RESEARCH ARTICLE

A RETROSPECTIVE STUDY OF RAILWAY FATALITIES BROUGHT FOR AUTOPSY AT JORHAT MEDICAL COLLEGE AND HOSPITAL, JORHAT, ASSAM

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Manuscript Info	*Abstract*
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	Background: Understanding the patterns of injuries sustained during railway accidents is crucial for developing effective preventive measures and improving safety protocols. A retrospective analysis was performed on a comprehensive database of medico-legal autopsy reports from railway accident cases brought for medico-legal autopsy spanning a period of three years. **Materials & Methods**: The study included victims of all age groups and demographics to ensure the diversity of injury patterns is adequately represented. Blunt trauma, lacerations, fractures, and organ damage were common. **Results**: In this study, railway incidents accounted for 2.2% of total deaths, with 78.3% of victims identified and 21.7% unidentified. Most victims were male (82.6%), aged 41-50, and incidents occurred mainly in summer, during August, and between 12 am and 8 am. Grease stains were found in 76.1% of cases, and most injuries included crush injuries (76.1%) followed by fractures and lacerations. The bodies of 60.9% victims were found in intact condition were as in 28.3% of the cases complete separation of the body parts were seen. Instantaneous death occurred in 50% of cases, while hemorrhage and shock was the second most common cause of death.

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Introduction:-

Indian Railways, an iconic symbol of the country's progress, is the lifeline that unites India's diverse landscape and cultures. Spanning vast distances, it weaves through bustling metropolises, scenic landscapes, and remote villages, playing an integral role in shaping the nation's socio-economic fabric. In recent times, various studies have been conducted to understand the patterns and causes of railway accidents in India. These studies delve into factors such as human errors, technical malfunctions, track maintenance, and signaling issues that contribute to accidents. In 2021, the Indian Railways, the world's fourth-largest railway network, witnessed a substantial surge in accidents, marking a notable increase of approximately 38.2% compared to the previous year. The state of Maharashtra reported the highest number of such incidents, accounting for 19.4% of the total 17,993 reported accidents, as per data from the National Crime Records Bureau (NCRB). These incidents occurred despite ongoing efforts to implement comprehensive safety measures across the railway network aimed at reducing accidents stemming from negligence, trespassing on tracks, incidents involving passengers falling from moving trains, and other related factors.

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According to the NCRB's 69th edition of data[14], these 17,993 railway accidents resulted in injuries to 1,852 individuals and tragically claimed the lives of 16,431 people in 2021. To provide context, in 2019, there were a total of 24,619 reported railway accidents, including 1,762 accidents related to railway crossings, as highlighted in the NCRB's dataset. By analyzing the data from past incidents, experts aim to identify potential risk areas and develop strategies to mitigate them effectively. This study aims to shed light on the significant efforts made in understanding accidents in the Indian Railways. By investigating the various studies conducted, we can gain insights into the challenges faced and the measures taken to ensure safer and more reliable rail transportation in India. As the nation strives to modernize its railways and improve connectivity, a thorough analysis of accidents and studies done on them is crucial in creating a safer and more efficient railway network for the future.

Aims and Objectives:-
1. Find out the magnitude of the problem with respect to different host factors like time, weather, season etc. of the road traffic accidents.
2. To analyze the types and severity of injuries sustained by individuals involved in railway accidents and make a comparative study.
3. To analyze the different modes of death in victims of railway incidents and the postmortem interval by which the victims are brought for autopsy.
4. To provide valuable insights for the development of targeted safety measures and improved emergency response protocols in railway accident scenarios.

Materials and Methods:-
1. **Data Collection**: Comprehensive retrieval of medico-legal autopsy reports from railway accident cases over a specific period of 3 years from 1st January 2020 to 31st December 2022, ensuring a diverse representation of victims of different demographics and injury patterns.
2. **Data Analysis**: Thorough examination of the collected data to categorize and quantify the types and severity of injuries sustained by victims.
3. **Statistical Analysis**: Utilization of appropriate statistical tools to identify significant trends, correlations, and factors contributing to specific injury patterns in railway accidents, enabling the formulation of evidence-based conclusions.
4. **Study setting**: Department of Forensic Medicine, Jorhat Medical College and Hospital, Jorhat
5. **Study period**: Three years (1st January 2020 to 31st December 2022)
6. **Inclusion criteria**: All autopsies where death occurred unnaturally due to railway incidents, both known and unknown victims were included for the study.
7. **Exclusion criteria**: Autopsies of victims where death occurred due to natural causes in or near the railway station were excluded from the study.

Results:-
Incidence
A total of 2023 numbers of medico-legal autopsies were performed in the Department of Forensic Medicine, Jorhat Medical College, Jorhat during the study period from 1st January, 2020 to 31th December 2022. Out of these 46 numbers of cases were deaths due to railway tract incidents.

Table 1:- Number of autopsies performed at JMCH mortuary and the percentage of death due to Railway Tract Incidents.

YEAR	INCIDENCE
2020	2%
2021	2.05%
2022	2.75%

Identity of the victims
The identities of the victims of railway tract incidents are given below:
Table 2:- Showing the Identities of the victims.

Known	36	78.3%
Unidentified	10	21.7%
Total	46	100%

It is seen from the above table that the known victims comprised of 36 cases (78.3%) and unknown comprised of 10 cases (21.7%).

Age distribution

In the present study, the age of the victims were divided according to their age into 7 groups. The age wise distribution of cases is shown in the table.

Table 3:- Age distribution of cases.

Age Group (Years)	No. of Cases	Percentage
0-10	0	0
11-20	2	4.3
21-30	8	17.5
31-40	8	17.5
41-50	10	21.7
51-60	9	19.5
>60	9	19.5
Total	46	100

The peak incidence is seen in the age group of 41-50 years with 10 cases (21.7%) followed by age group 51-60 years and above 60 years with 9 cases (19.5%).

Sex distribution of the cases

The following table shows the sex distribution of the victims.

Table 3:- Sex distribution of the victims in the study.

Sex	No. of Cases	Percentage
Male	38	82.6
Female	8	17.4
Total	46	100

It is observed from above table that among the 46 cases with railway injuries 38 cases were male comprising 82.6% and 8 were female comprising 17.4% of the total cases.

Seasonal variations

The seasonal variations of the occurrence of cases are given below.

Table 4:- Showing the seasonal variations.

Season	No. of Victims	Percentage
Summer(June, July, August)	20	43.5
Autumn(Sep, Oct, Nov)	8	17.4
Winter(Dec, Jan, Feb)	8	17.4
Spring(March, April, May)	10	21.7
Total	46	100

Most of the cases were reported in the summer comprising of 20 cases (43.5%) followed by spring season with 10 cases (21.7%).

Monthly variation

Month wise distribution of various cases:

Table 5:- Monthly variation of incidents.

Month	No. of Cases	Percentage
January	1	2.2
February	6	13
March	4	8.7
April	1	2.2
May	5	10.9
June	5	10.9
July	5	10.9
August	10	21.7

September	2	4.3
October	4	8.7
November	2	4.3
December	1	2.2

Highest numbers of railway tract deaths occurred in the month of August, a total of 10 cases (21.7%) and lowest number of cases in the month of December and January with 1 case (2.2%).

Diurnal variation
Variations of time of occurrence of incidents are given below.
Table 6:- Showing the diurnal variation of the cases.

Part of The Day	No. of Cases	Percentage
12 midnight to 8 AM	22	47.8
8 AM to 4 noon	16	34.8
4 noon to 12 midnight	8	17.4
Total	46	100

The highest number of incidents in the present study occurred in between 12 AM to 8AM comprising of 22 cases (47.8%) followed by 8 AM to 4 PM comprising of 16 cases (34.8%).

Condition of the body and degree of separation
Table 7:- The condition of the body and the degree of separation.

Condition of The Body	Number	Percentage
Intact Body	28	60.9
Complete Seperation	13	28.3
Partial Seperation	5	10.8
Total	46	100

Separation of body parts were seen in 18 cases out of which 13 case were completely separated while the rest 28 cases were intact bodies.

Decapitation involved in separation
A total of 18 cases showed separation of the body parts out of which 4 cases showed separation of the head from the body:
Table:- Body region involved in separation:

Decapitation	Number	Percentage
Present	4	8.7
Absent	42	91.3
Total	46	100

Patterns of injury
The study of pattern of external injuries sustained by the victims is as follows,
Table 8:- The pattern of injury in the victims of railway tract incidents.

Injuries Sustained	Number	Percentage
Abrasion	16	34.8
Contusion	3	6.5
Laceration	26	56.5
Abrasion + Laceration	22	47.8
Fracture	32	69.6
Fracture + Abrasion	25	54.3
Fracture + Laceration	26	56.5
Fracture+Abrasion+Laceration	30	65.2
Crush injury	35	76.1
Injury to organs	23	50

(The figures in the above table exceeds total number of cases due to presence of more than one injury pattern in the same victim)

It is found that crush injuries topped the list followed by fracture. Crush injury over head was noted in 15 cases while 10 cases involved over abdomen, 9 cases over lower limbs, 11 cases over thorax.

Mode of death

The various mode of death among the victims of railway tract incidents are given in the table below:

Table 9:- The cause of death in railway tract injury cases.

Mode of death	Number
Coma	7
Haemorrhagic Shock	12
Haemorrhagic Shock & Coma	4
Instantaneous	23
Total	46

In the present study, most of the cases died instantaneously with 23 cases.

Time since death

The approximate times since death of the cases under study are as follows.

Table 10:- The approximate time since death of the victims.

Time range	Number
2 to 6 hours	4
6 to 12 hours	11
12 to 24 hours	26
24 to 36 hours	4
36 to 48 hours	1
>48 hours	0

Most of the cases were examined within 12 to 24 hours of time since death followed by 6 to12 hours.

Discussion:-

Railway accidents have been a longstanding concern, impacting both urban and rural areas worldwide. This study, conducted at the Department of Forensic Medicine, Jorhat Medical College and Hospital, delved into the epidemiology and characteristics of railway accidents in Jorhat District, Assam, over a three-year period from 2020 to 2022. The findings shed light on various aspects of these incidents, providing valuable insights for prevention and safety measures. One of the striking findings of the study was that railway incidents accounted for only 2.2% of the total deaths in the region during the study period. While railway accidents often evoke significant public concern, this relatively low contribution to overall mortality emphasizes the importance of considering various other factors affecting public safety. Similar incidence was found in study conducted by Das G. et al[10], Raghavendra Vijaya D. et al[13] and Thakuria D. et al[6]. The study revealed interesting demographic profiles of railway accident victims. Out of 46 cases with railway tract injuries the identities of 36 cases (78.3%) were known which is similar to a study conducted by Rao D. et al[2]. The identity of 10 cases (21.7%) could not be ascertained at the time of autopsy as those cases were reported as unidentified cases. Male victims significantly outnumbered females, comprising 82.6% of the total cases which is similar to study conducted by Manigandaraj G. et al[9], Kumar Suresh V. et al[1] and Chatterjee A et al[3]. Additionally, a noteworthy pattern emerged regarding age distribution, with the highest number of deaths occurring among individuals aged 41-50 years. Similar incidence in the age group of 41-50 years was found in study conducted by Kumar Suresh V. et al[1], Moses Kumar Mohit T. et al[8]. Understanding these demographic trends is crucial for tailoring preventive measures and educational campaigns. Highest numbers of railway tract incidents were observed in the summer season with 29 cases (43.5%) which is similar to the findings of Chatterjee A et al[3]. In the summer season, highest number of cases were recorded in the month of August with 10 cases (21.7 %). Similar incidence of railway incidents in the month of August was found in a study conducted by Kumar Suresh V. et al[1]. Highest number of incidents of the present study occurred in between 12 midnight to 8 AM with 22 cases (47.8%) which is contrary to most studies and may be due to the timings of the trains crossing this region of Assam. This temporal pattern might reflect the rush and commuting associated with early morning hours, highlighting the need for enhanced safety awareness during these times. Separation of body parts were seen in 18 (39.1%) cases out of which 13 cases (28.3%) were completely separated, 5 cases (10.8%) were partially separated while the rest 28 cases (60.9%) were intact bodies which is similar to the findings of Mohanty MK et al[12]. A total of 18 (39.1%) cases showed separation of the body parts out of which 4 (8.7%) cases showed separation of the head from the body which is similar to the findings of Valsala K et al[4]. In the present study, the patterns of injury mainly in the external body

showed that crush injury topped the list with 35 cases (76.1%) followed by fracture with 32 cases (69.6%). Laceration constituted 26 cases (56.5%), contusion in 3 cases (6.5%), abrasion and laceration in 22 cases (47.8%), abrasion in 16 cases (34.8%), fracture with abrasion in 25 cases (54.3%), fracture with laceration in 22 cases (47.8%), fracture with abrasion and laceration in 30 cases (65.2%) and lastly injury to body organs in 23 cases (50%). The incidence in crush injury is similar to a study conducted by Kumar Suresh V. et al.[1] and Singha MK[5]. This information is invaluable for emergency response preparedness and can guide healthcare providers in delivering appropriate care to victims. Instantaneous death was observed in half of the cases, while hemorrhage and shock ranked as the second most common causes which are similar to the findings of Mazumder A & Patowari AJ[11] .These findings highlight the lethal nature of railway accidents and emphasize the importance of prompt medical attention and trauma care.

Conclusion:-
In this study conducted at Jorhat Medical College and Hospital's Department of Forensic Medicine, a comprehensive analysis of railway incidents over three years revealed several noteworthy findings. Railway accidents contributed to a relatively low 2.2% of total deaths, with a majority of victims being males in the 41-50 age group. The summer season, particularly August, and the early morning hours from 12 am to 8 am witnessed the highest incidence of railway incidents. Crush injuries were the most prevalent, affecting 76.1% of victims, followed by fractures and lacerations. Instantaneous death occurred in half of the cases, while hemorrhage and shock were the second leading causes of death. These findings underscore the need for targeted safety measures, especially during high-risk times and seasons, to mitigate the impact of railway accidents in the region.

Conflict of Interest:
Nil.

Source of Funding:
Self.

Ethical clearance:
Since the study was conducted on dead bodies brought for medico-legal autopsy which did not involve any clinical interventions, due permission from competent authorities was taken.

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