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Journal of Indian Academy of Forensic Medicine

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From Editor's Desk

Respected seniors and dear colleagues,

Heartiest greetings to all of you from the editorial board on this earthy, musky and musty fragrance on account of sprinkling to splattering rains all around the country. We continue giving you all the academic taste with some improvement, complying with the suggestions given by all of you and by self-directed learning. We are trying hard to do our best by putting in our continuous efforts, to upgrade at every step.

As promised, we have set up a dedicated **website for JIAFM.** This website has a submission portal, where the authors can submit their research articles along with all the required documents. Authors will be getting regular updates on successful submission, acceptance, or review process. We also have a payment gateway, on the website through which manuscript handling charges can be paid. Our new website will be having all the archives of previously published journals, more importantly, all the articles have been uploaded separately in JATS (XML) format, which will not only be easy for the authors to retrieve their published articles but also increase the visibility, citation, and subscriptions over the long run. Another feature added here is a search engine which would display the article of relevance to the authors, based on keywords. Reviewers will also be connected through the website for reviewing an article and similarly, the subscribers can place orders through this website. **Our new website is – https://jiafm.in**

This is entirely a new beginning and a new experience for us, and shortcomings are bound to come, which we all would be happy to receive from you through our official email ID, or can call directly to me, which we will try to resolve with time. The editorial board will be thankful to everyone for the suggestions, and guidance with a positive approach.

Continuous pagination in all the issues of one-year volume, **date of receiving and the date of acceptance** has already been restarted. As always, all the manuscripts in every issue of each volume undergo a double-blinded peer-review process; grammar, plagiarism check, statistics and material methodology check in the original articles (wherever required), along with a reference check.

Dr. Siddhartha Das as Joint Editor; **Dr. Mandar Sane; Dr. Narendra Patel** are Associate editors; and **Dr. Vivek Chouksey** as Assistant editors; **Dr. Richa Nigam** as Research and Statistical Editor; and **Mr. Chain Singh Lodhi** as the technical editor, have been supporting me throughout the journey of bringing up JIAFM volume 45 (2).

I honestly thank our **reviewers,** without whom we would not have come up with a quality issue as was desired. The name of reviewers who supported us, in this issue, had been added to the last page of the journal. They supported with sufficient reasons and detailed suggestions for the authors so that they could improvise, revise, or resubmit their work accordingly. I give my sincere thanks to all the **authors** who showed enough patience in the queue while waiting for their turn to undergo a lengthy review process before publication. I thank you all for your cooperation and continued support in the year 2023.

 Best wishes!

Sincerely

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EDITORIAL

Breach of Promise of Marriage: Charge of Rape: New Law is Required

Society is ever changing. Indian society is no exception. Live- in relationship is becoming common place and as a consequence the pre-marital sex is also no more a taboo in society as it was few decades ago. Result is that many grown up adult man and woman not only live together but have sexual intercourse also. When this relationship is broken due to any reason (there are multiple reasons) the woman in the relationship may file a case against the man. As the sexual intercourse was the part of relationship woman does not have any avenue to file a case but the law of rape. So the case against the man is filed under the Indian Penal Code (IPC) 376. We know rape is a cognisable offence. As soon as first information report is registered agony and ordeal of man begins. Of late such cases are on rise. According to one source in 2015 number of such cases was 7655 which increased to 10068 in 2016 and accordingly huge burden on system that includes police and judiciary even if we ignore the hardship of an individual accused, though he is a biggest sufferer. His body, mind, property and reputation all are at stake together.

It is obvious that in all such cases sexual intercourse is admitted. The crux part is the consent. IPC 376 has no specific provision or explanation that deals with sexual intercourse on the pretext of breach in the promise of marriage.

Therefore breach in the promise of marriage becomes 'a misconception of fact" within the meaning of sec 90 of IPC. Therefore, if the intention of promise of marriage is to deceive a woman for sexual intercourse and such promise is made and woman consents for sexual intercourse, such sexual intercourse becomes unlawful and attracts the provisions of IPC 376.

There are multiple case laws which endorse this view. Here are few examples-Pradeep Kumar v/s State of Bihar; Singh v/s state of Bihar and Deepak Gulati v/s State of Haryana. The important points which emerge from scrutiny of these case laws are-

» Since beginning the intention of perpetrator was malafide and not bonafide.

» False promise was made.

» This false promise amounts to misrepresentation of facts, deceit or fraud.

However, mere breach of promise alone would not come under the ambit of misconception of fact. Hence, such sexual intercourse would not amount to rape.

This way or that way, above referred things are the matter of investigation and trial to begin with, and appeals at higher levels to end with. Till the matter settles, man would suffer.

The other side as stated earlier, in modern times when live-in relationship is becoming common place. If we go into the history of live-in relationship we will find that it all started as women activism and gender equality but with no liability. Till we are happy we live together, when we are not we separate with no liability on either side man or woman. But the Supreme Court came to the rescue of woman in Velusamy v. D. Patchaiammal, and said that following certain conditions live-in relationship has the sanctity of presumption of marriage. Since then, Courts have

been lenient towards woman when matters related to man and woman relationship comes before them. Anyway, whatever it is, live-in relationship and pre-marital sex are not a taboo in Indian scenario as they were few decades ago. Now it is the turn of the law to make pace with the changing society.

Before we go further we examine what is marriage?

Marriage is contract. It is civil contract. Though in most of the societies and civilisation it is more than mere civil contract because it is a lifelong bond, it is a psychological bond, it is social and spiritual.

Still, breach of promise of marriage should attract, if at all any legal provisions it should be civil rather than criminal.

Going through the ancient literature about breach of promise of marriage we find that it existed since 17th century till early 20th century in many countries. It was more a civil matter rather than criminal. Probably whole idea was again to maintain the sanctity of woman (her reputation, her virginity, her chance of choosing other partner for marriage and loss of money. (The man would not be allowed to run away with luxury gift of diamond ring and break the promise of marriage). Values to these points mentioned varied time to time and region to region, but they still exist in first part of twenty first century. Probably that is the reason the Supreme Court said what it said in the above referred case of Velusamy v. D. Patchaiammal.

In those times also the woman had a privilege to change her mind and breach the promise of marriage and man would not sue her. But man could not and would not. Situation remains the same in modern times also.

Is the matter at hand so simple? No, it is not. Here the issue is not merely a civil breach of promise of marriage but at the same time having sexual intercourse with the woman in question on the basis of that promise.

So we settle that once the component of sexual intercourse is involved we will have to qualify the consent and accordingly will have to decide criminality of the accused if at all it is there. This is the whole point.

We don't have appropriate specific law or section or sub section under the law of rape to deal with such situation. Therefore, neither the woman nor the legal agencies have any alternative but to book the man under IPC 376 once the complaint is lodged. I suggest that there should be specific law to deal with this issue. And it should be certainly lighter in all legal senses (bailable to begin with) than the present law of rape where such cases are lodged. I put forth my arguments in favour of my suggestion.

Broadly speaking the women who adopt live-in relationship and also practice pre-marital sex are not minors but fully grown up adults. In most of the cases which have come up before the courts of law they have been an educated lot as well. When such woman submits herself to sexual intercourse does she not weigh the possibility, the probability or even improbability of marriage happening? Is it not her duty? More or less same point is stated in a case of Uday v State of Karnataka where it was found that victim

herself was aware of the improbability of marriage. Love relationships are relationships of passion and affection and submission. Woman may submit herself for sexual intercourse out of her feelings and love towards the person she loves. That was the situation in the present case. In another case court held that educated and powerful woman were assumed to be fully aware of the consequences of premarital sex and they provide their consent in accordance of those consequences.

Why the cases are filed.

As one author pointed out -"are the relationships going sour"? According to him any relationship may have wear and tear. Don't we see this happening in marital relationship? So it can happen when man and woman are living together in live-in or even living separately but having a relationship. The Sikkim High Court has taken cognisance of this fact and extended the benefit of doubt to the accused on the ground of relationship going sour. In another case the applicant chose such a time to lodge first information report that accused could not join his job and training even after passing one of the toughest examinations. Though, legally it was the prerogative of the applicant, but the intention was clear.

Justice Pratibha Rani of Delhi High Court has stated that women use rape laws as a weapon for vengeance and personal vendetta. They tend to convert such consensual acts as incidents of rape may be out of anger and frustration, thereby defeating the very purpose of the provision.

What is the solution?

Introduction of appropriate law to deal with such a situation is the permanent solution. This should be able to decipher the quality of consent and the differences between the breach of promise of marriage genuine or otherwise on one hand and false promise on the other. We know making a law or changing the existing one is a tough and time consuming job there till law is enacted or modified every such cases must go strict scrutiny. The Supreme Court Judges advised the trial courts to "very carefully examine whether the man actually wanted to marry the victim or had malafide motives from the start and had made false promise only to satisfy his lust. This essentially means that if a man can prove

that he intended to marry the woman but changed his mind later, then it's not rape.

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ORIGINAL ARTICLE

Pattern of Illness in Prisoners Admitted in a Tertiary Care Hospital of South Eastern Rajasthan

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Abstract:

The delivery of health care among prisoners is one of the most important aspects of improving human rights compliance. Estimating common healthcare problems in prisoners will be helpful in assessing their health status and recommending the rectifying steps. Therefore, knowing the types of morbidities will help us in making health policies which will be helpful in reducing the health burden in prisoners and will also help in reintegration of prisoners into mainstream society. The present study is a retrospective analysis to find out the common medical conditions in prisoners. The study was carried out by collecting data of 500 admitted prisoner in a tertiary care institute in south-east Rajasthan.

The majority (95.2%) of referred prisoners were male, from age group of 30-39 years, mean age of prisoners being 39.6 years and the majority (90%) were referred from Central Jail, Kota. The majority (53.2%) of prisoners were admitted to medicine department followed by psychiatry department (26.4%). A higher prevalence of anemia and pulmonary tuberculosis was reported among prisoners. Surgical illness related to infectious etiology and poor personal hygiene was common in prisoners. Psychosis not specified (17%), schizophrenia (8%), mixed anxiety depressive disorder (8%) and substance use disorders (16%) were common psychiatric conditions. Mean duration of hospitalization was 9 days.

Keywords: Pattern of illness; Referred prisoners; Tertiary care hospital.

Introduction:

Health care of prisoners is one of the most neglected issues in our society. The basic reasons are poor physical conditions that include over-crowding, limited availability of space, poor sunlight, non availability of fresh air, poor personal hygiene and poor nutrition. Social factors include separation from family and community. Psychological factors include feelings of guilt & remorse, negative view of self, feeling of loneliness, helplessness and lack of privacy. Other factors are substance abuse and poor availability of medical facilities. Many International studies have been conducted to report the poor health conditions of prisoners. A study was conducted to assess the health conditions of jail inmates in Italy by Voller F et al.[1] reported that around two-thirds of prisoners were suffering from pathologies like psychiatric (41.3 %), digestive (14.5 %), infectious (11.5 %), cardiovascular (11.4 %), endocrine, metabolic, immune (8.6 %) and respiratory illnesses (5.4 %).

 In India very few studies have been carried out to assess the health condition of prisoners. National Crime Records Bureau (2021) Government of India[2] reported that the natural deaths in prison were mostly (88.79%) due to aging and illness. The common illness was heart diseases, lung diseases, liver diseases, brain hemorrhage, kidney diseases and HIV. In contrast, the present study was conducted among the prisoners hospitalized in our tertiary healthcare institute to assess the health status of prisoners.

Materials and Methods:

The present study is a retrospective analysis, carried out in the Department of Psychiatry, New Medical College & Hospital, Government Medical College, Kota, Rajasthan. This tertiary care institute caters to patients referred from Kota and surrounding districts of south-east Rajasthan. The aim of this study was to describe the characteristics and health status of prisoners.

Prior permission from the ethical committee was taken to conduct the study. Data was collected from the hospital records of inpatients admitted between the periods of June, 2015 to March 2019. Total of 500 patients were admitted in prisoner's ward and a few other prisoners (female and children) admitted in the general ward as per legal norms. A specially designed Proforma that included age, gender, source of referral, date of admission and discharge, the department under which admitted, diagnosis, treatment outcome, total duration of stay in the hospital etc. was used. Data were analyzed by using SPSS version 22. The diagnosis was made as per ICD-10, WHO clinical guidelines and also on the clinical opinion.

Results:

Data of 500 prisoners admitted during the study period was evaluated and the findings are as follows. In our study majority

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(80%) of the prisoners were referred from central jail, Kota followed by district jails of Baran (6.4%), Bundi (5.6%), Jhalawar (4.4%), Sawaimadhopur (1.5%) and remaining 2.1% were referred from sub-jails of Ramganjmandi (Kota), Chhabra (Baran), Sangod (Kota), Nainwa (Bundi) and central jail, Ajmer (Figure 1).

Discussion:

The majority (95.2%) of referred prisoners were male and only 4.8% were females (male: female=19:1) (Table1). These findings are in accordance with the fact that males have more tendencies to commit crimes than females. This fact can be explained by various social, cultural and biological factors. Higher testosterone hormone levels, higher prevalence of conduct disorder in males may be responsible for antisocial behavior. The nature of the crime itself may also require consideration as a factor. This may be because our population is a male-dominated society; men have greater involvement in matters outside the household. Our finding is supported by many other studies like a cross-sectional study by Sunil D. Kumar, et al.[3] in the central prison of Gulbarga city and Hyderabad in southern region of India was conducted to assess the health status of the convicted life-term inmates also found higher prevalence of males (95.7%) as compared to females (4.3%) with male- female ratio of 22:1. Similar finding was also reported by Goyal S.K. et al.[4] who conducted a study that included 500 convicted prisoners of

central jail Amritsar, Punjab and found that 96% were males and only 4% were females with male - female ratio of 24:1.

The mean age of prisoners was 39.6 years (40.1 & 31.2 years for males & females, respectively). If we further classify them according to age, it was found that the majority (30.8%) of referred prisoners belonged to the age group of 30-39 years, followed by 40-49 years (23.4%), 20-29 years (18.6%), 50-59 years (11.8%), 60 years and above (11.6%) and remaining 3.8% of patients were up to 19 years of age (Table 1). Pankaj Kumar Gupta et al.[5] conducted a study in central jail Kota and reported that crime was more prevalent in younger age groups (20 -40 years) and the mean age of prisoners were 34.1 years. This fact

Figure 1. Distribution of prisoners according to referral center.

Table 1. Distribution of prisoners according to socio-demographic profile.

Sociodemographic factors		N	%
Sex	Male	476	95.2
	Female	24	4.8
Age group	≤19 Yrs.	19	3.8
	20-29	93	18.6
	30-39	154	30.8
	40-49	117	23.4
	50-59	59	11.8
	>60	58	11.6

Table 2. Distribution of prisoners according to department.

Department	N=500	%
Medicine	265	53.0
Psychiatry	130	26.0
Surgery	32	6.4
Pulmonary medicine	32	5
Urology	5	1.0
ENT	1	0.2
Ophthalmology	2	0.4
Orthopedics	24	4.8
Cardiology	8	1.6
Radiotherapy	1	0.2

Table 3. Distribution of prisoner according to illness.

Department	Illness	N	%
Medicine (N=265)	Cardiac	97	36.6
	Hematological	48	18.1
	Neurological	35	13.2
	Gastro-intestinal	30	11.3
	Pyrexia	30	11.3
	Respiratory	10	3.80
	Endocrinal (Diabetes)	7	2.60
	Renal	4	1.50
	Other	4	1.50
Psychiatry (N=130)	Psychosis NOS	22	16.92
	Schizophrenia	9	8.46
	MADD	9	8.46
	BPAD	6	5.38
	Depression	5	3.84
	MR	2	1.53
	No illness	54	41.53
Substance Abuse (N=23)	Smack	15	11.53
	IV drug abuser	5	3.84
	Alcohol	3	2.30
Surgery (N=32)	Hernia	12	37.5
	Gastrointestinal	14	43.75
	Genitourinary	6	18.75
Pulmonary Medicine (N=32)	Tuberculosis	20	65.60
	Other	14	34.40
Orthopedic (N=24)	Fracture	18	75.0
	Other	6	25.0
Urology (N=5)	Renal stone	4	80.0
	Other	1	20.0

Table 4. Distribution of prisoner according to outcome.

Outcome	N=500	%
Discharged	450	90.0
Transfer to icu/ other ward	23	4.6
Lama	22	4.4
Absconded	1	0.2
Death	4	0.8

Table 5. Distribution of prisoner according to stay in ward.

Duration of stay	N	%
1-5 Days	167	33.4
6-10 Days	204	40.8
11-15 Days	90	18.0
16-20 Days	18	3.60
>20 Days	21	4.20

can be explained by at this age, there may be problems like family disputes, marital problems, substance abuse and unemployment which might have led to an increase in crime.

Similar to our finding Dhanwantari Shukla et al.[6] conducted a retrospective study among 71 prisoners admitted in the surgical ward of Sanjay Gandhi Hospital a tertiary care center in the Vindhya region of Rewa, Madhya Pradesh reported the mean age of the prisoners was 39 years 9 months. Maximum patients (46.5%) were of the middle age group (31-50 years). Likewise Voller F et al.[1] reported that mean age of prisoner was 39.6 years.

The majority (53.0%) of prisoners were admitted under the medicine department followed by the psychiatry department (26.0%), pulmonary medicine (6.4%), general surgery (6.4%), orthopedics (4.8%), cardiology (1.6%) and remaining 3.2 % were from ENT, ophthalmology, radiotherapy & urology department (Table 2) .

If we further classify prisoners admitted under department of general medicine, it was found that majority (36.6%) were having cardiac illness (angina, chest pain, hypertension, myocardial infarction) followed by hematological problems (18.1%), neurological illness (13.2%), gastro-intestinal illness (11.3%), pyrexia of unknown origin (11.3%), respiratory problems (3.8%), endocrinology related problems like diabetes mellitus (2.6%), renal problems (1.5%) and remaining 1.5 % were suffering from other miscellaneous illnesses like heat stroke, snake bite, hanging etc (Table 3). Most of these medical conditions can be explained by poor hygienic conditions, poor nutrition, overcrowding and lack of proper sanitation in jail.

Of around 130 prisoners (26.0%) admitted under the Psychiatry department, 16.92% percent were diagnosed as Psychosis not specified, followed by Schizophrenia (8.46%), Mixed Anxiety Depressive Disorder (8.46%), Depression (3.84%), Bipolar Affective Disorder (5.38%) and only 2 cases of Mental Retardation were seen. Around 41.53% cases were admitted for mental status examinations and were found to have no active Psychotic symptoms. Out of the total patients admitted for psychiatric evaluation around 17.69% were patients of Substance/Drug abuse (Table 3). Out of them 11.53% patients were smack dependent, 3.84% intravenous drug abusers and 2.30% were alcohol dependent. A previous study which was conducted in Prisons of Central Jail, Kota by Vinod Kumar et al.[7] reported the prevalence of psychiatric disorders as 33%. Psychotic, depressive, and anxiety disorders were seen in 6.7%, 16.1% and 8.5% of prisoners respectively and 58.8% had a history of drug abuse/dependence prior to imprisonment. A higher prevalence of psychiatric co-morbidity was also reported by Rakesh Kumar et al.[8] conducted a study among 233 prisoners at central jail, Bikaner Rajasthan and revealed that about half (51%) prisoners were suffering from some kind of psychiatric illness. Psychosis was present in 7.7% whereas neurotic disorders were found in 43.3% prisoners, while 48.9% prisoners not show any psychiatric illness. The prevalence of Schizophrenia was 3.9%, Bipolar Affective disorder in 3.0% and Delusional disorder in 0.8%. If we talk about psychiatric morbidity of prisoners in western countries, Moschetti K. et al.[9] conducted a study among 664 prisoners of the Canton of Vaud, Switzerland and reported

higher prevalence of psychiatric illness in prisoners, 44.8% have at least one psychiatric condition. The most prevalent were neurotic (15.9%), personality disorders (16.2%) and illicit drugs (18.0%) among substance abuse problems. Only 37.0 % of study subjects have neither a chronic somatic nor a psychiatric condition.

Psychiatric morbidity are more common in prisoners, this fact can be explained by the level of confinement and isolation experienced by them which is detrimental to their mental-health. The prisoners are more vulnerable to psychiatric illness due to high level of stress, sleep deprivation, guilt feelings, anxiety about future misfortune and due to history of various psychoactive substance intakes.

Around 33 (6.4%) prisoners admitted under surgery department, 37.5% were operated for hernia and 43.75% were having other gastrointestinal problems like ulcerative colitis, appendicitis, ascitis, hemorrhoids and remaining 18.75% were suffering from genitourinary problems like calculus, cystitis, benign prostate hypertrophy etc. Only 5 patients were directly admitted under urology department, among these, 80% were cases of renal stones. These findings suggest surgical diseases related to infectious aetiology and poor personal hygiene are particularly common in prisoners (Table 3).

These findings were supported by a previous study by Dhanwantari Shukla et al.[6] revealed that the type of illness diagnosed in prisoners was gastro-intestinal diseases (23.9%), ano-rectal diseases (18.3%), genitourinary diseases (16.9%) and cellulites or abscesses (12.7%). Other common diagnoses include skin and soft tissue lumps (9.8%), injury (8.5%), uncomplicated inguinal-scrotal swellings (7.1%) and other problems (2.8%).

Around two-third (65.60%) of prisoners admitted under pulmonary medicine were diagnosed with tuberculosis while remaining were having other respiratory problems like chronic obstructive pulmonary disease (COPD), asthma, pneumothorax, pleural effusion etc (Table 4). The risk of developing pulmonary tuberculosis (PTB) was perhaps due to overcrowding, poor ventilation, close contact etc. The same finding is suggested by a study done by Chandra Kumar dolla et al.[10] among central prison inmates at Chennai, India. He found that the prevalence of pulmonary tuberculosis (PTB) 2.5 times higher as compared to prevalence of PTB in general population in the same areas, and 3.4 times higher as compared to national average. This strongly suggests that overcrowding facilitates the spread of droplet infections like PTB.

Three-fourth (75.0%) of prisoners admitted in orthopedic department were treated for bone fracture & remaining were having pathologies like avascular necrosis, cervical spondylitis, back pain etc (Table 3).

Around 90% of all admitted prisoners were discharged after successful treatment, whereas 4.6% were needed to shift to ICU, 4.4% left against medical advice (got bail order from court) and 0.8% of them died in which 50% were having tuberculosis (Table 4).

If we look at duration of hospitalization, It was found that

majority (40.8%) of prisoners stayed in the hospital for 6-10 days, followed by up to 5 days (33.4%) and only 4.2% stayed for more than 20 days (Table 5). Contrary to our findings Dhanwantari Shukla et al.[4] reported that maximum 43.7% patients needed hospitalization for less than 7 days; 31% of the patients were hospitalized for 8-14 days; 18.3% patients needed hospitalization for 15-28 days, while 7% of the patients needed hospitalization for >28 days. The average duration of hospitalization was 15 days.

Minimum duration of stay in the hospital was 1 day and maximum duration was 60 days, with mean duration of 9 days. Longer duration of stay was noticed in patients with cardiovascular illnesses, followed by psychiatric disorders, tuberculosis and orthopedic problems.

Conclusion:

Our study shows that the majority of the patients referred to tertiary care center belonged to middle age group with male preponderance. Most common complaints were related to emergency medical illnesses like angina, myocardial infarction followed by psychiatric illnesses. Thus there is need for development of emergency medical services within the prison so that morbidity and mortality can be reduced. The higher prevalence of communicable infectious disorders like tuberculosis among prisoners should prompt for early diagnosis and treatment to prevent spread among other inmates. Because of the high prevalence of psychiatric diseases in prisons, it would be sensible to screen every prisoner for any psychiatric illness.

High prevalence of drug/substance dependence is highlighted in our findings which at times become fatal if adequate treatment facilities are not there. Therefore a basic/primary care treatment for substance withdrawal should be made available in prison settings to prevent undue complications.

Limitation of the Study: This study includes only admitted cases of particular region and not those prisoners who are treated in outpatient departments, so the results cannot be generalized.

This is a hospital-based study with the prisoners admitted in ward acting as the study population. A population-based study conducted on all prisoners of all jails of the region would have been more comprehensive.

This is a retrospective study. A prospective study with direct interviewing and clinical examination of the prisoners would have been more fruitful.

Strengths of the study: We are the first one to conduct the study on admitted prisoners with psychiatric and other general health disorders in this region.

Conflict of Interest: None

Financial Assistance: None

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ORIGINAL ARTICLE

An Autopsy Based Study on Patterns of Injury in Homicidal Deaths in Imphal

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Abstract:

The pattern of homicide may be a useful indicator of the social stresses in a community and may also provide useful information for law-enforcement strategies and thus pattern of injury in such cases could possibly give a better understanding the manner of death. This is a prospective descriptive analysis of medico-legal autopsies performed in the mortuary of Regional Institute of Medical Sciences, Imphal from October 2013 to August 2015. In this study a total of 97 cases of homicide during the study period is analysed in various medico-legal aspects. Blunt weapon, firearm and bomb blast were commonest weapon employed. Multiple injuries and head injuries were commonest cause of death. This study is taken up to analyze the pattern of injuries in all homicidal deaths and to formulate measures for improvement of scenario etc.

Introduction:

Offences against human being can vary from non-culpable to culpable homicide. Homicide is killing of a human being by another human being.[1] There is no difference in the eyes of law, whether a wound by its nature becomes instantly fatal or whether the fatality occurred because of not taking any proper treatment.[2]

The pattern of injuries is changing because of population explosion, changing life style, drug & substance abusers and easy availability of various types of weapons. With the advancement of technologies human race is able to access to information regarding all sophisticated instruments and weapons that can be readily used for committing any offence and intoxication is an added menace to the existing problem.

Type of weapon chosen by perpetrator depends upon many factors and injuries caused by different weapon also vary. In view of this alarming situation, we undertook the present study so as to find out the types of injury, types of assault weapon and any particular pattern of injuries in all case of homicide during the period of study and to formulate measures to change the scenario.

Materials and Methods:

A prospective study on patterns of injury in homicidal deaths was conducted at the mortuary of the department of Forensic Medicine, Regional Institute of Medical Sciences (RIMS), Imphal Manipur during period from October 2013 to August 2015. All the cases brought to the department for medicolegal autopsy with alleged history of homicide and also the cases which

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were later registered as homicide during and after the autopsy, were included in the study. Data collected using structured proforma and information was collected from the police, victims' relatives and friends, and from the hospital records in cases of hospitalization.

Results:

A total of 520 medico-legal autopsies have been conducted in the mortuary of Forensic Medicine Department, Regional Institute of Medical Sciences, Imphal during the period from October 2013 to August 2015. Altogether 97 (18.65%) cases were of homicidal deaths during the study period and these cases were studied in details and comprehensively and thus the following results were observed.

Incidence of homicide: It is observed that for the last 10 years, there was a gradual declining trend of homicide after 2009. There was 388 (65.65%) homicide in the year of 2009 and then number came down to 49 (18.08%) in the year of 2014 as per Figure no 1.

In the present study, most commonly used weapon was blunt weapon comprising of 29.90%, followed by firearms or gunshots 23 (23.71%), bomb or explosives 17 (17.53%), sharp weapons 12 (12.37%), ligature material 6 (6.18%), hands for throttling 6 (6.18%). Least commonly employed weapons were combined gunshot & explosives in 2 (2.06%), fluid media for drowning in 1 (1.03%), combined blunt & sharp weapon in 1 (1.03%) case as per table no 1.

Method of Homicide: As per the table no 2 data, blunt force trauma was the commonest method of homicide which comprised of 30 (30.93%) cases, followed by gunshots in 23 (23.71%), bomb blasts in 19 (19.58%), violent asphyxia deaths in 13 (13. 40%), and sharp force trauma in 11(11.34%) cases. Only one death caused by combined blunt and sharp force injuries i.e. multiple methods.

Body parts affected: In the present study, almost every victim

Incidence of homicide

Figure 1. Bar chart showing year wise incidence.

sustained different types of injury in different parts of the body. Most of the victims suffered injury in multiple areas of the body which comprises 23 (23.71%), followed by head injury only in 16 (16.50%) cases, thoraco-abdominal injuries in 10 (10.30%), neck injury only in 10 (10.30%), head & neck 10 (10.30%), abdomen only in 7 (7.21%), head & thorax in 7 (7.21%), head & abdomen in 6 (6.18%), thorax only in 6 (6.18%) cases and least common sites were limbs in 1 (1.03%) and neck & abdomen in 1 (1.03%) cases as per table no 3.

Table 1. Types of weapons used.

Type of weapon	No of cases	Percentage
Blunt Weapon	29	29.896907
Firearm	23	23.71134
Bomb	17	17.525773
Sharp weapons	12	12.371134
Ligature material	6	06.185567
Hands (manual)	6	06.185567
Firearm + Bomb blast	2	02.061856
Fluid media	1	1.03092784
Sharp & Blunt weapon	1	1.03092784
Total	97	100

Table 2. Method of homicide.

Method of Homicide	No of cases	Percentage
Blunt force trauma	30	30.9278351
Gunshots	23	23.71134
Bomb blasts	19	19.5876289
Violent asphyxia	13	13.4020619
Sharp force trauma	11	11.3402062
Multiple methods	01	1.03092784
Total	97	100%

Table 3. Body parts affected.

Body part affected	No of cases	Percentage
Multiple body parts	23	23.71134
Head only	16	16.494845
Thoracoabdominal	10	10.309278
Neck only	10	10.309278
Head & neck	10	10.309278
Head & thorax	7	07.216495
Abdomen only	7	07.216495
Head & abdomen	6	06.185567
Thorax only	6	06.185567
Limbs only	1	1.03092784
Neck & abdomen	1	1.03092784
Total	97	100

Pattern of skull and spine fractures: In the present study, it was observed that most common type of skull fracture was depressed comminuted fracture among total 30 deaths with skull fractures, which comprised of 14 (45.16%) and next comes in order of frequency is fissure or linear fracture in 8 (25.81%) cases, followed by cut fracture 3 (09.68%). Perforating fracture, gutter fracture, ring fracture 1 (3.22%) and non-specific in 3 (9.68%) cases each as per table no 4.

Type of Intracranial haemorrhage: As shown in the table no 5, altogether 43 victims sustained head injury i.e. 44.32% of total homicidal deaths and most of them developed both subdural (SDH) and subarachnoid haemorrhage (SAH) comprising of 23 (53.48%) cases, followed by combined extradural haemorrhgae, subdural haemorrhage and subarachnoid haemorrhage in 9 (20.93%), subarachnoid haemorrhage only in 7 (16.27%), diffuse subdural haemorrhage in 3 (6.98%) cases. Combined subarachnoid haemorrhage and intraventricular haemorrhage (IVH) comprises only 1 (2.32%) case.

Defense wounds: As displayed the data on defense wounds in the table no 6, there was absence of any defense wounds in any part of the body in 66 (68.04%) cases, whereas in 31 (31.96%) cases recognizable defense wounds were present in different parts of the body.

Causes of death: Various cause of death following homicidal attacks are given in the table no 18, the commonest cause of death

Table 4. Pattern of skull and spine fractures.

Types of skull and spine fracture	No of cases	Percentage(%)
Depressed comminuted	14	45.16129032
Fissured fracture	8	25.80645161
Cut fracture	3	09.67741935
Perforating fracture	1	03.22580645
Gutter fracture	1	03.22580645
Ring fracture	1	03.22580645
Non specific	3	09.67741935
Total	31	100

Table 5. Types of intracranial haemorrhage.

Types of ICH	No of cases	Percentage
SDH & SAH	23	53.488372
EDH, SAH, & SDH	9	20.930233
SAH	7	16.27907
Diffuse SDH	3	06.976744
SAH & IVH	1	02.325581
Total	43	100

Table 6. Defense wounds.

Defense wound	No of cases	Percentage
Present	31	31.958763
Absent	66	68.041237
Total	97	100

Table 7. Causes of death.

Cause of death	No of cases	Percentage
Shock & haemorrhage	35	36.0824742
Intracranial hemorrhage	14	14.4329897
Head injury	13	13.4020619
Injury to the vital organs	13	13.4020619
Asphyxia	11	11.3402062
Contusion of the brain and ICH	6	06.185567
Combined asphyxia & head injury	5	05.154639
Total	97	100%

observed was shock and haemorrhage in 35 (36.08%) cases, followed by intracranial haemorrhage in 14 (14.43%) cases and head injury comprised of 13 (13.40%) cases. Deaths due injury to the vital organs were seen in 13 (13.40%) cases. Asphyxia contributed in 11 (11.34%) cases. Intracranial haemorrhage in combination with contusion of the brain contributed in 6 (6.18%) cases and head injury combined with asphyxia comprised of 59 (5.15%) cases as per table no 7.

Discussion:

In this study 97 cases of homicide victims were analysed during the study period in relation to the injuries sustained and ultimately leading to death.

In the present study, most commonly used weapon was blunt weapon comprising of 29.90%, followed by firearms or gunshots, bomb or explosives, sharp weapons, ligature material, hands for throttling. These findings are consistent with Slater S and Subramanyam S.[2] Blunt force trauma was the commonest method of homicide which comprised of 30 (30.93%) cases, followed by gunshots, bomb blasts, violent asphyxia death, and sharp force trauma cases. These findings are in accordance with Sharma D et al.[3] and Hugar BS et al.[6] The proportion of bomb blast and firearm injury cases are more as compared other places where similar studies performed which could be due to disturbed condition of international border areas.

In the present study, almost every victim sustained different types of injury in different parts of the body. Most of the victims suffered injury in multiple areas of the body which comprises 23 (23.71%), followed by head injury only, thoraco-abdominal injuries, neck injury only, head & neck, abdomen only, head & thorax, head & abdomen. These findings are consistent with other authors Patel DJ[7] and Mada P et al.[8]

In the present study, it was observed that most common type of skull fracture was depressed comminuted fracture among total 30 deaths with skull fractures, which comprised of 14 (45.16%) and next comes in order of frequency is fissure or linear fracture cases, followed by cut fracture, perforating fracture, gutter fracture, and ring fracture. These observations are in accordance with findings of Karthik SK[9] and Sashikanth Z.[10]

Altogether 43 victims sustained head injury i.e. 44.32% of total homicidal deaths and most of them developed both subdural (SDH) and subarachnoid haemorrhage (SAH), followed by combined extradural haemorrhgae, subdural haemorrhage and subarachnoid haemorrhage, subarachnoid haemorrhage, diffuse subdural haemorrhage. Similar findings were observed by Mohanty S et al.[4]

There was absence of any defense wounds in any part of the body in 68.04% cases, Similar observations were seen in works of Hugar BS et al.[6] and Mada P et al.[8]

The commonest cause of death observed was shock and haemorrhage in 35 (36.08%) cases, followed by intracranial haemorrhage and head injury cases, deaths due injury to the vital organs, asphyxia, etc. These findings are consistent with Sashikanth Z.[10]

Conclusion:

On analyzing the homicidal deaths occurred in this region of the northeastern state, it was found that though multiple anatomical regions were involved in most of the cases, the anatomical region head was most targeted region in majority of the victims. It was also observed that the type of injuries and choice of weapon also varied in accordance with the gender and age of the victims.

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ORIGINAL ARTICLE

Morphometric Analysis of Variations in Pattern of Talar Articular Facets on Calcaneum in North-West India

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Abstract:

Calcaneum, the largest tarsal bone forms joint with Talus (Talocalcaneal joint). The superior surface of calcaneum shows three facets for talus. Patterns of facets are variable in different populations. Knowledge of the facets is important for orthopaedic surgeons in correction of foot deformities, as facet number is an important factor in subtalar joint stability and formation of osteophytes in osteoarthritis. The objective of the present study was to identify the patterns of talar facets on calcaneum in North-West India population and their comparison with other population of the world. For the present study; 100 calcanei of unknown age and sex were used. The calcanei were retrieved from the department of Anatomy, at a tertiary care hospital and medical college, in Haryana. The current study will focus on talar articular facets on calcanei. Patterns of talar articular facets on calcanei were observed as described by Bunning and Barnett et al. Present study revealed that pattern I and II were commonly present in the North West population, and accounted for 83% and 16% respectively. The North West population presented Pattern I as the most common pattern as compared to the European population where pattern II was reported as the most common pattern, so variation in the facet pattern between races demand a modification of surgical technique of calcaneal osteotomy to meet the needs of a particular population.

Keywords: Calcaneum; Talar facets; Arthritis.

Introduction:

The Calcaneum is a small, stout bone, and due to its anatomical position resists putrifaction better than other bones, can remain preserved for longer times under natural climatic conditions and is less likely to be fragmented further. Therefore possibility of finding this bone intact, in fragmented skeletal remains, is much higher as compared to other bones.[1] Calcaneum is also a useful tool in determination of sex and its length being considered useful in stature estimation[2] The superior surface has three facets for talus. Earliest known study has been done by Bunning and Barnett[3] in 1963 . They classified the variations as follows:

Type A: Three facets -separated by variable space.

Type B: Two facets-anterior and middle which are either continuous or have a notch between them.

Type C: One facet- three facets form a continuity .

They studied and described articular facets with parameters of degree of separation, fusion and shape in various population groups like African, Indian, British, Egyptian and Spanish.

Morphological variations of articular facets of calcaneum may

predispose people to joint instability, ligamentous laxity and development of arthritic changes in the subtalar joint. Knowledge of such variations is essential for treatment and diagnostic procedures in orthopaedic surgeries.[4] In a study in India by Gupta et al. (1977) classified calcanei based on their articular facet.[5]

Materials and Methods:

For the study of pattern of talar facets on calcanei 100 complete human calcanei of either sex were procured. These bones were retrieved from Department of Anatomy, at a tertiary care Hospital in Haryana. Calcanei showing obvious pathological deformities were excluded from the study. The age of the calcanei was noted from the records and all the calcanei were around 40-50 years of age at the time of death. According to Bunning and Barnett[6] pattern of talar facets on calcaneum were classified as given in table below:

Table 1.-

Pattern	Feature
I (Fig 1,2)	Anterior (A) and Middle (M) facets fused
II (Fig 3,4) a. b. c.	Three separate articular facets Anterior (A) and middle (M) facet separated by < 2mm A and M separated by > 2mm and < 5mm A and M separated by > 5mm.
III	Anterior facet absent. Only middle and posterior facets present
IV	All the three facets fused. Only one facet on calcaneum.

Observations and Results:

Calcaneum with obscuring pathologies such as cortical bone deterioration was excluded from the study. All the calcanei were

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numbered for identification. Pattern of articular facets on calcaneum were observed and classified, and statistically analysed, and tabulated as below:

Table 2. Patterns of the talar articular facets of calcaneum on two sides:

Sr No	Pattern	Observed in		Percentage
1.	I Anterior and middle facets fused	Right	44	83%
		Left	39	
2.	II Anterior and Middle facets Separate	Right	6/50	16%
		Left	10/50	
3.	III Anterior facet absent	Right	0	1%
		Left	1	
4.	All three facets fused	Right	0	0%
		Left	0	

Study	Year	Country	N	I (%)	II (%)	III (%)	IV (%)
Bunning & Barnett[3]	1965	Britain	194	33	67	-	00
	1965	Veddah	10	60	00	-	40
	1965	Indian	78	78	22	-	0
	1965	African	492	63	36	-	1
Gupta SC et al.[5]	1977	India	401	67	26	5	2
Mini Mol et al.[7]	2012	India (Mumbai)	50	74	26	00	00
Priya et al.[8]	2006	South India	71	67.6	25.35	7.04	0
Madhvi C et al.[9]	2008	South India	222	72.1	19.4	6.8	1.3
Muthukumar N et al.[10]	2011	South India	237	65.82	33.33	-	0.42
Camposs & pellicio[11]	1989	Spain	176	53.41	39.77	6.82	00
Verhagen FD[12]	1993	USA	191	54.45	26.7	18.85	-
Saadaeh et al.[13]	2000	Egypt	300	63	30.3	4.7	2
Shahabpowr et al.[15]	2011	Belgium	49	44.9	44.9	10.2	0
Vucinic N[16]	2020	Serbian	59	45.76	40.68	13.56	-
Barbaix et al.[17]	2000	Belgium	134	25	64	11	00
Ragab et al.[18]	2003	American	1056	37	46	12	5
Present study	2022	India (Haryana)	100	83	16	1	0

Figure 1. Calcanei of left side showing pattern I.

Fig.2: Calcanei of right side showing pattern I (Fused middle and anterior facets).

Discussion:

In the present study, the Dominent pattern of calcaneal facets for the talus in our population is pattern I (fig 1, 2) amounting to 83% followed by pattern II near about 16%.

On comparison with studies in India, this finding coincided with study by Mini Mol et al.,[7] Gupta SC et al.,[5] Priya et al.,[11] Madhvi et al.[12] and Muthukumar N et al.[13] Outside India, similar results were observed in study conducted Spain,[11] Unites States of America[12] and Egypt,[13] however the frequency of this type of pattern was quite less. Comparison of data with other population revealed that

Figure 3. Calcanei of left side with pattern II.

Figure 4. Calcanei of right side with Pattern II.

African, Indian, Egyptian, Spain, American, Serbian population had pattern I as the dominant pattern whereas the Britain and Belgium population reported type II as the dominant pattern. Bunning and Barnett compared adult African, Indian and European calcaneal bones and found a distinct racial difference. Since the racial differences observed in adult bones were also present in foetal calcanei; it indicated that different races exhibited variations in the facets and the differences were not due to any sequelae to physical activities.[6] In the present study, percentage/frequency of pattern I is very high (83%), This can be explained on the basis of squatting position opted quite frequently by North West population. It can be proposed that in squatting position weight of the body is more frequently distributed in anterior part of talus and calcaneum thereby more chances of fusion of anterior and middle facets of calcaneum as was observed by study in Nepal.[14]

Shahabpour et al.[15] in his study on Belgium population reported equal distribution of pattern I and Pattern II, somewhat similar frequency was observed in a study conducted in Serbian population in 2020,[16] as compared to studies in year 2000 in Belgium[17] and American[18] where Type II pattern was more prevalent.

Information of the talar facets on the calcaneum is valuable for orthopaedicians who correct deformities of foot as pes planus, talocalcaneal arthritis, intra articular fracture and valgus deformities. . In the pattern II, the three separated calcaneal facets form an "osseous tripod" for the talus, especially for the head of the bone, and, in this way, more effectively prevent movements that can lead to trauma and subsequent development of osteoarthritis.[19]

Medicolegally various parameters are used for identification of a person, the important ones are the determination of age, sex, stature and race etc. Identification of human skeleton requires thorough knowledge, especially in the field of comparative osteology, craniometry and racial morphology, by performing quantitative analysis of bones. Calcaneum, due to its characterstics, can thus help in determination of race as above and also further can be subjected to determination of sex of an individual.[21]

Conclusion:

In the present study, the data collected from 100 samples of calcaneal bones from the state of Haryana was analyzed.

1. Pattern I had been dominant followed by pattern II. Pattern I dominant in population of Africa, Spain, Egypt and American population as also in the Indian population of Mumbai, Rajasthan and South India but Britain population showed Pattern II as the dominant pattern.

2. Predominance of Pattern I in the North West population (83%) by a large proportion as compared to the rest of India can be accounted for by the squatting position of the residents of this region.

3. Variation in the facet pattern between races demand a modification of surgical technique of calcaneal osteotomy to meet the needs of a particular population.

4. It is also important to note that individuals with types 1 and 2 facets have been shown to have asymmetric wear patterns which might cause heavy pain, possibly leading to a habitually inclined position of the foot during walking that predisposes to osteophyte formation and subsequent osteoarthritis.

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ORIGINAL ARTICLE

Study of Natural Deaths in Custody at Tertiary Care Hospital in Rajasthan

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Abstract:

As death is final outcome of life, it is inevitable in prisoners too. Pattern of deaths can reveal living conditions and practices in a population. This study was conducted to observe the pattern of natural deaths among prisoners autopsied at a tertiary care hospital in Jaipur during April 2017 to March 2018. During this period 16 cases of alleged natural deaths in custody were autopsied comprising of 15 males and 1 female. The natural deaths were almost evenly distributed in all age groups. Carcinoma was leading cause of death in (37.5%) cases, followed by cardio-vascular causes in (25%) cases, intracranial hemorrhage in (12.5%) cases, septicaemia in (12.5%) cases, tuberculosis associated with HIV in (6.25%) case and Pneumonia associated with Parkinsonism in (6.25%) cases. All (100%) of the natural deaths received medical attention prior to death and died in hospital. Injuries were present in 5 cases (31.25%) but were not attributed to causing deaths.

Keywords: Prisoners; Natural death; Custodial death; Carcinoma; Cardiac illness.

Introduction:

There were 4,66,084 prisoners in Indian jails in end of year 2018 with numbers steadily increasing[1,2] and same is true for international prisons.[3,4]

 The inmates in custody are marginalized people who have poor access to healthcare in the community, but on the flip side, prisons also provide a rare opportunity to screen for and treat illnesses, particularly contagious and chronic ones.[5,6] The living conditions in prisons must be healthy so that the prisoners are not punished twice, once by incarceration and a second time by illness. Updated studies on prisoner morbidity and mortality are important as prison healthcare is the responsibility of state-run public health services and such work may contribute in developing further nation-wide standards for prison healthcare, an issue that is increasingly recognised.[7-9] The International Covenant on Economic, Social and Cultural Rights (ICESR) states that prisoners have a right to the highest attainable standard of physical and mental health.

Studies world-wide have reported that mortality rates from natural causes are higher than external causes in prisoners.[10-15] Whereas some studies have revealed just the opposite.[16-18] Some studies have compared prevalence of diseases of prison populations with general population; and found infectious diseases and mental illnesses to be more common among prisoners[19,20] whereas as per a study in France, the overall mortality rate due to natural causes was lower among prisoners.[21]

Prisoners are known to have increased rates of morbidity, in particular, serious mental disorders,[22] tuberculosis[23,24] hepatitis and other infectious diseases,[25-27] and self-reported physical ill-health especially in elderly.[28] Proposals are given to improve prisoners health.[29]

There are always allegations of custodial torture, human rights violations, deliberate ill-treatment and failure to provide timely medical aid by the authorities to the deceased prisoners. Hence, the investigation helps to protect the interests of all parties involved: the deceased, the next of kin, the detaining authorities, and society as a whole.[30] It can also determine any pattern or practice that may have brought about the deaths; as any pattern of deaths in any population group is an indicator of living conditions of its members.

If the death is attributed as natural (caused solely by disease and/or the ageing process) some of the common questions that arise are- (a) Was the death avoidable with proper prevention, care and treatment? (b) Were the living conditions in jail up to the standards? (c) Was the prisoner provided with necessary and timely treatment for his/ her illness?

Though it is true that not every case of death in custody will be avoidable but it is possible to reduce the number of such deaths by preventive measures.[14] Hence this study was carried out to know the prevalent pattern of natural deaths among prisoners.

Materials and Methods:

The present study was an observational descriptive study of 1 year duration at tertiary care hospital in Rajasthan. After receiving approval of Institutional Ethics Committee all cases of alleged custodial deaths from April 2017 to March 2018 were observed and only deaths due to natural causes, (confirmed by inquest report, postmortem findings, visceral examination reports, clinical records, investigation and evaluation of circumstances) were included in this study. All the cases where cause of death was concluded to be due to external causes and cases where cause of death remained in-conclusive till writing of this research were

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excluded from this study.

Information collected included age, sex, type of custody, place of death, medical attention received, past medical history if known, allegations of foul play/negligence and cause of death. The postmortem was conducted and observations made regarding injuries, and gross pathology. The available documents of the deceased (treatment record, Inquest report, viscera chemical and histopathological examination reports, other available documents) were also studied. The observations were recorded in tabulated form and data extracted from them was evaluated.

Results:

Of all custodial death cases autopsied during study period, 16 were due to natural causes which included 15 males and 1 female. All the deceased prisoners were in jail custody.

The age distribution of these cases was as follows:- 2 cases (21 to 30 years); 3 cases (31-40 years); 2 cases (41-50 years); 3 cases (51-60 years); 3 cases (61-70 years) and 3 cases (71-80 years). The youngest prisoner was 23 years old who died due to epitheloid sarcoma and oldest was 79 years old who died due to Septiciemia consequent to intestinal pathology. Mean age of death was 52.6 years. All the cases of natural deaths were brought alive to the tertiary care hospital, admitted in various wards and given treatment prior to death. None of the natural deaths occurred in prison or in police custody. The cases had survival period after admission as follows- n=5 (less than 12 hours), n=4 (12 to 24 hours); n=4 (1 day to 7days) ; n=1 (1 to 2 weeks) and n=2 (2 to 3 weeks).

The Magistrate inquest report mentioned cause of death as "due to illness" in all cases.

During postmortem, signs of injuries were present in 5 cases (31.25%) (n=3 had old healing lesions; n=1 lesions at various stages of healing and n=1 old abrasion). None of the injuries were fatal. No injuries were present in 11 cases. Histopathological examination of viscera was done for all prisoners and pathological changes found in all cases.

The cause of death was attributed to carcinoma in n=6 (37.5%) cases, cardio-vascular cause in n=4 (25%) cases, intracranial hemorrhage in n=2 (12.5%) cases, septicaemia in n=2 (12.5%) cases, tuberculosis associated with HIV in n=1 (6.25%) case and Pneumonia associated with Parkinsonism in n=1 (6.25%) case.

Carcinoma (n=6) was sporadically distributed among the population. 4 case of carcinoma were in 20 to 50 years age group and 2 cases were in 60-70 years age. Mean age for death due to carcinoma was 44.8 years. No cases were present in 51-60 yr and 71-80 yr age groups.

Cardiac cases were sporadically distributed in 50 to 72 years age; no case was present below 50 years age groups. Mean age for death due to cardiac cause was 60.25 years.

Intracranial hemorrhage was present in 2 cases, one was 40 years old male who had acute hemorrhage and died on same day. The second case was 52 years old male who had chronic hemorrhage and was admitted for 2 days before death. Mean age for death due to Intra cranial hemorrhage was 46 years.

2 cases of septiciemia were observed, both were in 71-80 years age group. One had vertebral collapse, was bed ridden and subsequently developed septiciemia. The second case was known case under follow up for malignancy, Koch chest and type 2 diabetes mellitus and during postmortem necrosed part of small intestine was found with signs of septiciemia. Mean age for death due to septiciemia was 77.5 years.

Discussion:

A predominance of males (n=15) 93.75%was noted as compared to females (n=1). Similar male preponderance has also been noted in other studies on natural custodial deaths.[20,31-33] This male preponderance may be due to more numbers of male detentions which is also illustrated by national data of male and female prisoners.[2] A further study is required over a period of time to know pattern of deaths solely among female prisoners and also studies to compare patterns of deaths among male prisoners and female prisoners.

We divided our study population in10 years age intervals and found an almost even distribution of cases in all the age groups. If we divide the population as per young age (20-40 years); middle age (40-60 years) and old age (above 60 years), then also we observe an almost even distribution of cases in all age groups. However, in other studies clear-cut age discriminations were noted of old age[33] and in some studies of younger age groups[13, 35-41] which may be due to more inmates in jail of this age group.[2]

In a 10 year study at California the modal age of custodial deaths at state supervised facilities was observed to change from 30-34 year in 1994 to 45- 49 years in 2003. But, the death rate was higher for 55-74 year old in custody compared to general population.[4] The authors proposed need of probing into the general conditions of elderly prisoners and ways to make them more apt for geriatric prisoners.

A person in custody lives in entirely different set of conditions than outside world. If living conditions are good, this may even restore his health and well being thus prolong his life. In our study maximum cases (30%) belonged to greater than 61 years age group which corresponds to life expectancy of general public and also which likely explains maximum cases of Carcinoma followed by Myocardial infarction in present study. Carcinoma has been observed to be most common in other studies.[11] Cardiovascular illness (25% cases) were second leading cause of death with majority cases due to Ischemic heart diseases. Data regarding bulk of Cardiovascular causes of deaths are varied in various studies which range from 16.7% to 59.3% according to the age groups having most mortality.[11,16,20,43]

The incidence of custodial death and the pattern of their causes reveal a lot about prevailing living conditions of prisons. The incidences of custodial deaths vary from time to time and also across different regions of the world. In a 65 years (1939-2004) retrospective exploratory analysis from Maryland, Cardio-vascular disease was found to be the most frequent cause of death from the 1930s to the 1970s, with exception of 1940s, when syphilis and tuberculosis became most frequent. Asphyxia due to suicidal hangings was the predominant cause of death in the 1980s. Drug intoxication deaths were common in 1990s and

2000s. Sudden unexplained deaths involving violent behavior, the use of multiple restraints, and drug intoxication were identified after 1980s which coincided with increased cocaine abuse.[44]

In a study at Souses, Tunisia during 2006-15 death occurred inside prison in 42.3% cases and in hospital in 57.7% cases. They found violent deaths more prevalent in 18-30 yr age group and natural deaths in 51-60 years age group.[11] In Souses, there is a common practice of sentence suspension for medical reasons for the terminally ill prisoners according to their disease evolution. This practice is not reflected in our data as some prisoners had known chronic illnesses at terminal stages.

Prisoners constitute a high risk group for acquisition of tubercular infection as compared to general population owing to overcrowding, closed living conditions with insufficient ventilation, in addition to poor nutrition.

In England and Wales over a 20-year period 16% deaths were attributed to respiratory causes and standardised mortality rates and ratios from respiratory pneumonia and from other infectious causes were found to be higher than general population. This study highlighted the need for the screening and effective treatment of infectious diseases in prisoners.[20] Respiratory diseases especially tuberculosis, have been implicated to have substantial load in causing natural deaths in many studies.[11,33,34,38,39]

Studies in other parts of world show varying Tuberculosis rates.[40] In our study only one case (6.25%) of tuberculosis was observed which was also associated with retro-viral disease. This may indicate either good living conditions of prisoners at Jaipur or may be erroneous observation made due to small sample size and small study period. Further studies need to be made in this direction to see whether this observation is duplicated or not especially at lower level jails like tehsil. No deaths were reported due to other communicable diseases. In our study, septicaemia was found in 2 cases which were both very old and suffering from systemic diseases (71- 80 years).

Strengths and Limitations: This was a comprehensive study and for concluding cause of death we took into account all the available records to us, but final full investigation report was outside purview of this study. In absence of investigation reports of Magistrate and Human Right's commission, it is possible that scientific conclusion drawn was inadequate.

It was observed that proper records pertaining to prisoner's past medical illnesses and medical treatment, history of any addiction, duration of detention etc, were not available. Some may have contracted illness during confinement and some may have had pre-existing illnesses. In absence of such record no observations can be made regarding prevention measures. There was non-availability of previous medical records, informations regarding duration of custody and final full investigation report.

Our study was limited to 1 year of study period. A long duration study like Maryland,[44] is desired in this region to get an overview of changing trends and circumstances which are reflected in patterns of deaths of persons under custody.

Recommendations: Maximum deaths occurred due to

carcinoma; this highlights the need of collecting data of prisoner regarding personal, medical, surgical and family history, stringent pre-arrest health checkup, follow-ups and screening of prisoner population for early signs of malignancy. All this medical record should be computerized for easy availability and further reference.

5 cases in our study had evidences of old injuries. Though these injuries were not direct causes of deaths in these cases, but indicate towards falls and unintentional injuries. Therefore the interiors of prison cells residing such patients may need certain changes.

Most of the deaths occurred within 48 hours of admission to hospital which indicates that prisoners were brought to hospital in terminal critical condition. This suggests scope for updating medical facilities available in jail. Most importantly, the prisoners themselves must be trained to evaluate their own physical condition and report to doctors at first instinct. The people related with custodial responsibilities should also be properly trained for providing primary aid and to recognize when medical intervention is required. This will enable to differentiate between malingering and true illnesses. It must also be emphasized to prison staff that not giving timely medical aid to prisoner is an act of grave negligence.

Providing proper and timely medical aid with digitalized medical record keeping are the major areas which can be further worked upon. A structured delivery of health care services can be provided by setting up "Prison Health Services" which would enable police administration to provide timely and appropriate medical aid as per each prisoner's need. Appropriate use of telemedicine to access super-specialties of medical field at referral institutes can bring world class healthcare at prison's doorsteps.

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ORIGINAL ARTICLE

Custodial Deaths in Jamnagar Region of Gujarat: A 5-Years Retrospective Study Report

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Abstract:

Twenty cases of custodial deaths were examined retrospectively in the present study. Out of these twenty cases, there were nineteen cases of males and one case of females. The majority of the cases occurred in the age group of 31-40 years, followed by the 21-30 years age group. There were 14 cases of natural death in whom the presence of pre-existing diseases was found and 6 cases were of unnatural deaths. In this study out of 14 natural deaths, 10 cases were of Ischemic heart disease/myocardial infarction with 2 cases of renal failure and 1 case each of pulmonary tuberculosis and chronic hepatitis. There were 6 cases of unnatural deaths; there were 3 cases of suicidal hanging, 2 cases were of multiple body injuries caused by blunt force, and 1 case of accidental choking due to the aspiration of food material.

Introduction:

The word "Custody" may be defined as "Protective care" or "Guardianship of someone or something". In the legal term, it is any point of time when a person's freedom has been denied by law enforcement agencies, such as transport before booking, or during arrest, prosecution, sentencing, correctional confinement, etc.[1] Death in custody is defined as death occurring in some form of custodial detention whether in prison or police cell.[2] Deaths while in custody, are a matter of concern for one and the whole community with false allegations of violation of human rights. Studies have shown that there is increased morbidity and mortality with natural deaths with the people in custody.[3,4] Though some deaths due to illness are unavoidable but can be prevented with proper care and treatment by having the knowledge and data regarding such deaths to be provided to the prison/custodial officials. These can be facilitated through the implementation of preventive programs. This study aims to visualize the pattern of deaths to bring awareness and prevention programs to the law enforcement agencies for the betterment of prisoners.

Materials and Methods:

The present study was conducted retrospectively at the department of Forensic Medicine & Toxicology, Shri M. P. Shah Government Medical College, Jamnagar, Gujarat State. Altogether 20 cases of custodial death were identified during this study period over the last five years. Relevant data such as age, sex, cause of death, manner of death, place of death, any pre-

existing illness, etc. were gathered from postmortem examination reports on custody-related deaths during the period from 2015 to 2019. Other relevant information was also collected from the medical record files available at medical record department, Shri M.P. Shah Government Medical College, Jamnagar, Gujarat. The data were tabulated and then analyzed.

Observation:

A total of 20 custodial death cases were studied retrospectively. Out of these 20 cases, 19 cases were male and there was only 1 female. In the present retrospective study, the maximum number of cases of custodial deaths were seen in the year 2016 followed by the year 2018 and the least number of cases were seen in the year 2015 and 2017 which recorded only 1 case (Table no.1).

The maximum number of cases were observed in the age-group of 31-40 years followed by the age group of 21-30 years where 5 cases were recorded. The minimum number of cases was observed in the elderly age group comprising 2 cases. None of the case was seen below the age of 20 years (Table no.2).

Out of the total 20 cases, there were 14 cases of natural death in whom the presence of pre-existing diseases was found and 6 cases were of unnatural deaths. In this study out of 14 natural deaths, 10 cases were of Ischemic heart disease/myocardial infarction with 2 cases of renal failure and 1 cases each of pulmonary tuberculosis and chronic hepatitis. There were 6 cases of unnatural deaths; there were 3 cases of suicidal hanging, 2 cases of multiple body injuries caused by blunt force, and 1 case of accidental choking due to the aspiration of food material (Table no.3).

In this study, 14 numbers of cases were under the custody of Jail and 6 cases were under the custody of a police cell. Out of 14 cases of jail custody, 13 of them died in the hospital while receiving treatment and only one case was recorded who died in jail. There were 6 cases under police custody, out of which 4 cases died in the hospital while 2 cases died in the police custody cell (Table no.4).

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Table 1. Year-wise distribution of cases.

No.	Year	Cases	%
1	2015	1	5
2	2016	7	35
3	2017	1	5
4	2018	6	30
5	2019	5	25
	Total	20	100

Table 2. Age–wise distribution of cases.

No.	Age- group	Cases	%
1	0-10	00	0
2	11-20	00	0
3	21-30	05	25
4	31-40	07	35
5	41-50	03	15
6	51-60	03	15
7	61-70	00	0
8	71-80	02	10
	Total	20	100

Table 3. Distribution of cases according to the cause of death.

Cause of death	Cases	%
Tuberculosis	01	5
Ischemic Heart disease	09	45
Renal Failure	02	10
Myocardial infarction	01	5
Chronic hepatitis	01	5
Hanging (Suicidal)	03	15
Multiple injuries (Homicidal)	02	10
Choking (Accidental)	01	5
Total	20	100

Table 4. Distribution according to the type of custody.

Type of custody	Cases	%
Jail	14	70
Police	06	30
Total	20	100

Discussion:

The death of a person while in custody is tragic and it affects the family members the most. It catches the eye of all the concerned members of the family and also the community. In such kinds of deaths, there is always a kind of allegation towards the law enforcement agencies of the violation of human rights, prevention of proper care, non-availability of basic human needs & facilities and ignorance of timely treatment of the detainee/prisoner.

In the present study, we have analyzed a total 20 number of cases that have come across for the past five years in the department of Forensic Medicine & Toxicology, M.P. Shah Govt. Medical College, Jamnagar for the autopsy examination. All of these autopsies were carried out according to the strict rules of NHRC and postmortem videography was done in every case.

The majority of the cases studied died due to natural causes and similar observations were noted by various authors.[5-11] This finding is also consistent with the reports of NCRB 2021[12] &

Kumar K[13] In a study conducted by Jhamad AR et al.[11] & Jadhao VT,[10] infectious diseases of the respiratory system were mainly responsible for the natural causes of death but in our study, most of the deaths were due to pre-existing diseases; which mainly were involving cardiovascular system; infectious entity being low.

The present study showed the male preponderance with 19 cases belonging to males and only 1 case belonging to a female. These findings are consistent with studies done by Bansal YS et al.,[7] Sonar V et al.,[9] Wobeser WL et al.,[4] and Singh SP et al.,[12] The Greater involvement of males may be explained due to their common involvement in criminal activities and easy money-making minds. Bardale et al.[8] and Dogra TD et al.[14] reported no female cases which may be due to the rare committing crime nature of females.

The proportion of deaths recorded was highest in the age-group 31-40 years followed by the age-group 21-30 years. Comparable findings observed in India suggest that the major age group involved were in the range of 21-40 years which was consistent with studies done by Bardale et al.,[8] Jadhao VT,[10] Sonar V et al.,[9] Wobeser WL et al.[4] and Singh SP et al.[14] The maximum age of males studied was 75 years.

Suicide by hanging was the most common unnatural manner of death comprising a total of 3 cases followed by 2 cases of multiple body injuries by the usage of blunt force and 1 cases of accidental choking due to the aspiration of food material. Our finding regarding this manner of death is consistent with the works of Sonar V[9] & Jhamad AR.[11] Poisoning and hanging were also observed to be the most common method of suicide. The result of this study is consistent with the study done by Bansal et al.,[7] Jadhao VT.[10] Homicidal cases in custodial deaths are very uncommon. In the present study too there were only two cases of homicidal deaths accounting for only 10% of the total cases. We confirmed these homicidal cases from the police case papers and related hospital records. Our study was consistent with the works of other authors.[15,16]

In this study, 14 numbers of cases were under the custody of Jail and 6 cases were under the custody of a police cell. Out of a total of 14 cases in jail custody, 13 of them died in the hospital while receiving treatment and only one case was recorded who died in jail, which was due to a suicidal hanging. There were 6 cases observed to be under police custody, out of which 4 cases died in the hospital while 2 cases died in the police custody cell where they committed suicidal hanging.

All of these cases whether natural or unnatural show some sort of ignorance towards the prisoners/detainees. Authorities are not aware of any history related to them. They take action only when the condition deteriorates and the prisoners/detainees ultimately succumb to death despite receiving the proper treatment in the hospital. Keeping all these in view, National Human Commission has instructed the jail authorities and police to follow a formal medical screening of the prisoners/detainees who enter the jail or police cell so that the health of the inmate can be known properly and can be managed accordingly.[11]

Conclusion and Suggestions:

The study concludes that death occurring in the custody is mainly due to natural causes and in most cases due to the pre-existing history of any condition or illness; of which authorities are not aware of those facts. The study stresses the need for complete medical screening of the new prisoners/detainees as per NHRC recommendations and to provide them with timely and proper medical treatment.

In the present study, the most common mode of unnatural death is hanging, following multiple body injuries while detaining the suspected person. Awareness should be created among the authorities regarding the immediate detention of a person which may lead to pursuing his suicidal tendency. For the detention of a suspected person with multiple body injuries, he must be hospitalized first rather than confining him to custody.

Ethical Clearance: It was obtained as per our college guidelines.

Conflict of interest: None to declare

Source of funding: None to declare

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ORIGINAL ARTICLE

Profile of Suicidal Deaths - An Autopsy based Study

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Abstract:

Suicide is one of the leading as well as preventable cause of premature death not only in our country but worldwide. There has been an increase in the suicidal rates globally over the years. Suicide has many perspectives like religious, philosophical, anthropological, sociological, ethical, psychological, and psychiatric or biological.

The objectives of the present study were to describe the risk factors and different methods adopted for suicide in a district of southern state of India. A descriptive study was conducted on 175 dead bodies brought for medicolegal autopsy in the tertiary care centre, Alappuzha with history and post-mortem findings consistent with suicide. All the cases turned out to be homicide and accidents after investigation were excluded from the study. Information about the deceased were collected from close relatives and investigating officers.

Maximum suicide victims were seen in age group 40 to 60 years where male outnumbered females. Most of the victims preferred their home to commit suicide. Hanging was the most common method adopted followed by poisoning, burns and drowning. In the study population, physical illness seen as the most common reason for suicide followed by family problems. Burns were chosen as a preferred method by females than males. This study supports in finding out the stressors that could have led them to commit suicide and to suggest few strategies to prevent the suicides in the future.

Keywords: Suicide; Methods adopted; Risk factors; Suicidal ideation; Stressors.

Introduction:

The Government of India classifies a death as suicide, when it is an unnatural death and the intent to die commenced within the person. Moreover, there is a reason for the person to end his or her life. Those who have previously attempted suicide is at a greater risk for future attempts. The commonly used method of suicide varies between countries, and depends on the availability of effective means. Common methods adopted for suicide include hanging, pesticide poisoning, burns and drowning.

This study targets to describe the most common methods adopted and to describe the sociodemographic profile and risk factors that leads to suicide.

We can prevent suicide only by finding out the reasons behind it. The reasons may vary from region to region as they face different problems. So it is necessary to find out the stressors affecting that particular region. To find out such stressors, medicolegal autopsy may have to be followed by psychological autopsy.

Materials and Methods:

This descriptive study was conducted in a tertiary care centre in Alappuzha district in Kerala, during the period of May 2019 to

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April 2020. The sample size taken for this study was 175 and the study subjects were dead bodies brought for medicolegal autopsy with history and postmortem findings being consistent with suicide. Subjects were selected using inclusion and exclusion criteria. Cases in which relatives gave consent to participate were included in the study and cases with no bystander or relatives to give a reliable history and all the homicidal and accidental cases after police investigation were excluded from the study. The study subjects were examined for method adopted for suicide, their socio-demographic variations and characteristics, time of death, place of death etc. Data related to the life events and stressors preceding the suicide were collected from the relatives of the deceased and concerned investigating agencies by personal interview. Study tools included postmortem report, proforma, hospital records, and suicidal notes if any. Data entered using Microsoft excel worksheet and analysis done using SPSS version 18.0. Quantitative variables were analysed using test for difference in means and qualitative variables were analysed using chi-square-test. The original research was approved by the Institutional Ethics Committee.

Results:

Suicides seen more in age group 40-60 years (65 out of 175 cases accounting for 37.1%) whereas minimum number of suicides seen in age group above 80 years, accounting for 3.4% (6 out of 175 cases). Males (70.9%) outnumbered females (29.1%) in the current study. About 90% study subjects were literate and 74.8% were married. Majority, 126 out of 175 belonged to low socioeconomic status.

Majority of the suicides occurred at home (84.6%) followed by public places (8%) other than school (1.1%), workplace (1.7%) and hostel (0.6%). Around 35% of total population committed suicide during morning hours and 26.3% committed suicide during night. Most common method adopted by victims was hanging (67%) followed by poisoning (22%). Around 8.6% (15 out of 175) of cases had suicidal notes. Approximately 21% of the study population had history of previous attempts and 15 out of 37 (40.54%) used hanging as the method followed by poisoning (10 out of 37 i.e. 27.02%). In this study, 49 victims verbally expressed their suicidal ideation to their close people which included family members, friends, or colleagues prior to the incidence and 37 out of 175 (21.1%) had history of previous attempts.

Discussion:

Age and Sex: According to this study, maximum numbers of suicides were seen among males (70.9%) than females and most of them belonged to age group 40-60 years. Minimum numbers of suicides were seen in age group above 80 years. These findings were similar to a study on hanging conducted in Kerala where male suicide victims were more in number[1] and they belonged to the age group 21 to 60 years. Suicide rates in the most industrialized countries increased with age.[2] Similar observations noted in other studies conducted in India.[3,4] But in some of the western studies, maximum numbers of cases were reported between 21 to 30 years of age among both sexes.[5]

Educational status: Majority of the study subjects were literate (90%). Previous studies showed that the association of education and suicide is inconsistent. In an Indian study by Mohanty S et al.

Table 1. Method (s) adopted for suicide by the victims.

Method adopted	Number	Percent
Hanging	117	66.9
Drowning	2	1.1
Poisoning	38	21.7
Burns	14	8.0
Injuries due to Sharp instruments	1	0.6
Injuries sustained in railway traffic occurrence	3	1.7
Total	175	100.0

Table 2. Features of the suicidal note recovered.

Features	Category	Frequency (N = 15)
Language of the suicidal note	English	1
	Malayalam	14
	Hindi	0
To whom	Police	1
	Not Specified	14
Content	Asking forgiveness	1
	Expressing Love	7
	Accusatory	1
	Revenge	4
	Religious Theme	2
Whether the note is signed	Yes	3
	No	12
Whether the note is Well organised	Yes	15
	No	0

from 2000 to 2003, less educated or illiterates were usually the victims.[6]

Marital status: In the present study the majority of the victims were married. This finding was similar to various studies previously conducted in our country.[7-11] In these studies, mortality rates were higher among married persons than the unmarried persons in both sexes. This may be due to more responsibility and increased family conflicts among married people.

Socioeconomic status: There are higher suicide rates in persons of low socioeconomic status (72%). It was similar to previous Indian studies where low socioeconomic status was reported in 50 to 66% of suicide victims.[12-14]

Place of suicide attempt: Majority of the suicides occurred at home (84.6%) and the finding was similar to a study conducted at Bangalore, in which majority of the children who committed suicide were at their homes.[15]

Time of suicide attempt:

Around 35% of total population committed suicide during morning hours and 26.3% committed suicide during night. Only

Table 3. Reasons for committing suicide (N=175).

Sl. no.	Risk factors	Number	Percentage
1.	Academic failure	4	2.3
2.	Problems regarding Love affair	9	5.1
3.	Problems regarding Marital life	21	12.0
4.	Family problems	33	18.9
5.	Forced by parents to do something	5	2.9
6.	Psychiatric illness	18	10.3
7.	Physical illness	35	20.0
8.	Financial burden	24	13.7
9.	Alcoholism	20	11.4
10.	Quarrel with neighbours	2	1.1
11.	Others	4	2.3

Table 4. Gender-wise difference in methods used for suicide deaths.

Methods used	Gender			
	Male		Female	
	N	%	N	%
Hanging	83	67	34	66.7
Drowning	0	0	2	3.9
Poisoning	31	25	7	13.7
Burns	8	7	6	11.7
Cutting/Piercing instruments	0	0	1	2
Railway/Road traffic occurrence	2	1	1	2
Total	124	100	51	100

Table 5. Age group wise difference in method used for suicide (N=175).

Method of suicide	Age-groups									
	Below 20 yrs		20-40 yrs		40-60 yrs		60-80 yrs		Above 80 yrs	
	N	%	N	%	N	%	N	%	N	%
Hanging	14	82.3	39	84.8	39	60.0	23	56.1	2	33.3
Drowning	2	11.8	0	0.0	0	0.0	0	0.0	0	0.0
Poisoning	1	5.9	5	10.9	18	27.7	10	24.4	4	66.7
Burns	0	0.0	2	4.3	8	12.3	4	9.8	0	0.0
Sharp instruments	0	0.0	0	0.0	0	0.0	1	2.4	0	0.0
Railway/Road occurrence	0	0.0	0	0.0	0	0.0	3	7.3	0	0.0
Total	17	100	46	100	65	100	41	100	6	100

16.6% committed suicide during evening. In a previous study conducted at Turkey states, large number of young and middle aged people committed suicide more around midnight. Time patterns of suicide varied over time and they cannot be explained by biological rhythm alone.[16]

Methods adopted to commit suicide: Approximately 67% resorted to hanging followed by poisoning. These findings were similar to most of the studies conducted in India where hanging was the most frequently reported method of suicide, accounting for 10 to 72% of all suicides,[17-30] following self-poisoning (often ingestions of organophosphate pesticides). The easy availability of means of suicide like cloth, rope, variety of poisons might be a reason for this.

Suicidal note among study population: Suicidal notes were the last messages communicated by the dead to the live about their agonies and stressors. In this study, 15 out of 175 cases, accounting for 8.57% of suicides, left a suicidal note before committing suicide, which was similar to a previous study where only a minority of suicide victims, varying between 3-42% leave a note.[31] In the present study, majority of the suicidal notes were written in the native language of which 7 were expressing love. Social media was also used by a victim to express his suicidal ideation. The content of his Facebook live was an accusatory one which was in local language.

Reasons behind suicide: Physical illness was the most common reason behind suicide. Twenty percent (35 out of 175) of total population committed suicide due to physical illness which included carcinoma, stroke, old age related illnesses like severe myalgia etc. Physical health conditions such as asthma, back pain, brain injury, cancer, congestive heart failure, chronic obstructive pulmonary disorder, diabetes, epilepsy, HIV/AIDS, heart disease, hypertension, migraine, Parkinson's disease, psychogenic pain, renal disorder and stroke had been found as risk factors for suicide.[32]

Rest of the study population committed suicide due to family problems, financial burden and marital disharmony. In a country like India, young married girls may have to face serious difficulties after moving to their husband's home. The life and marital circumstances of women make them vulnerable to suicidal behaviour. Stresses may include arranged and early marriage, young motherhood, low social status, domestic violence, problems with in-laws, dowry problems and economic dependence. Some studies state that social, cultural, and religious constraints discourage women from employment, careers, and financial and social independence, and force them to remain within unhappy marriages in dependent living arrangements with extended family.[33-36]

Expressing suicidal ideation and history of previous suicide attempts: In this study,49 victims (28%) verbally expressed their suicidal ideation to their close people which included family members, friends, or colleagues in the recent past and 37 out of 175 (21.1%) had history of previous attempts. Communication of suicidal intent is an event that often precedes suicidal behaviour and individuals who have previously attempted suicide are at higher risk for subsequent suicide attempts. Approximately half of the suicidal victims (48.8%) had verbally expressed their suicidal feelings to at least one of their family members.

Conclusions and Recommendations: Suicide is an escapist measure taken by a person for whom death may appear to be the only immediate remedy for his/her problems. The increasing rates of suicides not only affect a particular individual or his/her family but also the society as a whole. Now it's a challenge for society to tackle this problem.

Few suggestions are to ensure easily accessible and low cost treatment for physical and psychiatric illness by the government, to improve adequate access to the palliative care and counselling for the terminally ill patients, to open more medical centers for proper counselling and conduct awareness camps to make people aware of signs of self-harm. Follow up and social support should be given to those who attempted suicide and survived. Early detection and intervention of people presenting with thoughts or plans to commit suicide is an important step for suicide prevention. So it is necessary to conduct more mental health awareness programs in schools and other educational institutions for students and parents and reform the education system. Unemployment and financial crisis is also an important risk factor that leads to the suicide of youngsters thereby, creating more job opportunities and easy availability of financial services/ loans with low interest rate will be helpful for them so that they do not have to depend upon moneylenders. Other suggestions include: ensure the protection of women through enforcement of strict laws against dowry, rape, body shaming, cyber bullying, domestic violence and restrict the access to the means of suicide such as pesticides, firearms, heights, railway tracks, poisons, licit and illicit drugs, sources of carbon monoxide such as car exhaust or charcoal, etc.

Conflict of interest: None to declare

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ORIGINAL ARTICLE

Study of Homicidal Deaths Autopsied in VSSIMSAR, Burla: A Three-Year Retrospective Study

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Abstract:

Killing of an individual is the highest level of aggression found in society. Incidence of homicide is on the rise and its pattern is also changing with time. The present retrospective study was conducted in the department of Forensic Medicine and Toxicology, VIMSAR, Burla from 1st January 2018 to 31st December 2020. All the cases brought to the department for autopsy, either confirmed or later registered as homicide by investigating officer were considered for study. Among 4918 autopsies conducted during the period of 3 years 119 cases (2.41%) were of homicidal deaths. 66.4% of homicide victims are males. Majority of homicidal deaths occur in the age group 21-30 years and 31-40 years accounting for 52% of total cases combinedly. 46.2% homicide victims succumbed to injuries at the spot. Majority of cases (44 cases, 37%) occurred during night hours. Infliction of injuries are present in multiple areas in 42.8% of cases. Blunt weapons (29.4%) were the most commonly used. Defence wound were present in 19% of cases. Most common site of fatal injury is head in 46.2% of cases. In majority of cases (46.2%) cause of death was due to craniocerebral injury.

Keywords: Homicide; Blunt weapon; Defence wound.

Introduction:

Homicide is killing of a human being by another human being. There are two types of homicides I) Lawful which includes justifiable and excusable homicide II) Unlawful which includes (i) murder (S.300, IPC), (ii) culpable homicide (a) amounting to murder (S.299, IPC) (b) culpable homicide not amounting to murder (S.304 IPC) (iii) rash and negligent homicide (S.304 A, IPC).[1]

The motives for committing homicidal deaths are usually arguments, revenge, robbery, feud, financial greed, property based conflicts etc. Cases of homicide are increasing day by day due to unemployment, drug addiction, life stress etc. Meticulous post mortem examination is needed in every case of homicide. The pattern of homicidal deaths greatly varies across different regions and population with different socio-economic status that keeps on changing with time.

The pattern of injuries in homicidal deaths may provide clue to the police. The incidence of homicide is increasing worldwide and the pattern is also changing because of population explosion, frustration, illiteracy, prevalent economic, social and political environment, insurgency, terrorism, drug addiction, changing life style, modern needs of the man and easy availability of various types of weapons.[2] Also defense wound forms a valuable evidence for reconstructing the fatal incidence in homicidal

deaths.[3] It is a challenging job for a forensic expert to solve the mystery of death in those cases particularly that initially comes as a natural death and subsequently turned into homicidal death. The role of autopsy surgeon becomes important in determining weapon of offence, probable position of accused and victim at the time of incidence by meticulous examination of injuries. At times, crime scene visit is helpful to reconstruct the crime and also gives clue to the investigating authorities to find the actual culprit.

Materials and Methods:

All types of murder cases and infanticides were included in this study. The data were collected retrospectively of period from 1st January, 2018 to 31st December, 2020 after getting approval from institutional ethics committee during which total 4918 autopsy cases were conducted at the mortuary of VSS institute of medical sciences and research, Burla, Sambalpur. Detailed history regarding age, sex, religion, address, incidence of offence, circumstances, weapons used in the offence etc. were collected from inquest, other documentary records, photographs and from statements of concerned investigating police officers and relatives of the victim. Autopsies were conducted as per standard autopsy protocol and the collected data were analyzed and compared with the studies done by different researchers around the world.

After obtaining the above information, separate data sheets were used for each case and were filled to record above information. These data were analyzed in order to get breakup of the information.

Inclusion Criteria: All the cases brought to the department for autopsy, either confirmed or later registered as homicide by investigating officer are considered for study.

- **Exclusion Criteria:** Any cases subjected for autopsy with

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alleged or suspected history of homicide but later registered as non-homicidal, based on autopsy findings, circumstantial evidence and police investigation were excluded.

- **Ethical clearance:** The study was carried out after obtaining ethical clearance from the institutional ethics committee.

Results:

During the study period a total of 119 cases of Homicidal deaths were studied that were subjected to autopsy at the mortuary of VSS Institute of Medical Sciences and Research, Burla and the results are tabulated under various parameters.

Among 4918 autopsies conducted during the period of 3 years 119 cases (2.41%) were of homicidal deaths. Males homicide victims 79 cases (66.4%) outnumbered females. Majority of homicidal deaths occur in the age group 21-30 years and 31-40 years accounting for (62 cases combinedly) 52% of total cases (Table 1). Most of the homicide victims succumbed to injuries at

Table 1. Age wise distribution of homicidal cases.

Age in years	Number of cases	Percentage (%)
< 1	1	0.8
1-10	0	0
11-20	16	13.5
21-30	31	26
31-40	31	26
41-50	16	13.5
51-60	10	8.4
61-70	9	4.2
71-80	5	4.2
Total	119	100

Table 2. Distribution based on involved body part.

Involved body part	Number of cases	Percentage (%)
Head	19	16
Neck	8	6.8
Chest	2	1.6
Abdomen	2	1.6
Lower limb	1	0.9
Head and neck	6	5
Head and chest	4	3.3
Chest and abdomen	2	1.6
Abdomen and genitalia	1	0.9
Abdomen and lower limb	1	0.9
Head and upper limb	11	9.3
Head and lower limb	6	5
Neck and chest	1	0.9
Neck and upper limb	2	1.6
Neck and lower limb	1	0.9
Miscellaneous	1	0.9
Multiple areas	51	42.8
Total	119	100

Table 3. Distribution based on types of injury.

Type of injury	Number of cases	Percentage (%)
Abrasion	65	54.6
Contusion	69	58
Laceration	59	49.5
Chop	17	14.2
Incised	23	9.3
Stab	11	9.2
Fracture/ dislocation	36	30.2
Burn	9	7.5
Drowning	1	0.8

the spot (55cases, 46.2%) followed by 33 cases (27.7%) within 24 hours of incident. Most of the cases occurred in outdoor places (82 cases, 69%). Majority of cases occurred during night hours (44 cases, 37%) followed by afternoon hours. Infliction of injuries are present in multiple areas (51 cases, 42.8%) of the body in majority of cases followed by head (19 cases, 16%) (Table 2). Contusion was the most common injury found in 69 cases (58%) (Table 3). Blunt weapons (35 cases, 29.4%) are the most commonly used offending weapons followed by sharp cutting weapons (32 cases, 26.9%) (Table 4). Blunt weapon injuries (52 cases, 43.7%) and sharp weapon injuries (27 cases, 22.7%) were found in majority of cases. Defence wound were present in 23 cases (19%) (Table 5). Head (55 cases,46.2%) is the most common site of fatal injury followed by neck (22 cases, 18.5%). Brain was the most common internal organ to be affected in 55 cases (42.6%). In majority of cases cause of death was due to craniocerebral injury (55 cases,46.2%) (Table 6).

Discussion:

Among 4918 autopsies conducted during the period of 3 years, 119 cases (2.41%) were homicidal deaths which is quite similar to Kulkarni DV. et al., Zanzrukiya K et al., Parmar DJ et al., Bambhaniya AB et al., Sonawane SS et al., Sumangal CN et al.[4-9] Some authors like Hugar BS et al., Mada P et al., Rastogi AK et al., Angam G et al., Sharma D et al., Patel DJ et al., and Sangal A et al. showed higher rate.[2,10-15] While Taware AA et al. have lower incidence (1.76%) of homicide than the present study.[16]

This study has shown male predominance which might be due to their aggressive nature, outdoor activities, risk taking behaviour and lead role in financial and property affairs. Similar findings were observed by majority of authors.[4-12,14-18] The present study shows equal number of homicidal deaths in age groups 21-30 years and 31-40 years which together comprises of more than half of the homicidal deaths i.e. 52% of total victims. These findings

Table 4. Distribution based on types of weapon.

Types of weapon	Number of cases	Percentage (%)
Sharp cutting	32	26.9
Blunt	35	29.4
Firearm	4	3.3
Bomb/Explosive	1	0.9
Cloth	7	5.9
Others	13	11
Not known	27	22.6
Total	119	100

Table 5. Distribution based on defence wound.

Defence wound	Number of cases	Percentage (%)
Present	23	19
Absent	96	81
Total	119	100

Table 6. Distribution based on cause of death.

Cause of death	Number of cases	Percentage (%)
Cranio cerebral injury	55	46.2
Haemorrhage and shock	32	26.9
Asphyxia	13	10.9
Neurogenic shock	7	5.9
Others (Peritonitis, Poisoning, Septicemia, Thromboembolism, Spinal Shock)	12	10.1
Total	119	100

are in line with most of the authors.[2,4-12,14-18] The factors contributing for highest incidents in the 21-40 Years age groups were due to marital disputes, property dispute, financial conflicts, unsuccessful romantic disputes, infidelity, revenge, dowry death in females, gang rivalry, unemployment and heated arguments.

Majority of homicide victims succumbed to injuries at the spot. This is similar with most of the authors.[6,7,10,13,15,17] This could be due to lethality of weapon, determination of assailant to kill the victim and tremendous force applied on the vital parts of the body. Most of the cases occurred in outdoor places which is quite similar with Sumangala CN et al., Patel DJ et al. and Sangal A et al.[9,14,15] This could be due to outdoor being the place where from the assailant can escape easily after committing the crime. While it differs from the observations made by Sonawane SS et al. and Mada P et al.[8,10] Majority of cases occurred during night hours. This is at par with Prashanth M et al., Sangal A et al. and Taware AA et al. Majority of the homicidal deaths taking place during night time could be due to the fact that there is little or no light at all during night hours, less surveillance and easy escape without being identified, hence it is the preferred time for committing the crime. Some authors like Bambhaniya AB et al. and Patel DJ have observed most cases occurring during evening hours.[7,14]

Multiple areas of the body are the most commonly affected region followed by head. This could be due to movements of different parts of body during the act and the assailant targeting the vital parts of body to kill the victim. While some authors like Parmar DJ et al., Patel DJ et al., Taware AA et al. and Mohan M et al. observed the head to be the most commonly involved body part.[6,14,16,18] However Sangal A et al. found the chest and abdomen to be the most common body part involved.[15] Contusion was the most common injury followed by abrasion and laceration. This could be due to preferred use of hard and blunt weapons. It contradicts with Patel DJ et al., Taware AA et al., Buchade DD et al. where abrasion is the commonest type of injury.[14,16,17] While Mohan M et al. found the most common injury type to be fracture followed by ligature mark.[18]

Death due to injury by the use of hard and blunt weapon was the commonest in our study observed in 35 cases (29.4%) followed by sharp cutting weapons in 32 cases (26.9%) which could be due to most of the cases of homicide were not premeditated and used the blunt weapon available at the site of the crime. Sharp weapons were the next commonly used tool for homicide. Most of the sharp weapon homicides were premeditated and involved in rivalry and intention to cause fatal injury to the victims. Firearms usage was very minimal in our study due to strict rules of government regarding the selling of fire arms. Uncommonly in our study one case of explosive usage has been documented. The findings of our study are consistent with most of the authors.[8,10,11,14,16-18] Our findings are not similar with Kulkarni DV et al., Zanzrukiya K et al., Parmar DJ et al. and Bambhaniya AB et al. where sharp cutting weapons are commonly used.[4-7] Sangal A et al. found the most commonly used weapon to be firearm in their study.[15] In 19% of cases defence injuries were present. Injuries on limbs which could be due to preventing the attack and grasping the weapon to protect vital parts of body. This is comparable with observations made by Parmar et al. and Sharma D et al.[6,13] While

Sachin S et al., and Patel DJ et al. have higher incidences of defence injuries.[8,14] Head was the commonest site of fatal injury infliction. It is similar with the observations made by Kulkarni DV et al., Parmar DJ et al., Sonawane SS et al. and Sharma D et al.[4,6,8,13] as head is the most accessible part and where a single injury can also lead to death of an individual. However Zanzrukiya K et al. described the neck as chief body part receiving the fatal injury.[5] Brain was the most common internal organ to be injured in majority of cases. Higher involvement of brain could be due to the fact that brain is vulnerable to even lesser amount of blunt force trauma and also when victim is knocked down, he often strikes his head on ground. The findings are similar to that of Parmar DJ et al., Sharma D et al. and Taware AA et al.[6,13,16] This is in contrary to the observations made by Bambhaniya AB et al. where lung was the most common internal organ to be affected.[7] Cause of death was predominantly craniocerebral injury which is consistent with Sonawane SS et al., Mada P et al., Sharma D et al., Taware AA et al. and Buchade DD et al.[8,10,13,16,17] It may be due to the fact that head is one of the most vital regions of the human body which is in focus in the great majority of assaults especially involving blunt injuries. Some authors like Kulkarni DV et al, Parmar DJ et al., Rastogi AK et al. and Sangal A et al. have observed haemorrhage and shock to be the cause of death in most cases.[4,6,11,15]

Conclusion:

Considering the above observations, we feel that there is necessity to look for solutions for the problems of youth, as it is the most common age group involved in such crimes. Strict night surveillance, installation of CCTV cameras at vulnerable places and strict implementation of laws against the ones possessing dangerous weapons and punishment for the same can help to reduce such heinous crimes. Finally the difference among the findings of Indian authors can be attributed to different geographical areas, cultural diversity and local issues. Hence there is need of more such studies in different regions to get proper profile of homicidal deaths.

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ORIGINAL ARTICLE

A Study of Injury Pattern and Mode of Accident of Fatal Injuries in RTA Cases Admitted in a Tertiary Care Centre -3 Year Retrospective Study

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Abstract:

Road traffic accident ranks among the top causes of death in the world; after ischemic heart disease, it is projected to become the second leading cause in 2020. A report states that 1.24 million people die every year worldwide on the roads. RTA is a public health issue that greatly affects individuals, families, communities, and nations. The cost of burden is estimated to be around 1–2% of a country's GNP in low-income countries. To know the pattern of fatal injuries in RTA cases. To correlate the survival period and cause of death in fatal road traffic accidents. Data from medico-legal autopsies of all RTA victims from 2018 to 2020 (n= 210) were collected in this retrospective study. Data were analyzed using SPSS software, V.22. The majority of the study population, 24.2% (51 out of 210), belonged to the 1-30 age group. Male predominance was noted in the study with 84.2% (177 out of 210). The type of accident was self-fall in high proportion 26.6% (56 out of 210) followed by a collision between 2-wheelers and 4-wheelers 24.2% (51 out of 210). Intracranial haemorrhage was reported in 140 (66.6%) study participants as the leading cause of death followed by hemorrhagic shock other than head and neck injury reported in 42 (19.9%) cases. A short revival period of fewer than 24 hours was noticed in intra-cranial haemorrhage (81 out of 140) followed by hemorrhagic shock other than head and neck injury (39 cases). Skull fractures are higher in 2-wheelers compared to other types of vehicles and pedestrians. (103 out of 140). The majority of fatal accidents occurred in two-wheelers. Hence, health education and awareness should be created among two-wheeler riders, especially drivers & pillion to wear helmets and follow safety measures while riding.

Keywords: Road traffic accident; Intra cranial hemorrhage; Skull fracture; Survival period.

Introduction:

The World Health Organisation (WHO) describes an accident as "an unpremeditated event resulting in recognizable damage." The American safety council defines it as an "occurrence in a sequence of events which usually produces unintended injury, death or property damage."[1] Road Traffic Accident (RTA) is any vehicular accident occurring on the roadway i.e. originating on, terminating on, or involving a vehicle partially on the roadway.[2,3] RTA ranks among the top causes of death in the world; after ischemic heart disease, it is projected to become the second leading cause in 2020.[4] In India over 1.3 lakh fatal outcome was reported in 2020 and 3.4 lakh people have sustained injuries.[5] India is responsible for around 10 percent of all road accident deaths in the whole world. In developing countries, around 85 percent of all deaths caused by road accidents occur, and nearly half of these accidents happen in the Asia-Pacific region.[6] The increased rate of fatality has been attributed to population explosion and increased motorization.[7] RTA is a serious public health issue that greatly affects individuals, families, communities, and nations. The cost of burden due to RTA is estimated to be around 1-2% of a country's gross national product (GNP) specifically in lower-income countries.[8,9] Injuries due to several factors like human error, vehicle problem, and environmental factors play crucial roles before, during, and after a serious RTA. The list of important factors are extensive like human errors, driver fatigue, speeding and overtaking, violation of traffic rules, poor traffic sense, mechanical fault of the vehicle or road conditions, road encroachment, traffic congestion and poor management.[10] The endangered groups are pedestrians, the elderly, children, and cyclists.[11-13] The objectives of the present study are to describe the distribution of injuries and demographic profile from autopsy cases due to fatal RTA, which can be used for the development of a strategy for the prevention of mortality due to RTA and public education on road safety.

Materials and Methods:

Ethical approval was obtained from Institutional Ethics Committee, J.N. Medical College, Belagavi to conduct the study. A retrospective study was conducted to analyze the deaths caused due to Road Traffic Accidents (RTA) which were subjected to post-mortem examination in the mortuary of KLE Hospital a tertiary care centre, in Belagavi from January 2018 to December 2020. Detailed information on the cases was based on medicolegal records and evaluation of post-mortem reports. Data were analyzed with age, sex, nature of the collision, mode of the vehicle, time of the collision, survival period, distribution of

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injury, internal findings, and cause of death, which was acquired from police inquest, history obtained from medical records and relatives.

Ethics statement: The study was approved by the institutional human ethics committee and institutional review board [Reference: MDC/DOME/258]. Data confidentiality was maintained.

Statistical Methods: Survival period, cause of death, Internal and external injury, etc., were considered as primary outcomes of interest. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. The association between

explanatory variables and categorical outcomes was assessed by cross-tabulation and comparison of percentages. The odds ratio along with 95% CI is presented. The Chi-square test was used to test statistical significance. P value <0.05 was considered statistically significant. Data were analyzed by using SPSS software, V.22.[14]

Results:

The majority of the study population like 51 out of 210 (24.2%) individuals belonged to the 21-30 years age group followed by 51-60 years (20%), 31- 40 years (16.6%), and 41- 50 years (15.2%). Male predominance was noted in the study with 177 out of 210 (84.2%). Nature of accidents for two-wheelers self- fall amounting to 56 out of 210 (26.6%), the proportion of two & four-wheeler collisions was 24.2% and 19% respectively, whereas pedestrians reported 36 out of 210 (17.1%). The majority of study

Table 1. Summary of baseline parameters (N=210).

Parameter	Number (%)
Age Group	
0- 20	18 (8.5%)
21-40	86 (40.8%)
41-60	74 (35.2%)
>60	32 (15.2%)
Gender	
Male	177 (84.2%)
Female	33 (15.7%)
Nature of Collision	
Pedestrian	36 (17.1%)
2-wheeler self-fall	56 (26.6%)
2-wheeler collision	40 (19%)
2 & 4-wheeler collision	51 (24.2%)
4-wheeler topple	15 (7.1%)
Heavy vehicle collision	12 (5.7%)
Mode of Vehicle	
Pedestrian	32 (15.2%)
2-wheeler	141 (67.1%)
4-Wheeler	26 (12.3%)
Heavy vehicle	11 (5.2%)

Table 2. Summary of injury-related parameters and cause of death (N=210).

Parameter	Number (%)
Time	
12 pm -6 pm	38 (18%)
6.1 pm-12 am	40 (19%)
12.1 am – 6pm	53 (25.2%)
6.1pm-12 pm	79 (37.6%)
Survival Period	
0-1 day	126 (60%)
2 - 7 days	52 (24.7%)
1.1 week - 1 month	29 (13.8%)
>1 month	3 (1.4%)
External injury	
Head	157 (74.7%)
Thorax	59 (28%)
Abdomen	59 (28%)
Limbs	178 (84.7%)
Internal injury	
Head	140 (78%)
Spine	11 (5.2%)
Thorax	56 (26.6%)
Abdomen	42 (20%)
Limbs	15 (7.1%)

Table 3. Comparison of survival period across the cause of death (N=210).

Cause of Death	Survival Period				P value
	0-1 Day	1- 7 Days	1.1 Week - 1 Month	>1Month	
Intracranial Haemorrhage (N=140)	81 (57.86%)	42 (30%)	16 (11.43%)	1 (0.71%)	<0.001
Hemorrhagic Shock (N=42) (Other than head and neck injury)	39 (92.86%)	3 (7.14%)	0 (0%)	0 (0%)	
Septicaemia (N=16) (Delayed complication)	0 (0%)	5 (31.25%)	9 (56.25%)	2 (12.5%)	
Others (N=12)	6 (50%)	2(16.67%)	4 (33.33%)	0 (0%)	

Table 4. Association of demographic and RTA parameters with a skull fracture in ICH cases (N=140).

	Skull Fracture		Odds ratio	P value
	Yes	No	(95 % CI)	
Age groups				
0-10 (N=3)	0 (0%)	3 (100%)	4.86(0, -)	0.99
11- 20 (N=7)	6 (85.71%)	1 (14.29%)	4.71(0.49, 45.1)	0.17
21-30 (N=31)	22 (70.97%)	9 (29.03%)	1.92(0.63, 5.80)	0.24
31-40 (N=22)	14 (63.64%)	8 (36.36%)	1.37(0.42, 4.44)	0.59
41-50 (N=23)	17 (73.91%)	6 (26.09%)	2.22(0.65, 7.54)	0.19
51-60 (N=29)	20 (68.97%)	9 (31.03%)	1.74(0.57, 5.32)	0.32
>60 (N=25)	14 (56%)	11 (44%)		
Gender				
Male (N=115)	81 (70.43%)	34 (29.57%)	2.581 (1.07, 6.23)	0.03
Female (N=25)	12 (48%)	13 (52%)		
Mode of Vehicle				
Pedestrian (N=21)	13 (61.9%)	8 (38.1%)		
2-Wheeler (N=103)	69 (66.99%)	34 (33.01%)	1.25 (0.47, 3.3)	0.65
4-Wheeler (N=12)	8 (66.67%)	4 (33.33%)	1.23 (0.28,5.45)	0.78
Heavy Vehicle (N=4)	3 (75%)	1 (25%)	1.85 (0.16, 20.94)	0.62
Survival Period				
0-1 Day (N=81)	60 (74.07%)	21 (25.93%)		
1- 7 Days (N=42)	26 (61.9%)	16 (38.1%)	0.56(0.25, 1.26)	0.16
1 Week-1 Month (N=16)	7 (43.75%)	9 (56.25%)	0.27(0.09, 0.82)	0.02
>1 Month (N=1)	0 (0%)	1 (100%)	-	1
Head (External)				
Yes (N=108)	72 (66.67%)	36 (33.33%)	1.05 (0.45, 2.41)	0.91
No (N=32)	21 (65.63%)	11 (34.38%)		
Head (internal)				
Yes (N=138)	93 (67.39%)	45 (32.61%)	-	0.99
No (N=2)	0 (0%)	2 (100%)		

participant's mode of the vehicle was 2-wheeler with 141 out of 210 (67.1%) followed by pedestrians 32 (15.2%) (Table 1).

In the majority of cases, the time of the accident was between 6 pm- 12 pm (37.6%), 79 out of 210 and it was 53 (25.2%) subjects between 12 am- 6 pm. Survival periods were 0-1 day recorded in the majority of cases amounting to 126 out of 210 (60%) followed by 2-7 days with 24.7% and 1 week to 1 month time in 13.8%. External head injuries were noticed in 157 (74.7%) cases, and thorax and abdomen injuries in 59 (28%) each. Limb injuries were noted in 178 (84.7%) cases. Skull fractures were noticed in 102 (48.57%) cases. Internal head injuries were more predominant with 140 out of 210, (78%) followed by thorax (26.6%), abdomen (20%), limbs with (7.1%), and spine with (5.2%). Intracranial haemorrhage was recorded in 140 (66.6%) cases as a cause of death, hemorrhagic shock in 42 (19.9%) cases, septicemia in 16 (7.6%) cases, and 12 (5.7%) had other causes for death (Table 2).

There was a statistically significant difference observed in the survival period across different causes of death (P value <0.001). A short survival period of 0-1 day, 2-7 days was reported in the majority of cases of intracranial haemorrhage, and hemorrhagic patients' septicemia was reported in the relatively high proportion in 1.1 weeks to 1 month survival time as per Table 3.

Compare to the female the odds of occurrence of skull fracture in ICH cases was 81 out of 115 (70.43%) in males and the association was statistically significant. (P value <0.05). Compared to pedestrians, the odds of occurrence of skull fracture in ICH cases was 13 out of 21 (61.9%) in 2-wheelers, it was 69 out of 103 (66.99%) in 4-wheelers, and it was 8 out of 12 (66.67%) in heavy vehicle types. There was no statistically significant association between the mode of the vehicle and skull fracture in ICH cases. Compared to a short survival period of 0–1-day, 1 week to 1 month had 7 out of 16 (43.75%) cases, the odds of occurrence of skull fracture in ICH cases which was statistically significant. The association of other confounding factors like age, and internal and external head injuries. The strongest association was observed with external head injuries with 72 out of 108 (66.67%) the occurrence of skull fracture in ICH cases as per Table 4.

Discussion:

Road traffic accident fatalities are an important focal point in the discipline of forensic medicine.[15-17] RTA is a more serious issue in that, the age groups commonly involved are the most productive age group, i.e., 15-40 years. Countries like India, that are still in the developing stage, face the double burden of already existent communicable diseases and increasing burden of non-communicable diseases, including RTA.[18] So, the present study was conducted to describe the distribution of injuries and demographic profile from autopsy cases due to fatal RTA, which can be used for the development of a strategy for prevention of mortality due to RTA, and public education on road safety. Kumar N et al. in their study involving 100 fatal RTA cases report that (88 %) involved were male, and (12 %) were female.[19] This is in line with the present study where males (84.2%) were more commonly involved than females (15.7%). They also report that

pedestrians and two-wheeler rider victims were (37 %) each. Similarly, in the present study, two-wheelers (67.1%) and pedestrians (15.2%) were the most commonly involved groups. The age group commonly involved in RTA, according to the present study, was 21-30 (24.2%). Other studies from different parts of India have also shown that the majority of the victims belonged to the 20–29 or 20–30 age group.[20-24] In our study, the majority of RTA happened between 6 AM to 12 AM (37.6%) followed by 12 am to 6 pm (25.2%). Earlier studies also report that most accidents took place between late afternoon/evening and late night/ midnight.[25-27] Farooqui et al. and Mishra et al. reported that maximum accidents took place in the daytime between the afternoon to evening.[28,29] In the present study, external injuries were commonly observed in the limbs (84.7%), followed by the head and skull fracture. Other studies report a similar trend.[3,30] Intracranial haemorrhage and hemorrhagic shock were the leading causes of death, in the present study (66.6% and 19.9%). This is similar to the findings of Dipak Kumar Das,[3] other studies[31-34] report hemorrhagic shock due to multiple injuries as the predominant cause. In the present study it was observed that following road traffic accidents, the majority of the victims died in 12-24 hours. This is in line with other studies.[3,32] This being a descriptive study, there were a few limitations. There were limited samples hence generalizability is poor. A prospective study including a large sample in multiple centers is recommended in the future to understand the epidemiology of RTAs.

Conclusion:

Based on the study's findings, male preponderance was observed in Road Traffic Accident deaths, intracranial haemorrhage was the most common cause of death and 60% of them died within the first day. The majority of the accidents happened in two-wheelers. Hence, health education, and awareness should be created among two-wheeler riders, especially drivers & pillion two wheelers to wear helmets and follow safety measures while riding Increasing emergency preparedness and decreasing fatalities can be done. From law enforcement it remains evident that strict enforcement of the rules is still necessary, and this Implementation of rules to monitor the speed of vehicles, lighting & signalling system.

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ORIGINAL ARTICLE

Estimation of Stature from the Length of the Sternum in the Ethnic Meitei Population– A Study in Medicolegal Autopsies

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Abstract:

Identification is necessary for living persons, dead persons, decomposed bodies, and mutilated and burnt bodies. In some cases where long bones are not available; the fresh sternal length can be used for stature estimation. Forty male cases belonging to the ethnic Meitei population within the age group 14-70 years were studied. Linear regression analysis was applied for the different sternal lengths to derive regression equations for the estimation of the stature of the study population. The linear regression obtained for the length of the manubrium, length of the body, combined length of the manubrium and the body and the total sternal lengths were $Y=5.7641X_1+138.53$, $Y=2.277X_2+140.6$, $Y=2.3229X_3+128.81$ and $Y=2.4786X_4+116.05$ respectively. The maximum correlation was observed for the total sternal length (R=0.569) followed by manubrium (R=0.475), the combined length of manubrium and mesosternum (R=0.462) and mesosternum (0.374). The study showed that there was a moderate positive correlation between all the sternal measurements with the cadaveric length.

Keywords: Sternum; Stature; Regression equation; Identification data.

Introduction:

Identification is the determination of the individuality of a person based on certain physical characteristics, i.e., exact fixation of personality. It is necessary for living persons, dead persons, decomposed bodies, mutilated and burnt bodies and skeletons.[1] Stature is an important aspect of an individual's identification. In some cases, such as mass disasters or crimes involving the dismemberment of the victim, the long bones may not be available or incomplete. In such cases, an alternative solution for stature estimation must be sought, and also when a quick estimate is required, fresh sternal length can be used for stature estimation.[2]

There exists a relation between human bones and the stature of an individual, which varies between two sexes as well as amongst different populations which depend on genetics, environmental, nutritional factors, etc. So, population and sex-specific stature estimation equations are needed. However, while estimating age, it must be remembered that the length of a dead body person is about 2.5 cm more than the living stature, possibly due to compression of soft tissues between inter-vertebral discs in a standing position.[3] A few workers observed that the total length of the sternum increases with height, while the manubrium shows some variation, the variation in the length of the manubrium is very less.[4] Hence, the present study was carried out to estimate the

stature from the length of the sternum of the ethnic Meitei population.

Materials and Methods:

The present study was conducted in the mortuary of the department of Forensic Medicine and Toxicology of a tertiary care teaching institute in Imphal.

The approval was taken from the institutional ethical committee of the institute and informed consent was taken from the relatives prior to the study. Forty male cases belonging to the ethnic Meitei population within the age group 14-70 years were included in the study. Fractures of the sternum with obvious deformity, and decomposed, charred, and mutilated bodies were excluded from the study.

The stature of the deceased was first measured with a portable stadiometer and recorded. An 'I'-shaped skin incision was made, and the sternum was removed as a single piece by cutting at the sternoclavicular joints and at the costochondral junctions. After removal, the sternum was cleaned thoroughly by manual stripping of soft tissue as much as possible. It was ensured that the end points of the Vernier calliper were touching the bone, without interference from any soft tissue, by removing as much soft tissue as possible and exposing the bony surface. The sternum was measured by taking midline measurements i.e., length of manubrium (LM-the straight distance from the centre of the suprasternal notch to the centre of the manubrio-mesosternal junction on the anterior surface of the sternum), mesosternum or body (LB-the straight distance measured on the anterior surface from the manubrio-mesosternal junction to the mesosterno-xiphoidal junction), and the combined length of manubrium and mesosternum (LMB-straight distance measured from the centre of suprasternal notch to the mesosterno-xiphoidal junction taken

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on the anterior surface of the sternum). The total length of the sternum (TSL-the distance between suprasternal notch and the xiphoid process measured from the posterior surface of the sternum) was also measured by a measuring tape and recorded. The sternum was replaced after the measurements. The findings were recorded, and the data entry was done using windows-based SPSS version 21.0 (Armonk NY: IBM Corp). A p-value of 0.05 or less was considered significant. Linear regression analysis was applied for the different sternal lengths to derive regression equations for the estimation of the stature of the study population.

Results:

Out of 40 subjects studied the majority belonged to the age group of 24-33 years (27.5%) followed by the age group of 34-43 years (25%). The cadaveric length ranged from 152-179 cm (mean±SD of 166.38±6.05 cm) and the total sternal length ranged from 16.2–23.5 cm (mean± SD of 20.30±1.39cm).

Sternal lengths in relation to stature are shown in table 1. A linear regression formula was obtained for different sternal measurements as shown in figure 1 to 4, denoted by Y=aX+b, where 'a' is the regression coefficient of slope or independent variable (sternal lengths), 'X' is the sternal measurement and 'b' is the regression coefficient of intercept/or dependent variable (stature). There was a moderately positive correlation between all the sternal measurements with the cadaveric length.

The standard error of the estimate was calculated for all the sternal measurements as shown in table 2, and was found to be lowest in total sternal length i.e., 5.045 followed by the length of

manubrium (5.396), the combined length of manubrium and mesosternum (5.438) and length of the mesosternum (5.688).

Overall analysis showed that the equation derived from TSL has the highest R2 value i.e., 0.3233 followed by the length of manubrium (0.226), the combined length of manubrium and mesosternum (0.2139) and the length of the body (0.14).

Table 1. Sternal lengths in relation to stature.

Sternal length	Range (cm)	Mean (cm)	SD (cm)
Total sternal (TSL)	16.2-23.5	20.30	1.39
Manubrium (LM) length	4-6	4.83	0.50
Mesosternum (LB) length	9.5-13.5	11.32	0.99
Combined length of manubrium and mesosternum (LMB)	14-19	16.17	1.21
Cadaveric length	152-179	166.38	6.05

Table 2. Linear regression models for stature determination.

Sternal length	Regression formulae	R	R2	Adjusted R2	Standard error of estimate (cm)	P value
LM	Y=5.7641X1 +138.53	0.475	0.226	0.206	5.396	0.0019
LB	Y=2.277X2 +140.6	0.374	0.14	0.117	5.688	0.0173
LMB	Y=2.3229X3 +128.81	0.462	0.2139	0.193	5.438	0.0026
TSL	Y=2.4786X4 +116.05	0.569	0.3233	0.306	5.045	0.0001

LM = Manubrial length; LB= Mesosternum, LMB=Combined length of manubrium and mesosternum and TSL= Total sternal length
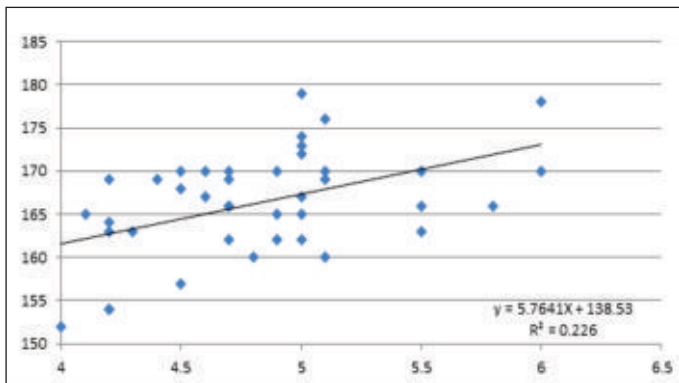

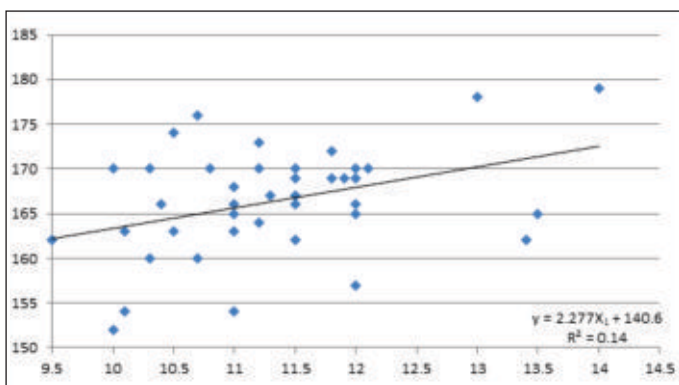**Figure 1. Correlation of the manubrium with cadaveric length.**

Figure 2. Correlation of the mesosternum with cadaveric length.
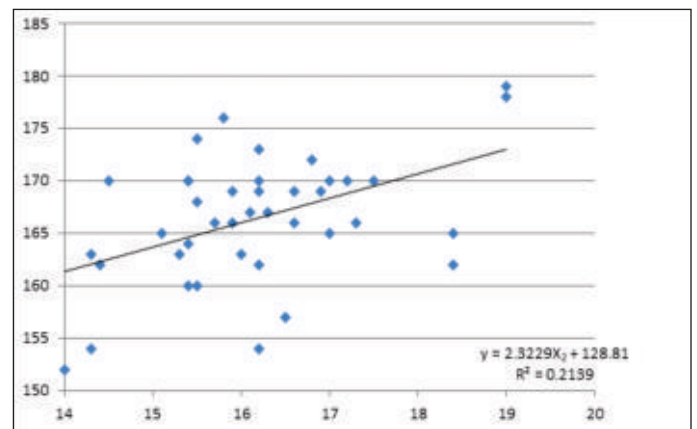

Figure 3. Correlation of the combined length of manubrium and mesosternum with cadaveric length.
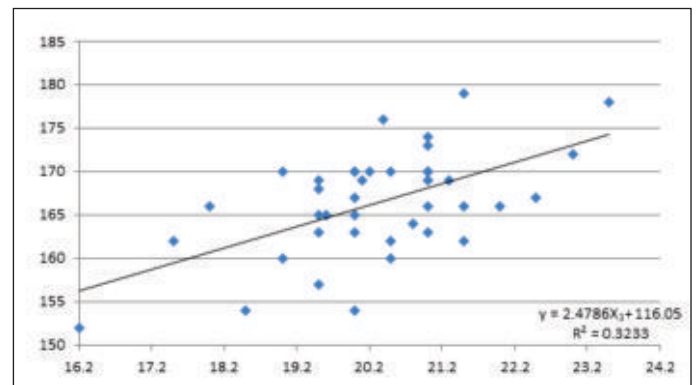

Figure 4. Correlation of the total sternal length with the cadaveric length.

Thus, the degrees of association of correlation between the total sternal length and stature have the highest accuracy when compared to the equations derived from all the other parameters.

The maximum correlation was observed for the total sternal length (R=0.569) followed by manubrium (R=0.475), the combined length of manubrium and mesosternum (R=0.462) and mesosternum (0.374).

Discussion:

There are biological and regional variations as far as the determination of the individuality of a person is concerned which have been proven in past and present studies.[5] The present study was conducted selectively on specific ethnicity i.e., the ethnic male Meitei population considering the biological and regional variations observed by previous researchers.

Workers like Singh et al.,[3] Menezes et al.,[6] Chandrakant et al.,[7] and Yongue et al.,[8] have developed regression equations by regressing the stature of the individual on the dry macerated sternum. The estimation of stature from the fresh sternal bones was conducted in our study, which is similar to the studies by Tumram et al.[2] and Marinho et al.[9]

Some of the studies by Tumram et al.,[2] Singh et al.,[3] Gupta et al.,[10] and Derade et al.,[11] excluded xiphoid process due to its high variability and included only the manubrium and mesosternum. However, in a study by Beraw et al.,[12] and Marinho[9] fresh sterna were studied including the xiphoid process as it was carried out in our study.

Further, there are very limited studies where the posterior curve length of the sternum including the xiphoid process was taken into consideration for stature estimation except in a study by Baraw et al.[12] Similarly, in our study, this sternal parameter was taken into consideration.

The present study showed that the total sternal length has the highest correlation coefficient (R=0.569), which is in accordance with a study by Menezes et al.,[7] Baraw et al.,[12] and Peiru et al.[13] On comparing all the parameters, total sternal length (TSL) showed the highest degree of correlation with stature (R=0.5696) followed by manubrium (R=0.475), combined length of manubrium and mesosternum (R=0.462) and mesosternum (0.374). However, in a study by Saraf et al.,[14] the combined length of sternum has the maximum correlation with the stature (R=0.894), followed by the length of mesosternum (R=0.853) and manubrium (R=367), which was different from our study findings. Also, in a study by Manorahan et al.,[15] the length of mesosternum and the combined length of manubrium and mesosternum for stature evaluation showed a greater correlation coefficient than the length of the manubrium. These variations between the studies could be because dried sterna were used in their study, whereas in our study fresh sterna were studied.

The standard error of estimate for the total sternum in our study was 5.045 which was comparatively higher than the study by Yongue et al.,[8] and Baraw et al.,[12] and lower than the study by other workers.[2,3,7] In a study by Chandrakanth et al.[7] the standard error of estimate value was found to be quite high and they concluded that the fusion status of the sternum affects the reliability and accuracy of estimation of stature.

Several studies have derived different formulae for both dry and fresh sterna. The formula derived in our study is applicable to the fresh sternum only and cannot be applied to the dry sternum.

The present study emphasizes the importance of the sternum as one of the reliable tools to calculate the stature of a person in addition to or in the absence of long bones.

Limitations and future directions: The study was carried out with a small size in a stipulated time frame. A study with a larger sample size may be taken up to come to a definitive conclusion in the future.

Conclusion:

It is evident from our study that the length of the sternum provides a positive correlation factor for stature. For the ethnic male Meitei population, the sternum may be used for stature estimation when long bones are not available. Further, it may be of immense help for anthropological studies. As the linear regressions derived are limited to a particular ethnic population of this region. Further studies may be carried out on different ethnic populations.

Conflicts of interest: The authors hereby declare that there is no conflict of interest

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ORIGINAL ARTICLE

A Study on Awareness of POCSO Act & Sec 375 I.P.C Amongst the Medical Professionals at Puducherry – A Cross Sectional Study

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Abstract:

Child sexual abuse, the most under reported crime, has gained public attention in the past years. The Protection of Children from Sexual Offences Act 2012 (POCSO) is a gender neutral friendly act to protect children from sexual related offences. Rape (Sec 375 IPC) law is amended with a sole agenda of safeguarding women and to ensure justice delivery with emphasis on physical and mental health care during judicial proceedings. The aim is to study the awareness of POCSO Act 2012 & Sec 375 IPC (Indian Penal Code) amongst the medical professionals in the state of Puducherry. It's a cross sectional study, conducted among the pre, para and clinical faculties & nurses. The total sample size was 305 and the sampling procedure used was convenience sampling. The study participants were consenting medical professionals. Out of nine questions on general information of child sexual abuse, only four questions were answered correctly by more than 50% of the participants. Out of thirteen questions asked on POCSO Act, only five questions were answered correctly by more than 50% of the participants. Out of eleven questions asked about the Sec 375 IPC (Rape), only one question was answered correctly by more than 50% of the participants. On analysing the outcome of the study, it is very much evident that medical professionals are not up to date regarding the recent amendments in the law related to medical field. It is mandatory to create awareness of POCSO act & Rape laws in the society. This lack of knowledge, may subject many children & women to repeated victimization.

Introduction:

Child sexual abuse, the most under reported crime, has gained public attention in the past years and has now become one of the high profile crimes of India.[1] The type of child abuse includes: physical, sexual, verbal, emotional (psychological), neglect & abandonment, torture and ill-treatment.[2] World Health Organization (WHO) defines child sexual abuse (CSA) as 'The involvement of a child in sexual activity that he or she does not fully comprehend, is unable to give informed consent to, or for which the child is not developmentally prepared and cannot give consent, or that violates the laws or social taboos of society'.[3]

The Protection of Children from Sexual Offences Act 2012 (POCSO) is a child (below 18 years, Gender neutral) friendly act which is to protect children from offences of sexual assault, sexual harassment and pornography and provide establishment for special courts for trial of such offences. The Act provides stringent punishment to the offenders. E.g. Aggravated penetrative sexual assault carries an imprisonment of 10 years and can be extended to imprisonment for life or death penalty.[4] CSA has profound consequences for the child. It is known to interfere with growth and development.[5,6] CSA has also been

linked to numerous maladaptive health behaviours, and poor social, mental and physical health outcomes throughout the lifespan.[7-9] In accordance with that, there is evidence that CSA can affect neurobiological systems, e.g. the cortical representation of the genital somatosensory field.[10] According to NCRB data of 2016, around 20,000 children are raped every year in India; many more cases go unreported; the available statistics is only the tip of the iceberg.[10-14]

In the existing system, the practicing doctors & other health care staff are not methodically trained about various aspects of CSA i.e. diagnosis, rational treatment, evidence collection, documentation of injuries and treatment of the child. This lack of knowledge, may subject many children to repeated victimization. The newly adopted POCSO Act, 2012 deals with all forms of sexual abuse on children and lays down the principles to handle the child in a systematic manner, protocols to be followed by individuals and hospitals for examination and treatment of the child, the manner in which judicial proceedings are to be carried out and is the most elaborate law about this problem.[15,16]

Rape (Sec 375 I.P.C – Indian Penal Code) results in violation of sexual autonomy and the bodily integrity of a woman and is punishable under the law.[17] To ensure the safety of women against these broader types of crimes, the law is amended. The revised definition of rape is not necessary to have a penetration of a woman's vagina, urethra, anus or mouth by a penis or penetration of the vagina, urethra or anus by finger (s), object (s) or body part (s), including oral sex against her consent, but just mere manipulating her for sexual intercourse amounts to rape. Thus, a

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man who has committed this offence shall be charged of rape under the newly amended law.[18] Women experiencing acts of violence are likely to visit health care centres more frequently than any other institution for seeking treatment, solace, protection and healing.[19] Interventions by healthcare providers can potentially mitigate both the short- and long-term effects of sexual violence against women, children and their families.[20,21]

The law is amended with a sole agenda of safeguarding women and to ensure justice delivery with emphasis on physical and mental health care during judicial proceedings. This requires appropriate training to all the stakeholders such as doctors, nurses, police, advocates and judiciary. There is an urgent need to create awareness among medical fraternity regarding the rights of the survivor and at the same time, reminding doctors regarding their role in such circumstances, where the amended law is very vast.

Table 1. Study participant's awareness regarding the topic 'child sexual abuse' in general.

S. No.	Question on	% of participants answered correctly
1	Indian ranking on child sexual abuse globally	32
2	Proportion of children who are sexually abused in India	32
3	Gender preponderance on child sexual abuse	10
4	Percentage of children who complain/speak about their abuse to anybody	40
5	Ideal time for sex education for children in general	90
6	First step to be done in a case of sexually abused child	42
7	Activities that come under sexual abuse of a child	98
8	Predominant relation of the person involved child sexual abuse (Accused)	80
9	Mandatory presence of external injuries in all cases of child sexual abuse	53

Table 2. Study participant's awareness on 'POCSO Act'.

S. No.	Question on	% of participant answered correctly
1	Name of the law for Child Sexual Abuse in India	63
2	Signs not considered as child sexual abuse	85
3	Period of time the effects of sexual abuse last in a child without intervention	30
4	Whether a doctor can examine a sexual assault child victim without a police requisition	28
5	Is it mandatory to inform police regarding the sexual abuse victim	23
6	The action of Doctor if victim or his/her mother denies to provide consent to inform to police	18
7	Whether sexual abuse victim examination should be done only in Government hospitals	45
8	Whether preferably a female doctor has to examine the victim of a CSA	60
9	Is it mandatory to provide free of cost treatment for victims of CSA, irrespective of government or private set up	30
10	What should be the first step when you examine a case of CSA	96
11	Whether medical care for Injuries, STD, HIV, Pregnancy testing, including Emergency contraception & psychological counselling come under emergency treatment of a sexually assaulted child	20
12	Whether documentation of the basic medical examination done is necessary or not	90
13	Is it mandatory that the concerned police officer should be present during medical examination even after the victim's denial for his presence at the examination room	20

Materials and Methods:

This study was a questionnaire-based Cross – Sectional study conducted amongst the medical professionals, which included the doctors (Pre, Para and Clinical faculties) & Nurses of the state of Puducherry. The research was approved by the institutional ethics committee. A semi structured validated questionnaire was prepared and was distributed amongst the study participants after explaining about the study and obtaining consent. The data obtained was statistically analyzed using appropriate statistical tests. Awareness among the study subjects was expressed as frequency and percentage. Sample size was calculated using the prevalence of awareness in POCSO act & Section 375IPC from the previous study which was found to be 51 %. The sample size was calculated as 305 using $N = 4pq/d2$, where $p = 51$, $q=49$, $d = 6\%$, considering the non responsiveness rate of 10%. The sampling procedure followed was convenience sampling. Inclusion Criteria: Medical professionals include doctors & nurses. Exclusion Criteria: Dentist, therapist (AHS), pharmacist & psychologist and persons associated with a health care system but doesn't provide therapeutic service of any type like ward boys, MTS, attenders. At the end of the study, the study participants were educated on the correct answers of the questions they attempted, thus increasing their knowledge about the subject concerned. Apart from the above mentioned effort, study materials in the form of PDF - Softcopy was issued to the participants for their benefit & further reading.

Observation and Results:

Section I – General awarness on child sexual abuse (table 1) out of nine questions asked about the general information on child sexual abuse, only four questions were answered correctly by more than 50% of the participants, rest five questions were not answered correctly even by half of the participants. The first question was on the global ranking of our nation in the CSA. 32% of the participants answered correctly as first place globally, whereas 68% of the participants answered wrongly. The second question was on the proportion of children who are sexually abused in India. 32% of the participants answered correctly as 1 in 2 children, whereas 68% of the participants answered wrongly. The third question was on the awareness of gender preponderance in sexual abuse. 10% of the participants answered correctly as both sexes, whereas 90% of the participants answered wrongly. The fourth question was on the awareness of percentage of children who will tell about their abuse to anybody. 40% of the participants answered correctly as 51-75%, whereas 60% of the participants answered wrongly. The fifth question was on the opinion for including sex education at which level of learning. 90% of the participants answered supporting at primary schooling, whereas rest 10% of the participants supported at various phases of education. The sixth question was on the awareness regarding the first step to be done in a case of CSA. 42% of the participants answered correctly as to take the affected child to a hospital, whereas 58% of the participants answered wrongly as to take them to an NGO or contact a nearby police station. The seventh question was on the awareness of activities that come under CSA. 98% of the participants answered correctly as the options mentioned like taking up skirt pictures, taking or

Table 3. Study participant's awareness on 'Section 375 –Rape law'.

S. No	Question on	% of participants answered correctly
1	Rape definition includes penetration of penis to any extent in what all parts of the body	32
2	Whether a man will be liable of committing rape if he just forces a woman to have sexual intercourse with some other person	12
3	Whether a man will be liable of committing rape if he penetrates the following objects into any extent into the vagina of a woman	9
4	Whether a man will be liable of committing rape if the person just manipulates a woman to have a sexual act but didn't do an actual sexual intercourse with the women.	2
5	Whether a man will be liable of committing rape if the person applies his mouth to the vagina of woman.	3
6	Whether 'Rape' is a medical diagnosis	13
7	Whether a woman be charged for rape against a man	33
8	If a woman does not have any external injuries, then it means she has consented for that sexual act?	22
9	The action to be taken when an accused of the child sexual offence denies medical examination	26
10	Any uniform guidelines to be followed in all hospitals in a case of child sexual abuse?	60
11	The action to be taken when a rape victim wishes to clean her private parts before medical examination.	30

showing sexual content/porn, exhibitionism, whereas 2% of the participants answered wrongly. The eighth question was on the awareness of relationship of the persons who are involved in the acts of CSA with the child. 80% of the participants answered correctly as a close acquaintance, whereas 20% of the participants answered wrongly. The ninth question was on the awareness of mandatory presence of external injuries in all cases of CSA. 53% of the participants answered correctly as not necessarily in all cases, whereas 47% of the participants answered wrongly as in all cases of CSA, external injuries are a must.

Section II – Awarness on POCSO Act (table 2) out of thirteen questions asked about the POCSO Act, only five questions were answered correctly by more than 50% of the participants, rest eight questions were not answered correctly even by half of the participants. The first question was on the awareness on the separate act for CSA in India. 63% of the participants answered correctly as "Protection of Children from Sexual Offences" Act, whereas 37% of the participants answered wrongly. The second question was on the awareness of signs considered as CSA and the question was asked in a negative way. 85% of the participants answered correctly as genital pain, social withdrawal & bedwetting, whereas 15% of the participants answered wrongly. The third question was on the awareness of lasting of the effects of CSA in a un interventioned child. 30% of the participants answered correctly as life long, whereas 70% of the participants answered wrongly. The fourth question was on the awareness, whether a doctor can examine sexually assaulted child victim without a police requisition. 28% of the participants answered correctly as yes, whereas 72% of the participants answered wrongly as no. The fifth question was on the awareness, whether intimation to police in a case of sexual assault victim is mandatory. 23% of the participants answered correctly as yes, whereas 77% of the participants answered wrongly as no. The sixth question was on the awareness on the action of a doctor, in

case the victim or the mother of the victim denies to provide consent regarding intimating the police. 18% of the participants answered correctly as proceed to inform the police, whereas 82% of the participants answered wrongly. The seventh question was on the awareness, whether sexual offence examination has to be conducted only in the government hospitals. 45% of the participants answered correctly as no, whereas 55% of the participants answered wrongly as yes. The eighth question was on the awareness, whether preferably a female doctor has to examine the victim of a CSA. 60% of the participants answered correctly as yes, whereas 40% of the participants answered wrongly as no. The ninth question was on the awareness; whether initial treatment for the CSA victims has to be free of cost irrespective it is government or private set up. 30% of the participants answered correctly as yes, whereas 70% of the participants answered wrongly as no. The tenth question was on the awareness regarding what should be the first step when you examine a case of CSA. 96% of the participants answered correctly as treatment of the victim, whereas 4% of the participants answered wrongly like police intimation, inform medical superintendent, evidence collection. The eleventh question was on the awareness regarding whether medical care for injuries, STD, HIV, pregnancy testing, including emergency contraception & psychological counselling come under emergency treatment of a CSA victim. 20% of the participants answered correctly as yes, whereas 80% of the participants answered wrongly as no. The 12th question was on the awareness, whether documentation of the basic medical examination done is necessary or not. 90% of the participants answered correctly as yes, whereas 10% of the participants answered wrongly as no. The thirteenth question was on the awareness regarding the mandatory presence of the concerned police officer in the place of medical examination even after the victim's denial for his presence at the examination room. Only 20% of the participants answered correctly as no and will advice the concerned police to wait outside, whereas 80% of the participants answered wrongly as yes will allow the police for legal purposes.

Section III – Awarness on Section 375 IPC (table 3) Out of eleven questions asked about the Sec 375 IPC (Rape), only one question was answered correctly by more than 50% of the participants, rest ten questions were not answered correctly even by half of the participants. The first question was on the awareness regarding the commitment of rape, if a person penetrates his penis to any extent in which all parts of the body. 32% of the participants answered correctly as all the parts mentioned namely vagina, anus, urethra & mouth, whereas 68% of the participants answered wrongly. The second question was on the awareness regarding, whether a man will be liable of committing rape if he just forces a woman to have sexual intercourse with some other person. 12% of the participants answered correctly as yes, whereas 88% of the participants answered wrongly as no. The third question was on the awareness regarding, penetration of which of the following into the any extent into the vagina of a woman is said to be rape. 9% of the participants answered correctly as all the mentioned options like penis, any foreign object or any part of the body, whereas 91% of the participants answered wrongly. The fourth question was on the awareness regarding, whether a person will

be held for charges for rape, if the person just manipulates a woman to have a sexual act but didn't do a sexual intercourse with her. Only 2% of the participants answered correctly as yes, whereas 98% of the participants answered wrongly as no. The fifth question was on the awareness regarding, whether a person will be liable for rape charges, when he applies his mouth to the vagina of woman. Only 3% of the participants answered correctly as yes, where as 97% of the participants answered wrongly as no. The sixth question was on the awareness regarding, whether rape is a medical diagnosis. 13% of the participants answered correctly as no, where as 87% of the participants answered wrongly as yes. The seventh question was on the awareness regarding, whether a woman be charged for rape against a man. 33% of the participants answered correctly as no, where as 67% of the participants answered wrongly as yes. The eighth question was on the awareness regarding, if a woman does not have any external injuries, then it means she consented for that sexual act. 22% of the participants answered correctly as all the options mentioned which included; Yes: probably a false allegation, No: probably a forceful consent is obtained & No: probably victim may be unconscious during the act, where as 78% of the participants answered wrongly. The ninth question was on the awareness regarding, the action to be taken when an accused of the child sexual offence denies medical examination. 26% of the participants answered correctly as to get a documented informed refusal from him, where as 74% of the participants answered wrongly The tenth question was on the awareness regarding, any uniform guidelines to be followed in all hospitals in handling the cases of child sexual abuse. 60% of the participants answered correctly as yes, where as 40% of the participants answered wrongly as no. The eleventh question was on the awareness regarding the action to be taken when a rape victim wishes to clean her private parts before medical examination. 30% of the participants answered correctly as to try to convince her and prefer to go for an medico legal examination, but ultimately it's the victim's consent which decides what has to be done ultimately, where as 70% of the participants answered wrongly.

Discussion:

In a study done by Yasvanth et al., a total of 100 faculties in private medical college in Chennai were included in the study. 70% of the people thought that non touching activities will not come CSA. 56% of faculties had the awareness of POCSO act. 35% of them felt that a child below the age of 13 years only come under the purview of POCSO act and only 34% thought child below 18 years also come under POCSO act. 60% of them were not aware of punishment under POSCO act. 57% of the participants had awareness of child abuse helpline number. 91% of them agreed that some children are sexually abused by older children. 68% of them disagreed that boys are not equally abused. 69% of them disagreed that majority of sexual abuse perpetrators are mentally ill or retarded. 91% of them disagreed that only vulnerable children are sexually abused.95% of them disagreed that perpetrators of abuse are often strangers. The study concluded that the awareness of CSA & POCSO Act 2012 amongst faculty were not satisfactory. Hence more sensitization programs were needed.[22] In a study done by Minakshi Bhosale et al., only 18 % of the participants had scored between 5 to 8 out of

10.2% of the participants had scores >8 and 90 % of the participants had scores <5, meaning there is lack of awareness and knowledge about CSA, even among health care workers. 89% of participants did not know the prevalence of CSA in India. Only 25.6 % were aware that both boys and girls are almost equally affected. 80 % participants did not know what to do when a child has suffered severe injuries following sexual abuse. Only 20.4 % were aware about the special act to deal with children suffering from CSA. Almost 52.4 % felt the need for including CSA as part of the curriculum form primary school.[23] Similar study on the awareness of MTP act 1971 was carried out among the apparently healthy reproductive age group population at Puducherry in which, the awareness was less among the people for whom the act was intended and implemented.[24] Studies estimating the awareness of rape law among the medical professionals were almost nil as many studies were conducted among the under graduate students.

In another study conducted by Shirley SA et al., of the 186 participants who participated in the study, only 24 participants (12.9%) were aware of the Protection of Children from Sexual Offences (POCSO) Act. Among the total participants only 61 (32.8%) were aware about the 24 hours toll free child helpline in India (1098). The awareness of uncommon physical indicators of child sexual abuse was low among the participants. The awareness of participants regarding various behavioural indicators of child sexual abuse like acute traumatic response (83.9%) and regression in behaviour (82.8%) were the commonly known behavioural indicators of child sexual abuse in the study. Regarding attitude towards offender's relationship to the child victim, 75.3% of the participants believed that the offenders were usually unknown persons, 63.5% believed that offenders were usually family members, followed by family friends (52.7%), neighbours (50.5%), other known persons (48.9%) and online friends (34.4%).[25]Apart from the medical professionals, awareness studies on POCSO Act was also conducted among the parents of the school going children, in which the awareness about POCSO Act was found to be less.[26]

Conclusion:

Apart from the present study, the above three studies were also having an common inference, that the awareness of latest amendments in POCSO act & Section 375 IPC was very much pathetic among the health care workers who are the first point of contact . If the doctors and the nurses do not know, what has to be done next, it will be a herculean task to establish justice for the victims of abuse. The only remedy is through conducting workshops/symposia about CSA & Rape in general and the relevant provisions of the POCSO Act, 2012, Section 375 IPC in Medical Colleges so that apart from general practitioners & nurses, the budding doctors (students) will also be sensitized towards CSA & Rape laws and will be ready in the future to recognize and tackle the ever increasing number of cases of CSA & rape. In fact, CSA, Rape law and other latest amendments in the laws related to medical professional should be included as part of the medical curriculum. The medical students should be imparted necessary training and ability to recognize violence against children& women at an early stage so that they can handle these

cases more confidently and with utmost care. Continuing medical education is required to enhance the ability of professionals to detect and manage CSA & Rape victims. There is a need of interdisciplinary care involving primary health care workers, police officers, child welfare committee workers, obstetricians, paediatricians, gynaecologists, general surgeons, paediatric surgeons, urologists, forensic experts, psychiatric specialists, anaesthetists etc. to handle these cases. The entire community should share the responsibility of rehabilitating the lives of these children, women and their families effectively.

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ORIGINAL ARTICLE

A Cross Sectional Descriptive Study for Estimation of Stature from Foot Length in South Indian Population

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Abstract:

Identification can be done by a myriad of methods and of them includes the measurement of stature by foot length The Study population includes the faculty and students of a tertiary medical care college and hospital and the residents of a district in South India between the ages group of 21-40 years. 200 members consisting of 100 male and 100 female were chosen by stratified random sampling. The height was measured by using standard height measuring instrument and foot length by a vernier calliper. A highly significant correlation was found between Stature and RFL (r=0.811) with the strength of association being more in males (r=0.677) than females (r=0.592). A highly significant correlation was also found between Stature and LFL (r=0.823) with the strength of association again being more in males (r=0.707) than in females (r=0.582). Between the two feet, the stature showed highly significant strong correlation with LFL (r=0.823) when compared to RFL (r=0.811). By comparing the r and r^2 values in different study groups it is seen that pooled sample shows better correlation than individual sex.　Regression equations were developed for individual sex and also for the pooled data. Stature showed a highly significant positive correlation with both foot lengths with the RFL exhibiting a slightly stronger association. Regression equation for stature developed in this study with respect to the pooled data exhibited a better goodness of fit for the Left foot length

Keywords: Stature; Foot length; Correlation; Regression equation.

Introduction:

Identification is an area of science which deals with establishing the unique characteristics of an individual and this field has seen lot of advancements in recent times. An individual's exact identity can be established by multiple methods which are both accurate and reliable such as fingerprinting, DNA analysis, retinal scans, etc to name a few. But challenges arise in cases especially in the dead where only partial identification is possible at times. In such cases, developing suitable methods which can be utilised rapidly with a fair degree of accuracy may prove to be quite useful. One such method is our area of interest where we are looking at the correlation of foot length with the stature of an individual. Stature is a primary identification characteristic and it progressively increases with age, becoming a constant at around 21 years. It is well known that there is a definite relationship between the height of a person and their various body parts like the length of head, torso, limbs, etc and the ratio between them is a constant for a particular age and sex. Estimating the height of an individual by measuring the various body parameters including foot length has been of immense interest not only for forensic experts but likewise for anatomist and anthropologists alike.[1]

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Materials and Methods:

The Study population includes the students and staff of a tertiary medical training centre and residents of district in South India between the ages group of 21-40 years. This original research was approved by the institutional ethics committee. 200 members consisting of 100 male and 100 female participants were selected for the study by using stratified random sampling based on age. General physical examination was conducted to know the health status and rule out any deformities in the subject.

The aim and objective of the study was explained and informed consent of the subject was taken. The measurement was made on the standing subject, his right leg being slightly bent and drawn backwards so that the body rested mainly on the left foot, to measure left foot and vice versa was done for the other foot. A vernier calliper was horizontally placed along the medial border of the foot. The fixed part of the outer jaw of the calliper was applied to the most prominent point of the back of the heel (pternion) and the mobile part of the outer jaw is approximated to the tip of the hallux or the tip of the second toe (acropodian) when the second toe is larger than hallux, and it was measured in centimetres approximated to the nearest millimetre. This was done separately for each foot to obtain the right foot length (RFL) and left foot length (LFL) respectively. The stature of each subject was recorded by asking him/her to stand erect with bare foot on the base of the standard height measuring instrument in a standing position. Then the subjects were asked to stand without support, with arms by the side of the body, head in steady position. The stature was measured from the ground to the highest point on the

subject's head with the help of horizontal thin plate in close contact with the scalp in centimetres and approximated to the nearest millimetres.

The data was tabulated, analysed and subjected to Data were analysed using SPSS v 22 software. If there is statistically significant difference (p<0.05) in means among any of the data groups then the data was tabulated and further correlation (to test the strength of association) and regression analysis was done.

Inclusion Criteria: a) Adults above the age of 21 years and below 40 years. b) Healthy individuals.

Exclusion Criteria: a) Adults with. b) Any Chronic illness.

c) Endocrine disorders (Dwarfism, Gigantism, Cretinism etc).

d) Individuals with deformities of Foot (Flat Foot), Lower limbs (Knock-Knee) and Vertebral Column (Scoliosis, Kyphosis).

Results:

Table 1. Comparison of mean of stature, RFL and LFL between male and female.

Variables	Stature in cm	RFL in cm	LFL in cm
Male	169.43±6.45	25.37±1.38	25.17±1.43
Female	155.94±5.67	23.24±1.09	22.94±1.03
Significance	t=16.380; p<0.001**	t=12.264; p<0.001**	t=12.886; p<0.001**

Table 2. Correlation coefficient (r), Regression coefficient (b), and value of constant (b) between foot lengths and stature

		Total	Male	Female	P-value
RFL Vs. Stature	Correlation Coefficient (r)	0.811	0.677	0.592	p<0.001*
	Regression Coefficient(b)	4.489	3.158	3.087	p<0.001*
	Value of constant (a)	53.591	89.297	84.203	p<0.001*
LFL Vs. Stature	Correlation Coefficient (r)	0.823	0.707	0.582	p<0.001*
	Regression Coefficient(b)	4.469	3.189	3.203	p<0.001*
	Value of constant (a)	55.195	89.163	82.477	p<0.001*

Table 3. Regression equation for the prediction of stature by right and left foot length.

	RFL	LFL
Total (Pooled)	Stature=53.591+4.489×RFL (r2 = 0.657 p<0.001*)	Stature=55.195+4.469×LFL (r2 = 0.678 p<0.001*)
Male	Stature=89.297+3.158×RFL (r2 = 0.459 p<0.001*)	Stature=89.163+3.189×LFL (r2 = 0.500 p<0.001*)
Female	Stature=84.203+3.087×RFL (r2 = 0.351 p<0.001*)	Stature=82.477+3.203×LFL (r2 = 0.338 p<0.001*)

Discussion:

The accurate estimation of stature is one of the key objectives during medico-legal autopsy. Stature estimation has been attempted on based on length of long bones, diameters of the skull, forehand length, etc by many workers in the past. However, little importance is been given for estimation of stature from foot length. Stature estimation can be really challenging when mutilated or fragmented body parts are presented for autopsy. The present study aims at finding answers to some of these problems. Table 1 compares the Stature, RFL and LFL between males and females wherein the mean male stature was found to be 169.43 cm (SD=6.45 cm) which was more than the mean female stature which was found to be 155.94 cm (SD=5.67 cm). These findings are consistent with similar studies done by Sonali Khanapurkar et al.,[1] Arif Rasheed Malik et al.,[2] Jakhar et al.[3] The finding were in contrast with studies by Rajesh et al.[4] and Mansur et al.[5] who found a lower mean stature in males and a higher mean stature in females. Study by Rameswarapu Babu et al.[6] found higher mean stature in both sexes when compared to our study The mean male RFL & LFL were 25.37 cm and 25.17 cm respectively which was more compared to its female counterparts which measured 23.24 cm and 22.94 cm respectively and this difference was found to be statistically significant. This could be attributed to attainment of maturity earlier in females compared to males and thereby necessitating the development of sex specific linear regression.

The mean RFL and LFL of males in present study was more in comparison to findings by Rajesh et al.,[4] Devesh et al.,[7] Mansur et al.[5] and Mehul et al.,[8] The female mean RFL was more than the those found by Mehul et al.[8] & Rajesh et al.[4] Female mean LFL is similar to Patel et al.,[9] other studies are in contrast with present study.

Table 2 measures the Pearson's correlation co-efficient (r), regression co-efficient (b) and value of constant (a) of stature with RFL and LFL among male and female respectively. A highly significant correlation was found between stature and RFL (r=0.811) with the strength of association being more in males (r=0.677) than females (r=0.592). A highly significant correlation was also found between stature and LFL (r=0.823) with the strength of association again being more in males (r=0.707) than in females (r=0.582). Between the two feet, the stature showed

Table 4. Regression equations for stature and foot length (present study in comparison with others).

Study Author	Region Conducted	Stature In Relation To RFL	Stature In Relation To LFL				
		Total	Male	Female	Total	Male	Female
Present study	South India	Stature=53.591+ 4.489×RFL	Stature=89.297 +3.158×RFL	Stature=84.203 +3.087×RFL	Stature=55.195 +4.469×LFL	Stature=89.163 +3.189×LFL	Stature=82.477 +3.203×LFL
Rahul et al.[8]	Moradabad, UP	y=90.32+3.07x	y=116.51+2.07x	y=14.75+6.39x	y=91.74+3.02x	y=115.45+2.11x	y=7.23x-3.62
Rameswarapu et al.[6]	Ghanapur, AP	y=47.971+4.782x	y=82.830+3.468x	y=73.523+3.615x	y=50.350+4.691x	y=80.955+3.547x	y=79.83+3.349x
Verma et al.[10]	Ghaziabad, UP	y=56.910+4.363x	y=53.918+4.497x	y=78.200+3.427x	y=56.088+4.393x	y=57.951+4.642x	y=73.568+3.620x
Sumita et al.[11]	Moradabad, UP	y=63.00+4.17x	y=69.99+3.93x	y=89.82+2.95x	y=64.99+4.09x	y=70.93+3.89x	y=93.17+2.81x
Jitender et al.[3]	Rohtak, Haryana	y=47.631+4.889x	y=86.620+3.414x	y=73.132+3.721x	y=43.852+5.047x	y=80.671+3.648x	y=65.194+4.068x
Mansur et al.[5]	Nepal	---------------	y=2.74x +100.1	y=2.66x +96.31	-------------------	y=2.738x +100.2	y=2.66x +96.40
Mehul C Upadhyay et al.[8]	Jamnagar, Gujarat	---------------	y= 86.96 ± 3.40RFL	y= 77.35 ± 3.61RFL	-------------------	y= 84.64 ± 3.49RFL	y= 78.92 ± 3.53RFL

(y = Stature & x = corresponding combined foot length from the respective study).

highly significant strong correlation with LFL (r=0.823) when compared to RFL (r=0.811). By comparing the r and r^2 values in different study groups it is seen that pooled sample show better correlation than individual sex, for estimating stature from foot length which is in agreement with our present study. It is also observed that left foot length shows better correlation to estimate stature than right foot length in this study and it supported by work of previous researchers (see table 4) and even international agreement for paired measurement at Geneva recommends to consider the left foot measurement than right foot. With respect to sex, males show better correlation as compared to females in most of the studies (as listed in table 4) and present study is in agreement with the same.

Table 3 shows the linear regression formulas for stature estimation from RFL and LFL independently as well as based on sex. The individual formulas for stature prediction from either sex irrespective of the side of the foot chosen, was not effective in predicting fluctuations in stature in >50% of the population (highest was r^2=0.5 in LFL for males). Whereas the overall formula for stature from RFL shows a 65.7% (r^2=0.657) and LFL shows a 67.8% (r^2=0.678) effectiveness in predicting variations in stature in the population which would be adequate considering the variables being examined.

Table 4 offers a table of comparison for the regression equation developed in the present study with others.

Conclusion:

Our study draws the following conclusions

» The relationship between stature and the foot lengths are highly significant with mean male foot lengths being higher than the female counterparts

» Stature showed a highly significant positive correlation with both foot lengths with the RFL exhibiting a slightly stronger association.

» The formula for stature developed in this study with respect to the pooled data (irrespective of sex) had a better goodness of fit for the LFL.

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Diagnostic Efficacy of Troponin – I qualitative Rapid test in Sudden Cardiac Deaths

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Abstract:

Everyone knows by conducting autopsy cause of sudden unexpected death can be established. However due to limitations of staff, budget and time it forces the autopsy surgeon to triage the cases. Out of which sudden cardiac deaths because of acute myocardial infarction constitute a significant percentage of caseload. When an autopsy is performed, there may be significant cardiovascular disease but there will be no gross or histological evidence of an acute myocardial infarct unless the patient survived for few hours. Troponin I (cTnI) done using peripheral blood was sampled percutaneously before conducting internal examination of each of 60 autopsies. The rapid assay result, histopathological results were tabulated and subsequently correlated. Out of 30 cases all showed positive result but in 30 controls 11 showed false positive results and 19 showed negative results. This result was statistically significant according to the chi-square test. The sensitivity of this assay in detecting cardiac-related death was 100%, with a specificity of 63.33%. In the appropriate setting, this rapid assay for cTnI can provide valuable data supportive of a cardiac-related death. This inexpensive test may best be used in triaging sudden deaths in persons and may optimize the use of the time and resources of the autopsy pathologist.

Introduction:

In the world one of the most leading causes of sudden death is mainly due to cardiac in origin in both developing and developed countries, accounting almost 50% of all deaths. In sudden cardiac deaths, acute myocardial infarction is the leading cause of morbidity and mortality.[1,2]

Sudden cardiac deaths because of acute myocardial infarction constitute a significant percentage of the caseload for autopsy surgeons. When an autopsy is performed, there may be significant cardiovascular disease but there will be no gross or histological evidence of acute myocardial infarct unless the patient survived for several hours following the event. Since in an estimate, infarction is not apparent on gross examination until 12-24 hours and light microscopic (H & E) changes are not apparent before 4-6 hours. Due to this acute myocardial infarction remains undiagnosed even after conducting autopsy.[3]

Consequently depending upon the blockage of coronary artery forensic experts have to diagnose the cause of death as acute coronary insufficiency which cannot be considered as the immediate cause of death. Similarly in instances like a driver sustaining head injury after angina, it is very challenging to decide whether the driver had died of myocardial infarction due to non-availability of confirmatory test.[4]

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Because of these limitations of autopsy findings and histopathological findings, it is necessary to establish some alternative tests. Diagnostic utility of different biochemical cardiac markers in biological fluids for postmortem diagnosis of MI is crucial. Since myocardial infarction is accompanied by the release of structural proteins and other intracellular macromolecules into the cardiac interstitium, like Creatine kinase, Myoglobin, Lactate dehydrogenase and Aspartate aminotransferase were some of the classical used conventional biochemical marker for autopsy cases. But because of low specificity of these conventional biomarkers for cardiac injury, the search for more specific alternative biomarkers recently gained momentum.[3]

Biochemical assays of creatine kinase MB fraction (CKMB) performed on serum has been used to document myocardial injury in the absence of morphologic changes. But newly developed assays for cardiac troponin I (cTnI) may detect myocardial injury with a greater sensitivity than CKMB.[5]

Troponin I, C and T form a complex that regulates the calcium modulated interaction of actin and myosin in striated muscle. In contrast to troponin C, immunoassays directed at troponin T and I allow for specific assessment of myocardial ischemia. Cardiac troponin T and I can be used for the diagnosis of acute MI. Cardiac troponin I (cTnI) is more specific marker than any other, because it does not have cross-reactivity and never has been found in a healthy population. Also, its sensitivity allows detection of even micro infarction and acute myocardial infarction much earlier after the onset of ischemia by using a rapid one-step assay in body fluids in autopsy cases.[3, 6-8]

In this study our aim is to evaluate the diagnostic efficacy of

Troponin - I in sudden cardiac deaths and our objectives are to analyze the results of rapid Troponin - I test in subjects who died of sudden cardiac causes and non-cardiac causes and also to correlate the results of rapid Troponin - I test with histopathological findings.

Materials and Methods:

The study was conducted on the dead bodies brought for autopsy with history of sudden death at the mortuary attached to tertiary care hospital after obtaining clearance from institutional ethics committee.

The present study is a Prospective Case Control study conducted in the department of Forensic Medicine.

Total 60 cases of routinely performed autopsies were included and divided into two groups as cardiac group (history suggesting cardiac signs and symptoms) (n=30) and the other one non-cardiac group (asphyxial deaths, traumatic deaths without chest trauma, natural diseases other than IHD) (n=30).

Inclusion Criteria: All the suspected cases of acute myocardial infarction brought dead to the casualty and admitted cases died undiagnosed with history of chest pain.

Sometimes other signs and symptoms will precede sudden cardiac arrest. So history of frequent episodes of chest pain or discomfort, heart palpitations, irregular or rapid heartbeats, fatigue, blackouts, weakness, vomiting, unexplained wheezing or shortness of breath, fainting or near fainting, feeling light headed or dizzy also taken into consideration but sudden cardiac arrest may often occurs with no warning.

Non cardiac deaths will be included as control. This will include natural cases other than ischemic heart disease, violent asphyxial deaths and deaths due to polytrauma without any evidence of chest trauma.

Exclusion Criteria: For cardiac group - traumatic injuries to heart, unknown cases, known case of cardiac disease within 08 to 10 days of previous episode, autopsy cases in which postmortem interval is more than 48 hours.

For non-cardiac group - traumatic injuries to heart, unknown cases In every case after external examination blood sample was collected by using a sterile syringe from the peripheral blood vessels (femoral). Subsequently sample was centrifuged and by using plastic dropper plasma was taken and placed in the well of troponin - I kit. Results were noted after 10 minutes, if red colored coating noted at both t and c line it was considered as positive result, if it was noted at only c-line, it was considered as negative and if it was noted at only t-line, it was considered as invalid and test was repeated with new kit. All this results were confirmed only after 10 minutes test procedure.

During autopsy after collecting the sample, heart was separated from thoracic block, gross findings of heart and coronaries noted, later histological evaluation also done.

Data collected and entry was done in excel. Data and statistical analysis were done by using statistical package for the social sciences (SPSS) software. Appropriate statistical tests were employed for the evaluation of data.

Table 1. Distribution of cases in cardiac and non-cardiac groups based on results of troponin – I qualitative Rapid test (n = 60).

Troponin – I	Cardiac (n=30)	Non-Cardiac (n=30)	
Positive	30 (50%) True Positive	11 (18%) False Positive	Positive Predictive Value (ppv) = 73.17%
Negative	0 (0%) False Negative	19 (32%) True Negative	Negative Predictive Value (npv) = 100%
	Sensitivity = 100%	Specificity = 63.33%	Accurac Y= 81.66%

Table 2. Final cause of death in the cardiac group cases and results of troponin – I test (n=30).

Sr No.	Cardiac Group Cases (n=30)	Final Cause of Death	Troponin – I Rapid Test	Number of Cases
1.	Only MI	Acute on chronic myocardial infarction	Positive	1
2.	ACI with MI	Acute on chronic myocardial infarction associated with acute coronary insufficiency	Positive	6
3.	ACI without MI	Acute myocardial infarction associated with acute coronary insufficiency	Positive	23
		Total		30

Table 3. Final cause of death in the non – cardiac group cases and results of troponin – I test (n=30).

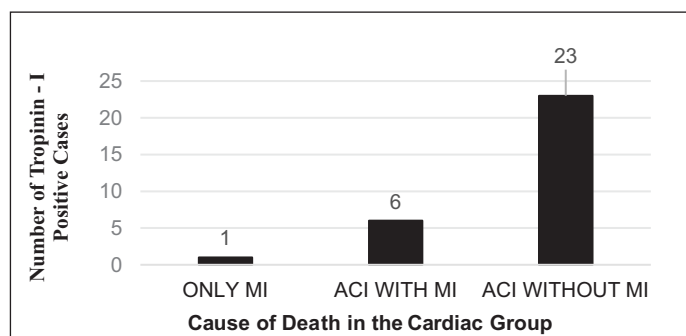| Sr No.	Non-Cardiac Group Cases (n=30)	Final Cause of Death (After Hp and Troponin-I Results)	Troponin – I Rapid Test Positive	Troponin – I Rapid Test Negative	Total Number of Cases
1.	Known case of Alcoholic liver disease	Cerebropulmonary edema in a known case of alcoholic liver disease	2	3	5
		Hypovolemic shock following upper GI bleed in a case of alcoholic liver disease	0	2	2
		Cirrhosis of liver in a known case of alcoholic liver disease	0	1	1
		Pneumonia in a case of alcoholic liver disease	1	1	2
		Acute pancreatitis in a known case of alcoholic liver disease	0	1	1
2.	Known case of Acute febrile illness	Cerebropulmonary edema in a known case of acute febrile illness	0	3	3
		Cerebropulmonary edema with intrapulmonary hemorrhage in a known case of acute febrile illness	1	1	2
		Pneumonia in a case of acute febrile illness	1	2	3
3.	Hanging	Asphyxia due to hanging	2	3	5
4.	Decapitation	Shock due to decapitation	2	0	2
5.	Road traffic accident (RTA)	Head injury due to RTA	1	0	1
6.	Fall from height	Head injury due to fall from height	1	0	1
7.	Known case of right foot gangrene	Pneumonia in a case of right foot gangrene	0	1	1
8.	Acute Pancreatitis	Acute pancreatitis	0	1	1
		Total	11	19	30

Graph 1. Final cause of death in the cardiac group cases and results of troponin – I test (n=30).

The association among study group will be assessed with Pearson chi-square test and p value less than 0.05 is taken as significant level.

Results :

In our present study all were aged below 50 years age, out of 60 cases 41 (68.33%) cases came positive for troponin –I test and 19 (31.67%) cases were negative.

In cardiac group (30 cases) all cases were positive for troponin – I test. In non-cardiac group (30 cases), 11 cases were positive for troponin – I test, 19 cases were negative. Sensitivity of test was 100% and specificity 63.33%. Positive and Negative Predictive Value were 68.97% and 78.95% respectively. It suggests that in our study the ability of test to identify those with the disease is 100%, but the ability of the test to identify those without the disease is 63.33%.

Diagnostic efficacy (accuracy) of troponin – I qualitative rapid test in our study is 81.66%.

'p value is <0.00001(significant).'

Discussion:

In this study, diagnostic efficacy of troponin – I qualitative rapid test in our study is 81.66%, it suggests that accuracy of the test to detect number of cases with disease and without disease is 81.66%.

There are no autopsy studies to compare the sensitivity, specificity and diagnostic efficacy of troponin – I qualitative rapid test. However, studies on troponin – t qualitative rapid test, quantitative analysis of troponin – I, troponin – T and other cardiac markers are available.

In the cardiac group all cases were positive to troponin – I qualitative rapid test and along with histopathological findings in which all cases shown some significant changes of heart which helps to confirm that they were died because of acute myocardial infarction, this is consistent with Cina SJ et al.[9] and Batalis NI[10] studies.

In non-cardiac group, 11 cases came positive for troponin – I qualitative rapid test in which 3 cases were known cases of alcoholic liver disease in which there were some findings suggesting cardiomyopathy is more likely to develop at an advanced state of liver function loss. This is also observed in the studies of Ortiz-Olvera et al.,[11] Wehmeyer MH et al.[12] In 2 cases of

acute febrile illness, no significant changes in the gross and microscopy of heart were observed and the reason for positive troponin –I test could be determined. Zhu BL,[8] Zhu BL,[13] Zhu BL[14] also noticed rise of troponin levels in cases of acute febrile illness. In 2 cases of asphyxia due to hanging the troponin –I test results positive without underlining cardiac pathology. The reason might be an intense agony with consequent acute myocardial suffering due to which there may be release of biomarkers in the heart leading false results. The similar findings are also observed by Zhu BL et al.,[8] Zhu BL et al.,[13] Zhu BL et al.,[14] Pérez Carceles MD et al.,[15] and Martínez Díaz F et al.[16]

The troponin – I test also turn positive in a case of decapitation and 2 cases of head injury caused due to road traffic accident and fall from height. White HD et al.[17] in their study stated that in such circumstances due to some amount of stress, troponin may be released as a result of tachycardia stimulating stretch-responsive integrins. Pérez Carceles MD et al.,[15] Martínez Díaz F et al.[16] also stated that some undetermined cardiac traumatism may have been involved. However none of these cases shown significant gross and histopathological findings that were conclusive evidence of cardiac pathology or traumatization.

In non-cardiac group, 19 cases came negative for troponin – I qualitative rapid test did not show any findings for the evidence of cardiac pathology on gross and histopathological examination.

Conclusion:

Troponin – I qualitative rapid test can be used in sudden deaths but some guidelines should be made. To get accurate results along with rapid troponin – I test, quantitative analysis should be practiced. In future if this study is studied in large population it will help the autopsy surgeon to find cause of sudden deaths.

In virtual autopsy setup, this type of rapid testing helps the autopsy surgeon to find the cause of death and decreases the duration of time and also helps to decrease the work load of autopsy surgeon. However, histopathology studies should be always done in cases of young cardiac SNDs, to rule out hidden pathologies such as Myocarditis, Cardiomyopathy etc.

Conflict of Interest: 'The Authors declares that there is no conflict of interest.'

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ORIGINAL ARTICLE

Reconstructions of Length of Radius From its Fragments- A Pilot Study in Eastern Indian Population

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Abstract:

In a demographically diverse, vast and densely populated country like India, the establishment of identity of a deceased assumes great medico-legal importance. It also poses a true challenge to the forensic scientist working in an environment where decomposition and taphonomic process are rapid. Structurally bones resist common degradation and putrefactive changes and remain longer as material for evidential value. Human skeletal remains are found under suspicious circumstances and doctors examining them need to give an opinion in the court of law. Forensic experts are often consulted regarding identification of skeletal remains. One of the important data for identification is the stature. The estimation of skeletal samples, for age, sex and stature are vital when found from sites in mixed lot. For this purpose, a technique will be highly appreciated for reconstruction of total length of long bones from their fragments. This current pilot investigation was designed to estimate the total length of radius using its fragmentary bone length in a population specific study thus in turn to employ them in stature formulae for population specific cases to estimate the final stature of the individual. After getting institutional ethical committee clearance, the study over 57 radii revealed linear equation where total length of radius was used as dependent variable and the different fragmentary length being the independent variables.

Keywords: Reconstruction; Radius fragments; Total radius length; Anthropometry.

Introduction:

In a country like India where population is demographically diverse, vast and dense, the fixation of identity of a dead body bears great medico-legal importance. It is also very challenging to the forensic experts to work in an environment where decomposition and taphonomic process are very fast. Structurally bones are resistant to degradation and putrefactive changes and act as a material for evidential value for long time. Human skeletal remains, found under suspicious circumstances are sent to forensic experts for examination in order to get an opinion in the Court of law.

Among four pillars of identification, stature is considered as one of the pillars. The estimated age, sex and stature of skeletal samples, plays a pivotal role when found from sites in mixed lot. For this purpose, a technique will be highly appreciated for reconstruction of total length of long bones from their fragments.

This pilot investigation was designed to estimate the total length of radius using its fragmentary bone length in a population specific study thus in turn to employ them in stature formulae for population specific cases to estimate the final stature of the individual.

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Dismembered human body parts throws greater challenge to the forensic experts. Various forensic experts, anthropologists have tried different methods in order to reconstruct the length of a long bone from its fragmentary remains. Various studies have established their methods with different degrees of precision. All such calculations pivot on the fact that the fragmentary parts show evidences of consistent ratios relative to the total length of long bones and it is the most vital part of identification of individuals from their skeletal remains. Among all the mathematical methods which have been used since dates, Regression formulae based on long bone measurements found to be more appropriate and trustworthy method which yields consistent and accurate results.

In Indian subcontinent, unidentified and unclaimed dead bodies are often mutilated by wild and stray animals. Loss of structural integrity of skeletal remains due to gnawing make identification difficult. Fragmented bones with destroyed ends are often brought for forensic works. In both anthropological and forensic practice, fragmented long bones are often presented as the only available resource to establish individuality. When the entire long bone is unavailable, one should apply the desired method to the available bony fragments to reconstruct its total length.

Reconstruction of total length of long bones from their fragments have been done widely earlier on different populations. Many attempts have been made by research scholars from different parts of the world to establish authentic population related models for practical use in forensic anthropology. Studies from India are also highly significant in number and relevance.

In 2010, in a scientific study Mukhopadhyay et al. presented a useful insight on the stature estimation from maximum femoral

length and the epicondylar breadth. The study was conducted among the Indian Bengali male's population. Software (SPSS statistical software for windows 10) revealed the regression equation as y=7.02 + 4.83x, where the dependent variable (x) is the epicondylar breadth (cm) and the independent variable (y) is the maximum femoral length (feet). 95% confidence interval with a p-value of less than 0.001 was obtained with Pearson's coefficient of 0.85, a standard error of 1.68 and R squared value of 0.722.[1]

In the domain of stature estimation of total length of radius from its fragments, author Huddar M had put significant effort through his work. He divided the radius into 7 segments (a-b,b-c,c-d,d-e,e-f,f-g,g-h) based on morphological characteristics from top of head to tip of styloid process.[2]

Significant effort had also been put on the value of radius bone in prediction of sex and height in the Iranian population by Mitra Akhlaghi, et al. The study was conducted on 106 (61 male, 57 female) cadavers of Iranian population. The total length of the cadaver was measured. Along with it, the maximum length of radius and ulna were measured. Statistical analysis was done using SPSS software version. P value of <0.05 was considered significant. The age groups were divided into 4 categories:

I = <20 years old; II= 20-39 years old; III= 40-64 years old; IV= 65 and> 65 years old. The mean age of individual was 39.19 yrs.
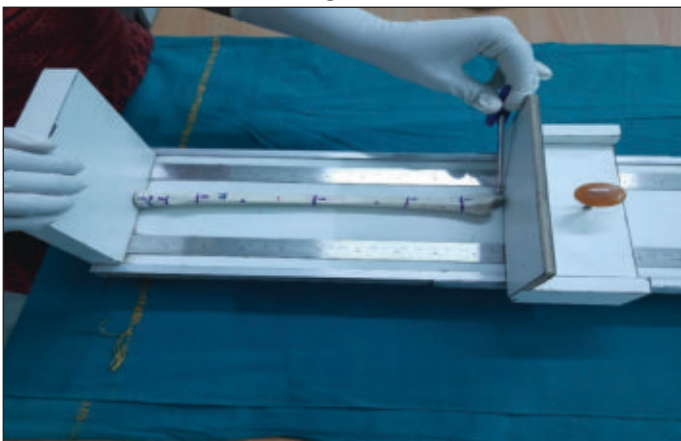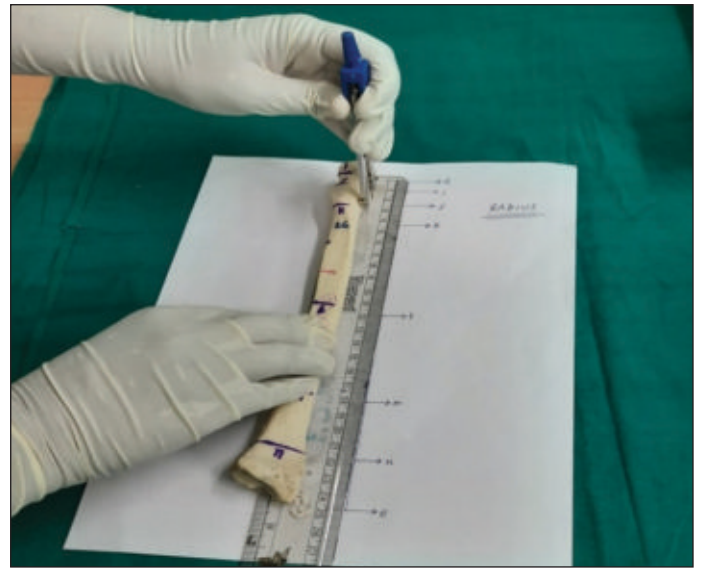

Figure 1

Figure 2

Figure 3

age (female=41.27; male=37.66). According to the regression test, there was a statistically significant (p=0.00) relation between the height of persons and the length of radius bone. The following equation was obtained to estimate the height on the basis of length of radius bone: Height (cm) = 74:79 + [3:91x the length of radius (cm)]. With the help of the above equation the stature and sex can be determined.[3]

In another study on South West Nigerian population by Ibeabuchi Nwachukwu Mike, et al., regression equation to estimate the total length of radius from its morphometry was obtained.[4]

Author Phalguni srimani, et al. gave emphasis on the usefulness of the biccipital groove of humerus in the morphometric analysis. The paper highlighted its clinical implications through its study in West Bengal population. The study was conducted on 107 dried cadaveric humeri (59 of right side and 48 of left) of unknown age and sex, collected from different Medical colleges of West Bengal. The total length, antero-posterior and transverse width of humeri at the surgical neck along with length, width, depth, medial wall and opening angles of biccipital groove were measured, with the help of ruler and vernier callipers. The length of BG was determined as the maximum distance between the most proximal and distal point of the groove. Width was calculated as the maximum distance between medial and lateral lips of the groove. Similarly depth was estimated as the distance between the greater/lesser tuberosity to the floor of the groove. The medial wall angle and the opening angle were computed as image analysis technique. All the parameters were measured by two observers separately and average values were taken. Data thus obtained were tabulated as Mean ± SD and statistically analyzed using SPSS software, version 16. The total length of the right humerus was found to be 303.71 ± 21.25 mm, the antero-posterior width of the right humerus was found to be 22.39 ± 1.35 mm and the right humerus transverse width was found to be 24.89 ± 2.00 mm. Similarly for the left humerus, the total length was found to be 294.69 ± 24.39 mm, the antero-posterior width was found to be 21.60 ± 1.38 mm and the transverse width was found

to be 24.01 ± 1.62 mm. The measurements of the length of the biccipital groove for the right humerus was found to be 71.59 ± 3.78mm and that for the left side was found to be 70.78 ± 5.04 mm which results in a mean length of 23.84% of total length of the humeri. The corresponding measurements of the width of the Biccipital Groove for the right and left humerus was found to be 71.59 ± 3.78 mm and 70.78 ± 5.04 mm respectively which results in a mean length of 33.22% of transverse width of the humeri. Finally the measurements of the depths of the biccipital groove was found as 4.63 ± 0.38 mm for the right humerus and 4.45 ± 0.30 mm for the left humerus which was found to be 20.65% of antero-posterior width of humeri. The average medial wall and opening angles of BG were found to be 50.22 + 5.350 and 81.41 + 10.900 on the right side. On the left side the corresponding measurements were found to be 53.83 +6.800 and 79.31 + 11.320 mm. Besides the non-existence of the supratubercular ridge of in some specimens, significant statistical differences were found in length, width, depth and medial walls angles of BG between right and left sides (p<0.005).[5]

Reviewing the literature, similar study on morphometric estimation on the humerus fragments on Turkish population was performed by S. Deniz Akman, et al. 120 adult humerus bones (64 right, 56 left) were collected from Cukurova University. The bone was divided into 6 segments. Statistical analysis was done using SPSS software version 9. The distances in maximum humeral length, H1, H2, H3, H4 and H5 segments were found to be 307.1 ± 20.8 mm, 6.5 ± 1.6 mm, 41.0 ± 5.1 mm, 24.2 ± 2, mm, 20.0 ± 2.2 mm and 23.9 ± 2.6 mm, (on the right side) and 304.8 ± 18.9 mm, 6.6 ± 1.3 mm, 40.9 ±3.9 mm, 40.6 ± 3.3 mm, 19.7 ± 2.5 mm and 39.7 ± 3.4 mm (on the left side), respectively. No significant difference was found in the morphometric measurements between left and right side specimens. The results thus obtained in this study on Turkish population were similar to that of 6 population of other countries.[6]

In similar type of study conducted by Kundu SD et al. showed, conducting over 79 numbers of humerus, the regression formula for Total length of humerus = 0.95+2.46ab+1.00bc+1.11de +0.62cd +1.02ef-0.68fg.[7]

R Squared value = 0.95

With the following landmarks

1) a = Most proximal point on the head. 2) b = Most distal point on the circumference on head. 3) c = Convergence of two areas of muscle attachments, just below the major tubercle. 4) d = lower end of deltoid tuberosity. 5) e = Upper margin of olecranon fossa 6) f = Lower margin of olecranon fossa. 7) g = Most distal part of trochlea.

Materials and Methods:

After getting the clearance from the institutional ethical committee, examination and measurements of all the fully ossified, dried and processed radius bones (57 in number from the departmental archive of Forensic Medicine, Burdwan medical college, Burdwan for the teaching program of undergraduate and postgraduate students (museum specimens) were done after excluding apparently unossified, diseased and injured bones, to conduct a descriptive cross-sectional study. Using

Table 1. Descriptive statistics of radius, showing its total length and fragmentary lengths of its seven segments.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Total length	57	19.30	30.10	23.3456	1.95056
h to i	57	.60	1.30	.9281	.18201
i to j	57	.70	2.20	1.1789	.31608
j to k	57	1.40	2.80	2.0877	.31057
k to l	57	5.70	9.70	7.3719	.67076
l to m	57	4.20	7.20	5.4772	.74211
m to n	57	2.00	4.40	3.0509	.55874
n to o	57	1.00	3.60	2.3088	.54847
Valid N (listwise)	57				

Table 2. The correlations of the total length and fragmentary segments of the radius with its proximal four segments (i.e. H to i, i to j, j to k and k to l).

Correlations						
		Total Length	h to i	I to j	j to k	k to l
Pearson Correlation	Total Length	1.000	.685	.657	.738	.582
	h to i	.685	1.000	.582	.442	.289
	I to j	.657	.582	1.000	.672	.286
	j to k	.738	.442	.672	1.000	.203
	k to l	.582	.289	.286	.203	1.000
	l to m	.728	.598	.534	.505	.164
	m to n	.435	.137	.112	.204	.358
	n to o	.578	.348	.096	.432	.355
Sig. (1-tailed)	Total Length	.	.000	.000	.000	.000
	h to i	.000	.	.000	.000	.015
	I to j	.000	.000	.	.000	.015
	j to k	.000	.000	.000	.	.065
	k to l	.000	.015	.015	.065	.
	l to m	.000	.000	.000	.000	.111
	m to n	.000	.155	.203	.064	.003
	n to o	.000	.004	.239	.000	.003
N	Total Length	57	57	57	57	57
	h to i	57	57	57	57	57
	I to j	57	57	57	57	57
	j to k	57	57	57	57	57
	k to l	57	57	57	57	57
	l to m	57	57	57	57	57
	m to n	57	57	57	57	57
	n to o	57	57	57	57	57

anthropometric set consisting of osteometric board, electronic digital calliper, measuring tape, flexible tape, dusting brush, pencil, OHP marker, standard prepared master charts for data recording. All the 57 radius were arbitrarily divided into different fragments by taking important anatomical landmarks on the bones, on the basis of their morphological characters. Measurements were taken using anthropometric set consisting mainly of osteometric board and electronic digital calipers. The author along with other three observers took four readings, and the mean value of these readings was recorded to minimize the inter-observer bias. Record was taken in centimeter (cm) and the measurement was up to one decimal place (nearest millimeter).

Table 3. The correlations of the total length and fragmentary segments of the radius with its distal three segments (i.e. l to m, m to n and n to o).

Correlations		l to m	m to n	n to o
Pearson Correlation	Total Length	.728	.435	.578
	h to i	.598	.137	.348
	I to j	.534	.112	.096
	j to k	.505	.204	.432
	k to l	.164	.358	.355
	l to m	1.000	.120	.394
	m to n	.120	1.000	.092
	n to o	.394	.092	1.000
Sig. (1-tailed)	Total Length	.000	.000	.000
	h to i	.000	.155	.004
	I to j	.000	.203	.239
	j to k	.000	.064	.000
	k to l	.111	.003	.003
	l to m	.	.187	.001
	m to n	.187	.	.249
	n to o	.001	.249	.
N	Total Length	57	57	57
	h to i	57	57	57
	I to j	57	57	57
	j to k	57	57	57
	k to l	57	57	57
	l to m	57	57	57
	m to n	57	57	57
	n to o	57	57	57

A. Dependent variable: Total Length.

Table 4. Model summary depicting the r-squared values and standard error of estimate of the different radial fragmentsa.

Model Summary[g]								
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.738[a]	.544	.536	1.32840	.544	65.740	1	55	.000
2	.860[b]	.739	.730	1.01413	.195	40.369	1	54	.000
3	.940[c]	.884	.877	.68297	.145	66.063	1	53	.000
4	.953[d]	.908	.901	.61414	.024	13.547	1	52	.001
5	.964[e]	.929	.923	.54279	.022	15.568	1	51	.000
6	.969[f]	.938	.931	.51224	.009	7.264	1	50	.010

The maximum length of the radius was the distance measured from the most proximal point on the head to the tip of the styloid process, using an osteometric board. The tip of the styloid process was placed against the vertical end-board while applying the movable upright to the radial head. The different fragments were measured using the digital calliper

The measurements obtained were initially inserted in the excel sheets and were later analysed using SPSS Statistical software for windows version 10.0. Metric data was reported as Mean, Standard deviation, Median and 95% confidence interval. P value of <0.05 was taken as significant Pearson's correlation to examine the association between the total lengths of radius bones and their fragmentary lengths.

After finding a positive correlation between length of radius bones and their respective fragments, Regression equation was obtained for the radius with the fragmentary lengths as the independent variable and the maximum length as the dependent variable, using the total sample (N= 57 Radius bone).

Table 5. Analysis of variance (anova) to compare the means of the radial segments.

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	116.006	1	116.006	65.740	.000b
	Residual	97.055	55	1.765		
	Total	213.061	56			
2	Regression	157.524	2	78.762	76.582	.000c
	Residual	55.537	54	1.028		
	Total	213.061	56			
3	Regression	188.339	3	62.780	134.590	.000d
	Residual	24.722	53	.466		
	Total	213.061	56			
4	Regression	193.449	4	48.362	128.226	.000e
	Residual	19.613	52	.377		
	Total	213.061	56			
5	Regression	198.036	5	39.607	134.434	.000f
	Residual	15.026	51	.295		
	Total	213.061	56			
6	Regression	199.942	6	33.324	126.999	.000g
	Residual	13.120	50	.262		
	Total	213.061	56			

Table 6. Standardised coefficients of the individual radial segments to the constant.

Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.670	1.206		11.334	.000
	j to k	4.634	.572	.738	8.108	.000
2	(Constant)	5.207	1.619		3.215	.002
	j to k	4.059	.446	.646	9.108	.000
	k to l	1.311	.206	.451	6.354	.000
3	(Constant)	2.303	1.148		2.007	.050
	j to k	2.695	.344	.429	7.838	.000
	k to l	1.229	.139	.422	8.818	.000
	l to m	1.161	.143	.442	8.128	.000
4	(Constant)	2.000	1.035		1.932	.059
	j to k	2.548	.312	.406	8.173	.000
	k to l	1.068	.133	.367	8.045	.000
	l to m	1.163	.128	.442	9.055	.000
	m to n	.585	.159	.168	3.681	.001
5	(Constant)	2.561	.926		2.766	.008
	j to k	2.353	.280	.375	8.403	.000
	k to l	.966	.120	.332	8.039	.000
	l to m	.917	.130	.349	7.075	.000
	m to n	.599	.141	.172	4.261	.000
	h to i	2.055	.521	.192	3.946	.000
6	(Constant)	2.992	.888		3.368	.001
	j to k	2.156	.274	.343	7.863	.000
	k to l	.870	.119	.299	7.325	.000
	l to m	.858	.124	.326	6.910	.000
	m to n	.637	.133	.183	4.778	.000
	h to i	2.009	.492	.187	4.085	.000
	n to o	.403	.150	.113	2.695	.010

The radius bone was divided into 07 (seven) segments where measurements were taken from the pre-determined anatomical points which are as follows—

1. h= Most proximal portion of the radial Head.

Table 7. The coefficients of the different radial segments, showing their individual correlation and the tolerance values.

Model		95.0% Confidence Interval for B		Correlations			Collinearity Statistics
		Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance
1	(Constant)	11.253	16.088				
	j to k	3.489	5.780	.738	.738	.738	1.000
2	(Constant)	1.960	8.453				
	j to k	3.166	4.952	.738	.778	.633	.959
	k to l	.897	1.725	.582	.654	.441	.959
3	(Constant)	.001	4.605				
	j to k	2.005	3.385	.738	.733	.367	.730
	k to l	.949	1.508	.582	.771	.413	.954
	l to m	.874	1.447	.728	.745	.380	.741
4	(Constant)	-.077	4.078				
	j to k	1.923	3.174	.738	.750	.344	.718
	k to l	.801	1.334	.582	.745	.338	.850
	l to m	.905	1.421	.728	.782	.381	.741
	m to n	.266	.904	.435	.455	.155	.854
5	(Constant)	.702	4.420				
	j to k	1.790	2.915	.738	.762	.312	.696
	k to l	.724	1.207	.582	.748	.299	.811
	l to m	.657	1.177	.728	.704	.263	.569
	m to n	.317	.881	.435	.512	.158	.853
	h to i	1.009	3.100	.685	.484	.147	.586
6	(Constant)	1.208	4.776				
	j to k	1.605	2.706	.738	.744	.276	.646
	k to l	.631	1.109	.582	.719	.257	.738
	l to m	.609	1.108	.728	.699	.243	.552
	m to n	.369	.905	.435	.560	.168	.844
	h to i	1.021	2.997	.685	.500	.143	.585
	n to o	.103	.704	.578	.356	.095	.696

2. i= Distal margin of radial head.

3. j=Upper end of radial tuberosity.

4. k = lower end of radial tuberosity.

5. l = Midpoint of insertion of pronator teres muscle.

6. m =Bifurcation of interosseous border.

7. n = Upper end of ulnar notch of radius.

8. o = Tip of styloid process.

Results:

Above table indicating that the variability of group means is large relative to the within group variability. F value = variance of the group means (mean square between) /mean of the within group variances (mean squared error). Larger F-values indicate good significance. However since the study population is small (n=57), F-values are somewhat lower; but still the values are quite significant and did not occur only by chance).

The above table showed the standardized regression coefficient of the segment (j to k) i.e. the segment between the upper and lower ends of the radial tuberosity, measured the greatest (7.863) at a significance level (1-tailed) of greater than 95%. This proves that this segment bears the best correlation with the total radial length compared to the other fragments).

Discussion:

57 dried and ossified radius bones were taken from the Departmental Archive and these were arbitrarily divided into 08 segments based on anatomical and morphological landmarks from the most proximal point on the head to the distal tip of the styloid process. The measurements obtained were analysed by SPSS statistical software for windows version 10.0. P value of less than 0.05 was considered significant, and 95% confidence intervals was employed in this study. Pearson's correlation was used to study the degree of association between the total radial length and the individual fragmentary lengths. The predicted cum observed lengths were calculated and they almost tallied and thus the results proved accurate and consistent.

The measurements of both sides (left and right) were grouped and noted separately but the results were pooled to obtain the regression equation. This was done because no significant difference in measurement between the left and right side in the sample of 57 radii.

The present investigation was a preliminary work and can be considered as a pilot study for estimating the regression equation to estimate the total length of radius from its fragmentary lengths. In a population specific sample. Being population specific, it can be applied in case studies pertaining to identification of human remains of that geographic domain when grossly mutilated bodies or bony fragments are sent for forensic autopsy.

Our study revealed the Regression equation of Radius as follows:

Total length of radius = 2.92+ 2.15 JK + .87KH + .85LM + .63 MN +2.00 HI+ 0.42NO

R Squared Value = 0.938

In his scientific study Mukhopadhyay et al. took 65 adult male human femur bones (23 were of the right side and 42 were of the left side) which were dried and ossified. Osteometric board and callipers were used as anthropometric tools to take the measurements of the specimens. In this work, the maximum length had been defined as the distance between the highest point on the head of the femur to the lowest point on the distal condyles. The epicondylar breadth has been defined as the distance between the two most laterally projecting points on the epicondyles. Software (SPSS statistical software for windows 10) revealed the regression equation as y=7.02 + 4.83x, where the dependent variable (x) is the epicondylar breadth (cm) and the independent variable (y) is the maximum femoral length (feet). 95% confidence interval with a p-value of less than 0.001 was obtained with Pearson's coefficient of 0.85, a standard error of 1.68 and R squared value of 0.722.[1]

In the study conducted by Huddar M, 140 dried, fully ossified radius bones were taken randomly from the anatomical department of medical college of Nagpur and a cross-sectional study was performed. Measurements were done using osteometric scale. The mean length, SD, coefficient of variation and proportions of length of the various segments of the radius were calculated. CI was 95%.In this study, the segment d-e, i.e, the lower end of radial tuberosity to the mid point of insertion of pronator teres showed statistically significant results for

calculating the total length of radius.[2]

In another study comprising of radial length, the age groups were divided into 4 categories:

I = < 20 years old; II= 20-39 years old; III= 40-64 years old; IV= 65 and > 65 years old. The mean age of individual was 39.19 yrs. age (female=41.27; male=37.66). According to the regression test, there was a statistically significant (p=0.00) relation between the height of persons and the length of radius bone. The following equation was obtained to estimate the height on the basis of length of radius bone: Height (cm) = 74:79 + [3:91x the length of radius (cm)]. With the help of the above equation the stature and sex can be determined.[3]

The study over nigerian population included 40 radius bones of unknown sex which were collected from University of Lagos. 9 parameters were taken into consideration. The distal breadth, sagittal diameter at mid-shaft, transverse diameter at mid-shaft (TDM), vertical radial head height (VRHH), maximum head diameter (max. HD), and minimum head diameter (min. HD) were measured using digital vernier caliper while the circumference of the radial head and the circumference at the radial tuberosity were measured using an anthropometric tape. Measurements were taken to the nearest cms. Right and left bones were compared using student's t-test and Pearson's coefficient was used for correlation. SPSS version 17 was used for statistical analysis. The mean length of the right radius was 26.3 ± 1.6 cm while that of left was 25.8 ± 1.9 mm. The mean differences were not statistically significant. The following equations were thus obtained: Right = 20.537 + 2.758 Max. HD; Left = 17.760 + 2.648 Max. HD + 2.922VRHH; Both = 13.637 + 5.148 TDM + 2.288 Max. HD.[4]

In the current study, an attempt has been made to get a regression formula from the different segments of radius with whole length of radius in which age of radius and the height of the human was not considered in contrast to study of Mitra Akhlaghi, et al.[3]

The current study also differs from the study of Mike Ibiabuchi,[4] where the diameters of the radius at different site were independent variables and the current study emphasized on different pre-defined anatomical landmarks over the longitudinal length of radial bones.

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ORIGINAL ARTICLE

Pattern of Limb Injuries in Road Traffic Accident: A Cross-Sectional Study in a Tertiary Health Care Centre in North East India

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Abstract:

According to World Health Organization, road traffic accident claims 1.2 million deaths annually and causes up to 50 million non-fatal injuries. A limb injury is any injury to a limb, either a leg or arm, or to the toes and fingers. Limb injuries include broken bones (cracked or fractured bones, eg. a broken arm), dislocations (when a bone has been moved or dislodged, eg. a dislocated shoulder), sprains (injuries to ligaments, eg. a sprained ankle), strains (injuries to muscles, eg. a strained thigh), nail injuries (injuries to toenails and fingernails, eg., a stubbed toe), and bruises (colored marks caused by bleeding under the skin due to an impact). A cross-sectional study was conducted in the mortuary of a tertiary health care centre in North-East India. The study was done from September 2019 to August 2021. All road traffic accident cases which were brought for medico legal autopsy were included. From the present study, it was found that maximum number of victims was due to two-wheeler accidents and most of the fatalities occurred after reaching hospital, mostly due to lack of prompt aid for the victim and less trauma center in the region. Injuries mostly seen are abrasion and a few cases of fracture. The cause of death is injury to major vessels involved in the fracture causing shock and hemorrhage. It is also observed that multiple limb injuries and limb injuries associated with fracture could be fatal which is significant (p< .001).

Keywords: Road traffic accident; Limb injuries; Two wheeler accident; Abrasion; Fracture; Fatality.

Introduction:

 Road traffic accident 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.[1] According to World Health Organization, road traffic accident claims 1.2 million deaths annually and causes up to 50 million non-fatal injuries. The injuries caused by road traffic accidents (RTAs) become a major public health problem worldwide and a major cause of morbidity and mortality with temporary or permanent disability.

A limb injury is any injury to a limb, either a leg or arm, or to the toes and fingers. Limb injuries include broken bones (cracked or fractured bones, eg. a broken arm), dislocations (when a bone has been moved or dislodged, eg. a dislocated shoulder), sprains (injuries to ligaments, eg. a sprained ankle), strains (injuries to muscles, eg. a strained thigh), nail injuries (injuries to toenails and fingernails, eg. a stubbed toe), and bruises (colored marks caused by bleeding under the skin due to an impact).[2]

More than 1.17 million people die in traffic accidents around the world every year, and 65% involve pedestrians. Meanwhile, 85% of pedestrian casualties include lower limb injuries, a much higher figure compared to motorized vehicle occupants. Lower limb injuries are the most common in pedestrian casualty.[3]

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The present work is designed to study the pattern of limb injuries to understand the circumstances and mechanism of causation of these injuries in Road traffic accident.

Materials and Methods:

A cross-sectional study was conducted in the mortuary of a tertiary health care centre in North-East India. The study was done from September 2019 to August 2021. All road traffic accident cases which were brought to the mortuary for medico legal autopsy were included in the study.

Cases with limb injuries with or without injury to other part of the body were included. Cases with unknown cause of death and decomposed bodies were excluded.

The Sample size was calculated as follows :

a) Prior information:

  – P: Prevalence rate of limb injuries = 15.8% (from a study by Shamim m[4])

b) Assumption:

  – 95% degree of precision

  – Z (critical value at 5% level of significance) = 1.96

  – L (allowable error) = 7

c)   Formula:

$$N = \frac{Z^2 \, P \, (1-P)}{L^2}$$; where N is the required sample size.

$$= \quad 104.2$$

$$\approx 105$$

Henceforth, adequate sample size for the proposed study is found to be around 105 road traffic accident cases with limb injuries. Study variables consisted of independent variables as age, sex, religion, address, caste, education, socioeconomic status and dependent variables as the patterns of upper limb injuries and lower limb injuries viz. abrasion, laceration, fracture, contusion, offending vehicles, type of victims, survival period, time and place of occurrence, etc.

Procedure and data collection: After giving brief introduction about our study, informed consent was taken from the relatives. The particulars of victim were recorded and a detailed history pertaining to nature of incident and time and place of occurrence was obtained from the police records and relatives of the victims. Information regarding the vehicle involved, road on which accident occurred, victim as pillion or driver or pedestrian, history pertaining to survival time after sustaining injury was obtained from relatives or accompanying persons or police and also from hospital records, if any.

1. Post mortem examination: a) External examination: Examination of wearing apparels: noting the tears, stains, tyre marks, foreign bodies etc., and other external findings like cyanosis, congestion, jaundice, post-mortem changes and recording of the injuries in detail- type, location, size, age of wound etc.

b) Internal examination: All the three body cavities i.e., the cranial, thoracic and abdominal cavities were opened and explored as done in routine post-mortem examination. The cavities and their contents were examined systematically and internal organ injuries and injuries of the limbs were thoroughly assessed and recorded.

To maintain confidentiality of the deceased, name etc was not used on the proforma. After obtaining all the required details and complete postmortem, finding was entered in the proforma.

Statistical analysis: The present study is carried out in the department of Forensic Medicine and Toxicology of a tertiary health care centre in North-East India. It is based on a primary sample of 105 road traffic accident cases with limb injuries that were brought to the mortuary. The type of study is cross sectional study and it was done during stipulated study period of two calendar years starting from August 2019 to July 2021. Autopsy reports and related information, so collected, were first transferred to Microsoft Excel worksheet and then to SPSS (Statistical Package for Social Sciences) data document. Then after thorough scrutiny and checking of the data, statistical analysis was performed by using IBM: SPSS Statistics Version 21.

All the categorical variables considered, were again described as number of cases and percentages. To establish association between the categorical variables with the type of injuries, c^2-test is applied, and interpretation is made accordingly. All comparisons are two-sided and the P-values of < 0.05, < 0.01, and < 0.001 were taken as the cut off values for significance, highly significant and very highly significant respectively.

Ethical issue: Ethical approval from the Research Ethical Board (REB), of the institute was obtained. Informed written consent was obtained from the deceased's party. Code was used during collection of data to maintain confidentiality. The data obtained was kept in the department of Forensic Medicine and Toxicology of the institute. The access to the data was restricted to the investigator and the guides. The study was self-sponsored study and there was no conflict of interest.

Results:

A total one hundred and five cases of fatal road traffic accident with limb injuries were studied during the study period in the mortuary of the tertiary heath care centre of North East India during the period of September 2019 to August 2021.

In the present sample of 105 road traffic accident cases with limb injuries, there are 83 males and 22 females with 79.0% and 21.0% respectively. It shows that male has more number of road traffic accident than that of his counterpart female.

Among the cases of road traffic accident, highest number of victims were observed among the age of 31-40 years which accounted for 24.8%; and lowest number of victims of about 1.9% were observed among the age group of 0-10 years.

Meitei maintains highest percentage (86.7) which is followed by Manipuri Muslim (8.6) and Manipuri Tribal (4.8%) respectively.

There are only two categories of socio-economic status viz., low class, and middle class; and the former has lower number of cases (14.3%) in the present sample while compared with the latter (85.7%).

Autumn (34.3%) is the season during which most road traffic accidents took place as against the lowest in spring season (16.2%).

Maximum number of victims was due to two-wheeler accident which accounted for 52.4% of which 38 (69.09%) fatalities were riders. Further, pedestrian was observed to be the next major fatalities of road traffic accident cases which account for 30.5% and by four-wheeler about 17.1% in which majority about 12 (66.67%) fatalities were among drivers.

Most of the fatalities occurred after reaching hospital which accounted for 84.8% and the least number of fatalities which is 1% occurred at home after taking primary treatment and sent home.

Most of the road traffic accident cases, 74.3% survived for a period of 1-24 hours before they succumb to their injuries. Further it is observed that 1 case survived for more than 1 week but unfortunately, he succumbed to his injuries.

Maximum fatalities were due to injuries to vital organs associated with shock and hemorrhages which accounts for 90.5% of cases and 9.5% of fatalities were due to injuries to the limb associated with shock and hemorrhages.

Injury-wise analysis: For analysis convenience, all the combination of multiple injuries are clubbed under the one caption of multiple injuries, and therefore in the following section, there are five categories i.e., fracture, abrasion, contusion, laceration, and multiple injuries considered as type of injuries as shown in Table 1. As mentioned elsewhere, in order to establish association between all the parameters, taken into

Table 1. Type of injuries a distribution of road traffic accident according to brief history.

Parameters		Type of injuries						x^2-value	df	P-value
		Fracture 8 (7.6%)	Abrasion 46 (43.8%)	Contusion 17 (16.2%)	Laceration 4 (3.8%)	Multiple injuries 30 (28.6%)	Total 105 (100.0%)			
Brief history	Two wheeler	4 (7.3%)	24 (43.6%)	11 (20.0%)	2 (3.6%)	14 (25.5%)	55 (100.0%)	3.340	8	.911
	Four wheeler	1 (5.6%)	8 (44.4%)	2 (11.1%)	-	7 (38.9%)	18 (100.0%)			
	Pedestrian	3 (9.4%)	14 (43.8%)	4 (12.5%)	2 (6.2%)	9 (28.1%)	32 (100.0%)			

Table 2. Type of injuries distribution of road traffic accident according to survival period.

x^2 –value; df: degree of freedom; P-value: probability due to chance factor

Parameters		Type of injuries						x^2-value	df	P-value
		Fracture 8 (7.6%)	Abrasion 46 (43.8%)	Contusion 17 (16.2%)	Laceration 4 (3.8%)	Multiple injuries 30 (28.6%)	Total 105 (100.0%)			
Survival period	On the spot	1 (6.2%)	4 (25.0%)	2 (12.5%)	2 (12.5%)	7 (43.8%)	16 (100.0%)	18.412	16	.300
	Within 1hr	1 (11.1%)	2 (22.2%)	0	0	6 (66.7%)	9 (100.0%)			
	1-24hr	6 (7.7%)	38 (48.7%)	15 (19.2%)	2 (2.6%)	17 (21.8%)	78 (100.0%)			
	>1week	0	1(100.0%)	0	0	0	1(100.0%)			
	Unknown	0	1(100.0%)	0	0	0	1(100.0%)			

Table 3. Type of injuries a wise distribution of road traffic accident according to cause of death.

Parameters		Type of injuries						x^2-value	df	P-value
		Fracture 8 (7.6%)	Abrasion 46 (43.8%)	Contusion 17 (16.2%)	Laceration 4 (3.8%)	Multiple injuries 30 (28.6%)	Total 105 (100.0%)			
Cause of death	Injury to limb	4 (40.0%)	-	-	1 (10.0%)	5 (50.0%)	10 (100.0%)	31.595	8	<.001
	Shock and haemorrhage	1 (1.9%)	29 (55.8%)	7 (13.5%)	-	15 (28.8%)	52 (100.0%)			
	Injury to vital organs	3 (7.0%)	17 (39.5%)	10 (23.3%)	3(7.0%)	10 (23.3%)	43 (100.0%)			

account, with the type of injuries, c^2-test is applied, and interpretation is made accordingly.

It may be observed from the table-1 that brief history has no significant association with the type of injuries. This statement is supported by the corresponding insignificant P-value which is more than 0.05, the significant level adopted. However the findings further reveal that on the records of brief history within the fracture, pedestrian and four wheeler are found the highest and the lowest respectively; within the abrasion, four wheeler and two wheeler, the highest and the lowest; within the contusion, four wheeler and two wheeler, the highest and the lowest; within laceration, no case of four wheeler found while pedestrian is found the highest followed by two wheeler. Within the case of multiple injuries, four wheeler and pedestrian are noticed the highest and the lowest respectively.

It is observed that, in most of the fatalities, there are five categories of survival periods which can be considered for analysis purposes. This is shown in table 2. They are on the spot, within 1hr, 1-24hr, >1week, and unknown. After applying the test one may infer that survival period has not much relationship with the happening of road traffic accident. This proclamation is based on the insignificant[2] value i.e., p=0.300.

In order to ascertain the relationship of cause of death with the type of injuries, table-3 has been introduced along with test value. Again, from the table it may be observed that cause of death has a very highly significant association with the type of injuries as evident by p<0.001.

Discussion:

In this study, most of the victims were males, there are 83 males and 22 females with 79.0% and 21.0% respectively. Study conducted by Murarka KI et al.,[5] Nilambar J et al.,[6] Mehrdad M et al.[7] have also similar to our study. It shows that male has more number of road traffic accident than that of his counterpart female. Predominance of male explained that male are more prone to lead a more active life, more exposed to traffic accidents and trauma, etc.

Majority of the victim were in the age range of 31-40 years with highest percentage (24.8%) and lowest incidence (1.9%) was seen in the age range of 45 - 50 years which is similar to studies conducted by Chaurasia AK et al.,[8] Nilambar J et al.,[6] Mehrdad M et al.[7] The highest in the age group 31-40 years could be due to fact that this is the most active phase of life

In case of the caste of victims, Meiteis constituted the highest percentage (86.7%) which is followed by Manipuri Muslim (8.6%) and Manipuri Tribal (4.8%). This is due to fact that Meiteis are the majority group in the study population which is in agreement with the findings of Bhuyan PJ and Ahmed F,[9] which state that the dominant community in a study population constitutes the highest percentage of the cases.

Most of the victims belong to the middle socioeconomic group (85.7%) and the remaining 14.3% belongs to the low socioeconomic group. On socio-educational front, this can be interpreted as to the affordability of the people to maintain the vehicle. This is in agreement with Reddy A et al.[10]

Autumn (34.3%) is the season during which most road traffic accidents took place as against the lowest in spring season (16.2%). Our finding is in contrast with finding of Singh H et al.,[11] Singh PK et al.[12] where winter was common season for RTA.

In case of survival period, there was a lone case that did not know the period. 1% of the cases survived for more than 1 week followed by those who survived for 1-24 hrs (74.3%). This is again followed by those who survived for 1 hour (8.6%) and death on the spot was 15.2% . Our finding is similar with Chaurasia S et al.[13] where most of the victim (30%) died within 12-24 hour whereas finding of Singh H et al.[11] showed that 39.5% deaths occurred within 1hr which is different from our finding.

In case of vehicle involved, maximum cases were caused by two-wheeler accidents (52.4%) and next was the pedestrian (30.5%) followed by four-wheeler (17.1%) which is similar with the findings of Bhuyan PJ et al.[9] This could be due to fact that two wheelers are the most commonly used means of transport in Manipur.

In terms of type of victims, rider of two wheeler was found to be of highest percentage (69.09%), followed by driver of four wheeler (66.67%), occupant of four wheeler (33.3%), pillion rider (30.9%), and pedestrians (30.5%). This finding is similar to study conducted by Mishra S et al.[14] and Navali AM et al.[15] This could be due to the casual attitude of two wheeler riders to traffic rules.

It is observed from our study (table-10) that type of victim has no significant association with the type of injuries. This statement is supported by the corresponding insignificant p-value which is more than 0.05, the significant level adopted. However, from the table it is observed that abrasion is the most common type of injury seen in all type of victims with the highest of 24 cases is seen in two wheeler followed by 14 cases in pedestrian and 8 cases in four wheeler road traffic accident. Further, among the various type of injuries sustained by two wheeler victims, laceration is the least which is seen in 2 cases, while fracture is seen in 1 case which is the least type of injury seen in four wheeler victims, whereas among pedestrian the least type of injury is laceration which is seen in 2 cases. In contrast to the study by George AS et al.[16] where Pillion riders were injured more often in collisions between two and four wheelers.

Our finding is similar with study by Jhakar JK et al.[17] and slightly different from the work done by Mishra S et al.[14] which found that common injuries were laceration & fracture (30%).

Regarding the cause of death, injury only to the limb with shock and hemorrhages was the cause of death in 9.5% of the cases and in the remaining 49.5% of the cases the cause death was due to shock and hemorrhage and 41% due to injury to vital organs. This is significant finding as the p value is < .001. This finding is different from previous workers[18,19] where limb injury alone has never been reported as the sole cause of death.

Regarding association of limb injury with the cause of death, out of 10 cases showing fatal limb injuries, the cases showed multiple limb injuries (50%) followed by fracture (40%) and laceration 1%. This proves that even if the limb is involved in vehicular accident, it could be fatal if there is multiple limb injuries or if there is fracture involved. This finding has not been seen in studies done by previous workers.

In this study, cases were taken which were brought to Regional Institute of Medical Sciences, so our finding may not be representative of all the fatal two road traffic accident with limb injuries happening in the state.

Conclusion:

From the present study, it is found that maximum number of victims was due to two-wheeler accidents and it is observed that most of the fatalities occurred after reaching Hospital, mostly due to lack of prompt aid for the victim and less trauma center in the region. In our study, injury mostly seen on the victims is abrasion and a few cases of fracture. The cause of death is due to injury to major vessels involved in the fracture causing shock and hemorrhage. From our study, it is observed that multiple limb injuries and limb injuries associated with fracture could be fatal which is significant (p< .001). The result of this study enables a health care provider to predict fracture and site of injury. Strict enforcement of road safety regulations and improving emergency medical services may prevent untimely deaths and disabilities caused by RTAs. Awareness campaigns concerning safety rules can be targeted at the high-risk groups with emphasis on improvement of the roads. The fact that the economically productive age-group was mostly involved should prompt an urgent public policy response with special reference to education, engineering, environment, and emergency care of road accident victims.

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ORIGINAL ARTICLE

Pattern of Suicidal Deaths by Hanging at Tertiary Health Care Centre During COVID Pandemic

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Abstract:

COVID 19 pandemic continues to pose serious public health problems and also problems related to financial, social and psychological issues. Because of factors such as loneliness, stress, financial issues, many people committed suicide during pandemic. Hanging was the most common method adopted for committing suicide.

The present study was conducted to highlight the current prevalence and pattern of suicidal deaths by hanging during COVID19 pandemic. We retrospectively reviewed suicidal deaths by hanging autopsied at tertiary medical care centre of Western Maharashtra during the period of 1st January 2021 to 30th June 2021. During the study period, 3780 medico-legal autopsies were performed, of which total 368 cases (9.73%) of death due to hanging were observed. Among 368 cases of death due to hanging, 366 (99.45%) were suicidal in nature while 02 cases (0.55%) were accidental in nature. Male outnumbered female with male: female ratio 3.46:1. The maximum number of cases (60.92%) was observed in age group of 21 to 40 years. The soft material was used in 190 cases (51.91%) while hard material was used in 176 cases (48.08%). The ligature material most commonly used for committing hanging was rope (46.17%) followed by saree (28.96%) and dupatta (17.75%). Most of victims 342 (93.44%) committed suicide by hanging in closed space like home and common close places.

Keywords: Suicide; Hanging; COVID 19.

Introduction:

The coronavirus disease 2019 (COVID) had created serious public health issues and most of the population was infected at same point of time during pandemic. To prevent the transmission and spread of virus, the lockdown was imposed in most of the countries globally. This had resulted into lot of hardship into lives of population and had a great impact on their social life, financial and psychological behaviour. There were lot of evidence that there was increased tendency for committing suicide due to loneliness, stress and financial problems. Even though primary focus of health care system was to treat covid infected patients but the psychological issues were not discussed and addressed sufficiently. The sudden death of earning member of family is not only devastating experience to family but to the community at large. It is end result of complex interaction of biological, genetic, psychological, sociological and environment factors.[1] Many middle-aged earning member lost their job due to pandemic situation, found themselves in major crisis without any other way out and found suicide as only solution to their problem.[2]

The official estimates of people who committed suicide annually in India vary greatly but according to National Crime Record Bureau of India, it was around as 2,00,000 people annually.[3] Hanging is a traditionally recognised and one of the most common methods of committing suicide in India. It's chosen as a method for committing suicide leaves little opportunity to change mind as generally death occurs quickly after suspension. Other common methods used for committing suicide include poisoning, drowning, self-immolation but non-reporting, under reporting, misleading information about manner of death are observed. On the contrary, hanging being sudden, unnatural, unexpected have to be reported to legal authorities, so investigated in details and subjected to medico-legal post mortem examination to determine cause and manner of death. Hence deaths by hanging are reliable indicator of suicide occurring in society.

Suicidal deaths by hanging have been studied by many researchers all over the world, but very few such studies were observed during in COVID 19 pandemic situation. The aim of current study is to highlight the current prevalence and pattern of suicidal deaths by hanging in COVID 19 pandemic situation.

Materials and Methods:

This is retrospective observational study carried out at our Tertiary Medical Teaching Institute, Western Maharashtra from 1st January 2021 to 31st June 2021. We retrospectively reviewed medico-legal autopsy records during the study period. All the cases of suicidal deaths by hanging brought for medico-legal autopsy at our centre during the study period were considered for the study while cases of accidental and homicidal hanging were excluded from study.

The detail information of selected cases was obtained from

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medico-legal autopsy report, inquest papers. The information obtained was tabulated systematically and analysed statistically. Being retrospective analytical study ethical clearance from institutional ethics commitee is not applicable.

Results:

During study period, 3780 medico-legal autopsies were performed; of which total 368 cases (9.73%) of death due to hanging were observed. Among 368 cases of death due to hanging, 366 (99.45%) were suicidal in nature while 02 cases (0.55%) were accidental in nature. Among suicidal deaths by hanging, male outnumbered female victims with male: female ratio 3.46:1. Male preponderance was observed in all age groups while in 31-40 years age group, significant rise in cases among males as compared to females were observed with male : female ratio 8.18:1. The detail distribution of suicide by hanging showed maximum number of cases [122 (33.33 %)] was observed in 21 to 30 years of age group, followed by 101 cases (27.59%) were observed in the 31 to 40 years of age group. Overall, 21-40 years of age group comprise highest number of cases [223 (60.92%)]. The youngest victim of suicidal death by hanging was 11 years old and oldest was 92 years old.

The ligature material as soft and hard ligature material used for committing suicide by hanging showed no significant difference as soft material was used in 190 cases (51.91%) while hard material was used in 176 cases (48.08%). The ligature material most commonly used for committing hanging was Rope (46.17%) followed by saree (28.96%) and dupatta (17.75%). Among male, rope (51.76%) was most commonly used as ligature material followed by saree (26.40%), while in female, saree (37.80%) and dupatta (35.36%) were commonly used as ligature material for committing suicide.

Figure no.1 showed most of victims 342 (93.44%) committed suicide by hanging in closed space like home and common close places. The most common place used for committing suicide by hanging among male was home 238 (83.80%), followed by common closed room 16 (5.63%) like latrine, vacant rooms, hotel room, staircase, animal sheds, open space 15 (5.28%), work place like shops, office, staff quarters 12 (4.22%), terrace 7 (2.46%). The most common place used for committing suicide by hanging among female was home 71 (91.02%) with only one case was observed in open space.

Discussion:

COVID 19 pandemic posed different challenges to mankind and

one of the challenges was to prevent suicidal deaths associated with covid during pandemic. In present study, among cases of death due to hanging, 99.45% cases of hanging were suicidal in nature while 2 cases (0.55%) were accidental in nature. Similar findings were observed by Patel A et al.[4] (97.5%), Cook CT et al.[5] (93.21%), Azmak D[6] (100%), Zanjad NP et al.[7] (98.44%) which showed maximum number of cases were suicidal in nature. The method used to commit suicide depends on victims understanding, availability and accessibility of suicide means and his / her determination. Hanging is commonly used as a method of choice for committing suicide as there is easy availability of ligature material for committing suicide, access to place where act can be completed successfully, confirm fatality, relatively painless method.

Male preponderance was observed among the hanging cases with average male : female ratio of 3.46:1. The findings of male preponderance among victims of suicide by hanging was also reported by Azmak D[6] (3.95:1), Nikolic S et al.[8] (03.16:1), Odabasi AB et al.[9] (2.49:1), Bhosale SH et al.[10] (2.17:1), Sharma Br[11] (2:1), Zanjad NP et al.[7] (1.71:1). While the study carried out by Osama Madni et al.[12] showed significant difference in the ratio of male to female as 6.66:1. As males might be facing more stressful situation, financial issues, unable to overcome problems and found only way out of this helpless situation is by committing suicide.

In this study, suicidal deaths by hanging were more common in the 21 to 30 years of age group (33.33%) followed by 31 to 40 years (27.59%) and overall, 21 to 40 years age group comprised highest number of cases (60.92%). High incidence of hanging in middle age group (21 to 40 years) were observed in studies by Sharma BR[11] (73.0%), Bhosale SH et al.[10] (64.5%), Zanjad NP et al.[7] (61.24%), Osama Madni et al.[12] (64.66%), Azmak D[6] (40.2%). The fact that 21 to 40 years age group is quite demanding where important responsibilities are shouldered on the middle age group persons and failure to tackle the pressure of those responsibilities along with financial crisis due to unemployment might result in committing suicide. During COVID pandemic, many middle-aged persons lost their jobs and also home isolation resulted into psychological and emotional disturbance which might also be responsible for committing suicide.

In this study, ligature material used for committing suicide was soft material in 51.91% of cases while hard material was used in

Table 1. Age wise and sex wise distribution of cases of suicidal death by hanging.

Age group (in years)	Male	Female	M:F ratio	Total
11 -20	29 (7.92%)	25 (6.83%)	1.16:1	54 (14.75%)
21-30	91(24.86%)	31 (8.46%)	2.93:1	122 (33.33 %)
31-40	90 (24.59%)	11 (3.00%)	8.18:1	101 (27.59%)
41-50	37 (10.10%)	7 (1.91%)	4.28:1	45 (12.29%)
51-60	17 (4.64%)	3 (0.81%)	5.66:1	20 (5.46%)
61-70	11(3.00%)	3 (0.81%)	3.66:1	14 (3.82)
70 and above	9 (2.45%)	2 (0.54%)	4.5:1	11(3.0%)
Total	284 (77.59%)	82 (22.40%)	3.46:1	366 (100%)

Table 2. Distribution of ligature material used for committing suicide by hanging.

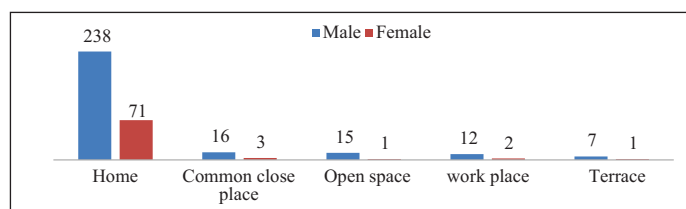| Ligature material		Male	Female	Total
Soft	Saree	75 (26.40%)	31 (37.80%)	106 (28.96%)
	Dupatta	36 (12.67%)	29 (35.36%)	65 (17.75%)
	Cloth	19 (6.69%)	00	19 (5.19%)
		130 (45.77%)	60 (73.17%)	190 (51.91%)
Hard	Rope	147 (51.76%)	22 (26.82%)	169 (46.17%)
	Wire	4 (1.40%)	00	4 (1.09%)
	Belt		00	2 (0.54%)
	Plastic pipe	1(0.35%)	00	1 (0.27%)
		154 (54.22%)	22 (26.82%)	176 (48.08%)
Total		284 (100%)	82 (100%)	366 (100%)

Figure 1. Distribution of places used for committing suicide by hanging.

48.08% of cases. The study carried by Zanjad NP et al.[7] observed hard material was used in 57.75% and soft material was used in 34.1%. While the study carried out by Goceoglu UU and Balki Y[13] observed that in maximum number of cases, hard material (92.5%) was used as ligature material for committing suicide by hanging. The study of Sharma BR et at.[11] observed soft material (77.72%) was commonly used as ligature material. The readily available material at the time of committing suicide is commonly used for hanging.

In the present study, the ligature material most commonly used for committing hanging was Rope (46.17%) followed by saree (28.96%) and dupatta (17.75%). The study carried out by Dixit PG et al.[14] (52%), Cook CT et al.[5] (59%), Sharma BR et at.[11] (50.9%), Bhosale SH et al.[15] (53.01%) reported that rope was most commonly used ligature material in all ages. Rope is easily available and present in almost all homes for household works. The present study also observed that among male, rope (51.76%) was most commonly used as ligature material, while in female, saree (37.80%) and dupatta (35.36%) were commonly used as ligature material for committing suicide. The study by Sharma BR et al.[11] observed that among female, soft material (90%) was commonly used as compared to hard material (10%). Saree and dupatta are routinely used by females and girls in India, so easily assessable to them.

In present study, most of victims 342 (93.44%) committed suicide by hanging in closed space like home and common close places. Vijaykumari N[16] (95.50%), Goceoglu UU and Balki Y[13] (81%), Bhosale SH et al.[15] (69.88%) reported that most common place used for committing suicide by hanging was home. Victim always prefer secured and secluded place where execution of act can be completed, and they are well aware of home and its surroundings.

Family members and friends plays very important role in preventing suicide by hanging. Recognising behavioural changes at earlier stages, proper counselling and early psychiatric consultation of person are possible useful measures for prevention of suicide. There should be public health policy which should design policies not only for socio economic development of high-risk persons, law implementation for employment, increased availability of diagnosis, treatment and follow up of psychiatric illness but also program to improve problem solving and coping skills.

Ethical Clearance: Not applicable.

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ORIGINAL ARTICLE

Estimation of Stature from Head Length in Adults in a Tertiary Care Teaching Hospital of Bareilly, Uttar Pradesh

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Abstract:

Stature is the height of the person in upright posture. It is one of the most important elements in the identification of an individual. In the recent times, due to natural disasters like tsunamis, earthquakes, floods, cyclones, and man-made disasters like bomb blasts, terror attacks, wars, plane crashes, mass accidents and other accidents, the need of establishing the identity of the person has become an important necessity for both legal and humanitarian reasons. Many a times, only skull is brought for medico legal identification, this necessitates to correlate the metric traits of the skeletal remains with the stature. The present study was conducted on 300 individuals in a tertiary care hospital of Bareilly, Uttar Pradesh. The study showed a significant co-relation between head length and stature.

Keywords: Stature; Head length; Anthropometry; Identification; Forensic.

Introduction:

Stature is the height of the person in upright posture. It is one of the most important elements in the identification of an individual.[1] In forensic anthropology; stature is among the four major categories of the basic biological profile along with sex, age and ancestry. Anthropometry constitutes the means of giving quantitative expression to the variations which different individuals or traits exhibit. 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.[2]

Many studies have shown the correlation of stature with body appendages & with long bones. But there are inter-racial & inter-geographical differences in measurements & their correlation with stature. What may be true for one race or one region may not be true for the other. One of the most durable and recognized part of human skeleton is skull. Human skull survives post-mortem taphonomic process and be reported to the authorities. Many a times, only skull is brought for medico legal identification and this is prevalent in the regions where the attacks by wild animals from deep forests are common. In such situations forensic experts always face difficulties to correlate the metric traits of the skeletal remains with the stature. Although a number of long bones are used for this purpose but cranial dimensions are more reliable and precise mean of predicting the stature. The length of the skull is approximately one eighth of the stature of the person as reported by Glaister (1957).[3]

Aim and rationale for the study: To investigate the relationship between head length and stature in adults. By this investigation this study aims to contribute to the existing body of knowledge in the fields of anthropometry, Forensic Medicine and healthcare. The findings may have implications for biometric analysis, age estimation, sex determination and other related areas of research and practical applications.

Materials and Methods:

The present analytical cross-sectional study was conducted to measure stature and head length of the study participants and to derive correlation between these measurements. The study was conducted in the Department of Forensic Medicine, Shri Ram Murti Smarak Institute of Medical Sciences, Bareilly, Uttar Pradesh after getting approval from Institutional Ethical Committee. The aim and objectives of the intended study were explained to the subjects and informed consent was taken. Prior ethical approval was obtained from the Institutional Ethical Committee. Study population comprised of students of MBBS and paramedical institute belonging to Uttar Pradesh state only. The study's inclusion criteria comprised students willing to participate, exclusively belonging to Uttar Pradesh, apparently healthy at the time of measurements, and within the age group of 18 to 30 years. On the other hand, students unwilling to participate, appearing unhealthy during measurements and those with skeletal or craniofacial deformities were excluded from the study. Additionally, students with Dwarfism and Gigantism were also excluded from the research sample. These criteria were implemented to ensure a suitable and representative cohort for the study, enhancing the accuracy and reliability of the results in exploring the correlation between stature and head length in the specified population.

$$N = 4 + \{(Z\alpha + Z\beta) \backslash C\}$$

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Where, C=0.5*ln ([1+r]/[1-r]), Zα as 1.96, (for 5% error), Zβ as 2.58 (for 95% power)

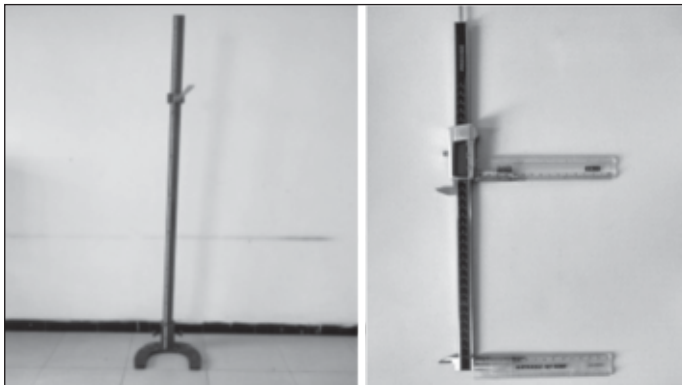and value of r as 0.5. The minimum number of sample required came out to be 72. For better precision of results a sample of 150 males and 150 females was taken.

Parameters and Anatomical Landmarks: In this study, two primary parameters were measured: stature (height) and head length. Stature referred to an individual's height, measured from the ground to the highest point on their head when standing erect. It is a fundamental anthropometric measurement used in various fields, including forensic medicine and healthcare. Head length was considered as the linear measurement from a specific anatomical landmark to another on the head. The anatomical landmarks used for head length measurement were "glabella" (the most prominent point on the forehead between the eyebrows) to "inion" (the external occipital protuberance at the back of the head). Vernier callipers were modified by addition of a common scale on the extended jaws (Illustration attached).

Data Collection: The study utilized several standard anthropometric instruments, including a Stadiometer and Vernier Calipers. To ensure consistency and minimize potential confounding factors, all measurements were conducted in a well-lit room at a fixed time between 2 pm and 5 pm, thus eliminating any diurnal variation that could affect the results.[5] The primary measurements taken from each student were their stature (height) and head length, and these measurements were recorded in centimeters to the nearest millimeter. To maintain accuracy and reduce potential errors, all measurements were taken by a single observer to avoid inter-observer bias. The process of recording measurements adhered to the guidelines provided by Singh and Bhasin, further ensuring the reliability and standardization of the data collection method.[6] By using these well-established anthropometric instruments and strictly adhering to standardized procedures, the study aimed to provide robust and valid data for analyzing the correlation between stature and head length in the study population.

Statistical Analysis: Data analysis involved entering the collected data into MS Excel 2010 and performing statistical analysis using SPSS software (V 20.0, IBM, U.S.A.). The computed statistical values encompassed mean, standard deviation, and median, providing a comprehensive overview of the data distribution. To determine the correlation between

stature and head length, Pearson's correlation coefficient was calculated. Additionally, regression equations were derived to predict stature based on head length measurements. A significance level of $p < 0.05$ was applied, indicating that results with a p-value below this threshold were considered statistically significant. These statistical procedures were employed to explore and quantify the relationship between stature and head length, facilitating the study's aim of establishing a correlation and enabling the prediction of stature from head length in the study population.

Results:

A total of 300 students participated in the study, out of which 150 were males and 150 were females. Participants belonged to the age group of 18-30 yrs. Mean age of the male study participants

Table 1. Distribution of the study participants based on sociodemographic characteristics:

Gender	N	Min (cms)	Max (cms)	Mean (cms)	SD (cms)	Median (cms)
Male	150	154	189	171.66	7.11	171
Female	150	142	172	157.89	6.03	158.75
Total	300	142	189	164.77	9.53	164
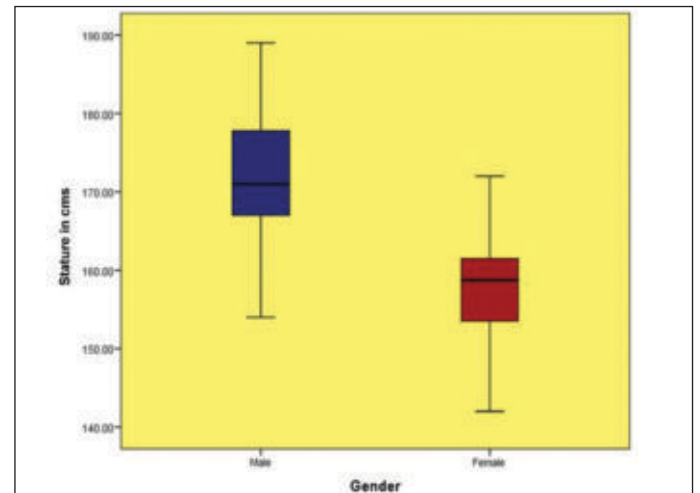
Figure 1. Box and whiskers plot showing the distibution of stature of study participants according to the gender.
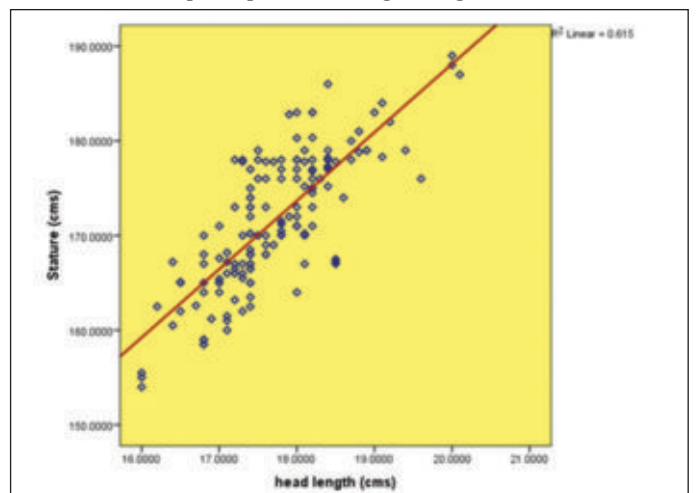
Figure 2. Scatter plot showing relationship between stature and head length along with regression trend line.

Illustration of the instruments used. (a) Stadiometer (b) Vernier Callipers.

was 21.01±1.55 years while it was lower 20.34±1.029 years among the females. Min and Max age of the study participants as reported in this study was 18 years and 25 years for both the gender groups respectively. The difference was noted in the median age among the males that was 21 years and females which was 20 years.

The mean stature of the males was 171.66±7.11 cms and it was 157.89±6.03 cms among the females. The stature of the tallest male and female was 189 cms and 172 cms respectively while the stature of the shortest one was 154 cms for male and 142 cms for female. Median stature among the males was 171 cms and among the females was 158.75 cms (Table 1). Overall mean stature of the study participants came out to be 164.77±9.53 cms, ranging from 142 cms to 189 cms and median stature was 164 cms (Fig. 1).

The relationship of stature with head length in male study participants. Pearson's correlation coefficient value was found out to be + 0.784 which is showing that stature is positively correlated with head length and the strength of correlation is strong. The correlation coefficient between the stature and the head length was found to be statistically significant ($p < 0.01$) (Table 2). The relationship of stature with head length in male study participants. The figure shows a positive correlation between stature and head length. The value of regression coefficient (R^2) is found to be 0.615 which states that 61.5% of the values of stature can be predicted using the head length (Fig. 2: Scatter diagram).

The relationship of stature with head length in female study participants. Pearson's correlation coefficient value was found out to be + 0.629 which is showing that stature is positively correlated with head length and the strength of correlation is strong. The correlation coefficient between the stature and the head length was found to be statistically significant ($p < 0.01$) (Table: 3).

The regression model presented here depicts the value of constant as 43.684 with the standard error of 8.333. The value of the

Table 2. Correlation of stature with head length in male study participants.

		Stature	Head Length
Stature	Pearson's Correlation	1	0.784**
	Sig. (2 Tailed)		<0.01
	N	150	150

Table 3. Correlation of stature with head length in female study participants.

		Stature	Head Length
Stature	Pearson's Correlation	1	0.629**
	Sig. (2 Tailed)		<0.01
	N	150	150

Table 4. Regression analysis between the stature and head length in male study participants.

	B	Std. Error	Beta	t	Sign. (p value)
Constant	43.684	8.333		5.242	<0.01
Head length	7.222	0.470	0.784	15.372	<0.01
Dependent variable is considered to be stature.					

Table 5. Regression analysis between the stature and head length in female study participants.

	B	Std. Error	Beta	t	Sign. (p value)
Constant	72.066	8.719		8.266	<0.01
Head length	5.113	0.519	0.629	9.854	<0.01
Dependent variable is considered to be stature.					

intercept is found to be 7.222 with standard error 0.470. The model is tested for significance and the value of t came out to be 5.242 for the constant and 15.372 for the intercept. Both the values are found to be statistically significant at $p < 0.01$ (Table: 4).

The regression model presented here depicts the value of constant as 72.066 with the standard error of 8.719. The value of the intercept is found to be 5.113 with standard error 0.519. The model is tested for significance and the value of t came out to be 8.266 for the constant and 9.854 for the intercept. Both the values are found to be statistically significant at $p < 0.01$ (Table: 5).

Linear equation for derivation of stature from head length in study participants:

Males	$Y = 43.684 + 7.22x$	{p value <0.01 }
Females	$Y = 72.066 + 5.113$	<0.01

The equation is represented in the form of $y = a + bx$, where, y is the value of the stature, a is the constant, b is the intercept and x is the value of the predictor variable.

Discussion:

This study contributes valuable evidence by establishing a clear correlation between stature and head length in a specific population of adults from Uttar Pradesh. It provides quantitative data on the relationship between these anthropometric parameters, which can aid in various applications, including identification from mutilated remains and solving critical forensic cases. Additionally, the study presents regression equations that allow for the estimation of stature from head length measurements. Such findings can enhance our understanding of human body proportions and assist in diverse fields such as forensic medicine, healthcare assessments and biometric analysis.

Anthropometry means the measurement of human beings, whether living or dead or on skeletal material.[7] No two individuals are exactly alike in all their measurable traits, even genetically identical twins (monozygotic) differ in some respects. In the present study majority 133 (44.33%) of the study participants were in the age-group of 20 completed years followed by 86 (28.67%) of the study participants who belonged to the age group of 21 completed years.

Similar age group has been included in the study of P Kanchan et al. where the age group of the study participants was 18 to 24 years and in the study of Varghese M Alex where the age group of the study participants was 18 to 25 years.[8,9]

The present study shows that the mean stature of the males was 171.66±7.11 cms and it was 157.89±6.03 cms among the females. Similar have been reported in the findings of SM Patel where the mean height of the males were 170.96 and of the females was 156.14 cms and also in the study of Arti LN where the mean height of males were 170.75 cms and of the females was 156.28cms.[10,6]

This study found that the mean head length of the males was 17.72±0.77 cms and it was 16.78±0.74 cms among the females. The head length of the males and females ranged from 16.00 cms to 20.10 cms and 14.80 to 18.80 cms respectively.

Median head length among the males was 17.60 cms and among the females was 16.80 cms. Overall mean head length of the study participants came out to be 17.25±0.88 cms, ranging from 14.80 cms to 20.10 cms and median head length was 17.30 cms.

In P Kanchan et al. mean head length for males was 18.5±0.72 cms which is slightly higher than the present study and also it was the same with the mean head length of females that was 17.53±0.81 cms.[8]

In this study pearson's correlation coefficient value was found out to be +0.784 between stature and head length in males and in female sit was +0.629. The correlation coefficient between the stature and head length was found to be statistically significant in both males and females ($p < 0.01$).

Study by Bardale et al. in males, found correlation coefficient for head length with height as 0.39 with standard error of estimate as 6.08. In females, for the same they found correlation coefficient of 0.32 with standard error of estimate of 5.67.[11]

In another study done in Kathmandu, Nepal substantial positive correlation between head length and height was found (r=0.734, P<0.001). This correlation implies that as head length increases, height also tends to increase. The study's regression equation, y=12.9+8.45x, with x representing head length and y representing body height, offers a practical means to predict body height based on head length measurements.[12]

Highly significant correlation was found between height and head circumference. The equation relating stature to the head circumference was derived as stature, y=97.19+1.11 head circumference for females and y=88.77+1.45 head circumference for males.[13] While a moderate positive correlation was observed in another study, the correlation coefficient values of 0.48 for males and 0.43 for females suggest that as one variable increases, the other variable tends to increase as well, but the relationship was not very strong.[14]

However, a study anticipated that the stature estimation derived from measurements of the cranium would be less accurate compared to those obtained from long bones, which are more commonly used in forensic anthropology for this purpose. Specifically, they expected that the estimates based on cranial measurements would have broader confidence intervals, indicating lower precision in the predictions. Nevertheless, they believed that these estimations would still offer reasonably narrow prediction intervals, making it feasible to use cranial measurements for stature estimation in forensic contexts.[15]

Conclusion:

These results indicate that stature can be accurately predicted from head length, facilitating identification from mutilated remains and assisting in critical forensic cases. The correlation and regression equations derived from the study can aid in predicting stature from other parameters included in the research, helping resolve medico-legal issues. However, it's crucial to note that these equations are valid only for the specific population studied and should not be generalized to other geographical populations without further research.

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ORIGINAL ARTICLE

A Study on the Pattern of Fingerprint Ridges for Determination of Gender in an Ethnic Tamil Population in Thiruporur Taluk of Tamilnadu

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Abstract:

Human identification is critical, although it might be difficult given that each person has a particular trait. Fingerprint is the best identification of both living and deceased individual. There are patterns like ridge density, macro characteristic and micro characteristic in fingerprint. Ridge density and thickness plays major role in differentiation male and female gender. This is comparative study conducted on 223 volunteers of 125 female and 98 males under the age group varying from 18-65 years in Tamil speaking population in Thiruporur Taluk. After informed consent and preliminary data, fingerprints were obtained from the volunteers by means of simple inking method as suggested by Cummins and Midlo for fingerprint pattern we used blue stamp ink with clean and dry hands of all ten fingers, fingerprint were imprinted on fingerprint format paper. The present study resulted that mean value of ridge density of female vary from 11.2 – 12.7 ridges/mm^2 with average of 11.95 ridges/mm^2 (~ 12 ridges/mm^2) and mean value of ridge density of male are 12.1 -13.7 ridges/mm^2 with average of 12.9 ridges/mm^2 (~13 ridges/mm^2) which shows that male have higher ridge density than female. In our study 'P' value compared between male and female showed non-significance in all fingers except little finger which was significant. Fingerprint ridge density is a very important parameter useful in gender distinction. In this study the fingerprint ridge density was found to be higher in males than in females. This will be useful among individuals of ethnic Tamil descent to predict the degree of sexual dimorphism based on ridge density pattern,

Keywords: Fingerprint; Identification; Ridge density; Ethnic; Tamil; Sexual dimorphism.

Introduction:

Fingerprint plays an important role for the identification of an individual in both living and deceased. Nowadays, Fingerprint identification is one of the most extensively used biometric technologies.[1] Fingerprint is a terminology which predominantly means an impression of the epidermal ridges of the fleshy distal portion of a finger formed by applying ink and pressing the finger on paper and is used as means of establishing identity. In 1926, Cummins and Midlo first coined a termed called dermatoglyphics which mean the study of fingerprint.[2] The word dermatoglyphics took from greek words where derma means skin and glyph means curve. Later, all over the world the study of fingerprint was known as dactyloscopy.[3] Before the development begins in 7th week of gestation there is a formation of volar pads. These pattern of elevation over the volar area of thenar, and hypothenar regions of the finger surfaces are not permanent but are temporary.[4] In intrauterine development the fingerprint development in foetus occurs between 10th to 14th week of gestation. Dermal ridges start to appear during the 12th week of intrauterine life and completed by the 24th week of intrauterine life.[5-7] These patterns are genetically determined and formed once, remain permanent for a lifetime.[8] Scientifically and mathematically proved that even identical and non – identical twin born with same zygote does not have same fingerprint. Statics shows that one in 64 million of population in worldwide shows same fingerprint.[9]

Gender is determined using ridge metrics which includes thickness to valley thickness ratio, ridge count, ridge density, ridge breadth, macro characteristic and micro characteristic. An important component of epidermal ridge is ridge density or number of ridges occurs in defined space in fingers. Ridge density has two important parameters: (1) Ridge breadth and (2) Ridge-to-ridge (furrow) distance. The fingerprint ridge density is the number of ridges present in a unit area of a fingerprint (FPRD). The density of epidermal ridges can be calculated using two parameters: Ridge width and distance between ridges.[10,11] The thickness of the epidermal ridges varies from person to person and from gender to gender. The number of ridges present in a unit area of a fingerprint is known as fingerprint ridge density. It is also known as the number of ridges in a specific location. The density of the epidermal ridge can be determined by looking at the following two parameters:

1. The width of the ridge. 2. The distance between ridges is measured in meters.

Individual epidermal ridge thickness varies with gender difference.[12] This present study was done with the aim to evaluate the ridge density of fingerprint patterns for determination of sex among ethnic Tamils using fingerprint format sheet.

Materials and Methods:

This cross-sectional study was conducted at Thiruporur Taluk of

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Tamil Nadu on an ethnic Tamil population from the period of July 2021 to July 2022. The study subjects were males & females of ethnic Tamil origin. The study was done among 223 (98 males and 125 females) of participants between the age group of 18 – 65 years living in Thiruporur Taluk. After the institutional ethical committee clearance (IEC No: 2019/446), the study was undertaken in the department of Forensic Medicine & Toxicology at Shri Sathya Sai Medical College & research Institute. Informed consent was obtained from the volunteers.

After collecting the preliminary data related to the subjects like name, age, sex, mother tongue and address, fingerprints of all the ten fingers of the hand was collected. The fingerprints were obtained from the participants by means of simple inking method as suggested by Cummins and Midlo. The selected subjects were asked to wash and dry their hands. A clean fingerprint plate was smeared with Kores thumb impression ink (black), with the help of a roller. The subjects were then asked to ink their fingers, rolling nail to nail on the inked surface, and imprint them on the finger-print slip in the designated area of all ten fingers. Hence fingerprints from 223 subjects (2230 prints) were analyzed during the study. Two straight lines bisecting each other were drawn. This bisecting point will be placed at the core or center of

the print. 5 mm above this, another transverse line will be drawn. Two squares of 25 mm^2 each were drawn on both sides (left and right). Ridge counting was analyzed and tabulated in all ten fingers of both males and females. The average tabulated values for both sides will represent the ridge density in a 25 mm^2 area.

For statistical analysis the data collected was tabulated and analyzed. The variations of average mean of ridge density and the ridge thickness were calculated for all the ten fingers in males and females. The differences in fingerprint ridge densities between the sexes were analyzed individually for each finger in both hands together. Student's t-test was applied for comparative analysis 'P' value of less than 0.05 was considered as significant.

Results:

The data analysis of this study on 223 volunteers (98 males and 125 females) shows that mean value of ridge density of female vary from 11.2–12.7 ridges/mm^2 with average of 11.95 ridges/mm^2 (~12 ridges/mm^2) and mean value of ridge density of male are 12.1-13.7 ridges/mm^2 with average of 12.9 ridges/mm^2 (~13 ridges/mm^2) which shows that male have higher ridge density than female (as shown in table -1).

Mann Whitney U-test done for all ten fingers which states that there exists no significant difference between the median of male and female samples in the all fingers of both the hands (as shown in table–2).

Student's t-test will be applied for comparative analysis where 'P' value of less than 0.05 was considered as significant. In our study 'P' value was not significant when compared with all fingers of both male and female except in little finger which showed a significant in right hand of p - 0.031 and left hand of p - 0.039 and

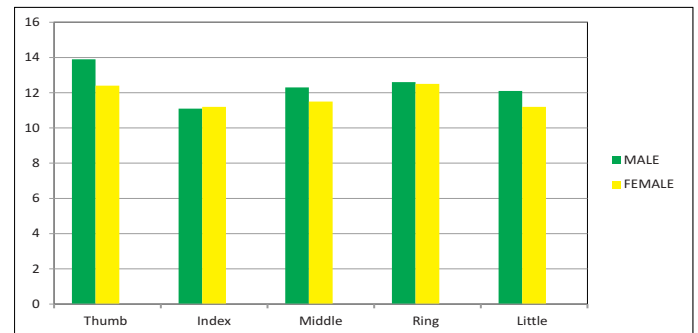**Table 1. Mean value of ridge density of male and female.**

Finger	Male		Female		t statistic	p-value
	Mean	SD	Mean	SD		
Right hand						
Thumb finger	13.8	4.2	12.7	4.2	1.834	0.068
Index finger	11.1	3.0	11.2	3.0	0.279	0.780
Middle finger	12.2	3.7	11.8	3.4	0.788	0.431
Ring finger	12.6	3.7	12.4	3.1	0.456	0.649
Little finger	12.1	3.3	11.2	3.0	2.172	0.031*
Left hand						
Thumb finger	13.9	3.5	12.4	4.4	2.778	0.006
Index finger	12.6	3.7	11.2	3.0	1.379	0.168
Middle finger	12.3	3.8	11.5	4.4	1.394	0.165
Ring finger	12.6	3.4	12.5	3.3	0.306	0.760
Little finger	12.1	3.4	11.2	2.8	2.071	0.039*

**Table 2. Mann whitney U-test for right and left of all ten fingers.**

Finger	z-value	p-value
Right hand		
Thumb finger	2.697	0.007
Index finger	0.279	0.780
Middle finger	1.228	0.220
Ring finger	1.796	0.072
Little finger	3.488	0.0005
Left hand		
Thumb finger	2.729	0.006
Index finger	1.379	0.168
Middle finger	1.579	0.114
Ring finger	0.832	0.405
Little finger	3.614	0.0003

Table 3. Comparison of 'P' value between right and left little finger.

Finger	P value
Right little finger	0.031*
Left little finger	0.039*

Figure 1. Graphical comparison of right - hand ridge density of male and female.
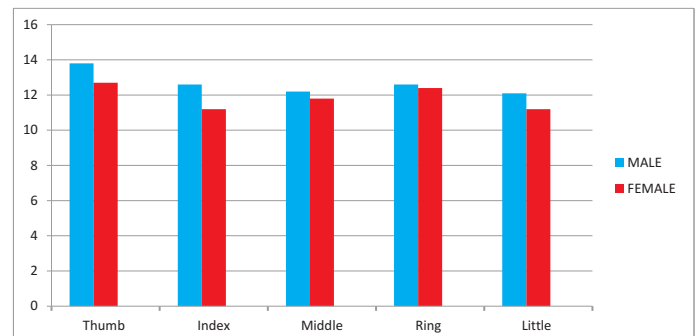
Figure 2. Graphical comparison of left hand ridge density of male and female.

left-hand show slightly higher value than female as comparison (as shown in table – 3).

In accordance with findings in this study ridge density of male and females of both hands are shown in graphical diagrams (as shown in fig. 1 & 2).

Discussion:

Among fingerprint pattern ridge density plays an important role in differentiating sex in various ethnic groups. The appreciation of finding ridge density goes to Cummins and midlo. This study shows sex determination among Tamil ethnic groups using ridge density pattern of fingerprint. Our present study show average mean ridge density of male ~ 13 ridges/mm^2 and female ~ 12 ridges/mm^2 respectively which says that male ridge density is higher than females where similar findings of previous studies such as Khadri SY, who found that male have ridge density of 12.4 ridges/mm^2 slightly greater than female having 12 ridges/mm^2 respectively.[13]

Compared with previous studies which differ from present study like Gagandeep Singh showed that female have ridge density of greater than 14 ridges/mm^2 when compared with male who have ridge density lesser than 14 ridges/mm^2 which resulted that female have higher ridge density than male.[14] Some other author like Regine Ynez H. De Mesa also showed dissimilar with present study showing female (25 ridges/mm^2) have higher ridge density than male (17 ridges/mm^2).[15] Even Natarajan Moorthy T study findings were not in concurrence with this study and showed that females (12 -14 ridges/mm^2) have higher ridge density than male (11 ridges/mm^2).[16] Amira A et al. study also have different finding when compared with present study which resulted female (~15 ridges/mm^2) have higher ridge density than male (~12 ridges/mm^2).[17] Study of TM Sucharitha showed dissimilar findings when compared with present study were female (~15 ridges/mm^2) have higher ridge density than male (~13 ridges/mm^2).[18] Thakkar analyzed that female (~14 ridges/mm^2) have higher ridge density than male (~12 ridges/mm^2) which was not similar with our present study.[19] Nayak analyzed that female (~15 ridges/mm^2) have higher ridge density than male (~11 ridges/mm^2) which dissimilar to present study.[20] Nithin analyzed that female (~14 ridges/mm^2) have higher ridge density than male (~13 ridges/mm^2) which was not alike to our present study.[21]

Gutierrez-Redomero analyzed that female (~17 ridges/mm^2) have higher ridge density than male (~16 ridges/mm^2) which was different to present study.[22] Kumar analyzed in index and middle finger of female having mean ridge density of index (13.22 ridges/mm^2), middle (13.94 ridges/mm^2) and male having mean ridge density of index (12.32 ridges/mm^2), middle (12.7 ridges/mm^2) showed that female have higher ridge density of index and middle finger compared with male which was dissimilar to our present study.[23]

The study of Chavan VA and Rajesh Kumar showed no significant difference of ridge density of males and females in Marathwada population and these findings neither agreed nor disagreed with the findings of the present study.[24] Another study done Nagurka ML showed that ridge density feature alone was not an effective factor for gender determination.[25]

The finding of increased ridge density in male subjects of the present study compared to females have differed with the findings of several other studies and this could be attributed to the possible reason that this study have been conducted in the ethnic Tamil population living in the Thiruporur taluk of Tamil Nadu and since this is ethnically a different population compared to the other studies which have been done in other ethnically different and diverse population. As India is a land of several ethnic diversities hence there is always a strong possibility of observing variable findings and this also explain the finding of increased male ridge density in this study compared to females.

Conclusion:

Fingerprint is considered as the best identification marker in both living and deceased individual. There were many studies on different population across the world to determine sex based on ridge density pattern in all ten fingers. The findings of this study showed that male have higher ridge density than female and this may be useful in differentiating between genders based on fingerprint ridge density analysis.

The findings of this study may be applied in establishing the degree of sexual dimorphism among the Tamil males and females based on fingerprint ridge density pattern found at the scene of crime.

Limitation of the study:

This study was done in a taluk of Tamil Nadu and for future research and extrapolation of the findings and results of this study it is essential to conduct similar studies in different other taluks and districts of Tamil Nadu to compare the findings and develop a broad database which will be useful to predict the identification of sexual dimorphism from the examination of fingerprint ridge density in the population of Tamil Nadu.

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ORIGINAL ARTICLE

Impact of COVID-19 Pandemic on Suicide Rates in Vidisha: A Record and Verbal autopsy Based Mixed Method Study

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Abstract:

COVID-19 came as a challenge to the world. Several ad hoc measures were adopted by countries to control the spread of the virus. These measures involved lockdowns which encompassed the closure of workplaces, entertainment places, and schools, loss of jobs, loss of income and inability to leave the house. These led to an increase in mental health issues in the population ultimately leading to an increased incidence of suicides. This study was done to identify the prevalence of suicide cases before and during the COVID-19 pandemic in the Vidisha district and to find various reasons and perceptions behind the suicides that happened during the COVID-19 period. First-order family members of 11 deceased individuals were interviewed with a semi-structured questionnaire.

It was found that the number of suicides during-COVID period increased to more than 1.5 times the pre-COVID number. This might be due to the unavailability of poison due to the lockdown, that the number of hanging cases increased more as compared to poison. Females had a significant association between the manner of suicide and the period. Pandemic-associated lockdown closure of economic activities, isolation and increased domestic conflicts were found to be the major factors that were responsible for suicides during the pandemic. Studies also showed that suicide is perceived as a weakness and a quick escape from problems.

Keywords: Suicide; COVID-19; Verbal autopsy.

Introduction:

COVID-19 started spreading in 2019 as a small outburst in the Wuhan province of China which quickly turned into a pandemic affecting almost the entire world, bringing the world to a standstill. The COVID-19 pandemic and mitigation measures have affected the mental health of millions of people across the world.[1] To control and restrict the spread of the virus, strict quarantine was implemented; while several countries including India enforced lockdowns. Social distancing, isolation and other factors like economic constraints, closure of educational institutes, leisure and recreational activities, loss of family member(s), loss of income, etc., caused great stress which triggered a wide variety of psychological problems such as panic disorder, anxiety and depression.[2]

While lockdown and social isolation have been recognized and regarded as effective measures to stop the spread of the COVID-19 virus, the reduced access to family, friends, and other social support systems caused loneliness, increasing mental health issues like anxiety and depression.[3-5]

Vulnerable groups for increased stress and anxiety include women, younger ages, and the unemployed. The stressors recognized include fear of contracting COVID-19, inability to

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execute a routine exercise schedule and worry about the future.[6] This has caused a surge in mental health-related issues (fear of COVID-19 infection, anxiety, stress, post-traumatic stress disorder, and depression) among the general population and healthcare workers.[7]

Various experiences from past epidemics suggest that these mental health issues can lead to an increased tendency to commit suicide in an individual with or without pre-existing mental or medical illness.[8,9] An autopsy examination is the gold standard for defining causes of death. The COVID-19 pandemic and its associated difficulties in terms of conducting autopsies have only further necessitated an alternative. One of the most interesting alternatives to the conventional autopsy is the verbal autopsy, a tool that originated in Africa and Asia in the 1950s and consists of a structured interview with the deceased's family members concerning the symptoms manifested by the person and the circumstances of death.[10]

Verbal autopsy is an important research tool that helps in determining the cause of death in cases where no or incomplete medical records are present or no medical attention was given to the deceased. WHO suggests that verbal autopsy can fill a critical gap in measuring the mortality from COVID-19 for deaths which occur outside of a healthcare setting.[11] Despite its use in different parts of India's health care delivery system, verbal autopsy remains an under-utilized and often misunderstood epidemiological tool.[12,13] Currently, there is a gap in suicide statistics and verbal autopsy data in India which can mainly be associated with the stigma attached to the subject. To establish more unbiased trends in understanding and prevention of suicide,
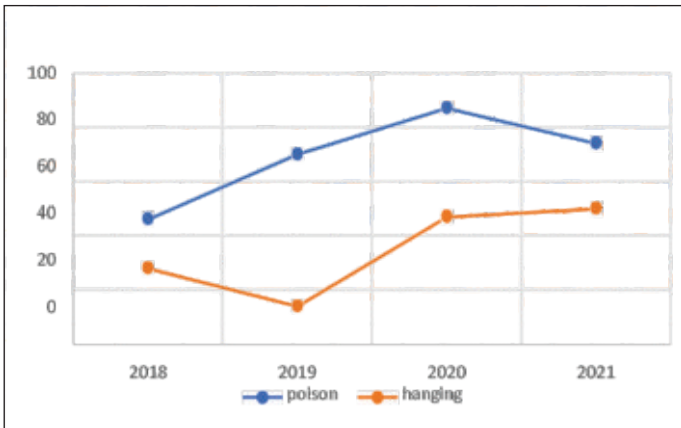
Figure 1. Year wise numbers of poisoning and hanging.

Figure 2. Manner of suicide.

Figure 3. Pre-covid.

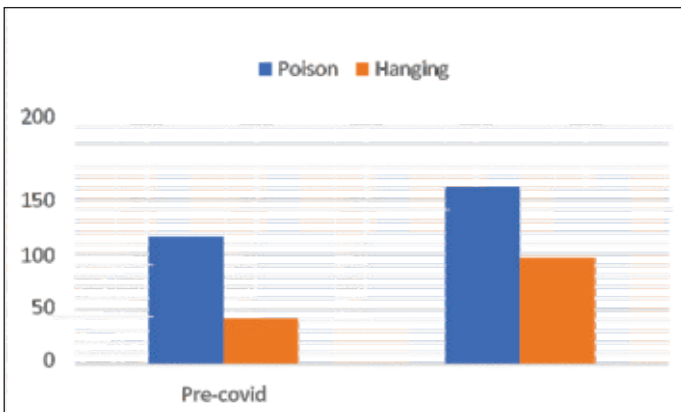**Figure 4. During covid.**

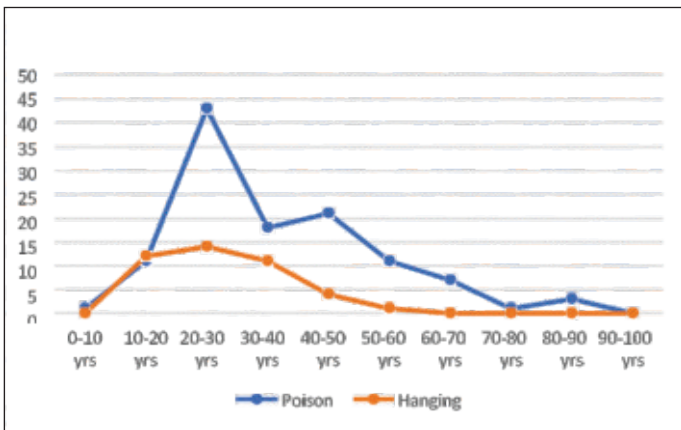**Figure 5. Manner of suicide in males.**
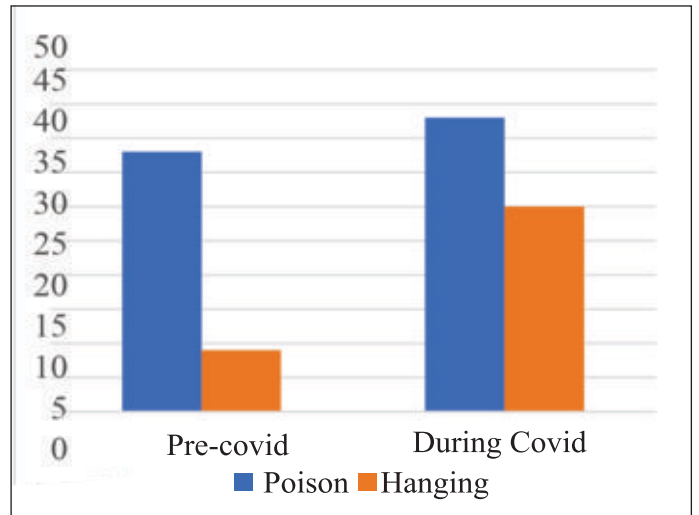
Figure 6. Manner of suicide in females.

it is necessary to carry out research focused on number of suicides and the predisposing factors. The present study was conducted with the objectives to find the prevalence and proportion of suicide cases before and during, identifying manners of suicide deaths and finding out various reasons and perceptions behind suicide cases through verbal autopsy.

Materials and Methods:

It is a mixed-method study with both quantitative and qualitative components. The study was conducted in two parts. The first part of the study is a quantitative analysis of the suicide rates before and during the pandemic. The second part of the study is the qualitative research where various reasons and perceptions behind suicide cases were gathered through verbal autopsy, by in-depth interviews of the first-order family relatives of the deceased. The study was conducted in the month of July 2022, at medical college hospital and the district hospital of Vidisha, after receiving approval from the Institutional Ethics and Institutional
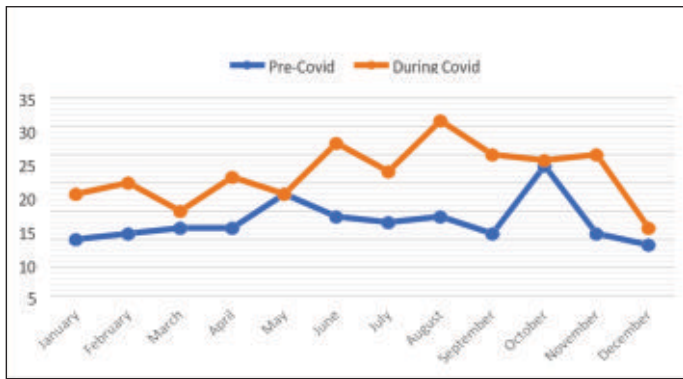
Figure 7. Month wise suicide trends.

Table 1. Age-wise distribution.

Age Group		Poison	Hanging	Total
0-10 years	Pre-COVID	1	0	1
	During COVID	1	0	1
	Difference	0	0	0
10-20 years	Pre-COVID	11	12	23
	During COVID	31	21	52
	Difference	20	9	29
20-30 years	Pre-COVID	43	14	57
	During COVID	57	32	89
	Difference	15	18	33
30-40 years	Pre-COVID	18	11	29
	During COVID	31	24	55
	Difference	13	13	26
40-50 years	Pre-COVID	21	4	25
	During COVID	22	10	32
	Difference	1	6	7
50-60 years	Pre-COVID	11	1	12
	During COVID	13	5	18
	Difference	2	4	6
60-70 years	Pre-COVID	7	0	7
	During COVID	6	3	9
	Difference	-1	3	2
70-80 years	Pre-COVID	1	0	1
	During COVID	0	0	0
	Difference	-1	0	-1
80-90 years	Pre-COVID	3	0	3
	During COVID	0	1	1
	Difference	-3	1	-2
90-100 years	Pre-COVID	0	0	0
	During COVID	0	1	1
	Difference	0	1	1

Research Committee.

The data was collected after the subject expert gave the research team formal training. Informed, written consent was taken from the interviewee before the interview. Full confidentiality and anonymity were assured for the family members and the deceased. For the quantitative part of the study, hospital records were accessed from the MRD section of the hospitals with prior permission from the concerned authorities.

For verbal autopsy, only the cases that fulfilled the following inclusion criteria were included-

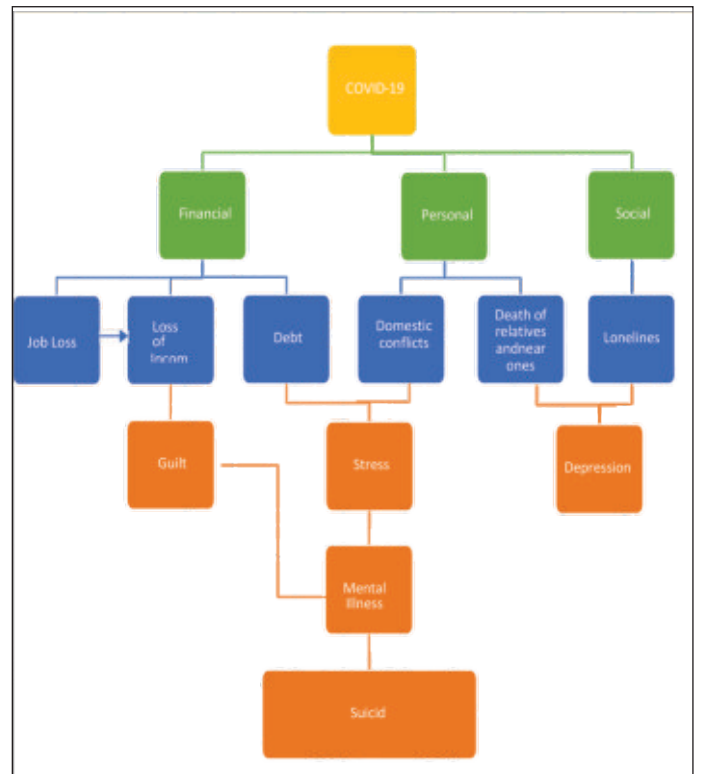1. The deceased ware the resident of the Vidisha district.

Figure 8. Thematic analysis of the reasons for suicides during Covid period.

2. The death occurred unnaturally and was labelled under various causes of suicide.

3. The subject agreed to participate in the study voluntarily and consent was obtained.

The following cases were excluded from the study-

1. Deceased is a resident outside the Vidisha district.

2. The family of the deceased is unwilling to participate in verbal autopsy or is unwilling to give consent.

3. Cases with insufficient or doubtful data were excluded.

For the quantitative part, retrospective data of all the suicides that have occurred over the period of 2 years before the COVID-19 pandemic in Vidisha (i.e., between January 2018 and December 2019) and 2 years during the pandemic (i.e., between January 2020 and December 2021) were accessed from the MRD section of the hospitals. From these records, 416 confirmed suicide cases were identified. These were confirmed by the history, findings and opinions mentioned in the post-mortem reports. The manner of suicide in these cases ware either poison consumption or hanging. Though there were some other manners of suicide as well like drowning, falling from heights and train accidents, it could not be confirmed if they were suicidal or accidental deaths. Therefore, these cases were excluded from the study. The data was then tabulated for further analysis.

For the qualitative part, the address and/or contact details of the family member were retrieved from the post-mortem report and from the respective police station records. A verbal autopsy was done by visiting the family of the deceased door-to-door, by

means of in-depth interviews of the family member of the deceased. A home-based interview was adopted to make the subject feel comfortable and relaxed in the setting of his/her home. A pre-tested piloted, semi-structured questionnaire was used for the interview, which was developed in close association with the experts and it was peer-reviewed and pre-tested. The questionnaire was developed from a semi-structured interview guide that was published in 2020, for Indian settings.[14] Though very elaborate, the interview guide was lacking in the component of COVID-19. Therefore, relevant questions were added to the same after discussion with subject experts. The questionnaire was then pre-tested. The subjects were also provided with a Participant Information Sheet in the vernacular language and Informed Written Consent was taken. Training and sensitization sessions for empathy, privacy and confidentiality were conducted under the guidance of a guide and co-guide as the subject is related to sensitive matters of death and suicide.

Of all the cases during COVID-19 pandemic, that were identified and shortlisted for the qualitative study, 11 subjects agreed to participate and gave their consent. The appointment was sought from the participants beforehand for the interview. A detailed informed written consent form was provided to the participants. All of the contents were explained in an easy and comprehensive language. All of their queries were answered. Participants were given Investigator's contact details for future use.

Hospital records were accessed and analyzed for suicide rate data. This record was present with the hospital administration. Post Mortem reports were checked to ascertain the manner of suicide. Quantitative data was entered and analyzed using Microsoft excel. The chi-square test was applied to find the association between the manner of suicide and the number of suicides pre-COVID and during-COVID periods in males and females. A qualitative assessment was done by thematic analysis.

Results:

A record of a total 416 suicide deaths between 2018 and 2021 was found in the associated hospitals. Out of these, 296 (71.15%) were males and 120 (28.84%) were females. Before the COVID pandemic (i.e., 2018 and 2019), 111 males and 47 females committed suicide. The mean age for males was 34.96 years whereas the mean age for females was 35.13 years. During the COVID pandemic, 185 males and 73 females committed suicide. The mean age for males was 32.79 years whereas the mean age for females was 32.87 years.

In the pre-COVID pandemic period, out of the total 158 suicides that occurred in the Vidisha region, 116 occurred by poisoning whereas 42 occurred by hanging. During the COVID pandemic period, a total of 258 suicides occurred in the region, out of which 161 were by poisoning and 97 were by hanging. Figure 1 shows the year-wise numbers of poisoning and hanging. Over the course of 4 years, the number of deaths by poisoning increased till 2020 and it decreased in 2021. In contrast to this, the number of deaths by hanging declined till 2019, after which it saw a sharp rise in 2020 (the first year of the COVID-19 pandemic) and a slight increase in 2021.

Age group distribution with a range of 10 years shows the

unimodal distribution in both periods as shown in the figure 3 and 4. From Table 1 the age group of 20 to 30 years saw the highest number of suicides in both pre-COVID period and during-COVID period, But the number was more during COVID period.

The number of poisoning deaths increased by 15 whereas the number of hanging deaths increased by 18 for the age group. While age group of 20 to 30 years had the highest number of suicides (57 and 89), the second highest number of suicides (29 and 55) were recorded in the age group 30 to 40 years followed by age group of 10 to 20 years (23 and 53).

Chi square test was applied to find association between the manner of suicide and the time period (table 3 & 4). The p value for males was more than 0.05 (statistically non-significant) but the p value for females was less than 0.05 showing that the data for females is statistically significant.

For the month wise distribution of number of suicide deaths (figure 7), unpaired T-test was applied. The p value was found to be less than 0.001 (p=0.0002) and was statistically highly significant. The pre-COVID period had the highest peak at October followed by the second highest peak in May. During-COVID period, these were August and June respectively.

For the qualitative part, 21 subjects were interviewed. Thematic analysis was done for the qualitative data of the study (figure 8). Various financial reasons like job loss, income loss and debt; personal reasons like domestic conflicts and death of relatives and near ones; social reasons like loneliness were found to be the major reasons that led to feelings of stress, guilt and depression which ultimately led to mental illness and ended in suicide. Reasons like losing money in gambling are included under 'loss of income', whereas isolation comes under loneliness. During interview, various perceptions of family members regarding suicide were observed. Family members perceived suicide as a quick escape from crisis and thought that it did not merit any sympathy for the deceased. Family members had some anger towards the deceased. In case of suicide of young adults (between 18 to 25 years), family members also had regret that the deceased did not try to share their problems and were dealing with them alone.

Discussion:

The study concluded that poisoning was the most popular method of committing suicide in Vidisha in the pre-COVID period. This is in agreement to a study conducted in Bhopal by Singh et al.,[15] to study the manner of suicide in the city. During- COVID period, although poisoning was still the most common method of committing suicide, the number of deaths by hanging increased more than number of deaths by poisoning. The reason can be attributed to the fact that during most of the year, lockdown was imposed and hence it became difficult to gain access to poison

In both pre-COVID period and during-COVID period, highest number of suicides were recorded in the age groups of 10 to 20 years and 20 to 30 years. The results are consistent with a similar study conducted in Cooch Behar Government Medical College and Hospital, Cooch Behar by Sengupta et al.,[16] where it was found that most cases of suicide were in age group of 10 to 20 years and 20 to 30 years. In both pre-COVID period and during-

COVID period, a male dominance in the number of suicides is observed. Similar results were obtained in the study mentioned above.

In both pre-COVID period and during-COVID period, the highest number of suicides were recorded in October and May. Contrast to this, during-COVID period, highest number of suicides were recorded in June and August. The result is consistent with the study from Nepal by Acharya et al.,[17] which found that the highest number of suicides were recorded in June, July and August, during-COVID period. Overall, in both pre-COVID period and during-COVID period, higher number of suicides were recorded in the 2nd half of the year, i.e., July to December, as compared to the 1st half (January to June) of the year. A possible reason for this difference could be that the 2nd half of the year in India has major festivals and these festivals can lead to financial crisis and increased stress.

In Vidisha region, people whose income was impacted due to COVID were at a greater risk of committing suicide. Other factors are unemployment, domestic conflicts and fear of COVID. Financial crisis and isolation were 2 major factors that led to suicide. Closure of economic and entertainment activities during the lockdown affected the mental health of people. On one hand it led to increased domestic conflicts while on the other hand it led to an increased feeling of loneliness and isolation. These led to stress and depression which ultimately led to suicide. Young population is at the greater risk of being affected by these factors as shown by the increase in number of suicides in age group 20 to 30 years and 10 to 20 years. Menon et al.,[18] have talked about various precipitating causes behind suicide deaths during COVID period in their study. Fear of COVID-19 infection was the dominant reason behind suicide, followed by financial crisis, loneliness, social boycott and pressure to be quarantine, COVID-19 positive, COVID-19 work-related stress, unable to come back home due to lockdown.

Conclusion:

This study concluded that due to COVID-19 pandemic and associated lockdown, the overall number of suicide deaths have increased. For the two-year period before the pandemic (2018, 2019), the number of suicides were 158 which increased to 258 in the similar period after the start of pandemic (2020, 2021).

While the most common method of suicide remained poison consumption, the number of deaths by hanging increased much more as compared to poisoning during-COVID period. Using verbal autopsy, the various reasons found behind suicides during-COVID period were financial crisis, death of a relative or a near one, isolation, domestic conflicts, and increased stress. Financial crisis was a major factor for the earning member of the family whereas isolation, loneliness and stress were a major factor in younger population. The various perceptions found behind suicide were that suicide is a quick escape from problems and the deceased was not strong enough to fight with the problems. In case of suicide of young person, it is also perceived that suicide could have been prevented if the deceased shared their problems with the family members. However, these results should not be generalized. More research is needed by the use of Verbal autopsy

tool to identify various reasons of suicide in different age groups.

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CASE REPORT

Hypertrophic Cardiomyopathy with Massive Cardiomegaly in Indian Young Adult: Autopsy Case Report

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Abstract:

The sudden death of a bread winning adult in the family is devastating for any family. Even worse is when the adult dies in his young adulthood. Cardiovascular pathologies dominate the causes of sudden deaths in young adults more than the central nervous and respiratory systems. The enlarged heart or cardiomegaly at autopsy is the first indication of such cardiac pathology. Cardiomegaly may result from various pathologies such as hypertension, cardiomyopathies, rheumatic valvular diseases, etc. The resultant increase in the heart's weight due to the cardiac myocytes' adaptive response to meet the demand in the above conditions is known as cardiac hypertrophy. Although multiple reports on cardiomegaly were described from clinical settings based on imaging modalities like X-ray or echo cardiography, the data is lacking from forensic autopsies, especially from India. This is the first case report describing a young adult male of 30 years old who died due to massive cardiomegaly with a heart weight of 878 g from hypertrophic cardiomyopathy.

Keywords: Cardiomegaly; Sudden death; Hypertensive cardiomyopathy; Left ventricular hypertrophy; Forensic pathology

Introduction:

The sudden death of young adults poses devastating consequences for the surviving family. Cardiovascular diseases are the most common cause of premature death in young adults at autopsy.[1] While atherosclerotic coronary artery diseases cause more fatalities in adults more than 35 years, fatal arrhythmias from structural abnormalities of the heart that include cardiomyopathies or due to arrhythmogenic disorders such as long QT syndrome, Brugada syndrome, etc. result in more deaths among adults younger than 35-40 years.[1,2] However, it is predicted that the cause of death in about 30% of sudden death in the young still may remain unascertained after a complete autopsy.[2]

Heart weight is the first and fundamental evidence of cardiac pathology.[3] The average heart weight in men is about 300 g, and in women, about 250 g, which roughly corresponds to about 0.45 and 0.40%, respectively, of an individual's body weight in the Indian population.[4] However, the heart weight varies across different people in other countries and is primarily influenced by various factors such as age, race, body height, weight, BMI, etc. For example, the average heart weight in the USA is predicted to be 331 g,[5] remarkably higher than the Indian population.

Enlargement of the heart from hypertrophy or dilatation of the chamber is known as cardiomegaly.[6] It is predicted that a person having a heart weight of more than 420 g to 450 g is a candidate for sudden death irrespective of coronary artery stenosis.[4,7] This increase in heart weight most likely results from cardiac hypertrophy, an adaptive response to the increased demands of physiological or pathological stress on the cardiac tissue. It also serves as a pathological substrate for arrhythmias and enhances the risk for cardiac failure, resulting in sudden cardiac deaths.[8]

Various pathologies such as hypertension, cardiomyopathies (hypertrophic, dilated, restrictive), rheumatic heart disease, cor pulmonale, ischemic heart diseases, and obesity are implicated in the genesis of cardiomegaly.[6] Numerous reports in the medical literature describe cardiomegaly due to the above etiologies, extensively from clinical settings based on imaging modalities like X-ray or echo cardiography. However, the data is lacking on incidences of massive cardiomegaly found in forensic autopsies, especially from India. To the best of our knowledge, this is the first report describing massive cardiomegaly (Heart weight: 878 g) due to hypertrophic cardiomyopathy in an Indian young adult.

Case Report:

A 30-year-old male auto driver by profession was brought dead to the emergency of our tertiary care center with an alleged history of being found unconscious in his auto around 5 pm. His medical and surgical history was unremarkable. However, the family history suggested his father dying of some unknown ailments, probably of cardiac origin. On external examination, the body was of a young male with an average build. Blood-tinged mucoid fluid is present in and around both nostrils. The rigor mortis was developed throughout the body, and lividity was fixed and present over the dependent parts of the back except over pressure areas. There were no signs of putrefaction and no external injuries present on the body. All clothes were intact and free from any visible discharge or stain. On the internal examination, the brain was remarkable for cerebral edema and multiple petechial hemorrhages in the white matter of the bilateral cerebrum and

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Figure 1. Shows weight of the heart measuring 778 g (1A) and grossly enlarged heart suggestive of massive cardiomegaly (1B).

Figure 2. demonstrates the asymmetric hypertrophy of the left ventricular wall (free wall>septum) on the cut section.

cerebellum.

The opening of the chest cavity has revealed striking enlargement of the heart (cardiomegaly), which weighed 878g after washing (Figure 1). The pericardial sac contained about 60 ml of serous fluid. The epicardial surface of the heart was unremarkable. Multiple atheromatous plaques were present in the lumen of the root of the aorta. There was no significant luminal narrowing present in the lumen of coronary arteries. Asymmetric hypertrophy of the left ventricle (Free wall >Septum) (Figure 2) was noted with the left ventricular wall thickness (LVWT) of 2.1 cm and the right ventricular wall thickness (RVWT) of 0.7 cm; both were measured 01 cm below the atrioventricular valves. Rest of the examination of the heart was unremarkable.

Both lungs were congested and edematous. On the cut section, blood-tinged frothy fluid was oozing out at places in both lungs. The stomach contained about 200g of semi-digested food material with no peculiar odor and mildly congested mucosa. The liver, spleen, and kidneys were congested, and the rest of the organs were unremarkable. Histopathological examination of the
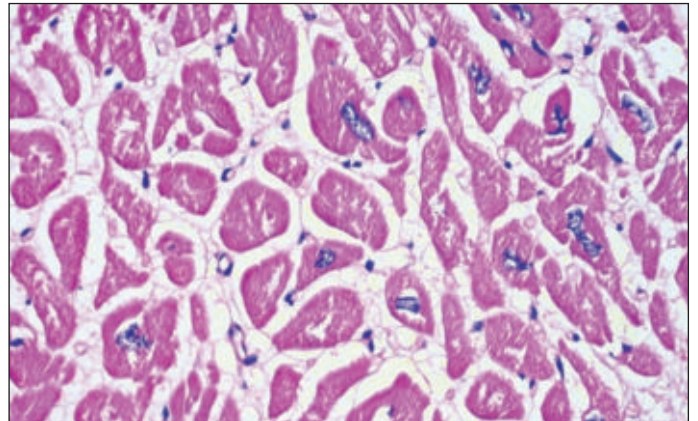
Figure 3. Exhibits photomicrograph of the cardiac muscle (H & E, 40X) exhibits enlarged, hyperchromatic nuclei indicative of cardiac muscle hypertrophy.

heart revealed cardiac muscle hypertrophy (Figure 3). The chemical analysis report was negative for any common poisons and intoxicants. Given the above findings, the cause of death was ascribed to hypertrophic cardiomyopathy and its complications which is a natural pathology.

Discussion:

Massive cardiomegaly with a heart weight of more than 800 to 850g is most often encountered in cardiomyopathies, valvular heart diseases, chronic atherosclerotic heart disease, congenital heart disease and morbid obesity.[8] Hypertrophic cardiomyopathy (HCM) is one of the most common causes of death among young adults. It is genetically inherited as an autosomal dominant disorder and frequently presents with sudden death as the first manifestation without any prior warning signs or symptoms. This is evident in the present case, who exhibited no signs and symptoms before death except for occasional mild chest discomfort. Clinically, age (less than 35 years), family history of sudden cardiac death in the first-degree relatives, maximum left ventricular wall thickness (LVWT), recent episode of unexplained syncope in the preceding six months, left ventricular outflow tract obstruction, LV systolic dysfunction, and LV apical aneurysm, etc. are attributed to be the indicators of HCM.[9] It is worth mentioning here that the patients with SCD of first-degree relatives are 20% more prone to die from SCD.[10] This is consistent with our case, whose father also had sudden premature death due to an unknown cardiac disease indicative of possible genetic inheritance.

Establishing the cause of death in SCD requires a detailed clinical history with special attention to the deceased's age and the circumstances of the death.[8] Diagnosis of HCM is challenging since it often results in no or minimal symptoms. Autopsy surgeons should preferably corroborate the findings of ECG and echocardiography together, if available, to arrive at a diagnosis of HCM. Because relying on either ECG or echocardiography, may result in poor judgment as both may indicate distinct risk information about LVH.[8]

Grossly, HCM is characterized by cardiomegaly and asymmetric hypertrophy of the septal wall. However, it should be stressed

here that the free wall hypertrophy may occasionally supersede septal hypertrophy[3,8] as observed in the present case. There is no documented case of massive cardiomegaly from young adults at autopsy in India except a single case report by Hugar et al. from Bangalore, India.[11] The report described a case of coronary artery insufficiency resulting from massive cardiomegaly with a heart weight of 880 g in a 46-year-old male. In contrast, the present case was a young adult of 30 years with an average build (unlike obese as described in Hugar et al.) who died due to massive cardiomegaly in the setting of HCM.

Although cardiac myocyte hypertrophy, myocyte disarray, and interstitial fibrosis are frequently reported microscopical features of HCM, they are not pathognomic of HCM. For example, myocyte disarray may also present in congenital heart diseases and in normal hearts.[3] It is important to note that the sampling was done from left ventricular septal and free walls at different levels, but the myocyte disarray could not be elicited in the present case. This may be attributed to the absent myocardial disarray from the selected sites, given the possibility of its patchy involvement within the myocardium.[12]

HCM arises from over 8000 variants of genetic mutations involving more than 50 genes. The most common genes responsible for HCM are MYBPC[3] and MYH7 genes that encode cardiac myosin-binding protein C (cMyBP-C) and beta-myosin heavy chain (beta-MHC), respectively.[9] When the cause of death is difficult to be ascertained, especially in arrhythmogenic heart disorders, the genetic testing of DNA from the postmortem blood of the deceased may establish the diagnosis. This molecular autopsy has been increasingly practiced in developed countries in recent decades.[2] However, in the present case, the diagnosis of HCM was made from family history, gross and histological examination of the heart. Hence, the molecular autopsy was not done in the present case. However, the deceased's family members were counseled to undergo periodic checkups with the cardiologist to prevent fatal outcomes. The early screening and identification of the HCM may help reduce the associated mortality by opting for various life-saving treatment modalities, including implantable cardioverter-defibrillator.[10,13]

Conclusion:

Massive cardiomegaly with a heart weight measuring 878g resulting in sudden death in the Indian young adult is described in the report. This report highlights the importance of diagnosing the exact pathogenic cause (HCM) leading to cardiac hypertrophy. Because the proper identification may indicate genetic conditions like HCM running in the families and helps prevent the morbidity and mortality of the first-degree relatives of the victim in the future. Hence, the autopsy surgeons should exercise utmost diligence and involve a multi disciplinary team, including pathologists, cardiologists, geneticists, and genetic counselors, when encountering such cases in forensic practice.

Ethical Clearance: Taken from Institutional Ethical Committee,

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CASE REPORT

An Unexpected Cause of Sudden Death Reported as a Case of Adverse Event Following Immunization (AEFI)

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Abstract:

Adverse event following immunization is any untoward medical occurrence which follows immunization and which does not necessarily have a causal relationship with the usage of the vaccine. Here we had a case where a 20-year-old male, who had taken second dose of Covishield vaccine and presented with complaints of fever, vomiting and abdominal pain. He was managed conservatively, but he collapsed and died at home, the next day. Autopsy revealed it as a case of small bowel volvulus with complications like gangrene and peritonitis. Volvulus of small intestine is a rare condition; non-specific clinical features and laboratory investigations make it difficult to diagnose. Coincidence with vaccination perhaps complicated the diagnosis in this case, which needed to be dealt as a surgical emergency.

Introduction:

Adverse event following immunization (AEFI) is any untoward medical occurrence which follows immunization and which does not necessarily have a causal relationship with the usage of the vaccine. Majority of events thought to be related to the administration of a vaccine are actually not due to the vaccine itself - many are simply coincidental events, others are due to human, or programme error. It is not possible to predict every individual who might have a mild or serious reaction to a vaccine, although there are a few contraindications to some vaccines. By avoiding the contraindications, the risk of serious adverse effects can be minimized.[1] According to the WHO, common side effects expected after COVID-19 vaccination are pain/tenderness at injection site, headache, fatigue, myalgia, malaise, arthralgia, pyrexia, chills and nausea; very rare events of demyelinating disorders have been reported but without causal relationship being established.

Case Report:

A 20-year-old male who took second dose of Covishield vaccine, was taken to the casualty of nearby taluk hospital following complaints of fever, vomiting and abdominal pain. He was given symptomatic treatment and sent home, and advised to consult surgery outpatient department on the next day. Early morning on the next day, he collapsed in bathroom at home and was brought dead to the casualty. His body was kept for medicolegal autopsy as an alleged case of death following vaccination, and brought to the Department of Forensic Medicine at Government TD Medical College, Alappuzha. RTPCR test for COVID-19 was done prior to autopsy and found to be negative. On autopsy, white froth was seen at nostrils and mouth. No injuries were present. Air passages contained frothy fluid. Lungs were congested and edematous (right-364gm; left-346gm). Both chest cavities contained straw coloured fluid (right-130ml; left- 60ml). Loops of small intestine (122cm distal to duodenojejunal junction, up to 94cm proximal to ileocecal junction) were distended, dark red in color and friable.

A portion of small bowel loops were seen twisted along the axis of its mesentery such that a tight constricting ring was formed at the base of those loops.

Peritoneal cavity contained 600ml of blood-stained fluid and emitted a disagreeable smell. Stomach and proximal part of small intestine contained bile-stained mucoid fluid emitting feculent smell, mucosa was pale. All other internal organs were congested. Segments of affected bowel, whole of dissected heart and tissue bits from all other major organs were subjected to pathological study. Histopathology report revealed: (a) Sections of small intestine – necrosis, extensive areas of hemorrhage and congested vessels, (b) Kidney – acute tubular necrosis, (c) Brain, Lungs– congestion and (d) All other organs – normal morphology. Cause of death was thus concluded as, death due to gangrene and peritonitis following volvulus of small intestine.

Discussion:

Small bowel volvulus (SBV) is a rare condition where small bowel twists around its own axis. The word 'volvulus' originates from the Latin word "volvere" which means "to roll or twist". Volvulus of the small bowel is rare; sigmoid colon is the commonly affected part. This condition is more commonly seen in children than the adults. This twisting of intestine can lead to partial or complete mechanical obstruction, which may or may not interfere with its blood circulation.[2] Due to its non-specific clinical features, the preoperative diagnosis of SBV is difficult. SBV can be broadly divided into primary and secondary variety based on the aetiology. In primary variety, there are no pre-existing anatomical abnormalities. In secondary SBV, there are precipitating factors like congenital abnormalities, bands, adhesions, and tumors. Abdominal pain is the most common

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Figure 1. Dilated and gangrenous bowel loops.

Figure 2. Volvulus of small bowel loops.

presenting feature. Severity of the pain depends on the level of vascular occlusion rather than the level of intestinal obstruction. Other presenting features include nausea or vomiting, distension and peritoneal irritation; these may be present all together or in any combinations.[3] Laboratory investigations are neither sensitive nor specific for the diagnosis of SBV. Patient may develop hypokalemic hypochloremic alkalosis if he has severe vomiting. Raised count of white blood cells may result due to systemic inflammatory response or sepsis following release of intestinal bacteria into the blood stream. Bowel ischemia is indicated by metabolic acidosis with elevated serum lactate levels.[4] Plain abdominal radiograph may reveal non-specific signs of bowel obstruction.[5] Rarely such radiograph may show dilated bowel loops with a spiral nebula in the mid abdomen,[6] or mass effect in the mid-abdomen and whirled appearance of bowel,[7] or distended stomach, duodenum and small intestine proximal to the transition point with a collapsed appearance or lack of gas shadow in the distal bowel loops,[8] which are all suggestive of SBV. USG is sensitive in infants, but it is less useful in adults as it is operator dependant. If it is successful, it shows either a whirlpool sign or classical barber pole sign.[9] CT scan is the investigation of choice; the bowel wrapping around the superior mesenteric artery shows the typical whirl pattern characteristic of SBV.[6] This is a surgical emergency, and once suspected there is no room to consider conservative management. Emergency laparotomy is indicated as there is high risk for gangrene.[10] Supportive measures include intravenous fluid supplement, insertion of Ryle's tube and venous thromboembolism prophylaxis.[11] Definitive diagnosis can only be made on exploratory laparotomy. Mortality in small bowel volvulus is very high when associated with necrosis of the bowel;[2] it varies from 5 to 35% in non-infarcted cases, and as high as 42 to 67%.[6] Prognosis of primary SBV is better because the majority of the patients are young, hence more physiologically fit

and perforation is uncommon.[10]

Conclusion:

This case was approached as a case of adverse event following immunization. Autopsy revealed it as a complicated case of SBV, which is undoubtedly a surgical emergency. Lesson to be learned here is that symptoms following immunization should not prevent us from anticipating unrelated medical/surgical conditions with similar manifestations, which might turn fatal if not diagnosed and managed promptly.

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CASE REPORT

Diagnosis of Hanging in an Alleged Case of Ligature Strangulation: A Case Report

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Abstract:

Hanging is one of the commonest method among the painless suicidal deaths. In few instances, false allegations are made by next of kin and they claim that the ligature mark over the neck of deceased is due to strangulation or postmortem hanging rather than ante-mortem hanging. Vice versa cases are also likely in an attempt to concealment of the crime. In such cases, complete post-mortem examination and incident scene visit are very helpful to differentiate between the two. In the case being reported, the authors report a case of young adult female individual in which ligature strangulation was alleged by the parents and investigating officer but which was diagnosed as a hanging after autopsy. Authors also report the important external as well as internal findings in a case of hanging and discuss the unusual complications lead to death after hanging.

Keywords: Asphyxia; Hanging; Ligature strangulation; Autopsy.

Introduction:

Hanging is a form of ligature strangulation in which the force applied to the neck is derived from the gravitational drag of the weight of the body or part of the body.[1] There are two forms of hanging- judicial and non-judicial.[2] The hanging mark almost never completely encircles the neck unless a slipknot is used. In literature, it is mentioned that death occurs within few minutes of hanging.[3] There are number of mechanisms by which hanging may cause death, which may act independently or in concert. In hanging, death is usually due to asphyxia or cerebral anoxia or vagal inhibition.[4] In delayed hangings, respiratory and neurological complications such as pulmonary or neurogenic edema develop as a result of post-obstructive pulmonary distress, aspiration pneumonitis etc. can arise as fatal complications of hanging.[5]

Case report:

A 19-year-old girl was referred to tertiary health care center with an alleged history of ligature strangulation. This case was labelled as a medicolegal case. On examination, she was unconscious, pulse rate was130/min, blood pressure was 96/60 mm of Hg, oxygen saturation at room air was 97 percent and she had tachypnea. All the investigation reports were normal. During hospital stay, she remained unconscious and was on intermittent positive pressure ventilator support. On 5th day of admission, physician diagnosed bilateral basal crept. Later, she suddenly become breathlessness and declared dead with diagnosis of hypotension with pulmonary oedema. Body was shifted to mortuary for autopsy.

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On history taken from the parents, the girl was alone at home at the time of incident. They were informed telephonically by the neighbor that; his daughter was lying on ground in unconscious state at home. She was referred to tertiary care hospital after giving first aid at local government hospital. The parents alleged that the girl was strangulated by the neighbor with chunni (a broad and soft cloth piece). Investigating officer also stated that the alleged ligating material i.e. chunni was recovered from the scene of incident. Police officer was unable to decide the case whether it was a case of hanging or ligature strangulation during his inquest; as the body was found in lying down condition and there was no eye witness at the scene.

Autopsy findings: The dead body was of average built. The face and eyes were congested. An interrupted reddish brown ligature mark in form of pressure abrasion was present on the left side of neck, situated above the level of thyroid cartilage in midline (Fig.1). It was deficient on the right side and nape of neck. It was situated 2 cm below the angle of mandible. On dissection, underlying sub-cutaneous tissues were white, glistening and showed marginal ecchymosis. The laryngotracheal structures were congested. Lumen of trachea was found occluded by mucus plug (Fig. 2). Intima of right common carotid showed multiple transverse tears (Fig.3). Epicardium showed multiple pin point punctate hemorrhagic spots (Fig. 4). Lungs were congested with sub pleural hemorrhages; on dissection, frothy secretions were oozed out (Fig. 5). After complete autopsy, cause of death was opined as pulmonary edema consequent to hanging.

The recovered ligature material was brought for the examination. It was in form of silk fabric and was strong enough to bear the weight of average built individual. It was smudged with brownish dust like stains at places. In crime scene report of this case mentioned that, loss of dust over the fan (alleged point of suspension) and a chair was present in the same room.

Discussion:

Hanging is a common mode of suicide, particularly in young

Figure 1. Showing a reddish brown ligature mark in form of pressure abrasion.

Figure 2. Showing congestion of respiratory tract mucosa and macroaspiration.

Figure 3. Showing subtotal transverse tear of carotid intima.

adults all over the world.[6] The term "near hanging" refers to a patient who survives a hanging injury long enough to reach the hospital. Most of the patient develops respiratory and neurological complication immediately after the rescue. Pulmonary edema is the commonest complication which usually occurs immediately following their rescue from acute airway obstruction or suicidal hanging.[7]

Debbarma S and Deka SJ conducted study on 8 cases in which delayed death in hanging were included. In six cases, histopathology of lungs and brain showed pulmonary edema and hypoxic injury whereas two cases reported pneumonia in lungs and congestion of brain.[8]

Nithin et al. reported that, development of pulmonary edema has played a major role as one of the causes of death in cases of
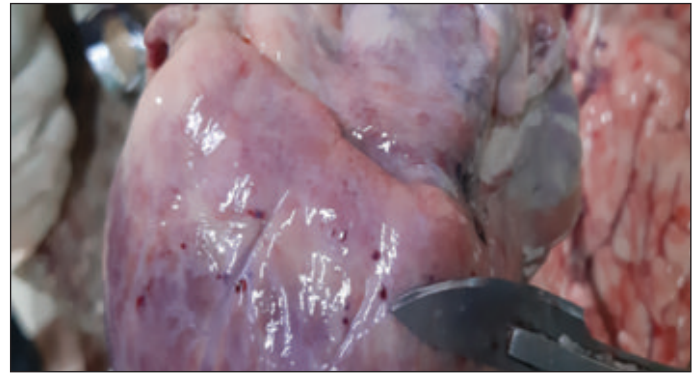
Figure 4: Showing multiple petechial hemorrhages on epicardium.

Figure 5. Showing subpleural haemorrhages.

hanging.[9] In cases of hanging and ligature strangulation, external findings scarcely provide any definite diagnosis and there is still a high need for autopsies. The development of the ligature mark is depend on many factors, including the ligature material (its width, softness, smoothness), the amount of force exerted on the neck, the duration of suspension, whether dropped or not, any material such as clothing, hairs interposed between the ligature and the skin. A broad soft ligature, such as a soft towel, may cause minimal mark or leave no mark at all.[10] Apart from the appearances of the hanging mark, there are some other features are also important. In hanging, evidence of dried marks of dribbling of saliva is suggestive of antemortem hanging but its absence alone will not suggest that the body was suspended after death. Petechial hemorrhage in deaths due to hanging are the exception rather than rule.[11]

In present case at primafacie, investing officer and parents mistaken this case as a case of ligature strangulation without any direct support, however, authors concluded it as a case of suicidal hanging. Ligature mark was present over left side of neck and above to the level of thyroid cartilage, which was supposed to developed due to by soft and broad ligating material i.e. chunni. Autopsy findings of neck and the survival period of 5 days after attempted hanging and incident scene visit report mentioned that disturbance of dust on the fan which is also indicative towards hanging.

Authors emphasized that the forensic assessment of hanging cases should always be based on a criminological and forensic evaluation of all the circumstances of the offence as well as on the post-mortem findings.

Conclusion:

Meticulous autopsy, examination of ligating material and circumstances of death are of utmost importance in differentiating the cases of hanging from ligature strangulation and manner of hanging.

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CASE REPORT

Acute Haemorrhagic Pancreatitis Presenting as Sudden Death

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Abstract :

Acute pancreatitis is a catastrophic event for human life. It can cause acute and sudden inflammation of the pancreas with a danger of involving peripancreatic tissue and other organ systems. Acute pancreatitis symptoms range from mild disease to fatal outcomes in some cases. In such cases, the pain and collapse are so quick that the event quickly follows death. Multisystem organ failure is the main reason for early deaths. Acute hemorrhagic pancreatitis is not a common cause of sudden death, preceded by non-specific abdominal pain and vomiting symptoms. We here discuss the case of a young male who presented to the emergency department in an unconscious state with a history of severe abdominal pain. Autopsy examination revealed features of acute pancreatitis on gross and histopathological examination. Acute pancreatitis is a severe, life-threatening condition and most deaths are sudden and unexpected. Hence, a detailed investigation is required for the diagnosis.

Introduction :

Acute hemorrhagic pancreatitis is an inflammatory condition presenting as a mild, self-limited condition to rapidly progressive disease with or without a fatal outcome. Mild acute pancreatitis is usually a self-limiting disease with rare mortality (less than 1% fatality), whereas severe acute pancreatitis or hemorrhagic pancreatitis is associated with a fatal outcome of 13.5-24%.[1,2] The incidence of acute pancreatitis ranges between 30% and 42% in autopsy samples.[3-6] Most of the available literature concerning acute pancreatitis dealt with clinical settings. Postmortem studies of fatal pancreatitis in medicolegal cases are insignificantly reported.[4,5] We report a case of a male who presented to the emergency department in an unconscious state with a history of severe abdominal pain.

Case report:

A 30-year-old male was brought to the hospital's emergency department in an unconscious state with a history of severe epigastric pain present just before unconsciousness. The on-duty doctor examined him and declared him dead on arrival. The victim had a similar complaint one day before the event, for which he took some medication. He was a chronic alcoholic and was on metformin to control hyperglycemia owing to a history of diabetes.

The medicolegal autopsy on the deceased revealed an adult male aged 30 years, well-built and nourished, measuring 166 cm. in length and 79 kgs in weight. Rigor mortis was observed all over the body. Postmortem lividity was present over the back except for the pressure points and was fixed. No evidence of external injuries was found on the body. Other external findings were unremarkable.

The internal examination of the opening of the body showed generalized brain and kidney congestion. Both lungs were congested and oedematous. The liver was congested and cirrhotic on morphological assessment. The heart weighed 290 gm, and the lumen of the coronaries was patent. The stomach contained about 50 ml of reddish fluid. Gastric mucosa showed small submucosal hemorrhages along the greater curvature.

The pancreas measured 23X7.5 cm and weighed 175 gms. Gross examination showed a soft, pulpy, and oedematous pancreas with frank hemorrhages at places (Fig. 1). The cut section revealed areas of hemorrhagic infiltration of the interstitial tissue (Fig. 2). The lumen of pancreatic ducts were patent. Samples were taken from the pancreas and liver for histopathological examination. The pancreas sections showed cellular infiltration in the parenchyma. There was evidence of necrosis of pancreatic parenchyma, including acini and islets with extension into peripancreatic adipose tissue, suggestive of acute hemorrhagic pancreatitis (Fig. 3). The liver sections confirmed cirrhotic changes (Fig. 4), and sections from the lung showed congested blood vessels (Fig. 5). Toxicological analysis report of viscera at the Regional Forensic Science Laboratory tested positive for alcohol and negative for other drugs/poisons. Because of gross and histopathological examination, the cause of death in the present case was acute hemorrhagic pancreatitis and associated complications.
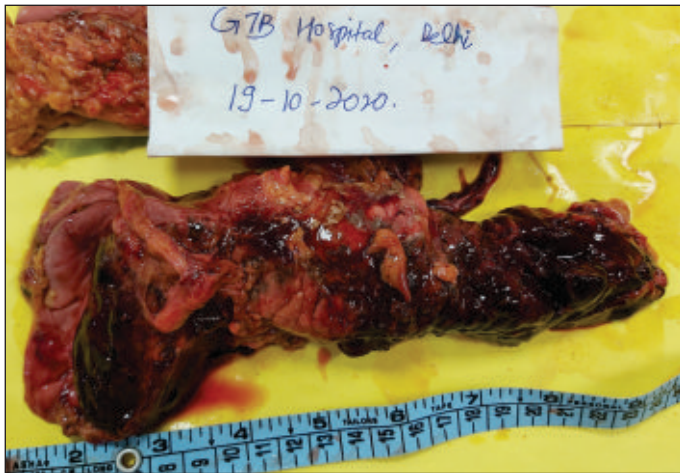
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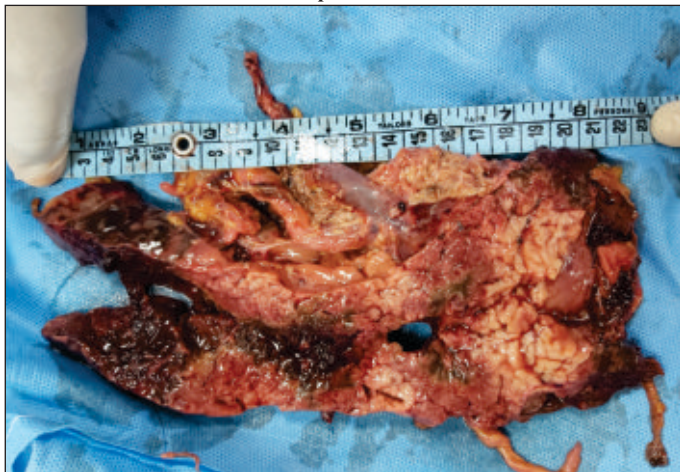**Figure 1. Showing soft, pulpy, oedematous with frank hemorrhages over the pancreas.**

Figure 2. Showing areas of hemorrhagic infiltration in the interstitial tissue on the cut section.
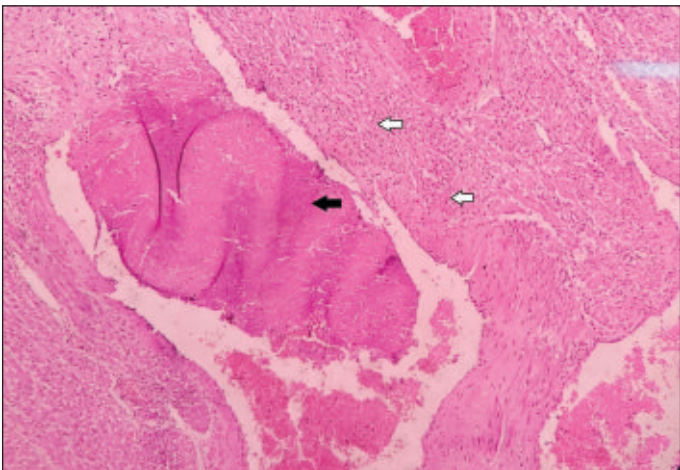

Figure 3. Showing cellular infiltration and necrosis of the pancreatic parenchyma.

Discussion:

Acute pancreatitis is a catastrophic event for human life. It can cause acute and sudden inflammation of the pancreas with a danger of involving peripancreatic tissue and other organ
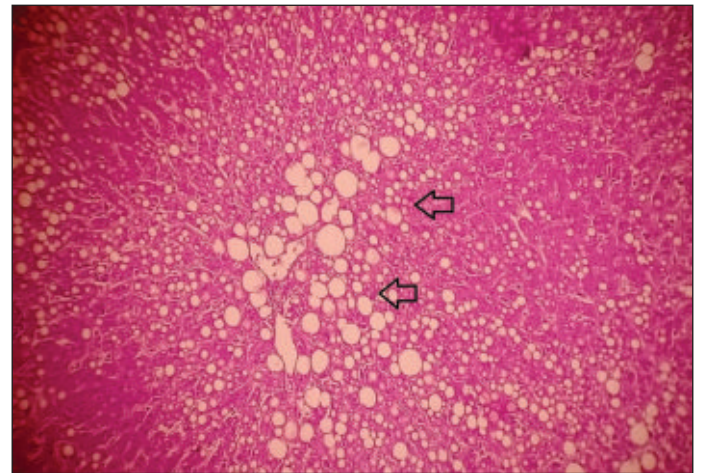

Figure 4. Showing numerous fat cells in the section of the liver (H&E, 10X view).
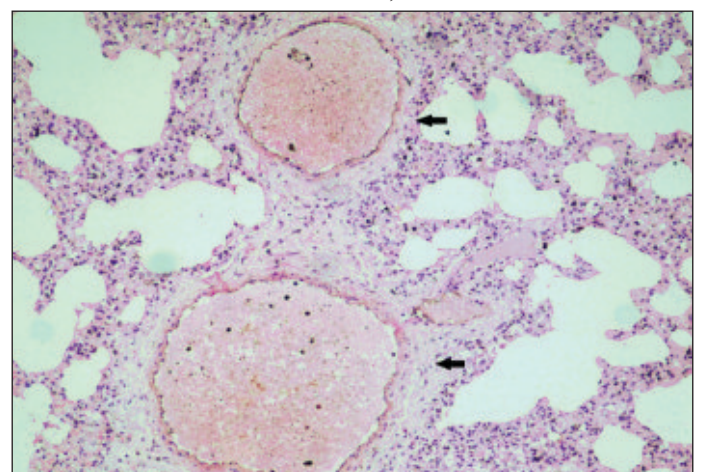

Figure 5. Showing congestion in the area of the lung (H&E, 10X view)

systems. Acute pancreatitis symptoms range from mild disease to fatal outcomes in some cases. Excessive alcohol congestion and gall stones are the most common causes of pancreatic injury, accounting for more than 85% of all patients with pancreatitis. The most common symptom of acute pancreatitis is a pain in the upper abdomen, followed by vomiting. In about 20% of patients with acute pancreatitis, life-threatening illness occurs due to severe damage to the pancreas.[7,8]

The prevalence of diabetes mellitus in the acute pancreatitis group is also significantly higher.[9] The fact that the deceased was on medication for diabetes in the present case should be considered an additional etiological factor affecting the patient's survival.

Multisystem organ failure is the main reason for early deaths. The pathology behind this damage may be linked to the release of various inflammatory mediators and cytokines from the damaged pancreas. The inflammatory mediators may be responsible for causing vascular injury, statis of intravascular coagulation causing damage to vital organs. The critical finding in such death is the presence of pulmonary edema. The lungs' involvement is the most common extra-pancreatic pathology observed in acute pancreatitis, ranging from 20-100% in autopsy studies.[10-12] Other

local complications include gastrointestinal bleeding and adjacent bowel necrosis, including the transverse colon's involvement.[13,14] The serum amylase level, ultrasonography, and computed tomography scan are mainstay diagnostic modalities in acute pancreatitis. Cases of sudden deaths due to acute pancreatitis are reported by authors where diagnosis could be made only at autopsy.[7,12,15-18]

In the present case, the decease had severe epigastric pain and was treated erroneously for gastritis when he had the first episode of pain and vomiting. He presented a second time to the health care facility with similar complaints in an unconscious state. The history of chronic alcohol consumption was present in the deceased. Gross findings in the pancreas and the other internal organs, such as pulmonary edema and necrosis of adjacent duodenum and transverse colon, supported the postmortem diagnosis of acute pancreatitis.

The histopathological findings very well corroborated the gross findings. At autopsy, a crucial diagnostic difficulty is postmortem autolysis of the pancreas. The rapid autolysis of the pancreas significantly affects its diagnosis on histopathological examination. The autopsy sample usually does not reveal typical acinar architecture. Inflammatory infiltrates, fat necrosis, and calcium deposits are the essential pathological features observed on light microscopy in acute hemorrhagic pancreatitis that differentiate acute hemorrhagic pancreatitis from postmortem autolysis of the pancreas.[18]

Acute hemorrhagic pancreatitis is not a common cause of sudden death, preceded by non-specific abdominal pain and vomiting symptoms. It is worth mentioning that acute pancreatitis is a vital differential diagnosis due to sudden death in the presence of fewer clinical manifestations in upper abdominal pain cases followed by vomiting. In such cases, the pain and collapse are so quick that the event quickly follows death.

Conclusion:

Acute pancreatitis is a severe and life-threatening condition. Hence, acute pancreatitis should be considered an underlying cause of sudden, unexpected deaths despite being less common in forensic settings. A high index of suspicion is required for clinical diagnosis. The forensic importance of acute hemorrhagic pancreatitis is related to the fact that most deaths are sudden and unexpected but usually follow severe upper abdominal pain episodes.

The gross findings of acute pancreatitis may overlap with those of postmortem autolysis of the pancreas, and therefore it is important to perform a microscopic examination to confirm the diagnosis. Postmortem serum amylase and lipase testing may support the diagnosis and explain the underlying patho-physiology.

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Necrophilia: A Complex Intersection of Crime and Psychological Disorder

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Abstract:

Necrophilia, the act of engaging in sexual activity with a dead body, represents a disturbing and rare form of paraphilia. This research paper explores the historical origins, psychological aspects, and legal dimensions of necrophilia, focusing on its classification into different classes based on intent and actions. Through the analysis of numerous case studies from various regions, the motivations behind such acts are examined, ranging from psychological disorders to revenge and sadism. The paper emphasises the need for specialised diagnosis and treatment, as necrophilia can manifest in different ways, from accidental tactile arousal during medical dissections to deliberate mutilation of corpses. Distinguishing between necrophilia as a psychological issue and as a criminal act is crucial, necessitating the involvement of both criminological and psychological expertise in handling such cases. To ascertain whether necrophilia should be considered a crime or a psychological disorder, the paper investigates the context of each incident, including the victim's cause of death and any prior sexual assaults. It calls for increased public awareness to facilitate early detection and appropriate treatment, preventing the escalation of these disturbing behaviours. The distinction between criminal necrophilia and paraphilic necrophilia is essential in determining suitable punishment and ensuring that those with psychological disorders receive medical care and rehabilitation to address their aberrant urges. In conclusion, this research forms the groundwork for comprehensive legal provisions and psychological support systems to address the complex intersection of necrophilia as a crime and as a mental health issue.

Keywords: Paraphilia; Necrophilia; Rape; Necrophagia.

Introduction:

Paraphilia: Recently one necrophilia case has been reported from Hyderabad, Andhra Pradesh,[1] India where a construction supervisor murdered a lady and after that he raped her. In a statement given by him to the police, he said that he had been stalking her before executing his plan. He managed to enter the premises of the victim where he raped her by giving her death threats then smashed her skull with a blunt object after her death, he repeatedly raped her, and then he runs away from the crime scene with her ornaments.

Sexual crimes are not new to the world. It's a common crime that is happening worldwide. One of the common forms of sexual crime is rape. According to the dictionary meaning rape is an "unlawful sexual activity and usually sexual intercourse carried out forcibly or under threat of injury against a person's will or with a person who is beneath a certain age or incapable of valid consent because of mental illness, mental deficiency, intoxication, unconsciousness, or deception."[2] Rape is generally committed with an alive person without taking her consent or sometimes the consent is there but it's not free. It is considered to be a heinous crime against women. It is pertinent here to mention that there are many instances where sexual intercourse is done with a dead body. Now the question which generally arises here is whether sexual intercourse with a dead person amounts to Rape. Whether it will be considered to be a crime if a person does sexual intercourse with a dead person? Coming to the first question there are numerous cases reported worldwide where a person has done sexual intercourse with a dead person. It's not normal for a person to do sexual intercourse with a dead person rather it's a psychological disorder namely Paraphilias, "where a person has abnormal sexual behaviors or impulses characterized by intense sexual fantasies and urges that keep coming back. The urges and behaviors may involve unusual objects, activities, or situations that are not usually considered sexually arousing by others". A person with paraphilia nature is known as "kinky" or "perverted".[3] It's tough to define paraphilia because of its nature. But a common definition that is accepted by all is given by DSM-IV (Diagnostic and Statistical Manual of Mental Disorders) which states that "recurrent, intense sexually arousing fantasies, sexual urges, or behaviors generally involving i) non-human objects, ii) the suffering or humiliation of oneself or one's partner, or iii) children or other non-consenting persons that occur over a period of at least 6 months."[4] Worldwide 8 types of paraphilia disorder are reported which are as follows[4] -

1. Paedophilia- Sexual preference for prepubescent children.

2. Exhibitionism- Exposing one's genitals to an unsuspecting person or performing sexual acts that can be watched by others.

3. Voyeurism- Urges to observe an unsuspecting person who is naked, undressing or engaging in sexual activities, or in activities deemed to be of a private nature.

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4. Frotteurism- Touching or rubbing against a non consenting person.

5. Fetishism - Use of inanimate objects to gain sexual excitement. 6. Sexual Masochism- Wanting to be humiliated, beaten, bound, or otherwise made to suffer for sexual pleasure.

7. Sexual Sadism- In which pain or humiliation of a person is sexually pleasing.

8. Transvestic Disorder- Arousal from clothing associated with members of the opposite sex.

There is one more category of paraphilia which is known as other Specified Paraphilic Disorders which includes a variety of paraphilic behaviors such as partialism; zoophilia; necrophilia; klismaphilia; coprophilia; urophilia; infantilism; telephone scatologia.

Necrophilia falls under the category of other specified paraphilic disorders. Even WHO has given Necrophilia a different code i.e., F65.8 under The International Classification of Diseases (ICD)-10 Classification of Mental and Behavioural Disorders.[5]

Necrophilia: Necrophilia is an act where a person gets sexual pleasure by doing sex with a corpse. It's a bizarre kind of activity in itself where a person does sex with a corpse and many times it has been found that the corpse was under putrefied conditions. The term Necrophilia is taken from the Greek words 'nekros' which means corpse and 'philia' means love.[6] The term necrophilia was first used by the Belgian psychiatrist Joseph Guislain (1797-1860). In many cases it has been observed that necrophilia is even associated with other forms of paraphilias for example sadism, cannibalism, vampirism (the practice of drinking blood from a person or animal), necrophagia (eating the flesh of the dead), necropedophilia (sexual attraction to the corpses of children) and necrozoophilia (sexual attraction to the corpses of or killing of animals also known as necro bestiality).[6] One interesting fact relating to necrophilia is that this kind of disorder has been found mostly in men in comparison to women.

In some mythological stories, necrophilia has been narrated. One such story is related to the Egyptian Goddess Isis who conceived her son Horus by using the dismembered part of her consort Osiris (he was murdered) as a dildo.[6] The story of Dimoetes is also famous in Greek mythology.[7] According to legend, Dimoetes married Euopis, the daughter of his brother Troezen. It was he who informed Troezen about his daughter Euopis's affairs with her brother and her sleeping with him. The girl hanged herself in shame and fear, but before her death, she has given terrible curses to the man who was responsible for her demise. Sometime after this incident, a body of a very beautiful woman was found near the surface of the seashore by Dimoetes brought by sea waves. He started to sleep with her because of the powerful desire for her which took hold of him. But that does not last long as the body started to decay. He built a huge burial mound for her and after that, he killed himself near her tomb as his desire did not slacken.

In almost every period of society, necrophilia cases were reported.[6] Another interesting fact relating to necrophilia is that sometimes it has been found that a person commits necrophilia

when he lost his loved one. One can take the example of Judaen, King Herod the Great[6] (circa 74 to 4 B.C). Among his all wives, he loved his second wife Mariamne most, whom he executed for adultery charges. But even after her death, he kept her body preserved in for 7 years to have intercourse with her.

Most necrophilia has been committed by a mortician or grave digger. A necrophiliac person prefers to work in the morgue or as a grave digger to satisfy their lust for corpses. In the past, there were many reported cases where the accused were sent to a mental institution for treatment and in some, they were imprisoned depending upon the nature of the cases.

One of the famous necrophilia cases of the 19th century was of Victor Antoine Ardisson[6] and he was also known by the name "Vampire of Muy" because he used to drink blood from the corpse. He was a grave digger and a necrophiliac. At the age of 19, Victor Ardisson started to work as a grave digger. According to the confession made by him after his arrest he accepted that he loves the cadaver of women, he used to talk with them and even he feels hurt when they don't respond to him. Even he kept the head of 13 years old girl whom he stole from the graveyard near his bedside and used that skull for oral sex. Because of his crimes, he was sentenced to spend the rest of his life in a psychiatric hospital at Pierrefau-du-Var. Victor Ardisson died on March 9, 1944, at Provence-Alps-Cote d'Azur, aged 71.

One of the most famous cases of necrophilia is related to the corpse of Eva Peron, wife of Argentine President Juan Peron.[8] Eva died at the age of 33 in July 1952 due to cervical cancer. The new regime was afraid of Eva's body as the rebel may steal it, thus it was decided to make the body disappear. It was after 20 years of her disappearance that her body finally reacted to her husband who returned from exile in 1973 and then became president of Argentina. According to many documents available related to the disappearance of the dead body of Eva Peron, it is said that the military person Colonel Carlos Eugenio de Moori Koenig was charged for the disappearance of Eva's body, and it was he who committed necrophilia with Eva's body along with his one staff Major Arancibia.[9]

The "Rape of Nanking of 1937"[10] was also very famous where the Japanese soldiers raped many Chinese women and murdered them after being raped, then forced Chinese men to do sex with the dead women. One Chinese man was reportedly murdered because he refused to do necrophilia with a corpse of a woman in the snow. The rape of Nanking is one of the most horrifying events in the history of war where an actual number of death cases is not yet known.

Serial Killer John Christie of Britain[1] is another case of necrophilia that is important to discuss here. John was famous among his school friends by nicknames like "Can't-Do-It-Christie" because of his sexual inadequacies encounter with his school girlfriend and maybe this was the reason behind his misogyny, according to the psychologist which led him to murder eight women between 1943 to 1953 at his residence 10 Rillington Place in Notting Hill, London. Even it was said by the others that his wife used to tease him about his attacks of impotence and neighbors also used to gossip regarding the same that she is

staying with him because of her fear. Christie after killing the woman used to keep the dead body close to him which is a common characteristic of necrophiliacs.

Nithari case of India where Surinder Koli[12] was charged with serial murder and rape of women and children in Nithari, India. Forensic experts while conducting psychoanalysis on Koli found that he was a necrophiliac, and was also suffering from necrophagia, where a person eats human flesh. Koli has made a voluntary confession of his crime before the Metropolitan Magistrate, New Delhi. He was sentenced to death by CBI Court in May 2022. Another case from Palghar, India was reported where a person confessed to the killing of a woman out of animosity and then he does sex with her dead body. Even in post-mortem also it was confirmed that the body of the victim was sexually assaulted after her death.[13]

Now from the above discussion, it is clear that it's not normal for a person to do sex with a dead person/corpse, and also, it's not normal for a person to eat human fleshes. Though it's common in Aghoris[14] who are the worshipper of Lord Shiva in India. One of the strangest things about Aghori's life is that they engage in physical relations with corpses during Sadhana. In this regard, the Aghoris say that this is also the way to worship Shiva and Shakti. According to them, if they immerse themselves in the worship of Shiva even while having a physical relationship, it is believed that they have reached the highest level of their spiritual practice. Aghoris also eat half burnt human flesh and they use a human skull as a container for storing and eating food.

Now the question which arises here is whether Necrophilia is a psychological issue or it should be considered to be a crime as there are many cases where it raises the doubt that a person who has done necrophilia should be treated as a criminal or a psychological patient.

Necrophilia as A Crime Versus Necrophilia as A Phycological Issue: As we have discussed above necrophilia means when a person does sex with a corpse. There are cases where a person feels a strong desire to have sex with his loved one even after her death as we have discussed above in the cases of Judaean King Herod the Great[6] (circa 74 to 4 B.C). Even there are cases where by looking at the dead body person has a strong desire for sex with it just like love at first sight like Dimoetes case.

There are also cases where a person only wants to do sex with a corpse-like in Victor Antoine Ardisson's[6] case. They simply had a strong crush on sex with a corpse. They don't feel comfortable having sex with alive women. There is another case of Kohli, who murdered others for the satisfaction of his sexual lust and necrophiliac tendencies.

From the above discussion, it can be said that sex with a dead person is common in every necrophilia but there are many dissimilarities in terms of the reason behind such an act which the author has identified from the various case studies, which are following-

1. In some necrophilia cases, the person feels a strong desire only for a particular corpse.

2. In some cases, they only had feelings for their lost loved one even after death.

3. Some people had sexual feelings only for corpses and, in some cases, they eat some part of the dead body like breasts or sometimes the whole body, etc.

4. Sometimes they murder the victim first so that she won't be able to disclose to others about the inability of the accused to perform sex with a woman due to his impotency and then they commit sexual intercourse with them.

5. Even cases are there where they raped the victim first and then they murdered the victim and after that again they committed sexual intercourse with it.

6. In some cases, a person purposely killed a victim out of revenge and then does sex with them.

7. Some accused stalked a victim to get a suitable time to commit rape on her and then they murdered her after the rape so that she won't be able to disclose it to others and then again, they commit sexual intercourse with her after her death.[15]

8. Lastly, morticians and gravediggers were prone to necrophilia.

Now from the above points, it can be summed up that necrophilia can be a crime according to the situation and it can be a phycological issue, especially in cases where a person has a desire to do sex only with the dead person and for that, they don't murder like the case of Victor Antoine Ardisson. For necrophilia what the researcher has found from her study is that there are 1) different situations (background before the act or during the act), 2) victims in necrophilia cases and 3) also the means rea of accused varies

Table 1. Sublcause of necrophilia.

Subclause	Description
A. Class I (role player)	Asks a living partner to act dead at the time of intercourse.
B. Class II (romantic necrophile)	Preserves the dead body of a spouse, mummifies it, and sleeps with it.
C. Class III (necrophilic fantasizer)	Visits cemeteries and masturbates in the presence of the dead.
D. Class IV (tactile necrophile)	Touches sexual parts of a dead body to get stimulation. Medical students getting an erection while dissecting cadavers also fall into this class.
E. Class V (fetishistic necrophile)	Preserves a part of a dead body (e.g., a breast) and wears it like a talisman or in a pocket.
F. Class VI (necromutilomaniac)	Mutilates the dead body and masturbates over it.
G. Class VII (opportunistic necrophile)	Performs intercourse with a dead body opportunistically. Commonly includes Morgue attendants and funeral workers with easy access to bodies.
H. Class VIII (regular necrophile)	Digs up dead bodies from graveyards and performs intercourse.
I. Class IX (homicidal necrophile)	Murders to perform necrophilia.
J. Class X (exclusive necrophile)	Can only perform intercourse with the dead and not the living.

from case to case. Based on the studies done by many experts, necrophilia has been classified under 10 subclauses[16]-

Class IX from the above classification is the person who after committing murder (which is a crime itself) does sexual

intercourse with the victim's body. These are the person who can do sex with both alive and dead people. On the other hand, Class X persons can't perform sex with a live person. They need a dead body to do sex. Other classes except for Class I and Class II are different because in class I the person is not dead but the offender pretended the lady to be dead for doing sexual intercourse with her and in Class II it's his loved one whom he does not want to lose at any cost even after her death. Class II offenders are having psychological issues where the person is sexually so connected with the dead person that it becomes unbearable for him to lose his lady love which is against the order of nature because after death a person has a legal right to decent burial.[17] Class I and II offenders commit necrophilia only with his known one, the only difference between them is that in class I the lady is alive, and in Class II the lady is dead. But in other Classes from III to X corpses of the women are unknown. In Class III to Class VIII necrophiliac, the act is committed with the corpse of another person, where he does wrong to the dead person and his family.[17] Now it's again a question of Law that whether a person who does sex with a dead person can be charged with rape. Because as per Indian law, rape can be done with only an alive person, because in cases of rape consent is an important factor and a dead body cannot give any consent. Here in India, we had only section 297 of the Indian Penal Code, 1872 which deals with the offenses of dead bodies. According to this section "Whoever, with the intention of wounding the feelings of any person, or of insulting the religion of any person, or with the knowledge that the feelings of any person are likely to be wounded, or that the religion of any person is likely to be insulted thereby, commits any trespass in any place of worship or on any place of the sepulcher, or any place set apart from the performance of funeral rites or as a depository for the remains of the dead, or offers any indignity to any human corpse, or causes disturbance to any persons assembled for the performance of funeral ceremonies, shall be punished with imprisonment of either description for a term which may extend to one year, or with fine, or with both".[18] Necrophilia is not defined under the Indian penal Code nor it is considered to be a separate crime even though we had several cases reported of necrophilia in which the famous case being the Nithari case of 2006. One can find the provision of Necrophilia in the US state of Georgia,[19] which considered it a separate crime under GA Code § 16-6-7 (2020)-

a. A person commits the offense of necrophilia when he performs any sexual act with a dead human body involving the sex organs of the one and the mouth, anus, penis, or vagina of the other.

b. A person convicted of the offense of necrophilia shall be punished by imprisonment for not less than one nor more than ten years.

Now regarding this also what the author will like to discuss is that for Class IX offenders of necrophilia, punishment should be given because for satisfying their sexual lust they are committing two crimes, first murder and then necrophilia. Indeed, homicidal behavior, including Lust murder and necrophilia, can be influenced by various factors, such as abnormal psychological attitudes. Some of these factors include sexual jealousy, a desire

to punish for perceived infidelity, substance abuse, depression, erectile dysfunction, educational background, mental health issues during childhood and sadistic attitudes. When these factors reach extreme levels, they may culminate in violent acts and deviant behaviors, such as Lust murder and necrophilia. Understanding and addressing these underlying psychological aspects are crucial in comprehending and dealing with such heinous crimes.[20] In some cases, it can be the rape of a victim, murder, and then necrophilia like the Azamgarh case of Uttar Pradesh.[21] Offenders belonging to these classes are a threat to society if they roam freely even if they are put behind a bar, they might harm the other cell mates for satisfying their lust. Coming to Class IV categories this necrophiliac person does not kill anyone rather they get sexual satisfaction from mutilating an already dead body. Even they don't do sexual intercourse with a dead body like in other Classes. Their erotic pleasure comes primarily from mutilating an already dead body and then masturbating simultaneously. They also need medical assistance for such a bizarre act. Class VII categories should be given punishment depending upon the nature of the cases.

Class VII and IX should get the punishment by law. But other Classes should be given psychological treatment as their act is not natural and it's a bizarre act. They cannot be cured simply by putting them behind a bar.

Certainly, based on the above discussion, we can categorize necrophilia subclause (See table-1) into two aspects: as a crime and as a psychological disorder. As we know that necrophilia involves engaging in sexual activities with dead bodies, which is considered illegal and unethical in most jurisdictions. Psychologically, it is classified as a paraphilic disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5).

Table 2. Classification of necrophilia as crime and psychological disorder.
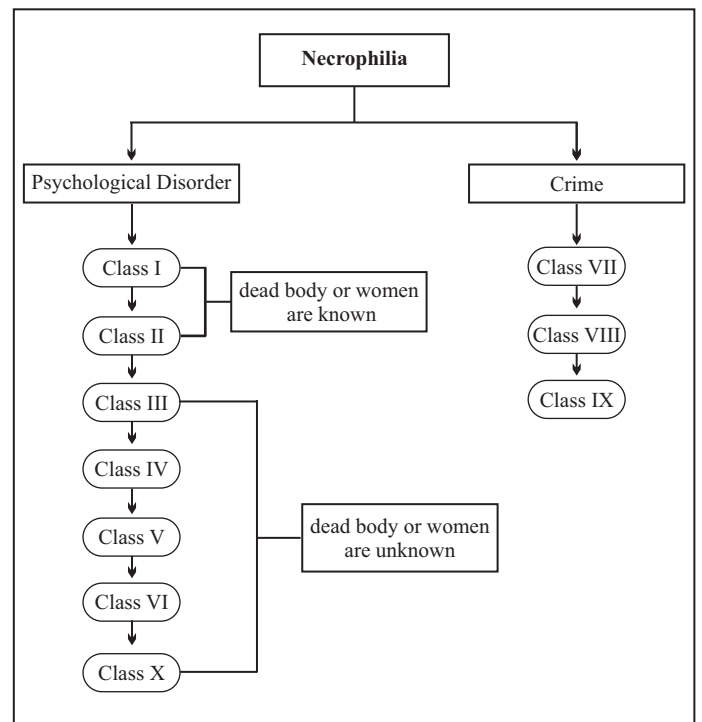
Here's a flowchart to represent the categorization of necrophilia on the basis of the above discussion :

According to the discussion above, it can be said that necrophilia can be a crime as well as a psychological issue. As per the discussion above to ascertain a necrophilia case whether it's a crime or a psychological issue, the help of an expert from the criminology and psychological department should be taken. These cases are different in comparison to other offenses. Thus, both these two different departments should work to deal with such cases. Every necrophiliac cases are different. One cannot judge a person as a criminal just because of the act. They have to judge according to their practice of necrophiliac acts and their psychological conditions. Just take an example of the medical students who upon touching the corpse during dissection get an erection (Class IV). He might don't know about his tactile necrophiliac conditions. Rather one can call it an accidental act where the person himself is not aware of this medical condition. As such he only needs medical help and assistance. A timely diagnosis of these psychological issues will help to control such behavior further. If it remains undiagnosed then the result might end in more serious phycological issues as well as their actions will be wrong against society as well.

There is another point to be discussed here is that in some instances, individuals with sadistic tendencies exhibit extreme behavior known as Lust murder, which involves a frenzied desire to commit violent acts, including murder. This disturbing aspect should also be considered when examining cases of necrophilia.[22]

Another important point to highlight here after discussing the above is that to consider a necrophiliac case as a crime first it is important to check/find out whether the 1) person has murdered the victim or not, 2) whether the death of the victim was natural or unnatural, 3) Sexual intercourse/forceful sexual intercourse was done with the victim before or after her death or sign of any other kind of sexual assault with her, 4) Cause of death or similarity of death pattern from any previous cases which is most common in serial killings cases will be helpful to bifurcate a case of necrophilia as crime and a paraphilia. If a crime is committed for the commission of another crime, then it will not only be a double wrong but it will be against the rule of the society and in no way, such can be excused. But when the person is already dead due to any other reason and then the necrophiliac person by getting an opportunity does the necrophiliac act or mutilate her body because of his necrophiliac conditions or eats the part of the body or gets ejaculation after touching the dead body then it can't be that serious offense like the above. Though it is also wrong and against nature. But this person needs proper medical care, they need phycological treatment. There is a need for psychological rehab centers for their proper treatment so that they can overcome their bizarre habits.

Conclusion and Suggestion:

WHO has defined necrophilia, but more research and identification of the victim are required particularly to check when a necrophilia act should be considered to be a crime and when it can be a psychological issue. All cases of necrophilia should be dealt with carefully because of their complicated nature. Awareness among the public is required so that it can be diagnosed early for better treatment and for the avoidance of it getting worse. Punishment can make a person sin-free but punishment can't cure mental illness. Mental or psychological issues can be cured through treatment only. It's a medical issue as well as issues related to crime and criminology where victims in most of the cases are unknown to the perpetrator. Different legal provisions are needed to punish the wrongdoer of this crime. Indeed, a dead body does not give consent but it does not mean that for satisfying lust one can kill someone, and then they will commit sexual intercourse with her. Even though the victim is dead but the act should be considered to be rape and accordingly it should be punished. There is a very minute difference between phycological cases of necrophilia and the criminal cases of it. If a necrophilia person for his needs kills someone then it's a crime, but if someone is using the dead body by digging it from the grave or by using the dead body available in the morgue then in such case they should not be treated as a core criminal but they should get the psychological treatment rather. Once they become normal then punishment can be given to them. But putting him directly behind the bar will not help them to become normal. Thus, All Necrophilia are Paraphilia but all Paraphilias are not Necrophilia Cases.

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REVIEW ARTICLE

India's Latest NHRC Advisory on the Problem of Floating Corpses in the River Ganges: Forensic Dental Recommendations

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Abstract:

In May 2021, thousands of human dead bodies were seen floating in the down-streams of the river Ganges. This incident highlights a few glaring issues, such as the inhumane treatment of human corpses, the potential escalation of the bio-hazardous situation, and most importantly the possibility of foul play and involvement of crime. As a response to this incident, the National Human Rights Commission issued a detailed advisory regarding the dignified management of the dead to all the states and union territories of India. In India to date, the identity of the dead is never associated with their dignity. The article introduces the 'right to identity' after death as an important interpretation and natural extension of the right to live with dignity. It is not only essential to identify a dead from a humanitarian perspective, but also from a forensic aspect to rule out any crime or wrongdoing. This article gives fundamental administrative recommendations in regards to how forensic odontology can solve the problem of unidentified dead bodies in India while maintaining their dignity.

Keywords: Dignity of dead; Forensic odontology; National human rights commission; Right to identity; Unidentified dead.

Introduction :

India witnessed massive numbers of COVID-19 patients and the number continues to rise. The first case of COVID in India was reported on January 30, 2020 in Thrissur, Kerala.[1] India announced a nationwide lockdown on March 24, 2020 to curb the spread of infection.[2] In spite of the preventive measures, the COVID pandemic has struck the entire world including India very hard. Hospitals are tested for their capacity to cope in situations of limited/scarce supply of life-saving resources like oxygen, medicines, etc. The total number of deaths due to COVID has exceeded the half million mark.[3] The crematoriums also saw an unprecedented number of bodies coming in for the last rites. Due to the nature of the disease, most of the time the bodies of COVID victims are not repatriated to their relatives and the responsibility of safe disposal/last rites of the body lies on the local administration.

The rights of the dead, oftentimes are not honoured and many such instances go unnoticed. During the COVID pandemic, when the entire healthcare system was overburdened with a storming number of COVID cases, a particular incident in Uttar Pradesh, Bihar, and Madhya Pradesh garnered a lot of media attention for the wrong reasons.[4-6] Thousands of bodies were seen floating in the River Ganges notably in Prayagraj, Buxar, Kanpur, Ghazipur, Chandauli and Varanasi.[7] It was speculated that the bodies belonged to the COVID victims whose last rites were performed on the banks of the River Ganges.

Many below dignity acts and some even amounting to crimes have been committed against the dead in the form of stealing from the dead,[8] overcharging the relatives for ambulance services[9] and last rituals of the dead,[10] stuffing numerous bodies one over the other during storage and transportation,[11] not using enough resources, like wood to ensure proper cremation[12] and inhumane handling of the dead.[13] There have been reported instances where in the body in a mortuary was eaten by rats[14,15] and dogs.[16]

In the background of such human rights violations, the National Human Rights Commission (NHRC) of India issued an official advisory for upholding the dignity and protecting the rights of the dead on May 14, 2021.[17]

Current Status of Rights of Dead in India:

The rights of the dead were first addressed after World War II wherein the bodies of soldiers were mutilated by the enemies even after death (as an act of overkill). The first legislation came into effect by way of Article 16 (II paragraph) of Geneva Convention 1949 IV.[18] Later as the years passed by, the rights and dignity of the dead, which initially were discussed in military and conflict parlance, percolated their way into civilians as well, encompassing each and every human being.

NHRC of India[19] was established under the Protection of Human Rights Act (PHRA) 1993,[20] later amended by the Protection of Human Rights (Amendment) Act, 2019.[21] It is in conformity with the Paris Principles, adopted at the first international workshop on national institutions for the promotion and protection of human rights held in Paris in October 1991, and endorsed by the United Nations General Assembly by its Regulations 48/134 of

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December 20, 1993.[22] The NHRC is an embodiment of India's concern for the promotion and protection of human rights.

Section 2 (1) (d) of the PHRA defines Human Rights as the rights relating to life, liberty, equality and dignity of the individual guaranteed by the Constitution or embodied in the International Covenants and enforceable by courts in India.

Article 21 of The Constitution of India[23] discusses the fundamental rights of any individual and includes the right to life and the right to personal liberty. Right to life is the most basic yet the most complex right. The Supreme Court of India, which is the guardian of The Constitution has interpreted the Article 21 (the right to life) in many ways including but not limited to the right to live with human dignity, right to livelihood, right to health, right to pollution-free air, right to education, etc. The 'Right to Identity' of the dead is yet to be addressed/interpreted as of now. The right to identity of the unknown dead is a natural extension of the right to live with dignity.

Right to Identity:

The right to identity should be interpreted under Article 21 of The Constitution of India in the context of the unidentified dead. Correct identification of the unknown dead is important from a humanitarian as well as forensic perspective.

The bodies found floating in the River Ganges not only raise the issue of inhumane treatment of the human corpses and the potential biological hazard but it raises many questions that are far more serious. Out of hundreds of bodies washed off by the river, how many actually died of COVID? What was the exact cause of death? Was crime involved? What was the identity of those bodies? The mystery about the cause of death of those hundreds of bodies remains unsolved and many questions are left unanswered.[24]

The United Nations Inter-Agency standing committee's operational guidelines on human rights in natural disasters[25] recommend that appropriate measures should be taken to facilitate the return of remains to the next of kin. Measures should allow the possibility of recovery of human remains for future identification and reburial if required. In India, Police will wait for 48-72 hours for any 'relative'[26] of the dead to show up and claim the body. Identification is attempted based on the 'big three'; age, sex and stature.[27] Personal effects found on the body can also be utilised, but the identity may not be conclusive in each case. Police also look for any signs of religion such as a religious tattoo, suggestive clothes, circumcision, etc., to decide the last rites of the dead. However, if the body is decomposed and not in a visually recognisable state, and also due to the fact that the majority religion in India is Hindu, the unidentified dead bodies are disposed of by way of cremation. Ideally, it is the duty of the Police to establish the identity of the dead in a scientific manner, refraining from the utilisation of visual cues and personal effects solely as indicators of one's identity.

As per the National Crime Records Bureau (NCRB), a quarter million bodies are passed off by the Police as unidentified each year and disposed of by way of cremation without any identification.[28]

Problems Associated with Unidentified Dead:

1. An unidentified body is equal to a family living in false hopes and misery. Identification of a body is essential for bringing closure to the mourning process.

2. If a person was a victim of a crime, without identification the case will not progress.

3. If thorough efforts are not exerted for identification, it can promote criminal behaviour of dumping the crime victims in a sacred river as a way to get rid of the body under the pretext of religious customs.

4. At the worse, if a body is wrongly identified using unscientific and unsound techniques, it can lead to lots of disastrous ramifications.

5. If a body is cremated or buried without identification, the right of dignity of the dead is breached.

The NHRC advises the Police that 'the dead bodies should not remain in the mortuary for more than 72 hours and in case of an unidentified body, the Police should make serious efforts for its identification and disposal accordingly in a dignified manner'.[17] The term 'serious efforts' is debatable and subjective. We can construe this statement as Police should utilize scientific methods of identification[29,30] in case of unidentified dead bodies. Forensic odontology is a reliable, economical, effective, and non-invasive method of scientific identification. A few recommendations to bring clarity in this regard are as below;

Recommendations:

1. A central act should be formulated, directing the Police/district administration to make use of scientific methods of identification, including Forensic Odontology.

2. The National Dental Commission (NDC) should take cognisance of the immense potential of Forensic Odontology and recognise it as a separate branch of dentistry and officially define its scope.

3. The leading Forensic Odontology organisations in India, The Indian Association of Forensic Odontology (IAFO)[31] and Indo-Pacific Academy of Forensic Odontology (INPAFO)[32] should express willingness to assist in this regard and take the necessary initiative.

4. IAFO and INPAFO maintain a detailed list of members and qualified Forensic Odontologists from all over India. IAFO and INPAFO can suggest to the Police/district administration a member in a particular city or area who is available and willing to assist as and when the need arises with regards to the identification of a body. Later, the local Police and district administration can maintain contact with the forensic odontologists independent of IAFO or INPAFO.

5. Oral autopsy should be conducted in each case of an unidentified body by a qualified Forensic Odontologist.

6. The dentition of the unidentified dead should be photographed which can enable dental identification in the future. With little additional training, a Police photographer can take intra-oral photographs. A database of these

photographs should be created and maintained by the Police/NCRB.

7. Lastly, the Police should take utmost efforts to preserve a biological sample such as a tooth for future DNA-based identification. A Forensic Odontologist can extract a molar tooth or any other suitable tooth and the same can be stored at minus 20ºC in a laboratory. A tooth is an ideal sample for DNA since it is made of hard tissue and it preserves the DNA really well. Also, obtaining the tooth sample is not an invasive process (if the same is compared to obtaining a liver sample which is routinely performed in India).

Summary:

The possibility of foul play and involvement of crime cannot be ruled out until conclusive identification of the dead is achieved. Forensic Odontology is a promising field under Forensic Science that offers solutions to this problem. NHRC should take cognisance of the availability of expertise in Forensic Odontology so the problem of unidentified dead will be taken care of to a large extent.

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