ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 09 | September - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PATTERN AND DISTRIBUTION OF FATAL RAILWAY TRAUMATIC INJURIES: A MEDICOLEGAL CASE SERIES AND INJURY SEVERITY ASSESSMENT

Forensic Medicine

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ABSTRACT

Background & Objectives: Railway accidents are among the most severe types of blunt force trauma encountered in forensic practice. They often result in crush injuries, amputations, body fragmentation, and multiple fatal injuries. This case series describes six railway fatality cases autopsied at Maulana Azad Medical College and Lok Nayak Hospital, Delhi. The study aimed to analyze the pattern of injuries, mechanisms of trauma, organ involvement and causes of death. **Results:** All six victims were adult males with a mean age of 33 years (range 22–55 years). The injuries occurred due to train-pedestrian impact, being run over by a train or dragging along the railway track. Traumatic amputations were present in three cases (50%). Head injuries were seen in all cases. Two victims had skull fractures with bleeding inside the skull while four had severe crushing of the head with extensive skull fractures and loss or extrusion of brain tissue. Multiple fractures of the limbs, ribs and spine were common findings. Internal organ injuries ranged from severe blood loss to major tears, complete transection, or loss of organs. **Conclusion:** The most common cause of death was shock due to multiple traumatic injuries and mutilation (50%), followed by severe head injuries (33.3%) and crush injuries involving the head and limbs (16.7%). Railway accidents produce characteristic injury patterns that are usually fatal. Careful forensic examination and documentation are essential for determining the cause of death, distinguishing injuries from postmortem damage, helping identify victims, and supporting railway safety measures.

KEYWORDS

Railway Trauma, Medicolegal Autopsy, Traumatic Amputation, Craniocerebral Injury, Blunt Force Trauma, Railway Fatality, Injury Pattern.

INTRODUCTION

Railway transport is an important mode of travel, but accidents continue to cause fatal injuries, particularly in densely populated areas where people cross or walk along tracks. The high speed and mass of trains transfer enormous force to the body, producing crushing, multiple fractures, degloving, traumatic amputation and fragmentation.

Medicolegal autopsy is challenging because the forensic pathologist must determine whether injuries occurred before death, reconstruct the mechanism, establish cause of death and assist identification. This case series describes six fatal railway cases examined at Maulana Azad Medical College and Lok Nayak Hospital, highlighting injury distribution and characteristic patterns.

Case Series

Case 1: Severe Polytrauma with Traumatic Left Lower Limb Amputation

A 30-year-old male was found dead on Safdarjung railway track and medicolegal autopsy was performed 3 days later. Findings included massive right parietal/temporal/occipital crush injury with comminuted skull fractures, multiple abrasions, a large right thigh laceration with femoral fracture, complete traumatic amputation of the left lower limb and crushed right foot. Internal examination showed diffuse scalp hemorrhage and marked pallor of organs. Cause of death: Shock due to multiple traumatic injuries involving head and lower limbs.

Fig 1a: Craniocerebral damage.

Fig 1b: Traumatic amputation of left leg with exposed bone.

Fig 1c: Amputated leg of left lower leg.

Fig 1d: Amputated right feet.

Case 2: Open Cranio-Facial Mutilation and Compound Leg Fracture

A 22-year-old male died after a railway accident near TKD Railway Station and medicolegal autopsy was performed 3 days later. Severe open cranio-facial crush injury with extrusion of brain matter, cheek laceration, chest abrasions/contusion and an open compound right tibial fracture were noted. Cause of death: Shock consequent upon crush injuries to the head and lower extremity.

Fig 2a: Showing craniocerebral damage due to blunt force.

Fig 2b: Both bone fracture of right lower limb with protruding bone fragments.

Fig 2c: Grease marks present over right lower abdomen.

Fig 2d: Image showing brain matter protruding through head.

Case 3: Craniocerebral Injury with Intracranial Hemorrhages

A 31-year-old male was struck by a train at Siraspur Railway Fatak and succumbed to the injuries during hospital treatment the same day. Seventeen external injuries were documented. A 6-cm frontal skull fracture, approximately 50 grams of epidural hematoma, diffuse subdural and subarachnoid hemorrhage, frontal contusion and left 2nd–7th rib fractures were present. Cause of death: Craniocerebral injury due to blunt force impact to the head.

Fig 3a: Lacerated wound over forehead.

Fig 3b: Skull fracture corresponding to lacerated wound.

Case 4: Decomposed Unknown Fatal Railway Impact

An unidentified adult male, approximately 30 years old, was found near Container Depot Okhla/TKD and autopsied after approximately eight weeks of preservation in cold storage. Decomposition was advanced. Facial, humeral and bilateral leg deformities with fractures were present. Scalp dissection showed hemorrhage and a 14-cm right parietal/frontal skull fracture extending to the cranial fossae with diffuse SDH and SAH. Cause of death: Craniocerebral injury due to blunt force impact to the head.

Fig 4a: Decomposition changes making identification difficult.

Fig 4b: Whitish fungal growth over whole back making hypostasis difficult to appreciate.

Case 5: Complete Body Mutilation, Fragmentation and Multi-Limb Amputations

A 30-year-old male was found in multiple fragments between TKD and Okhla railway stations on and autopsied about 5 days later. Four lower-limb and five upper-limb traumatic amputations, bilateral foot avulsions and catastrophic crushing of the residual trunk were present. Major viscera were crushed, mutilated or absent. Cause of death: Shock due to multiple traumatic injuries involving head, thorax, abdomen, pelvis and limbs.

Fig 5a: Massive crush injury involving whole torso.

Fig 5b: right lower limb.

Fig 5c: massive crushed injury over both lower limbs .

Case 6: Bipartite Body Severance, Cranial Disintegration and Internal Polytrauma

A 55-year-old male was found dead near Main Line Okhla Railway Station on 24 July 2026; autopsy on 26 July. The remains were in two main parts. There was massive cranio-facial crush injury, traumatic left upper-limb amputation, multiple chest and limb injuries, bilateral tibia/fibula fractures, complete cranial destruction, comminuted sternum, rib, clavicle & spinal fractures, 1000 mL hemothorax and deep liver lacerations. Cause of death: shock due to multiple traumatic injuries.

Fig 6a: Grease stain present over right knee joint.

Fig 6b: Mutilated body.

Fig 6c: Crushed head.

Fig 6d: Grease stains over right chest.

Distribution of Injuries and Statistical Tables

These tables categorize external injury distributions, skeletal fracture frequencies, visceral organ involvement, and fatal biomechanical mechanisms.

Table 1. Anatomical Distribution and Types of External Injuries

Case	Head/ Face	Thorax/ Abdomen	Upper limb	Lower limb	Grease/ Dirt
1	Facial lac.; skull crush; black eye	Lower-back abrasion	Left-arm abrasions	Leg amputation; femur #; foot crush	Intense
2	Craniofacial crush; cheek lac.	Chest abrasion/ contusion	Shoulder abrasions	Open tibia #; thigh abrasions	Intense
3	Forehead lac.; facial abrasions	Chest contusion; abdominal abrasions	Forearm/ hand abrasions	Open femur #; thigh/leg abrasions	Moderate
4	Facial deformity; nasal #	Decomposition	Humerus #	Bilateral tibia/ fibula #	Obscured
5	Head/trunk crush-disruption	Trunk crush; evisceration	5 traumatic amputations	4 traumatic amputations; foot lac.	Severe
6	Craniofacial crush; brain absent	Chest/ abdominal abrasions	Arm amputation; forearm #	Femur & bilateral leg #	Severe

Table 2. Spectrum of Skeletal Fractures and Traumatic Amputations

Case	Skull/Face	Axial	Upper limb	Lower limb
1	Comminuted vault/base; MC fossa	—	—	Lt tibia/fibula; Rt femur
2	Vault/base; facial fragments	—	—	Open Rt tibia
3	6-cm frontal–anterior fossa #	Lt ribs 2–7	—	Open Lt femur
4	14-cm parietal/frontal #	Nasal bone	Rt humerus	Bilat. tibia/fibula
5	Total cranial fragmentation	Rib cage/ pelvis fragmentation	Bilat. humerus/ radius/ulna # + amputations	Bilat. femur/ tibia/fibula # + amputations
6	Total craniofacial collapse	Sternum, ribs, clavicles, spine	Lt humeral amputation; Rt radius/ulna	Rt femur; bilat. tibia/fibula

Table 3. Internal Visceral Injury Spectrum

Case	CNS	Cardiothoracic	Abd./Pelvic	Status
1	Pale brain (1280 g); scalp extravasation	Pale lungs; heart intact	Pale liver/kidneys	Pallor; hypovolemia
2	Extruding, fragmented brain	Pale lungs; heart intact	Pale liver/kidneys	Pallor; hypovolemia

3	EDH ~50 g; SDH/SAH; frontal contusion	Pale lungs; heart intact	Pale liver/kidneys	Brain congestion; pale viscera
4	SDH/SAH; soft brain	Decomposed lungs; flabby heart	Autolysis	Greenish decomposition
5	Brain crushed/ absent	Heart/lungs absent	Viscera crushed/absent	Complete disruption
6	Brain absent/ crushed	1000 mL hemothorax; heart/lungs crushed	Liver laceration (12 × 6.5 cm)	Massive hemorrhage

Table 4. Medicolegal Cause of Death and Biomechanical Summary

Case	Cause of death	Mechanism	Force	Injury–death interval
1	Multiple traumatic injuries	Hemorrhagic/ neurogenic shock	Blunt	Instantaneous
2	Crush injuries	Hemorrhagic/ neurogenic shock	Blunt	Instantaneous
3	Craniocerebral injury	CNS failure	Blunt	<12 h
4	Craniocerebral injury	CNS failure	Blunt	Instantaneous
5	Multiple traumatic injuries	Polytrauma/ mutilation	Blunt	Instantaneous
6	Multiple traumatic injuries	Polytrauma/ exsanguination	Blunt	Instantaneous

DISCUSSION

1. Biomechanics & Mechanisms of Railway Injuries

Railway accidents produce extremely severe injuries because trains are large, rigid and carry substantial kinetic energy. Three major mechanisms were identified in this series:

- Direct impact by the front of the train, producing fractures of ribs and long bones and deep lacerations (Case 3).
- Throwing of the body onto track, ballast, poles or nearby structures, producing severe head injury and multiple abrasions (Cases 3 and 4).
- Run-over by train wheels, causing traumatic amputations, crushing, multiple fractures and fragmentation (Cases 1, 5 and 6).

2. Traumatic Amputations & Body Mutilation

Traumatic amputation occurred in 50% of cases. Case 1 had left lower-limb amputation; Case 6 had left upper-limb amputation with bipartite body separation; Case 5 showed the most extensive mutilation with multiple upper- and lower-limb amputations and catastrophic trunk crushing. Grease, dirt and crushed tissue at injury margins supported antemortem railway contact and helped distinguish these injuries from postmortem damage.

3. Head Injuries

Head injury was present in all six cases. Cases 3 and 4 showed skull fractures with intracranial hemorrhage, including epidural, subdural and subarachnoid hemorrhage with brain contusion. Cases 1, 2, 5 and 6 showed severe cranial crushing, facial destruction and extrusion or absence of brain tissue.

4. Internal Organ Injuries & Blood Loss

Marked visceral pallor in Cases 1–3 supported severe blood loss. Case 6 had approximately 1000 mL hemothorax with severe cardiac and pulmonary crushing and a deep liver laceration. In Case 5, extensive fragmentation made detailed organ assessment impossible because many organs were crushed or absent.

5. Forensic Challenges

Case 4 illustrates the difficulty of examining decomposed and unidentified railway victims. Despite advanced decomposition after prolonged cold storage, hemorrhage into surrounding tissues and fracture patterns supported antemortem injury. Cases 5 and 6 required careful collection, reconstruction and matching of fragmented body parts. DNA sampling, radiology and systematic documentation are important in such cases.

Recommendations

1. Improve Track Safety: Install fencing and boundary walls in high-risk areas to reduce trespassing.

2. Provide Safe Crossing Facilities: Replace level crossings with foot overbridges or underpasses wherever feasible.

3. Use Early Warning Systems: AI-based cameras, thermal sensors and automatic alarms can identify people or hazards at high-risk locations.

4. Standardize Forensic Examination: Use a uniform railway-fatality autopsy protocol incorporating DNA sampling, radiological imaging, grease/dirt documentation and detailed injury mapping.

CONCLUSION

Fatal railway accidents produce severe blunt-force injuries including major head trauma, multiple fractures, traumatic amputations and extensive visceral damage. The injury pattern depends on whether the victim is struck, thrown or run over. A thorough medicolegal autopsy is essential to establish cause and manner of death, distinguish antemortem injury from postmortem damage, identify fragmented remains and reconstruct the mechanism. Systematic documentation can also provide evidence for railway safety and prevention strategies.

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