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Case Report

Forensic Differentiation of Manner of Death in Railway Fatalities: A Four-Case Series

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ABSTRACT

Distinguishing suicide, homicide, and accidental death on railway tracks remains a persistent forensic challenge, because decapitation, transection, and mutilation produce overlapping injury patterns regardless of the underlying manner of death. We present four cases of railway fatalities in which scene investigation, autopsy findings, toxicological analysis, and circumstantial evidence were integrated to establish the manner of death. In Case 1, a suicide note and corroborative driver testimony confirmed suicide following financial distress. In Case 2, eyewitness accounts of a preceding family dispute established suicidal intent. In Case 3, a toxicologically confirmed blood alcohol level explained the impaired judgement underlying an accidental decapitation on a narrow-gauge track. In Case 4, a physically disabled woman was fatally struck during a routine daily activity, consistent with accidental collision. This series illustrates a reproducible, evidence-based framework combining injury morphology, scene reconstruction, toxicology, and corroborative history to support classification of railway fatalities and potentially reduce the risk of misclassification between suicide, homicide, and accident.

KEYWORDS

•Suicide • Homicide • Accident • Railway Fatalities • Crime Scene Reconstruction • Forensic Pathology • Train Run-Over Injuries

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INTRODUCTION

Railway fatalities represent a persistent medico-legal challenge in India, where the extensive rail network intersects daily life and exposes individuals to significant risk.[1] The incidence of deaths on railway tracks remains high, often attributed to overcrowding, negligence, and the easy accessibility of tracks. While the majority of cases are classified as accidental or suicidal, rare instances of homicide disguised as railway accidents demand heightened forensic scrutiny. However, differentiating among these manners of death is often complex due to overlapping injury patterns, postmortem alterations, and limited or ambiguous circumstantial evidence.

Railways are a widely accessible mode of transport, making them a frequent site for intentional self-harm.[2] Suicide by train is recognised as a highly fatal method, often associated with psychiatric illness, socioeconomic stressors, and impulsive behaviour.[3] Conversely, accidental railway deaths may occur due to negligence, trespassing, intoxication, or misjudgment of train speed and distance. Homicidal cases involving railway tracks are comparatively rare but are of particular forensic importance, as perpetrators may attempt to disguise the crime as suicide or accident by placing the victim on tracks postmortem or during incapacitation.[4]

To address this gap, we present four medico-legally resolved railway fatalities: a suicide corroborated by a note and driver testimony, a suicide corroborated by an eyewitness account, a toxicologically confirmed alcohol-related accident, and a disability-related accident, with the aim of illustrating a practical, reproducible approach to this differential diagnosis and highlighting the specific forensic and toxicological indicators that supported classification in each case. Misclassification of railway deaths can have profound consequences, including legal misjudgement, inaccurate mortality statistics, and emotional distress for families. Therefore, establishing clear diagnostic criteria and recognising subtle forensic indicators are crucial for accurate determination of the manner of death.

Injuries

In railway fatalities, injury morphology is strongly influenced by the victim's posture and point of impact.[5] An upright individual typically sustains grazed abrasions with longitudinal scratch marks, reflecting the primary wheel contact. Secondary imprint contusions and lacerations may result from projecting train parts such as handrails. Ballast and ground particles[6] frequently contaminate wound surfaces and natural orifices, while pressure stripes with irregular margins indicate lateral rail friction. Frontal impact commonly produces decapitation or complete transection; clean decapitation may be associated with suicidal positioning, whereas limb amputation may occur more commonly in accidental mechanisms; however, these patterns are not diagnostic in isolation.

Distinguishing antemortem railway injury from postmortem dismemberment based on the degree of bleeding, presence of vital reaction, character of tissue margins, and distribution of body parts is summarised in **Table 1** and is central to excluding staged or homicidal dismemberment, a comparison revisited in the Discussion in relation to the present cases.

Table 1: Key Differences Between Antemortem and Postmortem Dismemberment

Feature	Antemortem Railway Injury	Postmortem Dismemberment
Bleeding	Profuse with spatter	Minimal or absent
Vital reaction	Present	Absent
Tissue margins	Irregular, crushed	Clean or tool-marked
Distribution	Scattered body parts	Often localized
Associated injuries	Multiple trauma	May show prior assault

Investigation of Scene of Incident

The forensic surgeon should participate in scene examination alongside investigating officers prior to or during body retrieval. Statements from train drivers, crew, and witnesses, together with inspection reports of tracks, signals, and rolling stock, must be reviewed to establish train impact. The number and distribution of body parts depend on the trauma mechanism, body position, rail gauge, and victim stature. Body segments and nearby materials should be documented and photographed in situ with a perpendicular scale, preserving tool marks without tissue removal; subsequent dissection exposes bone ends carefully to avoid artefactual damage, and bone samples are taken at least 5 cm from the cut end to retain kerf features.

Odontological examination of decapitated heads includes assessment of jaws, teeth, and fragments, charted according to FDI coding with dental age estimation.[7]

Absence of clothing increases suspicion of criminal dismemberment. When present, garments are examined in situ and after removal, with documentation of type, colour, brand, material, and size. In railway collisions, clothing typically exhibits blood stains, ballast particles, dust, and superficial smearing extending into folds, pockets, and natural concavities.[8] Stripes, ruptures, and contamination with metallic particles may indicate ground impact, while inside-out displacement suggests dragging. Clothing should be sampled for trace evidence through fibre lifts and swabbing. Personal items such as jewellery, watches, and piercings are collected individually after examination to preserve evidentiary integrity.

Biological and physical samples are essential for identification. Blood stains, muscle, bone fragments (small bones preferred), scalp hair, and fingernails should be collected for DNA profiling.[9] In female victims, the cytospin technique, employed for forensic nuclear sexing, may support assessment of female biological sex by efficiently concentrating cells for the microscopic detection of Barr bodies. The technique may also facilitate the recovery of cellular material from internal organs, thereby extending its utility in forensic investigations.[10] Swab cards are suitable for blood, buccal cells, and tissue fragments, with specimen condition (fresh, decomposed, skeletonised, or burnt) documented prior to forensic serology.

Identification methods rely on friction ridge analysis, comparative dental evaluation, DNA analysis, and nail-isotopic profiling. Fingerprints and footprints are recorded after inking, and intact prints may be matched against biometric databases where available.

CASE PRESENTATION

Case 1

A 45-year-old man with a history of financial distress due to gambling was found dead adjacent to a railway track. A handwritten suicide note recovered from this person documented clear intent. The body lay in continuity with the rail line (Figure 1 & Figure 2), with blood staining along the rails and surrounding ballast consistent with active haemorrhage at the site and no evidence of postmortem relocation. The train driver reported observing the individual on the track immediately before impact, with no opportunity to prevent the collision, and no signs of struggle or third-party involvement were identified.

Autopsy revealed extensive polytrauma characteristic of railway injury, including multiple crush injuries, deep lacerations with abraded margins, comminuted fractures, and embedded ballast particles. All injuries demonstrated vital reaction, confirming antemortem occurrence, with no evidence of restraint or defensive injury.

Chemical analysis of blood and viscera was negative for alcohol and common poisons, providing no toxicological evidence of alcohol or the common poisons tested as contributory factors.

The documented suicidal intent, characteristic injury pattern, consistent scene findings, and corroborative driver testimony support multiple traumatic injuries due to railway collision as the cause of death, with suicide as the manner of death.

Figure 1: Lower limbs of the victim near the railway track

Figure 2: Anterior view of the victim's body on the railway track

Figure 3: Crushed body of the victim near the railway track

Case 2

A 35-year-old man was reported to have deliberately run onto a railway track following an acute family dispute; family members attempted but failed to prevent the act. Scene investigation revealed the body on the track with scattered remains and extensive blood and tissue dispersion consistent with high-velocity train impact (**Figure 3**). Eyewitness accounts strongly supported suicidal intent and provided temporal correlation with the incident.

Autopsy demonstrated severe mutilation, torn clothing (**Figure 4**), a crushed skull with extrusion of brain matter (**Figure 5**), and dismemberment with identifiable primary impact injuries characteristic of railway trauma. There was no evidence of restraint, prior assault, or defensive injury. Chemical analysis of blood and viscera was negative for alcohol and common poisons.

Corroborative witness statements, the typical injury pattern, and absence of homicidal indicators support polytrauma due to train collision as the cause of death, with suicide as the manner of death.

Figure 4: Torn clothing of the victim

Figure 5: Crushed skull with extrusion of brain matter

Case 3

A 40-year-old man was found decapitated on a narrow-gauge railway track in Gwalior, with a history suggestive of recent alcohol consumption before the incident. Scene examination revealed the trunk, with clothing intact and multiple injuries, on the track (**Figure 6**), while the head was found separately, in close proximity to the line. Decapitation was clean and at track level, with no evidence of struggle, drag marks, or external assault, and no disturbance of the surrounding scene.

Figure 6: Blood-stained clothing on the victim's body

Autopsy demonstrated sharp transection of the neck structures consistent with railway wheel action, with associated body and head injuries corresponding to train impact (**Figure 7**). Additional injuries were minimal, with no defensive wounds or signs of prior violence; personal belongings were recovered near the track (**Figure 8**).

Headspace gas chromatographic analysis of femoral blood demonstrated a blood alcohol concentration of above 97 mg/dL, consistent with acute intoxication at the time of death. Screening for common poisons and other drugs of abuse was negative.

The injury pattern, toxicologically confirmed alcohol intoxication, and absence of homicidal indicators support decapitation due to train run-over as the cause of death, with accident as the manner of death.

Figure 7: Head of the victim near the narrow-gauge track

Figure 8: Personal belongings recovered near the track

Case 4

A physically disabled 42-year-old woman was fatally struck by a fast-moving train during the early morning while reportedly attending to natural needs near an open railway track. Scene investigation, conducted in daylight, revealed no evidence of suicidal intent or third-party involvement. The body was found near the track with localised but severe injury (**Figure 9**); unrestricted access to the railway line and the victim's physical disability were considered significant contributory factors.

Figure 9: Extensive crush injuries on the victim's body

Figure 10: Blood-stained and torn clothing

Examination demonstrated extensive crush injury with severe trunk trauma and disruption. Clothing was torn and bloodstained (**Figure 10**), corresponding to the impact areas. The affected lower limb showed deformity and associated injury (**Figure 11**). together with fragmented body parts, was consistent with high-impact railway injury; there was no evidence of restraint, prior assault, or defensive injury. Chemical analysis of blood and viscera was negative for alcohol and common poisons.

Figure 11: Affected lower limb with associated injuries

Victim vulnerability, environmental risk factors, the characteristic injury pattern, and absence of suicidal indicators support blunt force trauma due to train collision as the cause of death, with accident as the manner of death.

Figure 13: Protrusion of intestinal loops through the disrupted trunk

DISCUSSION

This case series illustrates how integrating scene investigation, autopsy findings, toxicology, and circumstantial evidence can support differentiation of suicidal, accidental, and homicidal railway fatalities.

In suicidal railway deaths, as in cases 1 and 2, features such as documented intent (e.g., suicide notes), eyewitness accounts, CCTV footage and characteristic positioning of the body on the track are critical.[11] The presence of a clear psychosocial stressor may further support the interpretation of suicide. Similar case has been documented by Pathak *et al.*, in which severe traumatic injuries were documented, over face and head, might be due to a high-impact collision, due to a moving train.[13] Kulkarni *et al.*, documented rushed head injury was present with multiple displaced comminuted fractures of the vault extending to the base in a complex unplanned suicide.[14] Mishara *et al.*, documented the importance of CCTV footage in which it noted that a majority of attempters around 83 % of cases displayed observable risk behaviours.[15] In contrast, case 3 and 4 demonstrated accidental deaths

often involve contributory risk factors such as alcohol intoxication, physical disability, or environmental exposure.[16] Mishara *et al.*, documented that in 460 cases of railway accident cases in Canada substance abuse, age, and illness plays an important role in accidental fatalities.[17] These cases lack evidence of intent and are supported by situational vulnerability and absence of preparatory actions.

The pattern and distribution of injuries play a crucial role in forensic differentiation, and further, the victims' posture during run-over determines dismemberment patterns. Railway-induced injuries are typically characterised by clean or irregular transections, extensive soft tissue destruction, embedded foreign material (e.g., ballast), and widespread haemorrhage.[18] Localisation of body parts, blood distribution, and absence of drag marks help determine whether the event occurred at the site or if the body was relocated. The presence of vital reactions is essential to confirm ante-mortem trauma, especially in cases with severe dismemberment.

Importantly, homicidal cases involving postmortem placement on railway tracks may mimic accidental or suicidal injuries, so it is essential to distinguish genuine train run-over injuries from postmortem mutilation following homicide and differentiating parameters are shown in Table 2[19]; however, such cases often demonstrate inconsistencies, including lack of blood at the scene, presence of prior injuries, restraint marks, or evidence of incapacitation. None of these features was observed in the present series, providing support for non-homicidal interpretations in these cases.

Overall, no single finding, injury pattern, toxicology, or circumstantial account was diagnostic in isolation; classification in each case rested on the convergence of multiple independent lines of evidence. This underscores the value of a structured, multidisciplinary approach to avoid misclassification, which carries significant legal and social consequences.

Table 2: Differentiating features between true railway run-over injuries and homicidal/staged dismemberment

Parameter	True railway-related injuries	Homicidal dismemberment/ staged cases	Forensic significance
Alignment of cuts	Align with rail or wheel direction	Irregular, not aligned with the rail axis	Suggests mechanical train injury vs. manual dismemberment
Segment separation	Usually 5–10 cm apart	Widely separated or deliberately arranged	Distance helps infer mechanism of separation
Blood evidence	Fresh spatter along track perimeter	Minimal/absent if body placed postmortem	Indicates whether injury occurred at the scene
Nature of injuries	Clean transection consistent with wheel pressure	Decapitation with additional mutilation	Excessive mutilation suggests homicidal intent
Associated findings	No restraint/incapacitation signs	Ligature marks, restraints or toxicological evidence	Supports prior assault or incapacitation
Distribution of body parts	Localised near point of impact	Wide dispersal, sometimes decomposition/predation	Wide distribution suggests prior death elsewhere
Scene blood pattern	Abundant, consistent with active bleeding	Limited staining if severance occurred elsewhere	Helps determine primary vs. secondary scene
Postmortem placement	Not applicable	Parts may be placed on track after death	Indicates attempt to simulate a railway accident
Superimposed injuries	Train injuries dominate	Train run-over may overlay pre-existing sharp-force injuries	Can obscure original tool marks
Tool-mark visibility	Typically absent	May be partly/completely obscured by train injuries	Complicates differentiation; requires careful analysis

CONCLUSION

Differentiating suicidal, accidental, and homicidal railway fatalities requires the integrated evaluation of crime-scene characteristics, autopsy findings, toxicology, and circumstantial history, since no single finding is diagnostic in isolation. The four cases presented here show how corroborated intent, toxicologically confirmed intoxication, and recognition of disability- or negligence-

related vulnerability can each support a specific manner-of-death classification while providing no positive evidence of staged homicide in these cases. Systematic application of this framework, rather than reliance on injury pattern alone, can reduce misclassification and its legal and social consequences.

Limitations

Although the study provides an important insight into the deaths on railway tracks, it has some limitations. The study is a case series, and the determination of manner of death relied on the convergence of scene findings, autopsy reports, toxicological results, witness accounts and circumstantial information; the observations and findings cannot be generalized. The availability and reliability of this information may vary from case to case. Additionally, absence of homicidal characteristics should be treated with caution as severe railway trauma may obscure or modify pre-existing injuries. The study also doesn't provide validated diagnostic criteria or estimates of the sensitivity or any statistics supporting individual forensic findings; the observations should therefore be interpreted as illustrative of an integrated investigative approach rather than diagnostic findings.

Declarations

The figures included in this study are used solely to illustrate relevant artefacts for the purpose of understanding forensic investigations. They do not reveal the identity, name, or any other personally identifiable information of the victim. All photographs have been appropriately masked to ensure confidentiality and preserve the victim's anonymity.

Conflict of Interest

The authors declare that they have no conflicts of interest relevant to the content of this article.

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Author Contributions Statement

All the authors contributed equally to the conceptualisation, methodology, investigation, data curation, formal analysis, validation, visualisation, writing – original draft, and writing – review & editing of the manuscript. All authors have read and approved the final version of the manuscript.

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