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EDITORIAL

# DRIVING ETIQUETTE EDUCATION TO REDUCE ROAD TRAFFIC CRASHES

**Dinesh MG Fernando**

A prediction by the World Health Organisation, documented in the Editorial of the Sri Lanka Journal of Forensic Medicine, Science and Law in 2018[1], that road traffic injuries would be the eighth leading cause of death in 2030, has become true in less than half that time. As detailed in the *Lancet* Series on Road Safety, road traffic injuries (RTIs) were the eighth leading cause of death worldwide in 2022, accounting for 1.35 million deaths each year[2].

In Sri Lanka, 22153 accidents caused 2732 deaths in 2025[3]. This represents an increase of one RTI-related death per day, compared to 2024, which had 2359 deaths. In the first six months of 2026, the number of fatalities has risen by 119, compared to the same period in 2025.

In order to curb this increase, in recent times the police have increased the fines and punishments imposed for violation of road rules. While this is a step in the right direction, driving etiquette, which is not enforceable, also needs to be addressed.

Driving etiquette is the collection of unwritten rules and common courtesies that promote smooth, safe traffic flow. It goes beyond legal requirements to ensure mutual respect, accident prevention, and stress-free navigation for all road users. These principles revolve around communication, predictability, and sharing space fairly. In addition, it actually helps the movement of traffic. For example, you are in a line of bumper-to-bumper, slow-moving vehicles. You see a vehicle on a side road on the left, waiting to cross the main road and turn right where the traffic is free-flowing. If you courteously wait and create a gap for it to go, he goes on his way faster. Do you get even a second delayed? No. Within a minute after he has gone on his way, you have again reached the bumper of the vehicle in front of you. A roundabout is meant to create free-flowing traffic – if the rule of giving way to the person on the roundabout (on the right) is followed. However, if the way in front of you on the roundabout is blocked, moving in will only block the exit path of vehicles on your right, which will cause the entire roundabout to become gridlocked; causing delay to everyone, and increasing the congestion. In a situation where two lanes merge into one, the flow of traffic is faster if the vehicles in the two lanes merge like a 'zip' – one from each lane alternatively.

Expressways are a relatively recent driving experience for Sri Lankan drivers. Those who have driven in overseas countries are probably familiar with driving on an expressway. However, the vast majority of those who drive on the expressway have not had the experience. On the expressway, driving significantly slower than the speed of the majority of vehicles, results in increased accidents. Therefore, a good practice is to go with the traffic flow. Enforcing a minimum speed limit may become necessary. The overtaking lane should only be used for overtaking and then should get back into the left lane. The three-second rule should be employed actively on the expressway due to the much higher speeds.

Giving adequate signal time and checking mirrors before switching lanes is important. A fast-moving vehicle in the right lane will not

expect, and not be prepared for, a slower vehicle in the left lane pulling out in front of it. The on ramp should be used for accelerating to highway speed. Going to the end at a slower speed than the other vehicles travelling past and attempting to merge should not be done. In addition, those who are on the left lane can move to the right lane when they see an approaching vehicle on the on ramp, to enable a smooth merge. When exiting, the speed ought to be maintained and only once on the off ramp, slowing down should commence. Slowing down prior to getting on the off ramp may result in a rear end collision with a vehicle travelling at a constant speed (using cruise control) in the left lane.

Driver training schools do not educate, nor train, for driving on the expressway. Since it is not feasible to test drivers applying for the driving licence on the expressway, a simulator can be used for this purpose. The candidate will need to drive a specific number of hours and undergo a test on the simulator, prior to the road driving test.

## CONFLICTS OF INTEREST

The author declared no conflicts of interest.

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LEADING ARTICLE

# WRITING A CASE REPORT IN FORENSIC MEDICINE

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## ABSTRACT

Case reports (CRs) are an essential component of forensic medicine, providing detailed documentation of unique, unusual, or novel cases that can educate the medical and legal communities. If authors do not comply with the accepted guidelines, it will affect the quality and the scientific rigor and face ethical consequences. However, existing guidelines on CR writing do not address the unique issues specific to forensic medicine. This guide outlines the key components of writing a comprehensive CR in forensic medicine, developed from existing guidelines.

**Keywords:** *Autopsy; case report; forensic medicine; informed consent; privacy*

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## INTRODUCTION

Case reports (CRs) describe an issue and its management for scientific/academic purposes[1]. It is a detailed report of the diagnosis, treatment, and follow-up of an individual case. CRs also contain demographic information, including age, gender, ethnicity, geographical location, level of education, income, etc., of the presented case[2]. CR plays a vital role in the recognition of new and rare diseases and in the evaluation, intervention, and management of areas where the current evidence base is lacking. It aids in medical education and the discovery of complications or effects of common treatment. It can be used as a valuable source of new and unusual information that can encourage future research studies with a higher level of evidence[3-7]. A CR can be published as an abstract in research conferences or as a full paper in peer-reviewed journals. In the level of evidence hierarchy, the highest position is secured by a systematic review or meta-analysis of all relevant randomised controlled trials, whereas CR is positioned at a low level of evidence[8,9]. However, CR can be used as a valuable foundation for future research.

Additionally, a CR in forensic medicine provides sound medico-legal documentation. It plays a crucial role in improving the understanding of legal medicine and its applications. Forensic CR contributes to the identification of new forensic phenomena, mishaps of medical management, refinement and enhancement of investigative techniques, and medico-legal interpretation.
CR might depict some drawbacks, like the lack of a clear description and generalizability, the danger of over-interpretation of a single case or even a case series, limited/insufficient rigor due to inconsistency, incompleteness, or writing without adhering to guidelines, and rarely a lack of relevance or an emphasis[1,6,7,10,11].

Distinct differences could be seen between a clinical and a forensic CR. The purpose of a clinical CR is to document and share clinical experiences, unusual cases, or novel treatments in the medical field which often educate and inform healthcare professionals about unique clinical findings or therapeutic approaches whereas, in forensic CR, it is to document findings from a forensic investigation often related to legal cases which are used to provide evidence in legal proceedings and help in determining the cause and manner of death. Forensic CRs focus more on the investigation process, evidence analysis, and legal implications. Emphasis is on the forensic and investigative aspect of the case, unlike in a clinical CR, which focuses on patient diagnosis, treatment, and outcome, with emphasis on the medical and therapeutic aspect of the case. Regarding content and structure, forensic CR comprises scene description, autopsy findings, evidence analysis, and legal implications; whereas in clinical CR, much attention is put toward patient history, clinical findings, and analysis of the case in the context of existing knowledge in discussion and follow-up of the patient in the context of progress and long-term outcomes. The audience for forensic CRs can range from medical professionals and forensic scientists to legal professionals and law enforcement officers, and these reports may be used in legal settings and even presented in courts as scientific evidence. Clinical CRs are mostly used by healthcare professionals, including doctors, nurses, and medical researchers.

Consent and privacy are two important components of ethical considerations in CRs. In a clinical CR, informed written consent is obtained from the patient, ensuring confidentiality and ethical standards. In a forensic CR, if the victim is alive, informed written consent is obtained, like in a clinical case. The issue arises when the victim is deceased, where the consent must be taken from the next of kin. Victim anonymity is to be preserved by complying with institutional guidelines and ethical review board approval and recommendations.

## PROCEDURE

This article provides a detailed guide on writing a CR in forensic medicine. It outlines the structure and components of a CR, including introduction, case description, methods, results, discussion, and conclusion. This was developed with the aid of CARE and SCARE guidelines, which were created as a guide for writing CRs. CARE guidelines were first published in 2013 and updated in 2017 to enhance the accuracy, transparency, and usefulness of CRs[1,12]. Similarly, the SCARE guideline was first developed in 2016 following the identification of flaws in the field of surgery. It was created as a consensus-based tool for surgeons to document and report their surgical cases in a standardised manner, with subsequent updates in 2018 and 2023[11,13,14]. However, unique issues in writing a CR in forensic medicine are not addressed in CARE or SCARE guidelines, such as identification of the victim, consent, and scene investigation details. Therefore, the authors present a guideline to fill the gap in reporting comprehensive CRs in forensic medicine.

### Structure of a forensic case report

This guideline provides a standardised framework for reporting forensic cases. Its objective is to improve the quality and consistency of CR, making them more useful for practitioners in forensic medicine, other clinicians, and researchers. The basic structure of a forensic CR is detailed in Table 1.

**Table 1:** Structure of a forensic case report

| Topic | Item | Description |
|---|---|---|
| Title | 1 | The words 'case report' should appear in the title, or the title should reflect that they are case reports or case series. The title should be concise and highlight the area of focus. (e.g. presentation, patient population, diagnosis, outcome, manner, and/or cause of death/injury) |
| Keywords | 2 | Include three to six keywords that identify what is covered in the case report while minimizing the repetition of terms used in the title and the abstract (e.g. medico-legal diagnosis, manner/cause of death or injury). Keywords should be arranged in alphabetical order. Services such as MeSH Browser can be used to generate appropriate keywords[15]. |
| Abstract | 3 | Can be structured or unstructured. If structured, include the following headings: (1) introduction (2) case presentation/history/records, and (3) conclusion.<br><br>Introduction: Describe why the case is important to present over the existing forensic literature.<br><br>Case presentation/history/records: Detail the presenting complaint/s, clinical and demographic details and background information regarding the presentation with forensic relevance.<br><br>Detail the clinical/autopsy findings, investigations and results, and diagnosis with medico-legal interpretation.<br><br>Conclusion: Highlight the relevance and impact of the report. State the main takeaway lessons or potential implications for forensic practice without reiterating already presented findings. |
| **Full Manuscript** | | |
| Introduction | 4 | Background: Describe the area of focus and the relevant background contextual knowledge, stating the area which is going to be presented concerning the existing body of knowledge.<br><br>Describe why the case is unique compared to available literature and why this case should be reported, especially in relevance to health care, legal and other stakeholders. |
| Timeline | 5 | Summarise the sequence of events, including the date, time and place of the incident, and status at the presentation with subsequent management, including lab investigations, treatments and outcomes. |
| Case presentation/ history/records Patient information | 6 | Socio-demographic profile of the subject, including age, sex, ethnicity, geographical location, and occupation. Further body mass index, handedness, habits (especially smoking, abuse of drugs or alcohol) and the status of the condition of the body need to be included where relevant. |

| | | |
|---|---|---|
| | | State how the presented case was referred for medico-legal investigation (self-presentation, by referral or produced by legal authority)<br>Similar previous presentations and interventions, especially in cases of chronic abuse (e.g. gender-based violence, child abuse, drug abuse, etc.) or self-harm.<br><br>Past medical, surgical, psychosocial and family history, where relevant. |
| Scene Investigation | 7 | Describe the important findings relevant to the case presented. Such findings can be illustrated with the use of photographs, sketches or diagrams. |
| Clinical/autopsy findings | 8 | Describe the significant findings based on observations, clothing, and external and internal examination with the adopted technique. (e.g. eye dissection in fatal child abuse, pelvic dissection in sexual abuse.)<br><br>Reproduction of findings can be done with photographs obtained with a standard scale as a reference and colour code to minimize any size or colour distortions, respectively (ForensiGraph scale or American Board of Forensic Odontology (ABFO) scale with colour code/crosshair)[16,17].<br><br>Anatomical location should be identified with a distant photograph, while details of injury or pathology should be visible in a close-up photograph, preferably with an indicator, such as an arrow or a circle.<br><br>Use a scale reference to determine the actual size of the objects or distances within a photograph, which is essential for reconstructing a crime scene and understanding spatial relationships.<br><br>Include the date and time in photographs as they serve as evidence for medico-legal purposes.<br><br>Authors should respect the privacy of the victim while documenting findings. Patients' names and other identifying information should be removed from the figures. If any identifying details appear in text, tables, and/or figures, the author must provide proof of informed written consent received from the patient, i.e. a signed permission form. Facial photographs with bars placed over the eyes of patients should not be used in publication. If they are used, permission from the subject or next of kin is required.<br><br>Photographs obtained from different authorities (e.g. Police, Scene of Crime Officers) should be acknowledged. |
| Ancillary investigations, results and interpretation | 9 | Diagnostics assessment: Laboratory investigations and imaging (antemortem and postmortem).<br><br>Histopathology: stain type, magnification, and use of pointers to indicate pathology. |

| | | |
|---|---|---|
| | | Toxicology analysis: Equipment and analytical methods used with details of validation and accreditation.<br><br>State the limitations of investigations and results. |
| Intervention | 10 | Referrals and psychosocial interventions, such as experts who are involved, change of custody in child abuse, socio-economic support, etc. |
| Follow-up and outcomes | 11 | Give details regarding the consequences of injuries, disabilities, compensation, death investigations and the outcome of legal proceedings. |
| Discussion | 12 | Brief the forensic findings with their interpretation and justification of conclusions in relation to existing relevant literature.<br><br>Future implications: Describe the future implications for practice in forensic and other specialities and adaptability into guidelines and standards of practice.<br><br>Takeaway lessons: Outline the key medico-legal (or clinical) lessons from the case presented. |
| Strengths and limitations | 13 | Describe the strengths and limitations encountered during the medico-legal investigation and how the limitations can be overcome in future cases. |
| Perspective of the patient or the next of kin | 14 | Special reference to abused/tortured victims or /and their next of kin in relation to medico-legal management and follow-up. |
| Consent | 15 | Informed written consent must be received for publication from the patient or next of kin/guardian where relevant.<br><br>If the patient or family members are untraceable, then document the tracing efforts undertaken. It is wise to comply with the institutional guidelines, approval of the ethical review committee and follow international standards. |
| Additional information | 16 | State any author contributions, acknowledgements, conflicts of interest, sources of funding and where required, institutional review board or ethical committee. Care must be taken when formulating opinions on pending or ongoing court cases, and they should be handled sensitively. |
| References | 17 | According to a standard referencing style aligning with the requirements of the journal where the CR is to be submitted for publication (e.g. Harvard style, Vancouver style, APA (American Psychological Association) style). |

## CONCLUSION

This article provides authors with a guide aimed at writing a comprehensive CR in forensic medicine. This guide will help enhance the accuracy, standard, and outcome of a CR. This guide not only addresses current gaps in writing a CR in forensic medicine but also provides a structured approach to developing a CR in other clinical specialities. With the consensus of subject experts, this proposed structure can be further upgraded as a guideline for writing a CR in forensic medicine.

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## CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

## DISCLOSURE

ANV, EMKBE and CUW are members of the Editorial Board of the Sri Lanka Journal of Forensic Medicine, Science & Law. Therefore, they did not participate in any way in the publication/decision-making process of this submission, as per journal policy.

## ETHICAL ISSUES

None.

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None.

## AUTHOR CONTRIBUTIONS

**ANV:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **EMKBE:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **HMDDS:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **CUW:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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ORIGINAL ARTICLE

# COMPARISON OF THE EFFECTIVENESS OF PEER-ASSISTED LEARNING AND SMALL-GROUP DISCUSSIONS IN TEACHING FORENSIC MEDICINE IN AN UNDERGRADUATE MEDICAL PROGRAM

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## ABSTRACT

**Introduction:** Forensic medicine requires the application of analytical reasoning and medico-legal principles rather than rote memorisation. With the shift to Competency-Based Medical Education (CBME), active learning strategies are increasingly emphasized. Small Group Discussion (SGD) and Peer-Assisted Learning (PAL) are widely used approaches; however, direct comparisons in forensic medicine remain limited.

**Objectives:** This study compared the effectiveness of PAL and SGD in achieving immediate learning outcomes and sustaining delayed knowledge retention among undergraduate medical students, while also evaluating student engagement and feedback.

**Methods:** A quasi-experimental crossover study was conducted among 60 MBBS Phase 3 Part 1 students in the Department of Forensic Medicine, P.K. Das Institute of Medical Sciences, Kerala, India. Participants were randomly assigned to two groups and exposed to both PAL and SGD across six modules using a crossover design with a washout period. Immediate post-tests and one-month delayed tests assessed knowledge gain and retention, while engagement and feedback were measured using a validated 5-point Likert-scale questionnaire. Data were analysed using independent sample t-tests and chi-square tests.

**Results:** Immediate post-test scores were significantly higher with PAL compared to SGD (7.90 ± 1.92 vs. 7.42 ± 2.46; p = 0.042), with a significant advantage in the "Age Estimation" module (p = 0.009), while other modules showed no significant differences. Knowledge retention at one month was comparable (p = 0.475). Engagement scores were high for both strategies, with PAL demonstrating higher proportions of strong agreement.

**Conclusions:** PAL improves immediate learning outcomes and engagement more than SGD, while both methods achieve similar delayed knowledge retention, supporting a blended approach in forensic medicine teaching.

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## INTRODUCTION

Forensic medicine integrates medical knowledge with legal application, requiring students to apply concepts to real-life scenarios such as injury interpretation, age estimation, and medico-legal reporting. This transition from rote learning to application is often challenging, particularly when traditional lectures promote passive learning. With the shift toward Competency-Based Medical Education (CBME), there is increasing emphasis on active learning strategies that enhance participation, critical thinking, and problem-solving. Among these, Small Group Discussion (SGD) and Peer-Assisted Learning (PAL) have emerged as key approaches. SGD enables students to collaboratively analyse cases under faculty guidance, promoting teamwork and conceptual clarity, although its effectiveness may be influenced by unequal participation.

In contrast, PAL involves trained student tutors teaching their peers, creating a more approachable learning environment that encourages interaction while strengthening both learning and teaching skills. While PAL enhances confidence and engagement, SGD supports collaborative reasoning. Despite their complementary strengths, direct comparisons of these methods in forensic medicine remain limited, although structured active learning has been shown to improve knowledge retention and critical reasoning[1].

The evolution of medical education reflects a broader shift from passive didactic models to active, student-centred approaches that emphasise the application of knowledge. In forensic medicine, where bridging theory and legal practice is essential, such interactive methods are particularly relevant. Traditional teaching methods have been criticised for limited student participation, and comparative studies suggest that although lectures and SGD may yield similar objective test scores, small-group formats are more effective in improving motivation, doubt clarification, and self-confidence[2]. To enhance the effectiveness of small-group learning, structured frameworks such as the “Distribute, Discuss, and Develop” (3D) method have been introduced, demonstrating improved learning outcomes and communication skills compared to conventional formats[3].

Evidence from broader health professional education further supports the role of active learning. PAL, in particular, provides reciprocal benefits for both tutors and learners, contributing to the development of teaching, communication, and assessment skills[4]. Meta-analyses of randomized controlled trials indicate that PAL is superior to traditional teaching in improving theoretical knowledge transfer, practical skills, and student satisfaction[5], although some studies report comparable cognitive outcomes between PAL and faculty-led approaches[6]. The effectiveness of PAL is often attributed to “cognitive congruence,” where peer tutors share a similar level of understanding with learners, facilitating clearer communication. This is supported by findings from simulation-based education, where peer-led debriefing has been shown to be as effective as instructor-led sessions in terms of knowledge acquisition and student satisfaction, with some evidence of improved performance in peer-led groups[7].

Active learning strategies are particularly relevant in forensic medicine, where critical thinking and applied reasoning are essential. Scoping reviews highlight that case-based and problem-based learning enhance teamwork and analytical skills required for medico-legal practice[8]. Similarly, challenge-based learning approaches in forensic medicine demonstrate high student acceptance, with learners reporting improved understanding of complex medico-legal scenarios[9]. The benefits of small-group learning extend to related disciplines such as family medicine, where they have been associated with improved attention, conceptual understanding, and overall satisfaction compared to traditional lectures[10]. Peer-assisted approaches have also proven effective in specialised areas such as medical English training, where they enhance confidence and practical application[11]. More broadly, the integration of active learning strategies, including flipped classrooms and early clinical exposure, aligns with contemporary educational goals by improving engagement, retention, and clinical reasoning skills[12].

Despite strong support for these approaches, there remains a need for direct comparative studies of PAL and SGD within forensic medicine to inform optimal curriculum design for undergraduate medical students.

## OBJECTIVES

The primary objective of this study was to compare the effectiveness of PAL and SGD in achieving immediate learning outcomes and sustaining one-month knowledge retention among undergraduate medical students, while the secondary objectives were to evaluate and compare student engagement levels between PAL and SGD sessions using a validated scale and to assess and compare student feedback regarding the two different teaching-learning modalities in forensic medicine.

## METHODS

The study was conducted in the Department of Forensic Medicine at P.K. Das Institute of Medical Sciences, Kerala, India, where all PAL and SGD sessions were carried out in departmental classrooms under supervised academic conditions. A quasi-experimental crossover design was employed to ensure that each participant was exposed to both PAL and SGD, thereby minimising individual learning style bias and enabling within-cohort comparison, and the methodological flow is illustrated in Figure 1. Participants were MBBS Phase 3 Part 1 students who had not undergone structured teaching in the selected modules and who provided written informed consent; students serving as peer tutors, those previously exposed to the modules, those unwilling to consent, and those unable to attend all sessions were excluded. A total of 60 eligible students were selected using simple random sampling (lottery method) and equally allocated into Group A and Group B. The sample size was calculated for comparison of two independent means with a two-sided significance level of 0.05 ($Z_\alpha$=1.96) and 80% power ($Z_\beta$=0.84), based on an expected mean difference of 0.57 and standard deviations of 0.65 and 0.79 derived from Vijayan et al. (2025), yielding a required sample of 25 participants per group; allowing for 20% attrition, 30 participants were recruited per group[13]. Volunteers from Phase 3 Part 1 were screened for peer tutor roles using a structured checklist assessing clarity, confidence, and engagement, with a minimum score of 70% required to qualify for faculty-led training based on standardized lesson plans covering six modules: Injury Interpretation and Medico-Legal Classification, Alcohol Intoxication and Drunkenness Examination, Age Estimation, Sexual Offences including Examination and Documentation, Organophosphorus Poisoning including Clinical Features and Management, and Professional Misconduct. Training included mock teaching sessions with structured feedback, and competency was reassessed using a checklist evaluating content accuracy, communication, and facilitation skills, with only those scoring at least 80% selected as peer tutors; to ensure uniformity, all sessions followed faculty-prepared lesson plans with faculty observation and minimal intervention. Participants were divided into two groups of 30, each further subdivided into groups of 10 to facilitate active participation and individualised feedback. The six modules were divided into two sets, with Set 1 including Injury Interpretation, Alcohol Intoxication, and Age Estimation, and Set 2 including Sexual Offences, Organophosphorus Poisoning, and Professional Misconduct. During Period 1, Group A underwent PAL, and Group B underwent SGD for Set 1 modules, followed by a washout period of 3–7 days to minimise carryover effects; in Period 2, the interventions were crossed over, with Group A receiving SGD and Group B receiving PAL for Set 2 modules, ensuring that all participants were exposed to both teaching methods. Each session followed a standardized format comprising a 10–15 minute pre-briefing, a 60-minute teaching-learning activity (PAL or SGD), and a 10–15 minute consolidation phase, after which an immediate post-test of 15–20 minutes in Multiple Choice Question (MCQ) format and a 5-minute Likert-scale feedback questionnaire were administered; PAL sessions were conducted by trained peer tutors, while SGD sessions were facilitated by faculty. Sessions were conducted in separate classrooms to prevent contamination, with a tutor-to-student ratio of 1:10 maintained throughout; teaching materials and assessments were standardised,

post-test responses were anonymised, and reliability was assessed using Cronbach's alpha, while participants were instructed not to share materials until completion of the intervention, and full attendance was required for inclusion in analysis. Knowledge gain was assessed using immediate post-tests and a one-month delayed retention test in MCQ format, while engagement and feedback were measured using a validated 5-point Likert-scale questionnaire, and peer tutor competency was evaluated using structured checklists during training. Data were entered into Microsoft Excel and analysed using SPSS, with mean scores compared using independent sample t-tests and categorical variables analysed using chi-square tests, a p-value <0.05 considered statistically significant, and descriptive statistics used to summarise findings; although a crossover design was employed, independent t-tests were used due to unequal group sizes and attrition at follow-up, which limited the feasibility of paired analysis. Ethical clearance was obtained from the Institutional Ethics Committee of P.K. Das Institute of Medical Sciences, Kerala, India (Ref. No. IEC/03/151/25).

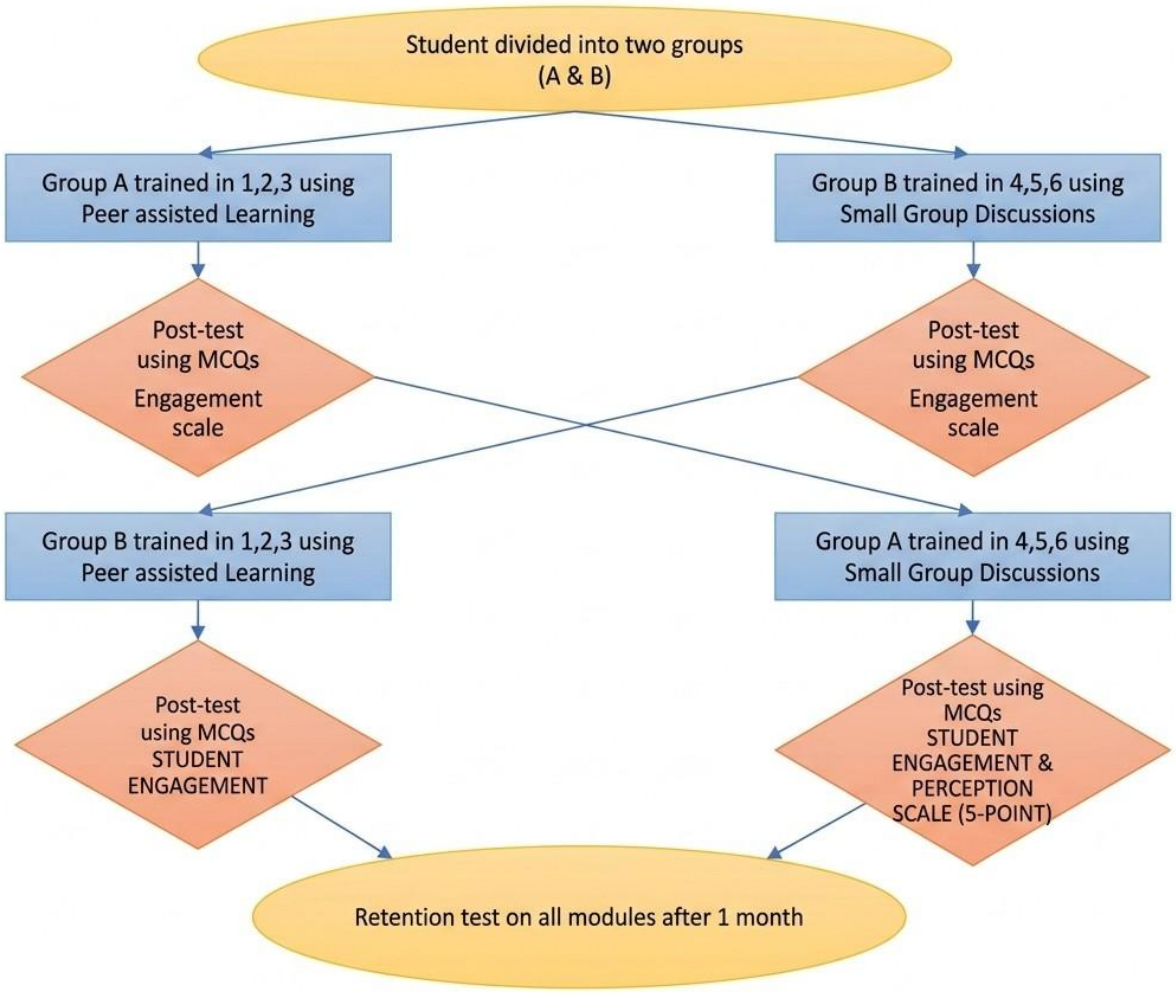


**Figure 1:** Flow diagram of the study methodology illustrating participant selection, grouping, intervention allocation and crossover design.

## RESULTS

The distribution of participants across forensic medicine topics under PAL and SGD is presented in Table 1.

**Table 1:** Distribution of participants across forensic medicine topics under PAL and SGD

| Topic | PAL | SGD |
|---|---|---|
| Age estimation in medico-legal practice | 30 | 29 |
| Alcohol intoxication and drunkenness examination | 29 | 27 |
| Injury interpretation and medico-legal classification | 27 | 28 |
| Organophosphorus poisons | 33 | 26 |
| Professional misconduct | 33 | 26 |
| Sexual offences | 32 | 25 |

This study compared the effectiveness of PAL and SGD using post-test scores across six forensic medicine topics. Overall, students exposed to PAL demonstrated significantly higher post-test scores compared to those taught using SGD, with a mean score of 7.90 (SD=1.92) versus 7.42 (SD=2.46), and a mean difference of 0.48 that was statistically significant (t=2.038, p=0.042), indicating superior immediate learning outcomes with PAL.

Topic-wise analysis showed a statistically significant advantage of PAL in Age Estimation in Medico-Legal Practice, where students scored higher (mean=5.72, SD=2.03) compared to the SGD group (mean=4.14, SD=2.39), with a mean difference of 1.59 (t=2.724, p=0.009), representing the largest effect size among all topics. In Alcohol Intoxication and Drunkenness Examination, the PAL group showed a marginally higher mean score (7.29±2.18) than the SGD group (6.93±1.94), though the difference was not statistically significant (t=0.647, p=0.521). Similarly, in Injury Interpretation and Medico-Legal Classification, PAL students achieved higher mean scores (8.65±1.13) compared to SGD (8.18±1.44), without statistical significance (t=1.342, p=0.186). In Organophosphorus Poisoning, both groups demonstrated comparable performance, with mean scores of 8.03 (SD=1.49) for PAL and 7.85 (SD=2.15) for SGD (t=0.386, p=0.701). In Professional Misconduct, the SGD group showed slightly higher scores (9.46±0.65) compared to PAL (9.13±1.07), though this difference was not statistically significant (t=−1.407, p=0.165). For Sexual Offences, mean scores were nearly identical between PAL (8.42±1.32) and SGD (8.32±1.57), with no statistically significant difference (t=0.274, p=0.785). Comparison of immediate post-test scores between PAL and SGD across topics is shown in Table 2.

**Table 2:** Immediate post-test scores: Comparison between PAL and SGD.

| Topic | PAL (N) | PAL (Mean±SD) | SGD (N) | SGD (Mean±SD | Mean Difference | p-value |
|---|---|---|---|---|---|---|
| Overall | 180 | 7.90±1.91 | 161 | 7.42±2.46 | 0.484 | 0.042* |
| Age Estimation | 29 | 5.72±2.03 | 29 | 4.14±2.39 | 1.586 | 0.009* |
| Alcohol Intoxication | 28 | 7.29±2.18 | 27 | 6.93±1.94 | 0.360 | 0.521 |
| Injury Interpretation | 26 | 8.65±1.13 | 28 | 8.18±1.44 | 0.475 | 0.186 |
| Organophosphorus Poisoning | 32 | 8.03±1.49 | 26 | 7.85±2.15 | 0.185 | 0.701 |
| Professional Misconduct | 32 | 9.13±1.07 | 26 | 9.46±0.65 | −0.337 | 0.165 |
| Sexual Offences | 33 | 8.42±1.32 | 25 | 8.32±1.57 | 0.104 | 0.785 |

*Significant at p-value <0.05

Knowledge retention assessed one month after the intervention showed no statistically significant differences between PAL and SGD across all six modules. The overall mean retention score for PAL was 7.75 (SD=1.86), compared to 7.59 (SD=2.11) for SGD (p=0.475), indicating comparable delayed-term retention between the two teaching–learning methods. Topic-wise analysis across Age Estimation, Alcohol Intoxication, Injury Interpretation, Organophosphorus Poisoning, Professional Misconduct, and Sexual Offences similarly demonstrated no statistically significant differences, with retention scores remaining comparable between both groups.

High levels of student engagement were reported for both teaching methods. However, across all engagement domains—attention, participation, comfort in asking questions, and peer interaction—a higher proportion of students in the PAL group reported strong agreement compared to the SGD group. Neutral responses were consistently more frequent among SGD participants. Student engagement under PAL and SGD is summarised in Table 3.

**Table 3:** Student engagement of learning effectiveness under PAL and SGD.

| Item | PAL (%) | SGD (%) |
|---|---|---|
| Attentive and focused | 88.6 | 75.3 |
| Actively participated | 84.8 | 69.0 |
| Comfortable asking questions | 82.1 | 66.4 |
| Engaged with peers | 82.6 | 63.9 |

Feedback related to interest, understanding, and stimulation of critical thinking demonstrated a similar trend. Although both methods were positively perceived, PAL was associated with higher levels of strong agreement, indicating greater perceived engagement and motivation. Student feedback regarding learning effectiveness is presented in Table 4.

**Table 4:** Student feedback on learning effectiveness under PAL and SGD

| Item | PAL (%) | SGD (%) |
|---|---|---|
| Interested and motivated | 82.1 | 67.7 |
| Better understanding | 83.1 | 69.6 |
| Encouraged critical thinking | 78.8 | 66.5 |

## DISCUSSION

The results of this study suggest that while both PAL and SGD are effective active learning strategies, they offer distinct advantages in the context of forensic medicine. The overall superiority of PAL in immediate post-test scores, particularly in the analytically demanding module of Age Estimation, indicates that peer-led environments may be more effective for achieving immediate learning outcomes in complex topics.

The significant improvement in immediate performance under PAL raises the question of whether the benefit stems from the pedagogy itself or the facilitator. It is likely that social congruence, the comfort and relatability provided by a peer, mitigates the "intimidation factor" often associated with faculty-led sessions. This facilitates a more open dialogue and higher engagement, which may explain the higher scores in the PAL arm. These findings are consistent with broader evidence suggesting that PAL surpasses traditional methods in theoretical knowledge transfer and practical skill acquisition[5,7].

However, the lack of significant difference in overall scores for other modules suggests that the choice between PAL and SGD may be less critical for less complex topics. This is supported by previous research indicating that while interactive methods are highly preferred by students, they do not always result in significantly higher test scores compared to other structured formats[2,6]. The "3D" method (Distribute, Discuss, Develop) has shown that structured frameworks in small groups can significantly improve comprehension, suggesting that the session's organization is as vital as the facilitator[3].

Regarding delayed retention, the finding that both methods resulted in comparable scores after one month reinforces the idea that active learning, regardless of the facilitator, supports the consolidation of knowledge into memory. Previous syntheses have noted the reciprocal benefits of PAL for both tutors and tutees, highlighting its role in skill development[4]. Furthermore, the application of interactive strategies in forensic medicine, such as problem-based and case-based learning, is crucial for developing the clinical reasoning and critical thinking required for medico-legal practice[8,11]. Our observation of high achievement in the PAL arm for context-rich topics like Age Estimation is further supported by evidence that students benefit immensely from multidisciplinary and authentic settings[9].
A critical distinction maintained in this study is the separation between student engagement and student feedback. In the present study, while both modalities recorded high satisfaction levels and were preferred over traditional didactic formats[10], engagement, defined by the depth of participation and cognitive involvement, was notably more robust in the PAL sessions. This suggests that while students may "satisfy" easily in a faculty-led SGD due to the perceived authority of the teacher, they "engage" more actively in PAL as the peer-led environment necessitates their direct contribution to the learning process. This distinction aligns with modern educational frameworks that caution against using satisfaction as a sole proxy for learning engagement[12].

In conclusion, the findings suggest that a blended approach, utilizing PAL for technically complex topics and faculty-led SGD for broader principles, may optimize the undergraduate forensic medicine curriculum.

## LIMITATIONS

Limitations include the use of independent sample t-tests despite a crossover design, due to unequal group sizes and attrition during follow-up. Additionally, the study was conducted in a single institution, which may limit generalizability.

## CONCLUSIONS

PAL demonstrated greater effectiveness than SGD in improving immediate learning outcomes and student engagement, while both methods were comparable in sustaining delayed knowledge retention, indicating that each approach contributes differently to forensic medicine teaching. A blended approach incorporating both PAL and SGD may therefore represent an optimal strategy for competency-based forensic medicine education.

## RECOMMENDATIONS

Based on the findings of the present study, PAL may be incorporated as a complementary teaching–learning strategy in undergraduate forensic medicine within a competency-based curriculum. It appears particularly suitable for topics that require structured reasoning, stepwise analysis, and application of medico-legal principles, such as age estimation and injury interpretation. Integrating PAL into routine teaching can enhance immediate learning outcomes while promoting active student engagement.

Rather than replacing faculty-led methods, a blended instructional approach is recommended. Combining PAL with SGD allows each method to serve a distinct purpose within the learning process. PAL can facilitate initial concept clarification and foundational understanding, whereas SGD can support consolidation, reflection, and deeper analytical engagement, thereby utilizing the strengths of both strategies in a complementary manner.

Institutions implementing PAL should ensure a structured process for selection, training, and evaluation of peer tutors. Systematic preparation through standardized lesson plans, structured discussion guides, and continued faculty supervision is essential to maintain academic rigor, consistency, and alignment with curricular objectives.

PAL may also be strategically employed to enhance student participation and improve the overall learning climate. It can increase learner comfort in asking questions and foster constructive peer interaction, particularly in

areas where students may hesitate to actively engage during traditional faculty-led sessions.

Given the comparable delayed-term knowledge retention observed with SGD, faculty-facilitated small group sessions should continue to play a significant role in reinforcing key concepts and encouraging reflective learning over time. This ensures that foundational knowledge is revisited and strengthened beyond immediate post-session gains.

Both PAL and SGD align well with the principles of CBME by promoting active participation, communication skills, teamwork, and analytical reasoning. Session objectives and assessment strategies should be explicitly mapped to the relevant competencies to ensure curricular coherence and meaningful outcome measurement.

Faculty development remains central to the effective implementation of these approaches. Educators should be oriented toward understanding PALas a structured pedagogical strategy rather than an informal academic activity. Training initiatives focusing on facilitation skills, supervision of peer tutors, and evaluation of active learning sessions are essential for sustainability.

Finally, further multi-institutional research with larger sample sizes is warranted to validate these findings and enhance generalisability. Future studies may also examine the influence of PAL on higher-order competencies, clinical reasoning ability, and performance in summative assessments, thereby contributing to stronger evidence for curriculum design decisions.

## LIST OF ABBREVIATIONS

**CBME** – Competency-Based Medical Education
**PAL** – Peer-Assisted Learning
**SGD** – Small Group Discussion
**MCQ** – Multiple Choice Question
**SD** – Standard Deviation

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## CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

## ETHICAL ISSUES

Ethical clearance for this study was granted by the Institutional Ethics Committee of P.K. Das Institute of Medical Sciences, Kerala, India (Ref. No. IEC/03/151/25).

## SOURCES OF SUPPORT

None.

## AUTHOR CONTRIBUTIONS

**NG:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **TDC:** Design of the work; the analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **RKS:** The acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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ORIGINAL ARTICLE

# FACTORS ASSOCIATED WITH MALE ELOPEMENT WITH UNDERAGE GIRLFRIENDS IN THE ANURADHAPURA DISTRICT, SRI LANKA

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## ABSTRACT

**Introduction:** Males who elope with underage girlfriends below 16 years of age are arrested by police in Sri Lanka and subjected to clinical forensic examination for prosecution under statutory rape and abduction laws.

**Methods:** During the three-year period from 2017 to 2019, the author/s examined 49 such males in the Anuradhapura District. The reasons for elopement and demographic characteristics were analysed retrospectively.

**Results:** The ages of the males ranged from 15 to 34 years, with a mean of 21.4 years and the highest frequency observed at 20 years (n=7). All examinees were aware of the legal age of consent for sexual intercourse and the legal age of marriage, and all expressed the intention to marry their female partners when legally permissible. Occupational histories revealed unemployment (18 cases), unskilled labour (n=11), skilled labour (n=4), farming (n=4), military service (n=4), private sector employment (n=3), business ownership (n=3 cases), carpentry (n=1), and masonry (n=1). Several reasons for elopement were identified: hostile domestic environment of the female partner, including physical assaults and scalds by parents or guardians (n=20); absence of a stated reason (n=6); attempts by the female partner's parents to separate the couple (n=5); insistence of the female partner (n=5); unsafe living conditions at the female partner's home (n=5); advice by the female partner's parents (n=4); and disclosure of the romantic relationship to the female partner's parents (n=3). One exceptional case involved a romantic relationship between half-siblings, which was opposed by both families.

**Conclusion:** Within the sociocultural context of Sri Lanka, judicial responses should prioritize psychosocial management and facilitation of lawful future marriage over punitive measures, as all couples expressed their intention to marry.

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**Keywords:** *Boyfriend; elopement; Sri Lanka; statutory rape; underage*

## INTRODUCTION

In Sri Lanka, sexual intercourse with a female below 16 years of age constitutes statutory rape under the Penal Code. Romantic relationships involving underage females often result in police intervention when couples elope or are suspected of engaging in sexual activity. Elopement is defined as the act of two individuals running away together, typically for marriage, without parental consent[1]. Some elopements occur in response to adverse social, familial, or cultural pressures.

Although elopement in many countries carries minimal legal consequences, in Sri Lanka it frequently results in criminal proceedings and produces significant psychological trauma for family members, as well as psychological, social, and medical consequences for the adolescent female[2,3]. When reported, all elopement cases involving females below 18 years are subjected to clinical forensic examination due to potential offences of statutory rape (female is below 16 years) and abduction (female is below 18 years).

Understanding the reasons motivating males to participate in elopement with underage female partners is essential for developing preventive strategies, improving medico-legal management, and informing judicial decision-making. The objective of this study is to explore the motives of males to elope with their underage girlfriends.

## METHODS

Anuradhapura district has been identified as a high-prevalence area for elopement involving underage females[4]. All medico-legal examination forms of males involved in elopement cases examined between 2017 and 2019 were retrospectively reviewed.

Routine medico-legal histories included reasons for elopement, knowledge of legal age limits for sexual intercourse and marriage, and future intentions. Following institutional approval, examination forms were reviewed without recording identifying details. Data extracted included age, occupation, stated reason for elopement, awareness of legal age limits, and future plans. The extracted data was analysed using descriptive statistics.

## RESULTS

Between 2017 and 2019, forty-nine males who had eloped with underage female partners were examined. Ages ranged from 15 to 34 years, with a mean of 21.4 years, with the highest frequency being recorded at 20 years (7, 14.3%). The age distribution is shown in Table 1.

**Table 1:** Age distribution (n=49).

| Age (years) | Number of examinees | Percentage |
|---|---|---|
| **15** | 2 | 4.1% |
| **16** | 1 | 2.0% |
| **17** | 5 | 10.2% |
| **18** | 5 | 10.2%) |
| **19** | 4 | 8.1% |
| **20** | 7 | 14.3% |
| **21** | 4 | 8.1% |
| **22** | 3 | 6.1% |
| **23** | 6 | 12.2% |
| **24** | 5 | 10.2% |
| **25** | 1 | 2.0% |
| **26** | 0 | 0.0% |
| **27** | 2 | 4.1% |
| **28** | 1 | 2.0% |
| **29** | 0 | 0.0% |
| **30** | 1 | 2.0% |
| **31** | 0 | 0.0% |
| **32** | 1 | 2.0% |
| **33** | 0 | 0.0% |
| **34** | 1 | 2.0% |
| **Total** | 49 | 100.0% |

The study population comprised individuals engaged in a variety of occupations (Table 2). Students constituted the largest occupational group, accounting for 15 (30.6%) examinees, followed by casual labourers with 12 (24.5%) examinees. Businessmen represented 6 (12.2%) participants, while unemployed individuals and farmers each accounted for 5 (10.2%) participants. Private company employees and self-employed individuals (masons and carpenters) each comprised 3 (6.1%) examinees.

**Table 2:** Occupations (N=49)

| Occupation | Number of examinees | Percentage |
|---|---|---|
| Students | 15 | 30.6% |
| Casual labourers | 12 | 24.5% |
| Businessman | 6 | 12.2% |
| No employment | 5 | 10.2% |
| Farmer | 5 | 10.2% |
| Private company employee | 3 | 6.1% |
| Self-employment (masonry, carpentry) | 3 | 6.1% |

All examinees were aware of the legal age for sexual consent and marriage and expressed a desire to marry their female partners when legally eligible. Eight categories of reasons for elopement were identified (Table 3). A hostile domestic environment was the most frequently reported reason for elopement (20, 40.8%). Other common reasons included attempts by the girlfriend's parents to separate the couple, the girlfriend's insistence, and an unsafe environment at the girlfriend's home, each reported by 5 (10.2%) examinees.

**Table 3:** Reasons for elopement

| Reason for elopement | Number of examinees | Percentage |
|---|---|---|
| Hostile domestic environment, including assaults and verbal abuse by parents | 20 | 40.8% |
| Attempt by the girlfriend's parents to separate the couple | 5 | 10.2% |
| Insistence of the girlfriend | 5 | 10.2% |
| Unsafe environment at the girlfriend's home (e.g., lack of privacy, illicit arrack vending by mother, frequent visits by unrelated men, living only with stepfather) | 5 | 10.2% |
| Advised by the girlfriend’s father | 4 | 8.2% |
| Disclosure of the love affair to the girlfriend's parents | 3 | 6.1% |
| The girlfriend was the half-sister of the boyfriend, and relatives disapproved the relationship | 1 | 2.0% |
| No reason disclosed | 6 | 12.2% |

## DISCUSSION

The most frequent reason for elopement was an unfavourable domestic environment experienced by the underage female partner. Physical abuse, scalding, and threats from parents or guardians prompted the female partner to seek escape, with the male partner assuming a protective role. Notably, no male reported opposition from his own parents, suggesting that family-level conflict predominantly originated from the female

partner's household. Research on underage girlfriends has also shown minimal (4%) opposition from boyfriends' parents[5].

From a psychosocial perspective, adolescents exposed to hostile home environments are at increased risk of maladaptive coping strategies, including elopement. Romantic attachment during adolescence may serve as a perceived source of emotional security, particularly when primary caregiving relationships are characterized by fear or instability[6].

The absence of a stated reason in some cases may reflect limited emotional insight, reluctance to disclose personal motivations during medico-legal interviews, or normative adolescent romantic idealism[7]. Attempts by parents to forcibly separate couples may paradoxically intensify attachment and precipitate impulsive decisions, consistent with known adolescent developmental dynamics.

Age distribution showed a peak at 20 years (n=7) with symmetrical distribution between 15 years and 25 years. Six cases were scattered between 27 and 34 years. These six cases showed the reasons as an unsafe environment of the girlfriend's house and attempts to separate the couple by the girl's parents. Occupational history did not show any government employee. Private company employees were also minimal in number, as 6% (n=3).

Insistence by the underage female partner and unsafe home environments highlight vulnerabilities related to neglect, poverty, parental substance misuse, or absence of supervision. In some cases, parents themselves advised elopement, likely influenced by awareness of legal practices whereby marriage is facilitated once the female partner reaches 18 years, thereby ensuring social legitimacy of the relationship[8].

Cultural norms in Sri Lanka place strong emphasis on female virginity and marriage as a prerequisite for sexual relationships. These norms may motivate couples to elope as a means of preserving marital prospects rather than pursuing casual sexual activity. The universal intention to marry among examinees supports this interpretation.

The primary reason for elopement with underage female partners is parental disapproval and hostile domestic environments within the female partner's household. The insistence of the female partner, parental advice, and absence of an explicit reason were several other reasons. Psychosocial intervention targeting adolescents and families is essential for prevention.

Criminalization without addressing underlying psychosocial factors may exacerbate trauma and disrupt future family stability. Medico-legal management should therefore incorporate psychosocial assessment, counselling, and family mediation. Preventive strategies should focus on parental education, adolescent counselling services, and community-based awareness programs.

## CONCLUSIONS

Parents who were handling underage victims of sexual assault need to be educated regarding the management of issues of relationships. Teenagers also need a supportive system to discuss personal problems. Legal responses should prioritize rehabilitation and facilitation of lawful future marriage rather than punitive action against male partners, as all couples expressed intent to marry.

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None.

## CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

## ETHICAL ISSUES

This study was conducted using retrospective medico-legal records obtained with permission from the head of the institution. Confidentiality and anonymity of the individuals were maintained throughout the study by excluding all personal identifiers from the data collection and analysis process.

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ORIGINAL ARTICLE

# PROCEDURAL TREATMENT OF MENTALLY ILL DEFENDANTS: A COMPARATIVE STUDY OF JORDANIAN AND EGYPTIAN LAW

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## ABSTRACT

**Introduction:** Mental health and the ability to discern and, procedurally, the defendant's fitness to participate effectively in proceedings are central to criminal responsibility and due process. When a defendant is suspected of a mental disorder, decisions on whether to suspend or continue proceedings, order psychiatric assessment/treatment placement, and allocate decision-making authority between prosecution and court can materially affect fair-trial guarantees. This article compares Jordanian and Egyptian approaches at the investigation and trial stages.

**Objectives:** (1) Identify when proceedings should be suspended if illness existed at the offense; (2) define prosecutorial and judicial powers to order placement and dispose of cases; (3) assess whether time in psychiatric facilities is credited toward sentence; (4) compare the effects of findings of non-responsibility (Jordan) versus acquittal (Egypt).

**Methods:** Doctrinal and comparative analysis of key statutes (Jordan CPC art. 233; Penal Law art. 92; Egypt CPC arts. 338–342; Penal Code art. 62), supported by illustrative high-court decisions and recent scholarship.

**Results:** Jordan permits treatment placement and continued necessary investigation but lacks an explicit suspension rule when illness existed at the offense, retains an exceptional pathway to try a mentally disabled defendant with a guardian or appointed lawyer, and does not credit psychiatric confinement toward sentence. Egypt mandates suspension when illness arises post-offense (art. 339), limits placement to 45 days (art. 338), authorizes a "no basis for a criminal case" order when evidence shows illness negated culpability at the time of the offense (art. 342), and credits psychiatric confinement toward sentence (art. 341). Substantively, Jordan orders "conviction with declaration of non-responsibility," whereas Egypt issues an acquittal.

**Conclusions:** Jordan should codify suspension when illness existed at the offence, credit psychiatric-facility time, clarify trial-while-disabled provisions, and standardize medical-assessment criteria and timelines to better align due process with culpability principles.

**Keywords:** *Criminal procedure; criminal responsibility; Egypt; Jordan; mental health*

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## INTRODUCTION

Mental capacity in criminal responsibility is commonly assessed by reference to the accused's ability to understand the nature and wrongfulness of the act and, where the applicable standard so requires, to conform conduct to the law[1]. In criminal law, insanity is generally treated as a legal defence concerned with functional impairment at the time of the offence rather than with the mere existence of a psychiatric diagnosis. Accordingly, the presence of a mental disorder does not in itself amount to legal incapacity unless it substantially impairs the person's ability to understand the nature or wrongfulness of the act, or to act in accordance with the law[2].

Insanity in the criminal law system describes a mental state that prevents individuals from understanding reality as they suffer from a mental illness[3]. According to Jordanian law, offenders who lacked cognitive appreciation of their actions and understanding that their behaviour violated legal statutes at the time of their offense should receive legal protection against criminal prosecution. The Egyptian law considers only those individuals who lose all consciousness and free will capacity as exempt from criminal responsibility[4]. Insanity serves as a barrier that prevents individuals from taking responsibility for their criminal actions.

Criminal investigations involving suspects with mental illness require attention to two related matters. The first is the symptoms and manifestations of the suspect's condition. The second is the clinical and legal procedures used to assess that condition.

For criminal responsibility, the relevant time is the time of the offence. The legal question is whether, at that moment, the mental disorder impaired the accused's cognitive or volitional capacity to the extent required by the applicable legal standard[5].

Procedural criminal law provides the mechanisms for identifying and verifying the disorder. These mechanisms include ordering psychiatric assessments and regulating whether and how the proceedings should continue. Procedural law also safeguards the accused's right to counsel, any necessary guardian protections, and the legal consequences of treatment placement.

Accordingly, substantive and procedural issues must be examined together. The procedural response in such cases depends on the substantive legal assessment of the accused's mental condition at the time of the offence.

Jordanian criminal laws do not include a general legal definition of insanity. In contrast to this situation, Egypt has established the Psychiatric Patient Care Law No 71 of 2009, which creates definitions for care contexts that serve as materials for legal interpretation. Article 1 of that Law defines a "psychiatric patient" as a "person who suffers from a neurotic psychological disorder or a psychotic mental disorder." The same article defines "psychological or mental disorder" as "any dysfunction of psychological or mental functions to the extent that it limits an individual's adaptation to their social environment; it does not include persons who have behavioural disorders only without a clear psychiatric or mental illness"[6].

The Jordanian Code of Criminal Procedure in Article 233(5) permits ongoing trial proceedings against a defendant with an intellectual disability who requires psychiatric (mental health) treatment. The defendant now faces barriers that prevent him from joining his defence team to create and execute his legal defence strategy. The Jordanian legal system lacks explicit regulations that state that time spent in psychiatric treatment should be deducted from a person's prison term. The Egyptian Code of Criminal Procedure Article 342 allows Public Prosecution to issue a no grounds criminal prosecution order when a defendant shows mental disorder symptoms during the time of their alleged crime. The prosecution under Article 342 has the power to conduct evaluations that resemble evidence assessment and criminal responsibility determination tasks, which belong exclusively to the judicial system, according to our argument.

Researchers have studied how mental disorders affect criminal responsibility more than they have studied the legal procedures that apply to

mentally ill or intellectually disabled individuals during their time as suspects and defendants. This article fills that gap by examining comparatively how Jordanian and Egyptian law regulate psychiatric assessment, stay/continuation of proceedings, prosecutorial and judicial powers, and the procedural consequences of treatment placement (including crediting time spent in psychiatric facilities). The study supports existing research while offering specific recommendations for necessary changes.

## METHODS

The research employs a doctrinal analytical method together with a comparative method. The study investigates the relevant Jordanian and Egyptian law provisions that define mental illness and intellectual disability determinations for defendants, as well as the judicial decisions that demonstrate how these laws function throughout both countries.

## RESULTS & DISCUSSION

### Suspension of the investigation against the defendant suspected of having a psychiatric or mental illness at the time of the crime

Article 233(1) of the Jordanian Code of Criminal Procedure does not expressly address whether the investigation should be stayed or continued, while it establishes that the accused was suffering from a psychiatric or mental disorder at the time of the offence. A comparable ambiguity arises under Article 339(1) of the Egyptian Code of Criminal Procedure, which provides that: "If it is established that the defendant is unable to defend himself because of a mental disorder that occurred after the offence, the initiation of proceedings or the trial shall be suspended until his mind returns." This provision is framed around post-offence incapacity and, on its face, does not regulate the procedural consequences of mental disorder existing contemporaneously with the offence.

In light of this textual structure, a principled reading of both procedural regimes supports suspending investigative steps that require the accused's effective participation once incapacity is established, to safeguard the rights of defence and the fairness of the proceedings. Nevertheless, neither Jordanian nor Egyptian procedural law provides a clear rule on whether and on what terms the investigation must be suspended when the accused's mental disorder is alleged or proven to have been present at the time of the offence, leaving a normative gap with direct implications for due process.

### Placement of the defendant suspected of having a mental illness at the time of the crime in a treatment shelter

Article 233(1) of the Jordanian Code of Criminal Procedure obliges the Public Prosecutor to order the placement of an accused who is suspected of suffering from a mental disorder in a designated psychiatric (mental health) facility for medical observation and assessment. This measure is triggered where there are indications of a mental disorder, including where the issue is formally raised by the accused's counsel or legal guardian, and aims to ascertain the accused's mental condition for the criminal proceedings.

A request to initiate psychiatric observation under Article 233(1) should be based on serious and substantiated indications of mental disorder, rather than raised in a cursory or formulaic manner. While this point is not expressly articulated in the Jordanian text, a comparable approach is reflected in Egyptian judicial practice: the Egyptian Court of Cassation has held that a mere passing assertion by defence counsel that the accused "suffered a mental condition and entered a state of insanity" does not, without more, constitute a serious plea requiring the court to act upon it[7] (Egyptian Court of Cassation, 17 May 1954).

Article 233(1) states that the defendant must remain in the treatment shelter until his psychological and mental well-being is ascertained. We note that this article does not stipulate a specific period for detention. This is in contrast to Article (338) of the Egyptian Law of Procedure No. (150) of 1950, which allows the defendant to be placed in a government mental health treatment shelter for no more than 45 days.

The purpose of placement is to verify a defendant's mental state and/or to verify his competence to appear before investigation and trial.

We believe that placing the defendant in the treatment shelter in such instances is precautionary in nature. This is done without a judicial order to mitigate the danger posed by a mentally ill defendant to himself and society[8].

The Jordanian Penal Code (Law No. 16 of 1960) provides a comparable precautionary measure under Article 29 to address the perceived dangerousness of an offender suffering from a mental disorder. In such cases, the legal mechanism for managing this risk is the imposition of the relevant precautionary measure, notably placement in a psychiatric facility where the statutory conditions are met[9].

**Continuation of the necessary investigation while the defendant is placed in the treatment shelter**

Placement of the accused in a psychiatric (mental health) facility for assessment does not, as a matter of principle, bring the investigation to a halt. Consistent with Article 233(1) of the Jordanian Code of Criminal Procedure, the prosecution may continue to take investigative steps that are necessary and do not require the accused's effective participation - such as questioning co-accused, appointing experts, hearing witnesses, and securing perishable evidence.

This is confirmed not only by Article 233(1) of the Jordanian Code of Criminal Procedure, but also by Article 340 of the Egyptian Code of Criminal Procedure[10].

**Decision of the Public Prosecution after the establishment of mental illness at the time of the crime occurred**

When expert assessment establishes that the accused suffered from a mental disorder at the time of the offence, such that criminal responsibility may be excluded, Jordanian practice requires the Public Prosecutor to refer the case to the competent court for a determination of criminal responsibility and the appropriate procedural disposition[9]. The Public Prosecutor is not empowered to terminate the proceedings through a non-prosecution decision on this ground; the Jordanian Court of Cassation has affirmed the absence of such prosecutorial competence[11]. By contrast, Egyptian law authorizes the Public Prosecution, following investigation, to issue an order that there are no grounds to institute criminal proceedings (Article 209). Where such an order (or an acquittal) is issued due to a mental disorder, Article 342 regulates the resulting measures, including placement in a psychiatric facility in the circumstances set out by the statute[12]. This approach, in practice, entails an evaluative determination closely connected to criminal responsibility and the evidentiary record, which should remain within the court's adjudicative competence[13].

In Egyptian law, the Public Prosecution must verify the presence of this illness in the defendant at the time of the crime, based on conclusive evidence. The Public Prosecution may collect evidence from expert statements or from medical reports to clearly illustrate the impact of this illness at the time the crime was committed.

The task of demonstrating the impact of a mental illness on a defendant's awareness and willingness at the time of the crime is a hard one and is decided based on evidence on a balance of probabilities. It is simply not enough to have a medical examination stating that the defendant has the illness[14].

If the mental illness is intermittent and the crime is committed during an episode of illness, here an order is issued stating that there is no basis for a criminal case due to the absence of criminal culpability. However, if it is committed during a recovery period, the responsibility remains[15-17].

Where the Public Prosecution has issued an order that there are no grounds to institute criminal proceedings, that order has a binding procedural effect and precludes the reopening of the same case on the same facts against the same accused. This applies, including where the order was based on the accused's mental illness at the time of the offence. Accordingly, if such a

case is later brought before a court by mistake, the court should declare it inadmissible of its own motion, since the matter has already been conclusively resolved by a prior prosecutorial order and concerns procedural finality and legal certainty[18,19].

**Investigation of the defendant who became mentally ill after the crime occurred**

Article 233(1)1 of the Law of Criminal Procedure of Jordan does not clarify the issue of suspending or continuing the investigation of the defendant in cases where it is proven that he suffered from a mental or psychological illness after committing the crime. In contrast, Egyptian law expressly stipulates in article 339(1) of the Law of Criminal Procedure that proceedings against a defendant who suffers from a mental illness, after the committing of the crime, shall be suspended until he/she recovers.

Article 233(1) of the Jordanian Law of Criminal Procedure stipulates that the Public Prosecutor must suspend investigation proceedings of a defendant after conclusively establishing that he has a psychiatric or mental illness that renders him unable to defend himself, to preserve the defence safeguards prescribed by law.

In both Jordanian and Egyptian law, the Public Prosecution and the court can collect evidence that indicates that the defendant suffers from mental illness when the defendant is charged, during interrogation, questioning witnesses and experts, or with a clear and conclusive medical report that proves the illness of the defendant[15].

During the investigation of a defendant, it is recommended that the member of the Public Prosecution must be very observant, in order to verify whether the illness is present or not. This is due to the fact that the defendant may claim, contrary to reality, that he has the illness in order to escape a penalty. The defendant may act, for example, babble with incomprehensible words, phrases, and sayings, in order to delude the member of the Public Prosecution that the defendant before him suffers from a mental illness[15,20].

**3.6. Placing the defendant under competent government medical supervision with the suspension of trial proceedings**

Article 233(2) of the Jordanian Code of Criminal Procedure empowers the trial court, where there are credible indications that the accused may be suffering from a mental disorder or an intellectual disability, to order that the accused be placed under the observation of three government physicians specialised in psychiatry for the purpose of reporting on the accused's condition[21]. In exercising this power, the court retains discretion, that is, it may order (or decline to order) psychiatric observation depending on whether the material before it gives rise to a serious doubt as to the accused's procedural capacity or criminal responsibility, an approach affirmed by the Jordanian Court of Cassation[22].

Where the accused or defence counsel requests psychiatric observation under Article 233(2), the court should, as a matter of fair-trial guarantees, order the accused's placement under the prescribed medical supervision unless the request is manifestly unfounded. This approach has been affirmed by the Jordanian Court of Cassation in its criminal jurisdiction[23].

A defendant suspected of having a psychiatric or mental illness must remain under medical observation for as long as necessary to provide the court with a medical report on his medical condition.

This is contrary to Article 338 of the Egyptian Law of Procedure, which allowed placing the defendant in a government treatment shelter specialized in mental and psychological illness for a period that must not exceed 45 days.

The Jordanian and Egyptian courts have held that, where the accused (or defence counsel) raises a serious contention of mental disorder affecting the accused's capacity, the trial court should order psychiatric observation/medical supervision (or appoint an expert) rather than dismissing the request without adequate reasons[24,25].

Medical reports concerning the accused's mental condition are crucial to determining whether the accused is competent to stand trial and to participate effectively in the proceedings. The Jordanian Court of Cassation has expressly recognised that such reports may materially affect both the course of the trial and its outcome[26].

**Placing the defendant in a psychiatric shelter until he/she is competent for trial**

Article 233(3) of the Jordanian Code of Criminal Procedure provides that, where the court is satisfied based on competent medical supervision that the accused suffers from a mental disorder and is not fit to stand trial, it shall order the accused's placement in a psychiatric hospital / specialised mental health facility until fitness is restored, and shall stay the proceedings against that accused alone. If the court is satisfied that recovery is not expected, it may order the accused to remain in the facility. In all cases, the court resumes the trial once the accused becomes fit to stand trial[15].

The Egyptian law in Article 339 gives the court the authority to place the defendant in a mental asylum, in conjunction with the suspension of his trial, until he is released. The suspension here does not include trial procedures taken with a non-defendant, such as questioning witnesses, and the suspension here does not extend to injunctions or necessary trial procedures, pursuant to Article 340 of the aforementioned Egyptian law.

It is noted that contrary to Jordanian law, Article 341 of the Egyptian Law of Criminal Procedure stipulates that the period spent by the defendant in a mental asylum shall be counted towards from the period of the sentence, similar to pretrial detention. Here, we recommend that the Jordanian legislator develop a new provision corresponding to the provision of Article 341 of the Egyptian law.

**Rendering the defendant inculpable or innocent due to being mentally ill at the time of committing the crime**

Under Article 233(4) of the Jordanian Code of Criminal Procedure, where the court is satisfied that the accused committed the offence and that, at the time of its commission, the accused suffered from a mental disorder that rendered him unable to understand the nature of his conduct, the court must enter a finding of guilt but declare lack of criminal responsibility, pursuant to Article 92 of the Jordanian Penal Code[27]. Article 92 exempts such a person from punishment and provides that the person shall be detained in a psychiatric hospital (specialised mental health facility) until a competent medical committee certifies recovery and confirms that the person no longer poses a danger to public safety[28]. The Jordanian Court of Cassation has affirmed this approach[29].

In comparative terms, Article 62 of the Egyptian Penal Code (Law No. 58 of 1937, as amended) provides that no criminal liability arises where the offender, at the time of the act, lacked awareness or free choice due to a mental disorder (and it further distinguishes cases of diminished capacity). This is broadly analogous to Article 92 of the Jordanian Penal Code, which exempts the offender from punishment where a mental disorder negates the relevant mental capacity at the time of the offence[30,31]. Procedurally, Article 342 of the Egyptian Code of Criminal Procedure provides that, where an order of "no merit to file the lawsuit" is issued or an acquittal is rendered because of the accused's mental condition, the issuing authority must order the accused's placement in a specialised mental health facility (in felonies and misdemeanours punishable by imprisonment) and may only order release after reviewing the institution's report and taking steps to verify restoration of mental capacity[32].

This procedural mechanism is functionally comparable to the Jordanian framework under Article 233(4) of the Jordanian Code of Criminal Procedure, read together with Article 92 of the Penal Code, in that both systems couple the outcome grounded in mental disorder with compulsory therapeutic detention until public safety concerns are resolved[31,33].

In Jordanian law, the court issues a special verdict: it first finds that the accused committed the actus reus of the offence, but because a mental disorder at the time of the offence negated criminal responsibility, it declares the accused not criminally responsible (and therefore not punishable). By contrast, Egyptian procedure frames the outcome as an acquittal where the case is dismissed or the accused is acquitted due to mental incapacity[34,35].

**Specificity of the decision rendering the mentally disabled person criminally inculpable, pursuant to Article 233/5 of Jordanian law**

According to Article 233/5 of the Jordanian Law of Criminal Procedure, when the court verifies that the defendant is mentally disabled, it may not prosecute him without the presence of his guardian or a lawyer to defend him. After such a trial, if he is found to be (mentally impaired) at the time of the offence, the court must convict him and issue its decision rendering him criminally irresponsible, placing him under the supervision of the probation officer for one to five years. This is confirmed by the Jordanian Court of Cassation in one of its decisions[36-39].

The court may also place him before that in the National Centre for Mental Health or in any other treatment shelter to treat him from manifestations of behaviour dangerous to public order that may accompany his mental disability[40,41].

The fifth paragraph of article (233) of the Jordanian Law of Criminal Procedure does not clarify the issue of suspending or continuing the trial of the defendant here, but the phrase "If the court finds from the medical supervision conducted by it that the defendant suffers from a mental disability, he may not be tried except in the presence of the person who has guardianship over him, and if this is not possible, the court shall appoint a lawyer to defend him."

Article 233(5) may be understood as a narrowly tailored exception to the general procedural principle recognised in both Jordanian and Egyptian criminal procedure that proceedings should be stayed where the accused is unfit to defend himself due to a mental disorder. The apparent legislative rationale in Jordan is that certain forms of intellectual disability are permanent and not amenable to treatment; an indefinite stay would therefore preclude any final judicial disposition and frustrate the protective measures contemplated by the statute. On this basis, Jordanian law permits the trial to continue notwithstanding the accused's placement in a psychiatric treatment facility, provided that the accused is represented by a legal guardian or defence counsel. Where the actus reus is established, the court may then issue the special disposition prescribed for such cases, including a declaration of lack of criminal responsibility and the imposition of the relevant supervisory measures. This interpretation has been affirmed by the Jordanian Court of Cassation[42].

## CONCLUSION

It should be noted that both the Jordanian and Egyptian laws empower the Public Prosecutor's Office to place the defendant suspected of psychiatric or mental illness in a treatment shelter to verify his/her psychological and mental well-being at the time of the crime. In Jordanian law, the public prosecutor must refer the case to the competent court after the defendant's psychiatric or mental illness is established at the time of the crime. In contrast, Egyptian law gives the Public Prosecution the power to issue an order stating that there is no basis for a criminal case.

In fact, if the defendant or his lawyer asks the court to refer the defendant to medical supervision to bring medical reports showing his psychological or mental condition, the court must accept this request. Jordanian law does not provide for the deduction of the time spent in a psychiatric asylum from the sentence duration imposed on the defendant, unlike Egyptian law.

Therefore, if it is proven that the defendant, at the time of the crime, was afflicted with an illness that made him unable to realize his behaviour, under Jordanian law, the court must issue its decision convicting him and declaring his criminal irresponsibility. In Egyptian law, it

must issue its decision: (acquitting him of the crime). There is an exception in Jordanian law, as follows: (The continuation of the trial of the defendant who is mentally disabled, while in the treatment shelter).

Finally, it is necessary to introduce a provision in Jordanian law on the suspension of proceedings against a defendant who has been found to have a psychiatric or mental illness until he returns to his senses, following the tracks of the Egyptian law, and to Introducing a provision in Jordanian law concerning the deduction of the time spent in a psychiatric or mental asylum from the sentence imposed on defendant, as is the case with pre-trial detention, following the tracks of the Egyptian law.

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CASE REPORT

# EXPLORING SPOUSAL HOMICIDE IN FORENSIC PSYCHIATRY: A CASE SERIES

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## ABSTRACT

**Introduction:** Spousal homicide (SH) in the forensic psychiatry setting can be the result of multiple aetiologies working together within the dynamic nature of intimate relationships. Defences attainable in SH include insanity, automatism, battered woman syndrome, and diminished responsibility. This case series illustrates the diversity of psychosocial, criminological, and psychiatric pathways leading to SH and highlights the role of forensic psychiatric assessment in determining criminal responsibility within the Sri Lankan legal context.

**Case Histories:** A 48-year-old male with a history of alcohol dependence was charged with the murder of his wife. He had controlling and possessive behaviours towards his wife and inflicted repeated physical and psychological trauma. At the time of the offense, he was in a state of intoxication. A 32-year-old female was referred following the murder of her husband. She endured recurring physical and psychological trauma from her unemployed, psychoactive drug-dependent husband. She was diagnosed with a depressive illness earlier. A 28-year-old male from a dysfunctional family, who exhibited impulsive behaviours, was charged with the murder of his wife. He reported persistent physical and emotional abuse from his wife and discovered her extramarital affair a week before the incident. A 45-year-old male was referred for the murder of his wife. He suffered from a delusional disorder and harboured delusions of infidelity towards his wife. His wife had sought help from legal authorities multiple times due to physical and emotional violence.

**Conclusion:** Determining criminal responsibility in SH requires a comprehensive forensic psychiatric assessment, including retrospective reconstruction of the offender's mental state at the time of the offence. The psychiatrist must understand the relevant legal defences so that an assessment in accordance with legal criteria can be done. Early contact with mental health services and understanding their criminological characteristics may help in identifying high-risk individuals and establishing opportunities for possible interventions.

**Keywords:** *Homicide; insanity; psychiatry; spouse; Sri Lanka*

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## INTRODUCTION

Global research shows that an intimate partner carries out one in seven homicides and that females are at a greater risk of being victims than males[1]. Spousal homicide (SH) can be the result of multiple aetiologies working together within the dynamic nature of intimate relationships. It appears that spousal or intimate partner homicides are not merely the endpoint of a series of non-lethal violent acts committed by the offender but a unique entity with a heterogeneous group of perpetrators. The majority of the offenders do not suffer from major psychiatric illnesses[2]. Poverty, psychoactive substance use, younger age, and history of violence have been identified as risk factors[3].

In Sri Lanka, one in three females suffers from intimate partner violence (IPV) that occurs within the context of legal marriage[4]. However, males too have been reported to be victims of IPV[5]. To our knowledge, no studies have been carried out to assess the nature and circumstances of SH in Sri Lanka. We report four divergent cases of SH referred to forensic mental health services by the criminal justice system for psychiatric assessment and treatment. These cases illustrate differing psychosocial backgrounds, psychiatric histories, and legal considerations relevant to criminal responsibility. The relevant information was obtained through clinical interviews of the offender, obtaining collateral information from family members, and reviewing past clinical records and police records.

## CASE HISTORIES

**Case 1:**

A 48-year-old male was referred with charges of murder of his wife while under the influence of alcohol. Married for nearly two decades, the couple had experienced increasing marital conflicts, particularly regarding their daughter's recent relationship. He had a history of alcohol dependence and controlling behaviour, often inflicting repeated physical and psychological trauma on his wife. Following an argument, he reported setting fire to his spouse "as a joke" after she had doused herself with petrol. While he claimed the act was unintentional, he admitted that during the first attempt, she did not catch fire and that he repeated the act, which ultimately caused the fatal burn, a sequence confirmed by collateral accounts. A forensic psychiatric evaluation revealed no evidence of psychiatric illness at the time of the incident. He was voluntarily intoxicated with alcohol. It was opined that he was capable of understanding the nature and consequences of his actions, as well as their wrongfulness and illegality, at the material time. He was assessed as fit to stand trial. Psychological interventions were recommended to address alcohol dependence and impulsivity.

**Case 2:**

A 28-year-old male was charged with the murder of his wife during a confrontation stemming from marital discord with verbal altercations and mutual physical abuse. Raised in a dysfunctional family, the accused had experienced significant childhood adversities alongside maternal psychiatric illness. On the day of the incident, the couple had fought over a perceived betrayal involving explicit communications between the wife and an alleged male partner via letters and mobile text messages. In response to repeated provocations, the man had struck his wife with a wooden pole, leading to her fatal injury. Despite demonstrating impulsive personality traits, a forensic psychiatry assessment revealed no psychiatric illness at the time of the incident, and he was deemed fit to stand trial.

**Case 3:**

A 32-year-old woman was referred following fatally injuring her husband during a domestic altercation. The couple had been married for four years, had a turbulent relationship with ongoing verbal and physical abuse fuelled by the husband's alcohol consumption and psychoactive drug dependence. On the day of the incident, she had returned home to find her child unattended and her husband intoxicated. A heated argument ensued, escalating into physical violence, and she reported having stabbed him with a kitchen knife. She had a history of postpartum depression two years before the index event, referred to psychiatric

services, but defaulted soon after. She did not display evidence of a major psychiatric illness at the time of the event and was not on any psychotropics. A forensic psychiatry evaluation concluded that she had the capacity to understand the nature and consequences of her actions and that she is fit to stand trial.

**Case 4:**

A 45-year-old male was referred with charges of murder of his wife, during which he had struck her head with a rock. He had exhibited symptoms of a long-standing delusional disorder, with persistent delusions of infidelity directed towards his wife, even at the time of the offense. He had previously been treated with risperidone but defaulted five years before the index event. His wife had previously sought legal protection on multiple occasions due to ongoing physical and emotional abuse and lived separately. On the day of the incident, the individual had acted in accordance with his delusional beliefs, leading to his wife's death. Although his psychiatric condition was acknowledged, the forensic psychiatry evaluation concluded that he had an understanding of the nature and consequences of his actions at the time of the incident. He was fit to stand trial.

## DISCUSSION

Observational studies have reported that most victims of SH are young, unemployed females[6]. Female victims of SH have been reported to be as high as 3.1 per 100,000 population[7]. While two of our female victims were in their thirties, one was in her fifties. Female victims of SH have often been continuously physically and emotionally abused by their partners, while this is found to be extremely rare in male victims[8]. While two of our female victims suffered long-term IPV, the female victim from case 2 was reported to be abusive both physically and emotionally by the perpetrator since the onset of their relationship. Most victims of SH have not been in contact with legal or medical services for protection from the perpetrators, which was affirmed in this series, where only one of four victims had sought legal support before the index event[6].

In cases such as those presented in this paper, forensic psychiatrists are expected to assess the presence of any mental illness that would affect the criminal responsibility of the offender and also ascertain the risk of recidivism, which may determine sentencing. Psychiatrists need to be aware of the different legal defences: insanity, automatism, battered woman syndrome, and diminished responsibility. The assessment involves retrospective reconstruction of the mental state of the offender at the time of the crime. The four cases described above portray how substance use, mental illness, and provocation in the background of long-term interpersonal conflict led to SH.

Case 1 describes an act of violence under the influence of alcohol. Substance abuse is less clearly associated with SH than homicide in general or spousal assault[9]. Under Sections 78 and 79 of the Penal Code of Sri Lanka, voluntary intoxication does not generally constitute a defence. However, Section 79 allows for an exception if it can be shown that the accused was incapable of forming the required *mens rea* for a specific-intent crime, such as murder[10]. In practice, this requires the accused to establish that intoxication so impaired his cognitive capacity that he was unable to form the requisite *mens rea* for the offence. In Dayaratne v. The Republic of Sri Lanka (1990 2 SLR 226), the Court of Appeal held that, in a charge of murder, Section 79 applies only where the evidence shows that intoxication deprived the accused of the capacity to form a murderous intention[11].

The role of a psychiatrist here is to assess the mental state of the perpetrator at the time of the crime retrospectively to help the legal system identify if he was able to form the guilty mind of committing murder while under the influence of alcohol. By evaluation of all information available and recreating his mental state at the time of the crime, his behaviour from the time leading to the event, during the event, and afterwards, clearly showed his ability to restrain, act rationally, and make reasonable choices despite the use of alcohol. Thus, despite being intoxicated, his cognitive capacity to form the *mens rea* was unaffected and did not qualify for a defence.

Cases 2 and 3 demonstrate homicides executed during periods of extreme distress following long-standing IPV by the partner. Here, the perpetrators demonstrate similar characteristics in their development and upbringing. Both reported an unhappy and insecure childhood, emotional dysregulation during adolescence, and impulsive personalities in adulthood. The intimate relationship with the victim turned out to be the only confiding relationship they had experienced. This striking pattern of similar inter-relational disputes and circumstances leading to SH has been described as 'spousal homicidal syndrome'[12]. When a female is the perpetrator in SH, there is often a history of long-term battering or an immediate victim precipitation[3]. Battered women tend to lose hope in the criminal justice system due to the socially sanctified nature of wife beating and the patriarchal community standards that exist, especially in the South Asian context[13]. Although it arouses great sympathy for the offender, psychiatrists need to express their opinions respecting objectivity while adhering to legal criteria.

A defence of automatism has been raised in similar cases where the act had been thought to be committed in a dissociative state under extreme distress[12]. In Sri Lanka, automatism is not recognized as a separate statutory defence but may be considered in limited circumstances under common law principles. For such a defence to be applicable, there must be evidence of a complete loss of voluntary control and awareness at the time of the act[14]. It is therefore necessary to distinguish involuntary behaviour from actions carried out in states of intense emotion, anger, or impulsivity, which do not in themselves amount to automatism. From a forensic psychiatric perspective, this distinction is often challenging, particularly in spousal homicides involving prolonged intimate partner violence, where stress and emotional arousal can mimic dissociative states. A careful assessment is required, focusing on the individual's behaviour around the time of the offence, including the organization and purposefulness of actions, as well as the ability to recall events before, during, and after the incident. A detailed forensic psychiatry assessment of the offenders in cases 2 and 3 revealed they were able to recall the events completely, which made it unlikely that they were in a state of dissociation.

Battered woman syndrome (BWS) is a psychological framework used to describe the effects of prolonged intimate partner violence and was originally conceptualized to explain the behavioural and emotional responses observed in women exposed to repeated abuse[15] and is not a defence by its own, but has been used as an adjunct to either provocation or self-defense[16]. Although BWS is not a formal psychiatric diagnosis, it refers to a state of psychological distress arising from sustained physical and emotional abuse by an intimate partner, commonly characterized by fear conditioning, hypervigilance, and altered perception of threat[15]. To ascertain a defence of such requires the offender to identify an imminent threat to life or serious injury that requires a proportionate response of self-defense[10]. The role of the forensic psychiatrist is to objectively assess the psychological impact of prolonged abuse and explain its relevance to the accused's perception of threat and decision-making at the material time, while maintaining a clear distinction between psychological vulnerability and legal responsibility[17].

Nearly one third of all SH offenders have been treated for a psychiatric disorder during their lifetime, which includes schizophrenia and other primary psychotic disorders, affective disorders such as depression, and a minority with personality disorders[18]. Two offenders in our series from cases 3 and 4 suffered from a depressive disorder and a delusional disorder, respectively, during their lifetime. Section 77 of the Penal Code of Sri Lanka requires an individual to lack the cognitive capacity to appreciate the nature, wrongfulness, and illegality of an act due to a reason of unsoundness of mind to meet the criteria of the insanity defense[19]. The forensic psychiatry assessment here was directed at identifying symptoms of major mental illnesses at the time of the crime and how they influenced the relevant capacities mentioned above. The mere presence of a mental illness, including a delusion, is insufficient to establish unsoundness of mind. To meet the legal criteria for insanity, the offender must have been

unable to understand the nature, wrongfulness, or illegality of his act at the material time.

The forensic psychiatrist's role is to collect and evaluate all relevant information—including clinical history, collateral accounts, behaviour before, during, and after the offence, and mental state at the time of the act—to reconstruct the offender's retrospective mental state. This assessment involves analysing whether the symptoms present were sufficient to impair the offender's capacities in accordance with the legal criteria. The psychiatrist then presents these findings to the court in a structured and objective manner, explaining the reasoning and evidence used to reach conclusions, including observed behaviours, clinical signs, and collateral information[20].

In case 4, although the offender held a delusional belief regarding his wife's fidelity, this belief did not impair his understanding of the nature, wrongfulness, or illegality of his actions. Therefore, he was considered of sound mind at the time of the offence, and the criteria for an insanity defence were not met. Similarly, although the offender in case 3 had a diagnosis of a depressive disorder, her mental state at the time of the crime did not display any depressive symptoms. Therefore, both offenders were considered to be of sound mind at the time of the offence and did not qualify for a defence of insanity.

These four cases also highlight the importance of understanding the criminological characteristics of IPV offenders, which may help in identifying high-risk individuals early and establishing opportunities for possible interventions. Across all cases, certain criminological characteristics emerged as indicators of elevated risk for spousal homicide. For example, impulsivity was prominent in cases 2 and 3, contributing to the rapid escalation of conflicts into lethal acts. Substance misuse, notably chronic alcohol dependence in case 1, impaired judgment, and increased aggressive tendencies. A history of IPV was evident in cases 2–4, reflecting entrenched patterns of control, abuse, and conflict within the relationship. Finally, psychiatric conditions, such as depression in case 3 and delusional disorder in case 4, further complicated the risk profile.

Empirical research supports the observations made in the 4 cases. Studies of intimate partner homicide perpetrators show that substance use disorders and other psychiatric conditions feature prominently among offenders referred for forensic psychiatric assessment, helping to identify individuals at elevated risk of lethal violence. Typologies of intimate partner violence and homicide perpetrators indicate that criminological, situational, and psychological traits—such as controlling behaviour, emotional dysregulation, and altered threat perception—distinguish profiles at higher risk for intimate partner homicide[22]. Meta-analytic evidence further confirms that substance abuse and abusive relational dynamics consistently predict intimate partner homicide, emphasizing the importance of behavioural and contextual risk factors in prevention strategies[23].

Understanding the aforementioned risk factors may help identify high-risk individuals early and establish opportunities for possible interventions. Timely referral to mental health services could prevent SH that occurs as a result of mental health conditions. Substance-related disorders may require both psychological and pharmacological interventions, while psychotic illnesses, such as delusional disorders, are treated with pharmacological agents such as antipsychotics[24]. Long-term interpersonal difficulties within marriages are well managed with psychological interventions such as family therapy that aim to improve communication, autonomy of each partner, agreement about roles, and reduce conflict[25].

## CONCLUSION

SH results from a multifactorial interplay of psychosocial, personality, and psychiatric variables. Comprehensive psychiatric evaluations and understanding of available defences facilitate accurate assessments of criminal responsibility and legal defences. Early identification of high-risk individuals, coupled with timely mental health interventions and legal safeguards for victims, may contribute to reducing the incidence of such fatal events.

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## CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

## ETHICAL ISSUES

The findings of the presented cases were used for academic purposes, with the informed consent according to the institutional guidelines, without divulging the identity of the individual.

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None.

## AUTHOR CONTRIBUTIONS

**DM:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **DW:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **CA:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CASE REPORT

# A RARE CASE OF FATAL GASTROINTESTINAL MUCORMYCOSIS IN A TODDLER DIAGNOSED AT MEDICO-LEGAL AUTOPSY: A CASE REPORT

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## ABSTRACT

**Introduction:** Gastrointestinal (GI) mucormycosis is a rare, rapidly progressive, and life-threatening angio-invasive fungal infection caused by fungi of the order *Mucorales*. It predominantly affects immunocompromised individuals and is associated with high mortality, particularly in infants and neonates. Owing to its nonspecific clinical presentation, diagnosis is frequently delayed or established post-mortem.

**Case Presentation:** We report the case of an 18-month-old toddler with a history of marginal prematurity, intrauterine growth restriction, malnutrition, and iron-deficiency anaemia who presented with abdominal distension, vomiting, and diarrhoea. The child was on a balanced diet with oral iron supplementation. He was initially managed for acute viral gastroenteritis; however, his clinical condition rapidly deteriorated, with the development of blood-stained stools and subsequent sudden cardiac arrest. Resuscitation was unsuccessful. A medico-legal autopsy revealed inflamed bowel loops and multiple gastric ulcers without perforation. Histopathological examination of the stomach demonstrated ulcerated mucosa with extensive necro-inflammatory debris and numerous broad, aseptate, ribbon-like fungal hyphae with angio-invasion. Grocott methenamine silver staining confirmed features consistent with GI mucormycosis.

**Conclusion:** This case highlights GI mucormycosis as a rare but fatal cause of acute gastrointestinal illness in children, particularly in the presence of predisposing factors such as malnutrition and iron deficiency anaemia on top of marginal prematurity. The nonspecific clinical features may mimic common gastrointestinal conditions, leading to missed or delayed diagnosis. Prompt and appropriate medical treatment, together with early histopathological confirmation in cases of presumptive or suspected mucormycosis, is essential to facilitate timely intervention for optimal outcomes.

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## INTRODUCTION

Gastrointestinal (GI) mucormycosis is a rare, life-threatening, and rapidly progressive angio-invasive fungal infection caused predominantly by fungi of the order *Mucorales*. Based on the organ system involved, mucormycosis is classified into pulmonary, cutaneous,

gastrointestinal, central nervous system, and disseminated forms[1]. GI mucormycosis is considerably less common than other clinical forms, accounting for approximately 5–15% of reported cases[2]. Ingestion of contaminated food is considered the source of primary infection, and the stomach, small intestine, and ileum are the most commonly affected sites[3]. The infected patients typically present with abdominal pain, abdominal distension, and bloody diarrhoea, and may be complicated by ulceration and perforation.

Immunosuppression is a major predisposing factor for GI mucormycosis in all age groups[4]. In paediatric patients, particularly those with a history of prematurity, autoimmune disorders requiring immunomodulatory therapy, corrective abdominal or congenital cardiac surgeries, or admission to paediatric intensive care units, there is an increased risk of developing this lethal fungal infection[5,6]. Although rare, gastrointestinal mucormycosis has also been reported in premature neonates, where it may clinically mimic neonatal necrotizing enterocolitis[7]. We report a rare case of gastrointestinal mucormycosis in a toddler with a history of prematurity and malnutrition, which was diagnosed during post-mortem examination.

## CASE PRESENTATION

An 18-month-old male toddler was admitted to the hospital with a two-day history of abdominal distension, vomiting, and loose stools. On admission, he was clinically dehydrated and given emergency intravenous fluid resuscitation. According to the history provided by the mother, the child was born with marginal prematurity and intrauterine growth restriction at 34 weeks of gestation following premature rupture of membranes. According to the history and clinical records, his birth weight was 1.85 kg, and he had received intensive care during the first 2 weeks for neonatal sepsis. Since then, his weight gain had been poor and was significantly below the expected weight-for-height percentile. He was under regular follow-up at a general paediatric clinic for malnutrition and iron-deficiency anaemia. The parents were advised regarding a balanced diet, and oral iron supplementation was prescribed.

He has been fed a combination of breast milk, supplemental formula milk, and a mixed diet. The child's meals were prepared by the mother, ensuring proper hygiene. The child was initially managed for acute viral gastroenteritis. However, despite fluid resuscitation and other supportive medical treatment, his clinical condition deteriorated with an increased frequency of bowel movement that subsequently became blood-stained. Laboratory investigations were suggestive of a recent viral infection, with a white blood cell count of 4.2 k/µL and a low haemoglobin level of 9 g/dL. After 36 hours of admission, the child suffered a sudden cardiac arrest, and resuscitation efforts were unsuccessful. A medico-legal autopsy was performed the next day.

Post-mortem examination revealed a thin, pale, and markedly underweight body (weight 6.9 kg, below -3SD at Weight for Age chart) with no external or internal congenital abnormalities. On internal examination, the bowel loops appeared inflamed but showed no evidence of necrosis or perforation. The stomach was inflamed, with congested mucosa and multiple ulcers (Figure 1). Blood-stained stool was present throughout the lower intestine (Figure 2) with inflammation and epithelial necrosis of the intestinal mucosa.

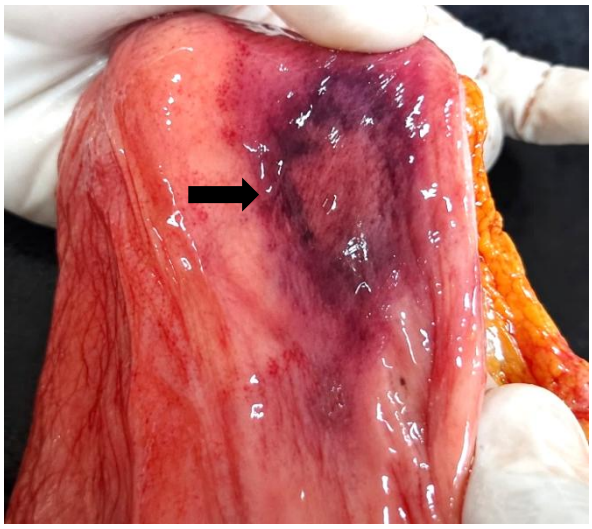

**Figure 1**: Specimen of the stomach demonstrating a gastric ulcer (arrow) with an inflamed, congested mucosal margin and a pale base.

**Figure 2**: Specimen of the small intestine demonstrating inflamed intestinal mucosa.

Postmortem samples were obtained for toxicology, microbiology, and histopathology studies. The samples were negative for common poisons, and no organisms were isolated. Histopathology of the stomach revealed ulcerated mucosa with necroinflammatory debris (Figure 3) and numerous aseptate broad ribbon-like, irregular branching hyphae at right angles (Figure 4). Multiple foci of angioinvasion were noted in the submucosal vessels (Figure 5). Morphology of the hyphae was compatible with mucormycosis.

The gastrointestinal lesion was stained with Grocott Methenamine Silver (GMS) stain, which demonstrated fungal hyphae stained in black consistent with mucormycosis (Figure 6). Microscopic examination of the liver, lungs, brain, and heart revealed features of multiorgan failure.

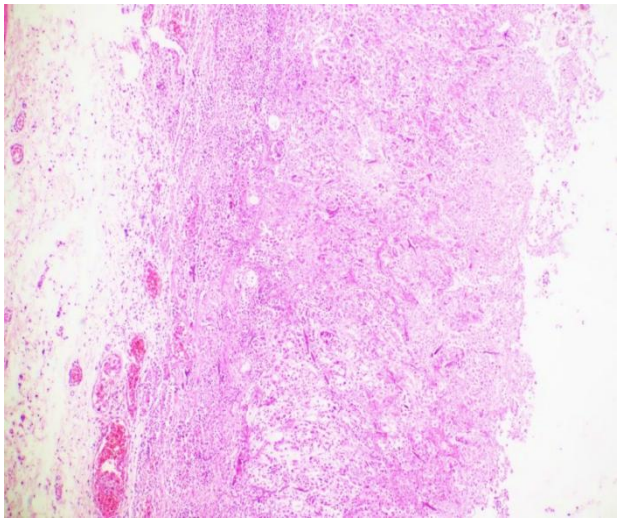

**Figure 3**: Ulcerated gastric mucosa covered by necroinflammatory debris (H&E, 4x10).

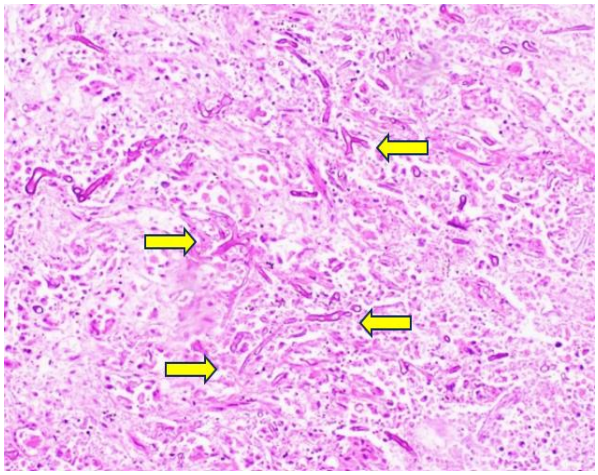

**Figure 4**: Numerous fungal hyphae (yellow arrows) in the gastric mucosa (H&E, 10x10).

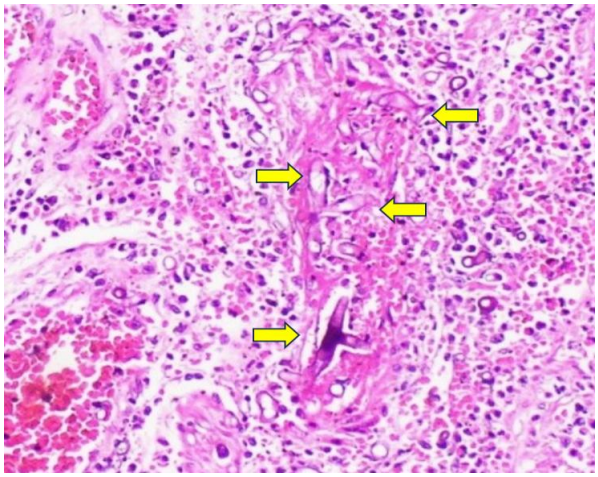

**Figure 5**: Fungal hyphae (yellow arrows) invading the gastric submucosal vessels (angioinvasion) with surrounding inflammatory cell infiltrates (H&E, 10x10).

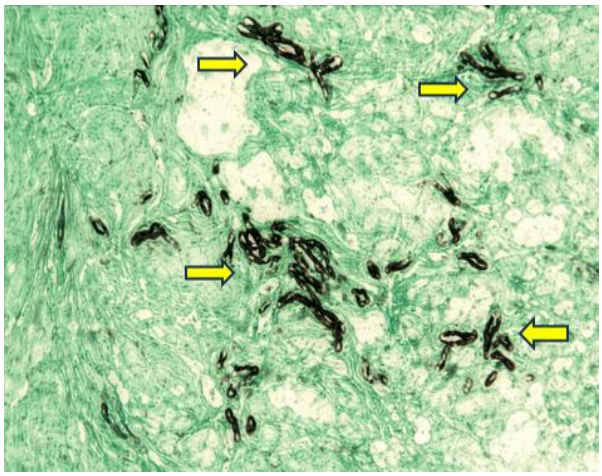

**Figure 6**: Gastrointestinal lesion, showing mucormycosis fungal hyphae (yellow arrows) stained in black (Grocott Methenamine Silver stain, 40X10).

## DISCUSSION

Mucormycosis is a severe, opportunistic, angio-invasive fungal infection mainly observed in immunocompromised paediatric patients. Ingestion of Mucorales spores from contaminated food or water predisposes patients to invasive mucormycosis, particularly in the presence of impaired mucosal defence mechanisms. Among the affected systems of the body, GI involvement may represent the sole manifestation of mucormycosis, accounting for approximately 7% of reported cases[8]. In paediatric GI mucormycosis, the stomach is the most commonly affected organ, followed by the colon, small intestine, and oesophagus[9,10]. Clinical manifestations are nonspecific and vary according to the site involved, with abdominal pain, distension, vomiting, and gastrointestinal bleeding being common features. Most reported cases describe massive GI bleeding and perforation as the cause of death. In our case, the disease manifested with bloody diarrhoea without intestinal perforation at the time of death, possibly due to the short duration of illness and rapid clinical deterioration leading to death. GI haemorrhage, bowel perforation, and local infarction often necessitate urgent surgical resection and systemic antifungal therapy with amphotericin B[11,12].

According to the World Health Organization classification, birth at 34 weeks of gestation is considered a late preterm delivery (range 34 – 36+6 weeks of gestational age at birth), while a foetal weight of 1850 g at 34 weeks is most likely due to intrauterine growth restrictions [weight below 10$^{th}$ centile][13]. Therefore, this represents a case of marginal prematurity associated with intra-uterine growth restriction. The child's birth weight was 1.85 kg, which was below the −3 SD centile according to the weight-for-age chart in the Child Health Development Record (CHDR). The body weight recorded at autopsy was 6.9 kg and remained below the −3 SD centile, indicating severe malnutrition. Antemortem investigations revealed moderate anaemia, with a haemoglobin level of 9 g/dL. Although the child had gained weight over time, adequate catch-up growth was not achieved despite receiving a balanced diet and supplementary iron therapy.

Considering the child's age of 18 months and the associated predisposing factors, malnutrition was likely the most significant contributor to the virulence and invasive potential of Mucorales. Protein-energy malnutrition in toddlers is a recognized major risk factor for invasive fungal infections, particularly GI mucormycosis. Malnutrition impairs both innate and adaptive immunity, weakens mucosal barrier integrity, reduces phagocytic activity, and predisposes to opportunistic fungal infections. Proposed pathophysiological mechanisms include phagocytic dysfunction, impaired chemotaxis, and defective intracellular killing of Mucorales, particularly within an acidic gastric environment[13]. Iron is an essential growth factor for Mucorales, and increased availability of free iron enhances fungal proliferation, angioinvasion, and virulence, thereby contributing to the pathogenesis of mucormycosis[14].

Clinically, it is difficult to diagnose GI Mucormycosis due to its nonspecific presentation and low clinical suspicion. Most cases are diagnosed accidentally during surgery or autopsy examination. Biopsy of the affected site within the GI tract remains the gold standard for establishing the histological diagnosis of GI mucormycosis[15]. Microscopic identification of broad, irregular, aseptate hyphae with a right-angle branching pattern and evidence of angio-invasion is important. In some cases, a positive fungal culture or polymerase chain reaction (PCR) result from the biopsy specimen is required to confirm the diagnosis[16]. In the index autopsy case, incidental findings suggestive of mucormycosis were identified primarily through histopathological examination. A definitive diagnosis could have been further confirmed by positive fungal culture or PCR testing. Considering the clinical history, autopsy findings, and ancillary investigation results, the cause of death was concluded to be GI mucormycosis complicated by dehydration and probable electrolyte imbalance secondary to fluid loss, in the background of malnutrition and history of prematurity.

## CONCLUSIONS

GI mucormycosis is a rare but highly aggressive fungal infection associated with significant mortality, particularly in vulnerable paediatric populations. This case highlights the diagnostic challenge posed by its nonspecific clinical presentation, which may closely mimic common conditions such as acute gastroenteritis or necrotizing enterocolitis, leading to delayed or missed diagnosis. Marginal prematurity, malnutrition, iron deficiency anaemia, and prior neonatal sepsis were important predisposing factors in this toddler. A high index of clinical suspicion, especially in at-risk children with rapidly deteriorating gastrointestinal symptoms, is essential. Histopathological examination and fungal cultures in combination with genetic material analysis (PCR) remain the cornerstone for definitive diagnosis. Early recognition, Prompt and appropriate systemic antifungal therapy treatment, together with early histopathological confirmation in cases of presumptive or suspected mucormycosis, is essential to facilitate timely intervention and improve outcomes.

## LIMITATIONS

Definitive species-level identification could not be achieved because fungal culture and molecular diagnostic techniques were not performed. While these ancillary investigations may enhance diagnostic confirmation, their availability remains limited in routine practice in Sri Lanka.

## ACKNOWLEDGEMENTS

None.

## CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

## ETHICAL ISSUES

The presented case was conducted for medicolegal purposes, and the findings were used for academic purposes, according to the institutional guidelines, without divulging the identity of the individual.

## SOURCES OF SUPPORT

None.

## AUTHOR CONTRIBUTIONS

**UGBJ:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **KBR:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CASE REPORT

# FORENSIC EXHUMATION OF A WARTIME MASS GRAVE AT KOKKUTHUDUVAI, MULLAITIVU, SRI LANKA: A FORENSIC CASE REPORT AND LESSONS LEARNT

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## ABSTRACT

**Introduction:** The exhumation of human remains from wartime mass graves presents logistical, emotional, and technical challenges, especially in a post-conflict area. This forensic field case report highlights the experience of exhuming a mass grave discovered in Kokkuthuduvai, Mullaitivu, Sri Lanka, following the country's civil war from 1983 to 2009.

**Case Presentation:** The excavation uncovered the skeletal remains of 52 individuals, suspected to be associated with Liberation Tigers of Tamil Eelam (LTTE) forces based on contextual, artefactual and clothing evidence. Descriptive anthropological analyses revealed a predominance of females, with ages ranging from approximately 12 to 53 years, and evidence of explosive and gunshot injuries. Major challenges included maintaining transparency and trust among a local population affected by the conflict and often distrustful of authorities. Strategies such as regular media briefings, independent observation, and culturally appropriate funeral rites were implemented to address these concerns, though they sometimes led to misinterpretation of scientific findings. Another challenge was managing the emotional impact on the survivors of the war, stemming from not getting answers about the fate of their kin. Financial constraints further complicated the project, as delays in the approval of funds hindered progress. Audio magnetotelluric techniques were utilized to delineate the grave's extent, minimizing disruption to local infrastructure. Definitive individual identification was not achieved due to the absence of traceable records and reference DNA for comparisons. Examination of skeletal remains presented challenges relating to the interpretation of perimortem, antemortem and postmortem trauma, with imaging studies proving valuable for differentiating these changes.

**Conclusion:** This experience from Sri Lanka highlights the importance of community engagement, emotional sensitivity, flexible funding, and advanced forensic techniques in mass grave investigations.

**Keywords:** *Exhumation; forensic anthropology; mass grave; skeletal remains; Sri Lanka*

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## INTRODUCTION

Sri Lanka is an island nation with a land area of 65,610 km$^2$ located in the Indian Ocean. The Sri Lankan Civil War, which lasted from July 1983 to May 2009, was a conflict between the separatist Liberation Tigers of Tamil Eelam (LTTE) and the armed forces of the government of Sri Lanka, fought mainly in the northern and eastern parts of the island[1]. The death toll of the conflict ranges from 70,000 to 100,000, with thousands reported missing[2-4]. Mullaitivu District in the Northern Province of Sri Lanka, predominantly inhabited by Tamils, was one of the epicentres of the conflict, witnessing several major battles and skirmishes and remained under LTTE control for about half the duration of the war[5]. The prolonged conflict led to significant loss of life, enforced disappearances, displacement, and long-term social and cultural disruption, particularly affecting the Tamil population of the region.

In the Tamil society of Sri Lanka, where Hinduism is the predominantly practised religion, dead bodies are cremated. During the Civil War, especially in LTTE-controlled areas, the practice of burials emerged, and the cemeteries were perceived as holy places[6]. The absence of proper burial and knowledge of the fate of missing relatives has left many families in prolonged states of grief and uncertainty.

Before the discovery of the mass grave discussed in this article, at least 32 graves had been identified. But only seven have been excavated, which include graves from Northern and Eastern provinces, namely Chemmani, Jaffna, Kalavanchikudy, and Mannar. Graves discovered in Matale and Sooriyakanda have been connected with deaths during the insurrection led by the leftist political party Janatha Vimukthi Peramuna (People's Liberation Front), while several graves found on the southern coast of Sri Lanka had been created to dispose of the victims of the 2004 tsunami disaster[7]. Investigations into the mass graves are uniquely challenging due to limited documentation of wartime deaths, lack of antemortem data or deoxyribonucleic acid (DNA) reference samples, and infrastructural constraints in the previously conflict-affected areas. The discovery of wartime mass graves in this region is not merely a forensic or legal exercise, but one deeply entwined with the cultural practices surrounding death and mourning.

Previous international experiences had shown that mass grave investigations require multidisciplinary collaboration involving forensic pathology, forensic anthropology, archaeology, radiology, and humanitarian engagement, with strict protocols, particularly in post-conflict settings. Issues such as clandestine burial, reburial, commingling of remains, and post-depositional disturbances complicate stratigraphic interpretation and recovery of remains[8,9]. Exhumations are often prolonged, resource-intensive, and require careful excavation over extended periods to preserve fragile remains and artefacts[10]. In addition, investigators face many ethical and legal concerns, such as the need to balance humanitarian and legal requirements, while ensuring adherence to human rights standards and maintaining the integrity of the investigation[11].

This manuscript is presented as a forensic field case report with reflective operational lessons from a wartime mass grave investigation in post-conflict Sri Lanka. The primary focus is on the operational, ethical, anthropological, humanitarian, and procedural challenges encountered during the exhumation and analysis process.

## CASE PRESENTATION

On 29$^{th}$ June 2023, the presence of human remains was first reported in Kokkuthuduvai (9.051912, 80.915362), located approximately 26 km south-east of Mullaitivu town, adjacent to the B-297 Mullaitivu-Kokkilai road (Figure 1), during an excavation of a trench to lay a water supply line by the workers of the National Water Supply and Drainage Board (Figure 2)[12]. On 6$^{th}$ July 2023, the site was preliminarily explored by the Forensic Pathologist of the District General Hospital, Mullaitivu, under the inquest order issued by the Magistrate of Mullaitivu. Since there are no separate laws for the disinterment of human remains in Sri Lanka, the magisterial order was issued as per the provisions of section 373 of the Code of

Criminal Procedure Act No. 15 of 1979[13]. Since it appeared to be a part of a larger grave site with remains belonging to multiple individuals, further exploration was immediately halted to facilitate a more organized excavation process.


**Figure 1:** Location of the exhumation site (9.051912, 80.915362) marked by the red pointer in the map of Sri Lanka (a) and the Mullaitivu area (b) and an outline of the excavation (c).

**Figure 2:** The site of initial excavation adjacent to B-297 road (arrow), which led to the discovery of human remains and clothing (circled).

A team comprising of the Forensic Pathologist of the District General Hospital, Mullaitivu; a Senior Professor in Archaeology at the Postgraduate Institute of Archaeology, University of Kelaniya; a specialist in Forensic Pathology with special interest in Forensic Anthropology from Teaching Hospital, Jaffna; Scene of Crime Officers (SOCO) from local police; lawyers and representatives from the Office on Missing Persons (OMP) was formed under the magisterial supervision to further investigate the site. A discussion was held at the court premises between the above team and the local political representatives, and it was planned to continue the excavation project systematically with the participation of the experts. The objective of the exhumation project was humanitarian and truth-seeking, to identify the victims and circumstances related to their deaths. The funding for the project was to be provided by the Ministry of Justice of Sri Lanka, through a proposal submitted to the Divisional Secretariat, Mullaitivu, which deviated from the usual process of obtaining funds from the Ministry of Justice of Sri Lanka via the local courts. Logistical arrangements were made before the excavation through a proposal submitted by the forensic experts. These arrangements included tented shading over the grave site, temporary shelters for security personnel, temporary toilet facilities, drinking water and electricity supply, and closed-circuit television (CCTV) coverage.

Under the magisterial order, the site was secured by the local police, erecting a permanent roof structure, since the site was open, hot and dry, with continuous CCTV coverage. Aerial drones from the Special Task Force of Sri Lanka Police were used to capture aerial photographs of the site, and audio magnetotelluric (ADMT) techniques were utilized to delineate the burial site's extent.

A systematic excavation of the identified burial feature was conducted in 3 phases, 6th to 15th eptember 2023, 27th to 29th November 2023 and 4th to 16th July 2024, with the interruptions

caused by the lack of a flexible funding scheme. The personnel who participated in the excavation, in addition to the aforementioned team, included the Medical Officers – Medico-Legal of the District General Hospital, Mullaitivu; postgraduate trainees in Forensic Medicine; postgraduate trainees in Archaeology; and labourers, while independent observers were present. The extent of daily progress was briefed to the public and media at the end of each day's excavation. The excavation process was coordinated by the Forensic Pathologist of the District General Hospital, Mullaitivu. The archaeology team excavated the site with the support of the forensic personnel. The Police and SOCO's involvement was in the management of the scene, maintaining the chain of custody and photography. The analysis of the recovered remains was conducted by the forensic team.

A systematic excavation procedure was followed, and the burial trench was divided into grids using string lines and pegs. The soil was removed layer by layer using hand tools, and the stratigraphy was carefully documented to preserve spatial relationships between remains. Skeletal remains and artefacts were photographed in situ, labelled with context numbers, and mapped. Detailed records were kept through written notes and scaled sketches. During the process, the initial burial trench (Figure 3) of 14x3 m was extended further 3 m onto the bituminous road, which had been widened after the Civil War. In the burial trench, commingled skeletal remains belonging to 52 individuals, suspected to represent individuals associated with LTTE forces based on contextual, artefactual, and clothing evidence, were identified. It was suggestive of a hasty mass burial, rather than an orderly individual burial or a commingling caused by pre-professional excavation. Their clothes, bones and artefacts were documented separately, dug out and packed in labelled containers under magisterial supervision for further analysis. These containers were transported to the Department of Forensic Medicine, University of Jaffna, for further examination. Throughout the process, the chain of custody was strictly maintained. Following the exhumation, the burial site was closed on 16th July 2024 and funeral rites were held according to local traditions and customs (Figure 4).

**Figure 3:** Layout of human remains, and clothing (arrows) scattered in the partially exhumed grave site.

**Figure 4:** Cultural ceremony held in July 2024 at the closing of the mass grave.

Anthropological examination was conducted at the Department of Forensic Medicine, Faculty of Medicine, University of Jaffna, according to standard forensic osteological principles described by Buikstra and Ubelaker and subsequent forensic anthropology references[14]. This included the estimation of the skeletal examination, age and sex estimation, trauma documentation and taphonomic observations. Clothes were examined for their type, identification markings and defects due to possible wartime trauma. Bones were examined using X-ray and computed tomography (CT) scanning, and grossly for injuries, signs of disease, and features to estimate stature and age at the time of death, and to determine the sex of the deceased. Assessment of trauma timing was based on fracture morphology and radiological correlation. Age and sex were estimated using morphological and metric analysis of bones and dental assessment by a team of experts from the Faculty of Dental Sciences, University of Peradeniya. Age was estimated using dental crown and root development[15] and radiological measurement of pulp/tooth ratio of maxillary and mandibular canines[16]. Sexual dimorphism in permanent maxillary and mandibular canines in the Sri

Lankan population[17] and anthropometric measures of the tibia[18] were used as reference data for sex estimation. Stature estimation was challenging due to postmortem breakage at the ends of most long bones. Taphonomic assessment included evaluation of fragmentation, weathering, root infiltration, soil-related changes, and postmortem damage.

The investigation adhered to internationally accepted forensic principles applicable to potentially unlawful deaths, including maintenance of the chain of custody, systematic documentation, multidisciplinary participation, and preservation of evidentiary integrity, as reflected in the Minnesota Protocol on the Investigation of Potentially Unlawful Death (2016)[19] and relevant standards[8, 20]. Following the completion of the anthropological analysis, the exhumed remains were retained under judicial custody.

## RESULTS

The estimated age ranged from approximately 12 to 53 years. Out of the 52 cases, 15 individuals (28.8%) were assessed as younger than 20 years, while 9 individuals (17.3%) were estimated to be between 20 and 30 years of age. Three individuals (5.8%) were estimated to be older than 30 years. In 25 individuals (48.1%), age estimation remained indeterminate or overlapped multiple age categories due to wide interval estimates, minimum-age assessments, or incomplete skeletal preservation. The majority of the individuals were females (31, 59.6%), while 21 were male (40.4%). By analysis of skeletal injuries and associated defects in clothing, findings suggestive of blast-related trauma alone were identified in 41 individuals (78.8%), firearm-related trauma alone in 7 individuals (13.4%), and combined blast and firearm-related trauma in 3 individuals (5.8%). In one individual (2.0%), the possible cause of death remained undetermined. These interpretations were descriptive and did not constitute a definitive determination of the cause of death. Findings of the skeletal analysis are summarized in Table 1.

**Table 1:** Summary of the findings of skeletal analysis

| Skeletal number | Estimated age (years) | Estimated sex | Main trauma pattern/interpreta-tion |
|---|---|---|---|
| **1** | 15-16 | Female | Blast injury |
| **2** | 24-30 | Female | Blast injury |
| **3** | Over 14 | Male | Gunshot injury |
| **4** | Undetermined | Male | Gunshot injury |
| **5** | 22-27 | Male | Undetermined |
| **6** | Over 20 | Male | Blast injury |
| **7** | 22-32 | Female | Blast injury |
| **8** | 22-34 | Female | Blast injury |
| **9** | 17 | Female | Gunshot injury |
| **10** | 16-17 | Male | Blast and gunshot injury |
| **11** | 14-15 | Female | Blast injury |
| **12** | 16-17 | Female | Blast injury |
| **13** | Over 20 | Female | Blast injury |
| **14** | 15-17 | Male | Blast injury |
| **15** | Over 17 | Female | Blast injury |
| **16** | 20-26 | Male | Blast injury |
| **17** | 17-18 | Male | Blast injury |

| | | | |
|---|---|---|---|
| **18** | Over 14 | Male | Blast injury |
| **19** | 21-31 | Female | Blast injury |
| **20** | Over 12 | Male | Blast injury |
| **21** | 31-37 | Female | Gunshot injury |
| **22** | 43-53 | Female | Gunshot injury |
| **23** | 15-17 | Male | Blast and gunshot injury |
| **24** | Over 13 | Male | Blast injury |
| **25** | Over 17 | Male | Blast injury |
| **26** | 14-16 | Male | Blast injury |
| **27** | Undetermined | Male | Gunshot injury |
| **28** | Undetermined | Male | Blast injury |
| **29** | 20-26 | Male | Gunshot injury |
| **30** | 29-39 | Female | Blast injury |
| **31** | 16-20 | Male | Blast injury |
| **32** | Over 17 | Female | Blast injury |
| **33** | Over 20 | Female | Blast injury |
| **34** | 21-27 | Female | Blast injury |
| **35** | 21-31 | Male | Blast injury |
| **36** | 36-38 | Female | Blast injury |
| **37** | Over 18 | Female | Blast injury |
| **38** | Over 12 | Female | Blast and gunshot injury |
| **39** | Over 17 | Female | Blast injury |
| **40** | 22-24 | Female | Blast injury |
| **41** | 18-28 | Female | Blast injury |
| **42** | 20-30 | Female | Blast injury |
| **43** | 17-18 | Female | Blast injury |
| **44** | Over 20 | Female | Blast injury |
| **45** | 19-20 | Female | Blast injury |
| **46** | 14-16 | Female | Blast injury |
| **47** | 26-28 | Female | Blast injury |
| **48** | Over 13 | Female | Blast injury |
| **49** | 14-16 | Male | Blast injury |
| **50** | 14-16 | Male | Blast injury |
| **51** | 24-27 | Female | Blast injury |
| **52** | Over 13 | Female | Blast injury |

Radiological examination assisted in differentiating perimortem fractures from postmortem damage and showed metallic fragments embedded in selected remains consistent with explosive trauma. Most remains were recovered clad in clothing resembling paramilitary-style uniforms, and some of these garments bore identification numbers. In relation to some individuals, “dog tags” bearing identification markings were retrieved. Many of the individuals who were identified as females using osteological assessments were clad in underwear, such as brassieres and panties, typically worn by females, supplementing the findings in the sex determination. Formal ballistic analysis was not possible because projectiles suitable for ballistic examination were not recovered. Further analysis could not be performed due to the fragmentation of the bones, and no positive individual identification was achieved.

## DISCUSSION

A major challenge faced in this excavation project was to maintain transparency and win the trust of the local population. Distrust towards the government and its officials, including the Forensic Pathologists and the Police, especially following an ethnic conflict, was a major issue encountered in the area. The excavating team tackled the issue by allowing the mass media and independent observers to inspect the grave site during excavation and at other centres where further forensic anthropological analyses were conducted. The participation of the local non-governmental organization, the Centre for Human Rights and Development (CHRD), representing the missing local population, in the exhumation and analysis process, with the permission of the magistrate, was also helpful in maintaining the transparency of the entire process. Daily briefings were held during the entirety of the 3 phases of excavation to maintain the transparency of the process and to clarify any issues raised by the local population and local political representatives. However, the information perceived by the local population and independent observers, who are not well-versed in scientific principles in forensic anthropology and archaeology, might have been misinterpreted, especially in the case of timing and nature of injuries, leading to misinformed opinion formation amongst them. Although it was not possible to prevent misinterpretations entirely, the forensic team made every effort to explain complex findings

as clearly as possible. The Minnesota Protocol[19], which emphasizes that investigations involving potentially unlawful deaths should maintain scientific independence, transparency, proper documentation, and respect for the dignity of the deceased and their families, was followed as it was relevant in this politically and culturally sensitive post-conflict setting.

Another challenging aspect to consider was the emotional impact on the survivors of the conflict with the missing kin. Studies have shown that when the fate of a loved one is unknown, it causes significantly greater psychological distress than confirmed deaths. This effect is seen in both adults and children, with the lack of closure identified as a factor exacerbating emotional suffering [21, 22]. Families seek closure through answers about the fate of their missing relatives, recovery and identification of remains, and proper burials, while their beliefs and expectations are respected until such closure is achieved[23]. Humanitarian guidelines published by the International Committee of the Red Cross (ICRC) emphasize that families of missing persons require clear communication, psychosocial support, and culturally appropriate handling of remains throughout the exhumation and identification process[24]. Similarly, in the Sri Lankan context, the families of the disappeared in Sri Lanka express the need for truth, accountability, and dignified remembrance. The Mullaitivu area was a major battleground during the civil war, and most of the local families had their kin involved in the war, as combatants, with many of them being killed or missing in action. Although 17 years had passed since the end of the conflict, the unresolved grief may have resurfaced among the local population during the excavation process, and some may have perceived the exhumation as disturbing the dead[25]. The local workers, who had also lost their kin during the war, became emotionally distressed upon recognizing the female cadre clothing and suddenly claimed that the remains might belong to their daughters. This created challenges in explaining the situation to them during the process and added pressure on other team members. To remedy this emotional impact, the local government officials facilitated the performance of funeral rites at the end of the excavation. However, the need for further analysis of the human remains, in a separate centre, hindered the opportunity to provide the deceased with a dignified burial. But there were no objections from families to the analysis of the remains.

The process of providing government funds for this project created issues with timely funding. Since the excavation was a dynamic process and new necessities emerged as it progressed, it required frequent changes to the budget. However, since the budget approval process was rigid and time-consuming, it created unnecessary delays in completing the excavation and further analyses. Therefore, it highlights the importance of a flexible funding scheme from the government and interested non-government organizations when the need for politically and culturally sensitive matters arises. It is worthwhile to mention that there was no significant political opposition to the process from the central or local government, except for the slow funding process.

During the preliminary excavation, it was noted that the grave site consisted of human remains from many bodies. A blind excavation, where the entire area is excavated without prior knowledge of the grave's extent, could also be disruptive to the remains in the grave. It could also be time-consuming, labour-intensive, and potentially disruptive to the local infrastructure, particularly the nearby B-297 road. To avoid unnecessary excavation and disturbance, ADMT were employed as a non-invasive method to delineate the burial site's boundaries. ADMT, a passive geophysical technique that measures naturally occurring electromagnetic fields to assess subsurface conductivity[26]. This method is effective in identifying areas with distinct resistivity characteristics, such as disturbed soils commonly associated with burial sites.

In this case, ADMT identified a low-resistivity zone surrounding the burial trench, which indicated areas where the soil had been disturbed, likely due to the burial of human remains. This disturbance caused the soil to be less compact than the surrounding undisturbed soil, which exhibited a higher resistivity. The contrast between these high- and low-resistivity zones allowed the excavation team to

accurately define the extent of the burial site and avoid further disruption to the local infrastructure. The ADMT data revealed that the grave extended to the midline of the adjacent B-297 road, which allowed the team to preserve one lane of the road and minimize disruptions to local traffic. By employing ADMT, the team was able to precisely target the area for excavation, significantly reducing the amount of unnecessary digging.

Commingling of remains is a recognized challenge in conflict-related mass burials, particularly where bodies are deposited rapidly in confined grave spaces, and it requires careful stratigraphic excavation and documentation[8]. The human remains in this mass grave were commingled, especially near the roadside of the grave, due to the overlapping of the bodies. The likely reason is that the grave was dug by machinery from the road towards the lateral side, and the remains were dumped from the road into the grave. So, many bodies overlapped with each other near the roadside and appeared as commingled. But with careful excavation and handling, it was possible to separate the remains successfully, as the clothing items encasing the bodies helped to keep skeletal bones together. Since the anatomical position, skeletal articulation, and clothing were found in expected positions, this grave can be considered a primary grave site. Only a small part near the road was disturbed by water supply workers, which led to the discovery of the mass grave.

Interpretation of the burial context was based on the scene observations, grave morphology, stratigraphic relationships, skeletal findings, associated clothing and artefacts, and the historical context of armed conflict in the Mullaitivu region. The commingled nature of the remains, the apparent hasty deposition of bodies within a single trench, the presence of trauma consistent with blast and firearm injuries, and the recovery of clothing and artefacts suggestive of a conflict-related mass burial, although a complete reconstruction of the event was not possible.

During the excavation, it was noted that some of the bodies contained identification "dog tags" with numbers and letters (Figure 5a), and during the examination of clothing, there were several clothing items with identification numbers and markings sewn onto them (Figure 5b), which were contextually consistent with clothing historically associated with LTTE cadres during the conflict period, although definitive attribution was not possible. An identification tag from a regular armed force would have included details such as name, rank and the unit of the combatant, which would have facilitated the identification of the remains[27]. However, since the LTTE was a paramilitary organization and it was defeated in 2009[1], there were no records which could be traced back to the identification numbers and markings. More specific identification through DNA analysis was limited in this context due to the unavailability of suitable family reference samples at the time of investigation and the absence of traceable records linking the recovered identification markings to known individuals. Biological samples were preserved for possible future DNA comparison should suitable family reference samples become available. Although family reference samples were not collected during the present investigation, future identification efforts may be facilitated if relatives or relevant records are identified.

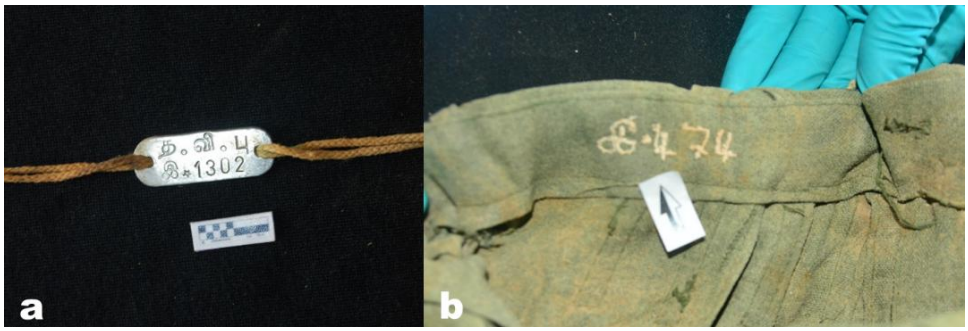


**Figure 5:** Markings on a "dog tag" (a) and (b) clothing recovered with the human remains.

OMP, an independent government body, played a key role in assisting the process of identifying the relatives of the victims of the

mass grave. They systematically collected data and supported forensic specialists in the identification of the deceased. OMP possessed records and testimonies related to persons reported missing, mainly in the final phase of the Sri Lankan Civil War (2006-2009), and there was a lack of data concerning the incidents in the 1990s, which corresponded to this mass grave. As a result, the chances of identifying the deceased were limited in this scenario, but OMP's active involvement will coordinate future identification attempts.

Interviews with the locals to determine the identity of the victims were not conducted since it was not within the scope of this investigation. However, such an approach would be helpful for the probable identification of the deceased when DNA analysis is not feasible.

Postmortem taphonomic processes, including soil pressure, environmental weathering, plant root activity, and fragmentation, can significantly alter skeletal remains and complicate the interpretation of perimortem trauma in mass grave investigations[28].

Differentiating perimortem trauma from postmortem damage requires careful observation of bone morphology, taphonomic changes, radiological findings, and scene information[20]. In this scenario, distinguishing antemortem or perimortem injuries from postmortem alterations, such as erosions, fractures, animal gnawing, and plant root infiltration, posed a significant challenge (Figure 6). The condition and completeness of the remains further complicated efforts to identify definitive trauma indicative of the cause of death. In some cases, high-energy explosive injuries may have resulted in extensive fragmentation or destruction of bones, further limiting conclusive assessments. Due to the limited availability of imaging resources, it was not feasible to radiograph all bone fragments. Instead, selected fragments with ambiguous features were examined using X-ray and CT imaging. The radiographic images provided a better perspective on the timing of the changes in the bone fragments at the time of death. Furthermore, apart from the perimortem injuries, radiographic studies identified evidence of fracture healing and bone deformities. While imaging studies were useful in assessing skeletal trauma, the interpretation of complex injuries still relied heavily on the expertise of forensic anthropologists, highlighting the need for specialized training in forensic anthropology, especially in a post-conflict context.


**Figure 6:** A fragment of a femur showing perimortem fracture (thin arrow), postmortem breaking (broad arrow) and embedded shrapnel (circled).

It should also be noted that the mere absence of fatal skeletal injuries does not exclude violence. Injuries involving soft tissues may leave no trace on the skeleton, while postmortem conditions of the remains, including decomposition, fragmentation, and taphonomic changes, can further obscure evidence of perimortem trauma.

## LIMITATIONS AND REFLECTIVE LESSONS

This investigation was conducted under several operational and methodological limitations. The

absence of antemortem data and reference DNA samples limited individual identification, highlighting the need for community outreach in the investigation and reference-sample collection in future post-conflict exhumations. Although transparency was prioritized through media access and independent observation, the absence of a formal community liaison or psychosocial support system contributed to misinterpretations and emotional distress. Financial delays disrupted the exhumation process, highlighting the importance of dynamic funding mechanisms. While techniques like ADMT were useful in delineating grave boundaries and minimizing infrastructure disruption, validation studies and the use of alternative geophysical methods would increase the usefulness of such applications. Interpretation of artefactual evidence, such as clothing and identification tags, relied on contextual information and therefore required caution. Selective use of imaging due to resource limitations may also have restricted comprehensive trauma analysis, particularly in differentiating perimortem explosive injuries from postmortem fragmentation. Future investigations would benefit from strategies for DNA identification, community engagement, flexible funding, and improved geophysical and radiographical facilities.

## CONCLUSIONS

The Kokkuthuduvai exhumation highlighted the complex scientific, operational, emotional, and ethical challenges involved in post-conflict mass grave investigations in Sri Lanka. The investigation emphasized the importance of scientifically sound forensic methods, transparent communication with affected communities, careful interpretation of uncertain findings, culturally sensitive handling of human remains, and flexible logistical support. The experience also demonstrated the value of multidisciplinary collaboration, non-invasive grave delineation techniques, and strengthened forensic anthropological and radiological capacity for future humanitarian investigations in post-conflict settings.

## LIST OF ABBREVIATIONS

ADMT - Audio magnetotelluric technique
CHRD - Centre for Human Rights and Development
CT - Computed tomography
CCTV - Closed-circuit television
DNA - Deoxyribonucleic acid
ICRC - International Committee of the Red Cross
LTTE - Liberation Tigers of Tamil Eelam
OMP - Office on Missing Persons
SOCO - Scene of Crime Officers

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## CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

## DISCLOSURE

EMKBE is a member of the Editorial Board of the Sri Lanka Journal of Forensic Medicine, Science & Law. Therefore, they did not participate in any way in the publication/decision-making process of this submission, as per journal policy.

## ETHICAL ISSUES

The presented exhumation case was conducted for medicolegal purposes, and the findings were used for academic purposes, according to the institutional guidelines.

## SOURCES OF SUPPORT

None.

## AUTHOR CONTRIBUTIONS

**SP:** Conception and design of the work; the acquisition, analysis, and interpretation of data work; drafting the work and reviewing it critically for important intellectual content; approval of the final version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and

resolved. **EMKBE:** Conception and design of the work; the acquisition, analysis, and interpretation of data work; drafting the work and reviewing it critically for important intellectual content; approval of the final version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **KV:** Conception and design of the work; the acquisition, analysis, and interpretation of data work; drafting the work and reviewing it critically for important intellectual content; approval of the final version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **BS:** Conception and design of the work; the acquisition, analysis, and interpretation of data work; drafting the work and reviewing it critically for important intellectual content; approval of the final version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **SPIMCSI:** Conception and design of the work; the acquisition, analysis, and interpretation of data work; drafting the work and reviewing it critically for important intellectual content; approval of the final version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **WMTL:** Conception and design of the work; the acquisition, analysis, and interpretation of data work; drafting the work and reviewing it critically for important intellectual content; approval of the final version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **UM:** Conception and design of the work; the acquisition, analysis, and interpretation of data work; drafting the work and reviewing it critically for important intellectual content; approval of the final version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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CASE REPORT

# FORENSIC CHALLENGES IN ESTABLISHING VIABILITY AND CAUSE OF DEATH IN A MUTILATED AND DECOMPOSED CASE OF SUSPECTED FEMALE FETICIDE: A CASE REPORT

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## ABSTRACT

**Introduction**: Female feticide remains a significant medico-legal and public health concern in India. Advanced decomposition and mutilation complicate autopsy interpretation and determination of live birth.

**Case Presentation**: A mutilated female foetus was recovered from rural Punjab in 2023. Only the lower abdomen, pelvis, and lower limbs were available. Measurements included length 33 cm, weight 1.2 kg, and foot length 6.5 cm. Female genitalia were identifiable. Advanced decomposition obscured postmortem changes. The umbilical cord (9 cm) was irregularly crushed, without haemorrhagic infiltration. Ossification centres were present in the talus, distal femur, and proximal tibia bilaterally. Internal organ distinction was impossible due to decomposition and missing organs. No vital reaction was observed at the wound margins.

**Conclusion**: This case underscores the interpretive limits of foetal autopsy under adverse conditions while reinforcing the urgent socio-legal imperative to address sex-selective practices. The case illustrates key forensic challenges: inability to determine live-birth status due to absence of lungs and decomposition; viability assessment supported by ossification centres (~28–30 intra-uterine weeks); and differentiation of postmortem mutilation from antemortem trauma, with findings favouring scavenging. Emerging literature highlights the value of integrating taphonomic knowledge, virtopsy, and meticulous documentation of both positive and negative findings to strengthen medico-legal conclusions.

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## INTRODUCTION

Female feticide, defined as the deliberate termination of female foetuses due to gender bias, persists as a critical medico-legal and socio-cultural issue in India. The underlying motives for female feticide include a strong societal preference for male children, entrenched patriarchal values, economic considerations such as dowry, and the perception of sons as providers of financial

security and family lineage. Despite initiatives such as the Beti Bachao, Beti Padhao campaign and enforcement of the Pre-Conception and Pre-Natal Diagnostic Techniques (PC-PNDT) Act, sex-selective practices persist, contributing to continued skewing of the sex ratio at birth[1,2].

The forensic pathologist plays a pivotal role in documenting such cases, particularly when mutilation or decomposition obscures accurate interpretation. Modern approaches, including virtual autopsy and advanced imaging, have been proposed to improve diagnostic accuracy when conventional methods are limited[3-5].

## CASE PRESENTATION

In September 2023, the local police recovered the remains of an unidentified foetus from an open field in a rural village of Punjab, India. The body, enclosed in a polythene bag, was submitted for medicolegal autopsy. The case was registered under suspicion of female feticide and concealment of birth by secret disposal of the dead body, based on the preliminary investigation (Figure 1a and 1b). The photographic documentation is limited to photographs obtained from police personnel during scene recovery and those taken during the autopsy procedure. The remains were brought for autopsy shortly after recovery, according to the police.



**Figure 1:** External view of the mutilated female foetus showing pelvis and lower limbs lying in the crime scene (Photographs obtained from police personnel).

External examination showed that the available portion included the lower abdomen, pelvis, and both lower limbs. The overall length of the available portion measured 33 cm, and the weight was approximately 1.2 kg. The foot length was 6.5 cm. The external genitalia were identifiable as female, with well-formed labia majora. The skin showed greenish-black discolouration consistent with decomposition. Rigor mortis has disappeared, and postmortem staining could not be appreciated, also due to advanced decomposition. In the umbilical cord, a remnant measuring 9 cm was torn and crushed at the distal end with irregular margins, without any haemorrhagic infiltration. Individual vessels could not be distinguished. No placenta was attached or recovered from the scene. Other external features indicated that both feet were developed, with toenails extending beyond the toe tips (Figure 2). The anal opening was patent, with meconium staining (Figure 3).

**Figure 2:** Developed feet on the fetus.

**Figure 3:** Anal opening with meconium staining (encircled), consistent with intrauterine passage. Additionally, intestines and omentum were seen protruding from the abdominal cavity due to truncation (arrow).

No other evidence of congenital anomalies or gross malformations could be assessed due to decomposition. The truncation of the abdomen showed irregular serrated margins, without any infiltration of blood, and did not show any consistency with an antemortem injury pattern (Figure 4a).

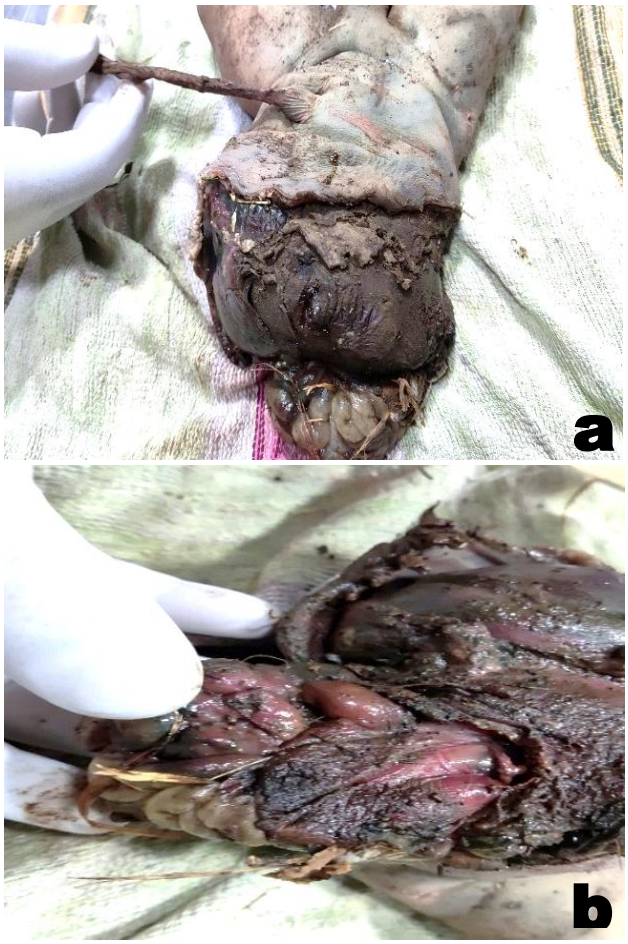


**Figure 4:** Irregular wound margins at the abdominal base without vital reaction (a) and overall view of decomposed foetal remains at the level of the truncated abdomen (b), highlighting mutilation and challenges in autopsy interpretation.

In the internal examination, the intestines and omentum were seen protruding from the abdominal opening. Internal organs were largely indistinguishable due to advanced decomposition, and no meaningful anatomical delineation could be made as the available organs were converted into a black pultaceous mass (Figure 4a and 4b). The lungs, heart, and part of the liver were missing.

Ossification centres were noted in the talus, distal femur, and proximal tibia bilaterally. The distal femoral ossification centre measured approximately 5 mm in diameter, which further supported an estimated gestational age in the late second to early third trimester. These findings correspond to a gestational age of approximately 28–30 weeks, suggesting that

the foetus had reached the age of viability (Figure 5). The wound margins and the viscera lacked vital reaction, ruling out antemortem injuries and favouring postmortem mutilation. Additionally, available viscera were sent for chemical analysis, which was negative. The femur was handed over to the police for DNA analysis.

**Figure 5:** Presence of ossification centres in the distal femur and proximal tibia (blue circle) bilaterally.

## DISCUSSION

This case highlights the forensic, medico-legal, and societal complexities encountered when examining mutilated and decomposed foetal remains in suspected female feticide. Three principal dilemmas were encountered: determination of live birth, estimation of gestational age and developmental maturity, and differentiation between antemortem trauma and postmortem mutilation.

Determination of live birth was impossible due to the absence of lungs and the advanced decomposition. Classical methods used in forensic practice to establish live birth, including the hydrostatic test, Fodéré's test, Ploucquet's test, and the stomach–bowel test, could not be performed because the relevant organs were missing and the remaining tissues were extensively decomposed. Indirect indicators such as the presence of meconium and the morphology of the umbilical cord were therefore interpreted cautiously and were considered inconclusive markers of live birth, as well as the possibility of it being a stillbirth. Assessment of vital reaction was performed through careful macroscopic examination of the wound margins, specifically looking for haemorrhagic infiltration, tissue swelling, or inflammatory changes. None of these features was identified in the present case, which supported the interpretation that the injuries were postmortem in nature. Similar limitations in determining live birth in decomposed foetal remains have been described in forensic pathology literature[3,4].

Gestational age estimation was done through skeletal examination. Ossification centres were identified in the distal femur, proximal tibia, and talus bilaterally. The appearance of these ossification centres is generally associated with late second to early third trimester foetal development, typically around 28–30 weeks of gestation. These findings, together with the anthropometric measurements obtained during autopsy, suggested that the foetus had reached a gestational age approaching the threshold of potential extrauterine viability rather than confirming viability itself. However, the presence of ossification centres alone cannot establish live birth and must be interpreted in conjunction with other autopsy findings and investigative circumstances. These developmental markers are widely used in forensic pathology to estimate foetal maturity and gestational age[3–6].

Histological examination of the umbilical stump may provide additional evidence of vitality by demonstrating inflammatory cell infiltration or vascular changes. However, in the present case, the umbilical cord remnant was markedly decomposed and crushed, rendering the tissue unsuitable for meaningful histopathological evaluation. Similarly, estimation of the postmortem interval was not possible because the remains were incomplete and already in an advanced state of decomposition at the time of recovery, and reliable scene findings were not available.

Recent literature has emphasized the growing role of non-invasive postmortem imaging techniques such as computed tomography (CT) and magnetic resonance imaging (MRI) in foetal autopsy investigations. These modalities allow

evaluation of skeletal development, identification of ossification centres, and measurement of long bones, thereby assisting in gestational age estimation when conventional autopsy is limited[7]. In the present case, however, postmortem radiological imaging was not performed because such facilities were not available at the forensic unit where the autopsy was conducted. Consequently, gestational age estimation relied on conventional anthropometric measurements and identification of ossification centres during autopsy.

Differentiating antemortem from postmortem injury was another key challenge. The truncation of the abdomen showed irregular serrated margins and lacked haemorrhagic infiltration, favouring postmortem mutilation rather than antemortem trauma. Experimental and observational studies in forensic taphonomy have demonstrated that scavenging animals can produce irregular tearing patterns that may mimic traumatic injuries[8,9].

Although the remains were recovered within a plastic bag, environmental exposure may have allowed access to scavenging animals if the bag was damaged, partially open, or degraded over time. Alternatively, animal interference may have occurred before placement of the remains in the bag.

Although forensic entomology may assist in estimating the postmortem interval and reconstructing postmortem events, no insect specimens were collected at the recovery scene; therefore, entomological analysis could not be performed in the present case.

Beyond the technical challenges, the gestational age suggested advanced foetal development, but the cause of death in this case remained inconclusive. This case underscores the broader medico-legal and socio-cultural implications of suspected female feticide. Even when the determination of live birth is impossible, identification of female sex together with evidence of advanced gestational age may raise suspicion of unlawful termination or abandonment. The forensic pathologist's role extends beyond diagnosis to meticulous documentation of both positive and negative findings, which may support judicial proceedings when direct evidence is lacking[1,2]. From a public health perspective, this case reflects the persistence of sex-selective practices despite legislative measures such as the Pre-Conception and Pre-Natal Diagnostic Techniques (PC-PNDT) Act. Continued documentation and reporting of such cases may contribute to improved awareness, policy enforcement, and medico-legal understanding of gender-based discrimination.

## CONCLUSION

The autopsy of a mutilated, decomposed female foetus demonstrates the limitations of foetal autopsy under adverse conditions. Incorporation of contemporary guidelines, taphonomic interpretation, and advanced imaging may enhance accuracy. This case emphasizes both the technical complexity of foetal autopsies and the moral urgency of preventing sex-selective practices.

## LIST OF ABBREVIATIONS

CT – Computed Tomography
IUW – Intrauterine Weeks
MRI – Magnetic Resonance Imaging
PC-PNDT Act – Pre-Conception and Pre-Natal Diagnostic Techniques Act

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## CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

## ETHICAL ISSUES

The findings of the presented cases were used for academic purposes, maintaining anonymity.

## SOURCES OF SUPPORT

None.

## AUTHOR CONTRIBUTIONS

**KP:** Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work

are appropriately investigated and resolved. **AS:** The acquisition, analysis, and interpretation of data for the work; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **AS:** Drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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