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Original Article

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Clinical Profile of Acute Poisoning Cases at a Tertiary Care Hospital in Kashmir, India: A Descriptive Cross Sectional Study

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Abstract

Acute poisoning from a variety of substances is common in every part of the world. The sooner the initial resuscitation, decontamination, and use of specific antidotes, the better the outcome. The main objective of this study was to describe the clinical profile and outcome of poisoning cases admitted to SKIMS Medical college, a tertiary care hospital located in central part of Jammu and Kashmir India. Descriptive cross sectional evaluations were conducted on all cases that were admitted to the hospital's emergency room over a period of one year from March 2022 to February 2023. The following parameters were examined using data taken from hospital medical records: socioeconomic factors, substances consumed, routes of intake, clinical symptomatology and severity of poisoning.300 patients were included in the study with different poisonings of which 35% were males and 65% were females. The most common form of poisoning was due to pesticides followed by rodenticides and opioid intoxication respectively. Majority of the patients had suicidal intent followed by accidental ingestion reported mainly in children. Few patient required intensive care admissions rest all were managed in general ward depicting mild severity of poisoning in majority of the patients. Three patients were brought dead to hospital secondary to opoid overdose and one patient died in hospital who had pesticide ingestion complicated by ventilator associated pneumonia. The less mortality in this study was likely due to mild severity of poisoning, early gut lavage and easy access to hospital. The effects of poisoning on the human body are negative regardless of the agents or method used and this has an impact on the treatment and outcome. Due consideration must be given to clinical, toxicological and epidemiological profiles. Therefore precise and prompt diagnosis, adequate treatment and effective preventative efforts are required. This study highlighted the importance of awareness and for the establishment of poison information centre for the better management and prevention of all poisoning cases.

Keyword: Acute Poisoning, Organophosphates, Opioids.

Introduction

Poison is defined as a substance that has the potential to cause damage to the health or even death. A person is exposed to it either by coming into contact with it or when introduced into the body by oral or parenteral routes and is usually used deliberately with this intend. Around 800000 suicide deaths were recorded worldwide in 2016 indicating a global suicide rate of 10.5 per 100000 people. In contrast India reported 18.5 per 100000

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suicide deaths nearly twice the global average [1,2]. Most suicide fatalities occur in developing countries as opposed to developed countries. The intentional consumption of poison is a common suicide method widely used in developing countries such as India [1]. The preponderance of poisonings that occur in India are caused by pesticides [2]. The harmful substances used in suicide poisoning in India include organophosphosphates, carbamates, opioids and other household poisons like rodenticides as well [3]. The second most prevalent method of intentional self-harm is drug overdose.

Numerous studies on poisonings and suicides have been conducted in India but most of them are retrospective in character and based on hospital or institutional records. We conducted a descriptive longitudinal observational research to determine the prevalence, type, severity, and trends in treatment outcome of acute poisoning including drug overdose in a tertiary care teaching hospital in Kashmir, India.

Materials and Methods

The present study was conducted at SKIMS Medical College and Hospital Srinagar Kashmir, India which is a 200-bedded tertiary care government run hospital. The study comprised a total of 300 patients who were admitted or referred with a history of acute poisoning. The study was conducted from March 2022 to February 2023 that is over a period of one year. The study included patients between 1 and 80 years who had been exposed to poison by different means like industrial exposure, domestic or agricultural means drug overdose or by accidental means. After consent from hospital authorities, data collection was carried out in accordance with hospital procedures.

Inclusion criteria:

This study included all patients who had a complete medical history, clinical signs of poisoning, eyewitnesses or circumstantial evidence of poisoning in the form of empty bottles, empty syringes and drug trips that were brought along with the patient by their attendants.

Exclusion criteria:

Patients whose identities were unknown or unreliable medical history and dubious clinical characteristics were excluded from the study.

Results

This study included 300 hospitalised patients of acute poisoning of which 105 (35%) were males (Table 1). Among 300 patients 3 patients were brought dead due to opioid intoxication. The majority of patients 132 (44%) were between the ages of 20 and 30 and the least amount 32(10.6%) were over 40-years old (Table 2). The mean (SD) age of patients was 25.7 years. The most common method of exposure to poison was via oral means. Most of the patients were from rural areas (Table 3). Poisoning was more common among married individuals. Majority of patients (8%) were admitted to a hospital in less than 4 hours after being exposed to a toxin/poison. For patients who were hospitalised, the average length of stay was 5 days. Most of the patients, 205 (69.02%) were treated in the medical ward and 92 (30.9%) patients and were treated in hospital's intensive care unit.7 patients required invasive mechanical ventilation of which one patient died secondary to ventilator associated pneumonia.

Table 1: Sex distribution

Total cases	Number of cases (%)
Males	105 (35)
Females	195 (65)

Table 2: Age group

Age in years	Number of cases (%)
0-10	5 (1.7)
11-20	82 (27.3)
21-30	132 (44)
31-40	49 (16.3)
>40	32 (10.7)

Table 3: Domicile

Domicile	Number of cases (%)
Rural	249(83)
Urban	51 (17)

Type of poison:

Pesticides (67%), rodenticides (14%), opioids (7%) and consumption of benzodiazepine (4%) contribute to the bulk of poisoning cases (Table 4).This might be related to their involvement in economic activities, high unemployment rates, and parental responsibilities. According to a 2004 study by Virendar et al, dowry system, gender bias,

mental instability, family and in-laws conflicts, and dependence on husbands were the leading causes of suicide in women [9].

Table 4: Type of poison

Type of Poison	Number (%)
Pesticide	201 (67)
Rodenticide	42 (14)
Opioid	21 (7)
Benzodiazepine	12 (4)
Corrosives	9 (3)
Kerosene	5(1.66)
Barbiturate	2 (0.66)
Thyroxine	2 (0.66)
Lithium	2 (0.66)
Methanol	2 (0.66)
Hydrocarbon siphoning	2 (0.66)

Clinical findings and treatments:

The most common clinical signs and symptoms were in the form of gastrointestinal like vomiting (80%), diarrhoea (65%) and abdominal pain (50%), neurological symptoms like drowsiness was observed in (8.6%) patients (opioid overdose). Agitation was seen in (8.6%) patients and fasciculation in (30.1%) patients of organophosphate poisoning. Cardiovascular manifestations like hypotension was observed in 6.6% patients, bradycardia in 42% of patients, and tachycardia in 4.7% patients and respiratory manifestations like hypoxia in 6.6% patients and bradypnoea in 3.3% of patients caused by opioid poisoning. Gastric lavage was done in all the patients except those with corrosive and kerosene poisoning. Intenive care monitoring was required in 53 (37%) patients. Symptomatic and supportive care was given to all the patients, besides specific antidotes were also given. Out of 300 patients 3 patients were brought dead to the hospital and all were intoxicated with opioids. One patient of pesticide poisoning died secondary to ventilator associated pneumonia.

Intention of poisoning:

In 254 (84.6%) cases the intention of poisoning was discovered to be suicidal; in 46 cases (15.33%) it was accidental; and in no case was it was homicidal(Table 5).The rate of suicidal poisoning in women was higher 185 (61.66%) than men115 (38.33%) and the rate of suicidal poisoning was more common among married individuals175 (58.33%).

Table 5: Intention of poisoning:

Intention of poisoning	Number of cases (%)
Suicidal	254 (84.6)
Accidental	46 (15.4)
Homicidal	0

Discussion

In an agricultural country like India where farming is the primary source of income, pesticides are widely accessible [10,11]. Furthermore, household chemicals were listed as the second-most frequent toxic agent utilised in poisonings in Ahmedabad with the greatest mortality rate in a study conducted by Presgrave Rde et al. [12]. The pattern of poisoning in a place depends on a variety of elements including availability, cost and access to poisonous substance, cultural and religious features of people and geographical considerations [13–15]. Depending on the material exposed there are different poisoning signs and symptoms. A general physical examination, mental status evaluation using the Glasgow Coma Scale (GCS), bedside laboratory tests and toxin detection can all aid in management. Antidotes were administered for specific treatments, such as flumazenil for benzodiazepine overdoses, intravenous atropine for organophosphorus compounds and naloxone for opoid intoxication. Similar to a systematic analysis carried out by Mew et al the current study revealed that organophosphorus chemicals were the leading cause of poisoning (81.1%)[16]. According to the results of the current study 35% of the patients were men which is in line with the findings of Patel et al. [17] and Singh et al. [18] reports. In our study, the majority of participants were between the ages of 20 and 30.Three of the patients were brought dead before any medical management could be carried out. Age, the toxicity of the poison, the amount of the substance taken, the patient's health status, early hospitalisation and proper management are only a few of the variables that affect poisoning-related mortality. Early care was possible in the current study since 83% of the patients were admitted to hospitals within 6 hours of poison exposure. The majority of patients ingested comparatively less toxic dose of the poison. These elements could be a factor in the non-fatality observed in these situations.

Limitations:

The key variables limiting the results may be the limited sample size and short study duration. Additionally majority of cases were determined to be diagnosed based on patient history and clinical examination rather than laboratory confirmation. This resulted from the hospital's lack of laboratory facilities.

Conclusion

In the current study it was shown that poisoning in Kashmir was primarily caused by organophosphate compounds. This calls for public awareness campaigns regarding the risk of poisoning and it's consequences. To raise awareness of the risks posed by such toxins the health and hospital authorities should take the lead. Establishing a poison control centre in the area will also aid in preventing and managing such poisoning incidents. It is pertinent to mention that in view of significant rise in opoid abuse by young adults there is immense need to establish addiction treatment facilities in major peripheral and central health institutions apart from availability of antidotes like naloxone to save the most productive age group from this menace.

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Conflict of interest: None to be declared

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Ethical clearance: The study has been approved by the institutional ethical committee (IEC) with the protocol number IEC/88/2023.

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Original Research Article

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Assessment of Knowledge and Attitude about POCSO Act among Medical Interns: A Questionnaire based Study

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Abstract

Background: The issue of child sexual abuse is a worldwide problem that exists among both developed as well as developing countries. The most vulnerable groups in society for sexual abuse are these children. The number of incidents involving child sexual assault is rising alarmingly.

Material and Methods: It is across sectional questionnaire based study from February 2023 to July 2023 comprising of 100 medical interns (50 males and 50 females) conducted at Jawaharlal Nehru Medical College, A.M.U, Aligarh, Uttar Pradesh.

Results: In this cross sectional study, 100 medical interns comprising of 50 males and 50 females participated. The questionnaire consisted of 10 multiple choice questions about the POCSO Act.76% of medical interns knew what the acronym POCSO Act means. The age of child under POCSO Act was known to 82% participants. 71% participants were aware that POCSO Act is gender neutral.

Conclusion: Although teaching young children about appropriate and inappropriate touching starts in the primary grades, CSA can be reduced by increasing knowledge and awareness in the local community. The cases of child abuse in India require a holistic approach from every member of society.

Keywords: POCSO Act, Child abuse, Sexual Offence

Introduction

The issue of child sexual abuse is a worldwide problem that exists among both developed as well as developing countries. The most vulnerable groups in society for sexual abuse are these children. The number of incidents involving child sexual assault is rising alarmingly. 2012 saw the adoption of the Protection of Children from Sexual Offences (POCSO) Act which was passed in order to safeguard minors from exploitation and sexual abuse. Additionally, it allows for the creation of special courts to hear cases involving child sexual assault. It also specifies the use of child-friendly practices for gathering evidence, looking into the offence, and holding a trial for it. A child is defined as a person who has not reached the age of 18 in accordance with the POCSO Act of 2012.

World Health Organization (WHO) defines Child Sexual Abuse as the engagement of a child in sexual

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activity that they do not completely understand, are unable to give informed consent to, are not developmentally ready for and are unable to give consent for, or that violates social norms or taboos.[1] Extreme repercussions from child sexual abuse (CSA) impede a child's development and growth.[2,3] CSA has been linked to a number of unhealthy habits and poor social, mental, and physical health consequences over the course of life.[4,5,6] For adult CSA survivors, greater risk for violent behaviour, domestic violence, and increased risk of CSA perpetration as adults are some other typical consequences. Future psychological effects that may occur include PTSD, depression, substance abuse, etc.

Physical abuse, sexual abuse, emotional abuse, and neglect are the four main categories under which the World Health Organization has categorized child abuse and maltreatment. Six different forms of child sexual offences are listed in the POCSO Act. i.e. Sexual Assault, Aggravated Sexual Assault, Penetrative Sexual Assault, Aggravated Penetrative Sexual Assault, Sexual Harassment and Using Child for Pornographic Purposes.

Material and Methods

This is a cross sectional questionnaire based study conducted among the Medical interns of Jawaharlal Nehru Medical College, A.M.U, Aligarh, Uttar Pradesh. A questionnaire was prepared consisting of 10 multiple choice questions about POCSO Act. 100 medical interns comprising of 50 males and 50 females participated in this study from February 2023 to July 2023. All participants attempted all questions. The purpose of the study and the procedure to fill up the questionnaire was explained to the interns. Statistical analysis was done by using Microsoft Excel and the results were calculated in percentages. Ethical clearance was taken for this research from Institutional ethical committee. A predesigned and pretested questionnaire form was compiled to capture the relevant information from the interns after obtaining informed consent.

Results

In this cross sectional study, 100 medical interns comprising of 50 males and 50 females participated. The questionnaire consisted of 10 multiple choice questions about the POCSO Act. According to knowledge based questions (Table no. 1), 76% of medical interns knew what the acronym POCSO Act means. The age of child under POCSO Act was known to 82% participants. 71% participants were aware that POCSO Act is gender neutral. Child helpline number of India was known to 63% of individuals. Only 74% of healthcare individuals were aware that punishment is graded as per magnitude of offence under POCSO Act. Trial of cases under POCSO Act are held at child friendly Special courts was correctly marked by 60% people.87% of people were aware of the POCSO Act's violations. 79% of participants were aware that failing to disclose child sexual abuse within the required time frame is a serious offence.90% participants knew that a child cannot be punished for giving false information or false complaint under the provisions of POCSO Act.

Table 1: Knowledge based questions regarding POCSO Act

S. No.	Questions	Correct Response	Incorrect Response
1	What is the full form of POCSO Act?	76%	24%
2	What is the age of child under POCSO Act?	82%	18%
3	Is POCSO Act a gender neutral law?	71%	29%
4	What is child helpline number?	63%	37%
5	Is reporting child sexual abuse mandatory?	95%	05%
6	What is the maximum punishment under POCSO Act?	74%	26%
7	Trials of cases under POCSO Act are held at?	60%	40%
8	What are the offences under POCSO Act?	87%	13%

Continue.....

9	Is there any time limit for reporting abuse under the POCSO Act?	79%	21%
10	Can a child be punished for giving false information or false complaint under the provisions of POCSO Act?	90%	10%

The current study on interns' attitudes towards child sexual abuse found that while 16% of them believed that the child welfare committee should play a key role, the majority of them- 84% suggested that the community at large, including all organizations-government and non-government should work together to support sexually abused children. According to 23% of participants, it is urgently necessary to start training children in elementary school in order to decrease child sexual abuse. While the majority of healthcare personnel (90%) agree that a coordinated effort of all of the aforementioned steps is necessary, just 38% of respondents believe that severe law enforcement is the most important thing to follow. In contrast, 23% believe that community awareness raising is more vital.

Discussion

In India, POCSO Act 2012 deals with child sexual abuse cases. It is divided into 46 sections and was published in official gazette on 20th June 2012 but came into force on 14th November 2012. Child sexual abuse has gone largely unrecognized and unreported in India for a number of reasons, including fear of embarrassment, guilt, community denial, associated sociocultural stigma, lack of confidence in government agencies, and a communication gap between parents and children about the issue.[7]

87% of the individuals knew various offences under POCSO Act which is similar to study conducted by Kaduet al.[8] The offences and punishments listed under POCSO Act of 2012, amended in August 2019 are as follows-

1. Sexual Assault- imprisonment of three to five years and fine
2. Penetrative Sexual Assault on child below 16 years of age- minimum imprisonment of 20 years which may extend to remainder of natural life and fine
3. Penetrative Sexual Assault on child of 16 to 18 years of age- minimum imprisonment of 10 years which may extend to imprisonment for life and fine
4. The Aggravated Penetrative Sexual Assault- minimum rigorous imprisonment of 20 years which may extend to imprisonment for life and fine or with capital punishment
5. Aggravated Sexual Assault- imprisonment of five to seven years and fine
6. Sexual Harassment-imprisonment which can extend uptothree years and fine
7. Use of child for pornographic purposes- five years and fine and in the event of subsequent conviction, seven years and fine

It is required to report cases of child sexual abuse in accordance with the POSCO statute. Calling the 24-hour toll-free emergency child helpline at 1098 is a simple action anyone who discovers an instance of child sexual abuse in India can do.[9]Child helpline number of India was known to 63% of individuals.To enhance reporting of such crimes and protect children in India, medical professionals need to be made more aware of this crucial undertaking. In comparison to Yasvanth[10], who discovered that 60% of people were not aware of the punishments mandated for the various offences mentioned by the act, in our study 74% of interns were aware of the maximum punishments described in the POCSO Act 2012.

95% of people were aware of the penalties for failing to report a case of child sexual abuse under the POCSO Act. Not reporting a case of child sexual abuse can result in a punishment of imprisonment of up to 6 months, with or without fine. This was a very encouraging finding. Knowledge about this punishment for doctors is really necessary. Singh et al[11] proposed a multi-centric and cohesive approach for the management and prevention of child sexual abuse. It also covers the application of laws and policies, identifying and punishing offenders, providing support for victims, professional training, and medicolegalamenities.

A doctor who treats a victim must show their expertise in taking a victim's history in a way that is child-friendly, gathering evidence after a thorough medical examination, treating any physical or genital injuries that may be present and assessing the victim's mental health and, if necessary, referring them for psychiatric counseling sessions. The victim's age may occasionally need to be assessed by the doctor in absence of ID card such as aadhar card, etc.

Conclusion

Although teaching young children about appropriate and inappropriate touching starts in the primary grades, child sexual abuse can be reduced by increasing knowledge and awareness in the local community. To handle the cases of sexual abuse for a better structural approach and improved outcome, a multidisciplinary approach involving primary healthcare professionals, police officers, legal agencies, lawyers, child welfare committee workers, Paediatricians, Gynaecologists, Forensic experts, Psychiatric specialists, and NGOs is essential. Ensure that POCSO Act knowledge is incorporated into school and university curricula. A youngster who has experienced sexual abuse requires the greatest possible counselling and psychological support. The cases of child abuse in India require a holistic approach from every member of society.

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Original Research Article

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A Study of Deaths Due to Hanging: A Retrospective Study a Research Paper

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Abstract

Hanging is one of the most common methods of committing suicide all around the world. This is retrospective study conducted between June 2014 to December 2016, which included 50 cases of Hanging which were autopsied in Mortuary of Government Medical College associated Hospital, Ambikapur, Sarguja, Chhattisgarh during this period. Out of 50 cases of Hanging, 26 (52%) cases were males and 24 (48%) cases were females. Maximum number of victims 16 (32%) were in the age group of 21-30 years. Maximum 48 (96%) cases occurred in closed place and least number of cases occurred in open place 02 (4%). Cyanosis was seen in 46 (92%) of cases and face congestion seen in 24 (48%) cases. Ligature mark present above the level of thyroid cartilage in maximum number of cases 48 (96%). Fracture of hyoid bone present in 1 (2%) case. Aim of the study was to find out incidence, trends and patterns of hanging in Chhattisgarh.

Keywords: Hanging; Cyanosis; Ligature mark; Autopsy; Suicide.

Introduction

Asphyxia is a condition caused by interference with respiration, or due to lack of oxygen in respired air, due to which the organ and tissues are deprived of oxygen. Mechanical Asphyxia is a broad term in which enough external pressure is applied to the neck, chest or other areas of the body, or the body is positioned in such a way that respiration is difficult or impossible.[1] In violent asphyxial deaths, the process of respiration i.e., exchange of air between the atmosphere and the lung beds is prevented by some violent mechanical means. Hanging is a process in which the body is suspended with a ligature around the neck which causes constriction of the air passage preventing exchange of air between the atmosphere and the alveoli of the lungs, leading to asphyxia and death. The constricting force is either the weight of the whole body or the weight of the head alone.[2] In India, hanging is among the top 5 methods of choice for committing suicide, the other preferred methods being poisoning, drowning, burning and jumping from a tall structure or in front of a train.[3] Main purpose of the study was to find out incidence, trends and patterns of hanging in Chhattisgarh.

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Materials and Method:

This is retrospective study conducted between June 2014 to December 2016, which included 50 cases of hanging which were autopsied in Mortuary of Government Medical College associated Hospital, Ambikapur, Sarguja, Chhattisgarh during this period. The data is collected from Inquest reports and post-mortem reports. The data thus obtained was analyzed and the study was done with respect to: age & sex wise distribution, manner of death, postmortem findings & Ligature findings. Information about crime scene obtained from police inquest report. The Collected data were tabulated on master chart and analyzed using Microsoft Excel.

Results

Distribution of Hanging cases according to Age and Sex:

Out of 50 cases of Hanging, 26 (52%) cases were males and 24 (48%) cases were females, thus indicating that majority of victims were males. Maximum number of victims 16 (32%) were in the age group of 21-30 years, followed by 15 (30%) victims and 08 (16%) victims were in the age group of 11-20 years and 31-40 years. Minimum numbers of victims were in the age group 71-80 years 01 (2%).

Table 1: Distribution of Hanging cases according to Age and Sex:

Age (in Years)	Male	Female	Total No. of cases	Total Percentage(%)
<10	00	00	00	0%
11-20	04	11	15	30%
21-30	08	08	16	32%
31-40	05	03	08	16%
41-50	03	02	05	10%
51-60	02	00	02	4%
61-70	03	00	03	6%
71-80	01	00	01	2%
>80	00	00	00	0
Total	26 (52%)	24 (48%)	50	100%

Place of occurrence of hanging cases:

Out of 50 cases of hanging maximum 48 (96%) cases occurred in closed place and least number of cases occurred in open place 02 (4%). In most of the cases ligature material was present along with the dead body insitu where as in remaining cases investigating officer was asked to provide ligature material for examination. In the present study ligature material was divided into two broad groups

1. Soft Material – Duppta, gamcha, Bedsheet, Saree etc.
2. Hard Material – e.g. Electric wire, Nylon rope etc.

In our study, dupatta was most common ligature material seen in 46% of cases. Knot was fixed in 82% of cases where as running type in 18% of cases.

Distribution of Hanging cases according to post-mortem findings:

Out of 50 cases of hanging, cyanosis was seen in 46 (92%) of cases, face congestion seen in 24 (48%) cases, sub conjunctival hemorrhage seen in 18 (36%) cases, dribbling of saliva was seen in 16 % of cases and petechial haemorrhage was seen in 11 (22%) of cases.

Table 2: Distribution of Hanging cases according to post-mortem findings:

Postmortem Findings	No. of cases	Percentage(%)
Face congestion	24	48%
Sub conjunctival haemorrhage	18	36%
Cyanosis	46	92%
Dribbling of saliva	16	32%
Petechial haemorrhage	11	22%

Location of ligature mark:

Out of 50 cases of hanging, ligature mark present above the level of thyroid cartilage in maximum number of cases 48 (96%).

Condition of Neck structure:

Out of 50 cases of hanging, fracture of hyoid bone present in 1 (2%) case.

Table 3: Condition of Neck structure:

Condition of Neck structure	No. of cases	Percentage(%)
Fracture of Hyoid bone	01	2%
Fracture of Thyroid cartilage	00	0%
Fracture of Cricoid cartilage	00	0%
No fracture	49	98%
Total	50	100%

Discussion

The use of the term asphyxia (Greek meaning pulselessness) in the forensic field is restricted to those forms of oxygen lack (anoxia, hypoxia) which results from mechanical interference with the process of respiration, that is, anoxic anoxia[4].

Out of 50 cases of Hanging, 26 (52%) cases were males and 24 (48%) cases were females, thus indicating that majority of victims were males. Maximum number of victims 16 (32%) were in the age group of 21-30 years, followed by 15 (30%) victims and 08 (16%) victims were in the age group of 11-20 years and 31-40 years. Minimum numbers of victims were in the age group 71-80 years 01 (2%).

Our result was similar to the observations made in the study conducted by Saiyed MZG the majority of the victims were males 46 (62.16%) while the females were 28 (37.83%) in number.[5]Most vulnerable age group was 21 to 30 years with total cases 34 (45.94%); by Chandegara PK et al in which males were 63% and females were 37%.[6] Most common age group was 21-30 years seen in 45% of cases.

Out of 50 cases of hanging maximum 48 (96%) cases occurred in closed place and least number of cases occurred in open place 02 (4%).

The observations in our study were similar to the study done by Patel AP et al majority of the victims (96.25 %) were recovered from closed areas. [7]

Out of 50 cases of hanging, cyanosis was seen in 46 (92%) of cases, face congestion seen in 24 (48%) cases, sub conjunctival hemorrhage seen in 18 (36%) cases, dribbling of saliva was seen in 16 % of cases and petechial haemorrhage was seen in 11 (22%) of cases.

Our results are similar with the study conducted by Saiyed MZG where out of 74 cases of hanging, Cyanosis was found in 70 (94.59%) cases. [5] Our results are not correlating with study conducted by Shaikh MMM where Facial congestion and cyanosis present in 34.88% cases of hanging and Dribbling of saliva was present in maximum 38.37% cases of hanging. [8]

Out of 50 cases of hanging, ligature mark present above the level of thyroid cartilage in maximum number of cases 48 (96%).

Our results are similar with the study conducted by Dekal V it was observed that in 192 (84.95%) cases, the level of ligature mark was above the level of thyroid cartilage. [9]

Out of 50 cases of hanging, fracture of hyoid bone present in 1 (2%) case.

The observations in our study were similar to the study done by Shaikh MMM et al where fracture of hyoid bone present in only11.63% cases;[8] by Miziara ID in which fracture of hyoid bone present in only 22.6% cases.[10]

Conclusion

In our study we conclude that, Out of 50 cases of Hanging, 26 (52%) cases were males and 24 (48%) cases were females, thus indicating that majority of victims were males. Maximum number of victims 16 (32%) were in the age group of 21-30 years. Maximum 48 (96%) cases occurred in closed place and least number of cases occurred in open place 02 (4%).

Suicide by means of hanging still remains one of the critical health issues leading to loss of life. Poverty, family dispute, mental illness, unemployment are some the important factor leading to suicide. Government and NGOs should actively participate

to overcome this problem. Focusing on stress management and proper mental health education should be provided.

Conflict of interests: The author declares that there is no conflict of interest.

Source of Funding: None

Ethical clearance: Ethical clearance from Ethical Committee G.M.C Amikapur Sarguja C.G. dated 29.05.17.

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Original Article

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Exploring the Prevalence of Psychological Autopsy in Indian Context

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Abstract

Background: Psychological Autopsy is basically done in order to understand the cause of death in equivocal and suicide death cases. It involves collecting information about the individual's life history, mental health history, and circumstances leading up to their death in order to gain insights into the complex factors that may have played a role.

Methods: The main aim of this study is to find the prevalence of Psychological Autopsy (PA) in India and to know how frequently is it being used as a means of investigation through close ended questionnaire of academicians, forensic psychologists, practitioners and trainees in the field of mental health, this study seeks to discover outcomes.

Conclusion: The fact that the majority of mental health professionals had never heard the phrase psychological autopsy, despite the fact that they had used it, was a significant weakness of this study.

Key words: Psychological autopsy (PA), Equivocal deaths, Investigations, Forensic Psychologists

Introduction

We can define *Psychological Autopsy* as an effort to identify the deceased's mental state prior to death. The psychological autopsy is crucial in reconstructing the psychic condition of the deceased person's mind, which in turn enables us to determine whether the death was accidental, the result of homicide, or both. This is a *Reconstructive Mental State Evaluation*, which is an expert request focused on examining a specific aspect of a deceased person's psychological condition at a previous time[8]. Psychological autopsy is a methodical procedure for assessing suicidal intention in equivocal cases.

The platoon conducting Psychological autopsy correspond of magistrate/coroner, medical officer, psychologist, psychiatrist, psychiatric social worker, police investigating officer, and law enforcement authorities [6]. And the time period for conducting the Psychological autopsy should be *1-6 months* as the collateral information collected from the family and friends may tend to be bias and memory loss can be seen as time moves forward[6]. A psychological autopsy is done by collecting *victim's medical history, suicide notes, school records, military records, employment records, coroner's report, forensic medical results, police reports, crime scene analyst reports, photos of the crime*

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scene, and autopsy results[6]. To investigate the circumstances surrounding the suicide, a forensic psychologist may occasionally even be dispatched right to the scene.

In India psychological autopsy became popular during the *Burari death case, Sushanth Rajput case and Sunanda Pushkar case*[1]. Psychological Autopsy was conducted in these cases to find a conclusion of the cause of death as well as to find the mental state of the person prior to death. This procedure is constantly the most effective means of giving information regarding the cause and manner of death. It can also be noted that psychological autopsy is complimentary investigation technique conducted by law police, death investigators, or medical examiners. It can be used in assisting their investigation using psychological theories. Various nations, including the *USA, UK, Canada, and Australia,* have already recognized psychological autopsy as crucial evidence in court. Although psychological autopsies are performed in India in accordance with *Section 45* of the *Indian Evidence Act*, their legal acceptability is still up for debate because there is no established protocol and no scientific evidence to support them[10].

Materials and Methods

AIM FOR RESEARCH

The main aim of the research was to find how frequently psychological autopsy is being used as an investigative tool in determining the cause and manner of death in suicide and undetermined death cases and prevalence of psychological autopsy in India. And the other aim was to know how common psychological autopsy was being used in their academics.

DATA COLLECTION

PRIMARY DATA

This study used a closed-ended online questionnaire to collect data from 50 participants, including mental health professionals, forensic psychologists, and academicians in India. The questionnaire aimed to determine the prevalence and use of Psychological Autopsy as an investigative tool. Initially, it was distributed online, and responses were gathered .Later, face-to-face interactions were conducted with academicians and mental health workers at NIMHANS to complete the questionnaire.

Consent to participate: Informed consent was obtained from all individual participants included in the study.

Time period: May 2023 to September 2023

Purposive Sampling: Purposive sampling was done in this study by choosing *mental health professionals, forensic psychologists and researchers* who have done prior studies on this topic.

Universe of the study: Across India

TOOLS USED:

Closed ended questionnaire using Google form

SECONDARY DATA

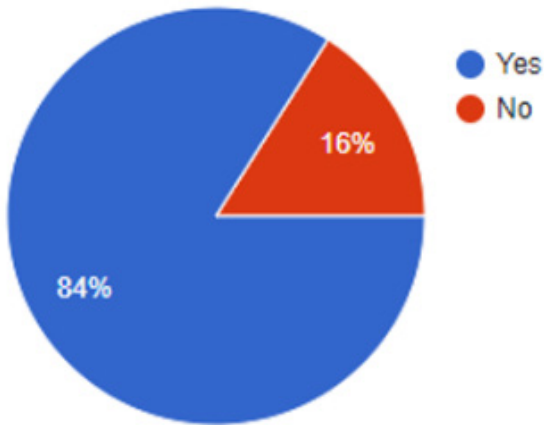
The *secondary data* was collected from various web resources.

Google Scholar, PubMed, MEDLINE

Results and Discussions

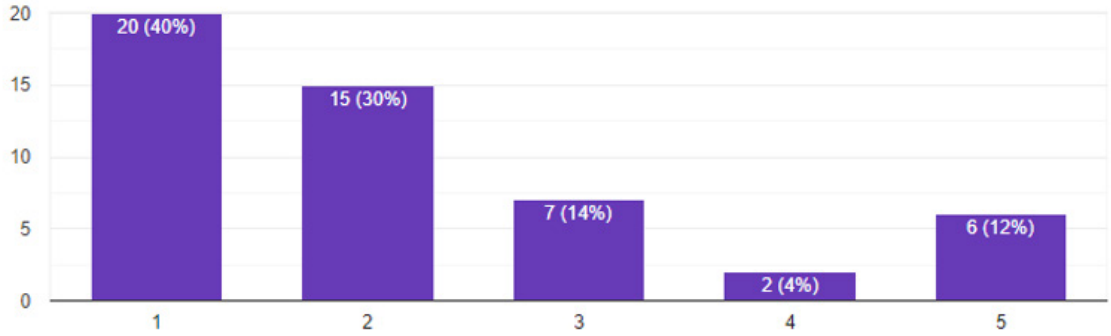
Based on the data obtained from the opinion based questionnaire we can see that how frequently psychological autopsy is being used as an investigative tool in India and its prevalence. From the data collected from various mental health professionals, forensic psychologists and academicians we could find the following:

1. Do you have any idea on the term Psychological autopsy?



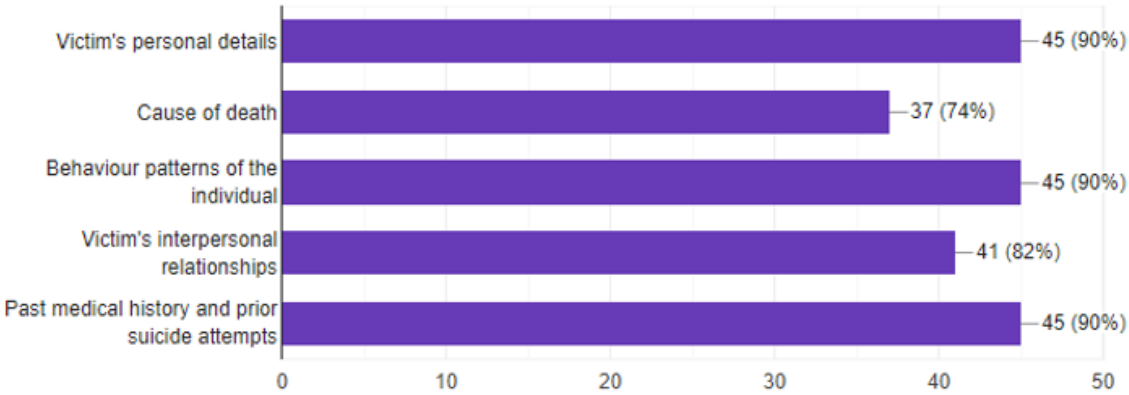
- **Figure 1: Figure shows responses of professionals to whether they have any idea on the term psychological autopsy.**

⇒ 84% opted yes they have an idea on the term psychological autopsy whereas a low percentage 16% have opted no.



- **Figure 2: Figure shows response of professionals stating if they know how important psychological autopsy is as an investigative tool.**

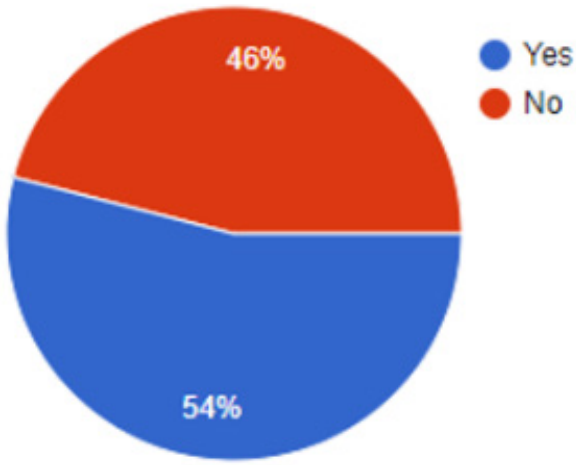
⇒ 70% have responded that psychological autopsy is important whereas 16% have said that it is not important.



- **Figure 3: Figure shows response of professionals on what all information are to collected while conducting psychological autopsy**

⇒ Based on the graph it is interpreted that 90% professionals told that it is important to collect past medical history, 90% have opted that it is important to collect victims personal details as well as behavioural patterns, 74% opted that cause of death details is also important while rest of the 82% opted saying that victims interpersonal relationship details is also important.

4. Do you know who all is included in conducting psychological autopsy?



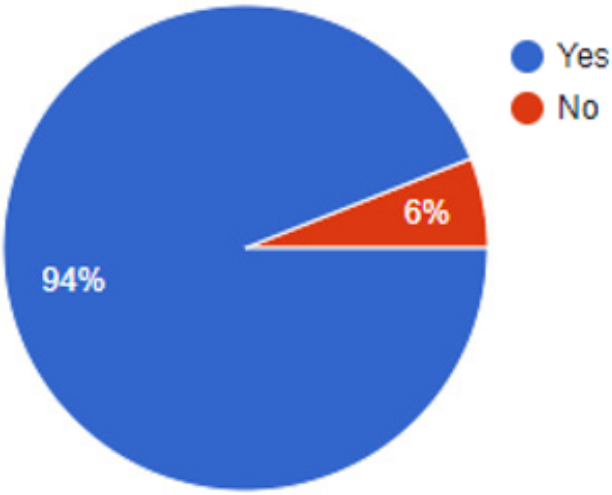
- **Figure 4: Figure shows response on if professionals know who all is included in conducting psychological autopsy.**

2. According to you, how important is psychological autopsy as an investigative tool?

3. What all information do you collect while conducting psychological autopsy?

⇒ 54% of the professionals know who is included in the team conducting psychological autopsy whereas 46% are not aware of this.

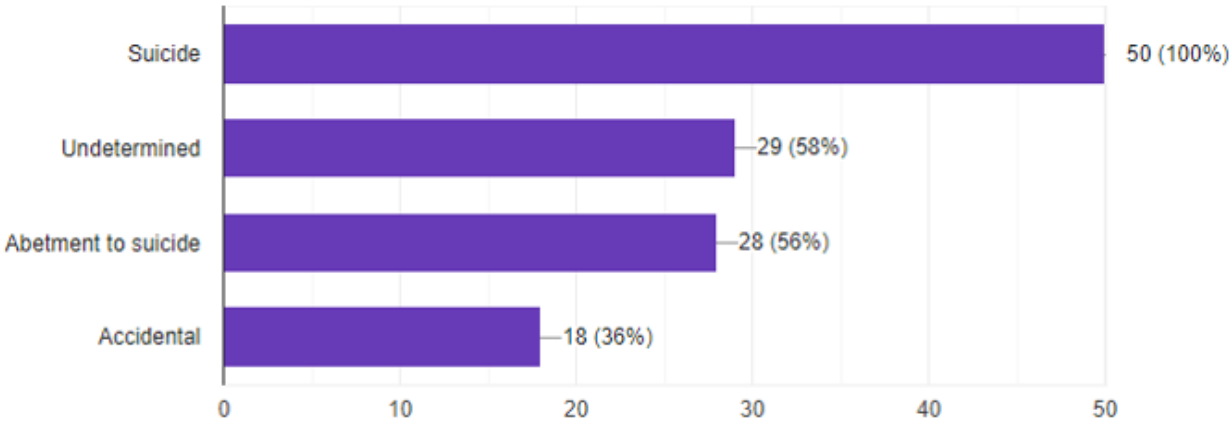
5. In cases where psychological autopsy is needed, do you collaborate with other professionals such as other psychologists or police?



- **Figure 5: Figure shows response of professionals to whether in cases where psychological autopsy is needed do they collaborate with other professionals**

⇒ 94% have opted yes saying they do collaborate with other professionals where 6% opted saying no that they are not collaborating with other professionals while conducting psychological autopsy

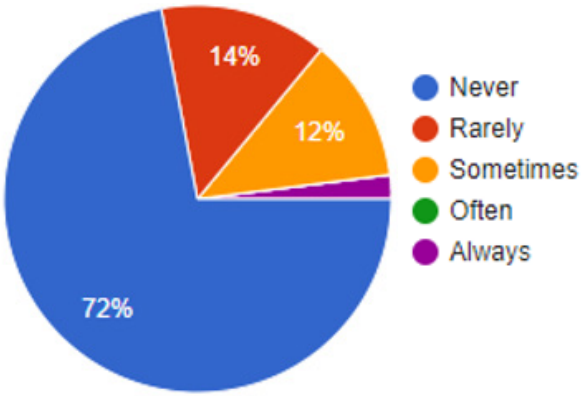
6. In what all cases psychological autopsy is being used?



- **Figure 6: Figure shows responses of professionals to whether they know in what all case psychological autopsy is being used.**

⇒ On interpreting the graph all of them have said that it is being used in suicide cases whereas 58% opted saying it is also being used in undetermined cases whereas 36% said that it is being used in accidental cases too.

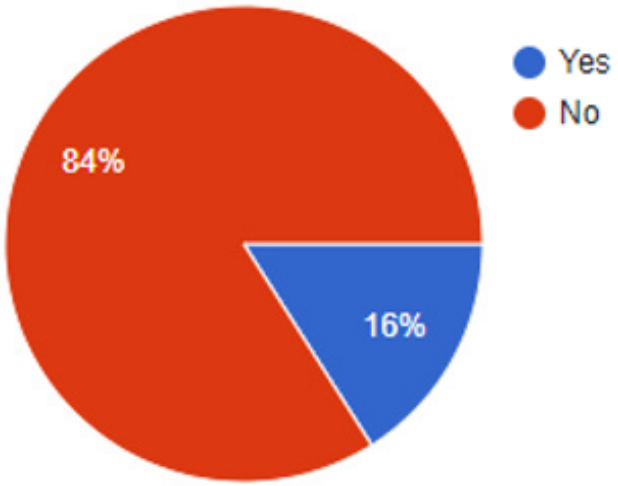
7. How often are you involved in cases that require psychological autopsy?



- **Figure 7: Figure shows response to whether professionals were involved in any case that require psychological autopsy**

⇒ On interpreting the pie chart it can be seen that 72% of the professionals have never involved in any cases that is conducting psychological autopsy whereas 14% professionals are rarely being included, 12% of professionals are sometimes being included and only 2% are always involved in psychological autopsy cases.

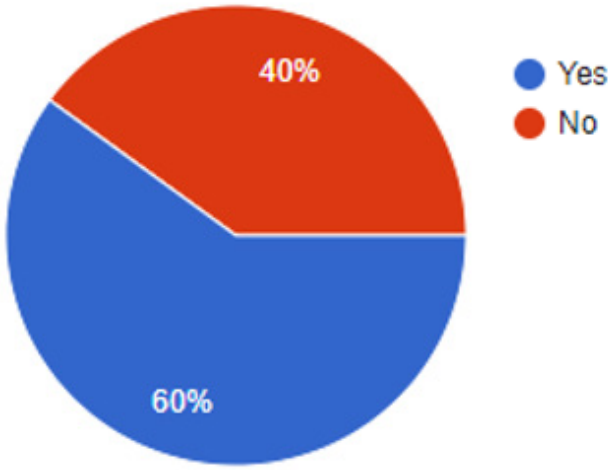
8. Are psychological autopsies commonly used as a standard investigative tool in your jurisdiction or practice?



- **Figure 8: Figure show response as to if psychological autopsy is commonly used as a standard investigative tool in their jurisdiction or practice**

⇒ On interpreting the pie chart in 84% professional's jurisdiction it is not being used as standard investigative tool whereas in 16% professional's jurisdiction it is being used as a standard investigative tool.

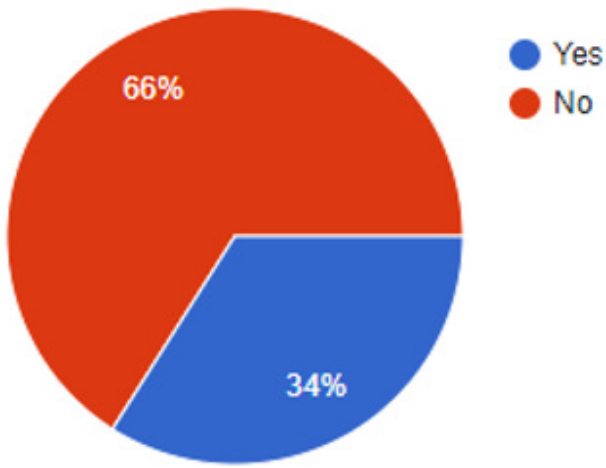
9. Are there any specific criteria or guidelines that determine when a psychological autopsy is recommended in a particular case?



- **Figure 9: Figure shows response of professionals whether there are any specific criteria or guidelines that determine when a psychological autopsy is recommended in a particular case.**

⇒ On interpreting the pie chart 60% of professionals has told there is specific criteria or guideline that determine if psychological autopsy is needed is in a particular case rest 40% said there is no such criteria.

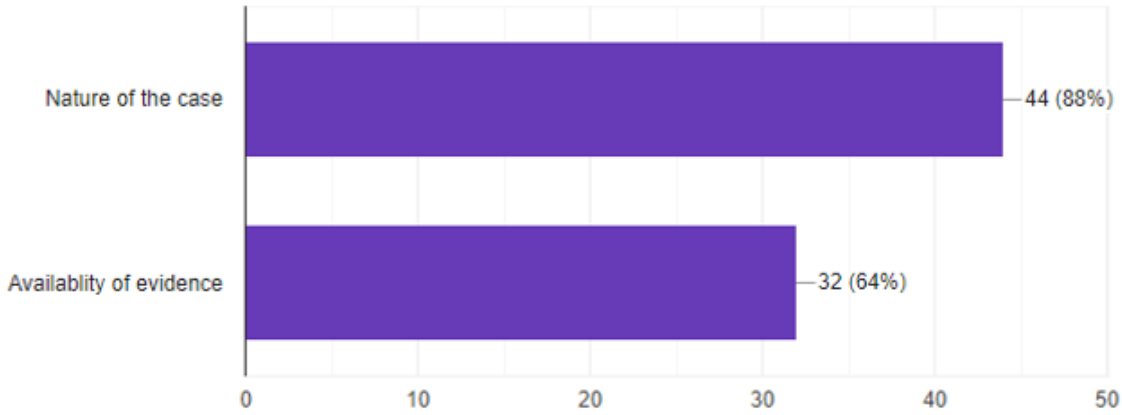
10. Have you noticed any trends or changes in the use of psychological autopsies over the years?



- **Figure 10: Figure shows response of professionals to whether they have noticed any trends or changes in the use of psychological autopsies over the years.**

⇒ On interpreting the pie chart it was seen that 66% said there is no change in the use of psychological autopsy whereas the rest 34% said that there are changes.

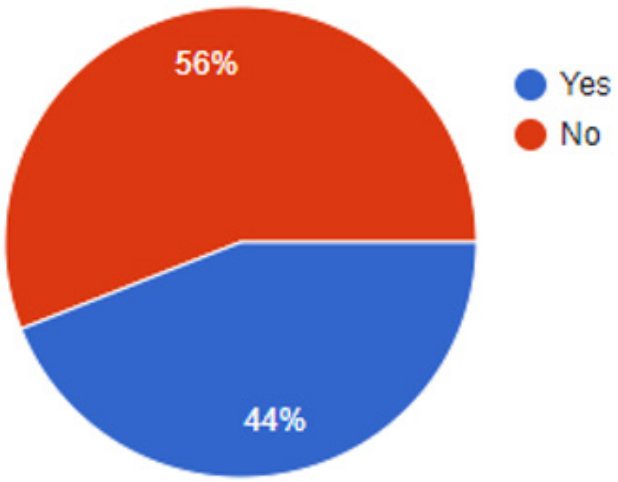
11. Are there any factors that influence the decision to conduct a psychological autopsy?



- **Figure 11: Figure shows response of professionals to whether there are any factors that influence the decision to conduct a psychological autopsy.**

⇒ On interpreting the graph 88% have told that nature of the case is an important factor whereas the rest 64% have told even the availability of the evidence is important.

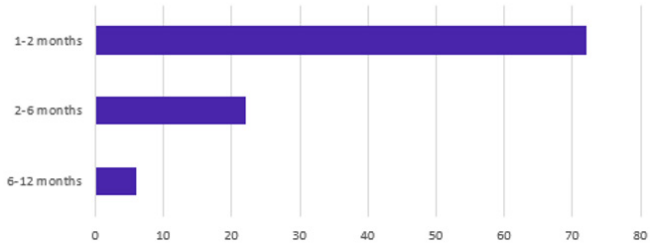
12. Are there any specific training programs or resources available to investigators regarding psychological autopsies?



- **Figure 12: Figure shows response of professionals to whether there are any specific training programs or resources available to investigators regarding psychological autopsy.**

⇒ On interpreting the pie chart 56% have opted yes saying there are training programmes or resources available while 44% said that there are no training programmes available.

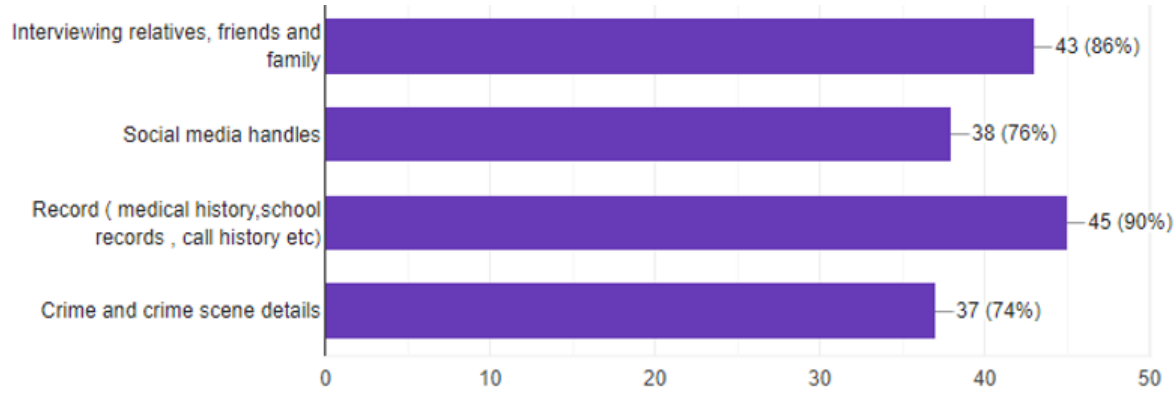
13. According to you, within what time period should psychological autopsy be conducted after death?



- **Figure 13: Figure shows response of professionals to whether they know within what time period psychological autopsy should be conducted after death.**

⇒ On interpreting the graph72% have said that within 1-2 months psychological autopsy should be conducted whereas 22% have said that within 2-6 months is the time period for conducting psychologicalautopsy rest 6% have opted saying the time period is 12 months and above.

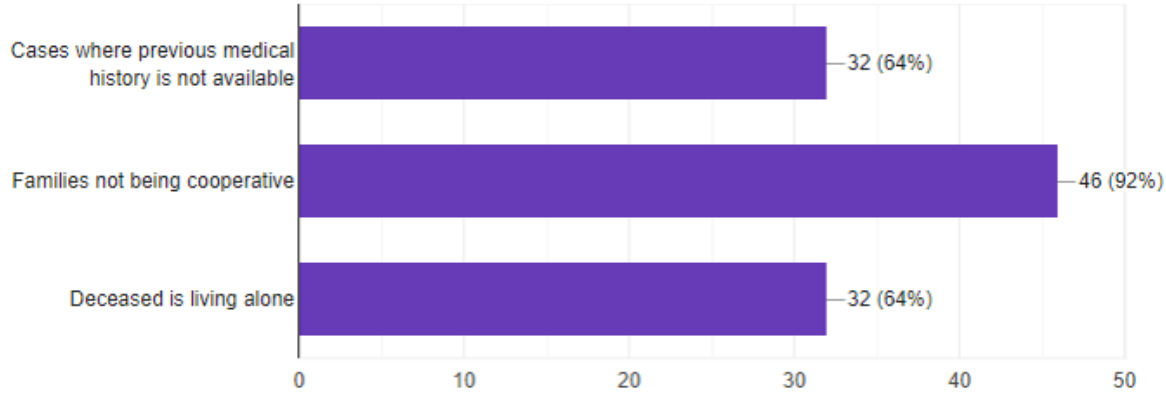
14. In the cases where deceased is living alone, how is the information collected?



- **Figure 14: Figure shows response of professionals on whether if deceased is living alone how the information is collected.**

⇒ On interpreting the graph it is seen that most of the professionals said that interviewing friends, family and other records are very important, whereas rest of the professionals have opted crime scene details and social media details collected are important when deceased is living alone

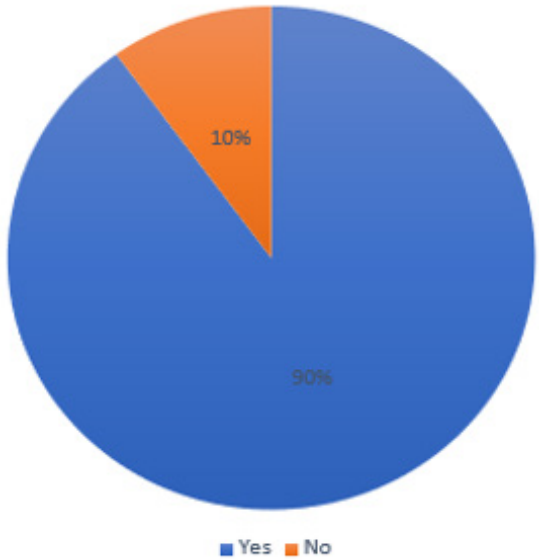
15. What are the main challenges in obtaining accurate and reliable information about the deceased individual's psychological history and mental state?



- **Figure 15: Figure shows response of professionals to what are the main challenges in obtaining accurate and reliable information about the deceased individual's psychological history and mental state.**

⇒ On interpreting the graph, it was seen that 92% have told that family not being cooperative is the main challenge whereas more than 64% have said all the three factors are main challenge in obtaining accurate and reliable information.

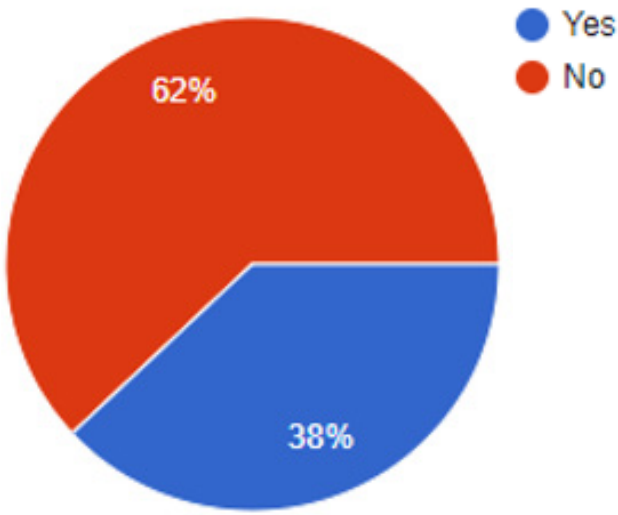
16. Do you consider potential biases or incomplete information provided by family members, friends, or other sources?



- **Figure 16: Figure shows response of professionals to whether they consider potential biases or incomplete information provided by family members, friends or other sources.**

⇒ On interpreting the pie chart, 90% opted yes saying they face potential biases and incomplete information whereas the rest 10% opted saying no.

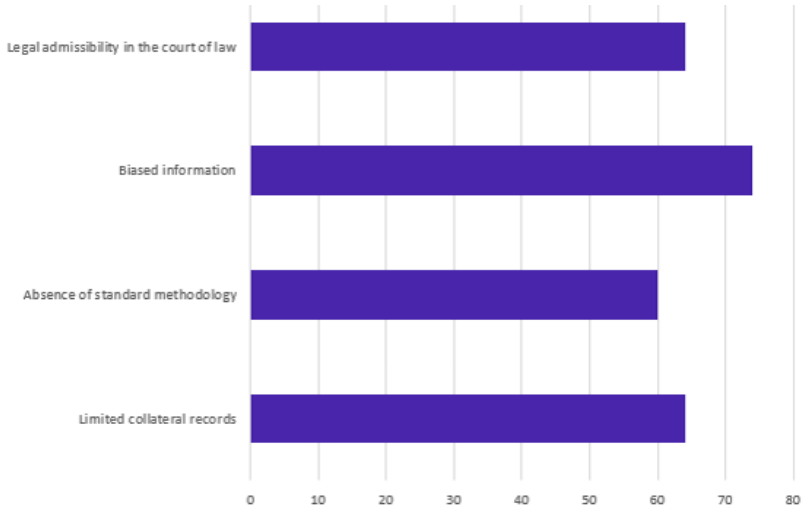
17. Have you encountered any ethical dilemmas or concerns specific to psychological autopsies?



- **Figure 17: Figure shows response of professionals as to if they have encountered any ethical dilemmas or concerns specific to psychological autopsy.**

⇒ On interpreting the pie chart 62% have told that they have not encountered any ethical dilemmas or concerns rest 38% told that they have encountered ethical dilemmas

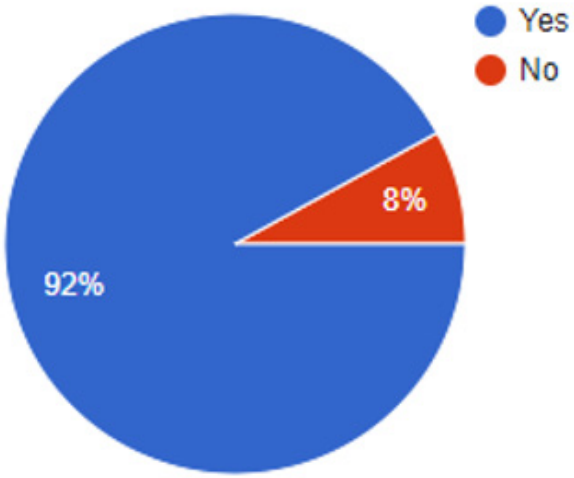
18. What are the limitations or challenges associated with conducting a psychological autopsy?



- **Figure 18: Figure shows response as to what are the limitations or challenges associated with conducting a psychological autopsy.**

⇒ On interpreting the graph 74% of the professionals said one of the major challenges in conducting psychological autopsy is biased information and above 50% of the professionals have chosen all other options.

19. Do you ensure the sensitivity and respect for the deceased individual's family and loved ones during the investigation?



- **Figure 19: Figure shows response as to if they ensure the sensitivity and respect for the deceased individuals family and loved ones during investigation.**
- On interpreting the pie chart 92% have opted yes saying that they ensure the sensitivity and respect for the deceased individual's family and loved ones during investigation rest 8% have opted no.

20. Suggestions given by the professionals who filled the form.

For this question which was optional 28 professionals have responded, important suggestions are:

- Psychological autopsy needs to be explored more in Indian setting in terms of standardized protocol and advancement for its use.
- We need training programs and strict learning standards for the people who are conducting this.
- Psychological autopsy is the area which is still budding in India. Many investigative officials are not even aware of such techniques. Due to which the admissibility in the system is affected

The utilization of psychological autopsy in criminal investigations in India has been noted to be very negligible and very less studies has been done on psychological autopsies in India[2][6]. Hence our study mainly focuses on the prevalence and current usage of psychological autopsy in India .Based on our study *84%* of the respondents have a knowledge on the term psychological autopsy while the others including mental health professionals doesn't have an idea on the term thus satisfying one of the major objective of the study which was to determine the prevalence of psychological autopsy. Another objective of the study that was satisfied was the results obtained regarding *70%* of the professionals said psychological autopsy is very important for investigation and other *30 %* said it is not important. The relevance of the study is that psychological autopsy is still a new area in India and many are not even aware of this method conduct and there is a need of standardizing the procedure so that it can be admissible in the court of law. Further extensive studies and researches are to be done on Psychological autopsy.

Conclusion

This study emphasizes on the prevalence of psychological autopsy in India and the frequency with which it is employed as an investigative tool to ascertain the reason and method of death in suicide and undetermined death cases. The study also sought to determine how frequently mental health professionals—including trainees—were involved in the investigative process as well as whether they were aware of it. And to ascertain Psychological autopsy was integrated into their academics. This study also aims to highlight the need for extensive study on psychological autopsy. Since the majority of respondents believed that psychological autopsy was crucial, more in-depth research is required to fully exploit this technique's potential in the investigation of suicidal and equivocal deaths as well as to standardize the techniques and procedures, which will aid in identifying the true cause of suicides and undetermined death cases. Through this questionnaire it was also possible to spread awareness about psychological autopsy to professionals who had a very little knowledge on this technique. There is a growing need for more research in this area with a larger sample size.

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Original Research Article

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A Study on Socio-Demogrpahic Profile on Suicidal Hanging Cases Brought for Autopsy to GMCH Mortuary: A Cross Sectional Prospective Study

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Abstract

Deaths by ligation around the neck are in practice from the time immemorial and before adventure of civilization. Hanging is that form of asphyxia, which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body or a part of the body weight. Due to population explosion, poverty and increasing stress and strain in our daily life, we frequently come across cases of suicides, homicides and accidents. The present study aims towards analyzing socio-demographic pattern, causes& precipitating factors for committing suicide by hanging in this region. Due to population explosion, poverty and increasing stress and strain in our daily life, we frequently come across cases of suicides, homicides and accidents[22]. According to the World Health Organization (WHO), over eight hundred thousand people commit suicide every year all over the world. In India, every year >1 lakh people commit suicide, and it accounts for 17.5% of all suicidal deaths in the world. Hanging is the most common method of committing suicide as it is believed to offer a rapid and relatively painless death, and there is no cost involvement other than that of the ligature material[2]. According to NCRB reports the incidence of suicides by hanging increasing every year by India, 31.5% in 2010, 32.2% in 2011, 37.0% in 2012[2]. The present study aims towards analyzing socio-demographic pattern, causes precipitating factors for committing suicide by hanging in this region.

Keywords: Hanging, asphyxia, suicide, socio demographic profile, autopsy

Introduction

Deaths by ligation around the neck have been occurring from time immemorial and before advent of civilization. The application of ligature for taking the life of another person was one of the common practices in uncivilized societies which were carried out into civilized societies[10]. Hanging is a form of violent asphyxial death, which is caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body or a part of the body weight. It may be complete or partial depending on the nature of suspension of the body[8]. Hanging could be of two types, namely complete hanging in which the whole body is

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suspended from the ground and partial hanging where a part of the body touches the ground[21]. Apart from the appearances of the hanging mark, internal cervical findings such as petechiae or ecchymoses in the soft tissue, fracture of hyoid bone and/or thyroid cartilage, and bruising of neck muscles greatly contribute in making a diagnosis of hanging[1,19]. As a rule of thumb, hanging is considered as suicidal unless proved otherwise[11]. The term asphyxia indicates a mode of dying, rather than a cause of death[15]. Due to population explosion, poverty and increasing stress and strain in our daily life, we frequently come across cases of suicides, homicides and accidents[22]. According to the World Health Organization (WHO), over eight hundred thousand people commit suicide every year all over the world. In India, every year >1 lakh people commit suicide, and it accounts for 17.5% of all suicidal deaths in the world. Hanging is the most common method of committing suicide as it is believed to offer a rapid and relatively painless death, and there is no cost involvement other than that of the ligature material[2]. According to NCRB reports the incidence of suicides by hanging increasing every year by India, 31.5% in 2010, 32.2% in 2011, 37.0% in 2012[2]. The present study aims towards analyzing sociodemographic pattern, causes precipitating factors for committing suicide by hanging in this region.

Methodology

This study was conducted on hanging cases coming for medico legal autopsy to the mortuary, GMCH during the 3 months study period from 01/12/2022 to 28/02/2023. A proper history, inquests, and other reports were collected on the information of friends and relatives. Consent of the legal guardian was taken in a prepared consent form. After due documentation, individual cases were taken and studied during autopsy.

Inclusion Criteria: • All the cases of suicidal hanging.

Exclusion Criteria: • Decomposed bodies • Strangulation cases. It was a cross sectional prospective study of death due to hanging to evaluate the incidence and other precipitating socio demographic factors.

Results

The total numbers of 223 hanging deaths which were brought to mortuary of Gauhati Medical College, Guwahati, Assam between 01/12/2022 to 28/02/2023 were analyzed.

In this 3 months study, a total of 920 medico legal autopsies were performed. Out of these, 223 (24.23%) hanging cases were found.

Sex Ratio:- In the present study out of 223 cases of hanging, 103 (46.18%) cases were male and 120 (53.81%) cases were female.

Table 1: Sex distribution of cases

Sl No.	Sex	No. of Cases	Percentage (%)
1	Male	103	46.18%
2	Female	120	53.81%
Total		223	

Incidence of Victims In Relation To Marital Status: - The incidence of hangings was more common in married individuals 119 cases (53.36%) as compared to single living person with 102 cases (45.73%). Widow people comprised of 2 cases 0.89%.

DISTRIBUTION OF HANGING VICTIMS AS PER RELIGION In the present study it has been shown that majority of hanging victims were Muslim.

DISTRIBUTION OF HANGING VICTIMS AS PER LOCALITY In present study it has been seen that majority of the hanging cases were hailed from rural area with 125 (56.05%) cases in comparison to urban area with 98 (43.94%) cases. In rural area female preponderance was more with 87 (72.50%) cases than female from urban area with 33 (27.50%). Whereas male from rural area had lower incidence with 38 (36.89%) than male from urban area had incidence with 65 (63.10%) cases.

DISTRIBUTION OF VICTIMS AS PER SOCIOECONOMIC STATUS: In the present study, it has been found that most of the victims were from lower socioeconomic status with 135 (60.53%) cases where male accounted as 57 (55.33%) cases and female accounted as 78 (65.00%) cases.

INCIDENCE OF EDUCATIONAL STATUS OF HANGING VICTIMS: In the current study, it has

been noticed that most of the victims had educational qualification up to high school group with 73 (32.73%) cases followed by primary school standard with 66 (29.59%) cases.

DISTRIBUTION IN RELATION TO DEGREE OF SUSPENSION: In the present study, it has been observed that complete hanging is more with 193 (86.54%) cases in comparison to partial hanging with 30 (13.45%) cases.

Table 2: Degree of Suspension

Degree of Suspension	Male Total=103	Female Total=120	No. of Cases Total=223	Percentage %
Complete	86 (83.49%)	107 (89.16%)	193	86.54%
Partial	17 (16.50%)	13 (10.83%)	30	13.45%

DISTRIBUTION IN RELATION TO DRIBBLING OF SALIVA: In the present study, it has been observed that in majority of the cases 188 (84.30%) showed absence of any salivary stain.

DISTRIBUTION OF VICTIMS AS PER OCCUPATIONAL STATUS: In the present study most of the hanging victims belongs to unemployed group with 47 (21.07%) cases, followed by victims belonging to business group 42 (18.83%). Student, private job, daily wage earner, cultivator, and government service group were comprised of 16 (7.17%), 26 (11.65%), 40 (17.93%), 39 (17.48%), and 13 (5.82%) cases respectively.

INCIDENCE OF VICTIMS AS PER AGE WISE DISTRIBUTION: In the present study it has been found that majority of the hanging victims belongs to the age group (19-29) years with total number of cases 67 (27.65%), followed by the age group (29-39) years with total number of cases 52 (23.31%).

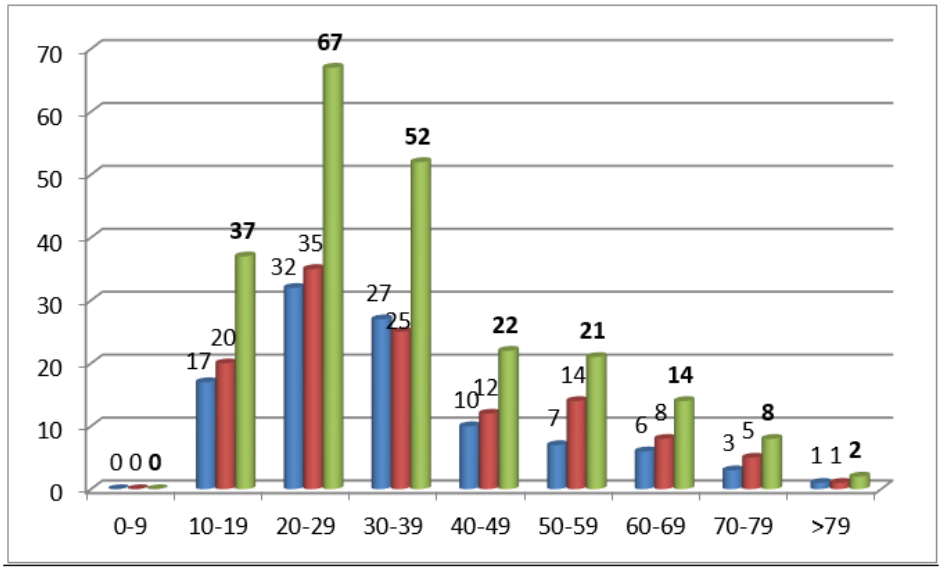

Fig 1: Age wise distribution of hanging cases

Discussion

The present study was carried out for period of 3 months duration from 01/12/2022 to 28/02/2023, a total of 920 autopsies were carried out in the mortuary of Forensic Medicine department, and out of these 223 cases were hanging. It was a cross sectional prospective study of death due to hanging to evaluate the incidence and other precipitating socio demographic factors.

In the present study, it is observed that out of 920 autopsies carried out in the mortuary of Gauhati Medical College and Hospital, 223 cases i.e. 24.23% were hanging cases and all were suicidal in nature.

Similar results were found in a retrospective study conducted by Baruah AM & Chaliha R (2014) at the Department of Forensic Medicine, Guwahati Medical College, Guwahati over a period of one year from January 2013 to December 2013; who found all the hanging cases to be suicidal in nature[3].

In the present study it has been found that majority of the hanging victims belongs to the age group (19-29) years with total number of cases 67 (27.65%). This is followed by the age group (29-39) years with total number of cases 52 (23.31%). Different outcomes were seen in a study by Sharija et al., as male dominance was noted in her study group as well as preponderance of female victims was noted in the younger groups[20]. Waghmare P B. et al., also mentioned that most affected age group was between 21 to 30 years[24]. This gives a hypothesis that younger yielding age group commonly vulnerable to suicide due to various factors such as academics, career and other related factors.Similarly in a retrospective study conducted in Department of FMT, RIMS, Ranchi prospectively from 1st March, 2013 to 30th May, 2014 by Kumar N et al (2016) found that out of 77 cases, a maximum of 9 (11.70%) cases belongs to the age group of (21-30) years followed by 8 (10.38%) cases falls under the age group (31-40) years[9]. This age group is most vulnerable because this period is more crucial struggling part of life where a person has to pass through great stress and strain, because he had to take all responsibilities of himself and family members too. In this period, they had to face lots of problems like job insecurity, financial insecurity, life style and also have the urge to be ahead of others in this highly competitive world. Besides the age group from (21-30) years, young people get frustration due to various reasons such as unemployment, family acceptance, poverty and love failure etc. so most of the victims were below 40 years of age.

During the study period of 3 months, in a sample of 223 cases, it was found that mostly females (53.8%) were affected as compared to males (46.1%). Similar findings with high female incidences were found in a study 'Deaths due to hanging among adolescents-A 10year retrospective study' conducted by S H Bhosle et al.(2015) who found that females(88.4%) were more affected than males(11.6%) among adolescents[5] and study by Begum Asma et al.(2017) 'Suicidal Death Due To Hanging' with (61.54%) females[4]. The findings are different as per 5 years prospective analysis of the autopsy records made by Samanta AK et al (2012), where male preponderance was more than female[17]. The female preponderance in our study might be the result of increased stress and oppression from the society, which is mostly dominated by men in our country, the social status and lack of financial independence and the burden of morality precipitating such incidences.

In the present study the incidence of hangings are more common in married individuals which comprised of 119 cases 53.36%. It suggests that marital disharmony was a major factor for suicide. A study on suicidal hanging conducted by Rao D (2015) between 2010 and 2013, out of 264 hanging cases, 186 (70.45%) cases was married victims[16]. In this study male married victims had higher preponderance than female married, which is opposite to the present study[16]. A prospective study conducted by Chandegara PK et al (2014) where he observed that married persons have more incidence of hanging with total of 66% cases where female married comprised of 81.3% cases and male married person with 59.6% cases, which is similar to the present study[25]. From current study and comparison with previous study it has been observed that both married male and females are higher chances of suicidal hanging death in India. Due to repeated physical and mental torture, females were go beyond the threshold level of self-constrain and may commit suicide by hanging. In case of male; poverty, lack of job, family problems, defamation and alcoholism may be the main reason for suicidal hanging. The reason could be stress associated with marriage, dowry problems, dependency, interpersonal problems with spouse and his relatives etc. in relation to their socio demographical variance, family quarrel among husband and wife was also an important cause, which poses major problems among Indian married man as well as women in our society.

In the present study it has been shown that majority of hanging victims were from Muslim families, which is in contrast to Waghmare PB et al (2014) in his study on "Analysis of Asphyxia Deaths Due To Hanging" revealed that out of total 60 cases of hanging, 71.66% cases belongs to Hindu religion, 25% cases were Muslim and 3.3% cases were

Christian[25]. The increase number of victims might be due to higher density of Muslim population in rural parts of Assam with poor socio economic conditions and standard of living, the socio cultural scenario being peculiar to India.

In the present study, it has been found that hanging victims were more in the lower socioeconomic status with 135 (60.53%) cases. The findings are similar to the findings of Das G et al (2014)[7] and study conducted in Surat by Chandegara PK et al (2014)[6] who found most of the victims from lower socio economic status and from rural areas. The cause of the higher rates of incidence of hanging cases among rural population in this study could be due to poverty, poor educational status, social isolation, greater difficulty in detecting the warning sign, limited access to health facilities and doctors, unemployment and lack of awareness about the value of life. It also reflects that majority of people still live in villages than the cities because in India villages are more in comparison to town area. This is in accordance with the general trend of criminal profile which originates from the roots of environmental and psychological factors. In the current study, it has been noticed that most of the hanging cases belongs to high school group with 73 (32.73%) cases and least hanging victims were found in post-graduate educational status with 03 (1.34%) cases .The incidence rate of suicidal hanging was gradually decreases with the increasing level of education. The findings are similar to the findings of Samanta AK et al (2012[18].

Most of the hanging victims preferred to hang in indoor place with 157 (70.40%) cases as compared to outdoor places with 66 (29.59%) cases. Findings are similar to the findings of Patel AP et al (2012) who observed that majority 96.25% committed suicide by hanging within the closed secure places[12].

Complete hanging is more with 193 (86.54%) cases in comparison to partial hanging with 30 (13.45%) cases. Findings are similar to the findings of Singh KHP et al (2013)[23] who found 68.57% complete hanging cases. The reason behind increase number of complete hanging cases in most of the studies probably due to belief on the 100% guaranteed and rapid death as because in complete hanging the entire body is suspended and the weight of the whole body is thrown upon the ligature.

In the present study most of the hanging victims belongs to unemployed group with 47 (21.07%) Cases, followed by victims belonging to business group 42 (18.83%). Findings are similar to the findings of Rawat V and Rodrigues EJ (2015)[14] who found majority of the victims were unemployed. The reason behind the occurrence of high incidence of suicidal hanging or any other suicidal deaths among daily wage earner and unemployed persons is probably due to financial distress, lack of social/financial support, difficulty to run family in daily competitive life.

In the present study, it has been observed that in most of the cases 196 (87.89%), the tongue is not protruded whereas it is protruded in only 27(12.10%) cases. Findings are like the findings of study by Rama Krishna et al.[13], 'who noted that the tongue was found to be protruded at its tip and bitten or placed in between anterior/incisor teeth in 293 (40.92%). In the present study, it has been observed that in most cases, 188 (84.30%) showed absence of dribbling of saliva. Findings are similar to the findings of Rama Krishna et al.[13]

Conclusion

A multisite intervention study on suicidal behaviors by the WHO had revealed that it is possible to reduce suicidal death by brief and lowcost intervention in developing countries. It is important to study the socioeconomic conditions and cultural factors involved in hanging cases in order to identify the vulnerable people who are likely to commit suicide in a target population. And as such this study will help us to understand the factors that may be the cause for hanging deaths and the outcome of these incidences.

Ethical Clearance: Taken From Institutional Ethics Committee of Gauhati Medical College & Hospital.

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Conflict of Interest: None.

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Original Research

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Study of Pattern of Injuries in Homicidal Deaths Autopsied at Belagavi Institute of Medical Sciences, Belagavi: A Prospective Study

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Abstract

Homicide means the killing of one human being as a result of conduct of another. Homicidal deaths are seen in every part of the world but the toll varies from place to place. As per National Crime Records Bureau and Statistics, in 1953 the number of homicidal deaths were 9082 which has exponentially increased to the extent of 29,272 in 2021.Such being the disturbing data and Belagavi being the biggest district of Karnataka state, a detailed study was undertaken on the pattern of injuries in homicidal deaths.

Materials and Methods: A Prospective study was conducted on all cases of homicidal deaths registered under Sec 302 IPC autopsied at Belagavi Institute of Medical Sciences from January 1st 2016 to June 30th 2017 formed the study material. Information on various factors such as age, sex, weapon used, injury pattern were noted for each case in a separate proforma.

Results: Among 1265 cases autopsied during the study period, 54 cases were homicidal deaths. Among 54 cases, head injuries were present in 15 cases (27.78%), stab injury involving neck, thorax and abdomen were present in 14 cases (25.93%), injuries caused by asphyxia were seen in 14 cases (25.93%), majority of the victims were males (64.81%) and the predominant age group was 20 to 39 years (48.15%).

Conclusion: The homicide being the preventable cause of death, its incidence and prevalence can be reduced by strict implementation of law. The long term, wide-ranging policies are required to eradicate this heinous crime.

Keywords: Homicide, Autopsy, Injury pattern, Weapon.

Introduction

Homicide is killing of a human being by another human being.[1]Today the world has become less safe than ever before. Increasing violence constantly threatens our well-being, with homicide being one of the scariest threats.

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The word homicide is derived from Latin word homo- "man'' and cide- "Icut".[2] Homicidal deaths are seen in every part of the world but the toll varies from place to place.

According to United Nations Office on Drugs and Crime (UNODC) 2019, intentional homicide caused the deaths of almost half a million people (464,000) across the world in 2017.Asia accounted for 23% of total homicide victim worldwide. Around 81% of homicide victims were male. Men aged between 15 and 29 are at the highest risk of homicide globally. The global average homicide rate stands at 6.1 per 100,000 population.[3]

As per NCRB statistics, in 1953 the number of homicidal deaths were 9082 which has exponentially increased to the extent of 29,272 in 2021.[4]As per NCRB(2021) both at national level and Karnataka, majority of the victims were males and they were in the age group of 15 to 45 years.[4]It is clear from all the above data that statistics played a major role in framing policies to curb the different menaces, murder being one of the major among the menace. The pattern of injuries may provide vital information to law enforcement agencies thereby helping the law to punish the accused.

With a large unemployed male population, increasing youth population, rapid urbanization and increasing alcohol and drug abuse, India is a ticking time bomb of everyday violence. Hence a detailed and thorough analysis and presentation of homicidal death is definitely the need of the hour.

AIMS AND OBJECTIVES OF THE STUDY

To know the pattern of injuries in homicidal deaths autopsied at Belagavi Institute of Medical Sciences, Belagavi.

Materials and Methods

The present study was conducted in the Department of Forensic Medicine and Toxicology

At Belagavi Institute of Medical Sciences, Belagavi from January 1st 2016 to June 30th2017

after getting necessary approval from the Institutional Ethics Committee.

Inclusion criteria:

All cases of homicidal deaths registered under Sec 302 IPC autopsied at Belagavi Institute of Medical Sciences during the study period.

Exclusion criteria:

All cases other than homicidal deaths autopsied at Belagavi Institute of Medical Sciences during the study period.

Source of data:

1. Information about the pattern of injuries sustained by the deceased was obtained from post mortem findings and hospital case records (in admitted cases).
2. The socio demographic profile of the deceased was obtained from police records, hospital records and also by direct interrogation with the next of kin, relatives and friends accompanying the victims.

Results

During the study period from January 1st 2016 to June 30th 2017, a total of 1265 cases were autopsied at Belagavi Institute of Medical Sciences, Belagavi. Out of 1265 cases, 54 cases were homicidal deaths constituting 4.26%. Out of 54 cases, 50 cases were registered under Sec 302 IPC and 4 cases which were registered initially under Sec 174(c) CrPC were later converted into Sec302IPC on perusal of autopsy findings**. (Table 1)**

Out of 54 cases, 35 were males (64.81%) and 19 were females (35.19%)- **(Table 2)** and maximum victims 13 (24.07%) each were in the age group of 20-29 years and 30-39 years, followed by 10 cases (18.52%) in the age group of 40-49 years, 6 cases (11.11%) each in the age group of 0-9 years and 50-59 years, and 3 cases (5.55%) in the age group of 10-19 years**. (Table 3)**

In the present study, majority of the victims were from urban area. Out of 54 victims, 35(64.81%) were from urban area and 19 (35.19%) were from rural area**. (Table 4)**

Among 54 cases, head injuries were present in 15 cases (27.78%), stab injury involving neck, thorax and abdomen were present in 14 cases (25.93%), injuries

caused by asphyxia were seen in 14 cases (25.93%),chop wounds involving torso seen in 3 cases (5.55%),burn injuries and blunt trauma to testes and abdomen were seen in 2 cases each (3.70%).Fire arm injury were seen in 1 case (1.85%). Pattern of injuries could not be determined in 3 cases (5.55%) due to skeletonisation/ putrefaction of the body. **(Table 5 and 6)**

Defence wounds were present in 13 cases (24.07%) whereas there was no defence wounds in 38 cases (70.37%).In 3 cases defence wounds could not be commented due to putrefaction/skeletonisation of the body**.(Table 7)**

Table No 1: Showing total number of medico-legal autopsies conducted in Belagavi Institute of Medical Sciences during the study period

Total No of Autopsied Cases	Total No of homicidal deaths among autopsied cases	Percentage
1265	54	4.26%

Table 2: Showing sex wise distribution of homicidal deaths

Sex of the deceased	No of cases	Percentage
Male	35	64.81%
Female	19	35.19%
TOTAL	54	100%

Table 3: Showing Age wise distribution of homicidal deaths

Age in years	No of cases	Percentage
0-9 yrs	6	11.11%
10-19yrs	3	5.55%
20-29yrs	13	24.07%
30-39yrs	13	24.07%
40-49yrs	10	18.52%
50-59yrs	6	11.11%
60-69yrs	1	1.85%
70-79yrs	1	1.85%
>80yrs	1	1.85%
TOTAL	54	100%

Table 4: Distribution of homicide according to domicile pattern

Area	No of homicidal cases	Percentage
Urban	35	64.81%
Rural	19	35.19%
Total	54	100%

Table 5: Showing distribution of pattern of injuries in homicidal deaths:

Pattern of injuries			No of cases	Percentage
Head injury	Skull fracture+ Intracranial haemorrhage	9	15	27.78%
	Intracranial haemorrhage	6		
Stab injury	Into thorax	5	14	25.93%
	Into abdomen	7		
	Neck	2		
Chop wounds			3	5.55%
Ligature strangulation			6	11.11%
Throttling			2	3.70%
Smothering			1	1.85%
Drowning			5	9.26%
Burn injuries			2	3.70%
Firearm injury			1	1.85%

Continue.....

Blunt trauma by kicking/fisting	To testes leading to testicular haemorrhage	1	2	3.70%
	To abdomen leading to foetal death by abruptio placenta	1		
Not known			3	5.55%
TOTAL			54	100%

Table 6: Showing distribution of stab injuries in homicidal deaths

Stab injury			Total no of cases	Percentage
Abdomen	Liver	2	7	50%
	Mesentry	2		
	Spleen	1		
	Kidney	1		
	Bowel	1		
Thorax	Heart	2	5	35.71%
	Lung	2		
	Subclavian Vessels	1		
Neck (Injury to major blood vessels)			2	14.29%
TOTAL			14	100%

Table 7: Showing presence or absence of defence wounds in percentage and numbers

Defence wounds	Total no of cases	Percentage
Present	13	24.07%
Absent	38	70.37%
Not Known	3	5.56%
TOTAL	54	100%

Discussion

A prospective study conducted to study pattern of injuries in homicidal deaths among autopsied cases at Belagavi Institute of Medical Sciences, Belagavi for a period of one and half years from January 1st 2016 to June 30th 2017 reveals that out of 1265 medico-legal autopsies conducted during the study period, 54 cases (4.26%) were of alleged homicidal deaths.

In the present study, majority of the victims were male constituting 64.81% whereas females constituting 35.19%.The ratio of male and female were1.84:1.The reason for male dominancy was probably due to the aggressive nature of male. Similar findings were observed in the study conducted by Chaudhary B L et al[5] and Basappa S Hugar et al[6]

In the present study it was observed that majority of the victims were in the age group of 20-29 years and 30-39 years i.e., the third and fourth decade of life. Our finding is similar to the study conducted by S.Mohanty et al[7]and AkshatVij et al[8].

In the present study majority of the victims were from urban areas constituting 64.81% (35 cases) whereas remaining 35.19% (19 cases) from rural areas. Study by Shetty A K[9] in Belagavi from 2003 to 2008 showed majority of the victims were from rural area constituting 57% which is in contrast to our study, which shows the effects of rapid urbanization in a period of about 14yrs.

In the present study, 17 cases (31.48%) of victims exhibited evidence of injuries due to sharp weapons. Among 17victims,14(25.93%) were victims of stab injuries involving (abdomen-7, thorax-5 and neck-2) 3 victims (5.55%) had sustained chop wounds.

15 cases (27.78%) sustained head injuries by hard and blunt weapons.6 victims (11.11%) exhibited evidence of injuries due to strangulation.5 victims (9.26%) showed evidence of drowning. Burn injuries and throttling were present in 2 cases each (3.70%).

1 victim (1.85%) sustained firearm injury. In our study, majority of victims sustained injuries due to sharp weapons which is similar to the study conducted by S.Mohanty et al[7]. Study conducted by Gadge Sachin et al[10] shows majority of victims (65.7%) sustained injuries by blunt weapons which is in contrast to our study.

Our study showed 24.07% exhibited evidence of defence wounds and 70.37% of victims had no defence wounds.

Conclusion

Man by nature is a fighting animal. Hence to expect a society without crime will be a myth. What's said above though is the reality to core, but still a crime like murder is and will always be undigestable. Meticulously planned &well conceived murders are the ones which pose grave threat to society. The problem at hand can be solved or settled by killing some human being, this very thought is horrendous and the even more horrible & unfathomable part of a murder is the culprit thinking that he can easily escape from clutches of law after such heinous crime.

Conviction rate for homicide is alarmingly less. Causes for such low conviction rates range from poor police investigation, witness turning hostile due to threat, shortage of investigating officers, lack of evidence and poor performance of the prosecutors. Faster trail of cases aided by fast and thorough investigation will, in all probability, increase the conviction rate and thus create a fear psychosis in the society that murderers will never go unpunished.

Fear of law is the need of the hour to curb such heinous crimes. The average homicide rate can be declined further, if Forensic experts, Police & Judiciary all work in unison & leave no stone unturned in getting conviction. Government should invest in socioeconomic development to bring down the rate of violent crimes.

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Original Article

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Unveiling the Causal Factors of Female Mortality in the Initial Seven Years of Marriage: A Cross-sectional Study

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Abstract

Introduction: This unique essay conducts a thorough investigation into the causes of female mortality within the first seven years of marriage. Despite substantial improvements in healthcare and women's rights, many countries continue to experience early female death after marriage. For establishing successful interventions and policies targeted at lowering this troubling trend, understanding the underlying causes is essential.

Aims and objectives: The purpose of this study is to analyze the underlying factors that contribute to early female death after marriage by combining quantitative and qualitative approaches, drawing on a multidisciplinary approach.

Methodology: All cases of "unnatural deaths of females within seven years of their marriage" brought to the Mortuary, over the one year from January 2017 to December 2017, totaling 152 cases, served as the basis for the current study.

Results: The study found several important characteristics that were linked to a higher risk of female mortality during the first few years of marriage. Socioeconomic inequalities, poor access to healthcare, gender-based violence, cultural norms and expectations, mental health issues, and restricted marital autonomy are some of these reasons. The findings underscore the intricate interplay between societal, structural, and individual elements that fuel this worrying trend.

Conclusion: This study reveals that the age group of 18-22 years experiences the highest casualties due to early marriage in India. The majority of victims lack the maturity to handle marital responsibilities. Husband's behavior plays a key role in these deaths, with cooperation and love being scarce. Lower middle-class women are at higher

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risk, and low education levels are influential. Addressing early marriage, promoting education, and raising awareness are crucial steps to protect the well-being of young women and create a safer environment within marriages.

Keywords: female mortality, marriage, causative factors, gender-based violence, healthcare access, socio-economic disparities, mental health, gender equality, interventions.

Introduction

There has been a shocking rise in untimely deaths among newlywed females in our communities in recent years.[1] Although marriage is frequently seen as a happy event, it involves major social, emotional, and economic changes.[2] The greater risk of female death in the first seven years of marriage, however, has been made clear by recent research, which is a concerning issue.[3] Despite improvements in women's rights and healthcare, this worrying trend still exists in many countries, needing a greater comprehension of its root reasons.[4]This problem is a result of several circumstances, including marital maladjustment, and discord between newlywed women and their in-laws' families.[5] The bride may have difficulties associated with pregnancy, childrearing, household responsibilities, and employment requirements when the guardianship changes and a new family is created, all of which can be stressful.[6] In addition, some women experience both emotional and physical abuse as a result of marital disputes, in-law issues, arranged and child marriages, joint families, the dominance of mothers-in-law, infidelity, infertility, the desire for a male child, sexual jealousy, unemployment, and financial dependence.[7][8] The dowry system in India poses a serious threat to married women, particularly Hindu women. Even global organizations are aware of this avaricious scourge.[9] The shocking truth is that women, even mothers, and mothers-in-law, frequently participate in deaths caused by dowries. Such violence has psychological and societal repercussions, hence evidence-based therapies and approaches are needed to address this problem.[10][11] The purpose of this study is to provide information on the underlying factors that contribute to early female death after marriage and the consequences for local authorities, healthcare professionals, and policymakers.[12][13]To improve women'swell-being, we want to advance gender parity in marriage relationships and society at large by recognizing the aforementioned factors.[14] The numerous contributing factors discovered in this study will be discussed in detail, along with the implications and potential solutions, in the parts that follow. Within the crucial first years of marriage, we want to decrease early female fatalities.[15]This study aims to contribute to the overall endeavor of building a safer and more equal environment for women inside the institution of marriage via thorough research and analysis.

Material and Methods

The 152 cases of "unnatural deaths of females within seven years of their marriage" that were reported to the District Mortuary in Kanpur throughout the course of a single year, from January 2017 to December 2017, served as the basis for the current study. After having informed and explained our investigation to their guardians and obtaining their agreement, information was obtained from their relatives, guardians, neighbors, and investigating police officers.

Exclusion Standards:

1. Unidentified bodies in which the pertinent history could not be determined.
2. Deaths where the cause of death was determined by autopsy to be natural.
3. Deaths that happened as a result of mass casualty events like train derailments, severe auto accidents, explosions, etc.
4. Deaths that resulted from traffic accidents, even though it wasn't the case of mass casualty.
5. Deaths in which history and questioning revealed that the marriage had lasted more than seven years

Observations and Results

Table 1: Distribution cases based on Age group

AGE GROUP	NO. OF CASES	PERCENTAGE %
18-20	36	23.68
21-22	50	32.89
23-24	19	12.50
25-26	27	17.76
27-28	11	7.23
29-30	9	5.92
TOTAL	152	100

The age group of 21–22 years saw the highest percentage of casualties (32.89%), followed by that of 18–20 years (23.68%).As a result, the majority of the victims are not mature enough to handle the responsibilities of marriage. No occurrences of unnatural deaths were discovered in the over-30 age group, having completed less than seven years of marriage, perhaps due to the practice of early marriage in India and because the person becomes mature enough.

Table 2: Distribution cases based onthe husband's Behavior toward the Wife

BEHAVIOR	NO. OF CASES	PERCENTAGE %
Co- operation	59	38.81
Loving	21	13.81
Rash / Negligent	44	28.94
Unhappy	53	34.86
Total	152	100

A key factor determining the deaths of women in the first few years following marriage is the husband's treatment of the wife (Table 2). Numerous aspects of conduct, such as whether the husband is cooperative, affectionate, rash, or has a bad relationship with his wife, influence incidence. In this study, we discovered that husbands were only cooperative in 59 cases (38.81%), whereas relationships were unhappy in 53 cases (34.86%) and could be attributed to rashness in 44 cases (28.94%). Only 21 cases (13.81%) involved husbands who showed their wives love.

Table 3: Distribution cases based on Socio-Economic Status

SOCIO-ECONOMIC CLASS	NO. OF CASES	PERCENTAGE %
LOWER (CLASS V)	10	6.57
LOWER MIDDLE (CLASS IV)	81	53.28
MIDDLE (LASS III)	55	36.18
UPPER MIDDLE (CLASS II)	6	3.94
UPPER (CLASS I)	0	0
TOTAL	152	100

The majority of the victims, or 81 cases out of 152 (53.28%), belonged to socioeconomic class IV (lower middle class) (Table 3). The middle class is next, where 55 cases (36.18%) were discovered. It was discovered that there were significantly fewer occurrences in the lower class (class V of the socioeconomic classification) i.e., 10 cases, or 6.57%, were discovered. Only 6 occurrences (3.94%) occurred in class II's upper middle class. The highest class (class -1) did not have even one case.

Table 4: Distribution cases based on Duration of Marriage

DURATION	NO. OF CASE	PERCENTAGE %
<1	27	17.76
1-2	40	26.31
2-3	22	14.47
3-4	12	7.89
4-5	19	12.50
5-6	10	6.57
6-7	22	14.47
TOTAL	152	100

A maximum number of deaths are found within two years of marriage. (Table 4). Most of such deaths were between 1-2 years of marriage (26.31%), followed by deaths within the first year (17.76%). Deaths between2-3 years of marriage were 14.47%, which is equal in number to deaths between 6-7 years of marriage. But in the latter group, many of the deaths were due to infertility. Deaths between 3-4 years and 5-6 years after marriage were 7.89% and 6.57% respectively.

Table 5: Distribution cases based on Religion of Female

RELIGION	NO. OF CASE	PERCENTAGE %
HINDU	141	92.76
MUSLIM	11	7.23
SIKH	-	
CHRISTIANS	-	
TOTAL		

Besides the fact that Kanpur has a big Muslim population of more than 20% of the victims (141 out of 152) were Hindu (92.76%) (Table-5)Only 11 Muslim cases (7.23%) were found in this study. Not a single case of newly married female death was found in Sikh and Christian communities.

Table 6: Distribution cases based on Community Character

COMMUNITY CHARACTER	NO. OF CASES	PERCENTAGE %
RURAL	83	54.60
SUBURBAN	47	30.92
URBAN	22	14.47
TOTAL	152	100

Table 6 shows the community character of the victims. The list is topped by a rural community with 80 cases (55.94%). While 44 cases (30.77%) belonged to a suburban community, whereas only 19 cases (13.29%) were from urban areas.

Table 7: Distribution cases based on Educational Status of Victims

EDUCATION STATUS	NO. OF CASES	PERCENTAGE %
ILLITERATE	38	25.00
PRIMARY	54	35.52
JUNIOR HIGH SCHOOL	13	8.55
HIGH SCHOOL	33	21.71
INTERMEDIATE	7	4.60
GRADUATE	6	3.94
POSTGRADUATE	0	0
TECH. PROFESSIONAL	1	0.65
TOTAL	152	100

Low educational status is an important factor influencing such deaths (Table-7) as the maximum number of victims has only primary level education (35.52%). A major proportion of females were illiterate (25.00%), while a little smaller number of females had a high school level education (21.71%). Intermediate and graduate-level educated women were 4.60% and 3.94% respectively. No victim was found in the postgraduate and only 1 (0.65%) technical or professional educational group.

Table 8: Distribution cases based onPlace of Incident

PLACE	NO. OF CASES	PERCENTAGE %
Husband's House	32	21.05
Parental house	17	11.18
In-laws House	100	65.78
Others	3	1.97
Total	152	100

In-laws' house was found is be the most common place (65.78%) where the incident happened (Table-8). It is followed by the places, where wives were living with their husbands (21.05%). 17 cases (11.18%) were found, where the incident had taken place in the parental house. In 3 cases (1.97%), places other than these were found.

Discussion

To understand the underlying causes of the phenomena of female mortality within seven years of marriage, a detailed examination is necessary. To facilitate the investigation of these aspects, references are provided that analyze the prior study.[16]Female death rates in the first few years of marriage have been linked closely to socio-economic inequalities. According to studies (Koskinen Set al., 1994;)[17] (Singh GK et al., 1935-2016), women from lower socioeconomic origins have increased mortality risks because they have less access to healthcare, education, and employment possibilities. Due to this inequality, healthcare treatments may be delayed or insufficient, which could hurt health and raise mortality rates.[18] Another important determinant for female death in the first seven years of marriage is inadequate access to healthcare. According to research, undiscovered medical issues and complications during childbirth are made more likely by inadequate access to reproductive health services, including prenatal and postnatal care (Raj A et al., 2010;)[19] To lower mortality risks, it is crucial

to improve healthcare systems, expand reproductive health services, and guarantee equal access to high-quality care.[20] Women's health and well-being are significantly impacted by gender-based violence, which also raises the chance of death in the first few years of marriage. According to numerous studies (Sabri Bet al.), gender-based violence is associated with poor health outcomes, such as injuries, mental health issues, and mortality.[21] The most important steps in resolving this issue are the implementation of comprehensive strategies to prevent and resolve gender-based violence, including judicial changes, services for survivors, and public awareness campaigns.[22]Marriage-related cultural expectations and practices have a big impact on how women's health turns out. Women's autonomy and freedom to make decisions may be restricted by societal norms surrounding fertility, delivery, and gender roles, which could harm their health (Marphatia AA et al., 2017). Improving women's health and lowering mortality risks requires challenging old gender stereotypes, advancing gender equality in marriage, and creating a supportive social environment.[23] The increased risk of female mortality in the first few years of marriage is greatly influenced by mental health issues. According to research (Rutter M. et al., 1985.[24] Ridley M et al., 2020). mental health disorders like depression and anxiety are linked to poor health outcomes and higher mortality rates. Comprehensive treatments targeted at addressing mental health concerns and lowering mortality risks must include integrating mental health services into basic healthcare, increasing knowledge of mental health problems, and eliminating stigma.[25] Another issue that may hurt women's health and well-being and maybe raise death rates is a lack of autonomy inside marriages. According to studies (Chowdhury et al., 2018; Thapa et al., 2019), women with poor decision-making capacity, financial dependency, and resource access are more susceptible to unfavorable health consequences. Women's health can be improved and mortality risks can be decreased by promoting gender equality, giving women access to education and economic opportunities, and fighting for their rights in marriage partnerships.[26]

Conclusion

This study draws attention to the grave problem of early marriage-related fatalities among Indian women, particularly in the 18–22 age range. Many victims are inadequate to deal with the responsibilities of marriage, which has adverse implications. The majority of deaths occur in the first two years of marriage, and the husband's behavior, which can frequently be defined by unhappiness and impulsive behavior, is significant. Socioeconomic status is another factor, with lower middle-class women being more vulnerable and having lower levels of education emphasizing the need for empowering and raising awareness. There are also apparent effects of community and religion, with Hindu victims and rural regions suffering more casualties. To ensure young women's well-being, it is crucial that we tackle early marriages, promote education, and build healthy relationships within marriages. To stop these occurrences and make the legal framework of marriage a safer place for women, governments, communities, and civil society must work together.

Conflict of Interest: There is no conflict of interest

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Ethical clearance: The institutional ethics committee of the hospital gave its approval to the study protocol. **Ethical clearance number is 158/IEC LKO/16. Ethical clearance taken from Independent Ethics Committee, KGMU, Lucknow**

All participants provided informed consent before the data was collected. Participants were promised that their answers would be kept private and anonymous.

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Original Article

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Relationship Between Menstrual Cycle and Suicide Based on Histo-Pathological Study of Cadaver Uterus in a Tertiary Care Center, South India

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Abstract

Suicide is a global health concern. The risk of suicide is more in females compared to males. Reproductive health related factors are the major reason for this increasing risk. The aim of the study is to find out the relationship between menstruation and suicide and to find out if there is any relationship exists between any of the other phases of menstrual cycle and suicidal behaviour. Hospital based cross sectional study was conducted in the Department of Forensic Medicine, Government Medical College, Thrissur which is a tertiary care centre. The study was done for a period of one year, from August 2015 to July 2016. The final sample size attained i.e the uterus specimens of reproductive age group during the study period is 100. Thus 50 were taken as cases and the other 50 who died of any other cause other than suicide were taken as control. Majority of the study participants belongs to 20 years of age group among cases. Most of our study participants were married in our study, majority of the study participants were above poverty line, no specific history of motivation towards suicide was found in majority of the study participants followed by psychiatric problems and family problems. Hanging was the most common method used for suicide. Among the cases majority of the study participants were in the late proliferative phase. In our study majority of the study participants committed suicide in the early proliferative phase.

Keywords: Suicide, Menstrual cycle, Uterus, Endometrium.

Introduction

Around one million people die every year due to suicide. 10-20 million people attempt to suicide. Annually 50-120 million people gets impacted profoundly by the suicide or the attempt made by a close friend or family member.[1] It was found that globally suicides constituted only 1.8% in 1998 where as it increased to 2.4% by the year 2020.[2] Suicidal ideation is the one which is described as contemplation

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about one's own death. Suicide attempt is defined as self injurious behavior with the implied or explicit aim to die.[3] Many risk factors which coexist along with this behavior. They are panic disorder or post traumatic stress disorder, drug misuse and cluster B personality disorders. These risk factors which coexist will change or accelerate the suicidal ideation to suicidal attempt. In addition to this, women will have other factors like menstrual cycle, pregnancy, postpartum psychosis, abortion, marriage related stressors which will accelerate women's suicidal tendency.[4-5] Though both males and females are victims of this unnatural form of death, gender variation exist in both suicidal deaths and suicidal attempt. According to some authors, attempt to suicide was found to be 3 times more among females compared to males but suicidal deaths are 3 times more common in males compared to females[6,7]. In current scenario, the suicidal attempts in both young and middle aged females have increased alarmingly. The factors which are responsible for the suicide are familial or social disharmony or mental depression.

The hormonal changes in the Menstrual cycle occurs in both the Proliferative phase and Secretory phase. From the first day of menstruation to ovulation the phase is known as Proliferative Phase. Secretory phase starts from ovulation till the start of next menstruation. The hormonal changes which occurs during these phases can lead to mood swings, depression and also plays a major role in the suicidal ideation. Many systematic reviews done in these topics stated that more deaths are common in proliferative phase.[8-11] In contrast some studies stated that the deaths are more common in secretory phase. But still no authenticative data is available in this matter.

Materials and Methods

Study setting: Hospital based cross sectional study was conducted in the Department of Forensic Medicine, Government Medical College, Thrissur which is a tertiary care centre. The study was done for a period of one year, from August 2015 to July2016.

Inclusion criteria:

- Women cadavers of reproductive age group 15-45 years which were determined cases of suicide

Exclusion criteria:

- Age <15 years and > 45years
- Decomposedbody
- Hermaphrodites
- Death occurring after 24 hours of suicide attempt
- Bodies of pregnant women

Sample Size: Based on the Leenaars AA et al[12] study "Menstruation and suicide: A Histo-Pathological Study" p1=25% and p2=4.5%. Substituting in the below formula,

$$=\underline{z\alpha + z\beta)\ 2 \text{ X } p \text{ X } q}D^2$$

Z alpha(constant)=1.96, Z beta (constant)=0.84, p=p1+p2/2, q=100-p, D=p1- p2

With 80% power, 95% confidence interval victims were recruited for our study. The final sample size attained i.e the uterus specimens of reproductive age group during the study period is 100.Thus 50 were taken as cases and the other 50 who died of any other cause other than suicide were taken as control.

Data collection: Personal particulars like name, age, gender, marital status, occupation, socioeconomic status, motivating factors for the suicide, apparent cause of death were collected. After getting blanket consent from the relatives of the deceased, the uterus specimens of the women cadavers of reproductive age group 15-45 years coming for the autopsy in this tertiary care centre were examined at the time of autopsy. The fundus was caught hold and with left hand it was pulled upward. With the right hand the cervix was felt and the vagina was cut as low as possible with the knife. The ligaments were severed and the uterus intact with the ovaries and the tubes were freed. The size of the uterus was measured. Blade of scissors was introduced into the cervical canal and the anterior wall was cut up to a distance of 1cm distal to the fundus in order to open the uterus. Then the incisions were extended up to the horns. The findings were noted. Subsequently a bit of uterus measuring 5mm width which involves full thickness of the endometrium to serosa was taken from the fundal portion of the anterior wall was transferred for the histo-pathological examination in freshly prepared,10% buffered formalin solution, in sealed bottles labeled with data, postmorterm number, age,

police station and crime number. The 5 mm block of average uterus tissue is fixed in 20 times its volume of buffered neutral formalin for about 8 hours at room temperature. Complete fixation required 12-24 hours at room temperature. After fixation thin sections of endometrium were taken from the uterus and kept in capsules for processing.

Statistical analysis: After collecting the data, it was entered in MS excel Windows10. Statistical analysis was done in SPSS 23. Continuous data were expressed in terms of Mean ± Standard deviation and Categorical variable were expressed in terms of numbers (percentages). P value of <0.05 is considered as significant.

Results

Majority of the study participants belongs to 20 years of age group 14(28%) followed by 26-30 years of age among cases 14(28%). In control group majority were in the 26-30 years of age 13(26%). Most of our study participants were married in our study 34(68%) followed by 43(86%). Majority of the study participants were above poverty line 31(62%) in cases and 44(88%) in control. (Table 1)

No specific history of motivation towards suicide was found in 16(32%) of the study participants followed by psychiatric problems 13(26%) and family problems 13(26%). (Figure 1) Hanging was the most common method used for suicide 27(54%) followed by burns 21(4%). (Figure 2)

Among the cases majority of the study participants were in the late proliferative phase 12(24%) followed by early secretary phase 11(22%). In control group most of the study participants were in early secretary phase 12(24%) and in early proliferative phase 12(24%) followed by late proliferative phase 10(20%). The difference between the groups were found t o be not statistically significant. (Table 2)

In our study majority of the study participants committed suicide in the early proliferative phase 18 followed by late proliferative phase 12. Nearly 50% of the study participants committed suicide in this phase due to psychiatric problems 4(50%) followed by family problems 2(25%). Psychiatric problems 3(25%) and the financial problems 3(25%) were the foremost cause of suicide in the late proliferative phase. In early secretary phase family problems were the foremost common cause 3(27.3%). No specific history was the most prevalent cause in the late secretary phase 5(45.5%) followed by family problems 3(27.3%). In menstrual phase, majority of the study participants who have committed suicide have no specific history 4(40%) followed by family problems as the second cause 3(30%).(Table 3)

Hanging was the most common method of choice for suicide in 7(87.5%) of the study participants in the early proliferative phase. In late proliferative phase around 10(83.3%) of the study participants opted for hanging followed by the poisoning 3(25%). Burns was the most common method of choice for suicide in early secretary phase 10(90.9%) followed by hanging. In late secretary phase burns was the most common method for suicide 6(66.7%). Hanging 7(70%) was the most common cause of suicide in the menstrual phase.(Table 4)

Table 1: Demographic characteristics of the study participants

Variables	Cases	Controls
Age category	14(28%)	6(12%)
<=20 years	9(18%)	4(8%)
21-25 years	14(28%)	13(26%)
26-30 years	2(4%)	10(20%)
31-35 years	11(22%)	7(14%)
36-40 years	0(0%)	10(20%)
>40 years		
Marital status Married Unmarried	34(68%) 16(32%)	43(86%) 7 (14%)
Socioeconomic status Above poverty line(APL) Below poverty line (BPL)	31(62%) 19(38%)	44(88%) 6(12%)

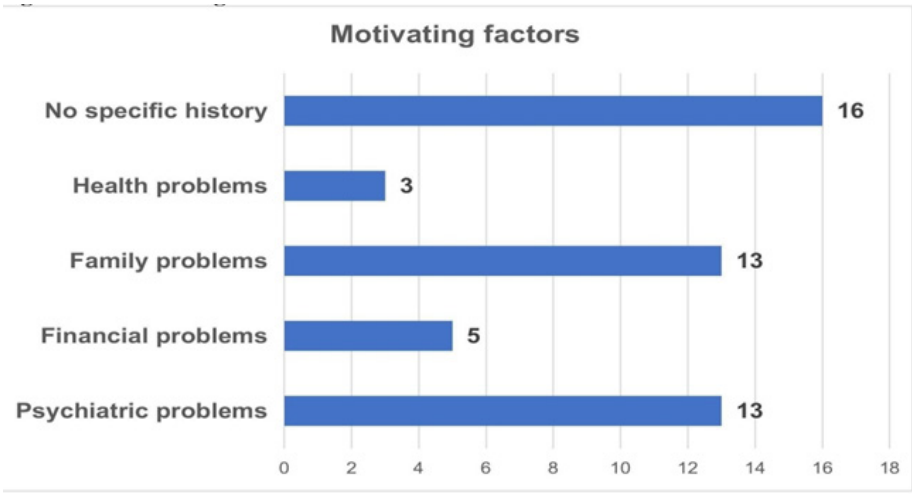

Figure 1: Motivating factors for suicide

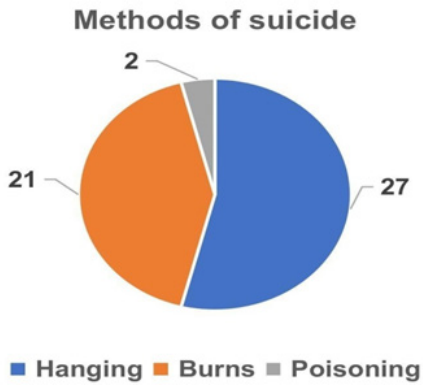

Figure 2: Methods of suicide

Table 2: Classification based on endometrial phase both in case and control group

Endometrial phase	Cases	Controls
Early proliferative	8(16%)	12(24%)
Late proliferative	12(24%)	10(20%)
Early secretary	11(22%)	12(24%)
Late secretary	9(18%)	7(14%)
Menstrual phase	10(20%)	9(18%)

Table 3: Distribution of motivating factors for suicide in each endometrial phase

Motivating factors	Endometrial phase				
	Early proliferative phase	Late proliferative phase	Early secretary Phase	Late secretary phase	Menstrual phase
Psychiatric problems	4(50%)	3(25%)	2(18.2%)	2(22.2%)	2(20)
Financial problems	0(0%)	3(25%)	1(9.1%)	1(11.1%)	0(0%)
Family problems	2(25%)	2(16.7%)	3(27.3%)	3(27.3%)	3(30%)
Health problems	0(0%)	2(16.7%)	0(0%)	0(0%)	1(10%)
No specific history	2(25%)	2(16.7%)	5(45.5%)	5(45.5%)	4(40%)
Total	18	12	11	9	10

Table 4: Distribution of method of suicide in each endometrial phase

Method	Endometrial phase				
	Early proliferative phase	Late proliferative phase	Early secretary Phase	Late secretaryphase	Menstrual phase
Hanging	7(87.5%)	10(83.3%)	1(9.1%)	2(22.2%)	7(70%)
Poisoning	0(0%)	3(25%)	0(0%)	1(11.1%)	1(10%)
Burns	1(12.5%)	2(16.7%)	10(90.9%)	6(66.7%)	2(20%)
Total	18	12	11	9	10

Discussion

Suicidal death is considered as an important indicator for the level of social, physical and mental health of an individual. Suicide death always pose a challenge for the Forensic expert as it is important to find the risk factors, risk factors and the pitfalls encountered by the victims. There is variation in incidence of suicidal deaths in different age group among women. This may be due to the marital status, manner of commission of suicide, time of the suicide attempt and different phases of menstrual cycle. Variation can occur due to multiple factors like psychological, socioeconomic, educational, cultural and geographical differences.

In our study around 60% of the women belonged to less than 30 years of age. This was similar to the Biswas et al[13] study where majority of the women died of suicide 58.2% was less than 30 years .This was also concurrent with the results shown by AASRA[14] where it was found according to a statistics that 139 women suicides in a day were of age less than 30 years. Similar findings were also seen in Patel V[15] work where it was published that women of 15-29 years are the most vulnerable group of committing suicide.

Majority of the study participants in our study were married 77%.Similar results was also seen in Biswas et al[13] study where 68.1% were married and the remaining 29(31.9%) were unmarried. This was in par with the observations made in AASRA[14] where it was found among 130 women who committed suicide 69 were housewives. Patel V[15] in his publication stated that marriage is found to be a psychological factor associated with suicide. Randy A Sansone et al[16] also had similar results which is concurrent with our study.

In our study hanging is the most common method of suicide 27(54%) followed by 21(42%)Burns and poisoning 2(4%).Similar results was also seen in Balaram NA et al[17] study and Dr surjith Sreenivas[18] study. This was in contrast to study done by Biswas et al[13]where 54.9% of women preferred burns followed by poisoning 27.5% and 6% hanging. In AASRA[14] study majority consumed poison 33.1 % followed by hanging 31.4%, 10% burning and 4% drowning.

In our study majority of the study participants were in late proliferative phase 12(24%) followed by early secretory phase 11(22%).This was in contrast to Biswas et al[13] study where majority were in early secretory phase 45.1% followed by proliferative phase 23.1%.Various studies were done to estabilish the relationship, some were in favour of proliferative phase and some in favour of secretary phase. No significant relation was found in our study between any of the phases of the mensturual cycle and the completed suicide. Similar results was also seen in Ekeberg O et al and Vanezis P.[19-20]

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Conclusion

It is concluded in our study that there is no significant correlation between any phases of menstrual cycle and completed suicide. No specific cause was the predominant reason motivating to suicide in our study Suicides were common in younger age group.

Recommendations: It is recommended to do further studies to find out the hormonal and the biological variations in the different age group and in different period like day and night and its association with the various phases of the menstrual cycle.

Ethical clearance: Taken from Institutional Ethics Committee, Govt. Medical College, Thrissur

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Original Article

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Unveiling Digital Document Manipulation: A Case Study in Forensic Examination

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Abstract

The ease of creating digital documents due to today's technological advancements has led to a surge in white-collar crimes involving forgery and manipulation. Detecting these digital document alterations presents a unique set of challenges to forensic investigators. The present study aims to uncover a forgery in a digitally manipulated document and demonstrate the successful detection of digital document alterations. This study examines a real-life case to explore the methods utilized by forensic experts in detecting and evaluating document forgery. It highlights the crucial role of digital forensic analysis in contemporary investigative procedures. This research emphasises the significance of understanding document forgery and the need for robust forensic techniques in detecting digital manipulation. Ensuring the integrity of digital documents is crucial in maintaining trust and reliability in today's information-driven era.

KEYWORDS: Digital Forgery, Digitally Manipulated Document, Document Forgery, White-Collar Crime.

Introduction

In the current era, we are amid of the digital age. Over the past decade, digital technology has emerged as the primary means for generating, manipulating, transmitting, and preserving information, knowledge, and intellectual property in the form of digital data. Digital data encompasses a wide range of dimensions, including audio, video, images, and documents, serving as a vessel for expressing and cultivating knowledge. The process of digitizing data, including knowledge and intellectual assets, has become increasingly accessible and feasible thanks to the advancements in digital technology[1]. The continuous advancement of technology has opened possibilities for remote service provision across various industries. In certain cases, service providers now require individuals to submit their identity documents or other essential paperwork remotely. These documents play a critical role in processes such as on boarding, admissions, travel document processing, and implementing procurement systems. While remote identification enhances convenience by eliminating the need for in-person visits, it also

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introduces risks associated with fraudulent activities. Fraudsters can exploit this system by using stolen or fake documents, manipulating genuine document scans or photos using graphic editors, or capturing document images from screens of mobile devices or computers. Additionally, the rapid evolution of deep fake technologies presents new opportunities for fraudsters to deceive unsuspecting individuals and organizations[2].

The evolution of digital technology has revolutionized the concept of written documents and has significantly impacted the landscape of white-collar crimes. Perpetrators of forgery have become more adept at utilizing technology due to the innovative advancements that it offers. They can now create falsified documents, with or without signatures, using various skills and tools provided by modern technologies. This ease of fabrication has extended to crucial government documents, wills, and educational certificates, making the art of document forgery more accessible and manageable[3].

Scanned and computer-generated documents pose particular vulnerabilities to manipulation, including text or page insertion, content alteration, cut-and-paste manipulation, and the creation of fraudulent composites using multiple genuine documents[4]. Criminals take advantage of the wide availability of image processing and editing software tools, as well as web-based technologies, to prepare fabricated digital documents or computer-generated hard copies. In some cases, these manipulated documents are presented as the sole evidence in a court of law, with the claim that the original documents have been lost or destroyed. Such forgeries, employing the techniques mentioned above, complicate document-related issues, making forensic detection significantly more challenging and intricate[5].

Considering the continuous progress in science and technology, discerning the authenticity of digitally fabricated documents or network-transferred files has become increasingly challenging. To address this issue, it is crucial for Forensic Examiners to remain abreast of the latest technological and scientific advancements[3]. Therefore, the primary aim of this study is to explore and elucidate various methods used to identify forgery in digital documents. By undertaking this research, valuable insights can be gained into the techniques employed in forensic examinations to detect and analyse manipulation, further contributing to the advancement of digital forensic analysis.

CASE OVERVIEW:

This study presents a case wherein authors examined a document pertaining to an electrical work (contract) worth lakh of rupees assigned to a contractor by an organization of national repute. The document in question (Figure-1a) was an authorization certificate that was submitted by the contractor in a digital format (.pdf) on the procurement site. The certificate purports to be issued by a manufacturer, outlining their commitment to provide extensive technical support and complimentary maintenance, along with spare parts, to the contractor for a period of seven years from the equipment's supply date. However, during the verification process with the manufacturer, it was revealed that they had never issued a document containing the specific terms and conditions mentioned in the questioned certificate. The manufacturer categorically denied the contractor's claims, asserting that they possess the genuine original document issued to the contractor. Furthermore, the manufacturer clarified that they have never made any promises to provide complimentary maintenance and spare parts for such an extended duration to any dealer or contractor.

Based on their possession of the genuine document, the manufacturer challenged the authenticity of the presented certificate. They contended that the document provided by the contractor was forged, suggesting that the contractor had manipulated the original document to suit their requirements and increase their chances of securing the contract. The manufacturer's denial and assertion highlight the discrepancy between the terms and conditions mentioned in the questioned certificate and the genuine document they issued. An investigation was requested to establish the authenticity of the questioned document and determine the manipulations and provide any other clue of evidentiary value after comparing the questioned document with the standard document (also in .pdf format) (Figure-1b) which was supplied by the manufacturer.

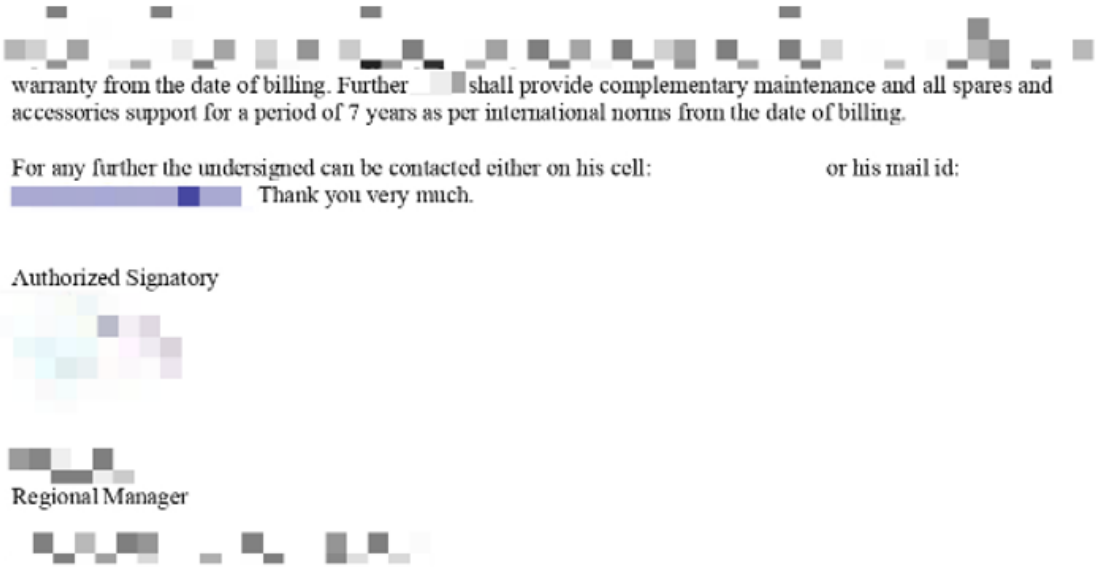

Figure-1a: Depicts the Questioned Document

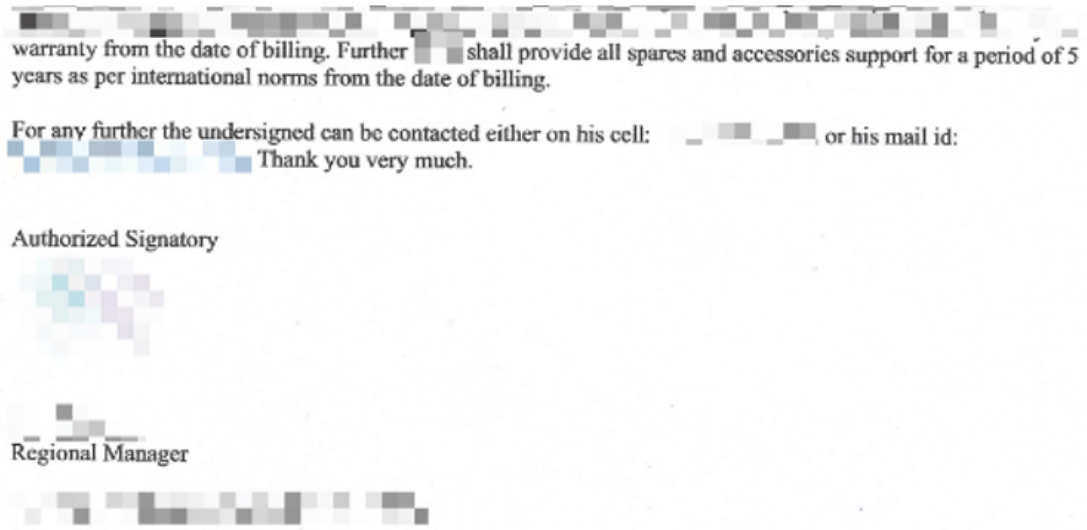

Figure-1b: Depicts the Standard Document

EXAMINATION AND RESULTS:

A comprehensive examination was conducted on both the standard document and the questioned document to identify any visual irregularities or inconsistencies. This involved scrutinizing various aspects, including potential imperfections in forgery, variations in design elements, discrepancies in fonts, spacing between letters and words, uniformity of the background, and overall alignment.

Furthermore, a detailed technical analysis of the PDF files was performed to assess their authenticity. This analysis encompassed investigating multiple parameters, such as file signatures analysis, metadata analysis, source identification, forensic examination of all file components, and comparing hash values.

The aim of these examinations and analyses was to identify any indicators of tampering or manipulation in the questioned document. By carefully assessing both the visual characteristics and the technical attributes of the PDF files, a comprehensive evaluation of their authenticity and integrity was conducted.

During the preliminary visual examination of both the standard and questioned documents, no

visual inconsistencies were observed regarding the font, design, spacing between letters and words, crowding, or alignment. However, a notable difference was identified in the tint of the stamp and signature area when compared to the background of the document (Figure-2a and 2b). This discrepancy strongly suggested that the signature and stamp marks were copied and pasted onto the questioned document.

Figure-2a &2b: Depicts copy-pasted signature.

After completing the visual examination, a thorough technical analysis was conducted on both the standard and the questioned documents. This analysis revealed several notable differences between the two documents. The observed differences are as follows:

FILE SIGNATURE ANALYSIS

As part of the technical analysis, the file signatures of both the standard and questioned document files were examined. The findings revealed a significant difference between the two documents. The questioned document exhibited signatures of two distinct file formats - one in .pdf format (Figure-3) and the other in .jpeg format (Figure-4). On the other hand, the standard document contained a single file signature, specifically in .pdf format (Figure-5).The process of file signature analysis involves comparing file headers and extensions with a known database of file signatures. This comparison serves two purposes: validating the identified file signatures and uncovering any hidden signatures that may be present. In the case at hand, the presence of different file signatures in the questioned document indicates the utilization of both .pdf and .jpeg files. This finding raises concerns about the authenticity and integrity of the questioned document, suggesting the possibility of file manipulation or unauthorized alterations.[6]

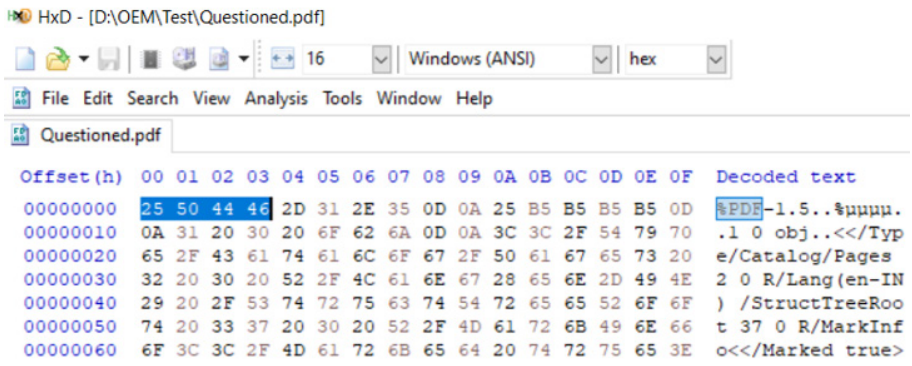

Figure-3: Depicts file signature for .pdf file format

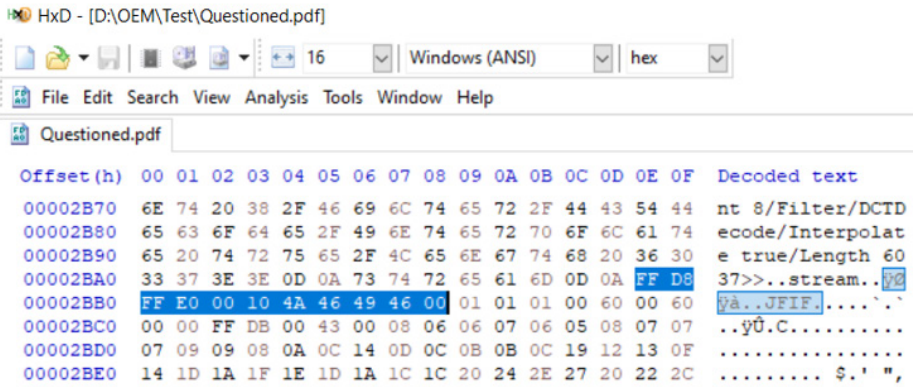

Figure-4: Depicts file signature for .jpeg file format

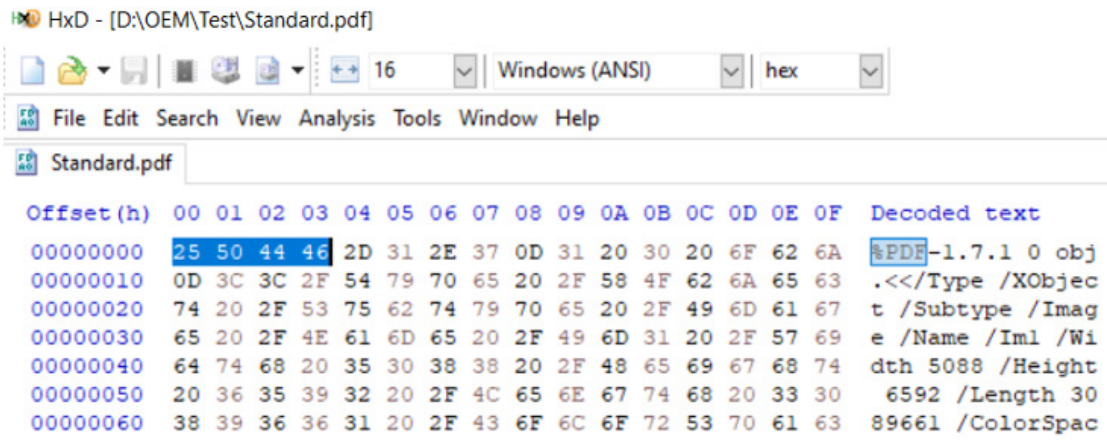

Figure-5: Depicts file signature for .pdf file format

METADATA ANALYSIS

During the analysis of the standard and questioned documents, a close examination of their metadata was conducted. Metadata refers to structured reference data that provides information about other data, aiding in the sorting and identification of attributes of the described information [7]. The following metadata parameters were observed and compared: creation and modification date and time, software used for document preparation, author name, PDF version, and size of the document files.

Discrepancies were identified in the metadata associated with the documents. These differences included variations in the creation date, author information, and modification history. Such inconsistencies raised concerns regarding the authenticity and potential alteration of the questioned document.

By analysing the metadata, insights into the document's origin, creation, and modification can be obtained. These variations in the metadata parameters between the standard and questioned documents provide valuable evidence of potential tampering or manipulation, highlighting the need for further investigation to determine the extent and nature of the alterations made.

Table 1: Depicts Metadata of the Standard and Questioned Files

File Properties	Standard Document	Questioned Document
Created Date & Time	29/12/2020 at 12:09:45	29/12/2020 at 12:09:45
Modified Date & Time	29/12/2020 at 12:09:45	01/01/2021 at 11:25:54
Accessed Date & Time	30/12/2020 at 02:24:36	01/01/2021 at 11:26:49
Author	Device Owner's Name	NA
Size	153 KB	318 KB
Writing Application	Microsoft Word 2016	NA
PDF Version	1.7	1.5

FORENSIC EXAMINATION OF FILE COMPONENTS

A comprehensive forensic investigation was conducted on all components of the PDF files. Discrepancies were identified in the object layers which includes variations in the arrangement of objects like images, annotations, and form fields. Such disparities indicated potential manipulation of the questioned document. Anomalies were also found in the embedded content within the PDF file. This could involve discrepancies in the embedded fonts, images, or multimedia elements, such as alterations or substitutions. These irregularities pointed towards possible manipulation of the document's content.

HASH VERIFICATION

A comparison of the hash values was conducted between the standard document provided by the manufacturer and the questioned document. The hash value of the standard document was 6016D0A47ADEB8F20CF4380654990149, whereas the hash value of the questioned document was E6BB2ED8F35548E535E8EF1849F05595. These hash values were found to be significantly different from each other.

Hash values can be likened to fingerprints of a file. They are generated by processing the contents of a file through a cryptographic algorithm, resulting in a unique numerical value that serves as an identifier for the file's contents. If any changes are made to the file's contents, even minor alterations, the hash value will undergo a substantial change. In the case of the standard and questioned documents, the dissimilarity in their hash values strongly suggests that the contents of the questioned document have been altered or manipulated in some way. This finding highlights the importance of hash value comparison as a forensic technique to detect changes or tampering in digital documents.[8]

These findings present compelling evidence that the questioned document is a fictious by-product of the original document. The fabrication process involved skilled digital modifications carried out using sophisticated digital processing tools and techniques. The type and scope of the changes are well beyond the capabilities of traditional document faking procedures. As a result, such comprehensive near-perfection modifications made on the source document could not have materialised in the reproduced questioned document without the use of digital technology, which gives exceptional operational and technological flexibility and ease. In the normal run of events, these types of devious skill and technology manipulations are unlikely to be observed by the recipient of a forged duplicate and will go unnoticed by the casual observer.

Discussion

On the one hand, the study clarifies a classic case of current technology's incursion into document fraud, and on the other, it indicates the perpetrator's level of mental manifestation and planning in the crime's implementation. As a result, the integrity of documents is jeopardized with each innovation in digital and reproduction technologies. The science of forensic examinations is based on experience and observations. Reasons must underpin science, and these reasons must be able to be communicated and assessed. [9] As a result, when examining such documents, a comprehensive approach backed by technological know-how is required. Many times, determining the authenticity or fraudulent nature of a document requires only careful consideration and correlation of all or a number of the various attributes that comprise the document [10]. Because technology has enabled the perpetrators to think and go beyond the simple reproduction process in creating such a spurious document from the source document, drawing a qualified conclusion of the authenticity of the standard and questioned document on this basis would have been irrelevant and even incorrect in this case. These attempted changes in the genuine source document, of varying kinds and dimensions, in order to generate a fictional document, are in fact devious forgery attempts to tamper with aspects that otherwise declare validity. In such circumstances, the most conclusive technique to prove document forgery is to identify the source document from which it was created[4]. Despite the fact that the questioned document was shown to be a forgery of the source document, the peculiarities found in the questioned document were identified as vestiges of the source document, which would not have been identified if the source document was not made available. These technologically based attempts at data manipulation in the document are aimed primarily at incorporating false elements of variability, dynamism, and divergence to give it a different look and appearance, as if it were originally a product of a different preparation, in order to confuse or mislead any potential investigation. The mistaken belief that traditional methods of document fraud continue in the world of digitized document fraud or machine rendered document fraud implies that manipulation of text size may go undetected. As a result, forensic examiners are obligated to address these new forms of evidence, which may be in an electronic form of the source document in the digital media. Forensic investigators cannot avoid and

ignore such developments in computer technology because they have a direct impact on the pattern of crimes in the field [5].

Conclusion

The final output of manipulations done using digital processes' scope, constraints, and uncertainties have become professional dangers, influencing the quality and type of forensic expert's findings. Generally, there is no evidence of manipulation if the original copy is not available. The sophistication of the alteration, information about the case's conditions, and intuition can all be used as indicators to distinguish conventional alteration from digital alteration [11]. Moreover, the document examiner's professional acumen, experience, and competence play a critical role in revealing the truth through innovative skills, continuous thought processes, and objective interpretation of data related to all forensic document problems that are a direct result of modern technological advancement. Because of advancements in the field of reproduction and digital technology, the major threat of digitized document fraud to the economy and society is unavoidable and expanding, and our forensic readiness is critical. [5]

Conflict of Interest: The content and names associated with the questioned and standard documents have been hidden to maintain the confidentiality.

Ethics approval and consent to participate: Not Applicable

Funding: Not Applicable

Authors Note: All the confidential documents utilized in the study were returned to their respective owners upon the completion and closure of the analysis. Furthermore, it's important to note that no personally identifiable information was included or utilized in the case study. I want to affirm that the study adhered to ethical principles throughout its execution.

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Dead Men Do Even Tell Filled Tales

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Abstract

Background: Dental identification of deceased individual is a core task in the forensic dentistry. The accurate recording of clinical procedures has become more important over the time because of the increasing trends of lawsuits worldwide. Advances in imaging, root canal anatomy and restorative materials have been consistently emerging in present research and practice. Hence, the purpose of this paper is to provide an update on interrelationship between restorative dentistry and forensic personal identification.

Aim: To observe the effects of predetermined incineration temperatures (400 and 800) on unrestored and restored teeth with different restorative materials, and its effect on length of tooth and volume of the pulp under Stereomicroscope and CBCT.

Materials and Methods: 48 extracted premolar teeth were divided into 2 groups based on predetermined temperatures and subdivided into 4 subgroups based on restorative material used. Subgroup i- Unrestored teeth, Subgroup ii- class I Amalgam restoration, Subgroup iii- class I Amalgomer restoration and Subgroup iv- class I Cention restoration. The Antemortem and postmortem records were compared using Stereomicroscope and CBCT.

Results: Teeth exposed to incineration at different temperatures will be analyzed under Stereomicroscope and CBCT.

Keywords: Forensic dentistry, Amalgam, Cention, Amalgomer, Stereomicroscope, CBCT.

Introduction

Forensic odontology is a unique discipline credited to the pioneering of Dr. Oscar Amoeda. Forensic odontology identified the victims of fire accident in Paris, France in 1897is one of the branches of dentistry that deals with the proper handling

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and examination of dental evidence and proper evaluation and presentation of the dental findings in the interest of justice.[1,2,3]

In the history, teeth and dental materials have been studied as an aid in the identification process of human remains.[4] Forensic odontology in particular has been found to be useful when the damage has been caused by heat. Fire causes 1% of the global burden of disease. An average of 1,80,000 deaths every year occurs by burns. Several communities cremate dead bodies at 760^0c-1150^0c resulting in the reduction of all tissues to ashes except teeth & bones. [4,5]

Restorative materials like Gold, Porcelain, Silver Amalgam, Composite are often unaffected even after prolonged exposure to fire. So the combination of healthy and restored teeth is said to be as unique as fingerprint. However the teeth & restorations undergo some changes when exposed to fire. [5]

Most of the features that damage the oral tissues and dental restorations can be seen directly by the naked eye but but use of microscope as an adjunct can be very helpful in observing the finer details of dental tissues, the surface involved in the dental treatment. [6,7]

Radiographs of teeth are one of the components of patients dental records and are definitive evidence in the court.[4] Comparing the radiographic records will exploits the matching of corresponding features at two levels i.e., external shape and internal architecture. With the recent developments in the endodontic imaging technology, the endodontic cone-beam computed tomography (CBCT) records of the root canal anatomy and post-treatment provide particularly rich sources of the characteristics that promote individualization. To date, limited studies have been done on the 3-D technology using the CBCT for the forensic analysis in human identification. [1,8]

Thus a combination of both morphologic and radiographic evidence would greatly enhance identification. So it is important to study the effect of heat on intact teeth and teeth restored with different restorative materials clinically & radiographically.[4]

AIM

The purpose of the present study was to observe the effects of predetermined incineration temperatures (400and 800) on unrestored and restored teeth with different restorative materials, and its effect on length of tooth and volume of the pulp under Stereomicroscope and CBCT.

Methodology

Inclusion & Exclusion Criteria:

Intact human permanent premolar teeth collected from institutional tooth bank which were extracted due to orthodontic and periodontal purposes with mature apex were included and teeth with root crack, internal resorption, external resorption, caries were excluded.

Preparation Of Specimens:

In this study, freshly extracted 48 intact human permanent premolars extracted due to orthodontic and periodontal purposes were collected and stored in saline until use. GV Black's class I cavities of depth and width of 2mm were prepared using diamond burs with water coolant (Figure 1)

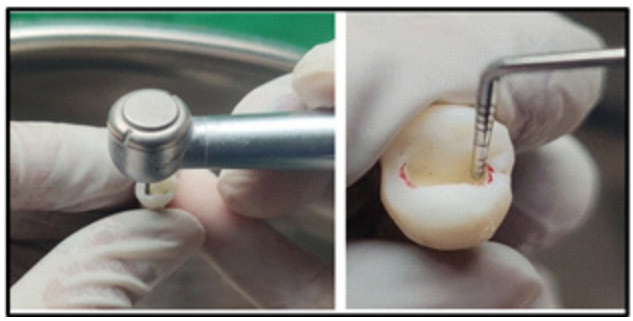

Figure 1: preparation of class I cavity on the specimens

Grouping:

A total of 48 teeth were divided into two groups based on incineration temperatures and further subdivided into four groups based on material used (Figure 2). From each subgroup half of the samples were evaluated for radiographic changes and other half for microscopic changes under CBCT and Stereomicroscope respectively.

Group 1 - 400ºC

Group 2 - 800ºC

Subgroup 1 - Control

Subgroup 2 - Amalgam(N=6)

Subgroup 3 - Cention (N=6)

Subgroup 4 - Amalgomer (N=6)

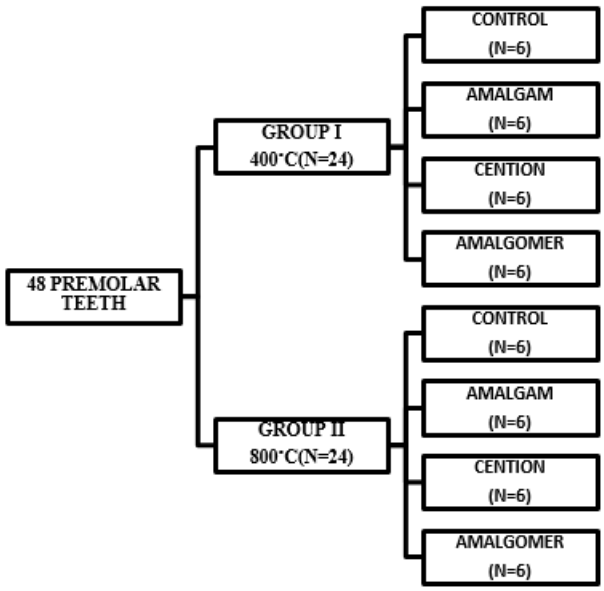

Figure 2: grouping of the specimens

After grouping, the restorative materials were manipulated according to manufacturer's instructions and were restored in respective groups (Figure 3). Then the teeth were subjected to CBCT and Stereomicroscope and these were considered as antimortem records.

Figure 3: Restoration of the specimens using different restorations

The samples were then subjected to pre-determined incineration i.e-400 and 800 in a digital burnout furnace for 15 minutes with an incremental frequency of 30 /minute in 2 cycles. After incineration teeth were again subjected to CBCT and Stereomicroscope and these were considered as postmortem records.

Results

The results were obtained by comparing both ante-mortem and post-mortem reports. The microscopic changes were compared under Stereomicroscope at 20x magnification and radiographic changes were compared using Cone Beam Computed Tomography.

At 400 Stereomicroscopic changes revealed discolored teeth intact crowns and loss of enamel translucency and root surface presented with minute vertical fracture lines in almost all samples irrespective of the group, amalgam surface showed increased granularity with intact marginal adaptation, in both Cention and Amalgomer group teeth presented with discolored restoration and contraction of the restorative material along the margins which was more pronounced in Cention group (Figure 4,5).

The CBCT changes revealed no significant changes in all groups except a thin radiolucent line extending till the base of the restoration in both Cention and Amalgomer groups.

At 800all the teeth were fragile, discolored and fragmentation and vertical fracture lines were more pronounced in all the groups, Stereomicroscopic changes revealed discolored dentinal tubules in control group, and even fragmented portion showed intact Amalgam restoration with granular changes, and dislodgement of restoration was seen in both Amalgomer and Cention groups but more pronounced in Cention group.

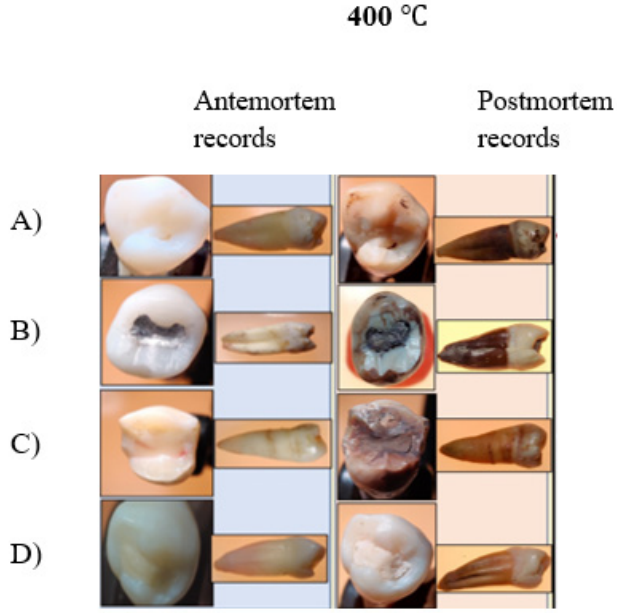

Figure 4: Stereomicroscopic Changes observed at 400 ºC in all groups a) Control group b) Amalgam group c) Cention group d) Amalgomer group

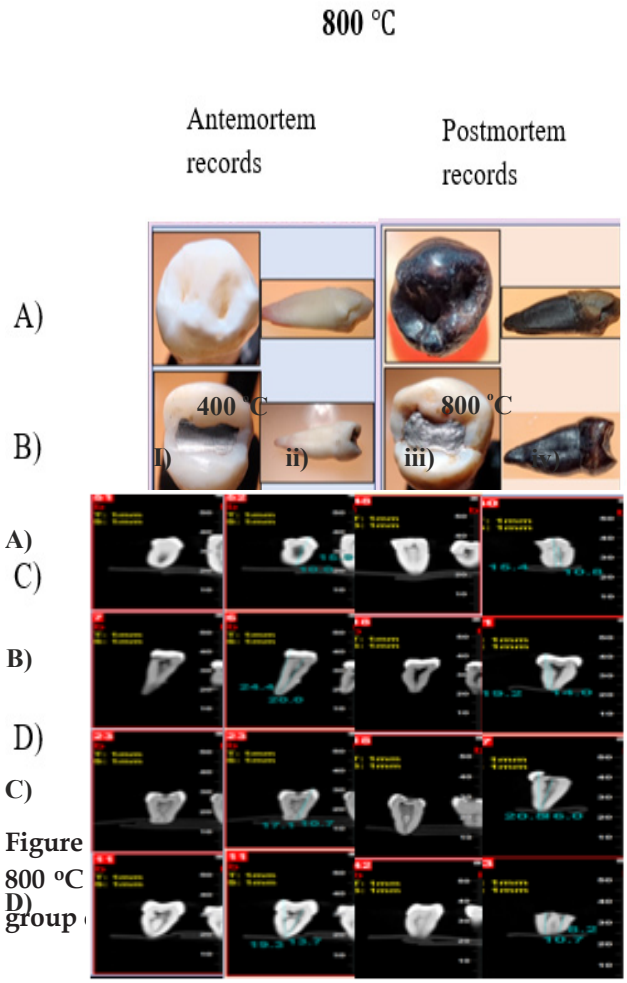

Figure 6: CBCT Changes observed at 400ºC 800ºC in all groups a) Control group b) Amalgam group c) Cention group d) Amalgomer group i) and iii)-Antemortem records ii) and iv) postmortem records

Discussion

Identification of burned victims through forensic dental analysis is difficult due to total loss of soft tissues. In such cases forensic odontology plays an important role in the medico-legal investigations because the dental remains can withstand temperatures to certain extent as they are extremely hard.[1]

Incidents such as the domestic fires of up to 649°C, burning of gasoline occur at around 800-1000°C and cremation of individuals happens at around 760-983°C. So In this analysis, the teeth were subjected to two different temperatures of 400°C and 800°C, simulating different temperatures for various fire incidents. The temperature of fires accidents depends on several factors, including the duration of the combustion, whether the place of the incident is an open or closed space, the materials used to stop the fire and the quality of the oxidant. [1,9]

In the present study, the period of 15 min was selected for the exposure to the heat, following a previously described methodology (Patidar et al.2010; Pol et al. 2015), in which the authors concluded that the changes that occurred in the materials after 60 min were no different from those that occurred after they were exposed to the heat for 15 min. [8]

Identification of individuals through dental records is dependent upon finding similarities between teeth and restorations present in a known person's dental records and those present in an unidentified deceased, so adequate information on the dental condition prior to death must be available.[7] The National Registry of Forensic Odontology has requested to various dental colleges to maintain dental records of patients and keep them updated at regular intervals. Arora and Bansal also proposed a meticulous plan for linking dental records with Aadhaar database. [10]

Considering the scarcity of literature that correlates the properties of dental restorative materials to the forensic field, this study aimed to evaluate the effect of heat on restorative materials like Amalgam, Cention and Amalgomer. Among them Amalgam showed highest resistance to heat followed by Amalgomer.

Silver amalgam initially (at 400°C) showed loss of glaze, expansion, and finally at 800°C, globule formation and splintering which was in accordance with the study done by Patidar et al 2010.[6]Merlati G 2004 also observedformation of globules and increased granularity due to mercury evaporation which was also observed in the present study at both temperatures i.e., 400°C and 800°C. Despite disintegration of the crowns, at different temperature levels Amalgam remained in place and maintained their shape which indicates its high resistance to heat.

Its resistance is also due to more significant quantity of crystallization reactions, that leads to more γ phases than γ1 and γ2 phases. [10,11]

Amalgomer CR is a recently introduced direct esthetic posterior GIC which is said to have strength comparable to that of Amalgam due to addition of ceramic particles. In addition to having mechanical strength approximating that of Amalgam, is free of shrinkage has the excellent wear resistance, and has superior radio opacity. It is the first study to use Amalgomer for personal identification. Amalgomer showed contraction along the margins due to loss of water, discoloration of material and loss of material at high temperatures when compared to amalgam. Amalgomer showed least resistance to heat when compared to amalgam. [10,12]

GIC restoration cracked at a low temperature of 200°C and fragmented at 800°C according to study done by Pol et al. 2015.[12,13] Raghavan et al. 2017 also found in his study that when teeth subjected to heat GIC was found to be least resistant.

Cention N is a novel bulk fill direct posterior restorative material based on "Alkasite" technology (a subgroup of the composite resin). Its advantages include bulk placement, optional light curing optimal physical/mechanical properties and superior esthetics. [13,14]

It was the first study to evaluate Cention for personal identification and results have showed that there was discoloration at lower temperature because composite resin materials begin to decompose due to volatilization of their organic component and complete loss of material in most of the samples at higher temperatures which indicated its least resistance to heat when compared to other restorative materials used in this study. [15,16]

In the control group teeth showed discoloration due to heat energy denaturing the bonds within the helical collagen molecules.[17] The collagen then takes on a more haphazard arrangement that affects the absorption of the visible light spectra and also cracks and fractures increased as temperature increases in accordance to Rossouw et al -1999 and Muller et al-2010suggesting these plays a role in identification of burn victims. [18,19]

In the present study, tooth length and pulp volume changes are more significant at high temperatures (800 °C) which was in accordance to the study done by George et al-2018. [5]

Apart from conventional methods, in this study advanced techniques such as CBCT was used as it allows a 3-dimensional record of teeth. Studies also proven that CBCT allows for the accurate calculation of tooth volumes, and the method is highly reproducible because of the good interexaminers' agreement. [20]

Conclusion

Forensic dental identification of burnt victims is often a daunting task. Teeth and dental restorative materials aid as valuable adjunctive in identification of burnt victims. The gold standard Amalgam shows higher resistance to heat followed by Amalgomer and Cention. The implementation of 3D technological advances offers a more accurate method and enhanced inter-relation of restorative dentistry and forensic personal identification.

Ethical Clearance: Ethical clearance was obtained from institutional ethical committee board with reference number MDC_R_088351

Source of Funding: Self funding

Conflict of Interest: Nil

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Original Research Article

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Eruption Pattern of Permanentcanine and Premolar Teeth among School Children aged 10 to 12 Years in a Rural Area: A Cross-Sectional Study

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Abstract

Background: Forensic dentistry is a specialized field that evaluates dental evidence to identify unidentified individuals and missing persons in legal proceedings. Dental charts are compared with known records to establish identity. Accurate age determination is crucial, and dental age assessment is reliable up to 17 years. The study aims to analyze permanent teeth eruption patterns of canines and premolarsin school children aged 10 to 12, contributing valuable insights for accurate age determination and identification in legal cases. The research seeks to aid the interest of justice in criminal, civil, and employment-related scenarios by understanding dental eruption patterns in this age group.

Methods: This was across-sectional study conducted among the school children of south Kerala belonging to age group of 10-12 years. Eruption pattern of permanent canines and premolars of 562 subjects were recorded and analyzed using SPSS software.

Conclusion: Sequence of eruption pattern of permanent canines and premolars were compared and it was observed with statistical significance that eruption of canineprecedes the eruption of second premolars. All the teeth erupted earlier in females compared to males.There was a significant relation with reduced body mass index and delayed eruption of teeth.

KeyWords: Eruption pattern; Canines; Premolars; school children, Body Mass Index (BMI)

Introduction

Forensic dentistry is a specialized area within dentistry and forensic science that plays a critical role in legal proceedings by utilizing dental evidence to aid in identifying unidentified individuals, missing persons, and victims of mass fatality incidents[1]. This involves comparing the dental structures of the victim with dental records of known individuals, obtained from sources such as private dental offices, prison, military dental databases, investigating agencies etc. Dental identification is considered reliable due to the durability of teeth, even in decomposed or mutilated bodies, making them lasting remains that can be used

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for accurate age determination and identification. Dental charts, containing details of dental eruption, growth, diseases, and restorations, can establish identity with a high degree of certainty, similar to comparing fingerprints. Teeth, both deciduous and permanent, are relatively indestructible due to their mineralization, making dental age assessment possible even in challenging cases.[2]

Age determination is a pivotal factor in determining the severity of crimes and appropriate punishments. In Indian Penal Code (IPC), certain sections consider the age of the accused and the victim, such as Section 82, which exempts children under 7 years from criminal responsibility, and Section 83, which acknowledges that children aged 7 to 12 years may lack the maturity to understand the consequences of their actions. The age range of 10-12 years is significant as offenses against individuals in this group are frequently reported. Accurate age determination is essential in various legal scenarios, including criminal cases, civil procedures like marriage and organ donation, and employment-related matters. Dental age assessment is a convenient and reliable method, particularly up to 17 years of age[3].

The study aims to contribute valuable information to the field of forensic dentistry by analyzing the dental eruption patterns of premolars and canines, as well as their relationship to gender, age, and nutritional status in school children aged 10 to 12 years. By understanding these patterns, it can provide insights that help determine age and identity, thereby serving the interest of justice in legal proceedings.

Materials and Methods

A cross-sectional study was conducted at SDV Government Upper Primary School, Neerkkunnam, Alappuzha district, Kerala during the year 2015. The study included school children aged 10-12 years who met specific inclusion criteria, such asverified birth certificates, no history of major dental interventions, and no documented or apparent nutritional deficiencies or illnesses. All children from class v to vii standard, about 562 (280 boys and 282 girls), were included in the study. Approvals were obtained from the Institutional Research Committee and Institutional Ethical Committee. Data collection started after obtaining, informed written consent from the school's head, and assent from the students.

Children who had completed 10 years but not 11 years were taken as **Group I** and those who had completed 11 years but not 12 years were taken as **Group II**. The groups were subdivided as follows: **Group I B** (Boys 10-11 years), **Group I G** (Girls 10-11 years), **Group II B** (Boys 11-12 years), and **Group II G** (Girls 11-12 years).The study involved examinations of each participant for developmental defects, nutritional deficiencies, and a history of surgical intervention or trauma. Height and weight were measured using standard methods, followed by dental examinations using a dental mirror and torchlight. Teeth eruption was recorded when the crown's tip penetrated the gum margin. Additional dental characteristics, like Carabelli's cusps, incisor shape, and ectopias (Buccal/Palatal), were also documented.

Data were entered into Microsoft Excel and analyzed using SPSS version 16.0 software. Mean and standard deviation summarized quantitative variables, while frequency and proportion summarized qualitative variables. Eruption patterns of premolars and canines were compared with age, gender, and BMI, and Chi-square test used to assess statistical significance.

Results and Discussion

A total of 562 school children aged 10-12 years were assessed for eruption pattern of individual teeth, this included 274 children who completed 10 years and 288 children who completed 11 years. The eruption pattern was analyzed under six headings: Upper First Premolar(UFPM), Lower First Premolar (LFPM), Upper Second Premolar (USPM), Lower Second Premolar (LSPM), Upper Canine(UC), Lower Canine(LC). It was observed that out of all subjects studied 92.9% (n=522)had erupted Lower first premolar, 92.0% (n=517) had erupted Upper first premolar, 90.7% (n=510) had erupted Lower canine,69.0% (n=388) had erupted Upper canine, 59.1% (n=332) had erupted Lower second premolar and 52.8% (n=297) had erupted Upper second premolar.

Dental eruption patterns:

The assessment of the dental eruption showed following findings. (Table 1)

(i) **First premolars:** In Group I (10-11years),over 80% of children had erupted Upper first premolars (84.7%, n=232) and Lower first premolars (88.4%, n=242). In Group II (11-12 years), more than 90% had erupted Upper first premolars (95.6%, n=285) and Lower first premolars (97.2%, n=280).

(ii) **Second premolars:** In Group I (10-11 years), only a small proportion of children had erupted upper second premolars (29.2%, n=80) and lower second premolars (35.8%, n=98). In contrast, a significantly larger number of children in Group II (11-12 years) had erupted upper second premolars (75.4%, n=217) and lower second premolars (81.3%, n=234).

(iii) **Canines**: In Group I (10-11 years), only 52.6% (n=144) had erupted upper canines, while 83.3% (n=228) had erupted lower canines. In contrast, the proportion of children in Group II (11-12 years) with erupted canines was significantly higher, with 84.7% (n=244) having erupted upper canines and 97.9% (n=282) having erupted lower canines.

Table 1: The eruption pattern of individual teeth according to age and gender-wise categories.

Age and gender group	UFPM	LFPM	USPM	LSPM	UC	LC
	Erupted n (%)	Erupted n (%)	Erupted n (%)	Erupted n (%)	Erupted n (%)	Erupted n (%)
Group I G (n=135)	116 (85.90)	124 (91.90)	40 (29.60)	48 (35.60)	79 (58.50)	117 (86.70)
Group I B (n=139)	116 (83.50)	118 (84.90)	40 (28.80)	50 (36.00)	65 (46.80)	111 (79.90)
Group II G (n=147)	146 (99.30)	143 (97.30)	111 (75.50)	119 (81.00)	128 (87.10)	144 (98.00)
Group II B (n=141)	139 (98.60)	137 (97.20)	106 (75.20)	115 (81.60)	116 (82.30)	138 (97.90)
Total (n=562)	517 (92.00)	522 (92.90)	297 (52.80)	332 (59.10)	388 (69.00)	510 (90.70)

The gender distribution in Group I (10-11years) showeda higher proportion of dental eruption in girls compared to boys except for Lower Second Premolars. In Group II (11-12 years), girls had a higher proportion of erupted teeth in the case of upper first premolar, lower first premolars, upper second premolar, and upper canine; while boys had a higher proportion in lower second premolar and lower canine (Table 1).

Comparison of dental eruption with different factors.

In children aged 10-12 years, comparing teeth eruption by gender revealed a higher proportion of females with erupted teeth (first premolars, second premolars, and canines) compared to males. However, this gender difference was statistically significant only for Upper Canine. Specifically, 73.4% of females had erupted Upper Canine, while 64.6% of males did, with a statistically significant difference ($p < 0.025$). Bivariate analysis showed that children in Group II (11-12 years) had a higher proportion of erupted teeth (first premolars, second premolars, and canines) compared to those in Group I (10-11 years), and this difference was statistically significant ($p < 0.001$).(Table 2).

Table 2: Comparison of dental eruption status with sex and age categories

Name of the teeth	**Variable category**		**Dental Eruption status**		**P value**
			Unerupted	**Erupted**	
UFPM	Sex	**Female (n=**282)	20 (7.1)	262 (92.9)	0.423
		Male (n=280)	25 (8.9)	255 (91.1)	
	Age	Group I (n=274)	42 (15.3)	232 (84.7)	<0.001
		Group II (n=288)	3 (1.0)	285 (99.0)	

Continue.....

LFPM	Sex	Female (n=282)	15 (5.3)	267 (94.7)	0.096
		Male (n=280)	25 (8.9)	255 (91.1)	
	Age	Group I (n=274)	32 11.7)	242 (88.3)	<0.001
		Group II (n=288)	8 (2.8)	280 (97.2)	
USPM	Sex	Female (n=282)	131 (46.5)	151 (53.5)	0.739
		Male (n=280)	134 (47.9)	146 (52.1)	
	Age	Group I (n=274)	194 (70.8)	80 (29.2)	<0.001
		Group II (n=288)	71 (24.7)	217 (75.3)	
LSPM	Sex	Female (n=282)	115 (40.8)	167 (59.2)	0.944
		Male (n=280)	115 (41.1)	165 (58.9)	
	Age	Group I (n=274)	176 (64.2)	98 (35.8)	<0.001
		Group II (n=288)	54 (18.8)	234 (81.2)	
UC	Sex	Female (n=282)	75 (26.6)	207 (73.4)	0.025
		Male (n=280)	99 (35.4)	181 (64.6)	
	Age	Group I (n=274)	130(47.4)	144 (52.6)	<0.001
		Group II (n=288)	44 (15.3)	244 (84.7)	
LC	Sex	Female (n=282)	21(7.4)	261 (92.6)	0.138
		Male (n=280)	31 (11.1)	249 (88.9)	
	Age	Group I (n=274)	46 (16.8)	228 (83.2)	<0.001
		Group II (n=288)	6 (2.1)	282 (97.9)	

*Chi-Square test

Comparing BMI with teeth eruption revealed significant differences. Erupted teeth were associated with higher BMI compared to unerupted teeth ($p < 0.001$). The most notable difference was observed for lower first premolars, with a mean BMI difference of -2.37 kg/m2. (Table 3).

Table 3 : Comparison of eruption status of teeth with BMI categories

Name of the teeth	Eruption status	N	BMI (kg/m^2)			
			Mean	Std. Deviation	Mean difference	P value
UFPM	Unerupted	45	16.46	1.74	-2.06	< 0.001
	Erupted	517	18.52	2.18		
LFPM	Unerupted	40	16.16	1.30	-2.37	< 0.001
	Erupted	522	18.53	2.18		
USPM	Unerupted	265	17.40	1.73	-1.82	< 0.001
	Erupted	297	19.22	2.25		
LSPM	Unerupted	230	17.16	1.71	-2.03	< 0.001
	Erupted	332	19.19	2.14		
UC	Unerupted	174	17.05	1.72	-1.89	< 0.001
	Erupted	388	18.94	2.16		
LC	Unerupted	52	16.47	1.61	-2.08	< 0.001
	Erupted	510	18.55	2.18		

*student`s t-test

Comparison between eruption of premolars and canines

Among 324 subjects, erupted canines and premolars were observed, while both remained unerupted in 44 subjects. Notably, 186 individuals had erupted canines without premolar eruption, while only 8 subjects displayed erupted premolars without canines. The predominance of canine eruption was found to be statistically significant (p-value <0.001). (Table 4).

Table 4: Comparison between eruption of premolars and canines

		Canines		P-value*
		Unerupted n (%)	Erupted n(%)	
Premolar	Unerupted (n=230)	44 (19.1)	**186 (**80.9)	< 0.001
	Erupted (n=332)	**8 (**2.4)	324 (97.6)	
Total		52	510	

*McNemar Test

Comparison of eruption of Canines between the upper and lower jaws

Both upper and lower permanent canines had erupted in 381 subjects, while both were unerupted in 45 subjects. Additionally, 129 subjects exhibited erupted lower canines with unerupted upper canines, and only 7 subjects had erupted upper canines with unerupted lower canines. These findings indicate that the eruption of lower canines precedes that of upper canines, which was statistically significant (p-value <0.001). (Table 5)

Table 5: Eruption pattern of Upper Canine (UC) compared to Lower Canine (LC).

		LC		P-value*
		Unerupted n (%)	Erupted n(%)	
UC	Unerupted (n=174)	45 (25.9)	129 (74.1)	<0.001
	Erupted (n=388)	7 (1.8)	381 (98.2)	
Total		52	510	

*McNemarTest

Prevalence of Caries among the study group.

In the 10-12-year age group, 15.8% (n=89) of children exhibited dental caries. Dental caries prevalence was higher in Group I (10-11 years) at 23% (n=63) compared to Group II (11-12 years) at 9.0% (n=26). Males had a higher prevalence of dental caries (17.1%, n=48) than females (14.5%, n=41). A significant association was observed between dental caries presence and BMI, with children having dental caries having a lower mean BMI (mean=17.38 kg/m2, sd=1.82 kg/m2) compared to those without dental caries (mean BMI=18.54 kg/m2, sd=2.24 kg/m2), with a p-value of <0.001.

Other morphological features- Carabellicus p was observed in 21 out of 562 subjects .Ectopias present only in four subjects.

Discussion

The present study aims at providing latest information regarding the eruption pattern of teeth as the overall socioeconomic and nutritional status of the people is improving from time to time. Hence latest studies and collection of new sets of data are very important as some changes may occur in the eruption pattern from time to time. The eruption pattern of permanent set of teeth in humans provides information regarding the age of the individual.

The mandibular (Lower) permanent teeth tend to erupt before maxillary (upper) teeth. The conventional teaching is that, age of eruption of permanent canines is 11-12 years and second premolars 10-12 years. The **first premolars** follow the **Upper** laterals incisors in sequence when the child is about 10 year sold; the **Lower canines** (cuspids) often appear at the same time. The **second premolars** follow during the next year, and then the **Upper canines** follow. Usually, the second molars come in when the individual is about 12 years of age; theyare posterior to the first molars and are commonly called **12-year molars.** The **Upper** canines occasionally erupt along with the second molars, but inmost instances of normal eruption, the canines precede them[1,4].

Dental age assessment based on eruption pattern is very useful inassessing the age below 14years and it will not do any harm to the subjects as it is a noninvasive procedure[5]. Forensic age estimations in the living are requested in relation to age thresholds in criminal investigations, during immigration procedures and for civil purposes. Previous studies on eruption sequence and timings of permanent teeth were conducted in different countries in different time periods and in different ethnic groups. The results from those studies showed variations in eruption pattern of premolars and permanent canines.

In the present study 562 school children of age group 10 to 12 years belonging to almost same socioeconomic group and geographical strata were taken as study samples and data collected was analyzed with statistical software. Their exact age is known as they from birth certificates. Hence the eruption timings of teeth can be correlated with actualage. Lower first premolar is the most prevalent tooth in the study subjects,522 out of 562 subjects (92.9%) had erupted Lower first premolar, 517 (92.0%)had erupted Upper first premolar, 510(90.7%) had erupted Lower canine,388 (69.1%) had erupted Upper canine, 332 (59.1%) had erupted Lower second premolar and 297 (52.8%) had erupted Upper second premolar which is the least prevalent tooth in the age group often to twelve years.

In the comparison of permanent canine and premolar eruption sequences, 186 subjects exhibited erupted canines before premolars, while only 8 subjects had erupted premolars with unerupted canines. This indicates a higher occurrence of canines erupting before premolars. This pattern was observed in both jaws and was statistically significant. These findings align with similar studies.[6–8] An Australian study revealed a sequence where, in the upper jaw, the first molar emerged first, followed by the central incisor, lateral incisor, first premolar, canine, second premolar, and second molar. In the lower jaw, the first molar was followed by the central and lateral incisors, canine, first premolar, second premolar, and second molar.[9] This order differed from studies in other countries and recent research, suggesting potential racial and ethnic variations in eruption patterns. Another European study in 2004 noted a change in the sequence, with the canine erupting before the second premolar.[6] A study among Delhi boys in 2002-03 confirmed a change in eruption patterns. They observed median eruption ages of maxillary canines at 9.9 years, mandibular canines at 9.7 years, maxillary first premolar at 9.7 years, mandibular first premolar at 10.1 years, maxillary second premolar at 10.6 years, and mandibular second premolar at 10.8 years.[7]These findings contradicted the conventional belief that permanent canines only erupt after both premolars. A study in Kerala examined school children aged 10-12 years from seven randomly selected schools, found that canines precede the eruption of second premolars.[8] Another study conducted in Karnataka, involving of 5007 school children concluded that permanent canines precede the eruption of second premolar in lower jaw.[10] The study revealed that all permanent teeth generally erupt earlier in females, and the presence of dental caries accelerates permanent tooth eruption. These findings highlight variations in eruption patterns and timings.

Eruption pattern in sexes

All permanent canines and premolars were observed to erupt earlier in females, in accordance with the eruption pattern described in various literatures. However, significant difference in eruption pattern was observed in the case of the upper canine.

Eruption pattern in relation to Body Mass Index

It has been observed that a delayed eruption of permanent canines and premolars is associated with a reduced Body Mass Index (BMI), which is consistent

with the findings of similar study conducted in Kerala. [8]

Conclusion

Forensic dentistry, forensic odontology and forensic odontostomatology are terms used for that branch of forensic medicine, which in the interests of justice deals with the proper handling and examination of dental evidence by its proper evaluationandpresentation.[2] Simple tooth counts and eruption patternaid in the determination of biological age of living persons along with radiological examination, especially for the young individuals for legal purposes.

This studyled to the following observations:

1. The eruption pattern of the first premolars in both jaws corresponds with earlier studies.
2. Permanent canines erupted before second premolars, a statistically significant and contrary finding to conventional beliefs.
3. Mandibular canines erupted earlier than maxillary canines, (this difference was statistically significant).
4. Eruption timings of all the studied teeth were earlier in females, however, statistical significance was observed in the case of maxillary canines.
5. A significant association was found between delayed tooth-eruption, presence of caries, and reduced body mass index.

The median age of eruption for permanent canines and premolars could not be determined due to the cross-sectional nature of the study, wherein observations were conducted at a single point in time. Additionally, the study did not incorporate radiological assessment of tooth eruption, which could result in a tooth on the verge of erupting being categorized as unerupted. Conducting a longitudinal study in conjunction with radiological assessments of tooth eruption would provide more precise eruption timings and mean ages for the permanent canines and premolars.

Conflict of interest: Nil

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Ethical Clearance:No.B6/79/2015TDMCA dated 23.01.2015

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Original Research Article

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A Study of Death Due to Railway Accidents: An Autopsy Based Cross Sectional Study Conducted in a Tertiary Care Hospital

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Abstract

A train accident is defined as "Collision, Derailment, or any other event involving the operation of n- track equipment". To estimate the pattern of injuries in Railway Accidents and to estimate the Cause of death and Manner of death in Railway Accidents. The present study is conducted in Department of Forensic Medicine, Government Stanley Medical College from January 2020 to December 2020 in all the cases of Railway Accidents subjected to postmortem examination. During the study period, 61 cases were subjected for autopsy, the most common age group is 20 to 40 years. The most commonly injured organ is Brain followed by Liver and most of them died within 12 to 24 hours prior to post mortem examination. The railway fatalities were more of accidental in nature, less frequently suicidal and rarely homicidal. Internal organs commonly involved Brain followed by spinal cord, liver etc., It is also found that injuries to the upper half of the body are more common when compared to that of lower half of the body. The most common cause of death was hemorrhage shock from Multiple injuries, followed by Head injury, Thoracic injury, and Abdominal injury.

Keywords: Cause of death, Manner of death, Pattern of injuries, Train Traffic Accident.

Introduction

Indian Railway is one of the largest railway network system in the world under a single management. Railway accidents occupy an important role in medical and legal disclosure on trauma and traumatic disorder [(1)].

A train accident is defined as "Collision, Derailment, or any other event involving the operation of n- track equipment". Author Bernard knight classified the Railway Accidents into three groups: a. Train Accident, b. Movement Accident and c. Non-movement Accident [(2)].

Accidental deaths are unfortunate events due to unawareness, ignorance, carelessness occurred under unforeseen and unplanned events or circumstances. Movement accident has been taken up for the study as the number of fatalities is far more cumulative. Non movement accidents are accidents on railway premises, but not connected with the movement of Railway vehicles [(3)].

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There have been various causes for train accidents ranging from Human Failure to Equipment Failure to Sabotage etc. Human failure has caused more than 86% of the total accidents. Out of this, 41% accidents were caused due to the failure of railway staff and the rest due to the failure of others. Equipment failure caused only 2.2% of the accidents[4].

Track failures and subsequent derailments are caused by twin factors– excessive traffic and underinvestment in rail infrastructure– an Indian Spent analysis of available data shows. Consider this: There has been a 56 % increase in the daily tally of passenger trains over 15 years–from 8,520 in 2000-01 to 13,313 in 2015-16. The number of freight trains increased by 59 % in the same period. But the running track length for all these trains increased by 11 only 12% in 15 years–from 81,865 kilometers to 92,081 kilometers. Slow track expansion and renewal and coach upgrades are the key factors involved [5].

The leading cause of deaths in railway accidents was fall from trains/collision of trains with people on tracks, which together accounted for 13,542 deaths. Other causes include - collisions (99 deaths), derailments (59 deaths), and explosion/fire (12 deaths) [6]. Causes for rest of the cases are not known.

A total of 99 consequential train accidents took place out of which 64 were due to failure of railway staff. Out of the 99 train accidents, 19 were caused due to the failure of factors other than the railway staff[7].

Aims and Objectives:

- To estimate the pattern of injuries in Railway Accidents.
- To estimate the Cause of death and Manner of death in Railway Accidents.

Material and Methodology

The present study conducted in Department of Forensic Medicine, Government Stanley Medical College mortuary in all the cases of Railway Accident subjected to postmortem examination. Data were collected from the post-mortem records, medical records, inquest reports and Crime scene investigations. The data thus collected were subsequently analyzed and compared with other national and international studies.

Study Design: Cross sectional Study.

Study Population: All the cases of Railway Accident deaths subjected to postmortem examination in Govt. Stanley Medical College mortuary during the study period.

Study Duration: 1 year (January 2020 to December 2020).

Inclusion Criteria: All cases of Railway Accident deaths subjected to postmortem examination in Govt. Stanley medical college mortuary on receiving requisition from the concerned Investigating Officer.

Exclusion Criteria: All the cases subjected to postmortem examination in Govt. Stanley medical college mortuary except Railway Accident deaths.

Results and Observation

Table 1: Age Wise Distribution

AGE GROUP	NO. OF CASES	PERCENTAGE (%)
<20 years	12	19.68%
21 – 40 years	26	42.62%
41 – 60 years	15	24.59%
>60 years	08	13.11%
Total	61	100%

Table 2: Circumstances of Accident

CIRCUMSTANCES OF ACCIDENT	NO. OF CASES	PERCENTAGE (%)
Walking on Track	14	22.96%
Crossing the track	34	55.73%
Lying on track	09	14.76%
Falling from train	04	06.55%
Total	61	100%

Table 3: Pattern of Injuries

A. External Injuries

EXTERNAL INJURIES	NO. OF CASES	PERCENTAGE (%)
Abrasions	61	100%
Contusions	38	62.29%
Lacerations	54	88.52%
Swelling and Deformity	23	37.70%
Decapitation	07	11.47%
Crush Injury	51	83.60%
Transection	16	26.22%

B. INTERNAL INJURIES

INTERNAL INJURIES	NO. OF CASES	PERCENTAGE (%)
Lungs	34	55.73%
Liver	48	78.68%
Kidney	18	29.50%
Spleen	16	26.22%
Brain	52	85.24%
Spinal card	49	80.32%
Stomach	11	18.03%
Bowel	19	31.14%
Fractures	43	70.49%
Diaphragm	14	22.95%
Heart	17	27.86%
Urinary Bladder	09	14.75%
Testes	02	03.27%
Internal Bleeding	47	77.04%
Intrapleural Bleeding	36	59.01%
Intraperitoneal Bleeding	22	36.06%

Table 4: Manner of Death

MANNER OF DEATH	NO. OF CASES	PERCENTAGE (%)
Suicidal	17	27.86%
Accidental	42	68.85%
Homicidal	02	03.27%
Total	61	100%

Table 5: Cause of Death

CAUSE OF DEATH	NO. OF CASES	PERCENTAGE (%)
Head Injury	06	09.83%
Thoracic Injury	04	06.55%
Abdominal Injury	03	04.91%
Multiple Injuries	48	78.68%
Total	61	100%

Figure 1: Grease Stain

Figure 2: Decapitation

Figure 3: Head Injury

Figure 4: Head and Chest Injury

Discussion

In the present study, the most common age group is 20 to 40 years (42.62%), which was similar to a study conducted by Pelletire A [8]. Males were predominant (78.69%), which was similar to a study conducted by Puttaswamy[9]. Time of accidents, most of them occurred during the morning hours (55.74%). Most of the victims had the regular habit of crossing the track (55.73%). All the cases were dead on spot and the bodies were found to lie outside the railway track. In most of the cases, grease stains were present.The most commonly injured organ is brain (85.24%) followed by liver (78.68%) and most of them died within 12 to 24 hours prior to post mortem examination.

The pattern of external injuries were abrasions (100%), contusions (62.29%), lacerations (88.52%), swelling and deformity (37.70%), decapitation (11.47%), crush injury (83.60%) and transection (26.22%). The pattern of internal injuries were lungs(55.73%), liver(78.68%), kidney(29.50%), spleen (26.22%), brain(85.24%), spinal cord(80.32%), stomach(18.03%), bowel (31.14%), fractures (70.49%), diaphragm (22.95%), heart (27.86%), urinary bladder(14.75%), testes (03.27%), internal bleeding (77.04%), intrapleural bleed (59.01%), intraperitoneal bleeding (36.06%).

The most common manner of death in the present study is Accidental (68.85%), followed by Suicidal (27.86%) and Homicidal (03.27%) and most of the deceased died of Multiple injuries (78.68%), followed by Head injury (09.83%), Thoracic injury (06.55%), and Abdominal injury (04.91%).

Conclusion

During the study period from January 2020 to December 2020 a total of 61 cases were studied. In the present study showing the males were more prone to railway Accidents than female. The maximum incidence of the cases was seen in the third and fourth decades of life. The accidents were more during the morning hours (5AM to 12PM) when the people rush to workplaces, schools, colleges etc.,

The railway fatalities were more of accidental in nature (68.85%), less frequently suicidal (27.86%) and rarely homicidal (03.27%).The accidental deaths by railway injuries occurred mostly while crossing the track or walking along the track.

From the analytical study of the railway Fatality injuries, Internal organs commonly involved are brain followed by spinal cord, liver etc., It is also found that injuries to the upper half of the body are more common when compared to that of lower half of the body. The most of the deceased were died of Multiple injuries, followed by Head injury, Thoracic injury, and Abdominal injury.

Conflict of interest if any: NONE.

Privacy / Confidentiality of the study subjects: Maintained.

Sponsor details: Not Applicable.

Compensation: Not Applicable.

Insurance: Not Applicable.

Ethical Clearance: Obtained from Institutional Ethics Committee. **IEC meeting held on 12.12.2019 at the council hall, Stanley Medical college, Chennai-1 at 10.00AM**

NAME OF ETICAL COMMITTEE: Institutional Ethical Committee, Stanley Medical College, Chennai -1. Certificate Number: 06/2019/FM/ IEC/ SMC

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Research Paper

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Forensic Examination of Fingerprint Patterns among Different Generations in South Indian Families

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Abstract

Fingerprint patterns are unique and reliable for identification. This research paper focuses on a comparative analysis to determine the inheritance of fingerprint patterns within Indian families. The sample collection process for this comparative analysis involved working with 10 families. The study aims to gain insights into the hereditary aspects of fingerprint characteristics among the Indian population. The research methodology involves the collection of fingerprints and the analysis of patterns using microscopes, magnifying lenses, and software. The results reveal both class and individual characteristics within fingerprints, contributing to our understanding of dermatoglyphics. The average class characteristics percentage totals around 71.5%, with an average individual characteristic percentage of approximately 13.6%. The research has implications for forensic investigations, genetics, and personal identification systems. Further studies with larger sample sizes and genetic analysis integration are recommended for future research.

Keywords: Fingerprint Patterns, Inheritance, Comparative Analysis, Indian Families, Dermatoglyphics.

Introduction

Fingerprint patterns have long been recognized as a unique and reliable form of biometric identification [1]. The study of fingerprints is known as dermatoglyphics[2]. Dermatoglyphics (ancient Greek derma: skin, glyphic: craving) the scientific study of prints of skin viz., [3] They are the perfect instrument for identifying an individual because they are created during early development and remain constant throughout life. Fingerprint analysis has been extensively studied and utilized in forensic science, criminal investigations, and personal identification. [4] There are various methods employed in the examination of fingerprints to extract relevant information for identification purposes. These methods include Visual Examination, Latent Fingerprint Development,[5] Fingerprint Imaging, and Automated Fingerprint Identification Systems (AFIS). [6] The most common fingerprint patterns in the Indian population are loop (65%), whorl (30%), and arch (5%). It is possible for family members to have similar fingerprints. This is due to our genetic codes.

There is an inheritable quality to fingerprint [7]. Pattern types are often genetically inherited, but the individual details that make a fingerprint unique are not. However, there has been limited research on the comparative analysis of fingerprint patterns in

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different generations of Indian families. Integrating genetic analysis techniques would provide a deeper understanding of genetic information [8]. Comparative analysis of fingerprint patterns in different generations of Indian families can provide valuable information about the inheritance patterns of fingerprint traits. It can help in understanding whether certain fingerprint patterns are more prevalent within families and whether they are pass on from one generation to the next. [9] The manuscript shed light on the heritability of fingerprint patterns in the Indian population and contribute to our understanding of the genetic basis of these traits. The study of fingerprint patterns in different generations of Indian families holds several potential benefits and applications. By understanding the familial patterns of fingerprints, accuracy of fingerprint-matching algorithms can be improved and the security of various systems that rely on fingerprint recognition, such as law enforcement databases, access control systems, biometric passports, criminal investigations, missing person cases, and disaster victim identification efforts can be enhanced. Examining fingerprint patterns within different generations of Indian families can provide valuable insights into the hereditary aspects of dermatoglyphics and their potential utility in various domains. The primary objective of this research is to conduct a comparative analysis of fingerprint patterns within different generations of Indian families, aim to:

- To Examine the similarities and differences in fingerprint class and individual characteristics across generations.
- To assess the hereditary aspects of dermatoglyphics within Indian families.
- To investigate the potential applications of family-based dermatoglyphics studies in forensic investigations and biometric authentication.

Materials and Methodology

Sample Collection & Preparation

1. For hygiene and accuracy, hands were sanitized prior to fingerprint collection. Fingerprint samples were systematically collected using a black stamp pad and placed on dedicated fingerprint cards, ensuring precise and accurate prints.
2. The sample collection for the comparative analysis involved obtaining fingerprints using fingerprint cards. The sample collection process for this comparative analysis involved Working with 10 families, each comprising a father, mother, and child. Fingerprint cards are standardized forms that include all the necessary details of an individual, along with their fingerprint data.
3. For the collection of fingerprints, a stamp pad with black ink was used. Specifically, the stamp pad used was the Writeaway Artline Stamp Pad, which is a small-sized pad measuring 101x61 mm. It is known for its 25% more ink/pad area and impressions, durable plastic case, and the ability to produce bright, smudge-free, and long-lasting clear impressions. It is designed to prevent ink transfer on the backside of the paper, ensuring the quality of the fingerprint impressions.
4. Explicit consent was obtained from everyone before their fingerprints were collected.

Informed Consent

Explicit consent was obtained from all participating families before collecting their fingerprints. Participants were informed about the purpose of the study, the methods involved, and the potential implications of the research. This ethical practice ensured that the families involved were willing contributors to the study, aligning with established research ethics guidelines.

Instrumentation Used

1. Compound Microscope [Sipcon, WF 15X].
2. Magnifying Lens [Gyanduly 5X, LxWxH22.3x10.9cm].
3. Adobe Photoshop Express[Version: 10.6.56].

Table 1: Shows abbreviation and meaning of fingerprints and its parameters

S.NO	ABBREVIATION	MEANING	ABBREVIATION	MEANING
1.	RT	Right thumb	UL	Ulnar loop
2.	RI	Right index	RL	Radial loop
3.	RM	Right middle	PW	Plain whorl
4.	RR	Right ring	TWL	Twinned double loop
5.	RL	Right little	CPL	Central pocket loop
6.	LT	Left thumb	DL	Double loop
7.	LI	Left index	TL	Twinned loop
8.	LM	Left middle	PA	Plain arch
9.	LR	Left ring	TA	Tented arch
10.	LL	Left little	AP	Accidental pattern

Results

The outcomes, after analyzing 10 families, were computed and are presented in below tables numbered 2, 3, 4, 5, 6, and 7.

Table 2: Shows the Fingerprints of the Mother, Father and Child of a Family

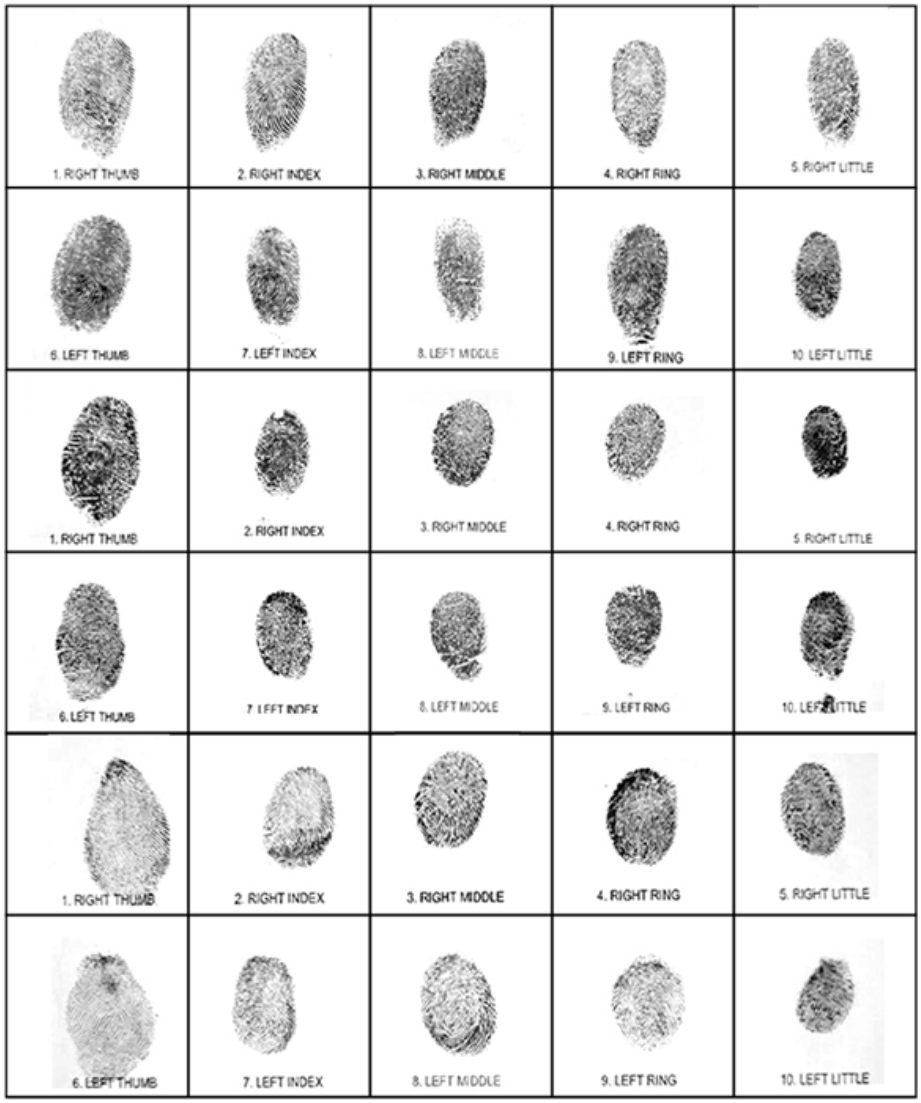

Table 3: Shows class characteristics of fingerprints (1-10 families)

S.NO	FAMILY	MEMBERS	PARAMETERS							
			RT	RI	RM	RR	RL	LT	LI	LM	LR	LL
1	FAMILY 1	F	UL	UL	UL	UL	UL	RL	RL	RL	RL	RL
		M	PW	RL	UL	UL	UL	DL	UL	RL	RL	RL
		C	UL	RL	UL	UL	UL	RL	RL	RL	RL	PA
2	FAMILY 2	F	PW	PW	PW	PW	PW	RL	RL	PW	RL	RL
		M	PW	UL	PW	PW	PW	PW	PW	PW	PW	PW
		C	PW	PW	UL	PW	PW	PW	PW	PW	PW	PW
3	FAMILY 3	F	UL	PA	TA	UL	UL	RL	PA	RL	RL	RL
		M	UL	UL	UL	UL	UL	RL	RL	RL	RL	RL
		C	TDL	RL	UL	UL	UL	RL	RL	RL	RL	RL
4	FAMILY 4	F	PW	PA	UL	UL	PW	TDL	PA	PW	PW	PW
		M	UL	UL	UL	UL	PW	RL	RL	RL	PW	PW
		C	PW	PA	RL	UL	UL	PW	PA	PA	RL	RL
5	FAMILY 5	F	PW	UL	UL	PW	RL	RL	RL	RL	RL	RL
		M	RL	RL	UL	PW	PW	PW	PW	PW	PW	PW
		C	PW	PW	PW	PW	PW	RL	RL	RL	RL	RL
6	FAMILY 6	F	TDL	UL	UL	UL	UL	CPL	RL	RL	RL	RL
		M	UL	PW	UL	UL	UL	RL	PW	RL	PW	RL
		C	UL	PW	PW	PW	UL	RL	PW	PW	PW	RL
7	FAMILY 7	F	UL	PW	PW	PW	UL	PW	PW	PA	RL	RL
		M	PW	PW	PW	PW	PW	PW	PW	PW	PW	RL
		C	PW	PW	PW	PW	PW	PW	PW	PW	PW	PW
8	FAMILY 8	F	PW	PW	PW	PW	PW	PW	PW	PW	PW	PW
		M	PW	PW	PW	PW	PW	PW	PW	PW	PW	PW
		C	PW	PW	PW	PW	PW	PW	PW	PW	PW	RL
9	FAMILY 9	F	UL	PW	PW	PW	UL	RL	PW	PW	PW	RL
		M	DL	UL	UL	UL	UL	RL	RL	RL	RL	RL
		C	PW	PW	PW	UL	UL	RL	RL	RL	RL	RL
10	FAMILY 10	F	PW	UL	UL	PW	UL	DL	PW	RL	PW	RL
		M	PW	UL	UL	RL	UL	DL	TA	RL	RL	RL
		C	PW	PW	PW	UL	UL	PW	RL	RL	RL	TL

Table 4: Shows individual characteristics of fingerprints (1-5 families)

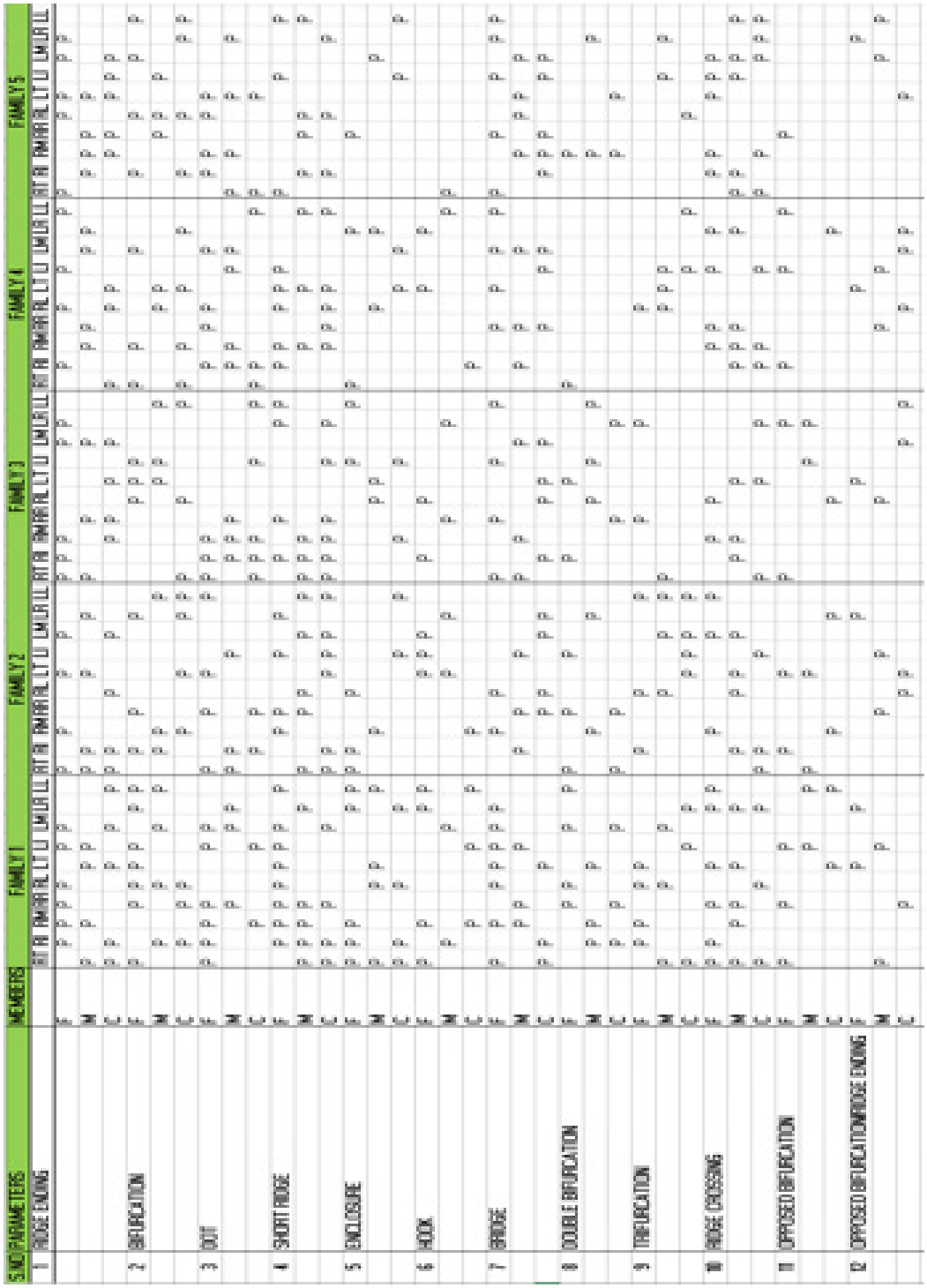

Table 5: Shows individual characteristics of fingerprints (6-10 families)

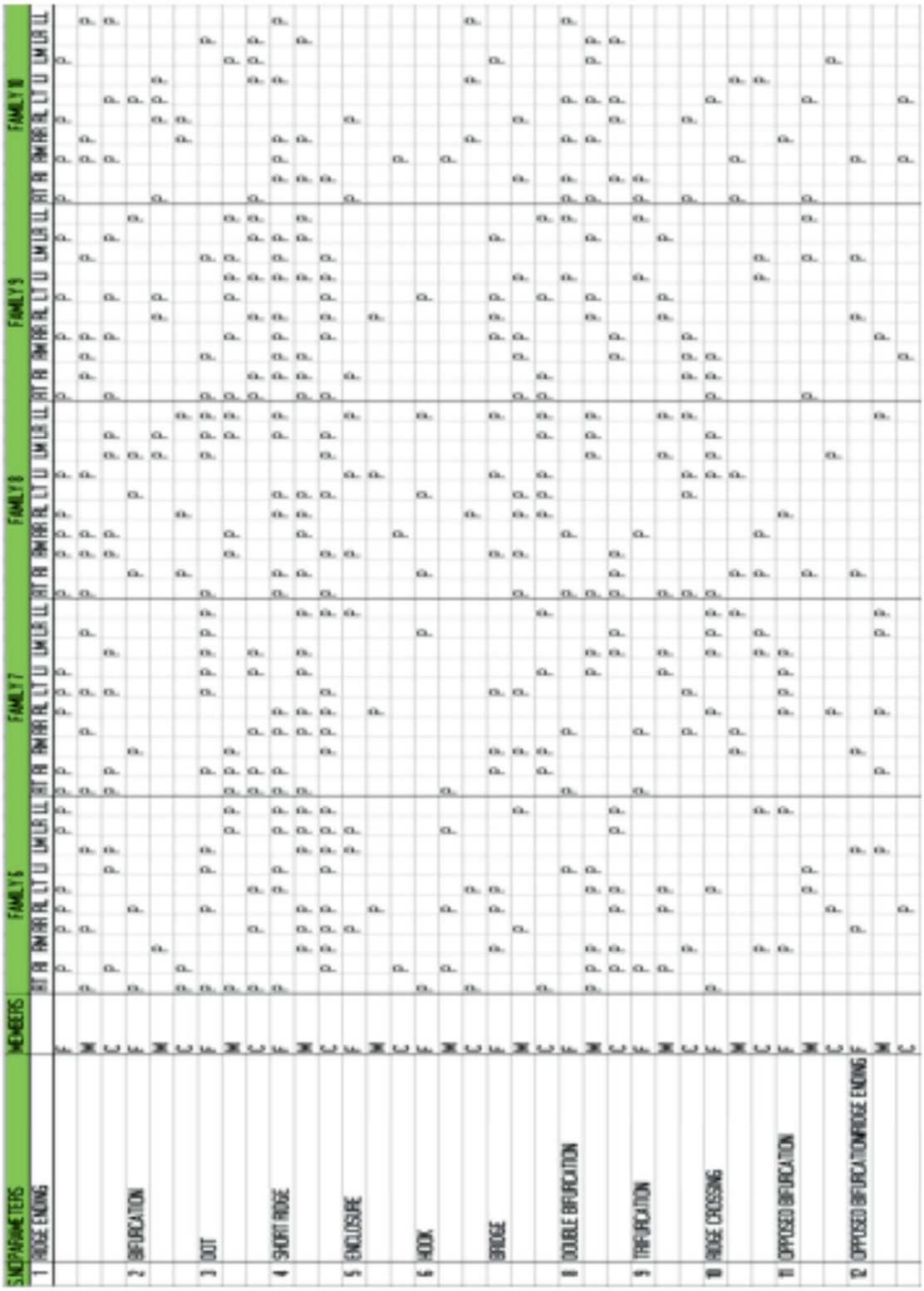

Table 6: Depicting Class Characteristics in Fingerprints of 10 South Indian Families

FAMILY	RIDGE DETAILS
1	RM (UL), RR (UL), RL (UL), LM (RL), and LR (RL) are similar
2	RT (PW), RR (PW), RL (PW), and LM (PW) are similar
3	RR (UL), RL (UL), LT (RL), LM (RL), LR (RL), and LL (RL) are similar
4	RR (UL) are similar
5	RR (PW) are similar
6	RL (UL) and LL (RL) are similar
7	RI (PW), RM (PW), LT (PW), and LI (PW) are similar
8	Only LL is dissimilar, other all fingers are like PW pattern
9	RL (UL), LT (RL), and LL (RL) are similar
10	RT (PW), RL (UL), and LM (RL) are similar

Table 7: Shows Individual Characteristics in Fingerprints of 10 South Indian Families

FAMILY	RIDGE DETAILS
1	In RT (Enclosure, ridge crossing), RI (Short ridge), RM (Bridge), RR (Short Ridge), RL (Bifurcation), and LR (Ridge crossing) is shows similarities with M1, M2, and M3
2	In RT (Ridge ending), RI (Bifurcation), RM (Ridge crossing), and LL (Trifurcation) is shows similarities with M1, M2, and M3
3	In RI (Dot, short ridge), RM (Dot) and LM (Ridge ending) show similarities with M1, M2, and M3
4	In RI (Dot), RM (Short ridge), RR (Bridge), LT (Short ridge), and LM (Bridge) Show similarities with M1, M2, and M3
5	In RM (Double bifurcation), RL (Bifurcation) and LT (Ridge ending, dot) Shows similarities with M1, M2 and M3
6	LR (Short ridge) and LL (Short ridge) show similarities with M1, M2, and M3
7	In RT (Ridge ending), RI (Dot), RR (Short ridge), RL (Short ridge) and LT (Ridge ending) Shows similarities with M1, M2, and M3
8	In RM (Ridge ending), RR (Ridge ending), and LT (Short ridge) Show similarities with M1, M2, and M3
9	RT (Dot) and LI (Short ridge) Show similarities with M1, M2, and M3
10	RI (Short ridge) and RR (Ridge ending) Show similarities with M1, M2, and M3

Discussion

The study reveals that in Family 1, ridge details such as RT (Enclosure, ridge crossing), RI (Short ridge), RM (Bridge), RR (Short Ridge), RL (Bifurcation), and LR (Ridge crossing) exhibit similarities with M1, M2, and M3. These parallels suggest a potential genetic connection between Family 1 members. In Family 2, the analysis uncovers correlations between certain ridge patterns Specifically, RT (Ridge ending), RI (Bifurcation), RM (Ridge crossing), and LL (Trifurcation) showcase resemblances with these established patterns, indicating a possible genetic influence on these ridge characteristics. In Family 3, distinct ridge features such as RI (Dot, short ridge), RM (Dot), and LM (Ridge ending) exhibit similarities with M1, M2, and M3. This observation suggests a potential hereditary basis for these specific ridge details among family members. For Family 4, the analysis highlights parallels between their ridge patterns (RI Dot, RM Short ridge, RR Bridge, LT Short ridge, LM Bridge). This similarity indicates a possible genetic influence on the formation of these specific ridge characteristics. Similarly, Family 5 showcases alignments between specific ridge characteristics (RM Double bifurcation, RL Bifurcation, LT Ridge ending, dot). This suggests shared genetic factors contributing to these ridge features. In Family 6, the ridge features LR (Short ridge) and LL (Short ridge) are show some similarities. This points towards a potential genetic basis for these specific ridge patterns within the family. Within Family 7, certain ridge characteristics like RT (Ridge ending), RI (Dot), RR (Short ridge), RL (Short ridge), and LT (Ridge ending) are show similarities. This indicates a possible genetic correlation between family members. The analysis of Family 8 ridge characteristics, including RM (Ridge

ending), RR (Ridge ending), and LT (Short ridge), highlights similarities with the M1, M2, and M3. In Family 9, the ridge details RT (Dot) and LI (Short ridge) exhibit similarities with the M1, M2, and M3. Finally, Family 10 demonstrates parallels between patterns such as RI (Short ridge) and RR (Ridge ending) are show similarities. This all suggesting a genetic basis for these specific ridge characteristics. This study contributes to our understanding of the complex relationship between genetics and fingerprint patterns, with potential implications in forensic and genetic research fields.

The distribution of class and individual characteristics percentages among the examined families' fingerprints provides valuable insights. When aggregating the percentages across all families, the average class characteristics percentage totals around 71.5%, with an average individual characteristic percentage of approximately 13.6%. This collective data offers a comprehensive view of the prevalence of these characteristics across all examined families' fingerprints. The formula used for calculation is Percentage = (Number of specific characteristics / Total characteristics) * 100. This formula allowed us to quantify the prevalence of both class (Arch, Loop, Whorl) and individual (Ridge Ending, Bifurcation, etc.) characteristics across the family fingerprints.

This research paper distinguishes itself from others, such as "A Study by Iju Shrestha et al. (2019)," [10] "Chinmayi Y et al.'s Findings (2020)," [11] in several significant ways. First, This comprehensive approach considers various fingerprint traits and employs advanced tools, including compound microscopes, magnifying lenses, and specialized software, to ensure precision. Unique to this study is the distinction between class and individual characteristics within families, a differentiation with practical implications in forensic investigations and identification systems. Furthermore, the paper provides quantified similarity percentages for both class and individual characteristics, aiding in interpretation. Looking ahead, there is a proposal for future research that integrates genetic analysis techniques and expands the sample size, with collaboration from experts in genetics and biostatistics to enrich insights into the genetic basis of fingerprint patterns within Indian families.

Conclusion

The paper examines the comparative analysis of fingerprint patterns in different generations of Indian families and has revealed both class characteristics and individual characteristics among the 10 families. The class characteristics identified similarities in specific fingerprint patterns across different family members within the same family. Individual characteristics were observed within each family, indicating unique fingerprint patterns that differentiate individuals even within the same family. These individual characteristics varied across different fingers. The average class characteristics percentage totals around 71.5%, with an average individual characteristic percentage of approximately 13.6%. While the current study included a diverse set of Indian families, future research should aim to increase the sample size. A larger sample size would provide more robust evidence regarding the inheritance patterns of dermatoglyphics within the Indian population.

Ethical Clearance: No Ethical clearance Required

Conflict of Interest: None to declare

Source of Funding: None to declare

Data Retention: We took several measures to ensure the confidentiality and ethical handling of the collected data. All fingerprint samples and associated data were securely stored in locked filing cabinets in a restricted-access area within our research facility. Access to this data was limited to authorized personnel directly involved in the study. Additionally, we removed personal details from confidential materials such as fingerprints and other identifiers during the analysis process to protect the privacy of the participants. Once the analysis was completed and the study findings were documented, all physical and digital copies of the collected data were securely disposed of in accordance with data protection regulations.

Ethical Clearance: While our manuscript did not mention ethical clearance directly, we want to clarify that we obtained consent from all participating families before collecting their fingerprints. Participants were fully informed about the purpose of the study, the methods involved, and the potential implications of

the research. This ethical practice ensured that the families involved were willing contributors to the study and aligned with established research ethics guidelines.

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Frequent Presentation of Counterfeit Gunshot Wounds in a Tertiary Care Hospital in North India: A Case Series

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Abstract

Introduction: Self-inflicted wounds, or wounds produced by another acting in accord with him, are wounds inflicted by a person on his own body. The purpose of fabricating injuries is to file a false claim of assault against an opponent, to alter the appearance of a minor injury in order to attract more attention and a harsher punishment for the alleged accused. Someone may also pretend these as defence wounds, so as to conceal homicide.

Result: In a short period of 1 year, i.e. from August 2020 to July 2021 in a single unit of Department of General Surgery, 8 cases of Counterfeit Gunshot Wounds are there which depicts that the foul play is at large scale and these gunshot wounds are not present over the vital organs of the body.

Conclusion: The combined efforts of all investigating authorities and doctors can help to avoid injury fabrication, which will not only decrease wasteful litigation in the courts, but will also help to avoid harassment of innocent individuals.

Keywords: Gunshot injuries, Fabricated wounds, Self-harm

Introduction

A firearm is a thermodynamic machine in which the potential energy of the gunpowder is transformed into the kinetic energy of the projectile.[1] The term Injury is under section 44 of IPC denotes as any harm whatever illegally caused to any person, in body, mind, reputation or property.[2]In order to dominate other humans, there is a tendency to use deception or fraud to gain sympathy from law enforcement authorities and obtain justice by deception or fraud. To blame the enemy, one approach is to create injuries on one's own body or the body of a friend. For criminal reasons, fabricated wounds are inflicted all around the world.

Fabricated injuries are usually created by a person on his or her own body, but they can also be made by another person acting in his or her behalf. The alleged person who faked injuries is complicit in the crime by injuring himself, so increasing the severity of the crime against the accused who may not have

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used a dangerous weapon and thus misleading the police by providing false information. The evaluation of these injuries, whether by a surgeon in the case of a surviving gunshot victim or a forensic pathologist in the case of the corpse, requires specialized training and skill. Self-inflicted or fabricated wounds are typically found on accessible body parts rather than in delicate places like the eyelids, genitalia, or nipples.[3,4,5] A significant indicator is the lack of fight or defence injuries. There can be discrepancies between the patient's account of the incident and the clothes damage or injury pattern. It is also important to take into account the presence of past attempts with similar old injuries. The majority of these injuries involve adolescent boys, with the upper limbs being the most common targets, according to a profile of these types of injuries.[6,7]

On a large scale, there is rising worry over the indiscriminate use of illegal country-made weaponry. To charge an opponent with assault or attempted murder, manufactured or self-inflicted injuries may be used to make a minor injury appear dangerous. In this article, we present a collection of eight cases with injuries which simulate gunshot wounds. We briefly discuss each case and emphasize the importance of scene investigation, clinical correlation and careful examination in such cases.

Material and Methods

This is an observational study conducted at Jawaharlal Nehru Medical College, AMU, Aligarh, Uttar Pradesh to study the features of counterfeit gunshot wounds from August 2020 to July 2021. This case series comprises of 8 cases which came to a single unit of Department of General Surgery over a span of 1 year. Ethical clearance was taken for this series from Institutional ethical committee. A documentary data collection form was compiled to capture the relevant information from the patients after obtaining informed consent.

Inclusion criteria

Counterfeit gunshot wounds in age group more than 15 years

Exclusion criteria

1. Age less than 15 years
2. Non-Counterfeit gunshot wounds

Case Reports

Case No.	Age	Gender	History	Entry Wound	Exit Wound	Occupation	Place of Residence	Reason for suspicion
1	65	Female	H/O gunshot wound by neighbour	1x1 cm antero-lateral aspect right forearm. No blackening and tattooing	1x1 cm postero-medial aspect right forearm	Homemaker	Rural	History not consistent with the injury and examination
2	23	Male	H/O gunshot wound by a known person of same village	2x2 cm right gluteal region. No blackening and tattooing	Not present	Student	Rural	History not consistent with the injury and examination
3	50	Male	H/O gunshot wound by a known person of same village	1x1 cm over back 10 cm left lateral to midline. No blackening and tattooing	5x1 cm over back in paraspinal area	Farmer	Rural	History not consistent with the injury and examination
4	45	Male	H/O gunshot wound by a known person of same village	2x1 cm medial aspect of right leg. No blackening and tattooing	Not present	Carpenter	Rural	History not consistent with the injury and examination

5	48	Male	H/O gunshot wound by a known person of same village	2x2 cm left hypochondrium. No blackening and tattooing	Not present	Farmer	Rural	History not consistent with the injury and examination
6	17	Male	H/O gunshot wound by neighbour	4x1 cm anterior aspect of left shoulder. No blackening and tattooing	1x1 cm posterior aspect of left shoulder	Student	Rural	History not consistent with the injury and examination
7	45	Male	H/O gunshot wound by a known person of same village	3x1 cm posterior aspect of right shoulder. No blackening and tattooing	Not present	Labourer	Rural	History not consistent with the injury and examination
8	55	Female	H/O gunshot wound by neighbour	4x3 cm antero-medial aspect of right thigh. No blackening and tattooing	3x2 cm postero-medial aspect of right thigh	Homemaker	Rural	History not consistent with the injury and examination

Discussion

In a short period of 1 year in a single unit of Department of General Surgery, 8 cases of Counterfeit Gunshot Wounds are there which depicts that the foul play is at large scale and these cases are usually coming from a particular area. These all gunshot wounds are either just touching the body or targeting the extremities thereby not coming in contact with the vital organs or parts of the body. This is not a common phenomenon and if its occurring again and again then suspicion arises or something is happening on a large scale. If 8 cases coming to a single unit of Department of General Surgery out of 6 units in one hospital, then think of the magnitude of cases in other hospitals too.

In today's environment, self-inflicted or fabricated injuries are increasingly widespread in order to benefit from false charges. The younger population, particularly males, is disproportionately affected.[8] In such suspected circumstances, a scientific medico-legal assessment by a forensic specialist is required to avoid superfluous investigations. When investigating a case of suspected counterfeit injury, look for old scars as well as recent injuries.

A provisional diagnosis of fabricated injury is made when one discovers recent injuries which are multiple, superficial and not on vital body parts. A study conducted by Bhullar et al on fabricated wounds showed that males (84.6%), 21 to 40 years age group (57.7%) were most commonly observed in the study and upper limbs (80%) were most common site affected in the study.[9]Gorea et al studied total of 757 cases of medico-legal injuries and reported that out of 159 cases of grievous injuries 62 were fabricated injuries.[10]

When there is no history of self-infliction but an allegation of assault, and the forensic pathologist has grounds to assume it was self-inflicted to fake injuries, he must make a determination based on the injury pattern. The following reasons may be behind fabricated or self-inflicted injuries-

1. To establish a false charge against another person with an ulterior motive.
2. To avoid arousing suspicion
3. To accuse an adversary of assault or attempted murder
4. To make a minor injury seem more serious

From the medico legal point of view, every injury recorded by the doctor who has examined the injured, is important and needs to be medico legally diagnosed in the right perspective in the disbursement of justice as a doctor is an "expert witness" in a court of law as per section 45 of Indian Evidence Act, 1872.The doctor must be able to distinguish between fabricated and non-fabricated injuries. The combined efforts of all investigating authorities and doctors can help to

avoid injury fabrication, which will not only decrease wasteful litigation in the courts, but will also help to avoid harassment of innocent individuals.

Conclusion

Fabricated wounds may only be ruled out following a thorough history and examination, which takes into account the number, direction, accessibility, site, depth, pattern of injuries. Careful investigation with a hand lens and photos can help determine the severity of injuries. A forensic specialist and police officer should investigate the crime scene together. The law should be changed to punish those who commit self-harm in violation of the constitution's spirit. By bringing such information and making it public as scientific article will help in the legal system to understand what is happening in society and if such cases are there then the law providing authority will get help with this information and people who are falsely implicated will be acquitted.

Conflict of interest: None

Ethical clearance: Taken from Institutional Ethics Committee Ref No. 465 dated 19/10/2021

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Original Article

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Retrospective analysis of pattern of injuries and cause of death in unclaimed dead bodies brought to Mortuary of Private Medical Institute

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Abstract

Introduction: Establishment of identity is required both in living and dead bodies and in both civil and criminal cases. Unclaimed body is defined as dead person who had no next of kin or no relative or no authorized representative willing to make final disposition of the remains.

Aims and objective: The aim of this study was to determine the pattern and distribution of injuries and to find out the cause of the death in unclaimed bodies.

Material and methods: In this retrospective study all the autopsies of unclaimed body from September 2018 to August 2022 were included.

Results: A total 75 unclaimed body were brought to mortuary for autopsy. Out of 75 cases, 65 (87%) were male and 10 (13 %) were female. Majority of unclaimed bodies in this study belonged to age group 40-50. Contusion on the body was most common type of external injury. Lower limb was most common body part for external injuries. Skull was most common site for fracture. Temporal and temporoparietal were most common cranial bone fractured. Mandible was most common facial bone fractured. Liver laceration was most common internal organ injured in unclaimed bodies. Subarachnoid haemorrhage was most common intracranial haemorrhage. Most common cause of death in the present study was haemorrhage and shock due to antemortem injury.

Conclusions: Identification of unclaimed dead body need to be increased by police workforce. Bodies which are unclaimed should be brought to mortuary just after prompt investigation so that autopsy should be started before decomposition which may interfere with autopsy finding and even in identification of the unclaimed body. Colour photography, DNA sampling, finger printing and maintaining dental records should be done for every unclaimed body.

Keywords: Unclaimed bodies; Pattern; Distribution; Autopsy; Identification.

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Introduction

Identification of an individual is one of the important medicolegal aspects of forensic medicine[1]. Identification means fixing the identity of an individual. Establishment of identity is required both in living and dead bodies and in both civil and criminal cases[2]. Unknown or unclaimed or unidentified body is defined as dead person who had no next of kin or no relative or no authorized representative willing to make final disposition of the remains[3]. There are various reasons when the body become unidentified or unclaimed which includes intentional mutilation, decomposition or natural or man-made incidences such as fire, building collapse, earthquakes, railways accidents, aeroplane crash or mass firing or road traffic accident or bomb explosion etc[4]. Purpose of the postmortem examinations is to identification of dead bodies, manner of death, cause of death, time since death[5]. Purpose of autopsy also includes especially in case of unclaimed bodies is to identify the sex, religion, race, age, dental formula, weight and height[2]. The unclaimed body brought for autopsy is placed in deep freezer of mortuary for 72 hours and if it is still unclaimed or unidentified the police officers have legal authority to dispose of the dead body[6,7].

The aim of this study was to determine the pattern and distribution of injuries and to find out the cause of the death in unclaimed bodies brought to mortuary of Hind Institute of Medical Sciences (Private Medical Institute), Barabanki.

Material and Methods

The present study is retrospective type of study. The unclaimed bodies brought to mortuary of department of Forensic Medicine and Toxicology, Hind Institute of Medical Sciences (HIMS), Barabanki for postmortem examination during the period of September 2018 to august 2022 (total 4 years period). During this period total 75 unclaimed bodies brought to mortuary for autopsy and all these were included in this study. Hind Institute of Medical Sciences (HIMS) is non-government/ private medical institute, and its mortuary is authorized for autopsy of unclaimed bodies only. Data regarding unclaimed bodies such as sex, age, cause of death, manner of death, pattern of injuries etc.was obtained from inquest papers, postmortem reports and detailed information provided by inquest officer at time of autopsy.

Study periods: 4 years duration from September 2018 to August 2022

Sample size: 75 cases

Inclusion criteria: Total autopsy done for unclaimed bodies.

Exclusion criteria: Unclaimed bodies which became identified.

Results

A total 75 unclaimed body were brought to mortuary for autopsy during the study period. Data was collected and filled and analysed in excel sheet. Out of 75 cases, 65 (87%) were male and 10 (13 %) were female (Figure 1). Majority of unclaimed bodies in this study belonged to age group 40-50 which included 23 cases (30.66%) followed by 30-40 age group which included 20 cases (26.66%) (Figure 2). Out of 75 cases, 8 cases didn't have any external injury (Figure 3). Contusion on the body (41.33% cases) was most common type of external injury followed by abrasion and laceration on the body (each constitute 34.66% of cases) (Table 1, Figure 4). Lower limb (44% of cases) was most common body partsustaining external injuries (Table 2). Upper limb and finger were most common body part to be amputated (Table 3). Skull was most common bone fractured followed by ribs (Table 4, Figure 5). Temporal and temporoparietal bone were most common cranial bone fractured (Figure 6). Mandible was most common facial bone fractured followed by maxilla (Figure 7). Liver laceration was most common internal organ injured in unclaimed bodies followed by laceration of lung (Figure 8). Subarachnoid haemorrhage was most common intracranial haemorrhage followed by subdural haemorrhage (Figure 9). Most common cause of death in present study was haemorrhage and shock due to antemortem injuries followed by coma due to antemortem head injury (Table 5, Figure 10).

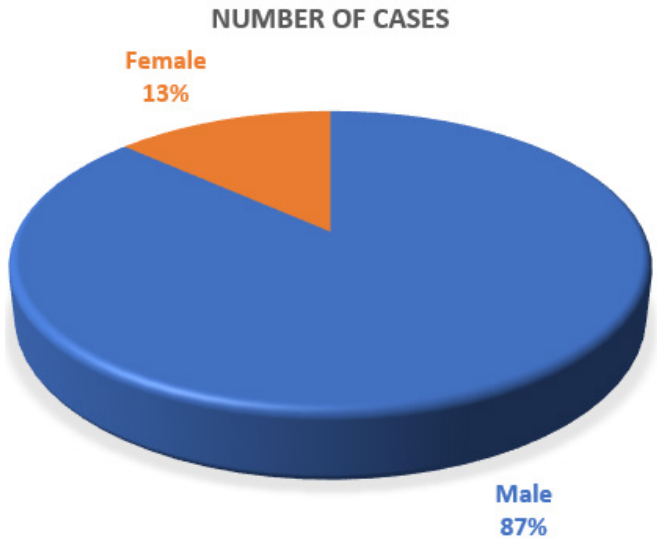

Figure 1. Distribution of sex

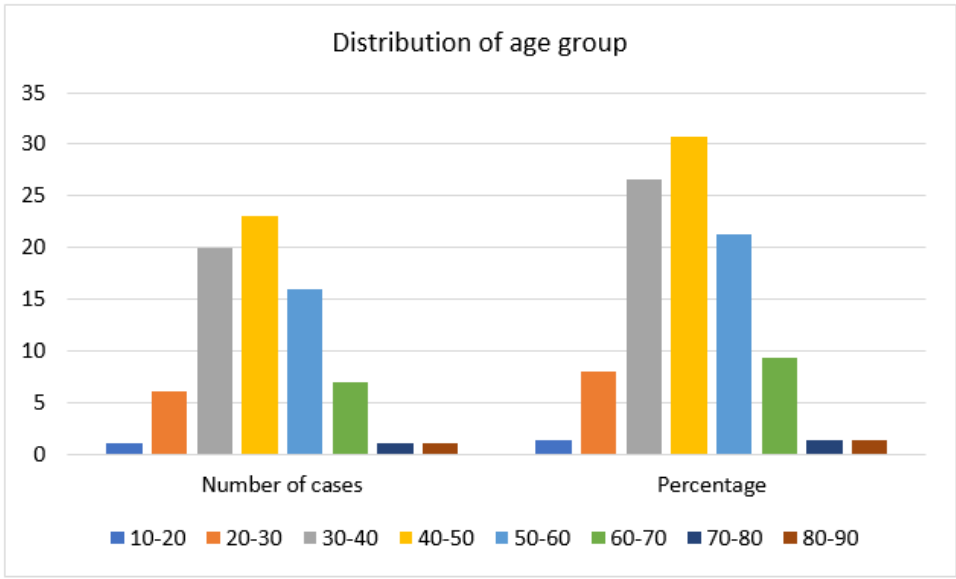

Figure 2. Distribution of age groups

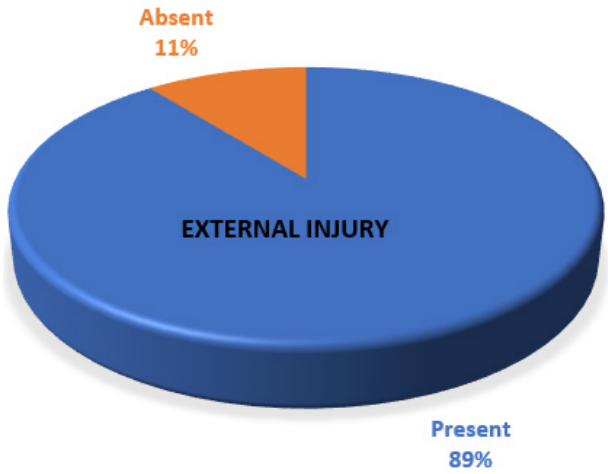

Figure 3. Showing Distribution of external injury

Table 1. Showing distribution of types of external injuries

Types of external injuries	Number of cases	Percentage
Abrasion on the body	26	34.66
Contusion on the body	31	41.33
Contusion over scalp	20	26.66
Laceration on the body	26	34.66
Laceration over scalp	4	5.33

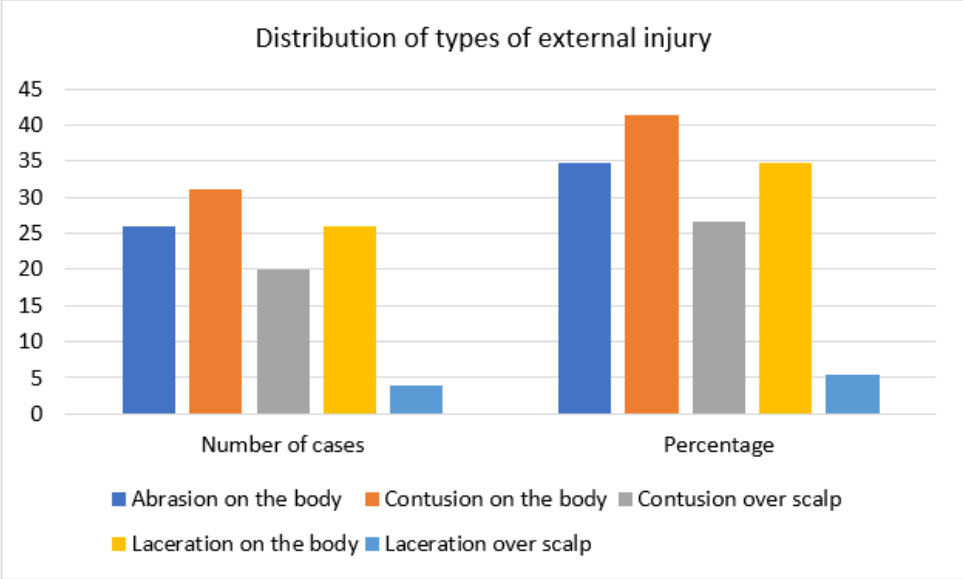

Figure 4. Showing distribution of types of external injuries

Table 2. Showing distribution of injuries on various part of the body

Distribution of injuries	Number of cases	Percentage
Head	26	34.66
Face	14	18.6
Chest	26	34.66
Abdomen	28	37.33
Buttock	12	16
Upper limb	28	37.33
Lower limb	33	44

Table 3. Showing amputation of various part of the body

Amputation	Number of cases	Percentage
Upper limb	2	2.66
Lower limb	1	1.33
Finger	2	2.66
Abdomen from thorax	1	1.33

Table 4. Showing distribution of various fractures

Distribution of fractures	Number of cases	Percentage
Ribs	14	18.66
Facial bone	8	10.66
Skull	17	22.66
Humerus	6	8
Radius	7	9.33
Ulna	2	2.66
Carpal metacarpal phalanges	11	14.66
Pelvic bone	3	4
Femur	5	6.66
Tibia	11	14.66
Fibula	10	13.33
Tarsal metatarsal and phalanges	6	8
Others	3	4

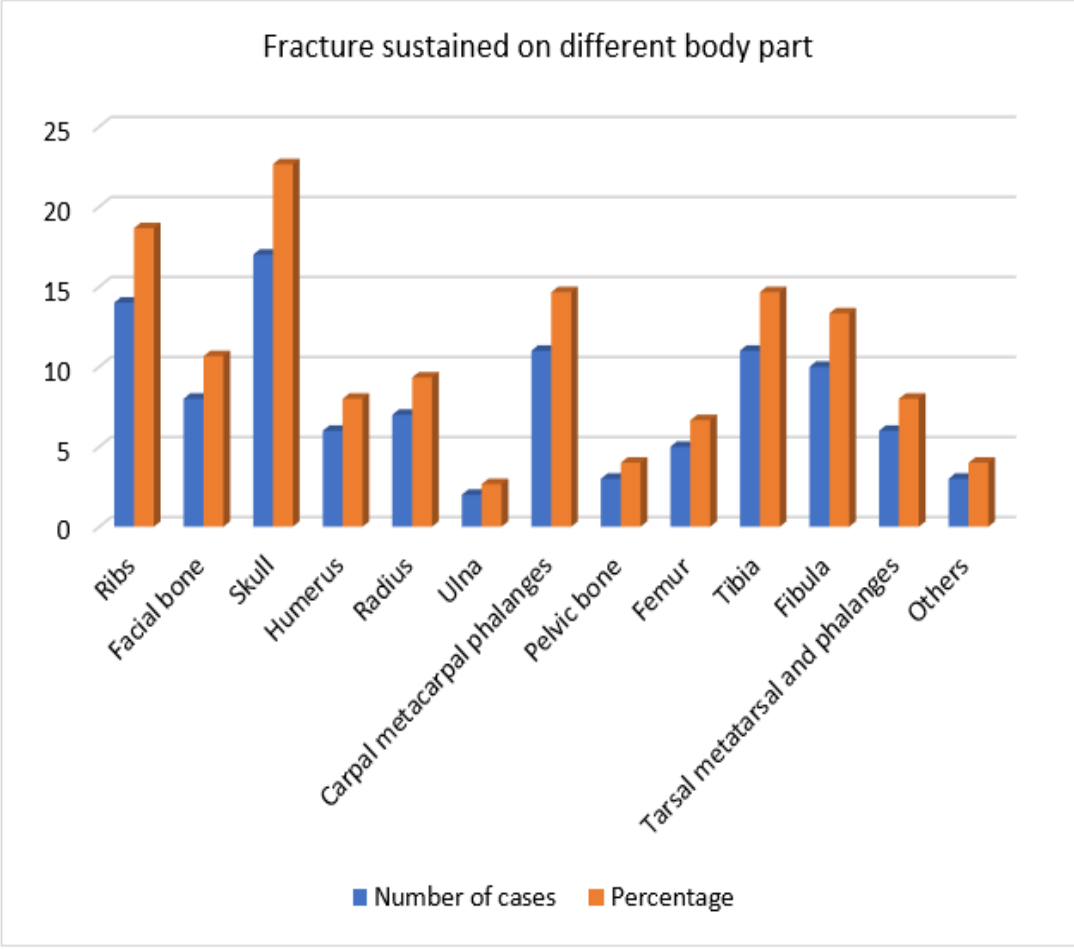

Figure 5. Showing distribution of various fractures

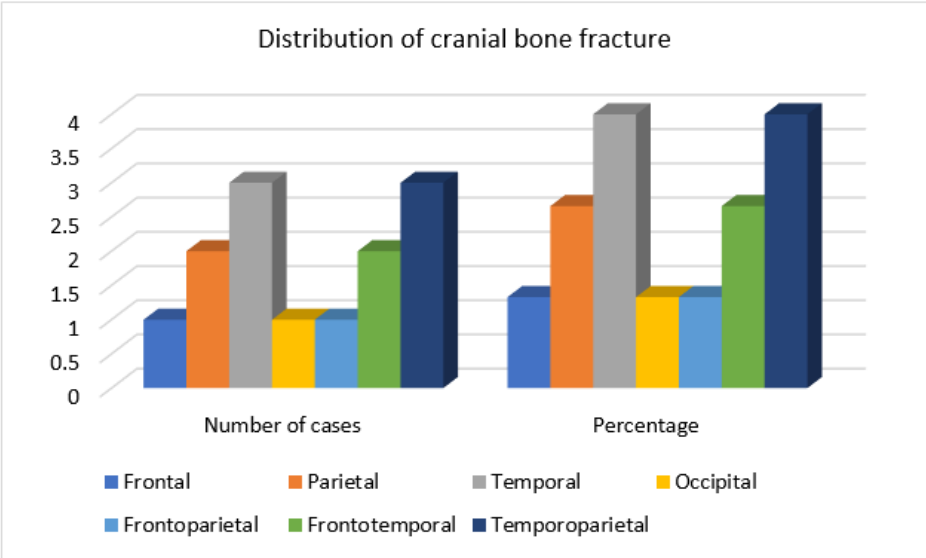

Figure 6. Showing distribution of various fractures of cranial bone

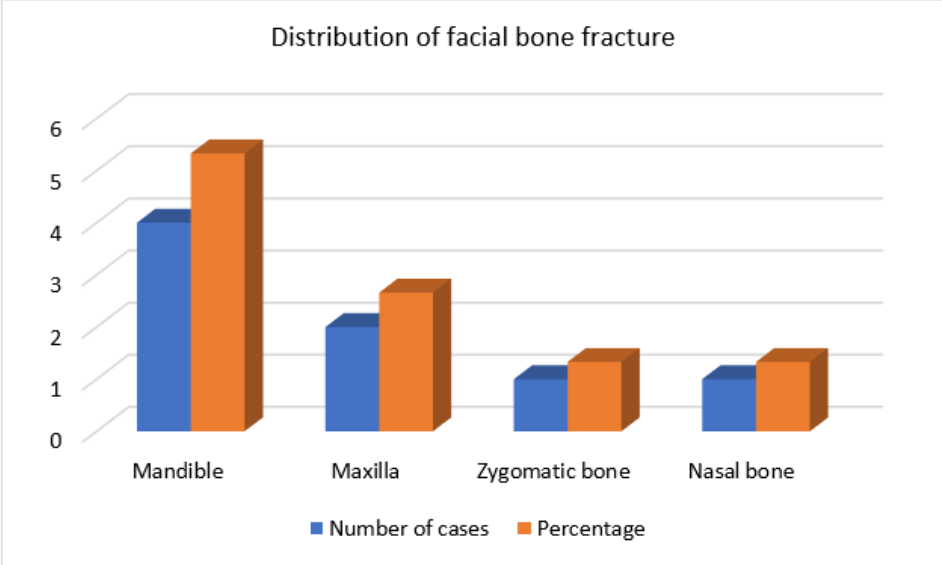

Figure 7. Showing distribution of various fracture of facial bone

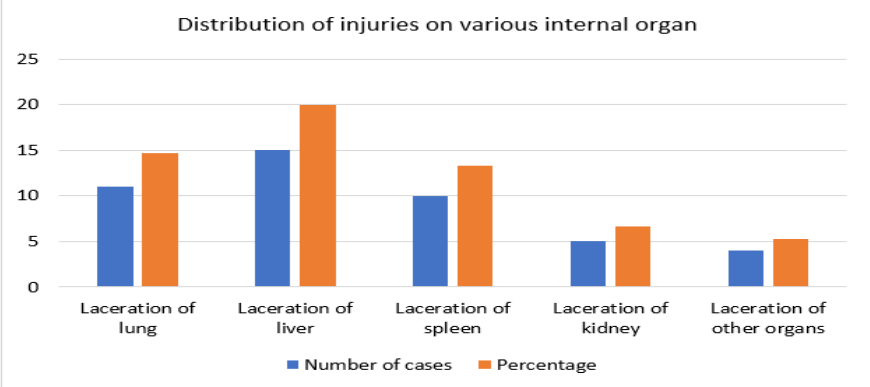

Figure 8. Showing injuries on various internal organs

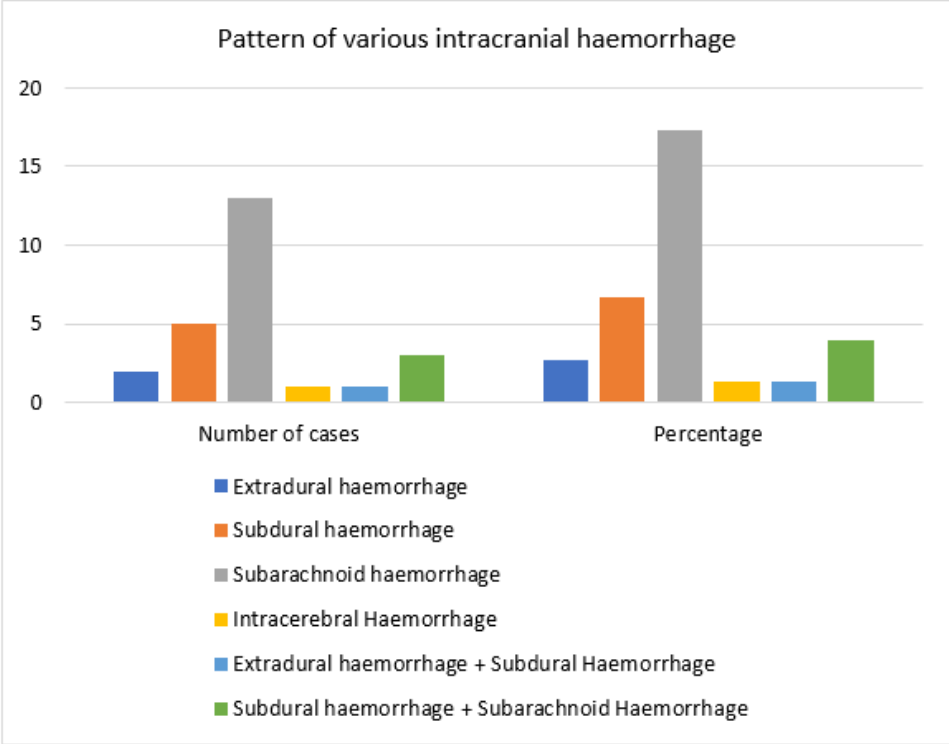

Figure 9. Showing distribution of various intracranial haemorrhages

Table 5. Showing cause of death

Cause of death	Number of cases	Percentage
Haemorrhage and shock due to antemortem injury	43	57.33
Coma due to Antemortem head injury	19	25.33
Septicaemia due to antemortem injury	4	5.33
Coma due to Cerebrovascular accident	2	2.66
Cause of death could not be ascertained	7	9.33

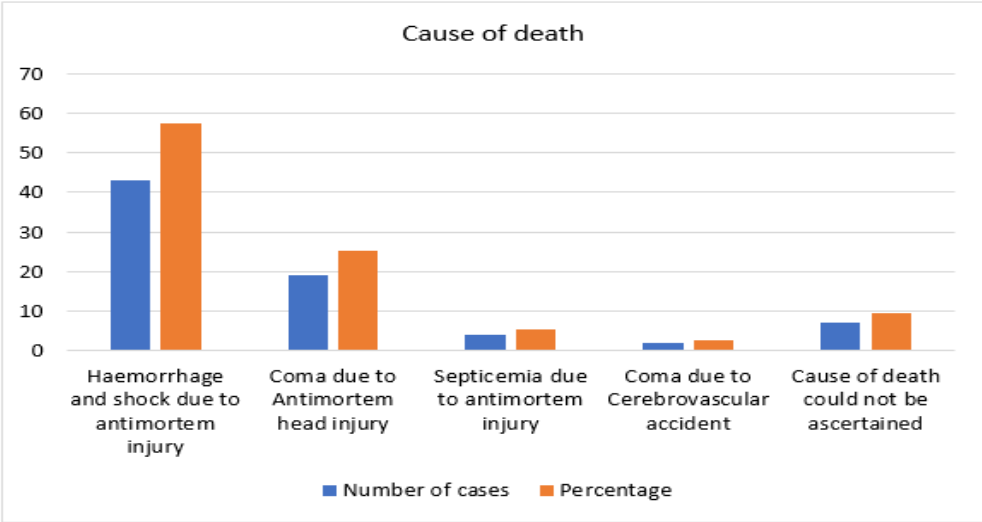

Figure 10. Showing cause of death

Discussion

Identification of dead body is one of the important aspect of postmortem examination for several reasons such as humanitarian, ethical and generous need to know which person had died, especially for providing information to surviving family members or relatives to established the truth of death with regard to that person for legal, official and statistical purposes, to documents the identity of person died for administrative and ceremonial purpose, show to be true for life insurance contract claims and dependent's pension or any other financial matters[8,9]. Unclaimed bodies brought for autopsy comprises important, significant and challenging cases for every postmortem examiner's carrier[10,11]. These cases assess the skill of the concerned specialist and investigating agencies. These cases require vast time spending formalities such as 72 hours waiting periods, details of deceased person and photograph publication in leading newspapers etc. An autopsy surgeon plays vital roles not only by collecting data through examination and dissection of the dead body but also by giving opinion concerning manner, nature and cause of death[2].

In our study there was male predominance which account for 87% of total cases which was exactly similar with study done in Kolkata (87% male)[12] and almost similar with study done in US (80% male)[13] as well as in Maharashtra[11] whereas higher value of male dominance found in the study done by Kumar et al in Chandigarh (97% male)[14] and was lowerin comparison with the study done in Patna (78.07%)[15]. These finding corelates with the fact that male predominance patriarchal society where men leave home in search of livelihood earning, search for job etc. Some time family members are unaware of the employment place of the person and in case of death of such person his body remained as unidentified or unclaimed[14]. Most common age group of death in our study was 40-50 years followed by age group 30-40 years which was similar with study done in Chandigarh[2]. Reason for this age group to be most common is because of most active and mobile age group respect with socioeconomic point of view and hence vulnerable to unnatural death such as accidental, suicidal and homicidal. In our study 11% cases didn't have any external injury. Most common type of external injury present in our study was contusion on body (41.33% of cases) followed by abrasion and laceration on the body (each account for 34.66%). Body part having highest distribution of external injury was lower limb (44% cases) followed by external injury on both upper limb and abdomen (each constitute 34.66% of cases) which was similar with study done by Md Jasim Uddin et al.[16] and Mandal et al[17] who in their study found that lower limb was most common site for external injury whereas Ranjan et al[18] in their study found that head and neck was most common site of external injury followed by lower limbs.

In our study common site offracture of was skull (22.66% of cases) followed by fracture of ribs (18.66% of cases). Most common cranial bone fractured in our study was temporal bone and temporoparietal bone followed by parietal bone and frontotemporal bone whereas study done by Mohan et al who found frontal bone as most common cranial bone fracture followed by parietal and temporal bone[19]. Most common facial bone fracture in our study was mandible (total 4 cases) followed by maxilla (total 2 cases). In the present study most common injury in vital organ was laceration of liver followed by laceration of lung followed by laceration of spleen which was similar with study done in Belagavi[20]. Most common intracranial haemorrhage in our study was subarachnoid haemorrhage followed by subdural haemorrhage which was similar with study of Mohan et al[19]and Nair et al[21]. Most common cause of death in present study was haemorrhage and shock due to antemortem injury (57.33% of cases) followed by coma due to antemortem head injury (25.33%) which was against with many studied[18,21,22,23,24,] who in their study found that most common cause of death was coma due to head injury followed abdominal or chest injuries.

Conclusions

Identification of unclaimed dead body need to be increased by police workforce. Investigation should be prompt with all up-to-date investigation approach. Police manpower should be increased. Bodies which are unclaimed should be brought to mortuary just after prompt investigation so that autopsy should be started before decomposition or before setting any artefact which may interfere with autopsy finding and even in identification of the unclaimed body. Colour photography, DNA sampling, fingerprinting and maintaining dental records should be done for

every unclaimed body. A universal online portal regarding missing person with all details like photographs, fingerprints, DNA profile, dental records, anthropometric data etc. should be started in India.

Conflict of Interest: Nil

Source of Funding: Nil

Ethical Clearence: Has been taken from the institutional ethical committee, Hind Institute of Medical Sciences, Barabanki.

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Original Article

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Detection of Tetrahydrocannabinol in Commercial Consumables: A Survey-Based Study with Real Time Samples

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Abstract

The study aimed to detect the presence of tetrahydrocannabinol (THC) in commercial consumables, specifically focusing on real-time samples. The study highlights the widespread use and cultivation of cannabis, with various compounds such as THC and Cannabidiol (CBD) present in the plant. THC is responsible for the psychoactive effects, while CBD is non-intoxicating and may have therapeutic benefits. The study also discusses the legal and social acceptance of cannabis across countries and regions. The study emphasizes the need for analysing street samples of pan-masala and other tobacco-containing orally consumable products for the presence of cannabis alkaloids, as they are often used as a concealment step for selling and purchasing cannabis. The experimental details include using chemicals and solvents from commercial sources, thin-layer chromatography (TLC) plates and an Ultraviolet-Visible spectrophotometer for detecting THC. The study used Dragendroff (DD) and Fast Blue B (FBB) reagents to identify THC. The THC quantities detected were 15.32 µM, 29.2 µM, 7.15 µM, and 5.3 µM respectively in the collected sample.

Keywords: Tetrahydrocannabinol, Cannabis, Cannabinoids, Dragendroff reagent, Fast blue B reagent, Oral consumable products.

Introduction

Cannabis plants produce many compounds of possible medical importance. Cannabis is among the very oldest of economic plants providing humans with fiber for spinning, weaving cloth, and making paper; seed for human foods and animal feeds; and aromatic resin containing compounds of recreational and medicinal value[1,2]. Human selection for varying uses and natural selection pressures imposed by diverse introduced climates have resulted in a wide variety of growth forms and chemical compositions[3,4] Innovative classical breeding techniques have been used to improve recreational drug forms of Cannabis, resulting in many cannabinloid-rich cultivars suitable for medical use. The biosynthesis of cannabinloid compounds is unique to Cannabis, and cultivars with specific chemical profiles are being developed for diverse industrial and pharmaceutical uses[5,6]. The active principle is not an alkaloid but a fat-soluble oleoresin, cannabinol. It is absorbed both from the digestive and respiratorytract.

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Cannabiscontains numerous chemical compounds called cannabinoids, with delta-9-tetrahydrocannabinol (THC) and cannabidiol (CBD) being the most well-known[7,8]. THC is responsible for the psychoactive effects associated with cannabis use, while CBD is non-intoxicating and may have potential therapeutic benefits[9]. Cannabis has been utilized for medicinal, recreational, and spiritual purposes in different cultures worldwide. Its legality and social acceptance vary across countries and regions.

Commonly, there is tingling and numbness of the extremities or in sleep for about six hours after the consumption of cannabis in its different forms. Rarely, drowsiness may be followed by coma and collapse, and death may occur from respiratory paralysis[10–12]. The harmful effects of THC can include impaired memory and cognition, decreased coordination and motor skills, increased heart rate, anxiety and paranoia, respiratory issues, and potential addiction or dependency[13,14] the biogenetic precursor in the biosynthesis of the psychoactive Δ9-tetrahydrocannabinol (THC Prolonged or heavy use of THC can also impact mental health, leading to an increased risk of psychosis or exacerbation of existing mental health conditions[15,16]. It's important to note that the specific effects can vary depending on individual factors such as dosage, frequency of use, and personal susceptibility. Insanity in India is often attributed to the chronic use (addiction) of this drug in any form and is known as hashish insanity[17]. In some cases, delusions of grandeur or persecution develop. Following the continued use of cannabis or rarely after its consumption for the first time, he may run amok. The minimum lethal dose of chars is about 2g, of ganja is about 8g, and for bhang about 10g per kilo body weight. Death may occur in about 12 hours in acute poisoning[18–20] Cannabis products are by far the most abused drugs on the illicit drug market. Cannabis can be grown in virtually any country. Production of herbal cannabis (marihuana) is widely dispersed, existing in almost every country in the world[21]. Cannabis in different forms is under the umbrella of NDPS act, but from past 2 decades its being observed that their infusion with street tobacco products and pan masala has started as an concealment step for there selling and purchasing one of the infamous case is of "Bhola Manucca" that occurred in Mumbai, it has now become a serious consent to have a prominent overview on the street market of local orally consumable products and in last few years the ratio of drug addiction has increased by 24% in India and in Maharashtra by 8% due to this reasons the steer samples of "pan-masala" and other tobacco containing, orally consumable products are needed to be analyzed for the presence of cannabis alkaloids for the assisting the legal system.

Experimental details:

Chemicals and Instruments:

The experiments were conducted in aerobic condition, using chemicals and solvents from commercial sources without further purification or recrystallisation. The thin-layer chromatography (TLC) plates used are 0.25 mm Merck TLC silica gel plates.

To remove volatile solvents, an IKA rotary evaporator with a dry diaphragm pump (10-15 mm Hg) was utilized, and the process continued until a constant weight was achieved using an oil pump (<300 mTorr). The UV-VIS spectrophotometer used was the Labindia UV-3200 model, capable of scanning speeds ranging from 2-3000 nm/min. This instrument incorporated a tungsten and deuterium lamp, which allowed for detection within the wavelength range of 190-1100 nm using a photomultiplier detector.

Reagent Preparation:

Dragendroff (DD) reagent was prepared by adding glacial acetic acid to bismuth subnitrate and potassium iodide in distilled water[22]. Fast Blue B (FBB) reagent was prepared by mixing fast blue B salt in anhydrous sodium sulphate[22]. All the prepared reagents were stored separately in amber-coloured reagent air-tight bottles.

Sample collection and preparation:

Street samples of various chewing tobacco products were collected to test the hypothesis using random selection or chance sampling, wherein each item in the population had an equal chance of being included in the sample. The collected samples consisted of loose (handmade) and packed samples, totalling 39, with 16 belonging to the loose category and the remaining 23 being filled materials. The weight of the open samples ranged from 5 to 8 g, while the packed samples ranged from 2 to 8 g.

Figure 1: Collected steer samples of "pan-masala" and other tobacco containing, orally consumable products.

Sample preparation:

For each collected sample same procedure was carried out. A 5mg sample was weighed and dissolved in deionized distilled water. A small amount of petroleum ether was added to the solution, and the entire mixture was subjected to a sonicator bath at room temperature for 15-20 minutes. Following this, the mixture underwent filtration using Whatman filter paper no. 45. The resulting filtrate was then transferred to a separating funnel for liquid-liquid extraction. In this process, 5 ml of petroleum ether was added, and the funnel was shaken to ensure thorough mixing. After allowing the aqueous layer and petroleum layer to separate, the petroleum layer was carefully removed. The original aqueous layer was subsequently washed with petroleum ether, repeating this step 3-4 times. All of the collected petroleum layers were combined and concentrated using a Rotar-evaporator. The resulting concentrated extracted samples were then subjected to further examination specifically targeting THC.

Results and discussion

Colour test and TLC:

The 39 extracted samples were initially tested with DD reagent to assess the success of the extraction process. The DD reagent test is commonly used for detecting alkaloids, resulting in a bright yellow colour when any alkaloid is present.

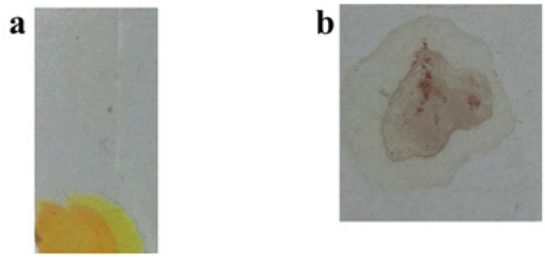

Figure 2: Positive colour test with DD reagent (a) and with FFB reagent (b).

Out of the 39 samples, 29 showed a positive result for the DD reagent test, indicating the presence of alkaloids. These 29 samples were then subjected to the FBB test, which targets explicitly THC. Among these samples, samples **5, 15, 27** and **33** displayed a purple-red colour during the FBB test, confirming THC's presence[23–25]. In both cases, false-positive and false-negative standards were used to verify the exact colour change.

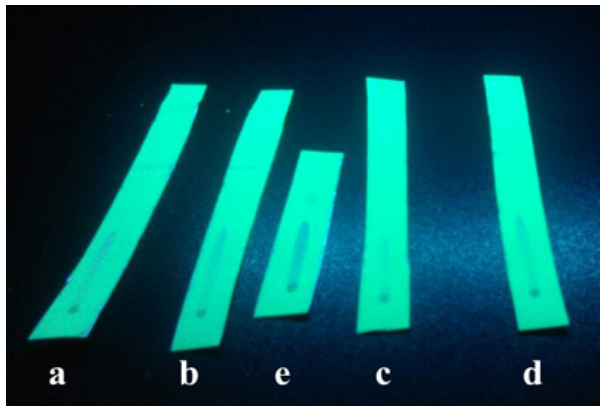

Figure 3: THC illustrating controlled THC sample (e), collected sample 5 (a), 15 (b), 27 (c) and 33 (d).

The samples that gave positive tests for both the Dargendroff reagent test and the Fast Blue B test were further tested by thin-layer chromatography (THC) and UV spectrometry, and the results were compared with the standard sample.

Table 1: TLC result for the collected samples 5, 15, 27 and 33.

Sample	hRf
Standard THC	37
05	36.66
15	36.54
27	37.11
33	37.02

Ultraviolet-Visible spectroscopic analysis:

A stock solution of 5 mM for the THC standard was prepared, and with serial dilution, the required concentration was prepared. The series of serially diluted concentrations of standard were analysed with the UV-VIS spectrometer[26,27]. The THC peak was observed around 278 nm[28]Δ9-tetrahydrocannabinol (or Δ9-THC. As the concentration increased, the peak height and area under the peck is also increased Figure 4a. Using this data, the calibration curve was plotted against a linear concentration range of 1-200 µM versus the area under the curve.

To further validate the presence of THC, UV-VIS spectroscopy was employed. This analytical technique provides a reliable means of identifying specific compounds based on their characteristic absorption patterns in the ultraviolet-visible range. The UV-vis spectroscopy confirmed the presence of THC in the previously identified samples **5, 15, 27** and **33.**

Using this calibration curve, Figure 4b, the THC concentration in the positive resulting samples **5, 15, 27** and **33** were calculated to be 15.32 µM, 29.2 µM,7.15 µM and 5.3 µM respectively.

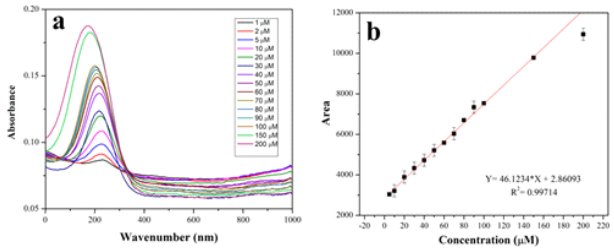

Figure 4: UV spectra (a) and calibration curve (b) for THC controlled sample in the concentration range of 1-200 µM.

Conclusion

The study describes the detection of THC in commercial consumables using real-time samples. Cannabis is a versatile plant with various uses and legality varies across countries. Cannabis products are widely abused drugs, and their infusion with street tobacco products and pan masala has become a concern. The study conducted experiments using chemicals and instruments and prepared reagents for detecting THC in analysing street samples of pan-masala and other tobacco-containing orally consumable products**5, 15, 27** and **33** were calculated to be 15.32 µM, 29.2 µM,7.15 µM and 5.3 µM respectively, with the help of calibration curve of standard THC sample with R^2 value 0.99714.

Ethical Clearance: Taken form dissertation committee, Institute of Forensic Science with informed consent from the vendors.

Conflict of Interest: Nil

Source of Funding: Self

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Original Research Article

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A Research Study on Histopathological Changes that are Seen in Lungs of Victims Who Died of Drowning

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Abstract

Drowning is considered to be the leading cause of death in water and the third most common cause of accidental death worldwide, with the highest drowning rates in developing countries. The WHO defines drowning as the process of experiencing respiratory impairment from submersion/immersion in liquid. For forensic experts, death in water is a multifaceted issue presenting a challenge to them. Since all the circumstances from natural death to homicide are possible in the water, critical examination and interpretation of all abnormal findings found during autopsy are of great importance.

Drowning is a diagnosis of exclusion, based on ruling out all other causes of death via complete autopsy and toxicology. Drowning causes hypoxemia, loss of consciousness, apnea and ultimately cardiac arrest. Fluid aspiration results in lung injury and acute respiratory distress syndrome. Acute Respiratory Failure is the main component of drowning pathophysiology. Near drowning results in multiple complications including aspiration pneumonia which is often life-threatening. Hence the histopathological changes in the lungs provide good corroborative evidence of death due to drowning. Nevertheless, for the examined drowning signs, no high diagnostic certainty could be observed. However, these findings can increase their diagnostic value if forensic doctors take influencing factors into consideration.

From the central record section of the Department of Forensic Medicine, Siddhartha Medical College, Vijayawada, Andhra Pradesh, about 80 medicolegal postmortem reports of death due to drowning in undecomposed bodies were selected in which one whole lung was sent for histopathological examination during the past two years i.e, 2020 - 2022. Parameters like Age, Sex and Marital Status were also studied. Histopathological examination of drowned lungs showed that congestion was seen in 92% of cases, oedema in 96% cases, dilatation of alveoli in 86% of cases, thinning of septa was seen in 84% of cases rupture of alveoli seen in 64% of cases and hemorrhageis seen in 46% of cases. Mostly males are affected and drowning deaths are seen more in 26 – 40 years age group. The histopathological investigations must be performed on all the organs of non-putrefied bodies with the aim of making the difference between death by drowning and other causes of death. The lung examinations can show over-distension of the alveoli, thinning of the alveolar septa and compression with narrowing of the capillary network.

Keywords: Drowning, Emphysema aquosum, Froth from nostrils, ARDS, Pulmonary oedema, Near drowning, Rupture of Alveoli

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Introduction

Drowning is a form of asphyxial death where air entry into the lungs is prevented due to submersion of mouth and nostrils into water or any fluid medium. Thus, drowning constitutes an impairment of tissue oxygenation consequent to submersion in the fluid medium. Complete submersion is not necessary because the process will be complete even if the nose and mouth are submerged. The term typical drowning indicates obstruction of air passage and lungs by fluid. It is also known as wet drowning. This is a classical form of drowning either in fresh water orsalt water. Here water is inhaled and swallowed and lungsget water lodged.

Atypical drowning indicates a condition in which there is very little or no inhalation of water in the air passage and includes dry drowning, immersion syndrome, and submersion of an unconscious and secondary drowning. In dry drowning, no or little water is inhaled in the respiratorytract. Death occurs from asphyxia caused due to laryngealspasm. In such cases, death is more or less instantaneous with lung fields are left dry. This is the best type of case for resuscitation. In **shallow water drowning**, drowning occurs in a small puddle of water when the depth of water is only a few inches but sufficient to submerge the mouth and nostrils. It occurs accidentally in those persons who are disabled or incapacitated such as small children, epileptics, drunkards, comatosed persons following head injury etc. In **immersion syndrome**, death is not due to drowning but results from cardiac arrest due to vagal inhibition. Sudden contact of cold water with the body surface especially the epigastrium, ears, nostrils, larynx or pharynx stimulates nerveendings and causes vagal inhibition. Secondary Drowning also called **near drowning** refers to a condition where there is survival of a person following an immersion episode. The victim may die subsequently as a result of pathophysiological consequences. This is not drowning in the truest sense but a complication or sequelae of drowning. A victim when rescued from water may appear alert and breathing or apparently responds to initial resuscitative measures. However, his condition may deteriorate and succumb to death. Death occurs as a sole or combined effect of pulmonary edema, aspiration pneumonia and/or electrolyte imbalance.[1]

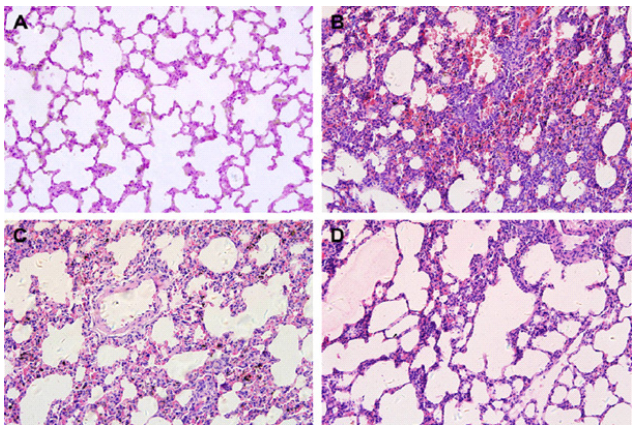
Epidemiology - Drowning victims are predominantly male (> 65%). It occurs in the summer months, more frequently seenin rivers, lakes, ponds and creeks. The age groups affected are the children (< 4 years)and young adults (15-24 years). Drugs and alcoholab use among teenagers are other associatedfactors.[2]

Many corpses are recovered from water, but not all have drowned. Of those that have drowned, pathological proof is often difficult or even impossible to obtain. The autopsy diagnosis of drowning presents one of the major problems in forensic medicine, especially when there is delay in recovering the victim. Bodies retrieved from water may have: 1. died from natural disease before falling into the water 2. died from natural disease while already in the water 3. died from injury before being thrown into the water 4. died from injury while in the water 5. died from effects of immersion other than drowning 6. died from drowning. All the above may show signs of immersion onexamination, but this is rarely helpful, other than confirming that they had indeed been in water. It doesnot assist in differentiating the mode of death.[3]

Histological Contributions to Diagnosis of Death by Drowning - At least one central and oneperipheral section needs to be investigated from every lobe of the lung. In addition to the lungs, liver, cardiacmuscle and kidneys may also be examined for signs of acuteoxygen deficiency and asphyxiation. An important histological finding in the lungs usually appears in the form of acute dilatation of the alveoli with extension, elongation and thinning of the septa and compression of the alveolar capillaries. The intensity of the alveolarexpansion can be affected by the manner and duration of the drowning process, age-dependent compliance and prior pulmonary disorders, etc.In case of rapid drowning, emphysematous expansion, partial ruptures in the alveolarsepta, empty alveolar spaces and dilatation of the capillaries are the prominent features; whereas in case of slow drowning, the findings basically are similar, though less pronounced quantitatively. Janssen has reviewed the subject and concludes that the histological changes may be helpful in the diagnosis of drowning but should be evaluated in conjunction with the other findings and the circumstances of the case.[4]

Much has been written about both light and electronmicroscopy of the lungs in immersion deaths, especially in continental Europe. The accounts are confusing, however, and sometimes contradictory, the consensus of opinion is that such changes are inconstant and unreliable. Much of the work has tried to confirm histologically the genuineness of 'emphysema aquosum' in both fresh and decayed bodies, but the dilatation and rupture of the terminal air spaces can occur not only as a result of drowning, but of passive immersion in water deeper than 4 m. Dilatation of the alveoli, thinning of the walls and compression of the capillaries are easy to observe, but the significance is always ambiguous. Rehclassified such lungs on the basis of reticulin fibers, but Heinen and Dotzauer showed similar changes in undrowned material. Janssen has reviewed the subject and concludes that though histological evidence may be helpful and indicative, it is never probative. The number of macrophages in the alveoli, adjusted to the size of the alveoli where distended, was studied by Betz et al., who claimed a diagnostic usefulness of the method as long as no autolytic changes werepresent.[5]

HISTOPATHOLOGICAL CHANGES IN LUNGS IN CASE OF DROWNING DEATHS



Materials and Methodology

From the central record section of the Department of Forensic Medicine, Siddhartha Medical College, Vijayawada, Andhra Pradesh, about 80 medicolegal postmortem reports of death due to drowning in undecomposed bodies were selected in which one whole lung was sent for histopathological examination during the past two years i.e, 2020 - 2022. Parameters like Age, Sex and Marital Status were also studied.

Results

The histopathological examination reports of the drowned lung in the studied 80 cases showed:

Table 1: Histopathological findings and its incidence seen in drowned lungs

Sl. No	Histopathological Finding	Incidence
1.	Congestion	92%
2.	Oedema	96%
3.	Dilatation of Alveoli	86%
4.	Thinning of Septa	84%
5.	Rupture of Alveoli	64%
6.	Hemorrhage	46%

Fig 1: Sex Pattern in studied 80 drowned cases –72 Males & Females 08 Cases

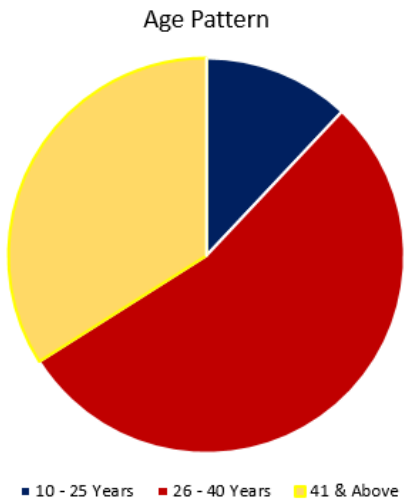


Fig 2: Age Pattern in 80 drowned cases – Age 5 to 25 Years Group: 12%, Age 26 to 40 Years Group: 54%, Age 41 & Above Years Group: 34%

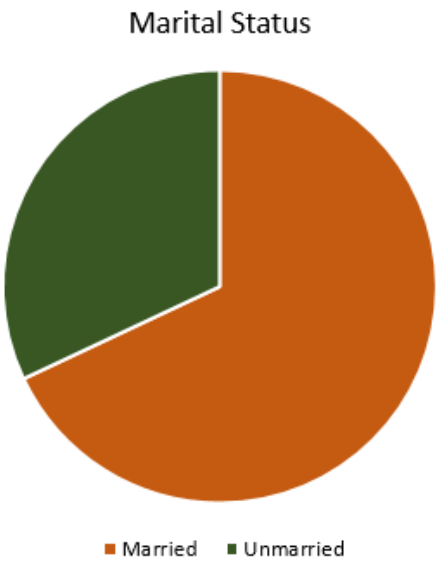


Fig 3: Marital Status in 80 drowned cases – Married – 68% Unmarried – 32%

Discussion

In the 80 cases of drowned lungs studied, histopathological findings were appreciated in almost all the cases. The histopathological finding of congestion is seen in 92% of drowned lung cases. The finding of edema is seen in 96% of cases. Dilatation of alveoli is seen in 86% of cases, thinning of septa is seen in 84% of cases, rupture of alveoli is seen in 64% of cases and the histological finding of hemorrhage is seen in 46%. Hence it is well understood now that histopathological examination of the lung forms an important complementary analytic test for confirming as well as ruling out death due to drowning. No variation in the incidence of histological findings was seen with sex and age. Similar findings were found in drowned lungs in their research study done by Jitendra Kumar Gour & Ravi Kant Saini.[6] The sex pattern in case of drowned cases clearly showed that males outnumbered females in deaths due to drowning. The finding of sex pattern in drowned cases was similar to study done by CC Nwafor and W.O Akhiwu.[7]The age pattern seen in drowned cases clearly shows that drowning deaths are seen more in the age group of 24 – 40 years followed by 40 years and lowest in 5 – 25 years age group. Similar findings were found in the study done by L Quan, P Cummings.[8]Coming to marital status pattern in drowned cases, most of the drowned victims were found to married when compared to unmarried victims. Similar findings with respect to marital status in drowned victims was found in study done by Laxman Gangadhar Phad & Shailendra G. Dhawane.[9]

Conclusion

The Histopathological investigations must be performed on lungs of non-putrefied bodies with the aim of confirming death due to drowning orruling out drowning as the cause of death from other causes of death. The lung examinations can show over-distension of the alveoli, thinning of the alveolar septa and compression with narrowing of the capillary network. The modifications in lungs are heterogeneous distributed and multiple sections must be performed to get the diagnosticvalue. In fact, the microscopic appearance may be entirely normal in some parts of the lungs. Several staining techniques must be performed such as the staining for elastic fibers and reticulin fibers. The examination of other organs like the brain, heart, and liver shows no specific histological changes indicative of hypoxia such as acute congestion and swelling of the capillary endothelia.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: As per the Institutional Ethical Clearance Committee, no clearanceis needed from the institution to doa study on dead people. Ethical Permission from the concerned head of the department is sufficient. Permission was taken from the head of the Forensic Medicine Department of Siddhartha Medical College, Vijayawada, Andhra Pradesh

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Original Research

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Age and Gender Determination using Maxillary Sinus and Sella Turcica on Lateral Cephalogram: A Retrospective Digital Radiographic Study

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Abstract

Background: Anthropometry is of immense importance in human identification and plays a major role in medico legal investigation of demise. Lateral cephalogram provides architectural, morphological details of skull and multiple points for comparison also presents various anatomical landmarks. The study aimed to evaluate morphometric analysis of Maxillary sinus & Sella turcicaparameters in gender determination & age estimation.

Methodology: The study included 300 digital Lateral cephalograms of age range 10-40 years divided in to 3 groups & 50 males and 50 females in each age group. Linear measurement was performed for Maxillary Sinus Height, Width and Index & Sella turcica (ST) Length, Depth and Diameter. Results indicated that all the study parameters were found to be statistically significant in determination of age except Sella turcica depth. Maxillary sinus parameters & Sella turcica diameter, length showed significant corelation between age group Group-1 and Group-II. Maxillary sinus width, height& Sella turcica length was found to be statistically significant in determination of gender. Discriminant equation of MS width had highest accuracy of 63.7% in determination of gender.

Conclusion: Lateral Cephalogram can be used to determine age and gender using linear measurements of maxillary sinus and Sella turcica.

Keywords: Maxillary sinus; height; width; index, Sella turcica; depth; diameter; length.

Introduction

Forensic odontology is proper handling, examination and evaluation of dental evidence also it has significant outgrowth in forensic medicinal sciences in providing justice by identifying the human remains of victims in catastrophic events, radiologic and chemical explosives, mass disaster. The fundamental principle in identifying in dental evidence is by comparing antemortem and postmortem records.[1,2] primary bone that is used in

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sex determination is pelvic bone and the second most common bone used is skull bone which manifests the sexual characteristics during puberty.[3] Age estimation is one of the several indicators employed in forensic cases which also has the importance in civil rights and social benefits.[4]

Radiographs are indispensable tools in forensic anthropology which is simplest and cheapest method compared to histological and biochemical methods in identification of humans. The accuracy depends on the quality of radiographs.[5] Various researchers have alleged that conventional radiograph as cost effective, easily available, and reliable in providing accuracy of 80–100%.[6]

Cephalometric landmarks like maxillary sinus and Sella turcica an anatomical structure in the middle cranial fossa of skull, which is bounded anteriorly by tuberculum sellae, posteriorly by dorsum sellae and inferiorly by the bony roof of the sphenoidal air sinus. can be used in gender and age determination.[7]

In the view of the above literature, this study intends to provide the tool for determination of age and gender in forensic odontology using two craniofacial landmarks i.e., Maxillary Sinus and Sella turcica from lateral cephalograms by linear measurements.

Materials and Methods

The study conducted included 300 lateral cephalograms between age about 11-40. The age groups were divided in to three groups with equal distribution of gender in each group. Lateral digital cephalograms images of the patients advised Lateral cephalogram for purpose of orthodontic treatment, good quality digital lateral cephalogram images are included. Lateral cephalogram images of the patients with congenital, developmental anomalies or pathology in the maxillary sinus, history of trauma and bone disorders, incomplete patient records, poor quality images& images that do not cover the area of interest are excluded from the study.

Method of study

The study is a lateral cephalometric retrospective radiographic study carried out for 2 years. The ethical clearance was obtained from institutional ethical committee of Al-Badar Rural Dental College & Hospital with registration numberEC/NEN/INST/2022/2710. The conducted study comprised of 300 lateral cephalograms with equal distribution of gender with 50 males and 50 females in each age groups. Lateral cephalograms were collected from the archives of Department of Oral Medicine and Radiology. The age groups were divided in to three.

Group1:11-20 years.

Group2:21-30 years.

Group 3:31-40 years.

The lateral cephalograms were obtained from Toshiba Panoramic device under standard exposure conditions recommended by manufacturer i.e., 80kv 10.0mA,10s & 37mGy.cm^2. The obtained lateral cephalograms included in the study were subjected to following digital measurements using CS Imaging software version-7.0.2. After1Monthintra-observer observation was done which included 60 lateral cephalogram which were selected from previous 300 lateral cephalograms with equal distribution of gender in each age groups and digital measurements were done for the all-study parameters

The study included 2 landmarks parameters of maxillofacial complex.

Maxillary Sinus (MS).[8]

- Height(H)- measured from most Superior to the most Inferior point.
- Width(W)- measured from most anterior to most posterior point.
- Maxillary Sinus Index(W/H)- The ratio of maxillary sinus width to height is taken as Maxillary sinus index

Sella Turcica (ST).[9]

- **Length**: The distance between the tuberculum Sella and the tip of the dorsum Sella.
- **Depth**: The line perpendicular to the length to the inferior most point on the floor.
- **Diameter**: The distance between the tuberculum Sella and a point on the posterior inner wall of the pituitary fossa furthest from the tuberculum Sella.

Statistical analysis:

The collected data was subjected to statistical analysis using power package of R program software version 4.2.2. P value ≤0.05 was considered to be statistically significant. The mean p values for different age groups were obtained from the One-way ANOVA. The P value for gender distribution was done by student's t test. P value for all the study parameters between different age groups were compared using Tamhane POST hoc test. Discriminant analysis for each parameter was done & Discriminant equation was obtained find the accuracy for genders determination. After 1-month Intra observer observation was done for 60 lateral cephalograms which were selected from previous 300 lateral cephalograms in which 10 males & 10 females were included in each age group and were measured for the same parameters.

Result and Discussion

The study included total of 300 digital lateral cephalograms with equal gender distribution in each age groups. All the parameters of maxillary sinus and Sella turcica length and diameter were statistically significant according to age groupsin which maxillary sinus Index presented with least p value 0.0015 indicating that it is better parameter to determine age (Table-1)which was in agreement with **Teixeira LC et al.**[10] in which the age group they included were similar to our study. **Rani SU et al.**[4]showed that Maxillary sinus height and width are greater in younger age group than older age groups and also maxillary sinus height has much probability to determine age when compared to maxillary sinus width similar results were observed in our study & showed that maxillary sinus height parameter had greater significance than maxillary sinus width.

In contrast to our study, a study conducted by **Najem SS et al.**[5] revealed that Maxillary sinus Height and width cannot be used to determine age as their study sample included Egyptian patients whereas our study was done in Indians in order to avoid variations arising from ethnicity. This could explain why the results may not coincide withother studies that were conducted on different populations.

Sella Turcica length and diameter had positive results in determination of age among which Sella Turcica Length had greater significance whereas Sella turcica Depth was not significant which was in agreement with **Muhammed FK et al.**[11] in which they focused to evaluate the linear dimension of Sella turcica in Chinese and Nepalese which may be reason of similar ethnicity found in Indians.

In contrast to our study **Chaurasia A et al.**[12] revealed that there was no significant difference observed with ST Diameter. **Kumar TS et al.**[13]**, Nagaraj T et al.**[14] suggested that Depth and diameter had the significant difference with age**. Sathyanarayana HP et al.**[15]revealed that all the above parameters of Sella turcica have significant difference according to age. The above studies revealed that the Sella turcica parameters increases with the age.

Significant correlation between Group-I and Group-II was found with all the study parameters with p value<0.005. Maxillary sinus height having highest mean difference of 2 among all the study parameters, whereas for the Sella Turcica Parameters only Sella turcica diameter &Length had positive correlation only between age group-I(11-20) years &II(21-30) years with Sella turcica length having highest mean difference of 0.9 among Sella turcica parameters.(Table-2)**. Subasree S et al.**[9] revealed that the less mean difference was found with Sella turcica Depth in between age group-II (21-30) years & age group-III (31-40) years which was in agreement with our study. **Kumar TS et al.**[13] also compared the linear measurements with different age groups it was noted that Sella turcica diameter had negative correlation between ≤10 years and 11-20 years which was not significant as the subjects in ≤10 years age groups were only 5 in number whereas in 11-20 years the subjects were161 in number and also the age group was under developing stage.

The mean values of maxillary sinus width and height were found to be greater in males than females & were statistically significant. Maxillary sinus height parameter presented to be best indicator to determine gender. (Table-3) Our study was in consistent with **Urooge A et al.**[16] who conducted a study on CBCT in which left Maxillary sinus width was the only study parameter found to be statistically significant with accuracy of 60%. The similarity could be because of

samples included were from same state (Karnataka) of India though the sample size was small. The other study was in agreement with our study was by **Velpula N et al.**[8] which was conducted on lateral cephalograms in Telangana region with similar age range in our study. The Maxillary Sinus width parameter was found to be statistically significant in gender determination followed by Maxillary Sinus index with accuracy of 79%, with mean valuesfor both parameters were higher in males than females with the above studies. Whereas our study revealed that, of all the study parameters Maxillary sinus width equation presented with highest accuracy of about 63.7% in determination of gender & Maxillary sinus Index was found to be statistically not significant with higher mean values in females compared to males. (Table-4) **Rani SU et al.**[4] revealed that both Maxillary sinus Height and Width have the significance in determination of gender. But Maxillary Sinus height had greater significance followed by maxillary sinus width which was consistent with our study**.**

In contrast to our study **Khaitan T et al.**[6] revealed that Maxillary sinus width was not significant & cannot be used for determination of gender,but Maxillary Sinus height was found to highly significant followed by Maxillary sinus index in determination of gender this may be due to less sample size included in their study in west Bengal population. The study done in Chennai population by **Subasree S et al.**[9] was in partial disagreement with our study as their study revealed that maxillary sinus width parameter was a poor indicator to determine gender, and for Maxillary sinus index similar results were noted that it was not significant for gender determination, whereas Maxillary height had highest significance for gender determination. **Sathawane SR, et al.**[17] conducted a study using CBCT which included Maxillary Sinus parameter like height, width &length which were measured bilaterally to determine gender & their study revealed that all the study parameters were significant except left maxillary sinus width.

In our study only Sella turcica length had mean values greater in males than in females and was significant for gender determination among all the study parameters of Sella turcica with accuracy of 57% for discriminant analysis of Sella turcica length(Table-4). Whereas other study parameters of Sella turcica width and diameter had higher mean values in females compared to males and were statistically not significant. Our study was in agreement with **Sathyanarayana HP et al.**[15] which revealed that Sella turcica length is significant in gender determination as it was done in Indian population.

In contrast to our study **Kiran C et al.**[18] revealed that Sella turcica diameter and depth both had significance in gender determination. The mean values were greater in males than in females which was contradictory with mean values in our study. Although the sample size was smaller that may be the reason for variation of results.

A study by **Badri MK, Alhojailyet al.**[19]revealed that all parameters of Sella turcica were significant in gender determination in Saudi Arabia population with less sample size. **Arthisri ASet al.**[20]**, Chaurasia A et al.**[12]**, Muhammed FK et al.**[11] **Subasree S et al.**[9] **& Kumar TS et al.**[13] revealed that all the study parameters of Sella turcica were found to be statistically not significant in gender determination as there was unequal distribution of subjects& small sample size.

All the study parameters were found to be statistically not significant between observation-1&2. None of the study discussed for intra observer comparison.(Table-5)

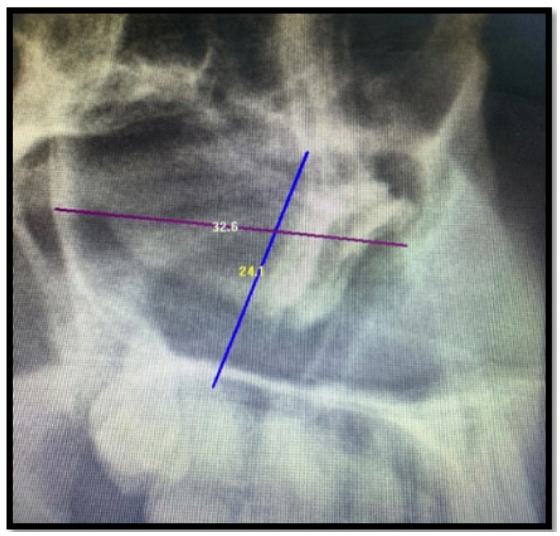

Figure 1: Linear Measurement of Maxillary Sinus showing

WIDTH-32.6 mm; HEIGHT-24.1mm

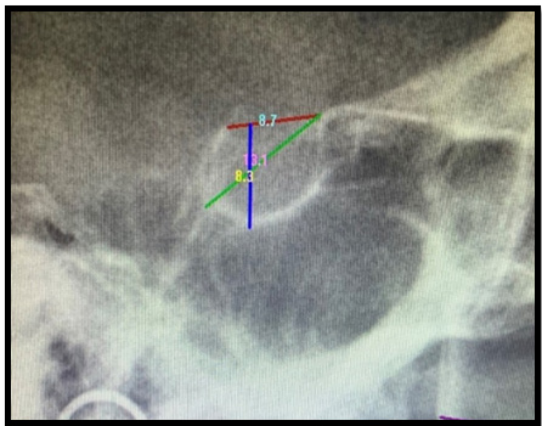

Figure 2: Linear Measurement of Sella Turcica showing

LENGTH-8.7mm; DEPTH-8.3mm; DIAMETER-13.1mm

Table 1: To Compare means of Maxillary sinus and Sella turcica study parameters between age groups using ANOVA

PARAMETERS		**AGE GROUP (YEARS)**		
		I (11-20) YEARS	**II (21-30) YEARS**	**III (31-40) YEARS**
MS WIDTH (MSW)	Mean	34.3	35.6	34.6
	SD	4.08	3.38	4.15
	P value	0.0494(S)*		
MS HEIGHT (MSH)	Mean	23.7	25.7	24.4
	SD	3.83	3.94	4.90
	P value	0.0028(S)*		
MS INDEX **(MSI)**	Mean	1.8	1.2	1.4
	SD	1.97	0.37	0.24
	P value	0.0015(S)*		
ST DEPTH (STd)	Mean	8.4	8.5	8.7
	SD	1.59	1.67	1.34
	P value	0.358(NS)		
ST DIAMETER (STDmt)	Mean	11.9	12.5	12.0
	SD	1.46	1.77	1.63
	P value	0.015(S)*		
ST LENGTH (STL)	Mean	8.9	9.7	9.5
	SD	1.73	1.98	1.71
	P value	0.0037(S)*		

MS-Maxillary sinus; ST-Sella turcica.

p value≤0.005-statistically significant*; p value≥0.005-Not statistically significant

Table 2: Comparison of all the study parameters among age groups using Tamhane Post Hoc

VARIABLES	BETWEEN	DIFFERENCE	P VALUE
MS WIDTH (MSW)	Group I and Group II	1.3	0.0522*
	Group I and Group III	0.3	0.8746
	Group II and Group III	1.0	0.1567
MS HEIGHT (MSH)	Group I and Group II	2.0	0.0021*
	Group I and Group III	0.7	0.4416
	Group II and Group III	1.3	0.0740
MS INDEX (MSI)	Group I and Group II	0.6	0.0009*
	Group I and Group III	0.4	0.2301
	Group II and Group III	0.2	0.2302
ST DEPTH (STd)	Group I and Group II	0.1	0.8833
	Group I and Group III	0.3	0.3364
	Group II and Group III	0.2	0.6176
ST DIAMETER (STDmt)	Group I and Group II	0.6	0.0161*
	Group I and Group III	0.1	0.8176
	Group II and Group III	0.5	0.0779
ST LENGTH (STL)	Group I and Group II	0.9	0.0029*
	Group I and Group III	0.6	0.0662
	Group II and Group III	0.3	0.5326

MS-Maxillary sinus;ST-Sella turcica,

p value≤0.005-statistically significant*; p value≥0.005-Not statistically significant

Table 3: Student t test to compare means and Standard deviation (SD) between gender

PARAMETER		GENDER	
		MALE	FEMALE
MS WIDTH (MSW)	Mean	35.9	33.8
	SD	4.00	3.53
	P value	0.0045(S)*	
MS HEIGHT (MSH)	Mean	25.5	23.7
	SD	4.27	4.21
	P value	0.0004(S)*	
MS INDEX (MSI)	Mean	1.40	1.48
	SD	0.27	1.66
	P value	0.5553(NS)	
ST DEPTH (STd)	Mean	8.4	8.6
	SD	1.52	1.56
	P value	0.2299(NS)	
ST DIAMETER (STDmt)	Mean	12.0	12.3
	SD	1.73	1.53
	P value	0.0604(NS)	
ST LENGTH (STL)	Mean	9.6	9.1
	SD	2.03	1.60
	P value	0.0121(S)*	

MS-Maxillary sinus; ST-Sella turcica,

p value≤0.005-statistically significant*; p value≥0.005-Not statistically significant

Table 4: Gender determination by discriminant equations and its percentage accuracy

PARAMETER	EQUATION	PERCENTAGE ACCURACY (%)
MS WIDTH (MSW)	-0.7110+0.0347(MS WIDTH)	63.7
MS HEIGHT (MSH)	-0.0749+0.0234(MS HEIGHT)	59.7
MS INDEX (MSI)	0.5208-0.0144(MS INDEX)	51.3
ST DEPTH **(STd)**	0.6927-0.0226(ST DEPTH)	49.0
ST DIAMETER (STDmt)	0.9019-0.0331(ST DIAMETER)	53.0
ST LENGTH (STL)	0.1322+0.0393(ST LENGTH)	57.0
ST LENGTH (STL)	0.1322+0.0393(ST LENGTH)	57.0

Note: Value of Equation, if ≥ 0.5 then Male otherwise Female

MS-Maxillary sinus;ST-Sella turcica,

Table 5: Comparison of intra observer observations after 1 month by using paired t-test

PARAMETERS	MEAN		P -VALUE
	OBSERVATION-1	OBSERVATION-2	
MS WIDTH (MSW)	34.610	34.575	0.957 (NS)
MS HEIGHT (MSH)	28.425	24.135	0.3304(NS)
MS INDEX (MSI)	1.503167	1.450333	0.3854(NS)
ST DEPTH (STd)	8.551667	8.601500	0.8348(NS)
ST DIAMETER (STDmt)	15.44	12.18	0.1566(NS)
ST LENGTH (STL)	9.115000	9.006667	0.7316(NS)

MS-Maxillary sinus;ST-Sella turcica, Observation-2: study done for 60 lateral cephalogram after 1 month.

p value≤0.005-statistically significant*; p value≥0.005-Not statistically significant

Conclusion

Even the parts of body are destroyed radiographs are indispensable weapons to provide justice to victim by comparing antemortem records during lifetime and postmortemradiographs. During mass disaster if all the skull bones are destroyed Maxillary sinus remain intact and Sella turcica a small saddle shaped anatomical structure has less chance of destruction during mass disaster, and this is landmark which is usually traced for cephalometric analysis. The various linear measurements in our Study revealed that all the study parameters of Maxillary sinus can be used to determine age. Discriminant function analysis revealed that maxillary sinus width had the highest accuracy in determination of gender. Sella Turcica Length and diameter can be used in determination of age. The study also revealed that the Morphology of the above anatomical landmarks vary with age, race and ethnicity. The conclusion drawn from the present study could be beneficial in forensic investigations for the identification of human victims. Further research is needed to know importance of Sella turcica and maxillary sinus in personal identification.

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Original Research Article

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Trends of Suicidal Poisoning in Southern part of Assam

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Abstract

Suicide is a leading cause of mortality among young people in many countries, making it a serious global public health problem. It is estimated that around 20% of global suicides are due to pesticide poisoning. This study was conducted with an objective to find out the commonest suicidal poison and its demographic distribution. This study was designed on victims of suicidal poisoning brought for medicolegal autopsy at Silchar Medical College and Hospital, Silchar, Assam between 15th October 2017 and 14th October 2022. Required information for the study was gathered from inquest reports, autopsy reports, chemical examiner's analysis report of viscera and available documents in the departmental records. The collected information was statistically analysed using Microsoft excel version 2019. Out of 64 cases, poison was detected in 33 Cases. Male victims surpassed females with highest number of victims from age group 21-30 years. Most common poisoning agent was organophosphorus compounds. Educational and awareness programs regarding usage and storage of pesticides can become an important step for the prevention of deaths due to poisoning. However more research is needed to better understand suicides involving pesticides in their cultural contexts.

Keywords: Organophosphorus, Pesticide, Suicide, Post-mortem, Assam

Introduction

Suicide is a leading cause of mortality among young people in many countries, making it a serious global public health problem.[8] It is estimated that around 20% of global suicides are due to pesticide poisoning, most of which occur in rural agricultural areas in low- and middle-income countries.[7] According to study, the vast majority of alarming number of poisoning deaths were due to intentional pesticide poisoning, indicating the importance of regulating highly hazardous pesticides to prevent deaths as recommended by the WHO and FAO.[11] Most pesticides are generally toxic to many non-target species, including humans. Insecticides are mostly not species-selective with regard to targets of toxicity, and mammals, including humans, are highly sensitive to their toxicity.[2]

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Aims and Objectives:

- To know the trends of suicidal poisoning deaths.
- To know the different aspects of poisoning as per age, gender, religion and demographic distribution.
- To know the most common type of poison used for suicide.

Materials and Methods

The materials for the present study were cases brought for medico legal autopsy from various police stations from southern part of Assam in the Department of Forensic Medicine and Toxicology, Silchar Medical College and Hospital, Silchar between 15th October 2017 and 14th October 2022. A total of 64 cases of suspected death due to poison were autopsied, out of which 33 cases were associated with deaths due to poisoning. Required information for the study was gathered from available documents in the departmental records through proper channel. The poisoning agent was identified by screening the autopsy report and the chemical analysis report. The information thus collected and was statistically analysed using Microsoft excel version 2019. Cases where the results of final chemical analysis were not received has been excluded from the study.

Results

Total four thousand and ninety-seven cases were autopsied in the Department of Forensic Medicine, Silchar Medical College, Silchar, Assam, during the period of five years (15th October 2017 and 14th October 2022). Out of these, 64 cases were suspected deaths due to poisoning, amongst those, poison was detected in 33 cases and 31 came out to be negative, which was confirmed from the chemical analysis report provided by Forensic Science Laboratory, Guwahati (Fig. 1). Out of these 33 confirmed cases of suicidal poisoning deaths, victims of male (n=18) surpass females (n= 15) (Fig. 2) and highest numbers of cases (n= 12) were found in the age group 21-30 years (Fig.3). Most of the cases were from a rural area (n= 26) as compared to urban area (n= 7) (Fig. 4). Victims of Hindu (n= 22) community were twice the number of Muslim (11) (Fig. 5). The most common poisoning agent used by the victims was organophosphates (n= 26) followed by carbamates (n= 5) which is depleted in Fig. 6.

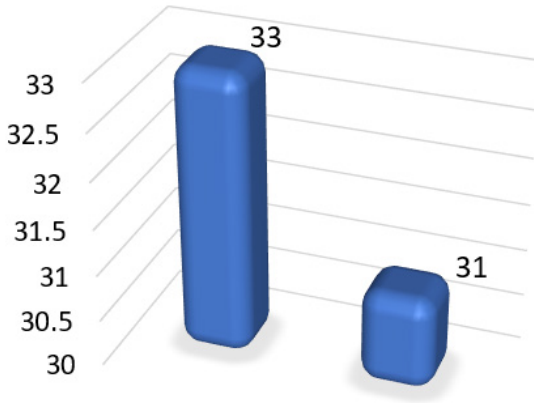

Fig 1. Total Poison detected

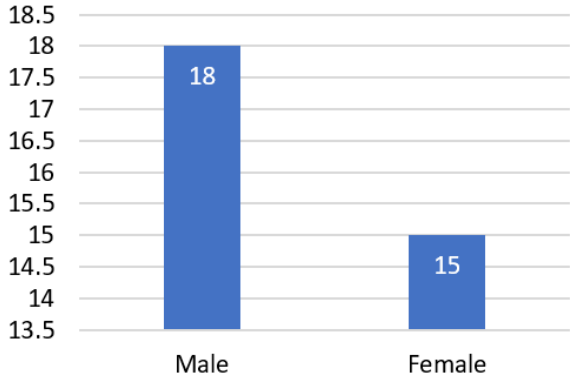

Fig 2. Gender wise Victims

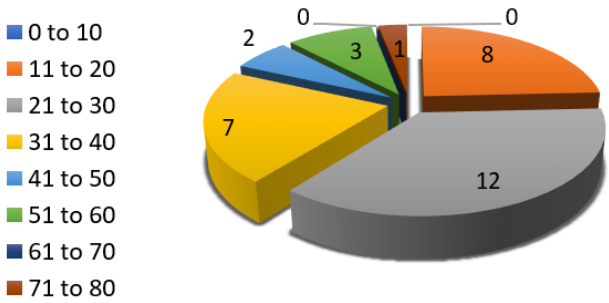

Fig 3. Age-wise distribution of victims

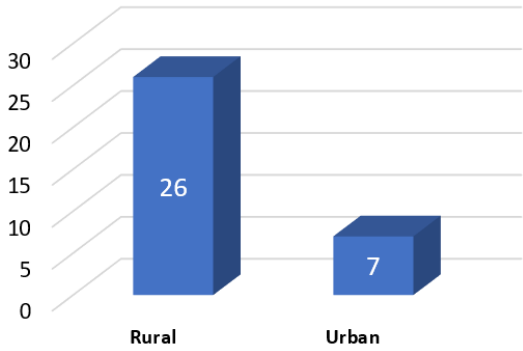

Fig 4. Location wise distribution of victims

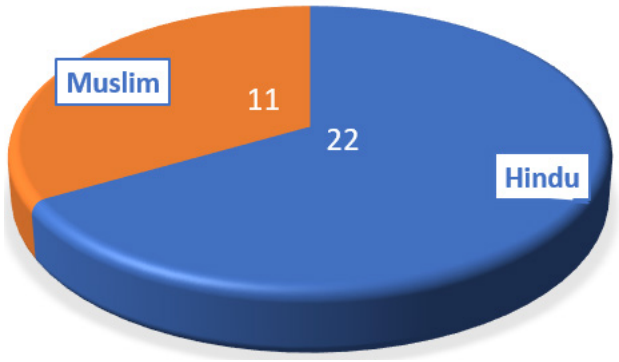

Fig 5. Religion wise distribution of victims

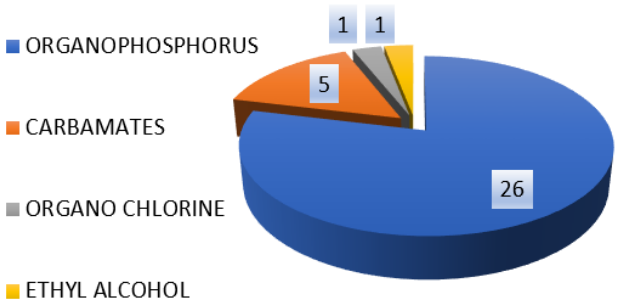

Fig 6. Distribution of victims on the basis of type of Poison

Discussion

Pesticide poisoning is a major public health problem in developing world.[1] Intentional self-poisoning has been the major cause of death due to poisoning.[4,14] Organophosphate pesticide poisoning is common in developing world [9] and the highest incidence is seen in India.[13] This study revealed that, maximum cases of suspected deaths due to poisoning was found in the age group 21-30 years. Similar results were found in other studies carried out by Khadka and Khadka[5]. Males (18) surpassed the victims of female (15). The male to female ratio in this study was 1.2:1. However male to female ratio given by Khadka and Khadka[5] was 1:1.09, which is quite different from the present study. Maximum number of victims belonged to Hindu (22) community. The most common poison used for suicide was organophosphorus (79%) followed by carbamates (15%). Current study findings are similar to that of other studies [3,5,6], where the most common poison was organophosphorus.

Conclusion

Suicide is often an impulsive act resulting from the failure to adjust with their surroundings and cope with the stress they are exposed to. The maximum cases of poisoning were confined to young males belonging to rural areas of Southern part of Assam. For easy availability and access to household Organophosphorus compounds, these have become one of the major products amounting to suicidal poisoning. Educational and awareness programs regarding usage and storage of pesticides can become an important step for the prevention of deaths due to poisoning. However more research is needed to better understand suicides involving pesticides in their cultural contexts. We believe that national pesticide regulation and improved medical management will produce a rapid decline in the devastating deaths due to pesticide poisoning.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from institutional ethics committee at Silchar Medical college, Silchar, Assam

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Original Article

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Deciphering Medicolegal Autopsy from the Perspective of Undergraduate Students in a Medical University in Karnataka

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Abstract

Background: Autopsy or postmortem examination is an important aspect of medicolegal investigation and an integral part of medical education. It is of paramount importance in ascertaining the cause of death, time since death, manner of death, collection of evidence and also in establishing a positive identification in case of unclaimed dead bodies. As part of medical curriculum, medical students are required to witness as well as perform a certain number of autopsies.

Methods: To understand autopsy from the perspective of medical undergraduate students, a questionnaire was prepared which contained questions to assess knowledge and to understand attitudes of students towards autopsy.

Conclusion: Almost all students opined that autopsies are an essential part of medical education. Most students opined that autopsy helped them in understanding basic anatomy of the human body as well as common pathological conditions. Few students expressed discomfort towards watching an autopsy. A good number of students showed interest in encouraging kin of the deceased to donate cornea. In conclusion, autopsy holds the potential in shaping students to competently opine about the cause of death, engage in research as well as to send a social message in the form of donating eyes after death.

Key words: autopsy, cornea, death, research

Introduction

Autopsy is an important research tool and investigative procedure which has played a significant role in the acquisition of medical knowledge. It helps in identifying the illness that the person suffered from leading to death i.e. cause of death, time since death, medico-legal issues surrounding death, etc. Many studies show that autopsy is central to medical education, since it teaches students about the underlying pathology, cause of death, death certification and statistics.[1]

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Number of autopsies witnessed by undergraduate medical students is gradually decreasing, which is of concern as students might have to perform an autopsy by themselves once they are medical practitioners.[2]

For medical students, autopsy is useful in understanding the anatomy of organs, pathological conditions and related medico-legal issues. The advantages of autopsy are many, but for some students, it is difficult to cope with the emotional aspects.[3] The present study was undertaken to know the perception and attitude of medical undergraduates towards autopsy.

The knowledge of viewing medicolegal autopsies, if not performing them, can broaden the knowledge, skills and attitude of the student, and it will also help the legal system to provide quick justice in criminal cases. [4] It is important for medical undergraduate students to develop a positive attitude towards autopsies and acquire the appropriate skills required for the procedure, otherwise chances of increase of necropsies are feeble.

The objective of the present study is to determine approach and perception of undergraduate medical students towards autopsies, specifically medicolegal autopsies.

Materials and Methods

This study aims at determining the attitude towards and perception of medico-legal autopsy among medical undergraduates. The study was carried out among the undergraduate second and third year medical students of SDM Medical University in Karnataka, India during the year 2023 using a self- administered questionnaire which was prepared after going through existing literature on the subject. Students were explained about the purpose of the study and were requested to fill up the questionnaires with their consent. They were informed about the confidentiality of information collected and participation of the students in the study was voluntary.

A detailed questionnaire was given to the students to fill out for the purpose of finding out usefulness and importance of autopsy as a teaching tool in undergraduate medical education; medical students' knowledge about post-mortem examinations; their personal experience of witnessing the post-mortem examination; whether attendance at autopsy should remain as a mandatory part of medical education and questions regarding their opinions of autopsies in general.

A total of 94 students participated in the current study. The data collected was compiled into tables and statistically analyzed.

Table 1: Questionnaire assessing responses of students with regards to medicolegal autopsy

Sl. No.	Question	Responses
1.	Are autopsies an essential part of medical education?	Yes (n=93, 98.94%) No (n=01, 1.06%)
2.	Autopsy is conducted in case of	Natural deaths (n= 00, 0%) Unnatural deaths (n= 87, 92.55%) Apparent deaths (n= 01, 1.06%) All deaths (n= 05, 5.32%) Not answered (n= 01, 1.06%)
3.	Does watching autopsies help you understand the basic anatomy of the human body?	Yes (n= 89, 94.68%) No (n= 05, 5.32%)
4.	Does watching autopsies help you understand common pathological conditions?	Yes (n= 88, 93.62%) No (n= 05, 5.32%) Not answered (n= 01, 1.06%)

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5.	Autopsy consists of	External examination (n= 00, 0%) Internal examination (n= 00, 0%) Both (n= 93, 98.94%) Not answered (n= 01, 1.06%)
6.	Given a choice, would you opt to not watch an autopsy?	Yes (n= 17, 18.09%) No (n = 69, 73.40%) Not answered (n= 08, 8.51%)
7.	What type of autopsy would you prefer viewing?	Actual autopsy in mortuary (n= 90, 95.74%) Simulated autopsy in skill lab (n= 03, 3.19%) Not answered (n= 01, 1.06%)
8.	What was your opinion on watching autopsy for the first time?	I learnt a lot from it (n= 75, 79.79%) It did not help me much (n= 11, 11.70%) I disliked it (n= 06, 6.38%) Not answered (n= 02, 2.13%)
9.	What are your general feelings towards watching an autopsy?	Comfortable (n= 69, 73.40%) Uncomfortable (n= 11, 11.70%) Intolerable (n= 01, 1.06%) Indifferent (n= 12, 12.77%) Not answered (n= 01 , 1.06%)
10.	In order to make autopsy viewing more beneficial for the students, how many students do you think should be allowed in the mortuary per case?	10 (n= 16, 17.02%) 15 (n= 21, 22.34%) 20 (n= 17, 18.08%) 25 (n= 38, 40.43%) Not answered (n= 02, 2.13%)
11.	What according to you is the best arrangement for students in order to facilitate viewing of the autopsy better?	Standing around autopsy table (n= 71, 75.53%) Seating tiers (n= 13, 13.83%) Viewing gallery separated by glass panes (n= 05, 5.32%) Watching live feed (n = 03, 3.19%) Not answered (n= 02, 2.13%)
12.	Estimating postmortem interval i.e. time since death by autopsies is	Accurate(n = 09, 9.57%) Approximate (n= 82, 87.23%) Erroneous (n= 00, 0%) Impossible (n= 00, 0%) Not answered (n= 03, 3.19%)

Continue.....

13.	Which of these is not particularly helpful in finding out the cause of death?	History from relatives of the deceased (n= 49, 52.13%) Visit to scene of crime (n= 17, 18.09%) Histopathological examination (n= 11, 11.70%) Chemical analysis (n= 02, 2.13%) Not answered (n= 15, 15.96%)
14.	Do you think subjecting a dead body to autopsy is distressing to the relatives of the deceased?	Yes (n= 69, 73.40%) No (n= 21, 22.34%) Not answered (n= 04, 4.26%)
15.	Should virtual autopsy replace conventional autopsy?	Yes (n= 18, 19.15%) No (n= 74, 78.72%) Not answered (n= 02, 2.13%)
16.	Virtual autopsy is best suited in deaths due to which of the following?	Multiple injuries (n= 45, 47.87%) Poisoning (n= 20, 21.28%) Smothering (n= 05, 5.32%) Electrocution (n= 17, 18.09%) Not answered (n= 07, 7.45%)
17.	Conventional autopsy is superior to virtual autopsy in deaths due to which of the following?	Poisoning (n= 44, 46.81%) Firearm injury (n= 16, 17.02%) Head injury (n= 17, 18.09%) Multiple injuries (n= 10, 10.64%) Not answered (n= 07, 7.45%)
18.	Does assisting the autopsy surgeon enhance knowledge and skills of students?	Yes (n= 82, 87.23%) No (n= 12, 12.77%)
19.	Do you find it repulsive smelling the stomach contents at autopsy in case of deaths due to poisoning/ intoxication?	Yes (n= 75, 79.79%) No (n= 17, 18.09%) Not answered (n= 02, 2.13%)
20.	Which of these is a good practice regarding autopsy?	Revealing case details to the media (n= 06, 6.38%) Allowing the family members to watch the autopsy in the mortuary (n= 06, 6.38%) Encouraging kin of deceased to donate cornea (n= 76, 80.85%) Discussing postmortem findings in public (n= 01, 1.06%) Not answered (n= 05, 5.32%)

Results and Discussion

Out of a total number of 94 students, almost all students opined that autopsies are an essential part of medical education (n=93, 98.94%). The findings of the present study were consistent with those of a study conducted by Patil A, Tasgaonkar VN, Dileep Kumar R et al[5] in which most of the students (96.66%) opined that post-mortem examination is useful in medical education. Similar results were observed in studies conducted by Aman Kumar et al[6] in which 96.81% of the students agreed that autopsy is necessary in medical education and Ballur MS[7] in which 95% of the students opined in favour of utility of postmortem examination in medical education. In a study conducted by Kakkeri SR, Ahmed KM, Ahmad SR et al[8] it was observed that 9.5% of the students opined that witnessing autopsy should be scrapped from the UG curriculum. Similar results were obtained in a study conducted by Ekanem VJ and Akhigbe KO[9] in which, only 7% of the students opined that autopsy should be scrapped from the curriculum in medical school. Slightly alarmingly, in a study conducted by Rao GV and Prasad SK[10], 25.33% of the students were of the opinion that autopsy should be scrapped from the medical curriculum. In the present study, 92.55% of the students opined that autopsy is conducted in case of unnatural deaths and 98.94% of the students opined that autopsy consists of both external and internal examination which shows that majority of the students possessed good knowledge and understanding of autopsy protocol. Majority of the students (94.68%) opined that watching autopsies helped them understand basic anatomy of human body and 93.62% of the students found watching autopsies helpful in understanding common pathological conditions. Similar results were obtained in a study conducted by Khoo JJ[11] in which 70.5% of the students believed that autopsy experience improved their understanding of anatomy and pathology. In a study conducted by Pakanen L, Tikka J, Kuvaja P et al[12], it was reported that autopsy teaching was found most beneficial in learning anatomy (4.18 +/- 1.1; mean usefulness score +/- standard deviation). In a survey study conducted by He MX, Wang JJ, Zhu Z et al[13] it was observed that many students took autopsies as one of the very important aspects for continuing study of anatomy and to learn the gross appearances of diseases in pathology. In the current study, given a choice to opt out of watching an autopsy, a small portion of students (n= 17, 18.09%) answered in the affirmative whereas majority of the students (n = 69, 73.40%) opined that they would prefer to watch an autopsy and a minority of students (n= 08, 8.51%) remained undivided as they did not answer this question. Similar results were obtained in various studies[7, 9, 10] however in one particular study[5] shockingly, given a chance, 93.33% of the students chose not to watch post-mortem examination at all perhaps pointing to an aversion to autopsy among students. In the present study, majority of the students (n= 90, 95.74%) opted to watch actual autopsy in mortuary rather than simulated autopsy. This question was included in the questionnaire with a view to find out whether autopsy teaching with the help of mannequins in skill labs is a feasible alternative as the number of actual autopsies conducted in the mortuary is inadequate since NMC requires each MBBS undergraduate to perform atleast 15 autopsies as per new curriculum. However, only a minority of students (n=3, 3.19%) were in favour of watching simulated autopsy in skill lab. In a study conducted by Flossel U, Clas S, Willemer M et al [14] , majority of the students (91.6%) regarded the practical and professional relevance of using simulation mannequins in training for external post-mortem examination as high. In the current study most of the students (n= 69, 73.40%) were comfortable on first exposure to autopsy. However in various studies [6, 7, 8, 9, 10, 15], most of the students expressed that they were slightly uncomfortable on first exposure to autopsy. In the current study, majority of the students (n=71, 75.53%) opined that standing around the autopsy table is the best way to view an autopsy with few students opting for seating tiers and viewing gallery separated by glass panes (n=13, 13.83% & n=5, 5.32% respectively). This question was asked with a view to determine if the modernization of several mortuaries in the country where some are equipped with viewing galleries positively influences students in viewing autopsies. From this study, it can be concluded that students still prefer the good old method of viewing autopsies by standing around the autopsy table possibly indicating that students gain more information by this. Most of the students correctly opined that time since death can be estimated approximately by autopsies (n=82,

87.23%) and a good number of students (n=49, 52.13%) opined history from relatives of the deceased may not be particularly helpful in finding out cause of death which shows that students are knowledgeable about postmortem examination. Majority of the students (n=69, 73.40%) felt that subjecting a dead body to autopsy is distressing to the relatives of the deceased. In contrast, in a study[10], only a minority of the students (n=12, 4%) opined that autopsy causes harassment to the relatives of the deceased. However, in some studies[11,16], it was observed that more than half of the family members of the deceased (n=117, 58.5%) refused consent to autopsy due to reasons of body disfigurement in autopsy, removal of visceral organs for chemical analysis and also due to delay in their religious funeral arrangements. In the present study, majority of the students (n=74, 78.72%) opined that virtual autopsy should not replace conventional autopsy. This is in contrast to the finding of a study[8] where majority of the students (n=106, 92.1%) preferred virtual autopsy over conventional autopsy. In the present study, fairly good number of students correctly opined that virtual autopsy is best suited in deaths due to multiple injuries (n=45, 47.87%) as opposed to deaths due to poisoning, smothering and electrocution and that conventional autopsy is superior to virtual autopsy in deaths due to poisoning (n=44, 46%) as opposed to deaths due to firearm injuries, head injuries and multiple injuries which shows that many students have adequate basic understanding of virtual autopsy procedure.

Conclusion

From the present study, it can be concluded that students possess good knowledge of autopsy procedures – both conventional and virtual as well as positive attitude towards viewing autopsies since it enhances their understanding of human anatomy and common pathological conditions. Few students experienced discomfort while watching an autopsy and many students found it repulsive to smell the stomach contents during autopsy. Despite emotional and unpleasant reactions, most of the students expressed a positive interest in observing actual autopsy at close quarters as opposed to simulated autopsy or viewing autopsy from galleries or seating tiers situated away from the autopsy table and in assisting the autopsy surgeon which is a favourable sign, given that, as per NMC curriculum, each student is required to perform atleast fifteen autopsies during their undergraduate studies. Most students also agreed that encouraging kin of deceased to donate cornea is good practice. Even with the advent of virtual autopsy, most of the students still preferred conventional autopsy. However, there is scope of training students in virtual autopsy and enhancing their knowledge. It is advisable to allot teaching hours for autopsy separately, in addition to theory and practical teaching hours which will have the effect of honing the skills of students interested in autopsy which might, in effect, encourage students to pursue a career in forensic medicine. Dedicated autopsy training also enables students to accurately document findings and draw logical conclusions which are the need of the hour with regards to medicolegal duties.

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Ethical clearance: The study proposal was presented before the institutional ethics committee prior to conducting the study and ethical clearance was obtained for the same. Ref: SDMIEC:52: 2020 Date: 06-03-2020

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Conflict of interest: None

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Systematic Review

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Forensic Dimensions of Chronic Stress (PTSD) and its Impact on Brain Activity and Mental Health: A Systematic Review

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Abstract

Introduction: The effects of chronic stress on the brain and mental health are significant and are frequently linked to post-traumatic stress disorder (PTSD). The impact of persistent stress, especially PTSD, on the brain and mental health is examined in this study from a forensic perspective. To ensure fair evaluations, assessments, and decision-making procedures, the legal system needs to comprehend these ramifications.

Aim: This study aims to investigate the neurobiological modifications, cognitive deficits, and psychological effects brought on by chronic stress and their applicability in a forensic setting. The study emphasizes the necessity for thorough evaluations in judicial procedures and seeks to shed light on the impact of prolonged stress on brain function and mental health.

Methodology: Using pertinent keywords including chronic stress, brain structure, brain function, depression, anxiety, and PTSD, a thorough search of scientific databases was carried out, including PubMed, PsycINFO, and Google Scholar. Relevance to the subject, the study's caliber, and the publication date were all considered while choosing papers. Key facts and insights were determined by a comprehensive study of the literature.

Results: Chronic stress affects emotional regulation, memory, and the stress response by causing neurobiological changes in the prefrontal cortex, hippocampus, amygdala, and HPA axis. Prolonged stress is accompanied by cognitive impairments, especially in PTSD, which include executive dysfunction and attention problems. Anxiety, sadness, and increased susceptibility to substance misuse are examples of psychological effects.

Conclusion: There are important forensic ramifications to persistent stress, particularly PTSD, on brain function and mental health. While psychological issues make it difficult to participate in court proceedings effectively,

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neurobiological changes and cognitive deficits might damage someone's credibility as a witness or victim. Fair evaluations require a bridge between neuroscience, mental health, and the legal system. Future studies should pinpoint distinct neuronal processes and consider efficient cures to lessen the effects on forensic outcomes.

Keywords: Anxiety, Brain function, Chronic stress, Depression, Neuroplasticity, Post-traumatic stress disorder (PTSD).

Introduction

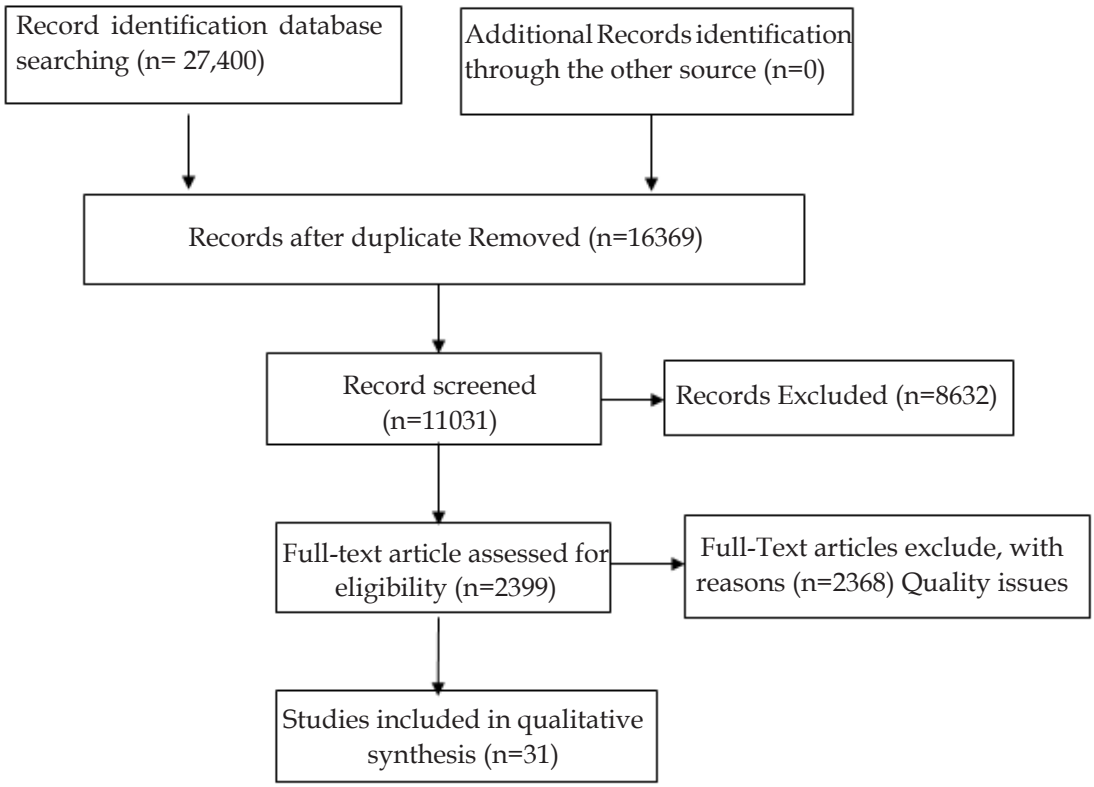
Millions of people worldwide suffer from chronic stress, which has serious effects on both physical and mental health. Acute stress is a typical physiological reaction to perceived dangers or challenges.[1] But when stress persists and becomes chronic, it can harm the brain and other bodily systems. [2] Processing stress and coordinating adaptive reactions takes place mostly in the brain.[3] Through intricate neuronal networks and signaling channels, it plays a crucial part in controlling emotions, cognitive function, and the body's reaction to stress.[4] Recent years have seen a substantial increase in research on the effects of chronic stress on the brain as more and more data points to the possibility that long-term exposure to stress might result in structural and functional changes that influence mental health.[5] The impact of persistent stress on brain anatomy is one area of research that has drawn a lot of attention.[6] The brain is an incredibly flexible organ that can change and adjust to experiences and environmental influences. [7] Chronic stress, on the other hand, has the potential to upset the delicate balance of neuroplasticity, resulting in morphological alterations in crucial areas involved in stress management, emotional processing, and cognitive performance.[8] The consequences of persistent stress are particularly susceptible to the hippocampus, a portion of the brain essential for memory and learning.[9] The hippocampus may atrophy and lose volume over time if it is exposed to stress chemicals like cortisol regularly. As well as making people more susceptible to mood disorders like depression, this structural change has been linked to problems in memory consolidation and retrieval.[10] The amygdala, which is crucial in processing emotions, especially fear and anxiety, is another area of the brain that is impacted by long-term stress.[11] The amygdala has been proven to grow in size and become more sensitive to stressors as a result of chronic stress, which can lead to an increase in anxiety-like behaviors and emotional reactivity.[12] These modifications may be what contributes to those who experience chronic stress having a higher chance of acquiring anxiety disorders.[13] Chronic stress has a significant impact on the prefrontal cortex (PFC), a part of the brain that controls emotions, executive processes, and decision-making.[14] To modulate emotional reactions and control stress-related behaviors, the PFC works in conjunction with the amygdala and other limbic areas.[15] Deficits in cognitive flexibility, impulse control, and emotional regulation can result from chronic stress, which can also damage the PFC's structural integrity.[16] These modifications in PFC function may hasten the onset of mood disorders like depression and aggravate symptoms in people who already have psychiatric problems.[17] Chronic stress can alter brain structure, but it can also have an effect on brain function at the cellular and molecular levels.[18] Long-term exposure to stress hormones can impair synaptic plasticity, neurogenesis—the process of producing new neurons in the adult brain—and neural communication.[19] The pathophysiology of neurological and mental illnesses can be influenced by these abnormalities, which can further impair brain function.[20]It is generally known that long-term stress is linked to neurological conditions including post-traumatic stress disorder (PTSD) and other neurological illnesses like anxiety and depression. [21] For the beginning and development of these illnesses, chronic stress is a substantial risk factor.[22] A person's likelihood of experiencing depressive and anxiety symptoms increases when they are subjected to prolonged stress, and those who already have these illnesses may have their symptoms get worse and have a harder time responding to therapy.[23] Neurological illnesses and chronic stress are linked by a variety of underlying processes. The hypothalamic-pituitary-adrenal (HPA) axis is a key player in regulating the negative effects of chronic stress on the brain.[24] Deregulation of stress hormone systems is also important. Serotonergic, noradrenergic, and dopaminergic neurotransmitter system dysfunctions in particular have been linked to depression,

anxiety, and PTSD etiology.[25]Chronic stress has a profound effect on brain structure and function, which promotes the emergence and amplification of neurological illnesses like depression.[26]

Methodology

A digital database was used in this study's literature review to search through a variety of publications and databases. The objective was to locate pertinent studies, and Bullion Words returned a total of 27,400 hits. 16369 articles were chosen after careful consideration to serve as a representative sample. The selection of 11031 samples for examination was the result of further analysis. However, 8632 study samples were disregarded as a result of download issues. After 2399 articles were eliminated due to quality problems, 2368 articles underwent a full-text analysis, leading to the final selection of 31 papers (n=31).

Prisma Flow chart:



Result

Neurobiological studies have shown that people who experience chronic stress experience structural and functional changes in brain areas such as the prefrontal cortex, hippocampus, amygdala, and the hypothalamic-pituitary-adrenal (HPA) axis. Emotional control, memory development, and stress response systems are all impacted by these changes. Additionally, prolonged stress, particularly in the setting of PTSD, is linked to cognitive dysfunctions such as attentional problems, problems with working memory, and worse executive functioning. Anxiety, sadness, and a higher propensity for substance addiction are psychological effects of persistent stress.

Discussion

The physiology of the brain has been proven to be significantly affected by chronic stress. It has been shown in several studies that chronic exposure to stress chemicals, such as cortisol, can alter the anatomical makeup of the brain. For instance, long-term stress can cause the hippocampus, a part of the brain that controls emotions and memory, to atrophy. This hippocampal shrinking may be a factor in cognitive decline and an elevated risk of mental illnesses

including sadness and anxiety. [27]Chronic stress has been recognized as a key risk factor for depression, a complicated condition with many underlying causes. The delicate balance of neurotransmitters in the brain, such as serotonin, dopamine, and norepinephrine, which are essential for mood regulation, can be disturbed by the frequent activation of stress reactions. These neurotransmitter systems may become dysregulated as a result of persistent stress, which might help depression symptoms emerge. [28]The processing of emotions, especially fear, and anxiety, is largely influenced by the amygdala, a portion of the brain. Chronic stress can affect the structure and operation of the amygdala, which can cause an inflated fear response and increased anxiety. According to studies, continuous exposure to stress hormones can increase amygdala activity, which can lead to a persistent state of worry and the emergence of anxiety disorders.[29]After experiencing a horrific experience, people may develop post-traumatic stress disorder (PTSD), a crippling illness. In the emergence and perpetuation of PTSD symptoms, chronic stress is a key factor. Long-term stress exposure can alter the amygdala and prefrontal cortex in the brain, which affects the fear response system. This can cause hyperarousal, unwanted memories, and emotional dysregulation. For successful preventive and treatment methods, it is essential to comprehend the connection between chronic stress and PTSD. [30]Stress and Chronic Neuroinflammation Stress that lasts for a long time can activate immune cells in the brain, which is known as neuroinflammation. Additionally, neuroinflammation has been tied to the etiology of several neurological disorders associated with chronic stress, including depression and PTSD. Chronic stress may harm neurons and alter how the brain communicates, which can affect both the ability to think clearly and feel emotionally. In reaction to ongoing stress, pro-inflammatory molecules are secreted.[31]

Conclusion

The effects of persistent stress, particularly PTSD, on the brain and mental health have important forensic ramifications. Chronic stress may alter a person's neurobiology and cause cognitive impairments, which can undermine a person's credibility as a witness or victim by impairing their capacity to recall and give correct testimony. A person's ability to participate effectively in judicial procedures may also be hampered by the psychological effects of continuous stress.The findings emphasize the significance of thorough evaluations that take into account how persistent stress affects a person's cognitive functioning, mental health, and dependability in legal circumstances. To ensure fair assessments, decision-making procedures, and improved results for those suffering from chronic stress-related diseases, it is essential to bridge the gap between neuroscience, mental health, and the legal system. To lessen the forensic effects of long-term mental health problems associated with chronic stress, further research should concentrate on identifying particular neurobiological pathways and investigating potent treatment strategies.

Future perspective:

Future studies should concentrate on identifying the precise neurobiological processes behind the effects of long-term stress and post-traumatic stress disorder (PTSD) on brain function as well as on effective treatment approaches to reduce the negative effects on forensic outcomes.

Conflict of Interest: There is no conflict of interest

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Ethical Clearance: Not Applicable

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Original Research Article

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Pattern of Head Injury in Fatal Road Traffic Accident: Retrospective Study

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Abstract

Road traffic Accident have been reported to be a major cause of morbidity and mortality. Due to increasing modernization, road traffic accidents have become exponentially more frequent and dangerous. Mortality rate from road traffic injuries accounts 29.2 per 100000 people[5]. This study was conducted in the Department of Forensic Medicine, Silchar Medical College, Silchar, from 1st November 2021 to 31st October 2022. The aim of the study is the pattern of head injuries in fatal road traffic accident. Out of the 981 autopsy cases were conducted during the above-mentioned period, a total of 200 cases were found deaths due to head injuries. Out of 200 cases, common age group involved was from 40-50 years, the deceased were more from rural areas. Maximum cases during winter season. Commonest injuries were scalp abrasion, linear fracture of skull and subdural haemorrhage. Head injury has become a common cause of death and disability among Road Traffic Accident cases. This further shows the need of strict implementations of traffic rules. Positive policy initiatives such as mandatory helmet legislation need reliable and consistent data to support ongoing monitoring and enforcement of such initiatives.

Key words: Skull fracture, Head injury, RTA, intracranial haemorrhage

Introduction

Road traffic accident is the major cause of morbidity and mortality. Increasing modernization of road traffic, it has become exponentially more frequent and serious.[2] Head injury is the result of variety of mechanisms including motor vehicle. India has second highest reported mortality rate of 29.2 per 100000 people from road traffic injuries.[5] The current study was carried out with a view to ascertaining the pattern of head injuries sustained during fatal motor vehicular incidents[3]. The prevalence of head injuries in relation to different epidemiological factors, which will help concerned authorities related with such cases to proceed in right direction.

Aims and Objectives

1. To determine the pattern of head injury in fatal road traffic accident.
2. To study the incidence of head injury in relation to age, gender, religion, demographic and seasonal distribution.
3. To know the types of head injuries and their frequency.

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Materials and Methods

This study was carried out over a period of one year starting from 1st November 2021 to 31st October 2022 in the Department of Forensic Medicine, Silchar Medical College and Hospital. Being the only tertiary care hospital in the entire southern Assam region, this hospital receives patients from the entire region. Hence, most of the autopsies are conducted at the Silchar Medical College. Cases of motor vehicular accident without head injuries, death due to other causes were excluded from the study. Each head injury case was examined and evaluated. All parameters were entered from the information collected from inquest report, dead body challan and autopsy reports. Data collected were entered in Microsoft excel sheet and statistical analysis was done using descriptive statistics.

Results

1. **Incidence:** Out of the 981 autopsy cases conducted during the above-mentioned period, a total of 200 (20%) cases were found deaths due to head injuries in fatal road incidents, reported at SMCH during the study period. Shown in figure: 1

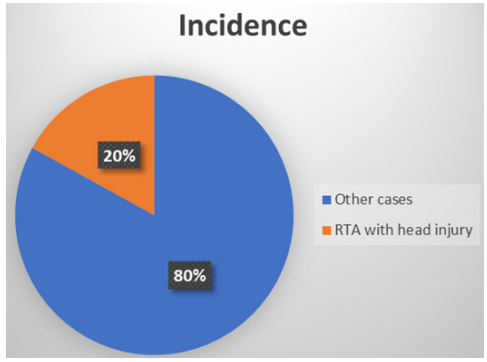

Figure 1

2. **Gender wise distribution:** The cases are seen more in male victims 165 (83%) as compared to female victim 35 (17%); (figure:2)

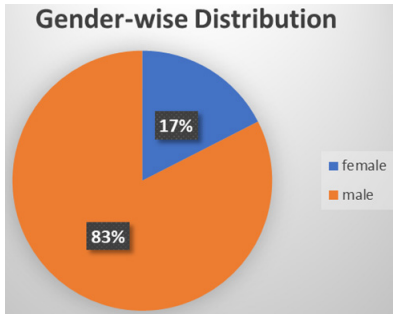

Figure 2

3. **Age wise distribution:** In the present study the highest number of RTA victim were between the age group of 40-50 years comprising of 60 in number followed by the age group of 20-30 years and 30-40 years has the same number of cases. (figure:3)

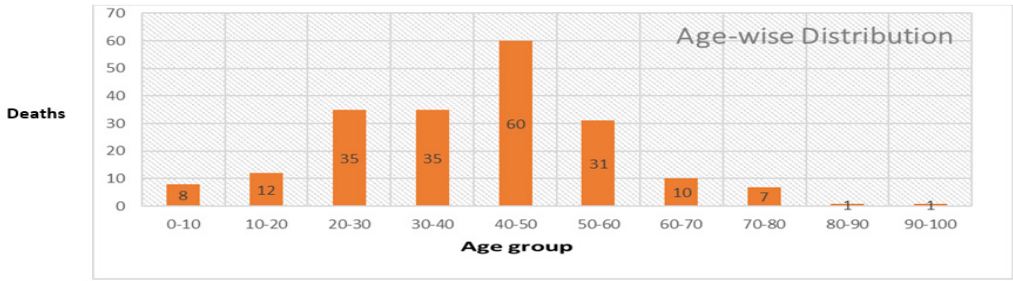

Figure 3

3. **Seasonal Variation:** In this study 50% (100 cases) were found in winter season followed by summer season 35% (70 cases) and least being the monsoon season. (figure:4)

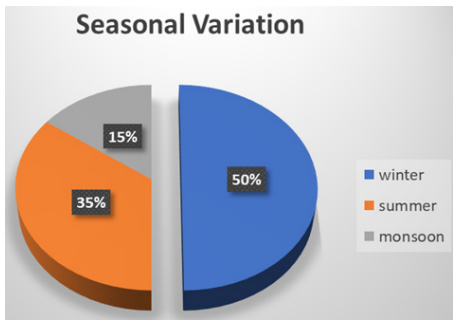

Figure 4

4. **Scalp injuries:** Majority of the victims had abrasion 73% followed by lacerated 18% injuries and bruise being the least common. (figure:5)

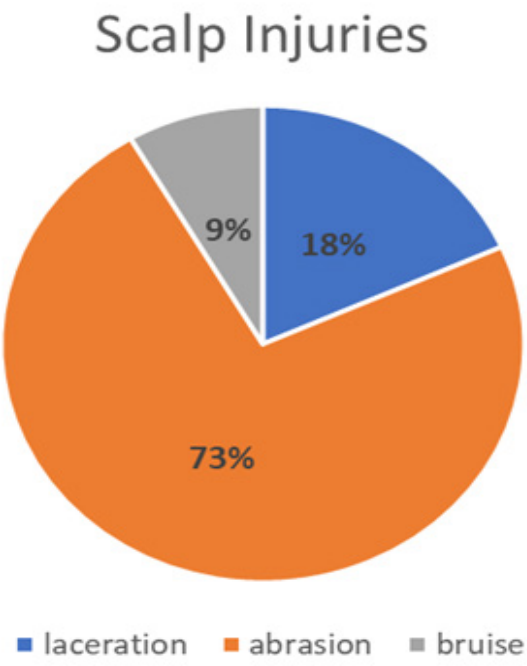

Figure 5

5. **Distribution of skull fracture:** Linear fracture alone was observed 36% was most common followed by 31% of basilar fracture, diastatic fracture 17%, comminuted fracture 16%. (figure:6)

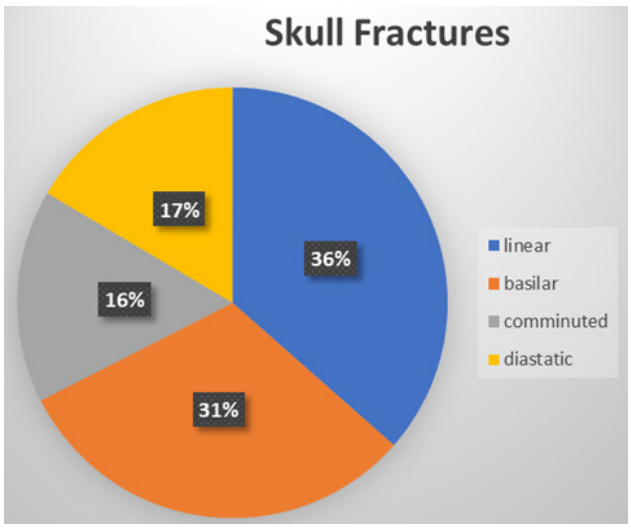

Figure 6

6. **Distribution of Intracranial Haemorrhage:** In this study Subdural haemorrhage SDH was found 49% followed by extradural haemorrhage EDH 31% and sub arachnoid haemorrhage SAH 20% (figure:7).

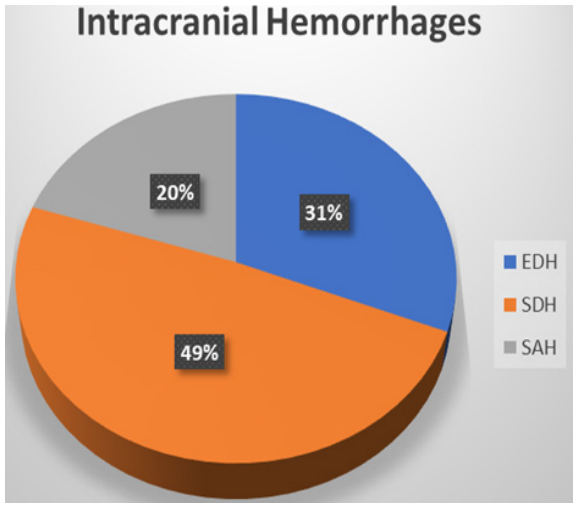

Figure 7

Discussion

1. In this study majority of the victims belong to the age group of 40-50 years (60 number of cases) that is compatible with studies by Pate RS, Hire RC, Rojekar MH[9] (21-30 years) and Jha N, Srinivas DK, Roy G, Jagadish S[4] (16-30 years).

2. The highest number of victims were male 165 (83%) and least numbers were found in female 35 (17%) which was similar with Jha N, Srinivas DK, Roy G, Jagadish S[4] 603 (83%) was male and 123 (17%) were female which is similar with study by Ravikumar R[10]. (87.75%).

3. This study shows that the most of the death in road traffic accident occurs during winter season similar findings seen with study of Algahtany MA[1] (21.3% during winter season).

4. Among the various injuries, commonest injury was abrasion (73%) followed by laceration (18%) and bruise (9%).

5. The commonest fracture was linear fracture (36%) that is consistent with Ravikumar R[10] and Menon A, Pai VK, Rajeev A[6] but with varying percentages.

6. Subdural haemorrhage (SDH 49%) was the most common Brain injury suffered by the victims which is consistent to Menon A, Pai VK, Rajeev A[6] (52.63%).

Conclusion

The present study is to view & isolate any set patterns emerging out the scenario of motor vehicular incident involving head injuries and to find out factors responsible for the types of injuries leading death of the victims, so that preventive and remedial measures can be adopted to reduce future mortality. There are two factors human & mechanical error, however human factor plays a greater role; this is in particular the case prevalent in most Indian road where people hardly look before crossing. Wearing helmet reduces the chances of serious head injury and fatality. So, in addition to existing traffic rules, better traffic training & education should be given to the public, and use of protective device like seat belt, head rest and helmets by both rider and pillion rider. Another factor is the influence of alcohol & drugs. Many collisions due to miscalculation of speed. Routine use of alcohol measuring gadgets, especially on the highway, and heavy penalty to the defaulters must be imposed to stop drunk driving. The majority of the deaths was within the first few hours of the incident. First aid medical care, ambulance and provision of well-equipped hospital will save the life of many victims.

Conflict of Interest: Nil

Source of Funding: Self

Ethical Clearance: Taken from institutional ethics committee at Silchar Medical college, Silchar, Assam

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Massive Myocardial Calcification: A Rare Autopsy Finding

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Abstract

Introduction: Myocardial calcification is rare and occur by two mechanisms- dystrophic and metastatic. It can present with variable clinical manifestations like congestive heart failure, cardiomyopathy, arrhythmia and sudden cardiac death.

Case Report: Post mortem visceraof a 50 year old male was received in the department of pathology with alleged history of burns, who died after two weeks of hospital treatment. There was no past history or investigation available in the post mortem papers. Whole heart, pieces of brain, both lungs, liver, spleen and both kidneys were received. On gross examinationno abnormality was observed in any of these viscera. Microscopic examination revealed extensive calcification in anterior, lateral & posterior walls of left ventricle of the heart. Sections from kidney showed features of chronic tubulointerstitial nephritis.

Conclusion: Myocardial calcification is rare and mostly diagnosed incidentally or on autopsy. Extensive sampling of heart and other viscera might help in finding the etiology in such rare cases of massive calcification in myocardium. Antemortem diagnosis can be made with computed tomography (CT) scan and endomyocardial biopsy.

Keywords: Autopsy, dystrophic calcification, myocardial calcification, tubulointerstitial nephritis.

Introduction

Massivecardiac calcification also called as heart of stone, is very rare.[1] Cardiac calcification is characterized by the abnormal accumulation of calcium salts in various parts of heart like coronary arteries, cardiac valves, myocardium and pericardium of heart.[2]

Two basic types of calcification have been recognised namely dystrophic and metastatic. Dystrophic calcification represents the sequelae of local tissue damage and cellular necrosis. It is not associated with abnormalities in serum calcium level showever, hypercalcemia has shown to accentuate the process.[3] Dystrophic calcification is more prevalent than metastatic calcification. The most common etiology is previous myocardial infarction leading to myocyte necrosis.[4]

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Metastatic calcification represents the consequence of a systemic process like hypercalcemia andor abnormalities of calcium homeostasis and can occur in normal or diseased tissue. Any abnormality of calcium metabolism like renal failure, increased bone turnover, hyperparathyroidism and vitamin D-related disorders can lead to metastatic calcification. Metastatic myocardial calcification is most commonly reported in patients with chronic renal failure who are on hemodialysis.[8]

It is also important to emphasise that the etiology of myocardial calcification can often also be multifactorial in origin. For instance, several cases of extensive calcification have been reported in patients after heart transplant due to a combination of repeated cellular rejection, transient renal failure, cardiac trauma, steroid administration and septicemia.[5]

Massive myocardial calcification usually have variableclinical manifestations such as chronic heart failure, restrictive cardiomyopathy, arrhythmia and sudden cardiac death. It is associated with poor prognosis and high mortality.[6]Various imaging techniques like radiographs, CT scanand echocardiography can detect their presence. These imaging technologies are currently used widely for the diagnosis in the field of forensics. The final diagnosis can be confirmed by histologic examination.[7]

Knowledge of these potential etiologies associated with myocardial calcification and their imaging patterns can help to provide a concise and accurate differential diagnosis, however histological examination remains gold standard.[8] We here by present a rare case of cardiac calcification identified on autopsy.

Case Report

Post mortem viscera of a 50 year old male was received in the department of pathology with alleged history of approximately55-60% superficial and deep burns and who died after two weeks of treatment. No significant past history or investigation was available in the post mortem papers. Whole heart, pieces of brain, both lung, liver, spleen and both kidneys were received. No abnormality was identified in the viscera on gross examination.

Microscopic examination revealed extensive areas of myocardial calcification involving the anterior, lateral and posterior walls of left ventricle of heart. Single cell calcification of cardiac myocytes are seen in most of the areas. The sections from left ventricle and inter-ventricular septum also showed areas of myocardial fibrosis along with foci of calcification. Sections from coronary arteries showed the presence of pathological intimal thickening in the right coronary and left circumflex arteries. Left anterior descending artery also shows presence of atheromatous plaque with calcification obstructing upto 70 % of the lumen. Von kossa stain was used to further confirm the presence of calcification as the calcified regions were identified by black staining on the calcified areas on the slide.

The sections from kidney show prominent foci of interstitial fibrosis with interspersed areas of tubular atrophy and admixed areas of mononuclear leucocytes. These histomorphological features were consistent with chronic tubulointerstitial nephritis. Sections from piece of both lungs, liver and spleen showed areas of congestion.

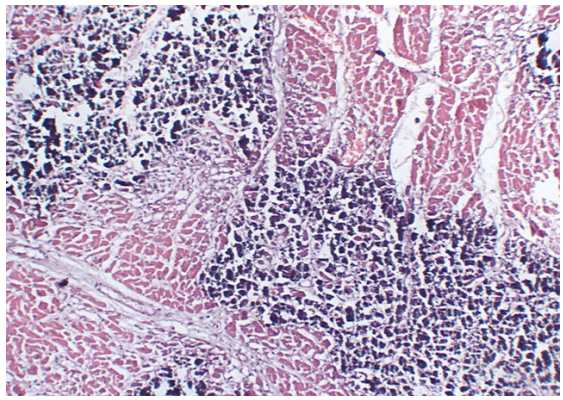

Figure 1: Microphotograph shows calcification in mvocardium(H&E x10).

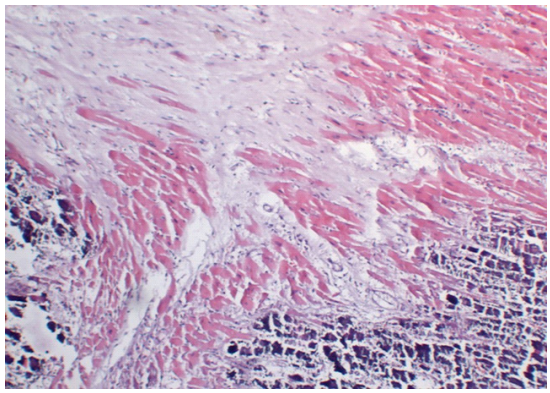

Figure 2: Microphotograph shows calcification in mvocardium with fibrosis (H&E x10).

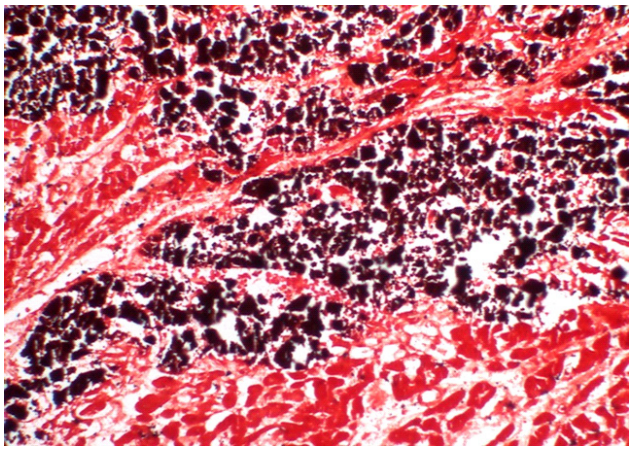

Figure 3: Microphotograph shows positive staining for calcium (Von Kossa x20).

Discussion

Cardiac calcification is not uncommon, however massive myocardial calcification with single cell infiltration is a rare entity usually detected incidentally at time of autopsy with limited published cases in the literature. [9,10] Although a certain degree of cardiac calcification is considered normal as a part of aging, it should be differentiated from pathological process as the latter can cause significant structural abnormalities and functional impairment.

Joo-Young Na[11] reported a case cardiac calcification on autopsy in a patient having medical history of chronic ischemic heart disease and endstage renal disease. The author observed cardiac myocyte dystrophy along with some myocytes showing partially calcified cytoplasm emphasising that calcification in this case was not from the interstitium such as the vascular walls. Thus the author considered that the isolated diffuse massive calcification of the heart was due to both dystrophic and metastatic calcification in this case.

In a retrospective study by Catellier[12] et al, four cases of cardiac calcification were reported on post mortem in which although healed myocardial infarctions were seen but calcitic deposits were not present within these scars in any case. It was observed that the distinction between dystrophic andmetastatic processes was difficult when the calcium deposition was observed in minimally damaged or apparently undamaged myocardium. It was suggested that calcium once present in heartis responsible for successive myocardial injury. Because of differences in tissue substrate, clinical diagnoses, metabolism and age complicate the chemistry of calcific deposition in the myocardium, it further suggested that use of either dystrophic or metastatic be avoided and these lesions may simply be described asmyocardial calcification.

In a prospective study by JoyLiBS[13] et al, they reported three cases of cardiac calcification diagnosed on CT scan with 5 - 13 weeks history of onset of calcifications in all three patients. It was likely that a relatively acute process such as sepsis was causing myocardial damage causing to the deposition of dystrophic calcifications. Histopathological examination of both these calcifications have been described to have identical findings of hydroxyapatite formation and both develop via a shared mechanism in which calcium enters myocardial fibers, initially becoming sequestered by the mitochondria but eventually accumulates throughout the muscle fibers.[14] It was concluded in the study that the calcifications were consistent with dystrophic calcifications as a plausible source of damage to the myocardium was identified. However, given that all three patients had a history of chronic kidney disease with calcium and phosphorus disturbances, there is likely that a component of metastatic calcification was also present in these patients.[13]

Shackley[15]et al reported a case of cardiac calcification in a patient with past history of coarctation of the aorta and pericardial effusions on thoracic CT scan which showed extensive myocardial calcification involving the interventricular septum, apex, anterior and posterior walls of the left ventricle. Calcifications were not identified in any other organ system and the patient's serum calcium levels were repeatedly in the normal range. Histologic examination revealed marked hypertrophy and massive calcification of the myocardium with focal fibrosis related to the calcified foci. Author stated that it was not possible to determine the cause of myocardial calcification in this case.

In another antemortem study by Aras[16] et al, calcification was suspected on X ray and confirmed on CT scan. However, since anatomicopathological study was not performed, etiology of the extensive

myocardial calcification in this patient could not be identified.

In the present study, there was no history or investigations available in the post mortem papers. Gross examination of the viscera revealed no abnormality, however the microscopic examination revealed presence of fibrosis along with coronary artery atherosclerosis and tubulointerstitial nephritis. Therefore, dystrophic calcification of the myocardium was possible. Further histopathology also revealed presence of calcification in individual myocytes rather than diffuse areas of calcification in foci of fibrosis which is better correlating to metastatic calcification which could possibly be due to hypercalcemia following renal failure. So, the possibility of either type of pathological calcification cannot be ruled out with the limited clinical details. This manuscript describes our experience of cardiac calcification which can act as a guide for physicians encountering this condition, as well as stimulate further research into this rare, although a very fascinating diagnosis.

Conclusion

Myocardial calcification is rare and mostly diagnosed incidentally on autopsy. Post mortem analyses and case reports provide valuable insights of this condition helping to shedlight on its rarity, potential predisposing factors and help to provide a concise and accurate differential diagnosis. Extensive sampling of heart and other viscera might help in finding the etiology in such rare cases of massive calcification in myocardium.Antemortem diagnosis can be made possible with use of CT scan and endomyocardial biopsy.

Conflict of Interest: There is no conflict of interest

Sources of Funding: Nil

Ethical Clearance: Not required

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Original Research

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Study of Postmortem Pericardial Fluid Concentrations of Troponin T (cTnT) in Sudden Natural Death

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Abstract

Background: Cardiovascular diseases are the most common cause of sudden natural deaths. Cardiac troponin T is a specific biochemical marker of myocardial injury. It may help in diagnosis of early myocardial ischemia when macroscopic or microscopic evidence of necrosis is not available after autopsy. Aim of this study was to assess the effectiveness of pericardial fluid troponin T in predicting the cause of death in sudden natural death and in estimating the post mortem interval.

Materials and methods: It was a pilot study. Sudden natural deaths brought to Forensic Medicine department of GMCH Nagpur for autopsy were included in this observational cross sectional study. Deaths were grouped into cardiac and non cardiac deaths. Pericardial fluid samples were collected by opening pericardial sac with sterile syringe and processed on Roche Cobas e411 autoanalyzer for estimation of levels of Troponin T.

Results: There was a statistically significant difference seen for the values between the groups ($p<0.05$) for Trop-T (ng/ml) with higher values in Cardiac cause. There was a statistically non significant correlation between postmortem interval vs Trop T ($p>0.05$).

Conclusion: Estimation of pericardial fluid Troponin-T may be used to predict the cause of death in sudden natural death.

Keywords: Troponin T, sudden death, natural death, post mortem interval

Introduction

Sudden death is defined as "deaths within 24 hours from the onset of the symptoms".[1] In most of sudden deaths (SD), it is the first and last clinical manifestation of an underlying disease in previously asymptomatic and healthy looking individual. In that case, only way to find out and register an exact cause of death is to do an autopsy.[2] 50-60% of the sudden deaths are due to cardiac diseases most common

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are coronary artery disease (CAD), Cerebrovascular disease (CVD), cardiomyopathy, rheumatic heart disease and congenital heart disease, etc.[3]

Epidemiology of sudden cardiac death (SCD) is not well studied in India. First study from India to evaluate the burden of Sudden Cardiac Death (SCD) in the community showed that SCD contributes to 10.3% of the total recallable deaths.[4] It is observed that more than 7 million lives per year are lost to SCD worldwide.[5] A majority of sudden death without any trauma will be visually inspected by a forensic medical examiner and reported with death due to atherosclerotic cardiovascular disease, coronary artery disease, myocardial infarction, or similar diagnosis. During autopsy, there may be significant cardiovascular disease but no gross or histologic evidence of an acute myocardial infarct unless the patient survives for several hours following the event.[6] Postmortem interval (PMI) in forensic medicine is commonly determined by the physical detection parameters. However, these methods do not give an exact PMI.

Troponin in body fluids degrades in a regular and predictable fashion. It could be used as a reliable biochemical marker for determining the cause of death and time since death.[7] Cardiac troponin T (cTnT) has previously been assessed by many researchers for the postmortem diagnosis of myocardial injury with some controversy. Blood in peripheral blood vessels gets putrified after death, hence the use of alternative biological fluids, such as pericardial fluid (PF) is fissible.[8]

Hence this study was planned with the aim of assessing the effectiveness of pericardial fluid troponin T in predicting the cause of death in sudden natural death and in estimating the post mortem interval.

Objectives:

1. To estimate postmortem concentrations of Pericardial fluid Troponin T in cardiac and non-cardiac sudden natural deaths.
2. To find out the effectiveness of concentrations of Pericardial fluid Troponin T in predicting cause of death in sudden natural cardiac and non cardiac deaths.
3. To study relationship between postmortem interval and postmortem concentrations of pericardial fluid Troponin T in sudden natural cardiac and non cardiac deaths.

Materials and methods:

Sudden natural deaths brought to Forensic Medicine department of Govt. Medical college, Nagpur, Maharashtra, India from January 2022 to July 2022 for autopsy were included in this observational cross sectional study. Deaths were grouped into cardiac and non cardiac deaths. Pericardial fluid samples were processed on Roche Cobase 411 autoanalyzer for estimation of levels of Troponin T. Study was carried out after approval from Institutional Ethics Committee. Permission from Head of the department of Forensic medicine was taken before sample collection. Written informed consent was obtained from the relatives of the study subjects. The proforma was filled in after eliciting the required data.

Inclusion criteria:

- Age- more than 18 years
- Sudden natural death within 24 hrs of onset of symptoms

Exclusion criteria:

- Pericardial Fluid samples contaminated with blood or Inadequate sample
- Cases with evident decomposition.
- Person dying after 24 hrs of onset of symptoms
- Any unnatural death (road traffic accidents, homicides, suicides, and blast injuries)
- Found dead or if deceased time since death is not known

Results and Discussion:

Table no. 1- Mean, SD and range

	N	Minimum	Maximum	Mean	Std. Deviation
Age	15	25	80	50.47	14.030
PMI in min	15	145	1660	917.07	449.831
Trop T (ng/ml)	15	2.0600	57.3800	22.684000	16.4802002

Table no. 2- Distribution as per Medical history

	Frequency	Percent
Chronic alcoholic	2	13.3
Hypertension, DM	1	6.7
Septic shock	1	6.7
Jaundice	2	13.3
Liver cirrhosis with pneumonia	1	6.7
Liver disease	1	6.7
Nil	7	46.7
Total	15	100.0

Table no. 3- Distribution as per Cause of death - Cardiac / non cardiac

	Frequency	Percent
Cardiac	8	53.3
Non cardiac	7	46.7
Total	15	100.0

Table no. 4- Inter group comparison of Trop T (ng/ml) between cardiac & non cardiac causes

Cause	N	Mean	Std. Deviation	Std. Error Mean	Mann-Whitney U value	Z value	p value of Mann-Whitney U test
Cardiac	8	31.323750	17.1309952	6.0567215	10.000	-2.083	0.037*
Non cardiac	7	12.810000	8.8357946	3.3396165			

*There was a statistically significant difference seen for the values between the groups ($p<0.05$) for Trop T (ng/ml) with higher values in Cardiac cause.

Bivariate Correlations:

		Trop T (ng/ml)
Postmortem interval in min	Pearson Correlation r value	-.059
	p value	.833
	N	15

There was a statistically non significant correlation between PMI vs Trop T ($p>0.05$)

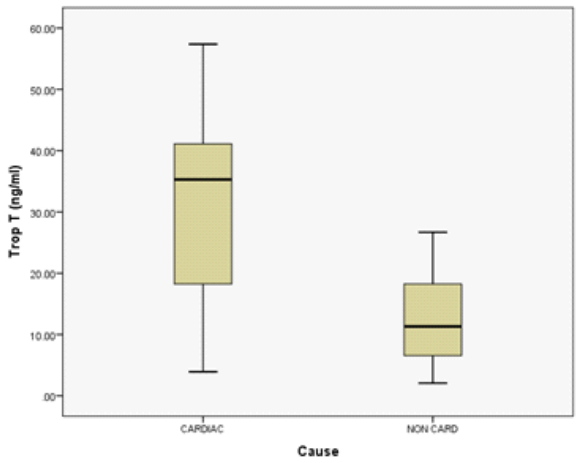

Figure no. 1: Troponin T concentration in cardiac and non cardiac deaths

Troponin T is involved in cardiac muscle contraction and it is widely used as immunochemical diagnostic marker of myocardial pathologies such as myocardial infarction, myocardial trauma, cardiomyopathies, cardiomyositis etc. The cardiac torponin-T has the same kinetics as cardiac troponin I, which is released within 6 hours after the onset of cardiac symptoms and peaks at 12 hours and remains elevated for at least 144 hours after the onset of symptoms.[6]

Major cause of sudden death is cardiovascular diseases. In this study cases among total sudden natural deaths most were due to cardiac cause.

There was a statistically significant difference seen for the values between the groups ($p<0.05$) for Trop-T (ng/ml) with higher values in Cardiac cause. M Zribi et al, 2021; found a significant elevation of Hs-TnT levels in pericardial fluid and cardiac blood in the cardiac group ($p = 0.014$, $p = 0.004$ respectively).[5] Study by S. Remmer et al, 2013; concluded that pericardial fluid troponin T levels were significantly higher in cardiovascular disease group than other.[8] MD Perez et al, 2004; observed similar findings where the highest levels of troponin I was seen in the group of cadavers who had died from myocardial infarction.[9]

There was a statistically non significant correlation between PMI vs Trop T ($p>0.05$).

Conclusion

Pericardial fluid Troponin-T may be used to predict the cause of death in sudden natural death.

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Original Study

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Histomorphological Spectrum of Lung Lesions in Medico- legal Autopsy in a Tertiary Care Centre

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Abstract

Background: Organ specific pathological changes seen during autopsy give a clear idea of the cause of death.

Lungs are one of the most important vital organs in the human body. They are almost always involved in terminal events of cardiovascular diseases. Autopsy is important not only to know the state of lungs but also to study the morphology of various diseases. Various studies have demonstrated that, 20-30% of sudden deaths are due to underlying pulmonary pathology.

Aims and objectives: The significance of this study is to highlight the spectrum of histomorphological features of lung lesions in medico-legal autopsies irrespective of cause of death.

Material and Methods: This was a retrospective study Medico legal autopsies over a period of 5 years carried out in the Department of Pathology in coordination with the Department of Forensic Medicine, Gulbarga Institute of Medical Sciences. Standard protocols are used for gross and histopathology processing.

Results: After thorough histopathological examination, of total 100 cases, various lesions were identified in 93 cases, in 7 cases tissue was autolysed.Majority cases seen in the age group of 20-40yrs with male predominance. The most common cause of death was Road Traffic Accident (RTA) and majority victims were males. The commonly observed pathological features congestion and oedema (44.4%), Pneumonia(26.8%), CVC(22.2%) tuberculosis(9.6%) and ARDS(6.6%).

Conclusion: The present study observed and documented histomorphological spectrum of lung lesions in medico-legal autopsies and highlighted various pathological conditions which are either direct or indirect cause of death.

This study emphasizes that spectrum of histopathological changes in lungs of autopsy cases irrespective of cause of death and highlights some incidental interesting findings in lungs.

Key words: Medicolegal, Lungs, Chronic venous congestion and tuberculosis.

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Introduction

Autopsy is a specialised method of systematic examination of a dead body with objectives of identifying the primary cause of death. The term "autopsy" is derived from the Ancient Greek word autopsia, means "to see for oneself" autos ("oneself") and opsis ("eye")[1,2]

Medico-legal autopsy or Forensic autopsies are done under legal orders in circumstances like unnatural deaths, sudden or suspicious death. The medico-legal autopsy is a procedure which detects the untreated disease, or the disease the person was unaware during his/her life time.

Various histopathological findings unrelated to the cause of death are noticed in routine histopathological examination of medico-legal autopsies. Organ specific pathological changes seen during medico legal autopsy give a clear idea of the cause of death. Histopathological examination of the autopsied specimen also gives a clear idea about incidental findings[3].

These findings have been proved to be of great academic value and serve as an eye opener to the infrequent lesions which go unnoticed when a person is alive. The medico-legal autopsy provides an opportunity for studying not only medically diagnosed diseases, but also the natural evolution of untreated disease. Autopsy also aids in the diagnosis of undiagnosed or misdiagnosed malignant tumours irrespective of underlying cause of death.

Lungs are one of the most important vital organs in the human body and are unique organs which have direct and constant connection to surrounding environment[4]. Lungs are commonly involved in various inflammatory and neoplastic conditions. They are almost always involved in terminal events of cardiovascular diseases. Various studies have demonstrated that about 20-30% of sudden deaths are due to underlying pulmonary pathology[5].

In medico-legal autopsies, depending on the cause of death, the lungs may be found affected in various conditions viz. a collapsed lung as in traumatic pneumo and/or haemo-thorax, or a non-collapsed lung as in pulmonary embolism, or an inflated lung as in emphysema or oedema from various causes; even detailed gross examination of lungs alone gives a clinical diagnosis.

The significance of this study is to highlight the spectrum of histomorphological features of lung lesions in medico-legal autopsies irrespective of cause of death.

Material and Methods

This study is a five- years retrospective cross-sectional study conducted from January 2016 to December 2020, carried out in the Department of Pathology, Gulbarga Institute of Medical Sciences attached to tertiary care hospital. Medico-legal autopsy cases done in either Forensic Medicine department of this institute or by Medical Officers from PHC or CHC in and around Gulbarga, where lung specimen was submitted for histopathological examination were included in this study irrespective of age, gender and cause of death. Both the lungs and single lung, either whole or partial which were sent in 10% formalin were included.

Cases in which lung specimen were not submitted; cases in which lung tissues were autolysed and cases in which microscopic histology was normal were excluded from the study.

Gross external examination and cut surface of all the lung specimens was done using standard protocols. The specimens were examined for size, consistency, colour, texture, areas of consolidation, oedema, exuding froth, pus, areas of haemorrhage, etc.

Representative bits of 3-4mm thickness were submitted for routine formalin fixed paraffin embedding process. Sections were stained with Hematoxylin & Eosin. Special stains like PAS, Zeil Neilson stain were done whenever required.

Ethical clearance was obtained from institutional Ethical committee with reference number **GIMS/ GUL/PHARMA/IEC/59/ 2020-21**

SATISTICAL ANALYSIS: Descriptive date was summarized, and percentage and frequencies were calculated.

Result

This is five-year retrospective study conducted in the department of Pathology Gulbarga Institute of Medical Sciences Kalaburagi from January 2016 to December 2020 included100 medico-legal autopsy cases.

The age of the deceased where a medico-legal autopsy was performed ranged from 1year 10 days to 72years.The mean age (range) of deceased in this study was 21-40 years and maximum cases were seen in this age group.

The number of males and females in this study was 72 and 28 respectively with a male to female ratio being 2.5:1.

Out of the 100 medico-legal autopsy cases. 7 cases (5 bilateral lungs and 2 right lungs were autolysed) hence these cases were excluded from the study. Total 93 cases of lung specimens showed significant histopathological changes. In 83 cases we received both right and left lungs and in 7 cases we received only right lung and in 3 cases only left lung.

Table 1: Mode of death with pathological lesions in lung

SI. No	Mode of death	No of cases
1	Sudden death	18
2	RTA	17
3	Assault/ injury to chest / laceration of lung	03
4	Epilepsy	09
5	Suicide/ hanging	05
6	Uterine rupture	05
7	Alcohol intoxication	06
8	Sepsis	04
9	Drug anaphylaxis	03
10	Burns	03
11	Electric shock	02
12	Snake bite	05
13	CVC etiology	02
14	Fall from height	05
15	SOL	02
16	Intestinal obstruction	02
17	OP poisoning	04
18	Unknown	05
	Total	100

The most common cause of death was sudden death due to myocardial infarction accounting for 18cases, followed by RTAs seen in 17 cases and epilepsy in 9 cases. The other rare causes were assault, suicide, alcohol intoxication, uterine rupture, snake bite, SOL in brain, burns, electric shock etc (Table 1). Most cases of sudden death occurred in the 3rd and 4th decade of life. Maximum victims of sudden death were males 98 and 2 were females. Highest frequency of RTAs was seen in age group of 20-40years. Most of the RTA and OP poisoning victims were males, and all burns victims were females.

The mean weight of the right lung in males was 850+/- 135gm and that in females was 700+/-100gm. The mean weight of left lung in males was 750+/-100gms and that in females was 550+/-90gms.

Table 2: Distribution Of cases according to various gross morphology of lung

Gross morphology	Total number of cases	Percentage
Anthracotic pigmentation	42	45.16%
Pneumonia changes	25	26.88%
Granulomatous inflammation	9	9.67%
Brown indurations (CVC)	10	10.75%
Lacerations	3	3.22%
Saddle thromboembolism in Pulmonary trunk	3	3.22%
Unremarkable	1	1.07%
Total	93	100

On gross examination the external surface and cut surface of both lungs showed anthracotic pigmentation in 42 cases (45.16%) mild to moderate anthracotic pigmentation observed in 38 cases, and 4 cases showed severe anthracotic pigmentation and these cases were associated with fibrosis on external surface, followed by total 25 cases showed pneumonia changes out of 25 cases (26.8%), different stages of lobar pneumonia like congestion, grey hepatization, red hepatization, observed in 18 cases, bronchopneumonia was observed in 4 cases,(Fig.3) aspiration pneumonia in 1 case and interstitial pneumonitis seen in 2 cases. Granulomatous inflammation observed in total 9 cases (9.67%), out of

9 tubercular granulomatous inflammations, on gross 5 cases showed apical cavitatory lesions, grey white firm millet like lesions observed in 3 cases and also showed multiple small cavities and millet like lesions in 1 case (Fig.2). Gross features of CVC like brown induration, firm and heavy lung were noted in 10 cases (10.75%) (Fig.1). Total 3 cases (3.22%) had chest injury showed laceration of lower and middle lobe in which 2 were right lungs and 1 was in left lung. 3 cases (3.22%) showed saddle thromboembolism in the pulmonary artery trunk, in 1 case right pulmonary artery showed complete obliteration of artery and 2 cases thromboembolism was seen in main trunk. Remaining 1 case (1.07%) lung specimen was unremarkable on gross examination. (Table.2)

Table 3: Distribution Of cases according to various Pathological lesions of lung

SI. No	Microscopic findings	No of cases	Percentage
1	Pulmonary vascular diseases	45	48.38
2	Pulmonary infection	34	36.55
3	Chronic obstructive pulmonary disease	14	15.05
	Total	93	100

In the present study all, pathological lesions observed in lung are categorized under three broad headings mainly Pulmonary vascular diseases which constitutes 45 cases (48.38%), followed by Pulmonary infection which constitute 34 cases (36.55%) and Chronic obstructive pulmonary disease are seen in 14 cases (15.05%) (Table.3) `

Table 4: Distribution of cases of Pulmonary vascular diseases

SI. No	Pulmonary vascular disease	No of cases	Percentage
1	Chronic venous congestion	10	22.22
2	Pulmonary edema with congestion	20	44.44
3	Pulmonary hemorrhage with congestion	3	6.66
4	Interstitial congestion	6	13.33
5	ARDS/DAD	3	6.66
6.	Thromboembolism	3	6.66
	Total	45	100

Commonest microscopy pathological lung conditions in the present study were pulmonary vascular disease observed in 45 cases. Out of 45 cases of pulmonary vascular diseases, congestion with oedema observed in 20 cases (44.44%). These cases showed congested blood vessels and intra-alveolar haemorrhages, alveoli distended with protein rich fluid. followed by Chronic venous congestion (Fig.4) seen in 10 cases (22.22%), microscopic findings in these cases were distended alveolar septa with congestion and heart failure cells are seen in alveoli. Interstitial congestion observed in 6 cases (13.33%) and pulmonary haemorrhage with congestion are observed in assault cases, thromboembolism and ARDS/DAD was observed in 3 cases (6.66%) each. (Table.4)

Table 5: Distribution of cases of pulmonary infection

SI. No	Pulmonary infection	No of cases	Percentage
1	Lobar pneumonia	18	52.94
2	Bronchopneumonia	04	11.76
3	Interstitial pneumonia	02	5.88
4	Aspiration pneumonia	01	2.94
5	Tuberculosis	09	26.47
	Total	34	100

Second most common pathological conditions observed is pulmonary infection constitutes 34 cases (36.55%), among infectious diseases lobar pneumonia (Fig.5) was the most common infection comprised of 18 cases (52.94%) characterized by vascular engorgement, intra-alveolar fluid and neutrophilic infiltrates followed by granulomatous inflammation (Fig.3) observed in 9 cases (26.94%), all cases showed caseous necrosis with Langhan's type giant cells and ZN stain was done in all the tubercular granulomatous inflammation cases but only 4 cases showed ZN stain positivity for AFB. These cases were diagnosed to be suffering from pulmonary tuberculosis. Other uncommon pulmonary infections observed are bronchopneumonia 11.76%, interstitial pneumonia in 5.88% and aspiration pneumonia in 2.94%. (Table.5)

Table 6: Distribution of cases of Chronic obstructive pulmonary diseases

SI. No	COPD	No of cases	Percentage
1	Emphysema	06	33.33
2	Chronic bronchitis	08	66.66
	Total	14	100

Other pathological entities observed in lung specimen are chronic obstructive pulmonary diseases (COPD) which comprises 14 cases (15.05%). Features of chronic bronchitis was observed in 8 cases (66.66%) characterized by mucosal gland hyperplasia and chronic inflammatory infiltrates and emphysematous changes (Fig.7) like airspace enlargement, mild fibrosis and chronic inflammatory infiltrates are seen in 6 cases (33.33%). In few cases chronic bronchitis associated with other pathological conditions like CVC lung and pneumonia. (Table.6)

Table 7: Concomitant lesions found in lung

1	Pneumonia with oedema	04
2	CVC with granulomatous inflammation	01
3	HMD with microthrombi	02
4	Bronchiolitis with veg matter in right bronchus and foreign body granulomatous inflammation	01
	Total	08

Present study in 8 cases concomitant lesions were observed. Pneumonia with oedema seen in 4 cases, hyaline membrane disease with microthrombi seen 2 cases and features of bronchiolitis with vegetable matter in right bronchus seen in single case.

The main histopathological changes seen in sudden death due to myocardial infarction was passive pulmonary congestion and pulmonary oedema, 2 cases of acute myocardial infarctions showed incidental findings like granuloma and chronic bronchitis.

In RTA cases microscopic changes were like interstitial congestion, pulmonary oedema and intra alveolar haemorrhages. Out of 3 cases of chest injury all 3 cases showed intra alveolar haemorrhage with haemothorax.

The most common histopathological changes seen OP poisoning was alveolar oedema, diffuse alveolar destruction and some amount of inflammation.

3 cases of snake bite showed features of cellular inflammation, necrosis and cytoplasmic vacuolation of pneumocytes.

Cases of burns showed diffuse alveolar damage, interstitial pneumonitis, and pulmonary oedema. All 3 cases of burns, trachea was sent to identify whether it was antemortem or postmortem burns. In one case tracheal mucosa was plugged with carbon soot and extensive carbon pigment in lung parenchyma was seen in cases of antemortem burns.

Gross morphology of Lungs

Fig 1: Gross photography of CVC of lung showing heavy rusty brown induration and on external examination.

Fig.2 Gross photography of upper lobe of right lung showing apical tubercular cavity with numerous millet like grey white nodules on cut section.

Fig.3 Gross photography of Tb bronchopneumonia shows foci of consolidation, lesions are 1-2cm, grey yellow dry centered on bronchioles (Arrow)

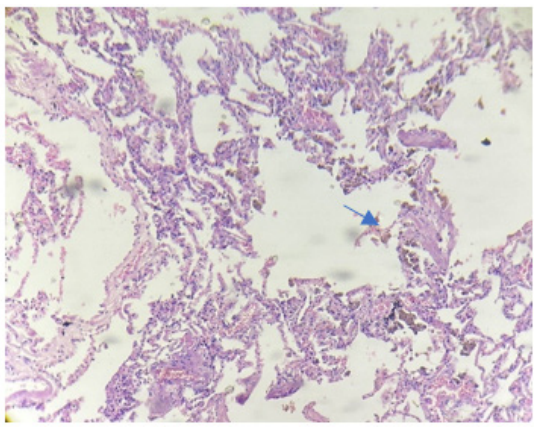

Fig.4 Section from CVC lung shows widened alveolar septa with congested blood vessels and hemosiderin laden alveolar macrophages (Heart failure cells) (H&E; 10X)

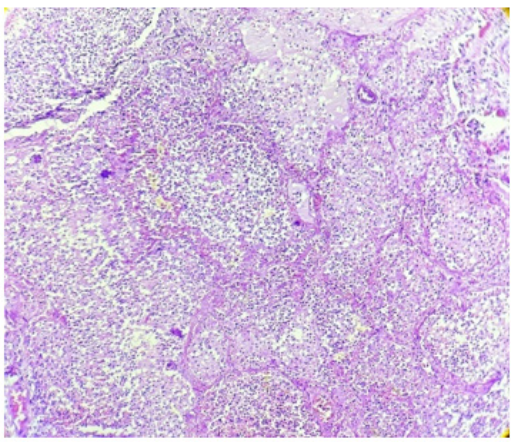

Fig.5 Photomicrograph of Lobar Pneumonia shows alveolar spaces distended by dense acute inflammatory infiltrates, RBCs and macrophages and eosinophilicoedema fluid. (H&E; 10X)

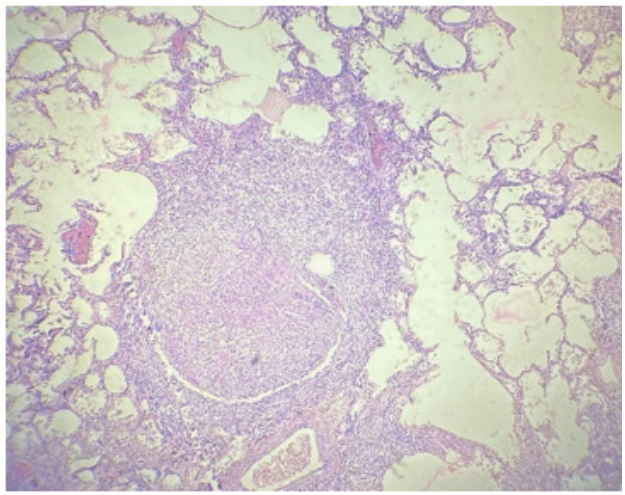

Fig.6 Photomicrograph of TB lung shows well formed granuloma with central caseous necrosis and surrounding alveoli are distended. (H&E; 40X)

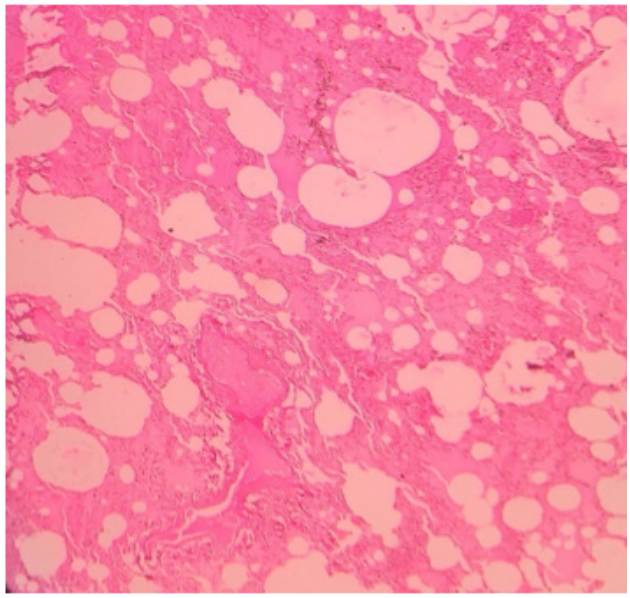

Fig.7 Photomicrography of emphysematous lung shows dilatedalveoli and thickened alveolar septa. (H&E; 40X)

Discussion

Present study was conducted to know various histomorphological changes that occur in lung specimens of medico-legal autopsies. Most of the lung specimens collected during medico-legal autopsies are submitted for histopathological examination when there is no known cause of death. In such conditions it's wise to examine the lungs thoroughly to suggest cause of death. Also, many incidental findings have been highlighted in this study irrespective of cause

of death, which are a great learning tool for both the pathologist and the forensic expert.

A total number of 100 medico-legal autopsies were studied with 166 lung specimens; maximum number of cases being found in the age group of 20-40 years. This finding was consistent with the studies conducted by Zanjad et al[6] and Selvam et al[7].

There was a male preponderance in our study with male to female ratio of 2.5:1 Similar sex predominance was observed by other authors like Selvam[7] and Hanmante RD[8]et al in their studies.

In the present study, the commonest pulmonary lesion encountered was pulmonary oedema with congestion (44.4%), which is similar to studies conducted by Todovoric et al[9] and Pathak and Mangal[10]. This could be death related pathological changes seen in lungs as a terminal event in all cases of cardiovascular diseases.

In developing country like our infective conditions like pneumonia and tuberculosis continue to be one of the major causes of mortality and morbidity. In our study lobar pneumonia was the commonest lung lesion observed in 52.94% cases. This was the main lesion seen deaths which occurred in hospitalised and old aged bed ridden patients. Present study is comparable with Selvambigai G et al[11]. Nazish S et al[12] found Pneumonia to be the first most common finding and Chauhan G et al[13] in their study.

Till date one of the major diseases in developing country like ours TB, though tuberculosis is very common in our area, we get daily patients of Tuberculosis, due to stigma associated with these leads to delay in diagnosis and treatment. This is the reason in Autopsy only 9 cases of Tuberculosis were found. Out of which two were cases of disseminated tuberculosis with lesion involving other organs. Kurawar RR and Vasaikar MS, also found the low percentage of Tuberculosis in their study[14.] Two of the total 9 cases of TB were also HIV positive as per given details and in 1 case granulomatous inflammation was an incidental finding. Similar observations was made in study conducted by Garg M etal[15]

Out of the 3 cases of thromboembolism, there was a history of sudden death in 2 cases, one had history of fall who sustained lower limb long bone fracture and other case was diagnosed with deep vein thrombosis. Histopathological examination revealed saddle thromboembolus in the pulmonary trunk. Similar observation seen in Misra P and Ghosh AK in their studies[16]

Three cases showed features of ARDS in this study. Retrospective study conducted by Sachdev S et all[17] observed low prevalence of ARDS.

Diffuse alveolar damage (DAD), interstitial fibrosis with pneumonia, hyaline membrane diseases and bronchiolitis with vegetable matter in the terminal bronchioles was seen in single case.

Conclusion

In medico-legal autopsies, the histopathological examination of lung specimens is very important which helps in establishing cause of death. The present study observed and documented histomorphological spectrum of lung lesions in medico-legal autopsies and highlighted various pathological conditions which are either direct or indirect cause of death.

In clinical practice pulmonary pathological conditions are commonly encountered, but studying of lung specimens not only provide diagnosis, also give the insight information of varying stages of different diseases. In our study, most of the cases are with unknown history of past illness. In such scenario autopsy findings will provide much information about either cause of death or some incidental findings. Our study also highlights the importance of identifying lethal infections like pneumonia and tuberculosis in developing countries as it can be a major contributor to mortality and morbidity. This study emphasizes that spectrum of histopathological changes in lungs of autopsy cases irrespective of cause of death and highlights some incidental interesting findings in lungs.

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Original Study

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Study of Morphological changes of Adrenals in Suicidal cases, An Autopsy-based Study at a Tertiary Care Centre at Odisha

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Abstract

Introduction: Uncertainty and instability are the norm of today's work envioronment. Now-a-days suicidal cases account for more than a million deaths each year. This work has been undertaken to study the Morphological adaptive changes in adrenal gland in such stressful conditions.

Aim & Objectives: To correlate the Morphological adaptive changes in adrenal gland in response to chronic stress since it is a stress responding organ common to both the HPA axis & Sympathoadrenomedullary axis.

Material & Methods: The study was carried out from 5th April 2021 to 5th April 2023 at SCB Medical college, Cuttack, Odisha. Right and Left adrenals of hundred suicidal cases and twenty accidental cases (control) were studied.

Results: On Morphological Analysis it was found that Adrenal gland increases both in weight & dimensions in suicidal cases as compared to Accidental cases. A normal pattern of Adrenal gland is informative of receipt of sudden violence i.e accident.

Conclusion: The present study concludes and supports the idea that chronic stress as in suicide usually induces adrenal growth which may have implications for forensic people in revealing the cause of unknown deaths.

Key words: HPA axis, Stress, Suicide, Sympathoadrenomedullary axis.

Introduction

The Adrenal gland reflects the functional changes of the stress system which leaves an imprint on the morphology of the gland. The body's reaction to a stressor is part of our survival mechanism. Under stress, the ACTH is released into circulation by the anterior pituitary. ACTH reaches the adrenal cortex where it stimulates the endocrine cells to secrete the steroid hormone cortisol. The Zona fasciculata

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of adrenal cortex is rich in lipids which acts as the raw material for the synthesis of cortisol. Chronic stress leads to hypertrophy **and hyperplasia** of zona fasciculata .[1].There is positive correlation between adrenal weight and total cortical thickness in both Right and Left adrenal[2].The proliferative effect of ACTH on adrenal is due to release of extracellular signal related kinases [3]. ACTH also induces expression of genes associated with cell cycle proliferation c- fos and c-jun .[4] Thus the bilateral enlargement of adrenal is mainly due to ACTH .[5]

Keeping in view of this present day situation where uncertainty and instability are the norm in today's work environment. Suicide is one of the ten leading causes of death in the world accounting for more than a million deaths annually. As per WHO, there is one suicidal death in 40 seconds throughout the world. India and China are responsible for 30% of all cases of suicide worldwide.

Therefore, the present research work has been undertaken to correlate and study the morphological adaptive changes in adrenal gland in stressful conditions as in case of suicidal deaths, because adrenal is a stress responding organ and reflects the functional changes of the stress system which leaves an imprint on the morphology of the gland.

Materials and Methods

The present study was carried outfrom 5th April 2021 to 5th April 2023 at SCB Medical college, Cuttack ,Odisha. Human adrenals of hundred suicidal cases & twenty accidental cases of different age groups were obtained from the Forensic Department after necessary formalities . Both Right & Left adrenals were collected separately in plastic containers containing the fixatives i.e. 10% Formal saline. Both the adrenals were dissected out from the upper pole of the kidney . After removing the fat , gross inspection was done with the help of hand lens for congestion , hemorrhage and oedema.

Inclusion Criteria

All established cases of suicide with prominent autopsy findings and relevant history .

Exclusion Criteria

- Cases with extremes of age groups i.e.< 15 yrs and > 60 yrs.
- Cases with doubtful and insufficient history.
- Suicidal cases which were brought for Post mortem after 8hrs of death depending on the environmental temp. and cause of death.
- Pregnant ladies

Morphological Analysis

After immersing the specimen in formalsaline for twelve hours , dimension i.e. Length , Breadth & Thickness of adrenals were measured using Vernier callipers.

The weight of adrenal was taken from Digital Weighing machine.

Statististical Analysis: Statistical analysis in this study comprises of one –way ANOVA with (Turkey's multiple comparison) test for comparing the dimensions of adrenal gland between suicidal and accidental cases. Chi-Square test is used for gross changes in adrenal gland.

Results

Table 1: AGE DISTRIBUTION OF DEATH CASES

Age Group (Yrs.)	Suicidal		Accidental	
	No. of Cases	Percentage	No. of Cases	Percentage
15-30	43	43.00	12	60.00
31-45	47	47.00	4	20.00
46-60	10	10.00	4	20.00
Total	100	100.00	20	100.00

Data depicted in **Table-I** represent the age-wise distribution of suicidal and accidental cases. It is evident that the age Grade representing (31-45 years) has highest incidence of suicidal cases accounting for (47%), the 2nd highest incidence accounting to (43%) is of younger age group i.e. 15-30 years and least

incidence of suicidal cases in older age group i.e. 46 to 60 years. But in case of accidental cases, the younger age group represent the highest percentage i.e. 60% which is explained by their unstable state of mind.

Table 2: GENDER DISTRIBUTION OF DEATHS

Sex	Suicidal		Accidental	
	No. of Cases	Percentage	No. of Cases	Percentage
Male	58	58.00	18	90.00
Female	42	42.00	2	10.00
Total	100	100.00	20	100.00

Data depicted in the table-2 represent the sex-wise distribution of both suicidal and accidental cases**.**

It is evident that the incidence of suicide and accident is higher among males than their female counterparts.

Table 3: AGE-WISE GENDER DISTRIBUTION OF DIFFERENT DEATHS

Cases	Male			Female		
	15-30 Yrs.	31-45 Yrs.	46-60 Yrs.	15-30 Yrs.	31-45 Yrs.	46-60 Yrs.
Suicidal	18	34	6	25	3	4
Accidental	10	4	4	2	0	0

This table depicts the age-wise gender distribution of both suicidal and accidental cases. It is evident that the number of suicidal case is maximum in males of middle age group and in females of younger age group .Accidental death was observed to be maximum in young males**.**

Table 4: Adrenal Weight (gms) of Suicidal and Accidental males of different age groups

Laterality		15 - 30 Yrs.		31 - 45 Yrs.		46 - 60 Yrs.	
		Suicidal (n=18)	Accidental (n=10)	Suicidal (n=34)	Accidental (n=4)	Suicidal (n=6)	Accidental (n=6)
Left	Mean	6.50*†	5.20*	6.10*†	5.00	5.9†	4.9
	±	±	±	±	±	±	±
	SE	0.07	0.04	0.34	0.10	0.14	0.05
Right	Mean	6.50*†	5.20*	6.10*†	4.90	5.8†	4.9
	±	±	±	±	±	±	±
	SE	0.07	0.05	0.05	0.06	0.17	0.14

* P<0.001; Suicidal Young Vs. Suicidal Elder

†: P<0.001; Suicidal Vs. Accidental deaths of respective age groups

This table shows the weight of adrenal glands of both suicidal and accidental cases among the male individuals.

The young age group (15-35 years) show a higher weight than the other two age groups. The adrenal weights of both sides in accidental and suicidal death cases were compared age wise. There was a significant difference among these groups (P < 0.001).

A highly significant difference (P< 0.001) was observed among the suicidal deaths of three different age groups by using Post Anova test.

Table 5: Adrenal Length (mm) of Suicidal and Accidental(males) death cases of different age groups

Laterality		15 - 30 Yrs.		31 - 45 Yrs.	
		Suicidal (n=18)	Accidental (n=10)	Suicidal (n=34)	Accidental (n=4)
Left	Mean	56.32*†	50.95	53.53†	49.95
	±	±	±	±	±
	SE	0.52	0.21	0.24	0.68
Right	Mean	56.36*†	51.10	53.32†	49.75
	±	±	±	±	±
	SE	0.44	0.18	0.21	0.18

* P<0.001; Suicidal Young Vs. Suicidal Elder

†: P<0.001; Suicidal Vs. Accidental deaths of respective age groups

The suicidal cases of 46-60 yrs did not show any significant differences in length, breadth and thickness as compared to the accidental deaths (Data not shown) .

MS1LTLT – Mean length of left adrenal in younger age group suicidal case

MA1LTLT - Mean length of left adrenal in younger age group accidental case

MS1LTRT – Mean length of right adrenal in younger age group suicidal case .

MA1LTRT - Mean length of right adrenal in younger age group accidental case

MS2LTLT - Mean length of left adrenal in middle age group suicidal case

MA2LTLT - Mean length of left adrenal in middle age group accidental case

MS2LTRT -- Mean length of right adrenal in middle age group suicidal case

MA2LTRT - Mean length of right adrenal in middle age group suicidal case

MS3LTLT - Mean length of left adrenal in older age group suicidal case

MA3LTLT - - Mean length of left adrenal in older age group accidental case

MS3LTRT - Mean length of right adrenal in older age group suicidal case.

MA3LTRT- Mean length of right adrenal in older age group accidental case

Similarly the abbreviations used for breadth and thickness are MS1BHLT, MA1BHLT, MS2BHLT- - - -

Table 6: Adrenal Breadth (mm) of Suicidal and Accidental (males) death cases of different age groups

Laterality		15 - 30 Yrs.		31 - 45 Yrs.	
		Suicidal (n=18)	Accidental (n=10)	Suicidal (n=34)	Accidental (n=4)
Left	Mean	46.84*†	41.32	44.61†	41.20
	±	±	±	±	±
	SE	0.30	0.24	0.19	0.33
Right	Mean	46.71*†	41.15	44.54†	41.08
	±	±	±	±	±
	SE	0.28	0.28	0.18	0.18

* P<0.001; Suicidal Young Vs. Suicidal Elder

†: P<0.001; Suicidal Vs. Accidental deaths of respective age groups

This table shows the breadth of adrenal glands of both suicidal and accidental cases among the male individuals.

Table 7: Adrenal Thickness (mm) of Suicidal and Accidental (males) death cases of different age groups

Laterality		15 - 30 Yrs.		31 - 45 Yrs.	
		Suicidal (n=18)	Accidental (n=10)	Suicidal (n=34)	Accidental (n=4)
Left	Mean ± SE	16.34*† ± 0.32	11.38 ± 0.24	14.21† ± 0.13	10.70 ± 0.19
Right	Mean ± SE	15.66*† ± 0.24	11.54 ± 0.23	14.11† ± 0.15	10.83 ± 0.15

* P<0.001; Suicidal Young Vs. Suicidal Elder

†: P<0.001; Suicidal Vs. Accidental deaths of respective age groups

This table shows the thickness of adrenal glands of both suicidal and accidental cases among the male individuals.

The adrenal thickness of accidental and suicidal death cases were significantly (P < 0.001) different as compared age wise.

Table 8: Naked Eye Examination

Gross features	Suicidal	Accidental	Chi-square	P Value
Oedema	50 (50.00%)	10 (50.00%)	0	>0.05
Congestion	63 (63.00%)	12 (60.00%)	0.06	>0.05
Haemorrhage	83 (83.00%)	9 (45.00%)	13.45	<0.001
Colour (Red)	97 (97.00%)	3 (15.00%)	80.69	<0.001

The above table depicts the gross changes of adrenal glands in both suicidal and accidental death cases. Chi-Square test revealed that the oedematous changes and congestion of adrenal glands are not associated with the type of death.

However, the incidence of haemorrhage in suicidal and accidental death (83% and 45% respectively), red colour of adrenal glands in (suicidal 97% and accidental 15% respectively) differ significantly P < 0.001). It revealed that the incidences of these two events are strongly associated with type of death.

Fig 1: Removal of Congested and Haemorrhagic Adrenal in Suicidal Case

Fig 2: Removal of Normal Adrenal in Accidental Case

Discussion

It is well known that adrenal is the target gland in HPA axis and plays an important role in stress modulation. There was a positive correlation between adrenal weight and total cortical thickness of both left and right adrenal gland providing direct evidence that increased adrenal weight is due to cortical hypertrophy.[2]

Probably, the reason or maximum sufferers in the age group of 15-45 years is due to frustration, early marriage, sudden emotional outburst, failure to cope with stress and strain of life at an younger age, poverty, unemployment etc. HPA and sympatheticoadreno-medullary axes are the systems mainly involved in maintaining homeostasis during the stress response, and the adrenal is an essential stress responding organ common to both systems .[6]

The adrenal gland is subject to dynamic structural changes including cellular proliferation and death. These two processes must be balanced to ensure the integrity and function of the adrenal gland.[7]Several theories have been proposed to explain the cellular replacement in the different zones of adrenal cortex. On one hand migration theory describes cell proliferation in the external part of the cortex, their migration and differentiation from glomerular zone to fascicular zone and from there to reticular zone where they end up degenerating and dying .[8]

In the rat, more recent immunohistochemical studies have demonstrated an undifferentiated zone between the zona glomerulosa and zona fasciculata which is proposed as a stem cell zone [9]According to the transformation theory, transformation may occur locally either between glomerular and fascicular or between fascicular and reticular zones. .When chronic intermittent stress of enough intensity is applied, an increase in the size of adrenal gland is observed which is independent of its relative body mass index.[10]

Studies by several works closely corroborates with our findings. A study conducted by who studied a group of 42 suicidal victims and 31 control cases of sudden death and reported a significant increase in adrenal weight in the suicidal group. [11-12.] Also the study of with our findings who stated that under chronic stress conditions, there is increased adrenal weight, due to hypertrophy and hyperplasia of the cortex.[6]

There was an increased adrenal weight due to the effect of prolactin during pregnancy. For this reason, we have excluded the pregnant ladies from our study as their increased adrenal weight might be due to increased prolactin level. A number of studies on adrenal dimensions with respect to stress have been put forth by several workers which closely corroborates with our findings.[13]

Conclusion

Considering the basic role of adrenal in coping up with stress, the human model of morphological study of adrenal gland has been taken up to correlate the morphological (adrenal weight and dimension) features in the confirmed suicidal cases. There was a significant increase in adrenal weight and dimension of suicidal cases as compared to the accidental cases of corresponding age groups,−− which probably serves the testimony to its adaptation to the stress factors. This project is a humble attempt in this field within the scope available. Further works in this regard is needed in showing more light on the medico-legal problems occurring from time to time. Thus this present study concludes and supports the idea that chronic stress induces adrenal growth, which may have implications for the forensic people in revealing the cause of unknown deaths.

Compliances of Authors

Conflict of interest

SP, PKP,BR and MP declare that they have Conflict of interest: No

Informed consent

All procedures followed were in accordance with the ethical standards of the responsible committee (institutional and national) and with the Helsinki Declaration of 1975 as revised in 2008 and Institutional ethics committee clearance was obtained.

Source of Funding Nil

Ethical clearance details : Date ; 07 .9 2015 ref no: IEC/IRB NO: 155/07.09.2015.

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Determination and Correlation of Finger Print Pattern and Blood Grouping in Diabetes Mellitus: An Analytical Study

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Abstract

Background: To Determine and correlate between fingerprint patterns and blood group in type II diabetes mellitus.

Results: One hundred individuals with type II diabetes mellitus and One hundred normal individuals as controls were selected for study. Fingerprints were obtained by dactyloscopy. Various fingerprint patterns like arches, whorls, loops were studied and correlated with the respective blood group based on ABO system among the volunteer controls and diabetics. After obtaining results, the analysis was made using Chi square test and One way ANOVA which showed, the most predominant fingerprint pattern among the 100 diabetic volunteers is "Arch pattern" and the most predominant blood group was "O" positive among the diabetic volunteers. Also correlating both finger print and blood group "Whorl pattern" with "B" blood group showed higher predominance among the healthy volunteers.

Conclusions: This is the first study correlating finger print pattern with blood grouping in subjects of Diabetes mellitus. Our study findings showed that O positive blood group with arch pattern type of finger print was the most common findings among diabetes. Thus correlating fingerprint pattern and blood grouping act as a early predictor tool for diagnosing Type II Diabetes mellitus.

Keywords: Fingerprint, Diabetes mellitus, Blood grouping, Dermatoglyphics, ABO system, Forensic

Introduction

Dermatoglyphics serves as analytical tool since prime valages which aids in forensic diagnosis [(1)].The term Dermatoglyphics can be split into derma and glyph where derma means skin and glyph means carving [(2)]. Finger print formation occurs at palm, soles, fingers and toes commences at 12th to 16th week of IUL and completed at 14th week or 6th month of fetal life. They remain unchanged throughout the course of life until the skin gets destroyed by the process of decomposition[(3)]. Two individuals taking identical finger prints are about one in 64 thousand millions[(4)] The discharges contained by the thumb prints comprise residues, copious chemicals and their metabolites which may be identified and used for the forensic determination.

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Blood group system is discovered by Karl Landsteiner. Total 19 major groups have been identified which vary in their frequency of spreading various races of mankind. Clinically, 'ABO' and 'Rhesus' groups are of major importance. 'ABO' system is further differentiated as A, B, AB, O blood group types according to presence of corresponding antigen in plasma[5]. Yet another biological record that remains unchanged throughout the life time of an individual is the blood group. Determining the blood group of a person from the samples obtained at the site of crime, helps identify a person. Landsteiner classified blood groups under the ABO blood group system. 'ABO' system is further Fingerprints and Blood groups classified as A, B, AB, and O people types according to presence of corresponding antigen in plasma. 'Rhesus' system is classified into 'Rh-positive' and 'Rh-negative' according to the presence or absence of 'D' antigen [6]

Diabetes mellitus (DM) is a worldwide ailment, and the pervasiveness is growing predominantly in developing nations. This is a key risk of the public health condition universally. Current appraisals specify that there were anticipated to increase to 366 million by 2030[7] DM can be broadly classified into– type I DM (T1DM) and (T2DM). Evidently, T2DM is now becoming epidemic in the 21st century where India leads the world with the largest number of diabetic patients. Converging points of evidence from population-based studies suggest that Indians are apparently genetically more prone to diabetes and insulin resistance.[8]

The aim of our research study is to determine as well as correlate finger print pattern, gender, blood grouping in subjects of diabetes mellitus.

Material and Methodology

The sample size was calculated using G*power software and decided to be around 100. All the participants those who are involved in the study were included after obtaining signed informed consent forms; approval of the ethics committee (IHEC/ I/ 0270/ 21) was obtained. The present cross-sectional study was carried at the out-patient department of oral and maxillofacial pathology, in our institution. Total of 200(50 male controls&50female controls; 46 diabetic males & 54 diabetic females) belonging to the age group of range 35-75 years were randomly chosen for the study. Performa was kept ready which included diabetic history, demographic data and also column for entering finger print pattern and blood grouping. The fingerprints were obtained from left thumb finger by using stamp ink method. After proper hygiene measures to thoroughly remove the dirt from the hands, fingerprints are taken. The finger prints were obtained in their respective Performa. The different patterns of fingerprints which include loops, whorls, and arches were dogged with the help of a hand lens. They were asked to wash their hands after the sample collection using hand wash. (Figure-1)

Fig. 1 Finger print patterns

Blood groups for all these persons were also evaluated after finger print collection using SPANCLONE (Anti A+ Anti B+ Anti D(Rh_o) Monoclonal antibody) using standard procedure and it was recorded in the proforma. (Figure-2)

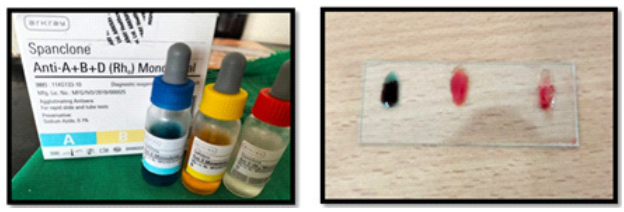

Fig. 2 Blood grouping

All the data were entered in the excel sheet and it was further analyzed and compared using appropriate statistical test.

Results

The finger print patterns and blood groups were evaluated. The results were tabulated for controls and diabetics separately.

Table 1: Prevalence of blood groups among Control males and females (n=100)

Males - 50; Females - 50

BLOOD GROUPS	MALES		FEMALES		TOTAL %	AVERAGE
	NO	FREQUENCY	NO	FREQUENCY		
A+	9	18	10	20	38	19
A-	0	0	1	2	2	1
AB+	3	6	2	4	10	5
AB-	0	0	0	0	0	0
B+	19	38	20	40	78	39
B-	2	4	0	0	4	2
O+	16	32	16	32	64	32
O-	1	2	1	2	4	2

Table 2 Prevalence of finger print among Control males and females (n=100)

Males – 50; Females – 50

GENDER	WHORLS NO FREQUENCY		ARCH NO FREQUENCY		LOOP NO FREQUENCY	
MALES	23	46	6	50	21	42
FEMALES	22	44	9	50	19	38
TOTAL	45		15		40	

Table 3 Prevalence of blood groups among diabetic males and females (n=100)

Males- 54; Females- 46;

BLOOD GROUPS	**MALES**		**FEMALES**		**TOTAL %**	**AVERAGE**
	NO	**FREQUENCY**	**NO**	**FREQUENCY**		
A +	15	28	5	11	39	20
A-	0	0	0	0	0	0
AB+	3	5	3	7	12	7
AB-	2	4	0	0	4	2
B+	10	19	11	23	42	21
B-	2	4	2	4	8	4
O+	21	35	23	50	85	43
O-	1	2	2	4	5	3

Table 4 Prevalence of finger print among diabetic males and females (n=100)

Males- 54; Females- 46;

GENDER	WHORLS NO FREQUENCY		ARCH NO FREQUENCY		LOOP NO FREQUENCY	
MALES	13	24	13	24	29	54
FEMALES	13	28	14	30	18	39
TOTAL	26		27		47	

The graphical representation of the results obtained were presented for controls and diabetics individually (Fig-3 & Fig-4)

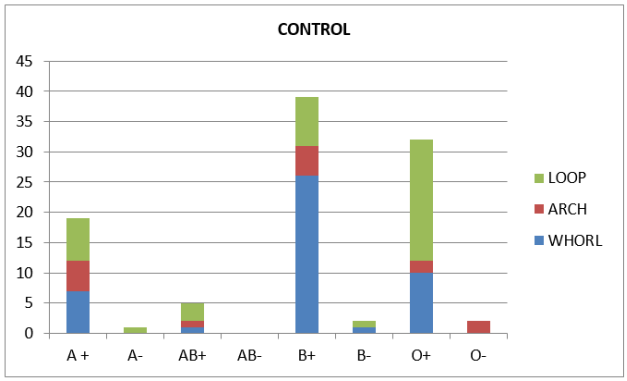

Fig 3: Co-relation of finger print patterns with blood grouping of Controls

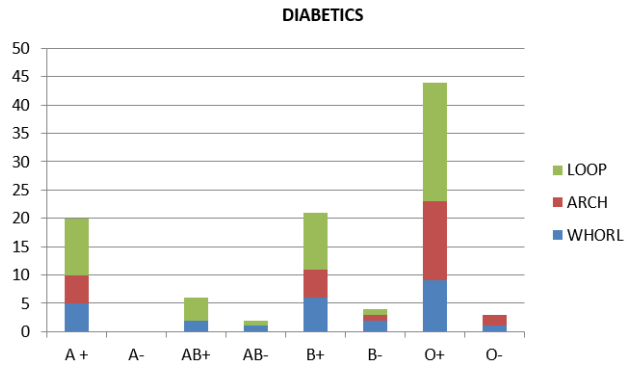

Fig 4: Correlation of Finger Print pattern with Blood grouping in Diabetics

BLOOD GROUP	CONTROL				DIABETIC			
	WHORL	LOOP	ARCH	TOTAL	WHORL	LOOP	ARCH	TOTAL
A+	7	5	7	19	5	5	10	20
A-	0	0	1	1	0	0	0	0
AB+	1	1	3	5	2	0	4	6
AB-	0	0	0	0	1	0	1	2
B+	**26**	5	8	**39**	6	5	10	21
B-	1	0	1	2	2	1	1	4
O+	10	2	20	32	9	14	**21**	**44**
O-	0	2	0	2	1	2	0	3

Fig 5: Correlation of Finger Print pattern with Blood grouping in Diabetics

Fingerprint pattern:

The fingerprint patterns were assessed for thumb finger of both the hands. We analyzed the finger print patterns according to Henry's system of classification in 1900 which classifies the fingerprint pattern broadly into loops, whorls, & arches. The percentage distribution and different pattern of distribution of these cases was calculated and tabulated. Predominantly Whorl pattern was noted in control subjects and Arch pattern of finger prints were noted in diabetic subjects with a percentage frequency of 44% and 42% respectively.

Chi- square analysis was done between the controls and diabetics finger print pattern and it showed p value of 0.143 which is non- significant.

Blood group:

From the distribution of blood groups among the subjects, maximum percentage of B+ was seen in control subjects and O+ blood group was noted in diabetic subjects.

Chi- square analysis was done between the controls and diabetics' blood grouping and it showed p value of 0.301 which is also non- significant.

The Correlation of blood group with finger print pattern in our study was done one way ANOVA statistical analysis and it showed value of p value of 0.070 for finger print patterns and 0.358 for blood grouping among the groups.

Discussion

Ameer et al (2014), collected finger prints from hundred diabetic subjects and found that majority of the patients were belonging to whorl pattern followed by patients belonging to Loop pattern and the least pattern was composite [9]. Our study was contradictory with this study showing predominantly Arch pattern of finger prints followed by whorl pattern & loop pattern.

Mehta et al (2015) conducted a study correlating finger print pattern with diabetic subjects, on one hundred diabetic subjects and concluded that there was significant difference between the subjects for the three fingerprint pattern and found that Whorl pattern was the dominant pattern found mostly in diabetic subjects. Loop pattern was significantly decreased while Arch patterns were significantly reduced in right and left hands of male and left hand of female diabetics[10]. This study was consistent with our study showing decreased pattern for loop pattern.

Meo et al (2016) did a systematic review with forty seven research documents extracting from search engines of ISI -Web of Science, EMBASE and PubMed. They also suggested from their findings that subjects with blood group "B" should be closely monitored by physicians as these subjects have an increased risk of type 2 diabetes[11].In contrary, our study showed a predominant 'O' positive blood group among the diabetics and 'B' positive blood group among the control group.

Manjusha et al (2017) performed a study correlating finger print and lip print pattern with 100 uncontrolled T2DM patients and 50 healthy controls. Type IV pattern of lip prints was found significantly more in the diabetic patients. Their study analysis showed that fingerprint analysis did not reveal any significant association with diabetes. [12]

Azhagiri et al (2018) did a study correlating finger print patterns with blood grouping of both the gender among 150 subjects. Total number of loops found in both gender in the left thumb print were 60 (40%), followed by whorls 40 (27%), Mixed 34 (23%) while Arches were present in a low frequency 16 (11%). Most of subjects in our study belonged to blood group "O" followed by "B", "A" and "AB" blood groups. Blood group O positive was the most common, whereas O negative and AB negative were the rarest. Highest numbers of Loops were found in blood groups O, B compared to A and AB. Frequency of all finger print patterns was found to be more in females. [13] Consistent to this study, 'O' positive blood group was predominant in type II diabetes mellitus.

Sathawane et al (2019), conducted a study correlating lip print and finger print pattern with the subjects of diabetes mellitus. The study was conducted on 50 control subjects and 50uncontrolled type 2 diabetic subjects showed the results of type IV pattern of lip print and whorl pattern of finger print was predominant in diabetic subjects. They

concluded that fingerprint and lip print pattern can be used as an early diagnostic aid/ marker for type – II diabetes mellitus subjects. [14]

Legese et al (2020) conducted study in Ethiopian population, of 424 participants and found, blood group O was higher in frequency. ABO blood groups showed significant association with T2DM, a chi-square value of 12.163 and P value of 0.007. Blood group B was associated with an increased risk and O blood group with decreased risk of type 2diabetes mellitus.[15] In contrary to this study, Our study findings showed that O blood group was increased among type II diabetes and B blood group was increased among control group.

Ingle et al (2020), in their research study reviewed that it investigates the problem of blood group identification and analysis of disease those arises with aging or disease called as lifestyle-based like hypertension, type 2-diabetes and arthritis from fingerprint by analyzing their patterns correlation with blood group and age of an individual. It is observed that fingers of an individual are having multiple unique patterns those are need to be extracted with computerized method with fingerprints image captured using digital device which allow finding known association of fingerprints patterns which may enhance the authenticity of the fingerprints in blood group identification and early indication of lifestyle-based diseases of an individual. They also added that analysis and classification of community based on age, blood group, fingerprint patterns and lifestyle diseases help to tackle any pandemic in future like COVID-19 in which mankind may suffer a lot having lifestyle based diseases like hypertension, type 2-diabetes[16]

Sharjeel et al (2021), conducted case control study in two hundred subjects, and found a significant association between blood group B and type 2 diabetes mellitus (p=0.006),whereas a negative association was seen between the blood group O and type 2 diabetes mellitus(p=0.001). A significant association was found between blood group B and risk of type 2 diabetes mellitus (T2DM).[17] This study findings were contrary to our study findings.

Ghafar et al (2022), conducted study on 484 diabetic subjects and 182 pre- diabetic subjects correlating blood group with diabetes. The percentage values of blood Group-B are32% in DM Vs. 31% in pre-diabetics, followed by blood Group-O as 18% in DM Vs.11% in pre-diabetics. In addition, percentage distribution of Rh system was also calculated, in which Rh +ve Group was high and more common in DM patients as compared to pre-diabetics. The inference of their study was Diabetes mellitus has a positive correlation with ABO blood groups, and people with Group-O have increased susceptibility to DM disease.[18] Our study findings were correlating with the findings of the above study in blood grouping.

Conclusion

Diabetes mellitus is becoming an epidemic alarm mainly for Indian sub- continent. We formulated this cross sectional study, correlating finger print pattern with blood grouping as a thought/ attempting of creating early diagnosis and early prevention from the analysis of previously conducted researches. This is the first study correlating finger print pattern with blood grouping in subjects of Diabetes mellitus. Our study findings showed that O positive blood group with arch pattern type of finger print was the most common findings among diabetes. From the results, highlights of our study were:

CONTROLS: The common findings in descending orders as follows:

B+ = Whorl Pattern

O + = Arch Pattern

O + = Whorl Pattern

DIABETICS: The common findings in descending orders as follows:

O + = Arch Pattern

O += Loop Pattern

B+= Arch Pattern.

Declaration

ETHCS APPROVAL AND CONSENT TO PARTICIPATE - All the participants those who are involved in the study were included after obtaining signed informed consent forms; approval of the ethics committee **(IHEC/ I/ 0270/ 21)** was obtained

AVAILABILITY OF DATA AND MATERIAL - . The data and information for each individual novice and expert participant used to produce our results are available

CONFLICT OF INTEREST – Nil

CONSENT FOR PUBLICATION - Applicable

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AUTHORS' CONTRIBUTIONS

- Dr. Mahalakshmi - Sample collection & data analysis
- Ms. Jincy - Sample collection
- Ms. Praveena - Sample collection
- Dr. Mahalingam Bhuvaneswari – Data analysis
- Dr. Sathish Muthukumar – Critical review
- Dr. Merlin Jayaraj - Critical review

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Original Research Paper

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An Autopsy Based Study of Deaths Due to Snake Bite in Kurnool Region of Andhra Pradesh

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Abstract

Snakebite envenoming is a neglected tropical disease (NTD) that is responsible for enormous suffering, disability and premature death. This study is an autopsy based epidemiological study of deaths due to snake bite conducted in Kurnool medical college attached Government General Hospital, Kurnool, Andhra Pradesh. The results of the study indicated that snake bites are more common among middle-aged, uneducated, male agricultural laborers working in fields during monsoon season. In Majority of the them bitten by snake over lower extremities. The majority of patients could not reach the hospital in time because their habitats are rural areas and not well connected to the nearby health centers.

KEY WORDS: Snake Bite, Neglected Tropical Disease, Kurnool Region of Andhra Pradesh, Autopsy Based Study on Snake Bites.

Introduction

Snakebite envenoming is a potentially fatal illness caused by toxins released during venomous snake's bite. As per Central Bureau of Health Intelligence the average snakebite cases is approximately 300,000 and average deaths due to snakebite is 2000 each year.[1] There is a huge gap between the number of snakebite deaths reported from direct surveys and official data.[1] Only a small proportion of snakebite victims across country report to the clinics and hospitals and actual burden of snakebite is grossly underreported.[1]

Accurate recording of data of incidence of snake bite is not available in India as many victims seek treatment from traditional healers and quacks initially and only when the condition worsens gets medical care from modern hospitals[2]. This epidemiological study of snake bite deaths was done in the Department of Forensic medicine, Kurnool medical college, Kurnool district, Andhra pradesh.

Materials and Methods

Data of this retrospective, epidemiological study of snake bite deaths was collected from all

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the medico-legal autopsies of snake bite deaths conducted during the period from February 2021 to July 2022 in the Mortuary of Kurnool Medical College & Hospital, Kurnool, Andhra Pradesh. we included all the autopsy cases of snake bite death being conducted in the study period and we have excluded all cases of decomposed bodies, bites from other animals and cases with obscure histories. As per the criteria, a total of 50 autopsy cases of snake bite death were included in the study and remaining 10 cases of decomposed bodies, 14 cases of bites from other animals and 6 cases with obscure histories were excluded. The data for the study was collected from inquests, autopsy reports, hospital records and information from relatives of the deceased. The data collected was tabulated in Microsoft Excel and analysed. The approval from the Institutional ethical committee of Kurnool medical college was obtained for conducting the study. This autopsy based retrospective, epidemiological study of snake bite deaths was conducted for 18 months from February 2021 to July 2022 in Kurnool medical college attached Government General Hospital, Kurnool, Andhra pradesh.

Observations and Results

In this retrospective, epidemiological study of snake bite deaths, a total of 50 cases were included in study as per selection criteria. Among those 50 cases, 31 cases (62%) were males and 19 cases (38%) were females. Number of cases as per age category were tabulated in the Table no -1. Categorization as per habitation of victims were mentioned in the table no-2. Regarding occupation of victims, 46% were agricultural laborers, 14% were other laborers, 16% were students, 10% were house-wives and 14% belong to other occupations. Regarding education status of victims, 16% of them were uneducated, 48% of them completed their primary education, 32% of them completed their higher secondary education, 4% of them were graduates. 62% of the victims were bitten by the snake during the daytime i.e., 6am to 6pm and 38% were bitten during the night time. More than 50% (i.e., 52%) of victims were bitten by a snake at fields, 22% were bitten at houses, 18% were at the house premises and 2% were at vacant lands. As most of the victims were from agricultural backgrounds 46% of them were bitten by the snake during their agricultural work at the fields, 22% were bitten while they were sleeping, 18% were walking and 8% were cleaning while bitten by the snake. 58% of the victims were bitten by the snake during the Monsoon season, 24% victims were bitten during the winter season and 18% were during the summer season. 32% of the victims did not see the type of snake that bitten them, 30% were able to identity that they were bitten by Krait snakes, 24% were Vipers and 14% were bitten by Cobra-snakes. Most of the victims I.e., 72% were bitten in the lower limbs, 26% were bitten in their upper limbs and 2% in other parts of their body. 80% of the victims were treated in Kurnool medical college attached hospital and 20% were brought dead to the hospital. Categorization of victims based on the time interval between the snake bitten and reaching to Kurnool medical college attached hospital were tabulated in the table no-3. Categorization of victims based on survival time from snake bitten to death were tabulated in the table no-4. The manner of death in the current study is accidental in all cases (100%).

Table 1: Age distribution of victims

AGE	Frequency	Percent %	Cum. Percent
Less than 10 years	2	4%	4.00%
11-20 years	9	18%	22.00%
21-30 years	10	20.0%	42.00%
31-40 years	10	20.0%	62.00%
41-50 years	10	20.0%	82.00%
51-60 years	6	12.0%	94.00%
61-70 years	2	4.00%	98.00%
71-80 years	1	2.00%	100.00%
Total	50	100%	100.00%

Table 2 : Habitation of victims

HABITATION	Frequency	Percent	Cum. Percent
Urban	4	8.00%	8.00%
Rural	45	90.00%	98.00%
Semi-Urban	1	2.00%	100.00%S
Total	50	100.00%	100.00%

Table 03 : Time interval between the snake bite and reaching to hospital

TIME2	Frequency	Percent	Cum. Percent
0 to 1 hr	3	6.00%	6.00%
– >1 to 6 hrs	35	70.00%	76.00%
– >6 to 24 hrs	4	8.00%	84.00%
– >24 hrs	8	16.00%	100.00%
Total	50	100.00%	100.00%

Table 04: Survival time after the bite

Time after bite	Frequency	Percent	Cum. Percent
Within 30 min	2	4.00%	4.00%
1 to 6 hours	8	16.00%	20.00%
6hrs-24 hrs	11	22.00%	42.00%
1-2 days	6	12.00%	54.00%
2-3 days	6	12.00%	66.00%
3-4 days	3	6.00%	72.00%
4-5 days	4	8.00%	80.00%
5-6 days	2	4.00%	84.00%
6-7 days	2	4.00%	88.00%
1 to 2 weeks	6	12.00%	100.00%
Total	50	100.00%	100.00%

Discussion

In this study, 20% of victims were aged 21-30 years, 20% were aged 31-40, 20% were aged 41-50 and 18% were aged 11-20 years. 4% were aged less than 10 years. This indicates that snake bites are common among middle-aged persons probably due to more involvement in outdoor work. Among total cases, 62% of victims were males and 38% were females. This is because in India predominantly males carry out outdoor work and risk of accidental exposure to snake bites is more common when compared to the females. Thapar R[3] et al were conducted a record-based retrospective study of clinico-epidemiological profile of snakebite poisoning cases admitted in Kasturbha Medical College, Mangalore. All the snakebite cases admitted from 2007 to 2011 were included. Results showed that 198 patients as victims of snake bite. 68.2% were males. Male: Female ratio was 2.1:1. Male preponderance was similar to the current study. The average age of patients was 34.8 years. Most of cases of snakebite were seen in age-group of 21–30 years followed by 41–50 years. 4.5% of cases were aged below 10 years, 17% were aged 11 to 20 years, 25% were aged 21-30 years, 13% were aged 31 to 40 years, 21% were aged 41 to 50 years, 12% of patients were aged 51 to 60 years, and 5% were aged above 60 years. In the study of Yogiraj et al[4], authors conducted the study for 2 years from 2010 to 2011. During this period among 1637 autopsies done, 43 were done for victims who died due to snakebite poisoning. Men: Women ratio was 1.5:1. Males constituted 60.4% of victims, Male preponderance was similar to the current study. The age of victims ranged between 01-61 years. 16.27% of victims were aged the 1-12 years of, 69.76% were aged 13-40 years and 13.95% victims were aged 41 to 61 years.

90% of the Victims were from rural localities, 8% were from urban locality and 2% were semi-urban in the current study. This implies that lack of facilities for early treatment in rural areas. Yogiraj et al[4] study and Subhash et al[5] studies were reported that most of the patients were from rural area, which is similar to the present study. In the study of Sandip B et al[6] most of the patients were from urban area, in contrast to the current study.

The victims of Among 50 Victims, 46% were Agricultural laborers, 14% were other laborers, 16%

were Students, 10% were house-wives and 14% belongs to other occupations in the current study. This implies that the victims of working in the fields (60% - 74%) are prone to snake bite because those fields are the habitats of the snakes. 16% of Victims were uneducated but 48% completed their primary education, 32% completed their higher secondary education, 4% were graduates in the current study. This implies that the victims with low education (64%) were didn't take proper precautions and wear proper footwear because of illiteracy. Navin Kumar et al[7] reported that most of the patients were doing farming, similar to the current study. 68% of patients were uneducated, 22% had primary education, 4% had SSC education, contrasting little with the present study.

In the current study most of the snake bite incidence was seen in outdoors (78%) and a similarity was observed in the study done by Ashok Kumar Shetty et al [8].

Maximum incidence was seen while doing agricultural activity (46%) followed by sleeping (22%) and walking (18%). This is because of the reason that agriculture is the main occupation in the region of the current study. People living in kuccha houses and sleeping on the floors, which are so proximity to the agricultural fields are the reasons for more incidence of cases in the present study.

Maximum number of deaths due to snake bite are (58%) during the Monsoon season, followed by winter season (24%) and comparatively less in summer season(18%) in the current study. This indicates that snake bites are more common during monsoon season because of more agricultural activity during this season when compared to winter and summer seasons. Studies of M Rajesh kumar et al [9] Gopal Shankar et al [10] , J Singh et al [11] were also in consistent with current study. Almost all the above studies were showing the same seasonal similarity as like present study and the reason may the same that the human activity in the agricultural fields is more during the monsoon season.

In the current study 6% of the victims received the treatment within an hour of snake bite, 70% of the victims received the treatment between 1-6 hours, 8% between 6 - 24 hours and 16% received the treatment after 24 hours of the snake bite. Majority of the cases (94%) are brought to the hospital after the golden hour i.e. after 1 hour of snake bite due to various reasons like lack of proper transport facilities, approachability and connectivity from the remote places to the health care facilities. The other reason in cases of bites from rural areas is approaching locally available traditional healers/ local quacks.

In the study population, 4 % of victims survived not more than one hour, 16% of victims survived for 1-6 hrs, 22% of victims had survived 6 hrs-24 hrs after the bite, 12% were 1-2 days and 10% were 2-3 days respectively in the current study. This implies that 20% cases died due to immediate effects of snake bite poisoning i.e., within 6 hours of bite and rest of 80% cases died due to complications of snake bite poisoning, i.e., more than 6 hours after bite. Navin Kumar et al [7] reported that the survival time was less than 6 hours in 45.5% of cases, 6 to 24 hours in 22.75% of cases, 1 to 3 days in 18.2% of cases and 3 to 7 days in 13.5% of cases which is in contrast to the current study in which 62% died within 6 hours of snake bite.

The manner of death in the current study is accidental in all cases (100%). Hence the percentage basing on manner of death in the current study is 100% accidental and 0% suicidal and 0% homicidal. In the study of Navin Kumar et al [7] also, all the cases (100%) of snake bites were accidental in manner.

The region or location of the body subjected for snake bite in 72% cases of current study is over the lower extremities, in 26% of cases, is over upper extremities and in 2% of cases, is over other parts of body in the current study. In the studies of Yogiraj et al[4], and Muhammad Aftab et al [12], et al majority of the patients had bites in the lower limbs, in similar to our study. In Muhammad Aftab et al [12] study most of the bites had happened in the nocturnal time in contrast to present study.

In the current study among 50 victims Sathish et al[13] et al reported that in 65.8% of victims, the type of snake was not identified by victim or surrounding members. Among identified cases, the commonest offender was viper which accounted for 31.6% of cases followed by cobra which caused 2.6% of the deaths among 38 victims. The most common snake identified was saw scaled viper followed by cobra

in Punde et al[14] study conducted research on 633 admitted patients in Mukhed, Maharashtra.

Conclusion

This study indicates that snake bites are more common among middle-aged, uneducated, male agricultural laborers working in fields during monsoon season.

The following preventive measures are advised based on the study findings:

- The surroundings of houses should be kept tidy and clean, free from prey of snakes.
- We recommend subjects to work during proper illumination, to wear protective clothing and foot wears while working in the fields and to have the facility to reach health care centre at earliest possible time.
- All the health care centers should have the stocks of anti-snake venoms and other lifesaving facilities.
- Meta-analysis of existing research and other multi-center studies of various hospitals are recommended.

Conflicts of Interest: None to declare.

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Original Research Article

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Mechanical Asphyxial Deaths: An Autopsy Based Cross Sectional Study in a Tertiary Care Hospital

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Abstract

Asphyxia is a condition caused by interference with respiration due to lack of oxygen in inspired air due to which the tissues are deprived of oxygen causing unconsciousness or death which could be due to any of the following causes such as Mechanical, Environmental or Toxic. To estimate the incidence and pattern of mechanical asphyxia deaths with epidemiological data such as age & sex wise distribution, various methods, manner, aggravating factors and substance abuse history of victim and to formulate certain measures for prevention. The autopsies of mechanical asphyxia deaths conducted at the mortuary of Government Stanley Medical College and Hospital, Chennai-01, during the period of 3months (October to December 2020).Information gathered from police inquest, postmortem reports, relevant history from relatives and friends of the deceased. During the period of study period, 581 deaths were autopsied in the mortuary, out of which 167 were of mechanical asphyxial deaths and the incidence was 28.74%. The most common form of mechanical asphyxial death was hanging (74.25%) followed by drowning (17.36%). The sex wise distributions of mechanical asphyxial deaths were most common in males 147 cases (88.02%) than females 27 cases (16.16%). Most of the deaths due to asphyxia were suicidal followed by accidental and most of the cases were suicidal hangings which is increasing day by day. With pattern of mechanical asphyxia deaths, we should also adopt certain measures for the prevention. Advised to the Public to cope up with the present scenario's causing mental stress in turn caused by unemployment, financial problems, family disputes etc.

Key words: Drowning, Hanging, Mechanical Asphyxia, Strangulation, Suffocation.

Introduction

Death is inevitable, but man and woman always try to fight against it. Modernization had made the life more stressful and hence incidence of suicide and accidents has been increased.

Asphyxia: An asphyxial death usually implies one due to mechanical blockage of the air passages. Asphyxia is a condition caused by interference with respiration due to lack of oxygen in inspired air due to which the tissues are deprived of oxygen causing

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unconsciousness or death and due to any of the following causes – Mechanical, Environmental, or Toxic.

Mechanical asphyxia: The term mechanical asphyxia is here applied to circumstances in which mechanical interference either (a) impedes access of air to the lungs or (b) reduces the blood supply to the head and neck or (c) causes sudden cardiac arrest due to stimulation of the carotid sinus – Vagal reflex mechanism. Example: Hanging, Strangulation, Drowning and Suffocation etc.

This study attempts to estimate the incidence and pattern of mechanical asphyxial deaths with epidemiological data such as age & sex wise distribution, various methods, manner, cause & precipitants and substance abuse history of victim and to formulate certain measures for prevention.

Materials and Methods

An autopsy based cross-sectional study performed in the department of Forensic Medicine, Stanley Medical College Hospital, Chennai during the study period from October 2020 to December 2020.

The details of the incident given by the relatives of the deceased were taken and the detail analysis of police inquest was done. Information collected from various sources like hospital case sheets, post mortem reports, inquest reports, FIR reports, and importantly information collected from the investigating officer, relatives and friends of the deceased accompanying the dead bodies.

All data regarding age, sex, religion, socioeconomic status, marital status, demographic area, occupation, and circumstances of death which includes the nature of incidence, precipitating cause, the time of occurrence, the time of death and the cause of death were collected from the police inquest report and FIR. Thorough detailed interviews of the friends, relatives, neighbors and police officials accompanying the dead bodies, also has to be done and finally the results were analyzed.

Observations and Results

A. Incidence of asphyxial death: Regarding the incidence of asphyxial death cases, out of the 581 cases being autopsied in mortuary, 167(28.74%) cases were of deaths due to asphyxia.

Table 1: Incidence of mechanical asphyxial death

Total Deaths	Mechanical Asphyxial Deaths	Other Deaths	Percentage Of Mechanical Asphyxial Deaths
581	167	414	28.74

B.Various methods of asphyxial deaths: The incidence of various asphyxial deaths was recorded. Out of 167 asphyxial death cases, hanging (74.25%) was found to be the commonest and out of 124 cases, 101 cases of were male and 23 cases were female. Next to hanging, drowning was the next common of all mechanical asphyxial deaths and out of 29 drowning cases (17.36%), 27cases were male. 3 cases were died due to strangulation with male preponderance and 3 cases were died due to aspiration and all were males.

Table 2: Type of Mechanical Asphyxial Deaths

S. NO.	TYPE OF MECHANICAL ASPHYXIAL DEATHS	MALE	FEMALE	PERCENTAGE
1	Hanging,	101	23	124 (74.25%)
2	Drowning.	27	2	29 (17.36%)
3	Strangulation	2	1	3 (1.79%)
4	Gagging	0	0	0 (0%)
5	Positional asphyxia	1	0	1 (0.59%)
6	Traumatic asphyxia.	3	0	3 (1.79%)
7	Choking	1	0	1 (0.59%)
8	Aspiration	3	0	3 (1.79%)
9	Suffocation.	1	0	1 (0.59%)
10	Smothering	1	1	2 (1.19%)
	TOTAL	140	27	167

C. History of substance abuse: 102 victims (61.07%) did not have any habit of taking either tobacco or alcohol or any other drugs; 23 victims (13.77%) used to take alcohol only, 17 (10.17%) victims used to take both smoking and pan masala and 11 victims (6.58%) were addicted to alcohol, tobacco and betel nut and also 2% of victims used to take drug abuse.

Table 3: Number of cases with history of substance abuse:

CATEGORY	NO OF CASES WITH HISTORYOF SUBSTANCE ABUSE	PERCENTAGE
Alcohol	23	13.77%
Alcohol + betel nuts	3	1.79%
smoking	6	3.59%
Smoking + betel nuts	17	10.17%
Alcohol + smoking + betel nuts	11	6.58%
Drug abuse	2	1.19%
Combined	3	1.79%
Nil	102(<20 years-29; others-73)	61.07%
Total	167	99.95%

D. Manner of death: Out of 167 asphyxial deaths, Suicidal deaths constitute the maximum number. It is observed from the table that among the 128 suicidal cases, 104 cases were male comprising 81.25% and 24 cases were female comprising 18.75%. In suicidal deaths, majority of cases were died due to hanging. Among 34 accidental deaths, 24 cases were drowning (85.29%), 3 cases were aspiration (8.82%) and 3 cases were traumatic asphyxia(8.82%). Out of 5 homicidal cases, 3cases were died due to strangulation. In homicide, one case of smothering and one case of drowning were reported.

Table 4: Incidence of manner of death in different types of mechanical asphyxia deaths:

S. NO.	TYPE OF MECHANICAL ASPHYXIAL DEATHS	SUICIDAL		HOMICIDAL		ACCIDENTAL		TOTAL
		M	F	M	F	M	F	
1	Hanging	101	23	0	0	0	0	124
2	Drowning	3	0	1	0	23	1	29
3	Strangulation	0	1	2	1	0	0	3
4	Gagging	0	0	0	0	0	0	0
5	Positional asphyxia	0	0	0	0	1	0	1
6	Traumatic asphyxia	0	0	0	0	3	0	3
7	Choking	0	0	0	0	1	0	1
8	Aspiration	0	0	0	0	3	0	3
9	Suffocation.	0	0	0	0	1	0	1
10	Smothering	0	0	0	1	1	0	2
	TOTAL	104	24	3	2	33	1	167

E. Cause and precipitants: Out of 167 deaths due to mechanical asphyxia, depression was the main causative factor in 58 deaths. Acute & chronic illness were played major role in the causative factor in 15 deaths, not specified history noted in 28 deaths, work pressure in 4 deaths, family dispute in 1 death and financial problems in 22 deaths.

Table 5: Cause &Precipitants vs Sex wise distribution of mechanical asphyxia deaths:

S. NO.	MOTIVE	MALE	FEMALE	TOTAL
1	Family Disputes	1	0	1
2	Depression	49	9	58
3	Work pressure	3	1	4
4	Not Specified History	23	5	28
5	Illness (acute & chronic)	11	4	15
6	Financial Problems	16	6	22
7	Affairs	0	1	1
8	Mental Status	4	0	4
	Total	107	26	133

Discussion

An autopsy based cross-sectional study was performed in the department of Forensic Medicine, Stanley Medical College Hospital, Chennai during the study period from October 2020 to December 2020 to estimate incidence and pattern of mechanical asphyxia death. Out of 581 autopsies, 167 cases were mechanical asphyxia deaths. This present study showed wide similarities and dissimilarities with other authors studies.

The incidence rate of asphyxial death in the present study is found to be 28.74%. Singh A et al[1], Palimar Vikram et al[2], Chaurasia N, Pandey SK et al[3], and Dhillon Sangeet et al[4]who observed slightly lower incidence of asphyxial deaths in their study. Choudhury BL et al[5], Patel-A et al [6]and Azmak D et al [7]observed slightly higher incidence rate of asphyxial death. The reason for variation in the incidence of asphyxial death in the different parts of world may be due to cultural, ethnic, geo-graphical and genetic difference.

In present study most common mode of death due to mechanical asphyxia is hanging (74.25%) followed by drowning (17.36%). Other mode were strangulation (1.79%) and throttling (1.79%) and choking (0.59%). Similar results were reported and endorsed by Chourasia et al[3] i.e: hanging (75.01%), drowning (22.79%), smothering (1.48%) and strangulation (0.74%). Study of Kanchan et al[15] were also reported more or less similar findings and these findings were endorsed my view of study findings. Study at mortuary of RCSM GMC Kolhapur was showing that hanging (58.55%) followed by drowning (39.90%) and other mode of deaths due to asphyxia were strangulation (1.03%) and throttling (0.5%). The findings of the present study were also similar with the several workers like Singh B et al[12], Momochand A et al[13], Azmak D[7], Palimer Vikram et al [2], Chaurasia N, Pandey SK et al[3], Choudhury BL et al [5] and Patel Ankur et al[6] in which hanging constitutes the majority of cases. In present study, there was no fracture of hyoid in hanging cases. Gagging was not reported in present study.

In this study, maximum incidence of asphyxial deaths was seen in age group from 31- 40 years, 21-30 and then in 11-20 years of age, contributing 25.74%, 22.75% and 14.37% of the total asphyxial deaths respectively. It clearly indicates that young adults are the main victims of asphyxial deaths. Out of 167 deaths 140 were male (83.83%), 27 were female (16.16%). It shows preponderance of male sex over female in mechanical asphyxial deaths. Males were the most common victims with male to female ratio being 2.5:1. The findings of the present study are similar with the study of study of Copeland AR et al [8], Auer A et al [9], Majumder BC et al[10], Lalwani S et al[11], Chaurasia N et al[3] and Patel-A et al[6]i.e: young adults are the main victims of asphyxial deaths and males were the most common victims.

In the present study, majority of the victims were in illiterate level followed by middle school level and primary level. Least affected group were in high school level and intermediate/diploma level. Number of illiterate people committing suicide is also high, poverty and struggles for survival being the main reason among this group of people which increased the number of incidences of suicide among them.

In the present study, 76.64% of mechanical asphyxial deaths were suicidal followed by accidental (20.35%) and homicidal (2.99%). All the cases of strangulation were homicidal whereas all the cases of choking were accidental. The present study is similar with the findings of Davidson A, Marshall TK et al [17], Majumder BC et al [10], Lalwani S et al[11], Azmak D et al [7], Kanchan T, Rastogi P et al[15], Chaurasia N, Pandey SK et al[3] , Patel Ankur et al[6] and Musaib Mohammed Shaikh M et al[18]

Alcohol abuse may lead to suicidal tendency through disinhibition, impulsiveness and impaired judgement. Compared to other substance abuse, alcohol played major role in association with occurrence of mechanical asphyxial deaths (hanging). The findings were endorsed by Choudhury BL et al [5]

In this study no deaths were reported due to sexual asphyxia among male and females. In this study, main causative factor was depression followed by financial problems. There were no specified/ relevant history mentioned in 28 cases. In females, depression was the leading causes where as in males, depression, ill health, financial crisis and mental status and family disputes were leading causes. The findings were endorsed by Palimer Vikram et al [2], Chaurasia N, Pandey SK et al[3], Choudhury BL et al [5] and Patel Ankur et al[6]

Conclusion

In the present study, suicidal deaths as a result of hanging and accidental deaths as a result of drowning seems to be the major contributing causes of asphyxial deaths. Hence the numbers of suicidal hanging cases are increasing day by day. Both these manners of deaths, somehow, indicates frustration and carelessness on the part of population which are preventable and needs to be rectified on urgent basis. A well designed and comprehensive mental health programs are needed to identify the causative factors and prevention of suicidal behaviors. Measures to improve the socioeconomic conditions through reforms in the fields of education, health, increase in employment opportunities are expected to lessen the existing stress and strain of the society. Advised to the Public to cope up with the present scenario's causing mental stress. They may be resolved by simple means of discussing and sharing facts with close friends, family members and colleagues and do practicing meditation, Yoga etc, to relieve mental stress and its consequences. This in turn will help to decrease the incidence of suicidal, homicidal or accidental cases of asphyxia. Drowning prevention strategies should be comprehensive and include: engineering methods which help to remove the hazard, legislation to enforce prevention and assure decreased exposure, education for individuals and communities to build awareness of risk and to aid in response if a drowning occurs, and prioritization of research and public health initiatives to further define the burden of drowning worldwide and explore prevention interventions.

Conflict of interest if any: NA

Privacy / Confidentiality of the study subjects: Will be maintained.

Sponsor details: NA

Compensation: NA

Insurance: NA

Ethical Clearance: Obtained from Institutional

Ethics Committee: Stanley Medical College, Chennai -1 dated 12.12.2019.

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