher than that of females; tht tends to agree with the similar studies conducted earlier. Therefore, estimating maximum cranial circumference of skull is an undisputable criterion for sex determination from skeletal remains. However, single parameter is of not much help in identification of sex of skull. So it is better to consider maximum number of parameters for identification of sex of skull.

Keywords: *maximum cranial circumference, Identification of sex, human skull.*

INTRODUCTION

In medicolegal cases bones form the important evidence in establishing the identity of the deceased.

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Traditionally the skull is most studied bone in physical anthropology.¹ to identify the deceased person from bone is most common and critical problem faced by anatomists, forensic experts and anthropologists.² traditional studies by non metric methods were not reliable. So morphometry and stastical methods were introduced. Purpose of this study is to establish standards and to know the reliability of sex determination from cranial circumference. With the above aim, cranial circumference measurements were taken and statistically analyzed and compared with the

results of the other workers who carried out similar studies.

AIMS AND OBJECTIVES

To measure the cranial circumference of available skulls, to know its sexual dimorphism and to study the utility and limitation of cranial circumference in sexing of skull and to compare with earlier studies. This may be helpful to establish the sex of a person from skeletal remains.

MATERIALS AND METHOD

100 Dry human skulls (50 males & 50 females) available in the department of forensic medicine and anatomy, M.R Medical College, Gulbarga were used for study. Maximum cranial circumference was measured with the help of thread and steel tape. Adult skulls, intact and undamaged were included and while those which were broken or damaged and having ambiguity of sex, were excluded. The skulls were differentiated in to male and female on the basis of certain classic anatomic structures like glabella, supraorbital ridge, nuchal line, mastoid process, muscular markings, external acoustic meatus etc. (Gray 1985 ³). With this 50 male and 50 female skulls were differentiated. Instruments used for the measurements of cranial circumference were standard flexible steel tape and thread.

Techniques of taking skull measurements: the techniques of taking measurements and landmarks on the bone were studied and taken from text books of practical anthropometry by various authors (Keen JA 1950 ⁴, Deshmukh AG. 2006 ²). The measurements were repeated twice in two separate occasions and the mean was taken to get accurate result and then recorded.

Landmarks on the skull for taking measurements were ³: 1. Glabella – it is the point which lies on the root of the nose between the supraorbital ridges of the forehead. It is the most projecting point on the mid- sagittal plane. 2. Opisthocranian – it is the most posteriorly projecting point in the mid-sagittal plane

Cranial circumference ²: it measures the horizontal circumference over glabella- opisthocranian – glabella, taken in maximum cranial length plane and at right angle to the mid- sagittal plane. It is measured with the help of thread and steel tape.

Measurements were taken in millimeters. All the values are tabulated and analyzed statistically by routine statistical methods. The value of Range, Mean, Standard Deviation (SD), Calculated Range (mean ± 3SD), Demarking Point⁵ and Identification Point are obtained. Maximum value of female range is considered as identification point for male. Minimum value of male range is considered as identification point for female. Maximum value of female calculated range is considered as demarcation point for male. Minimum value of male calculated range is considered as demarcation point for female. In case where female range/calculated range maximum value of male range/calculated range is considered as Identification point/Demarcation point for female and minimum value of female range/calculated range is considered as identification point/demarcation point for male. Subsequently ‘t’ is applied.

OBSERVATION

The Range, Mean, Calculated Range (mean ± 3 S.D.), Demarking Points (DP) of various parameters, Identification Point (IP) of various parameters, and the percentage of bones in which sex could be identified by them, are given in table no 1.

Table 1: Showing maximum cranial circumference parameter of Skull and their statistical analysis.

Sr. No	Parameters	Sex	Range	Mean	S.D.	‘p’ value	Calculated range Mean + 3 S.D.	I.P.	D.P.	% of bone identified by I.P.	% of bone identified by D.P.
1.	Maximum Cranial Circumference (in mm)	M F	480-530 462-520	497.66 483.76	13.18 17.07	<0.001<0.001	458.1-537.2 432.56-534.96	>520 <480	>534.96 <458.10	4 36	00 00

DISCUSSION

Skull is one of the commonest parts of skeleton used to opine on sex of an individual. Bass WM⁶ in his summary of the main differences in bones says that skull is probably the second best region of the skeleton to determine sex. The accuracy of determination of the sex of skeleton remains varies with the age of the subject, the degree of fragmentation of the bones and biological variability.⁷ in present study 100 skulls (50 male, 50 female) are studied for maximum cranial circumference parameter. Mean values of the parameters in present study are compared with mean values obtained by previous workers.

MAXIMUM CRANIAL CIRCUMFERENCE

The mean maximum cranial circumference of male was 497.66 mm ranging between 480-530 mm. The

mean maximum cranial circumference of female was 483.76 mm with the values ranging between 462-520 mm. The identification point of male skull was > 520 mm and of female skull was <480 mm and percentage of skull identified by I.P alone was 04% of males and 36% of females. The SD for male and female were 13.8 and 17.07 respectively. The calculated range of $\pm 3SD$ in males and females was 458.1-537.2 mm and 432.36-534.96 mm respectively. The Demarking point⁸ for males was >534.96 mm and for females it was <458.1 mm, and the percentage of skull identified by DP alone was 0% of males and 0% of females. 't' test was highly significant with $p < 0.001$.

Findings of present studies were similar with previous workers as shown in table no 2.

Table 2: Comparison of Maximum Cranial Circumference

SL NO	Name of worker	Male					Female					SS
		N	M	R	SD	DP	N	M	R	SD	DP	
1	Keen ⁴ (1950)	50	516.2	479-542	14.5	---	50	498.3	465-528	465-528	---	---
2	Bagde ⁵ (1981)	70	490	458-520	15.4	>492	30	470.3	438-492	15.2	<458	<0.001
3	Hong wei song ⁹ (1992)	30	5.091	---	21.5	----	30	498.8	---	22.6	--	<0.05
4	Deshmukh ² (2006)	40	496	470-529	13.3	>526	34	479	444-500	15.5	<456	<0.001
5	Present study (2009)	50	497.66	480-530	13.18	>534.96	50	483.76	462-520	17.07	<458.1	<0.001

Where N-number of skull, M-mean, R- range, SD-standard deviation, DP-demarking point, SS- statistical significance, Scale in mm

CONCLUSION

In present study, significant difference was found in the maximum cranial circumference of male and female skulls. The mean maximum cranial circumference of males is higher than that of females; that tends to agree with the similar studies conducted earlier. Therefore, estimating maximum cranial circumference of skull is an undisputable criterion for sex determination from skeletal remains. However, single parameter is of not much help in identification of sex of skull. So it is better to consider maximum number of parameters for identification of sex of skull.

Source of Support: Nil

Conflict of Interest: None Declared

Ethical Clearance: The Ethical clearance was taken prior to the study from the institution's ethical committee (Mahadeva Rampure medical college Ethical committee)

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Histopathological Study of Hepatorenopulmonary Changes in Deaths due to Organophosphorus Poisoning

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ABSTRACT

Postmortem changes in these detected cases are usually nil or in few cases late changes due to poison may be seen. Present study of histopathological changes in liver, lung and kidney in Organophosphorus poisoning is in relation to survival time after the consumption of poison along with that a suggestion that can have been proposed for quick diagnosis and early management of poisoning death. To study the effects of organophosphate on human body with particular reference to liver, lungs and kidney. The histopathological examination can support in arriving at the cause of death due to poisoning while toxicological analysis report is awaited. This can cut short the legal proceedings which is used to remain pending for evidence of poison from chemical analysis. Even though the histopathological findings are not specific for organophosphorus poisoning the progressive changes helps in the estimation of survival period after ingestion of poison and there by time since death before prior to autopsy.

Keywords: *Organo Phosphorus, Histo Pathological, Changes, Organs.*

INTRODUCTION

Organophosphorus compounds were first developed by Schrader shortly before and during the 2nd world war¹⁻². They were first used as an agricultural insecticide and later as potential chemical warfare agents.

Over the last few decades Agricultural pesticides have become a common household item in rural areas of the developing world. Due to their easy availability, pesticides have also become commonly used for intentional self poisoning. Acute Pesticide poisoning is now an important cause of morbidity and mortality world wide³⁻⁷.

Postmortem changes in these detected cases are usually nil or in few cases late changes due to poison may be seen. Present study of histopathological

changes in liver, lung and kidney in Organophosphorus poisoning is in relation to survival time after the consumption of poison along with that a suggestion that can have been proposed for quick diagnosis and early management of poisoning death. To study the effects of organophosphate on human body with particular reference to liver, lungs and kidney

MATERIALS AND METHOD

A study of 62 cases of organophosphorus poisoning, of which all are Positive cases declared in FORENSIC SCIENCE LABORATORY, Hyderabad fatalities both clinical and autopsied at the Department of Medicine and the Department of Forensic Medicine, Osmania General Hospital, Hyderabad has been made.

The records maintained at the Department of Medicine and the Department of Forensic Medicine, Osmania General Hospital includes copies of the following and Police inquest reports with circumstantial evidence includes copies of the following.

1. Hospital case sheet extracts.
2. Police requisition and inquest report.

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3. Reports of clarification of the circumstances surrounding the death.
4. The postmortem reports.
5. Forensic science Laboratory reports of the chemical analysis of the viscera of the deceased.
6. Histopathological staining and readings of the Pathology Department.

Information was also extracted from the relatives, attenders and eyewitnesses (in some cases), regarding the mode of poisoning and the type of poison used.

All the records of the poisoning fatalities were studied in detail and statement prepared to show the frequency of individual poisons, age and sex distribution, the average time of survival as shown in the tables.

An attempt has been made to ascertain the manner of death, taking into consideration the history given in the inquest report, the age of the deceased, the nature of the poison responsible for death and any other available information. The history given by the police should only be taken as hint. The autopsy findings should always prevail upon the history furnished in cases of any inconsistencies

OBSERVATIONS

The present subject was undertaken to study the toxic effects of organophosphates on human body particularly with reference to liver, lung and kidneys which place an ultimate goal in overall mortality from Organophosphate poisoning. The study was extended over a period of 3 years from the year 2008 – 2010 and the total number of 62 cases were subjected for toxicological and histopathological analysis. All the 62 cases are positive for toxicological analysis.

Perusal of Table No 1: shows that the characteristic of odor of poison observed in 70% of cases either from the contents or from the body cavities. In about 20% of cases the provisional diagnosis from smell is not possible and it needs confirmatory diagnosis from toxicological analysis. Usually hospital admitted cases which cross the dangerous zone provides no clue regarding the presence of poison except for generalized congestion of visceral organs.

Perusal of Table No 2: shows that visceral

congestion including the congestion of stomach mucosa observed in almost all cases irrespective of period of survival. Longer the period of survival the congestive changes initiates arises of irreversible changes ranging from degeneration to necrosis.

Perusal of Table No 3: shows that the commonest histopathological findings of lungs are congestion followed by edema and hemorrhage. These are the usual changes where mortality is observed in the first 2 days after ingestion of poison. Lymphocytic infiltration around the bronchioles, heart failure cells appear more prominent from 2nd day onwards. Haemosiderin pigment with alveolar hemorrhages and edematous changes are more prominent from 5th day onwards. Ruptured alveolar walls, gray hepatization and pneumonic changes are more prominent in more than 1 week survival cases.

Perusal of Table No 4: shows that the commonest histopathology findings of liver is congestion followed by degenerative changes like microvascularization, hydropic degeneration etc. As survival period progresses liver acquired nutmeg appearance around 3rd day and lymphocytic and neutrophilic infiltration is seen from 5th or 6th day. Lymphocytes and fever histocytic infiltration is more prominent in cases who survived 1 to 2 weeks.

Perusal of Table No. 5: shows that the commonest histopathological findings of kidney show patchy congestion in the first 2 days. The morphology otherwise normal. As survival period prolongs the degenerative changes are observed which gradually progresses to acute tubular necrosis. Table 6 showing the summary of changes in liver, kidney and lungs with respect to days and weeks of autopsy.

DISCUSSION

There is not much difference in the histopathological changes in tissues where death has occurred within 12 hours after consumption of poison when compared to cases which survived more than 12 hours. The histopathological examination findings in major organs for a maximum in cases which survived at least for 12 hours and in cases which survived more than 72 hours. This means that either the poison was highly toxic to cause of death of the victim in cases where death has occurred early or it has remained in the body for longer duration injuring the internal organs.

In gross macroscopic examination almost all the vital organs was to be congested and on microscopic study the usual changes seen in the liver as central venous congestion, micro vacuolization, hepatocytic degeneration and mononuclear infiltration. In case of lungs congestion, edema, hemorrhage, collapse of alveoli, alveolar thickening, dilated capillaries and round cell infiltration around bronchioles are commonly observed. In case of kidney the glomerular congestion, intraparenchymal congestion and acute tubular necrosis are commonest findings. The postmortem changes are not significantly altered the histopathological findings as autopsies are conducted with in 24 hours after death. Because of very high mortality and comparatively less period of survival all the cases showed presence of organophosphorus compounds on chemical analysis of the viscera. There are absolutely no such cases that are negative for chemical analysis of viscera and showing histopathological changes in the viscera.

There are definite histopathologically different findings with the lengthening of period of survival, which do point to that effect the different causes of death in acute and chronic poisoning can be derived from the findings in different organs discussed above. Exposure to chronic poisoning was common among the agriculture workers and industrial workers of pesticide units. However, also chronic poisoning as an epidemic or community affected sometimes possible following continuous leaks and contamination of water sources, which there by in turn crop up into drinking water and food cycle which is otherwise known as environmental pollution⁸⁻¹⁰. In these areas the dying person may be taken for a natural reason, though in fact, the death is applicable to chronic poisoning due to environmental pollution. The symptomatology and histopathological appearance, though basically will be the same, but the prolonged, unnoticed underwent signs and symptoms, may not urge necessary medical aid and in tern ask for medical investigations to that effect for a diagnosis of poisoning. And hence, the histopathology will be of “chronic insult to injury “nature, with much scarring and contracture of tissues of individual organs. The myoneural junctions of the striated muscle affected and is reflected in chronic wasting or loss of muscle bulk¹¹⁻¹⁴. The muscaranic and nicotinic nervous pathways of the central nervous system are either put to more work or suppressed to the function at all at varied places, which can also bad to psychiatric and physical sub normality

or deviation. However, no such cases was come across in this study.

Table-1: Shows odor emanating from the stomach contents

Characteristic odor	Number	Percentage
Present	43	69.23
Absent	19	30.59
Total	62	100

Table 2: Effects of poison in stomach (mucosal congestion)

Congestion of stomach Mucosa	No. of Cases	Percentage
Present	62	100
Absent	0	0
Total	62	100

Table 3. Histopathological findings of lungs in cases of fatal organophosphorus poisoning

Microscopic features	No. of cases	Percent
Congestion	33	73.3
Edema	31	68.9
Hemorrhage	31	68.9
Collapse of Alveoli	22	48.9
Alveolar thickening	16	35.6
Alveolar wall disturbance	6	13.3
Dilated capillaries	8	17.8

Table 4. Histopathological findings of liver in cases with fatal organophosphorus poisoning

Microscopic features	No. of cases	Percent
Congestion	31	68.9
Microvacoualization	26	57.8
Hydropic degeneration of hepatocytes	22	48.9
Mononuclear infiltration	24	53.3
Microvesicular steatosis	22	48.9
Macrovesicular steatosis	14	31.1
Bile pigment in the cytoplasm of the hepatocytes	12	26.7
Central venous congestion	9	20
Sinusoidal dilation	5	11.1
Centrilobular necrosis	8	17.8
Portal congestion	9	20
Hemorrhage	10	22.2
Patchy necrosis	7	15.6
Sinusoidal clusters of polymorphonuclear leukocytes	6	13.3

Table 5. Histopathological findings of kidney in cases of fatal organophosphorus poisoning

Microscopic features	No. of cases	Percent
Glomerulus congestion	37	82.2
Intraparenchymal congestion	32	71.1
Tubular degeneration	16	35.6

Table 6. Histopathological changes in liver, lung & kidney

DAY	LIVER	LUNG	KIDNEY
1 st day	Focal fatty changes in periportal areas, chronic venous congestion not prominent, most of the areas appears normal.	Areas of haemorrhages, congested capillaries in alveolar sept, pulmonary oedema, pulmonary haemorrhage	Glomeruli appears normal, some shows congestion, interstitium shows congested capillaries, tubules normal
2 nd day	Increased areas of fatty changes, few periportal lymphohistocytic infiltration, haemosiderin pigment in hepatocytes.	Pulmonary oedema, lymphoplasmocytic infiltration around the bronchioles, peribronchiolar areas shows neutrophilic infiltration.	Not much glomerular changes, Acute tubular necrosis in few patchy areas
3 rd day	Chronic venous congestion, patchy areas of congestion, focal fatty changes, nutmeg liver (congestion and pallor alternate areas)	Pulmonary oedema, congested blood vessels, chronic venous congestion, Heart failure cells appear, Peribronchiolar neutrophilic lymphoplasmocytic infiltrates, haemorrhages, haemosiderin pigmentation.	Acute tubular necrosis increased, patchy areas appears normal, glomeruli appears normal and tubules here and there appears normal.
4 th day	Chronic venous congestion, fatty changes in hepatocytes	Pulmonary oedema increased, congested capillaries in alveolar septa.	Patchy Acute tubular necrosis appears
5 th day	Diffuse dilatation of sinusoids and congestion.	Haemorrhages in alveoli and edema in some alveoli	Patchy acute tubular necrosis, few dilated congested intertubular capillaries.
6 th day	Dilated and congested sinusoids, few lymphocytic, Neutrophilic infiltration	Alveolar haemorrhages, pulmonary congestion, focal areas of edema.	Focal acute tubular necrosis, many congested capillaries in interstitium, glomeruli appears normal.
7 th day (1 week)	Dilated and congested sinusoids, lymphoneutrophilic infiltration	Pulmonary oedema	Glomeruli shows congestion, tubules shows acute tubular necrosis, congested and dilated capillaries in interstitium.
1-2 weeks	Fatty change increased, periportal inflammation, lymphoplasmocytic and few histocytic infiltration.	Pulmonary oedema, pneumonic changes, gray hepatization seen, lobar pneumonic changes seen	Focal acute tubular necrosis, dilated congested capillaries in interstitium, some areas glomeruli appears normal.
>2 weeks	Dilated and congested sinusoids, periportal lymphocytic infiltration, dilated central veins and congested.	Alveolar haemorrhages, ruptured alveolar walls, septa, pulmonary oedema.	Acute tubular necrosis with many congested capillaries, in some areas glomeruli appears normal.

CONCLUSION

The histopathological examination can support in arriving at the cause of death due to poisoning while toxicological analysis report is awaited. This can cut short the legal proceedings which is used to remain pending for evidence of poison from chemical analysis. Even though the histopathological findings are not specific for organophosphorus poisoning the progressive changes helps in the estimation of survival period after ingestion of poison and there by time since death before prior to autopsy. Chronic poisoning due to environmental pollution affecting the food chain and the community at large can be diagnosed and proper preventive and rehabilitative measure can be undertaken.

Conflict of Interest : Nil

Funding : Nil

Ethical Clearance : Institutional ethical clearance was obtained

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Comparative Study of Gap Analysis between Patient and Surgeon about Informed Consent to a Procedure

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ABSTRACT

Informed consent is a process by which the patient is informed about medical/surgical procedure that is being carried out and empowering the patient to take a decision, after weighing the pros and cons. The last step in this process is recording of the consent document with signature. It is required for all surgical procedures especially in the current day practice. In surgical practice, respect for autonomy translates into duty to obtain informed consent before the surgery. Our study aims to understand the gaps between the surgeon and his /her patient relating to informed consent. A questionnaire study was conducted on doctors and patients to assess the understanding of informed consent form. Results revealed that understanding of informed consent was moderate and largely inadequate in certain areas.

Keywords: *Informed consent, documentation, autonomy.*

INTRODUCTION

Informed consent is an important decision taken freely after being informed about the procedure, its significance, implications and risks of the procedure to the patient. After the patient has understood the process, it is written, dated and signed thus completing the process of informed consent. It is appropriately documented, by any person capable of giving consent or, where the person is not capable of giving consent, then by his or her legal representative^[1]. If the patient is unable to write or read, the oral consent in the presence of at least one witness may be given in exceptional cases^[2]. Section 13 in The Indian Contract Act, 1872 defines consent as “Two or more persons are said to consent when they agree upon the same thing in the same sense”^[3]. The principlistic approach i.e. autonomy- the right of an individual to make his own decision, beneficence- principle of acting in the best interest of the patient in the mind, nonmaleficence

- the principle of ‘above all do no harm’ and justice-concept that emphasizes fairness and equality among individuals; upholds human dignity^[4]. Studies from developing countries show that the view of informed consent is ritualistic. Patients are easily frightened or pressured to give consent without knowing their rights or contents in the informed consent^[5]. In India practice of medicine along with status in the society always has shown paternalistic attitude^[6]. With advances in science and technology in late 20th century it has made patients to undergo complicated interventions and procedures with uncertainty in the outcome^[7]. It became important for a person undergoing procedure to understand the nature and course of the treatment and understand the issues involved and agree and grant permission for the same because it is attempt to understand and justify the link between values and action. The change from paternalistic nature to contractual relationship between patients and doctors is an important milestone^[7].

METHODOLOGY

A study was conducted to understand the perceptions of informed consent among both patients and surgeons. This study size was 20 samples, collected by questionnaire method. Two questionnaires of similar questions were developed one for the surgeons and one for their patients. The questionnaire for the

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patients was also provided in their native language (Kannada / Malayalam). The questionnaire consisted of 12 questions with 'single best response'. The questionnaire was validated by 3 experts in the field of ethics and surgery. Ethical clearance was obtained from institutional ethics committee. For the sake of uniformity all patients included who had undergone similar procedure "appendectomy" were approached postoperatively. Informed consent from each participant was taken before conducting the study. Consent forms

were given in native language (Kannada/Malayalam/English) to each participant who was willing to participate. Questionnaires were given to the participants separately and ample amount of time (about 30 to 60 minutes) was given to them to tick the appropriate answers. The results tabulated using Microsoft excel sheet separately for doctors and patients. It was then subjected to analysis using Kappa. Kappa statistics was used to find out the agreement between the doctors and patients.

RESULTS

Table 1: Kappa values and agreement/disagreement on the items on the questionnaire

No.	Question	Kappa	Status
1	Explanation of diagnosis in detail	-.190	Disagree
2	Explanation of surgical details	-.81	Disagree
3	Explanation of total treatment cost	-.250	Disagree
4	Awareness about what part of the body is being operated	---	Agree
5	Explanation of risks and complications of the recommended surgery and the other treatment options	-.346	Disagree
6	Explanation of adverse outcomes associated with the surgery	-.114	Disagree
7	Explanation of time duration of hospital stay and post operative recovery	-.176	Disagree
8	Explanation of post operative care to be taken after discharge	-.452	Disagree
9	Explanation of how treatment is important and the consequences if treatment was not taken	-.316	Disagree
10	Decision-making for the procedure	-.219	Disagree
11	Information on whom to contact in any emergency post surgery	-.081	Disagree
12	Information on contact details of the doctor	-.522	Disagree

We asked the patient whether they felt that the diagnosis was explained in detail. There was disagreement between doctors and patients with 9 out of 10 patients thinking that they fully understood the diagnosis in detail, but only 6 out of 10 doctors agreed they had explained the diagnosis in detail (Kappa -.190).

When we inquired into whether the surgical procedure was explained in detail, we again observed a disagreement between the two groups with 9 out of 10 patients reporting that the doctor had explained the surgical procedure in detail but only 7 out of 10 doctors agreed they had explained the procedure in detail (Kappa -.81)

Upon asking whether the explanation of the total treatment cost was adequate, we observed a disagreement

with a Kappa value of -.250. 4 out of 10 patients told that they were explained about the treatment cost. When compared with doctors 6 out of 10 told they had not explained to the patients because of language barrier and technical barriers with communication.

When asked about the awareness of which part of the body was being operated, we found agreement between the two groups. This was the only area of the information disclosure that was in agreement.

When it came to explanation of risks and complications of the recommended surgery, and the other treatment options, we noticed a disagreement. 5 out of 10 patients told it was explained but the other 5 patients told it was not explained in detail. In comparison 8 out of 10 doctors said they felt they had

explained to their patients but 2 doctors reported issues of language barrier and thought their patients would not understand. The surgeons did not ask questions to the patients to clarify their level of understanding (Kappa value -.346).

Did the treating surgeon explain about adverse outcomes associated with the surgery? When asked this question, we found a statistically significant disagreement between doctors and patients. 6 out of 10 patients felt they were explained about the adverse outcomes but 4 reported inadequacy. In comparison 7 out of 10 doctors admitted they had informed but not in detail while the other 3 had not informed as they thought their patients would not understand (Kappa value -.114).

Regarding explanation of time duration of hospital stay and post operative recovery, we once again observed a disagreement with a Kappa value of -.176. 6 patients felt they were informed adequately about duration of the hospital stay. 2 patients reported longer hospital stay information. 2 patients reported no explanation. Comparing with the doctors only 3 out of 10 agreed they informed about the hospital stay.

We asked patients what was their perception on the explanation of post operative care to be taken after discharge, we observed a disagreement (Kappa -.452) with 7 out of 10 patients perceiving that they were informed in detail, 1 patient told that he was informed but not in detail and the other two told that they were not informed. 4 out of 10 doctors felt that they had provided adequate information on this aspect.

All the participants in this study were asked what they felt about the explanation of how treatment is important and the consequences if treatment was not taken. There was a disagreement between the two groups with a Kappa value of -.316. 8 out 10 patients reported that they were explained in detail about the treatment and 2 out of 10 were not explained. In comparison 7 out of 10 doctors agreed that they had explained about the treatment.

What were the perceptions of the participants regarding the decision-making? 6 out of 10 patients had left the decision to the doctor since they felt that their doctors knew better. 4 patients reported that elders of the house or relatives made the decision. In comparison 2 doctors reported that elders of the house

took the decision, 4 doctors said that patient themselves took the decision and 4 doctors informed that they had taken the decision themselves as they were the treating doctors and were doing things in good faith. There was a statistically significant disagreement with a Kappa value of -.219.

We asked the participants on whether there was information provided on whom to contact in case of any problems post-surgery, and whether the contact details of this person were made available. We observed disagreements on both counts (Kappa -.081 and -.522 respectively). 4 out of 10 patients had the doctor's contact information to be used in case of emergency. 7 out of 10 doctors had not given their contact information as they did not like sharing this information.

DISCUSSION

The process of informed consent is an important part in any kind of therapy. In the present study it was noticed that many patients did not know the meaning and importance of informed consent. Most of them thought that it was just a document that had to be signed before going to surgery. In a study conducted by Morrow G et al (1978), out of 77 patients 40 patients were given informed consent forms to take home before signing and 37 patients were made to sign it in clinic. Results showed patients who were sent home with unsigned consent forms recalled things better comparatively^[8].

In the present study when asked if explanation of post operative care was given, most of the patients were not aware about it. In 2012, Shubha Kumar et al conducted a qualitative study in Tamilnadu. In-depth interview-based study was done among patients and doctors to understand their perspectives about informed consent. All interviews of 14 patients and 8 doctors were audio recorded and then transcribed verbatim. Findings from the study revealed that understanding of informed consent was moderate and largely inadequate^[5]. The results were similar to the present study. One of the participants from the present study, a 25-year old male said that he had not given any attention to details, as he had left everything to his father to decide. It was also noted that a small amount of population had left it to the doctor to decide since he/she would know better than anyone else.

In the present study we came across doctors who said that they felt nothing wrong in deciding for the

patients since it was done in good faith considering their expertise in the field. But there were also few doctors who said that it was important to give patient the right to decide and efforts should be made to explain to the patients in a simple manner and help them understand. The conversation of an informed consent should be at the level of a 9th grade child (i.e. 12 to 14 years) understanding and break down complexities of a procedure should be in a simple language [8, 10, 11]. Legal proceedings involving medical negligence claiming for failure to provide enough information regarding the risks of a procedure or a surgery if discussed in Bolam's principle: the doctors are not guilty of any negligence if they have applied best practice, appropriate skill and care [12].

7 out of 10 doctors did not share their contact information. Authors felt that to build trust in doctor patient relationship, doctors need to be accountable.

When the notion of 'consent' in relation to health care is taken from the Indian Contract Act, consent loses its thrust to uphold the autonomy of a person. Authors feel that the surgeon has to walk the tight rope of need to obtain signature or thumb print of the patient *Vis a Vis* being understood by the patient which is equally important process as documentation.

The window of foreseeability entrusts more responsibility in surgeon while dealing with a patient with language barrier. So efforts must be made by surgeon to be understood by the patient through qualified translator.

CONCLUSION

The aim of this study has been to understand the gap regarding consent for appendectomy between the patient and surgeon. Our findings demonstrate patients knew about the part that needed to be operated, but were not made adequately aware about the cost, postoperative complications and adverse outcomes. Doctors can make their efforts more meaningful, if they get back to the patients and assess if the patients have understood by asking questions to the patients. Most of the decisions were either done by elders of the family or the doctors where the patient who was undergoing the procedure left the decision making to others.

We conclude that more deliberative efforts are required to gain confidence of the patient. The surgeons

should try to make the language simpler to understand, especially if consent forms are in local language. All these things require mindset and to focus on making informed consent truly "informed" and not just procedurally correct.

Ethical Clearance –Institutional Ethics committee

Source of Funding–Self

Conflict of Interest: None

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A Study on the Medico-legal Aspect of the Deaths due to Hanging in Ajmer Region

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ABSTRACT

Present retrospective study was carried out at the mortuary of J.L.N. Medical College, Ajmer from January 2015 to 31st December 2015. A total of 953 dead bodies were received for post-mortem examination during the study period. Out of them 49 cases were of Hanging The incidence rate of hanging is 5.14 % (49 out of 953) in the present study with a male: female ratio of 3.9:1 and 21-30 years age group being most commonly (46.93 %) involved population. All 49 cases under the study were suicidal in nature no cases were of Homicidal Hanging. Personal reasons (22(44.89%)) and family problems (10(20.40%)) were encountered to be the common reasons for committing suicide. Soft material 79.59 %) was more commonly used as ligature than the hard one (20.40 %). In these cases 47(95.91) were recovered completely hanging from a higher point (complete hanging), whereas only 2(4.08%) were recovered in kneeling down position or with toes or feet touching the ground (partial hanging); In 41 (83.67 %) cases the lividity was noticed on back side. 14(28.57 %) victims (27.5 %) presented with ecchymosis along the edges of the ligature mark because of violent movements at the terminal event. Discharge of semen was seen in 08 (16.32 %) cases whereas discharge of urine/faeces was noticed in 07 (14.28 %) cases. La facie sympathetic and defence wounds were noticed in none of the cases under the study. On internal examination all 49 cases (100 %) presented with white-glistening subcutaneous tissue and neck muscle no contusion was detected. In present study rupture of the strap muscles, fracture of thyroid cartilage or hyoid bone or tear in the intima of the carotid artery was not detected. The dribbling of saliva is considered as surest sign of ante-mortem hanging was noticed in only 36(73.46 %)cases .

Keywords: *Suicide; Hanging; Autopsy, Demographic variables*

INTRODUCTION

In spite of advancement in medical facilities, the natural end of life is inevitable. But for some persons, the death is destined earlier in an un-natural way. A few choose to make their own way by committing suicide. The major reasons are personnel problems, stress of life, family problems and financial problems. There are many methods for committing suicide like poisoning, hanging, self-immolation, drowning etc. Hanging provides painless death so it is one of the commonly adopted methods for suicide. However, in a few instances false allegations are made claiming that

the ligature mark over neck is of strangulation rather than hanging. Vice versa cases are also likely. In such cases, the post-mortem findings are very helpful to differentiate between the two.

Ajmer has an important place in the Indian history. Now a days due to population explosion, poverty and increasing stress and strain in our daily life, many people get stressed in this hard life. Some get overcome from that and some cannot. So they find easy way to come out of it and choose the way of suicide.

Suicide is a self directed having fatal outcome. There are many methods for committing suicide like poisoning, hanging, self-immolation, drowning etc.

Hanging is a form of violent asphyxial death produced by suspending the body with a ligature around neck and the constricting force being the weight or

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part of the body weight.^[1] It is the method of capital punishment adopted by Indian legislature.

All cases of hanging are considered to be suicidal until the contrary is proved.^[2] Any substance available at hand may be used as ligature. Articles commonly used as ligature are soft materials like 'dhotie', 'Saree', 'Bed sheet', 'Sacred thread', 'handkerchief', 'neck tie', or it may be the hard and pliable material like 'Electric cord', 'Belt', 'wire' or 'Leather strap'. In short, the material can be anything handy and available near the place of occurrence as the suicide is an impulse mediated act.^[3]

Present study is an attempt to analyze the socio-demographic pattern, causes and precipitating events for hanging as well as the place of the incidence, ligature material etc all of that helps the investigating authorities into the circumstances of death. Post-mortem findings are of utmost importance in differentiating the cases of hanging from ligature strangulation, so were also the part of the study.

MATERIAL AND METHOD

The present retrospective study of hanging cases was carried out at the mortuary of J.L.N. Hospital, Ajmer. The duration of the study was 1 year from January 2015 to 31st December 2015. A total of 953 dead bodies were received for post-mortem examination during the study period. Out of them, in 49 cases, the corpses presented with ligature mark over neck. On the basis of post-mortem findings and correlating with the detailed history elicited from the police and the relatives of the deceased, it was concluded that the cause of death was hanging in 49 cases. All these hanging cases were selected for the present study.

The details regarding history of the incidence, personnel details of the deceased and post mortem findings were recorded on specially designed proforma. The scene of incidence was visited and the findings were also entered into the proforma. The data so collected were tabulated on a master-chart and analyzed.

REVIEW OF LITERATURE

Amandeep et al^[4] also found nearby results with highest incidence (59.24 %) amongst the population of 15-25 years. Whereas Azmak D et al^[5] describes described highest victims (20.8 %) between 30 to 39 years. In the study of Sharija et al [6] at Southern part of Kerala, 28.73 % victims were recovered from open

places whereas remaining 71.27 % from enclosed area in the room. , O. Gambhir Singh et al^[7] and Naik S et al^[8] have described a few rare cases of homicidal hanging. The studies by Sharija et al, Naik S K et al and Sharma B R^[6, 8, 9] have shown variation regarding material used for hanging.

OBSERVATION AND DISCUSSION

A total of 953 dead bodies were brought for post-mortem examination at the mortuary of J.L.N Medical College, Ajmer, during the 1 year period ranging from January 2015 to 31st December 2015, After post-mortem examination and correlated with the history received from the police and relatives of the deceased, it was confirmed that in 49 cases (5.14%), the victims had died because of hanging. These 49 cases are the part of the study. It is clear that in majority age groups males' outnumbered female with a male: female ratio of 3.9: 1 (**Table 1**) On eliciting the detailed history from the police and relatives of the deceased, we came to know the fact that majority of the victims (47(95.92%)) were recovered from closed areas that is mostly at home or work place. Only 2 victims (2(4.08%)) hanged themselves to the twig of a tree or a beam at open place under the sky (**Table 2**). Out of 49 cases, 47(95.91 %) were recovered completely hanging from a higher point (complete hanging), whereas only 2(4.08%) were recovered in kneeling down position or with toes or feet touching the ground (partial hanging); most likely because of slipping of the knot at the higher point by weight of the body. (**Table 3**)

Seen from present study, in no, hanging was accidental or Homicidal in nature and all were considered to be of suicide hanging. (**Table 4**) However our study shows that, in 22(44.89%) cases, the victims committed suicide because of personal problems which may be failures in examinations, psychiatric problems or long time illnesses. In 10(20.40%) cases social/family/domestic problems played role. 4(8.01%), were classified to be of unknown reason as the deceased was unidentified or proper history was not available with the police or relatives of the deceased. (**Table 5**) Borrowings/financial problems were responsible for suicide in 5 (10.20%) and extramarital affairs/sexual problems in 8(16.32%) cases .

Some of the dead bodies under the study were received with ligature material in situ whereas for remaining cases police officer was asked to supply the

ligature material for examination. For the purpose of present study the ligature material is divided into two broad groups. (Table 6)

1. Hard - e.g., electric /nylon wire, rope etc.
2. Soft - e.g., dupatta, bed-sheet, saree etc.

In present study, 'Bed-sheet' was most commonly used ligature material 31 (63.26 %) which is easily available in almost every house. Present study that soft material being more commonly used than the hard one.

The difference in the studies could be because of fact that suicide is because of an impulse and for that the victim uses whatever material is available nearby on that particular period of time. To conclude it can be said that for a person to end his/her life by hanging, he/she may use any material available in the vicinity.

As the knot was fixed one in 22(44.89 %) cases and of running type in 27(55.10 %) cases, (Table 7) The ligature material was cut away from the knot, the cut ends tied with strings and preserved for examination at FSL. The knot impression over neck was compared with the actual knot. On the basis of the position of the knot-mark over neck (correlated with the actual knot of ligature material), the hanging was typical (knot impression over the sides of the neck) in only 02 cases (4.08%) whereas it was atypical in 47 (95.91%) cases (97.5 %) (Table 3)

On external examination it was seen that in all the 49 cases (100 %) of hanging one or more signs of asphyxia were noticed and the ligature mark was obliquely placed. In 46 (93.87 %) cases, the mark was situated at and above the level of thyroid cartilage (Table 8). In all these cases soft and broad material was used as ligature. (Table 6) In remaining 3 cases (20 %) the ligature mark was because of hard material and situated above the thyroid cartilage. None of the case showed ligature mark below the thyroid cartilage as the ligature slips upward in hanging position. Congestion of face because of venous occlusion was noticed in 38 (77.55%) cases.

Dribbling of saliva from the angle of mouth opposite to the knot, the surest sign of ante-mortem hanging [10-12] was noticed in 36 (73.46 %) cases. In 9(18.36. %) cases the distribution of post-mortem lividity was typical of hanging means in legs, feet, hands and forearms suggestive that lividity was fixed as the body was

suspended for more than 4 to 6 hours.

In 41 (83.67 %) cases the lividity was noticed on back side only when body was released from the point of suspension within a few minutes after death. 14(28.57 %) victims (27.5 %) presented with ecchymosis along the edges of the ligature mark because of violent movements at the terminal event.

Discharge of semen was seen in 08 (16.32 %) cases whereas discharge of urine/faeces was noticed in 07 (14.28 %) cases. La facie sympathetic and defence wounds were noticed in none of the cases under the study.

On internal examination all 49 cases (100%) presented with white-glistening subcutaneous tissue and neck muscle no contusion was detected. (Table 9) In no case under study rupture of the strap muscles, fracture of thyroid cartilage or hyoid bone or tear in the intima of the carotid artery was detected.

Table 1: Age and Sex Wise Distribution

Age grs(yrs)	Gender of the deceased		
	male	female	Total
0-10	00	00	00
11-20	02	02	04
21-30	18	05	23
31-40	08	01	09
41-50	10	02	12
51-60	01	00	01
Total	39(79.59)	10(20.40)	49 (100%)

Table 2: Place for Hanging

Place of Hanging	Cases
Open place	2(4.08%)
Closed place	47(95.92%)
Total	49

Table 3: Type of Hanging

Type	Cases (%)	
On basis of position of knot	Typical	02 (4.08%)
	Atypical	47 (95.91%)
	Total	49 (100%)

On basis of degree of suspension	Complete	47(95.91)
	Partial	2(4.08%)
	Total	49 (100)

Table 4: Manner of Death

Manner Of Death	Cases	Percentage (%)
Suicidal	49	100%
Accidental	00	0
Homicidal	00	0
Total	49	100

Table 5: Reason for Death

Reason for Death	Cases
Personal	22(44.89%)
Social/family/domestic problems	10(20.40%)
Borrowings	5 (10.20%)
Extramartial affairs/sexual	8(16.32%)
Not known	4(8.01%)
Accidental	00
Total	49(100 %)

Table 6: Ligature Material Used For Hanging

Ligature Material	Hanging (49Cases)
Soft Material	
Bed Sheet	31 (63.26 %)
Dupatta	5(10.20 %)
Sarree	1 (2.04 %)
Piece Of Cloth	2 (4.08 %)
Subtotal	39 (79.59 %)
Hard Material	
Electric Wire	01 (2.04 %)
Rope	9 (18.36 %)
Subtotal	10 (20.40 %)
Total	49(100 %)

Table 7: Type of Knot Type Of Knot	Hanging
Fixed	22(44.89 %)
Running	27(55.10 %)
Total	49(100 %)

Table 8: Post-Mortem Findings on External Examination

External Findings	Hanging (49Cases)
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Placement of ligature mark	Oblique (100 %)
Place of ligature Mark at neck	above thyroid
	3 (6.12 %)
at & above thyroid	46 (93.87 %)
Below thyroid	00
Congestion of face	38 (77.55 %)
Dribbling of saliva	36(73.46 %)
La facie sympathique	00
Postmortem Lividity	Typical
	9(18.36. %)
On back	41 (83.67 %)
Ecchymosis along edge of mark	14(28.57 %)
Discharge of semen	08 (16.32 %)
Discharge of urine/faeces	07 (14.28 %)
Struggle marks	00

Table 9: Post-Mortem Findings on Internal Examination

Internal Findings	Hanging	
Subcutaneous tissue	White glistening	49(100%)
	Contused	00
Fracture of thyroid	2(4.08)	
Fracture of hyoid	2 (4.08)	
Neck muscle contusion	3(6.12%)	
Strap muscle rupture	00	
Intimal tear of carotid artery	00	

CONCLUSION

The present study concluded that male component have higher incidence with male: female ratio of 3.9:1 and 21-30 years age group being most commonly (46.93 %) involved population. 49 cases under the study were suicidal. Personal reasons (22(44.89%)) and family problems (10(20.40%)%) were encountered to be the common reasons for committing suicide. Soft material 79.59 %) was more commonly used as ligature than the hard one (20.40 %). Present study shows that on an impulse for suicide the victims used whatever material available on the particular time. Dribbling of saliva, the considered surest sign of ante-mortem hanging was noticed in only 36(73.46 %)cases . Examination of scene of incidence has an immense value in such cases.

Source of Funding:- self generated

Ethical Approval:- formal consent was obtained

Conflict of Interest: however our study was confined with the hanging therefore this can be further used against the cases of strangulation. Cases of false allegation of hanging were not included in this study

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The Importance of Suprascapular Notch and Foramen in Identification

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ABSTRACT

Identification of a unknown dead body during postmortem examination in a very important aspect. There are various methods of identifying a dead body but still the need for new identification data is always evident. This study has been taken up to see the relevance of variations, absence and anomalies of Suprascapular notch and foramen in identification of dead bodies. Anatomical variations and anomalous or ossified superior transverse scapular ligament are also considered to be risk factors for suprascapular neuropathy. This study was taken up with the aim to study the variations of Suprascapular notch and foramen and in turn check the relevance in identification of a person. A total of 200 dry scapulae were collected from the Departments of Anatomy and Forensic Medicine in Gandhi Medical College, Telangana State, India. Various shapes like J, U, V, \cup , were noted along with absence in some cases. Commonest shapes seen are U, J and V in decreasing frequency respectively. In 6 cases the notch was absent, and there was a mere exaggeration of the superior angle giving a concave shape to the superior border in the current study. The suprascapular notch had converted into a foramen in 8 cases in the present study which amounting to 4 % and thereby gaining a new significance though it was rare in all previous studies. A new shape was seen in some cases which has been assigned a name 'inverted omega (\cup)' for further discussion in this study. The suprascapular notch at its junction with the superior border of scapula on either sides had spikes facing each other. As long as we have any old x-rays of the deceased we can always use the variations, anomalies and absence of Suprascapular notch and foramen as a very good tool in identification.

Keywords: *Suprascapular Notch, Suprascapular Foramen, Identification.*

INTRODUCTION

Identification of a unknown dead body during postmortem examination in a very important aspect. There are various methods of identifying a dead body but still the need for new identification data is always evident. This study has been taken up to see the relevance of variations, absence and anomalies of Suprascapular notch and foramen in identification of dead bodies. The suprascapular notch (SSN) is a notch in the superior border of the scapula, just medial to the base of the coracoid process. This notch is converted into a suprascapular foramen (SSF) by the superior transverse scapular ligament, and serves for the passage of the suprascapular nerve and sometimes the ligament is ossified [1, 2]. Anatomical variations and anomalous or ossified superior transverse scapular ligament are also considered to be risk factors for suprascapular

neuropathy. In previous studies, different types of SN were identified^[3, 4]. The suprascapular nerve which supplies motor branches to the supraspinatus, infraspinatus, and sensory branches to the rotator cuff muscles, and the ligamentous structures of the shoulder and acromioclavicular joint. According to Rengachary et al. 1979, there are six basic types of scapular notch^[5].

- Type I (8%): Notch is absent. The superior border forms a wide depression from the

Medial angle to the coracoid process.

- Type II (31%): Notch is a blunted V-shape occupying the middle third of the superior border.

- Type III (48%): Notch is U-shaped with nearly parallel margins.

- Type IV (3%): Notch is V-shaped and very

small. A shallow groove is frequently formed for the suprascapular nerve adjacent to the notch.

- Type V (6%): Notch is minimal and U-shaped with a partially ossified ligament.

- Type VI (4%): Notch is a foramen as the ligament is completely ossified.

Kopell and Thompson were the first to describe entrapment syndrome (1959) of suprascapular nerve at the site of the suprascapular notch [6]. Many studies have investigated and have identified the pathological factors related to this syndrome. The following proved to be involved in the aetiology as well as iatrogenic lesions during

- open or arthroscopic surgical procedures blind drilling during arthroscopic Bankart and SLAP repair advancement of rotator cuff during the repair of massive retracted rotator cuff tears [7, 8, 9]

- arthroscopic anterior or double interval slide
- during the decompression of suprascapular nerve entrapment

- anterior shoulder dislocation
- injury from direct trauma
- ganglion cysts
- synovial and Ewing's sarcomas
- and chondrosarcoma and lipoma

AIMS

1. To study the variations in Suprascapular notch and in turn check it's relevance in identification of a person.

2. To study the variations in Suprascapular foramen and in turn check it's relevance in identification of a person.

MATERIALS AND METHOD

A total of 200 dry scapulae were collected from the Departments of Anatomy and Forensic Medicine in Gandhi Medical College, Telangana State, India. The Suprascapular notches were examined for presence, absence and variation in shapes.

RESULTS

Table No.1: Suprascapular Notch and Foramen variations

Shapes	Number	%
J shape	51	25.50%
U shape	108	54.00%
V shape	24	12.00%
Absence of Notch	6	3.00%
*New shape identified υ	3	1.5%
Suprascapular notch converted into foramen	8	4.00%
Total	200	100.0%

The common shapes seen are U, J and V in decreasing frequency respectively, which concurs with the opinion of Rengachary et al [5]. In 6 cases the notch was absent, and there was a mere exaggeration of the superior angle giving a concave shape to the superior border in the current study. This was different from what was seen in the normal scapula, where the superior border of the scapula is comparatively straight, with an indentation (suprascapular notch) at the junction of the medial two-thirds and the lateral third, just medial to the base of the coracoid process. The suprascapular notch had converted into a foramen in 8 cases in the present study which amounting to 4 % and thereby gaining a new significance though it was rare in all previous studies. A thorough search of the literature revealed no report of absence of the suprascapular notch in a Nigerian scapula – this appears to be the first [8]. A new shape was seen in some cases which has been assigned a name 'inverted omega (υ)' for further discussion in this study. The suprascapular notch at its junction with the superior border of scapula on either sides had spikes facing each other.

DISCUSSION

The suprascapular notch is usually present in every scapula. It is commonly bridged by the superior transverse scapular ligament and thus converted into a foramen, which is called the suprascapular foramen. Morphological variations of the suprascapular notch are very important clinically for possible predisposing factors, for compression of

the suprascapular nerve in this region. In the whole population, approximately 1–2% all shoulder pain is caused by the suprascapular nerve entrapment syndrome [13]. Various factors have been identified as being causes of suprascapular nerve entrapment, including variation in the shape of the suprascapular notch along with a thickened superior transverse scapular ligament [5, 10, 11]. It could be postulated that complete absence of the suprascapular notch may also be one of the predisposing factors for the suprascapular nerve entrapment syndrome. The suprascapular nerve is a motor nerve originating from the upper trunk of the brachial plexus (C5 and C6) [12]. The suprascapular nerve entrapment is a pathological condition wherein the affected nerve is compressed within the narrow passage of SSN/SSF. The compression of the nerve leads to mechanical irritation during shoulder movement which in turn may aggravate the condition. With entrapment of the nerve, atrophy of both the infraspinatus and supraspinatus muscles may occur. Black et al. reported that paralysis, weakness, numbness, and burning sensations in the hand may be the initial symptoms; later, there may be only weakness of abduction and external rotation, as is seen in suprascapular injury [13]. Deformities in the shapes of the SSN are said to play a major role in this regard. However, clinical studies indicate that, there is no direct co-relation between type of the notch and nerve entrapment condition [9]

CONCLUSION

As long as we have any old x-rays of the deceased we can always use the variations, anomalies and absence of Suprascapular notch and foramen as a very good tool in identification. In conclusion, co-existence of the Suprascapular notch and tiny Suprascapular foramen as seen in current cases increases the risk of neuropathy by causing nerve irritation against bony margins during its passage through the foramen. The knowledge on such variations is essential for surgeons and orthopedicians, for making a proper diagnosis and for planning the most suitable surgical interventions. And at the same time thorough knowledge of these variations and anomalies will always guide the Forensic Expert in identification.

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Analysis of Sociodemographic Profile of Asphyxial Deaths due to Hanging in Urban Region of Karnataka

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ABSTRACT

Deliberate self harm or Suicide forms a large proportion of autopsies conducted in various hospitals and institutions in almost all parts of India. In the recent years, Hanging, a form of suicide, is the most common type of asphyxial death that forensic experts come across in their practice. A retrospective study was conducted in the Department of Forensic Medicine and Toxicology, Kempegowda Institute of Medical Sciences, Bangalore from April 2004 to March 2006, with an objective to study the socio demographic profile in autopsy cases of hanging. All the parameters were expressed in percentage. Out of 810 autopsies, 27.9% cases were that of hanging. Males were more vulnerable than the females. Hindus outnumbered the rest. Maximum belonged to lower socioeconomic class. Maximum incidence of hanging was noted between 21-30 years of age. 57.96 % cases occurred between 6PM to 6AM with maximum cases in rainy season. Most of the victims were educated, employed and belonged to urban area. Financial and family problems were the root cause for 43.82% of the deaths. The results of this study provides the necessary information in formulating remedial measures to prevent immature mortality.

Keywords: *Violent asphyxia, Hanging, Autopsy, demographic profile.*

INTRODUCTION

In India, amongst the fatalities that are subjected to medico-legal autopsies, asphyxia-related deaths account for a significant number of cases. Asphyxial deaths may be caused by different methods, such as hanging, strangulation (manual and ligature), suffocations (environmental, smothering, choking, mechanical and suffocating gases), chemical asphyxia (carbon monoxide, hydrogen cyanide and hydrogen sulphide) and drowning.^[1]

The pathos of suicidal deaths has always remained a major problem to the modern society. Hanging is a form of violent asphyxia which is most commonly employed as it is painless & the offending weapon being easily available at ones disposal.

As per the National Crime Records Bureau (NCRB) statistics for 2013, there were 1467 deaths /day due to accidents and suicides out of which there were 369 cases of suicides/ day . The four Metropolitan Cities — Bangalore (2,033), Chennai (2,450), Delhi (1,753) and Mumbai (1,322) have reported higher number of Suicides. These four cities together have reported almost 35.5% of the total suicides reported from 53 mega cities. Hanging was the method adopted for suicide in India in 53636 cases accounting for 39.8% of cases, whereas drowning was observed in 7646 cases of suicide (5.7%). The pattern of suicides reported from 53 cities showed that ‘Hanging’ (58.4%), ‘Poisoning’ (15.0%) and ‘Self Immolation’ (9.5%) were the prominent means adopted by the suicide victims in the cities.^[2]

In medicolegal practice, we cannot overlook the alarming rise in the rate of unnatural deaths. Surveillance of mortality trends enables the policy makers to plan the preventive and curative measures.

In this study an attempt has been undertaken in the view to gain, further knowledge and insight in to epidemiological trend of asphyxial deaths due to

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hanging in Bangalore South region.

MATERIALS AND METHOD

The study consisted of 810 medico-legal autopsy performed in the Department of Forensic Medicine, Kempegowda Institute of Medical Sciences, Bangalore, Karnataka during the period of 2 years (from April 2004 to March 2006). Out of total 810 medico-legal autopsies, 226 were hanging victims (27.9%).

Necessary information for the study was gathered from Police, inquest report and hospital treatment records. The relatives, friends, and neighbours of the victims were also taken separately for data collection. In few cases adequate information could not be obtained and such cases were put under "Undetermined/unknown group".

A detailed proforma for recording history, epidemiological data and the details of hanging etc. was prepared for filling the observation of the present study. The information thus collected, was statistical analyzed.

OBSERVATIONS AND RESULTS

During this study period, 810 cases were brought for post-mortem examination out of which 226 (27.9%) deaths were due to hanging. (Fig 1)

The maximum number of victims 101 (44.7%) belonged to age group of 21-30 years. There were 120 (53.09 %) male and 106 (46.91%) female casualties amongst hanging cases. Maximum sex differentiation was observed in the age group of 41-50 years with male and female ratio of 4.75:1 followed by 2.07:1 in 31-40 years age group. If we considered age group of 21-50 years, it showed about 3/4th of total hanging victims (75.3%). The incidence is significantly more in females in the age group of 21-30 years, with odds ratio of 2.78. The males outnumbered the females in totality and male to female ratio was 1.13:1. (Table 1)

Out of the 226 autopsies conducted, most of the victims were married 119, (52.61%) when compared to unmarried 96, (42.46%). The males outnumbered the females in both married and unmarried groups. There were four females who were divorced (1.76%). In seven of the cases, the deceased had lost their spouses (3.17%).(Fig 2)

In our study most of cases, 86(38.05%) were reported during the evening (6 pm-12 am) followed by 55 cases (24.33%) reported during day time (6AM-12 noon). A greater number of suicidal hanging cases (29.4%) were registered in the rainy season. (Table 2)

Most of cases, 206 (91.15%) took place at residence and 119 (52.65%) victims belonged to lower socioeconomic status. Majority of the victims were Hindus consisting of 198 (87.61%) cases. Amongst the total cases, 82.30% (186 cases) belonged to the urban area. It was also found that 223 cases (98.7%) were spot dead whereas only 1.3 % of cases are found to be delayed death with 8-10 days of hospital stay. (Table 2)

47.34% of the cases had an education upto high school. Graduates and post graduates comprised of 15.04 % cases. Illiterates amounted to 5.85 % of the cases. (Table 3)

Over half the study population was employed (57.96%) whereas 11.95% of them were unemployed. (Fig 3)

Present study showed that financial problems were the main reason for hanging in 23.46% of the cases which was closely followed by family problems accounting for 20.36% of the cases. (Table 4)

DISCUSSION

In India Violent asphyxial deaths are very common and increasing in number. A study conducted by Cun-Xian Jia and Jie Zhang on characteristics of young suicides by violent methods in rural China explained very well the need to study the demographic profile.

Age between 21-40 years was found to be more vulnerable to hanging. This was in accordance with the studies conducted by few authors.^[3,4] Emotional, aggressive, intolerant and irrational behavior amongst the youth drives them vulnerable whereas the least fatalities were observed amongst the victims in their extremes of ages due to limited exposure to suicidal material. Our findings was not in agreement with a south Indian study.^[5]

Further it was observed in our study that there was Males preponderance and comprised 53.09 % while Females were only 46.91 %. The Male to Female ratio was found to be 1.13:1 which correlates with studies by various authors. ^[6,7,8] This high incidence may be

because males being the bread winner are more exposed to stress & strain compared to females which is similar to the observations reported in different studies.

A view on religion depicted that most of the victims were Hindus (87.61%). This may be due to the low percentage of Muslims and Christian populations in South Bangalore region as well as their religious beliefs. More cases were found to be amongst lower socio economic status (52.65%). Married men were more prone to commit hanging. This was in accordance with studies by various authors.^[3,4] The rising prices of the basic amenities and inability to meet them financially could be the reason for cynicism in life. 43.82 % cases had family and financial problems as the motive for suicide. Analyzing the place and time of consumption, most of the incidents (91.15%) took place in the residence, because suicidal materials were available. Most lethal period of hanging was found to be 6PM-12 AM (38.05%), due to emotional outburst resulting from tiredness at the end of busy life & disappointments .The highest number of hanging cases, (29.4%) was recorded in the rainy season followed by summer season, (24.7%) cases. This is in contrast with the study of an author where maximum incidence was observed in summer season.^[9] Most of the victims belonged to Urban locality and similar finding was recorded in a north western study in India. ^[10]

In our study an in depth insight was given and found that majority of the victims had an education upto high school (47.34%) only 5.82% were illiterate. This is in accordance to studies by few authors. ^[4,10] Majority of the study group victims were employed. Students comprised of 15.49% of victims. This indicates the high amount of stress they are subjected to in their lives either due to personal affairs or the educational course by itself.

Table 1: Age & sex distribution of hanging cases

Age in Years	Male (n=120)	Female (n=106)	Total (n=226)	Sex ratio
11-20	12	30	42	0.4:1
21-30	51	50	101	1.02:1
31-40	31	15	46	2.07:1
41-50	19	4	23	4.75:1
51-60	5	4	9	1.25:1
> 60	2	3	5	0.67:1
The incident of committing suicide (Hanging) is significantly more in females of the age > 30 years ($\chi^2 = 12.781$, $p < 0.001$) with Odds ratio of 2.78				

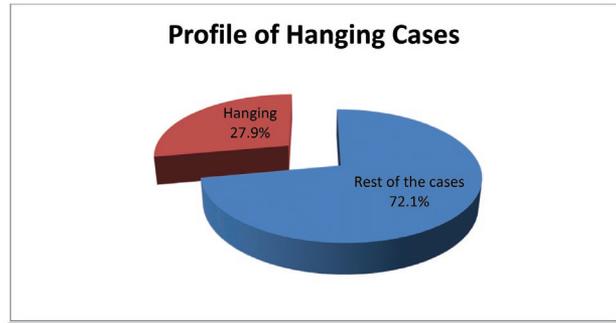


Fig 1: Profile of hanging cases

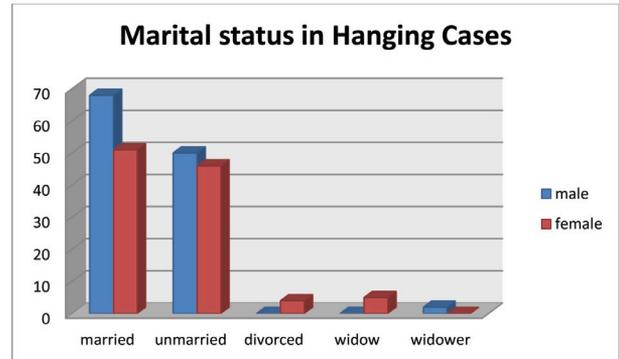


Fig 2: Marital Status in Hanging

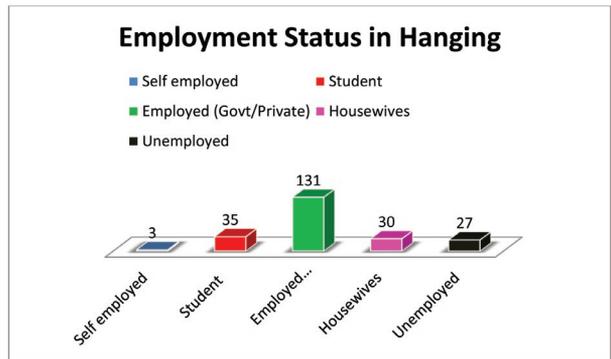


Fig 3: Employment status in Hanging

Table 2 : Demographic profile of hanging victims(n=226)

Characteristics		Frequency	Percentage
Religion	Hindu	198	87.61
	Muslim	20	8.85
	Christian	8	3.54
Socio economic status	Lower	119	52.65
	Middle	81	35.84
	Upper	26	11.51
Time	6am -12 Noon	55	24.33
	12 Noon – 6pm	40	17.71
	6pm – 12am	86	38.05
	12am-6am	45	19.91
Weather	Summer	56	24.70
	Winter	48	21.30
	Rainy	67	29.40
	Spring	55	24.60
Place of consumption	Residence	206	91.15
	Workplace	17	7.52
	Others	3	1.33
Locality	Urban	186	82.29
	Rural	40	17.71
Period of survival	Spot death	223	98.7
	>24 hours	3	1.3

Table 3: Education wise distribution of hanging cases

Education	Cases	Percentage
Illiterate	13	5.82 %
Primary school	10	4.42%
Middle school	28	12.36 %
High school	107	47.34 %
Post high school/ puc /diploma	19	8.40 %
Graduate or post graduate	34	15.04 %
Professional/honours	15	6.62 %

Table 4 : Motives in hanging.

motives [n=226]	Cases	Percentage
Infertility	2	0.88
Bereavement	1	0.44
Financial problems	53	23.46
Dowry	35	15.49
Failure in exam	14	6.19
Family problem	46	20.36
Illness/ mental illness/ psychological	28	12.38
Love failure	13	5.76
Unemployment	8	3.53
Unknown	26	11.51

CONCLUSION

Hanging, currently viewed as a rapid and accessible method of securing get away from difficulties and distress is largely an unforeseeable event. Prevention strategies should focus on countering the general perceptions of trouble-free death by hanging. The Nongovernmental organization along with the aid of community and governing bodies should devise few disguised and implicit messages that can bring about subtle changes in lay knowledge.

Correspondingly strict implementation of the law pertaining to suicide by the government and education to create awareness about the magnitude of the peril could help curb down the problem.

Conflicts of Interest : None

Funding: None

Ethical Approval : Obtained

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Original Research Article

Estimation of Stature by Glabella - Inion Head Length in South Indian Population – A Cross Sectional Study

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ABSTRACT

As there are cases brought for forensic examination where only the craniofacial region is available, estimation of stature from craniofacial dimensions is without doubt important in forensic cases. The study presented here attempts to estimate stature from craniofacial dimensions in the South Indian population. Establishment of individuality is an imperative aspect in any investigating procedure. There are various data available for identification. The height of an individual is one of them. When there is only part of the body is available the calculation of stature plays a vital role as far as the identity of an individual is concerned. There is scanty information regarding stature estimation using head length in South-Indian population. Therefore the current study has been designed to correlate head length and stature, and to derive regression equation that can be applied for estimation of stature in South Indian population.

Keywords: Anthropology; Stature; Head length; South Indians.

INTRODUCTION

It is well known that there is a definite relationship between the height of the person and various parts of the body like head, trunk and lengths of upper and lower limbs. The assessment of height of an individual from measuring different parts of the body has always been of immense interest to the Anatomists, Anthropologists and Forensic experts.¹

Trotter and Gleser² in 1958 reported that each group of American white, Negroes, Mongolian and Mexican needed different formulae to derive the most precise estimate of stature. In 1996 Yayimyili³ derived regression equations for estimation of stature for Turkish population. He also observed that application of formulae derived for African, European and Asian

populations led to suboptimal values for Turkish population. Thus, race specific regressions are yet to be derived for the accurate stature reconstruction.

There is no universally acceptable formula to express relationship between stature and head length of an individual. Estimation of stature of an individual in India by using formulae given by western workers involves an error of 5-8%.⁴ Various factors like race, sex, side of body, climate, heredity and nutritional status are attributed to variations in the ratios of length of different bones to that of stature.^{2, 5, 6}

South India comprises 20 % of total Indian soil and most of the people are of Dravidian decent. Hence the current study represents the anthropological data of Dravidian race.

AIMS AND OBJECTIVES

To correlate the Glabella- Inion head length with stature and to derive regression equations that can be applied for estimation of stature of South Indian population.

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MATERIALS AND METHOD

a) Source: The south Indian students population (Karnataka, Andhra Pradesh, Tamil nadu and Kerala) with their age above 18 years.

b) Study design: Cross-sectional study.

c) Sample size: 200 (100 males and 100 females)

d) Methodology:

Inclusion criteria:

1. Students born and brought up from Karnataka, Andhra Pradesh, Tamil Nadu, and Kerala.

2. Chronological age group above 18 years.

Exclusion criteria:

1. Students unable to stand.

2. Any pathological conditions of bones and limbs e.g., fractures, dislocations, poliomyelitis, osteoporosis, rickets, scoliosis and kypho-scoliosis etc.

3. Congenital anomalies.

4. Dwarfism and Gigantism.

5. Steroidal therapy.

e) Data collection: The study was performed in adherence to the principles established with the declaration of Helsinki (2000) and written consent was obtained for every student and all female subjects were examined in the presence of another female. Various socio-demographic factors and the following anthropometric data were entered in the pretested proforma. The measurements were taken at fixed time between 2 to 5 p.m. in order to eliminate discrepancies due to diurnal variation.

1. Standing height (Stature):

The subjects were made to stand bare foot on a base-board of a stadiometer in the Frankfurt plane where his/her head will be parallel to the floor with heels together and the weight evenly distributed between both feet. The height is measured in centimetres(cm) from the ground to the highest point of the head with the head piece of stadiometer firmly contacting the scalp.

2. Head Length :

Subjects were made to sit on a chair keeping head looking straight and measurement will be taken with spreading calipers between two points – from Glabella to Inion in cm.

RESULTS

The average stature in the present study is 172.44 cm for males and 159.49 cm for females and the average head length from Glabella to Inion is 18.69 cm for males and 17.28 cm for females. Head length from Glabella to Inion (G-I) shows a positive correlation (Karl Pearson’s) with stature for male, female and combined with p-value < 0.001. A total of 3 simple linear regression equations were derived in the study for male, female and combined (Table No.1)

Table 1: Showing simple linear regression equations for male, female and combined

Sex	Glabella-Inion (G-I)
Male (Y = A+BX)	Stature =122.132 + 2.692 G-I R= 0.530, R² = 0.281 SEE = 4.558
Female (Y = A+BX)	Stature =123.955 + 2.056 G-I R= 0.428, R² = 0.183 SEE = 5.624
Combined (Y = A+BX)	Stature = 91.486 + 4.141G-I R=0.652, R ² = 0.425, SEE = 6.6002

(Where, Y= Total body Height in cms, A = Constant, B = Regression coefficient, X = Head length(G-I) in cms, R = Correlation coefficient, R² = Coefficient of determination.)

DISCUSSION

In present study, approximate stature has been estimated from head length (Glabella to Inion). There are only few studies available to correlate with our study results. We have observed positive correlation between head length and height in the age group of 18-29 years with correlation coefficient of 0.530 (G-I) in males and 0.428 (G-I) in females and 0.652(G-I) combined for both males and females.

Jadhav et al⁷ have shown positive correlation between head length and height with correlation coefficient +0.53. This study included both sexes aged between 17-22 years and head length was measured between “gabella and inion”(G-I). The head length measured in their study is similar to the head length measured in our study.

Trotter M et al^{2,5} have stated that requirement of different regression equations among different races after studying different races for relationship between lengths of bones and stature.

Table 2. Coefficient of Correlation values from previous studies regarding stature and Head length and correlation with current study.

Workers and age of study group	Mean head length (Cm)	Correlation coefficient	Correlation with current study
Saxena ⁷ (1981) 25-30 Yrs	18.464 Nasion – Inion	+0.2048	No
Jadhav & Shah ⁸ (2004) 17-22 Yrs	17.65 Glabella – Inion	+0.53	Yes
Krishnan ⁹ (2008) 18-30 Yrs	16.50 Glabella - Inion	0.78	No
Ilayperuma ¹⁰ (2010) 20-23 Yrs	17.60 Glabella - Inion	0.72	No
Present study 19-28 Yrs	18.69(male) 17.28(female) Glabella-Inion	0.530(male) 0.428(female) 0.652(combined)	----

Our study shows positive correlation between stature as measured by regression equations with that of the actual height amongst the South Indian population which is in accordance to observations as made by other similar studies done by Jadhav & Shah⁸ and not in accordance with the study done by saxena et al⁷ (as the head length measured in their study is from Nasion to Inion), Krishnan⁹ and Ilayperuma¹⁰ where the head length measured is similar to our study. (Table no.2.)

Table 3: Showing regression formula worked out by various authors for Head length in different population and the present study.

SL NO	AUTHOR	POPULATION	HEAD LENGTH	MALE EQUATION (Y= A+BX)	FEMALE EQUATION (Y=A+BX)	CORRELATION With current study
1	Saxena et al ⁷ (1981)	Agra, UP	N-I	Y=134.42+1.504X		No, as the head length here is from Nasion to Inion
2	Jadhav HR and Shah GV ⁸ (2004)	Gujarat	G-I	Y= (138.77) + (1.77)X	Y= (128.03) +(1.72)X	No
				Y= (78.92) + (4.93) X		
5	Shivanand and Manjulabai K H (Present Study)	South Indian	G-I	Y=122.132+2.692 G-I	Y=123.955+2.056 G-I	----
				Y = 91.486 + 4.141 G-I		

The regression equations of our study are valid and applicable to the South Indian population. However the regression equations do not match with any other region of the India as these are individually different (Table No.3), this finding substantiates views expressed by other workers that, the state wise and population wise different regression formulae are required for estimation of stature.

CONCLUSION

There is a positive correlation between the head length (Glabella-Inion) with that of stature. We have come out with new set of regression equations i.e. [Stature=122.132 + 2.692 G-I] for male and [Stature = 123.955 + 2.056 G-I] for female. The regression equations of present study can be used upon the South Indian population with reasonable degree of accuracy.

Conflict of Interest – Nil

Source of Funding – Nil

Ethical Clearence – Obtained.

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Study of Fingerprint Patterns as an Absolute Identification Tool for Human Identification

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ABSTRACT

Identification means fixation of individuality of a person. It is classified as complete (absolute) or incomplete (partial). Complete identification denotes the absolute fixation of individuality based on the unique features present at the time of examination, viz age, sex etc. The criterion for Identification has been termed as primary and secondary. The primary criteria include fingerprints, DNA, dental characters and unique medical characteristics. The secondary criterion includes features such as deformity, marks and scars, X rays, personal effects and distinctive clothing. Personal identification through fingerprints has been recognized since long time and is regarded as the greatest contribution to the law enforcement machinery. The present study deals with fingerprint and ridge count pattern amongst individuals at Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly.

Keywords: *Fingerprint Pattern, Ridge count, Identification, gender differences.*

INTRODUCTION

Identification means fixation of individuality of a person. It is classified as complete (absolute) or incomplete (partial). Complete identification denotes the absolute fixation of individuality based on the unique features present at the time of examination, viz age, sex etc. The most successful approach utilizes a combination of more than one method. ⁽¹⁾ Some of the following points are usually noted for the purpose of identification like sex, age, race, complexion and facial features, hair, fingerprints, footprints, deformities, tattoo marks, scars, occupational marks, handwriting, clothes, personal articles, speech, voice, gait, mental power, memory, education and DNA profile etc. The criterion for Identification has been termed as primary and secondary. The primary criteria include fingerprints, DNA, dental characters and unique

medical characteristics. The secondary criterion includes features such as deformity, marks and scars, X rays, personal effects and distinctive clothing ⁽²⁾.

The word “Dermatoglyphics” is originated from two Greek words “Dermato” means skin and “Glyphic” meaning carving. The term “dermatoglyphics” was proposed by Harold Cummins in the year 1926.

In ancient India, ridge pattern study was known as “Samudra Shastra”. The epidermal ridge patterns were classified into “Chakra, Shankya and Padma” which corresponds with the Whorl, Loop and Arch system of modern classification. ⁽³⁾

Personal identification through fingerprints has been recognized since long time and is regarded as the greatest contribution to the law enforcement machinery. Through its unique characteristics, the science of fingerprint analysis provides a special service in the administration of justice and also in other areas where positive identification is of paramount importance. ⁽⁴⁾

The skin covering the anterior surface of human hand and plantar surface of the human foot is different in the texture and appearance than the one which covers

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the rest of the human body. This skin on the palmar and planter surface is continuously wrinkled with narrow minute ridges known as friction ridges. A finger print is an impression of the friction ridges on all parts of the exposed palmar surface of the hand.

Fingerprints have been extensively investigated from many points of view. Many detailed studies on their embryogenesis exist, numerous papers have been written on the inheritance of certain fingerprint features and they have been statistically linked to all kinds of common human features (gender) and some more obscure ones (sexual orientation, high blood pressure).

In view of this present study i.e. the fingerprint classification and the fingerprint ridge count for determination of identity, it will be still more helpful to ascertain the identity of the offender, whether it is a criminal or a civil case. This study would throw some light to restrict the field of searching and narrow the line of investigation. ⁽⁵⁾

AIMS AND OBJECTIVES

The present study was conducted with the following aims and objectives.

1. To determine the predominant fingerprint patterns in the persons residing in SHRI RAM MURTI SMARAK INSTITUTE OF MEDICAL SCIENCES campus, medical students, interns, staff of the institution and their families in SRMS-IMS.
2. To determine any pattern co relation with gender.
3. To determine the possibility of gender distribution in ridge count.

MATERIAL AND METHOD

The proposed study was conducted at department of Forensic Medicine and Toxicology SHRI RAM MURTI SMARAK INSTITUTE OF MEDICAL SCIENCES, Bhojipura, Bareilly for the period of one year (2014-15). The study was a prospective study with informed, voluntary participation.

The study material consisted of persons residing in the SHRI RAM MURTI SMARAK INSTITUTE OF MEDICAL SCIENCES campus, medical students, interns, staff of the institution and their families. The sample size was 500.

Subjects outside SHRI RAM MURTI SMARAK INSTITUTE OF MEDICAL SCIENCES were not included in the study. Subjects in which there was any evidence injury or disease (leprosy, burns, laceration, amputation, surgical scar) leading to change in fingerprint patterns were excluded from study. Informed written consent was obtained prior to taking the fingerprints with proper procedure explained to the subjects. Individuals who revoke/refuse consent at any stage of the study were deemed excluded from the study.

The permission from institutional ethics committee was taken prior to start of the study.

The methodology involved using the Glass slab Inking Roller method For collection of fingerprints. The upper portion of the radial side of the central core region of the prints was chosen as the area for analysis as described by Acree ⁽⁶⁾ because all finger print pattern types show a similar ridge flow in this region. This method serves to isolate ridges within a well defined area, facilitating the process of ridge counting. A 5mm X 5mm area was drawn on a transparent film and placed on the finger print samples in the chosen area. The epidermal ridges from one corner of the square to the diagonally opposite corner were counted. Dots were not counted. Forks were counted as two ridges excluding the handle and a lake was counted as two ridges. This value represented the number of ridges in 25 mm² area and reflected the ridge density value. Results and observations were recorded in proforma and were expressed in tabular, graphical and other usual forms used in scientific presentations, which included parameters such as numerical values of loops, whorls, arches and composites per finger per hand per subject as calculated in an area of 25 mm² ridge densities as calculated in the patterns of the subjects and relationship of ridge densities to gender as recorded in proforma for data collection.

Statistical analysis was done using "R" statistical analysis software, appropriate to the nature of the results and observations, in conjunction with a statistician. The statistical values and terms to be calculated included mean, standard deviation, ridge density analysis and application of Chi-Square test for data analysis.

RESULTS

The male and females in the study showed a

preponderance in loops in all fingers as assessed except in the case of female thumb where arches showed a predominance. The fingerprint pattern showed a distribution as follows. Loops were predominant followed by whorls, arches and composites being the least observed pattern. The frequency percentage of the patterns was 64.4 % loops, 27.39 % whorls, 7.3 %

arches and finally 0.91 % composites in the observed sample set.

The ridge density for both hands in males showed a minimum value of 9 and a maximum value of 14. The mean, standard deviation values for ridge densities in males is as tabulated below.

Table 1: Fingerprint Pattern in Males

	Finger	Index	Middle	Ring	Little	Thumb
LEFT HAND	Mean	11.08	11.07	11.02	10.94	11.01
	SD	1.1584	1.155	1.1787	1.1441	1.2302
RIGHT HAND	Mean	11.14	11.08	10.92	11.09	11.10
	SD	1.2741	1.2065	1.1122	1.1967	1.1951

The ridge count description of both hands for males showed a mean range of 10.92 to 11.14. The ridge index varied from a minimum of 9 to a maximum of 14 in males in both hands. The standard deviation varied from 1.1122 to 1.2741.

Table 2: Fingerprint pattern in Females

	Finger	Index	Middle	Ring	Little	Thumb
LEFT HAND	Mean	13.836	13.861	13.843	13.851	13.847
	SD	0.9682	0.9591	0.9657	0.9631	0.9607
RIGHT HAND	Mean	13.78	13.77	13.77	13.78	13.76
	SD	1.1024	0.655	0.664	0.655	0.666

The ridge count description of both hands for females showed a mean range of 13.76 to 13.86. The ridge index varied from a minimum of 12 to a maximum of 15 in males in both hands. The standard deviation varied from 0.9607 to 1.1197.

The ridge densities of the fingers were subjected to student t test for testing and validation of results.

The test showed a p value less than 0.0001, at a confidence interval of 95% with the degree of freedom as 498. This denotes that the differences observed in ridge densities between the two genders show statistically significant values.

This leads us to conclude that there indeed exists a significant difference in observed ridge densities among males and females in Shri Ram Murti Smarak Institute of Medical Sciences.

In terms of percentages, we found that the ridge count above 14 was higher in both the hands of females, having a percentage of 70.61 % among the left hand and 70.25 % in the right hand.

Thus from both the hands the predominant ridge density was found to be above 14.

In terms of percentages, we found that the ridge count above 9 and below 13 was higher in both the hands of males.

The left hand was found to have a percentage of 80.83 %. While the right hand was found to have a percentage of 80 %.

Based on the above findings we concluded that the mean ridge density of above 14 was more likely to be female, whereas the mean ridge density of below 13 was found to occur commonly in males.

DISCUSSION

In present study the loop was the most frequently observed pattern followed by whorl, in the total subject population in all ten digits.

The least frequently observed pattern in the total population were Composites followed by arches both in Male and Female.

K.S.Narayan Reddy has mentioned that the overall incidence of the four major types of fingerprints i.e. loops, whorls, arches and composites constitute about 60-70%, 25-35%, 6-7% and 0-2% respectively ⁽⁷⁾. This detail was in concurrence with our study.

Gangadhar.M.R, Rajashekara, Reddy. K (1983) has studied finger dermatoglyphics of male and female Adikarnatakas, a scheduled caste population of Mysore city of Karnataka state. The analysis includes both qualitative and quantitative characters. Of basic finger patterns type loops (57.11%) were common followed by whorls (27.89%) and arches (15.00%) in the general population. We also found that loops were predominant in the study population with an incidence of around 64%, followed by whorls and arches ⁽⁸⁾.

Purkait R, (2003) observed in his comparative study on frequency of fingerprint patterns and variation in the ten digit classification on males (454 samples-227 from each tribe) of Mundas and Lodhas, a tribal group of Midnapur district in West Bengal where Mundas exhibit higher frequency of whorl and loop patterns while loops are more frequent among Lodhas ⁽⁹⁾. Our study found no such whorl predominance but did exhibit similarity in terms of loop predominance in individuals.

Nithin V (2009) reported in his study on 250 males and 250 females of south Indian population most frequent fingerprint pattern as ulnar loop in the total Population as well as in the sex wise distribution.⁽¹⁰⁾

This is almost consistent with our study that details that loops were the most frequently observed pattern.

After reviewing our observation and other studies results it is felt that Uniqueness of fingerprint for an individual exists. The predominant pattern that we have found to exist in our population sample is loops. It is also found after reviewing our observations and reviewing literatures that there exists a difference in dominant patterns in some groups which needs further

investigation.

The statistical analysis of fingerprint pattern done by chi square test revealed that there was a value of 3.83, at a degree of freedom of 3 and a p value of 0.2803 which shows there is no statistically significant difference in percentages of pattern of fingerprints, in terms of gender.

Ridge Count / Density

The mean ridge count as estimated from our sample was 11.02 for males and 13.77 for females.

Reddy (1975) reported the mean ridge count for males as 13.41 and that of female as 12.04.⁽¹¹⁾

In comparison with this study our findings differ for Males and Females. Our sample size shows a reverse trend in terms of ridge density. The density as observed in males is lower than that of females.

A study was done on males and females of American Negroes and Caucasian Americans by Plato et al (1975). He found the mean ridge count in Male is more than female.⁽¹²⁾

In the present study we found that the mean ridge count being less in Males than in Females.

Dr. sudesh Gungadin (2007) showed that a mean ridge count of 13 ridges is more likely to be males and 14 ridges is likely to be females. This finding is concurrent with our study.⁽¹³⁾

These differences are statistically significant between the sexes in the distal region of the fingers, but not in the proximal region. Furthermore, differences in ridge densities between fingers have been shown, with the thumb and index fingers exhibiting lower ridge density than the other three fingers (middle, ring, and little). These findings can be applied in the field of forensic science in order to improve gender identification with fingerprints.

While our study showed significant differences in terms of ridge density among both the sexes, we encountered uniformity in the ridge count as compared to the above author who noted differences in between proximal and distal ridge densities. This finding is not concurrent with our study.

Though we found similar predominance and

rarity of fingerprint pattern in our population group, we disagree with the above author as there was no intermarriage among the study population sub group in our case.

Vinod C.Nayak (2010) reported that significant gender differences occur in the finger ridge count of 12 ridges more likely to be of males and more than 13 ridges is more likely to be of female origin in Chinese subjects. In Malaysian male 11 ridges or less and in female more than 13 ridges is observed. ⁽¹⁴⁾

However in our study we found that the mean ridge densities were lower in males than in females.

In our study, the lowest mean ridge density in males, in the right hand was found in the ring finger, while in the left hand the lowest mean ridge density was found in the little finger.

The lowest mean ridge density in females, for the right hand was found in the thumb, while for the left hand was found in the index finger.

The statistical analysis also revealed that a significant difference exists between the ridge densities among males and females and which should be further studied to be accepted as a parameter for identification.

CONCLUSION

The uniqueness of fingerprint pattern for an individual noticed in the present study. The most frequent fingerprint patterns among total population studied in Shri Ram Murthi Smarak Institute of Medical Sciences is as follows:

- The highest frequency of fingerprint patterns in Males is loops and Whorl. The least fingerprint pattern seen in Males is composite followed by arches.
- The predominant fingerprint pattern seen in Females is loops followed Whorl and arches. The least fingerprint pattern seen in Females is composite.
- There was no significant sexual dimorphism evident in pattern of fingerprint pattern between males and females.

In Males highest mean ridge count is noticed for right index finger (11.14) followed by right little finger (11.09). The least mean ridge count is noticed for left little finger (10.92).

In Females highest mean ridge count is noticed for left middle finger (13.86) followed by left index (13.85). The least mean ridge count is noticed for right thumb finger (13.76).

In general in the present study mean ridge count in Male are 11.02 and in Female are 13.77.

Conflict of Interest: Nil

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Role of Sacral Index & Corporobasal Index in Determining Sex of Adult Human Sacrum

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ABSTRACT

Establishing the identity of paramount importance in any investigation. Determination of sex of an unknown individual is one of the critical questions addressed when human skeletal remains are found both in forensic investigation and archeological studies. Therefore the study of sexual dimorphism of bones in human population is of paramount importance. Sacrum shows characteristic sexual differences which have obstetric, forensic and anthropologic application. In the present study, 200 sacra of known sex from Hyderabad Karnataka region were studied. Various parameters and indices were calculated & tabulated.

Observations: The mean of the Ventral Straight length in male is 107.3 mm in females is 93.4mm. The mean of sacral index in males is 95.2mm and in females are 107.68mm. The mean of the Corporobasal Index in male is 40.57mm and in females is 37.93mm.

Conclusion; The statistical significance was very high in sacral index and the most useful index in sexing of the female sacra. Statistically values for ventral straight length of sacrum and transverse diameter of body of first sacral vertebra were found to be significant.

Keywords; Sacral index, Corporobasal index, Identification, sexual dimorphism.

INTRODUCTION

Identification is necessary in living person as well as dead. Determination of sex from the skeletal remains is of tremendous medicolegal importance for establishing the identity of an individual to the forensic experts, anatomists and anthropologist.¹

Determination of sex of an unknown individual is one of the critical questions addressed when human skeletal remains are found both in forensic investigation and archeological studies. Therefore the study of sexual dimorphism of bones in human population is of great

importance to the forensic experts, anthropologists and anatomist.²

Most of the earlier studies were centered on morphological traits in descriptive manner, later on sexual differences were studied metrically and morphologically by applying the statistical comparative univariate and multivariate discriminate functional analysis to the data obtained.

It is established that almost all elements of human skeleton, show some degrees of sexual dimorphism, but Sacrum shows characteristic sexual differences which have obstetric, forensic and anthropologic application. It has applied importance in determining sex with the help of measurements carried upon it.³ Present study is an attempt to establish some of the parameters which will be of great help in sex determination both in medico-legal and anthropometric study. In the present study, 200 sacra of known sex were studied. Various parameters and indices were calculated. Observations

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were tabulated and compared with the results of previous workers.

MATERIALS AND METHOD

200 sacra of known sex (100 males & 100 females) used in this work are collected from Department of Forensic medicine & Toxicology, Department of Anatomy of Mahadevappa Rampure Medical College, Gulbarga & K.B.N. Institute of Medical Sciences, Gulbarga.

All the sacra were dry, free of damage or deformities. Sacra that are not ossified are excluded. Following instruments were used for the measurements of various parameters of Sacrum

- Sliding vernier Caliper.
- Marker Pen.

All measurements were taken personally and sufficient care was taken to avoid manual errors.

From each Sacrum following parameters were noted and indices calculated in the manner described below.

1. Ventral straight length (maximum length):

With the help of sliding vernier calipers Ventral straight length is measured from middle of antero-superior margin of sacral promontory to middle of antero-inferior margin of the last sacral vertebra.

2. Maximum sacral width:

With the help of sliding vernier calipers sacral width is measured by taking two points at the upper part of auricular surface anteriorly (or lateral most part of alae of sacrum).

3. Transverse diameter of 1st sacral vertebra:

With the help of sliding vernier calipers, maximum transverse diameter is measured by taking one point on each side of the lateral most point on the superior surface of body of 1st sacral vertebra.

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

1. Sacral index: $\frac{\text{Width of sacrum}}{\text{Straight Length of sacrum}} \times 100$
2. Corporobasal Index $\frac{\text{Transverse diameter of body of 1st sacral vertebra}}{\text{Breadth of sacrum}} \times 100$

Demarking point is the low or high values from the calculated range, which is derived by using the formula Mean±3SD, developed by Jit and Singh ⁴ (1966) and the

percentages of the bones thus identified were found out in relation to each parameter.

Identification point is a limiting point of actual range of every measurable parameter in male and female.

OBSERVATIONS

The observations are based on study of 200 of known sex (100 male & 100 female), dried completely ossified sacra. For each sacrum, metrical data are calculated using the formulae and the following details, Range, Mean, Standard Deviation(SD), Statistical significance, Identification point, Calculated range (mean±3SD), Demarking point, percentage of bones beyond demarking point and percentage of identified bones are obtained. ‘t’ value was applied for each parameter and significance was calculated.

The following tables show the recordings of these detailed measurements.

Table-1: Mid Ventral straight Length

Measurements	Male	Female
No of Bones 200	100	100
Length (mm)		
71-80	00	06
81-90	02	37
91-100	19	34
101-110	47	21
111-121	20	02
121-131	12	00
Total	100	100
Range	90-128	76-120
Mean	107.3	93.4
Standard Deviation (S.D)	9.0	8.9
Statistical significance	Highly significant	Highly significant
Identification point	>12.0	<9
Calculated range	80.4-134.2	66.6-120.2
Demarking point	>120.2	<80.4
Percentage beyond DP	11	6
% of bones identified	11	34
Statistically highly significant, ‘t’ value = 10.98, P<0.001, Significant at 1% level		

Table 2 - Maximum breadth of sacrum

Measurements	Male	Female
No of Bones	100	100
Width (mm)		
81-90	06	08
91-100	44	45
101-110	40	41
111-120	10	06
Range	85-115	84.0-117
Mean	101.6	99.9
Standard Deviation(S.D)	6.5	6.8
Statistical significance	Non Significant	Non Significant
Identification point	>117	<85
Calculated range	82.2-121.0	79.6-120.3
Demarking point	>120.3	<82.2
Percentage beyond DP	0	0
% of bones identified	0	1
Statistically non significant, 't' value = 0.15, P>0.05, Non significant at 5% level		

Table 3 - Transverse diameter of body of s1

Measurements	Male	Female
No of Bones	100	100
Length (mm)		
26-30	00	06
31-35	11	24
36-40	23	50
41-45	59	14
46-50	04	05
51-55	03	01
Total	100	100
Range	33.0-52.0	27.0-51.0
Mean	41.2	37.8

Standard Deviation(S.D)	4.0	4.4
Statistical significance	Highly Significant	Highly Significant
Identification point	>5.10	<3.30
Calculated range	2.92-5.31	2.45-5.10
Demarking point	>51.0	<29.2
Percentage beyond DP	1	1
% of bones identified	1	8
Statistically highly significant, 't' value = 5.72, P<0.001, Significant at 1% level		

Table 4 – SACRAL index

Measurements	Male	Female
No of Bones	100	100
Index		
70.01-80.00	08	00
80.01-90.00	20	01
90.01-100.00	43	17
100.01-110.00	27	50
110.01-120.00	02	20
120.01-130.00	00	10
130.01-140.00	00	02
Range	77.27-112.75	83.33-135.53
Mean	95.21	107.68
Standard Deviation(S.D)	8.43	9.86
Statistical significance	Highly Significant	Highly Significant
Identification point	<83.33	>112.75
Calculated range	69.91-120.51	78.11-137.24
Demarking point	<78.11	>120.51
Percentage beyond DP	1	26
% of bones identified	12	9
Statistically highly significant, 't' value = 9.6, P<0.001, Significant at 1% level		

Table 5 – Corporobasal index

Measurements	Male	Female
Total no of Bones 200	100	100
Index		
20.01-30.00	00	05
30.01-40.00	44	70
40.01-50.00	54	25
50.01-60.00	02	00
Range	33.64-51.02	26.32-50.00
Mean	40.57	37.93
Standard Deviation(S.D)	3.68	4.71
Statistical significance	Highly Significant	Highly Significant
Identification point	>50.00	<33.64
Calculated range	29.53-51.61	23.79-52.06
Demarking point	>52.06	<29.53
Percentage beyond DP	0	4
% of bones identified	2	17
Statistically highly significant, 't' value = 4.42, P<0.001, Significant at 1% level		

DISCUSSION

Though the primary function of pelvis is locomotor and withstanding the compressive and other stress due to weight, it has also other characteristics, particularly in respect to sexual differences, which are of obstetric, forensic and anthropological applications. In the discussion of sexual dimorphism of human sacra, the merits and demerits of each measurements, mean value for male and female, statistical significance were compared with other studies.

Accordingly, in the sexual dimorphism of human bones, Davivongs has stated that “as a general rule, the male bones are more massive and heavier than female bones. The crests, ridges, tuberosities and lines

of muscle and ligament attachments are more strongly marked in males. This rule also governs the size of joint and articular surfaces as well. ⁵

Krogman, W.M. (1949) ranked accuracy of sex determination using the pelvis at 95% followed by the skull at 92%. The mandible alone at 90% and the long bone measures at 80% accuracy ⁶.

Vertical straight length

In this study the mean of the Ventral Straight length in male is 107.3 mm ranging between 90- 128 mm & in females is 93.4mm ranging between 76-120 mm. Identification point for males is >120mm and for females <90mm. The Demarking point for males and females were >120.2mm & <80.4mm respectively and the percentage of sacra identified by demarking point alone is 11% and 6% respectively. The percentages of bones identified by identification point were 11% and 34% respectively. ‘t’ test was highly significant with P<001.

Width of sacrum

The mean of the Sacral Width in male is 101.6 mm ranging between 85 to 115 mm & in females is 99.9mm ranging between 84-117 mm. Identification point for males is >117 and for females <85mm. The Demarking point for males and females were >120.3 & <82.2 respectively and the percentage of sacra identified by demarking point alone is 0% and 0% respectively. The percentage of bones identified by identification point was 0% and 1% respectively. ‘t’ test was non significant with P>0.05.

Transverse diameter of S1

The mean of the Transverse diameter of S₁ in male is 41.2 mm ranging between 33 to 52 mm & in females is 37.8 mm ranging between 27-51 mm. Identification point for males is >51mm and for females <33mm. The Demarking point for males and females were >51mm & <29.2mm respectively and the percentage of sacra identified by demarking point alone is 1% and 1% respectively. The percentages of bones identified by identification point were 1% and 8% respectively. ‘t’ test was highly significant with P<001.

Sacral index:

The mean of sacral index in males is 95.21 and in

females are 107.68. The mean range for male bones is 77.27 -112.75mm and for female bones is 83.33 -135.53mm. Sacra with index more than 112.75mm are definitely female and below 83.33mm are male. The males and females which fall beyond Demarking point are 1% and 26% respectively. The percentages of the bones identified are 12% and 9%. The sex difference between in mean values of width of sacrum is statistically **highly significant**. The mean of sacral

index measurements of males and females agree nearly with the study results by Badge ⁷ (94.75 & 112.05), Mishra et al ⁸ (98.21 & 117), Patel et al ⁹ (96.25 & 113.25), Anterpreet Kaur ¹⁰ (93.68 & 125.35), Shibani et al (94.9 & 109.8) ¹¹, D Ravichandran et al ¹² (97.8 & 90.6) respectively. Other studies including Janipati et al ¹³ (104.78 & 115.72) and Patil et al ¹⁴ (114.94 & 126.2) documented higher values for mean of sacral index in males.

Table -6: Showing comparison of Sacral index with other studies.

Investigator	Male				Female				P-value Statistical Significance
	Sample size	Mean	Range	S.D	Sample size	Mean	Range	S.D	
Davivongs (1963)	50	104.16	86.9-123.2	8.93	50	115.49	96.2-140	10.39	<0.001 H S
Raju et al ¹⁷ (1980)	33	100.85	74.72-126.9	8.71	11	111.39	88.38-134.4	7.67	<0.001 H S
Badge (1981)	65	94.75	80.20-114	7.15	30	112.05	90.8-133.3	10.9	<0.001 H S
Mishra et al (2003)	74	98.21	90-108	4.89	42	117	103-131.25	7.00	<0.001 H S
Patel et al (2005)	32	96.25	90.5-106	4.6	32	113.25	104.8-131	5.74	<0.001 H S
Anterpreet kaur et al (2010)	20	93.68	58.9-128.3	11.57	20	125.35	90.94-159.76	11.47	<0.0001 H S
Shailaja et al ¹⁸ (2012)	190	94.24	53.57-152	11.78	64	113.19	91.89-146.15	10.26	<0.001 H S
Kanika et al (2011)	40	100.24	78.04-149.56	12.54	10	111.74	88.79-140.48	14.6	0.001 H S
Jyothinath et al (2012)	--	104	81-136	16.50	--	115.72	85-146	13.64	0.0004 H S
Shibani et al (2012)	127	94.9	80.5-109.3	4.8	123	109.8	87.9-131.7	7.3	<0.0001 H S
Present study	100	95.21	77.27-112.75	8.43	100	107.68	83.33-135.53	9.86	<0.001 H S

Corporobasal Index

The mean of the Corporobasal Index in male is 40.57mm ranging between 33.64 to 51.02mm & in females is 37.93mm ranging between 26.32-50mm. Identification point for males is >50.00 and for females <33.64. The Demarking point for males and females were >52.06 & <29.53 respectively and the percentage of sacra identified by demarking point alone is 0%

and 4% respectively. Percentage of bones identified by identification point were 2% and 17% respectively. 't' test was highly significant with P<0.001. Mean of corporobasal index for male sacrum & female sacrum documented by other studies include Mishra et al ⁸ (46.54 & 40.47), Kanika et al ¹⁴ (43.2 & 43.84), Jyothinath et al ¹⁵ (44.15 & 44.0) and Shibani et al ¹⁶ (43.80 & 41.70) .

Table -7: Showing comparison of Corporobasal index with other studies

Authors	Male				Female				P-value Statistical Significance
	Sample size	Mean	Range	S.D	Sample size	Mean	Range	S.D	
Davivongs (1963)	50	47.42			50	43.62			
Raju et al ¹⁷ (1980)	33	44.94			11	40.96			
Mishra et al (2003)	74	46.54	40-53.06	3.17	42	40.47	33.20-46.90	3.26	<0.001 H S
Kanika et al (2011)	40	43.22	32.87-54.81	4.28	10	43.84	32.77-52.38	5.44	0.598 N S
Jyothinath et al (2012)	--	44.15	37-55	5.31	--	44.00	30-58	7.41	<0.919 N S
Shibani et al (2012)	127	43.80	16.5-71.1	9.1	123	41.7	31.8-51.6	3.3	<0.02 Sig.
Present study	100	40.57	33.64-51.02	3.68	100	37.96	26.32-50.00	4.71	<0.001 H S

SUMMARY AND CONCLUSIONS

Sexual differentiation is studied on 200 sacra of known sex (100 male & female) from Hyderabad-Karnataka region. Three parameters were measured and two indices are calculated. They are subjected to statistical tests; standard deviation and statistical significance were calculated.

After a detailed study and comparison of the present study with other studies, it can be concluded that:

1. Identification point and demarking point help in sexing of the sacrum with certainty.
2. The mean difference between male and female bones for sacral index was high.
3. The statistical significance was very high in sacral index and the most useful index in sexing of the female sacra.
4. However, using a single parameter could not identify sex of sacrum. Hence it is concluded that for determination of sex of sacrum, maximum number of parameters should be used to attain 100% accuracy. In determining sex, continuance of such studies over a defined geographic area helps in establishing the anthropometric standards & contribute in observing changing trends in measurements which are influenced

by environmental, socioeconomic factors, physical stress and genetic factors.

Conflict of Interest: Nil

Ethical Clearance: Taken from ethical clearance committee, MRMCG, Gulbarga

Source of Funding : Self

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Awareness of Consumer Protection Act and Medical Indemnity Insurance among the Medical Practitioners in a Tertiary Care Hospital

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ABSTRACT

Introduction: Medicine is increasingly being commercialized and the patients expect the doctors to be answerable to them. So doctors are covered by various laws to protect the consumers. One such act is the consumer protection act (COPRA) 1986. This act cautions not only the consumers to be aware of negligence but also requires the doctors to act ethically^[3]. With increasing cases filed against the doctors, the compensation is a huge burden. This is taken care by medical indemnity insurance.

Materials and Method: This is a descriptive study done on a sample size of 185. It is an institutional study done in a tertiary care hospital (saveetha medical college). Doctors with MBBS degree and post graduate degree are included but the CRRIs are not included.

Result: Many doctors involved, knew the existence of consumer protection act through professional meetings. Only a handful of doctors knew about the details of consumer protection act, which increases the necessity to impart knowledge about COPRA to the doctors. Only few did't know the existence of medical indemnity insurance, while majority of the doctors got the information through professional meetings. Many doctors thought the medical indemnity insurance was a inevitable necessity for the times to come but many had not enrolled themselves.

Conclusion: This study is concluded highlighting the fact that COPRA act and medical indemnity insurance are yet to be completely accepted though they have slowly managed to creep into mere recognition of the practitioner.

Keywords: awareness among the medical practitioners, medical indemnity insurance, COPRA act, consumer protection act.

INTRODUCTION

Medicine, from ancient times is considered a very important part of one's life. Over time, as medicine advanced, it became lifesaving. From the time of Hippocrates, "Father of western medicine"^[1], to today, medicine has kept changing. But the most dramatic change is, in the mindset of the patients. Earlier the doctor was looked upon as a saviour but now, due to increasing negligence it is looked upon with an expectation that there would almost always be something wrong^[2].

Medicine is increasingly being commercialized and the patients expect the doctors to be answerable to them.

So doctors are covered by the consumer protection act (COPRA) 1986. This act cautions not only the consumers to be aware of negligence but also requires the doctors to act ethically^[3].

With increasing cases filed against the doctors, the compensation is a huge burden which is taken care by medical indemnity insurance. Therefore, it is important to have knowledge about it.

This study is done with a view that some knowledge about COPRA and indemnity insurance might be welcome among the medical professionals. This study is also the first to concentrate on both medical indemnity insurance and consumer protection act.

Since there is no sufficient data on the level of awareness of the consumer protection act and medical indemnity insurance in the state of Tamil Nadu, this study is proposed.

This study has the objective of assessing the awareness of consumer protection act and medical indemnity insurance among the medical practitioners in a tertiary care hospital.

MATERIALS AND METHOD

It is a Descriptive study, which is concerned only with the level of awareness of the subjects involved, regarding the consumer protection act and medical indemnity insurance. This study is done on 185 Medical practitioners in a tertiary care hospital (Saveetha medical college and hospital). The doctors were included in Proportion to population then by random sampling technique. Doctors with an MBBS degree including post graduate students who give consent, were included in this study. Medical students, CRRIs, Doctors and post graduates who do not give consent were not included.

RESULTS

KNOWLEDGE OF EXISTENCE OF COPRA ACT

In the study conducted, it was found that many knew the existence of COPRA act (94.1%) and only a few did not know about the COPRA act.

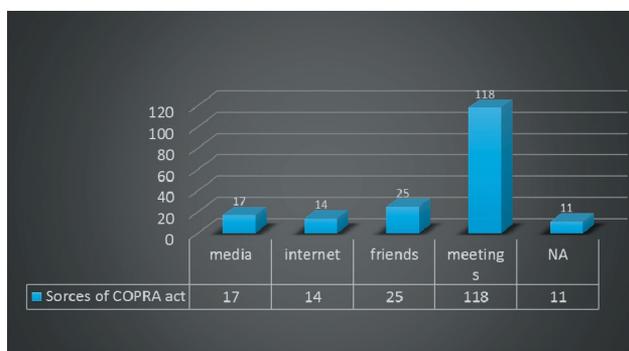


Figure 1: SOURCES OF COPRA ACT

The major source being professional meetings contributing a majority of 118, which is 63.8 % and the remaining contributed by friends or peer, media and internet, in the mentioned order (figure 1).

POSSESSION OF A COPY OF COPRA ACT

None of the doctors under survey had a copy of the COPRA act in possession with them.

Table 1: APPLICABILITY OF COPRA ACT

	Frequency	Percent
All doctors	165	89.2
Doctors of govt. sector	4	2.2
Doctors of private sector	5	2.7
Not applicable	11	5.9
Total	185	100.0

165 out of 185 doctors who took part in this study answered, all doctors are involved under the COPRA act. Only 5 out of 185 doctors, got the right answer which is, only doctors working for or in a private sector (Table 1).

TIME PERIOD WITHIN WHICH THE PATIENT CAN SUE

Many doctors did not know the time period within which the patient could sue them. Only 20 doctors answered correctly, which is 2 years.

Table 2: TIME PERIOD WITHIN WHICH THE DOCTOR SENDS HIS VERSION

	Frequency	Percent
2 weeks	25	13.5
1 month	26	14.1
2 months	60	32.4
No limit	63	34.1
Not applicable	11	5.9
Total	185	100.0

The doctor should send his version of the case within 30days from the date of complaint being filed. 26 doctors answered right. Majority thought there was no time limit (Table 2).

CAN THE DOCTOR BE SUED FOR REFUSING AN EMERGENCY CASE

53% of the doctors did not know that they can be sued if they refused to treat an emergency case.

Table 3: IN CASE OF MINOR, WHO CAN SUE THE DOCTOR

	Frequency	Percent
Parents	97	52.4
Guardian	63	34.1
Teacher	2	1.1
All the above	12	6.5
Don't know	0	0
Not applicable	11	5.9
Total	185	100.0

In case of a minor being treated, the parents, the teacher, or the guardian can sue the doctor, based on who was in-charge of the minor at that point of time (Table 3).

MAXIMUM PENALTY FROM THE NATIONAL FORUM

Majority of the doctors did not know the maximum amount that can be claimed from a national forum and not one of the 185 doctors chose the right option (>1 crore).

MAXIMUM PENALTY FROM THE DISTRICT FORUM

133 doctors did not know the maximum amount that can be claimed from a district forum out of the 185 doctors in the study. 32 doctors answered right (20 lakhs).

KNOWLEDGE OF THE EXISTENCE OF MEDICAL INDEMNITY INSURANCE

175 doctors out of 185 knew the existence of medical indemnity insurance. Only 10 doctors were not aware of it.

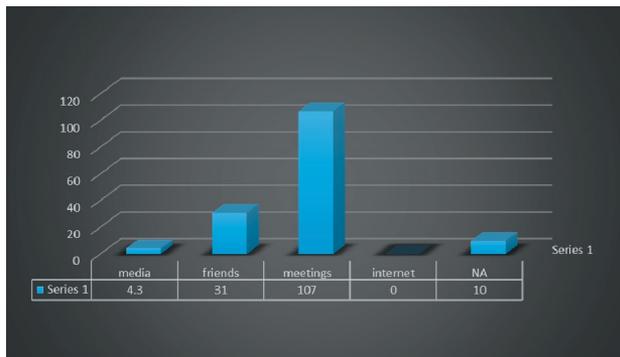


Figure 2: SOURCE OF MEDICAL INDEMNITY INSURANCE

Professional meetings were the major source of information regarding the medical indemnity insurance followed by media (figure 2).

WHAT IS MEDICAL INDEMNITY INSURANCE

All the doctors who were aware of the medical indemnity insurance knew that it was an insurance safeguarding the doctor in negligence cases.

Table 4: MEDICAL INDEMNITY INSURANCE, NECESSITY FOR A DOCTOR

	Frequency	Percent
Yes	175	94.6
No	0	0
Not applicable	10	5.4
Total	185	100.0

Table 5: ENROLLED IN MEDICAL INDEMNITY INSURANCE

	Frequency	Percent
Yes	15	8.1
No	160	86.5
Not applicable	10	5.4
Total	185	100.0

175 out of 185 doctors who knew about medical indemnity insurance, thought it was necessary for a doctor to have enrolled in a medical indemnity insurance but only 15 of them have. The rest 160 doctors have not enrolled themselves (Table 5).

DISCUSSION

Medical profession is one of the noblest professions that one can think of. It has evolved and improved to such an extent that a cure is invented to the most dreaded diseases, in not even half the time it took, a decade back. With so much new to learn and explore in the science world, there increases the responsibilities to safeguard the legacy of such a noble profession.

Consumer protection act (COPRA act)^[4] is an important law which is passed by the government of India for the safety and protection of patients. It was done with an aim that the patients get the maximum that they can avail from the doctors. Medical indemnity insurance was a step taken to control the loss caused to

the doctor in cases of negligence proved. To have a safe medical practice, it is necessary to deal with this subject in depth now and in the near future. Hence, this study.

Regarding the consumer protection act in 2014, a cross sectional observational study of sample size 44 showed the result: more than 90% of study subjects were aware of consumer protection act, but knowledge about the basic rules and regulations were lacking in a few studies^[5]. The result was that, the knowledge was poor regarding the rules.

In 2010, another cross sectional study done by questionnaire method in a sample size of 448 professionals was conducted. The result was that there was higher awareness among the medical than dental professionals and PGs were more aware in both professions, and private practitioners were more aware than academic sectors^[6]. This result was pertaining to doctors in Udaipur. The present study involving doctors in Chennai also was done using a questionnaire on a sample size of 185 and results were in accordance with the above study.

In 2013, a study was conducted by Prasad S, Menon I, Dhingra C, Anand R. It was a cross sectional study with a study sample of 348 professionals using a questionnaire consisting of 24 questions. A percentage of 84.8 (n=295) were aware and the MDS faculty were more aware^[7]. The major source of information according to the present study is professional meetings followed by media. About 94% were aware, which is a 9% increase in awareness within 2 years.

Many doctors are aware of the consumer protection act, but their knowledge about the consumer protection act is not satisfactory. Certain points to be noted are:

- Only the services provided in a private sector i.e, in exchange for money are included under COPRA act.
- The time period of 2 years is the limit for the consumer to file any complaints against the doctor.
- The doctor is given only 30days to send his version of the case after the complaint is filed.
- The doctor can be sued for refusing an emergency case and can be sued by any one like the parents, guardian, teacher, or anyone else who is in-charge of the minor, in case of treating a minor.

- The maximum penalty that can be claimed from a national forum is more than a crore and from a district forum is 20 lakhs.

In concern with the medical indemnity insurance, in 2014, a cross sectional survey on 306 dental practitioners who were selected by simple random sampling technique was done. They used the questionnaire by “GLOBAL CHILD DENTAL FUND” for professional indemnity insurance^[8] obtained from its website and modified according to the results of a pilot study. The conclusion was that most of the oral health professionals in Mumbai city do not have dental indemnity insurance. So there needs to be more awareness about the insurance^[9]. The previous study was conducted on dental professionals in Mumbai and this study is conducted on medical practitioners in Chennai, yet the result seems to be the same.

In 2014, all the necessary information on the problems that may arise during the practice of dental health service and also the knowledge regarding the various ways to take defence against law suits against them was highlighted by a study^[10].

Medical indemnity insurance is also well known among the practitioners mainly through professional meetings. Almost 95% of the doctors thought it was necessary for every doctor to have an insurance but they have not taken an initiative to enrol themselves. So the doctors must be explained the benefits of enrolling themselves, so that they are encouraged to take up the insurance. This is done through write ups in our project.

CONCLUSION

This study is concluded highlighting the fact that COPRA act and medical indemnity insurance are yet to be completely accepted though they have slowly managed to creep into mere recognition of the practitioner. This study, thus tries to bridge the gap and provide information on COPRA act and medical indemnity insurance, through the write ups given to the participants of the study.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Obtained

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Assessment of Load and Descriptive Analysis of Fatal Railway Injuries at SMS Hospital , Jaipur – An Autopsy based Study During the Year 2014-15

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ABSTRACT

Although less frequent than automobile accidents, train accidents have a major impact on victims' lives. Present Descriptive Observational study was done to assess the load and analyze the cases of fatal railway injuries at the Department of Forensic Medicine, SMS medical college and Hospital, Jaipur (Rajasthan) during period of May 2014 to November 2015.

Total 5828 medico-legal autopsies conducted and among them 126 cases were found to be railway related deaths hence the load was 2.16%. Majority of railway related deaths were accidental followed by suicidal deaths. Peak incidence of victims was in 2nd decade of age group followed by 3rd decade. Brain was the most commonly affected organ in railway fatalities.

The present study analyses the spectrum of perpetuating factors leading to railway fatalities including human errors and mechanical failures. This may help ourselves and society in formulating preventive measures that could possibly avert railway fatalities.

Keywords: Fatal, Fracture ,Injuries, Jaipur.

INTRODUCTION

In recent times there has been a spate of Railway Accidents in India, leading to loss of a significant number of human lives. [1] Although less frequent than automobile accidents, train accidents have a major impact on victims' lives.[2] Jaipur, being the capital of the state of Rajasthan is an important junction as regards to train traffic; catering to the arrival and departure of about 150 local and superfast trains. Being a metropolitan city, spread over an area of about 11,152 km square [3] the railway track crosses through inner parts city of Jaipur at various places, which range from lowly populated to highly populated regions including areas with congestion of road traffic too. Trains are a common

means of committing suicides owing to easy availability and higher chances of mortality. Apart from this, train accidents can also be used as a means of masking homicidal deaths to mimic the event as an accidental or suicidal railway death. Many of these fatalities do not raise any medico-legal questions as most of these events are witnessed, but in some cases the expertise of an autopsy surgeon is sought for a legal conclusion for the manner and nature of the injuries sustained. Cases of deaths due to railway injuries are important in respect to medico- legal investigation to find out the underlying cause and manner of death. Data pertaining to such events has never been reported in this region. This study was undertaken for assessment of load and to study the cases of railway fatalities for the pattern of injuries sustained, manner and cause of death with the evaluation of factors responsible for such events and to suggest recommendations for curbing such events.

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MATERIAL & METHOD

Study design: Descriptive Observational Study

Study setting: The study setting was the Department of Forensic Medicine and Toxicology, SMS Medical College and attached Hospitals, Jaipur in duration of May’ 2014 to November’ 2015.

Study subjects: All the cases of railway fatalities, irrespective of age, gender, socio-economic status and precipitating event autopsied at the mortuary, SMS medical college and Hospital, Jaipur were included in the study.

Inclusion criteria: All the autopsy cases of railway fatalities whose attendants gave their informed written consent.

Exclusion Criteria : All the autopsy cases of railway fatalities whose attendants did not give their informed written consent.

Study Tool: All the details pertaining to the profile of the deceased , precipitating event were noted along with the detailed recording of the external and internal findings during the post mortem examination. All the observations were recorded in the pre proposed Performa.

Data Collection: The investigator contacted the relative of the deceased and informed about the purpose of the study and obtained informed written consent from them. The questionnaire included information on age, sex, marital status, residence, occupation, education, outcome (survival / death), duration of survival after admission, and manner behind accident happened.

Analysis: Data were entered in MS excel sheet and descriptive statistical analysis was done.

OBSERVATION AND RESULTS

During the study period, a total of 5828 medico-legal autopsies were performed amongst which 126 cases were those of railway related deaths. Thus, the load of railway fatalities in Jaipur region was 2.16%.

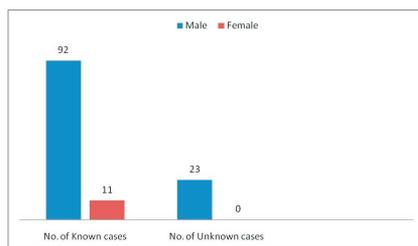


FIGURE 1: Sex Wise Distribution of Victims According to Their Identity Status n=126

All the unknown victims of railway related deaths were males. None of the females were of unknown identity status. 20% of the male victims were unknown at the time of post-mortem examination.

Majority of victims were between 21- 40 years of age. These were followed in numbers by the second and the fifth decades of life. The least affected age groups were more than fifty years of age.

The maximum numbers of railway fatalities in this study were accidental in nature (67.46%) followed by suicides (27.78%). In six cases (4.76%), the manner of the incidence remained undetermined.

Table 1 : Distribution of the Railway Fatalities According to the Duration of Survival After the Incidence n=126

Duration of Survival	No. of Cases	Percentage
Immediate	93	73.80
Within 6 hr	14	11.11
6-24 hr	08	06.35
1-3 days	01	0.79
>3 days	10	07.94
Total	126	100

Maximum victims (about 74%) died on the spot followed by death within 6 hours after the incidence. 06% victims survived a day and about 08% survived for 10 days.

Table 2 : Distribution of the Victims of Railway Fatalities According to the Level of Transection of the Dead Body n=35

Level of Transection	No. of Cases	Percentage
Head, Neck & Face	13	37.14
Chest	02	5.72
Abdomen	07	20.00
Periphery	13	37.14
Total	35	100

Most dead bodies amongst the transected ones were either decapitated or suffered amputations of peripheral body parts.

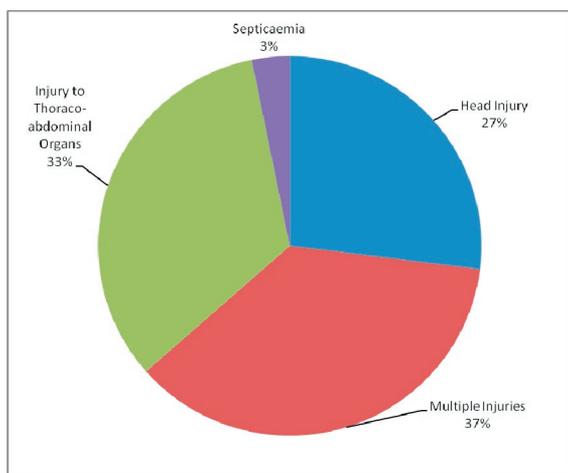


Figure 2 : Distribution of the Railway Fatalities According to the cause of Death

The victims of fatal railway related deaths mainly succumbed to multiple injuries followed by injury to thoraco-abdominal organs, head injury and septicemia.

Table 3 : Distribution of the Railway Fatalities According to the Pattern of Injuries

Region	Abrasion	Contusion	Abraded-Contusion	Crush Laceration	Fracture	Decapitation/Amputation
Head, Neck & Face	4	14	97	83	82	14
Chest	9	7	104	20	110	2
Abdomen	11	9	32	7	5	5
Periphery	39	11	44	66	118	24
Total	63	41	277	176	315	45

thoracic viscera. Liver was the third vital organ suffering fatal injuries followed by spleen and kidneys. The least affected vital organs were the intestines and the urinary bladder.

DISCUSSION

The present study was conducted over a period of 18 months from June 2014 to November 2015 to assess the load of railway related deaths. Out of the 5828 medico-legal autopsies conducted at the mortuary, 126 cases were of railway related deaths. The load of railway related deaths was 02.16% which is quite less as compared of other studies conducted in different parts of the country as 6.7% [Kumar A Varanasi 2014]⁴, 25.79% [Sheikh MI et al Surat 2008]⁵, 5.99% [Wasnik RN Nagpur 2010]⁶. The results of our study are similar to [Das G et al Silchar 2014]⁷ (1.96%). These differences

Most common type of injury seen was fracture which involved upper and lower limbs followed by abraded contusions and crush lacerations.

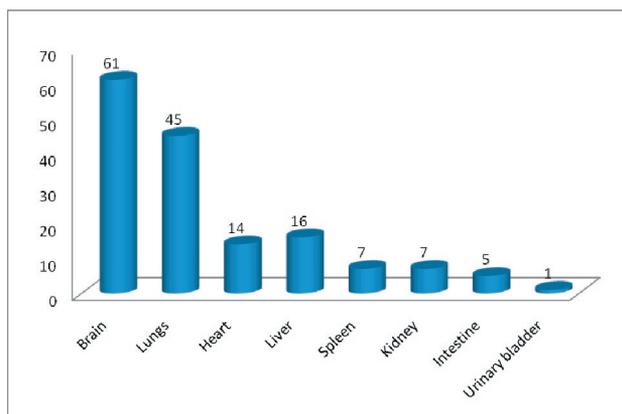


Figure 3: Distribution of the Railway Fatalities According to Organ Affected

Brain was the majorly affected organ in railway fatalities followed by the lungs and the heart, the

in various parts of the country can be explained by the geographical variations in the population, availability of rail road facility, security and the awareness of general population of the region. Jaipur, being the capital city of the state of Rajasthan is well equipped as regards to railway facilities and safety measures.

81.75% of railway fatalities autopsied during the study period were identified and remaining 18.25% dead bodies were unidentified until the time of post-mortem examination. Data pertaining to this variable is not mentioned in the comparable literature from the adjoining parts of the country except that of 59.5% unidentified railway deaths [Sheikh MI, et al, Surat, 2008]⁵ which are quite high as compared to this study.

Maximum number of victims were in 21-40 years of age group (54.76%); the peak occurring in age group

of 21-30 years (30.16%). Similar results have been reported by other authors like that of Sheikh MI et al Surat 2008⁴, Kumar A Varanasi 2014⁴ Puttaswamy Mandya 2015⁷, Tyagi S et al Mumbai 2015.⁹ The peak has been reported in 31-40 years by other authors. [Wasnik RN Nagpur 2010⁶ and Das G et al. Silchar 2014⁷]. Males predominated the study population (91.27%) out numbering the females (8.73%) which is similar to other studies [Puttaswamy Mandya 2015⁷, Tyagi S et al Mumbai 2015⁹, Wasnik RN Nagpur 2010⁶ and Das G et al Silchar 2014⁷]. The sex ratio in this study was 10.4:1, which is quite similar to 8.62: 1 [Wasnik RN Nagpur 2010]⁶. However, the results of this study are not similar to those of Kumar A Varanasi 2014⁴ who reported a male: female ratio of 1:1.3. The reason for high incidence of railway fatalities in males reflects their high activity levels and participation in high-risk activities. It is due to greater male exposure to the railways. On the contrary, females are involved in various indoor activities mostly due to cultural background and extra precaution taken by family members to keep them safe.

Our study revealed that accidental railway fatality was the commonest manner (67.46%) followed by 27.78% suicidal deaths which are similar to Wasnik RN Nagpur 2010 (91% accidental & 8.68% suicidal deaths)⁶, Kumar A Varanasi 2014 (88% accidental & 10% suicidal)⁴ and Tyagi S et al Mumbai 2015 (90% accidental & 2% suicidal).⁹

73.8% cases in this study were spot deaths and brought to the mortuary which were high in comparison to Sheikh MI et al Surat 2008 (52%)⁵ and Tyagi S et al Mumbai 2015 (48%)⁹. Amongst 33 cases recovered alive at the site of incidence 42% died within 6 hours and 6% died within 24 hours while only 8.73% survived more than 24 hours. The results of the present study are similar to Sheikh MI et al Surat 2008.⁵

Decapitation was the commonest (about 37%) followed by transection from the chest & trunk observed in 25.7% cases. Crush amputation of extremities (upper and lower limbs) were seen in 37% cases. Multiple fractures were seen commonly in most cases with fracture ribs seen as a common occurrence due to the effect of shearing and grinding force from rotating train wheels. The study revealed that head was injured in most cases followed by upper limbs, chest, neck lower limbs & trunk. Victims had also suffered other injuries

from primary and secondary impacts.

In the present study Brain was the most commonly affected internal organ (more than 48%) followed by lungs (35.7%), liver (12.7%), heart (11%), and Spleen & kidneys (5.6% each). Our results are quite similar to those of Wasnik RN, Nagpur, 2010.

The lung occupies most of the thoracic cavity and is superficial as compared to other organs in thoracic region hence they are more prone to injuries. Majority of the injuries of the chest occurred by the crush effect of the wheels of the train. Abdominal injuries were sustained following primary and secondary impact resulting in grave injuries to abdominal viscera. These results are similar to other studies. [Wasnik RN Nagpur 2010⁶ and Sheikh MI et al Surat 2008⁵]

Most common cause of death in our study was multiple injuries (37%) which involved multiple fractures, traumatic amputations of limbs and crush injuries. It was followed by injury to vital thoraco-abdominal organs (33%) followed by head injury (27%). Our results are in accordance with studies of Sheikh MI et al Surat 2008⁵ Wasnik RN Nagpur 2010⁶ and Das G et al Silchar 2014.⁷ Our results are dissimilar to study of Tyagi S et al Mumbai 2015⁹ who reported head injury to be the commonest cause of death followed by shock and hemorrhage.

CONCLUSION AND RECOMMENDATIONS

The present study was an effort to analyze the spectrum of perpetuating factors leading to railway fatalities including human errors and mechanical failures. The main aim was to help ourselves and society in formulating preventive measures that could possibly avert railway fatalities. The result of this study enables a health care to predict the pattern of injuries and fatalities. Strict enforcement of railway safety regulations and improving emergency medical services may prevent untimely deaths and disabilities.

1. A boundary wall on both sides of the track wherever possible would be erected and existing wall be repaired.
2. Fencing should be done around the rail track and between the two railway tracks, especially within city limits to prevent suicides having easy access to it.
3. By means of posters and advertisements in

the media, people should be encouraged to use over-bridges/under bridges at railway stations instead of using shortcuts of crossing rail tracks.

4. The fact that the economically productive age-group are mostly involved, an urgent public policy response with special reference to education, engineering, environment, and emergency care.

5. Self vigilances, adherence to the rules/regulations.

6. Awareness campaigns concerning safety rules targeted at the high-risk groups.

7. The autopsy surgeon should be well versed with the pattern of injuries which is very important to help the law governing authorities to reach a definite conclusion.

Ethical Clearance: Not Required.

Source of Funding: Nil

Conflict of Interest: Nil

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Psychiatric Morbidities Amongst' Victims of Suicide in Medico-legal Autopsies

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ABSTRACT

Suicide is derived from the latin word for 'self-murder'. It is a fatal act that represents the persons' wish to die. Suicide is difficult to predict but numerous clues can be observed. The most important concept regarding suicide is that it is almost always the result of a mental illness. Almost 95% of all persons who commit suicide have a diagnosed mental disorder. In spite of the development of suicide prevention programmes, the overall rate of suicide has not changed over the past several decades. In the current study an attempt was made to understand the associated mental illness amongst the victims of suicide brought for autopsy.

Keywords: *Suicide, Mental illness, Autopsy.*

INTRODUCTION

The term suicide is derived from the latin word for 'self-murder'⁶. It is a fatal act that represents the persons wish to die². There is a range, however, between thinking about suicide and acting it out. Some victims plan it for days, weeks or even years before acting, while for others it is seemingly an impulsive act. Suicide is difficult to predict but numerous clues can be observed. The most important concept regarding suicide is that it is almost always the result of a mental illness. Usually depression and is amenable to psychological and pharmacological therapy³.

There are over 35,000 deaths per year (approximately 100/day) in the United States attributed to suicide⁸. Figure published by the Bureau of Police and Research Development (BPRD), in India for year the year 1971-78 reveal a suicide rate of 6.3-7.9 / 1,00,000 population with an increasing trend in recent past⁴. In spite of the development of suicide prevention programmes, greater recognition of depression and advances in biological treatment for depression, the overall rate of suicide has not changed over the past several decades.

Amongst 95% of all persons who commit suicide have a diagnosable mental disorder.³³³³³ Depression accounts for 80% of this figure, schizophrenia accounts for 10% dementia or delirium 5%. Among all persons with mental disorders 25% are also alcohol dependent and have a dual diagnosis.

In the current study an attempt was made to know the association of mental illness amongst the victims of suicide brought for autopsy.

OBJECTIVES OF THE STUDY

- To find out the socio-demographic profile of the victims of suicide.
- Types of mental illness amongst the suicidal victims.

MATERIALS AND METHOD

Material for the study consisted of 100 cases of suicide brought for autopsy to the department of Forensic Medicine, Gauhati Medical College, Guwahati, Assam during the period of 1st August 2004 to 31st July 2005.

The various epidemiological data i.e. age, sex, religion, occupation, were gathered from police documents including inquest report, history obtained from the investigating officer, relatives, neighbors and friends. In regards to mental illness a through history obtained from close relatives, examination of available prescriptions, diagnosis as stated to the family members by treating physicians were all gathered pertaining to the last six months before death.

OBSERVATION AND RESULT

Out of 100 randomly selected cases of suicide against a total of 285 suicidal cases autopsied during the

period of 1st August 2004-31st July 2005; 45 were male and 55 were female. This goes against the prevailing trend that suicide is predominantly a masculine trait.

Age wise, the adolescent female (30%) were more prone to suicide. In the middle age groups both male and female comprised of 5%each, which was followed by old age group 1% each. However in the school age group suicide rate was 1% in both male and female. No case was reported below 10 years.

Religion wise Hindus were 95%, Muslims 3% and Christians 1%. Highest number was reported by housewives (28%)which was followed by students (17%) service holder(15%) and cultivator(13%).

Amongst the suicide victims primary education level comprised of 18% female and 7% male. This was followed by 23% illiterates of which 13 were male and 10 female. The least vulnerable group was with postgraduate qualification (3%) out of which 2 were female and 1 male.

Most cases were from rural background of which 35 were female and 27 male. The maximum number was from lower income group, with 23 female and 19 male. A higher incidence of suicide was found in the married groups 27females and 25 males. The unmarried group comprised of 23 females and 20 males. Highest number was represented to joint family group with 41 females and 31 males.

In relation to time of commitment of suicide, large majority committed suicide during midnight and early morning with 24 females and 23 male. Twenty five percent committed suicides during evening till midnight, 15% committed suicide between early morning till noon and 13% of cases choose the afternoon hours.

In this study, 62% committed suicide by hanging, 25% by poisoning, 5%either by drowning and jumping in front of running train. 3% used burning as mode.

In regards to psychological aspect 10%of the cases gave a history of substance abuse (heroin and cannabis) and mostly alcohol.

Mental disorder comprised of 3% in males and 5% in females. 2% of males having mental disorder were diagnosed with “major depressive disorder with psychotic symptoms” and 1% was diagnosed as having “schizophrenia”. 3% of female victims were

diagnosed as major depressive disorder and 2% were given a diagnosis of schizophrenia. Interestingly a fairly good number of cases (7%) were diagnosed as chronic physical illness with depression.

Most of the depressive groups both male and female were inpatient in the last 6months in psychiatric facilities and schizophrenic group had repeated hospitalization records.

The schizophrenic group received long acting depot antipsychotic injectable form and oral antipsychotic medications. However, compliance to drug treatment is unclear in the recent study.

In the depressive groups all the victims were prescribed antidepressant medications. Most violent method of suicide like burning was used by 2% female depressed and 1%male depressed victims. Alcoholics and substance abusers choosed the method of hanging for committing suicide.

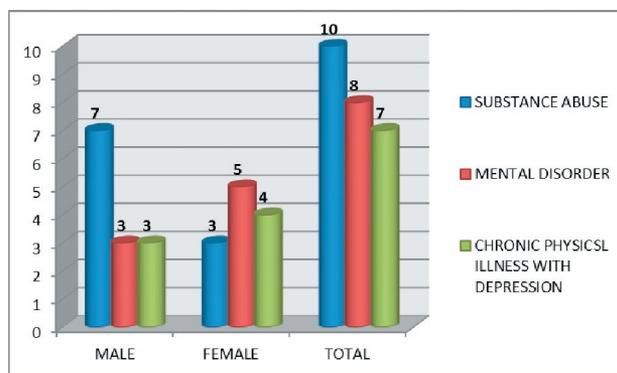


Figure 1: Diagram showing the underlying psychological causes of suicide.

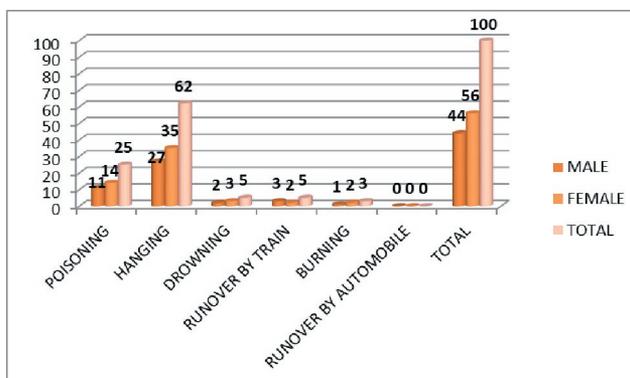


Figure 2: Diagram showing the methods adopted for committing suicide.

DISCUSSION

Psychiatric patients' risk for suicide is 3-12 times that of non-patients. The degree of risk varies, depending on age, sex, diagnosis and inpatient or outpatient status. Male and female psychiatric patients who have at some time been admitted in hospital have a five to ten times higher suicidal risk respectively, than their counterparts in general population.

Mental health condition analysis of suicide victims based on history taking, examination of connected documents including prescriptions and hospital records. Our study revealed, - 8% of the cases were suffering from major mental disorders (major depression and schizophrenia). Drug addiction and alcoholism comprised of 10% cases, seven percent suffered from chronic physical illness like diabetes, tuberculosis, vitiligo and arthritis along with comorbid depressive disorder.

Mood disorders are the ones most closely linked to suicide. Approximately 60-70% of suicide victims suffered a significant depression at the time of their death (). Satyavathi and Murthi Rao reported the existence of mental illness in 12% of cases in their series of suicide victims¹¹. Gupta in his series of 118 suicide victims, found 53.4% depressed and 5.9% having psychosis^{5,7}. The risk factors for suicide among patients with schizophrenia are young age, male gender, single marital status, previous suicidal attempt, vulnerability to depressive symptom and a recent discharge from hospital¹⁰. Epidemiological surveys have demonstrated that the vast majority of completed suicide are in patients with demonstrable psychiatric condition, where about 15-20% patients with mood disorder will commit suicide, making this disorder among the lethal of medical conditions⁹.

Upto 15% of all alcohol dependent persons commit suicide. Studies in various countries have found and increased suicide risk among those who abuse substances. The suicide rate for persons who are heroine dependent is about 20 times the rate for general population.

SUMMARY AND CONCLUSION

Suicidal behavior and suicide is a psychiatric emergency where there is disturbance in thoughts, feelings or actions and need immediate intervention. It is a complex multi dimensional phenomenon that

has been studied from philosophical, sociological and clinical perspectives. Most suicides among psychiatric patients are preventable, because evidence indicates that inadequate assessment or treatment is often associated with suicide. Some patients have severe personality disorder, are highly impulsive and commit suicide spontaneously ; often when dysphoric, intoxicated or both¹².

In this study emphasis was laid upon at the psychiatric illnesses amongsts' the victims of suicide and 8% were found to be suffering from major mental illness and all of them had past history of institutionalization ¹. All the patients were on medication however, compliance to therapy were not clear.

More violent methods of committing suicide were adopted by the group having major mental illness.

A numbers of methodological hurdles which weaken this study if not negate, is the random selection of cases and information obtained from relatives, police personnel and treatment documents. Sample size was relatively small; hence it does not the reflect community at large. In summary it may be concluded that mental illness causes a serious threat to suicidal behavior and the act of suicide. Crisis intervention in the form of supportive psychotherapy, environmental manipulation, dealing with support systems all might help to address this complex issue.

Ethical Clearance: Taken from institutional ethical committee.

Source of Funding: Self

Conflict of Interest: Nil

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Stature Estimation and Sex Prediction Using Measurements from Forearm Bones in Adult Egyptians

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ABSTRACT

Identification of unknown cadavers by constructing a biological profile from their skeletal remains is one of the main aims of any forensic pathologist. But yet, there are no organized studies are yet available for gender and height estimation in adult Egyptians.

Objective: To formulate a model for stature construction and sex prediction using fore arm bones' measurements in adult Egyptians.

Materials and method: Some measurements of the radius and ulna bones, in adult Egyptian cadavers were studied and statistically analyzed.

Results: The accuracy of both radial and ulnar lengths in sex determination was 98%, while it was 97.5%, and 92.3% consecutively, in case of using radial or ulnar lengths alone.

Conclusion: Radius and ulna bones, can help in sex prediction as well as stature estimation with high accuracy in unknown cadavers or remains.

Keywords: Radius; Ulna; Identification; Adult Egyptians; Sex; Stature.

INTRODUCTION

Osteometry is one of the branches of anthropometry dealing with the measurements of different parts of either the living body or cadavers including long bones of the arm. The use of forensic anthropology in medico-legal investigations has developed to be more common over time, with an escalating number of cases involving human remains including, partially fleshed, charred or dismembered remains. ^[1] Although metric studies may appear repetitive in principle and technique, such forensic studies must attempt to answer key questions related to age, sex, stature and race after examining incomplete or fragmentary remains. The forensic investigator must work with a checklist of the available bones and their accessible measurements, which could then be used altogether to optimize the determination of identity from such existing data. ^[2]

Sex differences determined in the shape, size and appearance of bones usually arise during development

and are consequences of individual genetic markers and response to sex hormones during puberty. Bone development in either sex is dependent on a combination of genetic markers and hormone exposure.^[3] The age of appearance of sex-specific morphological changes is dependent on a number of population specific genetic and environmental factors.^[4] As the degree of sexual dimorphism, and the age at which it occurs in males and females, varies between different populations, sex estimation standards are necessary to be population specific.^[5] The epiphyses of radius and ulna fuse with their respective diaphyses in the age group of 16-20 years. Standards used to analyze morphometric data are most precise when applied to the population from which they were derived.^[6]

The radius and ulna may be smaller and more fragile than other long bones as the femur; however, estimating their power to differentiate between the sexes will provide alternative markers for sex identification when more accurate bones such as the pelvis or femur

are absent or damaged.^[7]

AIM OF THE WORK

To formulate a model for stature construction and gender prediction using radius and ulna bones in adult Egyptians.

MATERIAL AND METHOD

This study was performed on 122 Egyptian cadavers (85 males and 37 females) presented to the Forensic medicine mortuary for pathological or medico-legal reasons in the period between first of January to end of December, 2014. All cadavers had intact and unharmed left forearms. Cadavers with severe rigor mortis, severe burning, and incomplete or charred skeleton, and advanced post mortem changes, history of fracture or deformities in upper and lower extremities as well as anonymous cadavers, were excluded from the study.

Ethical guidelines were respected and, written consents were obtained. The cadavers were placed in supine position on the autopsy table and the stature was measured using a steel tape with millimetric divisions. Incisions on forearm and wrist were done, soft tissues were removed and the adjacent joints were exposed. The distance between the head and styloid process of the radius and, the olecranon and styloid process of the ulna were measured by a Vernier calliper reading to 0.05 mm. For the determination of sex and estimation of stature, discriminant function analysis and linear regression were used, respectively. Finally the skin and joints were reconstructed.

RESULTS

Results were analyzed with SPSS 20.0 version for Windows. Relation between height and all measurements taken were determined by Pearson Correlation Analysis. For the determination of sex and estimation of stature,

correlation and regression coefficients were used. 85 of the studied subjects (69.7%) were males, and 37 (30.3%) were females. The cadavers of both genders were divided into 3 age groups according to the different ages examined during the study period for easier classification of the results:

I. Less than 25 years old

II. 25 to 44 years old

III. 45 to more than 65 years old

Descriptive data for each sex according to age, stature, radial and ulnar lengths were indicated in table (1). The mean age of males and females were 40.94 (18-65) and 34.36 (20-49) respectively. The average male stature is 1723 mm, that is, 138 mm taller than in females ($P < 0.0005$).

Radial ($P < 0.01$) and ulnar ($P < 0.0005$) male bone maximum lengths were more than those recorded in the female group (Table 1). The tallest stature was recorded in the age group (45-65) years in both genders as described in table (2). Mean radial and, ulnar lengths were higher in all age groups in males when compared to females as seen in tables (3 and, 4). Stature, radial length, ulnar length, correlation coefficient, regression coefficient and value of constant in males and females were given in table (5). The results of regression analysis and regression equations for estimating the stature can be seen in Table (6). Stature estimation can be determined by using the calculated regression coefficient and constant values for each sex from measured bone lengths, by multiplying a raw discriminant function coefficient for each bone length to which added the constant. Probability of sex determination according to sex distribution is given in Table (7). The accuracy of both radial and ulnar lengths in sex determination was 98%, while it was consecutively 97.5%, and 92.3% in case of using radial or ulnar lengths alone.

Table 1: Descriptive data for both genders:

Values	Males (n=85, 69.7%)				Females (n=37, 30.3%)			
	Mean	S.D.	Minimum	Maximum	Mean	S.D.	Minimum	Maximum
Age	40.94	10.1	18	65	34.36	11.1	20	49
Stature	1723	114	1573	1874	1585	149	1482	1633
Radial length	256*	14.1	247	261	253	13.7	248	260
Ulnar length	274**	14.9	268	312	260	14.0	257	274

* Statistically significant difference (P < 0.01).

** Statistically significant difference (P < 0.0005).

Table 2: Stature in different age groups as regards sex:

Stature	Male				Female				Total			
	Age gps	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min
<25	1624**	107	1573	1742	1562	157	1482	1614	1618	137	1583	1783
25-44	1764**	111	1643	1874	1594	143	1586	1632	1598	131	1565	1682
45-65	1781**	123	1675	1869	1597	146	1587	1633	1597	129	1564	1681
Total	1723**	114	1630	1828	1585	149	1551	1626	1604	132	1570	1715

** Statistically significant difference (P < 0.0005).

Table 3: Radius length, standard deviation, minimum and maximum lengths and univariate F-ratio in different age groups as regards sex:

Radius length	Male				Female				Total				F Ratio	t Test
	Age gps	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min		
<25	257	14.3	250	261	254	13.8	249	259	256	14.0	249	260	303.4	17.41
25-44	255	14.2	249	260	252	12.4	247	256	253	13.5	248	258	301.7	16.91
45-65	253	14.0	247	261	253	13.0	248	257	253	13.5	248	259	302.2	17.12
Total	256*	14.1	249	261	253	13.0	248	257	254	13.7	248	259	302.4	17.14

* Statistically significant difference (P < 0.01).

Table 4: Ulnar length, standard deviation, minimum and maximum lengths and univariate F-ratio in different age groups as regards sex:

Ulnar length	Male				Female				Total				F Ratio	t Test
	Age gps	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min		
<25	275	15.1	270	279	269	14.2	267	274	273	14.7	269	277	395.1	17.21
25-44	274	14.9	269	275	266	13.8	257	267	262	14.4	263	271	394.2	17.14
45-65	272	14.6	268	276	267	13.9	258	271	267	14.3	268	274	393.3	17.01
Total	274**	14.9	269	277	269	14.0	261	271	268	14.5	267	275	394.2	17.12

* Statistically significant difference (P < 0.0005).

Table 5: Stature, radial length, ulnar length, correlation coefficient, regression coefficient and value of constant in males and females:

Gender	Male		Female	
Total number	85		37	
Mean stature	1723**		1585	
Mean radial length	256*		253	
Mean Ulnar length	274**		269	
Correlation coefficient	Radius	0.709	Radius	0.781
	Ulna	0.655	Ulna	0.832
Regression coefficient	Radius	874.275	Radius	538.728
	Ulna	892.597	Ulna	571.241
Value of constant	Radius	3.289	Radius	4.118
	Ulna	3.141	Ulna	3.904

* Statistically significant difference (P < 0.01).

** Statistically significant difference (P < 0.0005).

Table 6: Calculation of stature from radial and ulnar lengths in both males and females

Stature = (Constant x Independent variable) + Regression coefficient		
Radius	Male	S = 3.289 x RL + 874.275
	Female	S = 4.118 x RL + 538.728
Ulna	Male	S = 3.141 x UL + 892.597
	Female	S = 3.904 x UL + 571.241

S: Stature, RL: Radial length, UL: Ulnar length.

Table 7: Accuracy of sex determination by radial and ulnar lengths with discriminant function analysis

Parameter used	Male number	Percentage	Female number	Percentage	Mean Percentage
Radius + Ulna	84/85	98.8	36/37	97.3	98.1
Radius	83/85	97.6	36/37	97.3	97.5
Ulna	81/85	95.3	33/37	89.2	92.3

DISCUSSION

The establishment of identity has an important judicial and criminal significances. Mass accidents and victims of traffic accidents deserve a special concern in identity establishment. Thus, appropriate practice and experience in identification by the collection of the available and appropriate data concerning the victims is indispensable. [8]

Final and definitive identification of human remains require DNA evidence but, the forensic anthropologist provides a rapid, low-cost, and convenient way of narrowing down the focus of an investigation. Note that

unless and until there is a reasonably small number of 'suspects', reference DNA samples are unlikely to be available. [9]

The current study was performed to evaluate the ability of using forearm bones to estimate body stature, and the accuracy of using such bones for gender prediction in adult Egyptian population. The mean stature in males and females in the current study was 1723 mm and 1585 mm; respectively. In the study conducted by Mall G et al. on fresh cadavers the mean body stature was reported to be 168 and, 156 cm for male and female; consecutively. [10] In Turkish study performed by Celbis

O et al., the mean stature in females and males was 156.8 and 169.9 cm; correspondingly.^[11] In current study, the least stature in both genders was recorded among the subjects related to the age group less than 25 years. This might be justified by undeveloped-bone growth for those subjects younger than 25 years. The higher mean stature among the subjects in the other two age groups can be justified by several reasons including more bone density and maturity. The maximum length of radius in both genders was recorded in the subjects in the age group between 25-44 years, which might be explained by bone maturity and absence of age dependent skeletal diseases such as osteoporosis and degenerative diseases of joints.

Mean radial and, ulnar lengths in the current study were higher in all age groups in males when compared to females. Mean radial and ulnar lengths in males was observed to be 256 and 274 mm, while that for females was found to be 253 and 269 mm successively, showing a statistically significant difference between the two genders ($P < 0.01$ and, $P < 0.0005$ successively). This was in accordance with the results of the study conducted by Mall. G et al. where the maximum length of radius in males and females was 24.6 and 22 cm; respectively.^[10] Holman et al. reported similar findings where the length of radius in males and females 24.3 and 21.9 cm; in succession.^[13] Van Riet RP et al. reported in his study that the mean length of radius in fresh cadavers of both genders was 235 mm.^[12]

Sex classification accuracy rates using the pelvis alone, is between 90% and 95%.^[14-16] Classification accuracies for the skull, ranges from 75% to 90%.^[17, 18] A high level of predictable sex classification precision has also been reported for the long bones: humerus 83% to 96%^[19, 20]; 89% to 96% for the radius^[10, 21]; 76% to 97% for the femur^[19, 20]; and 91% for the tibia.^[20] The range of classification accuracies presented in the present study using radius and ulna are comparable to those previously reported by other researchers and can be used to accurately estimate sex. Accuracy of sex determination based on the results of this study on using the length of radius or the ulna alone was 97.5% and 92.3% respectively and it gave accuracy of 98.1% when the lengths of the two bones were utilized together.

In the two studies conducted by Berrizbeitia and Mall G et al. the accuracy of gender determination by using radius bone was reported to be 96%, and 89%

successively.^[10, 21] In a study conducted on ulna bone, sensitivity of 78% and specificity of 93% were reported.^[22]

Stature estimation in the current study was determined by using the calculated regression coefficient and constant values for each sex from measured bone lengths, by multiplying a raw discriminant function coefficient for each bone length to which added the constant in both sexes. In spite of existence of general similarities between the equation of previous studies^[11, 23] and the current study, the presence of small differences could be attributed to racial differences and ranges of age for studied cases.

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An Analytical Study on Suicidal Hanging Cases

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ABSTRACT

Suicide or self destruction occurs through out the world. The rapid nature of death in hanging makes it one of the most popular method. A total 50 cases of hanging brought to the mortuary of NIMS Medical College and Hospital, Jaipur, for postmortem examination. They were studied during the period of Sep.2013 to Aug.2015. out of 50 hanging cases there were 35(70%) males, and 15(30%) females. The maximum number of cases were found in farmers 20(40%) followed by jobless 10(20%) and students 08(16%) each. Male dominance in society is because of stress, strain, alcohol addiction, break in love affairs, unemployment, failure in examination, loss of crops by natural disaster like flood, famine are the factors contributing to more number of cases of suicide.

Keywords: *Suicide, hanging, ligature.*

INTRODUCTION

Suicide is the act of killing himself who does not want to continue living. A person, who commits suicide, ruins or destroys his own career, social status etc. It is also defined as an act or instance of taking one's own life voluntarily and intentionally. The most common method of suicide is hanging and it is known since ancient times. Hanging or self suspension is the form of asphyxia which is caused by suspension of the body by ligature, which encircles the neck & the constricting force being the weight of body.

There are two types of hanging depending on the degree of suspension.

(1) Complete hanging- body is suspended completely without any part of body touching the ground.

(2) Partial hanging- body is partially suspended and toes, knees, buttocks are touching the ground.

The complete and high hanging favors homicidal in nature till proved otherwise, while partial or low hanging are mostly suicidal in nature.

There are also two types of hanging on the basis of knots-

(1) Typical hanging- in which knot is present on the occipital region.

(2) Atypical hanging- in which knot is present on any side of neck except occipital region.

Ligature mark follows the position of the noose, coming in contact during suspension. Firstly it is pale in colour; later it is reddish brown and parchment like. The instant nature of death by hanging makes it the most popular method of suicide. Rarely homicidal hanging has been reported. Death due to hanging occurs by combined effect of following methods injury to the spinal cord and brain stem and mechanical constriction of the neck structures specially trachea constriction which leads to asphyxia. Suicidal hanging should be differentiated from simulated suicidal hanging. For proper postmortem; examination should be carried out to look for complete or partial hanging, typical or atypical hanging. Check the ligature mark for its vital reaction and congestion of face and neck etc.

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AIMS AND OBJECTIVES

1. To determine the age, sex, occupation, marital status, type and place of hanging with highest prevalence of suicidal hanging.

MATERIAL AND METHOD

The study was conducted from 1st Sep. 2013 to

31st Aug. 2015. Total number of autopsies conducted in the department of forensic medicine and toxicology of NIMS Medical College and Hospital, Jaipur. Out of total 242 autopsies 50 are the suicidal hanging cases. The details about the victims, sex, age, marital status and place of hanging and type of hanging were obtained from the documents received from police officer.

RESULTS**Table 1: Age and sex wise distribution.**

Age in years	Male	Female	Total
10-20	6(12%)	2 (4%)	8 (16%)
21-30	15(30%)	10(20%)	25(50%)
31-40	10(20%)	2 (4%)	12(24%)
41-50	2 (4%)	1 (2%)	3 (6%)
51-60	2 (4%)	0 (0%)	2 (4%)
Total	35(70%)	15(30%)	50(100%)

Table 2: Place of hanging

PLACE	MALE	FEMALE	TOTAL
House	28(56%)	14(28%)	42(84%)
Outside	4 (8%)	0 (0%)	4 (8%)
Other	3 (6%)	1(2%)	4 (8%)
Total	35(70%)	15(30%)	50(100%)

Table 3: Occupation of the victims.

Occupation	No. of cases	Percentage
Farmers	20	40%
Jobless	10	20%
Students	8	16%
Housewives	3	6%
Any other	5	10%
Not Known	4	8%
Total	50	100%

Table 4: Marital status of victim

SEX	MARRIED	UNMARRIED	TOTAL
MALE	27(54%)	13(26%)	40(80%)
FEMALE	8 (16%)	2 (4%)	10(20%)
TOTAL	35(70%)	17(34%)	50(100%)

Table 5: Type of Hanging

Type of Hanging	Male	Female	Total
Complete	15(30%)	1 (2%)	16(32%)
Partial	20(40%)	14(28%)	34(68%)
Total	35(70%)	15(30%)	50(100%)

DISCUSSION

Hanging is common suicidal method which is carried out as per ages and the incidence of hanging is found in all the age groups from 10-60 years during my study period of 2 years, 242 cases were studied. It is reported that only 50 cases of suicidal hanging were seen which came to 20.66%. Out of 50 cases 35(70%) cases are of males and 15(30%) are of females. Maximum number of cases was found in the age group of 21-30 years followed by 31- 40years.

Sengupta et al also reported high incidence of hanging cases in the age group 21-30years. He reported 23(32.50%) case from 101 hanging case.¹Dixit et al reported 56(38.35%) case in the same age group from 146 hanging case studied in Nagpur region of maharashtra.²Singh et al carried out study on 296 suicidal cases in Imphal that comprises 154 hanging cases with 53(34.41%) cases in the same group³. The sexwise distribution of present study shows male 35(70%) cases and females 15(30%) cases with male to female ratio of 7:3, which is consistent to the study of Dixit et al. This study corresponds with similar findings of Dixit et al 75% male and 25% female, Sengupta et al 71.29% male and 28.71% female and Sharma et al 71% male and 29% female⁴.

The reasons for the male dominance in suicidal hanging cases in society are due to stress and strain in addiction to alcohol, failure in love affairs, unemployment and failure in examination. The reason for female suicidal hanging cases is abetment by the in-Laws and family problems and psychological instability. In present study farmers are the leading group which undergo suicidal hanging (40%) followed by jobless (20%) followed by students (16%). Very minor group housewives which perform suicidal hanging is only 3(6%). In remaining groups occupation is not known. High incidence is found in farmers because of loss of crops by natural disaster like floods and droughts, presence of poverty, lack or inadequacy

in reformatory schemes, frustration, and stress and strain. Unemployment is the major cause of suicides in jobless persons followed by alcohol addiction, failure in love affairs and failure in examination. The most common places of hanging in our study were houses (84%) followed by tree hanging (outside the house) (8%). Home was commonly preferred place of suicidal hanging in my study which is consistent to Davidson et al in 71.40% case⁵; Elfawal et al also reported most of the suicidal hanging cases at home⁶. Bowen et al also reported most of the suicidal hanging cases at home⁷.

CONCLUSION

The incidence of hanging is found in all the age group from 10-60 years in my study. It is reported that only 50 cases of suicidal hanging were seen which came to 20.66%. Out of 50 cases 35(70%) cases are of males and 15(30%) are of females. Maximum number of cases was found in the age group of 21-30 years followed by 31- 40years.

The reasons for the male dominance in suicidal hanging cases in society are due to stress and strain in addiction to alcohol, failure in love affairs, unemployment and failure in examination. The reason for female suicidal hanging cases is abetment by the in-Laws and family problems and psychological instability. High incidence is found in farmers because of loss of crops by natural disaster like floods and droughts, presence of poverty, lack or inadequacy in reformatory schemes, frustration, and stress and strain. Unemployment is the major cause of suicides in jobless persons followed by alcohol addiction, failure in love affairs and failure in examination.

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Molar Teeth Eruption: A Tool to Estimate Age

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ABSTRACT

Age determination is required in criminal responsibility, identification, employment judicial punishment, consent for marriage, rape, criminal abortion and prostitution etc. **Aims and Objectives:-**To determine the eruption of the first second, third permanent molar and to study the gender difference in the time of eruption of the permanent molars. **Material and method:-** The present study was a cross-sectional one, based on dental observations on 500 subjects out of them 300 were boys and 200 girls of Udaipur region ranging age from 6 to 25. **Result:-** the first permanent molar of maxillary region in boys was 6.83 yrs right quadrant and 6.75 yrs in left quadrant. Mandibular first molar erupts at 6.58 yrs in right and 6.66 yrs in left quadrant. In the cases of girls maxillary first molar tooth erupts at 6.92yrs in both quadrant and mandibular first molar erupt at 6.58 yrs. The second molar erupts at 11.66 yrs in all quadrants in boys, whereas second molar erupts at 11.92 yrs in the girls over right maxillary region and at twelve yrs in left side. The mandibular teeth of both sides erupt at 11.50 yrs. The third molar erupts between 17.5 yrs to 24 yrs in boys and between 17.2 yrs to 25 yrs in female. The eruption for first and second molars did not differ in right and left side of both upper and lower jaw. Difference in the effective age at eruption in the upper or lower jaw are not statistically significant.

Keywords:- eruption, quadrant, molar.

INTRODUCTION

In the world we live in, natural or manufactured, can be dated, numbered quantified or measured. A person's life span is measured as well, and one's age dated from the moment one is conceived. Age determination is required in criminal responsibility, identification, employment judicial punishment, consent for marriage, rape, criminal abortion and prostitution etc. Tooth formation is standard choice for estimating age as it shows less variability than other developmental features.

India is a very vast country with a diverse in population, climatic geographic variations. Therefore dental data from every geographic unit is essential to obtain a precise age prediction along with other data

like physical examination and radiological examination. Therefore a cross sectional study is carried out of around adult age group individuals of Udaipur region to estimate the timing of the permanent molar teeth.

AIMS AND OBJECTIVES

- (1) To determine the eruption of the first permanent molar
- (2) To determine the age of eruption of the second permanent molar
- (3) To determine the age of eruption of third permanent molar
- (4) To study the gender difference in the time of eruption of the permanent molars

REVIEW OF LITERATURE

Estimation of age via eruption of tooth was examined by Hoffman⁴ (1881) in Vienna. In spite without following the particular system, the estimation proved to be of some value Anatomical, Clinical,

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Radiographic and Microscopic examination can be useful. In India the first study related to this subject appears to be by Powell (1902)⁸ in Bombay, but his work was an attempt to define the range of variation rather than to estimate the mean age of eruption. Klein, Palmer and Kramer (1937)⁵ were the first workers to recognize the need for precise assessment of eruption age and claimed to have developed a suitable statistical technique for interpreting their data Lall and Townsend (1939)⁶ one third molar in 15-16 age group, two third molar in 16-17 and three third molar in between 17-18 yrs of age in Lucknow. Heredity, environment, endocrinal and nutritional factors play an important role in diversity was established by Brauer and Bahadur¹. The findings of Shouries et al (1946)¹⁰ established an early eruption of teeth in India then in USA. Clements EMB (1951)³ observed that in British children the early eruption is seen in superior economical and physical status group. The eruption was found earlier in girls than in boys.

MATERIAL AND METHOD

The present study was a cross-sectional one, based on dental observations on 500 subjects out of them 300 were boys and 200 girls of Udaipur region ranging age from 6 to 25. Date of birth were taken from school records

Table-1: Eruption of first molar tooth in boys

Age in months	No. of cases	% of cases with erupted 1 st erupted molar tooth			
		UP(Rt)	UP(Lt)	Low(Rt)	Low(Lt)
72-74	12	8.3	8.3	8.3	8.3
75-79	33	15.1	15.1	30.3	36.3
80-84	24	58.3	58.3	66.6	36.5
85-89	15	80	86.6	86.6	62.5
90-94	3	100	100	100	80
95-99	3	100	100	100	100
100-104	6	100	100	100	100
105-109	9	100	100	100	100
>100	12	100	100	100	100
Total	117	55.5	56.4	62.3	62.3

Time period:-this study was conducted between 1 march 2015 to 12th may 2015. In this period school admission were going on and so we can easy approach to the our target group.

Exclusion criteria:- subjects with Nutritional, Musculo-skelaton or endocrinal disorders were excluded. Subjects are not having reliable birth certificate are excluded from the study.

Inclusion Criteria:- the tooth was classified as erupted as soon as gum was pierced

Statistics:-

Eruption rate in different age groups for each molar separately for boys and girls were tabulated. Probit analysis was employed for identifying the effective age of eruption of the first and second molars. Separate analysis for male and female were carried out to understand the gender wise difference.

RESULT AND OBSERVATIONS

We are using symbols as "Ex" is the age of eruption, E_{50} for when permanent molar is present in 50% cases, M1 for first molar tooth, M2 second molar tooth, M3 for the third molar tooth

Table -2: Eruption of the first molar in the girls

Age in months	No. of cases	% of cases with erupted 1 st erupted molar tooth			
		UP(Rt)	UP(Lt)	Low(Rt)	Low(Lt)
72-74	8	0	0	37.5	37.5
75-79	16	25	25	37.5	37.5
80-84	40	50	55	60	60
85-89	8	75	75	87.5	75
90-94	8	75	75	75	75
95-99	5	100	100	100	100
100-104	8	100	100	100	100
105-109	4	100	100	100	100
>100	9	100	100	100	100
Total	106	56.6	60.3	67.9	66.8

Table No. 3: Effective age of eruption of first molar in boys & girls

Side of tooth	%of children	Rt quadrant boys		Rt quadrant in girls		Lt quadrant in boys		Lt quadrant in girls	
		Age by OG	Age by PA	Age by OG	Age by PA	Age by OG	Age by PA	Age by OG	Age by PA
Upper Jaw	25	6.58	6.33 (6.0-6.58)	6.42	6.50 (6.08-6.75)	6.50	6.33 (6.0-6.58)	6.42	6.50 (6.08-6.75)
	50	6.75	6.83 (6.85-7.08)	6.92	6.92 (6.66-7.16)	6.83	6.75 (6.58-7.0)	6.75	6.92 (6.66-7.16)
	75	7.25	7.25 (7.0-7.66)	7.50	7.33 (7.08-7.75)	7.00	7.16 (7.0-7.58)	7.50	7.33 (7.08-7.75)
	100	8.16	7.66 (7.33-8.33)	7.83	7.75 (7.42-8.42)	7.33	7.58 (7.25-8.25)	7.92	7.66 (7.42-8.33)
Lower Jaw	25	6.00	6.16 (5.75-6.42)	5.83	6.00 (5.42-6.33)	6.00	6.00 (5.66-6.42)	5.75	5.92 (5.33-6.33)
	50	6.66	6.58 (6.33-6.86)	6.66	6.58 (6.25-6.92)	6.66	6.66 (6.42-6.92)	6.66	6.58 (6.25-6.92)
	75	7.00	7.08 (6.83-7.50)	7.08	7.16 (6.92-7.66)	7.16	7.16 (6.92-7.58)	7.25	7.25 (6.92-7.75)
	100	7.33	7.50 (7.16-8.08)	7.92	7.75 (7.33-8.50)	7.50	7.58 (7.25-8.33)	7.92	7.83 (7.42-8.58)

Table -4: Eruption of Second molar tooth in boys

Age in months	No. of cases	% of cases with erupted 1 st erupted molar tooth			
		UP(Rt)	UP(Lt)	Low(Rt)	Low(Lt)
<120	8	0	0	0	0
120-124	8	25	25	25	25
125-129	12	16.6	16.6	16.6	16.6
130-134	12	16.6	16.6	16.6	16.6
135-139	8	25	25	25	25
140-144	20	60	60	60	60
145-149	16	87.5	87.5	87.5	87.5
150-154	12	83.3	83.3	83.3	83.3
155-159	16	75	87.5	75	87.5
>160	32	100	93.7	93.7	97.3
Total	144	61.1	60.4	59.7	60.4

Table -5: Eruption of Second molar tooth in girls

Age in months	No. of cases	% of cases with erupted 1 st erupted molar tooth			
		UP(Rt)	UP(Lt)	Low(Rt)	Low(Lt)
<125	14	1	0	7.1	7.1
125-129	5	20	0	20	20
130-134	9	22.2	33.3	44.4	55.5
135-139	0	0.00	0	0.00	0.00
140-144	6	66.6	66.6	83.3	83.3
145-149	17	52.9	64.7	76.4	76.4
150-159	44	79.5	70.4	90.9	90.9
>160	30	96.7	96.7	96.7	96.7
Total	125	64.8	62.4	74.4	71.2

Table 6: Effective age of eruption of second molar in boys & girls

Side of tooth	%of children	Rt quadrant boys		Rt quadrant in girls		Lt quadrant in boys		Lt quadrant in girls	
		Age by OG	Age by PA	Age by OG	Age by PA	Age by OG	Age by PA	Age by OG	Age by PA
Upper Jaw	25	11.42	10.83 (10.16-11.25)	11.08	10.83 (10.25-11.50)	11.42	10.83 (10.16-11.33)	10.83	10.83(10.50-11.66)
	50	11.66	11.66 (11.25-12.00)	11.58	11.66 (11.42-12.42)	11.66	11.66 (11.25-12.08)	11.58	12.00(11.58-12.50)
	75	12.08	12.42 (12.00-13.00)	12.66	12.83 (12.33-13.50)	12.08	12.50 (12.08-13.08)	13.08	12.83(12.42-13.50)
	100	13.75	13.16 (12.66-14.00)	13.50	13.66 (13.08-14.66)	13.08	13.25 (12.75-14.08)	14.00	13.58(13.00-14.50)
Lower Jaw	25	11.42	10.75 (9.92-11.25)	10.75	10.58 (9.18-11.16)	11.42	10.08 (10.00-11.25)	10.66	10.50(9.58-11.08)
	50	11.66	11.66 (11.16-12.16)	11.33	11.50 (11.00-12.00)	11.75	11.66 (11.16-12.08)	11.16	11.50(10.92-12.00)
	75	12.08	12.66 (12.16-13.25)	11.83	12.42 (11.92-13.08)	12.08	12.50 (12.08-13.16)	11.75	12.42(12.00-13.16)
	100	13.92	13.92 (12.92-14.42)	12.83	13.16 (12.58-11.16)	13.08	13.33 (12.83-14.25)	13.50	13.33(12.75-14.42)

Table -7: Eruption of third molar tooth in boys and girls

Eruption of third molar tooth in boys		Eruption of third molar tooth in girls			
Age in months	No. of cases Upper Jaw	No. of cases Lower Jaw	Age in months	No. of cases Upper Jaw	No. of cases Lower Jaw
<220	4 (22.6%)	5(33.3%)	<220	2(13.3%)	3(20.0%)
220-224	0(0.00%)	3(42.9%)	220-224	1(12.5%)	3(37.5%)
225-229	6(42.8%)	3(25%)	225-229	1(25%)	1(25.0%)
230-234	5(30.0%)	8(55.5%)	230-234	2(18.2%)	2(18.2%)
235-239	1(25%)	4(50.00%)	235-239	2(50%)	1(25.0%)
240-244	6(42.8%)	8(55.5%)	240-244	2(25%)	2(25.0%)
245-249	5(60.0%)	6(71.4%)	245-249	2(50%)	4(100%)
250-259	1(14.3%)	3(42.9)	250-259	1(25%)	0(0.0%)
260-269	2(40.0%)	4(75.0% 0	260-269	1(25%)	3(75%)
>270	5(80.5%)	5(80.5%)	>270	12(83.3%)	14(92.8%)
Total	35(34.3%)	49	Total	26(34.6%)	33(44.0%)

DISCUSSION

The present observations show a significant variation in tooth eruption. Comparing with the studies on South Indian children of Shouries et al (1946)¹⁰ the eruption age progressively advancing, it may be due to changes in dietary habits, nutrition and changes in socio-economical life style. Except for second molar tooth for boys effective eruption age in present study

advances for few months as compared with the studies of Ch. Lakshmi Kr (1987)²

Observations in the studies suggest a slight delay in the eruption of 1st molar then in the studies of Rao CM (1994)⁹. The timing of eruption of third molar is consistent the studies of Pathak at al (1999)⁷. Gingival eruption of third molar in lower jaw indicate the age of individual of at least 206 months.

Table 8:

City of Origin	Madras	Shimla (Rao CM et al.)	Tirupati (Ch.Lakshmi Kr)	Udaipur (present Studies)					
Gender		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Upper jaw	M1	6.59	6.91	6.10	6.10	6.00	5.70	6.75	6.83
	M2	12.37	11.86	12.00	11.50	11.60	11.50	11.66	11.58
Lower Jaw	M1	6.59	6.91	6.00	6.00	5.85	5.50	6.58	6.58
	M2	11.90	11.48	11.90	11.30	11.76	11.15	11.66	11.25

SUMMARY AND CONCLUSION

The effective age at eruption E₅₀ the first permanent molar of maxillary region in boys was 6.83 yrs right quadrant and 6.75 yrs in left quadrant. Mandibular first molar erupts at 6.58 yrs in right and 6.66 yrs in left quadrant. In the cases of girls maxillary first molar tooth erupts at 6.92yrs in both quadrant and mandibular first molar erupt at 6.58 yrs

The second molar erupts at 11.66 yrs in all quadrants in boys, whereas second molar erupts at 11.92 yrs in the girls over right maxillary region and at twelve yrs in left side. The mandibular teeth of both sides erupt at 11.50 yrs.

The third molar erupts between 17.5 yrs to 24 yrs in boys and between 17.2 yrs to 25 yrs in female.

The eruption for first and second molars did not differ in right and left side of both upper and lower jaw.

The effective time of eruption of boys and girls do not differ significantly in either upper or lower jaws. Difference in the effective age at eruption in the upper or lower jaw are not statistically significant.

A comparison of the current figures with the

eruption time of south Indian children fifty five yrs age (Shouries et al) suggest a marginal advance in the age at eruption of the first and second permanent molars, with the sole exception of the maxillary first molar

Point of Conflict:- A large sample of children should be studied, that sample should be put separately for boys and girls to asses gender difference more accurately. Other physical factors like built, body weight, socio-economical status should be included in along with time of eruption but due to technical limitation this is kept for further expansion of the study

Source of Funding :- Self generated

Ethical Committee approval:- Consent taken

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Profile of Medico-legal Cases in a Tertiary Care Centre at Greater Noida

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ABSTRACT

Casualty department of every hospital play a main role in management of not only medical emergencies but also of the medico-legal cases. In casualty the first attending doctor was usually a simple medical graduate which later on seeks expert opinion from various other departments. Profiling of Medico-legal cases is very much needed as the medico-legal cases differ from region to region depending upon geographic orientation, socioeconomic status, available health care facility etc.

This retrospective Study was carried out on total 591 medico-legal cases attending the casualty of Sharda hospital, a tertiary care hospital of Greater Noida UP from 1st Sep. 2014 to 31st Aug. 2015. The objectives of this study were to study demographic variables and pattern of medico-legal cases. Males (76.51%) outnumbered the females and maximum cases were of 21-30 years (32.10%) age group.

The majority of cases were from urban area (54%), April month showed maximum cases (11.3%) Road traffic accident was the commonest cause of injuries (48.750%). Blunt injuries constituted main fraction (82.6%) and fracture was present in (27.91%) of cases. Majority of cases showed injuries on more than one region of body (39.8%) and (53.46%) cases were admitted in different specialties. This study shows the workload of the medico-legal cases of a tertiary care hospital and urges availability of medico-legal experts and regular training of medical officers. This also provides valuable information to the policy makers to take effective measures.

Keywords: Medico – legal Case, Road Traffic Accidents, Fall From Height, Poisoning, Injuries.

INTRODUCTION

Medico-legal case is a case of injury or illness where attending doctor after taking history and clinical examination of the patients thinks that some investigations by law enforcing agencies are essential so as to fix the responsibility regarding the causation of the said injury or illness¹.

The casualty department is backbone of every hospital as all emergencies along with medico-legal cases first report to the casualty. Trauma is one of

the leading causes for almost all medico-legal cases attending the casualty of any hospital. It is estimated that in developing countries like India, mortality from injury will be more than those from communicable disease by the year 2020. Among trauma road traffic accidents are one of the major causes of disability and mortality in younger population and projected to be fifth leading contributor to global burden².

Our Sharda hospital receives large number of medico-legal cases every day as it is situated in a belt of fast growing infrastructure hub, educational institutes, and farming fields. Two major expressways connecting this city to Delhi and eastern Uttar Pradesh and this geographical complexity make it more prone for road traffic accidental cases. The mortality and economic losses imposed by morbidity resulting from injuries are

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largely preventable³.

Profiling of Medico-legal cases is an important aspect for the prevention of these preventable casualties in future and to study the crime rate of that area^{4,5}. This study is an attempt to provide data base for making strategies to reduce the numbers of medico-legal cases so as the burden of emergency department of the hospital.

AIMS AND OBJECTIVES

1. To analyze pattern of Medico legal cases
2. To study demographic variables of Medico-legal cases

MATERIAL AND METHOD

This retrospective study was conducted on the all medico-legal cases attending the casualty of Sharda hospital, a tertiary care hospital, of School of Medical Sciences and Research Greater Noida from 1st September 2014 to 31st August 2015. We excluded the Brought dead cases in this study. Information regarding age, gender demographic profile, mode, manner and pattern of injuries of each case was gathered and confirmed from hospital records, victim's attendants and police personnel. The collected data was analyzed statistically, observation discussed and compared with other studies.

OBSERVATIONS AND RESULTS

Table 1: Age and Sex wise distribution

Age (yrs)	Male (%)	Female (%)	Total (%)	Sex Ratio
0-10	30 (6.2%)	13(12.6%)	43(7.3%)	2.3:1
11-20	86 (17.7%)	17(16.5%)	103(17.4%)	5:1
21-30	191(39.2%)	30(29.1%)	221(37.4%)	6.4:1
31-40	101 (20.5%)	18(17.5%)	119(20.1%)	5.6:1
41-50	38 (7.8%)	10(9.7%)	48(8.1%)	3.8:1
51-60	31 (6.4%)	12 (11.7%)	43(7.3%)	2.6:1
>61 years	11 (2.3%)	3(2.9%)	14(2.4%)	3.7:1
Total	488	103	591	4.7:1

Table 1 shows that out of total of 591 cases studied 82.6% were males and 17.4% were females. Male female ratio was 4.7:1 indicating male predominance.

In this age group analysis maximum incidence was seen in age group 21-30 years comprising (37.4%) cases, this was followed by age group 31-40 years (20.1%). Combining both age groups, it is very clear that young adult male forms majority of the medico- legal cases.

Table 2: Urban Rural distribution

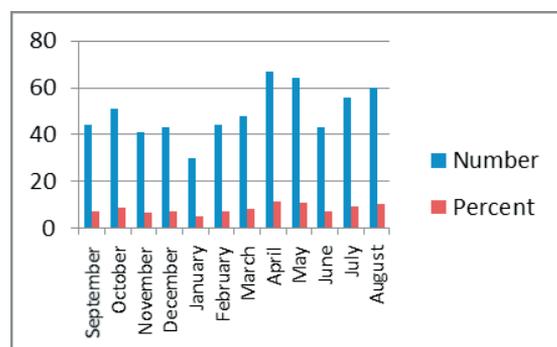
Residence	Number	Percent
Urban	319	54
Rural	272	46
Total	591	100

Table 2 shows that urban patients (54%) were more than rural patients which comprised of (46%) of total cases.

Table 3: Occupation wise distribution

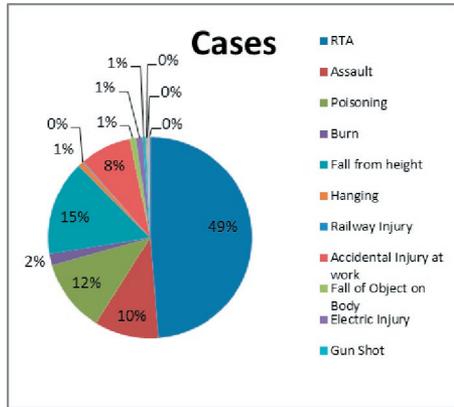
Occupation	Number	Percent
Govt. Job	3	1
Private Job	266	45
House wife	47	8
Student	162	27
Farmer	11	2
Not Known	102	17
Total	591	100

Table 3 Shows distribution of cases according to their occupation. Maximum no. of cases (45%) belonged to private sector job which included laborers, drivers, security personnel etc. followed by students (27%). Housewife comprised of 8% of total cases.



Graph 1: Month wise Distribution

Graph 1 shows the distribution of cases according to months. Maximum cases were reported in the month of April (11.3 %) followed by May (10.8%) and August (10.2%).



Graph 2: Cause of Injury

Graph 2 shows that Majority of cases were RTA cases (48.7%) followed by fall from height cases (15.2%) and poisoning cases (11.7%). Cases of assault were seen in 10.2% and accidental injury at workplace constituted (8.1%) of cases.

Table 4: Arrival Time

Time of arrival	Number	Percent
8AM-4PM	264	44.7
4PM-12AM	252	42.6
12AM-8AM	75	12.7
Total	591	100.0

Table 4 shows that 44.7% of cases reported to casualty between 8 AM to 4 PM in the evening. Least cases were seen during midnight to early morning.

Table 5: Manner of Injury

Manner of injury	Number	Percent
Accidental	454	76.8
Suicidal	62	10.5
Homicidal	69	11.7
No Information available	6	1.0
Total	591	100.0

Table 5 shows the maximum incidence of accidental injuries (76.8%) in reported cases followed by homicidal (11.7%) and suicidal (10.5%).

Table 6: Type of Injury

Type of Injury	Number	Percent
Blunt	488	82.6
Sharp	8	1.4
Absent	69	11.7
Burn Injury	11	1.9
Electric Injury	6	1.0
Amputation	6	1.0
Firearm Injury	3	0.5
Total	591	100.0

Table 6 shows that majority of cases had Blunt injuries (82.6%) comprising of lacerations, abrasion, bruises and deformity. (11.7%) cases did not show any visible injury externally at the time of examination, as they were cases of poisoning & did not sustain any injury

Table 7: Duration of stay in Hospital

Duration of stay	Frequency	Percent
< 1 day	329	55.6
1 – 5 days	134	22.6
6 - 10 days	46	7.8
11 - 15 days	39	6.6
> 16 days	44	7.4
Total	592	100.0

Table 7 Shows that majority of cases stayed in hospital for less than one day (55.6%) followed by patients who stayed from one to five days (22.6%)

Table 8: Outcome of cases

Outcome	Frequency	Percent
LAMA	76	13.08
Expired	11	1.89
Referred	4	0.68
Discharged	225	38.72
Not Admitted	265	45.61
Total	581	100.0

Table 8 shows that majority of cases were treated effectively in casualty and discharged without admission (45.61%), 38.72% cases were improved and discharged after admission in different specialties. (13.08%) cases left against medical advice and (1.89%) cases expired. Small number of cases was referred (0.68%).

DISCUSSIONS

In the present study total 602 cases were reported to the casualty during one year duration from 1st of September 2014 to 31st August 2015. Out of which 11 cases were brought dead and not included in this study. In our study majority of cases belonged to the age group 21 -30 years (32.1%) and age group 11-40 years constituted (74.9%) of the cases.

Involvement of this age group which is most active and most productive puts huge burden on economy and social loss to the country. Our findings are consistent with other studies¹⁻¹¹. In this study males (76.51%) outnumbered females (23.49%), consistent with previous studies¹⁻¹¹. Reason for this is the male member being earning member of family and is more exposed to physical forces and shows risk taking behavior.

In present study it was observed that urban population (54%) cases were more than rural population cases (46%). Our findings are consistent with Siddappa et al¹ and Hussaini et al¹¹, but our findings are not consistent with other studies^{3,7,10}. Reason being the demographic situation of the hospital which is surrounded by educational institutes & rapidly growing city.

In our study majority of cases (45%) seen were in private sector job including laborers, drivers & security personnel etc. followed by students (27%). Housewives comprised of (8%) of total cases. Large number of students in medicolegal cases is because hospital is surrounded by educational institutes, and they exhibit more risk taking behavior.

We observed in this study that (49.1%) of cases were seen from April to August month, majority were seen in the month of April (11.6%). Reason being, the increased movement on road, more agricultural activity, slippery roads and bad road conditions during this time. Our findings are consistent with Swarnkar et al³ and Gupta et al¹⁰, but our findings are not consistent with Garg et al⁷ where maximum cases were seen in month of September, and Hussaini et al¹¹ where majority of cases were seen in rainy season followed by summers.

In our study majority of cases reported to hospital between 8 AM to 4 PM (44.7%) and least number of cases were reported during midnight to early morning. This time matches with the working office hours where

people are more active on roads or busy at work place. Our findings are consistent with Siddappa et al¹ and Gupta et al¹² but different with Swarnkar et al³ and Garg et al⁷ studies, where maximum cases were reported during evening or evening to midnight.

In this study, Majority of cases, time of incidence was from morning to evening. Same pattern was observed between time of incidence & reporting to hospital. This shows that patient reached hospital without much delay after the incidence.

In majority of cases, incidence took place on road (51%) followed by home (27%) and work place (21%). High incidences of trauma on road are due to lack of awareness of traffic rules strict implementation of these rules and improper structuring of roads. Our findings are consistent with Swarnkar et al³ and other studies^{8,10} where commonest place of incidence was on road.

In our study road traffic accidents cases constituted (48.7%) followed by fall from height cases (15.2%) and poisoning cases (11.7%). Good quality roads, high speed & use of mobile phones are adding more number of road traffic accident cases day by day. Because Massive construction work is going on around this area, large number of cases of fall from height was seen.

Crime in this area is also one big factor which added to cases of assault which comprised (10.2%) of cases. Findings in our study are similar with Siddappa et al¹ and other studies^{5,7,10} but dissimilar to Malik et al⁴, Yadav et al⁶ studies where majority cases were of poisoning, and in Hussaini et al¹¹ study where majority were of assault.

In present study majority of the injuries were accidental (76.8%) followed by homicidal (11.7%) and suicidal (10.5%). These findings are consistent with studies^{1,7,10} for maximum accidental injuries but in all these studies suicidal cases were more than homicidal cases, but our findings are not consistent with Yadav et al⁶, where homicidal cases were more in number.

In accidental injury road traffic accident was commonest mode, in assault cases blunt object constituted commonest mode which is also seen in Swarnkar et al³. In suicidal cases commonest mode was poisoning. In our study alcohol intoxication was present in (3.55%) of cases and similar scenario is seen in Suryanarayana et al⁸ and Gupta et al¹⁰.

Present study showed that cases when reported to casualty majority were conscious (75.8 %), followed by unconscious (20%) and semiconscious (4.2%). Similar scenario is also seen in studies^{8,10}. In semiconscious or unconscious cases majority of cases were of road traffic accidents, fall from height and poisoning.

In our study majority of cases sustained Blunt injury (82.6%) comprising of abrasion, bruise, laceration, swelling & deformity. More number of these injuries is consistent with the road traffic accidents injuries. In (11.7 %) of cases there was no injury as they were cases of poisoning and reported to hospital with no history of trauma. Small number of cases comprised of sharp injury, burn injury, electric injury, firearm injury and amputation of limb. Findings are consistent with Gupta et al¹⁰ where blunt injuries were more common.

This study showed, in majority of cases more than one region was involved in followed by, but overall Head, neck and face were the most common region involved, consistent with Suryanarayana et al⁸ and Gupta et al¹⁰ studies.

In our study head injury was present in (13.5%) of cases which comprised of concussion, edema, intracranial hemorrhage, and fracture of skull bones. Out of these cases (92.21%) were discharged after improvement and (7.79%) expired. Fractures were observed in 165 (27.91%) of cases. Involvement of lower limb bones was seen in maximum number of cases (49.7%) followed by upper limb (17.6%). Skull bone fractures were present in 7.9% of cases. Our findings are consistent with Gupta et al¹⁰.

Majority of cases stayed in hospital for less than one day (55.6%), followed by cases which stayed till five days (22.6%) and rest of the cases stayed for more than six days. Our findings are similar with Garg et al⁷ and Gupta et al¹⁰.

In our study majority of cases were treated effectively in casualty and discharged without admission (45.61%), this shows effectiveness of the early initiation of treatment in case of emergency, (38.72%) of cases were improved and discharged after admission in different specialties. (13.08%) cases Left against medical advice, (1.89%) cases died and (0.68%) of cases were referred. Findings of our study are similar to Yadav et al⁶, Garg et al⁷ and Gupta et al¹⁰. In our study leading cause of death was head injury followed by

complications of poisoning.

CONCLUSION

Organized statistics about the types of medico-legal cases help in knowing the trend of occurrence of cases in the community. This study shows the load of medico-legal cases in a tertiary care hospital. In present study maximum number of medico-legal cases was due to RTA, followed by assault, poisoning seen in young adults of urban area. Such cases can be prevented by proper education and awareness of the young population by health professionals, stake holders' and social workers

Engagement of medico-legal expert in casualty and regular and periodical training of medical officers who are involved in handling of medico-legal cases also play an important role in better treatment and reduction of negligence cases.

Ethical Clearance: Taken from ethical clearance committee.

Source of Funding: Self

Conflict of Interest: Nil

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Radiological Age Estimation from Sternum in Living Individuals

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ABSTRACT

Age estimation from human skeleton forms an integral part in medico-legal practice. Human skeleton can be assessed radiologically to evaluate the aging process. Parts of the sternum, manubrium, body and sternum were assessed for fusion of the ossification centers on lateral views of plain radiographs. The aim of this study is to determine the age of an individual from inspection of the elements of sternum for fusion of the ossification centers radiographically. Fusion of manubrium and xiphoid process with the body of the sternum were studied radiologically. This data base of measurement and indices are statistically analyzed and conclusions are drawn. Sample size for the present study was 420. The mean age of fusion of the xiphisternum with the body of the sternum was 40 years for males and 42 years for females. The mean age of fusion of the manubrium to the body of the sternum was 55 years for males and 58 years for females.

Keywords : Sternum, Medicolegal, Manubrium, Xiphisternum

INTRODUCTION

Age determination is very important. Accurate means of age estimation is still lacking in developing countries. For age determination, different parts of the skeleton is useful at different age groups. Forensic experts rely on radiographs of various bones and joints for age determination. Manubrio-sternal and xiphisternal joints are used to determine the age in the middle and old individuals.

Epiphyseal fusion on radiographs is indicative of growth termination. Criteria are required for the accurate assessment of age in middle and old age groups. Closure of the sutures of the cranial vault has extreme variability in time period which cannot be relied upon. Fusion of the xiphisternum to the body of the sternum and fusion of the manubrium with the body of the sternum serve as tools for the estimation of radiological age in middle

and old aged persons. The findings are compared with similar studies by different authors at other geographic regions.

MATERIALS AND METHOD

Research approach : Evaluative approach.

Study Design : Prospective observational study.

Study period : 4 months.

Population : Patients scheduled for chest X-Ray (Lateral view)

Sampling technique : Non-probability sampling technique.

Materials used consist of 210 male and 210 female individuals of different age groups, free from musculoskeletal and endocrinal disorders with confirmed dates of births were selected. Subjects were divided on the basis of age into 7 age groups and male and females. Individual cases in which their date of birth was not certain, were not considered in the study. The X-Ray sternum lateral view was taken of study cases after obtaining written consent. Patients referred for lateral chest X-Ray view were selected in accordance to

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the age groups at St. John's Medical College, Bangalore. Radiological changes were assessed for the status of fusion of the xiphisternum and manubrium with the body of the sternum and recorded. Partial fusion or equivocal cases were not considered as it is difficult to comment on partial fusion on plain radiographs.

Lateral chest X-Rays were taken with the patient made to stand with the right shoulder touching the cassette in a true lateral position. Centering was done at the midpoint of xiphisternum. Factors used were 18 mAs and 80 kVp.

For age estimation, the elements of the sternum – manubrium, body and xiphoid process were examined for their fusion. The manubrio-sternal & xiphisternal articulations and sternal elements were carefully assessed for the degree of fusion. Grading was done as complete fusion or absent fusion.

At manubrio-sternal joint the degree of fusion was graded according to the following scale:

Absent fusion: A dark black radiolucent line seen in the joint, complete separation of bony pieces, absent fusion.

Partial fusion / Equivocal: Gap between joint begins to decrease, fusion present less or more than half of joining surface, white dense line visible, partial fusion.

Complete fusion: No gap between bony pieces, no white dense line visible, homogenous radio opacity

seen, complete fusion.

At xiphisternal joint the degree of fusion were graded according to the following scale:

Absent fusion: A dark black radiolucent line seen in the joint, complete separation of bony pieces, absent fusion.

Complete fusion: No gap between bony pieces, homogenous radio opacity seen, fusion present.

Findings on the radiographs were tabulated, analyzed and compared with similar studies from other authors.

RESULTS AND OBSERVATIONS

Study was conducted at St. John's Medical College, Bangalore during the period January 2016 and May 2016. Total of 250 cases were assessed radiologically for fusion of the ossification centers. Total of 210 cases were selected with the remaining 40 cases showing equivocal findings of fusion in the xiphisternal joint.

Present study showed that the mean age of fusion of xiphisternum with the body of the sternum was 40 years for males and 42 years for females. (Table 1) Mean age of fusion of the manubrium with the body of the sternum was 55 years for males and 58 years for females. (Table 2). The results of the present study have been compared to the previous studies. (Table 3, Table 4), In the present study, we conclude that the earliest age of fusion was 35 for both males and females.

Table 1. Fusion of xiphoid process to body of sternum according to age and sex

Age group	Number of cases	Male –Complete fusion	Male – No fusion	Female – Complete fusion	Female – No fusion
25-30	30	0	30	0	30
31-35	30	6	24	7	23
36-40	30	18	12	9	21
41-45	30	24	6	23	7
46-50	30	26	4	24	6
51-55	30	28	2	26	4
56-60	30	30	0	28	2
Mean		18.8	11.1	16.7	13.2
Standard deviation		10.7	9.88	10.27	10.27

Table 2. Fusion of manubrium-sterni with the body of the sternum according to age and sex

Age group	Number of cases	Male – Complete fusion	Male – No fusion	Female – Complete fusion	Female – No fusion
25-30	30	0	30	0	30
31-35	30	0	30	0	30
36-40	30	2	28	1	29
41-45	30	5	25	5	25
46-50	30	9	21	11	19
51-55	30	24	6	18	12
56-60	30	28	2	29	1
Mean		9.7	20.2	9.14	20.85
Standard deviation		10.75	10.75	10.18	10.20

Table 3. Comparison Study on Age of fusion between xiphisternum and body of the sternum.

Author	Year	Location	Age of onset (years)	Age of fusion Completion (years)	Mean age (Years)
Jit et al ⁽⁷⁾	1986	Punjab	Male 18, Female 21	-	-
Vasaiya K K ⁽¹³⁾	1992	Ahmedabad	Male 32, Female 33	Male 50, Female 50	-
Gautam et al ⁽¹¹⁾	2003	Ahmedabad	31-35	Male 50, Female 50	-
Das S K ⁽⁸⁾	2005	Kolkata	32	-	-
Tailor et al ⁽¹⁴⁾	2008	Surat	-	More than 40 for both sexes	-
Wadhawan et al ⁽¹⁵⁾	2010	New Delhi	Male & Female 31-35	-	Partial 35.42 Complete 55.95
Gaur et al ⁽¹⁶⁾	2010	Pune	31-35	>41	-
Vora D H ⁽¹⁷⁾	2010	Rajkot	Male 34, Female 35	Male 45, Female 44	-
Garg et al ⁽¹²⁾	2011	Punjab	Male 36, Female 35	-	Male 50.04 Female 46.42
Present study	2016	Bangalore	-	Male: 40 Female : 42	-

Table 4. Comparison study on age of fusion between manubrium and body of sternum

Author	Year	Location	Age of onset (Years)	Age of fusion completion (Years)	Mean age (Years)
Jit et al ⁽⁷⁾	1986	Punjab	Male 21, Female 21	-	-
Vasaiya K K ⁽¹³⁾	1992	Ahmedabad	Male 43, Female 45	Male 55 Female 55	-
Das S K ⁽⁸⁾	2005	Kolkata	28	-	-
Gautam et al ⁽¹¹⁾	2003	Ahmedabad	40	55	-
Tailor et al ⁽¹⁴⁾	2008	Surat	46	60	-
Wadhawan et al ⁽¹⁵⁾	2010	New Delhi	Male 46-50, Female 51	-	Partial 42.30 Complete 62.77
Gaur et al ⁽¹⁶⁾	2010	Pune	31-35	> 41	-
Vora D H ⁽¹⁷⁾	2010	Rajkot	Male 43, Female 40	M:60, F: 55	-
Garg et al ⁽¹²⁾	2011	Punjab	Male 37, Female 35	-	M:54.37, F:57.00
Current study	2016	Bangalore	Male 210, Female 210	M:55, F:58	-

DISCUSSION

Determination of age is a common medicolegal problem in both the living and the dead. ⁽¹⁾ Forensic radiology of the study of the sternum was first performed by Weznel (1788). Sternum is a long flat bone lying in the median part of the anterior thoracic wall. Sternum has 3 parts namely manubrium sterni, body of sternum & xiphoid process. Upper end of sternum articulates with the clavicle and margins articulate with the costal cartilage of first seven pairs of ribs. Ossification of the sternum occurs in five primary centers and one secondary center. One center for manubrium sterni appears at the age of 20th week, other two centers for 1st and 2nd segment of sternebrae respectively appear at the age of 24th-28th weeks. Sternebrae fuse with each other from below upward which begins at puberty and is completed by 25 years of age. The last two centers are for 3rd and 4th segment which appear at 28th-32th weeks and unites with the body the age of 40 years. The secondary center is for ossification xiphoid process at the 3rd year of age. ⁽²⁾

Sternum is increasingly used in age estimation in adults over 25 years of age. According to Jit and Bakhshi (1986), the fusion of xiphoid process with body of sternum is completed by 50 years of age. Fusion of

manubrium with body of sternum starts at the age of 40 years and is completed by 55 years of age. The present study shows that age group between 25-30 years shows no fusion of manubrium sterni with body. Similarly, the fusion of xiphoid process with the body is also absent. The age group of 50 years and above shows complete fusion of manubrium sterni with body and similarly fusion of xiphoid process with the body is completed. of 40 years and is completed by 55 years of age. The present study shows that age group between 25-30 years shows no fusion of manubrium sterni with body. Similarly, the fusion of xiphoid process with the body is also absent. The age group of 50 years and above shows complete fusion of manubrium sterni with body and similarly fusion of xiphoid process with the body is completed.

Age estimation in adults from closure of cranial sutures has extreme variability of age groups and changes like lipping of the lumbar vertebrae can be relied upon. ^(3,4) Changes in the pubic bone from pregnancy and parturition has variability and hence cannot be used for the accurate estimation of age. Krogman ⁽⁵⁾ concluded that xiphoid process fuses with body of sternum after 40 years. Glaister ⁽⁶⁾ mentioned that xiphoid process fuses with body at 40 and in advanced life the manubrium is occasionally joins the body, only the superficial part of

intervening cartilage is converted into bone.

Jit and Bakshi⁽⁷⁾ studied 772 male and 208 female and found that non fusion of manubrium could be seen above 60 years of age. Das⁽⁸⁾ concluded that the fusion at manubrio-corporal junction the age is above 28 years. Dogra⁽⁹⁾ mentioned that firm bony union between first and middle portion of sternum does not occur until late in life. Singh et al⁽¹⁰⁾ noted that earliest age at which fusion of joint start at 26 years in male and 31 years in female. Gautam et al⁽¹¹⁾ concluded that manubrium fusion begins at the age of 40 and completed at the age of 50 years. Garg⁽¹²⁾ found xiphoid process fusion at 36 years in male and 35 years in female.

CONCLUSION

The sternum can be visualized by radiography for age estimation. Age estimation from sternum can be considered in old age individuals with reliability. However, more criteria and standardization is required in this aspect for the accurate estimation of age from fusion of sternal elements. According to the present study xiphoid process fuses with body of sternum earliest by 36 years and fusion of manubrium with the body of the sternum is complete by the age of 60 years. Assessment of sternum by radiological means is valuable in determining the age in the living.

Conflict of Interest: None declared.

Source of Funding: None.

Informed Consent: Obtained.

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Study of Ossification at Elbow Joint in School Boys Aged 13-16 Years in Hyderabad City

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ABSTRACT

Age estimation of living is one of the most important tasks faced by Forensic practitioners, especially in developing countries like India. A study was conducted to know the status of ossification at Elbow joint in school boys of 13-16 years in Hyderabad city.

Method: Healthy school going school children (250 boys) of age group 13-16 years (150 of age 13 years and 100 of age 16 years), residents of Hyderabad city were examined for ossification status at Elbow joint

Results: In 13-16 years boys, at Elbow joint, Conjoint epiphyses was fused completely in 48%, Medial epicondyle was in stage 3 in 75.5%.

Conclusion: By the age of 13-16 years all epiphyseal centers around the Elbow joint were in the process of fusion.

Keywords: Elbow joint, ossification status, Age estimation

INTRODUCTION

Amid present scenario of increased number of litigations, cases of both criminal as well as civil, Forensic specialists are heavily burdened with cases of determination of age of individuals.

In developing countries like India, because of illitracy and ignorance regarding the importance of official records like birth and death, vast majority of population fail to give information of such vital events to the appropriate authorities entitled with these jobs. These causes paucity in such information when needed in a medico legal case.

Age group of 13-16 years is medico legally important in cases related with kidnapping, child labour, sexual offences, and juvenile offenders. In all such cases medical opinion regarding the age of victim or the accused is sought to give exact age. As higher courts have held correctly that it is not all possible on part of Forensic practitioners to give exact age but can give only exact range of estimated age. The principle methods that enable to give a fairly accurate range regarding the age of individual are height, weight, appearance of secondary

sexual characters, eruption of teeth appearance and fusion of epiphyseal ossification centers.

As determined by various studies so far in India, it is well known that there exists considerable variation in ossification of bones and teeth eruption in different regions of country and in different socio-economic groups. Hence in present study an attempt is made to know ossification status at elbow joint in school children between 13-16 years age group in Hyderabad city.

METHODOLOGY

The study was carried out involving 250 boys of age group of 1413-1616 years from Hyderabad city. These subjects were selected randomly from 1st day of 13th year to 364th day of 16th year.

Inclusion criteria:

- 1) Healthy normal boys between age group who have completed 13 years but not completed 16 years of age.
- 2) Subjects who had documentary evidence of

age in the form of birth certificate issued by municipal authority and or school records .

3) Subjects who were born and brought up in Hyderabad district.

Exclusion criteria:

1) Subjects with skeletal deformity, disease, malformation or injury.

2) Subjects with severe malnutrition, endocrinal disorders, and chronic illnesses.

Sampling method: Simple random sampling

Informed consent was taken from all subjects after explaining them the purpose and procedure of study. A proforma was prepared to collect all relevant information from the subjects. Individual subjects were given a specific code number from 1 to 200, in such a way that the proforma and x-ray film of a subject would bear the same number.

Physical examination: standard height measuring instrument was used to measure the height in cm were the subject was asked to stand straight without footwear,

heels together. Weight calculated in Kgs using standard weighing machine. For knowing the appearance and development of secondary sexual characters, the subjects were examined in private room.

Radiological examination: The subjects were subjected to the X-ray examination of the Elbow joint of right upper limb at the department of radio diagnosis and imaging H.S.K. Hospital, Hyderabad. X-rays of the Elbow joint was taken in both AP and Lat view using a factor of 55 kvp and 9MAS. Centering of X-ray tube over the epiphyseal care was taken.

RESULTS

Table 1: Age group vs. Number of subjects

Age group	Boys
13 Years	150
15 Years	100
Total	250

Table 1 depicts 150 boys of 14 Years (13-15 years) and 100 boys of 15 Years (15-16 years) were selected for the study.

Table 2. Ossification status around elbow joint

Ossification status	13 years boys		15 years boys		Total	
	n	%	N	%	n	%
Conjoint Epiphyses						
Stage 0	27	21	02	03	29	14.5
Stage 1	00	00	00	00	00	00
Stage 2	00	00	00	00	00	00
Stage 3	52	41	14	19	66	33
Stage 4	09	07	00	00	09	4.5
Stage 5	40	31	56	78	96	48
Total	128	100	72	100	200	100
Medial epicondyle						
Stage 0	00	00	00	00	00	00
Stage 1	00	00	01	01	01	0.5
Stage 2	08	06	00	00	08	04
Stage 3	106	83	45	63	151	75.5
Stage 4	04	03	02	03	06	03
Stage 5	10	08	24	33	34	17
Total	128	100	72	100	200	100

Cont... Table 2. Ossification status around elbow joint

Proximal end of radius						
Stage 0	00	00	00	00	00	00
Stage 1	00	00	00	00	00	00
Stage 2	02	02	00	00	02	01
Stage 3	110	86	34	47	144	72
Stage 4	08	06	14	20	22	11
Stage 5	08	06	24	33	32	16
T0tal	128	100	72	100	200	100
Proximal end of ulna						
Stage 0	00	00	00	00	00	00
Stage 1	07	06	00	00	07	3.5
Stage 2	31	24	08	11	39	19.5
Stage 3	68	53	27	38	95	47.5
Stage 4	10	08	09	12	19	9.5
Stage 5	12	09	28	39	40	20
T0tal	128	100	72	100	200	100

Table 2 shows ossification status around elbow joint among boys of 14 and 15 years age group. In 14 years boys Conjoint epiphyses was in stage 3 union among 41% of individuals and among 31% of boys showed complete union (Stage 5). Conjoint epiphyses was completely united in 78% of 15 years boys. So we can say that complete union of conjoint epiphyses with shaft of humerus in this area (Hyderabad city) is more likely to occur in 15-16 years age group.

Similarly stages of union for epiphyseal centers i.e., medial epicondyle, proximal end of radius, and proximal end of ulna is shown in the table.

Table 3: Ossification status and age around various epiphyseal centers

Age	Ossification status of conjoint epiphyses						
	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
13 years	27	0	0	52	9	40	128
15 years	2	0	0	14	0	56	72
Total	29	0	0	66	9	96	200
P < 0.005							
	Ossification status of medial epicondyle						
	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
13 years	0	0	8	106	4	10	128
15 years	0	1	0	45	2	24	72
Total	0	1	8	151	6	34	200
P < 0.005							
	Ossification status of proximal end of radius						
	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
13 years	0	0	2	110	8	8	128
15 years	0	1	0	45	2	24	72
Total	0	1	8	151	6	34	200
P < 0.005							
	Ossification status of proximal end of ulna						
	Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Total
13 years	0	7	31	68	10	12	128
15 years	0	0	8	27	9	28	72
Total	0	7	39	95	19	40	200
P < 0.005							

Table 3 shows significant correlation of ossification status of conjoint epiphyses, medial epicondyle, proximal end of radius and ulna with age.

DISCUSSION

Ossification of lower end of humerus takes place by fusion of four secondary centers, one for each of the following: the lateral epicondyle, the capitulum, the trochlea, and the medial epicondyle. Centers of ossification of the capitulum and the trochlea fuse together first and subsequently fuses with that of the lateral epicondyle to form conjoint epiphyses which later fuses with the shaft of the humerus while that of the medial epicondyle unites separately with the shaft.

In the present study it is observed that the conjoint epiphyses was completely united with shaft of humerus in 31% of subjects of the age 13-15 years while the same was completely united in 78% of the subjects of 15 – 16 years. The findings was consistent with other studies done in India by Lal and Nat (1939)³ in Lucknow boys, Galstaun (1937)⁴ in Bengal, Kothari (1974)⁵ in Marwar, Jain S (1999)⁶ in Jaipur, Bhise (2010)⁷ in Mumbai, Potdar AB (2012)⁹ in Hyderabad, and Jaybhave PL (2013)¹⁰ in Hyderabad

The age of fusion of conjoint epiphyses was observed to be 1 year early as compared to the studies by Patel DS (2009)¹¹ in Gujrat, and Janesh (2011)⁸ in Davangere and late by 1 year as compared to the study done by Pillai (1936)¹² in Madras.

Considering the foreign studies the age of union of conjoint epiphyses as observed in present study was seen to be consistent with the study by Siddhom and Derry (1931) in Egyptian Males as per the study done by Paterson (1929)

Similarly comparison of ossification of medial epicondyle of humerus, proximal end of radius and proximal end of ulna with other studies was done.

CONCLUSION

Age group of 13 years :

1) For conjoint epiphyses, majority of boys i.e., 41% were in stage of ossification Where as complete union (Stage 5) was seen in 31% of boys.

2) For medial epicondyle, majority of boys i.e., 83% were in stage 3 of ossification, where as complete

union (stage 5) was seen in 8% of boys

3) For proximal end of radius, majority of boys (86%) were in stage 3, where as only 6% showed complete union.

4) For proximal end of ulna most of the boys(53%) were in stage 3, where as complete union was seen in 9% of boys.

Age group of 15 years :

1) For conjoint epiphyses majority 78% of the boys showed complete union.

2) For medial epicondyle majority (63%) of boys were in stage 3 where as complete union was seen in 33% of subjects.

3) For proximal end of radius majority (47%) of boys were in stage 3 while 33% boys showed complete union

4) For proximal end of ulna 39% of boys showed stage 5 of development and 38% of boys in stage 3 .

Overall in the study group it was found that diet, exercise, socio-economic status did not have any effect on ossification status.

Conflict of Interest : Nil

Source of Funding : Nil

Ethical Clearance: Obtained from Institutional ethics committee

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Causes and Modes of Suicidal Attempts at JN Medical College Hospital, Aligarh Muslim University, India

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ABSTRACT

Suicide is the second commonest manner of unnatural death flanked by accident and homicide. The reasons for suicide and modes of attempted suicides vary from country to country and are also different in different races and cultures. This study was conducted at JN Medical College Hospital, Aligarh with the aim of knowing the common causes and modes of suicidal attempt.

The study was conducted over a period of 5 years from January 2007 to December 2011. A total of 1164 cases were included in the study 548 (47.08%) were males and 616 (52.92%) were females.

Poisoning was the most common mode of attempted suicide 530 (45.33%) cases, followed by hanging 252 (21.65%) cases. Domestic problems accounted for 255 (45.33%) cases as causes of attempted suicide. Regarding outcome of suicidal attempts 274 (23.54%) victims died in their suicidal attempt. The important findings in the present study included that 50% of the persons who attempted suicide were illiterates. Organophosphorus compounds (fertilizer) were used as poison and dowry related issues were important factors for attempting suicide.

Keywords: *Suicide, attempted suicide, organophosphorus poisoning, dowry death, hanging, Burns.*

INTRODUCTION

According to WHO, "Suicide is an act with a fatal outcome, that is deliberately initiated and performed by the deceased himself in the knowledge or expectation of its fatal outcome, the outcome being considered by the actor as instrumental in bringing about the desired changes in consciousness and/or social conditions."⁽¹⁾

According to Medrad Boss "Flight from death is mere survival and flight into death is suicide"⁽²⁾.

Every year throughout the world an estimated three quarters of a million take their own life and in many countries this is the leading cause of death in most productive age group⁽¹⁾.

All over the world, about 2,000 people end their life by means of suicide every day taking a toll of 80

to 100 deaths per hour. Around 10-15 times as many people make non-fatal suicidal attempts or perform para suicidal acts every day.

The causes suggested for suicides include childhood and family adversities such as childhood sexual and physical abuse, witnessing domestic violence, parental separation or divorce and living with substance abuse, mentally ill or criminal family members. Suicidal behavior is highly familial and heritable as well⁽³⁾.

The reason for suicide and modes of attempted suicides vary from country to country and is also different in different races and cultures. The reasons reported by western authors may not be the same in the Indian context.

In the light of the above facts, the present study was conducted at JN Medical College & Hospital, Aligarh Muslim University, Aligarh, with the following aims & objectives.

1. Epidemiological profile of patients with attempted suicide

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2. Various modes of attempted suicide
3. Causes of attempted suicide
4. Outcome of suicidal attempts.

PATIENTS AND METHOD

The present study was conducted at JN Medical College Hospital, Aligarh Muslim University, Aligarh, India in the departments of Forensic Medicine and casualty over a period of 5 years from January 2007 to December 2011.

For the purpose of the study 'suicidal attempts' was defined as "A person who had made deliberate act of self-harm consciously aimed at self-destructions irrespective of his/her intention to die".

The present study included 1164 suicidal attempt cases who reported to the emergency department of Jawaharlal Nehru Medical College Hospital during the period of study.

After a detailed history and clinical examination all the data were entered in the computer. At the conclusion of the study the data were analyzed by using SPSS 17.0 (Statistical package for social science, version 17.0). Chi square test was applied to test the association between the epidemiological variables and the modes and causes of attempted suicide.

Table – I: Reasons for suicidal attempts

Reasons	Males		Females		Total	
	No.	%	No.	%	No.	%
Quarrel with family member	42	07.66	40	06.49	82	07.05
Financial Crisis	70	12.77	10	01.62	80	06.87
Chronic Illness	18	03.29	28	04.55	46	03.95
Psychiatric Illness	73	13.32	48	07.80	121	10.39
Harassment by in laws	6	01.10	126	20.45	132	11.34
Domestic Problems	131	23.90	124	20.13	255	21.91
Extra marital Affair	7	01.28	26	04.22	33	02.84
Failure in Love	84	15.33	90	14.61	174	14.95
Sexual Assault	0	00.00	26	04.22	26	02.23
HIV Positive	18	03.29	8	01.30	26	02.23
Academic Failure	30	05.47	24	03.90	54	04.64
Death of Family member	13	02.37	12	01.95	25	02.15
Drug/Alcohol Abuse/Gambling	9	01.64	16	02.60	25	02.15
Infertility	7	01.28	18	02.92	25	02.15
Others	19	03.47	10	01.62	29	02.49
Not Known	21	03.83	10	01.62	31	02.66
Total	548	100.00	616	100.00	1164	100.00

RESULTS

Age: The mean age of male who attempted suicide was (32.1 ± 10.12 Years) and that of females was (29.22 ± 11.32 years). The youngest attempter was 12 years and the oldest was 70 years. The peak age of attempted suicide was 20 – 29 years.

Sex: 548 (47.08%) were males and 616 (52.96%) were females the male: female ratio was 1:1.2.

Rural/Urban: -Majority of the suicide victims were from rural areas 773(66.41%) and the rest 391(33.59%) from urban areas, this difference was statistically significant (P>0.05).

Education:-Illiterates constituted the majority of the suicidal victims 582(50%) and the least member were found in the graduates and above 86(7.39%).

Occupation: - Most of the victims were unemployed house wife group accounting for 402 (34.54%) and least were in teacher and police men group 04 (0.34%).

Marital status: - Majority of the victims were married people (68.9%).

Reasons for suicidal attempts: - Domestic problems accounted for the most common cause for attempted suicide 255 (21.91%) followed by failure in Love 174 (14.95%) other causes are given in the table I.

Modes of suicidal attempt: - Poisoning was the most common mode of suicidal attempt and accounted for 530 (45.33%) of cases. This was followed by hanging 252 (21.65%) and burns 242 (20.79%). The modes of suicidal attempt are given in table II.

Table – II: Modes of Suicidal attempt cases

Mode	Male		Female		Total		Mean Age
	No	%	No	%	No	%	
Burns	62	11.31	180	29.22	242	20.79	26.11
Drowning	14	02.56	18	02.93	32	02.75	33.97
Hanging	166	30.29	86	13.96	252	21.65	30.09
Poisoning	268	48.91	262	42.53	530	45.53	30.99
Run over by train	14	02.56	10	01.62	24	02.06	28.14
Jump from Height	6	01.09	8	01.30	14	01.20	25.00
Fire Arm	6	01.09	0	00.00	6	00.52	53.00
Self-Infliction/ Wrist Cutting	12	02.19	52	08.44	64	05.50	21.40
Total	548	100.00	616	100.00	1164	100.00	30.54

Outcome of suicidal attempt according to the mode: - A total of 274 (23.54%) patients died in their suicidal attempt and 890 (76.46%) survived. The maximum number of deaths occurred by poisoning 102 (19.25%) followed by burns 56 (23.14%). All the 6 (100%) patients with fire arm injuries died in their suicidal attempt. The outcome is given in table no. III.

Table – III: Outcome of suicidal attempt cases

Outcome	Male		Female		Total	
	No	%	No	%	No	%
Expired	140	25.55	134	21.75	274	23.54
Discharged	408	74.45	482	78.25	890	72.46
Total	548	100.00	616	100.00	1164	100.00

DISCUSSION

The word “Suicide” comes from to Latin roots, sui (“of oneself”) and cidium (“killing” or “slaying”), is the act of an organism intentionally causing its own death⁽⁷⁾. The present study consisted of 1164 patients who attempted suicide and reported to the casualty department of Jawaharlal Nehru Medical College Hospital for treatment.

The age range was between 12 to 70 years with a peak age group of 20 – 29 years. This is similar to the findings of other workers ^(4,5,6).

There were 548 (47.08%) males and 616 (52.92%) females who attempted suicide; the male to female

ratio was 1:1.2. Female predominance has also been observed by other workers^(7,8). The reasons for more young females attempting suicide in India is related to dowry harassment which was seen in 126 (20.45%) of victims in our study.

In the presents study domestic problems tops the list of reasons for attempted suicide with 255 (21.91%) cases followed by failure in love with 174 (14.95%) and harassment by in laws 132 (11.34%). Other causes included death of family member, gambling and drug/ alcohol addiction, infertility, psychiatric illness, quarrel with family members, financial crisis, chronic illness, extra marital affair, sexual assault, HIV positive status and failure in examination. Shukla et al⁽⁷⁾ and Sethi et al

⁽¹¹⁾ have also found domestic strife as the most common reason for suicide.

Some authors ^(4,10) have noted unemployment as a major cause of suicide. Other authors have reported depression as the most common cause of attempted suicide, Sethi et al ¹¹ found depression in 22.7%, Schizophrenia in 10.7% and drug and alcohol addiction in 9.3% of cases. In our study psychiatric illness was the reason for attempted suicide in 121 (10.3%) patients. In 2.66% of cases no cause of suicidal attempt could be determined but this group of patients should not be ignored as they are reluctant to reveal the true cause of attempted suicide because of fear and social stigma, these are the patients who may attempt suicide again and need to be counseled.

The method of attempting suicide varies from region to region depending upon the availability and the access to the methods adopted by the persons attempting suicide. In the present study poisoning was the most common method of suicidal attempt 530 victims, (45.53%) followed by hanging 21.65% and burns 20.79%. These findings are similar to many authors ^(12,13,14,15,16) with respect to poisoning.

Some authors ^(17,18,19,20,21) have found hanging as the most preferred method of suicide.

Physical methods like self-infliction of wounds and cutting of wrist (5.50%), drowning (2.75%), run over by train (2.06%) were less common in our study. Jumping from height (1.2%) and fire arm (0.52%) were the least commonly employed methods in the present study.

Insecticide poisoning was the most common method adopted for attempting suicide, this is because of easy availability and lack of stringent laws regarding its sale in our country. They accounted for 318 cases out of 530 cases of poisoning. 288 patients consumed organophosphorus compound to commit suicide.

Many authors from India ^(22,23,24,25) have found that organophosphorus compounds were the most common poison used for suicide. In United States of America, Jordan, Sri Lanka, Finland and Japan also the authors have reported the use of organo-phosphorus compound for suicide ^(26,27,28,29,30).

Rope was the most common ligature material used for hanging in the present study 150 cases (58.73%) other materials used were *saree* (11.9%) wire (8.73%)

Dupatta (7.93%) and *Lungi* (5.95%).

In the present study out of a total of 1164 suicidal attempt cases 274 (23.54%) patient died and 890 (72.46%) survived the attempt the ratio between death and survival was 1:3.25.

The ratio between suicide 'attempt' and 'commits' varies widely in the literature. One committed suicide for every eight attempts (1:8). Figures vary from 1:3 to 1:8. World Health Organization report of 1998 puts the prevalence of para suicidal acts estimated to be 10-20 times higher than completed suicide. In the present study, 90 cases (7.73%) had a previous history of attempted suicide. 50 had tried once before, 15 cases twice, 10 cases thrice and 5 cases more than three times.

Only 5% of the patients had received any counseling or psychiatric treatment prior to suicidal attempt. Family history of attempted suicide was positive in only 1% of cases.

Suicide note plays an important role in confirming the cause of death and is an essential component of 'psychological autopsy'. In the present study suicide notes were found in 59 cases (5%), this is much less compared to the studies of other authors ^(31,32,33) where the suicide notes were found in 19%, 35% and 40% of the cases respectively. One of the reasons for such a low incidence of suicide notes in our study could be because 50%(582) of our patients who attempted suicide were illiterates.

Conflict of Interest – Nil

Source of Support – Self

Ethical Clearance – From the institutional ethics committee, JN Medical College, Aligarh Muslim University, Aligarh

CONCLUSION

From the study, the following conclusions can be drawn. Most of the victims were young people between third and fourth decade of life. Female victims were slightly more than the males with a male : female ratio of 1:1.7. 23.54% cases died in their suicidal attempt. Majority of the victims were Hindus from lower socio-economic group. Poisoning by organo-phosphorus compounds was the most common mode of attempted

suicide following by hanging. Domestic strife was the most common precipitating factor for attempting suicide including dowry related problems. 23.54% cases died and 72.46% survived the attempt.

The present study has brought about many facts which need to be addressed in order to prevent suicidal attempts. One of the most striking finding was that 50% of the persons who attempted suicide were illiterates, hence improving the literacy rate will go a long way in reducing suicidal attempts. Provision of better psychosocial and family support to young persons to overcome the family strife. The public should be made aware of 'Dowry prohibition Act' and other legal provisions of dowry. Organophosphorus compounds(fertilizers) should not be made freely available and strict monitoring is needed for its use. Finally a holistic approach is needed to tackle the menace of 'suicide' for which a national policy on 'suicide prevention' is framed and implemented.

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Stature Determination from Ring Finger Length: A Study from South India

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ABSTRACT

Establishment of identity of the person when only dismembered body parts are available is a great challenge to the forensic expert. To narrow down the identification process certain physical characters have to be established and one of them is stature. The present study attempts to determine stature from ring finger length. Length of ring finger was measured of 200 individuals (100 males & 100 females) belonging to Mysore district, Karnataka, India aged between 21 and 30 years. Measurements of ring finger length (RFL) were recorded using a Vernier caliper and the individual height (stature) was recorded using an anthropometric rod and the data was subjected to statistical analysis using SPSS software. Mean stature was significantly higher in males than females. Mean RFL on right and left sides was 9.37 cm and 9.32 cm in males and 8.75 cm and 8.68 cm in females respectively. Mean RFL was greater in males than females of both hands. Statistically significant correlation was observed between stature and Ring finger length of both hands. Pearson correlation (r) for stature and finger lengths was higher among females than males. Independent linear regression equations to calculate the height was formulated in males & females separately.

Keywords: Anthropometer; Identification; Ring finger length; Stature; Vernier caliper;

INTRODUCTION

Stature is considered as one of the primary data for identification. Stature prediction occupies a relatively central position in the identification necessitated by the medicolegal experts or medical jurisprudence and also in the anthropological research. When a complete dead body is found, stature determination is rather an easy task; but in cases where only parts of a body are available, determination of stature of that individual becomes difficult.¹ Estimation of stature of an individual from the skeletal remains or from mutilated or amputated limbs or from parts of limbs has obvious significance in personal identification in the event of alleged homicide, accidents or natural disasters, mainly concerned with the forensic identification analysis. The retrieval of mutilated remains is not uncommon, because many a times the bodies are mutilated with the intention of either concealing the identity of the deceased after committing a crime or to facilitate the disposal of dead. In some circumstances fragmentary remains may also

be recovered from forests or lonely places mutilated by wild animals.² The need to develop methods to construct stature from various bones has been stressed by many workers due to its application in forensic medicine, in medicolegal enquiries and in identifying war or mass disaster casualties.

Various studies in past have utilized various body parts such as upper and lower extremities including hand and foot dimensions for estimation of stature.^{3,4} Krishan K et al study concluded that the living stature can be predicted from the Index finger length (IFL) and Ring finger length (RFL) with a reasonable accuracy in adolescent population of North India.^{5,8} Sen J et al conducted a study to find the correlation between stature and the lengths of the index and ring fingers & concluded that the regression models derived can be of significant utility in the estimation of stature.⁶ The present study attempts to determine the stature from ring finger length

MATERIAL AND METHOD

The study was conducted in Mysore, India. In this study length of ring finger & height were measured of 200 individuals (100 males & 100 females) belonging to Mysore district, Karnataka, India aged between 21 and 30 years. Nonresident Indians and individuals from other than Mysore district were excluded from the study. Subjects with Skeletal abnormalities and connective tissue diseases, which may be congenital or acquired, were also excluded. Informed written consent was obtained prior to recording the measurements.

Measurements of ring finger length of males and females were taken by using a vernier caliper and the height was recorded using Anthropometer rod. Stature was measured as vertical distance from the vertex to the floor. Measurement was recorded by making the subject to stand erect on a horizontal resisting plane, bare footed with shoulder blocks and buttocks touching the wall. Palms of hand were turned inwards and fingers horizontally pointing downwards. Anthropometer was placed in straight vertical position in front of the subject with head oriented in eye-ear-eye plane (Frankfurt Plane). The movable rod of the Anthropometer was brought in contact with vertex in the mid sagittal plane.⁷ To measure Finger Length the subject is asked to place his hands on a flat table, and the distance between the phallangions and dactylions of the ring fingers was recorded using a vernier caliper.⁷

STATISTICAL ANALYSIS

The data was analysed using SPSS(Statistical Package for social science)version 18.0 to calculate descriptive statistics of stature and finger length for male & female subjects. For assessing the correlation between stature and ring finger length, Pearson's correlation coefficient was calculated and its significance was tested at a p-value of less than 0.05. The correlation coefficient was calculated separately for both male and female subjects. Linear regression models and multiplication factor were also derived for stature estimation from ring finger length in males & females keeping the stature as dependent variable and ring finger length as an independent variable. A multiplication factor was derived by dividing stature by ring finger length in each individual. Mean of multiplication factor thus derived was taken as the multiplication factor for the estimation of stature from ring finger length in right and left hand

RESULTS

The stature of the individuals included in this study ranged from 159 cm to 182 cm in males and 145cm to 182cm in females. Mean stature was significantly more in males than females. Mean RFL of right and left sides was 9.37 cm and 9.32 cm in males and 8.74 cm and 8.68cm in females respectively. Mean RFL was greater in males than females in both the hands. Descriptive statistics of stature, ring finger length of both hands are depicted in table No.1 and table No.2. Statistically significant correlation was observed between stature and ring finger length of both hands. Pearson correlation (r) for stature and finger lengths was higher among females than males as shown in table No.3. The multiplication factors derived for the estimation of stature from RFL in both hands of males and females are shown in table No.4. Linear regression equations for estimation of stature in males and females are shown in table No.5. RFL showed a significant correlation with the stature in males and females. The right RFL in both sexes appears to be a better predictor of stature.

Table 1: Descriptive statistics of stature for the study group individuals.

Stature (cm)	Male (n=100)	Female (n=100)
Minimum	159.0	145
Maximum	182	182
Range	23.0	37.0
Mean	170	161.626
S.D	4.97	7.78

Table 2: Descriptive statistics of ring finger length for the study group individuals.

Ring Finger Length (CM)	Male (n=100)		Female (n=100)	
	Left	Right	Left	Right
Minimum	7.7	7.3	7.5	7.3
Maximum	10.8	10.9	10.2	10.5
Range	3.1	3.6	2.7	3.2
Mean	9.325	9.372	8.684	8.749
S.D	0.63	0.66	0.58	0.62

Table 3: Pearson correlation coefficient values of ring finger measurements with stature.

Gender	Left Hand		Right Hand	
	r	p-Value	r	p-Value
Male	0.315	<0.001	0.350	<0.001
Female	0.434	<0.001	0.383	<0.001

r= Pearson correlation coefficient

Table 4: Constant and regression coefficient values for stature estimation from ring figure measurements.

Gender	Side	Constant	Regression coefficient
Males	Right	146.26	2.622
	Left	147.80	2.471
Females	Right	119.688	4.793
	Left	111.394	5.784

Table 5: Linear regression equations for stature estimation from ring figure length.

Gender	Side	Equation
Male	Left	H = 147.80 + 2.471 (RFL)
	Right	H = 146.26 + 2.622 (RFL)
Female	Left	H = 111.394 + 5.784 (RFL)
	Right	H = 119.688 + 4.793 (RFL)

DISCUSSION

Prediction of stature plays an important role in the identification as required by the investigating team & also in the anthropological research. Stature is one such parameter that can be established even in mutilated and dismembered bodies. In this study an attempt was made to establish the stature of a person by using ring finger length. Males and females aged between 21 and 30 years, those who were natives of Mysore district of Karnataka state were included in the study. In the present study the mean stature among males was 170.84 cm with a standard deviation of 4.9718. The minimum & maximum heights were being 159 cm and 182 cm respectively. Among females mean stature was 161.62

cm with a standard deviation of 7.79. The minimum and maximum heights were being 145 cm and 182 cm, respectively. The Pearson correlation coefficients showed a high degree of correlation and all the values were statistically significant (p value < 0.05). Krishan et al estimated stature from index and ring finger length in a North Indian population of age between 14-18 years with correlation coefficient ranging from 0.671 to 0.748 in males and from 0.367 to 0.531 in females.⁸ In the present study age group of subjects is between 21 -30 years and the correlation coefficient ranged from 0.315 to 0.350 in males and from 0.384 to 0.434 in females. Krishan et al had noted higher correlation coefficient for males than females whereas in present study we have noted higher correlation coefficient for females than males. This difference could be attributed to population difference as Krishan et al had utilized adolescent north Indian population whereas the present study is done on south Indian population. The finding of our study is similar to study done by Rajesh Bardale et al⁹ from Maharashtra (where in the correlation coefficient ranged from 0.546 to 0.576 in males and from 0.594 to 0.596).

As this study was conducted on living individuals, a correction factor of 2.5 to 4cm should be added to the height determined when bones are available for stature estimation.¹⁰ From this study it is found that, for more accurate prediction of stature, independent linear regression equation should be used. This study involved a small sample size and only native people of Mysore district of Karnataka state, South India, so there is scope for further work to determine similar regression equations with larger sample for people from other parts of the Country and World.

CONCLUSION

Present study shows that there is significant correlation between stature and ring finger length. Hence this can be of help in identification of unidentified and dismembered bodies. This study is conducted in localized geographical area with limited sample size (200) hence similar studies are proposed in different populations of larger sample size.

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Ethical Clearance: Written consent from the participant obtained.

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The Forensic Application of Vitreous Humour Biochemistry in Postmortem Disease Diagnosis

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ABSTRACT

Vitreous humor is an inert, transparent, jelly like substance that fills the posterior four fifths of the cavity of eyeball which offers shape to the eye. Vitreous humour were collected from the eyes of 50 dead bodies (28 males and 22 females) at the Federal Medical Center Yenagoa morgue. The vitreous supernatant was analyzed for glucose, total protein, albumin, globulin, sodium, potassium, chloride, bicarbonate, urea and creatinine using WHO certified methods. SPSS 18-21 and excel Microsoft were employed for data analysis. The level of vitreous glucose in diabetic cadaver was significantly higher ($P < 0.05$) and that of vitreous albumin significantly lower ($P < 0.05$) when compared with values obtained for non diabetic cadaver. Two deaths resulting from renal failure exhibited elevated urea and creatinine. A statistical relationship was not observed for vitreous chemistry of hypertensives. In conclusion, it is suggested that postmortem chemistry should be incorporated among the baseline routine forensic investigations.

Keywords: forensic Science, Postmortem, electrolytes, vitreous, glucose.

INTRODUCTION

The vitreous humour is a transparent, colourless, gelatinous mass that fills the space between the lens of the eye and the retina lining the back of the eye of humans and other vertebrates. It is found at all stages of life as far as during organ formation in the uterus of the woman. Water constitutes 98-99% of the total volume of the vitreous humour (as opposed to 75% in the cornea). The viscosity of vitreous is two to four times that of pure water¹.

In 1993, Coe defined forensic chemistry as “one of the more important ancillary procedures for the forensic pathologist”. Postmortem chemistry utilizes array of samples of which vitreous humour stand as a choice. Vitreous humour has been used for many years as the preferred specimen for postmortem confirmation of the ingestion of ethanol and other substance of abuse². It is preferred to blood and tissue as it does not deteriorate rapidly. For these reasons, vitreous humour has been a preferred sample for the estimation of postmortem interval and other toxicological analysis for over half a century. Biochemicals assayed in the vitreous and

results of some of the parameters are proportional to antemortem serum or plasma results³.

Chemically, electrolytes are substances that become ions in solution and acquire the capacity to conduct electricity. It serves as a buffer in the body. However, in postmortem situation, the fine balance maintained by electrolytes is distorted by the collapse of the respiratory and circulatory apparatus as decomposition progresses. These electrolytes are also present in the vitreous and are of great use in estimating time of death and to an extent implicated in certain diseases. Glucose is an important analyte in clinical chemistry that is used mainly in the diagnosis of diabetes mellitus. Urea and creatinine are markers of kidney dysfunction or abnormality. Total protein, albumin and globulin are all utilized in the assessment of the liver integrity and drug monitoring. Also, globulin is an indicator of inflammation or infection⁴. All these biochemicals are known to be pivotal in disease diagnosis; hence their measurement in the vitreous could be of use in the assessment of disease in a postmortem case where blood is of no medical and legal use.

The most investigated post-mortem analytes in vitreous humour are potassium, sodium, chloride, calcium, magnesium, phosphate, urea, creatinine and lactate^{1,5-10}. As for total protein, albumin and globulin, little or no studies have been done.

Over the years, the use and addition of these ancillary laboratory studies has greatly enhanced the utility of the autopsy. Coe⁸ indicated that the antemortem vitreous glucose concentrations were 85% of the plasma glucose values. This contradicted the earlier suggested 50% of plasma glucose concentration¹¹. Many previous studies have addressed the postmortem concentrations of vitreous humor glucose^{10, 12-13}. A rapid decrease in vitreous glucose levels is caused in the postmortem period due to the anaerobic degradation or glycolysis. The decrease may be up to 35% in the first hour to 70% after 6 hours PMI¹².

AIM AND OBJECTIVES

Aim

To assess the applicability of vitreous chemistry in the diagnosis of major chronic diseases in Bayelsa State, Nigeria.

Objectives

The objectives of this research work are:

1. To evaluate the validity of some of the study parameters in diagnosing probable cause of death.
2. To determine the efficiency and accuracy of studied vitreous chemistry in the postmortem diagnosis of diabetes mellitus and hypertension.

MATERIAL AND METHOD

Study Area

The study was conducted at the Federal Medical Centre (FMC), Yenagoa, Bayelsa State, Nigeria. Bayelsa state is located within Latitude 4° 15' North and Latitude 5° and 23' South¹⁴. It is also within longitude 5° 22' West and 6° 45' East. According to the 2006 census figures, Bayelsa has a population of about 1.7 million people¹⁴.

Study Population

Vitreous humor were collected from the eyes of 50 deceased bodies at the FMC Yenagoa morgue. Twenty

two (22) were deceased females and twenty eight (28) were deceased males. The time of death and cause of death for hospital based deaths were obtained from the medical records as stated by the nurse or clinician on duty. Based on the available records in the deceased medical files the minimum age was 25 years and the maximum was 83 years. The post mortem interval (PMI) which is from time of death to the time of vitreous sample collection was 2.0 to 15hours. The reported/documented causes of death was recorded for each dead body.

ETHICAL APPROVAL

The experimental protocol was approved by the Ethics Committee of the Federal Medical Center, Yenagoa, Bayelsa State. Informed consent was also obtained from family representatives of the deceased before the samples were collected.

Selection Criteria for Cadavers

The time of death and time of sample collection were recorded for each cadaver. Dead bodies embalmed were excluded from the study. Formaldehyde is known to coagulate protein, hence distorting its primitive configuration. Contaminated samples with trace of tissues and blood were also rejected. The age of the dead subjects and sexes were recorded.

VITREOUS HUMOR COLLECTION

The vitreous humor samples were collected by the method of Coe (1989)¹⁵. On an average 2.5 mL was collected from each subject. Only crystal clear liquid free from tissue contamination and fragments was used in the study.

Immediately after sample collection in each case, the vitreous humour was transferred into fluoride oxalate tubes for glucose determination and plain containers for proteins, electrolytes and renal biomarkers determinations. Prior to analysis the vitreous samples were centrifuged at 2050 g for 10 min. The supernatants were separated and used for the analysis.

Laboratory Methods and Procedures

Vitreous total protein and albumin were estimated quantitatively using biuret and bromocresol Green Methods respectively. Vitreous globulin concentration was derived by subtracting vitreous albumin from

vitreous total protein. Ion selective electrode (ISE) (analyzer ISE 4000) was used for the analysis of the vitreous electrolytes: sodium, potassium, chloride and bicarbonate. Vitreous urea and creatinine were estimated using diacetyl monoxime and Jaffes methods respectively. Vitreous glucose was estimated quantitatively using glucose oxidase method.

Data were analyzed with Statistical Package for Social Sciences (SPSS) program (SPSS Inc., Chicago, IL, USA; Version 18-21) and Microsoft excel. Student *t*-test was used for comparing values of the measured biochemical parameters between diabetic and non-diabetic cadavars. Also same was applied for hypertensive and non-hypertensive cadavars.

2.7 STATISTICAL ANALYSES

RESULTS

Table 1: A comparison of studied postmortem humour biochemical parameters in normoglycaemic and hyperglycaemic corpses

Measured Parameters	Normoglycaemic (Mean ± SD) n=32	Hyperglycaemic (Mean ± SD) n= 18	P-Value	Comment
Glucose (mmol/l)	4.5 ± 3.6	7.2 ± 4.4	P < 0.05	S
Total Protein (g/l)	4.3 ± 2.8	3.5 ± 2.8	P > 0.05	NS
Albumin (g/l)	1.5 ± 1.2	0.77 ± 0.71	P < 0.05	S
Globulin (g/l)	2.8 ± 1.6	2.7 ± 2.1	P > 0.05	NS
Sodium (mmol/l)	136 ± 14	133 ± 13	P > 0.05	NS
Potassium(mmol/l)	6.3 ± 1.4	7.2 ± 3.9	P > 0.05	NS
Chloride(mmol/l)	121 ± 15	119 ± 19	P > 0.05	NS
Bicarbonate (mmol/l)	14 ± 7	12 ± 7	P > 0.05	NS
Urea (mmol/l)	8.0 ± 10.5	8.9 ± 5.5	P > 0.05	NS
Creatinine (mmol/l)	127 ± 142	142 ± 111	P > 0.05	NS

Key

NS= non significant S=significant n= number of subjects

Table 2: A comparison of studied postmortem humor biochemical parameters normotensive and hypertensive corpses

Measured Parameters	Normotensive (Mean ± SD) n=32	Hypertensive (Mean ± SD) n= 8	P-Value	Comment
Glucose (mmol/l)	7.1 ± 5.7	8.6 ± 5.7	P > 0.05	NS
Total Protein (g/l)	4.2 ± 2.9	3.5 ± 2.1	P > 0.05	NS
Albumin (g/l)	1.3 ± 1.2	1.1 ± 1.1	P > 0.05	NS
Globulin (g/l)	2.9 ± 1.7	1.4 ± 1.0	P > 0.05	NS
Sodium (mmol/l)	134 ± 14	139 ± 8	P > 0.05	NS
Potassium(mmol/l)	6.7 ± 2.7	6.0 ± 2.0	P > 0.05	NS
Chloride(mmol/l)	120 ± 17	119 ± 13	P > 0.05	NS
Bicarbonate (mmol/l)	13 ± 6	13 ± 8	P > 0.05	NS
Urea (mmol/l)	8.4 ± 8.5	10.6 ± 9.3	P > 0.05	NS
Creatinine (mmol/l)	137 ± 129	122 ± 115	P > 0.05	NS

DISCUSSION

Utility of vitreous biochemistry in postmortem diagnoses of diabetic or hyperglycemic status

The World Health Organization (WHO) defined Diabetes Mellitus on the basis of laboratory findings, as a fasting venous plasma glucose concentration greater than 7.8 mmol/L (140 mg/dl) or greater than 11.1 mmol/L (200 mg/dl) two hours after a carbohydrate meal or two hours after the oral ingestion, even if the fasting blood glucose is normal. Estimation of glucose in the dead has proved difficult based on the effect of rigour and livor mortis on glucose concentration. Glucose in postmortem is speedily broken down into lactic acid as a result of anaerobic respiration in the death. Since glucose levels in the body after death fall rapidly due to anaerobic degradation or glycolysis¹², interpretation of postmortem glucose levels presents with unique challenges. This can only be resolved by the utilization of vitreous humour that is strictly protected by the complex eye structure.

The mean vitreous glucose levels were found to be significantly higher ($P < 0.05$) in the diabetic group than the non-diabetic group. The diabetic group exhibited a mean of 7.2 ± 4.4 as against 4.5 ± 3.6 of the non-diabetic group. Another parameter that showed a significant difference ($P < 0.05$) was vitreous albumin. The mean of the diabetic group for albumin was 0.76 ± 0.77 as against 1.5 ± 1.2 of the non-diabetic group. The vitreous albumin showed an inverse relation to diabetes mellitus. This typifies that as vitreous glucose increases, vitreous albumin decrease. On the other hand all the other studied parameters showed an insignificant difference $P > 0.05$.

However, this work is in accordance with Amith⁵, which also showed an increase in glucose concentration in diabetic cadaver. Amith⁵ attributed the difference in glucose concentration between diabetic and non diabetic groups to glucose retention by the later. It is possible that the diabetics retain higher glucose levels in the body and the rate of fall in their glucose levels may be more gradual as compared to the non-diabetics⁵.

Utility of vitreous biochemistry in postmortem diagnoses of hypertension.

Hypertension is known to distort the fine electrolytes balance in antemortem blood. This is a clinical fact because of the pressure exerted on various body organs.

Utilizing blood as a sample of choice for biochemical profiling in hypertensive cadaver will lead to wrong result. This is because of the massive blood perfusion and anaerobic respiration and fermentation that take place during death. Hence, the need for a sterile sample void of artifactual contamination. vitreous humour stands out a choice because of its sterility, inhibited fermentation and perfusion attributes. All the biochemical parameters studied exhibited non-significant difference ($P > 0.05$) between hypertensive and non-hypertensive deaths. This is based on the comparison between normotensive and hypertensive cadaver's biochemical parameters analysed. The ocular muscles and other eye accessories buffered such impact, hence ensuring that the vitreous humour chemistry is not affected. This have finally brought to bear that vitreous chemistry cannot be applied in diagnosis of hypertension or confirming dead resulting from hypertension.

Utility of vitreous biochemistry in postmortem diagnoses of renal compromise.

The key biochemical parameters in the diagnosis of renal dysfunction are serum urea and creatinine. These biochemical parameters are known for long to be an indicator of end point acute or chronic renal diseases. They are routinely used in the Medical Laboratory for the assessment of kidney function and functionality. About three cases of renal failure and two CVD cases in this research showed an elevated vitreous urea and creatinine as compared to other causes of death. These further the notion that death caused by renal dysfunction can be diagnosed using vitreous urea and creatinine. The vitreous urea and creatinine of deaths not linked to kidney compromised showed stable concentrations. This a potential evidence of the suitability of vitreous urea and creatinine in renal dysfunction diagnosis, especially in autopsy that renal failure diagnosis is obscure. Both urea nitrogen and creatinine in blood, vitreous, and CSF reflect antemortem levels and remain stable for days and despite moderate decompositional changes¹⁶⁻¹⁸. This work is in line with that of Coe,¹⁷ and Zhu *et al.*¹⁹ that stated that postmortem urea nitrogen and creatinine are sufficiently accurate to support a diagnosis of renal diseases despite antemortem history or autopsy findings.

CONCLUSION

The research was aimed at utilizing vitreous humour for disease diagnosis. Vitreous biochemicals such as

vitreous glucose are diagnostic of hyperglycaemia. Hence, vitreous humour is a good sample of choice for the diagnosis of diabetes mellitus in the post-mortem. On the other hand, deaths resulting from hypertension do not have an impact in altering vitreous biochemical parameters studied. Hence, no studied biochemical parameter can be diagnostic of death resulting from hypertension.

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Conflict of Interest: Nil

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A Study of Medico - Legal and Clinical Aspects of Head Injuries in Around Warangal District

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ABSTRACT

Most prominent part exposed in the body is head by virtue of its situation. It is the part mostly bears the brunt of violence accidental, suicidal or homicidal injuries. The head injuries are mostly due to 'Direct' or 'Indirect' trauma, as a result of blunt force or sharp objects either local or general. The present study was done in the Department of Forensic Medicine, Kakatiya Medical College, Warangal. During the period of Jan 2011 to Oct 2012. Out of 208 head injury deaths, high incidence of 83.65% (174) deaths were noticed in Males in the age group of 21-30 years. 78.36 % deaths were noted due to accidents. Incidents of fissured fractures of the skull were seen in majority cases of head injuries (39.42%). In large number of cases subdural haemorrhage was noticed. Out of 208 cases, 52 cases were brought dead, which were considered to be the instantaneous deaths. 23.55% of cases were died within 2 days of admission and 28.36% of cases were died after two days of admission.

Keywords : *Head Injury , Intracranial Haemorrhage, Skull Fracture.*

INTRODUCTION

The study of " Medicolegal and Clinical aspects of head injury has got great importance because of its added complexity to the problems for the reason that the full effects of the trauma cannot be completely evaluated until some time has elapsed after the alleged injury. The often ill-defined clinical manifestations, the impact of claim settlements, and deliberate malingering oppose further difficulties to the problem of fair decision. Most prominent part exposed in the body is head by virtue of its situation. It is the part mostly bears the brunt of violence accidental, suicidal or homicidal injuries.^{1,2,3} The head injuries are mostly due to 'Direct' or ' Indirect' trauma, as a result of blunt force or sharp objects either local or general. The diagnosis of exact lesion due to trauma is difficult for Neuro-Physician, treatment and management is unfruitful to Neurosurgeon and at the tailed the evaluation of mechanism of injury etc., is a puzzle to Forensic expert. The rapid industrialization, population explosion and The mad craze for greater speed made the situation worse.

In modern civilian casualties there is a fairly high incidence of head injuries. Number of fatalities in such accidents are also high. Hence understanding the underlying mechanisms the pathological the physiological disturbances and rational principals of treatment in Head injuries become more essential. For this all the deaths due to head injuries need Medical Legal autopsy. The importance of Forensic Medicine not only limited to fatal results which occur and also for many other important Medico-legal implications-arise in connection with these injuries like time of survival, act of violation, interpretation with correlation, for accurate reconstruction, subsequent sequelae, legality-liability and compensation etc⁴.

This fatality rate from the epidemic of trauma on the highways increases steadily. Equally on the increase of Sports-connected injuries and injuries from Social upheaval and violence (C.G.Tedeschi) It has been truly said that no injury to the Head is trivial to be ignored or so serious as to despair of" – Rowbotham⁵. "It is prudent to assume that every unconscious patient has sustained a Head injury and that his condition is due to this, unless or until it is shown to be due to some other cause"

(POLSON)⁶

AIMS AND OBJECTIVES

- To study the Medico – Legal and clinical aspects of head injuries and the morbidity rate.
- To study the incidence of head injuries in different age groups.
- To study the head injuries in relation to sex.

MATERIAL AND METHOD

The present study was done in the Department of Forensic Medicine, Kakatiya Medical College, Warangal. During the period of Jan 2011 to Oct 2012, 1615 bodies referred by the police of which 208 cases had died as result of head injuries. These include cases wherein death occurred on the spot and cases admitted and died in MGM Hospital, Warangal.

The object of this piece of work is to analyse 208 cases in general. Only those cases with a clear cut history of injury to the head due to fall from height, assault with blunt objects or sharp objects, traffic accidents any railway accidents were taken up for this study. Decomposed, exhumed bodies and skeletal remains were not included in this study. Inference regarding the incidence of age, sex, etiology of blunt force, injuries, period of survival and associated injuries were assessed.

RESULTS

Detailed postmortem study was conducted on 208 cases due to head injuries, during the period from January 2011 to October 2012, in the department of Forensic Medicine, Kakatiya Medical College, MGM Hospital, Warangal. A clinical follow up was also conducted on 2183 patients admitted with head injuries, in the Department of Neuro Surgery, MGM Hospital, Warangal, during the period from the January 2011 to October 2012.

Total no. of P.M.'S conducted in 2011 were 875 in this 14.17% deaths were noted due to head injuries and in 2012 from January to October 740 P.M.'S were conducted in this 11.35% deaths were due to head injury. Out of 208 head injury deaths, high incidence of 83.65% (174) deaths were noticed in Males and a lower incidence of 16.34% (34) deaths were noticed in Females. Number of admitted patients died due to head

injury in 2011 were 79 and in 2012 up to October were 77 (table-1)

A high incidence of 21.63% deaths were noted in the age group of 21-30 years. A low incidence of 7.69% deaths were noted in the age group of 0-10 years. (table-2)

78.36% deaths were noted due to accidents. 5.76% deaths were noted due to fall from height and 15.86% deaths were noted due to assaults. (table-3)

Incidents of fissured fractures of the skull were seen in majority cases of head injuries (39.42%). 12.01% of cases of head injury were seen without any fracture of the skull. (table-4). In large number of cases subdural haemorrhage was noticed. In 2.88% of cases combination of more than one haemorrhage was seen. Contusion of brain was seen in 23 cases along with other forms of intracranial haemorrhages. Lacerations of brain was seen in 26 cases along with other forms of intracranial haemorrhages. (table-5)

Out of 208 cases, 52 cases were brought dead, which were considered to be the instantaneous deaths. 23.55% of cases were died within 2 days of admission and 28.36% of cases were died after two days of admission. (table-6)

DISCUSSION

Meticulous post mortem study was conducted on a total of 1615 cases during the period from January 2011 to October 2012, in which 208 cases were deaths due to head injuries. The incidence of head injuries in relation to total post mortem examinations conducted was 12.87%. In this 52 cases were brought dead to the mortuary, which were considered to be the instantaneous deaths, out of this 36 cases were died at the spot, remaining 16 cases were died during transport due to exclusive damage of head and brain with or without associated other injuries. Remaining 16 cases were died during transport to the hospital.

The other 156 (75%) were the hospital deaths, amongst the total number of 2183 head injury cases, which were followed clinically. The remaining clinically followed cases were revived. In a total 208 deaths, 174 (83.65%) were Males and 34 (16.34%) were Females. A high incidence of deaths in Males was due to their activities and attitude. Low incidence was observed in females as they are not involved generally in activities

like men, and due to their feminine attitude majority of women are confined to their houses. A high incidence of 45 (21.63%) deaths were noted in the age group of 21-30 years, out of them 43 were males and 2 were females. A low incidence of 16 (7.69%) deaths were noted in the age group 0-10 years. Overall high incidence of deaths were recorded between the age group 21-50 years. Total 123 deaths were noticed out 208 cases with an incidence of 59.13%. This can be attributed to their physical activities and social involvement. The variation in deaths in the different age groups depend upon the activities of persons, and their attitude. For example an average Indian Female is more confined to their house and less exposure to the society. A major toll of deaths due to head injuries were noted in traffic accidents. In the present study total 163 deaths were seen out of 208, with an incidence of 78.36%. Among these deaths, the incidence was more marked in the age of 21-50 years. Anyhow it is evident that, Males are more involved. The people in the age groups are more involved in their physical activities, day to day deeds and travel more frequently. Deaths were also recorded in the age groups of 0-10 and 61 & above.

In the present study the second most common cause of deaths due to head injuries are assaults. 33 deaths of 208, were assaults. The commonest age group involved in assaults was 21-40 years. 17 deaths out of 33 were in this age group. Assaults are very frequent in Rural areas of Warangal District. The most brutal ways of assaults where like striking with hunting sickles, axes, crowbars, stones and iron pipes. A total number of 12 deaths were noted due to fall from height with an incidence of 5.76%.

The fissured fractures are the commonest, involving vault, base and in some cases both. They are likely to be caused by forcible contact with broad resisting surface like ground, blows with an agent having relatively broad striking surface. In the present study incidence of fissured fractures were seen in majority of cases, with a total of 82 (39.42%) cases. In 21 (12.01%) cases intracranial lesions were seen without any fracture of the skull.

Lack of muscle fibres and thinness of fibrous walls and elastic lamina predispose the various categories of intracerebral haemorrhages, as the brain slides within the skull⁷. As a rule, the extradural haemorrhage is associated with a fissure fracture that crosses the groove

of the meningeal vessels on the inner surface of the skull. Rupture of middle meningeal artery or the accompanying veins or both, is the most common cause of extradural haemorrhage. In the present study, subdural haemorrhage was noted in majority cases. A total of 147 cases were seen with an incidence of 70.67%. Some cases were studied in the present series, where there were combinations of brain injuries and haemorrhages like contusions 23 (11.05%) lacerations 26 (12.05%) were noted in combination with subdural, subarachnoid and intracerebral haemorrhages

In the present study 52 were instantaneous deaths with an incidence of 25% which correlates with D.J.Reddy and Chandra Gouda, 48 deaths were reported within 6 hours, hours after admission with an incidence of 23.02% which coincides with Chandra Gouda, 49 deaths were reported within 24 hours after admission with an incidence of 23.55% which coincides with D.J.Reddy and Chandra Gouda, and 59 cases were died after 2 days of admission with an incidence of 28.36% which also coincides with D.J.Reddy and Chandra Gouda^{8,9}.

SUMMARY

1. Detailed postmortem study was conducted on 208 cases died due to head injuries, during the period from January 2011 to October 2012, in the department of forensic Medicine, Kakatiya Medical College, MGM Hospital, Warangal.

2. A clinical follow up was also conducted on 2183 patients admitted with head injuries, in the department of Neuro Surgery, MGM Hospital, Kakatiya Medical College, Warangal, during the period from January 2011 to October 2012.

3. On a total of 208 cases Postmortem conducted, 52 were brought dead, with an incidence of 25%.

4. The other 156 were hospital deaths with an incidence of 75%.

5. A total of 2183 cases due to head injuries were followed clinically during the study period out of which the above 156 were the deaths.

6. In a total 208 deaths, 174 (83.65%) were Males and 34 (16.34%) were females. A high incidence in males, is due to their Social activities and attitude.

7. An overall high incidence of deaths were seen

between the age group of 21-50 years (59.13%) which is attributed to their active life.

8. Total 33 deaths were reported in assaults, in the present study with an incidence of 15.86% which is relatively more in Rural areas of Warangal District.

9. Total 12 deaths were recorded due to fall from height (5.76%)

10. In the present study, fissure fractures were the commonest variety followed by combined, comminuted and depressed fractures of the skull. In 12% cases, there was no fracture at all.

11. Subdural haemorrhage was the commonest variety in the present study. In this series, there were combinations of brain injuries and haemorrhages like contusions and lacerations were noted in combination with, extra dural subdural, subarachnoid and intracerebral haemorrhages.

12. 28.36% deaths were recorded after 2 days of admission in to the hospital. 23.65% deaths were within 2 days after admission, and 23.02% were within 6 hours after admission.

Table 1: Incidence of head injuries and deaths and clinical followup of head injury cases in the department of neurosurgery

month	Total Number of patients admitted		Total No. of Deaths	
	IN 2011	IN 2012 UP TO OCT	IN 2011	IN 2012 UP TO OCT
January	81		7	
		93		4
February	92	96	8	9
March	93		6	5
		133		
April	89	128	5	11
May	92	118	7	9
June	89	101	5	6
July	94	96	6	8
August	98	98	6	7

September	91	101	5	11
October	85	119	6	7
November	113	-	10	
December	83		8	
		-		
Total	1100	1083	79	77

Table 2: Distribution Of Deaths Due To Head Injuries Age And Sex Wise

Age in years	Male	Female	Total no. of deaths	Percentage
0-10	6	10	16	7.69%
11-20	22	5	27	12.98%
21-30	43	2	45	21.63%
31-40	37	4	41	19.7%
41-50	32	5	37	17.78%
51-60	20	5	25	12.01%
61 & above	14	3	17	8.17%
Total	174	34	208	100%

Table 3: Etiology of head injuries in relation to age.

Age in years	Traffic Accidents	Fall from height	Assaults
0-10	12	3	1
11-20	22	3	2
21-30	36	1	8
31-40	32	-	9
41-50	29	-	8
51-60	19	2	4
61 & above	13	3	1
Total	163 (78.36%)	12 (5.76%)	33 (15.86%)

Table 4: Different types of fractures of the skull in association with head injuries

Nature of Fracture	Vault	Base	Both	Total	Percentage
Fissured	52	23	7	82	39.42%
Depressed	21	-	-	21	10.04%
Comminuted	19	13	-	32	15.38%
Combined	20	15	13	48	23.07%
No fractures	-	-	-	25	12.01%

Table 5: Incidence of intracranial and intracerebral lesions in head injuries

Total	EDH	SDH	SAH	MIXE	I.C.H	Brain Injuries	
no.				D			
of							
death							
s due							
to						Contusio	Lacerati
head						ns	ons
injury							
es							
208	28	147(70.6	27(13.98	6(2.88	17(8.17	23(11.05	26(12.5
	(13.46	7%)	%)	%)	%)	%)	%)
	%)						

Table 6: Incidence of period of survival after head injuries

Time of Survival	No. of cases	Percentage
Instantaneous death	52	25%
Died with in 6 hours	48	23.07%
Died within 2 days	49	28.55%
Died after 2 days	59	28.36%

CONCLUSIONS

1. Thus concluding here and even looking into the history of trauma, we realized that it did not take long for man to appreciate that the head is one of the most vulnerable parts of the body. This is well attested by the creation of the protective helmet worn by warriors for back in the antiquity and now as well, at war and at peace, while at work and in a variety of sport connected activities.

2. Here in the present study it is evident that, road traffic accidents are the main culprit of head injuries, for a human being travel is inevitable. The Indian culture is not enough developed in acquiring the regular habits like wearing helmets wearing seat belts, strictly, following traffic control rules. The Indian Roads are so disastrous and congested a minor mistake can through them into hell.

3. The life saving medical facilities are not in reach for common man. Practically even the available

hospitals are equipped poorly and expert hands are deficient.

Conflict of Interest- No

Ethical committee clearance was taken

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A Rare Forensic Autopsy Case Report of *Thanatophoric Dysplasia Type I*

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ABSTRACT

Thanatophoric dysplasia (TD) is a rare disease but commonly found in lethal neonatal skeletal dysplasia, which is caused by pR248C mutation in the fibroblast growth factor receptor 3 (FGFR3) gene. The incidence is found 1 in 15,000-40,000 births. There are two types including type I and type II by primarily determining skull and femur shape. TD type I found bowed femurs but not commonly found cloverleaf-shaped skull while TD type II found cloverleaf skull but femur was straight. Present report reveals a case of forensic autopsy of male death fetus in utero, which was diagnosed to be TD type I where large head with prominent forehead bones (frontal bossing), depressed nasal bridge, mesomelia of legs, platyspondyly, curved of both humeri and femurs, and lung hypoplasia. Femoral epiphyseal growth plate retardation and disorganization was found microscopically.

Keywords: *Thanatophoric dysplasia; Neonatal pathology; Skeletal dysplasia; Forensic medicine; Autopsy*

Thanatophoric dysplasia (TD) is a rare disease but it is commonly found in lethal neonatal skeletal dysplasia of 1 in 15,000-40,000 births¹. This disease was first described in 1967 by Marateaux and Lamy² where the fetus has specifically abnormal characteristics of shortening of the limbs relative macrocephaly with frontal bossing, flat nasal bridge, narrow thorax with lung hypoplasia and flattened vertebrae (platyspondyly). TD can be classified into two types, categorized by curved of femurs³. For TD type I, femur has curved shape similar to telephone receiver while TD type II has straighter femurs. The clover-leaf shaped skull is not commonly found TD type I. Causes of this disease is from Fibroblast Growth Factor Receptor 3 (FGFR3) gene mutation^{3,4}. Most of the fetus died within a short period after birth due to respiratory failure from lung hypoplasia.

The authors reviewed the literature and found not enough information about autopsy case of TD in both macroscopic and microscopic examination. Therefore, the present paper reported a forensic autopsy case of TD type I and revealed pathology of the fetal bones.

CASE REPORT

A death fetus in utero at 19 weeks of gestational age was receive for autopsy. The fetus was male extruded from a 34-year-old mother by medical vaginal induction. The body weight was 250 grams, with crown-heel length of 20 centimeters. The head, chest and abdominal circumference were 19, 13 and 12 centimeters, respectively. External characteristics showed relative macrocephaly with frontal bossing, mild hypertelorism, flat nasal bridge, numerous skin folds of lower limbs, generalized skin slippage, and shortening of legs (mesomelia). No abnormality of palmar and plantar skin crest was found. The length of extremities is shown in Table 1.

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Table 1. Length of extremities show as table (in mm.).

Portion	Fetus	* Standard for	
		18 wks	20 wks
Arm	28	23.6	34.8
Forearm	26	18.7	28.1
Hand	20	15.6	24.3
Thigh	32	27.5	41.3
Leg	24	26.6	41.1
Foot	25	18.4	30.0
Body length (Crown-heel)	200	220.7 ± 10.4 for 19 wks	

*Data from Potter’s pathology of the fetus, infant and child. 2nd ed.⁵



Figure 1. Postmortem examination showed relative macrocephaly with frontal bossing, mild hypertelorism, flat nasal bridge, numerous skin folds of lower limbs, generalized skin slippage, and shortening of legs (mesomelia).

Post-mortem babygram show 1) Prominent cranial vault with asymmetric cloverleaf skull deformity, 2) small body thorax, hypoplastic lungs with very short ribs, 3) severe platyspondyly with high ratio of disc spaces to vertebral bodies, 4) squared iliac wings with hypoplastic iliac bones 5) micromelia, and 6) ‘French telephone’ deformity of curved/shortened femurs.



Figure 2. Postmortem babygram showed prominent cranial vault with asymmetric cloverleaf skull deformity, ‘French telephone’ deformity of femurs, and deformities of thorax and pelvis.

The vertebral bodies were thin (platyspondyly) and intervertebral cartilage were wide. Short femurs (mesomelia) were found with curved of both humeri and both femurs (shaped like a French telephone receiver). Additionally, pelvic bone hypoplasia was found. (Fig. 3)

Mesomelia and curved femur

(French telephone receiver) Platyspondyly

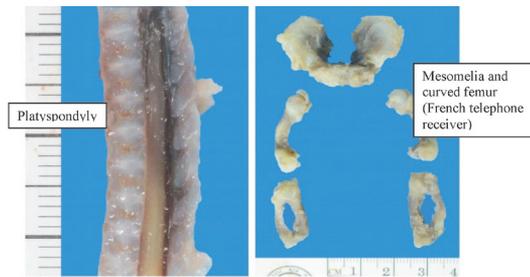


Figure 3. The vertebrae, pelvis, femurs and legs

Figure 3. The vertebrae, pelvis, femurs and legs

Gross examination of internal organs showed lung hypoplasia. Measurement and organ weights of fetus are illustrated in Table 2. Congenital anomalies of other visceral organs, such as heart, great vessels, and abdominal organs, were not found. The brain was mildly decomposed. Microscopic examination of visceral organs reveals unremarkable. Histopathology of epiphyseal growth plate from the femoral heads show borders between the cartilage and the primary spongiosa were irregular and disorganized without column formation. Extension of ossification groove of Ranvier and periosteal expansion of bone formation is seen. (Fig. 4)

Table 2. Measurements and organ weights of fetus show as table

Organ	Fetus	*Standard for 19 wks gestation
Weight in gm.		
Body	250	248 ± 46
Brain	30	35.2 ± 6.6
Heart	2.0	1.9 ± 0.5
Lungs	3.9	7.1 ± 2
Liver	9.4	12.1 ± 3.2
Spleen	0.2	0.27 ± 0.11
Kidneys	2.0	2.28 ± 0.56
Adrenal glands	1.2	1.03 ± 0.34
Thymus	0.2	0.39 ± 0.12
Circumference in mm.		
Head (fronto-occipital)	190	117.9 for 18 wks 166.8 for 19 wks
Chest	130	-
Abdomen	120	-

*Data from Potter's pathology of the fetus, infant and child. 2nd ed.⁵

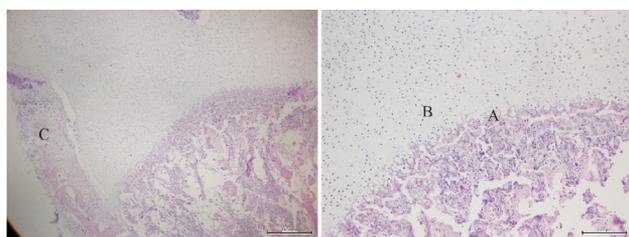


Figure 4. Histopathology of epiphyseal growth plate (100x and 400x respectively) showed borders between the cartilage and the primary spongiosa were irregular (A) and disorganized without column formation (B). Extension of ossification groove of Ranvier and periosteal expansion of bone formation is seen (C).

DISCUSSION

Dead fetus is an important issue in forensic pathology. Pathologist should concern whether the fetus was dead by natural disease or unnatural cause. Especially, the death of fetus should be determined by the pathologist that it was due to harmful act of the parents which might lead to prosecution of the parents, or the death was only due to the abnormality of fetus itself. Therefore, the knowledge of fetal and pediatric pathology is important for forensic pathologist.

Thanatophoros originates from a Greek term for "death bearing". Maroteaux et al.² described Thanatophoric Dysplasia (TD) as the disease first found in 1967 in dwarfism fetus with specific characteristics of micromelia, narrowed thorax, large head with prominent frontal bossing and depressed nasal bridge. According to radiographic examination, platyspondyly (flattening of vertebral bodies) was found with widened intervertebral disk spaces, flared metaphysis of long bone and telephone receiver configuration of femurs. The fetus usually died in the first few hours or days after birth due to respiratory distress from narrow thorax and lung hypoplasia. The incidence can be found 1 in 15,000-40,000 births¹.

TD can be divided into two types, which are categorized by characteristics of skull and femurs shape³. TD type I can be found 80% in which specific characteristics are curved femur shape similar to telephone receiver and not commonly found cloverleaf shaped skull⁶. TD type II can be found 20% in which specific characteristics are different from TD type I in terms of cloverleaf shaped skull and straighter femur⁶. Moreover, vertebral body is slightly taller than TD type I.

TD is caused by mutation in the Fibroblast Growth Factor Receptor 3 (FGFR3) gene that contains 19 exons, spanning 16.5 kb on 4p16.3⁷⁻¹⁰, resulting in a change in codon 248 from arginine to cysteine (p.R248C). Histopathology characteristics are retardation and disorganization of growth plate with irregular borders of the periphysis. There is fibrous extension of the ossification groove of Ranvier and periosteal expansion of bone formation¹¹. Highly effective prenatal diagnosis can be performed by two-dimensional and three-dimensional ultrasound⁸, by observing characteristics of external fetal morphology, the structure of the fetal bones and the cranial sutures.

Polyhydramnios is often found in the late second and third trimesters in both TD type I and TD type II. Some pathology that can also be found are thickening of nuchal translucency, ventriculomegaly, agenesis of the corpus callosum¹², cardiac anomalies and hydronephrosis.

Differential diagnosis of the diseases which discovered skeletal dysplasia with micromelia other than TD are achondrogenesis, homozygous achondroplasia, osteogenesis imperfect type II, congenital hypophosphatasia and diastrophic dysplasia.

This report revealed the case of the death male fetus in utero at 19 weeks of gestational age, who was extracted by medical vaginal induction and diagnosed to be TD type I from autopsy. Important anomalies found include macrocephaly, short thigh, lung hypoplasia, curved of humeri and femurs, flat vertebral bodies, mesomelia, and retardation with disorganization of epiphyseal growth plates. Unluckily, there was decomposition of brain, resulting in inability to study the detail of pathology of brain.

CONCLUSION

This paper reports forensic autopsy of one case of death male fetus in utero, which was 19 weeks of gestational age and diagnosed to be TD type I. The diagnosis showed large head with prominent forehead, depressed nasal bridge, mesomelia, telephone receiver-shaped femurs, platyspondyly, lung hypoplasia and retardation with disorganization of epiphyseal growth plates.

Acknowledgement: None

Ethical Clearance: This study has been reviewed

and approved by the Committee on Human Rights Related to Research Involving Human Subjects, Faculty of Medicine Ramathibodi Hospital, Mahidol University, based on the Declaration of Helsinki (MURA2015/580).

Source of Funding: None

Conflict of Interest: None

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Retrospective Analysis of Death due to Burns in Gulbarga Region

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ABSTRACT

Burns represent one of the major health problems in India. Prolonged morbidity & disability due to burns result in economic loss to the individual family, the society & the state.

The present retrospective study has been conducted for the period of 5 consecutive years from 2011-2015 based on autopsy of the unnatural death cases resulting from burns. This study was carried out in the department of Forensic Medicine & Toxicology at Khaja Banda Nawaz institute of medical science Gulbarga (North-Karnataka) and includes 156 cases of death due to burns.

Most of the cases were from rural area 119(76.28%) compared to urban 30(19.23%). Predominant age group found to be 21-30 years (35.89%) followed by the age group 31-40 years (21.79%). Most of the deceased were from the married group 136(83.33%) followed by unmarried 20(12.82%). Manner of burn death was unknown in most of the cases 92(58.97%) followed by accidental burn deaths 56(35.89%), suicidal 6(3.84%) and homicidal 2(1.28%).

It was observed that in 26.92% cases, more than 90% of the body surface area was involved. In 5.1% of the deceased were seen with burns which involved <40% of the body surface area.

Lack of safety measures is an important cause for burns. Awareness campaigns & public education on safer first-aid practices, availability of good burn care facilities in all Government & Private institutions should be available to curb this menace of burn injuries.

Keywords: Burns, rural area, Total body surface area.

INTRODUCTION

Burn injuries rank very high as most severe types of injuries suffered by the human body and attributing high morbidity & mortality among victims¹. An estimated 2,65,000 deaths every year are caused by burns related trauma the vast majority occur in low & middle income countries like India².

Deaths due to burns have serious medico-legal importance as it is considered as commonest cause of unnatural deaths in India. The manner of burns is said to be in mystery, lies & unreliable statements. The reason may be personal, domestic, occupational, social tragedy and more recently dowry³.

In India death of a female below 7 years of marriage is linked to dowry death and such cases are investigated by magistrate under 176 CrPc (Dowry death) and other female burn & male burn death are routinely investigated by police as per section 174 CrPc.

A burn injuries death is very painful but what compels or in what circumstances women or men commits suicide or homicide or those accidentally burned but most heinous is burning of newly married women i.e. homicidal burning. In this respect it is very difficult to find out the manner (Suicidal, Accidental & Homicidal) of burn injuries that in what circumstances the burn injuries took place, it can only be possible by meticulous investigation of scene of crime and

interrogation of person concerned.

AIMS & OBJECTIVES

1. To collect data to find out various information related to age, sex, marital status & surface area of burn.
2. Habitat (Rural/Urban).
3. Manner of death.
4. To Know survival period.

MATERIALS AND METHOD

Present retrospective study was carried out on the unnatural burn death cases brought by police to the Department of Forensic Medicine, Khaja Banda Nawaz institute of Medical sciences, Gulbarga.

Study data was collected from autopsied record register for the duration from 1st January 2011 to 31st December 2015.

Detailed history of the case was obtained from the deceased's close relatives, friends, police and the other available persons who were present at the time of incidence and those accompanying the victims, with special reference to general information like Name, Age, Sex, Address, Marital status, Education, Socio-economic status and occupation etc. And other information like date & time of the incidence, period of hospitalization, police inquest & details of autopsy examination was recorded.

Total 156 cases of deaths due to burns were recorded. The information was compiled, tabulated and analyzed. Findings of Post-mortem examination were compared with history and circumstances to know whether they are consistent or not. Conclusions were drawn after comparing and discussing it with similar type of the work carried out by the other authors.

RESULTS

Out of total 986 autopsies which were conducted at Department of Forensic Medicine and Toxicology, Khaja Banda Nawaz institute of Medical Sciences, Gulbarga during the study period from 1st January 2011 to 31st December 2015, 156 were burns deaths.

The present study revealed that, the total number of burn injuries deaths was 156, which were autopsied,

and it was found that 114(73.07%) were females and 42 (26.92%) males. Females clearly outnumbered males thereby constituting a male to female ratio of 1:3(Table N0-1).

Maximum number of burns victim were married 136(83.3%) giving a married-unmarried ratio of 2.4: 1(Table No-2).

It was observed that maximum number of cases were in the age group of 21-30 years, and minimum number of cases were found in the age group of 61-70 years, and no cases were found above the age of 71 years. More male victims were present in the age group 51-60 years and more female victims in age groups of 21-30 years followed by 31-40 years & 41-50 years.(Table No-3).

Irrespective of the gender, in most of the victims 87.5% the burn injury covers more than 50% for the total body surface area (TBSA) followed by less than 50% of the TBSA 15% (Table No-4).

Out of 156 cases, maximum period of survival was more than one month in 05 cases, Maximum number of cases died within 24 hours of admission i.e 47(30.12%). 35(22.43%) cases died within one week of admission.(Table no-5).Regarding the cause of death most of the victims died of septicemia followed by primary shock including spot deaths or death on the way to hospital & hospital death within 24 hours of burn infliction.

(Table No-6) shows regarding manner of death 58.97% case are unknown manner, accidental 35.89%, suicidal 3.84% & homicidal 1.28%.

DISCUSSION

Burns are the only unnatural cause of death in India in which females outnumber males by a large margin⁴. Burns in developing countries like India is endemic and continues to be a major challenge to the health care provider and society⁵. Though there is no time trend in this region, yet 16.80% of the total deaths are autopsied. However Virendra kumar et al⁶ in his study reported this rate as 19.40%.

Incidence of burn death on the basis of 5 consecutive year 2010 to 2015 among cause of total deaths 986, death due to burn 156 which is 2nd most common cause of death after road traffic accident. Similar study also says that burn is major cause of death⁷.

In the present study data deaths due to burns are more common amongst the married subjects. This may be due to the reason associated with the marriage. Both in married & unmarried subjects, females outnumbered males. This findings coincide with the study done by Mohanty S et al⁸, 71.4% were married & 28.06% were unmarried in burns victims.

Virendra kumar et al⁶ observed 75% of female burns victims. In present study we find that incidence of burns is more common among females in all age groups except in the elderly and age group of 51-60 years of age, where male are at higher risk.

In the study conducted by Virendra kumar et al⁶, about 78% of the victims were in the age group of 11-40 years. Highest deaths were reported between age 21-30 years in study conducted at North Karnataka by Tapse SP et al⁹. In our study about 57% of the victims were in the age group of 21-40 years, and about 70% of the victim were in the age group of 11-40 years.

In the study of Virendra kumar et al⁶, the overwhelming majority (92.50%) of the victims had more than 40% of the total body surface area (TBSA) burns indicating the incompatibility with life even at a tertiary care center. About 94% mortality in over 40% of TBSA was reported in study from North Karnataka by Tapse SP et al⁹. In our study, 92% mortality is in cases of over 40% of TBSA.

Tapse SP et al⁹, in their study reported less than 1 hour survival period in 49% burns deaths, 3-7 days survival in 8% deaths & 1 week survival period in 78% deaths. In our study 66.65% of burns death are within a week and 37.17% burns deaths between 3-7 days of the incidence of burns.

Among known manner of death accidental manner more common than other suicidal & homicidal which are very less number, other study also finds the same results^{10,11,12}. Regarding manner of the death it can be differentiated by investigation and inquiry of case regarding fact.

Table (1) Sex wise Distribution

SEX	No of cases	Percentage
Male	42	26.92%
Female	114	73.07%
Total	156	100

Table (2) Marital status of victim

Marital status	No of cases	Percentage
Married	136	83.33%
Unmarried	20	12.82%
Total	156	100

Table (3) Age & Gender wise distribution of victims of burns

Age group (Years)	Males	Females	Total no of cases	Percentage
1-10	03	04	07	4.48%
11-20	05	07	12	7.69%
21-30	05	51	56	35.89%
31-40	08	26	34	21.79%
41-50	06	16	22	14.10%
51-60	12	03	15	9.61%
61-70	03	07	10	6.41%
71 & above	00	00	00	000%
Total	42	114	156	100%

Table (4) Distribution of burns over total body surface area

% of Burns	No of cases	% of cases
0-10%	00	00%
11-20%	00	00%
21-30%	03	1.92%
31-40%	05	3.20%
41-50%	10	6.41%
51-60%	14	8.97%
61-70%	35	22.43%
71-80%	17	10.89%
81-90%	30	19.23%
>90%	42	26.92%
Total	156	100%

Table (5) Survival period of victims of burns

Survival period	No of cases	Percentage
<24 hours	47	30.12%
1-3 days	12	7.69%
3-5 days	23	14.74%
5-7 days	35	22.43%
1wk – 1month	34	21.79%
>1 month	05	3.20%
Total	156	100%

Table (6) Distribution of burn death case on the

basis of manner of death

Manner of death	Frequency	Percentage
Accident	56	35.89%
Homicidal	02	1.28%
Suicidal	06	3.84%
Unknown	92	58.97%
Natural	Nil	Nil
Total	156	100%

CONCLUSION

The present study highlights the following features pertaining to the burn deaths.

1. Death due to burns is the 2nd most common cause of death after road traffic accidents.
2. Majority of the deaths occurred in the married subjects (83.33%).
3. Most of the burn victims are females in child bearing age.
4. Peak incidence of mortality due to burns was observed in adolescent and young age groups (11-40 years).
5. Mortality of 90% was observed in subjects having TBSA of above 40%.
6. Majority of the deaths occurred within a week of the incidence (about 66.65%).
7. Regarding manner of death most of the case are unknown manner and accident, suicidal & homicidal are less number.

Burn injuries constitute a serious problem with a very high mortality among victims although these injuries are preventable.

Many injuries are linked to social, cultural and biological issues in causation, recognized as man-made and behavior linked disorders and linked to socio-demographic transition.

Most of the time lack of safety measures is an important cause for burn. Public awareness through different communication channels and education through schools could be provided about burn-related safety practices.

There should be availability of good burn care facilities in all public institutions as near to place of accident as possible.

If burn injuries are caused by any unlawful means, culprits should be booked and Government must take coercive steps & punish the culprits in fast track courts to give a message to the society about its commitment towards control of such crimes.

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

Source of Funding: Self Funding.

Ethical Clearance: Not Applicable.

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The Phasial Distribution Pattern of Various Entomological Species on Decomposing Human Corpses Establishing Faunal Succession

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ABSTRACT

Background: Forensic entomology refers to the science of exploring vivid information as determined from the distribution of insects and their derivative in the investigation of various events related to death/crime. Dead human corpses are tempting hosts to a wide variety of insect species ranging from fungi to arthropods. This infestation occurs within minutes after death and leads to changes in the pre-existing conditions by their activities, their by favouring subsequent invasion by a different array of organisms/ species. These insects approach the corpse in second to few minutes, lay eggs in natural orifices/ wound sites, pass through various developmental stages, feed on the corpse ensuing further decomposition.

Aims: The objective of the present study is to identify the species/ subspecies of organisms infesting human corpses during various stages of decomposition, to study seasonal variations of species infesting the corpse, to find affinity of these species to some specific locale and to establish secondary wave of faunal activity.

Material and method: The present was carried out on 100 decomposed corpse under guidance from expert entomologist where various forms of entomological evidences were available. This study was carried out in the mortuary of Gandhi Medical College, Bhopal from 2009 to 2012. All necessary information regarding scene of crime, location, climatological conditions were recorded based on police papers, history narrated by relatives and meteorological conditions prevalent. Postmortem examination was done and various samples collected were subject to rearing. Available cases were categorized in five stages: Stage I - Fresh, Stage II – Bloated, Stage III – Active decay, Stage IV – Post decay and Stage V – Skeletonized. Seasonal prevalence of various insect species was done and location wise distribution of various species was also done. All available records were then analyzed to arrive at the goals of present study.

Observation and Results: Out of 100 cases, 54 were known, 46 were unknown. 82 cases were males and 18 cases were females. Life cycle stages of various fly species were the commonest collected evidences. Calliphorids were found in 78% cases, Sarcophagids in 13%, Muscidae in 3% cases, Calliphora in 2% cases, in 4% cases species remained unidentified. Beetles were found in 8 cases, cockroaches in 05 cases and red ants in 01 case. *C. Megacephala* was found in 55.2% cases and *C. Rufifaces* in 43.2% cases. Maximum activity of insects with overlapping was found in rainy season (July to September). *C. Rufifaces* was more commonly observed in corpse found in less habitat places.

Conclusion: In the present study outlines the fact that human corpses provide platform for a progressively changing niche to a wide variety of organisms in phased manner. The condition of the corpse changes and provide nidus for a different set of species, hence representing faunal succession. The silent testimony of these little creatures can provide promising help in solving related crimes.

Keywords: Corpses, Entomology, Fauna, Successional wave.

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INTRODUCTION

Forensic entomology refers to the science of exploring vivid information as determined from the distribution of insects and their derivative in the investigation of various events related to death/crime.

Dead human corpses are tempting hosts to a wide variety of insect species ranging from fungi to arthropods. This infestation occurs within minutes after death and leads to changes in the pre-existing conditions by their activities, their by favouring subsequent invasion by a different array of organisms/ species. (Smith 1986¹, Anderson & Valnerhoven 1996²). Usually blood or other body fluids escaping out from body provide the initial impetus for these six-legged arthropods dominating terrestrial fauna. These insects approach the corpse in second to few minutes, lay eggs in natural orifices/ wound sites, pass through various developmental stages, feed on the corpse ensuing further decomposition. The eggs usually hatch in first 24hrs when maggots crawl up and pass through active stages (1st, 2nd, 3rd, instar larval stages), fully grown larvae bury themselves in soil, turn brownish-black (a stage called pupae). Adult form of flies are now ready to evolve, there by completing the life cycle (this entire process is completed within 2-3 weeks). During these developmental events the corpses pass through bloated state where putrid gases are generated and a different variety of fauna is attracted to the corpse. Subsequently, the putrid gases escape making the end of active decomposition state of the body coinciding with the completed life cycle of the arthropod invader. Hence, the corpse hosts a vivid growth of various species in varying permutations & combination. Dipterian family (Including blow flies and flesh flies of Calliphoridae & Sarcophagidae species) and Coleopteran family (Including Histeridae and Dermestidae species) outnumber any other species in terrestrial settings. (Reed 1958³, Payne 1965⁴, Braack 1986⁵, Putman 1977⁶, Fullar 1934⁷). Therefore, necrophagus species (feeding on body) initially invade the corpse to be followed by other organisms having no direct relation to the body which include predators of necrophagus species and other amphibious species of beetles, ants and wasps which are active during later/ advanced stage of decay and utilize corpse as a part of extension of their environment. This process involves overlapping of stages. Dipterans trigger the initial move and provide platform for the successional wave. (Chapman and Shankey 1954⁸).

A plethora of factors influence the successional wave, the most important being environmental condition of vegetation, locality, temperature, rainfall and soil fauna (Bornemissa 1957⁹, Erzinclioglu 1986¹⁰). Insects and their derivatives are so closely related to the

decomposing corpses that their mere presence at the site of crime together with basic knowledge of their life cycle can possibly work to fill the gap in the chain of events and aid in the investigational profile of various events.

The objective of the present study is to identify the species/ subspecies of organisms infesting human corpses during various stages of decomposition, to study seasonal variations of species infesting the corpse, to find affinity of these species to some specific locale and to establish secondary wave of faunal activity.

MATERIAL AND METHOD

The present study was carried out in the mortuary of Gandhi Medical College, Bhopal during 2009-2012, under the supervision of expert entomologist. A total no. of hundred cases which were brought for autopsy were taken into consideration where entomological evidences were present in various forms/ stages of life cycle. These cases were classified into five categories based on the condition of the corpse at the time of examination :-

Stage 1: Fresh (Includes cases just after death up to first signs of bloating)

Stage 2: Bloated (Include cases with bloating)

Stage 3 : Active decay (Involves cases post bloating and release of putrid gases)

Stage 4 : Post decay (Involves cases where most of the corpse is reduce with scanty tissues remaining)

Stage 5 : Dry/skeltonised

All necessary related information was gathered from police papers including scene of crime, circumstantial evidences, site of finding the body, history as narrated by relatives/friends etc. A meticulous autopsy was done to find the duration, cause, mode and manner of death. All forms of entomological evidences available were systematically noted down and careful collection of samples from various stages were done which were then subjected to rearing under direct observation for identification of species/organisms. Eggs, larvae, pupae were separately collected and reared in the mortuary as they were placed in dry containers with lids along with available mass of tissue from corpse. These containers were left, undisturbed and observed from time to time.

After appearance of adult forms identification was done (Easton and Smith 1970¹¹). Existing climatological conditions including mean temperature and humidity were recorded, seasonal activity of various species was charted according to weather conditions. Corpses were classified into categories according to their location to find special affinities, if any. The gathered information was then utilized to establish secondary wave of faunal succession.

OBSERVATIONS AND RESULTS

In the present study a total of 100 cases were considered of which 54 were known and 46 were unknown in identity. 82 cases were males, 18 case were females. Clothing were partial in 28 cases while 55 cases were fully clothed.

Table No. 1(a): Distribution of corpse on the basis of decomposition status

Stages	No. of corpse
Stage I (Fresh)	6
Stage II (Bloated)	31
Stage III (Active decay)	34
Stage IV (Post decay)	25
Stage V (Skeletonized)	4

Table No. 1(b): Entomological evidence collected stage wise

Stage of Decomposition	Total No. of corpse	Entomological Evidence	
		Type	No. of cases
I-Fresh	06	Eggs	03
		Eggs+Larvae	01
		Larvae	02
II-Bloated	31	Eggs	03
		Eggs+Larvae	03
		Larvae	25
III-Active Decay	34	Eggs	02
		Eggs+Larvae	01
		Larvae	26
		Larvae+Pupae	03
		Larvae+Beetle	01
		Pupa+Cockroach	01
IV-Post Decay	25	Larvae	17
		Pupa+Ants	02
		Pupa+Larvae	04
		Larvae+Pupa+Adult fly	01
		Pupa+Beetle+Cockroach	01
V-Dry/ Skeletonized	04	Larvae+Beetle+Cockroach	03
		Larvae+Ants	01

As is clear from above two tables various life cycle stages of flies were found to be the commonest collected evidence in the present study. Dipterans predominate the fate of corpse in the initial stages while other scavengers make their way in later stages and becomes active. Flies and their products were predominated fauna in first month of decomposition (upto stage of active decay) while dermastids, clerids and ants were commoner during later stages (beyond active decay stage). It does establishes the fact that the subsequent demolition of the corpse a whole new set of predators pounce upon the remnant corpse. Apichat et al (2007)¹² reported activity of beetles and other scavengers in advanced stages of decomposition.

Earlier researchers also observed similar findings where Dipteran flies pioneered corpse invasion and channeled pathways for subsequent invasion by other insects (Chapman & Sankay 1954⁸, Megnin 1894¹³). Demolition of corpses started with Dipekans and ended up with beetles (Kashap & Pillai 1989¹⁴).

The main array of insects found on the corpses were blow flies (family Calliphoridae), flesh flies (family Sarcophagidae), occasionally house flies (family Muscidae), Dermastid beetles (family Dermestidae) and bone beetles (family Cleridae). Calliphoids were found in 78% cases, Sarcophagids in 13% cases, Muscidae in 3% cases, Calliphora in 2% cases and 4% cases species remains unidentified. Beetles were found in 08 corpses (in 3 cases both Dermastid and Cleridae beetles were found), cockroach were present in orifices in 5 cases and mass of red ants was present in 01 case.

Among the Calliphorids Chyrosoma Megacephala and Chyrosoma Rufifaces were commonest species almost paralleling and frequenting the corpses at the earliest. Megacephala and Rufifaces were found in 55.2% and 43.2% cases respectively. In 02 cases Sarcophagids were present as initial infestors while overall activity was noted upto post decay stage (peek activity was found during later part of active decay stage).

Table No. 2: Seasonal distribution of various flies species on corpses (more than 01 fly species were present in some cases)

	Summer (Apr.-June)	Rainy (July-Sep.)	Autumn (Oct.-Nov.)	Winter (Dec.-Jan.)	Spring (Feb.-Mar.)
C. Ruffifacies	10	17	2	8	7
C. Megacephala	14	23	6	7	5
Calliphora Vicina	0	0	0	2	0
Sarcophagidae	4	6	2	1	3
Muscadae	0	3	1	0	0
Unidentified	0	4	1	0	1

The activity of fly species was maximum during rainy season (July – September). During this months ideal temperature and humidity settings accounted for maximum activity. However, the activity was relatively low in the rainiest month of July. Summer season with relatively high temperature was also ideally suited for the growth of various species. The activity was relatively slow in cooler months particularly with respect to the species cohabiting *Chrysosoma* during later part of active decay stage. *Calliphora Vicinia* species (present in 2% cases) was found in cooler months of winter season. Earlier studies mention that *Calliphora Vicinia* enters human dwelling places in winter months (Catts and Haskell 1990¹⁵, Nolte et al 1992¹⁶).

Coe 1978¹⁷ reported that *Chrysosoma* flies are primary fauna visiting the corpse. Bharti and Singh (2000¹⁸) adds that *Chrysosoma* and *Calliphora* go hand in hand during initial endeavour on the corpse.

Table 3: Distribution of corpses on the basis of location

Locale	No. of Corpses
Urban open	27
Urban Closed	09
Sub urban open	15
Sub urban closed	03
Rural open	20
Rural closed	05
Water	17

In spite of the fact that *C. Megacephala* was the commonest species, *Chrysosoma Ruffifacas* outnumbered *Megacephala* species in bodies found in open condition and less habited places (in 12 cases). *Megacephala* was more commonly observed in bodies recovered from

water bodies. Both cases of *Calliphora* were found in urban and suburban closed spaces while beetles were found in open spaces with shrubs and forest like topography.

CONCLUSION

The present study clearly outlines the fact that human corpses provide platform for a progressively changing niche to a wide variety of organisms in phased manner. The condition of the corpse changes and provide nidus for a different set of species, hence representing faunal succession. Though, there are variations in the participant species depending upon the climatic scenario and location of the corpses but a distinct wave of secondary overlap is discernable. This knowledge can in term be utilized to answer a number of questions related to corses where decomposition has set in. The silent testimony of these little creature can prove promising help in solving related crimes.

Ethical Clearance - Taken from College Ethical Committee (Gandhi Medical College, Bhopal)

Source of Funding - Nil (Self)

Conflict of Interest - Nil

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Clinical Audit- A Comparative Study of Clinical Findings and Autopsy Findings in Deaths due to Trauma

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ABSTRACT

Trauma is a major public health problem affecting millions of people across the world. Limited studies (clinical audit in trauma) are available in our settings regarding the relationship of ante mortem clinical diagnosis and postmortem autopsy findings in cases of trauma. This study is an attempt to compare ante mortem clinical diagnosis with autopsy findings to find an agreement or disagreement between the two in 200 patients who died of trauma and underwent autopsy examination in Government Medical College, Thiruvananthapuram. Discrepancies if any were classified based on Battle et al system of discrepancy classification. There were no discrepancies (class V) in 57.5% of cases, Class I discrepancy was found in 4.5% cases, Class II discrepancy in 10.5%, Class III in 14% and Class IV in 13.5% of cases. Most commonly overlooked injuries were of the chest.

Keywords: *Clinical audit, clinical findings, autopsy findings, discrepancy.*

INTRODUCTION

Trauma is the modern day epidemic and ubiquitously emerging major public health problem around the world. In the field of medicine trauma is often synonymous with injury. Over five million people worldwide lose their lives due to injuries and violence while hundreds of millions more are injured every year and some of them are left with lifelong disabilities.¹ Young people between the ages of 15 and 44 years, account for almost 50% of the world's injury related deaths.^{2, 3} Injuries can have serious economic impact not only on victims and their families but the nation as a whole.^{3, 4} India is experiencing an increasing trend with regard to injuries at an alarming annual rate of 3%, particularly in road traffic accidents.⁴

Amidst such an increasingly critical environment, clinical audit has become an indispensable tool as a

quality improvement measure to retain competence of healthcare professionals and validate their trust and respect⁵. In spite of medical and technological advances, clinicians may under-diagnose or even misdiagnose a patient's condition or cause of death. Literature has repeatedly pointed out discrepancies between clinical and autopsy findings, and it is through this diagnostic role by revealing diagnostic errors that the autopsy helps present day clinicians to deliver better standards of treatment to patients thus improving the quality of health care.⁶

Hence this study was undertaken with the aim of comparing clinical with autopsy findings in traumatic deaths to find if there is agreement or disagreement between the two.

MATERIALS AND METHOD

A cross sectional study was conducted in the Department of Forensic Medicine, Government Medical College, Thiruvananthapuram on 200 cases with history of trauma treated in the Medical College Hospital, and brought for autopsy to the department Mortuary. Respective clinical case records were perused for obtaining clinical data. Both clinical and autopsy

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findings were recorded in structured proforma . Discrepancies between clinical and autopsy findings were classified based on Battle et al and Anderson et al discrepancy classification⁷ and all data thus obtained was further subjected to statistical analysis.

Table 1: Battle et al. and Anderson et al. discrepancy classification.

		Discrepancy
Major	CLASS I	Principal diagnoses definitely affecting clinical outcome
	CLASS II	Principal diagnoses possibly affecting clinical outcome
Minor	CLASS III	Secondary diagnosis either symptomatic but not treated or likely to have affected prognosis
	CLASS IV	Secondary diagnosis that could not have been made clinically
	CLASS V	No discrepancy

RESULTS

.Males outnumbered females in cases of trauma related deaths with 85% of study population being males and remaining 15% females. Age of victims ranged between 9 years and 90 years. Maximum number of trauma victims was within the age group 51 to 60 years, i.e (26.5%). 64.5% of traumatic deaths studied comprised of persons between 21 and 60 years of age (Table: 2)

Table. 2: Age distribution of cases

Age in years	Frequency	Percent
<10	2	1.0
11-20	12	6.0
21-30	20	10.0
31-40	16	8.0
41-50	40	20.0
51-60	53	26.5
61-70	35	17.5
71-80	16	8.0
>80	6	3.0
Total	200	100.0

Road traffic accidents (RTA) were responsible for majority of deaths (78.5%) in this study. In 13% of cases, death was consequent to fall from height. This was followed by deaths due to fall of heavy objects on the body, assault and other non specific causes occurring in 3%, 1% and 4.5% of cases respectively (Fig. 1)

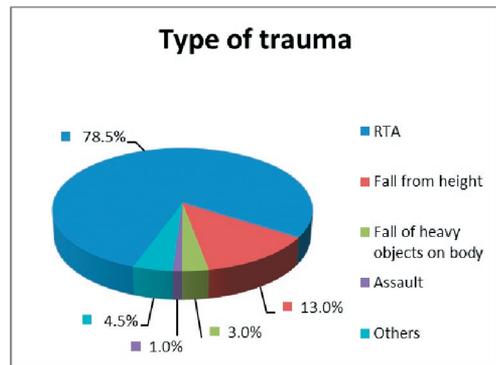


Figure 1: Distribution of cases according to type of trauma

There were no discrepancies between clinical and autopsy findings in 115 cases, constituting 57.5% of the study population (class V). Rates of discrepancies for Class III and Class IV were 14% and 13.5% respectively. Class II discrepancies in which missed principal diagnoses possibly affecting clinical outcome, were found in 21 cases (10.5%). Class I discrepancies in which principal diagnosis definitely affecting clinical outcome were found in 9 cases (4.5%) .

Table 3: Distribution of cases according to discrepancies

Discrepancy Classification	Frequency	Percent
Class I	9	4.5
Class II	21	10.5
Class III	28	14.0
Class IV	27	13.5
Class V	115	57.5
Total	200	100.0

Head injury was the most common type of trauma and was seen in 163 cases (81.5%) followed by chest injuries seen in 55 cases (27.5%). Limb fractures were seen in 41 cases (20.5%) and fractures of spine seen in 32 cases (16%). Abdominal injuries were the least common and found in 20 cases (10%).

Agreement between autopsy and clinical findings were maximum in case of head injury and limb fractures. Out of 163 cases of head injuries recorded at autopsy, 162 cases (99.3%) were detected clinically. Out of the 41 limb fractures recorded at autopsy, 40

cases were clinically detected (97.4%). Of the 55 cases of chest injuries detected during autopsy, 42 cases were clinically diagnosed and remaining 13 cases were undetected. Chest injuries were missed mostly during clinical examinations. Of the 20 cases of abdominal injuries seen during autopsy, 16 cases could be detected clinically. In injuries of spine, out of 32 cases found during autopsy, 26 were clinically diagnosed and 6 cases were missed. Hence in this study, clinically missed injuries when compared with autopsy were maximum with regard to chest, followed by abdomen and spine (Tables: 4)

Table 4: Comparison of different injuries – clinically diagnosed and missed

Type of Injury	Clinical findings		Autopsy findings		Clinically diagnosed	Clinically missed
	Frequency	Percent	Frequency	Percent		
Head	162	81	163	81.5	162 (99.3%)	1 (0.7%)
Chest	42	21	55	27.5	42 (76.3%)	13 (23.6%)
Limb Fractures	40	20	41	20.5	40 (97.5%)	1(2.5%)
Abdomen	16	8	20	10	16 (80%)	4 (20%)
Spine	27	13.5	32	16	26 (81.2%)	6 (18.8%)

Other medical conditions detected clinically included consolidation of lungs, septicemia, renal failure and coronary insufficiency. In this study only gross findings of these lesions were considered for comparison with clinical findings.(Fig: 2)

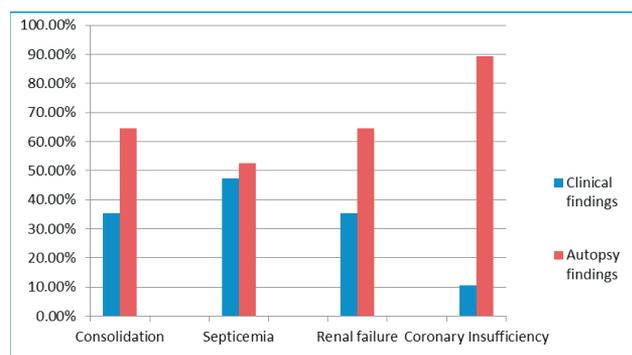


Fig: 2 Distribution of various medical conditions diagnosed clinically versus autopsy.

(C,S,R,C : Consolidation of lungs, Septicemia, Renal Failure and Coronary Insufficiency).

The survival period in hospital in 19.5% of study cases was between 6-24 hours, 20.5% of cases was between 24-72 hours, 30% cases was between 72 hours

to 1 week, 14% cases was for up to 1-2 week and 16% cases was more than 2 weeks.

DISCUSSION

Diagnostic discrepancies in this study were classified according to Battle et al and Anderson et al⁷ system of discrepancy classification. It has been found that out of a total of 200 study cases, there was no discrepancy between clinical and autopsy findings in 115 cases (i.e 57.5% of cases were correctly diagnosed clinically). This finding was in agreement with a similar study in the same institution by Dr.O.Geetha and Dr. S. Girish⁷, in which 62% cases were correctly diagnosed. There was a difference in discrepancy rates (Class V discrepancy) of 4.5% between the two studies. This could have been due to the larger sample size used in the present study. This could also be due to the factors like difference in type of trauma suffered by patients with respect to the previous study.

Agreement between autopsy and clinical findings were maximum in head injury (99.3%), followed by limb fractures (97.4%), spinal injuries (81.2%),

abdominal injuries (80%) and least in case of chest injuries (76.3%). This finding was at variance with the study by Dr. O.Geetha and Dr. S. Girish⁷, where head and spinal injuries were diagnosed correctly in 88.6% and 83.3% respectively. This was followed by limb fractures (62.5%), chest injuries (36.1%) and abdominal injuries (35.7%). Head injuries showed maximum clinical diagnostic accuracy in both the studies. This could be due to the fact that clinical presentations in head injury are too obvious to be missed and due also to advancements in imaging technologies. .

Chest injuries were the most commonly overlooked injuries in the present study, which were missed clinically in 13 cases from a total of 55 detected at autopsy. In all these cases of missed chest injuries, patients had additional severe injury involving head or abdomen. This finding was in agreement with the previous study.

Rates of discrepancies for Class III and Class IV classifications were 14% and 13.5% respectively. It was not in accordance with the previous study. This group included lung infections, hospital acquired infections, renal failure and coronary insufficiency, which even if detected would not have substantially altered the outcome.

In the present study, class II discrepancies were found in 21 cases (10.5% of total cases). It included minor lung contusions, haemothorax, and minor abdominal or spinal injuries, occurring concurrently with more severe head injuries. A plausible explanation for this could be that clinical diagnosis was restricted to severe injuries and therefore other associated injuries or infections were overlooked.

Class I discrepancy was found in 9 cases (4.5%), whereas it was 25% in the previous study⁷. This high rate of discrepancy found in Dr.O.Geetha and Dr. S. Girish's study could be because, majority of study cases survived for a short duration of time in the hospital, thereby precluding possibilities for reasonable clinical diagnosis owing to time constraints. However in the present study, cases with duration of survival less than 6 hours were excluded, which therefore meant better diagnostic accuracy.

Regarding other medical conditions in trauma victims, maximum disparity was observed in diagnosis of coronary artery insufficiency (89.5%) which could

be explained by its subtle and vague manifestations in trauma patients. Similarly the low rates of detection of infection and renal failure could also have been due to asymptomatic or atypical clinical presentations of the same.

Discrepancy rates observed in this study were also broadly conforming to similar international studies conducted in Croatia⁸, Barcelona⁹ and Slovenia¹⁰, where major discrepancy (Class I and II together), were 11.6%, 14.8% and 9.78% respectively.

CONCLUSIONS

Class I discrepancy in which principal diagnosis definitely affecting the clinical outcome was found in 4.5% of cases. Class II discrepancies in which missed principal diagnoses possibly affecting clinical outcome were found in 10.5% of total cases. Class III and Class IV discrepancies were seen in 14% and 13.5% of cases respectively. No discrepancies (Class V) were found between clinical and autopsy findings in 57.5% of the study population Agreement between autopsy and clinical findings were maximum with regard to head injury (99.3%), followed by limb fractures (97.4%), spinal injuries (81.2%), abdominal injuries (80%) and least in case of chest injuries (76.3%). Chest injuries were the most commonly overlooked injuries in the present study.

STATEMENT

Institutional Ethical Committee of Government Medical College, Thiruvananthapuram had given ethical clearance for this study and there are no issues of any conflicts of interest whatsoever.

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Assessment of Load and Medico-legal Profile of Firearm Injuries and Associated Deaths at SMS Hospital, Jaipur During the Year 2014-2015

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ABSTRACT

Background: Gun shot injuries are a great challenge for medical professionals because of high mortality rate. Survival of victim depends upon the extent of damage and promptness of medical services.

Objective: Present study was undertaken to analyse medico-legal aspects of fatal gunshot injuries to provide data in Jaipur region.

Study Type: Hospital based Descriptive Observational Study.

Place and Duration : Department of Forensic Medicine and Toxicology , SMS Medical College and attached hospitals, Jaipur (A tertiary health care centre in north-western INDIA) during the study period of 17 months (May 2014 to October 2015) .

Observation and Results: Out of 23,584 registered medico-legal cases 115 were cases of gunshot injuries with burden of 0.49%. 11 cases were of fatal out of 5135 autopsies conducted. 05 fatal cases died within 6 hours , Homicides were the most common manner of incidence, Rifled firearm weapons were the preferred employed firearm weapon , more than half cases of distant fires were the offending shot in the present study.

Conclusion: Rifled firearm weapons were the most commonly employed firearm weapon. Coma and Shock resulting from gunshot injuries were the cause of death in most fatal cases.

Keywords: *Firearm Injuries, Singeing, Abrasion Collar, Hemorrhagic Shock*

INTRODUCTION

Firearm is any instrument or device designed to propel a projectile by means of explosion of gases generated by combustion of an explosive substance.¹ Firearm (FA) injuries pose great health burden and presents enormous challenge for health and national economies.² Firearm are the most dreaded killing tool used by human being. Firearm injury is a global problem and causes considerable problems in a developing country like ours, where poverty and violence are common. External injuries seen trivial but majority of them prove fatal due to extensive damage of vital organs and major blood vessels. In this study the medico-legal aspects of Gunshot injuries were studied in the cases

brought to SMS hospital Jaipur for injury report or post-mortem examination.

MATERIAL & METHOD

Study design: This descriptive observational study was carried out during May, 2014 to October, 2015.

Study setting: The study setting was the Department of Forensic Medicine and Toxicology, SMS Medical College and attached Hospitals, Jaipur. This is the largest public hospital of the Rajasthan state which is situated in the Capital of Rajasthan.

Study subjects: All fatal and non-fatal medico-legal cases of firearm injuries reported the Department

of Forensic Medicine and Toxicology, SMS Medical College and attached Hospitals, Jaipur.

Inclusion criteria

1. Cases admitted for treatment.
2. Cases whose autopsy was done in the mortuary of the Department of Forensic Medicine & Toxicology.

Exclusion criteria

1. cases of air gun injuries
2. cases of explosion injuries and
3. cases whose informed written consent was not undertaken.

Study tool

A questionnaire was developed and pre-tested to record type of injury / firearm, outcome (in case, the subject admitted for treatment) and motive behind firearm injury.

Data collection

The investigator contacted the subject, and informed about the purpose of the study and obtained informed written consent from patients themselves, or from nearest relative, in case of subjects those who were recruited from the mortuary.

The questionnaire included information on age, sex, marital status, residence occupation, education, outcome (survival/ death), duration of survival after admission, and motive behind accident happened.

Analysis

Data were entered in MS excel sheet and descriptive statistical analysis was done.

OBSERVATION & RESULTS

9.57% of all firearm cases died and 90.43% survived and discharged routinely after appropriate treatment. Among the 11 fatal cases, about half of the cases died within 0-6 hours including 3 spot deaths. Only single patient survived for more than 3 days. 18% patients died within 6 to 24 hours after the incidence. 27% cases died within 1-3 days after the incidence.

TABLE 1: Distribution of Victims according to their Duration of Survival after sustaining the Gun-shot injuries (N= 11)

Duration of survival in fatal cases	Number of Cases	Percentage
0-6 hours	05	45.45
6-24 hours	02	18.18
1-3 days	03	27.27
>3 days	01	09.09
Total	11	100

Majority of the incidences of gun-shot injuries were homicidal in nature (78.26%) followed by accidental episodes. 2 cases were of suicidal gun-shot injury. Rifled weapon were most commonly used weapon in about 72% cases. Shotgun was employed for fire arm injuries in 27.83% cases.

Table 2: Distribution According to Type of Firearm Weapons used for offending the victims N= 115

Type of Weapon	Total No. of cases	Non fatal cases	Fatal cases	%
Rifled firearm weapon	83	72	11	72.17
Smooth bore fire arm weapon	32	32	00	27.83
Grand Total	115	104	11	100

Incidences of rifled firearm weapons were fatal in 13.25% cases. None of the victim offended with shotguns succumbed to it. Rifled fire arm weapons were significantly related to fatality.

In majority of the cases, gun-shot injuries was fired from distant range (52.17%) and in another major lot of cases, the range remained undetermined (36.52%); possibly may be deciphered in conjunction with a ballistic expert. 6.96% cases were of contact fire, 3.48% of close and a single case (0.87%) of near range of fire.

Table 3: Distribution according to the range of Fire Arm Weapon Used for offending

N= 115

Range of Fire	No. of Cases	Percentage
Distant	60	52.17
Not Determined	42	36.52
Contact	08	6.96
Close	04	3.48
Near	01	0.87
Total	115	100

In 45.5% cases hemorrhagic shock was the cause of death which was equally contributed by coma in 5 cases. Only one victim died due to septicemic shock who was the victim who survived for 21 days after sustaining gun-shot injuries.

Table 4: Distribution of Victims of Firearm Injuries according to the targeted body part in gun-shot injuries and range of fire

N=115

Body Parts	Range of fire					Total	Percentage
	Distant	Undetermined	Contact	Close	Near		
Periphery	22	12	02	02	00	38	33.04
Chest	15	19	01	00	01	36	31.30
Abdomen	11	09	00	01	00	21	18.26
Head	11	01	05	00	00	17	14.78
Neck	01	01	00	01	00	03	2.61
Total	60	42	08	04	01	115	100

Entry wounds were analyzed on the basis of their characteristics appearance to naked eyes, presence of blackening. Scorching, tattooing and singeing were in cases of close range fire at the same time presence of inverted margins, abrasion and contusion collar etc. in distant range fire.

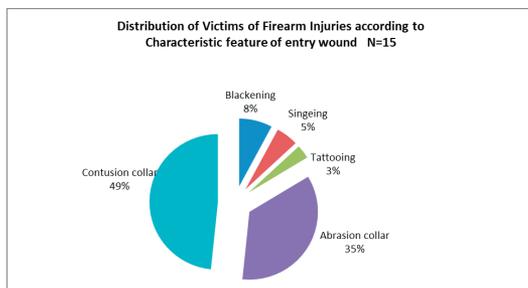


FIGURE NO. 1: Out of 11 fatal cases of gun-shot injuries, brain was the most commonly affected vital organ (54.55%) followed by heart (18.18%), liver & Intestine in one case each.

The commonest targeted body parts were the peripheries including the upper and lower limbs (33.04%). The next to follow was the chest in 36 cases (31.30%). Abdomen including pelvis was targeted in 18.26% cases and head was the soft target in only 14.78% cases. Least affected body part was neck with only 3 cases.

The anatomical locations of fatal gunshot injuries were determined in all 11 cases.

The head (54.55%) was the most common site of fatal gun-shot injuries followed by chest (36.36%). In 9.09% cases the fatal gunshot was an abdominal region and resulted in death due to haemorrhagic shock. A single case of head injury died due to septicemic shock. All cases of fire arm injuries on the chest region also died due to shock and haemorrhagic.

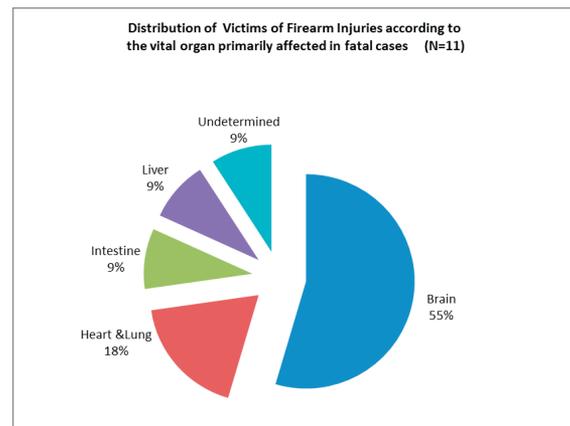


FIGURE 2. In a single case of gunshot injury of an unidentified individual whose dead body was recovered as partially skeletonised being in the advanced stage of putrefaction, foreign bodies were recovered from both skull and thoracic cage due to which the vital organ primarily affected could not be assessed definitely.

DISCUSSION

Out of 115 victims of firearm injuries, only 9.57% people suffered fatal injuries. Most of the other authors have studied only fatal firearm injuries. Among the fatal cases, 05 (45.45%) died within 6 hours including 3 spot deaths; 02 (18.18%) in next eighteen hours i.e. in 6-24 hours after the injury. Rest 04 patients (36.36%) victims survived the event for more than one day. Sachan R et al Kanpur 2013³ reported similar results.

Homicides (78.26%) were the most common manner of firearm injuries in the present study followed by 19 (16.52%) accidental and 02 (1.74%) suicidal firearm injuries.

Homicidal intent was predominant in most other studies like of Sachan R et al Kanpur 2013 (92%)³, Chaurasia N Varanasi 2014 (85.4%)⁴, Patnaik K K et al Behrampur 2014 (96%)⁵, Kumari S et al Agra 2014 (88.34%)⁶. Other studies have considered either only homicidal like of Patowary AJ et al Guwahati 2005⁷, Pradipkumar KH et al Imphal 2005⁸ or suicidal firearm injuries by Rao D Bangalore 2015⁹. The preponderance of homicide in gun-shot injuries is explainable as these deadly weapons are generally used in planned manner or more so impulsively in a planned assault.

Rifled firearm weapons (72.17%) were the most commonly employed firearm weapon to offend the victims in the present study followed by smooth bore fire arm weapon (27.83). But, our results are not in accordance with those of Kumari S et al Agra 2014.⁶

Distant fires (52.17%) were the predominant offending shot in the present study similar to that reported by Pradipkumar KH et al Imphal 2005.⁸ In 36.52% cases the range remained undetermined due to lack of the characteristic features of firearm wounds. Close (3.48%) and contact (6.96%) range fires were found in less numbers, which is quite obvious owing to the lesser representation of suicidal gun-shot injuries in this study. Distant fires had produced most fatal wounds in this study, followed by contact shots. But our findings were quite low in comparison to those of Kumari S et al Agra 2014 (53.3%)⁶ and Sachan R et al Kanpur, 2013 (60.66%).³

There was presence of entry wounds in all 100% victims. In 52.04% cases there was a single entry wound as also reported by Patowary AJ Guwahati 2005⁷ which

was quite low from that of Kumari S et al Agra 2014 (95% with only 5% cases of double firing)⁶ but findings of the present study were quite low in comparison to other studies done in the same state, Kumar R, Varanasi 2013¹⁰ and Sachan R et al. Kanpur 2013³. This is explainable as the majority of the gun-shot wounds in this study were distant fires. In the present study, a single exit wound was found in 16.52% cases and in 1.74% cases there were two exit wounds. These results are quite low in comparison to those of Kumar R Varanasi 2013¹⁰ and Kumari S et al Agra 2014⁶ who reported presence of exit wounds in 61.36% (with one exit wound in 18.18%, two in 19.31%, three in 10.22% and more than three exit wounds in 13.63% victims) & 60% victims (with single exit wound in 86.7% and double exit wounds in 13.3% cases) respectively. Abrasion and contusion collars were the most consistent findings in entry wounds of rifled firearm weapons. The characteristic features of blackening, singeing and tattooing were seen in relatively fewer number of entry wounds, because the majority of gun-shot entry wounds in this study were distant fires. Blackening was seen in 12 cases and tattooing were in 5 cases. These findings of the present study are very low from those of Kumar R Varanasi 2013¹⁰ and Kumari S et al Agra 2014⁶ and can be attributed to the variation in the predominantly used firearm weapon and range of fire in both studies.

Chest (31.3%) remained the most commonly targeted body region in this study followed by abdominal region (18.26%) and, head & face (14.78%). These results bear slight variation with those of Kumari S et al Agra 2014⁶ (most common site was abdomen- 30.9%, followed by chest- 21% and head- 16%). In 33.04% cases firearm wounds were found on peripheries and neck was the least affected part of the body (2.61%) and those of Sachan R et al Kanpur 2013³ where abdomen followed by head & neck was the commonest site.

In fatal cases of firearm injuries, head (54.55%) was the most commonly targeted body part followed by chest (36.36%) and abdomen (9.09%); similar to observations of Pradipkumar KH et al Imphal 2005.⁸ Head region also remained the target in both cases of suicidal deaths being the most vulnerable site for suicide with firearm weapon. But, these are variable from those of Kumar R Varanasi 2013¹⁰ and Patowary AJ Guwahati 2005⁷ where chest followed by neck and head and Patnaik K K et al Behrampur 2014⁵ where chest followed by head were the most commonly offended body parts in

fatal cases with 25% fatal entry wounds in abdomino-pelvic region too. In the present study, peripheries and neck were not affected in fatal gun-shot injuries as also reported by Patnaik K K et al Behrampur 2014⁵ who reported only 7% firearm wounds in lower limbs in fatal cases.

Brain and meninges (54.55%) were the most commonly injured vital organ in fatal cases followed by lung& heart (18.18%); similar to that reported by Kumar R Varanasi 2013.¹⁰ However, this was not so in the observations of Patnaik K K et al Behrampur 2014⁵ who reported highest involvement of lungs (29%) followed brain, stomach and intestine (16% each). Liver and intestines were the least affected internal organs in this study (9.09% each); which is again quite low as that reported by Patnaik K K et al Behrampur 2014⁵ but the differences are easily attributable to the differences of the pattern of gun-shot injuries sustained by victims in the two studies. No other vital structures were observed to be affected in fatal cases of gun-shot injuries.

In 90.43% cases, gun-shot injuries was the only injury sustained on the body and in rest 9.57% cases; associated injuries of blunt trauma were seen on the body possibly due to struggle or secondary impacts after firearm injuries, but these were not fatal. The findings are similar to those of Kumar R Varanasi 2013¹⁰ who reported the presence of associated injuries in 8.33% victims suffering fatal injuries; but quite high from those reported by Pradipkumar KH et al Imphal 2005 (2.99%).⁸ Foreign body was recovered from the body in 34.78% cases. Wound debridement was the most commonly employed treatment modality, possibly due to preponderance of distant fires on peripheral parts of the body. Exploratory laparotomy, chest tube drainage and craniotomy were the other treatment modalities employed in different patients according to the type and site of gun-shot wounds suffered.

Coma due to head injury and Shock & hemorrhage resulting from gunshot injuries (45.45% each) were the cause of death in most fatal cases. Only one case (9.09%) died due to septicemia consequent to firearm injury. Hemorrhagic shock was the most common cause of death in the study of Patowary AJ Guwahati 2005⁷, Kumari S et al Agra 2014⁶ and Sachan R et al Kanpur 2013.³

CONCLUSION

- Rifled firearm weapons (72.17%) were the most commonly employed firearm weapon to offend the victims in the present study followed by smooth bored weapon in 27.83%.
- Distant fires (52.17%) were the predominant offending shot in the present study.
- In 52.04% cases there was a single entry wound. More than one fire was found in 19.13% cases in the present study. Exit wounds were present in only 18.26% cases.
- In 73.04% cases, only a single body region was inflicted upon by use of firearm weapon.
- Coma due to head injury and Shock & hemorrhage resulting from gunshot injuries (45.45% each) were the cause of death in most fatal cases.

Ethical Clearance: Ethical clearance for the study was obtained from Institute Ethics Committee of SMS Medical College, and attached group of Hospitals, Jaipur.

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Pattern and Distribution of Long Bone Fractures in Victims of Road Traffic Accidents in Bangalore City

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ABSTRACT

Accident is an event, occurring suddenly, unexpectedly and inadvertently under unforeseen circumstances. Road traffic accidents (RTA) rank first among all accidents throughout the world. In developed countries, it is the most common cause of death below the age of 50 years. RTA account for almost 1.3 million deaths and a further 20 to 50 million non-fatal injuries per year globally. Road traffic injury is defined as a fatal or a non-fatal injury incurred as a result of collision on a public road involving at least one moving vehicle.⁽¹⁾

Rapid urbanization, unplanned roads and highways, incompetent traffic system, violation of traffic laws by the drivers and pedestrians, overcrowding, reckless driving etc are possible explanations for increased figures of RTA.

Pattern of injury varies considerably depending upon whether the victim is a pedestrian, a pedal cyclist, a motor cyclist or a vehicle occupant. They sustain large varieties of injuries and occurrence of skeletal injuries is extremely high. The classical fatal skeletal injuries in pedestrians are skull fractures and fractures of the lower limb bones. In case of a rider or a pillion rider of a motorcycle, the most common injury is fracture of the skull, commonly known as motor cyclist's fracture, whereas four wheeler occupants sustain transmitted fracture of femur or pelvis, fractures of the skull and whiplash injury.⁽²⁾

When compared to head injury, the other skeletal bone fractures make the patient to suffer from greater degree of morbidity. Skeletal injuries alone due to RTA is a rare cause of death, but indirectly results in death, like the fracture of long bones leading to haemorrhage and shock due to rupture of large vessels. Trauma is the leading cause of death and disability for patients under 45 years in the industrialized world.^(3,4) These rates are declining in the developed countries but injuries are important and are largely neglected health problem in developing countries.⁽⁵⁾ Road traffic crashes constitute a major public health problem in our setting and the young adult male in their economically productive age-group are mostly involved.

This hospital based study was undertaken to report the pattern and distribution of long bone fractures in RTA. It is a retrospective descriptive study on RTA victims presenting to St. John's Medical College Hospital, Bangalore between October, 2015 and May, 2016. Study group comprised 400 individuals who met with RTA and had extremity injuries. Study period is 8 months. The affected age group was between 15-47 years and the great majority of them were males (305) 76%. The commonest site of injury was lower extremities (216) 54%. Injuries to upper extremities (156) comprised 39% of the cases.

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Plain radiography was done in all patients (100%). CT was required in 13 patients (3.3%). MRI and other radiological modalities were not done in this study. Chronic osteomyelitis developed in 10 patients (2.5%) and amputation was carried out in 5 patients (1.25%)

Keywords: RTA, fracture, traffic, victims

INTRODUCTION

Bone fracture has been described as the break in continuity of a bone.⁽⁶⁾ This could be the result of excessive force, stress or trivial injury as occurs in pathological fractures.⁽⁷⁾ Road traffic accident is recognized as a major cause of morbidity and disability.

While for along time road traffic injuries have been the leading cause of permanent disability and mortality among those aged 10 to 50 years in developed countries, the same picture is unfolding in developing countries as they undergo what has been termed the "epidemiology of transition".⁽⁸⁾ In many developing countries, not only is the incidence of various injuries increasing but also the causative factors are changing from the historical patterns such as falling from trees to injuries due to occupational hazards, interpersonal violence and road traffic injuries, which appear to be the leading cause of traumatic injuries.⁽⁹⁾

Injuries in general and road traffic injuries in particular have not received the attention they deserve in most developing countries. Lack of empirical data and poor quality of the data that exist is probably part of the problem.⁽¹⁰⁾ Motorcyclists represent a particularly vulnerable group of road users. Due to their relatively small size compared to other vehicles, motorcycles are often missed, not noticed, or fall in the blind spot of other drivers.⁽¹¹⁾ Relative to car crashes, motorcycle crashes have received relatively less attention by the research community despite the high mortality rates.

The objective of the study is to show the magnitude of the problem and to see the pattern of extremity bone fractures of adults caused by road traffic accidents in Bangalore city. The study provides basis for establishment of prevention strategies as well as treatment protocols.

MATERIALS AND METHOD

Prospective study on 400 victims of RTA with extremity injuries presenting to St. John's Medical College Hospital, Bangalore. This hospital drains most of the RTA cases in Bangalore city.

Sample size: 400

Study area: Bangalore City.

Study period: October, 2015 – May, 2016 (8 months)

Inclusion criteria:

All victims of RTA presenting to casualty or referred to the department of Orthopedics with extremity injuries were included in the study.

Exclusion criteria:

Those who died on arrival to the casualty and those patients without extremity fractures.

METHODOLOGY

A performa was designed to document all the relevant data. Ethical clearance was obtained from the institutional ethical review board (IERB). The study design is a retrospective descriptive study involving all patients fulfilling the inclusion criteria who presented to the casualty between October, 2015 – May, 2016. Using a data collecting sheet (Performa), a group of 400 patients injured due to RTA were studied. The following data was recorded: age, sex, region of the body injured and type of fracture.

All victims of RTA were studied for skeletal injuries. Information of the victim regarding age and sex will be gathered from hospital records. In each case, an external and internal examination will be done for fractures and other injuries. Patients radiographs were carefully studied and evaluated. Plain radiographs were done in all cases (100%) with the requirement of CT for few cases (3.3%).

Statistics: Clinical data was tabulated and analysed by proportions and percentages.

RESULTS

There were 305 (76%) males and 95 (24%) females. Age ranged between 15 -> 69 years.

There were 120 patients (30%) between (15-25 years) and 140 patients (35%) between (26-36 years), 66 patients (16.5%) between (37 -47), 36 patients (9%) between 48-58 years, 26 patients (6.5%) between 59-69 years and 12 patients (3%) with age > 69 years.

Site of injuries: The upper extremity was involved in 39% of cases, lower extremity in 54% of cases and the clavicle in 7% of the cases.

Types of fractures:

Closed (82.5%), displaced (88.5%) and comminuted (62.5%) fractures were the majority.

Complications: There were three patients (0.75%) with chronic osteomyelitis, five patients(1.25%) with amputation, two patients (0.5%) with delayed union and twopatients (0.5%) malunion. Non-union was not recorded as a complication.

Table 1: Age distribution of patients with RTA presenting to St. John’s Medical College Hospital between October 2015 – May 2016

Age Range (years)	Frequency	Percentage
15-25	120	30
26-36	140	35
37-47	66	16.5
48-58	36	9
59-69	26	6.5
> 69	12	3
Total	400	100

Table 2: Pattern of long bone involvement in patients with RTA

Site	Frequency	Percentage
Upper extremity	156	39
Lower extremity	216	54
Clavicle	28	7

Table 3: Frequency of involvement of bones in fractures of RTA victims

Bone	Frequency	Percentage
Tibia and fibula	56	14
Radius and ulna	48	12
Femur only	72	18
Radius only	56	14
Tibia only	80	20
Humerus only	36	9
Clavicle only	28	7
Ulna only	16	4
Fibula only	8	2

Table 4: Nature and type of fracture seen in RTA victims from October 2015 – May 2016

	Frequency	Percentage
Closed	330	82.5
Open	70	17.5
Total	400	100
Displaced	354	88.5
Undisplaced	46	11.5
Total	400	100

Table 5: Specific pattern of fracture seen in RTA victims from October 2015-May 2016

	Frequency	Percentage
Comminuted	250	62.5
Transverse	76	19
Oblique	58	14.5
Spiral	8	2
Impacted	8	2
Total	400	100

DISCUSSION

Road traffic accidents, which in 1990 ranked as 9th leading cause of disability adjusted life years lost, is predicted to reach the rank of three in 2020.⁽¹²⁾The most common age group involved in our study group is 26-36 years followed by 15-25 years. The male to female ratio in this study was 3.2:1.

Jha N et al in their study of injury pattern among road traffic accident cases in a tertiary hospital in south India found that more than 53% of the victims were in the age group between 20 – 40 years. The male to female ratio in this study was 1.8:1.⁽¹³⁾ Swarnkar M et al in their study of trauma in central India observed that the male to female ratio was 3.9:1.⁽¹⁴⁾ Okaro IO et al in their study of anatomic pattern of fractures and dislocations among accident victims observed that the male to female ratio to be 1.8:1.⁽¹⁵⁾ Akinpelu et al in their study of RTA in Nigerian tertiary hospital were observed that total of 47.3% trauma admissions were in the third and fourth decade of life, with mean age at 32 years.⁽¹⁶⁾ The male-female ratio was 2.5:1. Most of the accidents occurring in our region was a result of high velocity RTA with the lower extremity commonly injured than the upper extremity.

Motorcyclists were common victims of RTA in our study group. The majority of road traffic crash victims were young in their most reproductive and productive years and showed a male preponderance. This group represents the economically active age and portrays an economic loss both to the family and the nation and the reason for their high incidence of road traffic crash reflects their high activity levels and participation in high-risk activities such as recklessness driving/riding, over-speeding, driving/riding under the influence of alcohol and driving/riding without wearing any protective gears.

Male predominance in this study is due to their increased participation in high-risk activities. Individuals engaged in motorcyclists riding are often in their 3rd and 4th decades of life and commonly display carefree behaviors which could result in RTA.⁽¹⁷⁾ The upper extremities play a very essential role in mobility and control especially with the use of motorcycles which are a common mode of transportation. Extensive contraction of the muscles of the arm have been shown to be mainly responsible for fractures which occur in this region of the body.⁽¹⁸⁾ Closed, displaced and comminuted extremity fractures accounted for the majority of cases recorded in this study. The age of the individuals affected as well as the force exerted by muscle attachments to the long bones could be the reasons for findings.⁽¹⁸⁾

CONCLUSION

Trauma represents a major epidemic of non-communicable disease in the present era. Road traffic accidents account for maximum fracture presentation. In this study, individuals most commonly affected were in the age group 26-36 years followed by 15-25 years. Lower limb fractures were more common than the upper limb fractures with tibia being the most commonly fractured bone in the lower limb and radius in the upper limb. Awareness campaigns concerning safety rules targeted at the high risk group (adult males) will help in reducing the occurrence of RTAs. Knowledge of the pattern and distribution of long bone fractures in victims of RTA will help the hospital authorities for better management of trauma cases, improvement of patient outcome and providing better health care services. We also recommend development of a multidisciplinary team consisting of physiotherapists, occupational therapists for rehabilitation as part of management of trauma.

Conflict of Interest: None declared.

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A Study of Pattern of Injuries in Vehicular Accidents

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ABSTRACT

Road traffic accidents will be the third most common cause of disability worldwide. Presently 5 million people are dying worldwide as a result of injuries in vehicular accidents. This number is increasing day by day with increasing technology, urbanization, population, which ultimately leads to increased utilization of vehicles in developed countries and developed countries. The present study was done in the department of forensic medicine, Guntur medical college, Guntur basing on the autopsies of vehicular accidents during the period from 1st January 2006 to 31st December 2006. 298 cases were studied out of this most deaths occurred in male in the age group of 31-40 with head injuries.

Keywords: Vehicular accidents, head injury, intra cranial hemorrhage, skull fracture.

INTRODUCTION

Accidents are unpredictable events resulting in recognized injury. They are considered as world's most serious health problem because accidents are so alarmingly on increase all over the globe and we are hopelessly helpless. Vehicles are main means of transport and communication. It involves vehicles on roads, trains, vehicles on sea i.e., boat & ship, vehicles of air i.e., aeroplane, helicopter, with increasing technology, urbanization, population, the utilization of vehicles has increased. Vehicles on road constituted for maximum number of deaths in vehicular accidents. Hence road traffic accidents are considered as number one killer in developing countries including India. Presently 5 million people are dying worldwide as a result of injuries in vehicular accidents. It is estimated that by the year 2020, 8.4 million people will die every year from injury, and injuries in vehicular accidents. Road traffic accidents will be the third most common cause of disability worldwide. In 2005, 94,968 persons were killed in India in road traffic accidents. In the

2005, 10,534 persons were killed in Andhra Pradesh in road traffic accidents.

Many factors operate at the time of vehicular accident, of these important are human errors relating to driver of vehicles and victims due to poor traffic sense, mechanical fault of vehicles, bad condition of roads, violation of traffic rules, environmental factors, accidental falls from vehicles example: trains, due to unsafe traveling methods, overloading of vehicles, unforeseen problems like derailment leading to mass disaster, the condition of roads, road encroachments, alcohol consumption by drivers etc., There is a serious risk to the community due to vehicular accidents. The number of minor as well as serious injuries, the human suffering and economic loss due to disabilities caused by the accidents is invaluable. Thus while medical science has conquered the ravages of many diseases and epidemics, accidents have become a new epidemic of public health importance calling for equal efforts for control and prevention. Hence it is essential to study the problems of traffic accidents from time to time so that improved measures can be suggested to minimize the morbidity, mortality and subsequent economic loss to the society. The present study was based on the medico-legal autopsies conducted on victims of vehicular accidents in department of forensic medicine, Guntur medical college, Guntur to observe different pattern of

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injuries

AIMS & OBJECTIVES

To ascertain different pattern of injuries in victims of vehicular accidents and suggest suitable remedial measures to reduce morbidity and mortality due to vehicular accidents.

MATERIALS AND METHOD

The present study was done in the department of forensic medicine, guntur medical college, Guntur basing on the autopsies of vehicular accidents during the period from 1st January 2006 to 31st December 2006.

OBSERVATIONS AND DISCUSSION

In the year 2006, 936 post-mortem examinations were conducted in the department of forensic medicine, guntur medical college, guntur. Out of which 298 (31.83%) deaths were due to vehicular accidents.

In this study, males constituted 241 (80.87%) cases, females were involved only in 57 (19.13%) cases. Out of 241 males, 90 (30.20%) cases were in age group 31-40 years, out of 57 females 18 (6.04%) cases were in age group 31-40 years and least involved were above 70 years age group. The findings in this study were consistent with the studies of d.m. sosin, j.j. sacks, p.holmgreen et al¹, julianstella, clive cook, peter spirvulis², robertson, angus, giannoudis, peter v. Branfoot, toby; barlow, ian; matthews, stuartj et al³.

In this study out of all 298 cases labourers were involved maximum i.e. 119 cases in which male labourers were 101 (33.89%) cases, female labourers were 18 (6.04%) cases. Least involved were students 15 cases, in which males were 12 (4.02%) cases, females were 3 (1.01%) cases. 169 (56.71%) accidents occurred in the daytime (6am to 6 pm), 129 (43.29%) accidents occurred in the nighttime (6pm to 6am). Maximum no. Of deaths occurred in pedestrians 118 (39.59%) cases, second were motorcyclist 50 (16.78%) cases and third were occupants of light motor vehicles 40 (13.43%) cases, hence pedestrians were primary sufferers of vehicular accidents. 62 (20.81%) cases died within six hours followed by 55 (18.45%) deaths were instantaneous deaths, followed by 44 (14.76%) deaths between 12-24 hours. This is indicating the need for emergency trauma care centers in the country to help the injured as early as possible.

In region wise injuries incidence head is injured maximum 245 (82.21%) cases followed by 183 (61.41%) cases sustaining lower limb injuries, followed by 153 (51.34%) cases sustaining upper limb injuries, least region involvement was in genitals only 15 (5.03%) cases. These findings were compared with the studies of chen, shyr-chyr md; lin, fang-yue md; chang, king-jen md⁴, nilambarjha, d.k. srinivasan, gautamroy, s. Jagdish et al⁵.

pattern of head injuries observed were

- a) Contusions are most common injuries in scalp founding 150 (50.33%) cases
- b) Skull fractures found in 201 (67.45%) cases
- c) Intracranial hemorrhages are found in 199 (66.77%) cases
- d) Most common type of skull fracture is fissured 159 (79.10%) cases
- e) Temporal bone is most commonly involved 105 (52.23%) cases followed by parietal bone involvement 66 (32.83%) cases.
- f) Basal skull fractures seen most commonly in middle cranial fossa 72 (24.16%) cases followed by anterior cranial fossa.
- g) Out of 298 cases 199 (66.77%) cases intracranial hemorrhages were present in which subdural hemorrhages were most common in 150 ((50.33%) cases followed by subarachnoid hemorrhages in 96(32.21%) cases.

These findings were consistent with the studies made by nilambarjha, d.k. srinivasan, gautamroy, s. Jagdish et al⁵, sarkar, soumitra md; peek, corinne; kraus, jess f et al⁶, sahdev p, lacquamj, singh b, dogra td et al⁷.

Neck injuries:- fractures of the cervical vertebrae were seen in 18 cases (6.04%) cases. Abrasions were found on neck in 12 cases (4.04%) cases.

Facial injuries : abrasions were the most common injuries present in face 84 (28.18%) cases. Fracture of facial bone is seen only in 6 (2.01%) cases.

Chestwall injuries: abrasions and contusions were most common injuries on chestwall, rib fractures seen in 66(22.14%) cases followed by collarbone fracture 21(7.04%) cases. Scapula injury is not found in total 298 cases. laceration of lung is observed in 66 (22.14%)

cases. No heart injuries were seen. These findings were consistent with Chen, Shyr-Chyr MD; Lin, Fang-Yue MD; Chang, King-Jen MD⁴, e. O. Odelowo⁸ (1994).

Abrasions were most common injuries present on abdominal wall. Laceration of liver seen in 18 (6.04%) cases. In spleen no contusions were seen, lacerations observed in 3 (1.01%) cases. In kidneys 3 (1.01%) cases contusions as well as lacerations were observed. No injuries were present in intestines. This findings were compared with the study made by e. O. Odelowo⁸. Fracture of pelvis is seen in 12 (4.02%) cases, bladder injuries seen in 3 (1.01%) cases, external genitalia injuries present in 15 (5.03%) cases.

In this study, extremities were second common sufferers. The primary being the head injury. In upper limbs abrasions were most common injuries seen in 117 (39.26%) cases followed by fracture of bones 33 (11.07%) cases. In lower limbs abrasions were most common injuries seen in 132 (44.29%) cases followed by fracture of bones seen in 63 (21.14%) cases. Lower limbs were at high risk than upper limbs in vehicular accidents. These findings were consistent with Wick Chen, Shyr-Chyr MD; Lin, Fang-Yue MD; Chang, King-Jen MD⁴, Nilambarjha, D.K. Srinivasan, Gautamroy, S. Jagdish et al⁵. Vertebrae were fractured in 18 (6.04%) cases. These findings were compared with the studies of Sarkar, Soumitra MD, Peek, Corinn MD; Kraus, Jess F et al⁶.

The different pattern of injuries observed in pedestrians (118 cases) commonly are head injuries 101 (85.59%) followed by upper and lower limb injuries 60 (50.84%) cases. Contusions are most common injuries in scalp, fissured fractures were more, temporal bone was more involved, anterior cranial fossa is commonly involved in basal skull fractures. Subdural hemorrhages are more, ribs were more fractured in the chest. Abrasions were most common external injuries.

The different pattern of injuries observed in motorcyclist (50 cases) commonly are head injuries 48 (96%) cases followed by lower limb 36 (72%) cases, contusions are most common injuries in scalp, fissured type skull fractures were more, temporal bone was more involved, anterior and middle cranial fossa are commonly involved in basal skull fractures. Subdural hemorrhages are more, only collarbone fractures are seen in the chest, no abdominal and pelvic injuries were observed. Fracture

of upper and lower limbs were common. Abrasions were most common external injuries.

The different pattern of injuries observed in occupants of light motor vehicles (40 cases) commonly are head and lower limb injuries 27 (67.50%) cases followed by upper limb. Contusions are common in scalp, fissured fracture is common involving temporal bone and middle cranial fossa. Subarachnoid hemorrhage is seen in most of cases. Ribs and sternal fractures are seen in chest. No abdominal and pelvic injuries, fracture of bones of lower limb is most common.

The different pattern of injuries observed in occupants of heavy motor vehicles (36 cases) commonly are head injuries 27 (75%) cases followed by lower limb 21 (58.33%) cases. Contusions of scalp is seen commonly, fissured type of fracture involving temporal and only middle cranial fossa observed. Subdural hemorrhages are more, ribs were fractured commonly in the chest. External genitalia is involved commonly, fracture of limb bones seen in lower limb only.

In case of pillion riders head injuries are more common, only abrasions are seen externally. The drivers of heavy motor vehicles and light motor vehicles were only few sustaining head and limb injuries only. No other injuries were observed. Railway passengers sustained head and lower limb injuries only. In cases of cyclist (17 cases) lower limb involvement is seen in majority of cases 15 (88.23%) cases followed by head and other injuries. In case of bullock cart passengers most common injuries were seen only in head and upper limb.

In this study out of 298 cases 245 (82.21%) died primarily of head injury associated either with fracture of skull or intracranial hemorrhages or brain injuries. This finding was consistent with the studies of Julian Stella, Clive Cooke and Peter Sprivilis et al², Sarkar, Soumitra MD, MPH; Peek, Corinn MPH; Kraus, Jess F et al⁶, Sahdev P, Lacquamj, Singh B, Dogra TD et al⁷, Gissane and Bull⁹, Bhaskaran et al¹⁰.

CONCLUSION

By comparing the data of the present series of 2006 with of the previous studies, the incidence of fatal vehicular accidents is gradually increasing in number day by day.

- Males were more predominantly effected.

- The vulnerable age group was 31 – 40 years, this shows that the people of the most active and productive age group are involved in vehicular accidents, which adds a serious economic loss to the community.

- Labourers were more predominantly effected, it shows that more accidents were seen among low socioeconomic group of people.

- Most of the accidents occurred in daytime, these hours are the busiest as commuters go to and return from factories, offices, schools and business places.

- Pedestrians are more involved in vehicular accidents followed by motor cyclist.

- Heavy motor vehicles are primary causes of vehicular accidents in this study followed by three wheelers like autos.

- Abrasions were the most common injuries present externally on the victims of vehicular accidents.

- Head injury is most common injury seen in vehicular accidents.

- Skull was fractured more commonly than any other bone.

- Intra cranial hemorrhages were the most common type of brain injuries.

- Lungs were more commonly injured than heart.

- Liver was more commonly injured than any other organ of abdomen.

- Extremities were the second commonly injured sites.

- Cause of death in majority of cases was due to head injury, associated with fracture of skull or intra cranial hemorrhages or injury to the brain.

Suggestions and recommendations

based on observations an attempt has been made to give some recommendations to reduce the number of accidents.

Vehicle:

1. slow moving traffic like cycles and bullock carts should not be allowed on congested roads.

2. dazzling lights should not be used.

3. defects should be rectified periodically

4. improper or heavy loading must be avoided

5. there must be automatic signaling for vehicles separately i.e. Separate signal for each type of vehicle.

6. authorized parking places for vehicles should be strictly observed.

Drivers:

1. severe penalties for rash driving.

2. colour blindness should be checked up.

3. Drunken drivers must be punished severely.

4. Talking in cellular phones should be strictly prohibited.

5. Wearing of helmets for two wheeler drivers must be implemented.

6. Wearing of seat belts for four wheeler drivers must be implemented.

Public:

1. Pedestrians must use footpaths.

2. Pedestrian crossings must be strictly observed.

3. Education to be given regarding road sense and traffic rules.

Road:

1. automatic light control must be put.

2. footpaths must be constructed.

3. speed breakers, zebra crossings, widening of roads – neolights i.e. Mercury lights should be there in the zebra crossing.

4. demarcation of roads to prevent mixing and accidents.

5. Dividers must be constructed to prevent collision of vehicles in opposite direction.

6. Proper drainage for road, so that the road will not damage.

7. Strict implementation of one-way traffic.

8. Proper control of road traffic at peak and congested hours.

Railways :

1. Installation of warning devices like sirens at unmanned gates must be implemented.

2. Trespassing of rail road property should be declared as prohibited and unlawful.

3. Reducing public access to the tracks.

4. Improving surveillance by railway staff.

5. Facilitating emergency staff.
6. Educate the public regarding safe traveling in trains.

Alcohol: Examination of drunken drivers for alcohol by modern methods like breath analyzer should be done and must be punished by heavy penalties. Drivers who are suffering from coronary artery disease, hypertension, diabetes mellitus, and epilepsy should be advised to change their occupation.

Police: there must be vigilance on all the above-mentioned points from police side.

Conflict of Interest – No

Ethical Comity Clearance: Was Taken

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Trajectory of Blood Drops in an Experimental Model with the Use of a Firearm

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ABSTRACT

Background: Blood marks analysis is a common technique used in forensics. However, current methods used have their limitations and deviations. The most commonly used trigonometric model is based on the linear movement of a blood drop, which disregards air resistance and gravitational force which affects all mass points in an area of space.

Objective: The aim of this paper is to map the flight trajectory of blood drops in an experimental environment with the use of a firearm and to evaluate the option of replacing the real world flight trajectory by a more accurately definable parabolic approximation.

Method: An experimental model was created which simulates the real world dispersion of blood in the case of firearm use. Blood samples with a volume of 100 ml were placed into a plastic bag and were shot at. For the purpose of the experiment was prepared wooden chamber (dimensions: 2 x 2 x 2 m). Plastic bags containing blood samples were hanged in the chamber and positioned into the chamber's center. Blood samples were shot at from a distance of two meters by a Taurus .357 magnum handgun. Magnum .357 FMJ ammunition was used. Each shot was recorded by a high speed camera under a 90° angle placed on the sample's level in a 2 m distance from the chamber.

Results: Based on the physical and experimental models it was determined that the real flight trajectory of blood drops may be defined by a parabolic approximation while maintaining validity for 90 % blood drops. The parabolic approximation does not significantly differ from the ballistic curve and real flight trajectories in cases of lower flight velocities and blood drop sizes of less than 0,5 mm, meaning blood drops located in a distance of less than 0,5 m from the point of origin. From the progression of the curves capturing the flight of blood drops it was ascertained that for the purpose of using trigonometric models, it is best to use bloodstains located less than 1m from the convergence point, the reason being the fact that the deviation caused by the use of the parabolic approximation is minimal and doesn't cross 3 mm. The use of the parabolic approximation with distances of over 2 m leads to deviations of more than 3 mm when compared to reality.

Conclusions: The outcome of these comparisons shows that the real world flight trajectory differs very little from the ballistic curve and parabolic approximation under the given experimental conditions. In crime reconstructions the angle of incidence (angle of impact) of a blood drop impacting a horizontal surface plays an important role. In this area the outcomes of the ballistic curve and the parabolic approximation are nearly

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identical, especially for blood drops with low initial speeds, which constituted the majority under the specific experimental conditions.

Keywords: *Blood samples, analysis, parabolic approximation, flight trajectory, forensic ballistics, biomechanics*

INTRODUCTION

Under the assumption of the individuality of crimes, each interpretation of a crime requires an individual approach^{1,3}. An analysis of events leads to the understanding of its dynamics and at the same time helps us to understand the actions of the perpetrator. The analysis of biological traces, specifically blood stains is a well known method used in crime reconstructions and establishing of the trustworthiness of events. The relationship between the layout and the shapes of bloodstains first came to the attention of Balthazard in 1939. Literature determining the relationship of a blood drops flight trajectory and its shape appeared many years later^{24,25,31}. Geometry, which was by that time commonly used in ballistics, began to be utilized for the determination of the incidence of bloodstains. Thanks to the growing interest in this area an independent forensic field studying bloodstains in relation to their size, shape and amount, was established.

Specific physical characteristics of a blood drop after its separation from a larger blood formation determine its spherical shape and typical patterns after impact. Based on the study of these impact patterns a functional relationship was established: the lower the angle of incidence of a blood drop is, the more elongated the impact pattern will be, thus the stain will appear to have an elliptical shape⁹. The speed of a flying blood drop and the material of the surface of impact is also taken into account¹⁴. Based on these parameters the angle of incidence of a blood drop may be approximated³². Other methods based on trigonometry are in practice used to define the quantitative parameters of a blood drop incidence and can significantly contribute to the investigation of a crime.

In most papers as well as in forensic practice only one method is used which is based on the trigonometric model with the use of a straight line. As a flying blood drop is effected by gravity and air resistance, it is

very likely that the use of a straight line in the model significantly distorts the calculated trajectory length. The results could be made more accurate by using a parabola, which more accurately captures the trajectory of a flying blood drop, especially when the blood stain is located on a horizontal surface.

The main goal of this paper is to map the flight trajectory of blood drops in an experimental model with the use of a firearm. These trajectories will be compared with mathematically definable functions and a mutual relation will be established.

Alternative objective of this paper can be a guideline how to recognize droplets in the blood trace that are relevant for determination of the place of origin even with the use of the current trace reconstruction methods, and other ones, the use of which would lead just to an increase of uncertainty when used with current methods.

METHOD

Experiment characteristics

An experimental model was created which simulates the real world dispersion of blood in the case of firearm use. Blood samples with a volume of 100 ml were placed into a plastic bag and were shot at. The shot and subsequent blood dispersion were filmed by a high speed camera.

Material collection and transportation

Fresh pig blood was used for the experiment obtained at slaughterhouse Sedlcany, belonging to the company Kosova Hora a.s.. Five liters of blood were collected. Pig and human blood have very similar physical properties; pig blood is therefore a suitable substitute to be used in the experiment. Comparison of physical properties is made in (see in table 1).

Table 1: Comparison of physical properties of human and pig blood ⁵

	HUMAN BLOOD	PIG'S BLOOD	DISTILLED WATER
VISCOSITY (x 10 ⁻³ g/ms)	3.8 – 5.1	3.4 – 6.1	1
SURFACE TENSION (x 10 ⁻² N/m)	5.1 – 6.1	5.3 – 5.8	7.2
DENSITY (g/m ³)	1052 - 1063	1062	1000

Collected blood was whipped to prevent unwanted coagulation during transportation and experiment preparation. To make the conditions of the experiment as close to reality as possible, the blood sample was diluted by a 3,8 % sodium citrate solution in a 1:9 ratio¹². The change in blood density related to coagulation can have an effect on its physical properties and may in a negative way effect the experiment. The blood was transported in a plastic five liter container. Individual 100 ml samples were prepared on location at the shooting range by placing the blood into enclosable plastic bags.

Experimental procedure

The experiment took place at a private shooting range (Combat Kladno in Libusin, Czech republic). The shooting range is an outdoor facility, therefore a wood chamber (dimensions: 2 x 2 x 2 m) was constructed for the experiment. Plastic bags containing blood samples were hanged in the chamber and positioned into the chamber's center. Chamber walls were covered with paper sheet which were replaced after each shoot.

Blood samples were shot at from a distance of two meters (see in figure 1.) by a Taurus .357 magnum handgun.



Fig. 1 Camera setup and shooters position during the experiment (experimental data)

The firearm was a steel revolver with a manual reloading mechanism and a 150 mm long barrel. .357 magnum type firearms use bullets with a truncated cone-shaped frontal part. The bullet's speed can reach up to 342 m/s. Each shot was recorded by a high speed camera under a 90° angle placed on the sample's level in a 2 m distance from the chamber. The camera used a Nikkor 12-24 mm objective shooting 600 frames per second. The experiment was performed in two days under partly cloudy and windless conditions.

Video to picture image converter software was used to convert the recorded video into individual images in jpg. format. These images were subsequently processed using GIMP 2.0 software. Individual blood drops were tracked in one hundred consecutive images in different layers and their coordinates were recorded in pixels in every fifth image. 20 sets of coordinates were acquired for each blood drop. This date was later used in Excel 2007 to create a graphic visualization of a drops flight. The resulting curve was then compared with the ballistic curve and parabolic approximation. These images were also used to determine the boundary behind which all blood samples can only be found in the form of drops, thus they are all detached from the blood splatters. Were analyzed only track of drops, which have been traced by the point of impact on the papers and they moved only in a plane perpendicular to the axis of the lens of speed camera.

On the reconstruction of the droplet trajectory we propped ourselves upon the assumption that when the endpoint, the starting point and the camera recording of the trajectory from one direction are known, the trajectory is thus already determined. We so assume that neither the rotation of the droplet no the flow of the liquid in the droplet play significant roles in the droplet flight direction and that the plane the droplet moves in is fixed. The shots from the camera that is placed in the projectile axis justify this assumption. Although this camera is capable of time resolution of 1/60 of a second only, we can state that with most droplets no measurable systematic aberration from this plane have occurred and the impact of Magnus force on the droplet trajectory won't show measurably, any more than its internal convection.

GIMP 2.0 was also used to process images taken during the experiment inside the chamber. These images document the blood marks resulting from each shot. With the help of the software a set of sizes of blood marks in specific designated areas were ascertained in different sections of the chamber. The date was later visualized by creating a graph using Excel 2007.

BLOOD STAIN CLASSIFICATION

According to Bevel & Gardner in 2002, blood stains may be categorized in various ways. An important classification criterion is the size and shape of a blood stain. The deformation of blood drops

caused by the influence of different forces on the drop's surface tension is a major source of information when investigating the mechanisms of its formation. The basic IABPA (*International Association of Bloodstain Pattern Analysis*) classification allows us to quickly pinpoint the source and clarify the origin of a blood stain. Irrespective of the classification a complex thorough analysis needs to be conducted and all factors that may have influenced the creation of a specific blood mark always have to be taken into consideration²⁷.

Classification based on the impact velocity of blood drops

Blood marks may be categorized into three groups based on their impact velocities. According to Morris & Brenner in 1988, there is an inverse relation between a blood drop's size and the force that led to its formation. Consequently the higher the impact speed of a bullet on the blood source the smaller the diameter of the blood stain will be. Low impact velocity designation is used in the case of freefalling drops with velocities of up to around 10 m/s, these velocities are reached in cases of blood dripping from an open wound or from an object. Stains formed under these conditions have a diameter of up to around 4 mm, the diameter is also affected by the distance of the blood source to the impact surface. The resulting size of the stain is determined by the volume of a blood drop and its velocity, which increases with the rising height of the fall. For example, blood drops freely dripping from a wound have constant volumes of around 0,5 ml. The maximum velocity such blood drops may reach is 7,5 m/s. At these velocities a balance between the resistance force and gravitational force is reached¹⁵ (see in figure 2.).

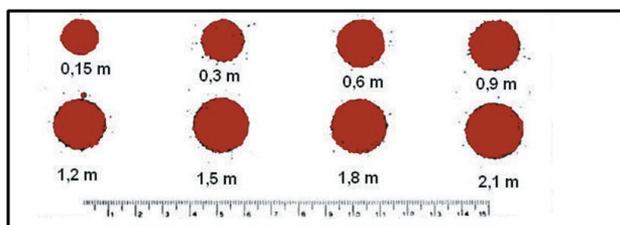


Fig. 2 Blood stain size in relation to the height of the source¹⁵

DIRECTIONALITY OF BLOOD DROPS

Determining the direction of incidence of blood drops on their directionality is one of the basic methods of IABP²². If spherical blood drop falls on the base at an angle other than 90°, it creates an elliptical blood stain. According shaped

patches may be incident angle backward subtracted. Spot is elongated in the direction from which it came. If the angle of incidence very sharp, i.e. 20° or less degrees occurs subsequent of splash droplet in the direction. It's called - *a satellite smear*. If the angle of incidence equal to 90°, is a blood stain circular shape^{5,16,22,23}.

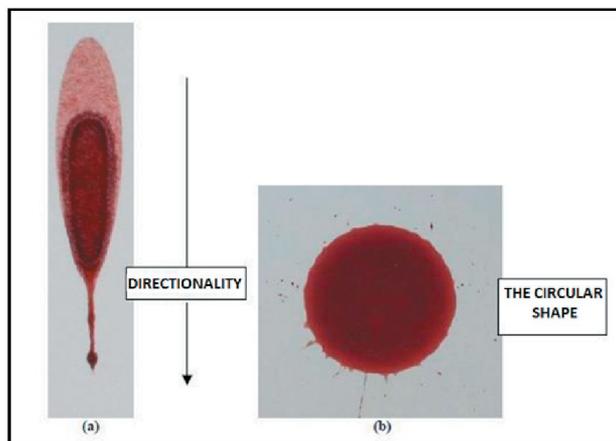


Fig. 3 The shape of the blood spots, depending on the angle of incidence²²

LINE METHOD

Line method is the basic method used in determining the origin of blood stains. Based precisely on the directionality of blood stains. With this we can find so called - *a point of convergence*. This is a point or area on a two-dimensional surface, where on the basis of directionality the blood traces directed all around²². Their determining at the crime scene is a relatively simple. It is the intersection of the imaginary lines, which can stretch in the direction of a directionality blood spots. This point only identifies the location where you found the source of origin of the blood drops, eg. possible of victim of a crime⁵. The place of origin of blood spots occurs perpendicular to the point of convergence. You can determined a specifically the place by the angle of incidence.

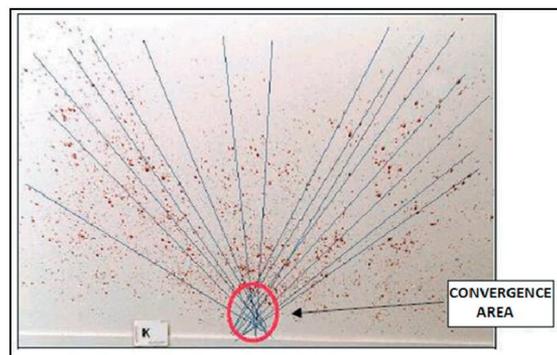


Fig. 4 Line method and the point of convergence²²

Determining the angle of incidence

Determine the angle of incidence on the basis of the blood spots is possible if there is a suitable surface, which prevent it soak in and is not otherwise damaged²¹. To determine the angle of incidence, it is necessary to measure the width and length of blood stains. The first connection between the incidence angle and the dimension of a blood droplet described Balthazard². His thoughts elaborated McDonnell in 1971 and using trigonometry so determined: *Balthazard formula*.

$$\sin \alpha = \frac{W}{L}$$

where α is the angle of incidence drops, **W** is the width and **L** is the length of the blood spots.

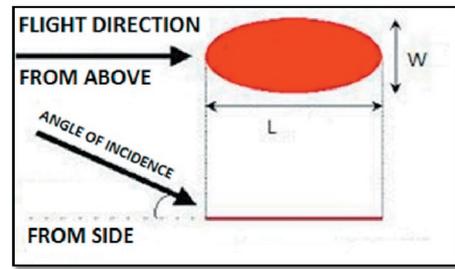


Fig. 5 Schematic representation of the determination of the angle of incidence by blood spots

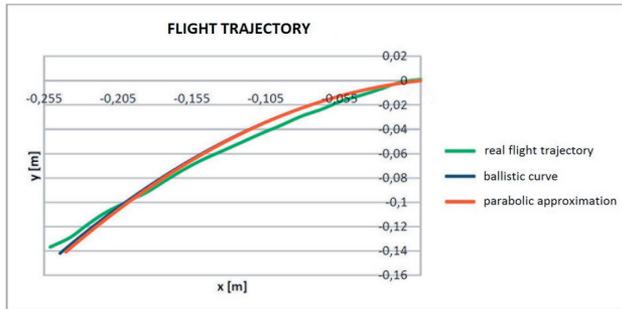
RESULTS

Were created a flight path of a blood drops in real conditions: **a) the ballistic curve** and **b) the parabolic approximation**. Into the physical model were inserted a different values of velocity and diameters of blood drops. On the basis of calculations and graphic representation of the results it was possible to create a picture of the effects of these variables on the flight path the blood drops.

Table 2. Measurement results (Shot no. 1, drop no. 4) (experimental data)

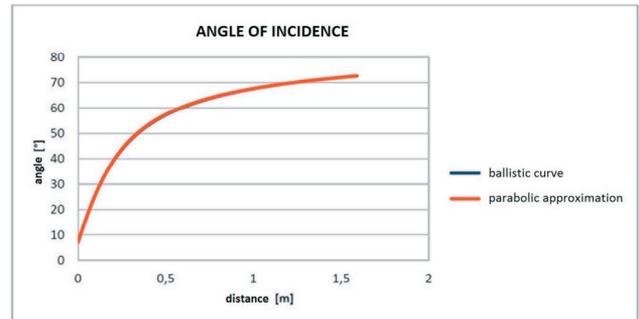
BLOOD DROP no. 1.4.							
D [m]	t [s]	x	y	x [dx]	y [dy]	Vx [m/s]	Vy [m/s]
0.005	0	429	604	480.48	- 678.48	1.6128	0.2088
	0.00833333	417	606	467.04	- 678.72	1.6128	0.672
dt	0.01666667	405	611	453.6	- 684.32	1.7472	0.672
0.00833333	0.025	392	616	439.04	- 689.92	1.4784	0.5376
	0.03333333	381	620	426.72	- 694.4	1.6128	0.8064
dxy	0.04166667	369	626	413.28	- 701.12	1.6128	0.672
1.12	0.05	357	631	399.84	-706.72	1.7472	0.9408
	0.05833333	344	638	385.28	- 714.56	1.344	0.672
	0.06666667	334	643	374.08	- 720.16	1.7472	0.9408
	0.075	321	650	359.52	- 728	1.4784	0.8064
	0.08333333	310	656	347.2	- 734.72	1.7472	0.9408
	0.09166667	297	663	332.64	- 742.56	1.4784	0.9408
	0.1	286	670	320.32	- 750.4	1.4784	1.0752
	0.10833333	275	678	308	- 759.36	1.6128	1.2096
	0.011666667	263	687	294.56	- 769.44	1.6128	0.9408
	0.125	251	694	281.12	- 777.28	1.7472	1.0752
	0.13333333	238	702	266.56	- 786.24	1.4784	1.2096
	0.14166667	227	711	254.24	- 796.32	1.344	1.2096
	0.15	217	720	243.04	- 806.4	1.6128	0.9428
	0.15833333	205	727	229.6	- 814.24	1.57696	0.95872

Legend: **t** stands for time, **dt** is the time differential, **dx** is the calibration constant for the calculation of pixels into mm, **x (dx)** and **y (dy)** are coordinates calculated using the calibration constant, **v_x** and **v_y** show a velocity of the flying blood drops in various directions.



Graph 1. Comparing the real world flight trajectory of the blood drop 1.4. with a ballistic curve and parabolic approximation. (v_x = 1,6 m/s; v_y = 0,2 m/s; D = 0,005 m), (experimental data)

As shown in graph 1. of calculated values. Ballistic curve is only slightly differing from the parabolic approximation, when considering a standard dimension of a blood drops and slow flight speed blood drops.



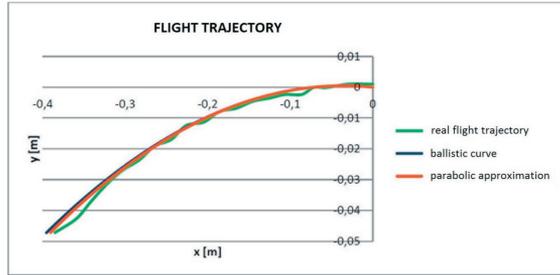
Graph 2. Angle of incidence of the blood drop 1.4. in flight along a ballistic curve and parabolic approximation (experimental data)

From the graph 2. of calculated values, shows that at slow flight speeds, ie. to 1.6 m / s and the standard dimension of a blood drops (D = 0.005 m), the angle of impact by the ballistic curve almost equal to the incident angle at the parabolic approximation.

Table 3. Measurement results (Shot no. 1, drop no. 7) (experimental data)

BLOOD DROP no. 1.7.							
D [m]	t [s]	x	y	x [dx]	y [dy]	V _x [m/s]	V _y [m/s]
0.006	0	359	516	402.08	- 577.92	3.6822	0.1
	0.00833333	332	516	371.84	- 577.92	3.0912	0.1344
dt	0.01666667	309	517	346.08	- 579.04	1.8816	0
	0.00833333	295	517	330.4	- 579.04	1.7472	0.2688
dx	0.03333333	282	519	315.84	- 581.28	2.4192	0
	0.04166667	264	519	295.68	- 581.28	2.1504	0.1344
1.12	0.05	248	520	277.76	- 582.4	2.5536	0.1344
	0.05833333	229	521	256.48	- 583.52	2.4192	0.2688
	0.06666667	211	523	236.32	- 585.76	2.4192	0.1344
	0.075	193	524	216.16	- 586.88	2.2848	0.4032
	0.08333333	176	527	197.12	- 590.24	2.5536	0.1344
	0.09166667	157	528	175.84	- 591.36	2.1504	0.5376
	0.1	141	532	157.92	- 595.84	2.4192	0.2688
	0.10833333	123	534	137.76	- 598.08	2.2848	0.5376
	0.01166667	106	538	118.72	- 602.56	2.4192	0.4032
	0.125	88	541	98.56	- 605.92	2.2848	0.5376
	0.13333333	71	545	79.52	- 610.4	2.2848	0.672
	0.14166667	54	550	60.48	- 616	2.1504	0.672
	0.15	38	555	42.56	- 621.6	3.0912	0.5376
	0.15833333	15	559	16.8	- 626.08	2.39232	0.3584

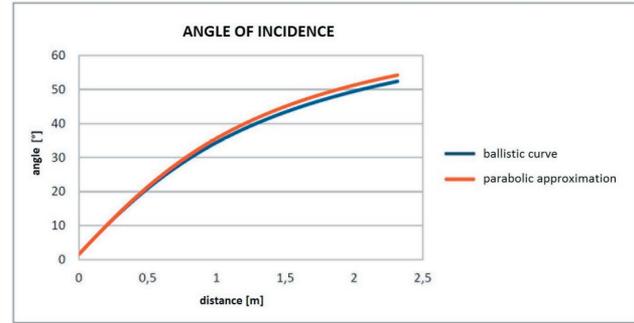
Legend: **t** stands for time, **dt** is the time differential, **dx** is the calibration constant for the calculation of pixels into mm, **x (dx)** and **y (dy)** are coordinates calculated using the calibration constant, **v_x** and **v_y** show a velocity of the flying blood drops in various directions.



Graph 3. Comparing the real world flight trajectory of the blood drop with a ballistic curve and parabolic approximation (vx = 3,6 m/s; vy = 0,1 m/s; D = 0,00616 m) (experimental data)

If the flight speed of blood drops is increased about two meters per second, it can be seen that slightly

increases the difference between ballistic curve and a parabolic approximation



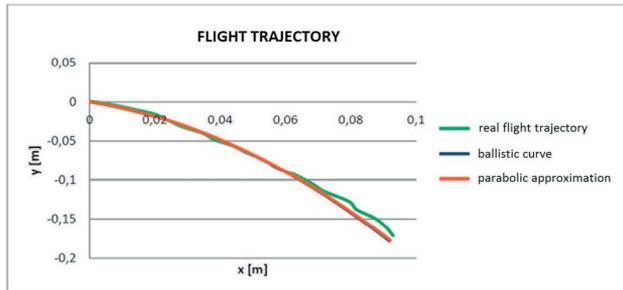
Graph 4. Angle of incidence of the blood drop 1.7. in a flight along a ballistic curve and parabolic approximation (experimental data)

When an increase a blood drops speed of two meters per second, there is a change of the angle of incidence that is overall smaller. Ballistic curve and the parabolic approximation, they are initially based on the same angle up to a distance of thirty centimeters, but in place of the impact angle is slightly different.

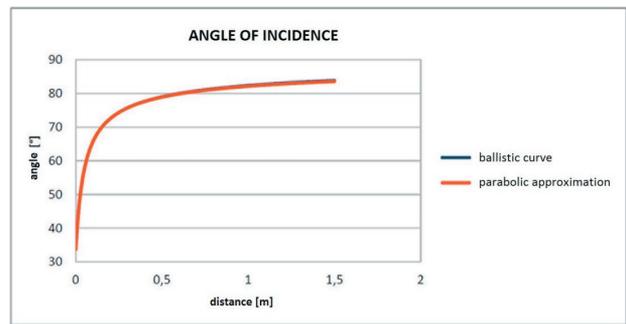
Table. 4 Measurement results (Shot no. 3, drop no. 7) (experimental data)

BLOOD DROP no. 3.7.							
D [m]	t [s]	x	y	x [dx]	y [dy]	Vx [m/s]	Vy [m/s]
0.006	0	785	679	879.2	- 760.48	- 0.672	0.4032
	0.00833333	790	682	884.8	- 763.84	- 1.0752	0.9408
dt	0.01666667	798	689	893.76	- 771.68	- 0.672	0.672
	0.00833333	803	694	899.36	- 777.28	- 0.4032	0.8064
dx	0.03333333	806	700	902.72	- 784	- 0.5376	1.0752
	0.04166667	810	708	907.2	- 792.96	- 0.8064	1.0752
1.12	0.05	816	716	913.92	- 801.92	- 0.4032	0.9408
	0.05833333	819	723	917.28	- 809.76	- 0.672	0.9408
	0.06666667	824	730	922.88	- 817.6	- 0.5376	1.0752
	0.075	828	738	927.36	- 826.56	- 0.672	1.2096
	0.08333333	833	747	932.96	- 836.64	- 0.4032	1.0752
	0.09166667	836	755	936.32	- 854.6	- 0.672	1.0752
	0.1	841	763	941.92	- 854.56	- 0.672	1.04784
	0.10833333	846	774	947.52	- 866.88	- 0.4032	1.0752
	0.01166667	849	782	950.88	- 875.84	- 0.9408	1.6128
	0.125	856	794	958.72	- 889.28	- 0.2688	1.2096
	0.13333333	858	803	960.96	- 899.36	- 0.672	1.344
	0.14166667	863	813	966.56	- 910.56	- 0.4032	1.344
	0.15	866	823	969.92	- 921.76	- 0.2688	1.3442
	0.15833333	868	833	972.16	-932.96	- 0.55552	1.19168

Legend: t stands for time, dt is the time differential, dx is the calibration constant for the calculation of pixels into mm, x (dx) and y (dy) are coordinates calculated using the calibration constant, v_x and v_y show a velocity of the flying blood drops in various directions.



Graph 5. Comparing the real world flight trajectory of the blood drop with a ballistics curve and parabolic approximation ($v_x = 0,6$ m/s; $v_y = 0,4$ m/s; $D = 0,006$ m) (experimental data)

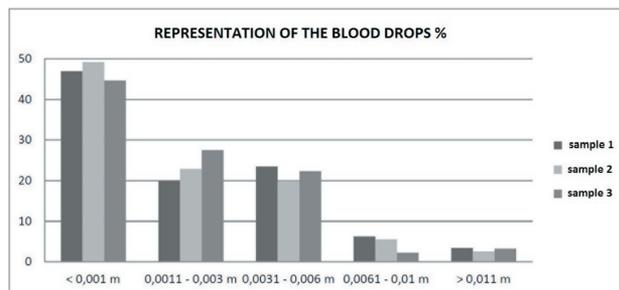


Graph 6. Angle of incidence of the blood drop 3.7 in flight along a ballistic curve and parabolic approximation (experimental data)

In the overall evaluation of the physical model can be stated that the flight path and the angle of incidence affects not only the surrounding environment, but also the speed and diameter of the blood drops. On graphs 5 and 6 can be seen that the course of parabolic approximation is subject to certain conditions with ballistic curve is almost identical. If we use a very slow speed flying drops with a standard diameter.

Table 5. Blood drops sorted by size, calculations were based on the analysis of the sample with the use of GIMP 2.0 (experimental data)

BLOOD DROPS DIAMETER [m]	SAMPLE no. 1 [%]	SAMPLE no. 2 [%]	SAMPLE no. 3 [%]
< 0.001	46.95	49.15	44.63
0.0011 – 0.003	19.91	22.88	27.52
0.0031 – 0.006	23.48	19.92	22.31
0.0061 – 0.01	6.24	5.51	2.28
> 0.011	3.42	2.54	3.26



Graph 7. Representation of blood drops by size, calculations were based on the analysis of the sample with the use of GIMP 2.0 (experimental data)

DISCUSSION

The graphs and calculated values show that the parabolic approximation given a very accurate description with minimal deviation in comparison to real world movement of up to 0,003 m for blood marks with the following parameters. The diameter of blood drops

suitable for the parabolic approximation is negligible for distances of up to 0,5 m from the source, with increasing distances of the source the rising diameter of blood drop leads greater deviations. Therefore it is suitable to use the parabola with blood drops under 0,006 m in diameter for greater distances. Blood mist released immediately after the penetration of a blood source by a bullet is an exemption. Particles forming the mist are so small that they cannot be labeled as blood drops. Together with air these particles form a suspension, which acts like a gas, with its flight dynamics being affected by several more factors such as the direction and force of airflow.

Graph 3. shows that the vast majority of blood drops formed after the use of the Taurus handgun has a diameter of less than 0,006 m. Considering only the drop size the parabolic approximation is more accurate then linear models for around 90 % bloodstain formed by the impact of blood drops. Not only blood drops are

released after tissue penetration. Apart from blood mist, larger continuous bodies of blood are released from which blood drops are gradually detached. The video recording taken during the experiment shows that these blood bodies only appear in an area defined by the surface of a sphere measuring 0,6 m in diameter with its center being in the penetration point. Behind this boundary blood particles are only in the form of drops. In the case of a continuous body of blood a flight trajectory cannot be clearly defined, this is given by the expansion and oscillation of the blood body during flight.

The resulting deviations are also given by the flight velocities of individual drops. These velocities are affected by the speed of the bullet which gives them their initial momentum. However, a mathematical relation between these velocities cannot be defined. The bullet moves in sonic speeds, in our case with the initial velocity of 340 m/s, blood drops only move in subsonic speeds. The maximum velocity of blood drops in our experiment did not exceed 6 m/s. In lower velocities a parabola corresponds to the ballistic curve. Deviation at the point of impact is less than 0,003 m. At speeds of around 10m/s the parabola straightens, which increases the difference between the parabola and ballistic curve in the point of impact and angle of incidence. With increased distance from the source, the difference may be several meters. With distances of 1m and less from the source the differences in the point of impact don't exceed 0,005 m even with higher speeds. As it is impossible to determine the impact velocity of a blood drop from a bloodstain, it is suitable to analyze blood drops nearest to the source during crime scene reconstructions. The resulting deviation is minimal in with high initial velocities.

A category for itself according to Jackson and Wells are bloodstains of purely circular shapes without any signs of directionality in proximity to the source. In these cases blood drops moved in freefall. In such cases the use of the ballistic curve or parabolic approximation is irrelevant. When comparing a flight trajectory with a linear approximation within a physical model, it was ascertained that the difference in the impact point in comparison to the ballistic curve was in the range of mere centimeters in distances of less than 0,5 m and speeds of around 3 m/s. The use of the linear based trigonometric model in quick examinations of a crime scene may therefore seem sufficient.

Crucial difference can be observed in cases when the direction of the movement of a blood drop is above the axis of the penetration point. The blood is randomly exiting the penetration point in all directions. From the resulting bloodstains the angle of origin cannot be ascertained, however the angle of incidence can. In linear approximations the angle of origin coincides with the angle of incidence 90° , with the angle of incidence being constant throughout the whole flight even at impact. The angle of incidence in models based on the ballistic curve and parabola gradually changes. Most significant differences are observed in cases when the blood drop is bound upward. If we use standard formulas based on directionality, resulting deviations of a calculated angle α may reach up to 35° . Therefore when analyzing bloodstains it is not sufficient to only cover the flight trajectory but to also make an accurate determination of the angle of incidence, this is all mentioned in the work of Liesegang in 2004. Even in this respect the parabolic approximation provides more accurate results. With speeds of up to 5 m/s the angle of incidence α differs only 5° in comparison to the ballistic curve. The extent of the deviation is determined by the same mathematical identity as in the case of the impact point: with the increasing flight velocity and distance from the source the deviation of the angle of incidence α may rise up to 20° .

CONCLUSION

Based on the physical and experimental models it was determined that the real flight trajectory of blood drops may be defined by a parabolic approximation while maintaining validity for 90 % blood drops. The parabolic approximation does not significantly differ from the ballistic curve and real flight trajectories in cases of lower flight velocities and blood drop sizes of less than 0,5 mm, meaning blood drops located in a distance of less than 0,5m from the point of origin. From the progression of the curves capturing the flight of blood drops it was ascertained that for the purpose of using trigonometric models, it is best to use bloodstains located less than 1m from the convergence point, the reason being the fact that the deviation caused by the use of the parabolic approximation is minimal and doesn't cross 3mm. The use of the parabolic approximation with distances of over 2 m leads to deviations of more than 3mm when compared to reality. The creation of formulas incorporating the parabolic approximation seems, according to our experiment, as a valid method

for a more accurate calculation and reconstruction of blood drop flight trajectory, or rather reconstructing the events that led to the formation of a bloodstain. The implementation of the physical model into a computer program, which created a visual representation of the data, revealed that the parabolic approximation was more accurate in 75% of bloodstains and the ballistic curve in 99% of bloodstains^{10,13}. The discussion contains several analyses of the droplet movement and there are given reasons for why they should be excluded from processing by classical methods that are using rectilinear approximation of droplet trajectories.

Conflict of Interest - We have no conflict of interest. Experiment was performed with the inanimate material (bags containing pig blood). Therefore, we do not conflict with the **ethics committee**.

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Profile and Pattern of Suicide in Mangaluru

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ABSTRACT

The pattern of suicide varies from one region to another. It is based on education, socioeconomic status, psychiatric and other medical ailments and many other factors. The present study was on suicide over a five year period in Mangaluru. Deaths due to suicide increased from 78 in 2009 to 110 in 2013 and a male to female ratio being 3.2:1. The 15-30 years age group constituted 33.1% of the total suicidal deaths. Most suicides took place in rural areas(79%). Hanging was the most common method of suicide employed. Deaths due to suicide are preventable by developing region specific strategies based on sound databases.

Keywords: Profile, Suicide.

INTRODUCTION

The word suicide has been derived from two Latin words, “sui” and “cedere” which when put together means “killing oneself”¹. Edwin Shneidman, Father of contemporary suicidology defined it as “the conscious act of self-induced annihilation, best understood as a multidimensional malaise in a needful individual who defines an issue for which the act is perceived as best solution”². World Health Organization (WHO) recorded 804000 deaths per year due to suicide with an annual global age- standardised suicide rate at 11.4 per 1 00 000 population³. It also estimated that 170000 deaths by suicide occur in India every year⁴. According to National Crime Records Bureau (NCRB), Karnataka contributes to 8.4% of total suicidal deaths in the country⁵. Pattern of suicide differs from one region to another depending on the prevailing cultural and religious influences and the socio demographic profile of the individual. Knowledge about the pattern of suicide

in an area helps in identifying the risk factors so as to formulate region specific preventive strategies. Suicide prevention programmes can only be developed on the basis of sound databases. This study was undertaken to understand the patterns and changing trends of suicide over a period of time in the coastal city of Mangalore. The rationale behind conducting this study is to quantify and understand the patterns of suicides, to know the incidence, the subgroups of population most vulnerable to such deaths and the methods being used in Mangaluru. This information can be of paramount significance to formulate prevention strategies which are customised to region specific demographics and which can be implemented in a culturally sensitive manner.

METHODOLOGY

This is a record based retrospective study. As per the law of the land all unnatural deaths are to be subjected to medico - legal autopsy in India. The data required for the study was collected and studied from all the cases subjected to autopsy at the District Wenlock Hospital which caters to about 90% of all medico legal autopsies and Justice K.S. Hegde Charitable Hospital, both the hospitals being major tertiary care centres situated in Mangaluru, from January 2009 to December 2013.

Details of age, sex of the victim, medical history, psychiatric history, drugs, alcohol use sociodemographic

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profile and suicide technique used were extracted from the Police Inquest report (form 146(ii)) and from the post mortem report. All the data obtained was kept confidential to protect the identity of the study subjects.

Inclusion Criteria

Death without any evidence of murder or accident and considered as suicide beyond any doubt were included in the study.

Only those cases that were designated as suicide after full Police investigations, post mortem examination and Regional Forensic Science Laboratory report were included.

Exclusion Criteria

Deaths due to any other cause other than suicide were excluded.

All doubtful deaths where circumstances were not conclusive or where findings were not consistent with history of suicide were excluded.

Cases of unknown bodies without any identification or personal or sociodemographic data were excluded.

Statistical Analysis

The data was analysed with Statistical Package for Social Sciences (SPSS) version 16.0. Comparison between categorical variables was done with the Chi – squared test. P value less than 0.05 was considered significant.

Objectives Of The Study

1. To analyse the trends and patterns of suicide in Mangaluru with sociodemographic profile of the suicide victims

2. To compare the trends, patterns and sociodemographic profiles of suicide victims from studies conducted in other parts of the country and world.

RESULTS

The study comprised of 462 suicidal deaths over the five year period out of which 16.9 %(78) were in 2009, 16.9% (78) in 2010, 17.7%(82) in 2011, 24.7%(114) in 2012 and 23.8%(110) in the year 2013.

Thus, the ratio of suicidal deaths of males in

comparison to females was 3.2:1. The studies showed that the highest number of suicides were in the 15- 30 years age group followed by 31- 40 years age group. The 15 – 30 years age group constituted 33.1%(153) of the total suicidal deaths while 31-40 years age group recorded 20.3% (94) of the total number of deaths due to suicide. The p value calculated equals 0.024. Thus the association between age and suicide was found to be statistically significant. These results are represented in figure 1.

The analysis of the domicile distribution of the suicide victims showed that 79% of the individuals were from rural areas while 20.9% were from urban areas.

Analysis of education level of the suicide victims revealed that 29.9% of the individuals received education till High school, 23.8% received college education, 22.5% are educated till Pre –University, and 19.7% received primary education. The p value calculated is 0.002 which highlights that there is a significant association between the two parameters. These results are depicted in figure 2.

The occupation profiles of the suicide victims were analysed and revealed that 24% were unskilled labourers, 16% were Professionals, 13.6% were home -makers, 11% were skilled, 9.5% were unemployed, 8.9% were retired and 6.1% were semi- skilled workers and 10.8% were students. These results are represented in figure 3.

The suicide victims were observed for their marital status. The analysis revealed that 53.7% were married and 39.4% were unmarried.

On analysis of the various methods adopted to commit suicide, it was deduced that hanging (325) , poisoning (63) and drowning (60) were the most commonly used methods for committing suicide (Figure 4).

DISCUSSION

In the present study, 462 cases of deaths by suicide were analysed which were obtained from the autopsy reports over a period of 5 years from January 2009 to December 2013. The number of suicide cases increased over a period of five years. Similar trends were observed in Maharashtra, Lucknow, Haryana, Turkey and Kuwait^{1, 6-9}. However the results of the present study differ

from those of Germany, Jamaica, and Singapore where suicide rates have reduced over a period of time due to various public campaigns against suicides, interventions for depression and improved socioeconomic status in these regions¹⁰⁻¹².

The present study showed higher preponderance among the males to commit suicide. The patriarchal society in India mandated that men have to be the breadwinners of the family which is an added responsibility other than familial and relationship duties. Similar trends were observed in regions listed in Table 1

Table 1: Male to female ratio of suicidal deaths in different regions

Place	Male: female suicide ratio
Manipal ¹³	2:1
Kerala ¹⁴	2.43:1
Turkey ⁸	2.5:1
Nagpur ¹	2.5:1

The current study showed that higher numbers of suicide were seen among the individuals in the younger age groups. Such high suicide rates among the youngsters could be because of the emotional challenges faced by them during personality evolving phase. The young people are more vulnerable to take extreme decisions as they go through the transition phase from being dependent to self-reliant. In a developing economy like India, dwindling employment opportunities and lack of social security schemes has a crucial role to play in increasing the number of suicide among the young people. The World Health Organisation in its recent report has stated that India has one of the highest suicide rates in the world especially among the 15-29 age group¹⁵. The findings of the studies in Lucknow, Gauhati, Manipal, Nepal and Sri Lanka coincided with the results of the present study^{6,16-19}.

Most number of suicide victims in the present study completed education till High school or Pre-University. Patel V et al, Badiye A et al, Fernando R et al and Sharija S et al have published studies showing similar results^{4,1,19,20}.

The occupation profile of the individuals in the present study shows that 24% of them are unskilled

labourers. These findings were similar to the studies conducted in other regions^{1,19,20,4}. Abell et al's findings from his studies in Jamaica contradicted the results of the current study where professionals and senior officials showed higher tendency to commit suicide due to demanding, competitive and stressful work life¹¹. The study reveals that 10.3% of the suicide victims were unemployed. Patel V et al, Meel BL, Sharija S and Sreekumari K have concluded from their studies that unemployed individuals are more susceptible to commit suicide due to added stress of financial constraints and frustration of not having a full time job^{4,21,20}.

It is evident from the results that a higher number of students also resort to suicide. The present day competition compels the students to excel academically and achieve more, leaving very little scope for any fault or failure. The students are reluctant to accept even minor setbacks and they opt to end their lives instead of facing the situation.

Higher number of suicides was reported from rural areas of Davangere, Haryana and Kurnool which were in accordance with the results obtained from the present study^{22,7,23}. Developed countries like Australia with a substantial amount of rural population also showed higher number of suicides among people of rural areas²⁴.

Studies conducted in Nagpur, Gauhati, Davangere, Kerala and Sri Lanka showed that suicide rates are higher among the married people and the results of the current study match with these findings^{1,16,22,20}. Although marriage is considered to be protective factor against suicide as it provides companionship and support from the spouse. Adverse marital situations like conflicts, dispute and abuse could act as a precipitating factor for suicide. Higher rates of suicide in the married individuals could also be due to the stress of added responsibilities of spouse and children, financial constraints in supporting a family.

The present study represents that hanging is the preferred method of suicide in Mangalore. It appears to be the choice of committing suicide in both genders and individuals from both rural and urban areas. Similar findings published by other authors with higher number of suicidal deaths due to hanging are enlisted Table 2.

Table 2 Percentage of suicidal deaths by hanging in various studies

Authors	% of suicide by hanging
Karbeyaz et al ⁸	60.9%
Badiye et al ¹	52.73%
Baruah AM and Chaliha R ¹⁶	40.2%
Qi et al ²⁴	35%
Abell WD et al ¹¹	78%

Suicide by hanging has increased over a period of 5 years in the current study. Such similarity in trends were also observed in Manipal, Kerala and Transkei^{13,20,21}.

The popularity of hanging as a method of suicide could be attributed to its higher lethality ensuring death and easy availability of ligature materials and suspension points.

Consumption of poison as a preferred method of suicide was observed in Davangere, Lucknow, Sri Lanka and Western Nepal respectively which is not in agreement with the present study^{22,6,19,18}. It could be attributed to the fact that that these areas are predominantly agrarian economies while Mangaluru has turned out to be a fast growing city with a downward trend in agricultural practices. Suicides by poisoning have been reported in large numbers in Mangaluru and neighbouring regions in the past²⁵⁻⁶. However in the current study the interruption in such trend was noticed. The deaths have reduced due to immediate seeking of treatment, improved emergency health services, availability of state of the art Intensive Care Units at the hospitals and higher number of Tertiary Care Centres in this region.

Fewer deaths due to suicides by drowning were reported in the present study. Earlier studies conducted in this region showed a high overall mortality as a result of drowning as a method of suicide²⁷. Studies conducted in other regions like Lucknow, Davangere, Maharashtra, Sri Lanka, Nepal and Turkey show that drowning is not commonly used method to commit suicide which is in agreement with the current study^{6,22,1,19,18,8}.

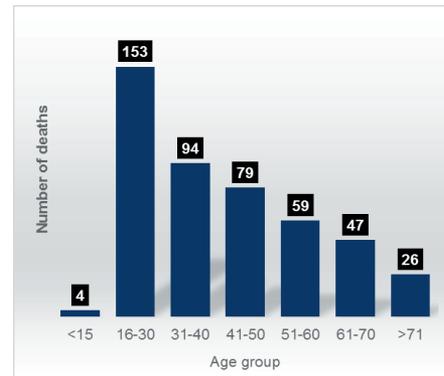


Figure 1 Age wise distribution of suicidal deaths

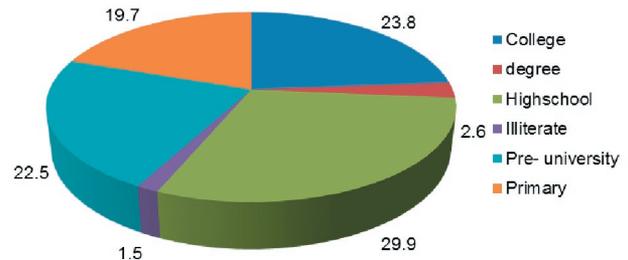


Figure 2 Education level of suicide victims

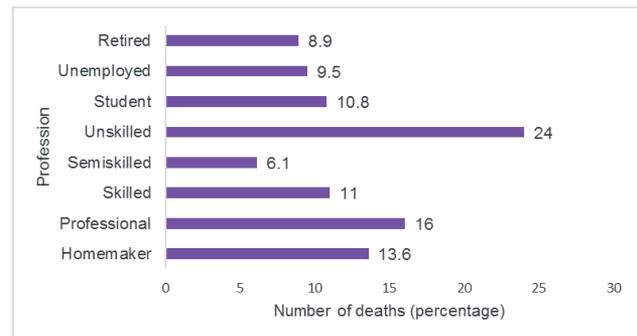


Figure 3 Occupation of suicide victims

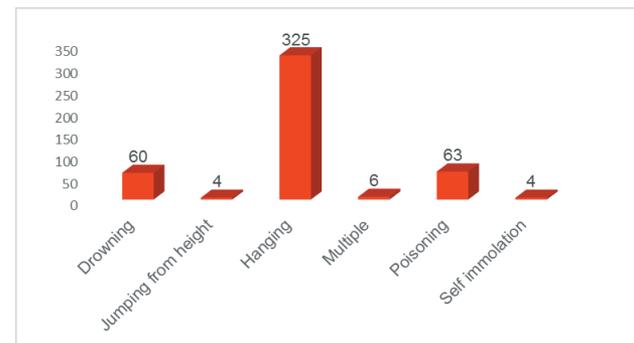


Figure 4 Methods adopted by suicide victims

CONCLUSION

The study highlights the need of integrating data on suicide from all Tertiary Care Centres for strengthening the databases. Awareness has to be created among the public regarding high suicide rates prevalent in the

region. People also should be educated about warning signs of suicide like previous suicidal attempts or expressing wish to end life by self. The measures implemented to reduce the suicide rates have to be reviewed at regular intervals to assess their success. Suicide has emerged as a social problem and immediate and long term measures need to be implemented to curb this disastrous trend.

Conflict of Interest : None

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Determination of Sex from Hand Dimensions in South Indian Population

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ABSTRACT

Introduction: Personal identification is an important role of forensic experts during mass disasters like earth quakes, tsunamis, plane crash etc. Sex determination is an important factor in establishing identity in forensic practice. Forensic anthropometrists use various anthropometric techniques to determine sex from such dismembered body parts. Such anthropometric techniques aim to find out cut off point in measurement of various body parts or bones that discriminate between male and female

Aim: The aim of present study is to correlate hand dimensions in both sexes and to derive cut off points for Hand dimensions.

Materials and Method: The study was conducted in the Department of Forensic Medicine & Toxicology, M.S. Ramaiah Medical College, Bangalore, in the year 2016. The material consisted of 150 young and healthy students (75 males and 75 females) in the age group of 20-21 years after taking informed consent to participate in the study. Subjects of south Indian origin were selected based on their mother tongue. The data obtained was computed and analyzed using Statistical Package for Social Sciences (SPSS, version 23.0) computer software.

Results: The mean values of hand dimensions and hand index were more in males than in females. Minor bilateral variation of hand breadth in males and hand length in females was observed. Cut off points estimated are 18.26 cm for hand length, 7.8 cm for hand breadth and 42.62 cm for hand index. Hand length has more accuracy in determining sex and then hand breadth and hand index.

Conclusions: Hand dimensions and index show sexual dimorphism. Any measurement above the cut off point would indicate male sex and measurement below cut off point would indicate female sex. Hand length is more accurate than hand breadth and index to differentiate sex.

Keywords: Hand length, Hand breadth, Hand index, Identification, Anthropometry, Sex determination

INTRODUCTION

Personal identification is an important role of forensic experts during mass disasters like earth quakes, tsunamis, and plane crash etc. Even in routine practice, for establishment of corpus delicti, identification of the dead is a must. Anthropometry was the first scientific system used by police to identify criminals. It dates back to 19th century when French Police Officer, Alphonse Bertillon introduced the use of a number of anthropomorphic measurements to identify habitual criminals. Later many new anthropometric methods and techniques have been evolved for human identification.

Multiple methods need to be applied in different scenarios for a positive identification.

Determination of sex is a foremost factor in establishing identity in forensic practice. This task becomes quite challenging in cases where there are mutilated and dismembered human remains. To establish identity in such cases, morphological and metric assessment of the characteristics of the living and skeletal remains is done. Such metric assessment is termed as Forensic anthropometry. Dimensions are taken from a particular region of human body which helps in determination of various identity data viz. sex,

age, stature etc. ⁽¹⁾

Many studies have been undertaken for assessing stature, sex, race, etc from anthropometric measurements of different parts of body for identification purpose. Gender dimorphism has been established in all such studies. Various anthropometric techniques are used to determine sex from such dismembered body parts. Such anthropometric techniques aim to find out cut off point in measurement of various body parts or bones that discriminate between male and female. ⁽²⁾

Males are generally tall, well built than females due to effect of sex hormones. The degrees of such sexual dimorphism are influenced by a variety of environmental and genetic factors, and also by interaction between them.⁽³⁾ As skeletal development is influenced by genetic and environmental factors, no two populations would have same anthropometric measurements. Studies on hand dimensions, hand index have been done in the past; but the results would be applicable only to that particular study population.

The present study was carried out to ascertain the sexual dimorphism in hand measurements specifically for population of South India.

MATERIAL AND METHOD

The study was conducted in the Department of Forensic Medicine & Toxicology, M.S. Ramaiah Medical College Bangalore in the year 2016. The material consisted of 150 young and healthy students (75 males and 75 females) in the age group of 20-21 years after taking informed consent to participate in the study. Subjects of south Indian origin were selected based on their mother tongue. The hand length was measured as straight distance between distal crease of wrist joint and the most anterior projecting point i.e. tip of middle finger. The breadth of hand was measured as straight distance from the most laterally placed point on the hand of 2nd metacarpal to the most medially placed point located on the head of 5th metacarpal. The measurements were taken by using anthropometric

sliding and spreading calipers and measuring tape. Hand index was calculated by dividing the hand breadth by hand length and multiplied by 100.

Inclusion criteria

1. Medical students above 20 years of age and less than 21 years of age studying in M.S. Ramaiah Medical College, Bangalore
2. Subjects of south Indian origin using mother tongue (Tamil, Telugu, Malayalam, and Kannada etc.) as a criteria for origin.

Exclusion criteria

1. Subjects having any skeletal deformity and other disorders which could have affected the general or bony growth.

Statistical analysis

The data obtained were computed and analyzed using Statistical Package for Social Sciences (SPSS, version 23.0) computer software. Descriptive statistics were generated using the software. The data were statistically analyzed to determine sex by measurements of hand. Independent samples T-test was applied to determine statistical significance of bilateral differences well as to determine statistical significance of gender difference in Hand dimensions and Hand Index. P-value of less than 0.05 was considered significant. Cut off points were derived to determine sex from Hand length, Hand breadth and Hand index as below. Cut off point = $(\text{Mean value for male} + \text{Mean value for female}) / 2$

Value more than cut off point suggests male and value less than that suggests female.

Accuracy of cut off points was calculated as below.
Accuracy (%) = $(\text{Correctly assigned male cases} + \text{correctly assigned female cases} \times 100) / \text{Total cases}$

RESULTS

Table 1: Statistical comparison of right and left sided hand dimensions and hand index

Cases	Parameters	Right			Left			p value
		Range (cm)	Mean (cm)	SD	Range (cm)	Mean (cm)	SD	
Males	Hand length	16.8-21	19.23	0.91	17-21	19.24	0.86	0.76
	Hand breadth	7.27-9.1	8.29	0.38	7.58-9.02	8.35	0.36	0.019
	Hand Index	39.5-48.9	43.18	2.16	39-48.2	43.3	1.80	0.098
Females	Hand length	15.5-19.5	17.24	0.85	15.8-19.3	17.36	0.82	0.001
	Hand breadth	6.01-8.01	7.28	0.37	6.14-8.2	7.28	0.41	0.847
	Hand Index	37.5-46.4	42.19	1.76	38-46.1	41.9	1.93	0.051

Dimensions and indices in both hands were observed to be more in males than in females. It was also observed that the left hand dimensions are slightly more than the respective right hand dimensions. Statistically, hand index in both sexes does not show significant bilateral difference ($p < 0.05$). However, bilateral difference in hand lengths in females ($p > 0.05$) and hand breadths in males ($p > 0.05$) was observed. But the difference is relatively small i.e. 0.15 cm in male hand breadths and 0.12 cm in female hand lengths. (Table No. 1)

Table 2: Statistical comparison of male and female hand dimensions and hand index

Parameters	Male (Mean)	Female (Mean)	p value
Right Hand length	19.23	17.24	0.00
Right Hand breadth	8.29	7.28	0.00
Right Hand Index	43.18	42.19	0.002
Left Hand length	19.24	17.36	0.00
Left Hand breadth	8.35	7.28	0.00
Left Hand Index	43.3	41.9	0.00

Mean values of bilateral hand lengths, breadths and indices are higher in males than in females. Statistically significant difference ($p < 0.05$) was observed in hand dimensions and indices amongst males and females. (Table No. 2)

Table 3: Calculation of cut off points using combined right and left hand measurements

Parameters	Male (Mean of right and left)	Female (Mean of right and left)	Cut off point	Accuracy %
Hand length	19.235	17.3	18.26	88
Hand breadth	8.32	7.28	7.8	90
Hand Index	43.24	42.05	42.64	65

Estimated cut off points are- 18.26 cm for hand length, 7.8 cm for hand breadth and 42.62 cm for hand index. Values more than these figures are suggestive of male sex and values less than these figures are suggestive of female sex. Further hand breadth (90%) has highest accuracy in differentiating sex followed by hand length and hand index. (Table No. 3)

DISCUSSION

Identifying dismembered and mutilated human remains has always been one of the prime roles of forensic personnel. Determining sex in such conditions is crucial in fixing the exact identity and it reduces the number of matching identities.⁽¹⁾ Many studies have been conducted to assess the sex from anthropometric measurements. Human hand alone may sometimes be recovered in mass disasters like plane crash, bomb blasts etc. In such a scenario, dimensions of the hand would help in knowing the sex and further would help in identification. Hence this study was undertaken to study the sexual dimorphism in hand length, breadth and hand index.

In the present study we observed that the hand length, breadth and index are more in males than in females. The same has been observed in many other similar studies. In contrast to Varu et al, it was observed that the left hand dimensions are slightly more than the respective right hand dimensions.⁽²⁾ Bilateral variation was observed in male hand breadth and female hand length. But this difference is relatively small. Such small bilateral variation was also observed by Bindurani et al⁽⁴⁾ and Varu et al. Danborn observed that both hand and foot the indices are significantly ($P < 0.05$ and <0.001) higher in the males than the females. But within the same sex, males did not show significant difference in the hand index. For females, both hand and foot indices were significantly ($P < 0.001$) different.⁽⁵⁾ However, Asha et al and Agnihotri et al observed that there was no statistically significant bilateral difference.^(6,7) Sexual dimorphism was observed in mean hand lengths, breadths and indices; this difference is statistically significant with $p < 0.05$. Similar observations were made by Ishak et al⁽⁸⁾ and Danborn et al.⁽⁵⁾

Cut off points deduced are 18.26 cm, 7.8 cm and 42.62 cm for hand length, hand breadth and for hand index respectively. These cut off points have an accuracy of 88 %, 90% and 65 % for hand length, hand breadth and for hand index respectively. Hand dimensions have more accuracy than hand index. However, Varu et al estimated the cut off points for hand length, breadth and index as 17.2, 7.7 and 44.6 respectively; accuracy estimated to differentiate sex was 73.25%, 82% and 69.5% for hand length, hand breadth and for hand index respectively. Hand breadth showed highest accuracy in determination of sex, followed by hand length and

hand index.⁽²⁾ A study by Krishan K et al reported that hand and Foot dimensions show higher accuracy when compared to Hand and foot index.⁽⁹⁾ In a study done by Ishak, cut of points calculated was 18.57 cm and 8.48 cm for hand length and hand breadth respectively. Hand breadth was able to differentiate sex with the higher accuracy (93.3%), followed by hand length (91.3%). The breadth and length of the hand contribute most significantly to sex discrimination; cross-validated sex classification accuracies range between 82.6 and 96.5% with a sex bias of $\leq 5\%$.⁽⁸⁾

These cut off points differ from one population to another as environmental and genetic factors affect growth and development of human skeleton. We recommend such anthropometric studies need to be done on various populations and thereby the data can be utilized in forensic practice.

CONCLUSIONS

Hand dimensions and index show sexual dimorphism. Bilateral minor variation in the same sex was also observed. Cut off points were derived irrespective of the side. Any measurement above the cut off point would indicate male sex and measurement below cut off point would indicate female sex. These cut off points are specific for a particular population. Accuracy for these cut off points was also calculated. Hand length is more accurate than hand breadth and index to differentiate sex.

There is no **Conflict of Interest** in this study.

Ethical Clearance: was taken prior to the conduction of study

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