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A Retrospective Study of Deaths Due to Railway Accidents Autopsied in A Tertiary Care Teaching Hospital of Tripura

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ABSTRACT

Background: Railway accidents remain a significant cause of unnatural deaths in India, posing major public health, medico-legal, and socioeconomic challenges. Understanding the demographic profile, manner of death, and injury patterns is essential for prevention. The aim is to analyze the demographic characteristics, manner of death, injury patterns, and causes of death in railway accident fatalities autopsied at a tertiary care teaching hospital in Tripura, and to suggest preventive measures.

Methods: This retrospective study included all railway accident cases subjected to medico-legal autopsy at the Department of Forensic Medicine and Toxicology, Agartala Government Medical College & GBP Hospital, Tripura, from January 2017 to December 2023. A total of 60 cases were analyzed.

Results: The majority of victims were aged 21–30 years (36.67%). Most of the victims belonged to lower socioeconomic strata, with laborers being the most affected occupational group. Accidental deaths constituted 73.33%, while suicidal deaths accounted for 26.67%. Crush injuries (38.33%) and decapitation (30%) were the most common injury patterns. Hemorrhagic shock (56.67%) was the leading cause of death.

Conclusion: Railway fatalities predominantly affect young, economically productive males from socioeconomically vulnerable backgrounds. Most deaths are accidental and occur at the scene due to severe injuries such as crush injuries and decapitation, resulting in rapid fatality.

Key-words: Railway accidents; Unnatural deaths; Medico-legal autopsy; Injury patterns; Cause of death; Hemorrhagic shock; Crush injuries; Decapitation

INTRODUCTION

An ''accident'' is defined as an unexpected, unplanned occurrence which may involve injury. A WHO advisory group in 1956 defined ''accident'' as an unpremeditated event resulting in recognizable damage [1]. A train accident is defined as a "collision, derailment, or any other event involving the operation of on-track equipment". The rail transport system first appeared in England in the year 1820 & in India, it was first introduced in 1853 from Bombay to Thane.

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The first accident to kill a passenger happened in 1833 at Hightstown, New Jersey [2]. Ever since the railway engine was invented, a railway disaster has been associated with numerous fatalities. Thousands of people have been killed over the years in railway incidents, since this constitutes a common mode of public transport system all over the world, especially in India, which has a large railway network with unprotected railway crossings [3-6]. Railway accidents occupied an important role in the medical and legal disclosures on trauma and traumatic disorders [7]. The Britishers had introduced this railway system to move their troops faster and transport goods, with a view to improving their trade and sustaining their rule in India. Fortunately, it proved to be a great boon for India's development in post independent era. From a very modest beginning in 1853, when the first train steamed off from Mumbai to Thane in 34 km, Indian Railways has grown into a vast network of 6909 stations

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spread over a route length of 63327 km. 2 with a fleet of 8153 locomotives, 45350 passenger service vehicles, 5905 other coaching vehicles and 207719 wagons as of date. The growth of Indian Railways in the 150 years of its existence is thus phenomenal. Presently, it is said to be the 2nd largest railway network in the world, transporting 17 million passengers and more than one million tons of freight daily. With so many advantages from Railways, the silent price our country is paying is the mortality rates we see due to Railway accidents. According to NCRB, 17,993 railway accidents caused injuries to 1,852 people and deaths to 16,431 people during 2021 [8].

Railway fatalities taking toll of human lives and the economy are often underreported and go unnoticed and the victims of these incidents are also ill-compensated. It is therefore necessary to pay adequate attention to Railway fatalities and formulate appropriate policies for giving equal treatment to the victims of these events and to make efforts to mitigate these. Another challenge faced by Forensic Medicine Experts is in cases with a suspicion that the deceased had been killed at some other place and then put on or around Railway tracks, where it is difficult to differentiate homicides from suicides and accidents. Railway pattern of injuries should be differentiated from other injuries and also assess which of those injuries are either antemortem /post-mortem.

MATERIALS AND METHODS

Research Design- This was a retrospective descriptive study conducted at the Mortuary of the Department of Forensic Medicine & Toxicology, Agartala Government Medical College & GBP Hospital, Tripura, over a period of seven years from January 2017 to December 2023.

Methodology- All cases of railway accident–related deaths subjected to medico-legal autopsy during the study period were included. A total of 60 cases fulfilling the inclusion criteria were analyzed.

Data were collected retrospectively from post-mortem examination reports, police inquest records, and hospital case sheets. Information regarding demographic profile, socio-economic and educational status, occupational details, time and manner of death, place of death, injury patterns, survival period, and cause of death was recorded using a structured proforma and tabulated for analysis.

Inclusion and Exclusion criteria

Inclusion criteria- All cases of Railway Accident brought for medico-legal autopsy.

Exclusion criteria- Cases of advanced stage of decomposition and mummification.

Statistical Analysis- The collected data were entered into Microsoft Excel and analyzed using SPSS version 21. Results were expressed as frequencies and percentages. The Chi-square test was used to assess associations between qualitative variables. A p-value of less than 0.05 was considered statistically significant.

Ethical consideration- Ethical clearance for the study was obtained from the Institutional Ethics Committee of the Tertiary Care Hospital of Tripura. Confidentiality of all medico-legal records was strictly maintained.

RESULTS

Table 1 shows the demographic distribution of railway accident victims. The highest number of victims belonged to the 21–30 years age group (36.67%), followed by 31–40 years (23.33%). Males constituted the majority (88%), and most victims were married (63.33%). The predominant religious group was Hindu (76.67%).

Table 1: Demographic characteristics of railway accident victims (n = 60)

	Category	Frequency	Percentage (%)
Age group (years)	11–20	10	16.67
	21–30	22	36.67
	31–40	14	23.33
	41–50	6	10
	>51	8	13.33
Sex	Male	53	88
	Female	7	12
Marital status	Married	38	63.33
	Unmarried	19	31.67
	Others	3	5
Religion	Hindu	46	76.67
	Muslim	10	16.67
	Christian	3	5
	Buddhist	1	1.67

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Table 2 depicts the socio-educational and economic profile of the victims. Most victims had high-school level education (40%). Labourers formed the largest occupational group (40%), followed by employed and unemployed individuals. Nearly half of the victims belonged to the lower socio-economic class (45%).

Table-2: Socio-educational and economic profile of railway accident victims (n = 60)

Variable	Category	Frequency	Percentage (%)
Educational status	Illiterate	15	25
	Primary	12	20
	High school	24	40
	Higher secondary	5	8.33
	Graduate	4	6.67
Occupational status	Labourer	24	40
	Employed	10	16.67
	Unemployed	9	15
	Student	9	15
	Housewife	8	13.33
Socio-economic status	Lower	27	45.
	Lower middle	19	32
	Middle	14	23

Table 3 presents the distribution of accidents according to time of occurrence, manner of death, and place of death. A majority of incidents occurred during night hours (38.33%). Accidental deaths constituted 73.33% of cases. More than half of the victims were declared dead at the spot (56.67%), while the remaining were either brought dead or died in the hospital.

Table 3: Distribution of Time of Accidents, Manner, and Place of Death

Parameter	Category	Frequency	Percentage (%)
Time of Accident	Morning	13	21.67
	Afternoon	11	18.33
	Evening	13	21.67
	Night	23	38.33
Manner of Death	Accidental	44	73.33
	Suicidal	16	27
Place of Death	On Spot	34	56.67
	Brought Dead	14	23.33
	Hospital	12	20

According to Fig. 1, the maximum number of victims (33.33%) succumbed within 0.5 hours of the incident, indicating the rapid fatal nature of railway injuries. This was followed by victims who survived for 6–12 hours (16.67%). Only a small proportion of victims (5%) survived for more than 24 hours after the accident.

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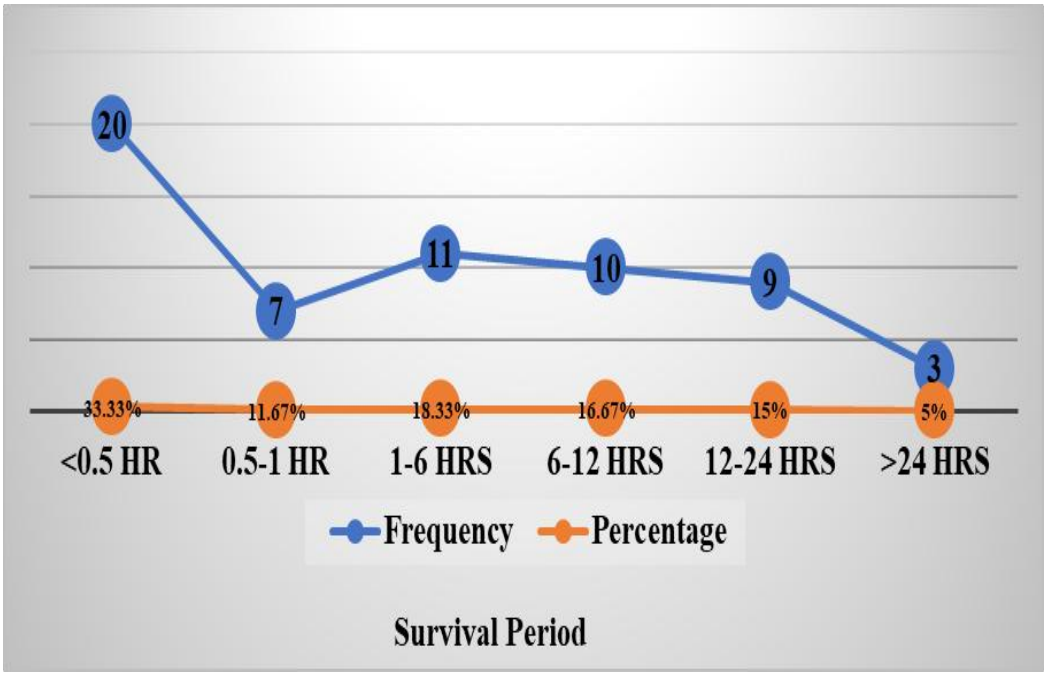

Fig. 1: Distribution of survival period following railway accidents.

Fig. 2 demonstrates the distribution of injury patterns among railway accident victims. Crush injuries were the most common type of injury (38.33%), followed by decapitation (30%). Other injuries included amputations and multiple fractures, reflecting the severe and mutilating nature of railway trauma.

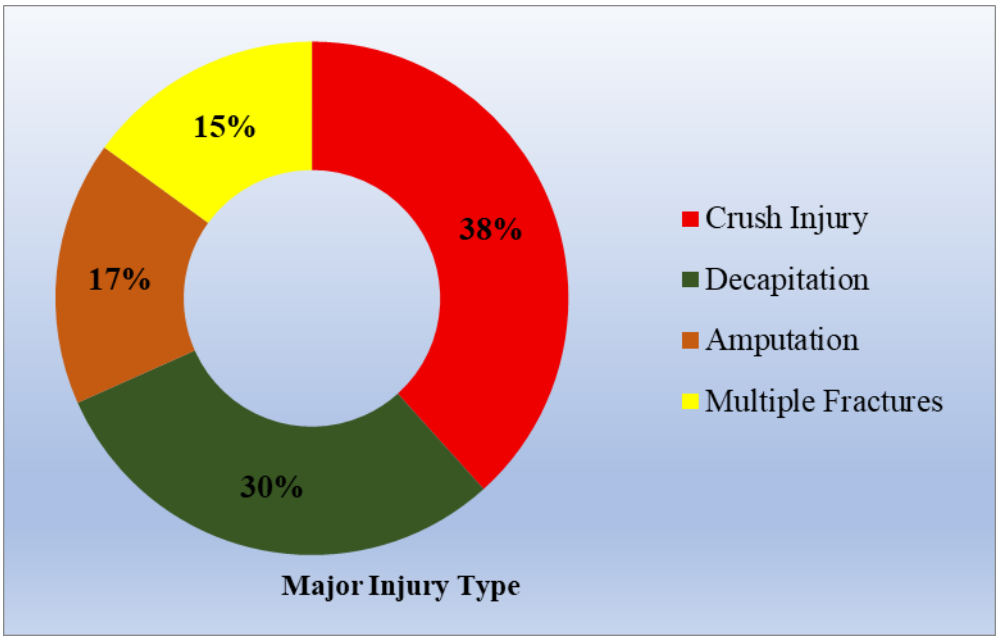

Fig. 2: Distribution of injury patterns in railway accident fatalities

Fig. 3 shows the distribution of causes of death in railway accident victims. Hemorrhagic shock was the leading cause of death (56.67%), followed by head injury (30%) and multiple injuries (13.33%), highlighting the high lethality associated with massive trauma.

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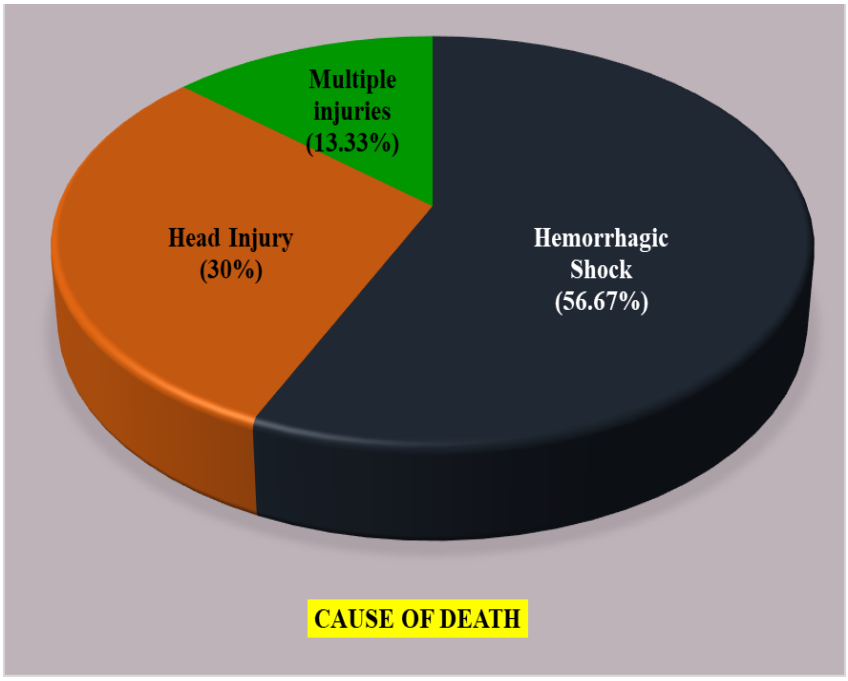

Fig. 3: Distribution of causes of death in railway accident victims

DISCUSSION

In this present study, 60 cases of railway-related fatalities autopsied at a tertiary care center were analyzed. The findings reveal that the majority of victims belonged to the age group of 21-30 years (36.67%) followed by 31-40 years (23.33%), reflecting that young and middle-aged adults are the most vulnerable due to high mobility and occupational exposure. Kumar *et al.* also documented the majority of deaths in the 21–40 year age group, supporting the present findings [12]. Moses and Ammani reported a higher concentration of victims in the 31-40 years group, followed by 21–30 years [9]. Similarly, Malick and Goswami observed maximum fatalities in the age group of 41–50 years, followed by 31–40 and 21–30 years, which again highlights the predominance of the working-age population among victims [10].

In this study, males predominated overwhelmingly (88.33%) compared to females (11.67%). This is consistent with Malick and Goswami and Singha's study [9,10]. Male predominance is generally attributed to greater exposure to outdoor work, higher risk-taking behaviour and greater interaction with railway environments. Most of the victims in this study were married (63.33%). A substantial proportion belonged to the lower socioeconomic class (45%) and the majority were labourers (40%), suggesting a strong socio-economic vulnerability pattern where economically weaker sections are more exposed to hazardous railway environments.

Regarding temporal distribution, accidents occurred most commonly during the night (38.33%) followed by evening and morning hours. This partially corresponds to findings of Kumar *et al.*, who reported the majority of suicidal deaths at night, whereas accidental incidents were more frequent during daytime [12]. Conversely, Jibril *et al.* observed maximum fatalities between 6 am and 12 pm [11].

In terms of manner of death, accidental deaths constituted 73.33% while suicidal cases accounted for 26.67%. These findings are similar to those of Jibril *et al.* and Kumar *et al.* [11,12]. This highlights the persistent problem of unsafe railway track usage, such as crossing and walking along tracks. In the present series, more than half of the victims were declared dead at the spot (56.67%), reflecting severe trauma incompatible with life, whereas 23.33% were brought dead and 20% expired in the hospital.

With respect to the pattern of injuries, crush injuries (38.33%) and decapitation (30%) were predominant, followed by amputations and multiple fractures. Malick *et al.* reported a very high frequency of lacerations and fractures along with multisystem injuries [9]. Jibril *et al.* also reported multiple injuries as the most common in accidental cases and decapitation was frequently in suicides [13]. Kumar et al likewise documented

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decapitation, particularly in suicidal incidents and head region involvement, as the most common [12].

The leading cause of death in the present study was hemorrhagic shock (56.67%), followed by head injury (30%) and multiple injuries (13.33%). Moses and Ammani reported multiple injuries as the predominant cause of death, followed by head injury [9], while Malick S and Goswami A similarly identified head injury either alone or with shock as a major cause. Singha also documented head injury as the leading fatal factor [10]. Jibril *et al.* described multiple injuries and blunt trauma to the head as the most common causes of death [11].

The chi-square analysis in the present study did not reveal any statistically significant association between sex and survival period, residence and cause of death, or age group and major injury type. This indicates that railway injuries are largely non-discriminatory in outcome once impact occurs, and lethality remains high irrespective of demographic variables. Limited comparative statistical studies are available in the literature; hence, future research incorporating analytical comparisons across larger datasets may provide a clearer understanding. Strengthening railway safety policies, enhancing public awareness, enforcing track-trespass control and improving trauma care accessibility remain essential measures to reduce the mortality burden associated with railway incidents [13,14].

CONCLUSIONS

The present study highlights that railway-related fatalities predominantly involve young to middle-aged males belonging largely to socioeconomically vulnerable backgrounds. Most incidents were accidental in nature, frequently occurring during night hours and particularly in the rainy season. The majority of victims sustained devastating injuries such as crush injuries and decapitation, resulting in hemorrhagic shock and severe head trauma as the leading causes of death. A substantial proportion of individuals were declared dead at the scene, reflecting the extreme impact and rapid fatality associated with railway injuries. Statistical analysis did not demonstrate significant associations between demographic factors and outcomes, suggesting that once impact occurs, mortality risk remains uniformly high irrespective of age, sex, or residence. These findings reinforce observations from previous Indian literature and emphasize the urgent need for comprehensive railway safety strategies. Strengthening public awareness on safe railway track behaviour, restricting trespassing, improving surveillance and enforcement, and enhancing timely trauma care and transport facilities are crucial to reducing preventable mortality. Multi-centric prospective studies with larger cohorts are recommended to further understand risk determinants and guide policy implementation aimed at improving railway safety and outcomes.

CONTRIBUTION OF AUTHORS

Research concept- Ashis Das, Shauni Gope, Debasree Debnath
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