

ORIGINAL ARTICLE

Analysis of Injury Patterns in Railway Track Death and their correlation with Manner of Death in the Bhopal Region- An Autopsy Based Study

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Abstract:

Cases of deaths due to railway injuries are important in respect to medico- legal investigation to find out the underlying cause and manner of death. This study was undertaken for assessment of load and to study the cases of railway fatalities for the pattern of injuries sustained, manner and cause of death with the evaluation of factors responsible for such events and to suggest recommendations for curbing such events. The primary goal of this study, which focused on 107 railway-related deaths at the Gandhi Medical College in Bhopal, was to identify the cause of death from the pattern of injuries. In our study we found 91.6% of the 107 victims were men, while 8.4% were women. Most victims (54.2%) were in the age range of 21 to 40. 90.7% of 107 incidents resulted in spot deaths. In case of the visceral injuries brain and liver are maximum affected organs. Externally abrasion and contusions are commonly seen in both type of cases, abrasion found in almost 100 percent cases. Laceration and crushed injuries are more commonly seen in accidental cases and decapitation seen only in suicidal cases. There were no homicide cases in this study; instead, 66.4% of the cases were accidental and 33.6 percent of the cases were suicide. Our study's analysis suggests that after detailed examination of spot and body position at the scene of crime, closely checking for injury pattern and their frequency in same type of cases, obtaining detailed history from police, relatives and eye witnesses we can opine a possible manner of death.

Keywords: Decapitation; Suicide; Amputation; Trauma; Accident; Railway.

Introduction:

Indian Railways (IR) is a statutory body under the jurisdiction of Ministry of Railways, Government of India that operates India's national railway system.¹ It manages the fourth-largest railway network in the world by size, with a route length of 67,956 km as of 31 March 2020. 45,881 km or 71% of all the broad-gauge routes are electrified with 25 kV 50 Hz AC electric traction as of April 2021.^{2,3} With ever increasing mechanization vehicular accidents are steadily increasing in magnitude and frequency. Indian Railway is the largest railway system in the world under a single management.

Railway accidents occupied an important role in the medico legal disclosures on trauma and traumatic disorders.⁴ In India most of the railway tracks run in the overly populated areas and being the cheapest mode of transportation, most trains travel thickly packed, especially in India, having a large railway network with unprotected railway crossings. All these factors increase the possibilities of accidents.⁵ The railway also provides a convenient mode of suicides and many cases have been reported where a person was deliberately lying across the railway line or even place his head on the line in order to achieve self-destruction.⁶ Railway related deaths account for approximately

one percentage of all fatalities submitted to medico legal autopsies. The purpose of all railway track death investigations is to establish the cause of incidents. Regulatory authorities may fix the responsibility and safety authorities will want to see what can be done to prevent recurrence.⁷

In recent times there has been a spate of railway accidents in India, leading to loss of a significant number of human lives.⁸ Although less frequent than automobile accidents, train accidents have a major impact on victim's lives.⁹ Bhopal, being the capital of the state of Madhya Pradesh is an important junction as regards to train traffic; catering to the arrival and departure of about 200 local and superfast trains per day and more than 385 trains within a week.¹⁰ Being a metropolitan city, Bhopal district is spread over an area of about 2772 km square¹¹ the railway track crosses through inner parts of city of Bhopal at various places, which range from lowly populated to highly populated regions including areas with congestion of road traffic too. Trains are a common means of committing suicides owing to easy availability and higher chances of mortality.

Apart from this, train accidents can also be used as a means of masking homicidal deaths to mimic the event as an accidental or suicidal railway death. Many of these fatalities do not raise any medico-legal questions as most of these events are witnessed, but in some cases the expertise of an autopsy surgeon is sought for a legal conclusion for the manner and nature of the injuries sustained. Cases of deaths due to railway injuries are important in respect to medico-legal investigation to find out the underlying cause and manner of death.

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Article History

DOR : 08.05.2023 DOA : 19.10.2023

Material and method:

This is a cross sectional descriptive study. In 4356 autopsies, 107 cases (2.45%) were railway related deaths, which form the cohort of the present study. All autopsies were performed during a 20 month period from January 2020 to August 2021 in the department of Forensic Medicine and Toxicology of Gandhi Medical College, Bhopal, which is a tertiary care teaching hospital in state of Madhya pradesh.

The data of each deceased will be collected on a proforma specially designed for this study which includes history given by police, previous medical records if so, autopsy findings and forensic science lab evidence which will be analyzed for correlation.

Limitations of study: Many a times the history given by relatives, police and eye witnesses are not completely reliable and do not correlate with the findings of the case/body which may be the cause of limitations in this study. Sometimes photographs of the case/body and location of the body distorted due to mishandling by untrained personnel.

Results:

During the period from January 2020 to August 2021 (20 months) a total of 107 cases were reported as railway track deaths which were studied. Railway deaths constituted 2.45% of the total autopsies conducted during the study period. The maximum incidence of cases were seen in the fourth decade of life closely followed by third decade of life (Table 1). Males predominated the study with the gender ratio of 10.9:1 showing that males are more prone than females in railway track deaths (Table 2). The railway fatalities were more of accidental in nature (66.4%), followed by suicidal (33.6%) and no homicidal cases were found

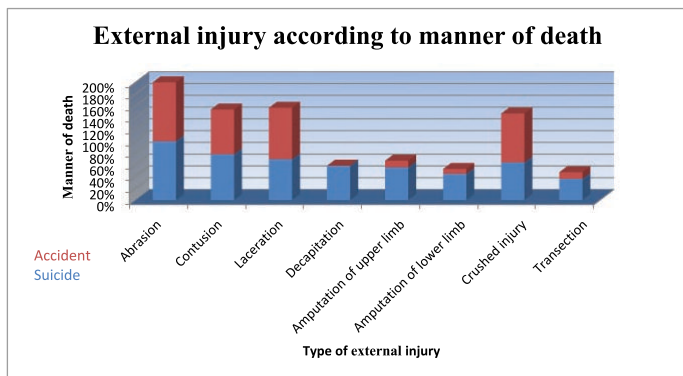


Figure 1. External injury according to manner of death.

during the study period (Table 3). The most difficult task in railway injury death autopsy cases is to established the identity of deceased, 77.5% cases were identified and 22.43% cases were unidentified until the time of postmortem. Accidents were more during the evening and night hours. Railway fatalities were more during the rainy season. January was the month with more number of mortality cases. It is very difficult to determine manner of death by just seeing the injury patterns.

After detailed examination of spot and body position at the scene of crime, closely checking for injury pattern and their frequency

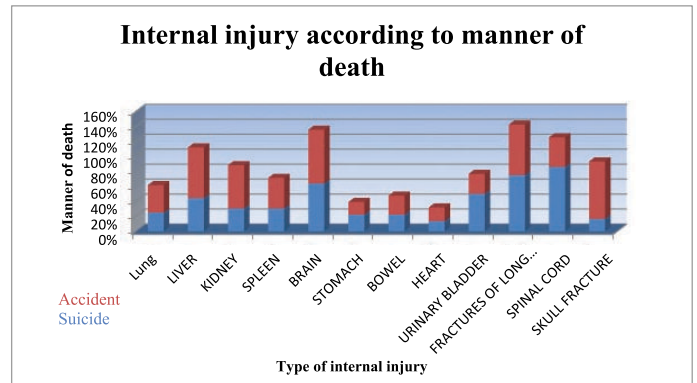


Figure 2. Internal injury according to manner of death.

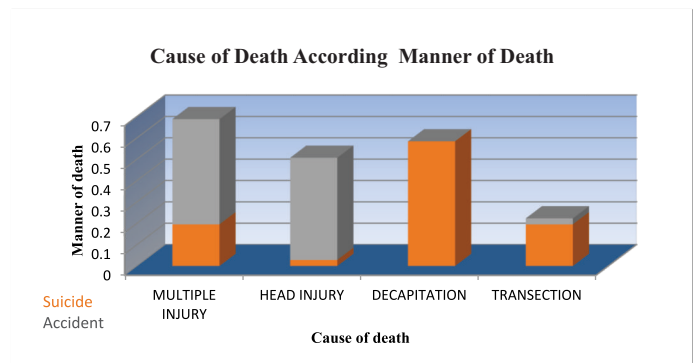


Figure 3. Cause of death according manner of death.

in same type of cases, obtaining detailed history from police, relatives and eye witnesses we can opine a possible manner of death. The accidental deaths by railway injuries occurred mostly while crossing the track or walking along the track. The suicidal deaths by railway injuries occurred mostly by lying on the track. From the analytical study of the railway fatality injuries it was revealed that fractures were most commonly seen.

Internal organs commonly involved are brain followed by liver, spinal cord, kidney, spleen, lungs etc. In accidental cases laceration and crushed injuries were the most common external injury whereas in suicidal cases decapitation, amputation of limbs and transection of body were the most common external injuries (Table 4) (Figure 1).

In accidental cases lungs, liver, spleen, kidney and skull fracture were the common internal organ injury whereas in suicidal cases spinal cord, stomach and bowel were the common internal organ injuries (Table 5) (Figure 2). Abrasion, contusion, fractures of long bones and brain injuries are found almost same in both accidental and suicidal type of cases. It is also found that injuries to the upper half of the body are more common when compared to that of lower half of the body. 90.7% cases were spot dead and which clearly shows the severity of railway injuries. Multiple injuries and head injury is most common cause of death in accidental cases. Decapitation and transection is most common cause of death in suicidal cases (Table 6) (Figure 3).

Discussion:

Out of the 4356 medico-legal autopsies conducted at the mortuary, 107 cases were of railway related deaths. The burden of railway track related deaths was 2.45% which is similar to other

Table 1. Age wise distribution.

Age group	Frequency	Percent
11-20	7	6.5
21-30	28	26.2
31-40	30	28.0
41-50	18	16.8
51-60	11	10.3
61-70	8	7.5
70+	5	4.7
Total	107	100.0

Table 2. Sex wise distribution.

Sex	Frequency	Percent
Male	98	91.6
Female	9	8.4
Total	107	100.0

Table 3. Sex wise distribution.

Manner	Frequency	Percent
Suicide	36	33.6
Accident	71	66.4
Total	107	100.0

Table 4. External injury according to manner of death.

External Injury	Suicide (N=36)	Accidental (N=71)
Abrasion	36 (100%)	71 (100%)
Contusion	28 (77.77%)	54 (76.05%)
Laceration	25 (69.44%)	62 (87.32%)
Decapitation	21 (58.33%)	0 (0.0%)
Amputation of upper limb	20 (55.55%)	8 (11.26%)
Amputation of lower limb	16 (44.44%)	6 (8.45%)
Crushed injury	23 (63.88%)	59 (83.09%)
Transection	13 (36.11)	8 (11.26%)

studies Das G et al.¹⁴ (1.96%) and Rohit Kumar et al.¹⁵ (2.16%). And quite less as compared to other studies conducted in different parts of the country as 6.7% Kumar A,¹⁶ 25.79% Sheikh MI et al.,⁴ 5.99% Wasnik RN.¹² These differences in various parts of the country can be explained by the geographical variations in the population, availability of rail road facility, security and the awareness of general population of the region. Although the death toll in 2020 was lower than in the last four years, it remains important as passenger traffic was restricted following the announcement of the corona virus lockdown on March 25. Only freight trains were in operation during the closure period. Before the railroad began, a special Shramik train ran from May 1st, taking migrant workers home.

77.57% of railway fatalities autopsied during the study period were identified and remaining 22.43% dead bodies were unidentified until the time of postmortem examination. Which is similar to Rohit Kumar et al.¹⁵ which is 18.25% unidentified bodies. Maximum numbers of victims were in 21-40 years of age group (54.2%). The peak occurring in age group of 31-40 years (28%). Similar results have been reported by other authors Wasnik RN¹² and Das G et al.¹⁴ Males predominated the study population (91.6%) out numbering the females (8.4%) which is similar to other studies Puttaswamy,¹⁷ Tyagi S et al.,¹⁸ Wasnik RN¹² and Das G et al.¹⁴ The sex ratio in this study was 10.9:1, which is quite similar to 10.4:1 Rohit Kumar et al.¹⁵ and 8.62:1 Wasnik RN.¹² However, the results of this study are not similar to those of Kumar A¹⁶ who reported a male: female ratio of 1:1.3. The reason for high incidence of railway fatalities in males reflects their high activity levels and participation in high-risk activities. It is due to greater male exposure to the railways. On the contrary, females

Table 5. Internal injury according to manner of death.

Internal injury	Suicide (N=36)	Accidental (N=71)
Lung	9 (25%)	26 (36.66%)
Liver	16 (44.44%)	48 (67.60%)
Kidney	11 (30.55%)	41 (57.74%)
Spleen	11 (30.55%)	29 (40.84%)
Brain	23 (63.88%)	51 (71.83%)
Stomach	8 (22.22%)	12 (16.90%)
Bowel	8 (22.22%)	18 (25.35%)
Heart	5 (13.55%)	13 (18.30%)
Urinary bladder	18 (50%)	19 (26.76%)
Fractures of long bone	27 (75%)	48 (67.60%)
Spinal cord	31 (86.11%)	28 (39.43%)
Skull fracture	6 (16.66%)	54 (76.65%)

Table 6. Cause of death according manner of death.

Cause of death	Manner of death		Total
	Suicide	Accident	
Multiple injury	7(19.44%)	35(49.29%)	42
Head injury	1(2.77%)	34(47.88%)	35
Decapitation	21(58.33%)	0(00%)	21
Transection	7(19.44%)	2(2.81%)	9
Total	36	71	107

are confined to various indoor activities principally and further precaution taken by members of the family to keep them safe.

The information furnished by police in the inquest report on the basis of history from eye witnesses, relatives and spot examination. Our study revealed that accidental railway fatality was the commonest manner (66.4%) followed by (33.6%) suicidal deaths which are similar to Rohit Kumar 2016 (67.4% accidental & 27.7% suicidal),¹⁵ Wasnik RN (91% accidental & 8.68% suicidal deaths),¹² Kumar A (88% accidental & 10% suicidal)¹⁶ and Tyagi S et al. (90% accidental & 2% suicidal).¹⁸

Decapitation (Figure 4) was the commonest (about 58.3%) followed by transection from the chest & trunk (Figure 5) observed in 19.4% cases in suicidal cases. Crush amputation of extremities (upper and lower limbs) were seen in 46.7% cases which is also shown in study of Panigrahi H et al.²⁰ Multiple fractures were seen commonly in most cases with fracture ribs seen as a common occurrence due to the effect of shearing and grinding force from rotating train wheels.

The study revealed that head was injured in most cases followed by upper limbs, chest, neck, lower limbs & trunk. Victims had also suffered other injuries from primary and secondary impacts which is similar to the study of R Raut ji.¹³

In the present study Brain was the most commonly affected internal organ (69.2%) followed by liver (59.8%), spinal cord (55.1%), kidney (48.6%), Spleen (37.4%) and least heart (16.8%). Our results are quite similar to those of Wasnik RN.¹² Abdominal injuries were sustained following primary and secondary impact resulting in grave injuries to abdominal viscera and transection at the abdominal level. These results are similar to the studies of Wasnik RN¹² and Sheikh MI et al.⁴

In this study suicidal death occurs most commonly by lying over the track (86.11%) and in few cases by walking on the track in front of the train (11.11%), whereas the most common circumstance of accidental railway related deaths was during the crossing the track (56.33%) which is similar to the study of



Figure 4. Decapitated body present in between rails.



Figure 5. Transected body present half on the track and half on side.



Figure 6. Showing decapitation and amputation of both legs in same case.



Figure 7. Showing multiple abrasion present over both lower limbs.



Figure 8. Showing multiple abrasion and graze abrasion.

Panigrahi H et al.²⁰ In this study, in case of accidental death externally laceration and crushed injuries are most common and internally lungs, liver, spleen, kidneys and skull fractures are most common which is similar to the study of Dr. Syed Zubair Ahmed Tirmizi et al. study.¹⁹ In this study in case of suicidal death externally decapitation, amputation of limbs and transection is most common and internally stomach, bowel and spinal cord injuries are most common which is similar to the study of Panigrahi H et al.²⁰ (Figure 6).

Abrasion, contusion, fractures of long bone and brain injuries are found almost same in both type of cases. These results are closely similar to Dr. Syed Zubair Ahmed Tirmizi et al. study¹⁹ (Figure 7 & 8). Most common cause of death in our study was multiple injuries (39.3%) which involved multiple fractures, traumatic amputations of limbs and crush injuries. Our results are in accordance with studies of Sheikh MI et al.⁴ Wasnik RN¹² and Das G et al.¹⁴ Our results are dissimilar to study of Tyagi S et al.¹⁸ who reported head injury to be the commonest cause of death followed by shock and hemorrhage.

Miscellaneous factors which also contributed in accidental railway track death such as consuming alcohol while sitting on track, taking photographs (selfie) in front of an oncoming train, and living near track in slum area also proved to be fatal due to regular movements near the railway tracks.

Conclusion:

The proper certification of death in general and of railway deaths in particular, is dependent not only on the skill of the autopsy surgeon, but also on his knowledge and grasp of the connected medico-legal issues. The following observations should be considered while determining the medico-legal cause of death.

1. Postmortem findings.
2. Immediate circumstances leading to death.
3. Explicit or implicit mental intent of the victim and
4. Psychological profile and pattern of the victim or causality.

The victim's implicit mental intent, as well as his psychological profile and pattern, may be essential in comprehending the cause of the fatality and its legal values. Autopsy findings and real accident reconstruction are the most important predictors of medico-legal cause of death. The presence of severe injuries, such as crush injuries to the head, traumatic decapitations, trunk crush injuries, and limb amputations, may indicate that the cause of death was traumatic. The pattern of injuries and situations reveals the traumatic character of dying.

The purpose of the railway deaths investigation is to ascertain the cause of death; it is not a court for determining legal liability.

As a result, the entire technique of the investigation differs from the type of investigation that may be undertaken in other sorts of incidents. In most circumstances, when a dead corpse is discovered along a railway track, the public might assume it was an accidental or suicidal death. The same is true when a dead person is discovered in a railway compartment, which can be assumed to be a natural death. In all of these cases, the investigating officer is more concerned with getting the dead body to the nearest mortuary and completing the formalities than with conducting a thorough inspection of the crime scene.

Typically, the study of the crime scene is limited to capturing one or two images, which is insufficient. This is how many crucial clues are lost in the first stage. The same is true when a medical officer gets a railway fatality for autopsy. The autopsy is performed with a preconceived notion of suicide or accident in mind, taking into account the pattern of injuries across the body. Suicidal deaths are defined as decapitation or traumatic amputations, whereas multiple trauma fatalities are defined as accidental.

When compared to other cases, the Medical Officer spends less attention without looking into history because the majority of these cases are reported as unknown bodies. As a result, partial autopsies and inappropriate analysis of injury patterns became a prevalent source of error in medico-legal evaluation. The damage should be inspected in further detail to determine whether it is ante mortem or post mortem from bleeding infiltration into tissues or essential organs.

In questionable circumstances, a thorough histo-pathological study is performed to resolve the issue. The determination and evaluation of casualties in railway fatalities may be complex, but careful investigation of the medico-legal casualty frequently proves to be of medico-legal relevance to many individuals and societal groups.

Compliance with ethical guidelines: This study was approved by Institutional Ethics Committee of Gandhi Medical College, Bhopal (MP) affiliated to Madhya Pradesh Medical Science University, Jabalpur (MP), India.

Registration No. (code) ECR/1055/Inst/MP/2018

Sponsorship (Yes/No): No

Conflict of Interest: - None

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