

A Retrospective Study on The Pattern of Injuries Encountered in Railway-Related Deaths Brought for Autopsy at a Tertiary Care Hospital

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Abstract

Introduction: India has the largest network of railways, providing the basic mode of transportation for passengers and freight. Railway-related deaths are either accidental or suicidal, and we may also encounter homicidal deaths by using railway tracks to mask them. Railway-related deaths are rising due to various factors, viz., unmanned level crossings, lack of safety precautions during entraining or detraining, poor infrastructure, and poor safety measures. This study was conducted to determine the manner of death and the various patterns of injuries encountered in fatal railway-related deaths.

Material and Methodology: All the cases of fatal railway-related deaths brought for the autopsy to our mortuary from January 2023 to December 2024 were considered for the study. The data was collected from the Inquest report, postmortem report, relatives of the deceased, and police regarding the circumstances of death. The data was analysed systematically.

Results: A total of 99 cases were observed during the study period. Maximum fatalities (37.4%) were reported among the age group of 31-40 years. Majority of the deceased were male (99%); among them, 74 (74.8%) were known individuals and 25 (25.2%) were unknown. The maximum number of deaths observed was from 12 pm to 6 pm (33.3%), followed by 6 pm to 12 am (28.3%). Most of the deaths were accidental (72.7%) and in 16.2% of cases, the manner of death cannot be ascertained. The majority of accidental deaths were due to trespassing (65.3%). Injuries to the head were observed in most of the cases (56.1%). Among the 99 cases, Shock and Hemorrhage was the most observed cause of death (35.4%), followed by Head injury (26.3%).

Keywords: Railway-related deaths, Accidental, Trespassing, Shock and Hemorrhage.

Introduction

India has the largest network of railway providing the basic mode of transportation for

passengers and freight. It carries about 10-12 million passengers every day, travelling the length and breadth of our country covering about 10,000 sq. kilometers¹. It is also one of the cheapest modes

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of transportation, that is spread across the whole country. Death associated with railways mostly occurs when a person attempts to cross the track or uses the track as a convenient route for walking². Accident prone spots, unmanned crossing and railway tracks passing through the city limits which are usually not covered by fencing further worsens the situation³. Railway-related fatalities, whether accidental or intentional, constitute a substantial public health and forensic challenge.

In recent years, railway-related deaths have emerged as a critical issue in many regions, with a diverse range of circumstances leading to such incidents, including accidental falls, collisions and suicides. Understanding the pattern and severity of injuries associated with these incidents is crucial for improving railway safety measures and planning preventive strategies. After reviewing the literature on railway-related death, it was observed that, the pattern of injuries related to railway-related deaths and its mechanism was not properly researched and for this purpose, we plan to find out the pattern of injuries related to railway accidents. The present study will provide valuable insight into the mechanism of trauma, help forensic experts in determining the manner of death and guide policymakers in enhancing safety protocols. The findings will contribute to a better understanding of railway-related fatalities and support efforts to mitigate their occurrence.

Material and Methodology

This is a retrospective, descriptive and analytical type of study conducted at the Department of Forensic Medicine, Dr.V.M.G.M.C, Solapur (Maharashtra), over a period of two years between 1st January 2023 to 31st December 2024. The type of sample included were all fatal railway-related deaths that were brought for autopsy to our centre.

Inclusion criteria - All the unnatural deaths, encountered in railway related deaths, which were brought for autopsy.

Exclusion criteria - All the natural deaths and decomposed bodies, encountered in railway related deaths, which were brought for autopsy.

In each case, complete autopsy was conducted and the data was collected from the Inquest report, autopsy report and police regarding the circumstances of death. The data collected was recorded in a designed proforma sheet and tabulated in Microsoft excel sheet and analyzed.

Observations and Results

A total of 4647 autopsies were conducted during the study period, i.e. from 1st January 2023 to 31st December 2024, of which 99 (2.1%) cases were due to railway related deaths.

It was observed that, out of 99 cases, maximum number of railway fatalities was observed in the age group of 31-40 years (37.4%), followed by 41-50 years (20.2%) of age group as depicted in Chart no.-1. Majority of railway fatalities were observed among males (99%) and only one case (1%) of female death related to railway fatality was observed (Table no.- 1). Majority of the deceased were Hindus (66.7%), while 9.1% of deceased were Muslims. However, in 24.2% of cases, religion could not be traced (Table no.-2). During study, 74.8% of the individual's identity could be traced out, while in the rest of cases (25.2%), individual's identity could not be traced out, even after thorough investigations (Table no.- 3). Maximum fatalities occurred during the time interval of 12 pm - 6 pm (33.3%), followed by 6 pm -12 am (28.3%) and 6 am to 12 pm (25.2%) respectively (Chart no.- 2). It was observed that haemorrhagic shock (35.4%) was leading cause of death, followed by head injury (26.3%) (Table no.- 4). In majority of the cases, the manner of death was accidental (72.7%), followed by suicidal (11.1%). However homicidal death was not registered during the study period. In 16.2% of cases, manner of death could not be traced out even after thorough medicolegal autopsy and police investigations (Table no.- 5). Most accidental deaths occurred during trespassing (65.3%) while the other ways of accident were - falling from moving train (15.3%), accidental fall during acceleration (9.7%) and accidental fall during deceleration (9.7%) (Table no.- 6). Majority of the injuries were sustained to head (56.1%), followed by injuries to lower limbs (48.8%) and upper limbs (45.8%) respectively.

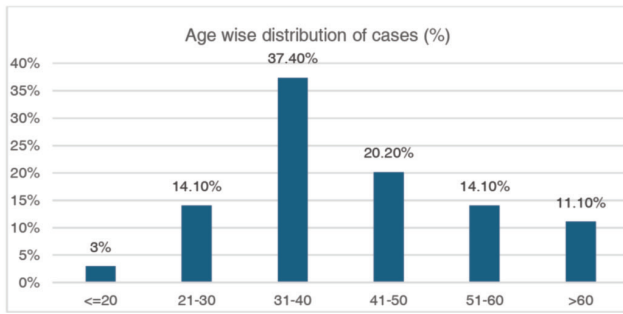


Chart No. 1: Age Wise Distribution

Table No. 1. Gender Wise Distribution

Male	Female	Total
98 (99%)	1 (1%)	99 (100%)

Table No. 2. Religion Wise Distribution

Religion	No of Cases
Hindu	66 (66.7%)
Muslim	9 (9.1%)
Not Known	24 (24.2%)
Total	99 (100%)

Table No. 3. Percentage of Known and Unknown individuals

Known	Unknown	Total
74 (74.8%)	25 (25.2%)	99 (100%)

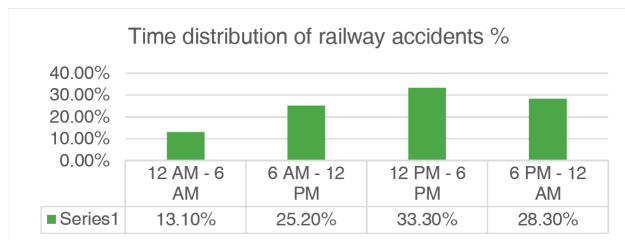


Chart No. 2: Time Wise Distribution

Table No. 4. Cause of Death

Cause of Death	No of Cases
Blunt Injury	3 (3%)
Crush Injury	15 (15.2%)
Decapitation	8 (8.1%)
Head Injury	26 (26.3%)
Haemorrhagic Shock	35 (35.4%)
Traumatic Transection	10 (10.1%)
Injury to vital organs	2 (2%)
Total	99 (100%)

Table No. 5. Manner of Death

Manner of Death	No of Cases
Accidental	72 (72.7%)
Suicidal	11 (11.1%)
Homicidal	0 (0%)
Not Known	16 (16.2%)
Total	99 (100%)

Table No. 6. Manner of Accident

Manner of Accident	No of Cases
Trespassing	47 (65.3%)
Falling from moving train	11 (15.3%)
Accidental fall during Acceleration	7 (9.7%)
Accidental fall during Deceleration	7 (9.7%)
Total	72 (100%)

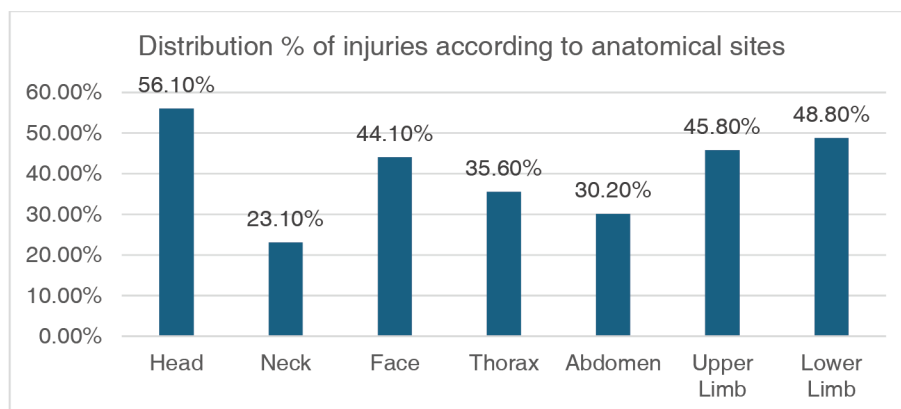


Chart No. 3: Distribution of Injuries According to Anatomical Sites

Table No. 7. Pattern of Injuries

Region	Abrasion	Contusion	Laceration	Abraded-Contusion	Crush-Laceration	Fracture	Decapitation/Amputation
Head, Neck & Face	49	43	33	28	16	59	8
Thorax	33	35	13	39	3	61	4
Abdomen	54	27	18	41	7	19	9
Periphery	71	74	72	77	51	73	5
Total	207	179	136	185	77	212	26

Figure 1: Traumatic Transection at the level of T₁₂-L₁ vertebrae

Figure 2: Multiple injuries encountered in railway accident while trespassing

Discussion

The medico-legal expert should be aware about the pattern of injuries encountered in railway-related deaths which will help the investigating police officer to know the manner of death. Out of 4647 autopsies carried out during study period, 2.1% of the cases were of railway-related deaths. Similar trend of railway fatalities was also observed by different authors in various parts of India where

the observed percentage of railway related deaths were- Rohit Kumar Meena et. al (2.16%)⁴, Rautji R et.al (1.41%)⁵, Basavaraj Patil et. al (3.55%)⁶, Hussaini S et.al (4.51%)³, Chandru K et. al (4.65%)⁷, and Malick DS et.al (4.99%)⁸. While studies conducted by other authors, the percentage of railway related deaths were observed to be on higher side as- T. Mohit Kumar Moses et.al (9.04%)⁹, Manoj Kumar Mohanty et.al (9.2%)² and Pawan R. Sabale et. al (19%)¹⁰. The variations in the percentage of railway related death might be due to region wise variation having railway junction and frequency of trains passing from that region and density of population around the railway tracks.

In our study, maximum number of railway fatalities was observed in age group of 21-40 years (51.5%). Similar results were observed in the studies conducted by Hussaini S et.al (51.72%)³, Rohit Kumar Meena et. al (54.76%)⁴, Basavaraj Patil et. al (45.4%)⁶, Chandru K et. al (58.5%)⁷, T. Mohit Kumar Moses et.al (49%)⁹, Pawan R. Sabale et.al (60.5%)¹⁰, Savaradekar Ret.al (62.4%)¹¹, Shantilal Pargi et.al (54.8%)¹² and Arabinda Chatterjee et.al (51%)¹³. The individuals in this age group are the young adults at the peak of their physical and mental capabilities which make them to take unnecessary risk by boarding in running train, hanging on door of train when trains are overcrowded resulting in more casualties.

Out of 99 cases, majority of railway fatalities were seen among males (99%) while there was only one female deceased observed during the study period. The male predominance was observed in the study conducted by Manoj Kumar Mohanty et. al (79.5%)²,

Hussaini S et.al (89.6%)³, Rohit Kumar Meena et. al (91.3%)⁴, Basavaraj Patil et. al (92.7%)⁶, Chandru K et. al (70.76%)⁷, T. Mohit Kumar Moses et.al (86.7%)⁹, Pawan R. Sabale et.al (90.2%)¹⁰, Savaradekar R et.al (91.62%)¹¹ and Arabinda Chatterjee et.al (81%)¹³. Male travel more frequently by train and at times takes unnecessary risk exposing them to injuries and death.

In our study, most of the victims who succumbed to death due to railway injuries belong to Hindus (66.7%). Similar result was seen in the study conducted by Basavaraj Patil et. al (82.5%)⁶ and Arabinda Chatterjee et.al (65%)¹³. This can be explained by higher density of Hindu population in the study region than other communities.

Majority of the deceased's identity was known (74.8%) but in 25.2% of cases, their identity could not be traced out even though thorough investigations was carried out. Similar finding was seen in the studies conducted by Rohit Kumar Meena et. al (81.7%)⁴ and T. Mohit Kumar Moses et.al (55%)⁹. The incidence of railway related death usually happens suddenly and person may not be carrying any identification card along with them. Also considering the extensive nature of injuries with distortion of face, it poses challenge to investigating officer to make positive identification of deceased.

It was observed that maximum fatalities occurred during the time interval of 12 pm to 6 pm (33.3%), followed by time interval of 6 pm to 12 am (28.3%). Similar findings were seen in the study conducted by Pawan R. Sabale et.al¹⁰ (28% and 27% respectively), while in the study conducted by Savaradekar R et.al¹¹, maximum fatalities were observed during 6pm to 10pm (31.58%) followed by 6am to 10am (26.61%) respectively. In the study conducted by T. Mohit Kumar Moses et.al⁹, maximum fatalities were seen during 6 pm to 6 am (50.2%) followed by 6 am to 12 pm (27.8%) respectively. In the study conducted Arabinda Chatterjee et.al¹³, maximum fatalities were seen during 6 am to 12 pm (41.5%) followed by 12 pm to 6 pm (28%) respectively. The timing of railway related fatality depends upon the timing of trains from that particular area and

therefore the variations in timing of accident was observed in different studies.

It was observed that shock and hemorrhage was the most common cause of death that accounted for 35.4% of the cases, followed by injury to the head (26.3%). Similar findings was seen in the study conducted by Shantilal Pargi et.al (36.5%)¹² in which shock and hemorrhage was found to be most common cause of death. However, study conducted by Hussaini S et.al (67.24%)³ and Chandru K et. al (83.1%)⁷ observed shock and hemorrhage as most common cause of death, though the percentage of shock and hemorrhage in railway related deaths varies in those studies. Profuse bleeding usually observed through open and extensive amputated injuries which is common feature in various accidents and before patient shifted to emergency medical facility, patient succumb. The study conducted by Pawan R. Sabale et.al (44.09%)¹⁰, Savaradekar R et.al (45.74%)¹¹ and Arabinda Chatterjee et.al (56%)¹³, observed head injury as most common cause of death which is inconsistent with our study. Often railway related death involves direct impact to the head resulting into accidental head injury.

In the present study, the manner of death was found to be accidental in 72.7% of cases while there was no case of homicide during our study period. Similar findings were seen in the studies conducted by Manoj Kumar Mohanty et. al² (80.7%), Hussaini S et.al³ (93.96%), Rohit Kumar Meena et. al (67.46%)⁴, Basavaraj Patil et. al (69.07%)⁶, Chandru K et. al (86.15%)⁷, T. Mohit Kumar Moses et.al (63%)⁹, Pawan R. Sabale et.al (90.04%)¹⁰, Savaradekar R et.al (89.12%)¹¹ and Shantilal Pargi et.al¹² (67.46%). Sometimes, the expression of heroism in youngsters compounded by the use of psychoactive substances also potentiates the incidences of occurrence of accidental deaths in them. Accidental deaths are also commoner in males due to the higher spurt of activity for livelihood in their lives.

Majority of the accidental deaths occurred due to trespassing which accounted for 65.3%. Other causes of accidental deaths were - falling from moving train (15.3%), accidental fall during acceleration (9.7%) and accidental fall during

deceleration (9.7%). Similar findings were seen in the study conducted by Manoj Kumar Mohanty et. al (64.8%)², Rautji R et.al (57.48%)⁵, Malick DS et.al (34%)⁸, T. Mohit Kumar Moses et.al (56%)⁹, Pawan R. Sabale et.al (59.04%)¹⁰ and Savaradekar R et.al (59.37%)¹¹ where trespassing was observed as the most common manner of accident. This could be due to - unmanned/unauthorized railway crossings, poor maintenance of fencing/barriers along railway lines, ignorance of basic rail safety rules, using mobile phones or listening to music while walking on or near railway tracks, lack of surveillance and enforcement, etc. Such types of deaths can be easily prevented if proper preventive measures are taken and by public awareness.

In this present study, maximum number of injuries were sustained to head (56.1%), followed by injuries to lower limbs (48.8%) and upper limbs (45.8%) respectively. Similar findings were seen in the study conducted by Hussaini S et.al³ in which 54.31% of injuries were sustained to head and injuries over both upper and lower limbs comprised 63.79%. Also, in the study conducted by Rohit Kumar Meena et. al⁴ injuries sustained over to head comprised 37.14% of cases while over the peripheries also accounted for 34.14% of all injuries.

It was observed that the most common pattern of injury involved in this study constituted fractures majorly over the peripheries, followed by fractures over the thorax and head respectively. Similar findings were seen in the study conducted by Rohit Kumar Meena et. al⁴ which showed fractures as the most common pattern of injury. Run over injuries by railway are common resulting into fractures and amputation.

Conclusion

This present study analysed railway-related fatalities, highlighting that most victims were males aged 31-40 years which earn bread and butter for their families, with trespassing and accidental falls being major causes. The primary cause of death was shock and hemorrhage as the railway accidents causes severe trauma/leads to high impact injuries, blunt injuries to vital organs leads to profuse internal

bleeding, crush injuries to limbs and in some cases leads to amputation of limbs. The contributing factors include overcrowding and disregard for safety regulations.

Though certain limitations were also encountered as this was a retrospective, single-centre study, limiting the generalizability of findings across different regions and also it lacks proper collection of information from the relatives and the police. Only autopsy data was analyzed; detailed behavioural, psychiatric, or toxicological profiles of the victims were not explored. Also, the cases involving decomposed bodies were excluded, which could underestimate certain categories of death.

To enhance railway safety, the study recommends increasing train frequency, providing ambulances at stations, training railway staff in first aid, fencing tracks and raising public awareness. Citizens can prevent accidents by adhering to safety practices like avoiding track crossings and boarding trains safely.

Railway authorities should enforce strict safety laws, improve pedestrian infrastructure (e.g., footbridges and subways), remove obstacles near tracks and ensure better crowd management. These measures, along with forensic insights into injury patterns, can help reduce fatalities and plan future railway safety policies.

Ethical Approval: As this is a retrospective study, ethical approval was not obtained and data was kept confidential and no harm was done to any individual.

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