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# Genital Lichen Sclerosus Mistaken for Child Sexual Abuse and Genital Mutilation

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## Abstract

Child sexual abuse is a severe and widespread problem across the globe. The sexual exploitation of children is incomparable whose dynamics are very unusual to that of adult sexual abuse and hence should be handled and investigated differently. Failure to misdiagnose sexual abuse can expose the children to the risk of further abuse and may lead to serious consequences. This case report describes the forensic examination of a 17-year-old girl who primarily presented to the obstetrics and gynecology department with complaints of episodic acute urinary retention and difficulty in passing urine. While evaluating her, the primary physicians observed complete adhesion and fusion of labia majora. This unusual presentation made the examining physicians suspicious of genital mutilation and child sexual abuse. The examination revealed that the labia majora was less appreciable and was fused like parchment-like skin with no visualization of labia minora, clitoris, hymen and vaginal opening. There were no fresh signs of injuries to the anogenital region and no evidence of any surgical procedure done in the recent past suspected to be of genital mutilation. The local examination findings and absence of signs of trauma or surgical scar marks disproved the suspicion of genital mutilation and sexual abuse. The patient's condition was diagnosed with lichen sclerosus et atrophicus, causing genital labial sclerosis. The attending physicians often mistake such conditions as signs of suspected sexual abuse and if not correctly identified, may invite unwarranted child abuse inquiry by law enforcement authorities.

**Keywords:** Forensic examination, lichen sclerosus, complete labial fusion, child sexual abuse, genital mutilation.

## Introduction

Child sexual abuse is a severe and widespread problem across the globe. The exact prevalence of CSA is not known; however, a recent systematic review of

55 studies from twenty-four countries has found that in females and males, it ranged from 8 to 31% and from 3 to 17% respectively<sup>1</sup>. In India, CSA is highly prevalent, adversely affecting children's health with

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an estimate that about 10-55% of boys and 4-41% of girls attending schools and colleges have experienced at least one form of CSA<sup>2</sup>. To address this issue, the Government of India passed the much-needed law The Protection of Children from Sexual Offences Act (POCSO), in 2012. This law provides penal provisions for many actions which include sexual assault, exploitation for pornography and aggravated sexual assault involving children less than 18 years of age. The act also mandates the setting of Special Courts to expedite the trials in such offences. The relevant role of medical and health professionals is mentioned in the POCSO Act, of 2012. It ranges from reporting the case to the police, taking history, documenting the injuries, confirming sexual abuse, providing medical care, collecting forensic evidence and testifying in a Court of law<sup>3</sup>.

The sexual exploitation of children is incomparable whose dynamics are very unusual to that of adult sexual abuse and hence should be handled and investigated differently. It is said that in children disclosure of sexual abuse does not occur immediately after the incidence rather it occurs during a process rather than a single incidence often initiated after a complaint or a behavioural change<sup>4</sup>. Failure to misdiagnose sexual abuse can expose the children to the risk of further abuse. Similarly, serious consequences arise when sexual abuse is misdiagnosed in a child, like removing the child from parental care to foster care, prosecution of an innocent person, unnecessary medical examination, diagnostic evaluation and unpleasant police investigations. Many skin conditions of the genitalia can mimic signs of sexual abuse in children leading to erroneous diagnoses. Streptococcal infection, poor hygiene, vaginitis, and lichen sclerosis can produce redness, fissures, inflammation, vaginal bleeding, and hypopigmentation around the genitalia region are often misdiagnosed as evidence of genital abuse<sup>5</sup>.

This case report illustrates a rare case of complete labial fusion in an adolescent unmarried girl primarily referred by obstetric surgeons for forensic opinion with an initial impression of sexual abuse and genital mutilation. The rare presentation of genital labial sclerosis due to Lichen Sclerosus [LS], in this case, posed a confusing problem in its diagnosis and subsequent management. A search of

the literature revealed very few cases where LS was mistaken for sexual abuse in children<sup>6-11</sup>. Failure to recognize the underlying disorder may initiate a child abuse inquiry by law enforcement authorities, thereby causing resentment and distress. The present case is probably the first to be reported from India.

### Case Report

A 17-year-old unmarried girl presented to the Department of Obstetrics and Gynaecology with complaints of difficulty passing urine (thin stream of urine) with episodic acute retention of urine for the past two years. She had one episode of urine retention previously, which was relieved in a private hospital following catheterization. According to her parents, the child had a history of eruptions and pruritis in labia majora, which were relieved after medication. The patient had her menarche at the age of 12 years and had normal external genitalia since birth.

On examination, adhesion and fusion were present in the whole of labia majora with a single pinpoint opening at the midline for urinary and menstrual blood discharge. Ultrasonography (USG) revealed a trabeculated thick wall urinary bladder suggestive of chronic outlet obstruction. The ovaries and uterus were normal. The examining physicians were baffled by the absence of the typical structures of female genitalia like labia minor, hymen, clitoris, vaginal and urethral opening. Instead, a tiny orifice was seen discharging foul-smelling pus. The unusual presentation made the examining physicians suspicious of genital mutilation type III and sexual abuse, and the case was referred for forensic opinion.

After taking informed written consent, a forensic examination was done where the patient denied any history of sexual intercourse or assault or genital mutilation. There were no injuries on the body of the child. Local genital examination revealed that labia majora was ill-developed and was fused like parchment-like skin. Labia minora and vaginal orifice were not visualized [**Fig. 1**]. A single pinpoint opening was present in the midline. A delimited, whitish, and atrophic area of skin near the thighs, the perineum and the perianal region, was appreciable. Furthermore, the anus and perineal region showed no signs of harm. There was no evidence of new or old injuries to the external genitalia. Also, there

was no evidence of any operative procedure done in the recent past. Given the history elicited by the patient and parents and local examination findings, forensic opinion was restricted to diagnosing it as genital malformations ruling out the diagnosis of genital mutilation and abuse. Against the backdrop of all the results, the diagnosis of LS was established and confirmed by the Dermatologist. The patient was operated on for adhesiolysis, labioplasty and clitoroplasty with skin grafting by Plastic surgeons restoring her normal genitalia [Fig.2]. Later the patient was discharged after successful treatment and attended routine follow-up in the OPD of the hospital.



**Figure 1: Complete labia majora fusion and a small pinpoint opening in the midline.**



**Figure 2: External genitalia showing labia majora with draining catheter in-situ after operation**

## Discussion

The case presented here demonstrates the atypical presentation of LS in a child affecting the genital region, thereby mistakenly diagnosed as a case of sexual abuse and genital mutilation. It also demonstrates the often widespread uncertainty of attending physicians with the diagnosis of LS. Lichen sclerosus et atrophicus (LSA) or LS is commonly misdiagnosed as a chronic progressive inflammatory disease of the vulvovaginal area with unclear aetiology. However, some newer evidence suggests a possible auto-immunogenicity process or genetic predisposition in its aetiology mainly affecting dermal and epidermal tissues of the anogenital region<sup>12-16</sup>. It predominantly affects postmenopausal women with children accounting for just 10-15% of all instances<sup>17</sup>. It is characterized by whitish, hypopigmented areas of skin in the anogenital region<sup>6</sup>.

Itching is the most common symptom of LS. Still, vulvar pain, dysuria, persistent constipation, recurring ecchymoses, and bloodstaining of the underpants are all possible signs, but the vagina and hymen are unaffected<sup>7-9,18-19</sup>. Due to the chronic course, patients can develop sclerotic plaques, labial fusion, ecchymoses, genital atrophy, contraction and stenosis of the urinary tract and the vaginal orifice<sup>6, 20-21</sup>. When LS affects a girl's vulva, the skin becomes thin, fissured, and easily damaged by little pressure or friction, leading to haemorrhages and contusions. This finding may be misinterpreted as injury, particularly sexual assault, and may lead to false allegations and hostile investigations<sup>17</sup>. Contrasting to sexual assault trauma, the hymen is intact and not involved in LS<sup>17-18</sup>. Though it's dangerous to diagnose LS avoiding misinterpretation of sexual assault in children, it is vital to understand that the two diagnoses are not mutually exclusive<sup>10,20,22</sup>. When needed, a comprehensive laboratory and multidisciplinary evaluation to rule out sexual abuse are required. Hymenal trauma is a crucial indicator of sexual abuse, independent of the kind of abuse<sup>11</sup>.

The second diagnosis suspected by the primary physicians, in this case, was that of female genital mutilation. Female circumcision (FC) or female genital mutilation (FGM) describes practices that manipulate, alter, or remove the external genital organs in young girls and women for non-medical

reasons<sup>23-24</sup>. There are four different types of FGM as per the WHO classification, and the current estimates indicate that around 90% of cases include Type I, II and IV, and about 10% are Type III<sup>25</sup>. Usually, women carry out these procedures with no medical training using tools such as scissors, knives, scalpels, pieces of glass and razor blades without using anaesthesia or antiseptic treatment. However, these procedures in recent years have been carried out in healthcare settings by trained healthcare personnel<sup>26</sup>. A visual reference tool is provided for healthcare workers to diagnose the types and subtypes of FGM.<sup>27</sup> In India, the custom of FGM and FC is commonly practised in the Bohra community, and is referred to as “Khatna” or “Khafz/Khafd”. The process involves cutting the tip of a girl’s clitoris usually at the age of 6-7 years, generally done by a traditional cutter or “semi-religious mullanis” or any experienced woman<sup>28,29</sup>.

In the present case, the aid of a forensic physician was rightfully requested since the primary care physicians could not explain the findings and misdiagnosed the genital labial sclerosis as child sexual abuse and genital mutilation. However, subsequent forensic examination disproved this diagnosis owing to the lack of signs of fresh or old anogenital injuries and the absence of surgical scar marks over the external genitalia. The history elicited by the patient and her parents also helped in excluding the diagnosis of sexual abuse and genital maiming. The patient was not reported to the legal authorities because the work-up revealed no evidence of sexual abuse, and the diagnosis was confirmed as Lichen Sclerosus subsequently by the hospital dermatologists.

In lichen sclerosis et atrophicus, the skin becomes thin and easily damaged, increasing the susceptibility to trauma. Minor injuries and bruises may be magnified and can raise suspicion of possible childhood sexual abuse<sup>11</sup>. Trauma to the hymen is an essential marker in identifying if sexual abuse has occurred or not, regardless of the presence of lichen sclerosis<sup>8</sup>. The lack of awareness in diagnosing this condition in children often leads to confusion and notifying it as CSA by the healthcare providers, frequently leading to sexual abuse investigations, which are highly traumatic for the child and everyone involved<sup>6,9,30</sup>. These suspicious lesions warrant

appropriate investigation, which can be distressing for all concerned involved in paediatric care. Failure to identify these lesions of lichen sclerosis et atrophicus can lead to unsuitable forensic investigations.

## Conclusion

The present case demonstrates many skin conditions of the genitalia can mimic signs of sexual abuse in children leading to erroneous diagnosis, in this case, LS. The implications of identifying child abuse are reasonably well understood from a forensic standpoint however misdiagnosing them will cause unnecessary child sexual victimization. In the worst-case scenarios, criminal prosecution might result in the unjustified imprisonment of suspects. The present case report substantiates that a multidisciplinary approach in the examination is needed to confirm the accurate diagnosis in such a confusing presentation of illnesses to avoid painful legal investigations. Since physical force is seldom inflicted, the conclusive signs of genital trauma are rarely seen in child abuse cases and accurate interpretation of genital findings requires specialist training, and wherever possible, experts in this field should be consulted.

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**Authors Contribution:**

1. Dr Amit Patil - supervised forensic examination, draft manuscript writing, literature review, editing, finalization of the manuscript.
2. Dr Mukta Agarwal - primary care physician, examined and operated on the patient.

3. Dr Prabhat Kumar – performed the forensic examination.
4. Dr Himanshi Narang – assisted in the forensic examination, manuscript writing, and literature search.
5. Dr Shashank Ranjan – assisted in the manuscript writing and literature search.

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# A Case Report of Complex Suicide in a Pregnant Female

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## Abstract

Planned complex suicide constitutes a very rare mode of suicide. They are highly likely to be mistaken for murder. We report a case of a 22-year-old female that was brought dead to RIMS mortuary after being reported dead at her home. An Autopsy conducted showed a ligature mark which was suggestive of hanging. Greenish-colored fluid in the stomach with wall congestion at places with erosions and bleeding suggestive of Copper Sulphate poisoning (paint ingestion). An in-utero dead fetus was also found when the enlarged uterus was thoroughly examined. Suicides and suicide attempts are a big public health problem that have progressed in the last two decades and are ever increasing since then. Planned complex suicides, therefore indicate the mental dropout of individuals and social failure. Role of depression hovering around people nowadays cannot be denied. When people die committing such suicide, surviving family is left with shock, anger, grief, symptoms of depression and anxiety and may even experience thoughts of suicide themselves.

**Keywords:** Suicide, Hanging, Poisoning

## Introduction

Suicide is among the top 10 leading causes of death in individuals of all ages. In 1974, Marcinkowski et al. suggested a general division of suicide patterns, namely Simple versus Complex.<sup>1</sup> Complex Suicide is defined as a combination of methods used to achieve death. Complex suicides are categorized into -Planned and Unplanned. In planned complex suicides, previously planned 2 or more methods with high mortality rates are used at the same time to ensure death even if one of the methods fails. Most of the cases of complex suicides mimic homicide.<sup>2</sup> So, proper history, meticulous crime scene investigation and carefully performed autopsy are vital to ascertain

the manner of death. Genetics and early environment challenges are linked to suicidal behavior and increased attitudes toward death. The combination of corrosive substance intake and hanging is unique, unusual, and potentially more fatal as both are sufficient to cause death individually.

## Case Report

In the present study, a 22-year-old married female victim, was brought to the Trauma Centre emergency room of RIMS, RANCHI, Jharkhand from her in-law's house. She was declared brought dead and the body was kept in RIMS mortuary. The next day, the autopsy was conducted after proper history was taken

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from her husband, father as well as father-in-law. The autopsy revealed a 2-3 cm wide ligature mark around the neck. Cutting the esophagus, it revealed bleeding from diffused sites. The stomach had greenish-blue colored fluid, around 150 cc by volume. The mucosa of the stomach had congestion and erosions at places. An in-utero dead fetus (of about 24 weeks) was also found when an enlarged uterus was cut open and examined. So, it was concluded that the victim died of Copper Sulphate Poisoning and Hanging.



**Fig 1: Continuous Ligature mark all around the neck suggestive of Hanging.**



**Fig 2: Froth coming out of both the nostrils facial congestion and cyanosis of lips.**



**Fig 3: Greenish-blue fluid in stomach with its extension till small intestine. Mucosa is congested and eroded at places.**



**Fig 4: 24 weeks dead foetus found inside the gravid uterus.**

### Discussion

**GENDER AND AGE** - In this case, the sex of the victim was female, though commonly complex suicide cases are presented by males. But this case is unique as a female has employed two violent methods of suicide. The age group of the case is young adults (22 years), which marks an age of prompt slapdash thoughts and short temper.<sup>3</sup>

**Scene** - This occurred at the victim's in-law's house.

**Suicide notes and suicide attempts** - A suicide note is one of the most important pieces of evidence in differentiating a murder or a suicide in complex suicide deaths. But in this case, no suicide note was recovered. A history of previous suicide attempts is also vital to give an opinion on Homicide-Suicide in such cases. In this case, no such attempt was made by the victim previously.

**Psychiatric illness or motivational factors** - In this study, the victim was in a state of chronic depression, and her depressive episodes aggravated after pregnancy. Moreover, she was ill-treated by her husband and they were poverty stricken too. So, fear of future of child to be born became a motivational factor for this planned complex suicide.

**Differential diagnosis b/w suicide and homicide** - In this study, there was no evidence of violence (e.g.- Défense Wounds). There was no evidence of any mechanical injury, externally or internally. There is also a history of psychiatric illness, which is a fundamental factor for complex suicides. So, this is a case of planned complex suicide.

## Conclusion

Planned complex suicides are unusual, mostly fatal yet preventable. We should never overlook the past attempts of suicide and suicidal thoughts shared with near ones. High-risk factors like Mental Illness, chronic disease, history of torture, mental or physical harassment, and drug abuse must be identified and addressed seriously at the family and societal levels.<sup>4-9</sup> Moreover, many different combinations of suicide methods are employed in a complex suicide.<sup>10</sup> So, it is also important to perform a comprehensive autopsy to correctly determine the cause of death, which may otherwise potentially be mistaken as murder.

In conclusion, the phenomenon of complex suicides in pregnant females represents a deeply distressing intersection of mental health struggles, societal pressures, and the unique vulnerabilities associated with pregnancy. These cases underscore the urgent need for comprehensive mental health support systems that cater specifically to pregnant individuals, addressing not only their psychological well-being but also the complex interplay of social, economic, and familial factors that contribute to their distress. It is imperative for healthcare professionals, policymakers, and communities to recognize the signs of mental health challenges in pregnant women and provide timely interventions and support networks to mitigate the risk of complex suicides. Furthermore, fostering open dialogue and reducing the stigma surrounding mental health issues in pregnancy is crucial in creating a supportive environment where individuals feel comfortable seeking help without fear of judgment or condemnation. By prioritizing holistic care and proactive intervention strategies, we can strive towards a future where tragedies stemming from complex suicides in pregnant females are minimized, and every individual receives the care and support they need to navigate the challenges of pregnancy and mental health with resilience and hope.

### AVAILABILITY OF DATA AND MATERIALS

All the data that was presented, mentioned, and analysed in this research is available upon request in the Forensic Record Book as well as the Postmortem Report Record in the Department of FMT, RIMS, Ranchi, Jharkhand. The medicolegal reports are not publicly available due to their private/legal nature but may be provided upon request.

## Ethical Clearance: Not required

Informed consent was taken from the deceased relatives for publication and images.

## Conflict of Interest: None

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# Postmortem Analysis of Lethal Honeybee Stings: A Case Report

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## Abstract

The deceased, a 55-year-old male, arrived at our mortuary after succumbing to multiple honeybee stings. Initial examination disclosed pronounced facial swelling and urticarial eruptions. The deceased, who was engaged in gardening, experienced a rapid onset of symptoms following numerous bee stings. Surprisingly, his medical history showed no prior severe allergic reactions to bee stings. This suggested an acute anaphylactic response, highlighting the unpredictability of such reactions. The absence of previous hypersensitivity underscores the sudden and fatal nature of the incident, emphasizing the need for prompt medical intervention in cases of unexpected severe allergic reactions.

**Keywords:** Honeybee stings, Anaphylaxis, Autopsy, Case Report

## Introduction

Lethal outcomes following honeybee stings are rare but pose a significant public health concern, warranting comprehensive postmortem analysis to elucidate contributing factors and improve forensic understanding.<sup>[1]</sup> While honeybee stings are generally innocuous, severe allergic reactions leading to fatality remain an infrequent yet critical manifestation <sup>[2]</sup>.

According to epidemiological data from the World Health Organization (WHO), an estimated 1-2% of the global population exhibits severe allergic reactions to insect stings, with honeybees being one of the primary culprits <sup>[3]</sup>. Furthermore, honeybee-related fatalities have been reported across various regions, with notable incidence rates in areas of high beekeeping activity or where honeybee populations thrive. For instance, in agricultural communities heavily reliant

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on beekeeping for pollination services, occupational exposure to honeybee stings may contribute to an increased risk of severe reactions and adverse outcomes [4]. The scarcity of detailed postmortem investigations in such cases underscores the need for a focused exploration into the pathological and toxicological aspects. We present a case report detailing the tragic consequences of an individual subjected to multiple honey bee stings, resulting in a fatal outcome.

#### Postmortem examination:

Rigor mortis was present all over the body. Postmortem staining was present on the back of the body. Multiple bee stings (more than 100) on face (**figure-1**) and exposed parts of neck and hands were present. Diffuse edema, erythematous patches were present over the affected areas. Soft tissue edema observed in epiglottis area and laryngeal mucosa during internal examination leading to significant laryngeal obstruction (**figure-2**). Pleural and peritoneal fluids were present. The lungs were congested and edematous (right lung 1124g; left lung 1104 g). The kidneys showed congestion.



**Figure-1: Multiple bee stings (more than 100) on face**



**Figure-2: Soft tissue edema observed in epiglottis area and laryngeal mucosa**

#### Cause of death:

Asphyxia from upper airway edema following acute anaphylactic shock from several honey bee stings was determined to be the cause of death.

#### Discussion

The comprehensive postmortem examination of individuals who have succumbed to honeybee stings unveils significant external and internal gross findings indicative of fatal reactions. External examination typically reveals multiple bee sting puncture wounds distributed across exposed skin surfaces, often concentrated around the head, neck, and extremities. These findings align with the characteristic defensive behavior of honeybees and provide valuable circumstantial evidence of exposure [5]. Internally, gross examination frequently reveals signs of acute anaphylaxis, including diffuse tissue edema, pulmonary congestion, and hemorrhage. Notably, the presence of airway obstruction due to laryngeal edema or bronchospasm may be evident, further corroborating the diagnosis of fatal allergic reaction [6]. The observed soft tissue edema suggests localized inflammatory responses in the upper airway, contributing to the pronounced symptoms [7]. The patent airways and moderate fluid collections indicate a rapid and severe systemic reaction [8]. The congested and edematous lungs signify respiratory distress, a common consequence of anaphylaxis [9]. Kidney findings may suggest circulatory compromise [9, 10]. The absence of known allergies reinforces the sudden and unpredictable nature of severe reactions to honeybee stings [9, 10].

#### Conclusion

This case underscores the potential severity of multiple honey bee stings, emphasizing the need for heightened awareness and prompt medical intervention. The postmortem findings provide valuable insights into the complexities of severe bee sting reactions. This report aims to contribute to the understanding of such cases, facilitating improved recognition, and management, ultimately aiming to prevent similar tragic outcomes. The absence of a documented history of bee sting allergies underscored the unexpected and severe nature of the reaction. These postmortem findings contribute

to our understanding of lethal honeybee stings and inform forensic protocols for similar cases.

### Learning objectives:

Swift identification of anaphylaxis, especially in the absence of documented allergies, is crucial for effective intervention.

Thorough diagnostic evaluation, including allergen-specific testing and postmortem analysis, is essential for accurate cause-of-death determination.

Forensic investigations, guided by detailed postmortem analysis, contribute significantly to understanding and refining protocols for fatal honeybee stings.

Tailoring treatment strategies based on individual patient characteristics enhances the management of severe anaphylactic reactions.

Ongoing medical education for healthcare professionals and public awareness campaigns are vital for preventing and managing fatal outcomes following honeybee stings.

**Conflicts of interest:** Nil

**Informed Consent:** Informed consent was obtained after explaining the purpose of research to the family member.

**Source of funding:** None

**Ethical Clearance:** Not required as it is a case report.

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## Splenic Epithelial Cyst: A Rare Entity on Autopsy

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### Abstract

**Introduction:** Splenic cyst is a rare entity with very few cases reported in literature. The diagnosis is usually incidental on autopsy, associated with symptoms due to enlargement, rupture, infection, or hemorrhage. It can be of two types - parasitic or nonparasitic cyst.

**Case Report:** Postmortem viscera of 33 year old male were received in the department of Pathology for histopathological examination. Grossly, an enlarged spleen weighing 180 gm and measuring 9x8x6 cm was identified. On cut section, an eccentric unilocular cyst measuring 7x6 cm was identified. The cyst was filled with brownish mucoid material and thickness of cyst wall was 0.1-0.2 cm. Microscopically, the cyst wall was lined by cuboidal epithelium with fibrocalcified wall.

**Conclusion:** Primary splenic cyst is a rare diagnosis. Although the diagnosis of splenic cyst can be established by radiological means, histopathology is mandatory to determine whether the cyst is primary or secondary in origin.

**Keywords:** Autopsy, epithelial cyst, spleen.

### Introduction

Cystic disease of the spleen is a relatively rare entity usually encountered incidentally at time of autopsy having an incidence of 0.07%.<sup>1</sup> It may account for 30% of all splenic lesions and can be congenital, neoplastic, vascular, inflammatory or posttraumatic in origin.<sup>2</sup> Splenic hydatid cyst is the most common cystic lesion in spleen with an incidence of 0.5-4%.<sup>3</sup>

The mean age of presentation of splenic cyst is approximately 17 years with a slight female

preponderance. Nearly 80% of these cases are solitary, unilocular cysts at the time of initial presentation. The diagnosis is usually incidental on autopsy and it is associated with symptoms due to enlargement, rupture, infection or hemorrhage.<sup>4</sup>

The splenic cysts can be classified as secondary (pseudocyst) or primary (true) cysts. Also, primary cysts are further classified as parasitic and nonparasitic. About 10% of all splenic cysts are nonparasitic primary splenic cysts which are usually

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congenital in origin. Pseudocyst lacks an epithelial layer in the cystic lumen and is primarily induced by abdominal trauma. A true splenic cyst is one having an epithelial lining which are further categorised as epidermoid, dermoid or mesothelial types based on the type of lining. The luminal lining of true cyst is epithelial which can be readily be misidentified for endothelium. This diagnostic dilemma can be resolved by use of immunohistochemical stains like keratin and factor VIII. True splenic cyst lining is positive for keratin and negative for factor VIII.<sup>5,6</sup>

True cysts and false cysts are typically identical on various imaging modalities like ultrasonography (USG) or computed tomography (CT) scan. Although pseudocyst typically have thicker fibrous walls, calcifications and internal debris and CT scan may give a relatively clearer picture regarding intracystic fluid, internal septations or calcifications. Final diagnosis is made using histopathological evaluation of the cyst wall lining only.<sup>7</sup>

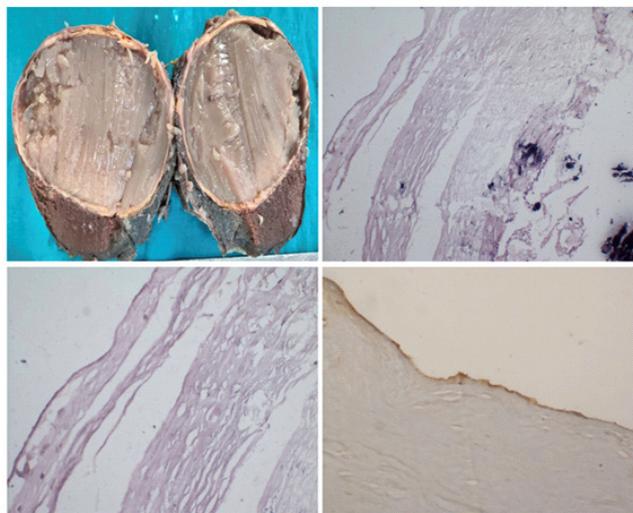
Here, we report a rare case of epithelial splenic cyst diagnosed incidentally at the time of autopsy

### Case Report

Post mortem viscera of a 33 year old male was received in the department of Pathology for histopathological examination. No significant past history or investigations were available in the post mortem papers. Pieces of both lungs, liver, spleen and both kidneys were received. Grossly, an enlarged spleen was identified weighing 180 gms and measuring 9x8x6 cm. On cut section, an eccentric unilocular cyst measuring 7x6 cm was identified with cyst wall thickness of 0.1 cm. The cyst was filled with brownish mucoïd material. No abnormality was identified in other visceral organs on gross examination.

Microscopic examination initially revealed fibrocollagenous tissue only. Following which extensive sampling was done which revealed cyst focally lined by flattened epithelial lining with fibrocalcified wall. The epithelial cells were positive for cytokeratin on immunohistochemistry. Surrounding splenic tissue was unremarkable.

Representative sections from both lungs, liver and both kidneys do not show any significant pathological change.



**Figure 1 A: Gross specimen of splenic cyst containing mucinous material. B - Microphotograph from cyst wall showing fibrocalcified tissue ( H&E 10X). C - Microphotograph from cyst wall showing flattened epithelial lining of cyst ( H&E 20X). D - CK positive epithelial lining ( IHC 20X).**

### Discussion

Splenic cystic lesions are extremely rare and infrequently observed in day to day surgical practice. They are predominantly seen in the second and third decade of life and are asymptomatic but can have symptoms related to the size of cysts like fullness of abdomen, local or referred pain or rarely thrombocytopenia. In a study conducted by Robbins et al over the span of 25 years out of 42,327 autopsies, only 32 cases were diagnosed with splenic cysts. In epithelial cysts, portions of the cyst wall can be desquamated and multiple sections may be required to identify the lining epithelium remnants. Failure to identify scant remnants of the epithelial lining can lead to erroneous classifications of these lesions as parasitic echinococcal disease, infarction, infection, pyogenic splenic abscess, cystic neoplasms like hemangioma/lymphangioma, tubercular abscesses, hydatid cyst or metastatic diseases of spleen. As each etiology has different clinical course and management, it is utmost importance to reach a final diagnosis.<sup>8,9,10</sup>

Although the exact origin of true cysts remains unknown, it is believed that they arise from mesonephric tissue in the developing spleen

during the early stages of embryonic development. According to certain theories, they can also occur when peritoneal or mesothelial cells become trapped or infolded in the splenic parenchyma during fetal development.<sup>8</sup>

Kang et al reported a case of splenic cyst a 20-year-old female with history of abdominal pain. Following which laparotomy was done showing that the cyst was arising from the spleen. It was adhered to the left lateral side of the liver and left stomach wall. The pathologic report indicated a primary epidermoid splenic cyst with cyst walls lined by stratified squamous epithelial cells. The patient was discharged on the 10th postoperative day with an uneventful post-operative period.<sup>11</sup>

In another study by Jeffrey A et al, a 32-year-old woman presented with a several months history of abdominal pain in her left upper abdomen. CT scan revealed a very large splenic cyst with compression of adjacent viscera and splenectomy was performed. The resected spleen measured 20 cm in diameter and weighed 3 kg. On cutting open, cyst cavity contained serous brown fluid. Microscopic examination revealed a single layer interior lining of cuboidal epithelium, consistent with the diagnosis of an epithelial cyst.<sup>12</sup>

Rana et al reported a case of 12-year-old female child with complaints of dull pain, discomfort and feeling of fullness in left upper abdomen for 15 days. USG and CT scan showed an enlarged spleen with well-defined cystic mass measuring 10.2x8.4 cm in size. Splenectomy specimen revealed a large cystic lesion with a diameter of 10 cms on upper pole was discovered, with almost total replacement of splenic tissue at one side. Histopathological examination revealed stratified squamous epithelial lining of cyst and the diagnosis of splenic epidermoid cyst was confirmed. The postoperative clinical course of the patient was satisfactory and uneventful.<sup>13</sup>

In another study by Gupta et al, a case of simple epithelial cyst of the spleen was misdiagnosed clinicoradiologically as tubercular splenic abscess. A splenectomy specimen measuring 10x8x6 cm and weighing 266 gm was received. Cut section revealed a unilocular cyst measuring 7 cm in diameter. Histopathology revealed focal areas of denudation

showing intense inflammatory reaction with fibrosis in cyst wall. No granuloma or parasite were identified on serial sectioning of the cyst. Stain for acid fast bacilli and fungus were negative. Final diagnosis of simple epithelial cyst spleen with rupture was made.<sup>14</sup>

In the present study, there was no history or investigation available in the post-mortem papers. Histopathological examination was consistent with a diagnosis of epithelial splenic cyst. This manuscript describes our experience of diagnosing a splenic cyst which was encountered accidentally at the time of autopsy. The distinction of various types of splenic cysts is important for efficient patient management because tubercular cysts, parasitic cysts, pyogenic splenic abscess, hydatid cyst or neoplasms can be easily identified on histopathological examination and further management for each of these diagnoses is different from one another.

## Conclusion

Primary splenic cyst is a rare diagnosis. Although a diagnosis of splenic cyst can be established by radiological means, yet histopathology is mandatory to determine the exact etiology of cyst. Final diagnosis of nature of cyst will help the clinician to decide the further course of treatment.

**Source of funding:** none

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# Point of Care Ultrasound in Suicidal Hanging Scenario: A Case Report

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## Abstract

In the emergency department, swift and comprehensive management is crucial for a patient with a history of suicidal hanging due to the potential life-threatening consequences. Upon arrival exhibiting signs of unconsciousness and gasping respirations, the individual indicates severe hypoxia and impending respiratory failure. Immediate assessment is essential to address hanging-related injuries and potential increased intracranial pressure (ICP). The initial focus includes securing the airway, ensuring oxygenation, and providing circulatory support. Point-of-care ultrasound (POCUS) emerges as a vital tool for rapid identification of structural brain abnormalities, aiding in the assessment of raised ICP. Addressing raised ICP involves integrating therapeutic interventions guided by POCUS findings, including measures to reduce cerebral edema, optimize perfusion, and prevent secondary brain injury. POCUS's portability and immediacy seamlessly integrate into emergency resuscitation, providing valuable insights for tailored therapeutic strategies. Emphasizing a rapid and multidisciplinary approach is essential for optimal patient outcomes.

**Keywords:** Suicidal hanging, Medico legal, POCUS,

## Background:

The exploration of Point of Care Ultrasound (POCUS) in the context of suicidal hanging scenarios addresses a critical dimension of emergency medicine and trauma care.<sup>[1]</sup> Suicidal hanging

poses a substantial public health concern globally, contributing significantly to morbidity and mortality rates.<sup>[2]</sup> According to various epidemiological studies, hanging is a prevalent method of suicide, accounting for a notable portion of suicide-related

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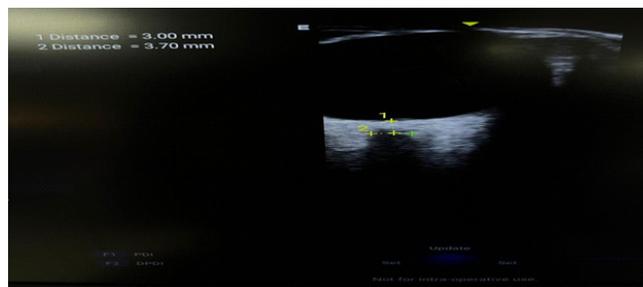
incidents (World Health Organization, 2019).<sup>[3]</sup> Despite the gravity of this issue, the nuances of its immediate and profound physiological impacts, especially regarding intracranial dynamics, demand focused investigation.<sup>[4]</sup> The manuscript delves into the unique challenges posed by suicidal hanging, emphasizing the necessity for swift and accurate diagnostic tools. POCUS emerges as a technology with the potential to revolutionize the assessment of patients in these scenarios. Its portability and real-time imaging capabilities position it as an invaluable tool in the emergency setting, allowing for rapid evaluation of structural and functional aspects, particularly in the identification of raised intracranial pressure (ICP) and associated traumatic brain injuries.<sup>[5]</sup> By elucidating the distinctive context of suicidal hanging and highlighting the role of POCUS, this manuscript aims to contribute valuable insights to the broader discourse on trauma management and emergency care.

### Case presentation

In his 20s, a patient with a history of suicidal hanging, presented to the Emergency Department (ED) exhibiting critical signs and symptoms. On arrival, he displayed unconsciousness and gasping respirations, suggestive of severe hypoxia and impending respiratory failure. Immediate attention was directed towards securing the airway, ensuring oxygenation, and providing circulatory support. A comprehensive medical history revealed a recent episode of profound psychological distress, prompting an attempt at self-harm through hanging. This information underscored the urgency of assessing both hanging-related injuries and the potential for raised intracranial pressure (ICP). Given the critical nature of the case, Point of Care Ultrasound (POCUS) was employed as a diagnostic tool. POCUS swiftly identified structural brain abnormalities, including cerebral oedema or haemorrhage, contributing to the assessment of raised ICP (Figure-1). Real-time imaging allowed for a dynamic evaluation of intracranial dynamics, facilitating prompt decision-making in the management of traumatic brain injuries. Findings from POCUS guided therapeutic interventions aimed at reducing cerebral oedema, optimizing cerebral perfusion, and preventing secondary brain injury (Figure-2).



**Figure No.1 Lower horizontal marking optic nerve sheath diameter before**



**Figure No.2 Lower horizontal marking Optic nerve sheath diameter after treatment**

The patient's response to these interventions was closely monitored, and adjustments were made as necessary. POCUS played a pivotal role in this ongoing assessment, providing valuable insights into the patient's neurologic status. The integration of POCUS into the management of the patient highlighted its significance as a rapid and effective tool for evaluating and responding to the complex challenges presented by suicidal-hanging incidents, contributing to a more informed and tailored approach to patient care.

### Investigations:

We prioritized a comprehensive assessment for this patient, utilizing routine blood and serum investigations. Complete blood count (CBC) and basic metabolic panels were sent to evaluate haematological parameters, check for signs of anaemia or infection, and assess electrolyte balance and organ function, coagulation status, and liver function, among other factors. We emphasized the integration of Point of Care Ultrasound (POCUS) as a pivotal diagnostic tool in suicidal hanging. POCUS provided immediate insights into intracranial dynamics, enabling real-time evaluation of structural and functional aspects of the brain. This facilitated the prompt identification of cerebral oedema. The strategic inclusion of POCUS in the diagnostic protocol significantly enhanced the

efficiency and accuracy of assessments, guiding timely therapeutic interventions within the confines of the emergency setting. POCUS ensured a comprehensive and precise approach to evaluating and managing patients following suicidal-hanging incidents.

#### **Differential diagnosis:**

It is a confirmed case of suicidal hanging based on the history and clinical features.

#### **Treatment and outcome:**

On arrival at the Emergency ward, we immediately initiated a rapid assessment and secured the airway promptly. Endotracheal intubation was done to ensure adequate ventilation. Supplemental oxygen and Mechanical ventilation were given to maintain adequate oxygenation. The patient was stabilized hemodynamically by ensuring adequate fluid resuscitation. Inotropic support was given for cardiovascular support. Continuous monitoring of vital signs, including heart rate, blood pressure, and oxygen saturation was done. Frequent neurological assessments were done to detect any changes in the patient's neurological status. Continuous neurologic monitoring was done to assess for signs of increased intracranial pressure (ICP) or neurological deterioration. Point of Care Ultrasound (POCUS) played a vital role in the real-time evaluation of intracranial dynamics, assisting in the identification of cerebral oedema. We employed strategies to manage elevated ICP, such as maintaining head elevation and administering osmotic agents (e.g., mannitol). Treatment in the context of point-of-care ultrasound in suicidal hanging scenarios involves a meticulous blend of emergency and intensive care strategies. The integration of POCUS allowed for real-time neurological assessment, contributing to the prompt identification of intracranial complications and facilitating targeted interventions to optimize patient outcomes.

#### **Discussion**

Monitoring changes in ICP is essential for guiding therapeutic interventions and optimizing patient outcomes. POCUS provides a non-invasive means of assessing ICP dynamics, contributing to the ongoing surveillance of patients at risk for increased intracranial pressure. By offering critical information swiftly, POCUS aids in the early identification of complications and supports a proactive approach to patient management [6].

The integration of POCUS into the management of suicidal hanging and raised ICP underscores its role as a versatile and indispensable diagnostic tool. Its ability to provide rapid, accurate information contributes to a more nuanced understanding of the patient's condition, enabling healthcare professionals to tailor interventions based on real-time assessments.

#### **Take home message:**

- **Shift in Paradigm:** POCUS revolutionises the handling of emergency and critical care in cases of suicidal hanging.
- **Quick Decision-Making:** Brain abnormalities are detected by real-time imaging, which facilitates quick and well-informed decision-making.
- **Best Results:** POCUS directs customised tactics that minimise cerebral oedema, maximise perfusion, and guard against secondary brain damage.

**Conflicts of interest:** Nil

**Informed Consent:** Informed consent as obtained after explaining the purpose of research to the family member.

**Source of funding:** None

**Ethical Clearance:** Not required as it is a case report.

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## Imidacloprid Associated Convulsions: A Rare Case Report

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### Abstract

**Background:** Acute pesticide poisoning is a global health concern, with organophosphorus compounds contributing significantly. Neonicotinoids, like imidacloprid, have emerged as alternative insecticides due to their selective action on pest nervous systems. This case report explores imidacloprid poisoning, emphasizing clinical manifestations and the ongoing search for safer pesticides.

**Methods:** A 46-year-old male, chronic smoker, and alcoholic, presented with suicidal imidacloprid poisoning. The patient experienced seizures, central nervous system (CNS) depression, hyponatremia, and respiratory arrest, necessitating mechanical ventilation. The case details the comprehensive evaluation, including imaging studies, and presents vital signs, laboratory results, and physical examinations. The patient received supportive care, and the discussion outlines the treatment strategy, highlighting the challenges and successes in managing imidacloprid toxicity.

**Conclusion:** This case underscores the complexity of imidacloprid poisoning, particularly noting convulsions secondary to hyponatremia. It stresses the need for further research into imidacloprid's metabolic effects and advocates for vigilant monitoring and supportive care in such cases. The report calls for increased reporting to enhance understanding and knowledge sharing regarding the potential toxic effects of imidacloprid, contributing to better management strategies for pesticide poisoning.

**Keywords:** Imidacloprid, Convulsions, Dyselectrolytemia

### Introduction

Acute pesticide poisoning is a major health problem worldwide; organophosphorus poisoning accounts for most fatalities, and therefore alternative

insecticides are used, hoping they are less harmful to humans but potent enough to control pests. Acute pesticide toxicity is extremely common in developing countries of the Asia-Pacific region, particularly

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in setting of low education and poor regulatory frameworks. India is an agricultural country with a large rural population (60–80%), where pesticides are freely available and are used extensively and quite frequently for self-poisoning.

Imidacloprid belongs to neonicotinoid class, which selectively acts on nervous system of pests via nicotinic acetylcholine receptors (specifically  $\alpha 4\beta 2$  subtype), resulting in their favourable toxicological profile in case of human exposures<sup>1</sup>. Despite its lower toxicity, several cases have been reported with a range of serious complications, including neuropsychiatric sequelae, rhabdomyolysis resulting in acute kidney injury, ischemic and metabolic encephalopathy, ventricular fibrillation, multiorgan failure, and even death after exposure to imidacloprid.

We report a case of imidacloprid poisoning with suicidal intention who developed a variety of manifestations including hyponatremia, convulsions, central nervous system (CNS) depression, and respiratory arrest requiring mechanical ventilation and who recovered subsequently with supportive care.

### Case Report

A 46-year-old male patient who is smoker and chronic alcoholic, 65kgs in weight and previously in good health, farmer by occupation from rural area of Karnataka with no past history of Seizure disorder, head injury or any previous cerebrovascular events, presented to the Emergency department with H/o accidental inhalational contact with FIPROCIL-40% + IMIDACLOPRID 40%. Patient was exposed to the insecticide as he was spraying it without any protective gear. Imidacloprid belongs to neonicotinoids compounds, chemically similar to nicotine, and other members of neonicotinoid class include acetamiprid, clothianidin, thiacloprid, dinotefuran, nitenpyram, and thiamethoxam. Patient presented with an episode of seizure and was drowsy and disoriented. Patient was intubated in view of low GCS score-8. CT BRAIN showed essentially normal study.

Upon the initial physical examination, His vital signs were as follows: a blood pressure reading of 130/82 mmHg, a pulse rate of 114 beats per minute, a

respiratory rate of 16 breaths per minute, and a body temperature of 96.6°F. Pupils were of equal size and reacted promptly to light. Clear breath sounds were heard bilaterally, and the heartbeat was regular, with no audible murmurs. The abdomen appeared soft, flat, and free from tenderness.

The laboratory results showed the following values: haemoglobin level at 13.9 mg/dL, white blood cell count at 12070/mm<sup>3</sup>, platelets at 231000/mm<sup>3</sup>, prothrombin time at 12.1/0.88 seconds, activated partial thromboplastin time at 28.8 seconds, albumin at 4.5 g/dL (within the normal range of 3.5–5.3 g/dL), glucose at 101 mg/dL (normal range: 70–105 mg/dL), aspartate aminotransferase (AST) at 47 U/L (normal range: 0–36 U/L), alanine aminotransferase (ALT) at 21 U/L (normal range: 0–36 U/L), blood urea nitrogen at 9 mg/dL (normal range: 6–21 mg/dL), creatinine at 0.65 mg/dL (normal range: 0.6–1.2 mg/dL), sodium at 115mEq/L (normal range: 134–148 mEq/L), potassium at 4.4mEq/L (normal range: 3.0–4.8 mEq/L), and calcium at 7.4 mg/dL (normal range: 7.9–9.9 mg/dL).

Urinalysis was unremarkable. An electrocardiogram (EKG) showed sinus tachycardia. The chest radiograph showed no radiological abnormality. 2d echo showed mitral valve prolapse with EF-55%. Ultrasound abdomen and pelvis showed raised cortical echoes of bilateral kidneys with mildly globular left kidney, minimal interloop free fluid. The patient was started on prophylactic antibiotics, antiepileptics and other supportive care was given.

### Discussion

In this instance, the individual was exposed to Imidacloprid. Initially, the patient presented drowsy and disoriented along with an episode of seizure. Patient was intubated in view of low GCS score and was given supportive care. Hyponatremia and Hypocalcemia were corrected. IV Antiepileptics were administered. He was extubated and post extubation vitals were stable.

Imidacloprid is the first neonicotinoid compound commercialized with widespread use and is most common among human intoxications due to neonicotinoids. It is classified as moderately

hazardous (Class-II WHO; toxicity category-II EPA) based on animal studies<sup>2</sup>. These compounds can be absorbed via ingestion, dermal or inhalational route, and there is more severe poisoning with oral ingestion than other routes. Neonicotinoids are agonists at nicotinic acetylcholine receptors and interfere with transmission of impulses by increased activation, leading to fatigue and paralysis<sup>3</sup>. Receptor stimulation affects CNS as well as autonomic nervous systems. Selective toxicity to insects as compared to mammals is because of different structures and compositions of receptor subunits. CNS stimulation causes dizziness, drowsiness, disorientation, and coma while autonomic nervous system stimulation causes sweating, dilated pupils, tachycardia, and hypertension which may lead to coronary spasm and cardiac ischemia and therefore with the risk of arrhythmia, hypotension, and bradycardia<sup>4</sup>.

A review of the available literature indicates that imidacloprid poisoning can involve gastrointestinal, cardiorespiratory, and nervous systems or it can be multisystem and can be life threatening. Treatment of imidacloprid poisoning largely remains supportive in the absence of effective antidote. Our patient was treated with supportive care and he recovered without any sequelae. As neonicotinoids are considered relatively less toxic, here with this case report and with the review of literature, we want to stress that there should be close monitoring of poisoning due to imidacloprid and these patients should be managed with supportive care<sup>2</sup>.

### Conclusion

This case discusses the first reported case of Imidacloprid causing convulsions secondary to hyponatremia. It highlights the limited availability of case reports regarding the toxic metabolic effects of Imidacloprid. The article underscores

the need for further studies and case reports to gain a better understanding of Imidacloprid toxic effects on various systems in humans. As a result, careful patient observation is essential in cases of Imidacloprid poisoning to gather more information about its potential toxic effects.

Informed consent has been taken from the patient in their understandable language.

**Conflicts of Interest:** Nil

**Source of funding:** Self

**Ethical Clearance:** INSTITUTIONAL ETHICS COMMITTEE,

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## An Unusual Case Report of Unplanned Complex Suicide

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### Abstract

The phenomenon of complex suicide is well-known and defined as the use of more than one suicidal method to cause death. It accounts for 1.5 to 05 % of all suicidal deaths. In complex suicides, planned and unplanned acts are differentiated. In unplanned suicides, one or more methods are used consecutively after the previous method failed and did not result in death. The present case report discusses the unplanned suicide of a young, extremely obese, 18-year-old boy. The boy was found in an unconscious state at his home in the bathroom, in sitting position on the floor with his neck suspended to the shower head with a rope with multiple cut marks over his body. During the autopsy, external examination revealed a ligature mark around neck and multiple superficial incised injuries over his face, neck and both wrists. Detailed autopsy examination confirmed the cause of death as asphyxia due to suicidal hanging with multiple incised injuries over the body. It is of utmost importance for the forensic investigator to have in-depth knowledge about different unusual suicidal methods. This will prevent unnecessary criminal investigation and help in the concrete establishment of the manner and cause of death.

**Keywords:** Unplanned suicide, adolescence, hanging, asphyxia

### Introduction

Suicide is defined as death caused by self-directed injurious behavior with the intent to die as a result of the behavior.<sup>1</sup> Suicides are classified into Simple and Complex Suicides. Simple suicide is defined as the adoption of one method to end one's life and induce death. Complex suicide involves the adoption of a combination of more than one method.<sup>2,3</sup> A planned complex suicide is a complex action mechanism planned in advance to protect the victim from failure and ensure death. The characteristic of a complex unplanned suicide is that after the failure of the first

attempt to die, the person continues to try by using different destructive means to achieve the ultimate goal which is death.

Suicide is among the foremost causes of death worldwide, especially among adolescents.<sup>4,5</sup> Adolescence is a transition phase where a child experiences certain major changes reaching adulthood. At times this phase becomes quite challenging for them making their life vulnerable to death by committing suicide. Incidence of suicide varies depending upon the culture, quality of life, education status, study-related stress and familial

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relationships. The estimated suicide rate for 10 to 19-year-olds based on WHO mortality data from 2010 to 2016 was 3.77/100,000 people.<sup>6</sup>

The estimated lifetime prevalence of suicide ideation, plans, and attempts among adolescents is 12.1%, 4.0%, and 4.1%, respectively.<sup>7</sup> The risk of suicide is relatively low in childhood, and significantly increases from early adolescence to late adolescence and early adulthood.<sup>6,8</sup> Adolescent boys are more likely to die by suicide whereas adolescent girls are more likely to have experienced suicidal ideation and suicide attempts.<sup>9-11</sup> Suicidal thoughts and behaviors among youth should be given utmost importance to take timely necessary steps to prevent such acts. The present case report describes one such case of an adolescent boy who adopted an extreme step in the form of an unplanned complex suicide.

### Case Report

The present case report details an unplanned complex suicide of an 18-year-old male in 12<sup>th</sup> standard living with his parents and younger sister. The body of the boy was discovered in the bathroom of his house, with a rope tied around his neck, suspended to the shower bar and brought for postmortem examination.

On external examination, the boy was found to have an extremely obese build. Signs of asphyxia in the form of facial congestion and cyanosis of fingernails were present. A ligature mark was present over the anterior aspect of the neck, at the level of the thyroid cartilage, running obliquely upwards and backward as shown in Figure no. 1. Multiple subcutaneous tissue to muscle-deep incised injuries were present on the face on both sides of the forehead, both sides of the neck, and both wrists ventrally (Figure no. 1, 2, 3). On internal examination, both lungs showed petechial hemorrhages. The stomach contents and examination of other organs were unremarkable. After the completion of the autopsy, the cause of death was established as hanging.



Figure 1 Ligature mark over neck.



Figure 2- Multiple incised injuries over left wrist.



Figure 3- Multiple incised injuries over right wrist.

## Discussion

Suicide is the leading cause of death in all age groups. Complex suicide refers to suicides in which more than one suicide method is applied. This refers to those cases of suicide in which the simultaneous combination of several methods of suicide is adopted to guarantee one will at least succeed. The purpose of the second suicide method adopted and furthermore, methods that may be adopted is to make the suicide plan foolproof if the first method fails. However, the term complex suicide is also used for those cases in which the methods of suicide are not adopted simultaneously, but successively. It could be where the first method chosen did not cause death if death occurs too slowly, or if this method causes too much pain. The suicidal individual uses the same tool several times successively because the first injury did not cause death immediately or at least did not induce immediate incapacitation. This may be the case especially when firearms or sharp tools are used to commit suicide.<sup>12-15</sup>

To differentiate the two types from each other, the names Planned complex suicides and unplanned complex suicides originated. Planned complex suicides are in which the success is to be guaranteed by a planned coincidence or mutual acceleration of two or more methods of suicide. In contrast to the group mentioned above, unplanned suicides are those in which the suicidal individual uses one or several other forms of inflicting damage to him or herself directly after the unintentional failure of a first attempt in the same course of action.<sup>16</sup>

The number of planned and unplanned complex suicides compared to simple ones is about 1-5% of the total number of suicides. They are more common in males.<sup>17,18</sup> The choice of the method of committing suicide correlates with the degree of determination to die, the greater the desire to end one's life, the more deadly and brutal the method of committing suicide. The term lethality score is the ratio between the number of successfully executed suicides and the number of unsuccessful attempts to commit them in that particular analyzed way. The best-known is the table of lethal scores made by a group of American authors based on the analysis of more than four thousand suicides and suicide attempts in a total of 28 ways over five years.<sup>19</sup> According to their data, the

lethality score for hanging is  $89.50 \pm 4.38$ . Usually, the methods of suicide in previous attempts, as well as the first attempt in unplanned complex suicide, have a lower lethality rate compared to the method that follows the first unsuccessful attempt in unplanned complex suicide<sup>20</sup>. Compared to women, men tend to commit suicide in a way that has a higher lethality.

The present case demonstrates that a young boy committed suicide by means of an unplanned complex suicide. The boy first tried cutting the blood vessels of the neck on both sides and both wrists. It proved to be extremely painful and an unsuccessful way of committing suicide and in a frenzy, the boy also cut his forehead on both sides. It aggravated the pain with which he was already suffering. He then adopted a quick, less painful and faster method to commit suicide by hanging himself. The boy had not planned to hang as his primary means of suicide, however, upon failure of cutting the blood vessels, he resorted to a relatively quicker means by choosing to hang. This was evident at the crime scene too. On recreation of the crime scene, blood stains were found all over the house walls, curtains and floor, more on the balcony from where he had cut the rope when he was bleeding. The weapon used was a kitchen knife found in the living room. A similar case report has been described by Tatwal B et al, in which the 22-year-old had committed a planned complex suicide involving slashing of the wrist and hanging.<sup>21</sup>

It is a major challenge for forensic experts to differentiate simple suicide from complex suicide. The complexity involved in the history, circumstances and autopsy findings makes it even more difficult to conclude. Cases where there is evidence of the application and adoption of more than one method of suicide often raise suspicion. In such cases, a meticulous autopsy and crime scene investigation with a clear history of any previous suicidal attempt along with some triggers is essential to conclude the cause and manner of death.

## Conclusion

Complex suicides almost always arise a suspicion of a planned homicide and can be mistaken for it if not carefully investigated. A variety of different combinations of suicide methods are used in complex suicides, including some that have not previously

been described in the literature. Victims always come up with innovative ideas to complete and execute their final aim of committing suicide. Hence, forensic experts should not immediately assume and form an opinion that points towards homicide. Rather one should think wisely, conduct a meticulous autopsy after considering all the possibilities and then reconstruct the scene of crime before finalising the cause of death. Previous suicide attempts and likely trigger factors in adolescents must be given due consideration. The knowledge of potential risk factors for suicidal behavior in adolescents allows early identification of the upcoming act. The quality of the parent-child relationship must be improved so that the parents can identify what their child is going through and can act accordingly to prevent such extreme steps.

**ETHICAL CLEARANCE-** The autopsy was conducted by a team of doctors including the Professor and HOD, separate permission from the department is not required and therefore not obtained. The identity of the deceased is masked and therefore permission from relatives was not obtained.

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## Expertise of Forensic Specialist in the Clinical Forensic Medicine Unit: A Need of the Hour

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### Abstract

In the casualty it is the duty of an Indian Medical Graduate to examine and record the details of medico legal cases and send intimation to the police. In emergency services sometimes the Indian Medical Graduate is not able to record the injury details of the patient due to lack of expertise, disinterest and sense of apprehension towards legal procedures. According to the new curriculum the Indian Medical Graduates study Forensic Medicine in the second and third year and during Internship they are again posted in Forensic Medicine to undergo medico legal training. In the Postgraduate curriculum of Forensic Medicine they have casualty postings. The number of postgraduates joining Forensic in various medical colleges is dropping at an alarming rate as it is considered as dead body science. Clinical Forensic Medicine (CFM) is the area of forensic medicine that relates to the medical examination and assessment of the living. It also has a significant public health and safety role. Research based on clinical forensic examination results have the potential to contribute to injury and death prevention. The aim of this article is to share the author's experience in the Clinical Forensic Medicine unit.

**Keywords:** Clinical forensic medicine unit, Forensic specialist, Injury cases, Medico-legal cases.

### Introduction

Indian history is a witness to the nobility of the medical profession and the doctors were placed on the same pedestal as that of God, however, the role of medicine in administration of justice was not a much discussed topic<sup>1</sup>. The first recorded medico-legal autopsy in India was performed by Dr Edward Bulkley on 28 August 1693 and the first wound certificate was issued by him two years later<sup>2</sup>.

In India the branch of Forensic Medicine has undergone dynamic changes of its tasks emulating the social circumstances of that particular era<sup>3</sup>.

One such change is the introduction of Clinical Forensic Medicine which introduces the subject of forensic medicine in a clinical set up. Any case registered in a hospital with injuries comes under its purview<sup>4</sup>.

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A doctor posted in emergency Medicine department has to deal with injuries related to accident/ suicide /homicide. It is the duty of any doctor attending medico legal case to intimate the police under section 39 of Criminal Procedure code failing which he / she is punishable under section 176 of Indian Penal Code, 202 Indian Penal Code & 201 Indian Penal Code<sup>5</sup>.

### *Medico Legal cases*

According to Indian Institute of Legal Studies "A Medico-Legal Case can be defined as a case of injury or ailment, etc., in which investigations by the law-enforcing agencies are essential to fix the responsibility regarding the causation of the injury or ailment. It is a medical case with legal implications for the attending doctor where the attending doctor, after eliciting history and examining the patient, thinks that some investigation by law enforcement agencies is essential. It may be a legal case requiring medical expertise when brought by the police for examination"<sup>6</sup>.

Whenever a Registered Medical Practitioner comes across a case of injury or ailment due to accidents/ Suicide/ Homicide or when there is any disparity between the history given by the victim or bystander and the examination findings, it becomes the duty of Registered Medical Practitioner to report the same to the police at the earliest<sup>7</sup>.

The health care professional in the emergency department is the first person to come in contact with the victim. Depending on his knowledge and skills the case is assessed and evaluated and labeled as MLC or Non MLC<sup>4</sup>. India is a country with diversity in culture and religion so sometimes the doctor is under tremendous pressure to just treat the patient and not to inform the police. In most of the hospitals /clinics set up the first contact health professional is a non Forensic doctor while in a medical college it may or may not be so<sup>1</sup>

The problem faced if a non forensic doctor examines the patient is missing or misinterpretation of an injury which could have been a valuable finding in a particular case and thereby denying justice to the victim.<sup>8</sup> The Medico-legal report was found to be lacking some of the crucial details like patient bio-data, proper history of the incidence, identification

mark, and incorrect injury documentation affecting the correct framing of the opinion. Some findings like six penny bruises and defense wounds which may be seen in sexual assault and assault cases respectively can get misinterpreted in the report adversely affecting the outcome of the case.

The reason for this scenario is lack of experience/ knowledge in dealing with medicolegal cases. Before 2019, the subject of Forensic Medicine & Toxicology was taught to medical students for only one year but with the implementation of Competency Based Medical Education (CBME) curriculum the duration of teaching Forensic Medicine changed to 2 years (Phase II & Phase III- Part I)<sup>9</sup>. As per the CBME curriculum the students are formatively assessed for certifiable skills in both simulated & Clinic based environments giving them more exposure to medicolegal cases. In addition to this as per Compulsory Rotatory Medical Internship (CRMI) 2021 the interns are posted in the department of Forensic Medicine & Toxicology for a period of seven days. This also adds to their skill and experience<sup>10</sup>. So an Indian Medical Graduate (IMG) passing out from an Institution becomes more efficient and proficient in dealing with medico legal scenarios compared to earlier generations.

### *Clinical Forensic Medicine*

Clinical Forensic Medicine is recognized as a separate branch in only a few countries<sup>11</sup>, while in others it is a sub division of Forensic Medicine<sup>12</sup>.

In India the first Clinical Forensic Medicine Unit (CFMU) was started by Mahatma Gandhi Institute of Medical Science (MGIMS), Maharashtra to deal with medico legal issues related to accidents and emergencies.<sup>13</sup>

In many of the current Medical colleges set up, the clinical Forensic medicine has been introduced in the department of Forensic medicine & toxicology as a sub division or unit to tackle the dilemma faced by the treating doctors in categorizing the case as Medico Legal or not.

Clinical Forensic Medicine Unit (CFMU) in Yenepoya (Deemed to be University) became functional in the year 2021. All the forensic medicine faculties with MD qualification are the members of this unit and are posted in CFMU on rotation

basis. Under the faculty a final year postgraduate in Forensic Medicine & Toxicology is posted as first responder to visit the casualty to observe the victim. The postgraduate is assisted by first year PG & Interns posted in Forensic Medicine & Toxicology as a part of their CRMI program. As the first responder it is the duty of the PG to document the history given by the subject/Victim, followed by a thorough physical examination after taking appropriate consents (from the victim if 18 yr old or above and Assent from Child (victim) along with consent from parent if child is above 12 and below 18yr). The PG has to intimate the respective police station. The Postgraduate has to then inform the details of the case to the Forensic MD staff posted. Yenepoya Medical College being a private institution case of drunkenness, potency examination is usually not conducted.

As per POCSO Act 2012, "in case the victim is a girl child, the medical examination shall be conducted by a woman doctor" (Section 27(2) of POCSO ACT 2012) however, non availability of a woman doctor should not be a ground for denial / delay of examination.<sup>14</sup> Since number of female doctors in Forensic Medicine is comparatively less the examination of female survivor of sexual assault becomes a challenge. Here comes the importance of establishing a Multispeciality clinical forensic medicine unit which should preferably include a gynecologist, Paediatrician, Clinical Psychologist and a nursing staff trained in forensic nursing.

Clinical Forensic Medicine Unit (CFMU) should be made mandatory in all Medical Colleges. Postgraduates in Forensic Medicine should be posted in Casualty to check the possible medico-legal cases to get a firsthand experience. There is an urgent need to re do the Forensic curriculum for the undergraduates & postgraduates

### *Cases seen in Yenepoya CFMU*

#### *Case of Child Abuse*

A 5 year old boy was brought by his family with an alleged history of assault by his 4 year old sister. During the process of history collecting the parents revealed that two days back the boy had dipped his hands in hot oil and also dropped hot water on himself. The boy was also found to have been admitted previously with a fracture of mid shaft of tibia and fibula due to alleged history of slip and fall in the bathroom.

On physical examination the child was found to have multiple injuries all over the body. The injuries were noticed to be at different stages of the healing process (point 1- 10).

1. Contusion present over both eyes. (Black eye)
2. Multiple abrasions over an area, 8.5cmX7cm, smallest measuring 1 cm in length and largest measuring 5 cm in length, on face across the right cheek, upper and lower lip (Fig 1)
3. Multiple abrasions over an area of 15cmX5cm, obliquely placed, present on front of chest and abdomen across the midline
4. Multiple healed abrasions, scab fallen off, with hypo pigmented patches, of sizes varying from 0.5cm - 3cm, at multiple sites on back of trunk.
5. Multiple abrasions over an area, 25cmX5.5cm, on back of chest across the midline, upper end at lower end of right shoulder blade, 8.5cm outer to midline.
6. Superficial burns over an area of 3cmX3cm, with surrounding inflammation, on the palmar aspect of the right hand, 3cm below the wrist. The edges showed pus laden brownish scab.
7. Dermo epidermal burns, involving the entire tip of index and middle finger of right hand with loss of nails and associated with inflammation.
8. Superficial burns over an area of 8.5cmX3.5cm, present on left buttock, which is 7.5cm outer to gluteal cleft
9. Multiple abrasions over an area of 12cm X 7cm, over front and inner aspect of right thigh.
10. Multiple Abrasions over an area of 5.5cm X 3cm, present on outer aspect of back of right hand (Fig: 2)



**Fig 1: Multiple injuries in & around the lips**

**Fig 2: Multiple Abrasions outer aspect of back of right hand**

The pattern and age of injuries were not consistent with history given by the parents. The child was scared and sad. Parents were not inclined for admission. This discrepancy made the forensic expert to contact the Child line services upon which parents confessed of child abuse but fearing the consequence of their act, they absconded before the officials reached the hospital.

Another case examined was of a one year old infant with history of incessant crying and fever of few hours duration. The child was apparently normal when the mother left him in the care of a nanny known to her. On her return from work she found her son inconsolable and having fever. The Pediatrician examining the child noticed a rash on his body and suspecting a foul play the forensic dept was intimated. On careful examination by forensic doctor it was found to be a tramline bruise which was tender on touch. A tram line bruise may be produced when an object like Lathi, belt, wire strikes the skin surface or when the body contacts a patterned surface<sup>15</sup>. The nanny was called for further history taking, during which she confessed of hitting the child. The mother refused for any further proceedings and the child was discharged against medical advice.**it**

#### *Case of Assault*

A 39 year old male was brought to the casualty with the alleged history of skid and fall from bike. On examination by the first responder (Forensic Postgraduate) 5 incised wounds and one abrasion was documented. The examining PG was suspicious of the authenticity of the history given by the victim as the pattern and type of injuries were not consistent with it. Intimation was sent to the police and when they interrogated the victim revealed the truth that he was assaulted by some people and it was the assailant who brought him to the casualty. The victim lied to the treating doctor as he was afraid of the bystander (assailant) standing nearby.

#### *Case of suspected Poisoning*

An 18 year old male was brought to the casualty with a suspected history of poisoning. The treating doctor was advised by a Forensic doctor on duty to collect stomach wash, which was collected and later sent to the Department of Forensic Medicine. The patient died after 5 days and the body was sent for

autopsy. During autopsy the viscera was collected and handed over to police for sending it to the regional forensic Lab in Mangalore. The stomach wash collected of the same patient was also sent for chemical examination.

In a usual treated case of poisoning resulting in death, the viscera sent for examination show nothing of importance but in this particular case as stomach wash was also sent, the chemical analysis of stomach wash showed positive for Glyphosate which was an important finding in stating the cause of death. However the viscera analysis didn't show any trace of Glyphosate.

### **Conclusion**

The Clinical Forensic Medicine serves as a liaison between the hospital and judicial services providing valuable expertise in cases involving injury, assault and others. It plays the dual role of accurate assessment and documentation of injuries thereby ensuring prevalence of justice and protection of patient's fundamental rights. In the clinical forensic medicine unit the Forensic expert uses his medical knowledge and legal expertise to ensure beneficence and justice to the patients. The need of the hour is Multispecialty Clinical Forensic Medicine Unit (MCFMU). The team should include in addition to Forensic expert, a pediatrician, an Obstetrician (Preferably Female) a Psychiatrist / Psychologist and also include nursing staff trained in Forensic Nursing. The change in Syllabus of Indian Medical Graduate and introduction of compulsory rotation posting for Interns in Forensic Medicine and Toxicology is a welcome step towards strengthening CFMU, thereby opening up more job opportunities attracting medical students to pursue a career in the field of Forensic Medicine. The expertise of multidisciplinary medical professionals will help to fill the gaps in patient treatment thereby upholding the ethical principles of justice, truth and hassle-free legal proceedings due to fool proof documentation by the Clinical Forensic Medicine unit.

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**Ethical approval:** This article does not contain any studies with human participants or animals performed by any of the authors.

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# Necrophilia: A Cruelty Towards Corpse-Review Analysis

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## Abstract

Necrophilia is a paraphilia in which the offender finds sexual gratification in having sex with the dead. Most nations and jurisdictions have laws against this practice. According to a report from Legal Services India, currently, cases of Necrophilia in India are being referred to under the provisions of Section 297 and Section 377. There hasn't been much research done in that field. History and several case studies indicate that this is exceedingly destructive, not just for the person with the disorder but also for society as a whole. The focus of the current research project is to describe and investigate the problem of sexual encounters with corpses and their social repercussions. The paper explores conceivable motives for having sex with the deceased. Additionally, how such drives can impact the psychological forensic evaluation of criminals who have had sex with corpses.

**Key Words:** Necrophilia, Corpse, Psychological Forensic Evaluation.

## Introduction

Necrophilia is attraction towards the dead whether sexual or asexual and this is not a usual or customary practice but is a paraphilic disease. It is also known as necrophilism, necrolagnia, necrocoitus, necrochlesis, and thanatophilia<sup>2</sup>. It can occur alone or in conjunction with a number of other paraphilias, such as sadism, cannibalism, vampirism (the practice of drinking blood from a person or animal), necrophagia (eating the flesh of the dead), necropedophilia (sexual attraction to the corpses of children) and necrozoophilia (sexual attraction to the corpses of or killings of animals – also known as necrobstantiality). It is classified as a paraphilia by

ICD10 and the Diagnostic and Statistical Manual (DSM)<sup>14</sup>. According to historical evidence and a few case studies, this is tremendously destructive to society as well as the person with the disease. It can be used to describe someone's arousal and interest in fantasies or actual sexual interaction with the deceased. The necrophile may engage in sexual activity with the corpse in a variety of ways, including oral sex, penilevaginal to anal intercourse, or masturbation while the body is still.

Due to the fact that the deceased cannot consent, necrophilia is regarded by specialists and policymakers as being non consensual. The management of a person with necrophilia may

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benefit from cognitive therapy, the use of sex-drive-reducing drugs, and support with enhancing social and sexual relationships.

### Historical Background

In the ancient world, sailors returning corpses to their home country were often accused of necrophilia. Long travel distances, isolation, and a lack of witnesses all permitted and even encouraged sailors to engage in acts of necrophilia involving dead bodies. Since individuals have been practicing necrophilia for years, it is thought to be an ancient notion.

In the 1980s, archaeologists discovered paintings of Moches, popularly known as the "Greek of the Andes," in pyramids that showed dead people having sex. There are also theories that claim that some civilizations once engaged in necrophilia as a tradition or rite. The father of history wrote in his book "The Histories" that Egyptians had a tradition of letting a woman's body rot for three to four days prior to preservation in order to forbid having sex with the corpses. Necrophilia is most frequently observed among gravediggers and mortuary workers, who may be drawn to it by their proximity to dead people and sense of loneliness. Additionally, it's conceivable that they were necrophiles before choosing this line of work. It is common knowledge that necrophiles select careers that give them unrestricted access to dead bodies.

#### Classification of Necrophilia

It is not a new idea to abuse a body, but it took a while for it to be recognized as a serious medical problem. Different authors have tried to categorize different types of necrophiliacs because there are different forms of the practice. But via his research, Dr. Anil Aggarwal (a professor of forensic medicine) has suggested a new, ten-tier classification of necrophilia, which is as follows;

*Class I: Role Players* This kind of necrophiliacs are more into role play. Their sex arousal is not particularly for the dead but for living persons pretending to be dead. Some authors have also named it as Pseudonecrophilia.

*Class II: Romantic Necrophiles* When necrophiliacs have romantic tendencies which they

want to fulfill after being separated from their loved ones, they tend to continue their sexual relationship by preserving the dead bodies of their loved ones or parts of them to feel sexual arousal in future.

*Class III: Necrophilic Fantasizers* When people only fantasize about having sexual relationship with the dead and just the presence of the dead or any cemetery gives them sexual arousal, erections or pleasure.

*Class IV: Tactile Necrophiles* Tactile Necrophiliacs are one step ahead of Class III Necrophiliacs. The people falling in this category may have to touch the dead to feel orgasm or assault the dead body to get their sexual arousal. Medical students who get erection while dissecting also fall in this category.

*Class V: Fetishistic Necrophiles* This class of necrophiliacs is also known as necrofetishists because they tend to cut out parts of the dead to preserve it for their sexual arousals just by feeling the parts but they are different from romantic necrophiles as they do not preserve parts out of affection or their romantic feelings.

*Class VI: Necromutilomaniacs* This class of necrophiliacs is considered to be very disturbed but they do not engage in any sexual intercourse with the dead. They find erotic pleasure by mutilating the dead bodies in a severe way and masturbating simultaneously.

*Class VII: Opportunistic Necrophiles* This class of necrophiliacs are opportunistic in nature. They generally do not have intercourse with the dead at first instance or fantasize about having sexual intercourse with them but if the situation is such that they get an arousal or erection while in presence of a dead body under any circumstance then they take full advantage of the opportunity and intercourse with the dead.

*Class VIII: Regular Necrophiles* This class of necrophiliacs are the classic example as they do not feel pleasure while having sexual intercourse with living beings but only find pleasure in having intercourse with the dead although they engage in sexual activities with living persons from time to time.

*Class IX: Homicidal Necrophiles* This class of necrophiliacs are the most dangerous because they

kill people to satisfy themselves sexually. These people are mostly found to be engaged in unnatural sex and often involved in cannibalism.

*Class X: Exclusive Necrophiles* This class of necrophiliacs find having sexual intercourse with living persons next to impossible and a dead body is a necessity for them to find pleasure<sup>1</sup>.

#### *Legal Consideration*

It is actually lawful in many nations to have necrophilia, a psychosexual disorder. Additionally, it is now illegal in other nations that respect the privacy of the deceased and view abuse of the dead as a crime. However, the laws in the less developed and ambiguous nations that contain penal provisions relating to the culpability for necrophilia are not very clear.

Indian law does not specifically address necrophilia, however Section 297 of the Indian Penal Code, 1860, criminalizes acts such as "trespassing in burial places," which can result in up to a year in prison, a fine, or a combination of the two. However, there is no specific offense for mistreating the deceased. In India, Section 297 of the Indian Penal Code, 1860 is the only provision that can determine a person's responsibility in situations of necrophilia. There was no opportunity for punishment under any other Indian legislation prior to 2018, as Section 377 of the Indian Penal Code, 1860 provided for punishment for engaging in unnatural relations. India has different kind of laws to protect different communities from sexual abuse and offences such as Protection of Children against Sexual Offences Act, 2012, The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013, Juvenile Justice (Care and Protection of Children) Act, 2015, Human Rights Act, 1993, Section 67 of the Information Technology Act, 2000, Sections providing for punishment of Rape and other offences related to sexual abuse in the Indian Penal Code, 1860. But none of the laws provide for protection of the dead or their dignity<sup>4</sup>.

#### *Psychology and Necrophilia*

Psychology of necrophiliacs is a distinct concept from that of a criminal because it is not essential that a necrophiliac is committing an act with criminal mind

or intention. Although erotic dreams and cravings are typically present in necrophiliacs, it is still difficult to pinpoint the precise psychology behind those who engage in these types of actions. Few psychologists still hold the belief that necrophiliacs believe the dead are free from pain and that using their corpses for a little pleasure will not harm them, despite their understanding of the psychology of necrophiliacs through case studies. In the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), recurrent, intense sexual interest in corpses can be diagnosed under other specified paraphilic disorders (necrophilia) when it causes marked distress or impairment in important areas of functioning<sup>4</sup>.

### **Methodology**

The present study focuses on reviewing and analyzing research articles and newspaper reports published on Necrophilia. An online information search was conducted through sites such as online newspapers, blogs, and articles etc. Data as well as information, were collected from different sources like Newsday, Shodhganga, Researchgate etc. Each Combined data was analyzed and discussed qualitatively.

### **Case Reports**

#### *CASE- I*

The Noida Serial Murders was a series of serial murders committed by Moninder Singh a businessman, and Surinder Koli his house servant in their village. This case was the rarest of rare cases in the history of India. The 'Nithari' case came into light in 2006, when eight skeletons were found in a drain of one house in Noida. 16 people died as a result of House of Horror, one of numerous serial killers that exist worldwide. The peculiar aspect of this case is that no one, not even the home's owner, is aware that Surender Koli, his domestic helper, has a history of committing heinous crimes. The murders began in 2003, when an unusually large number of youngsters from Nithari Village were reported missing. Even in 2004 and 2005, there were numerous reported missing children that could be seen. The accused in these murders, Surinder Koli and Moninder Singh, were identified before the end of 2006. In fact, the victims of Koli's killer have grown with time. In

his final confession, Koli described in detail how he lured a total of 16 victims (9 female children, 2 male children, and 5 adult women) into the residence, brutally murdered them, attempted to have sex with their dead bodies, chopped and consumed their body parts, and threw the corpses at the back of the house and into a drain on the main road<sup>3</sup>.

#### CASE- II

A 21-year-old woman was being pulled to a nearby bush by the accused Rangaraju on June 25, 2015, while she was walking home from her computer class. Then, in violation of Section 302 of the IPC, he killed the woman by slitting her throat, and after that, he "raped" her. After filing a chargesheet and registering a case, the police spoke with the accused in a voluntary statement. After taking note of the offense, the magistrate sent the case to the sessions court, who filed charges against the defendants under Sections 302 and 376 of the IPC for rape and murder. The session's judge concluded after reviewing the evidence that the prosecution had established beyond a reasonable doubt that the defendant had killed the victim and then "raped" the body. For murder, the defendant was given a strict life sentence and ordered to pay a fine of Rs. 50,000. He received a further 10 years of harsh jail for raping the victim's dead body, as well as a fine of Rs. 25,000<sup>20</sup>.

#### CASE-III

A 17-year-old kid was shockingly accused of killing a nine-year-old boy and then allegedly had sex with the corpse. The incident, according to accounts, happened in Kerala. According to police, the incident happened as a result of the adolescent wanting to replicate an act he watched in a pornographic video. According to reports, the nine-year-old child declined the teenager's approaches. However, this did not sit well with the 11-year-old, who beat up the latter and murdered him. The accused has confessed to the crime. According to police officials, the post-mortem reports indicate that the kid may have been subjected to sodomy after his death. Additionally, according to police officials, the accused knew the youngster was dead before having sex with the corpse. Police officers are currently looking into whether the accused has ever committed crimes comparable to this one<sup>11</sup>.

#### CASE-IV

The city police have arrested a 24-year-old man from Mumbai, accused of necrophilia. The accused Nagesh Gholap an alleged necrophiliac was arrested for murdering and raping a 14 year old girl. According to the police, the girl went missing when she stepped out of her house to buy medicines from a nearby shop, from where she was lured by Nagesh, who took her to his house. Nagesh admitted to have murdered the girl first and then raping her. During his interrogation, the accused has said that he first drowned the girl in a water tub and then assaulted her with a rod so that she did not scream for help and after that raped her<sup>10</sup>.

#### CASE-V

People in Palghar were stunned by the dramatic case of a shopkeeper who is accused of killing a 32-year-old female customer and having sex with her corpse later. A novelty shop owner in Nalasopara town named Shiva Choudhary, 30, was detained and placed in police custody. Investigations reveal that the victim got into a fight with the accused over the cost of some items when visiting his shop to buy a few household items. Following the argument, the victim was assaulted by the accused, dragged behind his store by her hair, tried to be strangled, and had her neck chopped with a knife. The autopsy report also made the shocking revelation - that she had been sexually assaulted after her murder<sup>9</sup>.

#### CASE- VI

In Pakistan, a necrophilia case was reported in 2011, when a grave keeper named Muhammed Rizwan from Karachi was jailed after confessing to raping 48 female corpses. In a stunning revelation, parents in Pakistan are reportedly putting padlocks on their dead daughters' graves to protect them from rape. According to reports, necrophilia instances are on the rise in the country. The fact that a woman is raped every two hours in a society that takes great pride in its family-oriented ideals has been driven into our collective awareness to the point of repetition. The sight of padlocks on female graves, on the other hand, is enough to make a whole community hang its head in shame and never dare to gaze at the so-called vases of dignity<sup>13</sup>.)

#### CASE- VII

Dennis Andrew Nilsen (November 23, 1945 – May 12, 2018) was a Scottish serial killer and necrophile who murdered at least twelve young men and boys in London between 1978 and 1983. Nilsen was sentenced to life in prison on November 4, 1983, after being found guilty of six charges of murder and two counts of attempted murder at the Old Bailey. In December 1994, this recommendation was revised to a whole-life tariff. Nilsen was imprisoned at Full Sutton maximum security prison in his later years. Nilsen committed all of his killings between 1978 and 1983 at two North London homes. His victims were duped into going to these addresses and then strangled or drowned. Following each murder, Nilsen would undertake a ritual in which he cleaned and clothed the victim's body, which he kept for extended periods of time, before dissecting and disposing of the remains by burning them in a bonfire or flushing them down the toilet<sup>8</sup>.

#### CASE- VIII

A hospital electrician in Britain pleaded guilty to murdering then sexually assaulting two women in 1987 before, decades later, carrying out scores of sex attacks on corpses in mortuaries. He has previously been jailed for sexual assaults on 78 dead women and girls between 2008 and 2020. Fuller, 68, of Heathfield, East Sussex, appeared at the Old Bailey earlier this month and was sentenced to four years in prison for abusing another 23 women.

The former electrician molested the ladies at hospitals in Kent and Sussex for 13 years. Between 2007 and 2020, he admitted to 12 counts of sexual penetration of a body and four counts of possession of extreme pornography<sup>7</sup>.

#### CASE- IX

Serial killer Jeffrey Dahmer (1960–1994) was known to perform oral sex or masturbate, or both, upon the corpses of his victims before dismembering them. In unguarded, taped interviews with his defense attorney, Wendy Patrickus, Jeffrey Dahmer explicitly stated that he had sex with his victims before and after their deaths. He explained that he wanted to remain with the person as long as possible, preserving some of his victims' selected organs, skeletal tissue, and bones<sup>12</sup>.

#### CASE- X

Ted Bundy (1946–1989) was an American serial killer who raped and murdered at least 30 young women during the 1970s. He also confessed to participating in necrophilic acts, claiming to have chosen secluded disposal sites for his victims' bodies specifically for post-mortem sexual intercourse<sup>12</sup>.

### Result and Discussion

Sexual relations with dead bodies or corpses are referred to as necrophilia. It is regarded as a serious criminal as well as a psychological condition. From the above data it is clear that most necrophiles are heterosexual males between the ages of twenty and fifty. Necrophilia is a particularly male thing. In the study mentioned earlier, 95 percent of the necrophiles were men. In addition, 100 percent of the cases of necrophilic homicide were perpetrated by men.

Some necrophiles attempt to work in mortuaries, where they have easy access to dead bodies. This troubling behaviour is motivated by a variety of factors. To begin with, the desire to have sex with dead bodies is frequently motivated by a strong aversion to engaging with potential living partners. Necrophiles believe that human corpses are not physically, intellectually, or emotionally detrimental. This gives them a more clear path for expression, sexual fascination, and sexual actions. Second, necrophiles may have complete control over their feelings during sexual intercourse with corpses because corpses cannot reject or disagree with them. Third, necrophiles lack sexual inhibitions, self-esteem, social recognition, and overall regret for the consequences of their actions. Finally, the habit of abusing the substance may lead to fantasies of intercourse with a corpse. They may regard sexual practices with dead bodies as loving and warm, allowing a reunion with a departed loving partner.

The study has gone through ten case studies which contain five Indian and five International cases. From the reviews and cases available, it is clear that the number of international cases is much higher compared to Indian. Also coming to the legal side also, there shows a huge difference in sentencing, punishing and criminalizing. Based on these reported cases, it is obvious that the majority

of them are homicidal necrophilia. The prospect of sexual deviants acting out their desires on unwitting victims is what frightens us the most. The victims are murdered so that the offenders might satisfy their violent cravings. Necrophilic homicides are very sensationalized cases, regardless of their relative rarity. These distressing stories involve serial killers and sadistic lunatics who murder the victim, dispose of the body, and then retrieve the body to either relive the murdering experience or simply enjoy sex with it again and again. As previously said, all necrophiliacs are not ill, some are pseudo necrophiliacs and others are opportunistic necrophiliacs, therefore distinguishing in terms of mental health is tough because there are several circumstances that alter a person's mental state from time to time.

### Conclusion

Necrophilia is a morbid fascination with death and the dead and more particularly, an erotic attraction to corpses. The term "necrophilia" is extremely ambiguous. When analyzing necrophilic case studies, we can only do our best to categorize while also being aware of the constraints and applicability of our classifications. We must comprehend the motivations for loving the living in order to comprehend the varied necrophiles and the circumstances in which a person's preferences could shift to emphasize the dead. The term should be vigorously addressed by mental health experts, researchers, and policymakers because it is destructive to not just the person using it but also to other humans, whether they are alive or dead. Due to the nature of the disorder, both the social sciences and the field of mental health require greater attention.

The investigations of numerous researchers and prior cases reveal that the mindset of necrophiliacs is changing due to social, economic, and other circumstances, but no effective solution has been found, owing to the lack of a meeting point between medical science and legislation. With regard to social views, there might be considerable differences in treatment, punishment, or implications depending on the country and its values and laws. Necrophilia is still poorly understood and elicits more emotional responses than empirical study. There should be some methods to improve the legal stance on

necrophilia. Modifications and the creation of new provisions are required from time to time, but a lack of understanding and care in this area could lead to major consequences in the future.

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## Homicide-Suicide: A Systematic Review in Indian Scenario

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### Abstract

'Homicide-suicide' is the death of both the victim and the assailant. These violent acts involve the killing of the most intimate partner or family members, followed by suicide. The circumstances that provoke may vary from person to person, the most common being family and marital disputes. The dyadic death cases are of immense importance as they reflect on the mental health of society, the financial problems of the country, or the breakdown of family relations. An increase in such cases in India points towards undetermined psychological stress and depression in the population. Identifying and creating awareness in the population can help mitigate such violent crimes.

**Keywords:** Dyadic Deaths; Homicide; India; Perpetrator; Suicide.

### Introduction

A homicide-suicide is an act where an individual kills one or more people and then commits suicide almost immediately or within a week's period. <sup>1</sup> So, in 'homicide-suicide' there is the death of both the victim and the assailant. These are the most violent acts involving the most intimate partners or family members. With the change in occupational patterns, long-distance relationships, and pandemic scenarios, it is certain that the socioeconomic burden has increased on individuals. It is not uncommon to see deaths among close-related

groups of individuals. Families perished as a result of premeditated, collective impulse-driven decisions. These are part of dyadic deaths (which also include pact suicides).<sup>2</sup> They generate much public concern and attention in the present era of social media, which is also a highly complex entity in forensic psychiatry. Filicide-suicide is a subset and a special category of homicide-suicide events where the victim(s) are children and the perpetrator is one of the parents or both.<sup>3</sup> The association of different psychosocial causes is eventually being revealed behind this deliberate act, which include infidelity, domestic and marital disputes, financial instability, psychiatric

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illnesses, and drug addiction of drugs.<sup>4-5</sup> The first COVID-19 infanticide-suicide case was published by Mamun MA et al. in Saudi Arabia. Financial crisis and fear of COVID-19 infection were the causative factors.<sup>6</sup> Although homicide suicide events are rare when compared with other unnatural deaths, this form of lethal violence produces stronger emotional feelings in the public when compared with homicide or suicide alone.<sup>8,9</sup> This article intends to describe the victim-assailant relationship, provoking factors, and the cause of death of such cases of homicide-suicide reported in India that are documented in the literature.

The emotional reaction is even stronger in cases of mass murder or when children are involved. This article intends to review a number of studies related to the homicide-suicide combination in the Indian context. This is an attempt to integrate and describe cases of homicide-suicide. India has seen exceptionally few cases relating to homicide-suicide, as compared with numerous other nations. Even so, very little has been published in scientific journals. But the trend is rising in this decade.

### Methodology

We conducted a systematic review of the

literature published from January 2000 to January 2024 on homicide and suicide. This review included only cases reported from India. A search in different electronic databases was made: PubMed, Science Direct, and Scopus. The following keywords were used to identify the relevant articles: "homicide-suicide," "murder-suicide," "filicide-suicide," "familicide suicide," "infanticide-suicide," and "neonaticide-suicide." We also examined reference lists of relevant reviews.

The inclusion criteria for our review were as follows: All studies that examined the characteristics and backgrounds of perpetrators of homicide-suicide (possibly including studies specifically focused on filicide-suicide, neonaticide-suicide, mass-murder-suicide, parricide-suicide, etc.). We included studies only from India. The exclusion criteria were that the data published was insufficient or unclear.

### Results

After the literature search, 9 studies met our inclusion criteria, while 2 studies that were cited as references in other studies were rejected due to insufficient data.

The details of the study are presented in Table 1.

**Table: 1 Homicide-suicide - Case and Case series.**

Year of publication	Type of study	Author	Victim-Perpetrator Relationship	Reason	Cause of death of victim	Cause of death of Perpetrator
2008	Case series	Gupta BD et al	Mother 8 Cases	Family disputes	Burning or drowning	burning or drowning
2011	Case series	Ghormade PS et al	Husband/ Consortial (male)/Father	Marital disputes/ infidelity	Incision over neck/Hanging	Hanging
2015	Case report	Gadharirk et al	Mother	Marital disputes and dowry	Drowning	Drowning
2016	Case report	Ashok-Chaudhari V et al	Lover/ Consortial (male)	tense love affair and monetary dispute	Gun shot	Gun shot
2017	Case report	Bhengra A et al	Husband	suspicion of infidelity	Assault by saline stand	Hanging
2022	Case report	Gavale et al	Husband	suspicion of infidelity	Incision over neck	Hanging
2023	Case report	Raut et al	Consortial (male)	suspicion of infidelity	Head injury	hanging
2024	Case report	Pai c et al	Husband	Care giver burn out	Smothering	Hanging

## Discussion

Homicide suicide deaths are reported from different parts of India, are more commonly observed in illiterate and low socio-economic groups, and include single or multiple victims. Most of the incidents occurred at home, and the perpetrator was related to the victim, with the exception being a case report by Bhengra A et al., a very rare incident reported from a hospital. In a retrospective study by Gupta BD et al., the murder-suicide trend in Gujarat state over a period of 5 years was analyzed (2000–2004). In which 8 mothers committed murder of their children (age group of 6 months to 7 years), involving 10 female and 3 male victims, followed by their suicide. Deaths were caused by burning or drowning.<sup>10</sup> In three cases of dyadic deaths reported by Ghormade PS et al., all the murders were committed by males. In these two instances, the husband killed his wife or partner, and in the third case, the wife was killed along with a daughter. The manner of deaths was different.<sup>11</sup> Gadharirk et al. reported a case in which a 26-year-old mother committed suicide immediately after throwing her two sons into the well. A history of marital quarrels and cruelty to married ladies regarding dowry was present. So, it was found that she had been under some kind of stress since a week before the tragic event.<sup>12</sup> In a much rarer study by Ashok-Chaudhari V et al., dyadic deaths were caused by the misuse of the service pistol. Where a male perpetrator killed the victim, who happened to be his lover, before shooting himself. The service pistol issued by the police department was misused for both acts. After proper psychoanalysis, the main reasons for dyadic death were a tense love affair and a monetary dispute between the perpetrator and victim.<sup>13</sup> In a study by Bhengra A et al., dyadic death was reported from a hospital. A hospital has never been reported as a place for such incidents. A man killed his wife by the saline stand in a general ward. Then he committed suicide by hanging himself from the ceiling fan of the hospital. The husband killed his wife on suspicion of infidelity.<sup>14</sup> A study by Ateriya et al. on a triple filicide and suicide was reported. The mother drowned all three of her daughters in a tank when they were asleep. Later, she drowned herself in the same water tank. She was depressed and frustrated for not having any male children, which subjected her to humiliation by her husband and her

in-laws for failing to bear a son. For this reason, she probably decided to end her life along with her three daughters.<sup>15</sup> In a case report published by Gavale et al., the husband killed his wife with a sharp object and later hanged himself. The main reason for such an act is suspicion of infidelity.<sup>16</sup> In a much more recent study by Raut et al., a consortial relationship was found to be dead. A woman was killed with a hammer by her partner, who later hanged himself. It was established through the police statements from friends that the male partner suspected infidelity, hence the reason for the crime.<sup>17</sup> In a study published in January 2024 by Pai et al., a first case of dyadic death involving geriatric care was reported. The lady suffered from a stroke 7 years ago and has been bedridden since then. And her husband was the main caregiver. The old lady was found on her bed with a pillow on her face, and the husband hanged himself in the adjacent room. It was concluded to be a dyadic death by a psychological autopsy, a crime scene investigation, and other corroborative findings. The main cause of this act was caregiver burnout syndrome.<sup>18</sup>

In this review, only two articles were case series; the rest are case reports. Barring the case series by Gupta BD et al., which considered only females as perpetrators, in the rest of the articles, male perpetrators were frequent offenders. The perpetrators were in the age group of 30–50 years, suggesting they were earning individuals in their productive lives, indicating financial and marital stress. One exception is a case of a “caregiver burnt out” reporting in January 2024 belonging to the geriatric age group. The reason for homicide-suicide deaths was psychological stress from family disputes, infidelity, monetary crises, love affairs, and a case of caregiver burnout syndrome. The culprit usually attempts self-annihilation due to an extreme degree of guilt or an attempt to escape from criminal punishment. The manner of injuries by male perpetrators to the victims varied from cut throat injury, gunshot, smothering, assault by hammer, and other objects, while suicide by them involved gunshot and hanging. The manner of injuries by female perpetrators by drowning and burning committed suicide in the same manner. However, the investigation of dyadic deaths remains a challenge for the investigators, especially in concluding the

manner of death as the assailant is also dead.

### Conclusion

Among the cases studied, there was no clear conclusion regarding gender distribution in the perpetration of crime. Both men and women seem to be equally contributing to the crime. Family disputes and infidelity were among the frequent reasons for the crime, followed by a monetary crisis. In one rare case, a dyadic death due to caregiver burnout syndrome occurred in a geriatric couple. The male perpetrators committed the homicide by assaulting and hanging themselves, while the female perpetrators preferred drowning and burying for the act. Irritation, rage, and violence can be signs of mental illness. An increase in such cases in India points towards undetermined psychological stress and depression in the population. Identifying and creating awareness in the population can help mitigate such violent crimes.

**Ethical clearance:** None required

**Source of Funding:** None

**Conflict of Interest:** No

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# Profile of Suicidal Deaths in Females Brought to a Tertiary Care Centre in North Bangalore

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## Abstract

**Introduction:** Suicide is an important health hazard across the world. The SDR (Suicidal Death Rate) observed in Indian females is over three times higher than the rate expected globally for regions with similar socio-demographic profile.

**Objectives:** This study is aimed at analysing the pattern, probable motives, and socio-demographic factors of female suicidal deaths across all age groups subjected for autopsy to the Forensic Medicine department, M.S Ramaiah Medical College.

**Materials and Methods:** Detailed information regarding the deceased and the circumstances of death were collected from the police and relatives by a standard proforma questionnaire. Data was analysed using computer software, Statistical Package for Social Sciences (SPSS) version 20.0.

**Results:** Total of 93 cases of female suicides were autopsied in the study period, and the most common age group observed was 21-30 years (30%), commonly educated up to high school (32.2%), majority of cases falling within class IV socio-economic status with 38.7% cases (Modified Kuppaswamy's classification). Married women comprised 41.9% cases. Hanging (76.3%) was the most often used method, commonly occurring at the time periods of 6AM-12PM and 6PM-12AM with 29 cases (31.18%) each. Frequently motivated by monetary reasons with 18.27% and mental illnesses accounting for 16.12%.

**Conclusion:** The increasing suicide rate creates a challenging obstacle for public health personnel. This study is a step toward a larger multi-centre study where deeper analysis and necessary interventions can be postulated.

**Keywords:** Suicide; Female; Hanging; Bangalore; Autopsy

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## Introduction

The deliberate act of taking one's own life is called "Suicide". Suicide affects the individual, their families, friends, and communities. Every year more than 2,00,000 individuals commit suicide in India, with various causes such as mental illness, discrimination, debt and financial loss, chronic pain, etc.

According to the National Crime Record Bureau, India reports have shown gradual increase in unnatural female deaths in India from 1967 to 2019. Among the various causes for unnatural deaths, it should be noted that according to the 2019 statistics put forth by the World Health Organisation, India ranks 41<sup>st</sup> in the world for total number of suicides per 100,000 population, with women forming 11.1 cases out of every one lakh persons, which is the 7<sup>th</sup> highest in the world.<sup>(1)</sup> Globally, suicides are more common in men, although the sex ratio is closer to 1 to 1 in developing countries, such as China wherein a higher suicide rate has been reported in rural Chinese women (30.4 per 100,000) than in Chinese men (23.8 per 100,000).<sup>(2)</sup> This is similar to the scenario in India, where it is noted that the SDR (Suicidal Death Rate) observed in Indian females is over three times higher than the rate expected globally for regions with similar socio-demographic profile. However, various rates of suicide have been reported in India and in most of these reports the investigators rely on data from police records, which typically under-report cases of suicide.<sup>(3,4,5)</sup> The access to means directly affects the method of suicide that is chosen in India. As India is a largely agricultural nation- pesticide poisoning and hanging are seen to be the common methods, along with jumping from a height and railway injuries.<sup>(6)</sup>

With the rising trend of suicidal deaths in females, a prospective study to understand the pattern of such deaths in females is vital as there is a need to improve the protective systems and to curb these potentially preventable deaths.

## Material and Methods

All cases of unnatural deaths amongst females subjected for autopsy to the Department of Forensic Medicine M.S Ramaiah Medical College and Hospital, Bangalore between October 2017 to March 2019.

This prospective study was undertaken in which all cases received as brought dead to the mortuary of M.S Ramaiah Medical College and Hospital, Bangalore were included in the study, including cases with survival periods and treatments given in our hospital or referred to our hospital. All unknown and/or unclaimed female cases and other female deaths due to any manner apart from suicide or unconfirmed cases of suicide were excluded.

Detailed information regarding the deceased, relevant histories, and the circumstances of death were collected from the police, kith, and kin of deceased by a standard proforma questionnaire used to collect information regarding the demographic pattern after obtaining informed consent. Photographs of the case and any additional articles such as suicide notes, crime scene photos, and hospital records were perused as and when available. Data were analysed using Statistical Package for Social Sciences (SPSS) v.20.0 software.

## Results

During the study period from October 2017 to March 2019, a total of 1,235 cases were brought for autopsy to our centre. Out of 142 unnatural female deaths, 93 cases were confirmed to be suicides, constituting 65%. Age wise distribution showed that the most common age group involved was 21-30 years (30.1%). A minimum age of 11 years old and a maximum age of 84 years was noted. (Figure No. 1)

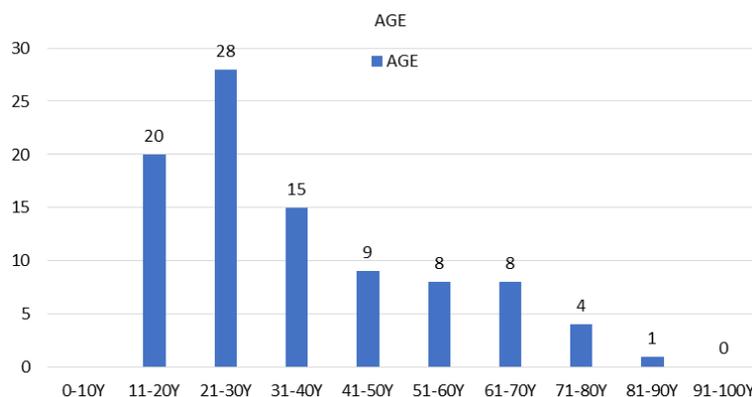


Figure No. 1: Age-wise distribution of cases

In terms of marital status, it was observed that single women, and married women constituted 37 cases (39.7%) and 39 cases (41.9%) respectively. While divorced women and widowed women formed 10 cases (9.3%), and 7 cases (7.5%) respectively.

With regards to education levels, a majority of females were educated up to high School amounting to 30 cases (32.2%). While illiterate females accounted for 6 cases (6.4%). (Table no. 1)

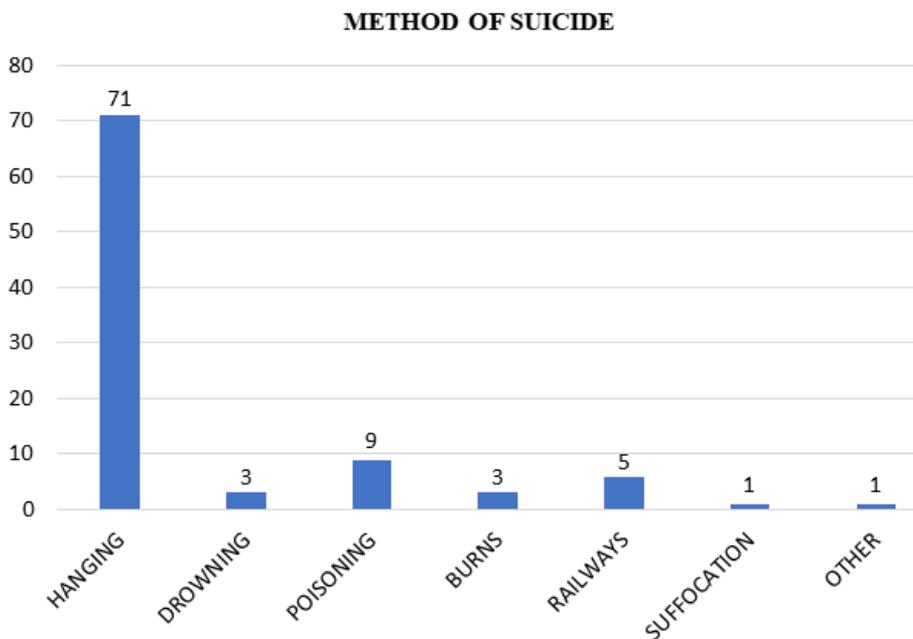
**Table No. 1: Education level of cases.**

EDUCATION	Frequency	Percent
Illiterate	6	6.4
Primary School	12	12.9
Middle School	12	12.9
High School	30	32.2

Intermediate	18	19.3
Graduate	12	12.9
Post-Graduate	3	3.2
Total	93	100

The socio-economic status of the sample group (Modified Kuppaswamy's classification) shows majority of cases fall within class IV with 36 cases (38.7%) and class V with 30 cases (32.2%). Class III and class II follow with 19 cases (20.4%) and 8 cases (8.6%) respectively. The study had no cases of class I.

With regards to the method of suicides, the most commonly method was Hanging with 71 cases (76.3%). 'Other' includes a case of complex suicide involving both poisoning and hanging, resulting in a delayed death. (Figure No. 2)



**Figure No. 2: Distribution according to the method of suicide**

The reasons for suicide was gleaned from the suicide notes and the history from the loved ones. The most common motive was monetary with 17 cases (18.27%). Second was mental illness accounting for 15 cases (16.12%), mental illness included: 12 cases of diagnosed depression, with 7 being treated. 2 women with history of depression, and 1 case of bipolar disorder on treatment. Loneliness was also a significant cause for suicide with 5 cases (5.37%), seen in women who were elderly and widowed. (Table no. 2)

**Table No. 2: Distribution according to reasons for suicide**

REASONS FOR SUICIDE	FREQUENCY
UNKNOWN	8
MONETARY	17
MENTAL ILLNESS	15
PHYSICAL ILLNESS	2
DOWRY	6
HARASSMENT BY INLAWS	1

Continue.....

BULLYING	2
ACADEMIC FAILURE	11
LOVE FAILURE	11
BEING UNMARRIED	4
PRESSURE TO MARRY	4
INABILITY TO CONCEIVE	2
SUSPICION OF EXTRAMARITAL AFFAIR OF WIFE	3

SUSPICION OF EXTRAMARITAL AFFAIR OF HUSBAND	1
ARGUMENT/ DISAGREEMENT	1
LONELINESS	5
Total	93

The most common time period was observed to be 6AM-12PM and 6PM-12AM with 29 cases (31.18%) each. (Table no. 3)

**Table no. 3: Crosstabulation of the method of suicide and the time of incident**

Suicide method	Time of incident				Total
	12AM-6AM	6AM-12PM	12PM-6PM	6PM-12AM	
HANGING	21	19	10	21	71
DROWNING	0	2	0	1	3
POISONING	1	3	2	3	9
BURNS	0	1	1	1	3
RAILWAYS	0	4	0	1	5
SUFFOCATION	0	0	0	1	1
OTHER	0	0	0	1	1
Total	22	29	13	29	93

## Discussion

### Demographic details:

In our study, the most common age group of the deceased was 21-30 years (30.1%) & 11-20 years (21.5%), factors such as marital disharmony, relationship issues, dowry deaths, academic, etc. most often affect these age groups. Similar findings were seen in a study conducted by Manoj Bhausahab Parchake et al in the Marathwada region, where it was observed that out of 392 cases, 44.39% were in the age group of 21-30 years.<sup>(7)</sup>

**Marital status:** A majority of the deceased women in our study were married with 41.9%, and the second most noted was single/unmarried with 39.7%. Widows comprised 7.5% of cases, and divorced women comprised 9.3%. Of the 39 married women, 25 cases (64.1%) were below 7 years of marriage; 6 cases were of Dowry Death, with 3 cases occurring within 3 years of marriage. These findings were also consistent with the results of the study done by Rajesh C. Dere & Col. K.M. Rajoo in Loni, with married women forming 83.22% and unmarried

women forming 16.78%.<sup>(8)</sup> Similar findings were also observed in studies by Kulshrestha.<sup>(9)</sup>

**Educational Status** Maximum deaths were observed in females who were educated upto high school level 30 cases (32.2%), least common were those educated up to postgraduate level.

This is seen to concur with the study done by S. Kumar and Anoop Kumar V. which showed that the most common educational level was up to high school with 42.32% and 4.83% of the victims were illiterate.<sup>(10)</sup>

These findings are also similar to the study done by Manoj Bhausahab Parchake & R. V. Kachare, where maximum number of deaths were observed in females educated up to high school with 38.52%.<sup>(7)</sup>

**Socio-Economic-Status** In the study it is seen that the majority of cases fall within class IV with 36 cases (38.7%) and class V with 30 cases (32.2%). Class III and class II follow with 19 cases (20.4%) and 8 cases (8.6%) respectively. The study had no cases belonging to class I. A decrease in the number of suicides is seen

with females from lower socio-economic statuses (classes I to III). Similar findings were seen in study by Kulshresta in Delhi.<sup>(9)</sup>

### Method of suicide

Out of the 93 cases, 71 cases (76.3%) were of hanging, 9 cases of poisoning, 5 cases were of railway injuries. Drowning cases and burns cases (3.2% each). Suffocation and other methods comprised 1 case each. 'Other' includes a case of complex suicide involving poisoning and hanging, resulting in delayed death.

Similar findings were seen in the study done by Mandar Ramchandra Sane, Ananda K in South Bangalore, in which the commonest method of suicide was hanging (71.8%) and poisoning (11.8%).<sup>(11)</sup>

This contrasts the study done by Manoj Bhasaheb Parchake & R. V. Kachare, where burns (61.9%) and poisoning (17.09%) were common, the reason cited- "Maximum number of females in this study are young, married and housewife. Most of the time they were in kitchen and more in contact with fire and cooking materials being easily available in house are usually preferred by Indian women to commit suicide." This variance is likely due to the fact that there is an exclusive government burns centre in the city. Also, the increase in liquified-petroleum-gas cylinders by government schemes, the reduction in open fire cooking and kerosene stoves, and increased safety standards in most buildings.

### Reasons for suicide

The most common reason was monetary with 17 cases (18.27%). The second most common was mental illness accounting for 15 cases (16.12%). As our centre is located in a rapidly developing urban area that is composed majorly by students and young women, it is hence within reason to assume that that is why monetary problems and mental illnesses (depression mainly), academic failure, and relationship related issues are the leading motivations for suicide.

In the study population it was observed that in the age group of 11-20 years, the most common reasons for suicide was seen to be academic failure (39.28%) and monetary (10.71%).

In the age group of 21-30 years, the most common reasons for suicide happened to be

marriage/relationship related including reasons such as dowry, harassment by in-laws, love failure, inability to marry, pressure to marry, inability to conceive, and extramarital affairs. This is similar to Sahu & Mohanty where marital disharmony (55.5%) constituted the chief cause of suicide in this age group.<sup>(12)</sup> Monetary issues and mental illness seem to be a factor in almost all age groups. This could be due to the rapid urbanisation and expensive cost of living in the city, reduced downtimes, and even lack of mental health awareness. Loneliness seems to be a common motivating factor for women above the age of 40 years. This concurs with the study done by Mohindra KS & Haddad S.<sup>(13)</sup>

**Time of incident** It was noted that in the 71 cases of hanging, the most common time periods were 12AM-6AM & 6PM-12AM with 21 cases (29.5%) each. Poisoning was more common during 6AM-12PM & 6PM-12AM with 3 cases each (33.33%). Railway cases were noted to be most common during the time period of 6AM-12PM with 4 cases (80%). This is similar to the findings of the study done by Sachil Kumar & Anoop Kumar Verma. Wherein it was noted that out of the 456 cases studied, most of the incidents took place at the night time with 163 cases (35.75%), evening 149 cases (32.67%), and morning 85 cases (18.64%).<sup>(9)</sup> This could be because most people attempting suicide would like to do so in a situation where they can be alone and not be disturbed, or even may occur as a result of the loneliness during these time periods. As most of these cases occurred in nuclear families, and at home; it is likely that the times when other members are asleep or occupied would be considered.

### Conclusion

A total of 93 cases of female suicidal deaths were autopsied in the study period, in which the two most common age groups observed were 21-30 years (30%) & 11-20 years (21%). Females in the study were most commonly educated up to high school in 30 cases (32.2%) with majority of cases falling within class IV with 36 cases (38.7%) and class V with 30 cases (32.2%). (Modified Kuppaswamy's classification) It was also observed that married women constituted 39 cases (41.9%), and single/unmarried females comprised 37 cases (39.7%).

Of the 93 cases of suicidal deaths, 71 cases (76.3%) were of Hanging, the most common time period was observed to be 6AM-12PM and 6PM-12AM with 29 cases (31.18%) each. The most common motives for suicide being monetary reasons with 17 cases (18.27%) and mental illnesses accounting for 15 cases (16.12%).

The limitations of the study mainly include the history furnished by the police or family being inadequate or inaccurate or concealed due to various obligations, this produces a difficulty in accessing the history and the motivations behind the death.

Suicide or attempted suicide is one of the major indicators of mental health of a population. Which may be caused by a multitude of factors such as unemployment, dowry disputes, failed ideals of love, illegitimate pregnancy, extra-marital affairs, monetary need or debts, and loneliness. Women's self-expression and life-choices have been curtailed by a lack of financial and societal freedom. The increasing suicide rates creates a challenging obstacle for public health personnel and medical health professionals alike in setting out to assess the complex relationships between gender and suicidal behaviour to facilitate women-specific suicide prevention strategies. This study is a step toward a larger multi-centre study where a deeper analysis including the precipitating factors of suicide can be analysed and necessary sociological interventions can be made to prevent the same.

**Conflict of Interest:** NIL

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**Ethical clearance:** SS-1/EC/020/2017 (Institutional Research Ethics committee, MS Ramaiah Medical College, Bangalore)

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# A Cross Sectional Analytical Study of Deaths Due to COVID-19 in Eastern India

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## Abstract

**Introduction:** The present study is an epidemiological study of the fatal cases of COVID-19 positive by Reverse Transcriptase Polymerase Chain Reaction in a tertiary care centre in West Bengal. The trace, track and treat mode of investigation has helped in the control and timely intervention in the disease pathogenesis

**Objective:** to analyse the epidemiological characteristics of COVID-19 related deaths in tertiary centre in Eastern India and comprehended the pattern of deaths due to COVID-19. This will help in understanding the gaps between infection and deaths.

**Methods:** It was a cross sectional analytical study. The Medical certification of cause of death was studied and data was tabulated. We collected deaths due to COVID-19 in a tertiary set up in Eastern India from March'2020 to September'2020.

**Results:** A total of sixty-one deaths were studied. Among the deaths with COVID-19, mild type accounted for the most followed by the severe type. The median age was 65 years 50% of the deaths were distributed in 60-80 years age group. Additionally, the male to female ratio was 3:1. % of patients had underlying comorbidities. It was noted more amongst males. Most of the underlying diseases were hypertension, Diabetes Mellitus, cardiovascular diseases.

**Conclusion:** COVID-19 posed a greater threat to the elderly people and men with fatal consequences.

**Keywords:** COVID-19, deaths, co-morbidities, cause of death

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## Introduction

India has a population of 140 crores. Since the outbreak of COVID-19 pandemic, India in its three waves has witnessed 5 lakhs deaths<sup>1</sup>.

The first reported death in India due to COVID-19 was that of a 76 years old male, a known case of hypertension, Diabetes Mellitus and Bronchial Asthma with a travel history to a Middle east country. The second known death was that of a 69 years old female, whose son had a travel history and shared a common household. After that there were series of death in similar age group and known co-morbidities. The third death was that of a 64 years old male with multiple known co-morbidities and had a travel history to Dubai.<sup>2</sup>

The mortality rate due to COVID-19 has often been defined as excess mortality<sup>3</sup>.

SARS CoV2, responsible for Coronavirus Disease (COVID)-19 was isolated from cases of pneumonia of unknown origin. The test, track and treat helped reduce the mortality of the otherwise infectious disease and thus iad in decreasing the mortality<sup>4</sup>.

The mortality rate of the disease was 1.28% in India in 2021<sup>5</sup>. The mortality rate in USA and Europe is 1.5%<sup>6</sup>. Systemic involvement in COVID-19 was varied. It affected Cardiovascular system in few, in others respiratory system was affected. The variable factors included gender, Angiotensin Converting enzyme expression, existing co-morbidities and the genetic predisposition affected the outcome. We

undertook this study to understand the systemic involvement and the affected system.

## Methodology

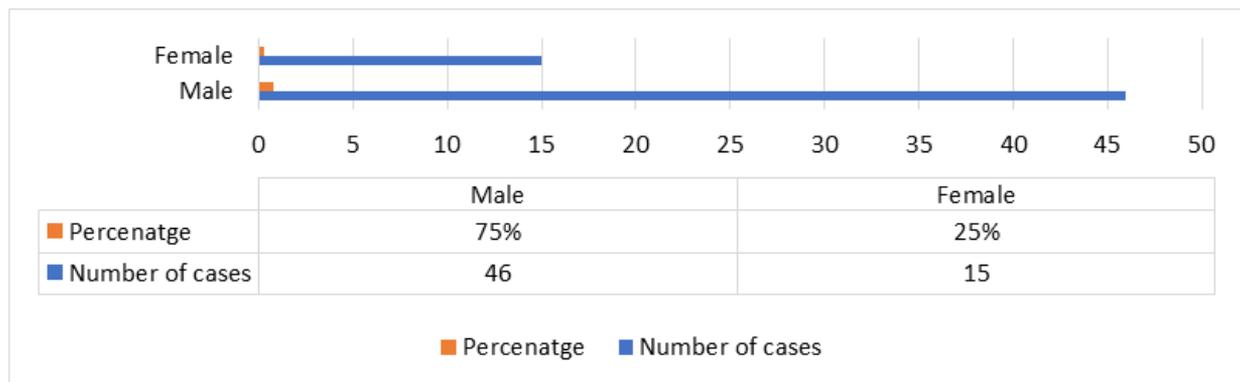
Our study is a cross-sectional analytical study. We pursued all the records of cases which were Reverse Transcriptase Polymerase Chain Reaction cases of COVID19 which tested positive between March 2020 to September 2020 which were given a cause of death. We did not include cases where cause of death was ill defined like found dead or sudden cardiac arrest. Sample size: we included the deaths that occurred in the hospital in patients who had COVID-19 or who recovered and died due to its complications. Our sample size was 61.

## Method

In our study, we included all the cases who were admitted to a Tertiary Hospital in southern part of West Bengal, India and were diagnosed as a case of COVID-19 by Reverse Transcriptase Polymerase Chain Reaction. The Medical certification of cause of Death was used to collect the data which had been duly filled and signed by a Registered Medical Practitioner. The data was collected for demographics, co-morbidities and cause of death as filled in MCCD.

Understanding the immediate cause of death is critical in addressing any potential gaps in care and improving outcomes in patients with COVID-19. This is the only study to the best of our knowledge talking about immediate cause of death in this region.

## Results

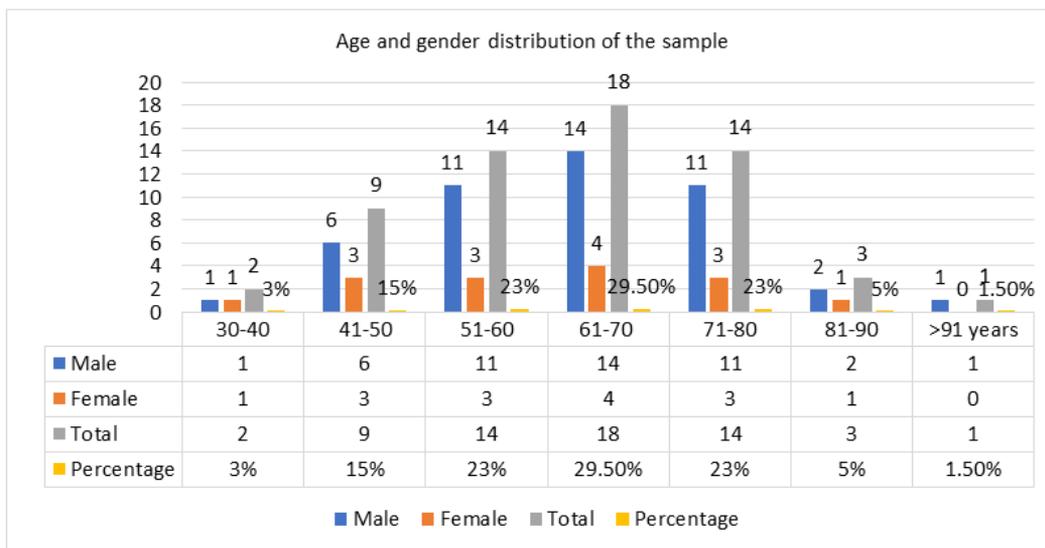


**Fig 1: Gender distribution of the study population**

75% (n=46) of our sample size were male and 25% (n=15) were female. The male: female ratio was 3 : 1

**Table 1: Age distribution of the study population**

Mean	30.5
Std dev	21.92031
Confidence Interval	5.60885
Ratio	3 : 1



**Fig 2: Age and Gender distribution of sample**

Around 30% of fatalities were in the 61-70 years (n=18, M:14, F:4) age group followed by 71-80 years which was 23% (n=14, M: 11, F:3) and 51-60 years (n=14, M:11, F:3). 41-50 years (n=9, M:6, F:3) were 15% of the total sample size and 5% was in 81-90 years age group (n=3, M:2, F:1)

Mean	8.714286
StdDvn	6.824326
Confidence Interval	1.747784
Median age	65 years

**Table 2: Co-morbidities present in the study population**

Co-morbidities	Number	Total	Percentage
<b>Endocrine</b>			
Diabetes mellitus	27	30	20%
Hypothyroid	3		
<b>Cardiovascular</b>			
CAD	8	81	55%
Hypertension	32		
DCM	34		
MI	1		
Corpulmonale	1		
Complete heart block	1		
Congestive heart failure	3		
Sudden cardiac death	1		
CAD LV dysfunction	1		
Cardiogenic shock	1		

Continue.....

<i>Psychiatry</i>		<b>1</b>	
<i>Schizophrenia</i>	<b>1</b>		
<i>CNS</i>			
<i>CVA</i>	<b>3</b>		
<i>Multi system atrophy</i>	<b>1</b>	<b>5</b>	
<i>Parkinson's</i>	<b>1</b>		
<i>Haematological</i>			
<i>Anaemia</i>	<b>2</b>	<b>5</b>	
<i>Leukaemia</i>	<b>2</b>		
<i>Metabolic acidosis</i>	<b>1</b>		
<i>Nephrology</i>			
<i>AKI</i>	<b>3</b>	<b>16</b>	<b>11%</b>
<i>CKD</i>	<b>13</b>		
<i>GIT</i>		<b>1</b>	
<i>Portal hypertension</i>	<b>1</b>		
<i>Respiratory</i>		<b>5</b>	
<i>LRTI</i>	<b>1</b>		
<i>COPD</i>	<b>3</b>		
<i>Tb</i>	<b>1</b>		
<i>Death after recovery of COVID-19</i>	<b>2</b>	<b>2</b>	

Out of the co-morbidities, 55% of the co-morbidities were cardiovascular like coronary artery disease, hypertension, dilated cardiomyopathy, myocardial infarction, congestive heart failure.

Endocrine causes like diabetes mellitus and hypothyroid were around 20% of the co-morbidities and 11% were renal causes like acute kidney injury and chronic kidney diseases.

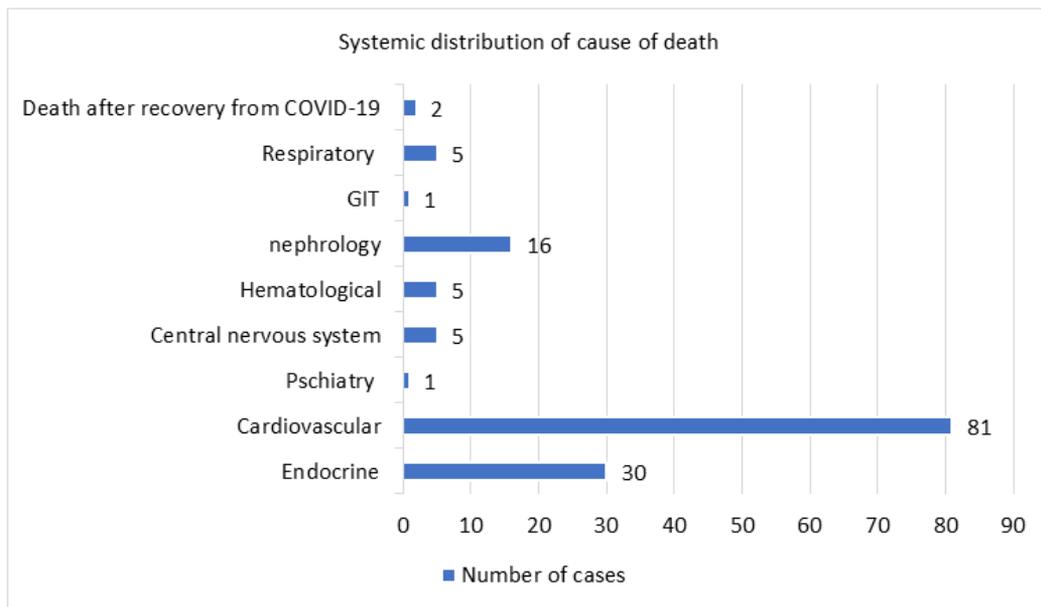


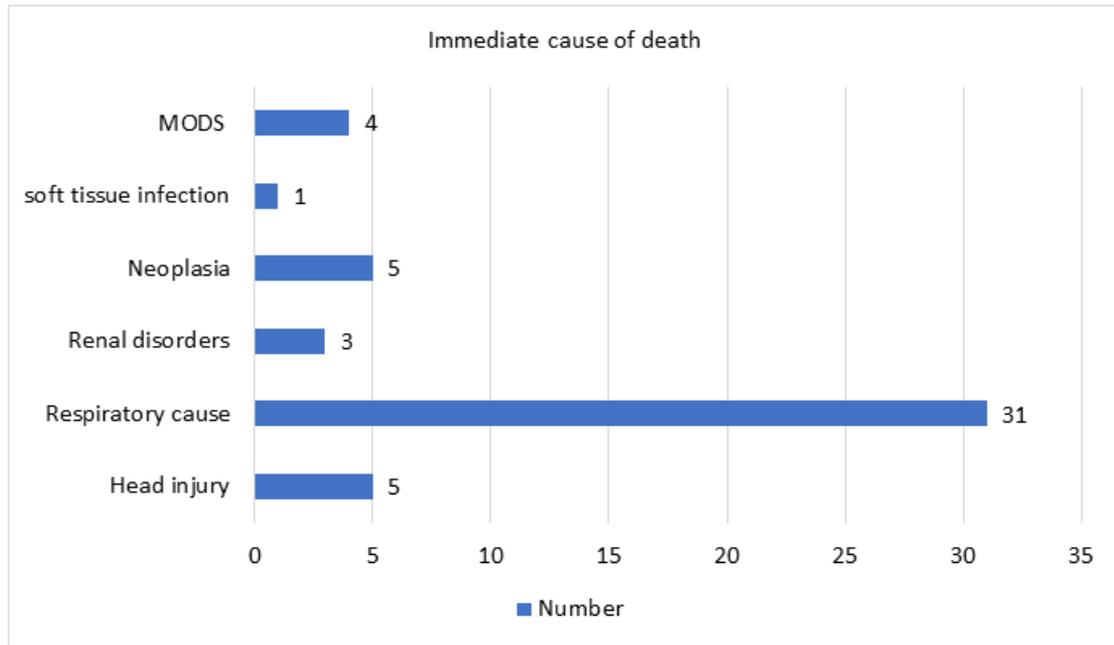
Figure 3: Depicting the systemic distribution of cause of death

**Table 3: Immediate Cause of death of the study population**

<b>Immediate cause of death</b>	<b>Number</b>	<b>Total</b>	<b>Percentage</b>
Head injury		5	8%
Acute on chronic Subdural hematoma	1		
Head injury and intracerebral haemorrhage	2		
Cerebral Vascular Accident	2		
<b>Respiratory causes</b>		39	64%
Acute exacerbation of Chronic Obstructive Pulmonary Disease	1		
Acute Respiratory Distress Syndrome	4		
Bilateral pneumonia	7		
LRTI	1		
URTI	1		
Pulmonary oedema	1		
Shortness of breath	3		
Aspiration pneumonia with sepsis	1		
Atypical pneumonia	1		
CoVID pneumonia and complications	18		
Disseminated tuberculosis	1		
<b>Renal disorders</b>		4	7%
Acute Kidney Injury on Chronic Kidney Disease	2		
Chronic Kidney Disease stage V	2		
<b>Gastrointestinal</b>		2	3.2%
Upper Gastro Intestinal bleed	1		
Decompensated cirrhosis of liver	1		
<b>Neoplasia</b>		5	8%
Disseminated malignancy	3		
Tumour lysis syndrome	1		
Recurrent glioblastoma multiforme	1		
Necrotising soft tissue infection	1	1	1.8%
MutliOrganDysfunction Syndrome and Sepsis	5	5	8%

64% of the deaths were due to respiratory cause as the immediate cause of death. it was followed by 8% cases of immediate deaths in head injury. Multi-organ dysfunction syndrome and neoplasia each.

Renal disorders were 7%. Gastrointestinal causes were 3% and necrotising infection were seen as immediate cause of death in 1.8%



**Fig 4 depicting immediate cause of death**

### Discussion

COVID-19 had the world at tenterhooks as the aetiology was not known, treatment was not specific. However, due to diligent interplay of the medical, biotechnology and people themselves the fight against the infection succeeded. However, the need to learn and evolve is essential to know the gaps that existed between the disease, cure and the existing co-morbidities. This played an essential role in understanding the gaps between treatment and the results achieved.

SARS-CoV2 virus was identified as the aetiology of the disease. Interestingly it enters the body through Angiotensin Converting enzyme 2. This has a varied expression all over the body and it also is dependent on sex hormones. Differences in the expression of ACE2 caused by sex hormones may help in explaining the sex disparities in COVID-19 infection, severity, and fatality. This may explain the varied infectivity and mortality pattern not just amongst gender but also amongst individuals<sup>7</sup>.

The male: female ratio in our study was 3:1 for mortality. Few studies have found same susceptibility to male and female in terms of patients testing positive<sup>8,9</sup>. However, the mortality rate was more in males as compared to females<sup>10</sup>. Hospitalization was also found to be 1.5 times in males as compared to females<sup>11</sup>. The reasons enlisted for less fatality in females are often said to be due to enhanced immune response<sup>7,12</sup>.

Female COVID-19 patients may also experience lower severity and fatality rates than male patients due to their enhanced immune responses, different sex hormone causing varied response of ACE2 receptors on cells<sup>7,12</sup>.

Varied expression of ACE2 on cells cause it to act on multiple organs like endocrine organs, cardiovascular system, respiratory system, gastrointestinal system, hepatobiliary system<sup>13</sup>. In our study, out of all the co-morbidities, 55% of the co-morbidities were cardiovascular like coronary artery disease, hypertension, dilated cardiomyopathy, myocardial infarction, congestive heart failure.

Endocrine causes like diabetes mellitus and hypothyroid were around 20% of the co-morbidities and 11% were renal causes like acute kidney injury and chronic kidney diseases.

Median age in our study was 65 years. Median age have ranged from 44 years to 75 years<sup>14</sup>

Though COVID-19 is largely understood to be a respiratory disease, emerging evidence has shown that it can directly affect other organs in the body. Data suggest that a higher expression and activity of ACE2 may increase vulnerability to COVID-19 infection and fatality. For example, increased ACE2 expression was high in the lungs of patients with comorbidities associated with higher risk to COVID-19 infection

Comorbidity :atleast one co-morbidity was reported in many studies<sup>15</sup>. 22% of the cases of Stokes et al had an underlying co-morbidity<sup>16</sup>. Cardiovascular diseases, diabetes and chronic lung disease were the most frequent underlying disease<sup>17</sup>. Majority of the patients with fatality had atleast one existing co-morbidity<sup>15</sup>.

In our study, out of the co-morbidities, 55% of the co-morbidities were cardiovascular like coronary artery disease, hypertension, dilated cardiomyopathy, myocardial infarction, congestive heart failure. Hypertension, obesity and diabetes were the most common pre-existing co-morbidities.<sup>14, 15 16,17</sup>

Endocrine causes like diabetes mellitus and hypothyroid were around 20% of the co-morbidities. COVID-19 is often exacerbated due to underlying and co-existent endocrine disorder. Additionally, the infection casues an alteration in the normal physiological process of underlying organs. This leads to an altered response of the body to the stress leading to harmful results. A.19

11% were renal causes like acute kidney injury and chronic kidney diseases.

In our study,64% (n=39)of the deaths had immediate cause of death as Respiratory infections. In most of the studies, peripheral blood have shown an increased number of neutrophils. They are known to be a major source of chemokine and cytokine leading to cytokine storm. This is often understood to be the reason for Acute respiratory distress syndrome<sup>20</sup>.

Particularly, one study regarding postmortem COVID-19 patients found SARS-CoV-2 antigens in the tubular epithelial cells of the kidneys, suggesting that SARS-CoV-2 can directly infect the kidney<sup>21</sup>.7% of our cases (n=4) had renal cause of death like acute kidney injury or Chrnoic kidney disease stage V.

Furthermore, another study found that SARS-CoV-2 infected human induced pluripotent stem cell-derived cardiomyocytes, displaying the direct effects of SARS-CoV-2 on the heart cells<sup>22</sup>. Arrhythmia have been frequently quoted as a common cause of death in COVID-19 patients. Out of the arrhythmia, supraventricular tachycardia is the most frequent<sup>23</sup>. It is said it is due to Ferroptosis which is caused due to accumulation of lipid ROS in cells, resulting in fatal lipid peroxidation<sup>24</sup>.

Accurate determination of the immediate causes of death in patients with COVID-19 is important for optimal care and mitigation strategies. 64% of the deaths were due to respiratory cause as the immediate cause of death.Oud et al<sup>25</sup> found nearly five-fold rise in ARDS-related deaths 2020. COVID-19 as a cause of death was present in over 80% of all ARDS-related deaths that year.

It was followed by 8% cases of immediate deaths in head injury. Other studies have also noted an increase in head injury due to domestic violence, falls and decreased reporting to hospital due to lockdown.<sup>26</sup>

Understanding the immediate cause of death is critical in addressing any potential gaps in care and improving outcomes in patients with COVID-19.

Limitations of the Study: the sample size was limited. The sample was also regional in distribution and may not represent the entire sample.

Conclusion: the expression of the innate mechanism of immunity, ACE2 on organs of every individual made him uniquely predisposed to the complications of CoVID-19 Infection. Male and female were diagnosed equally. However, the mortality rate in male to female was 3:1. The age group of 60-80 years was severely affected. The respiratory casue of death like Acute respiratory distress syndrome, pneumonia and complications were commonly encountered as cause of death. cardiovascular co-morbidities were the majority of the pre-existent co-morbidities.

**Ethical Statement:** Ethical Clearance taken. IEC/CHKol/2021/Apr/011 dt 12 Apr 2021

**Conflict of Interest:** Nil

**Source of Funding:** Nil

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## Sex Estimation using Mandibular First Molar and Maxillary First Molar: A Comparative Study

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### Abstract

**Introduction:** Estimation of sex from skeletal remains is an important initial medicolegal aspect of forensic and anthropological examination. Among various methods of sex estimation only DNA analysis gives absolute proof of sex estimation, but such methods are meticulous, immoderate and relatively prolonged and involves difficult DNA extraction technique. Teeth are strongest and toughest structure in the human body which are resistance to fire, decomposition and many other changes and teeth development completed before bone maturation making teeth relevant sex indicator hence teeth can be used for sex estimation. The 1<sup>st</sup> molar tooth is suitable tooth since it erupts early and very little chance of impaction than other teeth.

**Aim:** The aim of our study was to evaluate the sex estimation by mesiodistal width of mandibular and maxillary 1<sup>st</sup> molar teeth in north Indian population.

**Materials and Methods:** The sample comprised of dental impression from 106 individuals (53 males and 53 females), all young adults between 20 and 35 years of age. Impressions of the teeth were made using irreversible hydrocolloid (alginate) material and casts poured in dental stone. Mesiodistal (MD) dimensions of mandibular and maxillary 1<sup>st</sup> molar of both right and left side were measured by digital caliper.

**Results:** Data were summarized as Mean and SD. Groups (in Gender Male vs female) were compared by unpaired or independent Student's t test. Mean maxillary width of 1<sup>st</sup> molar of both right and left side were higher in male than female but were statistically not significant whereas mean of maxillary 1<sup>st</sup> molar width of right side though

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slightly higher in male than female but was statistically not significant whereas of left side mean was lower in male than female and statistically not significant in young north Indian population. Very little sexual dimorphism shown by maxillary and mandibular 1<sup>st</sup> molar.

**Conclusion:** The study confirmed that maxillary and mandibular 1<sup>st</sup> molar did not establish a tool for sex estimation in north Indian populations since there was no statistically significant difference in mesiodistal width of mandibular and maxillary 1<sup>st</sup> molar among males and females on both the right and the left sides jaw.

**Keywords:** Maxillary molar, Mandibular molar, Sexual dimorphism, Sex estimation, Mesiodistal width, Sex estimation.

**Abbreviations:** MD: Mesiodistal, SD: Standard deviation, mm: Millimetre.

## Introduction

Estimation of sex from skeletal remains is an important initial medicolegal aspect of forensic and anthropological examination<sup>1,2</sup>. There are various methods of sex estimation like cheiloscopy<sup>3,4,5</sup>, odontometry<sup>6</sup>, osteometry<sup>7</sup>, DNA analysis<sup>8</sup> and among them only DNA analysis gives absolute proof of sex estimation, but such methods are meticulous, immoderate, relatively prolonged and involves difficult DNA extraction technique and requires skilled and trained personnel<sup>9,10</sup>. Teeth are strongest and toughest structure in the human body which are resistance to fire, decomposition and many other changes<sup>11</sup> and teeth development completed before bone maturation making teeth relevant sex indicator<sup>12,13,14</sup> hence teeth can be used for sex estimation not only in living but also in mutilated bodies, decomposed bodies, or from fragmentary skeletal remains<sup>15,16</sup>. Sexual dimorphism means difference in size and appearance among male and female teeth that can be applied for sex determination<sup>17</sup>. Sex estimation by dental characteristics is mainly based on the comparison of metric and non-metric dental traits between men and women<sup>1,18</sup>. Metric analysis of tooth parameter is one of the acknowledged methods of sex determination by teeth. The 1<sup>st</sup> molar tooth is suitable tooth since it erupts early and very little chance of impaction than other teeth<sup>19</sup>. The aim of our study was to evaluate the sex estimation by mesiodistal width of mandibular and maxillary 1<sup>st</sup> molar teeth in north Indian population.

## Material and Methods

### Material required

1. Alginate
2. Dental stone

3. Maxillary Impression Trays
4. Mandibular Impression Trays
5. Rubber Bowl
6. Spatula

The alginate dental impression forms an imprint (i.e., a 'negative' mould) of those teeth and gums, which can then be used to make a cast or 'positive' model of the patient's dentition.

### Sample size

#### Sample selection:

sample size was calculated by formula

$$N = Z_{\alpha}^2 p(1-p) / E^2$$

Where  $Z_{\alpha}$  is critical value of z-score at  $\alpha$  level of significance (at  $\alpha = 5\%$ ,  $Z_{\alpha} = 1.96$ ),  $p$  is proportion and  $E$  is permissible error. 7.48 % of sexual dimorphism observed by 1<sup>st</sup> molar width (7.03% by 1<sup>st</sup> maxillary molar width and 7.93% by 1<sup>st</sup> mandibular molar width parameter)<sup>20</sup>. So,  $p = 7.48\%$ , i.e., .0748,  $1-p = .9252$ ,  $E = 5\%$  i.e., .05. So,  $n = (1.96)^2 \times 0.0748 \times 0.9252 / (.05)^2 = 106.34 \approx 106$ .

Study was conducted on 106 volunteer subjects (53 male and 53 female) of both the sex having age group between 20 to 35 years at Integral Institute of Medical Sciences & Research, Integral University Lucknow. Informed consent was taken from all participants. Before starting study, ethical clearance was taken from Institutional Ethics Committee (IEC), IIMS&R Integral University, Lucknow with reference number IEC/IIMSR/2023/11.

### Inclusion Criteria:

1. Age between 20 to 35 years.
2. Fully erupted with complete set of teeth.

3. No history of orthodontic treatment.
4. No history of any type of prosthesis.
5. Non-carious, non attrited, non-hypoplastic, non-traumatic and periodontally healthy teeth.

#### Exclusion Criteria:

1. Age below 20 years and above 35 years.
2. Misaligned, spacing teeth, diastema or crowded teeth
3. Carious teeth, restored teeth, fractured teeth, hypoplastic teeth, teeth with prosthesis, attrited teeth, mobile teeth.

#### Methodology and tooth measurements

Impressions of the teeth were taken using irreversible hydrocolloid (alginate) material and poured by dental stone (Figure 1). Mesiodistal (MD) dimensions of mandibular 1<sup>st</sup> molar and maxillary 1<sup>st</sup> molar of both right and left side, were measured on the casts using a digital caliper calibrated to 0.01 mm. The MD dimension was defined as the greatest distance between contact points on the approximate surfaces of the tooth crown and was measured with the caliper beaks placed occlusally and aligned with the long axis of the tooth (Figure 2 and 3). If teeth were rotated or misaligned, measurements were taken between points on the approximate surfaces of the crown where it was considered that contact with adjacent teeth would normally occur. Sexual dimorphism calculated by following formula given by Garn et al<sup>21</sup>.

Sexual Dimorphism in percentage (%) =  $[(Xm/Xf)-1] \times 100$ , where  $Xm$  is the mean value for males and  $Xf$  is the mean value for females.



Figure 1. Dental cast

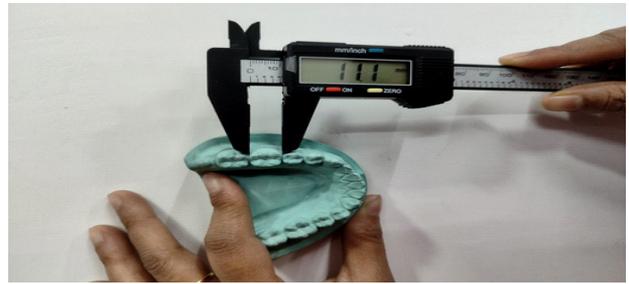


Figure 2. Measuring mesiodistal width of mandibular 1<sup>st</sup> molar by caliper



Figure 3. Measuring mesiodistal width of maxillary 1<sup>st</sup> molar by caliper

#### Results

Data obtained were quantified and analysed statistically using SPSS (Statistical Package for the Social Sciences). All description shown in table 1 to 4. Data were summarized as Mean and SD. Groups (in Gender Male versus female) were compared by unpaired or independent Student's t test. In our study mean of right mesiodistal mandibular 1<sup>st</sup> molar width was higher in male (for right mesiodistal mandibular 1<sup>st</sup> molar width  $8.045472 \pm 0.803611$ ) than female (for right mesiodistal mandibular 1<sup>st</sup> molar width  $7.892075 \pm 0.761553$ ) but statistically not significant ( $p$  value  $> 0.05$ ). whereas the mean of left mesiodistal mandibular 1<sup>st</sup> molar width (Table 1) was slightly lower in male (for left mesiodistal mandibular 1<sup>st</sup> molar width  $8.040566 \pm 0.70829$ ) than female (for left mesiodistal mandibular 1<sup>st</sup> molar width  $8.081321 \pm 0.857824$ ) and was statistically not significant ( $p$  value  $> 0.05$ ). Whereas as mean of right and left mesiodistal maxillary 1<sup>st</sup> molar width (Table 2) was higher in male (for right mesiodistal maxillary 1<sup>st</sup> molar width  $8.509434 \pm 0.657093$  and for left mesiodistal

maxillary 1<sup>st</sup> molar width  $8.53283 \pm .632797$ ) than female (for right mesiodistal maxillary 1<sup>st</sup> molar width  $8.476981 \pm .741891$  and for left mesiodistal maxillary 1<sup>st</sup> molar width  $8.411887 \pm .843263$ ) but was statistically not significant ((p value  $>.05$  for both

right side and left side maxillary 1<sup>st</sup> molar). Very little sexual dimorphism shown by right and left mandibular 1<sup>st</sup> molar (Table 3) as well as right and left maxillary 1<sup>st</sup> molar (Table 4).

**Table 1. Measurement of mean and standard deviation of mandibular 1<sup>st</sup> molar width among male and female**

Sex	Right mesiodistal mandibular 1 <sup>st</sup> molar width (in mm)			Left mesiodistal mandibular 1 <sup>st</sup> molar width (in mm)		
	Mean	Standard deviation	p value	Mean	Standard deviation	p value
Male	8.045472	.803611	.315479	8.040566	.70829	.790241
Female	7.892075	.761553		8.081321	.857824	

**Table 2. Measurement of mean and standard deviation of maxillary 1<sup>st</sup> molar width among male and female**

Sex	Right mesiodistal maxillary 1 <sup>st</sup> molar width (in mm)			Left mesiodistal maxillary 1 <sup>st</sup> molar width (in mm)		
	Mean	Standard deviation	p value	Mean	Standard deviation	p value
Male	8.509434	.657093	.812051	8.53283	.632797	.405701
Female	8.476981	.741891		8.411887	.843263	

**Table 3. Calculation of % Sexual dimorphism from right and left mandibular canine**

Right mandibular 1 <sup>st</sup> molar	1.94 %
Left mandibular 1 <sup>st</sup> molar	-0.5 %

**Table 4. Calculation of % Sexual dimorphism from right and left maxillary canine**

Right maxillary 1 <sup>st</sup> molar	0.38 %
Left maxillary 1 <sup>st</sup> molar	1.43 %

## Discussion

Sex determination is initial steps in reconstruction of the identity of a person. Due to their durability and strength, teeth have excellent value for sex estimation especially when there is difficulty in preservation of skeleton either due to anthropic or taphonomic reasons<sup>22,23,24,25,26,27</sup>. Although the morphology of teeth is similar among male and female, it is not necessary that size of teeth remain same, as the size of teeth is influenced by multiple factors like diet, metabolic activities etc. Assessment of tooth parameter are non-invasive, quick, easy, less time consuming compared to analysis of DNA<sup>28</sup>. In this study the mean value of mesiodistal maxillary 1<sup>st</sup> molar width of both right and left side was compared. Mean mesiodistal value

was slightly higher in male compared to female but the difference was not statistically significant (with p value  $>.05$ ). The finding was similar with study done by Aditya Jain<sup>29</sup>, Dahal S. et al<sup>30</sup>, Deo et al<sup>31</sup>, Babu et al<sup>32</sup>. Whereas statistically significant difference (p value) found in mean value of mesiodistal width of maxillary 1<sup>st</sup> molar between male and female in studies done by Stroud et al<sup>33</sup>, Perzigian<sup>34</sup>, Sonika et al<sup>35</sup>, Ghose and Baghdady<sup>36</sup>, Hattab et al<sup>37</sup>, Ghodosi et al<sup>38</sup>, and Rai et al<sup>39</sup> in which they found male had larger teeth parameter than female in all dimension. Though the difference in teeth parameters was due to more thickened dentine in male than female, as the Y chromosomes in male increases the mitotic strength of teeth germ and promotes dentinogenesis, whereas X chromosomes promotes amelogenesis<sup>40</sup>. The present study showed no significant difference (with p value  $>.05$ ) in mean value of mesiodistal width of mandibular 1<sup>st</sup> molar of both right and left side between male and female (though right mesiodistal width was slightly higher in male than female and left mesiodistal width was slightly higher in female than male but insignificant), indicating almost symmetrical dimension which is similar to study done by Dr. Chandramani et al<sup>41</sup> who found mesiodistal width

of mandibular first molar was not significant for sex estimation. In contrast to our study Kazzazi SM and Kranioti EF<sup>20</sup> and many others<sup>17,42,43,44,45,46,47</sup> who found statistically significant difference in mandibular mesiodistal measurement between male and female (p value <0.001). These differences may be due to geographical variation. In the present study very little sexual dimorphism shown by mesiodistal dimension of mandibular and maxillary 1<sup>st</sup> molar. Sexual dimorphism shown by right and left maxillary first molar was 0.38 % and 1.43% respectively (average 0.905%). These finding of present study was similar with study done by Dahal S. et al<sup>30</sup> who reported sexual dimorphism of 0.893% and 0.606% by right and left maxillary 1<sup>st</sup> molar respectively and study done by Ghose and Baghdady<sup>36</sup>, who observed sexual dimorphism of 0.8% in the study of Iraqi population. Many studies in Indian scenario showed different results as Narang et al<sup>48</sup> and Ahmed et al<sup>32</sup> observed 6.9% and 4.4% of sexual dimorphism on right and left sides of maxillary 1<sup>st</sup> molar respectively. Similar finding was reported by Sonika et al.<sup>35</sup> who found sexual dimorphism of 4.74% and 4.84% in the right and left maxillary 1<sup>st</sup> molar respectively. Sexual dimorphism shown by right and left mandibular 1<sup>st</sup> molar was 1.94 % and -0.5 % (no sexual dimorphism) respectively. Little study present on sexual dimorphism shown by mandibular 1<sup>st</sup> molar. Study of Kazzazi SM and Kranioti EF<sup>20</sup> shows 7.93 % of sexual dimorphism in mandibular 1<sup>st</sup> molar which is much higher than finding in our study. These variations among various populations may be related to sample size of the study and selections, as well as genetical and racial variances, which are most probably linked to different ethnicity.

### Conclusions

The present study did not show statistically significant difference in mesiodistal width of mandibular and maxillary 1<sup>st</sup> molar among males and females on both the right and the left sides jaw. Hence, this study could not establish mandibular and maxillary 1<sup>st</sup> molar as a tool for sex estimation.

**Conflict of Interest:** Nil

**Source of Funding:** Nil

**Ethical Clearance:** Has been taken from the Institutional Ethics Committee (IEC), IIMS&R Integral University, Lucknow with reference number IEC/IIMSIR/2023/11.

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# Para-suicide by Self-Poisoning: Profile of Toxic Agents Used in Aligarh District of India

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## Abstract

**Background:** Para-suicide by self-poisoning is a major public health concern throughout the world, especially in developing countries. It is a cause of considerable morbidity and mortality as well as consuming scarce medical resources which would have been used otherwise. The survival of such patients to a considerable extent depends on the competence of the attending doctors, nature of toxic agent consumed and the availability of specific antidote.

**Objective:** The sole purpose of this study is to provide proper knowledge and awareness of health professionals on the common toxic agents used for self-poisoning.

**Material and methods:** This prospective study was conducted by identifying and reviewing all self-poisoning cases that were presented at the emergency department of JNMCH, A.M.U Aligarh, over a span of 2 years. A total of 375 cases of self-poisoning were entered into the emergency department register, but only 315 files were considered for this study.

**Results:** In this study majority patients belong to 15-24 years' age group i.e. 153(48.57%) with male dominance. The most ingested substance for non-fatal self-poisoning was a pharmaceutical drug 71(22.54%) followed by agrochemicals like rat poison 60 (19.05%), Aluminium phosphide 46(14.60%) and organophosphate 33(10.48%). There were significant ( $p<0.01$ ) gender differences noted in type of substance used.

**Conclusion:** Accessibility has been noted as a factor affecting the choice of drug used. Implementing the pesticide act strictly will allow the government to have control over the production, sale, distribution, storage, and use of pesticides.

**Keywords:** Para-suicide, Self-poisoning, Aluminum phosphide, Organophosphorus, Self-harm

## Introduction

An act with non-fatal outcome, in which an individual deliberately initiates a non-habitual

behavior that, without intervention from others, will cause self-harm, or deliberately ingests a substance more than the prescribed or recognized therapeutic dosage to gain sympathy or manipulate the

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environment, called para-suicide.<sup>1</sup> The choice of toxic agent used for self-poisoning varies between countries and seems to depend more on substance availability than its lethality. The toxic substance commonly used in self-poisoning include Agrochemicals, household chemicals, prescription and over the counter medicine like paracetamol, benzodiazepines, NSAIDS, anti-depressant etc., drugs of abuse and plants poisons.<sup>2</sup> In agriculture based developing country like India situation is quite different. The agent used mostly for self-poisoning is agrochemical pesticide, it was taken orally, at home and during daytime.<sup>3,4</sup> The use of pesticide in these countries is very extensive and unregulated, so it is easily available for use as a suicide agent. For this reason, pesticide self-poisoning becomes a major contributor of suicidal death in developing country, particularly from rural areas. At least half of the patients making suicidal gestures by using prescribed drugs are psychotropic medications, which are frequently used in case of deliberate self-poisoning and parasuicide.<sup>5</sup> The main objective of this study is to provide proper knowledge and awareness of health professionals on the common toxic agents used for self-poisoning.

### Material and Methods

This prospective study was conducted by

identifying and reviewing all self-poisoning cases that were presented at the emergency department of JNMCH, A.M.U, Aligarh over a span of 2 years from March 2015 to February 2017. A total of 375 cases of self-poisoning were entered into the emergency department register, but only 315 files were considered for this study. Data analysis was undertaken by using R studio version 3.3.1. A value of  $p < 0.01$  was statistically significant and other simple descriptive tests were also used during the study.

### Results

A total of 315 patients met eligibility criteria to be included in the study, of whom 186 (59.05%) were males and 129 (40.95%) were females with male female ratio 1.44:1. Most of the patients belong to 15-24 years of age accounting to 153 (48.57%), followed by 25-34 years 85 (26.98%). Of these males, constitute 87 (46.77%) from age group of 15-24 years, 50 (26.88%) from age group of 25-34 years and female constitute 66 (51.16%) from age group 15-24 years, 35 (27.13%) from age group 25-34 years as depicted in table number 1.

**Table 1: Distribution of self-poisoning patients according to age and sex**

Age (in years)	Males N (%)	Females N (%)	Total N (%)
<15	04(02.15%)	07(05.43%)	11(3.49%)
15-24	87(46.77%)	66(51.16%)	153(48.57%)
25-34	50(26.88%)	35(27.13%)	85(26.98%)
35-44	28(15.05%)	15(11.63%)	43(13.65%)
45-54	10(05.38%)	04(03.10%)	14(4.45%)
55-64	05(02.69%)	01(0.78%)	06(1.91%)
≥65	02(01.08%)	01(0.78%)	03(0.95%)
Total	186	129	315

The most common substance taken for self-poisoning was a pharmaceutical drug 71 (22.54%) of these 39 (20.97%) were ingested by males and 32 (24.81%) were by females. Among the Agrochemicals, rat poison 60 (19.05%) rank top in the list, followed by aluminum phosphide 46 (14.60%), organophosphate 33 (10.48%), organochlorine 23 (7.30%), Pyrethroids 12 (3.81%) and 9 (2.86%) were carbamates. Males

were more likely than females to ingest aluminum phosphide 36 (19.35%), organophosphate 22 (11.83%), organochlorine 14 (7.53%) and corrosive 13 (06.99%), whereas females were most likely than male to ingest rat poison 29 (22.48%), Pyrethroids 9 (06.98%), kerosene 7 (05.43%). Others 21 (6.67%) includes common household chemicals like hair dyes, Dettol, etc. as shown in table number 2.

**Table 2: Distribution of substance used for self-poisoning**

Poisonous substance		Male N (%)	Female N (%)	Total N (%)	p-value
Agrochemicals	Organophosphate	22(11.83%)	11(08.53%)	33(10.48%)	0.013
	Aluminium phosphide	36(19.35%)	10(07.75%)	46(14.60%)	< 0.01
	Organochlorine	14(07.53%)	09(06.98%)	23(07.30%)	0.238
	Rat poison	31(16.67%)	29(22.48%)	60(19.05%)	0.855
	Carbamates	06(03.23%)	03(02.33%)	09(02.86%)	0.345
	Pyrethroid	03(01.61%)	09(06.98%)	12(03.81%)	0.041
Drugs		39(20.97%)	32(24.81%)	71(22.54%)	0.313
Corrosive		13(06.99%)	05(03.88%)	18(05.71%)	0.019
Plant poison		02(01.08%)	02(01.55%)	04(01.27%)	1
Kerosene		01(0.54%)	07(05.43%)	08(02.54%)	0.012
Phenol		04(02.15%)	04(03.10%)	08(02.54%)	1
Others		13(06.99%)	08(06.20%)	21(06.67%)	0.217
Unknown		02(01.08%)	00(00%)	02(0.63%)	0.317
Total		186(59.05%)	129(40.95%)	315(100%)	

The most reported class of drug involved in self-poisoning was the benzodiazepine 18 (25.35%) followed by acetaminophen/NSAID 16 (22.54%), antibiotic 6(8.45%), antidepressant 5(7.04%), antiepileptic 4(5.63%), antipsychotic 3(4.23%) and antihypertensive 2 (2.82%). Interestingly, males were more likely to take benzodiazepines 13 (33.33%)

than females, whereas females were more likely to take acetaminophen / NSAID 12 (37.50%). 7 (9.86%) patients take another class of drug like multivitamins, antihistamines, cough syrup, etc. Among 10 (14.08%) patients' class of drug were not known as shown in table number 3.

**Table 3: Distribution of drugs used for self-poisoning**

Drugs class	Male N (%)	Female N (%)	Total N (%)	p-value
Acetaminophen/NSAID	04(10.26%)	12(37.50%)	16(22.54%)	0.013
Antibiotic	04(10.26%)	02(06.25%)	06(08.45%)	0.563
Benzodiazepines	13(33.33%)	05(15.63%)	18(25.35%)	0.019
Anti-epileptic	01(02.56%)	03(09.38%)	04(05.63%)	0.479
Antihypertensive	01(02.56%)	01(03.13%)	02(02.82%)	01
Anti-depressant	03(07.69%)	02(06.25%)	05(07.04%)	01
Anti-psychotic	02(05.13%)	01(03.13%)	03(04.23%)	01
Other	04(10.26%)	03(09.38%)	07(09.86%)	01
Unknown	07(17.95%)	03(09.38%)	10(14.08%)	0.179
Total	39(20.97%)	32(24.81%)	71(22.54%)	

Table 4 shows that out of 53 repeaters majority were ingested drug 23 (43.39%) were ingested as a toxic substance followed by rat poison 11 (20.75%),

Aluminium phosphide 6 (11.32%), organochlorine 3 (5.66%) and corrosive 3 (5.66%).

**Table 04: Type of substance used by repeaters**

Poisonous substance	No of patients	Percentage
Organophosphate	01	1.89%
Aluminium phosphide	06	11.32%
Organochlorine	03	5.66%
Rat poison	11	20.75%
Carbamates	01	1.89%
Pyrethroid	01	1.89%
Drugs	23	43.39%
Corrosive	03	5.66%
Plant poison	00	0%
Kerosene	01	1.89%
Phenol	00	0%
Others	03	5.66%
Unknown	00	0%
Total	53	16.83%

Table 5 shows that the females were more likely than males to ingest a substance that was already available in the home 115(89.15%), while males were more likely than females to ingest a substance kept

in the field or garden 09(04.84%), or to purchase 42(22.58%) the substance with the intention of self-poisoning.

Out of all cases of para-suicidal self-poisoning, the majority takes place inside the house 300 (95.23%) followed by workplace 11 (03.49%). Females 126(97.67%) were more likely than male to attempt inside the house. There was a clear variation in the number of para-suicidal self-poisoning with the time of day. Of the total, 183(58.10%) cases were reported in the evening hours, of these 105(56.45%) were males and 78(60.47%) were females. 75(23.81%) cases reported in the morning hours, of these 48(25.81%) were male and 27(20.93%) were females, followed by 57(19.09%) cases at nighttime of these 24(18.60%) were female and 33(17.74%) were males. Most of the patients 289(91.75%) ingested single substance for self-poisoning of these 166(89.25%) were males and 123(95.35%) were females. The multiple agent / drugs were used for self-poisoning in 26 (08.25%) cases. But 20 (10.75%) cases of self-poisoning were associated with alcohol at the time of the attempt.

**Table 05: Sex wise distribution of characteristic of poison**

Variable		Male N (%)	Female N (%)	Total N (%)
How poison was obtained	Kept at home	135(72.58%)	115(89.15%)	250(79.37%)
	Kept in field/garden	09(04.84%)	04(03.10%)	13(04.12%)
	Bought for ingestion	42(22.58%)	10(07.75%)	52(16.51%)
Place of Incidence	Workplace	08(04.30%)	03(02.33%)	11(03.49%)
	Home	174(93.55%)	126(97.67%)	300(95.23%)
	Others	04(02.15%)	00(00%)	04(01.27%)
Time of attempt	Morning	48(25.81%)	27(20.93%)	75(23.81%)
	Evening	105(56.45%)	78(60.47%)	183(58.10%)
	Night	33(17.74%)	24(18.60%)	57(19.09%)
Number of Chemical Agents	Single	166(89.25%)	123(95.35%)	289(91.75%)
	Double	20(10.75%)	06(04.65%)	26(08.25%)
Association with alcohol		20(10.75%)	00(00%)	20(06.35%)

### Discussion

Out of 315 cases of Para-suicidal self-poisoning presented at the emergency section, 186(59.05%) were males dominating over females 129 (40.95%) with male to female ratio 1.44:1.

The high incidence of Para suicide amongst males as shown in this study, is like the previous

study done internationally<sup>6,7</sup> and nationally.<sup>8,9</sup> Male dominance is easily understandable by the fact that males are more often exposed to the stress of day-to-day life, occupational hazards, monsoon dependent cultivation practices, crop failures, financial difficulties, loss of job, discord at home and workplace etc.

In the present study, it was observed that the majority of Para- suicidal self-poisoning cases belonged to age group 15-24years 153 (48.57%) followed by 25-34years 85 (26.98%). Our survey is similar to study conducted by Dash et al.<sup>10</sup> Female preponderance was more differentiated in the younger age groups, whereas there was a male preponderance amongst those aged 35 years and older. This is reproducible with the study of Hawton K et al.<sup>11</sup>This can be interpreted by the fact that this age group is the determining factor of life in terms of studies, marriage, lack of employment, breakup in the family support system and the failure of love affair. Therefore, they are subjected to a substantial amount of mental stress during this period.

The most ingested substance for non-fatal self-poisoning was a pharmaceutical drug 71(22.54%). There were significant ( $p < 0.01$ ) gender differences in type of substance used. Females were more likely to have ingested a pharmaceutical drug (24.81% vs 20.97%), Rat poison (22.48% vs 16.67%), House hold chemicals like kerosene (5.43% vs 0.54%) and phenol (3.10% vs 2.15%).

The most frequent used agent for self-poisoning was drug overdose, in contrast to older studies of Eddleston et al<sup>6</sup> which report pesticide ingestion as the most common substances used, but similar to findings of Hanwella et al<sup>12</sup> and Gouda et al.<sup>13</sup>This is likely to be a reflection of reduced availability of pesticides, perhaps secondarily to the gradual urbanization of the country and easy availability of over the counter drugs both in urban as well as in rural areas. Indeed, both males and females reported that their reason for choice of substance was accessibility. Reasons for the higher rate of pesticide ingestion among males could be that in agricultural areas, pesticides are more easily accessible to males who work in the fields, compared to females.

In present study among the Agrochemicals, rat poison ranks top in the list, followed by aluminium phosphide, organophosphate and organochlorine. The high overall incidence of rat poison particularly among females could be due to reason that there is a rapid urbanization of Aligarh district and their adjoining area. Rat poisons were commonly used in both rural as well as urban areas but other agrochemicals like aluminium phosphide and

organophosphate were used only in agricultural areas.

In our study, like other north Indian study of Sharma et al<sup>14</sup>, aluminium phosphide were the commonly used agrochemical for self-poisoning particularly by males. Kanchan et al<sup>15</sup> reported in his study that organophosphate was the most used agrochemical for self-poisoning.

This regional variation can be explained by the facts that aluminium phosphide is the most common agrochemical used for pest control in wheat farming which is the predominant staple food in north India, and it is easily available in the market and small shops. Whereas organophosphate compounds are the predominant agro-chemicals of pest control in rice fields of south India where people depend on rice more than wheat.

A large variety of medicinal drugs was used to attempt Para- suicidal self-poisoning. Most commonly, patients had ingested benzodiazepines and acetaminophen/NSAID. Interestingly, males (33.33%) were more likely to take benzodiazepines than females (15.63%), whereas females (37.50%) were more likely to take Acetaminophen/NSAID than males (10.26%). This gender difference was statistically not significant ( $p > 0.01$ ). Our study agrees with the findings of Kumar et al<sup>16</sup> and Jesslin et al<sup>17</sup> who reported that benzodiazepine was the most used class of drug for Para-suicidal self-poisoning.

In India, most drugs including benzodiazepines are available over the counter. They are particularly popular as sleeping, tension-relieving pills. It is very comfortable for somebody to walk into a drug store and acquire a package of drugs. The salesperson who is rarely a qualified chemist hardly ever asks any question and dispenses the drug quite readily. The preference for benzodiazepines over analgesics in our work is slightly confusing. Pain relieving pills like acetaminophen/NSAIDs are equally freely available in India. Analgesics being 'pain killers' may not make the mental relief desired by so many patients as compared to benzodiazepines.

The highest incidence of medicinal drug as a choice of toxic substance used by repeaters is due to the reason that, the drugs commonly used for self-poisoning like Benzodiazepine, Paracetamol,

NSAID etc. have a low case fatality rate. Drug self-poisoning on acute ingestion produces very few symptoms, if survive- the patients will have few or no complications. In contrast, Agrochemicals like aluminium phosphide, organophosphate, organochlorine etc. on ingestion produce profoundly serious, life-threatening symptoms and need immediate ICU admission for their management. Survivors of acute agrochemical or corrosive poisoning often require extensive follow up for the management of their complication.

Females 115 (89.15%) were significantly ( $p < 0.01$ ) more likely than males 135 (72.58%) to take a substance that was already available in the house, while males 42 (22.58%) were more likely than females 10 (07.75%) to purchase the substance with the intention of self-poisoning or ingest a substance kept in the field or garden. Bose et al<sup>18</sup> and Phillips et al<sup>19</sup> also reported the same pattern.

Our results indicate that most of the subjects attempted Para-suicide rather than suicide as the act was not premeditated. It was attempted at home so the chances of being found were better. When we analyzed the distribution of self-poisoning attempts regarding time cycles, we found that there was a truly clear variation by the time of the day for both sexes with peak incidences in the evening and a trough in the morning. Doganay Z et al<sup>20</sup>, Doshi A et al<sup>21</sup>, Valtonen H et al<sup>22</sup> also reported the same pattern in time cycle of self-poisoning.

The number of attempted suicide due to self-poisoning may exhibit circadian rhythm because various physiological phenomena, like hormone levels and mood, show circadian rhythms. Increased adrenergic activity and lowered serotonergic activity in the afternoon might play a role in mood changes.<sup>23</sup>

People tend to go to work during the daytime and return home in the evening; many social problems and verbal arguments are likely to happen in families during the evening, when it is the time for family members to gather and discuss matters. These arguments might lead to impulsive acts and even to suicidal tendencies. This sequence of events is likely to favor attempted suicide because these people do not really want to die, but rather they want to demonstrate their anger.

In most patients, 289(91.75%) were using single agent while 26 (8.25%) were using combination of agents. Statistically no significant ( $p < 0.01$ ) gender difference was reported in number of agents used for self-poisoning. This finding is in line with the study of Jones et al.<sup>24</sup>

## Conclusion

Ease of accessibility has been summoned as a factor influencing selection of substance ingested and it is possible that younger individuals particularly those dwelling in urban areas would find it easier to obtain medication overdoses rather than pesticides. The increasing occurrence of drug overdoses among young people in our study is a causal agent for grave worry. Rigorous implementation of pesticide acts so that import, manufacture, sale, transfer, distribution, storage, and utilization of pesticides can be under the oversight of the government. Poison information centers should be set up in each district throughout the state as it will benefit the common man in timely diagnosis and treatment. All the hospitals should have separate toxicological units exclusively dealing with clinical poisoning cases. Primary health Centre should be promoted to provide immediate effective treatment for self-intoxication.

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# Retrospective Analysis of Hospital Deaths in a Rural Tertiary Care Hospital

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## Abstract

Death is an inevitable aspect of life, impacting every individual universally. While it cannot be avoided, efforts can be made to delay it and enhance life expectancy. This retrospective study analysed 860 hospital deaths in the year 2022 at Great Eastern Medical School & Hospital, focusing on various epidemiological and chronological factors. The highest number of deaths occurred in the age group of 60- 70 years, while the lowest number of deaths were recorded in the age group of 10-20 years. A higher incidence of deaths was observed in medical branches compared to surgical branches. The common diagnoses leading to death were cerebrovascular accidents and chronic kidney disease, with septic shock and multiorgan dysfunction identified as the predominant cause of death.

**Keywords:** Death, Cerebrovascular accident, Sepsis, multiorgan dysfunction.

## Introduction

Death is an inevitable and universal aspect of human existence. While it cannot be avoided, efforts can be made to delay it and enhance life expectancy. Mortality statistics play a crucial role in understanding the health status, disease patterns, and aetiologies prevalent in society. A well-documented death dataset is essential for identifying leading causes of death and associated comorbidities, aiding in the formulation and strategic implementation of national preventive programs for various diseases such as malaria, tuberculosis, hypertension, and diabetes.

Death is defined as the permanent and irreversible cessation of circulation, respiration, and the absence of elicitable reflexes. This definition extends to the death of individual cells and tissues within the body.<sup>1</sup> The death rate in India witnessed an increase of 2.1 deaths per 1,000 inhabitants in 2021 compared to the previous year, reaching a peak of 9.45 deaths per 1,000 inhabitants.<sup>2</sup>

Noncommunicable diseases (NCDs) are responsible for 74% of all global deaths, with 41 million people succumbing to them annually. Cardiovascular diseases, cancers, chronic respiratory

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diseases, and diabetes collectively account for over 80% of premature NCD deaths. Lifestyle factors such as tobacco use, physical inactivity, alcohol consumption, unhealthy diets, and air pollution significantly contribute to the risk of NCD-related deaths.<sup>3</sup>

Comorbidities, particularly diabetes mellitus and hypertension, play a substantial role in mortality. Individuals with multiple coexisting medical conditions are termed multimorbid. In India, hypertension, diabetes mellitus, dyslipidaemia, and cardiac issues are prevalent contributors to morbidity and mortality.

## Materials and Methods

This retrospective study examined 860 deaths that occurred in Great Eastern Medical School Hospital in the year 2022. The analysis included variables such as age, sex, days post-admission when the patient died, time of death, causes of death within the first day of admission, month-wise admissions versus deaths, department-wise distribution of deaths in medical and surgical branches, total medical versus total surgical deaths, mortality statistics for various surgical branches (both preoperative and postoperative), statistics on different comorbidities, provisional diagnosis, immediate cause of death, and medicolegal case deaths with disease types. Cases categorized as brought dead were excluded from the study due to the inability to determine a proper cause of death.

## Results and Discussion

A total of 860 deaths were analysed in the year 2022, revealing important insights into mortality patterns in the studied population. The findings are discussed below:

The highest number of deaths occurred in the age group of 60-70 years ( $n = 176$ ), while the lowest number was recorded in the age group of 10-20 years ( $n = 19$ ). This trend is consistent with the vulnerability of older individuals to diseases. The ratio of deaths in the first 40 years of life (0-40 years) to the next 40 years (40-80 years) was 1:3.15, indicating a significant increase in mortality after the age of 40. Factors such as fatal diseases, multimorbidities, decreased immunity, and limited rural tertiary care facilities

may contribute to higher mortality in the 40-80 age group. Research studies from Priyanka Patel suggested that morbidity is more in older adults which in turn may later to mortality.<sup>4</sup> The ratio of deaths between 0-10 years and 10-20 years was 2.78:1. Neonatal deaths accounted for a substantial portion, with 84.90% occurring in the first year, 75.5% in first month of life. Causes included hyaline membrane disease, neonatal jaundice, sepsis and prematurity, emphasizing critical neonatal care.

Males accounted for 62.22% of the total deaths, surpassing females (37.78%), even though number of admissions were almost same in comparison (Males - 19932 vs Females -19541).<sup>5</sup> This gender difference in mortality could be attributed to stressors like financial challenges, occupational hazards, accidents, and unemployment along with higher rates of cigarette smoking and alcohol consumption in rural areas.

A noteworthy proportion of deaths (40.11%) occurred within the first day of hospital admission, possibly due to the severity of the disease and delayed hospital arrival.

Among the acute diseases, fevers ( $n=39$ ) dominated the first day deaths, possibly due to people neglecting fevers in rural areas and taking treatment from quacks, and finally succumbing to them after attending to a tertiary care hospital. Most deaths (61.74%) took place within 3 days of hospital admission, highlighting the severity of diseases and the time required for the body to respond to treatment. A high percentage (80.58%) of deaths occurred within one week, pointing towards the critical nature of the health conditions at the time of admission.

The highest number of deaths was observed in August, followed by November, while the lowest number occurred in February. Seasonal variations may be attributed to factors such as infectious diseases, road traffic accidents, and weather-related conditions. More deaths were recorded during the rainy season (40.11%), possibly due to poor hygiene, inadequate drainage leading to water stagnation, increased mosquito-borne illnesses, respiratory tract infections, and higher incidence of road traffic accidents on slippery roads.

Highest number of deaths were recorded in the time between 9:00A.M - 5.00 P.M ( $n=292$ ) followed by

207 deaths in the time between 5:00P.M. - 11:00P.M. Deaths were lower between 3:00 A.M. to 6:00A.M. (n=91), Contrary to popular belief, that deaths occur more during this time of day due to absence of medical personnel. Even though the monitoring by medical personnel is high from 6:00A.M to 11:00P.M, more no of deaths (75%) happened in this time.<sup>6</sup>

More deaths (40.11%) occurred during the rainy season, followed by winter (30.81%) and summer (29.07%). Poor hygiene and inadequate drainage in rural areas during the rainy season may contribute to water stagnation, leading to an increase in mosquito-borne illnesses, respiratory tract infections, snake bites, and road traffic accidents due to slippery roads.

Medical branches accounted for a higher percentage of deaths (88.16%) compared to surgical branches (11.84%). General medicine recorded the highest number of deaths (n=177), followed by Cardiology(n=124), Neurology (n=102), Respiratory medicine(n=100), Emergency medicine(n=90), Nephrology(n=87), Paediatrics (n=53), and Neurosurgery(n=50). Neurosurgery and general surgery (n=20) in surgical branches recorded higher deaths, often associated with severe brain disease and surgical pathology.

Out of 12,917 surgeries conducted, post-surgical deaths were relatively low (n=22, 0.17%). Pre operatively more deaths were recorded in neurosurgery (n=45) followed by General surgery (n=14). Post operatively six deaths are seen in general surgery followed by neurosurgery (n=5). Among the 50 neurosurgery department deaths, 45 deaths were pre-operative in nature indicating severe brain disease and bad prognosis of the patient.

Hypertension (n=162), diabetes mellitus (n=79), and carcinomas (n=25) were the most prevalent comorbid conditions. These factors likely contributed to the complexity of cases and increased mortality rates.

A total of 801 medicolegal cases were recorded, with 59 cases proving fatal. Traumatic brain injury (n=33) and poisonings (n=14) were common

medicolegal cases handled by the Emergency Medicine department.

In this study, highest number of cases were diagnosed as Cerebro Vascular Accident (n=91)<sup>5,7</sup> followed by Multi Organ Dysfunction Syndrome (n=60), Chronic Kidney Disease (n=55), Shortness of Breath under evaluation (n=54), Fevers (n=51), Acute Kidney Injury (n=43), Pneumonias (n=39), Myocardial Infarction (n=31), Head injury (n=33), Intracranial haemorrhages (n=33), Respiratory failure (n=28), Pulmonary oedema (n=25), Carcinomas (n=25), Preterm/Hyaline Membrane Disease (n=23), Coronary artery disease (n=20), Decompensated liver disease (n=19), Heart failure (n=16), altered sensorium under evaluation (n=16), Acute respiratory distress syndrome (n=14), Poisonings (n=14), cellulitis (n=11) etc as shown in Table no.4

In this study, leading causes of death that recorded were Sepsis with multiorgan dysfunction (n=224), Respiratory failure (n=89), Cardiogenic shock (n=74), Pneumonias (n=64), Head injury/Intracranial haemorrhages (n=64), Respiratory distress syndrome (n=59), Cerebro vascular accident (n=54), Myocardial infarction (n=32), Pulmonary oedema (n=25), Heart failure (n=21), Hypovolemic shock (n=16),

Metabolic Encephalopathy (n=14), metabolic acidosis (n=13), chronic kidney disease (n=11) etc as shown in Table no 5.

Sepsis with multiorgan dysfunction was diagnosed more often clinically, and few cases (n=21) were diagnosed after blood culture and sensitivity. Escheria coli was isolated as a predominant organism. The reason for less isolates could be due to the collection of samples after antibiotic dosage. It indicates the need for collection of blood samples from patients before giving antibiotics. Among the sepsis with MODS cases as cause of death, fever with thrombocytopenia (n=19), chronic kidney disease (n=15), acute kidney injury (n=15), chronic liver diseases (n=12), chronic kidney disease (n=11), Cerebro-vascular accidents (n=9) were dominant associated causes of death.

**TABLE-1: AGE WISE MORTALITY ANALYSIS (n=860)**

AGE IN YEARS	NUMBER OF DEATHS	PERCENTAGE
0-10	53	6.16
10-20	19	2.20
20-30	42	4.88
30-40	84	9.76
40-50	136	15.81
50-60	168	19.53
60-70	176	20.46
70-80	148	17.20
80-90	34	3.95

**TABLE-2: DURATION OF HOSPITAL STAY (n=860)**

DURATION	NUMBER OF DEATHS	PERCENTAGE
<1DAY	357	41.51
1DAY-3DAYS	174	20.23
3DAYS-1WEEK	162	18.83
1-2WEEKS	109	12.67
2-4WEEKS	48	5.58
>4WEEKS	10	1.16

**TABLE-3: MORTALITY ANALYSIS OF SURGICAL BRANCHES (n=94)**

SURGICAL DEPARTMENT	CONDUCTED SURGERIES	PRE-OPERATIVE DEATHS	POST OPERATIVE DEATHS	TOTAL DEATHS
NEUROSURGERY	367	45	5	50
GENERAL SURGERY	1431	14	6	20
SURGICAL ONCOLOGY	294	5	3	8
SURGICAL GASTROENTEROLOGY	241	4	2	6
ORTHOPEDICS	1173	1	3	4
PLASTIC SURGERY	201	2	1	3
CTVS	222	0	2	2
UROLOGY	1130	1	0	1
ENT	431	0	0	0
OPHTHALMOLOGY	5872	0	0	0
GYNECOLOGY	724	0	0	0
OBSTRETICS	763	0	0	0
DENTAL	63	0	0	0

**Table 4 Provisional/final diagnosis(n=860)**

S . No	Diagnosis	No of cases	Percentage
	Central nervous system		
1	Cerebro vascular accident	91	10.58
2	Head injury	33	3.88
3	Intracranial haemorrhages	33	3.88
4	Altered sensorium/evaluation	16	1.86
4	Meningitis/encephalitis	6	0.69
	Sub Total	179	
	Respiratory system diseases		
1	Shortness of breath/evaluate	54	6.27
2	Pneumonias	39	4.53
3	Respiratory failure	28	3.25
4	Pulmonary oedema	25	2.90
5	Hyaline membrane disease	23	2.67
6	ARDS	14	1.62
7	COPD	12	1.39
8	Pleural effusion	7	0.81
9	Tuberculosis	7	0.81
10	Pneumothorax	2	0.23
	Sub Total	211	
	Cardiac diseases		
1	Myocardial infarction	31	3.6
2	Coronary artery disease	20	2.32
3	Heart failure	16	1.86
4	Rheumatic heart disease	11	1.27
5	Chest pain under evaluation	9	1.04
6	Cardiomyopathy	8	0.93
7	Cardiogenic shock	5	0.58
8	Arrhythmias	5	0.58
	Sub Total	105	
	Gastrointestinal diseases		
1	Decompensated liver diseases	19	2.20
2	Abdominal pain evaluation	11	1.27
3	Bowel obstruction	6	0.69
4	Intestinal perforation	5	0.58
	Sub Total	41	
	Renal diseases		
1	Chronic kidney disease	55	6.39
2	Acute kidney disease	43	5.00
3	Dyselectrolytaemia	5	0.58
	Sub Total	103	

Continue.....

	Others		
1	Sepsis with MODS	60	6.97
2	Fever with thrombocytopenia	51	5.93
3	Carcinomas	25	2.90
4	Poisonings	14	1.62
5	Cellulitis	11	1.27
6	Neonatal sepsis, jaundice	7	0.81
7	Long bone fractures	5	0.58
8	Hypovolaemic shock	4	0.46
9	Metabolic acidosis	4	0.46
10	Burns	4	0.46
11	Metabolic encephalopathy	4	0.46
12	Diabetic ketoacidosis	4	0.46
13	Sickle cell anaemia	3	0.34
	Sub Total	196	
	Multiple provisional diagnosis	25	2.90
	Total	860	

**Table 5: Immediate Cause of death (n=860)**

S.no	Cause of Death	No. of cases	Percentage
1	SEPTICK SHOCK	224	26.04
2	RESPIRATORY FAILURE	89	10.34
3	CARDIOGENIC SHOCK	74	8.60
4	PNEUMONIA	64	7.44
5	HEAD INJURY/ SDH/IVH/SAH	64	7.44
6	RESPIRATORY DISTRESS SYNDROME	59	6.86
7	CEREBROVASCULAR ACCIDENT	54	6.27
8	MYOCARDIAL INFARCTION	32	3.72
9	PULMONARY OEDEMA	25	2.90
10	HEART FAILURE	21	2.44
11	HYPOVOLEMIC SHOCK	16	1.86
12	HYALINE MEMBRANE DISEASE	16	1.86
13	METABOLIC ENCEPHALOPATHY	14	1.62
14	VENTRICULAR TACHYCARDIA	14	1.62
15	METABOLIC ACIDOSIS	13	1.51
16	CHRONIC KIDNEY DISEASE	11	1.27
17	HYPOXIC ISCHEMIC ENCEPHALOPATHY	9	1.04
18	SEIZURES	8	0.93
19	PULMONARY ARTERIAL HYPERTENSION	7	0.81
20	PULMONARY TUBERCULOSIS	7	0.81
21	CARDIOMYOPATHIES	7	0.81

Continue.....

22	FEVER+_ THROMBOCYTOPENIA	6	0.69
23	PLEURAL EFFUSION	5	0.58
24	MULTIPLE DIAGNOSIS	5	0.58
25	RHEUMATIC HEART DISEASE	5	0.58
26	CARCINOMA STOMACH	4	0.46
27	PULMONARY THROMBOEMBOLISM	3	0.34
28	PNEUMOTHORAX	2	0.23
29	SEPTIC ENCEPHALOPATHY	2	0.23
	Total	860	99.87

### Conclusions

- Patients aged 40 years and above face a significant increase in mortality, with death chances tripling after the age of 40. Neonates and infants in their first month and year of life, respectively, are particularly vulnerable.
- Male mortality rates surpass females, despite similar admission numbers.
- Deaths on the first day of admission are higher, emphasizing the severity of diseases or delayed hospital arrival. A substantial proportion of deaths occurs within three days of admission, highlighting the critical nature of these cases.
- More deaths occurred during the daytime 6 AM to 11 PM.
- Rainy seasons witness a higher number of deaths compared to other seasons.
- Cerebrovascular accidents are the predominant diagnosis.
- Sepsis with multiorgan dysfunction emerges as the leading cause of death.

These conclusions provide critical insights into the demographic and temporal patterns of mortality, departmental risks, and common diagnoses. The identification of leading causes of death, particularly sepsis with multiorgan dysfunction, underscores the importance of targeted interventions and proactive healthcare strategies to improve patient outcomes. The findings presented here can guide healthcare professionals and policymakers in enhancing preventive measures and optimizing healthcare delivery.

**Conflict of interest:** None

**Source of funding:** Self

**Ethical Clearance:** Permission was obtained from Institutional Ethics Committee, Great Eastern

Medical School, Srikakulam, Dated 21/12/2023, ref no: reg.no.170/IEC/GEMS&H/2023.

**Acknowledgement:** The authors extend their sincere appreciation to medical records department for their cooperation and support throughout the study.

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# A Cross Sectional Study on Estimation of Stature from Head length in the Population of Telangana

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## Abstract

Determination of stature from head length is equally significant like determining from other body parts. A cross sectional study on estimation of stature from head length was conducted in the population of Hyderabad, Telangana at Malla reddy institute of medical sciences. Study population consists of 154 members, who include 75 males and 79 females, participants were in the age group of 18-23 years. Data was collected from participants after obtaining informed consent. Measurement of head length was taken from the top of vertex to the bottom of the chin in centimeter (cm) scale. A linear regression formula was obtained to correlate head length and height. Linear regression equations for total study population is  $Y=77.59 + 4.135(\text{HL})$ , male population is  $Y=118.5 + 2.46(\text{HL})$  and female population is  $Y=159.71 + 0.062(\text{HL})$ . Statistical results of the study,  $R^2 = 0.333$ , Standard error = 0.475 and P value <0.0001 reveals statistical significance of the study. Separate formulae for male and female individuals will give more accurate results.  $\pm 5$  cm difference in the stature was observed in the study population with the derived equation. Height is approximately 8 times the head length in Female population and 7.5 times in male population in the study group.

**Key words:** Stature, head length, regression equation.

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## Introduction

Stature is defined as height of an individual. It is more useful during crime investigation in identifying the individual when only body parts were available, in medico legal cases determination of stature from body parts is very much important, it has great significance because height has significantly correlated with different body parts like limb, head, trunk and vertebral column etc.

Stature has a key role in identification of unknown dead bodies, when mutilation of body parts occurs in mass disasters like bomb blasts, fire accidents, building collapse, train accidents and plane crashes. Identification of a person can be done by estimating the stature from dismembered body parts by using linear regression formulae. Stature varies at different times of the day by one and half to two cm, it is less in the afternoon and evening due to reduced elasticity of the inter vertebral disc and the longitudinal vertebral muscles. In advanced age and malnutrition stature is reduced, it is reduced after the age of 30 years due to the natural process of senile degeneration about 0.6mm per year. Stature is greater on lying down position. It increases after death by about 2cm due to relaxation of muscle and joints<sup>1</sup>.

In ancient times 'Vitruvius<sup>2</sup> says in his work on architecture that the measurement of human body are distributed by nature as follows, i.e., four fingers make one palm, four palms make one foot, six palms make one cubit and four cubits make a man's height, he concluded that the man's outspread hands are equal to his height.

The aim and objective of the study is to determine the height of an individual from the head length in the study population of Hyderabad Telangana and to establish a separate equation for male and female individuals. This study is very much useful for law enforcement agencies to determine the stature from head length more accurately in the population of Telangana.

## Materials and Methods

A cross sectional and prospective study was conducted for estimation of height from head dimensions in the population of Hyderabad, Telangana. Study was conducted from 1<sup>st</sup> September

2023 to December 31<sup>st</sup> 2023. Study population consists of 154 members, which include 75 males and 79 females in the age group of 18 years to 23 years of medical students of Malla reddy Institute of Medical Sciences, Hyderabad, Telangana. An informed consent was obtained from each participant before commencement of the study and names of the Participants were kept anonymous.

Healthy individuals in the age group of 18 to 23 years and willing to participate in the study were considered and individuals suffering from Nutritional, genetical, metabolic and skeletal abnormalities are not considered for this study. Materials used are stadio meter, scale and two planks.

Measurement for head length was taken from top of the vertex to the chin, this was measured on centimeter scale, a plank was placed on the top of the vertex and another plank was placed under the chin, the distance between these two planks was considered as head length. Participant's height was measured in standing erect position on centimeter scale by using stadio meter. The data was collected in to the excel sheet and statistically analyzed for the regression equation by using SPSS (version 21) software.



Fig-1: Head length measurement in cm

## Results

A cross sectional study on estimation of stature from head length was conducted at Malla reddy medical college hyderabad telangana. Study population consists of 154 includes 75 male and 79 females. The following results were found.

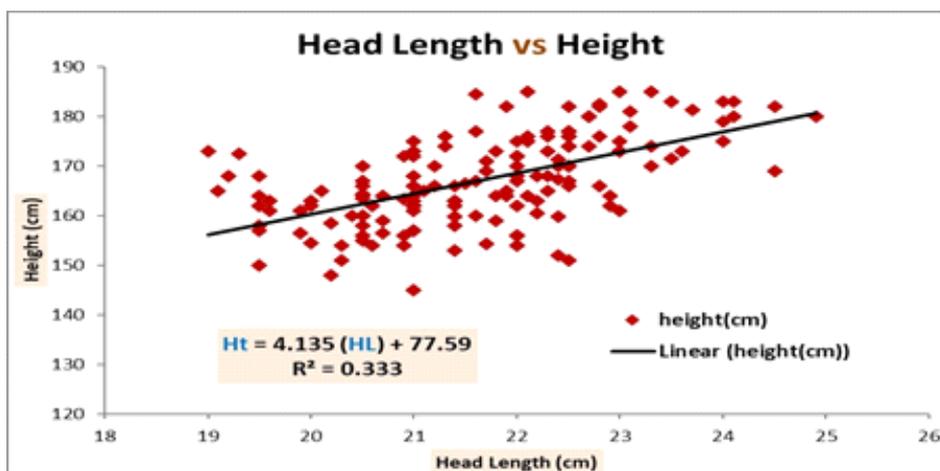
The linear regression formula for estimating the height is  $y = a + (bx)$ ,  $y =$  dependent variable (height),  $a =$  constant,  $b =$  independent variable coefficient,  $x =$  independent variable i.e. length of head.

**Table-1: Showing the details of regression statistics.**

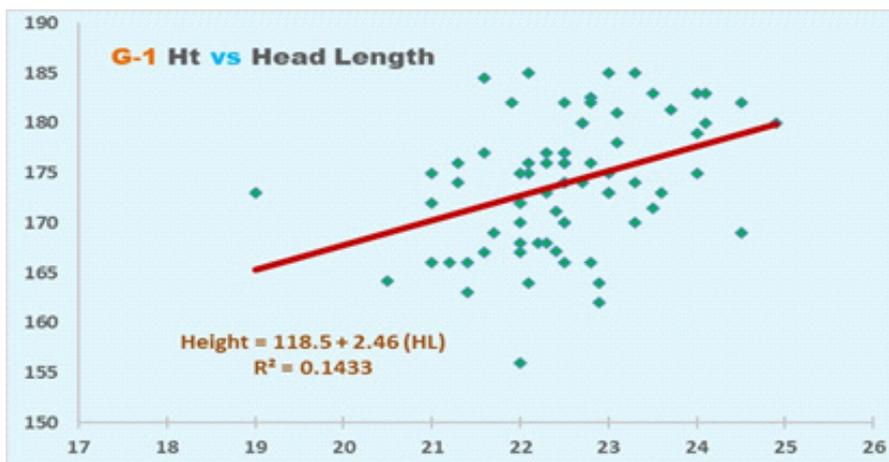
	Coefficients	Standard error	p-value	Lower 95%	Upper 95%
Intercept	77.593	10.304	4.1765E-12	57.236	97.950
Head length (cm)	4.135	0.475	4.93944E-15	3.197	5.074

**Table-2: Linear regression formula for total study population, male and female population.**

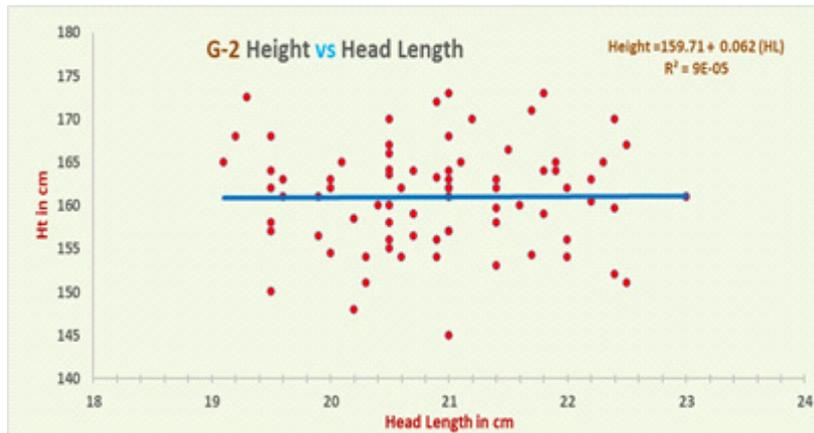
Regression statistics	Total Population equation	Male population equation	Female population equation
Height (Y)	$Y = 77.59 + 4.135(x)$	$Y = 118.5 + 2.46(x)$	$Y = 159.71 + 0.062(x)$
R <sup>2</sup>	0.333	0.1433	0.997
P Value	<0.001	<0.001	<0.001
95% Confidence interval	3.197 - 5.074	4.354 - 6.054	4.786 - 6.243



**Figure-2: showing the details of head length Vs height in total population and linear regression formula**



**Figure-3: showing the details of head length Vs height in male population and linear regression formula**



**Figure-4: showing the details of head length Vs height in female population and linear regression formula**

### Discussion

A cross sectional study on estimation of stature from head length was conducted at Hyderabad, Telangana. Total study population consists of 154 which includes 75 male and 79 females. Statistical analysis was done and results of the study reveal the  $R^2 = 0.333$ , Standard error 0.475 and P value  $<0.0001$  shows statistical significance of the study. The 95% confidence interval showing the accuracy of the results obtained from linear regression equation for total population is 3.197 – 5.074, for male population it is 4.354 – 6.054 and for female population 4.786 – 6.243.

Linear regression equation for total study population is  $Y=77.59 + 4.135 (HL)$ , coefficients of intercept is 77.59 and Head length is 4.135. Linear regression formulae for male population is  $Y=118.5 + 2.46 (HL)$  and Linear regression formulae for female population is  $Y=159.71 + 0.062 (HL)$ . Stature calculated with these equation is close to the normal height,  $\pm 5$  cm difference was observed in the study population.

Various studies were conducted in India and abroad on estimation of height from head length using linear regression equation and observed a definitive correlation. Studies conducted in Madhya Pradesh by Krishan K<sup>3</sup> and in Central India by Atul S Keche<sup>4</sup> and in Karnataka by Mohan Prasad<sup>5</sup> on estimation of stature from head length dimensions showed significant correlation. Study in South Nigeria conducted by Dennis E. O. Eboh<sup>6</sup> on height estimation from head dimensions also revealed significant correlation.

Determination of stature from head length is useful in crime investigation when the only body part that is head was available. Estimated stature as per the study formulae is approximately 8 times of the head length in female population and 7.5 times in male population. Separate equations for male and female population will yield better results because the mean height difference for male and female study population is about 13cm and the mean head length difference of 3 cm is observed.

### Conclusion

A strong correlation of stature from head length in the population of Hyderabad, Telangana was observed in our study. Separate equations for male and female population will give better results.  $\pm 5$  cm difference in the stature of an individual was observed in the study population with the derived equation. Height is approximately 8 times of head length in female population and 7.5 times in male population in the study group. Similar results were found in studies conducted in India and abroad.

**Source of funds:** Self.

**Conflict of interest:** Nil

**Ethical clearance:** We obtained ethical clearance from institutional ethics committee on 20-7-23, Ref No: EC/NEW/INST/2023/TE/0235.

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# Pattern of Injuries in Victims of Fatal Road Traffic Accidents in Southern Haryana: An Autopsy-Based Study

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## Abstract

**Background:** Road traffic accident is one of the major avoidable public health problems and is on the rise which can be attributed to increase in the number of vehicles, daily life changes, nasty tendency of violating traffic rules, anarchic traffic system and risky approach. It is a matter of national concern, in view of its extent and gravity and the subsequent negative impacts on the economy, public health and the general wellbeing of the people. The aim of this study was to know the pattern of injuries in victims of fatal road traffic accidents.

**Material & Method:** The present study was a prospective, cross-sectional study. The study was conducted at the tertiary healthcare centre in southern Haryana. Total of 75 cases of fatal road traffic accident cases were enrolled during one year of study period. The basic information about the deceased like age, gender, mode of travel of victim was obtained from investigating officer narration and inquest papers. During autopsy, detailed examination of injuries was carried out and the autopsy findings were recorded and analyzed.

**Results:** It was observed that out of 75 cases male outnumbered female in ratio 5.25:1. Majority of the victims belonged to age group 21-30 year (26.7%). Among the external injuries, abrasions were most common followed by lacerations. It was also observed that majority of the victims had intracranial hemorrhage (60%) followed by rib fracture (41.3%) and 17.3% of the victims had pelvis fracture.

**Conclusion:** From the present study it was concluded that road traffic accidents were more common in the younger age group and two wheeler occupants followed by pedestrians were most vulnerable to road traffic accidents.

**Keywords:** Road traffic accidents; pattern of injuries; abrasions; intracranial hemorrhage

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## Introduction

Road traffic accident (RTA) is any vehicular accident occurring on the roadway i.e., originating on, terminating on, or involving a vehicle partially on the roadway. It may include collision of an automobile with a pedestrian, or another automobile or with a non-automobile on the roadway or fall from a moving vehicle causing injuries or death of the involved individuals.<sup>1</sup>

Injuries and fatalities occur in all forms of transportation but numerically road traffic accidents account for the great majority worldwide, causing more than a million deaths annually and injuring about 20–50 million. If the current trends continue, road traffic injuries are likely to rise to the fifth leading cause of death by 2030. Approximately 90% of these deaths occur in low- and middle-income countries, where the road traffic fatality rates are higher as comparative to high income countries. The pattern of injury, fatal and otherwise, varies significantly depending upon whether the victim is a vehicle occupant, a motorcyclist, a pedal cyclist or a pedestrian.<sup>2</sup>

Road traffic accidents not only affects primary victims but it has got innumerable secondary victims in the form of family and relatives, who suffer financially, psychologically and socially, though morbidity does not reckon with these social aspects of the problem.<sup>3</sup>

The present study is an attempt to analyze the pattern of injuries in autopsy cases with an alleged history of fatal road traffic accidents with regards to

age, gender, mode of travel of victim, external and internal injuries sustained.

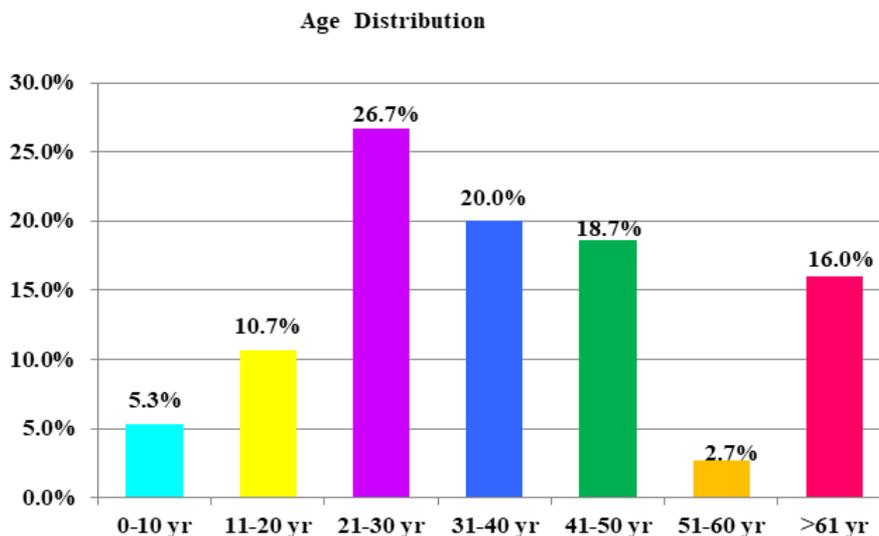
## Material and Methods

The present study was a prospective, cross-sectional study. The study was conducted in the Department of Forensic Medicine of a tertiary care center of southern Haryana. Total of 75 cases of fatal road traffic accident cases were included during one year of study period, after obtaining Institutional Ethical Clearance. Decomposed, unidentified and dead bodies with no specific history were excluded. A proforma was designed especially for the purpose of the study. The basic information about the deceased like age, gender, address, mode of travel of victim, type of offending vehicle was obtained from investigating officer narration and inquest papers. Each injury was recorded as per the involvement of body region. During autopsy, detailed examination of injuries was carried out and the autopsy findings were recorded on standard autopsy proforma and the information thus collected, was statistically analyzed.

## Observations and Results

In our study, it was observed that out of 75 cases, 63 were male (84%) and 12 were female (16%), the male outnumbered female in ratio 5.25:1.

It was observed that individuals belonging to age group 21-30 years were most affected in road traffic accident (26.7%), followed by 31-40 years (20.0%), the age wise distribution of victims is depicted in Figure 1.

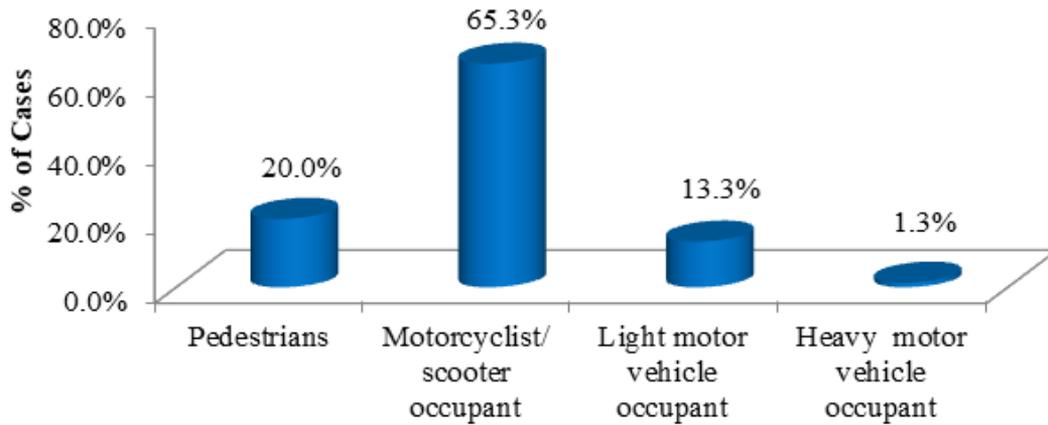


**Figure 1: Bar diagram demonstrating the age distribution (%) of individuals involved in fatal road traffic accidents (n=75).**

It was observed that motorcyclist / scooter occupants were most affected by RTA comprising 65.3% cases followed by pedestrians (20%), light

motor vehicle occupants (13.3%) and least affected were heavy motor vehicle occupant (1.3%). (Figure 2)

**Mode of travel of victim**

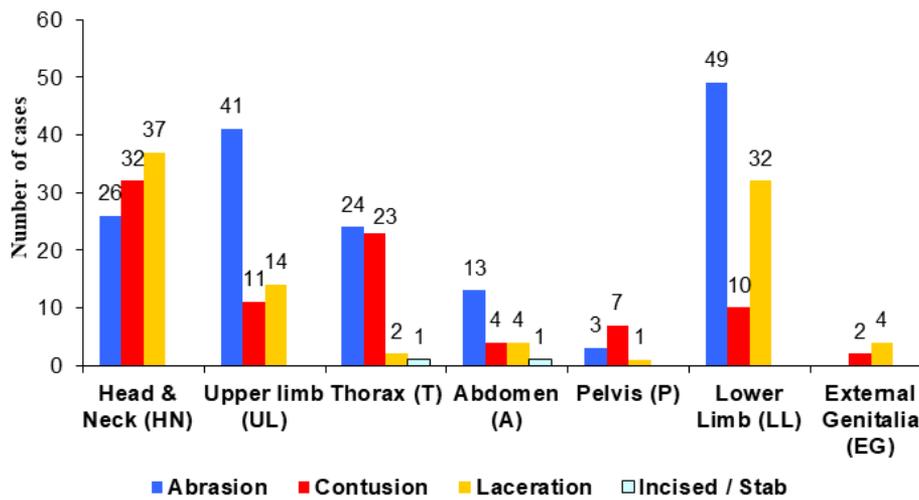


**Figure 2: Bar diagram demonstrating the mode of travel (%) of the victims involved in fatal road traffic accidents (n=75).**

It was observed that among external injuries, the victims who had injuries over head & neck region, the majority had lacerations (49.3%), followed by contusions (42.7%) and abrasions (34.7%). Those who had injuries over upper limb, the majority had abrasions (54.7%) followed by lacerations (18.7%) and contusions (14.7%). Injuries over thorax were mainly abrasions (32.0%) and contusions (30.7%).

However, majority of abdominal injuries were abrasions (17.3%). Those who had injuries over pelvic region majority had contusions (9.3%), followed by abrasions (4.0%). Victims who had lower limb injuries; majority had abrasions (65.3%), followed by lacerations (42.7%) and contusions (13.3%). Injuries over external genitalia were mainly lacerations (5.3%) followed by contusions (2.7%). (Figure 3)

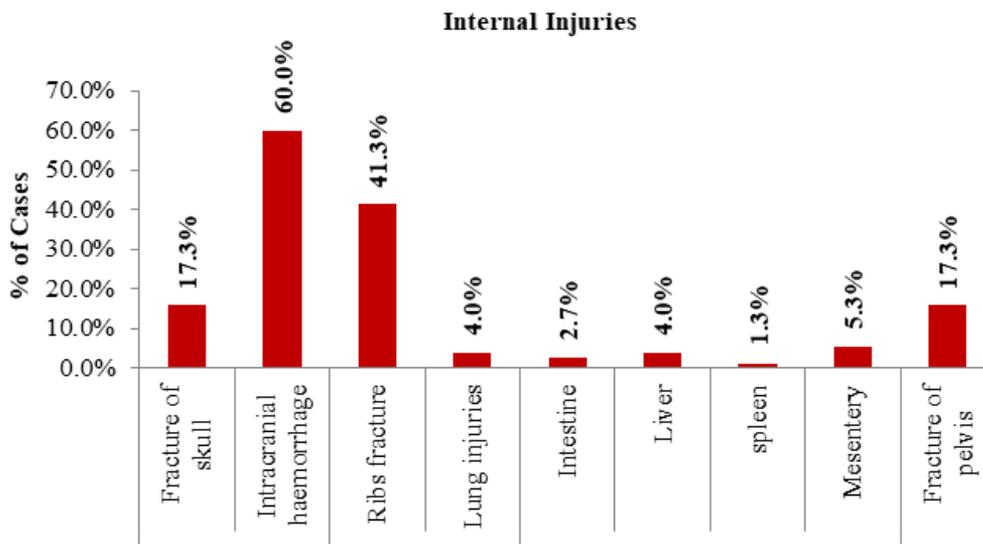
**External Injuries**



**Figure 3: Bar diagram demonstrating the region of body involved and type of external injury sustained in the victims of fatal road traffic accidents (n=75).**

It was observed that in majority of cases of fatal road traffic accident, 60.0% had intracranial haemorrhage followed by rib fractures (41.3%),

fracture of skull (17.3%) and fracture of pelvis (17.3%). (Figure 4)



**Figure 4: Bar diagram demonstrating the type of internal injury sustained (%) for the victims involved in fatal road traffic accidents (n=75).**

The table 1 shows the mode of travel of victim and external injuries sustained. For the victims who were pedestrians, it was observed that 86.7% had head & neck injuries followed by injuries over upper & lower limb (73.3%) and thorax injuries (53.3%).

For the victims with mode of travel as motorcycle or scooter occupant, it was observed that 91.8% victims had lower limb injury, while 89.8% had head and neck injuries and 73.5% had upper limb

involvement. The victims with mode of travel as light motor vehicle occupant, it was observed that 80.0% victims had lower limb injury, while 70.0% of the victims showed involvement of both head & neck and thoracic region. However, only a single case of heavy motor vehicle occupant was reported in the present study. Further, a significant association between mode of travel of the victim and head & neck injury was observed.

**Table 1: Showing mode of travel of victim and external injuries sustained in victims of fatal road traffic accidents (n=75).**

Mode of travel of victim	Frequency	External Injuries						
		Head & Neck	Upper Limb	Thorax	Abdomen	Pelvis	Lower Limb	External Genitalia
Pedestrians	15	13	11	8	5	3	11	1
		86.7%	73.3%	53.3%	33.3%	20.0%	73.3%	6.7%
Motorcyclist/scooter occupant	49	44	36	29	13	3	45	5
		89.8%	73.5%	59.2%	26.5%	6.1%	91.8%	10.2%
Light motor vehicle occupant	10	7	5	7	2	3	8	-----
		70.0%	50.0%	70.0%	20.0%	30.0%	80.0%	-----
Heavy motor vehicle occupant	1	-----	1	-----	1	-----	1	-----
		-----	100%	-----	100%	-----	100%	-----

## Discussion

The number of deaths on the world's roads remains unacceptably high, with an estimated 1.35 million people dying each year. Road traffic injuries are now the leading cause of death for children and young adults aged 5–29 years. More than half of all road traffic deaths are among vulnerable road users; pedestrians, cyclists and motorcyclists.<sup>4</sup>

In our study a total of 75 cases that satisfied the inclusion and exclusion criteria were included and it was observed that out of 75 cases 63 were males (84%) and 12 were females (16%) and males outnumbered females in ratio 5.25:1. These findings are in general agreement with the studies conducted by Singh & Dhatarwal,<sup>5</sup> Rao & Mukerjee,<sup>6</sup> Verma et al.,<sup>7</sup> Guntheti & Singh<sup>8</sup> and Bhagwat et al.<sup>9</sup>

Individuals belonging to age group 21-30 years were mostly affected in road traffic accident (26.7%), followed by 31-40 years (20.0%) and 41-50 years (18.7%), and least effected were those belonging to the age group 51-60 years (2.7%). It was also observed that individuals above 61 years age group were frequent victims of RTAs in this region. It might be due to their lack of knowledge of road safety measures, leading to increased fatalities. The age group 21-30 years is the most active phase of life, physically and socially, hence outnumbers the other road users. It was observed that majority of the cases (65.4%) lie within the economically productive age group of 21-50 years. These findings are in general agreement with the studies conducted by Singh & Dhatarwal,<sup>5</sup> Kiran et al.,<sup>10</sup> Dhillon et al.<sup>11</sup>

It was observed that motorcyclist / scooter occupants were most affected by RTA comprising 65.3% cases followed by Pedestrians (20%), light motor vehicle occupants (13.3%) and least affected were Heavy motor vehicle occupant (1.3%). Majority of the victim in the present study were motorcyclist / scooter occupant, this can be explained by the fact that for majority of Indian families, motorcycle/scooter is preferred mode of transportation. Being a rural area, the majority of the road users were either pedestrians or two-wheeler users. The findings of the present study are in general agreement with the study conducted by Dagar et al.,<sup>12</sup> and Chourasia et al.<sup>13</sup> However, the findings are contrary to the study done by Khan et al.<sup>14</sup> as they observed that pedestrians were most commonly affected by fatal road traffic accidents.

It was observed that all the victims had multiple external injuries in the form of abrasions, lacerations, contusions and incised wound. Among the external injuries, abrasion was most common injury in majority of the victims, followed by laceration, contusion and the least observed was incised wound. Further, a significant association between mode of travel of the victim and head & neck injury was observed i.e., there was high occurrence of head and neck injuries in the victims of fatal road traffic accident, irrespective of their mode of travel. Similar trends were observed by Aggarwal et al.<sup>15</sup> However, the findings of the present study are contrary to the study done by Chourasia et al.<sup>13</sup> as they observed maximum injuries over upper limb and abdomen respectively.

It was observed that in majority of cases of fatal road traffic accident, 60.0% had intracranial haemorrhage followed by rib fractures (41.3%), fracture of skull (17.3%) and fracture of pelvis (17.3%). A high incidence of brain injury was due to the fact that two-wheeler users were not using helmet. The findings of the present study are in general agreement with the study conducted by Dhillon et al.<sup>11</sup>

Limitation of the study: The small sample size is the major limitation of the study.

## Conclusion

From the present study it was concluded that road traffic accidents were more common in the younger age group and two wheelers' occupants followed by pedestrians were most vulnerable to road traffic accidents. Road traffic accident is one of the major avoidable public health problems. The road traffic accidents result in mortality, morbidity and disability of the victims. So, public attention, awareness, preventive and remedial strategies pertaining to the human habitations, roadways and to reduce the morbidity and mortality should be undertaken to control fatal road traffic accidents.

**Conflict of interest:** None

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Ethical approval: The study was approved by the Institutional Ethics Committee (SHKM GMC, Nalhar, NUH) vide Letter No. SHKM/IEC/2018/31 dated: 29/10/2018.

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# An Epidemiological Profile of Poisoning: A Retrospective Study

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Rajeev kumar<sup>4</sup>, Hitesh Chawla<sup>5</sup>, Renu Yadav<sup>6</sup>

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## Abstract

**Background:** Poisoning is acknowledged as a significant contributing factor to deaths in most of the low- income and middle income countries. Even though poisoning is regarded as a global burden, different parts of the world may experience different types of poisoning. For the purpose of creating and implementing appropriate policies to address this acknowledged public health issue, it is imperative to understand the epidemiology of poisoning cases in a given area. **Material & Method:** The present study was a retrospective study of poisoning deaths that were brought for medico legal autopsy at a tertiary care facility in southern Haryana between January 2018 and December 2023. A total of 264 medico legal autopsies for poisoning deaths were performed during the study period. Relevant information and subjective data like age, gender, marital status & occupation have been collected from medico legal autopsy register from January 2018 to December 2023.

**Results:** It was observed that out of 264 cases female outnumbered male in ratio 1.3:1. Majority of the victims belonged to the second and third decade of life. Married couples were more vulnerable and the majority of the victims (64.77%) had accidentally consumed poison.

**Conclusion:** The epidemiology of poisoning is highlighted in the study, which shows that poisoning fatalities accounted for almost 30% of total autopsies. Since the region is heavily dependent on agriculture, to control deaths caused by poisoning awareness programs should be implemented vigorously to educate and nurture the character of young people.

**Keywords:** Epidemiology; Autopsy; Poisoning; Suicide; Pesticides

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## Introduction

A poison is anything that, upon being introduced into the body or coming into contact with any body part, will cause harm or death by local or systemic action, or both. In reality, every substance has the potential to cause toxicity and every drug has the potential to be toxic when used erratically.<sup>1</sup> According to the WHO, about 640,000 people die each year from poisoning, with the majority of these deaths occurring in low and middle income countries. Unfortunately, the death rate from poisoning is much higher in developing countries compared to developed countries. The reasons for this discrepancy can be attributed to poor and prompt management of poisoning cases, awareness among the general public, preventive and regulatory measures. For instance, national data in India showed that 70,000 people died annually from poisoning, with a mortality rate of 2.4 per 100,000 population.<sup>2</sup>

Poisoning is one of the major epidemics of non-communicable diseases in the 21<sup>st</sup> century. Amongst the unnatural deaths, poisoning deaths are second to those caused by road traffic accidents. In the past, poisoning deaths caused by pesticides were mostly accidental. However, the easy availability, low price and unrestricted sale of pesticides have resulted in an increase in the number of suicidal cases as well.<sup>3</sup> The manner of poisoning varies depending on the age, and in the pediatric group, poisoning is usually caused by ingestion of commercial and household toxic products (usually out of curiosity), whereas in the adolescents and adults, deliberate self-poisoning is the most common type of poisoning.<sup>4</sup>

The prevalence of poisoning varies from region to region depending on several factors such as availability and access to poison, socio-economic and educational background, knowledge on pesticides and its use, etc. The rapid industrialization and large-scale use of pesticides in the agriculture sector, albeit in an uncontrolled way have increased the prevalence of poisoning. Pesticides are the most common cause of poisonings in India and many developing countries; the reason being agriculture-based economy, poverty, hazardous practices, illiteracy, lack of knowledge, inadequate protective gear, and easy access to highly toxic pesticides.<sup>5</sup>

Poisoning cases are common at our center as it is the only tertiary care facility in the area. So, the present study aims to gather demographic information about poisoning in this area as well as analyze the epidemiological profile of poisoning related deaths. In order to create and execute appropriate policies in addressing this under recognized public health concern and to reduce the burden of poisoning deaths in the society.

## Materials and Methods

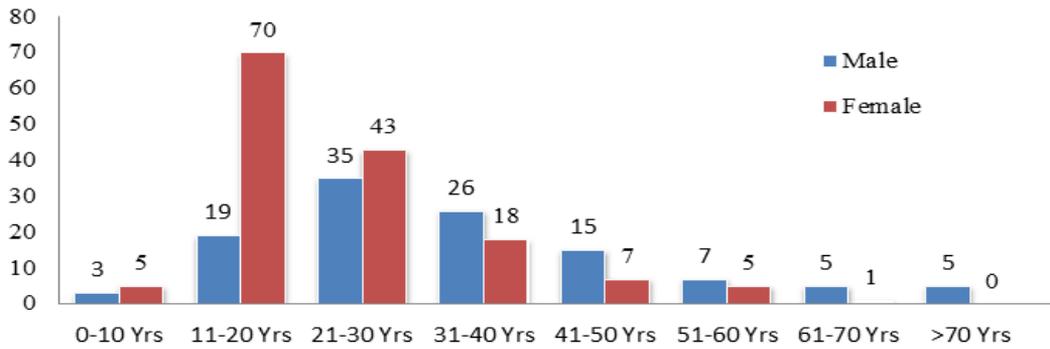
The present study was a retrospective study, carried out in the Department of Forensic Medicine of a tertiary care centre in southern Haryana, between January 2018 and December 2023. The study included 264 poisoning deaths autopsied between January 2018 and December 2023 at the aforementioned centre. This study comprised of hospital deaths and deaths in the jurisdiction of Nuh district alleged to have died due to poisoning. Relevant information and subjective data like age, gender, marital status, and occupation was collected from medico legal autopsy register while detailed information regarding the circumstances of the death was collected from inquest papers maintaining at most confidentiality. Data was collected and tabulated using a pre-designed format and the information thus collected, was statistically analyzed.

## Observations and Results

A total of 886 medico legal autopsies were performed between Jan 2018 to Dec 2023 at the study centre. Deaths due to poisoning comprised 264 cases i.e. an incidence of 29.79% among the total autopsies conducted during the study period.

In our study, it was observed that out of 264 cases, 149 were female (56.43%) and 115 were male (43.56%), the female outnumbered male in ratio 1.3:1. However, most of the deaths observed in females were at 11–20 years of age, while in males the majority of deaths were at 21–30 years of age. Nearly two-third of all the cases were in the 2<sup>nd</sup> to 4<sup>th</sup> decades of life. It was also, observed in the study that the age group of 11–20 years old accounted for maximum number of poisoning cases (33.71%), followed by the age groups of 21–30 years old (29.54%), 31–40 years old (16.66%) and least cases belonged to age group of above 70 years old (01.89%). Age-group wise gender-specific distribution of poisoning cases is depicted in Figure 1.

**Age & Gender Distribution**



**Figure 1: Age-group wise gender-specific distribution of poisoning cases (n=264).**

It was observed that the majority of cases of poisoning occurred in rural areas, with 82.57% of the victims coming from rural backgrounds and only 17% from urban areas. Also, 62.50% were Muslims being majority in number, followed by 37.50% Hindus. Incidence of poisoning was found more common

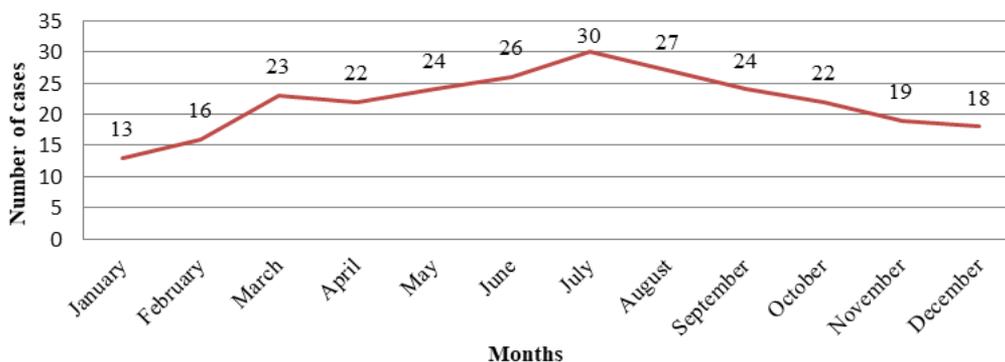
among married couples 59.84% (158) versus 40.15% (106) in unmarried. Majority of the victims (64.77%) had accidentally consumed poisonous substance, whereas 35.22% of the victims committed suicide by ingesting poison. Demographic attributes associated with poisoning cases are depicted in Table 1.

**Table 1: Showing Demographical attributes associated with poisoning cases.**

Demographical attributes	Poisoning cases	Percentage
Residence	Rural	218
	Urban	46
Religion	Hindu	99
	Muslim	165
Marital Status	Married	158
	Unmarried	106
Manner	Suicidal	93
	Accidental	171
	Homicidal	0

It was observed that maximum numbers of poisoning deaths (30) occurred in the month of July, followed by 27 deaths in August and least in the

month of January. The month wise distribution of poisoning deaths is depicted in Figure 2.



**Figure 2: Month wise distribution of poisoning deaths (n=264).**

In the present study occupation-wise distribution showed that poisoning is more common among people who are homemakers contributing 29.54%

cases, followed by workers (18.18%) and students (16.66%). The occupation wise distribution of poisoning deaths is depicted in Figure 3.

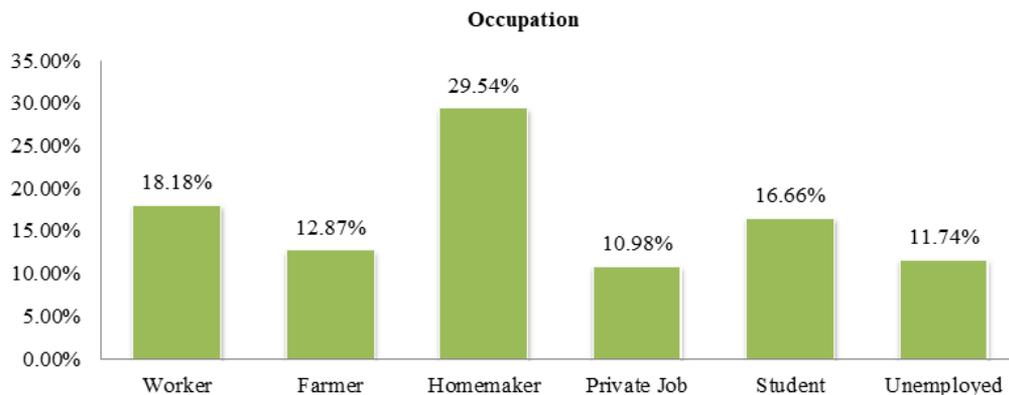


Figure 3: Occupation wise distribution of poisoning deaths (n=264).

### Discussion

Analysis of the data in the present study gives an incidence rate of 29.79% for death due to poisoning out of total 886 autopsies conducted during the study period. In the present study, poisoning death cases were higher in females (56.43%) than male deaths (43.56%), it was interesting to note that the majority of fatal cases occurred in females aged 11 to 40 years, and males aged 21 to 50 years. This difference indicates that females are more susceptible to poisoning in their second decade than males, and males are more susceptible than females in their fourth decade. The findings are in general agreement with the studies conducted by Parekh and Gupta<sup>2</sup>, Bhandari et al<sup>6</sup> and Rajesh et al<sup>7</sup>. The higher incidence of poisoning among females may be due to the fact that women are more likely to experience stress, tension, and struggle to manage family life with limited resources, domestic violence, unemployment, and behavioral issues. The findings of our study are contrary to those of Kirubakaran et al<sup>8</sup>, Selvam and Singh<sup>9</sup> and Mugadlimath et al<sup>10</sup> where males outnumbered females.

Present study showed that incidence of poisoning is more common in rural areas (n=218, 82.57%) than in urban areas (n=46, 17.42%). Rural population forms the major bulk of the population in Nuh district, also the majority of the rural population in Nuh district is dependent on agriculture. This makes them easily exposed to insecticides as well as susceptible to

animal-poisoned substances. This may be one of the reasons why the number of poisoning cases in rural areas was higher than urban areas in this study. The results are similar to the study conducted by Kirubakaran et al<sup>8</sup> and Mugadlimath et al<sup>10</sup>. In our study Muslims are the most affected (62.5%) than any other religion which may be attributed to the Muslim majority and the fact that maximum inhabitants of the region who are engaged in agriculture related occupations follow Islam. Findings of the study are contrary to the study done by Bhandari et al<sup>6</sup> and Mugadlimath et al<sup>10</sup> where most of the individuals affected were Hindus.

It was also observed that married couples were more vulnerable as compared to unmarried (59.84% versus 40.15%) Research shows that the marital status of the individual plays an important role. The desired bliss of marital life comes with many responsibilities and unexpected issues that require maturity, emotional, and psychological support. The inability to handle the marital responsibilities and the inability to resolve marital disagreement are some of the reasons that drive the individual to take extreme steps to end their life. Our observation was similar to the study of Bhandari et al<sup>6</sup>, Kirubakaran et al<sup>8</sup>, Mugadlimath et al<sup>10</sup> and Rajesh et al<sup>7</sup>. In present study maximum poisoning cases according to the manner of death are found to be accidental (n=171, 64.77%) followed by suicidal (n=93, 35.22%). During the study period, there were no reports of fatal homicidal poisonings, suggesting that poisonings

are no longer a preferred method of homicide in this area, similar to a study done by Kanchan et al.<sup>11</sup>

Present study showed that peak incidence of poisoning fatalities occurred during the months of June, July and August. The findings are similar to the study done by Parekh and Gupta<sup>2</sup>. However, in a study done by Kanchan et al<sup>11</sup> the month wise distribution of cases saw a peak incidence of poisoning fatalities in March and May. The cause of seasonal variations and month wise distribution of fatal poisoning cases remains unclear. Agricultural practices and availability of agrochemicals may have a contributory effect. Occupation-wise distribution showed that poisoning is more common among people who are homemakers contributing 29.54% cases. The high incidence may be because females are more exposed to stress. The findings are similar to the study done by Kirubakaran et al<sup>8</sup> and Bhandari et al.<sup>6</sup>

Limitation of the study: Limitations exist as they arise primarily from the fact that this is a retrospective record based study. A major limitation is that the study comprised of deaths alleged to have died due to poisoning. The particular substance or compound was not further identified. Toxicological analysis is required to further enhance the quality of epidemiological literature on poisoning in our area.

### Conclusion

The epidemiology of poisoning is highlighted in the study, which shows that poisoning fatalities accounted for almost 30% of total autopsies. The majority of victims were females in their second to fourth decade of life. This could be due to increased stress and responsibility at a younger age, the sensitive nature of the young population, economic challenges, unemployment and the easy availability of toxic and poisonous substances. Since the region is heavily dependent on agriculture, to control deaths caused by poisoning awareness programs should be implemented vigorously to educate and nurture the character of young people. Strict rules and regulations should be implemented to control over the counter sale of harmful and toxic agents. Retail products should be provided with information on the harmful side effects and fatal doses, as well as preliminary treatment and precautions to be taken in the event of accidental ingestion or exposure to the toxins.

**Conflict of interest:** None

**Ethical approval:** Prior permission was not taken from the IEC as it was a record-based study without involving any live subjects or experimentation.

**Source of Funding:** None

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# An Analysis of Spine Injuries Seen in Fatal Motorized Two-Wheeler Accidents

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## Abstract

The global prevalence of two-wheelers is experiencing a notable surge, particularly evident in developing countries, attributed to their economical price points and widespread accessibility. Their compact dimensions, manoeuvrability, and user-friendly nature have solidified their status as among the most prevalent forms of transportation worldwide. In the context of this study, we undertook a comprehensive examination of spinal injuries observed in post-mortem assessments of individuals involved in motorized two-wheeler accidents. Our findings underscore a significant trend: cervical spine injuries emerge as the most prevalent type of injury across both helmeted and non-helmeted riders. This analysis sheds light on the critical importance of understanding the specific injury patterns associated with two-wheeler accidents, serving as a foundational resource for informing public policy initiatives aimed at enhancing safety measures and mitigating the risks associated with this increasingly prevalent mode of transportation. By elucidating the prevalence and characteristics of spinal injuries in such incidents, this research contributes valuable insights towards fostering safer road environments and reducing the toll of two-wheeler accidents on individuals and communities worldwide. It is intended that the data provided by this study would serve to cover the information gap in this area and contribute to known facts, facilitating policy planning and guiding necessary measures.

**Key words:** Vertebral injuries, spine injuries, road traffic accidents, motorized two-wheelers.

## Introduction

As two-wheelers are very inexpensive to acquire and maintain compared to other vehicles, the number of two-wheeled vehicles is rising worldwide,

especially in developing nations. The motorbike has become a common mode of transportation due to its mobility, speed, and ease of avoiding traffic jams on the road as well as its ability to maneuver over challenging terrain.<sup>1</sup>

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### ***The Burden of the Motorized Two-Wheeler Accident Related Injuries:***

Faduyile F, Emiogun F, Soyemi S, et al. in their autopsy based study conducted on 5,661 cases (2009-2014) in Lagos, Nigeria found that in a motorcycle accident, males are more commonly injured than females and the peak age group was 31-40 years followed by 21-30 years. The majority of the victims were motorcycle riders, followed by pillion passengers. The craniocerebral injury was the cause of death in majority of the followed by multiple injuries and the most commonly injured organ was head followed by the lower limbs.<sup>1</sup>

Hsieh CH, Hsu SY et al. (2015) in their retrospective analysis of motorcycle-related injuries from the Trauma Registry System in Taiwan identified and compared 4028 male and 2919 female patients who were hospitalized for treatment between January 1, 2009 and December 31, 2013 concluded that women motorcycle riders have unique injury characteristics, including bodily injury pattern, as well as a lower injury severity score and in-hospital mortality when compared to male motorcycle riders.<sup>12</sup>

H S Chhabra and M Arora (2015) in their retrospective study done in Haryana, found that the Road Traffic Accident (45%) is the most common cause of the traumatic spinal cord injury. Out of the cases having traumatic spinal cord injury 66.67% were paralysed, and 71.18% were completely injured. The most compound injury was seen in cervical spine (41%) followed by thoracic spine (30.5%) and the most common time was during daytime (43%). Accidents which had happened on the roads other than the highways have higher incidence of traumatic spinal injuries, which is 39.5% on the highways and 60.5% on the other roads.<sup>10</sup> According to the autopsy based study done by Sharma et al in Chandigarh, India, the incidence of traumatic spine injury is 13.4%.<sup>13</sup>

According to the NCRB, in 2020, two-wheelers were responsible for the greatest number of fatal road accidents (58,129 deaths), accounting for 43.6% of all road accidental deaths, out of which 11,665 (20%) occurred in the state of Madhya Pradesh, India.<sup>2</sup> In spite of recent advancement in the fields of technology and medical sciences, death and deformities following road-traffic accidents are

yet to be controlled successfully rather incidences of RTA have been increasing at an alarming rate everywhere.<sup>11</sup> The importance of epidemiological studies in planning prevention strategies as well as clinical and community services for persons with spine injury is well established.<sup>3,4</sup> These studies provide a baseline to monitor the effectiveness of interventions and help in prioritization for resource allocation and thus should be especially helpful for developing nations, who have limited resources.

### **Material and Methods**

The present study was conducted in the department of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal (M.P.), India from September 2021 to August 2022. All the deaths pertaining to the fatal motorized two-wheeler accidents brought to the Gandhi Medical College Mortuary during this study period have been included. The history regarding the circumstances of the accidents and other relevant data was collected through the autopsy requisition form and through the detailed history taking from the police personnel, friends, relatives etc. Approval to perform this study was obtained from the Scientific and Ethics Committee, Gandhi Medical College, Bhopal (M.P). Material included a pre designed proforma containing relevant information about the cases. Information was derived from autopsy reports, autopsy registers, police reports and hospital (clinical) records, where necessary.

### **Results**

Out of 4590 autopsies performed in the Department of Forensic Medicine & Toxicology, Gandhi Medical College, Bhopal, over the study period, 878 cases of fatal motorized two-wheeler accidents were reported. Therefore, the proportion of deaths due to fatal motorized two-wheeler accidents is 19.13%. Of the 878 two-wheeler accident cases only 57 (6.49%) cases had a history of riding the vehicle with a helmet.

The vertebral injuries constituted 4.6% of the total cases (n=40). Among the helmeted cases (n=57), 10 cases (17.54%) of vertebral injury were seen whereas there were 30 (52.63%) instances of vertebral injuries in the non-helmeted group. The cervical vertebra

fracture is the most common injury seen in both non-helmeted and helmeted cases (n=22 and n=8, respectively), followed by thoracic vertebrae (n=6)

combining both helmeted and non-helmeted groups (Table 1).

**Table 1: Observation of spine injuries in cases with and without using helmet**

Description	Total Cases (n)	Helmeted Cases (n)	Non-Helmeted Cases (n)
Total autopsies performed	4590		
Fatal motorized two-wheeler accidents	878 (19.13%)	57	821
Vertebral injuries	40 (4.6%)	10	30
Most common injury (cervical vertebra fracture) - Helmeted Cases		08	
Most common injury (cervical vertebra fracture) - Non-Helmeted Cases			22
Cases with thoracic vertebrae fracture (both helmeted and non-helmeted)	06		

### Discussion

The most common type of spinal injury found in our study is of cervical spine in both helmeted and non-helmeted riders of the motorized two-wheelers. The spinal injury is more common in riders who did not wear a helmet while riding a motorized two-wheeler. Despite its size and population, India has not had any proper study on this matter so far. These findings are in accordance with the study done by Chhabra et al.<sup>10</sup>

Pilot/Demographic studies have been conducted in other nations but the information from these studies does not represent this country. However, according to these studies, there are significant epidemiological differences in India as compared with other developed countries. An insight into the epidemiological/demographic details is important for developing strategies for prevention programs. RTA is the most common cause of injury in India<sup>5,6</sup> and hence is expected to be the most common cause of spinal injury as well. According to the data released by National Crime Bureau, during 2022, 45.5% victims of road accidents were riders of motorized two-wheelers.<sup>7</sup> Various factors play a role in high incidence of road traffic accidents in India. Different mindsets, and poor

and inexperienced driving techniques are important factors.<sup>5,8</sup> Traffic rules are often viewed as imposed and there is a tendency to treat them with disdain. Thus, high speeds and other human errors leading to road traffic accidents is quiet common. Other studies report human error as being the only cause in 57% of all accidents<sup>5</sup> and a contributing factor in over 90% of all accidents. This highlights the critical importance of prevention programs, including public awareness and education. The rate of poor traffic management is a low influencing factor that may reflect people's low awareness. Experts implicate improper segregation of traffic and pedestrians, overloaded vehicles, significant volume of non-motorized traffic not only on the urban as well as rural roads but also on four-lane divided highways and deteriorating traffic law enforcement due to the absence of enforcing teams, skills, facilities and resources as significant predisposing factors.<sup>5</sup> Other implicated factors include limited scientific crash investigation, analysis and dissemination of information.<sup>9</sup>

### Conclusion

There is no established pattern when it comes to the daily distribution of injuries. Human error, poor road infrastructure and unfavorable driving

conditions most often predisposed to road traffic accidents. The significantly higher number spine injuries probably reflect the need to establish proper services for pre-hospital and acute care. It is necessary to conduct an appropriate epidemiological study that can confirm the results of the study and help develop appropriate prevention programs.

Although the efficacy of helmets has been proven in reducing the fatalities due to head injuries through various studies, still, in this study, there are cases in which spinal injuries have been observed in helmeted riders. This may be due to sub-standard helmets or poor helmet quality or poor design. The government should ensure that the helmet production standards should be strictly followed. The designs of the helmet should also be improved so as to prevent spine injuries in the persons wearing the helmets.

**Conflict of interest:** None to declare.

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# An Autopsy Based Study of Suicidal Deaths in Gandhi Hospital, Secunderabad

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## Abstract

Suicide is a serious global public health issue. Suicide refers to the act of intentionally causing one's own death. The aim of the study is to find the pattern of suicidal deaths and to identify the high-risk groups. The study was carried out in the Department of Forensic Medicine and Toxicology, Gandhi Medical College, Secunderabad, Telangana. This was based on the observation of 200 deaths due to suicides in 18 to 45 age group during the study period January 2020 to July 2021. It is observed that majority of victims were aged between 18-25 years (33.50%) and married (61.50%). Males (77.00%) are more victims as compared to females. The leading motive behind suicide was emotional factors (32.5%) and most commonly adopted method to commit suicide was hanging (41.50%). Health education, counselling, timely crisis intervention either by medical or social methods will reduce the number of suicide victims.

**Keywords:** Poisoning, Hanging, Suicide, Suicide note, Suicidal death.

## Introduction

Suicide refers to the act of intentionally causing one's own death. According to World Health Organization (WHO)'s latest estimates published in "Suicide worldwide in 2019" states that Suicide remains one of the leading causes of death

worldwide<sup>1</sup>. Southeast Asia aspires Sustainable Development Goal (SDG) of reducing the suicide death rate by one-third till 2030<sup>2</sup>.

In the last three decades, the suicide rate has increased by 43% but the male to female ratio has been stable at 1.4: 1. Majority (71%) of suicide in India are

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by persons below the age of 44 years which imposes a huge social, emotional and economic burden<sup>3</sup>. As per WHO's approximation, there is one suicide every minute and an attempted suicide every third second. It implies that the number of killed due to suicide is greater than that of the ones killed due to the armed conflict<sup>4</sup>.

Padubidri et. al.<sup>5</sup> did a study consisted a series of 328 consecutive autopsies on women in the reproductive age group, between 2009 and 2011 at the Government Wenlock District Hospital, Mangalore, India by qualified specialist forensic medicine experts. In this study, the preponderant method of suicide was by poisoning at 42.3% (63 cases), followed by hanging (34.9%), burns (11.4%) and drowning (9.4%). These four methods comprised 98% of the total suicidal deaths. Accidental deaths were predominantly caused by burns (62.2%) and road traffic accident (23.1%)<sup>5</sup>.

There is a felt need to decrease the rate of suicidal deaths by creating awareness about factors leading to suicidal deaths, and the importance of keeping an eye on people who has previously attempted for suicide. Hence this study was conducted to analyze various factors that are leading to suicidal deaths so that we can do awareness interventions to improving this important public health issue.

## Materials and Methods

**Study setting:** An autopsy-based study was conducted in Gandhi Hospital Secunderabad, Telangana, through the period of January 2020 to July 2021.

**Source of data:** Data was collected from Inquests, First Information Reports, statements made by the relatives and eye witnesses, hospital records, panchanama at the scene of offence through the police and post mortem examination reports.

**Inclusion criteria:** All cases of deaths due to suicides under the age group of 18 to 45 years brought to the mortuary of Gandhi hospital were included.

**Exclusion criteria:** The following cases were excluded from study:

- Isolated deaths where proper evidence was not procured.
- Poisoning cases where chemical analysis report of Forensic Science laboratory was negative.
- Properly documented homicidal and accidental deaths.
- Advanced decomposition cases where cause of death could not be determined.

## Results and Discussion

In this study we collected the data of 200 suicidal death cases came to the mortuary of Gandhi Hospital Secunderabad during the study period. In the present study, the age group 18 to 25 years constituted majority of deaths (33.5%), similar to the study done by Karthik et. al.<sup>5</sup>. The peak age for committing suicides was 21 to 30 years with the percentage of 43.27%. The highest number of cases were recorded in the Hindu group i.e., 91.5% due to higher percentage of Hindus in general population followed by Muslim 05% and Christians 3.5%. Majority of the cases were from Lower Socio-Economic class (55.5%) followed by middle Socio-Economic class (42.5%) and least from Upper class (2%).

The present study revealed married people are predominant amounting to 61.5%, followed by unmarried (36.5%), divorced (01%), widow (01%). Majority of the cases were labourers by occupation (40%), Home Makers were 13%, Agricultural labourers were 06%, Private Employees 14% and unemployed 03%. Similarly results were also found in the study conducted by Sandeep Krishna Murthy Kosaraju et. al.<sup>7</sup> were females in age group of 20-30 years, uneducated, married and daily laborers by occupation had higher incidence of suicidal attempts. (table 1)

In this study group, 37% of suicidal deaths were seen in those who were admitted in hospital and died during the treatment, remaining 63% deaths were those which occurred at the scene. Hanging is the most commonly adopted method to commit suicide i.e., 41.5% of deaths. The other means adopted

for committing suicide in the decreasing order of percentage of deaths are as follows, poisoning 26.5% (Organophosphorus poisoning 20.5%, Herbicide poisoning 3%, Acid poisoning 2%, Phenytoin poisoning 1%). This result is consistent with a study done by Kanchan et. al.<sup>8</sup> in which most favored method of suicide amongst males and females was hanging (36.9%) followed by poisoning (34.7%).

According to the present study, leading motive behind suicide was emotional factors 32.5%, followed by marriage related issues 23.5%, due to illness (mental health and physical health) 20.5%, due to financial problems 20%, due to love failure 2.5% and not known is 1% of deaths. (table 2). Total of 97 deaths out of 200 cases were preceded by fight or argument, in which 72 were male and 25 were female.

Similarly, in the study by Thomas Simon et. al.<sup>9</sup> highest number of deaths occurred in the cases preceded by fight or argument the 153 case-subjects, 24% attempted impulsively. Impulsive attempts were more likely among those who had been in a physical fight and less likely among those who were depressed. In the present study highest number of deaths recorded during morning time from 06:00AM

to 12:00PM, 31.5% and least from early mornings 12:00AM to 06:00AM, most of the cases (64.5%) were of those who died immediately after suicide, followed by those who were admitted in the hospital and survived 48 hours to one week i.e., 11.5% followed by 24 to 48 hours i.e., 8%, 12 to 24 hours is 7.5%, less than 12 hours is 6%, more than a week is 1.5% and the least is percentage was seen in the group who survived more than a month, more deaths occurred in winter 35.5%, followed by rainy 32.5% and summer 32%. (table 3)

In this study the male gender is predominant amounting to 77% and females 23% (figure 1), resembling with study of Sachil Kumar et. al.<sup>10</sup>. There were 5204 cases of males (56.61%) and 2258 female (43.38%) victims. Our study shows urban preponderance 60%, followed by rural cases 40% (figure 2). In contrast to the above results, study conducted by Suchita Rawat et. al.<sup>11</sup> the resulted cases were majorly reported from rural regions (1217 cases, 92.8%) than compared to urban regions (95 cases, 7.2%). In this study most of the deaths were noted in their houses 77%, outside 12%, on railway track 10%, and Work place 1%. (figure 3).

**Table 1: Distribution of study population according to person (n=200)**

Variable	Category	Total no. of deaths	Percentage
Age distribution	18-25 years	67	33.5
	26-30 years	40	20
	31-35 years	43	21.5
	36-40 years	40	20
	41-45 years	10	5
Religion	Hindu	183	91.5
	Muslim	10	5
	Christian	7	3.5
Socio-economic status	Lower class	111	55.5
	Middle class	85	42.5
	Upper class	4	2
Marital status	Unmarried	73	36.5
	Married	123	61.5
	Divorced	2	1
	Widowed	2	1

Continue.....

Occupation	Unemployed	6	3
	Labourer	80	40
	Agricultural labourer	12	6
	Homemaker	26	13
	Driver	13	6.5
	Student	17	8
	Private employee	28	14
	Doctor	1	0.5
	Cricket coach	1	0.5
	Business	4	2
	Others	6	3
	Not known	6	3
Education	Illiterate	64	32
	Schooling	38	19
	Intermediate	19	9.5
	Degree	40	20
	B. Tech	5	2.5
	Graduate	2	1
	Post graduate	4	2
	Not known	28	14

**Table 2: Distribution of study population according to cause & motive of death**

Hospital admission	Yes	74	37
	No	126	63
Cause of death	Hanging	83	41.5
	Poisoning	53	26.5
	Burns	17	8.5
	Drowning	17	8.5
	Multiple injuries	29	14.5
	Stab injury	1	0.5
Motive behind suicide	Emotional factors	65	32.5
	Marriage related issues	47	23.5
	Financial problems	40	20
	Illness	41	20.5
	Love failure	5	2.5
	Not known	2	1

**Table 3: Distribution of study population according to time period**

Variable	Category	Total no. of deaths	Percentage
Time of incidence	06:00 am - 12:00 pm	63	31.5
	12:00 pm - 6:00 pm	60	30
	06:00 pm -12:00 am	60	30
	12:00 am - 06:00 am	17	8.5

Continue....

Survival period	less than 12 hours	12	6
	12 to 24 hours	15	7.5
	24 to 48 hours	16	8
	48 hours to one week	23	11.5
	more than one week to one month	3	1.5
	more than one month	2	1
	Nil	129	64.5
Season	Winter	71	35.5
	Summer	64	32
	Rainy	65	32.5

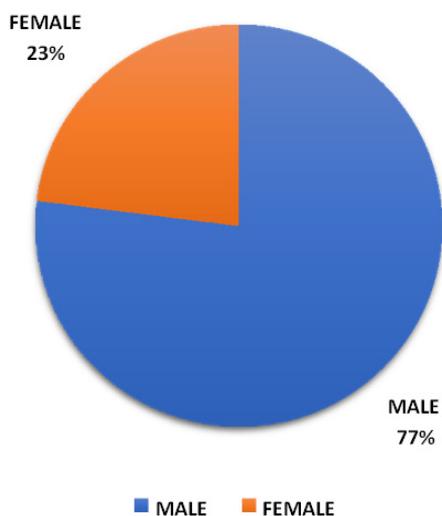


Figure 1: Distribution of study population according to gender

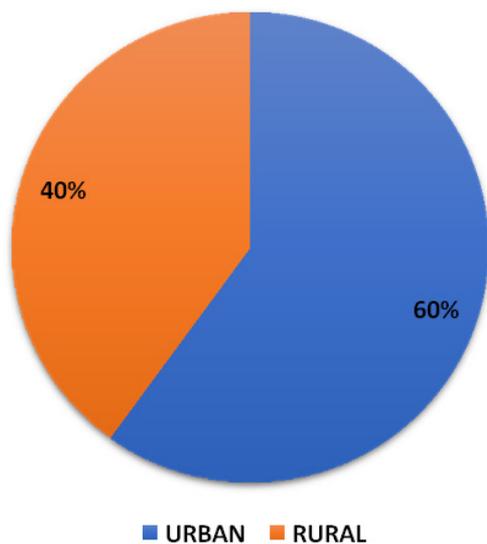


Figure 2: Distribution of study population according to geographical area

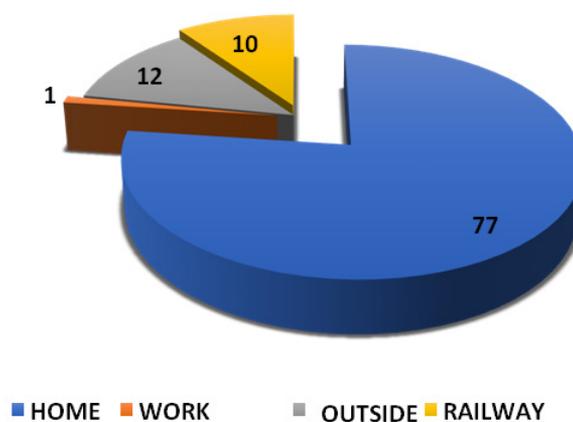


Figure 3: Distribution of study population according to place

### Conclusions

Introduction, review of literature and studies conducted by various researchers earlier were reviewed and correlated with the present study. The study highlights various factors associated with deaths by suicides and interventions in preventing such deaths. Results from the study are tabulated and graphically represented to draw conclusions and give suggestions. The following conclusions were drawn after the study of 200 cases of deaths due to suicide in age group 18-45yrs at Gandhi Hospital Mortuary, Secunderabad. Majority of victims were aged between 18-25yrs (33.50%), males comprised the majority victims as compared to females (77.00%), maximum cases recorded during morning hours (31.50%), majority of victims were married. (61.50%), most commonly adopted method to commit suicide is hanging (41.50%).

Early identify access, manage and follow up anyone who is affected by suicidal behaviors. Psychological counselling should be provided to all people in order to tackle any kind of stress in education, unemployment, financial problems, physical illness, emotional problems, marriage related issues. Training of general practitioners is effective in the prevention of suicide. It improves treatment of depression and anxiety, quality of the provided care and attitudes towards suicide.

**Conflict of interest:** Nil

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# Rapid Competitive Immunochromatographic Assay for the Detection of Tetrahydrocannabinol in Human Urine

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## Abstract

**Background:** Cannabis is among the earliest mind-altering drugs known to man and has been around for at least 4000 years. Today it is world's most commonly used illicit drug, with more than 300 million regular users. The aim of the study is detection of tetrahydrocannabinol (THC) in urine using immunochromatographic assay- a qualitative method.

**Materials and method:** Retrospective study was done based on the report of urine tests conducted in the Dept. of Forensic Medicine in one year from July 2022 to June 2023. Consent from the individual brought for examination by the police.

**Results and Conclusion:** Total 118 cases were studied; all were males among which 93 were positive and 25 negative. It is a preliminary screening test for cannabis substance abuse which will help the Police for further investigation.

**Key words:** Cannabis, tetrahydrocannabinol (THC), immunochromatographic assay, qualitative method.

## Introduction

Cannabis is among the earliest mind-altering drugs known to man and has been around for at least 4000 years. Today it is world's most commonly used illicit drug, with more than 300 million regular users.

In term of popularity ratings, it stands 4<sup>th</sup> among psychoactive drugs (after caffeine, nicotine and alcohol)<sup>1</sup>.

Cannabis preparations are derived from Indian hemp plant (*Cannabis sativa*) which is hardy,

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aromatic annual herb that grows wild under most climatic conditions. The main active principle is delta-9 tetrahydrocannabinol (THC). Apart from THC, *Cannabis sativa* contains a number of other cannabinoids, including cannabidiol, cannabinol, cannabidolic acid, cannabicyclol and cannabigerol. So far more than 60 of these cannabinoids have been identified<sup>1</sup>.

Toxic effects arise mainly from the abuse of various cannabis preparations for their mind-altering properties.

1. Marijuana- refers to any part of the plant or its extract that is used to induce psychotomimetic or therapeutic effects.
2. Ganja- resinous mass composed of leaves and bracts, in India (where the term actually originated), it is used to refer to crushed leaves and inflorescences of female plants.
3. Bhang- consists of dried mature leaves and flower stems that are ground with water and mixed with milk or fruit juice.
4. Hashish (charas) - preparations made out of dried resin collected from flower tops.
5. Sinsemilla- refers to seedless (unpollinated female) plant
6. Marijuana 'blunts'- cheap cigars sliced open, packed with cannabis and resealed.

Mode of Action:

- It appears that cannabinoids exert many of their actions by influencing several neurotransmitter systems and their modulators. These include GABA, dopamine, acetylcholine, histamine, serotonin, noradrenaline and prostaglandins.
- Cannabinoid receptor location and density in animal models has correlated well with clinical effects in humans. The highest density of receptors occurs in the basal ganglia and molecular layer of cerebellum, which correlates with its interference in motor coordination.
- Intermediate levels of binding were found in the hippocampus, dentate gyrus and layers I and IV of cortex, consistent with effects on short term memory and cognition.
- Low receptor density is noted in the brainstem areas controlling cardiovascular

and respiratory functions, which correlates with cannabinoids known lack of lethality.

- After binding to receptors, cannabinoids also produce effects through second messenger systems including inhibition of adenylcyclase and calcium channels and also probably by enhancing potassium channel activity.<sup>1</sup>

Cannabis drug testing describes various drug test methodologies for the use of cannabis in medicine, sport and law. Cannabis use is highly detectable and can be detected by urine analysis, hair analysis, as well as saliva tests for days or weeks.

Purpose of the test:

- Medical screening- although its not common to screen hospitalized patients for drug use, cannabis testing may be used to assess patients in specialty medical settings, such as psychiatric care and substance use treatment programmes.
- Employment testing- workplaces may require that applicants be tested for use of cannabis and other drugs. Testing is required by law in some workplaces.
- Military testing- random drug test are required by the department of defence for members of the military. Drug tests can also be ordered when a commander believes service member using drugs or after safety issue or accident.
- Athletic testing- drug testing may also be required for professional athletes. The anti doping agency prohibits cannabinoids for competing athletes regardless of the legality of cannabis in the location of competition.
- Legal and forensic testing- testing for cannabis and other drugs may be conducted in court case or investigation.<sup>2</sup>

Biological timeline- most cannabinoids are lipophilic (fat soluble compounds that easily store in fat, thus yielding a long elimination half life relative to other recreational drugs. Metabolites of cannabis are usually detectable in urine drug tests from 3days up to 10 days according to Redwood laboratories; heavy users can produce positive tests for 30days or longer after ceasing cannabis use<sup>3,4</sup>. The length of time may vary to some degree according to metabolism, quantity and frequency of use.

Marijuana use can be detected up to 3-5days after exposure for infrequent users, 1-15days for heavy users, and 1-30days for chronic users and/or users with high body fat<sup>5,6</sup>. The main metabolite excreted in the urine is 11-nor-9-carboxy-THC, also known as THC-COOH. Most cannabis drug tests yield a positive result when the concentration of THC-COOH in urine exceeds 50ng/ml<sup>7</sup>. Urine testing is an immunoassay based test on the principle of competitive binding.

Of all the matrices, urine is the most commonly used for adolescent drug testing and is the most thoroughly studied<sup>8,9</sup>.

However, for an adolescent patient, its collection is somewhat invasive since it requires either a sophisticated collection protocol which is not readily available in medical offices or direct observation (e.g., by a clinician or a parent) to prevent tampering<sup>10,11</sup>.

Currently, the most commonly used urine drug testing approach involves automated immunoassay either alone as a point-of-care test or as an initial screen for a 2-step testing procedure<sup>10,12</sup>. Results from IA are qualitative (i.e., a drug or its metabolite is denoted either present or absent, without the quantity reported). In the 2-step approach, a screening IA is followed by confirmatory gas chromatography-mass spectrometry (GC-MS).

#### **Aims and Objectives:**

- Detection of tetrahydrocannabinol (THC) in urine using immunochromatographic assay- a qualitative method.
- To reduce the incidence of addiction of Cannabis abuse by helping the investigating agency.
- Utilising this diagnostic test to assess patients in specialty medical settings, such as psychiatric care and substance use treatment programmes.

#### **Materials and Method**

Retrospective study was done based on the records of urine tests conducted in the Dept. of Forensic Medicine in one year from July 2022 to June 2023. Permission obtained from the Head of the Department for access to reports and study was conducted for two months.

#### **Methodology**

INSIGHT-THC device is a rapid, qualitative, immunochromatographic assay for the detection of tetrahydrocannabinol(THC) in human urine. This test is used to screen the tetrahydrocannabinol intoxication.

#### **Principle:**

INSIGHT THC is based on the principle of agglutinating sera on membrane and utilizes the technique of competitive immunochromatography. The conjugate pad is impregnated with two components- Anti tetrahydrocannabinol antibody monoclonal conjugated to colloidal gold and rabbit IgG conjugated to colloidal gold.

As the test specimen flows through the membrane assembly of the device, the Anti tetrahydrocannabinol antibody monoclonal colloidal gold conjugate complexes with Tetrahydrocannabinol present in the test specimen and travels on the membrane due to capillary action along with the rabbit IgG colloidal gold conjugate. This complex moves further on the membrane to test region (T) where it is not immobilized by Tetrahydrocannabinol conjugated to BSA coated on the membrane, forming no band. The absence of this band in the test region (T) indicated a positive result.

The rabbit IgG colloidal gold conjugate and unbound complex if any move further on the membrane and are subsequently immobilized by the goat anti rabbit IgG antibodies coated on the membrane at the control region (C) forming a pink colored band. This control band acts as a procedural control and serves to validate the test results.

#### **CASE DETAILS:**

The accused with history of Ganja consumption were brought by the Police to Department of Forensic Medicine and Toxicology KRIMS Karwar. Total 118 cases are examined from July 2022 till June 2023, after receiving requisition from the Police.

Specimen collection: no special preparation is necessary. The urine was collected when the accused was brought for examination to the Dept of Forensic Medicine, KRIMS Karwar in a sterile plastic container. Consent from the individual brought for examination by the police was taken and 5ml of urine was collected in a sterile container.

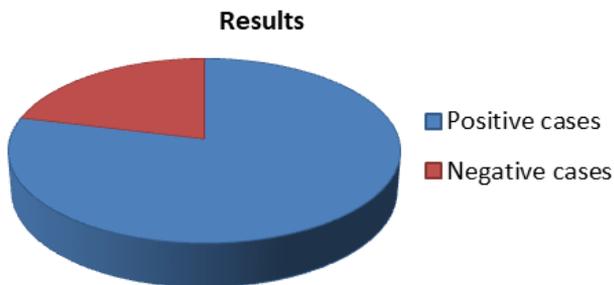
By holding the sample dropper vertically, two drops of test specimen urine is dispensed into the specimen port (S) of INSIGHT-THC device. Stop watch is started and the results are read after 5 minutes. One pink coloured band appears at the control region (C) which indicates that the specimen contains detectable amount of tetrahydrocannabinol.

**Testing procedure:**

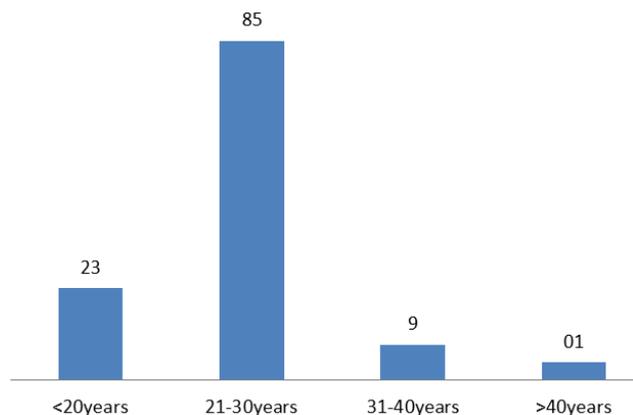
- The INSIGHT-THC kit was kept at room temperature and opened from the foil pouch.
- The device was labelled with marker bearing the name of the accused to be examined.
- The testing device was placed on a flat horizontal surface.
- Holding the sample dropper, two drops of the test specimen was dispensed into the specimen port (S) on the device and stop watch started. The results were read at the end of 5minutes.

**INTERPRETATION OF RESULTS:**

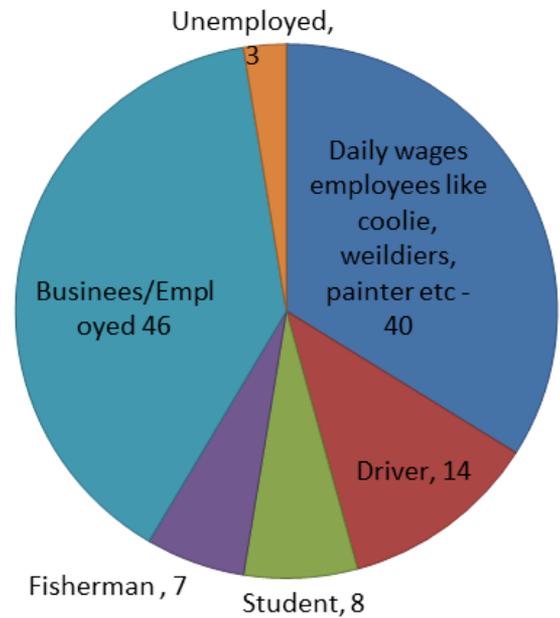
- Total number of cases examined 118. (all males)
- Positive: 93
- Negative: 25



**Graph 01: Showing total results of the study**



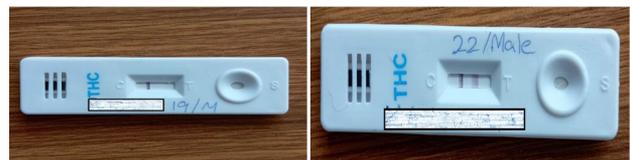
**Graph 02: Age wise distribution of the cases:**



**Graph 03: Occupation wise distribution of the cases:**



**Figure 01: Insight THC Device**



**Figure 02: Positive Result**

**Figure 03: Negative Result**

**Discussion**

Rosendo LM, et al<sup>13</sup> study proposes a rapid procedure for simultaneous quantification of delta-9-tetrahydrocannabinol (THC), 11-hydroxy-delta9-tetrahydrocannabinol (11-OH-THC), 11-nor-9-carboxy-delta9-tetrahydrocannabinol(THC-COOH), cannabidiol (CBD), and cannabinol (CBN) in urine

samples. The limits of quantification and detection were between 1 and 10ng/ml using 0.25ml of sample. The findings of our study detect THC levels equal or greater than 50ng/ml using 0.1ml of sample (2drops of urine sample).

Rosendo LM, et al<sup>13</sup> study used micro extraction by packed sorbent (MEPS) to pre-concentrate the analytes, which were detected by gas chromatography-mass spectrometry, and our study is based principle of competitive immunochromatography.

B Wei, L Wang, BC Blount<sup>14</sup> have validated a multifunctional method using ultrahigh performance liquid chromatography coupled with tandem mass spectrometry for analysis of delta-9-tetrahydrocannabinol (THC), cannabidiol and cannabinol and two major metabolites of THC, 11-nor-9-carboxy-THC and 11-hydroxy-THC in active users and particularly in people exposed to secondhand marijuana smoke (SHMS). This method used positive electro spray ionization (ESI) mode to reach the sensitivity needed to detect trace SHMS exposure with limits of detection (LOD) ranging from 0.002 to 0.008ng/ml and 0.005 to 0.017ng/ml for free (unconjugated forms) and total (unconjugated plus conjugated forms) measurements respectively. This study is sensitivity rates higher than our present study.

### Conclusion

The assay is designed for use with human urine only.

Sensitivity- INSIGHT-THC detects THC at concentrations equal to or greater than 50ng/ml.

Specificity- the following structurally related compounds produced positive results when tested at levels equal to or greater than the concentrations listed below:

Compound	Concentration (ng/ml)
11-nor- 8-THC-9-cacoxylic acid	50
11-nor- 9-THC-9-cacoxylic acid	50
11-hydroxy-9-tetrahydrocannabinol	1000
8-tetrahydrocannabinol	7500
9-tetrahydrocannabinol	10000
Cannabinol	10000

The cut off levels for distinguishing positive from negative specimens is not universal and depends on the laboratory, testing device or the agency conducting the test commonly either 20ng/ml, 50ng/ml or 100ng/ml.

There is a possibility that technical/or procedural errors as well as other substances or factors may interfere with the test and cause false results.

Testing of cannabis especially in urine detects evidence of use, not current intoxication or addiction.

The length of time following drug use for which positive result may occur is dependent upon several factors, including the frequency and amount of drug, metabolic rate, excretion rate, drug half life, the user's age, weight, activity and diet.

Drug testing can be stressful process. Positive drug test result requires additional confirmation testing conducted in laboratory. Possibility of positive cannabis test result due to passive or secondhand exposure to cannabis smoke. Research suggest that testing positive after second hand exposure to cannabis smoke is unlikely as metabolite levels in the body aren't sufficient to be detected in most drug tests.

Urine test report is qualitative, meaning that it may only show a positive or negative result and not additional information about the type and level of specific cannabinoids. Hence it is a preliminary screening test for cannabis substance abuse which will help the Police for further investigation.

**Conflict of Interest:** None

**Ethics approval and consent to participate:** Approved by Institutional Ethics Committee of Karwar Institute of Medical Sciences, Karwar. Reference no: IEC/KRIMS/O/20/2023-24; dated: 6<sup>th</sup> October 2023.

**Consent for publication:** The article does not disclose any personal data of the subjects and consent to publish the article is obtained from Institution Ethics Committee.

**Availability of data and materials:** The datasets analysed during the current study are not publicly available due to confidentiality reasons as these are Medico legal documents. But are available from the

corresponding author on reasonable request after permission from the concerned authorities of the Institution.

**Funding:** NIL

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# Clinico-Epidemiological Study of Adult Acute Poisoning at Tertiary Care Centre in Hadoti Region: A Cross Sectional Study

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## Abstract

**Objective:** To study Clinico-epidemiological parameters of adult acute poisoning at tertiary care centre in Hadoti region of Rajasthan.

**Methodology:** A prospective cross sectional was conducted on 50 patients, presenting to the Government medical college and associated group of hospitals of Kota, Rajasthan. The data about demography and laboratory parameters were collected after admission of the patient and analyzed.

**Results:** The mean age of patients was 28.4(13.0-58.0) years. The proportion of male was 62%. Most common mode of poisoning was ingestion(98%). suicidal circumstance was in 45 (90%) (Male : Female=2:1) and accidental in 5 (10%) patients (Male:Female=1:4). Most of the suicidal poisoning cases (34%) from the age group 20 to 29 years. Insecticidal poisoning was the most common poisoning. In drug poisoning most common from sedative group or benzodiazepine group, in corrosive poisoning most common was Phenyl. The most common symptom was Vomiting (90%). 48 patients were successfully discharged from ward or ICU and 2 were expired from ICU.

**Conclusion:** Study has provided a comprehensive overview of poisoning in Rajasthan, focusing on hospital data. The findings indicate that male gender and longer delays in seeking treatment at primary care facilities are associated with lower survival rates. The study highlights the need for increased public awareness about the importance of promptly transferring poisoning cases to hospitals, calling for attention from planners and policy-makers.

**Keywords:** Adult poisoning, Hadoti region

**Take Home Message:** The study highlights the need for increased awareness about the risks of poisoning, particularly among young adults, and the importance of prompt medical intervention in cases of poisoning.

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## Introduction

A poison is defined as any substance that can cause harm to the body upon ingestion (consumption), inhalation (breathing), injection, or absorption through the skin. Throughout human history, poisons have been utilized for various purposes, with their most prevalent uses including weaponry, antidotes for venom, and medicinal applications.<sup>(1)</sup>

In recent decades, agricultural pesticides have become prevalent household items in rural regions of the developing world. Their widespread availability has led to their frequent utilization in deliberate cases of self-poisoning.<sup>(2)</sup>

Unintentional and deliberate poisoning constitutes a medical emergency with the potential for significant morbidity and mortality. Each year, numerous individuals lose their lives to suicide, with approximately twenty times as many attempting it.<sup>(3)</sup> The highest rates of suicide occur in low- and middle-income countries.<sup>(4)</sup>

Depending on the toxins involved, acute toxicity can present with diverse symptoms. Individuals experiencing organ failure require admission to the intensive care unit (ICU) for specialized care and organ support.<sup>(5)</sup> High mortality rates may arise due to various factors, including the type of toxin, timing of symptoms onset, and occurrence of multi-organ failure. Swift identification and prompt treatment in the emergency department (ED) and ICU are crucial to prevent hospital morbidity and mortality in poisoned patients. In rural regions of the developing world, agricultural pesticides have increasingly found their way into households over the past few decades. Their ready availability has led to their frequent utilization in deliberate cases of self-poisoning. According to estimates from the World Health Organization (WHO) in 1990 (World Health Organization 1990), approximately 3 million poisoning incidents resulting in 220,000 fatalities occur each year. Nearly all of these deaths, about 99%, transpire in developing nations.<sup>(6)</sup>

Only a limited number of studies have investigated the epidemiology and clinical characteristics of

poisoning in Rajasthan.<sup>(7-14)</sup> The pattern of poisoning in the hadoti region of Rajasthan remains poorly understood. Consequently, there is a pressing need to gather regional clinical and epidemiological data on poisoning. These data will facilitate the optimal utilization of existing resources for the prevention and management of poisoning incidents. Therefore, this study aimed to assess clinical and epidemiological indicators for acute poisoning and outcomes among patients brought to the tertiary care facility.

## Material and Methods

This was a single centre prospective cross sectional study done at government medical college and associated hospital, Kota (Tertiary care centre of Hadoti region ) between 13<sup>th</sup> July 2023 to 28<sup>th</sup> January 2024. A total of 50 patients were included in this study.

Detailed history regarding Demographic data, clinical manifestations, comorbidities, past history of suicidal attempts and psychiatric treatment were taken after taking informed consent to patients or their relatives after admission of the patient in hospital. History taken from either relatives or patient. Type of poison and route of exposure, intention of poisoning identified whether it was intentional/suicidal or accidental and time taken to reach at tertiary care centre were duly noted. If poison was ingested, gastric lavage done if not contraindicated in emergency.

Explicit treatment was administered to the cases and managed with antidotes when deemed necessary. Patient decontamination was conducted if required following initial stabilization. Subsequent to an initial evaluation, care, and a brief observation phase, the patient's course of action was decided based on the observed level of toxicity and anticipated progression. Factors such as the need for vasopressors, ICU admission, mechanical ventilation were evaluated. Patients were monitored until their discharge or demise.

Venous sample drawn within 24 hours of admission for Complete blood count, Renal function test (Blood urea and Serum creatinine). Complete

blood count measured by an automated hematology analyzer (sysmax XS-800i, Japan) in central laboratory of Government medical college, kota. And manually corrected by pathologist to overcome any technical error. Routine biochemical test - Renal function test, performed by automated biochemistry analyzer (Erba mannheim EM-200 or Erba mannheim XL-640) in central laboratory of Government medical college, kota.

**Inclusion criteria:** All adult patients presented in emergency due to acute poisoning during the period from 13<sup>th</sup> July 2023 to 28<sup>th</sup> January 2024 were included.

**Exclusion criteria:** Age less than 10 years were excluded.

**Statistical analysis:** The SPSS IBM program version 25 (IBM SPSS Advanced Statistics, Chicago, IL, USA) was used to input and analyze data. Frequency and percentages were used to characterize nominal data, and the Chi-squared or Fisher's exact test was used to compare these data. Continuous data were reported using mean  $\pm$  SD and compared using an unpaired t-test. The median and interquartile range (IQR) were used to characterize and compare non-normally distributed data and compared using the Mann-Whitney U test. *P* value < 0.05 was deemed statistically significant. The association between two variables was measured by the Spearman rank-order correlation coefficient

## Results

During the research period, 50 patients with acute poisoning admitted from the emergency room. The mean age of patients was 28.4(13.0-58.0) years. The proportion of male patients was 62%. Out of the 50 patients, a maximum number (n = 13) was from the 20-30 years of age group. One male patient in the study population had previously been diagnosed with psychiatric illness. Depression was the psychiatric illness. Three patients had past history of poisoning.(Table-1)

Continue.....

**Table-1: Epidemiological features of adult acute poisoning.**

PARAMETER	N =50	%
<b>Age (years)</b>		
Mean age $\pm$ SD	28.4 $\pm$ 10.58	
Range	13-58	
10-19	12	24
20-29	18	36
30-39	11	22
40-49	6	12
50-59	3	6
<b>Gender</b>		
Male	31	62
Female	19	38
<b>H/o psychiatry treatment</b>		
Yes	1	2
No	49	98
<b>Past history of poisoning</b>		
Yes	3	6
NO	47	94

The Ingestion route was the most common mode of poisoning. The Dermal or exposural route of poisoning was seen in only one (2%) patient. The one case of dermal poison was male and from aerosols and fumes of organophosphate poison. The most common circumstance of poisoning was suicidal (Male-female ratio was 2:1) and accidental in 10% patients (male-female ratio was 1:4). In males the suicidal poisoning was 96.77% and in females 78.94%. The accidental poisoning in males was 2.7% and in females it was 21.05%.(Table-2)

**Table-2: Comparison between male and female in term of route of poisoning and circumstances.**

PARAMETER	MALE n (%)	FEMALE n (%)
<b>Route of poisoning</b>		
Ingestion	30 (60%)	19 (38%)
Dermal	1 (2%)	0
<b>Circumstance of poisoning</b>		
Suicidal	30 (60%)	15 (30%)
Accidental	1 (2%)	4 (8%)

**Table-3: Comparison of circumstances and gender in different age groups.**

AGE GROUP (Years)	CIRCUMSTANCE			
	SUICIDAL		ACCIDENTAL	
	Male	Female	Male	Female
10-19	5(10%)	6(12%)	-	1(2%)
20-29	13(26%)	4(8%)	-	1(2%)
30-39	6(12%)	4(8%)	1(2%)	-
40-49	4(8%)	1(2%)	-	1(2%)
50-59	2(4%)	-	-	1(2%)

Among the all cases Insecticidal poisoning was the most common poisoning presenting to emergency seen in 30%, among in insecticidal poisoning organophosphate poisoning was most common seen in 9 (18%) patients.(Table-4)

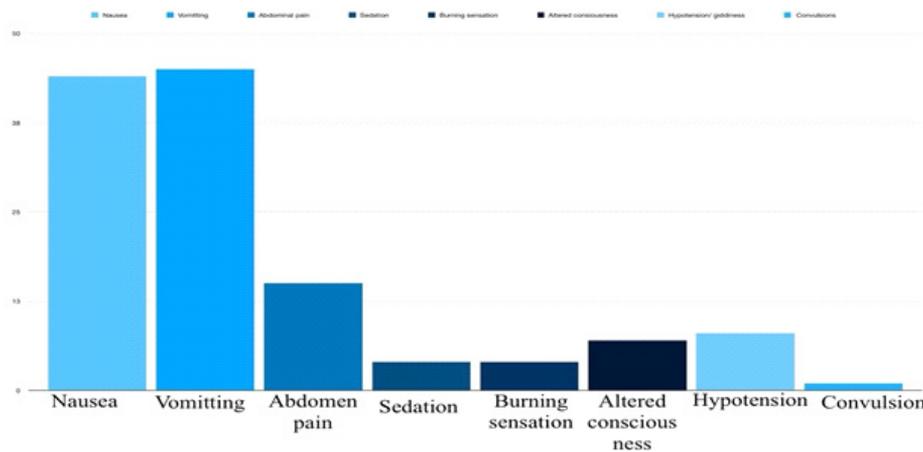
**Table-4: Categories of poison**

CATEGORY OF POISON	N= 50	%
Insecticides	15	30
Unknown	11	22
Rat killer	6	12
Drugs	6	12
Corrosive	5	10
Celphos	4	8
Herbical	1	2

Fertilizer	1	2
Ratanjot	1	2

In the category of drug poisoning most common drug used from sedative group or benzodiazepine groups (66.66%) followed by paracetamol and cetrimide lotion. And in category of corrosive poisoning most common corrosive product used was Phenyl (40%) followed by sulphuric acid , hydrochloric acid and glutaraldehyde.

All patients were symptomatic. The most common symptom at the time of presentation was Vomiting(90%) followed by nausea(88%), abdominal pain(30%), hypotension(16%),altered consciousness(14%),sedation(8%), burning sensation(8%) and convulsion(2%). ( Figure-1)



**Figure-1: Clinical manifestations in adult acute poisoning.**

ECG was Abnormal in 2 patients (4%), one case had changes of LBBB and one had ST-depression. Chest X-ray was Abnormal in 3 patients (6%), all of them had findings of Aspiration Pneumonitis. Elevated blood urea was seen in 16% and serum

creatinine in 8%. Leucocytosis was seen in 22%, Thrombocytopenia in 6% cases.

33 patients (66%) were reached in emergency within 3 hours after took poison. After admission in emergency Gastric lavage were not done in corrosive

poisoning cases. vasopressor support was mostly needed in aluminum phosphide poisoning. Ventilator support was needed in aluminum phosphide and organophosphate group poisoning. Two patients were expired from ICU, both were male and one patient died due to unknown poisoning and one died due to organophosphate poisoning.(Table-5)

**Table-5: Management of acute poisoning patients.**

PARAMETER	n	%
<b>Gastric Lavage</b>		
Done	45	90
Not Done	5	10
<b>Vasopressor Support</b>		
Required	7	14
Not Required	43	86
<b>Ventilation support</b>		
Required	5	10
Not Required	45	90
<b>Outcome</b>		
Discharge	48	96
Mortality	2	4

## Discussion

The present study addresses Clinico-epidemiological profile of patients presenting to the emergency department of our institution at Kota, Rajasthan. Various studies were conducted on poisoning pattern in Rajasthan.<sup>(7-14)</sup> There is only one study in the literature evaluating on fatal poisoning pattern of 799 patients in Kota region done during 2009-2011.<sup>(10)</sup> Ours is the most recent study involving 50 patients Kota.Singh *et al.*<sup>(15)</sup> showed that the majority (36%) of the cases of poisoning belonged to the age group 21-30 years.

Thapa *et al.*<sup>(16)</sup> showed that the most common age group in poisoning cases was 21-30 years. In our study, the maximum number of patients was from the age group of 20-29 years (36%), followed by age groups of 10-19 years (20.3%). The mean age of the patients in our study was 28.4 ± 10.58 years, compared with the above studies. This can be attributed to increased work stress, family issues, financial strain, and other life-settling issues in this age group.

In a study by Patel *et al.*<sup>(17)</sup>, 59.2% of patients with poisoning were male. Similarly, in our study of 50 participants, 31 (62%) were males. The male predominance of poisoning might be due to their greater exposure to stress in everyday life and work dangers compared to females.

As per Shah *et al.*<sup>(18)</sup> the most common route of exposure was oral ingestion (71.4%) of poison, followed by dermal and inhalation routes.

In a study by Pannu *et al.*<sup>(19)</sup> ingestion for self-harm remained the predominant method of poisoning. And the ratio of intentional self-harm to unintentional exposure was 4:1. Also showed that about two-thirds of the poisoning cases included pesticides, with organophosphate (22.6%), aluminum phosphide (18.9%), and paraquat (4.7%) being the most prevalent substances. Similarly, in our study, the most common route of ingestion was by oral route (98%) and insecticide was the most common cause of poisoning in 15 patients (30%).

Teklemariam *et al.*<sup>(20)</sup> observed that the common presenting symptom in patients with poisoning was diarrhea and vomiting (49.5%), which was followed by altered consciousness (16.5%) and epigastric discomfort (13.6%). In our study, vomiting were the most common symptoms seen in 90% of patients, followed by nausea in 88% of patients, followed by abdomen pain in 30% of patients.

According to a study by Mathai *et al.*<sup>(21)</sup> patients with hemodynamic instability who presented late had early signs of organ failure, had acidosis, and required vasoactive medications had a poor prognosis. In the same research, patients who required mechanical ventilation and vasoactive support also had a greater mortality rate.

Rajbanshi *et al.*<sup>(22)</sup> showed that 16.5% of survivors of poisoning had acute renal failure. In our study, 8 patients (16%) had elevated blood urea and 4 (8%) had increased serum creatinine, patients with non-organophosphorus poisoning had 1.6 times more ICU mortality. In our study, mortality rate in patients with poisoning was 4%. Unknown poisoning (2%) and OPC poisoning (2%) has the highest mortality rate.

## Limitation

This study has certain limitations. It was conducted in a single center. The epidemiological data do not incorporate socioeconomic conditions, cultural and religious information, or occupational data, which might have given further insight into the clinical spectrum of poisoning. Because our hospital is a tertiary care center, individuals with poisoning might have appeared late after obtaining first aid at the local level, thus missing the precise identification of toxins. As the institute of this study is located in an urban area, the patients are more likely to reach from urban area leading to a Selection Bias (Berkson's Bias). We did not include patients with snakes or unknown bites. Multicenter studies with larger sample sizes are required in the future for the generalizability of our results.

## Conclusion(s)

We can say that our study has contributed a large prospective profile on poisoning in India, albeit from a hospital perspective. Male gender and longer event-to-treatment latency at primary care levels had a negative impact on survival. The study reveals some issues that require attention from planners and policy-makers such as greater awareness among the public regarding the importance of prompt transfer to hospital for all poisoning cases, measures to expedite the transfer of serious patients to tertiary care centers, and setting up of specialized poison units in secondary and tertiary care hospitals. Field studies on poisoning are difficult to organize but if conducted in the light of these hospital-based results will clarify some issues that have not been addressed such as the underlying reasons that lead to the poisonings, reasons for delay in seeking treatment, and the extent of ignorance regarding the safe use of pesticides.

**CONFLICT OF INTEREST:** Nil

**SOURCE OF FUNDING:** No Source

**ETHICAL CLEARANCE:** Ethical Clearance taken from INSTITUTIONAL ETHICAL COMMITTEE, GOVERNMENT MEDICAL COLLEGE, KOTA on 10 July 2023 (Reference no. is not available)

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# An Evaluation of Time Since Death, from Potassium Level of Vitreous Humour in the Eyes of Deceased, Brought for Autopsy at Department of Forensic Medicine and Toxicology in a Government Medical College of Garhwal Region, Uttarakhand: A Cross Sectional Study

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## Abstract

**Background:** The Post-mortem interval is the time between death and the examination of a corpse. It is important to know when the crime was committed. It helps the police to start their investigations with the information available and to process cases more efficiently.

**Materials and Methods:** The sample of vitreous humour was collected from the posterior chamber of both eyes by aspirating gradually and slowly through a puncture 5-6 mm away from the limbus using a sterile 20-gauge needle taking care to avoid tearing of any loose tissue fragments surrounding the vitreous chamber.

**Results:** In the present study there were 80 subjects, out of these subjects' the maximum subjects were from 26-35 years and the minimum were from 66-75 years of age group.

**Conclusion:** Our study found that an appreciable pattern of increased potassium concentration in vitreous humour was observed every 12 hours of post-mortem interval, with an approximate 2mmol/l increase.

Keywords: Time since death, vitreous humour, medicolegal post-mortem examination.

## Introduction

Not a day goes by without news of unnatural deaths such as murders, suicides, or accidents. In all of these cases, the time elapsed since death is an important key point for the investigative team to

begin an investigation. In most cases, the apparent cause of death is always given by the investigating officer, which is consistent with the doctor's opinion. The issue, however, is the time elapsed since death and the time of the event, which form the starting point of the investigation<sup>1</sup>.

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The Post-mortem interval is the time between death and the examination of a corpse. It is important to know when the crime was committed. It helps the police to start their investigations with the information available and to process cases more efficiently. It also helps in the inclusion and exclusion of suspects and criminals and in verifying the statements of the suspect. Estimated time since death, useful in the event of a dispute like property inheritance, insurance claims, etc<sup>2</sup>.

Changes that occur in the chemical composition of bodily fluids such as blood, vitreous humour, synovial fluid, and cerebrospinal fluid immediately after death are explained by tanto-chemistry. After death, electrolytes and chemicals are redistributed, cellular integrity is lost, and energy-dependent transmembrane transport does not occur. Therefore, it will be difficult to interpret post-mortem blood samples. Only stable analytes can be predicted in blood samples due to impaired active membrane transport and rapid metabolic degradation after death<sup>3</sup>.

Among various body fluids such as blood, serum, cerebrospinal fluid, aqueous humour, synovial fluid and vitreous humour, the determination of vitreous potassium concentration is the most widely used method<sup>4</sup>.

The vitreous fluid, a crucial supporting structure for the eyeball's optical function, is an acellular, transparent, inert, colourless, hydrophilic viscous fluid that lies between the lens and retina. Its volume is roughly 4 cc, and its weight is about 4 grams. With soluble proteins, amino acids, low molecular weight components, glucose, type II collagen, hyaluronic acid, inorganic salts, and ascorbic acid, it is made up of 99% water<sup>5,6</sup>.

There is a close relationship between the vitreous' composition and that of serum, aqueous humour, and cerebrospinal fluid. It is easily accessible, comparatively stable, less prone to abrupt chemical changes, and well-guarded against contamination and decomposition. Because of this, it is a better fluid to analyze when determining the time since death than other fluids<sup>7</sup>.

Even in cases of severe head injuries and burns, the vitreous humour and eye are well protected. This was often described as a "miraculous Escape"<sup>8</sup>.

Numerous studies have demonstrated that as the post-mortem period lengthens, the vitreous potassium level rises. An increase in the post-mortem interval was correlated with a linear rise in potassium concentration<sup>9</sup>.

Potassium increases along with the post-mortem interval, while there is no correlation with calcium or sodium and a negative correlation with sodium<sup>10</sup>.

The sodium concentration in the normal body is 136-145 mEq/l. The potassium concentration in the normal body is 50-55 mEq/kg body weight, or 160 mmol/l. At the same time, 98% of potassium is inside the cell. Its extracellular concentration is 3.5-5.5 mmol/l. Normal vitreous sodium is 118-124 mmol/l and vitreous potassium is 2.6-4.2 mmol/l. Potassium is actively transported from the ciliary body into anterior and posterior chambers. Lens also contributes<sup>2</sup>.

## AIMS & OBJECTIVES

The study will be conducted to:

1. To assess the use of vitreous humour in the finding of postmortem interval.
2. To compare the level of potassium in both eyes after death.

## Methods/ Methodology

- **Study design:** A cross-sectional study
- **Study population:** All dead bodies brought for postmortem examination to the Department of Forensic Medicine & Toxicology in VCSGGIMS & R,Srikot,Srinagar,Pauri Garhwal,UTTARAKHAND
- **Place of Study:** Department of Forensic Medicine & Toxicology, VCSGGIMS & R,Srinagar, Pauri Garhwal, Uttarakhand.
- **Sampling Technique:** Continuous Sampling method.
- **Period of study:** 1st June 2023 to 31<sup>st</sup> December 2023
- **Inclusion criteria:** all dead bodies brought for medico-legal postmortem examination to the Department of Forensic Medicine & Toxicology, whose exact times of death are known were selected for the study.
- **Exclusion criteria:** (a) Cases whose exact time of death is not known and with previous

history of eye or orbital injury or surgery, posterior segment disease.

- (b) Decomposed and charred bodies.

- **Method of Collection of Data:**

1. The sample of vitreous humour was collected from the posterior chamber of both eyes by aspirating gradually and slowly through a puncture 5-6 mm away from the limbus using a sterile 20-gauge needle taking care to avoid tearing any loose tissue fragments surrounding the vitreous chamber.
2. The sample was kept in plain sterile vial. Then the samples were properly labeled and sent to the biochemistry laboratory.
3. The samples were centrifuged at 3000 rpm for 10 minutes by LAB LINE AUTOMATED ANALYZER.
4. The sample was analyzed in PSR ST-PRO electrolyte analyzer by the Ion selective electrode (ISE) method.
5. All the biochemical analysis was carried out immediately post extraction. The sample was analyzed for the potassium content of vitreous humour. Finally, the data was analyzed and various statistical tests were performed on it.
6. The information regarding the exact time of death was gathered from the police inquest report, death certificate, death slip, and clinical details from hospital records, correlated and checked by relatives, friends of the deceased, and concerned investigating officers.
7. Only the clear vitreous humour was analyzed. Turbid or blood-stained samples were discarded.

- **Statistical Analysis:**

1. The collected data was compiled in a MS Excel version 21.
2. Normal data was presented as mean SD± while non-normal data was presented as median IQR.
3. All the statistical analysis was done on IBM SPSS version 20. P value <0.05 were taken as statistically significant for all the measures of association.

- **Statistical tests:** The one-way ANOVA test and regression line formula were used for comparison and show linear regression.

## Results

**Table 1: Distribution of cases based on age (N=80)**

Age (in years)	No. of cases	Percentage (%)
04-15	04	5
16-25	15	18.7
26-35	27	33.7
36-45	14	17.5
46-55	12	15
56-65	06	7.5
66-75	02	2.5
Total	80	100

In the present study, there were 80 subjects, out of these subjects' maximum subjects were from 26-35 years, and the minimum were from 66-75 years of age group (Table 1).

**Table 2: Distribution of cases based on gender (N=80)**

Gender	No. of cases	Percentage (%)
Male	53	66.2
Female	27	33.7
Total	80	100

In the present study, there were 80 subjects, out of these subjects' maximum subjects were Males 66.2% and the minimum were females 33.7 years of age group (Table 2).

**Table 3: Distribution of cases based on post-mortem interval time (N=80)**

Post-mortem Interval Time (PMI)	No. of cases	Percentage (%)
0-12 hours	18	22.5
12-24 hours	38	47.5
24-36 hours	15	18.7
36-48 hours	09	11.2

In the present study distribution of cases based on post-mortem interval time the maximum subjects were in between 12-24 hours and the minimum subjects were 36-48 hours (Table 3).

**Table 4: Potassium concentration level (mmol/l) of both eyes**

Eye	Mean	Median	SD	Min	Max	P value
Right	7.87	7.75	1.47	5.9	12.1	0.601
Left	7.63	7.5	1.25	5.7	11.9	

The potassium ion concentration in both as we observed in the present study had a p value of 0.601. The concentration of potassium ions in the two eyes therefore not significantly different. In the present study, maximum potassium ion concentration (right

eye 12.1 mmol/l & left eye 11.9mmol/l) was observed in the subject with postmortem interval of 36-48 hours and least concentration (right eye 5.9 mmol/l & left eye 5.7 mmol/l) was observed in the subject with postmortem interval 0-12 hours (Table-4).

**Table 5: Concentration of potassium in vitreous humour with post-mortem interval**

Eye		Post-mortem interval {hours}				
		0-12	12-24	24-36	36-48	
R	Mean	6.60	7.78	9.23	8.52	One way ANOVA test. F = 0.41
	SD	1.24	1.19	1.21	1.47	
L	Mean	6.37	7.52	8.96	9.52	P Value = 0.54
	SD	1.26	1.21	1.22	1.25	

Model	R	R Square	Adjusted R Square	S. E
1	0.512 a	0.262	0.252	10.054

**Table 6: Linear regression for the right eye potassium level**

a. Predictors: (Constant), Right eye potassium level

b. Dependent Variable: Actual TSD

Model	Unstandardized Coefficients B Std. Error		Standardized Coefficients Beta	t	Sig.
Constant	-5.907	6.034	0.512	-0.979	0.331
Right eye K	3.963	0.753		5.260	0.000

**Table 7: Linear regression for the left eye potassium level**

Model	R	R Square	Adjusted R Square	S.E
2	0.836 a	0.698	0.694	6.428

Model	Unstandardized Coefficients B Std. Error		Standardized Coefficients Beta	t	Sig.
Constant Left eye K	-34.988	4.543	0.836	-7.702	0.000
	7.766	0.578		13.435	0.000

We used SPSS software to conduct the following linear regression to determine the regression line from 80 autopsy cases where the time since death was less than 48 hours. Regression analysis has been conducted on the potassium levels in the left and right eyes.

The constant for the linear regression formula for Table 6 is -5.907 and at last the regression formula for right eye potassium level is  $Y = (3.963 \times X) - 5.907$ .

The constant for the linear regression formula for Table 7 is -34.988 and at last the regression formula

for left eye potassium level is  $Y = (7.766 \times X) - 34.988$ .

Where, X = potassium concentration and Y = time since death.

### Discussion

- During the study period a total of 80 medico legal autopsies were performed at Department of Forensic Medicine & Toxicology, VCSGGIMS & R, Srinagar, Pauri Garhwal, Uttarakhand, during the period of 1st June 2023 to 31<sup>st</sup> December 2023. In our study, maximum number of autopsy cases were in the age group of 26-35 years i.e., 27 (33.7%), followed by 16-25 years i.e., 15 cases (18.7%), (table 1). These findings are in consistency with findings of Patel UP et al<sup>1</sup>.
- The present study majority of victims were male 53(66.2%) as compared to female 27 (33.7%). Similar findings were seen in studies done of Kurup SS et al.<sup>11</sup>[Table-2]
- In the present study, in most cases samples were collected within 12-24 hours of death followed by 0-12 hours and 24-36 hours of death. And few samples were collected with 36-48 hours post mortem interval. [Table-3]
- The observed potassium ion concentration in both eyes in the current study had a p-value of 0.601. As a result, [Table 4] shows that the concentration of potassium ions in the two eyes is not significantly different. Numerous investigations also reveal that the concentration of potassium ions in the two eyes is the same.
- In the present study, the subjects with post-mortem intervals of 38-48 hours had the highest concentration of potassium ions (right eye 12.1 mmol/l and left eye 11.9 mmol/l), while the subjects with post-mortem intervals of 0-12 hours had the lowest concentration (right eye 5.9 mmol/l and left eye 5.7 mmol/l) [Table 4].
- The concentration of potassium ions in the vitreous humour increases linearly with increasing post-mortem intervals, as Tables 5 and 6 & 7 show. This shows a direct correlation between the increasing post-mortem interval and the rise in potassium ion concentration.
- We observed, following the application of the regression formula, that the potassium concentration in the vitreous humour increased steadily over 12 hours. The concentration of potassium in the vitreous humour was found to increase significantly every 12 hours after the death, at a rate of about 2 mmol/l. Thus, measuring the time since death based on variations in vitreous humour potassium content was far more beneficial.
- In an effort to determine the post-mortem interval, a number of studies have been conducted on the electrolyte concentration level in vitreous humour.
- Nauman et al<sup>13</sup> done a study on 211 post-mortem cases in 1959. Which is showed an increase in the vitreous K<sup>+</sup> values; however, no attempt was made to correlate these values with the post-mortem interval. Additionally, an average concentration of 7.2 mg/dl was found, corresponding to an average post-mortem interval of 9 hours.
- Jaffe et al<sup>14</sup> examined 31 cases (none of them had uremia or electrolyte imbalance) in 1962, and the K<sup>+</sup> concentration in the vitreous was connected to the post-mortem period. He discovered a steady increase in K<sup>+</sup> levels that begins soon after death and lasts for 125 hours. Bodies kept at room temperature and those refrigerated did not significantly differ from one another.
- Sturner et al<sup>15</sup>, Gantner et al<sup>16</sup> Conducted a more thorough analysis in 1963 and 1964 (involving 54 coroner and 37 hospital cases). The average difference between the two eyes was 0.1 meq/L in 15 of these cases where vitreous humour was extracted from both eyes at the same time. The post-mortem interval and the K<sup>+</sup> values, which were determined by flame photometry, showed a linear relationship in the 54 coroner cases.
- Coe et al<sup>17</sup> in the year of 1969 found a biphasic rise in vitreous K<sup>+</sup> levels although there was a linear rise with increasing post-mortem interval up to 100 hours. In the initial hours following death, there was a more rapid rise, with a 95% confidence interval of about  $\pm 12$  hours.

- Gregora et al<sup>18</sup> in the year of 1978, calculated the amount of K<sup>+</sup> in the vitreous humour of 47 deceased people using the technique of atomic absorption spectroscopy. Research revealed that the quantity of both increased linearly with the lapse of time since death.
- In 2003, Prasad et al<sup>19</sup> conducted a study on the relationship between the vitreous K<sup>+</sup> level and the post-mortem interval. The results indicated a strong positive association between the rise in K<sup>+</sup> level following death and the post-mortem interval.
- Choo-Kang E et al<sup>20</sup> discovered a linear correlation between the vitreous K<sup>+</sup> concentration and the post-mortem interval after analyzing 105 instances. In the early post-mortem period, the rise was biphasic, with a steeper slope than in the later hours.
- In the current study, the potassium ion concentration for both eyes across age groups was found to be non-significant (p = 0.601) (Table 4). Similar findings were seen in studies done by Rathinam RD et al<sup>21</sup>.
- 349 samples out of 269 instances were used. By using flame photometry, the K<sup>+</sup> levels of the two eyes were found to be similar, in studies done by Adelson et al<sup>22</sup>.
- Mull A et al<sup>23</sup> proposed in his research that the concentration of vitreous biochemical components varies at the same rate in the same pair of eyes, and that this time-dependent variation can be used to precisely estimate the post-mortem period. Potassium levels increased linearly from 7.04 mEq/L to 15.81 mEq/L, which is comparable to the values reported by Govekar G et al<sup>24</sup>.

### Conclusion

The study conducted at the Department of Forensic Medicine & Toxicology, VCSGGIMS &R, Srinagar, Pauri Garhwal, Uttarakhand, to know the Time since Death, From Potassium Level of Vitreous Humour in the Eyes of the Deceased during a period from 1st June 2023 to 31<sup>st</sup> December 2023, comprising a total of 80 medico-legal autopsies. Our study found that an appreciable pattern of increased potassium concentration in vitreous humour was observed every 12 hours of post-mortem interval, with an approximate 2mmol/l increase. It

corresponds to the rule of 12. Significantly raising potassium levels with time after death is beneficial for law enforcement. The findings of this study research will improve time-of-death estimation and help law enforcement agencies solve crimes more quickly.

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**Conflicts of interest:** There are no conflicts of interest

**Ethical Clearance:** Obtained from Institutional Ethical Committee Veer Chandra Singh Garhwal Govt Institute of Medical Sciences and Research Srinagar Pauri Garhwal Uttarakhand with reference number MC/IEC/2022-23/80 on date 8.7.2023.

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# Cardiopathology in Methamphetamine Poisoning-Related Deaths in Chiang Mai Thailand

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## Abstract

**Background:** Blood Methamphetamine levels have been utilized to assess methamphetamine exposure and its toxicity. Heart is a major target organ of methamphetamine intoxication. In some autopsy cases heart pathologies have been revealed at low level of methamphetamine and extensively to be understand a relationship between the blood methamphetamine level and heart pathology.

**Aim:** The aim of this study was to assess the relationship between blood methamphetamine level and heart pathology by using postmortem cases.

**Methodology:** One hundred and twenty medico-legal cases were included and blood methamphetamine or amphetamine levels in whole blood along with heart pathological finding were determined.

**Results:** Coronary atherosclerosis, myocardial fiber hypertrophy, and fibrosis of the left ventricular myocardium were highly frequency findings in methamphetamine intoxication. Interestingly, forensic cases revealed myocardial fiber hypertrophy in chronic methamphetamine users.

**Conclusion:** The levels of methamphetamine and amphetamine associated with myocarditis, cardiomyopathy and dystrophic calcification mitral valve. Evaluation of methamphetamine and amphetamine levels are key biomarkers for predicting the seriousness of heart-related pathological conditions.

**Key words:** Methamphetamine, Amphetamine, heart pathology, Arteriosclerosis, BloodMethamphetamine level.

## Introduction

Methamphetamine (Meth) is a synthetic drug and stimulate at central nervous system. It has emerged

as a significant public health concern due to its widespread use and the myriad of adverse effects it exerts on various organ systems<sup>1,2</sup>. One of the critical

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areas of concern is its impact on cardiovascular health, particularly its association with heart pathology. Meth abuse has been linked to a range of cardiovascular complications, including hypertension, arrhythmias, and structural damage to the heart<sup>3</sup>. Understanding the intricate interplay between Meth use and heart pathology is essential for healthcare professionals, researchers and policymakers to develop effective strategies for prevention, intervention and treatment.

Meth use is growing globally resulting in significant morbidity and mortality exacerbated by a poorly understood increase in multiple forms of cardiovascular disease<sup>4,5</sup>. Meth use is associated with cardiovascular disease through two main mechanisms: catecholamine toxicity and direct effects on cardiac and vascular tissue<sup>6</sup>. In vivo models with long-term Meth exposure, histopathological examinations have presented cardiac lesions including necrosis of the myocytes, atrophy, mitochondrial degeneration, inflammation, interstitial oedema and fibrosis<sup>7</sup>. The lesions could be reversible after Meth cessation<sup>8</sup>. In post-mortem examination, the heart presented concentric myocardial hypertrophy, extensive myocardial remodeling with perivascular and interstitial fibrosis and myocardial scarring due to infraction<sup>9</sup>.

Normally, cytochrome P450 2D6 (CYP2D6) is an essential enzyme in drug metabolism, especially addictive substances, Meth, codeine, fentanyl, and methadone<sup>10</sup>. The enzyme CYP2D6 plays the most crucial role in the transformation of methamphetamine and the ratio of Am/ Meth reflected to CYP2D6 activity<sup>11</sup>. Meth is metabolized by CYP2D6 to give amphetamine (Am). Meth was excreted unchanged form in the urine, while only 37-54% was excreted as Am<sup>12</sup>. Polymorphism in CYP2D6 might be related the heart failure in Meth intoxication<sup>13</sup>.

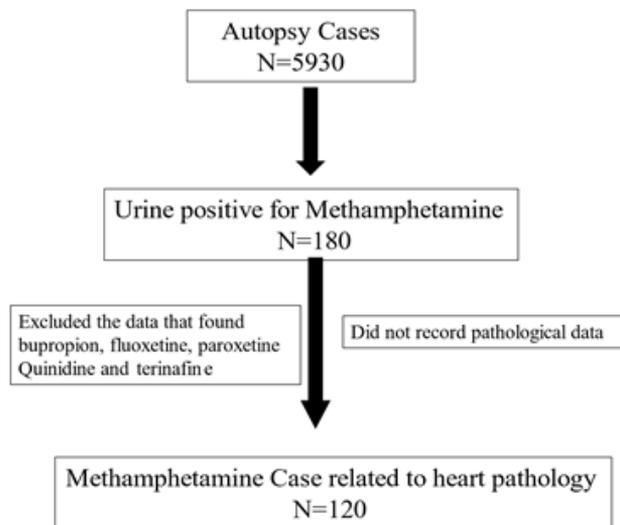
There still is uncertainty about the percentage of patients that develop heart failure or other cardiac pathologies due to Meth abuse. Exploration of the intricate relationship between Meth use and heart pathology, delving into the physiological mechanisms, clinical manifestations, and broader implications for public health. In many cases where the level of a drug is present in the body at a quantity below lethal doses, death may still occur. The presence of the drug in the bloodstream or urine,

even in small amounts, may not serve as a reliable indicator of the cause of death. The objective of this study was to study correlation between Meth level and cardiopathology using postmortem cases. It might be contributed to a more comprehensive understanding of the challenges posed by Meth abuse on cardiovascular well-being and inform efforts to mitigate its impact on individuals and communities.

## Materials and methods

### Study design:

This study investigated medico-legal cases where autopsies were performed at the Department of Forensic Medicine, Faculty of Medicine, Chiang Mai University, between 2017 and 2022. Urine samples were screened for methamphetamine using an immunoassay kit. Blood and heart samples were collected to confirm the presence of methamphetamine and to investigate; heart pathology. The case selection process is depicted in Figure 1. This study received ethical approval from the Research Ethics Committee, Faculty of Medicine, Chiang Mai University (Study code: FOR-2565-0069, Research ID: 0069).



**Figure 1: Flow chart of inclusion criteria for case selection**

### Methamphetamine and amphetamine analysis

Methamphetamine (Meth) and amphetamine (Am) were analyzed using liquid chromatography tandem mass spectrometry (LC-MS/MS) by applied the method of Nakashima<sup>14</sup>. In brief, whole blood samples were transferred to microcentrifuge tubes

and spiked with saturated sodium tetraborate and internal standards Meth-D5 and Am-D5. The mixture was extracted with 1-chlorobutane, followed by centrifugation at 13,000 rpm for 5 minutes at room temperature. The organic layer was collected and evaporated under nitrogen gas. The residue was reconstituted with a 9:1 mixture of 5 mM ammonium formate and 0.1% formic acid. The final extract was analyzed by LC-MS/MS following the operating conditions presented in Table 1.

**Table 1: Instrument parameter for methamphetamine and amphetamine with LC-MS/MS**

HPLC-Agilent 1290 Infinity	Details
Autosampler	Agilent G4226A
Column	Zorbax Eclipse C18 rapid resolution HT 2.1 × 100 mm 1.8 μm 600 bar
Guard column	Zorbax Eclipse Plus-C18 Narrow Bore Guard column 2.1 × 12.5 mm 5 μm
Column temperature	40 °C
Flow rate	0.3 mL/ min
Mobile phase	A: 5 mM ammonium formate with 0.1% formic acid in ultrapure water B: 0.1% formic acid in acetonitrile
Gradient solvent (%B, min)	Initial, 5%; 3 min, 30%; 2 min, 90%; 6 min, stop time 11 min, post run 4 min
Injection volume	5 μL
MS-Agilent 6490 Triple Quad	
Capillary (V)	3500
Gas temperature (°C)	320
Gas flow (L/ min)	9
Nebulizer (psi)	45
Nozzle voltage (V)	500
Sheath gas Temp (°C)	350
Sheath gas flow (L/ min)	11
Ion source	ESI positive mode
Scan type	MRM

## Histological examination

The heart was carefully removed and weighed. Selected heart tissues were fixed in a 4% paraformaldehyde solution, dehydrated through an alcohol series, cleared in xylene, and finally embedded in paraffin wax. These paraffin blocks were sectioned at 5 μm thickness using a microtome and stained with hematoxylin and eosin (H&E) following the method of Department of Pathology, Faculty of Medicine, Chiang Mai University, Chiang Mai Thailand. Upon histological examination, various cardiopathological findings were observed, including myocardial fiber hypertrophy, fibrosis of the left ventricle (LV) myocardium, contraction band necrosis within the ventricular myocardium, myocardial infarction, cardiomyopathy, endocarditis, myocarditis, dystrophic calcification of both the aortic and mitral valves, and coronary atherosclerosis.

## Statistical analysis

Quantitative variables were presented as mean ± standard deviation (SD), while qualitative variables were expressed as percentages. Descriptive statistics were employed to summarize the data. Spearman correlation analysis was conducted to assess the relationships between the levels of methamphetamine (Meth), amphetamine (Am), the Am/Meth ratio, and various pathological findings. A p-value of less than 0.05 ( $p < 0.05$ ) was considered statistically significant.

## Results

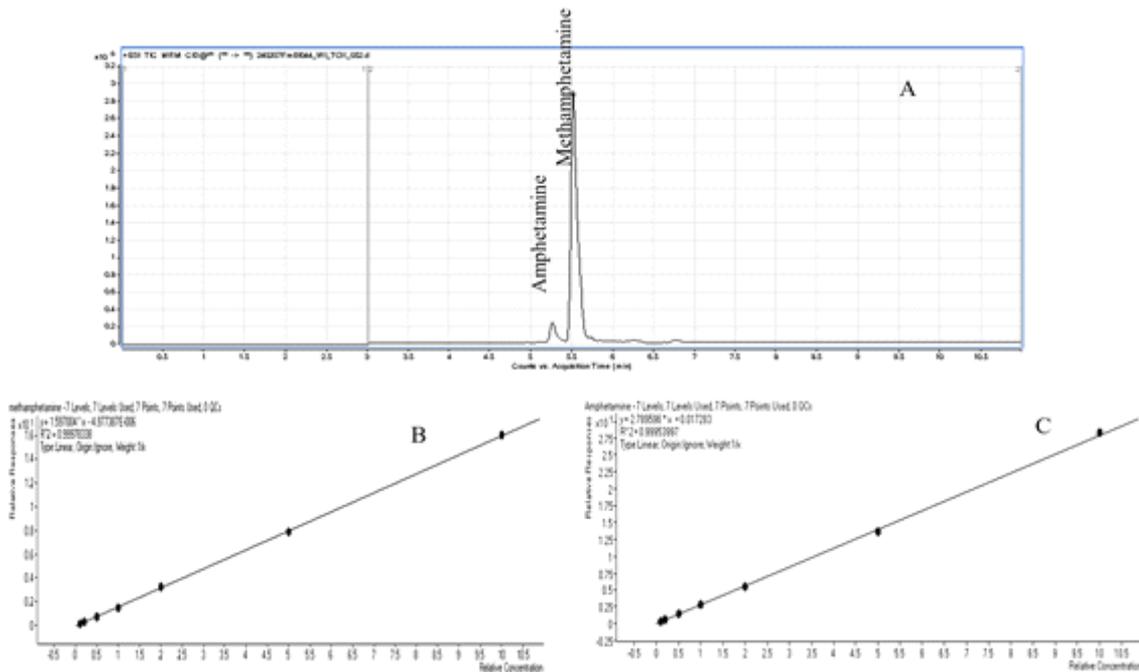
A total of 120 cases were included from 5930 autopsied cases that tested positive for methamphetamine in blood and urine samples. The subjects comprised 107 males (89.2%) and 13 females (10.8%). The age of the subjects ranged between 14 years and 77 years. The mean age for males and females was 39 years each. Methamphetamine blood levels ranged from 0.01 to 12.50 μg/mL (with a mean of  $0.45 \pm 1.23$  μg/mL), while amphetamine levels ranged from 0 to 1.10 μg/mL (with a mean of  $0.06 \pm 0.14$  μg/mL). The amphetamine/methamphetamine ratio ranged from 0 to 1.50 (with a mean of  $0.20 \pm 0.21$ ), and the weight of the heart ranged from 144 to 950 grams (with a mean of  $386.86 \pm 129.23$  grams). The results are presented in Table 2.

**Table 2: The demographic data of the subjects.**

Parameters	Male	Female	p-values
Numbers (n=120)	89.2%	10.8%	ND
Age (years)	38.9± 11.5 range 14-77	38.6±9.5 Range 26-60	0.847
Methamphetamine levels (ng/ mL)	0.45±1.29 Range 0.01-12.5	0.47±0.58 Range 0.01-2.20	0.225
Amphetamine level (ng/mL)	0.06±0.15 Range 0-1.10	0.06±0.06 Range 0-0.20	0.143
Amphetamine/ methamphetamine ratio	0.20±0.21 Range 0-1.14	0.22±0.39 Range 0-1.5	0.368
Heart weight (g)	392.08±129.54 Range 144-950	344.69±123.37 Range 205-590	0.171

Meth intoxication was found in male more than female cases about 8 times. However, the blood level of Meth, Am and Am/ Meth in male and female were similar. The retention time of Meth, Meth-D5, Am and Am-d5 showed 5.63, 5.64, 5.43

and 5.40 min, respectively. The limit of detection and quantitation of Meth presented 1 and 10 ng/ mL. Similarly, Am showed 5 and 10 ng/ mL, respectively. The LC-MS Chromatogram of Methamphetamine and amphetamine is presented in Figure 2.



**Figure 2: LC-MS Chromatogram of Methamphetamine and amphetamine (A), standard curve for methamphetamine (B) and amphetamine (C)**

The range of Meth and Am concentrations presented 0.01-12.5(mean 0.45) and 0-1.10ng/ mL (mean 0.06), respectively. Am is a major metabolite of Meth that can be found in blood and samples. Ratio

of Am/ Meth is reflected for CYP2D6 activity and the results revealed 0-1.14 and 0-1.50 for male and female, respectively. For autopsy cases, the CYP2D6 activity showed low the ratio value and could be assumed as

poor metabolizer<sup>11</sup>. CYP2D6 is an enzyme found in the liver that is responsible for metabolizing Meth<sup>15</sup>. People who have certain variations (polymorphisms) in the CYP2D6 gene metabolize Meth differently. Those with two reduced-function alleles (poor metabolizers) metabolize Meth more slowly, which can lead to higher levels of the drug in the bloodstream and increased risk of toxic effects<sup>16</sup>. Meth is a stimulant drug that can cause a variety of harmful effects, including addiction, psychosis, heart damage, and stroke. Heart weight of male and female who exposed to Meth were similar, however the heart weight in the Meth intoxication were higher than normal<sup>17</sup>.

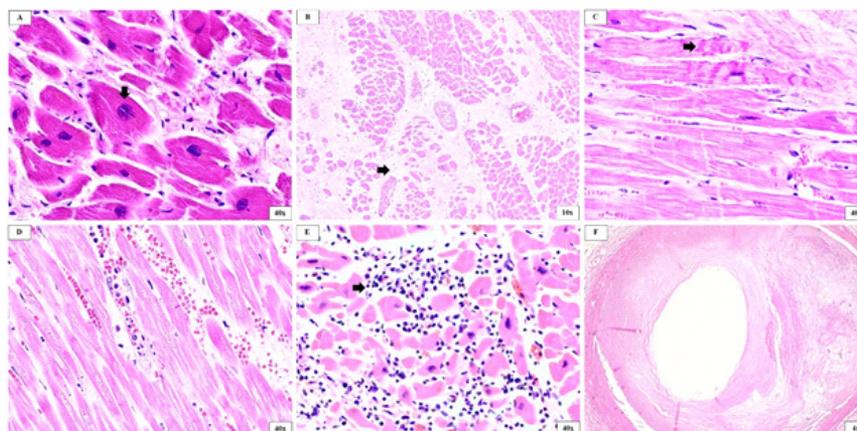
### Pathological findings

Pathology of the heart can be categorized and

presented in Table 3. Coronary atherosclerosis, myocardial fiber hypertrophy, and fibrosis of the left ventricular (LV) myocardium were highly frequent findings in Meth intoxication. Exposure to Meth is associated with acute vascular constriction and vasospasm<sup>3</sup>. It induces inflammation and increases T cells and macrophages, activating proinflammatory signaling and the fibrosis process<sup>18</sup>. Chronic Meth use induces endothelial damage and pulmonary hypertension<sup>3</sup>. Our results showed that coronary atherosclerosis (55%), myocardial fiber hypertrophy (35.8%), and fibrosis of the LV myocardium (25%) were very frequent pathological findings. Interestingly, forensic cases revealed myocardial fiber hypertrophy in chronic Meth users. The results are presented in Table 3 and the pathological findings are shown in Figure 3.

**Table 3: Characteristics of heart pathology that found in postmortem related with Methamphetamine.**

Characteristic of Heart Pathology	Amount (n=120)	Percentage (%)
coronary atherosclerosis	66	55.0
myocardial fiber hypertrophy	43	35.8
fibrosis of LV myocardium	30	25.0
contraction band necrosis ventricular myocardium	24	20.0
myocardial infarction	15	12.5
cardiomyopathy	3	3.0
dystrophic calcification aortic valve	2	1.7
myocarditis	2	1.7
dystrophic calcification mitral valve endocarditis	1	0.8

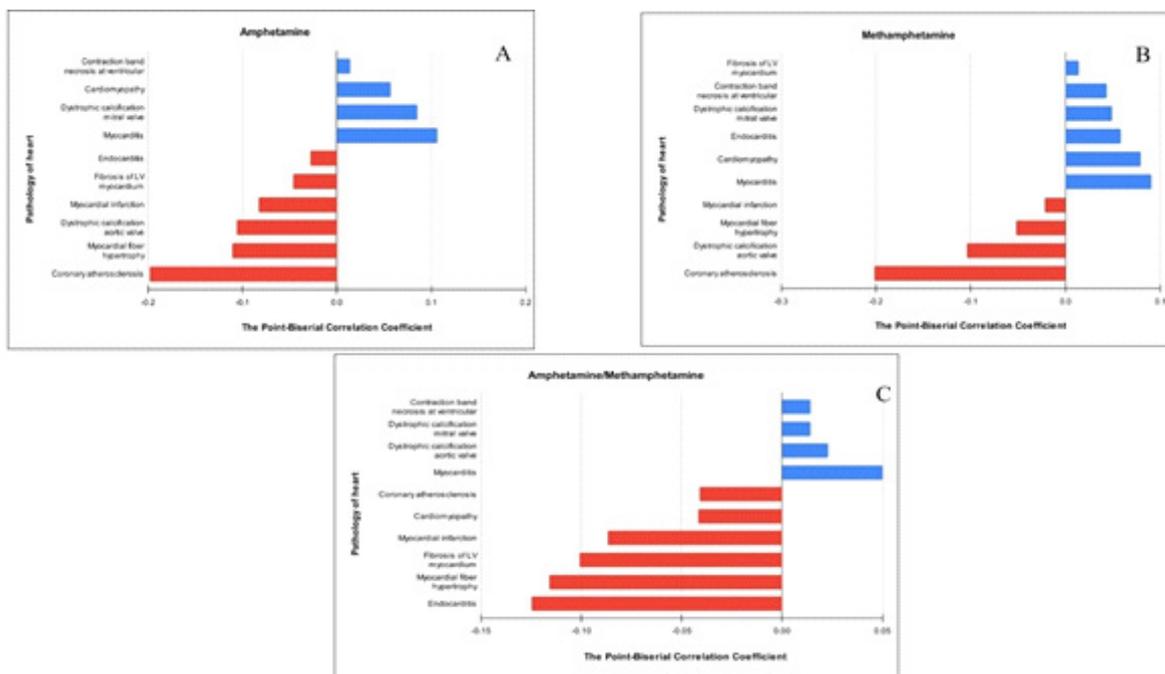


**Figure 3: Heart pathology in methamphetamine-related postmortem case and stained with Hematoxylin and eosin. A) Myocardial fiber hypertrophy Arrow shown scattered enlarged nuclei in myocardial fiber (40x), B) Fibrosis of left ventricular myocardium showed by arrow (10x), C) Contraction band necrosis at ventricular myocardium showed by arrow (40x) D) Acute myocardial infarction. The myocardial fibers shown coagulative necrosis and neutrophilic infiltration (40x), E) Myocarditis in methamphetamine-related postmortem case. Arrows shown interstitial lymphocytic infiltration. Hematoxylin and eosin (40x), F) Coronary atherosclerosis (4x).**

### Correlation of blood level of methamphetamine, amphetamine and Am/Meth ratio and pathological findings

The study found that only the levels of Meth and Am associated with myocarditis, cardiomyopathy and dystrophic calcification mitral valve. Akhgari presented that cardiovascular pathology was revealed about 68% and myocardial fiber hypertrophy, mild, moderate to severe atherosclerosis and focal degeneration/necrosis were found in Meth poisoning-related death<sup>19</sup>. For, Am/Meth ratio related with myocarditis and dystrophic calcification mitral valve. Correlation of blood level of Meth,

Am and Am/Meth ratio and pathological findings are presented in Figure 3. In this research showed that a low dose level of Meth, Am, and the Am/Meth ratio is associated with a high rate of coronary atherosclerosis. The potential link between CYP2D6 genotype, Methamphetamine (Meth) use, and coronary atherosclerosis is a complex and ongoing area of research. Some studies suggest that poor metabolizers (individuals with two reduced-function alleles) have higher Meth blood levels, potentially increasing the risk of adverse effects<sup>20</sup>. However, Meth-induced cardiotoxicity, it could well explain increasing reports of heart failure in Meth abusers<sup>21</sup>.



**Figure 4: Correlation of blood level of methamphetamine, amphetamine and Am/Meth ratio and pathological findings by the point-biserial plot.**

### Discussion

Methamphetamine is a highly addictive central nervous system stimulant that can have severe and long-lasting effects on a person's physical and mental health. Meth poses a grave threat to both

individual health and public safety, highlighting the importance of prevention, treatment, and support for those affected by addiction. Meth use can have profound effects on the cardiovascular system, ranging from acute complications such as

tachycardia and hypertension to chronic conditions like cardiomyopathy and increased risk of myocardial infarction.

For autopsy cases, the CYP2D6 activity showed low the ratio value and could be assumed as poor metabolizer<sup>11</sup>. CYP2D6 is an enzyme found in the liver that is responsible for metabolizing Meth<sup>15</sup>. People who have certain variations (polymorphisms) in the CYP2D6 gene metabolize Meth differently. Those with two reduced-function alleles (poor metabolizers) metabolize Meth more slowly, which can lead to higher levels of the drug in the bloodstream and increased risk of toxic effects<sup>16</sup>. Meth is a stimulant drug that can cause a variety of harmful effects, including addiction, psychosis, heart damage, and stroke. Heart weight of male and female who exposed to Meth were similar, however the heart weight in the Meth intoxication were higher than normal<sup>17</sup>.

Coronary atherosclerosis, myocardial fiber hypertrophy, and fibrosis of the left ventricular (LV) myocardium were highly frequent findings in Meth intoxication. Exposure to Meth is associated with acute vascular constriction and vasospasm<sup>3</sup>. It induces inflammation and increases T cells and macrophages, activating proinflammatory signaling and the fibrosis process<sup>18</sup>. Chronic Meth use induces endothelial damage and pulmonary hypertension<sup>3</sup>.

The study found that only the levels of Meth and Am associated with myocarditis, cardiomyopathy and dystrophic calcification mitral valve. Akhgari presented that cardiovascular pathology was revealed about 68% and myocardial fiber hypertrophy, mild, moderate to severe atherosclerosis and focal degeneration/necrosis were found in Meth poisoning-related death<sup>19</sup>.

The potential link between CYP2D6 genotype, Methamphetamine (Meth) use, and coronary atherosclerosis is a complex and ongoing area of research. Some studies suggest that poor metabolizers (individuals with two reduced-function alleles) have higher Meth blood levels, potentially increasing the risk of adverse effects<sup>20</sup>. However, Meth-induced cardiotoxicity, it could well explain increasing reports of heart failure in Meth abusers<sup>21</sup>.

## Conclusion

In this study, it was discovered that incidents of methamphetamine poisoning and fatalities linked to narcotics occur about 8 times more frequently in males than in females. It was noticed that only the levels of methamphetamine and amphetamine were connected to coronary artery disease. However, the Am/Meth ratio didn't show a correlation with this condition, suggesting that drugs and their by products might not be directly linked to the occurrence of CYP2D6 activity-related heart conditions. Thus, evaluating the levels of methamphetamine and amphetamine is critical for predicting the seriousness of heart-related pathological conditions.

**Conflict of interest:** No conflict of interest

**Source of funding:** There is no source of funding

**Ethical clearance:** This research has received approval from the the Research Ethics Committee, Faculty of Medicine, Chiang Mai University (Study code: FOR-2565-0069, Research ID: 0069).

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# Study of Pattern of Death in Unclaimed Dead Bodies Autopsied in a Tertiary Care Hospital: An Autopsy Based Cross Sectional Study

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## Abstract

Article 6 of universal declaration of Human Rights states that "Everyone has the right to recognition everywhere as a person before the law". Identification means the determination of the individuality or recognition of that person or dead body based on certain physical characters unique to that individual. It may be complete or partial. Complete identification means the absolute fixation of the individuality of a person, while partial identification means ascertainment of only some facts like race, sex, age and stature. Visual identification is not reliable in majority of the cases, therefore two important identification marks should be noted in live and dead cases. The description should contain anatomical land mark, size; colour either raised or not raised from surface and if no distinct mark is available left thumb impression may be taken. Other points which are considered in establishment of identity are race, religion, sex, age, and other age related changes, acquired peculiarities like mole, tattoos, and congenital deformity. In decomposed and mutilated cases accurate identification is needed for establishment of corpus delicti after homicide. The identification of cadavers is a crucial issue in forensic setting, but the official extent of this problem is still poorly known in most countries. The fact that an underestimated problem of unclaimed decedents exists can be seen from the very small number of published articles on the topic.

**KEY WORDS:** Pattern of death, unclaimed dead bodies, fingerprints, DNA, identification.

## Introduction

The determination of the individuality of a person is called Identification.

In other term it is defined as recognition of that person or dead body based on certain physical characters unique to that individual. Complete or partial identification are two types of identification. The absolute fixation of the individuality of a person

is called complete identification. Only few features like race, sex, age and stature are assessed in Partial identification.

Dead bodies whose identity is not known are unidentified dead bodies. There is none to claim these dead bodies. There is none to perform the last rites. Simply to say they are orphaned dead bodies without legitimate disposal. Unknown male persons or unknown male dead bodies in USA and United

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Kingdom are called John Doe (male). Unknown female persons or unknown female dead bodies in USA and United Kingdom are called Jane doe (female).<sup>1</sup> In India the dead ones are simply referred to as unknown or unidentified bodies.<sup>2</sup> In both living and the dead identity should be established for civil, criminal and ethical purposes and not only for forensic investigation. Many civil procedures will become incomplete without identification.<sup>3</sup> Investigating officers and Forensic Doctors are helpful in establishing identity.<sup>4</sup> Identification becomes difficult in case of a body recovered in skeletonised or in mutilated state. It is an emerging social problem that has to be taken in concern in developing countries.<sup>5</sup>

### Materials And Methods

#### STUDY DESIGN:

Present study is a cross sectional study of 100 unclaimed dead bodies autopsied at the Department of Forensic Medicine and Toxicology, Government Stanley Medical college, Chennai during the year

2019. All the data related to the unclaimed cases were analysed, paying particular attention to demographics to make a comprehensive study. Standard autopsy protocol was followed and relevant samples/viscera were subjected to chemical analysis, histopathological examination and visit to scene is undertaken in specific cases so as to arrive at conclusion regarding cause and manner of death. A standard form was used to collect information from materials.

### Results

**TABLE 1: SEX RATIO OF UNCLAIMED CASES**

TOTAL NO OF UNCLAIMED CASES	MALES	FEMALES
206	180	26
100%	87%	13%

This table shows sex ratio of unclaimed cases. In that 206 unclaimed bodies 180 cases (87%) were males and 26 cases (13%) were females. This shows the more number of male sex cases in the unclaimed dead bodies.

**TABLE 2: AGE WISE DISTRIBUTION OF UNCLAIMED CASES**

Age group in years	No of cases		Total	Percentage of total unclaimed cases
	Male	Female		
<1	1	1	2	2%
21 - 30	7	0	7	7%
31 - 40	17	0	17	17%
41 - 50	17	3	20	20%
51 - 60	26	4	30	30%
61 - 70	16	0	16	16%
71 - 80	6	1	7	7%
>80	0	1	1	1%

This table shows age wise distribution of unclaimed cases. More number of cases in the age group of 51 - 60 years 30% of total cases. Next to it in the age group of 41 - 50 years 20% of total cases.

Least number of cases in the age group of less than 1 year 2% of total cases and more than 80 years 1% of total cases.

**TABLE 3: RELIGION OF UNCLAIMED DEAD CASES**

RELIGION	NO. OF CASES	PERCENTAGE
NOT KNOWN	85	85%
HINDU	13	13%
MUSLIM	2	2%

This table shows religion of unclaimed dead bodies. The religion was not known in 85% of cases. 13% of cases were Hindu and 2% of cases were Muslims.

**TABLE 4: PLACE OF BODY FOUND DEAD**

PLACE OF BODY FOUND DEAD	NO. OF CASES
HOSPITAL	21
ROADSIDE	16
FOOT PATH	16
RAILWAY TRACK	14
SEASHORE	6
ROAD	5
ABANDONED PLACES	5
RAILWAY PLATFORM	4
TRANSIT	2
HOME	2
BUS STAND	1
DUST BIN	2
METRORAIL STATION	1
POND	1
RIVER	2
TEMPLE SIDE	1
WATER CANAL	1

This table shows place of body found dead. Most of deaths occur in the hospital (21 cases). 16 cases were found dead on the roadside. 16 cases were found dead on the foot path. 14 cases were found dead on the railway track.

**TABLE 5: NATURAL CAUSES OF DEATH IN UNCLAIMED CASES**

S.NO	NATURAL CAUSE OF DEATH	NO. OF CASES
1.	CHRONIC LUNG DISEASE	28
2	CORONARY ARTERY DISEASE	17
3	PNEUMONIC CONSOLIDATION	6
4.	INTRACRANIAL HEMORRHAGE	5
5.	SEPSIS	2
6.	CONGENITAL HEART DISEASE	2
7.	NO DEFINITE OPINION	2
	TOTAL	62

This table shows natural causes of death in unclaimed cases. The cause of death was chronic lung disease in 28 cases, coronary artery disease in 17 cases, pneumonic consolidation in 6 cases, intracranial haemorrhage in 5 cases, sepsis in 2 cases, congenital heart disease in 2 cases and no definite opinion in 2 cases.

**TABLE 6: UNNATURAL CAUSES OF DEATH IN UNCLAIMED CASES**

S.NO	UNNATURAL CAUSE OF DEATH	NO. OF CASES
1.	MULTIPLE INJURIES	26
2.	HEAD INJURY	4
3.	DROWNING	5
4.	HANGING	2
5.	POISONING	1
	TOTAL	38

This table shows unnatural cause of death in unclaimed cases. The cause of death was multiple injuries in 26 cases, head injury in 4 cases, drowning in 5 cases, hanging in 2 cases and poisoning in 1 case.

**TABLE 7: MANNER OF DEATH.**

S.NO	MANNER OF DEATH	NO. OF CASES
1.	NATURAL	61
2.	ACCIDENTAL	24
3.	SUICIDAL	4
4.	UNDETERMINED	7
5.	HOMICIDAL	2
6.	NOT APPLICABLE	2

This table shows manner of death in unclaimed cases. The manner of death is natural in 61 cases, accidental in 24 cases, suicidal in 4 cases, undetermined in 7 cases, homicidal in 2 cases and not applicable in 2 cases.

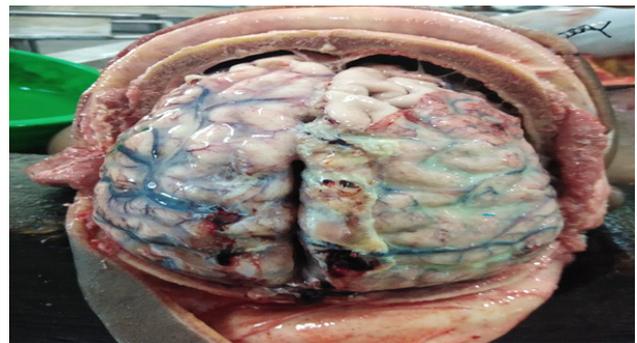
**TABLE 8: EFFORTS TAKEN BY INVESTIGATING OFFICER**

S.NO	EFFORT	DONE IN NO. OF CASES
1.	LOCAL INQUIRY	100 (100%)
2.	PHOTOGRAPHS OF BODY, CLOTHS, CRIME SCENE TAKEN	100 (100%)
3.	CLOTHS, PROSTHESIS, POCKET CONTENTS IF PRESENT NOTED	100 (100%)
4.	SCARS/MOLES IF PRESENT NOTED	85 (85%)
5.	TATTOOS IF PRESENT NOTED	21 (21%)

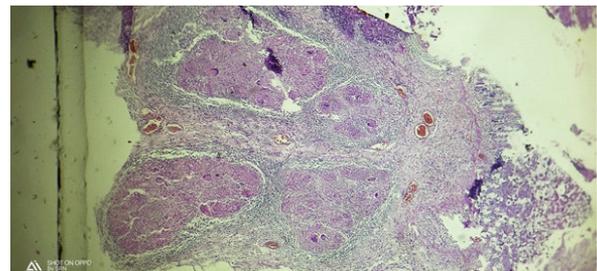
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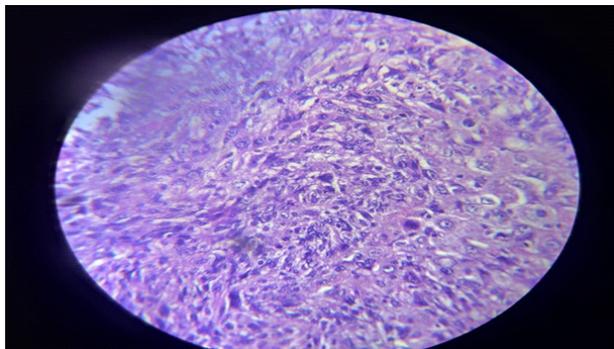
6.	FINGERPRINTS TAKEN	94 (94%)
7.	SPECIMEN FOR DNA ANALYSIS	16 (16%)
8.	ADVERTISEMENTS IN PRINT MEDIA, MESSAGE TO ALL POLICE STATIONS IN CHENNAI AND DGP OFFICE FOR INFORMATION	100 (100%)

This table shows efforts taken by investigating officer. Local inquiry in 100% cases, photographs of body, cloths, crime scene taken in 100% of cases, cloths, prosthesis, pocket contents if present noted in 100% of cases, scars/moles if present noted in 85% of cases, tattoos noted in 21% of cases, fingerprints taken in 94% of cases, specimen for DNA analysis taken in 16% of cases and advertisements in print media, message to all police stations in Chennai and DGP office for information in 100% of cases.

**FIGURE 1: COLOUR PHOTO SHOWING A CASE OF SUBDURAL EMPYEMA.**

A case of subdural empyema.

**FIGURE 2: PICTOMICROGRAPH OF TUBERCULOSIS LUNG SHOWING TYPICAL MULTIPLE WELL FORMED EPITHELIROID CELL GRANULOMA WITH LANGERHANS GIANT CELLS AND NECROSIS.**



**FIGURE 3: PICTOMICROGRAPH OF SYNOVIAL SARCOMA SHOWING SPINDLE CELL PROLIFERATION IN FASCICLES AND SHEETS WITH ATYPIA.**

### Discussion

During our routine medico-legal activities we come across a number of unfortunate individuals who meet accidental deaths, foul play or other sudden death among strangers. Though they display many characteristics by which relatives, friends may identify them, no central body ever knows of them. This is the fate in almost all countries<sup>6</sup>. The dead body is kept for 72 hours or so, awaiting someone to claim it, when no one turns up, the governmental agency with reluctance, makes frugal experience towards the disposal of the dead. Finally, the remains of the unknown individual lay permanently buried in the earth and the body will be labelled as unknown. The relative or the loved one of the dead person will be waiting somewhere for his or her return<sup>7</sup>.

Unclaimed bodies brought for post-mortem examination comprise a very significant and important group of cases in every autopsy surgeon's career. These cases really test the skill and expertise of the specialist and the investigative agencies. Most of the cases require time consuming formalities, as required by the law, viz., a waiting period of 72 hours, publication of photographs and details of the deceased in the leading dailies, interactive pooling of data from various agencies all over the country<sup>8</sup>.

A forensic medicine specialist can contribute very much by giving detailed data gathered from a thorough examination and dissection of the body.

A thorough search of the literature did not yield much information regarding the identification.

There are many legal, financial and social implications that stem from the number of unclaimed bodies<sup>9</sup>. It is therefore imperative that research into this matter be conducted, that protocols and methodology be established in order to address the problems associated with unclaimed bodies, and to limit the economic and social impact thereof.

There are many problems which are encountered while dealing with unclaimed bodies in India. In our country, death investigation is primarily done by the police. Many of the functions initially performed by the police at the scene of crime actually fall within the realm of Forensic Medicine Service. It is here that many problems are encountered as there is no service level agreement between the two departments regarding the specific functions to be performed by each<sup>10</sup>.

One of the primary objectives of medico legal autopsy is identification of the deceased in unclaimed cases. Establishment of identity in all such cases needs team work whether the autopsy surgeon collects data for identification<sup>11</sup>. In addition, finger prints, forensic photography, DNA analysis and superimposition help to achieve the goal of victim identification. Investigation into the identity of an unknown body at the autopsy room often falls by the wayside as the investigating officer no longer collect data at the scene of offence that may assist in identification. The investigation into death of a person is thus no longer handled by a single agency but involves cooperation of multiple government departments<sup>12</sup>.

Unidentified bodies in the forensic setting constitute a global problem<sup>13</sup>. Though it is of great concern to many governments, very little data on the extent of this phenomenon is available in international literature. The present study is a cross sectional study to ascertain the cause and manner of death in unclaimed dead bodies in Government Stanley Medical College Hospital during the year 2019.

In the year 2019, 2026 cases were registered for autopsy in the department of Forensic Medicine, Government Stanley Medical College, Chennai. Of them 1820 cases were registered as known cases, whereas 206 cases were registered as unknown cases.

This number is high when compared to international literature. Determining the true extent of this phenomenon in Chennai is therefore important, as these unclaimed bodies have many social and economic consequences. Not only are families unaware that their loved ones have passed away, but they are also unable to bury and mourn them.

### Conclusion

A man is borne with an identity and deserves to die with the same. This is the fundamental right of being born a human. However, due to natural calamities, mass disasters, intentional/unintentional acts of fellow human beings, a number of "unclaimed bodies" come to fore<sup>14</sup>.

Death under any circumstance is unwanted and painful. The number of unclaimed deaths in the city of Chennai is quite alarming. A large number of the deaths were due to a disease condition, road traffic accidents, railway accidents were avoidable. Hence, the results may not be comparable with those of the developed countries.

Sincere efforts from the government are required to provide food, shelter, employment, proper implementation of road and railway safety measures, welfare programmes and maintaining a register for migrants and CCTV surveillance in bus, railway stations to reduce the burden of such deaths<sup>15</sup>.

Prompt and better identification methods along with coordinate efforts of the law enforcing agencies would help in establishing the identity of such individuals<sup>16</sup>. Advancement in the field of computers, genetic engineering including DNA analysis etc have led to development of new methods of identification.

Little is known about the levels and cause of death among the homeless people in India<sup>17</sup>. They are too often overlooked by public health scholars. People living on the margins are usually absent from public health surveys and epidemiological studies to know the gravity of this problem and form preventive measures. What is eventually required is a sympathetic, humane and scientific approach to the whole problem to find a suitable solution for establishing the identity of the dead.

**Conflict of Interest:** Nil.

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**Permission taken from Department:** Yes.

**Ethical clearance obtained from** Institutional Ethical Clearance Committee (Government Stanley Medical College & Hospital Chennai) dated 19.12.2018.

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# Prevalence of HIV in Dead Bodies Posted for Autopsy: A Cross Sectional Study at a Tertiary Care Hospital

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## Abstract

**Background:** There are various reports regarding the suicide commission by HIV positive persons, but as such postmortem serological studies are yet not done to document the status in autopsy. Also it's vital to test a body before autopsy to avoid infection to the forensic experts and concerned persons in autopsy and allied work.

**Objectives:** The objective of the study was to estimate the prevalence of HIV infection, in unreported post-mortem cases in the autopsy room.

**Material and Methods:** The prospective study was done at the Department of Forensic Medicine in collaboration with the Department of Microbiology located in the Tertiary Care Government Hospital, Mumbai. Total of 216 cases were examined during a span of one year. Cases selected as per inclusion and exclusion criteria, tested for HIV after taking consent from guardians.

**Results:** Most common age group was found to be 31-40 years. Males were 72.22% while females were 27.78% of study. Out of total 6 were tested positive for HIV. Out of total 6 HIV cases 4 (80%) were males and 2 (20%) were females. Out of 6 cases 5 (83.3%) were below 50 yrs. 82.3% tested positive in first 24 hours of death. 3 (50%) died due to pulmonary tuberculosis, 2 (33.3%) due to meningitis and 1 (16.7%) due to lobar pneumonia. Conclusions: HIV among dead bodies presenting to autopsy is not uncommon.

**Keywords:** HIV, Autopsy, Medico-legal investigations

## Introduction

The prevalence of HIV in Indian population is one of the major causes contributing to the death by

secondary infection. The post-mortem serological investigations are a very simple tool to establish status of person which can be helpful in medico-

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legal investigations of death. Medico legal autopsy is mandatory in all sudden, unexpected, unexplained, unattended natural deaths or any unnatural death, but the prevailing conditions in mortuaries make it a potential health hazard for those working there<sup>1-3</sup>. Many studies have confirmed that, with the cessation of life, certain pathogenic bacteria are released, which if left unchecked may prove hazardous to the personnel<sup>4</sup>.

In resource limited healthcare settings like India, the situation is worse of and the risk is further compounded by additional factors like high daily working load, traumatized state of many of the bodies, adverse working conditions and inconsistent availability of protective gears<sup>5-6</sup>.

Medical history is not available in the cases which are unknown and unclaimed, brought dead to the mortuary. In most of the cases usually, the medical history of subject may be incomplete and may even be incorrect if fictitious history is given by relatives<sup>7,8</sup>. Practically it is very difficult to know the infectious status (HIV, HBV & HCV) of each and every deceased person brought for the postmortem before conducting the autopsy. With death, the translocation of microorganisms becomes easier in the absence of any live membrane or cellular barrier.<sup>9,10</sup>

Considering the present situation, where HIV, HBV & HCV infection are taking global epidemic. The present study was designed to estimate the prevalence of HIV infection, in unreported post-mortem cases in the autopsy room, and raising awareness in the autopsy surgeon regarding the infectivity of cadavers.

### Material and Methods

However pre-mortem blood samples of cadaveric donors are usually not available especially in medico legal cases at the Forensic Medicine Department. With the implementation of EU Directives 2004/23/EC and 2006/17/EC (European Union 2004, 2006)<sup>11-13</sup> basic requirements of viral safety were defined in general. The prospective study was carried out at the Department of Forensic Medicine in collaboration with the Department of Microbiology located in the Tertiary Care Government Hospital, Mumbai. Total of 216 cases were examined during a span of one year.

**Inclusion criteria:** All hospitalized cases (death within 24 hours of admission) sent for post-mortem examination whose HIV status was not known, All unknown or unclaimed bodies sent for postmortem examination.

**Exclusion criteria:** Cases already diagnosed for HIV and cases were family members refused to give consent for HIV testing.

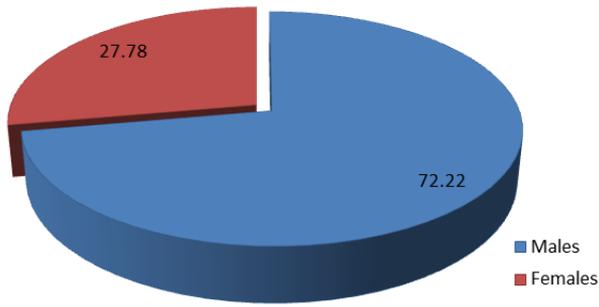
An informed consent either from the family members or relatives of the deceased or the investigating officer of unknown or unclaimed bodies was taken for all post-mortem samples. 5 ml of blood sample was collected in three plain vacutainers each with proper labeling to Microbiology department. The blood was allowed to clot at room temperature for 30 minutes then centrifuged at 3000 rpm for 10 minutes and the serum was separated using a micropipette into sterile vials. The aliquoted samples were processed immediately for HIV antibodies. Data was entered into Microsoft excel and analyzed using SPSS version 20 for p value. P value of <0.05 was taken as significant.

### Results

**Table 1: Age wise distribution of study sample**

Age Group(yrs)	No of patients	Percentage
0-10 years	12	5.56
11-20 years	13	6.02
21-30 years	27	12.50
31-40 years	50	23.15
41-50 years	37	17.13
51-60 years	29	13.43
>60 years	48	22.22
Total	216	100
Mean $\pm$ SD	43.75 $\pm$ 19.54 (1 month-85 years)	

In the present study of 216 samples 6 were tested positive for HIV. Regarding manner of death the present study did not find any case of suicide. Most common age group was found to be 31-40 years.



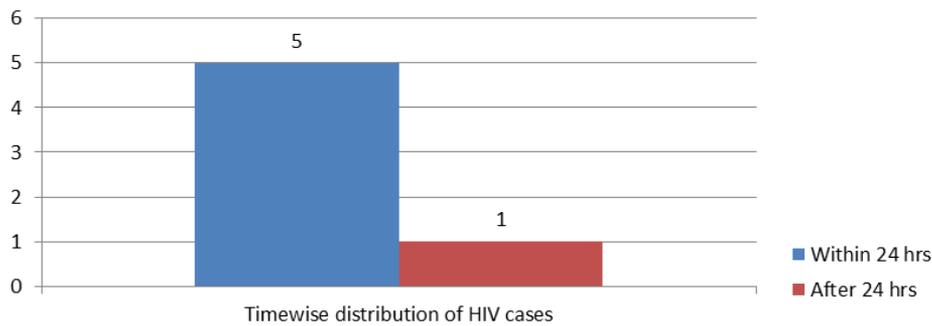
**Fig 1: Gender wise distribution of study sample**

Males were 72.22% while females were 27.78% of study sample.

**Table 2: Age and gender wise distribution of positive cases**

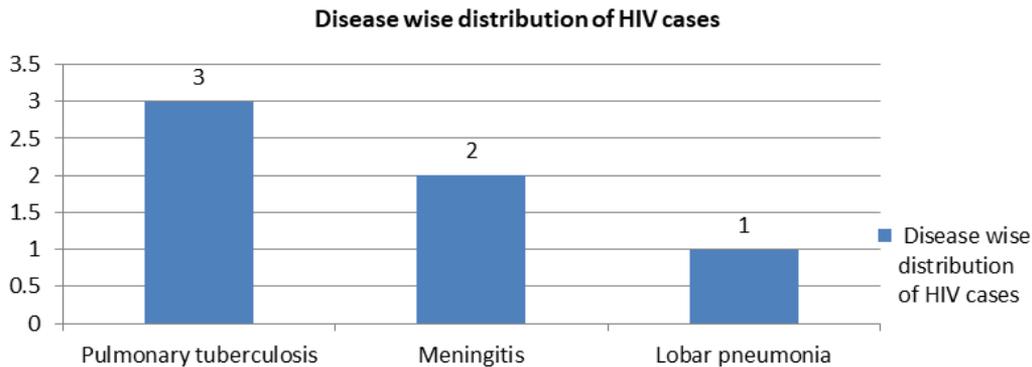
Gender	HIV
Male	4
Female	2
Age groups	
31-40 yrs	2
41-50 yrs	3
51-60 yrs	1

Out of total 6 HIV cases 4 (80%) were males and 2 (20%) were females. Out of 6 cases 5 (83.3%) were below 50 yrs.



**Fig 2: Time wise distribution of positive cases**

82.3% tested positive in first 24 hours of death.



**Fig 3: Disease wise distribution in HIV positive cases**

Out of total 6 HIV cases 3 (50%) died due to pulmonary tuberculosis, 2 (33.3%) due to meningitis and 1 (16.7%) due to lobar pneumonia.

**Discussion**

Forensic handlers are at constant risk of acquiring infectious diseases like HIV, HBV & HCV, etc. Forensic handler’s deals with situation like drug abuse, commercial sex workers and unidentified

bodies which increases risk of infection transmission in forensic handlers. There are very little data available for the prevalence of HIV, HBV and HCV in autopsy bodies. The prevalence of HIV, HBV & HCV is one of the major contributing cause for death, but not directly leading to death. HIV causes immune suppression leading to secondary infections like pulmonary tuberculosis, tubercular meningitis, Lobar pneumonia, etc and death.

Out of total 216 cases, males were 72.22% while females were 27.78% of study sample. The present study of 216 samples 6 were tested for HIV. Most common age group was found to be 31-40 years. In the present study prevalence of HIV was found to be higher (2.78%) than various other studies that may signify high viral distribution in the geographical area. Study done by Eza D, Cerrillo G, Moore DAJ et al<sup>14</sup> (0.5%) had lower prevalence than our study. HIV positive results in 6 cases were showing positive in both groups of within 24 hours (5 out of 6) and after 24 hours (20%). The serological conditions are not directly leading to death. But the deaths in HIV positive persons are known due to secondary infections. In the present study all the tests done were screening test, no confirmatory test done, which was a limitation of this study.

### Conclusion

HIV infection transmission is preventable by taking universal precaution in autopsy room. The post-mortem serological investigation of HIV may be useful to establish the manner of death when not known.

**Ethical Clearance:** Ethical approval was taken from Grant Government Medical College and Sri J. J. Group of Hospitals Mumbai, Maharashtra dated 17.1.17.

**Conflict of Interest:** Nil.

**Source of funding:** Nil.

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# Gender Differences on Data of Palm Sweat Pores in Myanmar and Cambodian Nationality

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## Abstract

The sweat pore is helpful in terms of identification like minutiae. This research aims to study the differences in the number of sweat pores, types of sweat pores, and the size of sweat pores in male and female volunteers of Myanmar and Cambodian nationality. The researcher has studied the differences in sweat pores data to explore differences between the genders. This research consists of 100 volunteers aged 20-60 years. The results found no significant differences between the genders of the two nationalities. This research revealed that men had more sweat pores than females. In Myanmar nationality, males have an average number of sweat pores at  $112.8 \pm 1.6$ , while females have  $110.6 \pm 0.9$  sweat pores. In Cambodian nationality, males found an average number of  $131.2 \pm 0.8$  sweat pores and  $130.72 \pm 1.9$  in females. Studies on the types of sweat pores have found them to be more closed than open sweat pores. Except for female volunteers of Myanmar nationality, more open sweat pores were found than closed sweat pores. Besides, the size of sweat pores in Myanmar was small in both genders, followed by medium and large. Meanwhile, the Cambodian found similar findings in male volunteers. The exception was female volunteers with the same small and medium-sized sweat pores and found the least large sweat pores. Studying data on sweat pores on the palms of different nationalities is very important in forensic science.

**Keywords:** Pore, Gender differences, Myanmar, Cambodian

## Introduction

Fingerprint identification is a widely employed method encompassing fingerprints, palm prints, and sole prints<sup>1</sup>. All three types can be utilized to verify an individual's identity through consistent verification principles<sup>2</sup>. Examining an Automated Fingerprint Identification System (AFIS) is a common practice for identifying perpetrators in various cases, as the

system relies solely on fingerprints and minutiae for testing. Nevertheless, verifying an individual's identity can be approached through three critical characteristics of a fingerprint: Feature 1 involves the overall pattern of the fingerprint, Feature 2 encompasses the distinctive characteristics of the lines, and Feature 3 includes sweat pores, incipient ridges, and other permanent details<sup>3,4</sup>.

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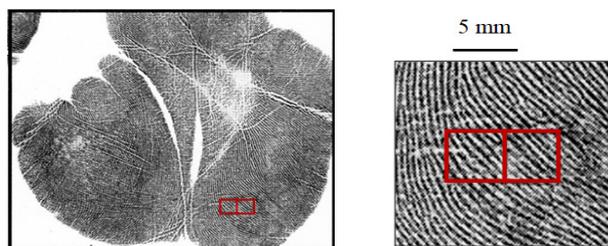
Sweat pores constitute a distinctive third level of fingerprint features arranged in rows on the fingerprint's surface<sup>5</sup>. They begin forming in the 5th and 6th weeks of gestation and reach full development by the 21st week<sup>6</sup>. Like pattern and minutiae, sweat pores serve as a viable means of identification due to their specificity, durability, and abundance compared to other unique characteristics. In a one-inch area, as many as 23-45 sweat pores can be present<sup>7,8</sup>. In 1912, Edmond Locard pioneered utilizing sweat pores for identification. He conducted extensive studies on their patterns and proposed four criteria—size, shape, types, and density of sweat pores.<sup>9,10,11</sup>

This research serves as an initial exploration of sweat pores in the right and left palms among Myanmar and Cambodian volunteers. The primary objective is to underscore the significance of sweat pores in the context of identification. The study aims to analyze discrepancies in sweat pores between male and female participants, emphasizing on the number, types, and size of sweat pores.

### Material and Methods

This research consists of 50 Myanmar volunteers (25 men and 25 women) and 50 Cambodian volunteers (25 men and 25 women). All samples were randomly sampled with volunteers aged between 20 and 60. All volunteers are foreign workers under the MOU with the Thai government. Regarding collecting palm print samples, all volunteers read the agreement and sample collection procedures carefully and signed consent before starting the process. The samples were collected by washing hands thoroughly. Before, the palm print was stamped with black forensic ink onto a newly created form specifically for use in research. The form does not include the volunteer's signature but is instead coded not to reveal the volunteer's information.

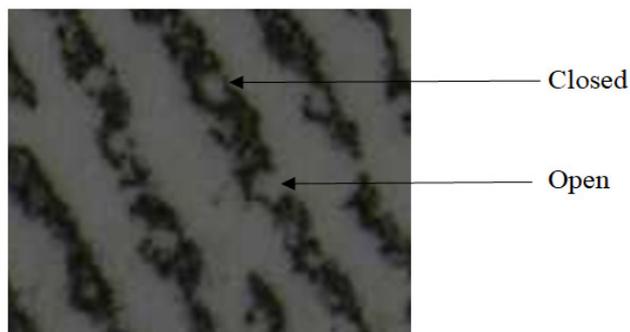
The outer area of the palm print was chosen to study the characteristics of sweat pores, and a rectangular region measuring 5x5 mm<sup>2</sup> was determined (Figure1). The selection of this analysis area follows the Acree method<sup>12</sup>. All data presented in the results are the combined average outcomes. The research utilized a DCS4 (Foster + Freeman) eyewitness camera set to a focus level of 0.314 and a resolution of 1000 dpi.



**Fig 1: Example of palm print and square size 5x5 mm<sup>2</sup>**

Sweat pore data from the right and left palm prints of males and females were scrutinized to determine the quantity of sweat pores. The total number of sweat pores in a 25 mm<sup>2</sup> area was tallied, and this value was then presented as the overall average number of sweat pores. Besides, other characteristics were analyzed, including type categorization. Types were classified as open and closed, as illustrated in Figure 2. The size of the sweat pores was also examined, with categorization into small, medium-sized, and large sweat pores. This analysis followed the principle of comparing sweat pores with the largest one in a 25 mm<sup>2</sup> area, utilizing the method outlined by Bindra et al<sup>9</sup>.

All collected data underwent statistical analysis using SPSS version 11. The mean values of the right and left palms on the outer mound were subjected to a T-test at a significance level of p-value < 0.05. Subsequently, differences among subjects, specifically males and females, were assessed using Independent-Samples T-test statistics.



**Fig 2: Types of pores.**

### Results and discussion

This research investigated the quantity, types, and dimensions of sweat pores on the outer surface of the right and left palms, each covering an area of 25

mm<sup>2</sup>, among volunteer foreign workers of Myanmar and Cambodian nationality. The study encompassed 100 volunteers, aged between 20 and 60, evenly distributed with 50 individuals from each nationality (25 men and 25 women). Statistical analyses were conducted to discern patterns in sweat pore types and sizes among men and women of Myanmar and Cambodian nationality, presented in Tables 1 and 2, respectively. For individuals of Myanmar nationality, the number of sweat pores within the 25 mm<sup>2</sup> area ranged from 96 to 125 for males (mean = 112.8, S.E. = 1.6052) and 102 to 119 for females (mean = 110.6, S.E. = 0.9815). In the case of Cambodian nationality, males exhibited 122 to 138 sweat pores (mean = 131.2, S.E. = 0.8327), while females displayed 118 to 145 sweat pores (mean = 130.72, S.E. = 1.9643). Despite the observed higher frequency of sweat pores in males, no statistically significant differences were identified between genders in both nationalities.

**Table 1: Descriptive statistics: number of pores in males and females in Myanmar population.**

Descriptives	Male	Female
Mean	112.8	110.6
Standard error of mean	1.6052	0.9815
Median	114	110
Mode	109	110
Standard deviation	8.0260	4.9075

Sample variance	64.417	24.0833
Range	29	17
Minimum	96	102
Maximum	125	119
Sum	2820	2765

**Table 2: Descriptive statistics: number of pores in males and females in Cambodian population.**

Descriptives	Male	Female
Mean	131.2	130.772
Standard error of mean	0.8327	1.9643
Median	131	130
Mode	131	120
Standard deviation	4.1633	9.8214
Sample variance	17.3333	96.46
Range	16	277
Minimum	122	118
Maximum	138	145
Sum	3280	3268

The results of the comparative analysis, evaluating the disparity in the quantity of sweat pores within the 25 mm<sup>2</sup> area between males and females in both Myanmar and Cambodian nationalities, revealed no statistically significant difference. For Myanmar nationals, the p-value was 0.2492; for Cambodian nationals, the p-value was 0.8234, as mentioned in Table 3.

**Table 3: Comparison of pore characteristics between both sexes in Myanmar and Cambodian population.**

Pore characteristics/ 5x5 mm <sup>2</sup> square	Myanmar population			Cambodian population		
	Male	Female	P	Male	Female	P
Number of pores	112.8±8.03	110.6±4.91	0.2492	131.2±4.16	130.72±9.82	0.8234
Types : Closed	26%	23%	0.0621	26%	27%	0.0706
Open	24%	26%	0.0802	24%	23%	0.0532
Size : Small	28%	29%	0.1574	21%	21%	0.3489
Medium	13%	14%	0.2491	18%	21%	0.3783
Large	9%	7%	0.4035	10%	9%	0.1514

Table 3 provides a comprehensive overview of sweat pore data, facilitating a comparison of gender differences in Myanmar and Cambodian nationalities. The investigation into types of sweat pores discerns between closed and open sweat pores, revealing a consistent prevalence of closed sweat pores over open sweat pores in both genders. This alignment with the findings of Bindra et al<sup>9</sup> reinforces

the notion that closed sweat pores tend to outnumber open sweat pores. Notably, an exception is observed among females of Myanmar nationality, where more open sweat pores (26%) are identified compared to closed sweat pores (23%). Further analysis of closed sweat pores between males and females in Myanmar (p=0.0621) and Cambodian (p=0.0706) nationalities yields non-significant differences. Similarly,

examining open sweat pores in Myanmar ( $p=0.0802$ ) and Cambodian ( $p=0.0532$ ) nationalities indicates no statistically significant gender disparities. These outcomes align with the research conducted by Nagesh et al<sup>10</sup> corroborating the absence of discernible differences in sweat pore types between genders.

According to the study of the size of sweat pores on hypothenar of the right and left palms in both nationalities In Myanmar, small sweat pores were found the most in both males and females (28% in males, 29% in females). Below are medium-sized sweat pores (13% in males, 14% in females) and the least number of large sweat pores (9% in males, 7% in females). Meanwhile, in the Cambodian nationality, males found sweat pores. The most common were small (21%), followed by medium-sized sweat pores (18%), and the least common were large sweat pores (10%). However, small, and medium-sized sweat pores were found in equal percentages in females, 21%, and large sweat pores were found in 9%. In all three sizes of sweat pores between males and females of Myanmar nationality, it was found that there was no significant difference. In the Cambodian nationality, the results of the research between males and females found that there were no significant differences as well. The results are consistent with the study of Nagesh et al<sup>10</sup> which found that gender differences do not affect the size of sweat pores.

### Conclusions

This research delved into the quantitative and qualitative aspects of sweat pores, encompassing their number, types, and size on the hypothenar of the right and left palms among male and female volunteers from Myanmar and Cambodian nationality. The findings underscored a higher frequency of sweat pores in males than females within a 25 mm<sup>2</sup> area, a consistent trend across both nationalities. Examination of sweat pore types revealed a predominance of closed sweat pores, except for females from Myanmar, where open sweat pores surpassed closed ones. Regarding sweat pore size among Myanmar nationals, both males and females exhibited a prevalence of small sweat pores, followed by medium-sized sweat pores, while

large sweat pores were the least common. Similar results were observed in Cambodian males, with a distribution of small, medium-sized, and large sweat pores. In contrast, Cambodian females displayed an equal occurrence of small and medium-sized sweat pores, followed by large sweat pores. Gender-based analyses yielded no significant differences in the number, types, or size of sweat pores in Myanmar and Cambodian nationalities. The implications of these findings are particularly noteworthy in the context of forensic science, suggesting potential advancements in fingerprint identification in Thailand by incorporating sweat pores alongside distinctive features.

**Ethical Clearance:** This study has ethics committee approval Ref. No : REC 63.1019-126-1198 from Silpakorn University Research, Innovation and Creativity Administration Office.

**Conflict of interest:** None

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# Trends in Suicidal Deaths Brought for Medicolegal Autopsy at Govt. Rajaji Hospital, Madurai: A Retrospective Study

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## Abstract

Suicide is a major cause of death in today's world. The pattern of suicidal deaths in a particular area points not only to the quality of living but also the social and mental makeup of the population.

**AIM AND OBJECTIVES:** 1. To ascertain suicidal death patterns in and around Madurai. 2. To analyse the data with respect to demographics presentation, methods used for committing suicide. 3. To find out the underlying factors that led to Suicide.

**METHODOLOGY:** The study was conducted at Govt. Rajaji Hospital mortuary, Madurai which covers almost entire district for medicolegal autopsies. The study period was from 01/01/2021 to 31/12/2021 which amounts to one year study. The study design comprised of thoroughly scrutinised information gathered from autopsy related documents, history of relatives of the deceased, hospital records, concerned investigating officers and laboratory report of viscera and other relevant details available in our department. Suicide notes if any were also included. Data was analysed using standard statistical method.

**RESULTS:** Out of 986 cases of suicidal deaths majority of the cases were Male belonging to the age group 21-30 years followed by age group 31-40years. Poisoning and Hanging were the most common methods employed. Most of the victims were of lower socioeconomic class belonging to rural background. Economic instability and family conflict were the most common cause that led to suicides.

**CONCLUSION:** Suicidal deaths are preventable by the combined effort of the Government agencies, adaption of healthy lifestyle, counselling facilities and change in the mindset of the people to adapt to all difficult situations in life.

**KEYWORDS:** Suicide, Autopsy, Poisoning, Economic instability, Counselling.

## Introduction

Suicide (Latin *suicidium*, from *sui caedere*, "to kill oneself") is the act of intentionally causing one's own

death. According to Durham, the French biologist, suicide is death resulting directly or indirectly from a positive or negative act of the victim himself,

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which he knows will produce this result. Around 800,000 to a million people die by suicide every year, making it the 10<sup>th</sup> leading cause of death worldwide. Suicide and attempted suicide, while previously punishable, is no longer in most Western countries. The World Health Organisation (WHO) reported that one individual dies by suicide every 40 seconds<sup>1</sup>. The UN's Sustainable Development Goal(SDG)3 is "Ensure healthy lives and promote well being for all at all ages" and the target SDG 3.4 explains "By 2030, reduce by one-third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well being" under which one indicator (SDG 3.4.2) is the suicide mortality rate<sup>2</sup>. India and Sri Lanka have the highest suicide rate(12.9%) in the Southeast Asia region<sup>3</sup>. A review reported that compared to other high income countries, Asia has higher average suicide rates<sup>4</sup>. Thus suicide which is very much a by product of the advancements of society needs a careful and refined approach so as to study the factors related to it, the causes and if possible to find ways to prevent such a tragedy. Very few reviews are available on suicide

in South Asia<sup>5</sup>. Present study is an attempt to throw light on such issues.

### Material and Methods

The study was conducted at Govt. Rajaji Hospital mortuary, Madurai which covers almost entire district for medicolegal autopsies. The study period was from 01/01/2021 to 31/12/2021 which amounts to one year study. The study design comprised of thoroughly scrutinised information gathered from autopsy related documents, history of relatives of the deceased, hospital records, concerned investigating officers and laboratory report of viscera and other relevant details available in our department. Suicide notes if any were also included. Since the Research study is Retrospective and based on documents verification, Informed consent from the relatives of the deceased is not necessary.

### Findings:

A total of 3715 autopsies were carried out during the study period out of which cases were opined to be that of suicides which constituted 26.54% of the total cases (Table 1)

**Table No.1: Showing suicides in relation to total autopsies:**

TOTAL CASES	SUICIDE CASES	PERCENTAGE	OTHER CASES	PERCENTAGE
3715	986	26.54%	2729	73.46%

### Age and sex:

The age group 21-30 years recorded the highest number of cases followed by 31-40 years with males numbering 640 and females 346. In the age group 21-30 males constituted 29.69% of cases and females

35.5% while in the age group between 31-40 males consisted of 24.84% cases and females 20.8%. Least number of cases was observed in the age group above 60 years in both males and females.

**Table No.2: Showing suicides in relation to age and sex:**

AGE IN YEARS	MALE	PERCENTAGE	FEMALE	PERCENTAGE
1-10	0	0	0	0
11-20	65	10.15%	62	17.91%
21-30	190	29.69%	123	35.50%
31-40	159	24.84%	72	20.80%
41-50	88	13.75%	31	8.95%
51-60	77	12.03%	39	11.2%
>61	61	9.53%	19	5.49%

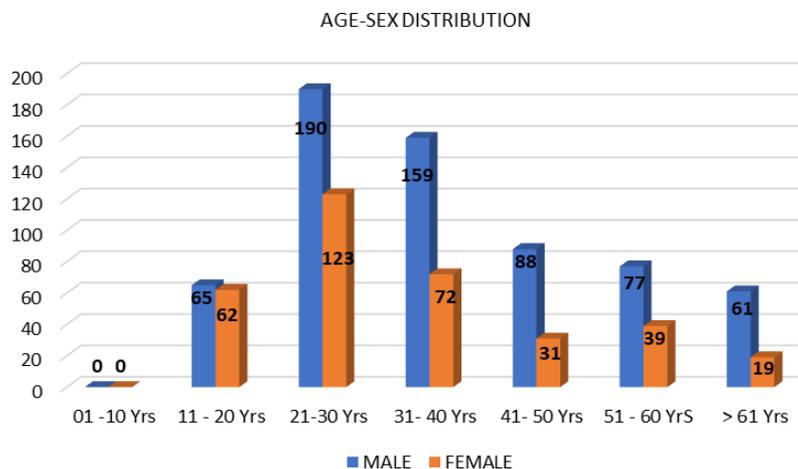


Figure 1: Age -Sex Distribution

**Method of committing suicide:**

Poisoning was the method which accounted for the highest number of cases 359(36.4%) followed by hanging 351(35.59%) cases and thermal burns with 181(18.35%) cases. Drowning accounted for 53 deaths.

Table No.3: Showing methods adopted for suicide:

METHODS	NUMBER OF CASES	PERCENTAGE
Poisoning	359	36.4%
Hanging	351	35.59%
Thermal burns	181	18.35%
Drowning	53	5.37%
Railway accident	39	3.95%
Miscellaneous	3	0.3%

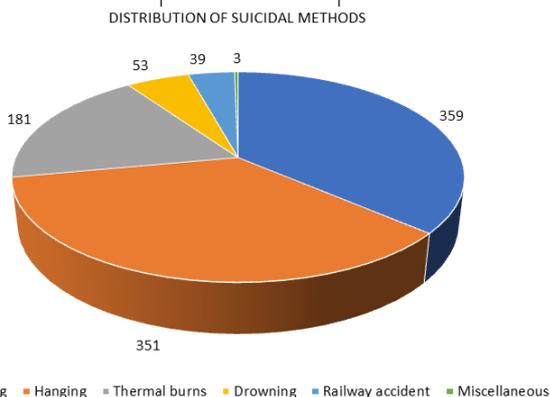


Figure 2: Suicidal Method

**Location:**

The majority of the victims belonged to rural background with 658 cases (66.73%) and 328 cases (33.27%) belonged to those of urban background of victims.

Table No.4: Showing suicides in relation to location:

LOCATION	NUMBER OF CASES	PERCENTAGE
Rural	658	66.73%
Urban	328	33.27%

**Socioeconomic status:**

The Lower class people were the majority of affected victims with 563 cases (57.10%) followed by the middle class 307 cases (31.14%) and last by the upper class people 116 cases (11.76%)

Table No.5: Showing economic status of victims:

ECONOMIC STATUS	NUMBER OF CASES	PERCENTAGE
Upper class	116	11.76%
Middle class	307	31.14%
Lower class	563	57.10%

**Marital status:**

Of the 986 cases 801 cases (81.23%) were married while 185 cases (18.77%) were unmarried.

Table No.6: Showing marital status of victims:

MARITAL STATUS	NUMBER OF CASES	PERCENTAGE
Married	801	81.23%
Unmarried	185	18.77%

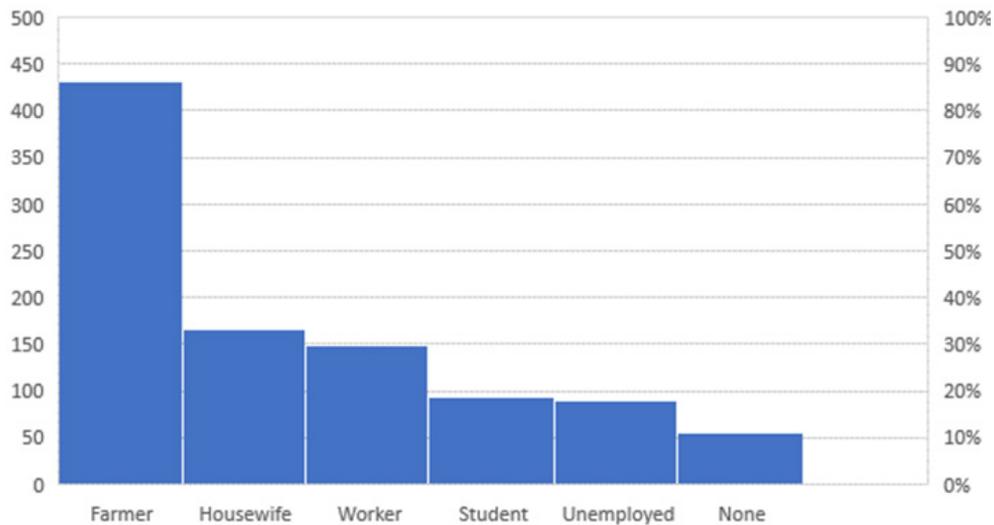
**Profession:**

The majority of the victims belonged to farmer by profession with 432 cases (43.82%), 166 cases (16.83%) belonged to housewife, 90 cases (9.12%) were unemployed and 94cases (9.53%) were students.

**Table No.7: Showing Profession of victims:**

PROFESSION	NUMBER OF CASES	PERCENTAGE
Farmer	432	43.82%
Housewife	166	16.83%
Worker	148	15.02%
Student	94	9.53%
Unemployed	90	9.12%
None	56	5.68%

**DISTRIBUTION OF PROFESSION**



**Figure 3: Profession of victim.**

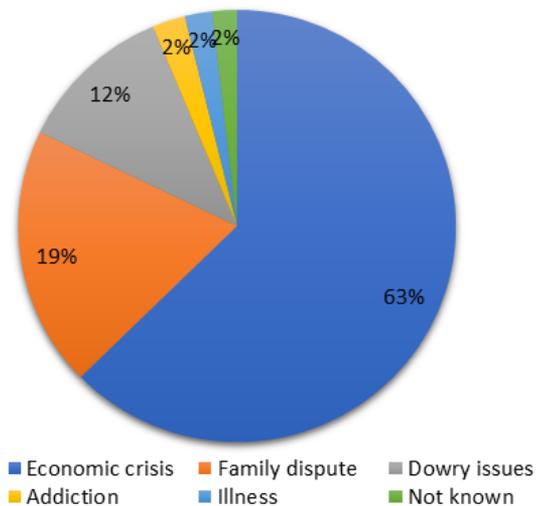
**Cause of Suicide:**

Economic crisis/poverty was the most common cause involved with 618 (62.68%) cases followed by family related conflicts or problems with 192 (19.47%) cases. Dowry was a cause with 114 cases (11.56%). Addiction, illness were the other causes. In nearly 18 cases sufficient information regarding the cause could not be elicited.

**Table No.8: Showing causes of suicide:**

CAUSES OF SUICIDE	NUMBER OF CASES	PERCENTAGE
Economic crisis/ Poverty	618	62.68%
Family Dispute	192	19.47%
Dowry Issues	114	11.56%
Addiction	24	2.44%
Illness	20	2.03%
Not known	18	1.82%

**CAUSES OF SUICIDE**



**Figure 4: Cause of suicide**

**Discussion**

In among the un-natural deaths, suicidal deaths account second leading cause of death next only to

road traffic accidents in a developing country like ours. The increase in the population resulting in lack of job opportunities, frustration in life, chronic diseases / illness, dowry and ill-treatment by husband and in laws, lack of adjustment problems had resulted in enormous number of deaths.

Suicide cases account for nearly 26.54% of cases undergoing autopsy. This is slightly less to the findings of Santosh CS et al<sup>14</sup> who found suicides in nearly 44% of cases autopsied. However the relative large numbers of cases brings fore to the fact that suicide is now an inseparable part of medico legal autopsy.

#### **Age and Sex:**

Most of the victims belong to the age group between 21-30 and 31-40 years which is similar to the studies by Behera A et al<sup>6</sup>, Singh H et al<sup>10</sup>, Meera T et al<sup>11</sup>, Sharija S et al<sup>12</sup> and Vijaykumari N<sup>13</sup>. This can be explained by the fact this age group is the most active and are entrusted with the responsibilities of the family leading to conflicts and economic distress which forces one to end his or her life.

As in our study the highest numbers of cases were observed in the males. Males being the bread winner of the family and many being farmers which is similar to the study conducted by B R Sharma<sup>15</sup> and Kh. Pradipkumar Singh<sup>16</sup>. The higher incidence of males can be attributed to the demographic distribution in the area and also the financial responsibility heaped solely on the male in our society.

#### **Methods of committing suicide:**

In our study the most common method employed to die were poisoning, hanging, burns and drowning in the decreasing order which is similar to the study by Behera A and colleagues, Vikram Patel et. Al<sup>17</sup>. Though the study by S K Dhatarwal<sup>18</sup>, B R Sharma<sup>15</sup>, were similar with regard to poisoning as the leading cause of death, burns was the second leading cause of death in their study. This distribution can be explained by the geographical location of the study area which is agriculture based and hence comes with more number of agriculture poison use. Hanging is easily managed with use of garments and kerosene being commonly used kitchen oil is also used.

#### **Location:**

Maximum number of people who committed suicide was from rural background in our study, which is similar to the study by B R Sharma<sup>15</sup> where many committing suicide were from rural area. This reflects that majority of people still live in villages than the cities.

#### **Economic Status:**

Majority of the victims belonged to lower socioeconomic class in our study. This is similar to the study of Behera A et al<sup>6</sup>. This is due to the fact that economic crisis leads to poor quality of life leading to suicide

#### **Marital Status:**

Majority of the cases in our study were married which is similar to the studies of Behera A et al<sup>6</sup>, Singh H et al<sup>10</sup>, Meera T et al<sup>11</sup>, Sharija S et al<sup>12</sup>, Vijaykumari N<sup>13</sup> and Santosh CS et al<sup>14</sup>. This is due to more responsibility and increases familial conflict among married people.

#### **Profession:**

In our study the highest numbers of cases were observed in farmers by profession followed by housewives and unemployed. In farmers more deaths are due to economic imbalance, insufficient infrastructure, lack of support system to provide assistance and easy availability of pesticides. These findings are not similar to any study due to geographic and demographic variations.

#### **Causes of suicide:**

In our study economic causes, poverty and familial conflicts are the leading causes which are similar to the studies of Behera A et al<sup>6</sup>, Singh H et al<sup>10</sup>, Meera T et al<sup>11</sup>, Sharija S et al<sup>12</sup> and Vijay kumari N<sup>13</sup>. This is also similar to the NRCB data<sup>9</sup>. This finding is relevant as economic instability and indebtedness leads to the person being termed an outcast in the society which leads to suicide. Also Meera T et al<sup>11</sup> mentions illness as another important factor which is not consistent in our study The rising economic costs associated with treatment and insufferable misery leads the person to commit such a step.

## Conclusion

Suicide is an escapist measure taken by a person whose cognitive abilities are completely masked and clouded by confusion and in whom death may appear to be the only immediate certainty upon which he can lay hands on. With the growing menace of this event the challenges lie ahead not only on the individual but also the society as a whole to tackle this problem.

### A few suggestions are made:

- Creation of more employment opportunities for the weaker sections of the society
- Easy availability of credit services for the poor so that they do not have to depend upon moneylenders for credit.
- Cooperation between Government and Non-Government agencies in implementation and awareness of welfare programmes for the poor.
- To understand the need for psychiatric help and proper counselling for people showing signs of self-harm
- To reform the education system this puts a heavy price on marks and not on skill of a person.
- Stringent dowry laws which prevents familial conflict regarding the same.
- Better and vigilant policy of the Government on the sale and storage of pesticides and agriculture poisons.
- Though it is not possible to bring back those lives which are often lost in such a tragic manner but identifying the underlying factors in the social system which promote suicidal tendencies and improving the mental health of the community can certainly prevent such incidence further. As such a multidisciplinary approach is required to prevent the loss of many valuable lives and the recognition of suicide not as an unfortunate event but as a 'social epidemic'

**CONFLICT OF INTEREST:** NONE DECLARED

**SOURCE OF FUNDING:** SELF

**ETHICAL CLEARANCE:** Ethical committee approval obtained from Institutional Ethical Committee, Government Rajaji hospital, Madurai.

Ref No. 00766/IEC/2024-29 dated 05/02/2024

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## A Study on Suicidal Poisoning in a Tribal Area of Mahabubabad, Telangana

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### Abstract

**Background:** Pesticide poisoning kills hundreds of thousands of people in the Asia Pacific region each year. The majority are from deliberate self-poisoning with organophosphorus pesticides (OP), paraquat etc. It is a critical health problem in rural areas, where hazardous pesticides are easily available. Very few studies were present regarding this in India and research on anti-dotes to commonly available pesticides is very minimal. According to WHO report, it is the 2<sup>nd</sup> most common cause of death among people aged 15-29 years.

**Methodology:** An observational study was conducted to study suicidal poisoning cases from Jan-June 2022 in a retrospective record-based manner. Qualitative variables were represented with graphs and tables. Quantitative variables were represented with mean and Standard deviation. Multinomial logistic regression was done to test the significance of poisoning agents with survival status. Nagelkerke R-squared mean regression model was considered in the analysis. p-value less than 0.05 was considered significant.

**Results:** The incidence of suicidal poisoning was 696(~0.46%) during the study period. The mean age of the study population is 32.5±12.3 years. Majority of the cases were Organophosphorus compounds and paraquat comprising a total of about 26.11%. Fatality rate was 17.4% Multinomial logistic regression of various poisoning agents showed high significance of mortality OP poisoning (p=0.03), Paraquat poisoning (p<0.001) and Herbicides (p=0.02).

**Conclusion:** Young populations were more prone to commit suicide suggesting increased recognition of the need for a coordinated response involving public health officials and psychiatric specialists to conduct mental health awareness camps and to provide counselling. Strengthening of translational research to develop anti-dotes for commonly available pesticides.

**Keywords:** deaths, pesticide, poisoning, suicide, tribal

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## Introduction

Poisoning as a means of suicide is not only a health problem but also a social problem in a larger aspect. Verbal autopsies in several rural areas of the country documented that the suicide rates may be five-fold higher compared to the national average.<sup>2</sup> It is a critical health problem in rural areas, where hazardous pesticides are easily available in the home and nearby shops. According to WHO report, it is the 2<sup>nd</sup> most common cause of death among people aged 15-29 years.<sup>3</sup> Although global age-standardized suicidal rates showed an overall decline in the 2019 report, it varies in developing countries with low incomes where there is a considerable incidence of suicidal poisoning.<sup>4</sup> As per the National Crime Record Bureau (NCRB) report of 2021, 164,033 people committed suicide in India, with a rate of 12 per 100,000 population which rose from 11.3 per 100,000 in 2020.<sup>5</sup> Suicide by consuming poison was 25.1% in 2021.<sup>5</sup> Family Problems (other than marriage related problems)' (33.2%), 'Marriage Related Problems (4.8%) and 'Illness' (18.6%) have together accounted for 56.6% of total suicides in the country during the year 2021. The overall male: female ratio of suicide victims was 72.5: 27.5.<sup>5</sup> Many cases go unreported when the attempts become non-fatal. Suicidal methods vary based on social, economic, and cultural backgrounds. Suicide results from complex biological, genetic, psychological, socio-cultural, and environmental interactions.<sup>6</sup> Highly Hazardous Pesticides (HHPs) of World Health Organization (WHO) toxicity classes Ia, Ib, and II - such as the organophosphorus insecticides monocrotophosphorate, and methyl parathion or the herbicide paraquat<sup>7</sup>- have been responsible for most pesticide suicides worldwide over the last five decades.<sup>8,9</sup> Medical treatment of pesticide-poisoned patients is challenging, particularly in tribal areas, where access to healthcare facilities is much lower.

There is very little focus on this social issue by the policymakers in India. Very few studies were done on this topic all over India. Hence, this study was undertaken with the aim to study the suicidal poisoning cases in this region.

**Objectives:** • To study the incidence of suicidal poisoning during the study period. • To assess the mortality rate of various poisoning agents consumed by the subjects.

## Methodology

**Study type:** Observational study

**Study location:** Tribal area of Mahabubabad, Telangana

**Study period:** Jan-June 2022

**Inclusion Criteria:**

- Subjects who committed suicide by means of ingestion of poisoning agents.
- Both males and females

**Exclusion Criteria:**

- Subjects with severe comorbidities including renal, hepatic and cardiac disorders.

**Data collection:** An observational study was conducted in tribal area of Mahabubabad from January to June 2022 in a retrospective record-based manner. As area hospital of Mahabubabad is the only tertiary care centre available in this area, all the poisoning cases are usually admitted here. Hence the incidence of poisoning cases was recorded at this centre. Variables collected included age, sex, type of poisoning and survival status. The poisoning agent was identified and recorded after collecting used bottles from the patient's attender at the time of admission. Thus, collected data was entered in Microsoft Excel (Ms Office 365) and analysed. Qualitative variables were represented with graphs and tables. Quantitative variables were represented with mean and standard deviation. Multinomial logistic regression was done to test the significance of poisoning agents with survival status. Nagelkerke R-squared mean regression model was considered in analysis. p-value less than 0.05 was considered significant. The approval was taken with Rc.No 42/2023 dated 3 November, 2023.

## Results

The incidence of suicidal poisoning was 696 (~0.46%) during the study period. Out of all the 696 subjects, 54.2% were comprised of males and 45.8% were females. Mean age of the study population is 32.5±12.3 years.

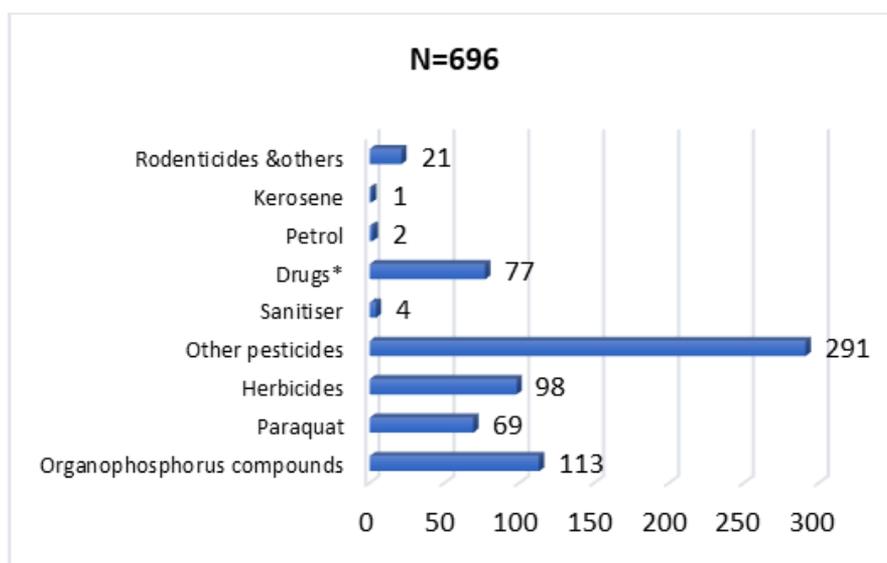
**Table 1: Sociodemographic profile of the study population**

Parameter	(N=696)	In %
<b>Sex</b>		
Male	375	53.9
Female	321	46.1
<b>Age (In Years)</b>		
<15	13	1.9
16-25	229	32.9
26-35	238	34.2
36-45	128	18.4
46-55	53	7.6
56-65	18	2.6
>65	17	2.4
<b>Mean Age</b> <b>32.5±12.3</b>		

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<b>Marital status</b>		
Unmarried	99	14.1
Married	597	85.9
<b>Employment</b>		
Agricultural works	512	73.6
Others	184	26.4

**Table 1** shows the demographic profile of the study subjects. Majority 238 (34.2%) of the subjects were aged between 26-35 years. Subjects aged <15 years were 13(1.9%), 16-25 years were 229(32.9%), 36-45 years were 18.4%, 46-55 were 7.7% and remaining were aged between 55-65 years (18,2.6%) and >65 years (17,2.4%). About 16.2% were unmarried. Majority (73.6%) were working as agricultural labourers.

**Fig 1: Distribution of poisoning agents among the study subjects**

\*Drugs: Paracetamol, Metformin etc

**Fig 1** depicts the type of compounds used for suicide among the study subjects. Majority 291(41.8%) had used various pesticides. Organophosphorus compounds and paraquat comprised a total of about 26.11% with 16.2% of OP poisoning and 9.91% of Paraquat compounds respectively. Suicide by Herbicidal agents were (98,14.08%), Drugs (77,11.1%), Rodenticides (21,3.02%), sanitiser (4,0.57%), petrol (2,0.3%), Kerosene (1,0.14%) and Other were 21(5.9%).

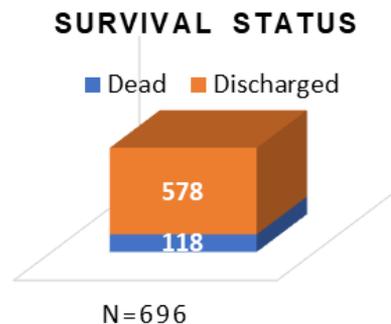
**Fig 2: Survival status of the study subjects**

Fig 2 shows the survival status of the study accounting to 16.9%. subjects. Total 118 died due to suicidal poisoning

**Table 2: Multinomial logistic regression showing survival status with various poisoning agents.**

Agent	Dead(=N)(In%)	Discharged(=N)(In%)	p-value*	Exp(B)
OP	39(5.8)	74(10.9)	0.03	0.256
Paraquat	61(9)	8(1.2)	<0.001	0.022
Herbicides	2(0.3)	96(14.2)	0.02	8
Rodenticides and others	16(2.3)	380(56.3)	~0.08	~3.2
Total	118(17.4)	578(82.6)		

Negelkerke R-Square- 0.551, Survival status 1.00- Dead, 2.00- Discharged---1.00-

\*Multinomial logistic regression was used to test the significance with various poisoning agents

Table 2 shows the survival status of the subjects across various poisoning agents. Fatality was high with Paraquat poisoning (9%) followed by OP compounds (5.8%). Herbicides accounted for 0.3% and mortality with rodenticides and others was 2.3%.

Multinomial logistic regression was used to test the significance of survival status with various poisoning agents. Significant results were obtained for OP poisoning (p=0.03), Paraquat poisoning (p<0.001) and Herbicides(p=0.02). No significant results were observed with other pesticides.

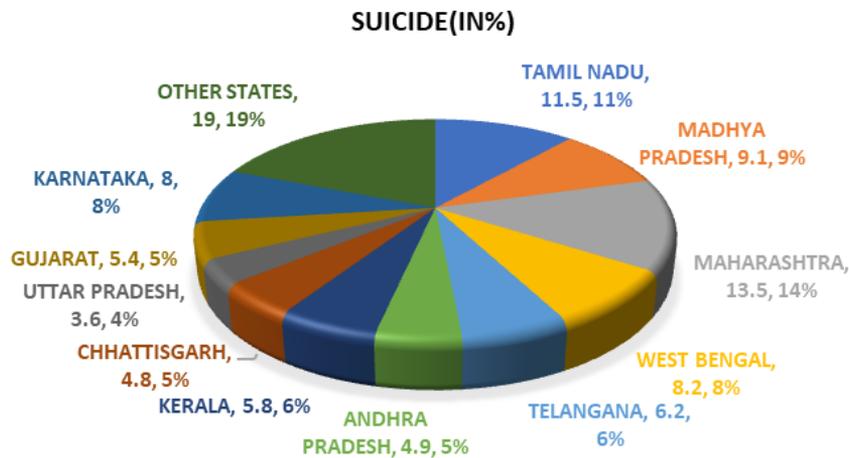
**Discussion**

This study was based on tribal area of Mahabubabad, Telangana. The population was estimated to be 145,679 in 2022.<sup>10</sup> Several Tandas’ (rural settlements) exist in this area.

The present study comprised of 696 cases during the study period.

In the present study, incidence of suicidal poisoning was found to be 696 during the study period. Males comprised of 54.2% and 45.8% were females. The gender disparity was marginal in this study population. Majority 238 (34.2%) of the subjects were of young age between 26-35 years. Mean age of the study population is 32.5±12.3 years. Poisoning is a major problem in young adults who commit suicide mainly due to hardships of life encountered during early adulthood.

As per national Crime records bureau 2021, suicidal rates among various states is depicted below(Fig 5).<sup>5</sup> Majority of suicides had occurred in Maharashtra(13.5%).Telangana contributes to 6.2% of the cases.



**Fig 5: National Crime Records Bureau(NCRB), 2021**

NCRB data indicate that pesticides were used in 441,918 reported suicides in India from 1995 to 2015, 90.3% of which occurred in 11 of the 29 states.<sup>11</sup>

Based on a study in Uttar Pradesh by Narendra et.al., among suicidal poisoning cases ( $n = 98$ ), the most common age group involved was 11-20 years (36.7%) followed by 21-30 years (35.7%), 31-40 years (16.3%) and more than 40 years (11.2%). Majority of the cases were males (59.2%) and the most of them belong to rural areas (58.2%).<sup>12</sup>its socio-demographic profile and its reasons in all admitted cases of suicidal poisoning in hospital.

**Methods:** A cross-sectional study was conducted on cases of poisoning of any age group admitted in the Chhatrapati Shivaji Subharti Hospital, Meerut. Poisoning cases with history or evidence of suicide were further interviewed. A semi-structured interview schedule in Hindi was used to collect data. Microsoft Excel 365 and R software version 3.6.0 were used for data entry and analysis respectively.

**Results:** Among total 135 poisoning cases admitted in hospital, 126 provided consent and included in the study. Prevalence of suicidal poisoning was 77.7% (98

In a retrospective study done by Sharma et.al, a total 505 patient files with poisoning cases were admitted at emergency department. The mean age of the patients was  $28.43 \pm 14$  years. In gender-wise ratio, male patients (59%) were comparatively higher than the females (39%).<sup>13</sup>

In the present study about 16.2% were unmarried. Majority (73.6%) were working as agricultural labourers which makes them easily accessible to various pesticides and other chemicals. Majority 291(41.8%) committed suicide with various pesticides. Organophosphorus compounds and paraquat comprised 16.2% and 9.91% respectively. Suicide by Herbicidal agents were (98,14.08%), Drugs (77,11.1%), sanitiser (4,0.57%), petrol (2,0.3%), Kerosene (1,0.14%) and Other were 21(5.9%). Insecticides and pesticides, which are easily available in this region, enable them to commit suicide in their moments of despair.

In a similar study by Sharma et.al., study, majority of poisoning cases, 310 (61.38%) consumed organophosphorus compound (OPC), whereas other cases used medicinal (4.14%), corrosive (4.14%), phenol (3.16%), chemicals (1.98%), kerosene (1.58%),

alcohol (1.38%), plants (1.38%).<sup>13</sup> In a study by Tanuj Kanchan on suicidal poisoning in Southern India, preference for organophosphates was relatively more in males when compared to females, who preferred zinc phosphide, carbamates and medicinal agents.<sup>14</sup> In another study by Chaudari et.al, the most common poison used was organophosphates (48.7%).<sup>15</sup>

Pooled analysis of studies in Indian population from 2010-2020 revealed that pesticides were the main cause of poisoning in adults, with an incidence of 63% (63%-64%)(95% C.I). Also, a forensic toxicology analysis on 674 cases of self-poisoning suicidal deaths in Iran between 2011-2015, the most often used suicide method was self-poisoning with pesticide (aluminium phosphide tablets,91.8%) followed by opioids(5.7%), methamphetamine(3.1%), cyanide(2.5%) and strychnine(1.5%) and organophosphates (0.2%).

According to University of Bristol study on highly hazardous pesticide self-poisoning in India, 1-in-4 suicides occur in India and about 30% of these deaths are by pesticide ingestion -the state of Maharashtra had the most suicide deaths in 2021.<sup>16</sup>

In India about 70% population belong to rural areas<sup>17</sup> where, agriculture is the main livelihood and hence accessibility and availability to these pesticides is very high.

In the present study, total 118 cases died due to suicidal poisoning accounting to 17.4%. The case fatality rate was high with Paraquat poisoning (9%) followed by OP compounds (5.8%). Herbicides accounted to 0.3% and mortality with rodenticides (and others) was 2.3%. Multinomial logistic regression of various poisoning agents showed high significance of mortality OP poisoning ( $p=0.03$ ), Paraquat poisoning ( $p<0.001$ ) and Herbicides ( $p=0.02$ ). This is attributed to the high toxicity of the compounds as well as non-availability of specific anti-dote with respect to paraquat and herbicidal poisoning.

In a study by Sharma et.al., the average stay in the hospital was  $12.53 \pm 7.53$  days and mortality rate was 8.31%.<sup>13</sup> In Chatterjee et.al, study conducted in West Bengal, 93.19% of poisoning cases were attributed to suicide. Corrosives constituted 13.68% of the acute poisoning cases and pesticides constituted 12.16% of the total cases. In Faisal et.al., study on suicide attempts by poisoning, the most consumed agents

were acetaminophen in 59 (45.83%) and non-steroidal anti-inflammatory drugs (NSAIDs) in 22 (16.92%). The ICU admission rate was 8.5% (n=11).

In a systematic review on lethal poisoning conducted between 1999-2018 by Ayanthi et.al., deaths due to pesticide poisoning (94.5%) were dominant across the study period compared to other classes of poison [hair dye paraphenylenediamine poisoning (2.6%), medicine overdose (1.4%) or plant poisoning (1.0%)]. In Chatterjee et.al., study, the mortality rate was 16.05% and 34.72% respectively in corrosives and pesticide poisoning respectively. Univariate analysis of mortality in pesticide poisoning cases indicated that delay in getting primary care increased mortality. In Anuradha et.al., study, Of the 46 who died from self-poisoning, 78.3% had taken pesticides and 19.7% had eaten poisonous plants.<sup>18</sup> In systematic review (1999-2018) by Ayanthi et.al., among the pesticides, aluminium phosphide was the most important lethal poison during the first 10 years before declining markedly.<sup>19</sup> In a study conducted in Poland by Anna et.al., from 1999-2020, out of 14,660 self-poisoning suicide attempts, there were 2258 cases of deaths during the study period.<sup>20</sup>

According to Bose et.al., eighty percent of the self-poisoning cases obtained the poisonous substance in or in close proximity to the home, highlighting the importance of safe storage in the domestic environment.<sup>18</sup>

### Strengths and Limitations of the study:

The strengths of this study includes sample size, which is large and regression analysis was done which reduces the confounding effect.

The retrospective nature may have excluded few cases who died and couldn't make it to hospital. This may have introduced selection bias.

As it's a record-based study, the precise situation of this region might be known, and external validity might be a limitation in this study.

### Conclusion

Despite a moderate decline in suicide rate over the last 20 years, India still has a large burden of suicide.<sup>21</sup> Pesticides are frequently used as a method

of suicide - the nationally representative Million Death Study estimated that the rate of death by self-poisoning was 7.9 per 100,000 per year for women and 13.8 per 100,000 per year for men, with pesticides used in the majority of these.<sup>22</sup>

As majority of the population depends on agriculture as livelihood in this rural set-up and due to high availability and accessibility to various pesticides the subjects commit suicide in their moments of despair. New preventative strategies are therefore greatly needed.

Young populations are more prone to commit suicide. The current response from a public health, medical and research point of view is inadequate.<sup>1</sup> Increasing recognition of the need for a coordinated response involving public health officials and psychiatric specialists to conduct mental health awareness camps and to provide counselling is very much essential.

Strengthening of translational research as the human toxicity of pesticides is poorly studied. There is dire need to develop anti-dotes to commonly available pesticides to help improvement in diagnosis and treatment.

Strict enforcement of laws is much needed to prevent suicides in this area.

Political commitment is necessary and suicidal prevention policies should be framed.

**Ethical Clearance:** The Ethical approval was taken from Office of Principal, Government Medical College, Mahabubabad with Rc.No 42/2023 dated 3 November, 2023.

**Conflicts of interest:** None

**Funding:** NIL

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# A Prospective Study of Gunshot Injuries among the Patients Admitted to the Emergency Department

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## Abstract

**Background:** Increased incidence of firearm injuries in developing countries has been attributed to poverty, unemployment, political instability, lack of education and unequal distribution of wealth. It is one of the important causes of morbidity and mortality in our country.

**Material and methods:** This prospective study was conducted at Jawaharlal Nehru Medical College Hospital, AMU, Aligarh in the department of Forensic Medicine and in the Trauma and Emergency department between October 2018 to September 2020. 130 patients of Gunshot injuries were included after obtaining informed consent.

**Results:** Males (n=115; 88.46 %) were the predominant victims of gunshot injuries while female patients comprise of 11.54 % (n=15) only. Male to female ratio was 7.67:1. Majority (n=115; 88.46 %) of the gunshot injury cases were the result of homicidal motive. Lower (n=50; 35.46 %) and upper extremities (n=41; 31.53 %) were the most common sites of injury.

**Conclusion:** There is a need to decrease the number of firearms used and sold in India. We need to eradicate illicit local community gun manufacturing units.

**Keywords:** Gunshot, Country made Guns, Illegal Weapons

## Introduction

Firearm injury is one of the important causes of morbidity and mortality in our country. There has been a continuous increase in the incidence of these injuries in recent years because of an ease

of availability of illegal sophisticated modern and country made guns and ammunition nowadays in the illegal market. In 2016, India officially reported total national firearm murder cases 3775 (12.39%) out of 30450 homicidal deaths which was around 10.5 % in 2015.<sup>1</sup>

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Incidences of interpersonal violence, dacoity, robberies, terrorism, have shown to adopt these new weapon as a choice as they are small, lethal and handy to use from a distance. Accidental shooting deaths from people firing guns into the air have become so common at weddings in the National Capital Region (NCR) area that firearms have been banned by some villages in the region at marriage celebrations. Prohibition or restriction by the government's law enforcement agencies find it difficult to curb these weapons.

According to statistical data of National Crime Record Bureau, number of victim murdered by firearm during 2014 in India were 3655, out of which 540 killed by licensed firearm and 3115 killed by unlicensed firearm. In 2016, a total of 3775 victims were murdered by using firearm weapons out of which 3453 were non licensed weapons.<sup>1</sup>

Increased incidence of firearm injuries in developing countries has been attributed to poverty, unemployment, political instability, lack of education and unequal distribution of wealth.<sup>2</sup> Easier availability of handguns and rifles is rising and as a result there is a rise in gunshot wound victims seen at hospitals.<sup>3</sup>

Examination of the victim of firearm injuries need to ascertain the characteristics of entry wound such as muzzle imprint, burning, smudging, tattooing or stippling and the collar of abrasion. The exit wound will not show these characteristics, except the everted margins of different sizes. With the above background knowledge of firearm injuries and its consequences on the patient and society, the present study was conducted to study the present state of patients presenting with gunshot injuries reporting at Jawaharlal Nehru Medical College, Aligarh Muslim University, Aligarh and to study the impact on healthcare system and the society at large.

## Material and Methods

This prospective study was conducted at Jawaharlal Nehru Medical College Hospital, AMU, Aligarh in the department of Forensic Medicine and in the Trauma and Emergency department between October 2018 to September 2020. Written consent was taken from the victim or family member for inclusion in the study. Medicolegal details were recorded as per the prepared proforma which included name, age, gender, address, qualification, history of the incident including details of assailant, act and weapon; vitals, GCS score and brief systemic examination findings; Site, type, size of the gunshot wounds along with other features were noted

### Inclusion Criteria

1. Patients or his/her relatives giving informed Consent for inclusion in the study.
2. Patients of all age groups.
3. Patients with gunshot wounds in any part of the body.

### Exclusion Criteria

1. Patient or his/her relatives not giving consent for inclusion in the study.
2. Patients brought dead to the Casualty.
3. Patients of trauma without gunshot injury.

## Results

This prospective study was carried out at Jawaharlal Nehru Medical College hospital, Aligarh Muslim University, Aligarh from October 2018 to September 2020. 130 patients of Gunshot injuries were included after obtaining informed consent. These patients presented to Emergency department of JNMCH for treatment during the study period.

**Table 1: Distribution of patients on the basis of age and sex**

Age Group	Males	Females	Total	Percentage
0-10 Yrs	3	0	3	2.30%
11-20 Yrs	16	4	20	15.38%
21-30 Yrs	37	2	39	30%
31-40 Yrs	32	4	36	27.69%
41-50 Yrs	17	3	20	15.38%

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51-60 Yrs	8	1	9	6.92%
61-70 Yrs	1	1	2	1.53%
> 70 Yrs	1	0	1	0.76%
Total	115 (88.46 %)	15 (11.53 %)	130	100

Table 1 shows the distribution of patients of gunshot injuries on the basis of age and sex. Age of the patients ranges from 2½ to 75 years. Peak incidence was observed in age group 21-30 years comprising of 30 % (n=39) of the patients. 27.79 % (n=36) of the patients were in 31-40 years age group. Next common age groups were 11-20 years and 41-50 years comprising of 15.38 % (n=20) patients each. There was only 1 patient (0.76 %) in >70 years age group. Mean age for gunshot victim was 32.16 ±12.85 years. Males (n=115; 88.46 %) were the predominant victims of gunshot injuries while female patients comprise of 11.54 % (n=15) only. Male to female ratio was 7.67:1.

**Table 2: Distribution of patients on the basis of educational status**

Educational status	No. of patients (n=130)	Percentage
Illiterate	4	3.07%
Primary school	12	9.23%
Middle school	30	23.07%
High school	27	20.76%
Intermediate/ diploma	27	20.76%
Non-professional graduates	25	19.23%
Professional graduates	4	3.07%
Above graduate	1	0.76%

Table 2 shows that maximum number (n=30; 23.07%) of victims were having middle school qualification. Number of victims having high school and intermediate qualification were 27 (20.76 %). 22.30 % (n=29) of the victims were having graduate level qualification out of which 4 patients (3.07 %) were having professional qualification (B.tech, BBA, BCA, etc). Twelve (9.23 %) patients were having primary school qualification. Least number of victims were of illiterate class (n=4; 3.07 %) and above graduate class (n=1; 0.76 %).

**Table 3: Distribution of patients on the basis of motive of gunshot injury**

Motive of injury	No. of patients (n=130)	Percentage
Homicidal	115	88.46%
Accidental	7	5.38%
Suicidal/Self inflicted	1	0.76%
Caught in cross firing	4	3.07%
Not known	3	2.30%

Table 3 show that majority (n=115; 88.46%) of the gunshot injury cases were the result of homicidal motive. In 7 (5.38 %) cases, there was no motive to cause injury but injury was caused due to accident (mishandling, party fire). Four (3.07 %) patients were caught in cross firing and sustained gunshot injuries. In one (0.76 %) case, patient inflicted gunshot injury to himself. In 3 cases, motive was not known.

**Table 4: Distribution of patients on the basis of ammunition**

Ammunition	No. of patients (n=130)	Percentage
Bullet (Rifled)	103	80%
Pellets (Shotgun)	26	19.23%
Airgun	1	0.76%

Table 4 show the distribution of patients on the basis of ammunition used to cause the injury. In 80 % (n=103) of the cases, it was bullet that caused the gunshot injury and hence rifled firearm might have been used to fire the bullet. In 26 (19.23 %) cases, gunshot injury was caused by pellets fired from a shotgun firearm. In one (0.76 %) case, it was an airgun pellet that caused the injury to a boy while playing with friends.

**Table 5: Distribution of patients on the basis of number of entry and exit wounds**

Number of entry & exit wounds	No. of patients	Percentage
Single entry wound (Bullet)	96	73.84 %
Double entry wounds (Bullet)	2	1.53 %
Multiple pellets entries	26	20 %
Single pellet entry	1	0.76 %
Graze	5	3.84 %
No exit wound	75	57.69 %
Single exit wound	49	37.69 %

Table 5 show the distribution of patients on the basis of number of entry and exit wounds. In 96 patients (73.84 %), there was a single entry wound. In two cases (1.53 %), 2 entry wounds were identified. In 26 cases (20 %), there were multiple pellet entries. In 5 cases (3.84 %), a graze wound was identified which was caused by the passage of bullet tangential to the skin. In one case (0.76 %), only one pellet was found that was fired from an airgun. In 49 cases (37.69 %), there was one exit wound while in 75 cases (57.69 %) there was no exit wound. In one case (0.76 %), there were more than one exit wounds.

**Table 6: Distribution of wounds on the basis of features of entry wound**

Features of entry wound	No. of wounds (n=105)	Percentage
Muzzle impression	0	0 %
Burning	5	4.76 %
Blackening	11	10.47 %
Tattooing	35	33.3 %
Abrasion collar	27	25.7 %
No feature	52	49.5 %

Out of the total 105 bullet wounds (100 entry wounds plus 5 graze wounds), there were 35 wounds (33.3%) in which tattooing was seen. Blackening was seen in 11 entry wounds (10.47%) and Burning was seen in 5 entry wounds (4.76%). Muzzle impression was not found in any of the entry wound which means that there was no patient in which shot was fired with gun in contact with the skin. Abrasion collar was seen in 27 entry wounds (25.7%). In remaining 52 entry

wounds (49.5%) there was none of these features was present as depicted in table 6.

**Table 7: Distribution of patients on the basis of site of injury**

Site of injury	No. of patients (n=130)	Percentage
Head, Face and Neck	12	9.23%
Chest	19	14.61%
Abdomen	20	15.38%
Upper extremity	41	31.53%
Lower extremity	50	38.46%
Back	12	9.23%
Multiple sites	18	13.84%

Table 7 show that lower (n=50; 35.46 %) and upper extremities (n=41; 31.53 %) were the most common sites of injury. Next most commonly injured sites were abdomen (n=20; 15.38 %) and chest (n=19; 14.61 %). Injury to multiple sites was seen in 18 (13.84 %) cases while injury to Head, neck, face (n=12; 9.23 %) and back (n=12; 9.23 %) was least commonly seen.

**Table 8: Distribution of patients on the basis of final outcome**

Final outcome	No. of patients	Percentage
Discharge	126	96.90%
Death	3	2.31%
Referred	1	0.76%

Table 8 shows the distribution of patients on the basis of final outcome. 126 patients (96.9 %) were discharged after treatment in the hospital. One patient (0.76 %) was referred to higher centre while 3 patients (2.31 %) died during their treatment in the hospital.

## Discussion

Firearm injuries are commonly encountered and are a major health problem that severely affects the criminal justice and health-care systems. Violence is among the leading causes of death worldwide. Young males are the usual victims. Loss of the country's youth results in loss of energetic workforce posing a great economic burden on the society and economy.

Our study showed that majority of the victims were males (88.46 %). In other studies, the males affected were in the similar range.<sup>4,5</sup> In our study, the victims between 21-40 years were found to be most commonly victimized. It is consistent with most of the studies conducted in India and other parts of the world.<sup>6,7,8</sup> The youngest victim of the present study was a child of 2½ years and the oldest victim was of 75 years of age. The finding of high proportion of firearm related injuries among males could be due to their gender role which compel them to be more exposed to the outside environment than females. They are more often involved in interpersonal violence and are perpetrators of civil conflicts.

Throughout the world, the motive is homicidal in majority of cases of gunshot injuries. In our study also, in majority of cases (88.46 %), the motive was homicidal followed by accidental (5.36 %) and suicidal (0.76 %). Our results regarding suicide are in contrast with the studies done in developed countries by Natthida Owattanapanich et al<sup>9</sup> in US(2020)- 17 %. In India also, cities like Mumbai<sup>7</sup> and Pune<sup>5</sup> have a higher suicide rate by firearms.

The incidence of homicidal injuries in our region is due to uncontrolled use of unlicensed, country made guns, which are cheap, easily available.<sup>4</sup> In our study, suicide is less common because people tend to use other methods such as hanging and poisoning which are easily available.<sup>4</sup> Incidence of suicide by firearm is more in developed countries where guns are freely available and cause instantaneous death without much suffering. In USA, guns can be purchased from the super markets. There is gun culture in some developed countries resulting in high homicide and suicide rate using guns.

In our study there was only one patient who was 25 year male who shot himself on his hand resulting in self-inflicted injury. These are generally because of personal or social issues. In 4 (3.07 %) out of 7 cases of accidental gunshot injuries, incident happened during a party while in 2 cases (1.53 %), accident happened by mishandling of firearm. In one case, accident happened among playing children when a child accidentally shot other by airgun. In our study there were 4 cases (3.07 %) of gunshot injuries in which victim was caught in cross firing between two parties.

We observed in our study that in 80 % of the cases, it was bullet that caused the gunshot injury and hence rifled firearm might have been used to fire the bullet while in 26 (19.23 %) cases, gunshot injury was caused by pellets fired from a shotgun firearm and in one (0.76 %) case, it was an airgun pellet that caused the injury to a boy while playing with friends. Our results are at variance with those of Sangeeta Kumari et al<sup>10</sup> who reported that Shotgun injuries were 60% and rifled firearm injuries in 36.67% and Shailendra Pal Singh et al<sup>4</sup> observed shotgun injuries in 84.5% and rifled firearm injuries in 13.6% cases.

In our study, we observed that in 96 patients (73.84 %), there was a single entry wound. There were two cases (1.53 %) in which two entry wounds were identified. In 26 cases (20 %), there were multiple pellet entries. In 5 cases (3.84 %), a graze wound was identified. In one case (0.76 %), there was only one pellet entry wound was found that was fired from an airgun. In 49 cases (37.69 %), there was one exit wound while in 75 cases (57.69 %) there was no exit wound. In one case (0.76 %), there were more than one exit wounds. Our results are in consistency with those of Sangeeta Kumari et al<sup>10</sup> (Single entry- 74.6 %, double entry- 6.8 %, multiple entries- 18.6 %). Our observations are not consistent with M Bapin Kumar et al<sup>6</sup> (Single entry-30.94 %, double entries- 16.98 % and multiple entries 52.08 %). In 57.69 % of the patients in our study, there was no exit wound. This might be because of the use of country made firearms by the assailants which are generally low velocity firearms.

In our study, muzzle impression was not found in any of the entry wounds which means that there was no patient in which shot was fired with gun in contact with the skin. Burning was seen in 5 (4.76 %) entry wounds and hence these were probably the near contact shots. Blackening was seen in 11 (10.47 %) entry wounds and therefore these were the close range shots. We observed that there were 35 (33.3 %) wounds in which tattooing was seen and hence these were probably near range shots. In remaining 52 (49.5 %) entry wounds none of these features was present. So in majority of the cases, shot was fired from a distance from the victim. These observations may direct us toward the intention of the assailant which might have been either just fire and run or fire from hidden places in majority of the cases.

In our study it was found that lower (n=50; 35.46 %) and upper extremities (n=41; 31.53 %) were the most common sites of injury. Next most commonly injured sites were abdomen (n=20; 15.38 %) and chest (n=19; 14.61 %). Our results are in agreement with other authors.<sup>11-14</sup>

Shailendra Pal singh et al<sup>4</sup> reported that trunk (34.8%), lower extremity (32.6%) and upper extremity (21.7%) were the most common sites. In our study, as most common sites were upper and lower limbs, hence it can be concluded that the either the assailants were not trained shooters or the intention of the assailant was not to kill. Rather the assailant might have fired the shot in the heat of the moment. This behaviour can be attributed to the availability of illegal and country made cheap firearms in our region.

### Conclusion

Our study proves that gunshot injuries are a risk to life and society. There is a need to decrease the number of firearms used and sold in India. We need to eradicate illicit local community gun manufacturing units. It is obvious that private gun ownership should be strictly limited and the illegal availability should be prevented. Elimination of these illegal country made firearms is of utmost importance in order to curb the homicidal firearm mortality and morbidity rate. Further, display and firing of firearms in marriages and parties should be strictly banned and persons indulging in such activities should be punished under relevant sections of Indian Penal Code.

**Ethical Clearance:** Taken from Institutional Ethical Committee (No. 255/FM dated 24/02/2021)

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# Permanent Teeth Eruption Pattern in the Age Group of 5 to 15 Years: A Cross-Sectional Study in Southern India

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## Abstract

**Introduction:** Age estimation plays a vital role in various medico legal cases including both civil and criminal litigations. Assessment of age of an individual by examination of teeth is one of the universally accepted methods of age estimation. In the present study we observed the patterns of dental eruption in Coimbatore. In this study we considered the eruption pattern of all permanent teeth (Molar 1 teeth, Central Incisor teeth, Lateral Incisor teeth, Pre Molar 1, Pre Molar 2, Canine and Molar 2).

**Material and Methods:** The present study was a community based cross sectional study conducted in C.R.R. Matric Higher Secondary School, Ondipudur. C.R.R. Mat.Hr.Sec. School (CMHSS) located at Coimbatore S.S. Kulam, Ondipudur, The study was conducted among 1000 study participants

**Results:** The mean age for complete eruption of the first molar teeth and central incisor was observed to be between 75.9 to 77.9 months and 80.8 to 84 months respectively. Lateral Incisor teeth was completely erupted among all the study participants aged between 105.2 and 107.4 months of age. The mean age for complete eruption of the first premolar was observed to be between 109.58 to 112.6 months. The mean age for complete eruption of the second pre molar was observed to be between 131.0 to 133.8 months. Complete eruption of Canine and second molar was observed to be between 142.6 to 144.8 months and 174.5 - 178.6 months of age respectively.

**Conclusion:** First Pre Molar, Second Pre Molar, Canine and the second molar appears to be earlier on left side as compared to the right side. The eruption of the second molar tooth was significantly earlier in the female study participants as compared to the male study participants. The dental eruption patterns should be studied in detail to assess the role of various associated factors like nutrition, oral hygiene.

**Keywords:** Age estimation, Dental eruption, Forensic odontology, Forensic dentistry

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## Introduction

Forensic odontology or Forensic dentistry, a relatively young branch of forensic medicine deals with the science of dentistry to aid in the administration of justice. Eruption of teeth is not always bilaterally symmetrical in both halves of the jaw. Assessment of age of an individual by examination of teeth is one of the universally accepted methods of age estimation. The teeth eruption time may differ in upper and lower jaw. There are variations among eruption of teeth among both genders like the eruption of teeth is earlier in females as compared to males. Males have larger tooth than females. The first primary teeth to erupt are usually the lower central incisors, premolar and molar erupt one year earlier than upper jaw.<sup>1-6</sup>

Dental eruptions are especially useful in determining the age of the children. The appearance of permanent teeth is especially useful in narrowing the age of the individual. Other obvious anthropometric indicators like height and weight can also narrow down the age group the individual may belong to but it cannot be decisive.<sup>7</sup>

The assessment of age of an individual can be done by examining the oral cavity for the appearance of various dental markers. This can be done by examination of the oral cavity clinically and by using radiological images of the teeth. Examination of the oral cavity is used to identify the age of the individual based on the eruption stage of teeth. While the radiological examination requires a level of skill, manpower and financial resources, the examination of the oral cavity is a cost effective alternative especially in a developing countries like India. However, clinical examination of the oral cavity should be used along with other indicators like physical development, pubertal and age related changes hence, while estimating the age, sum total of all these factors should be taken into consideration.<sup>9-10</sup>

The present study was undertaken to provide a baseline data source on the patterns of dental eruption in Coimbatore. The eruption pattern of all permanent teeth (Molar 1 teeth, Central Incisor teeth, Lateral Incisor teeth, Pre Molar 1, Pre Molar 2, Canine and Molar 2) was observed.

## Materials and Methods

The present study was a Community Based Cross Sectional study C.R.R. Matric Higher Secondary School, Ondipudur. C.R.R. Mat.Hr.Sec. School (CMHSS) located at Coimbatore S.S.Kulam. The present study included all the 1000 students. Simple Random Sampling was used to select the study participants. Approval for the study was obtained from the Institutional Ethics Committee of Coimbatore Medical College and Hospital ((Regd. No.ECR/892/Inst/TN/2016) dated 29.01.2019). Written informed consent was obtained from the parents and local guardians of the students. Individual assent was obtained from all the children who participated in the study. The data was entered and analyzed by using Statistical Package for Social Sciences (SPSS) (version 21.0) software package. A p value of less than 0.05 was considered to be statistically significant. Microsoft Excel was used to generate graphs, charts.

## Study Procedure

After obtaining informed consent from the parents and assent from the children, socio-demographic details was collected. The students were divided according to their completed months of age as completed 72months, 84months, 96months, 108months, 120months, 132months, 144months, 156 months, 168 months, 180 months. A detailed dental assessment was done for all the students with the help of an experienced dental surgeon. The oral cavity is examined with the help of a torch light and a dental mirror while the study participant's mouth was held wide open using a tongue depressor. The dental chart was used to record information regarding the number of teeth erupted and stage of eruption that was observed and recorded. Dental charting is done according to Modified F.D.I (Federation Dentaire Internationale) system.

The stages of tooth eruption are done in the following manner. Stage 0: Fall out of primary tooth and non-eruption of permanent tooth. Stage 1: Crown Tip of tooth penetrated the gum margin (positive clinical eruption). Stage 2: Crown in oral cavity beyond gum margins but not reached occlusal plane. Stage 3: Occlusal surface is in contact with its counterpart and the bite complete. In the present study Stage 0 was considered as not erupted, Stage 1

& 2 were considered as not completely erupted and Stage 3 as erupted

## Results

### Distribution of Eruption status and sites of teeth:

#### Molar 1 teeth:

We observed that the molar 1 teeth was completely erupted in more than 90% of subjects in all jaws at the expected age. The percentage of participants with incomplete eruption was (10.6%) except left upper jaw (7.5%) and tooth was not erupted 2.1% of the study participants in the left upper jaw.

#### Central Incisor teeth:

All the study participants had complete eruption in all jaws, right upper (90%) left upper (92.8%) right lower (88.4%) left lower (93%) at expected age group and not completely erupted in right upper (9.1%) left upper (6.6%) right lower (11.8%) left lower (6.8%) and those with not erupted subjects were observed in 1.2 % of the right and left upper jaws respectively of the study participants.

#### Lateral Incisor teeth:

We found that almost all the study participants had complete eruption in all jaws, right upper (98%) left upper (98.5%) right lower (100%) left lower (100%) at expected age group and not completely erupted in right upper (1.4 %) left upper (1.5%) and those with not erupted subjects were observed in 0.6 % of the right upper jaw of the study participants.

#### Pre Molar 1

The eruption patterns of the Pre Molar 1 of right upper (81.3 %) and left upper jaws (85.5%) was completely erupted in more than 80% of subjects. The same of right lower and left lower jaws were 91.3% and 96.4% respectively at expected age group. In the right upper and left upper jaws incomplete erupted Pre Molar 1 was seen in less than 15% of the study participants. Those with no eruption was seen in less than 5% of the study participants.

#### Pre Molar 2:

The eruption patterns of the Pre Molar 2 of right upper and left upper jaws was completely erupted in more than 87.8% of subjects. The tooth

was completely erupted in right lower and left lower jaws was 94.6% & 95.4% respectively at the expected age group. In the right upper and left upper jaws incomplete erupted pre molar 2 was seen in less than 8.6% of the study participants in the right upper and left upper jaws. In the right lower and left lower jaws incomplete eruption was seen in 3.6% of the study participants. Those with no eruption was seen in less than 3.6% of the study participants in the right upper and left upper jaws and 2.3% and 0.8 % respectively.

#### Canine:

The eruption patterns of the canine teeth of right upper and left upper jaws was completely erupted in 90% of subjects. The completely erupted tooth in right lower and left lower jaws was 96.9% & 97.2% respectively at the expected age group. In the right upper and left upper jaws incomplete erupted canine was seen in 6.2% and 7.6% respectively. In the right lower and left lower jaws incomplete eruption was seen in 3.1% and 2.8% of the study participants. Those with no eruption was 3.1% and 1.6% in the right upper and left upper jaws.

#### Molar 2:

The eruption patterns of the second molar teeth of right upper and left upper jaws was completely erupted in 67.1% and 64.4% of the study participants respectively. The completely erupted tooth in right lower and left lower jaws was 73.8% & 78.9% respectively at the expected age group. In the right upper and left upper jaws incomplete erupted second molar was seen in 9.4% and 14.8% respectively. In the right lower and left lower jaws incomplete eruption was seen in 13.6% and 8.5% of the study participants. Those with no eruption was 23.5% and 20.8% respectively in the right upper and left upper jaws. In the right and left lower jaws no eruption was seen in 12.6% of the students.

### Comparison of eruption of teeth of right and left sides of upper and lower quadrants

We observed that among the eruption pattern of the lateral incisors, the right lower tooth had developed significantly earlier ( $p=0.01$ ) as compared to its counterparts. The complete eruption of the first pre molar was significantly earlier on the left side of both upper ( $p=0.01$ ) and lower jaws ( $p=0.01$ )

as compared to the right side. The eruption of the second premolar was significantly ( $p=0.02$ ) earlier on the left lower jaw as compared to its counterparts. Complete eruption of Canine tooth was significantly earlier in the left side of both the upper and lower jaws. Complete eruption of left lower second molar was significantly earlier ( $p=0.001$ )

#### Comparison of eruption of teeth between genders

We observed no significant variations in the

mean age for eruption pattern of first molar, central incisor, lateral incisor, first pre molar, second pre molar and canine among both genders. Though age differences were variable there was no noted statistical significance among both genders in the time taken for complete eruption of the aforementioned teeth. We also found that the development of the second molar was significantly earlier among females as compared to males.

**Table 1: Age and gender distribution of the study participants**

Age in months	Male (n=557)	Female (n=443)	Total (n=1000)
Completed 72 months	32	28	60
Completed 84 months	30	20	50
Completed 96 months	62	58	120
Completed 108 months	59	41	100
Completed 120 months	41	49	90
Completed 132 months	69	41	110
Completed 144 months	73	57	130
Completed 156 months	49	41	90
Completed 168 months	126	94	220
Completed 180 months	16	14	30

**Table 2 Distribution of Eruption status and sites of teeth (n = 1000)**

Teeth	Side of Teeth	Status Of Eruption		
		Complete (%)	Not complete n (%)	Not erupted n (%)
Molar - 1 (72months) n=60	Right Upper	54 (90.4)	6 (10.6)	0
	Left Upper	54 (90.4)	5 (8.8)	1 (2.1)
	Right Lower	54 (90.4)	6 (10.6)	0
	Left Lower	54 (90.4)	6 (10.6)	0
Central Incisor (96months) n=120	Right Upper	108 (90)	11 (8.8)	1 (1.2)
	Left Upper	111 (92.4)	8 (6.4)	1 (1.2)
	Right Lower	106 (88.4)	14 (11.6)	0
	Left Lower	112 (93)	8 (6.8)	0
Lateral Incisor (108months) n=100	Right Upper	98 (98)	1 (1.4)	1 (0.6)
	Left Upper	98 (98.5)	2 (1.5)	0
	Right Lower	100 (100)	0	0
	Left Lower	100 (100)	0	0
Pre Molar - 1 (132months) n=110	Right Upper	89 (81.3)	16 (14.6)	5 (4.1)
	Left Upper	94 (85.5)	11 (10.4)	5 (4.1)
	Right Lower	100 (91.3)	7 (5.6)	3 (3.1)
	Left Lower	106 (96.4)	4 (3.6)	0

Continue.....

Pre Molar - 2 (144 months) n=130	Right Upper	114 (87.6)	11 (8.6)	5 (3.8)
	Left Upper	114 (87.6)	11 (8.6)	5 (3.8)
	Right Lower	123 (94.6)	4 (3.1)	3 (2.3)
	Left Lower	124 (95.4)	5 (3.8)	1 (0.8)
Canine (144months) n=130	Right Upper	118 (90.7)	8 (6.2)	4 (3.1)
	Left Upper	118 (90.8)	10 (7.6)	2 (1.6)
	Right Lower	126 (96.9)	4 (3.1)	0
	Left Lower	126 (97.2)	4 (2.8)	0
Molar - 2 (168months) n=221	Right Upper	148 (67.1)	21 (9.4)	52 (23.5)
	Left Upper	142 (64.4)	33 (14.8)	46 (20.8)
	Right Lower	163 (73.8)	30 (13.6)	28 (12.6)
	Left Lower	174 (78.9)	19 (8.5)	28 (12.6)

Table 3 Comparison of eruption of teeth between right &amp; left upper &amp; lower jaws

Teeth	Upper jaw				Lower jaw			
	Right	Left	Test of Significance Z ; p value		Right	Left	Test of Significance Z ; p value*	
Molar - 1	89.4	89.4	0.00	1.00	89.4	89.4	0.00	1.00
Central Incisor	89.2	92.8	0.229	0.07	88.0	92.8	0.00	1.00
Lateral Incisor	97.5	98.1	1.987	0.01	100.0	100.0	1.733	0.07
Pre Molar - 1	80.7	84.3	2.818	0.01	90.9	96.8	4.236	0.01
Pre Molar - 2	87.8	87.8	1.773	0.08	94.2	95.7	2.286	0.02
Canine	89.8	90.3	2.722	0.01	97.2	97.7	2.834	0.01
Molar - 2	66.8	63.9	1.757	0.07	73.8	78.4	3.691	0.001

\*p value less than 0.05 was considered to be statistically significant

Table 4 Comparison of eruption of teeth between genders

Teeth	Male		Female		Mean Difference	Test of Significance	
	Mean± S.D (months)		Mean ± S.D (months)			" t "	p value*
Molar - 1	76.6	2.4	76.9	2.9	0.3	0.345	0.07
Central Incisor	82.3	6.6	81.8	6.5	0.5	0.377	0.06
Lateral Incisor	106.4	6.4	106.0	6.6	0.4	0.418	0.06
Pre Molar - 1	110.8	9.7	111.8	10.4	1.0	0.756	0.06
Pre Molar - 2	132.8	6.5	130.6	6.9	2.1	1.92	0.08
Canine	143.6	6.7	143.7	6.4	0.1	0.149	0.008
Molar - 2	174.1	5.0	169.1	20.9	5.0	6.889	0.001

\*p value less than 0.05 was considered to be statistically significant

### Discussion

The present study was a community based cross-sectional study undertaken to study eruption patterns of permanent teeth among school going children in Coimbatore. The study involved 1000 participants aged between 5 and 15 years.

The first molar teeth was the initial permanent teeth to erupt, this finding is in line with various anatomy, dental and forensic texts which emphasize the same. We observed that the first molar teeth was completely erupted between 75.9 to 77.9 months. These findings are similar to the findings from various studies that have shown that the complete eruption of first molar teeth occurs between 72 to 84 months. We observed that the complete eruption of the Central Incisor teeth was observed between 80.8 to 84 months.

Various studies and texts have shown that the complete eruption occurs between 72 to 96 months.

The lateral incisors completely erupted between 105.2 and 107.4 months of age. Lyon,<sup>11</sup> Apurba, Nandy et al<sup>12</sup> have also mentioned that the average age of complete eruption of the lateral incisors occurs between 84 to 108 months. The complete eruption of the lateral incisors was significantly earlier in the left as compared the right lower jaws.

We observed that the complete eruption of the first pre molar teeth was observed between 109.58 to 112.6 months of age. The complete eruption of the lateral incisors was significantly earlier in the left as compared the right in both the upper and lower jaws. The second pre molar was completely erupted between 131.0 to 133.8 months. The complete eruption of the second premolar was significantly earlier in the left lower jaw as compared to the right lower jaw. Studies conducted by Ghai et al<sup>13</sup>, Grewal et al,<sup>14</sup> and Kerr et al<sup>15</sup> have also reported similar findings.

The canine completely erupted between 142.6 to 144.8 months of age. The complete eruption of the canine was significantly earlier in the left as compared the right side. Studies have shown that the left side teeth are earlier to erupt as compared to the right side. The complete eruption of the second molar teeth was observed between 174.5 - 178.6 months of age. The complete eruption of the second molar was significantly earlier in the left side as compared the right side with respect to the lower jaw. We also found that the development of the second molar tooth was significantly earlier among the females. Studies by Ghai et al,<sup>13</sup> Grewal et al,<sup>14</sup> Kerr et al<sup>15</sup> and Grewal et al<sup>16</sup> have reported similar findings.

### Conclusions and Recommendations

This study can be used as a baseline data to carry out large multi-centric studies or larger community based studies can be undertaken in the geographical area. The dental eruption patterns should be studied in detail to assess the role off various associated factors like nutrition, oral hygiene etc. Further studies with radiological assessment could add more evidence to the existing literature.

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# A Study on Psychological Autopsy of Suicidal Cases of North Bengal Region

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## Abstract

There are times when physical evidence found at post-mortem examination does not uncover the cause and mode of death. This is known as equivocal death. The psychological autopsy is an attempt to reconstruct the decedent's life to get a better understanding of his cause of death. It is used to determine the victim's psychological intent, using interviews and examination of documents to reconstruct the behaviour, personality, lifestyle, habits and history of the victim prior to death. Psychological autopsy helps as an investigative instrument which requires an application of abilities, experience, and training to assess a variety of factors including the behaviour, thoughts, feelings, and relationships of an individual who is deceased. There may be situations that the family members of the deceased does not want to reveal the facts about his death. Hence the counselling and interviews of family members, friends, and relatives has to be done with empathy. So the interviewer has to be flexible. The interviewer should establish mutual respect and confidence, with the informant, and ensure confidentiality and anonymity, and also obtain an informed consent before the interview. Hence one should be qualified and skilled to conduct the interview. False information also can be given due to lack of memory or it may be intentional. Suicide note, Personal documents, Medical records, school records, military records, employment records, should be carefully analysed. With the above mentioned information, a psychological autopsy report is produced, the final conclusion depends on the accuracy of the data collected from the interviews, examination of relevant documents and other materials. Therefore the interviewee's probabilities and limitation to science should be noted. Thus the final judgement as to the mode of death is based upon a review of all the known facts and circumstances; including the coroner's report, forensic medical report, police reports, crime scene analyst reports, and the psychological reconstruction, so that people may learn from the tragedy and, hopefully, be cautious and reduce the chances of similar occurrence in future. Psychological autopsy is most often used in cases of suspected suicide or homicide in an attempt to reconstruct the personal life and character of the deceased, to uncover hidden facts that may help to give family members peace of mind and also plays a role in revealing the manner of death.

**Keywords:** Psychological autopsy, Suicide, Behaviour, Autopsy.

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## Introduction

Psychological autopsy refers to a postmortem examination that seeks to reveal the intention of the deceased through a retrospective evaluation by structured interviews of family and relatives as well as a perusal of relevant records<sup>1</sup>. Originally devised for investigating, clarifying, and assisting police inquiries on the mode of death in equivocal deaths<sup>2</sup> Psychological autopsies have, in recent times, been more commonly used as a research tool for investigating risk factors for suicidal deaths. To a large extent, this has been driven by the accepted "truism" in suicide research that roughly 90% of suicide decedents have one or more diagnosable mental disorders.<sup>3</sup> Although many psychological autopsy studies have been published from India, but there has been no attempt to systematically review the available literature. Further, currently accepted psychological interview practices suffer from several limitations. Lack of standardised instruments or methods, informant bias, lack of interviewer training, recall bias and problems with selection of controls are some of the key drawbacks<sup>4</sup> which have also, predictably, led to questions about the admissibility of psychological autopsy evidence in courts.<sup>5</sup> The psychological autopsy is a systematic process used in a death investigation to come to an educated conclusion as to the manner of the death when the manner is in question. When a death is due to the actions of the decedent, the manner is typically either suicide (intentional) or accidental (unintentional). While the psychological autopsy can be particularly helpful in cases where the manner of death is equivocal or indeterminate, it can also be used when the cause and manner are not in question. In these cases, the psychological autopsy may provide insight as to why the death occurred – the perfect storm of circumstances. The majority of cases we have researched are at the behest of the surviving families with a need to understand their loved one's death. We have conducted this study to find out the demographic factors involved in suicidal death cases and to access the mental condition of the deceased just before the death.

## Material and Method

Following approval of the institutional ethics committee, North Bengal Medical College, close

relatives of all deceased came to the mortuary of Department of Forensic Medicine and Toxicology, NBMCH within the time period of 1<sup>st</sup> July 2022 to 31<sup>st</sup> December 2022 with history of suicide were interviewed. Dead bodies in advanced stages of decomposition, unknown dead bodies were excluded from the study. This is a descriptive cross sectional study. The informed consent was obtained from the interviewee & relatives. Total 106 cases were interviewed, data were collected in a pre-structured proforma where history taken about the deceased in respect of educational qualification, economical status, place of living, marital status, presence of love affair, mode and number of previous suicide attempts, family history of suicide, medical and psychiatric disease, loss of job and recent financial losses, any underlying cause present or not. Medical history including mental diseases, name and types of drugs used by the deceased were also collected. Economical status were measured as per Modified Kuppaswami scale<sup>6</sup>. Collected data were analyzed by using Microsoft Excel and latest version of SPSS software.

## Result and Discussion

Among the 106 total cases, incidence of suicide was higher (60.38%) in male in comparison to female (39.62%) (Fig 1). Sarkar et al found equal distribution of gender in same institution few years back<sup>7</sup>. Complete opposite result was seen by Chowdhury et al at Sundarban area of West Bengal, where females were dominant in suicidal deaths (67.1%)<sup>8</sup> Current study reveals suicidal deaths are higher among 20-39 years age group (45.28%), followed by 0-19 years age group (22.64%), 40-59 years age group (21.69%), and lowest in above 60 age group. Study subject with minimum age 13 years and maximum age 88 years are observed in the study. Result is somewhat similar with the study by Chowdhury et al, where median age of suicide for male and female were respectively 24 years and 22 years<sup>8</sup> The findings are also supported in Pan India scenario, where it was observed that 42% people committed suicide were from age of 15-39 years<sup>9</sup>. Among the total study population, rate of suicide is significantly higher in residents of rural areas (67.63%) whereas only 12.11% people were from urban areas (Fig 2). Similar findings were reported by Kumar et al, in

their study based on Uttar Pradesh, India<sup>10</sup>. On the contrary, it was exactly opposite in UK and Ireland<sup>11</sup>. Educational Attainment is inversely proportional in the current study (Fig 3), where it is lowest among the subjects completed their Graduation or Post Graduation in compare with the subjects attained primary level education, middle school education and without any formal education. Data from National Crime Record Bureau strongly supports this finding<sup>12</sup>. MK Shrivastava et al<sup>13</sup> and KK Kamalijja et al<sup>14</sup> also observed similar findings though later found higher trends in middle school pass. Marriage plays a significant risk factor in current study as most of the subjects (68%) are married. Findings are strongly supported in the studies done in Indian context<sup>131514</sup> Conflicting result found in the studies conducted in Europe<sup>16</sup>. Only 22% of study subjects had a history of psychiatric illness or mental disorder and 56% of them were taking anti psychotic drugs. Findings are conflicting with the data provided by WHO, where 60% of subjects committed suicide were suffering from any mental disorders<sup>21</sup> Cavangah et al<sup>3</sup> EK Moscici et al<sup>22</sup> reported more higher rates in Europe and USA. All the previous study<sup>14,9,23,8,4,3</sup> highlighted lower socioeconomic status, sudden financial loss, loss of job are significant causative factors in suicidal deaths. Current study also strengthen that cause with that of 77% of subjects were from lower sosocio-economic status, and 34% were undergone sudden financial loss.

**Table 1:**

Attributes	Frequency	Percentage
<b>Sex</b>		
Male	64	60.38
Female	42	39.62
Transgender	0	0
<b>Age-</b>		
0-19	24	22.64
20-39	48	45.28
40-59	23	21.69
60 onwards	11	10.37
<b>Source of history -</b>		
Family members	70	66.04
Relatives	34	32.08
Neighbours	2	1.88

**Table 2:**

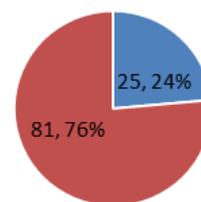
<b>Marital status</b>		
Unmarried	34	32.07
Married	72	67.92
Divorce	0	0
<b>Educational status</b>		
Illiterate	24	22.64
Primary school	37	34.9
High school	24	22.64
Higher Secondary school	12	11.3
Graduate	9	8.5
<b>Previous attempt of suicide</b>		
Present	25	23.58
Not present	81	76.42
<b>Family history of suicide</b>		
Present	11	10.37
Not present	95	89.63
<b>History of death of family members:</b>		
Present	28	26.42
Not present	78	73.58

**Table 3:**

<b>History of mental illness of deceased</b>		
Present	29	27
Not present	77	73
<b>Socio-economic status of survivors</b>		
Unemployed	11	10.4
Low	73	68.86
Middle	19	17.92
Higher middle	2	1.88
Higher	1	0.94

**DISTRUBUTION ACCORDING TO HISTORY OF LOSS OF JOB:**

- HISTORY OF LOSS OF JOB PRESENT (23.58%)
- HISTORY OF LOSS OF JOB ABSENT (76.42%)



**Fig. 1: Distribution according to the history of loss of job:**

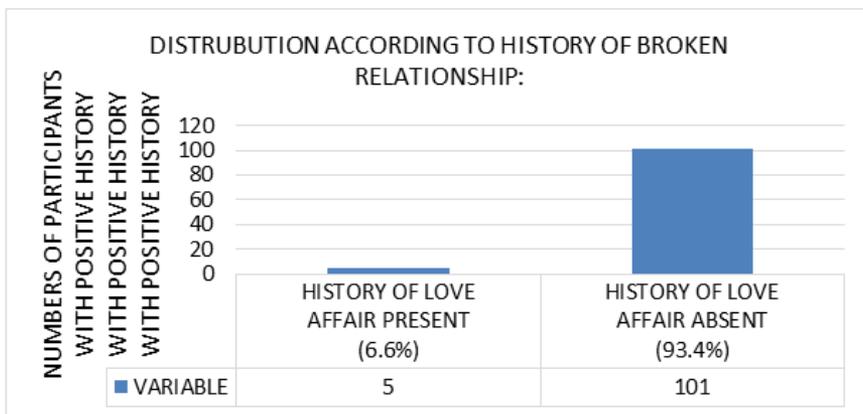


Fig. 2: Distribution according to history of broken relationship

DISTRIBUTION AS PER ANY HISTORY OF FAILURE IN EXAMINATION:

- HISTORY OF RECENT FAILURE IN EXAMINATION PRESENT (8.5%)
- HISTORY OF RECENT FAILURE IN EXAMINATION ABSENT (91.5%)

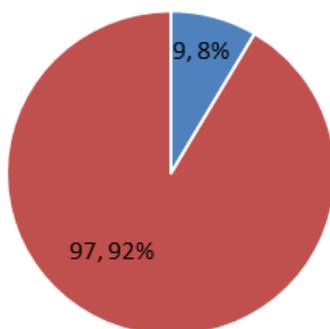


Fig. 3: Distribution as per any history of failure in examination:

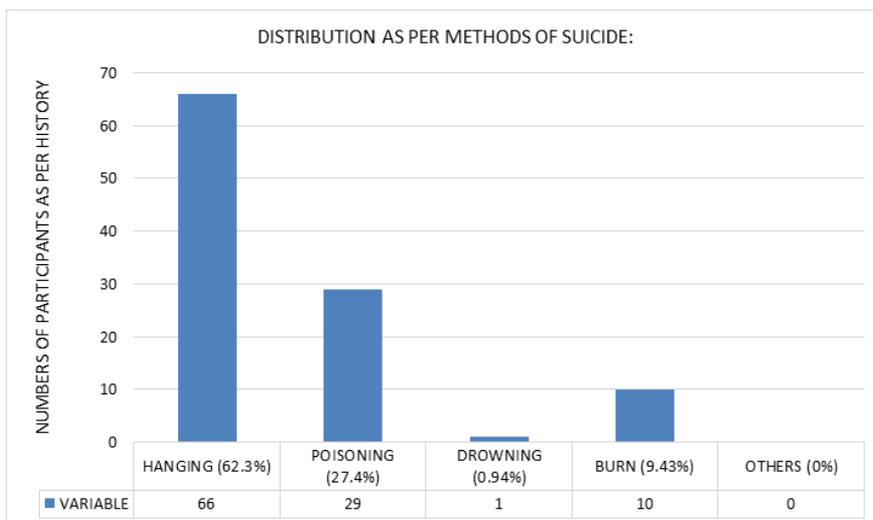
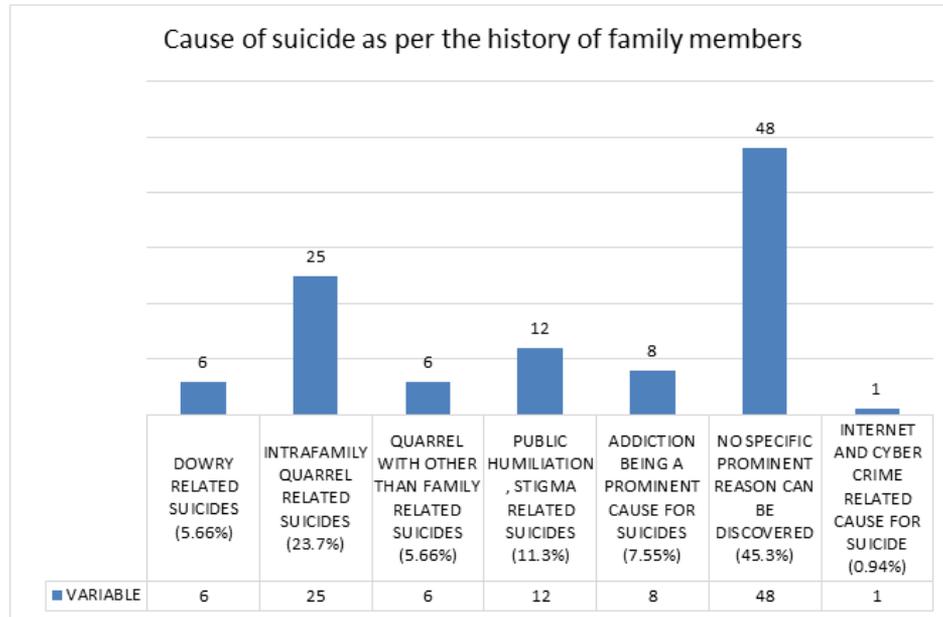


Fig. 4: Distribution as per the method of suicide:



**Fig. 5: Distribution as per prominent contributing causes that lead to suicide as per history by family members:**

### Conclusion

The present study showed that suicidal deaths are commonly seen in cases of unemployed and low income group male gender in the age group 20-40 years of age. Married persons are more prone to commit suicide and in most of the suicidal deaths, previous attempt of suicides were not present. Family history of suicide were found only in about 10% cases & history of death of family members were found in only 26.42% cases. Presence of mental illness is one of the precipitating factor of suicide and in our study was seen in only 27% cases. Few cases were due to loss of job (24%) and history of broken relationship (5%). Hanging followed by poisoning was the most common mode of suicide.

**Conflict of interest:** No such.

**Source of Funding:** Nil

**Ethical clearance:** From the institutional ethics committee, North Bengal Medical College. (Reference No. - IEC/NBMC/M-01/52/2022 Dt. - 15.07.2022)

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