

Prediction of Survival using TRISS in Train Accident Victims in Tertiary Care Hospital Delhi

Mahesh Kumar*, Mansi Kumar**, Anil Kohli***, A.K. Tyagi***, Adarsh Kumar****, Sudhir Kumar Gupta*****

Authors Affiliation: *Assistant Professor, Department of Forensic Medicine and Toxicology, **Assistant Professor, Department of Obstetrics & Gynaecology, Rama Medical College Hapur (Ghaziabad) UP. ***Professor, Department of Forensic Medicine and Toxicology, University College of Medical Sciences, Delhi. ****Professor *****Professor & Head, Department of Forensic Medicine and Toxicology, All India Institute of Medical Sciences, New Delhi.

Reprints Requests: Mahesh Kumar, Assistant Professor, Department of Forensic Medicine and Toxicology, Rama Medical College, Hapur (Ghaziabad), Uttar Pradesh 245304.

E-mail: mahesh25881@gmail.com

Received on 05.12.2016, Accepted on 15.12.2016

Abstract

Evaluation of trauma and prediction of outcome in 255 train accident victims in Delhi was studied out of which 40 cases survived and taken up for this study. Trauma and Injury Severity Score (TRISS) was calculated and its correlation with period of survival was determined. Males and females were 86.7% and 13.3% respectively. Mean age was 37.5 years. Most common age group involved was 21-30 followed by 31-40 years. The region of the body most commonly involved in survivors was the lower limbs followed by upper limbs, head and chest while in the victims who died was head followed by chest and abdominal injury. Thirty percent of the survivors belonged to TRISS group 50-80 followed by 70% survivors to TRISS >80 group. There was a positive correlation between TRISS and probability of survival.

Keywords: Trauma and Injury Severity Score (TRISS); Abdominal injury; Limbs.

Introduction

Railways were first introduced in India in 1853. By 1947, the year of India's independence, there were forty-two rail systems. In 1951 the systems were nationalized as one unit, the Indian railways, becoming one of the largest networks in the world. The Indian railways have 115,000 kilometers of total track over a route of 65,808 kilometers and 7,112 stations. It has the fourth longest railway network after those of the United States, Russia and China. In India in 2014, 2,547 Railroad (Railway crossing) accidents were reported in which 2,575 deaths occurred, comprising 2,186 males, 388 females and 1 transgender. During this period other Railway accidents reported were 28,360 in number in which 25,006 deaths occurred, comprising 21,407 males, 3,587 females and 12 transgender. In Delhi in 2014, 11 Railroad (Railway crossing) accidents were

reported in which 11 deaths occurred, comprising 9 males and 2 females. During this period other Railway accidents reported were 914 in number in which 856 deaths occurred, comprising 764 males and 92 females. (There were no transgender deaths in Delhi) [1,2].

Rail road accidents are those train accidents which occur on unmanned/manned crossings when people try to cross the railway track, and all the other types of train accidents are categorized in the other Railway accidents i.e. passengers falling off the roof of moving trains, falling while entering or alighting from moving trains or falling off the platform or crossing the railway track at places other than railway crossing and being struck or run over by trains.

Trauma related to railway accident victims is usually severe, instantly fatal and extremely mutilating. Certain features such as wheel marks on

the body, dirt and grease contamination and the manner of severance of tissues deserve special observation to rule out criminal violence [1].

Various scores are available for measuring severity of injuries in trauma victims like, Abbreviated Injury Scale (AIS), Injury Severity Score (ISS), New Injury Severity Score (NISS), Trauma and Injury Severity Score (TRISS) and Revised Trauma Score (RTS).

The TRISS is a composite of the ISS, Revised Trauma Score (RTS), and age. It has great predictive value but its widespread applicability is limited because it is difficult for many trauma facilities to compute because it requires 8 to 10 variables [3].

Material and Methods

1. Material for the present study was collected from the cases of train accidents brought to the Mortuary of Department of Forensic Medicine for Medico-legal autopsy and Casualty of a Tertiary care hospital, Delhi.
2. Cases of train accidents brought during the period November 2010 to February 2012 were taken up for the study. A total of 255 cases were studied irrespective of age and sex of victims, of which 40 cases were discharged from the hospital after appropriate treatment and rest died due to fatal train accident injuries.
3. The severity of the injuries has been established using the NISS. NISS of each injured body region have been calculated using the Association for Advancement of Automotive Medicine, latest protocol 2005 [2].
4. NISS along with Glasgow Coma Scale (GCS), Systolic Blood Pressure (SBP) and Respiratory Rate (RR) have been used to calculate Trauma and Injury Severity Score (TRISS) in victims surviving the railway accidents by using TRISS calculator which determines the probability of survival from the ISS, RTS and patient's age. ISS and RTS scores can be inputted independently

or calculated from their base parameters.

5. Dead bodies showing severe degree of decomposition particularly of the internal organs have been excluded from this study to avoid false interpretation of findings.
6. Detailed information regarding manner of incidence and the category of victims was obtained from inquest papers, police, and relatives of the deceased. Victims were categorized as pedestrians, vehicular occupants, train occupants, falling from the door of moving trains and falling from the roof of the moving trains.
7. Consent for the participation in the study has been taken from victims/ relatives of deceased.
8. The Patients/ next of kin were informed about this study, methodology to be used and why this study was necessary in this region.

In patients surviving the train accidents, information was also obtained from the hospital case records of the admitted patients.

Results

Cases of train accidents brought during the period November 2010 to February 2012 were taken up for the study. A total of 255 cases were studied irrespective of age and sex of victims, of which 40 cases survived and discharged from the hospital after appropriate treatment and rest died due to fatal train accident injuries. Of the total 40 survivors involved in train accidents, the results are as follows-

Age Incidence

In the victims, most common age group involved was between 21-30 years of age comprising 49% of cases followed by 31-40 years age group comprising 31% of cases. Victims of >60 years age comprised only 2% cases and there was no victim below 10 years of age (Table 1, 2).

Table 1: Age distribution of Survivors

Age groups in year	Males	Females	Total	Percentage
0-10	00	00	00	0.0
11-20	04	01	05	12.5
21-30	18	01	19	47.5
31-40	08	01	09	22.5
41-50	01	02	03	7.5
51-60	01	01	02	5.0
>60	01	01	02	5.0
TOTAL	33	07	40	100

Table 2: Sex distribution in Survivors

Age group in years	Males	Percentage	Females	Percentage
0-10	0	0	0	0
11-20	4	12.12	1	14.29
21-30	18	55.55	1	14.29
31-40	8	24.24	1	14.29
41-50	1	3.03	2	28.57
51-60	1	3.03	1	14.29
>60	1	3.03	1	14.29
TOTAL	33	100	7	100

Duration of Hospital Stay

In 40 total survivors, the duration of stay in hospital was less than 24 hours in 7 cases and up to 3 days in 5 cases. Sixteen victims were in 72-168

hours group (3-7 days), and 12 victims were in >168 hours group (>7 days). Only one victim was in 0-6 hour's group (Table 3).

Table 3: Distribution of Survivors in relation to duration of stay in the hospital

Duration of hospital stay (in hours)	Survivors	%
0-6	01	02.5
6-12	03	07.5
12-24	03	07.5
24-72	05	12.5
72-168	16	40.0
>168	12	30.0
Total	40	100

Regions of Body Involved in Victims Surviving Train Accidents

Lower limbs were involved in 62.5% of victims,

followed by involvement of upper limbs (55%). Head involvement was only in 5 victims (12.5%) and chest injuries were found in 9 victims (25%)(Table 4).

Table 4: Distribution of victims in relation to body regions involved

Body region involved	Survivors	%
Head	05	12.5
Chest	09	22.5
Upper limb	22	55
Lower limb	25	62.50

*Total exceeds 100% because more than one body region involved per victim.

New Injury Severity Score (NISS) in the Survivors

Maximum survivors (34) were found having NISS less than 25 while NISS 25-50 was seen in 05 victims

and only one case was found in the NISS group 50-75 (Table 5).

Table 5: Distribution of victims in relation to NISS

NISS Groups	Survivors	Percentage
0-25	34	85.5
25-50	05	12.5
50-75	01	02.5

Probability of Survival

Twenty eight survivors out of 40, were found to have a probability of survival >80 TRISS group (most cases were between 85-95%). 12 survivors were in between

50-80 TRISS group (most cases were between 70-80%) while no survivor was found in TRISS 0-50 group out of 50 victims. Probability of survival was measured in terms of TRISS value which is proved to be more accurate for penetrating then blunt injuries (Table 6).

Table 6: Distribution of victims in relation to TRISS

Triss	Survivors	%
0-50	0	00
50-80	12	30
>80	28	70

Table 6: Distribution of victims in relation to TRISS

Triss	Survivors	%
0-50	0	00
50-80	12	30
>80	28	70

Results showed a positive correlation between TRISS value and Ps (period of survival) with an *r*-value of -0.226 ($p < 0.001$) and Coefficient of a determination $r^2 = 0.051$. This means that as TRISS value increases period of survival increases.

Discussion

Age and Sex

Of the 40 victims who survived, the most common age group involved was between 21-30 years comprising 47.5% of cases followed by 31-40 years age group comprising 22.50% of cases. Victims aged more than 60 years age comprised only 5% cases.

There was no victim below 10 years of age. A large number of cases in this study belonged to age group of 21-40 years (70%). This can be attributed to the fact that this age group has a high level of participation in outdoor activities and therefore is most vulnerable to trauma.

Among these 40 victims, males comprised 33, i.e. 82.5% of total cases, while females were only 7 in number, i.e., 17.50% of the total cases (Table 1, 2). Males being more involved in outdoor activities prefer railways as the cheap, quick and comfortable mode of transport for travelling from one place to another and are therefore more vulnerable than females. In the study of Howells et al [4], males were also the commonest victims (Table 7).

Table 7: Comparison of sex of survivors in different studies

Studies	Male	Female
Present study	82%	18%
Spaite et al ⁵	90%	10%
Akkas ⁶	68%	32%

In the study done by Spaite et al [5] among the 31 survivors out of total 41 victims 90% were men and the age ranging from 1 to 67 years (mean age = 31.2 years). The results of this study in relation to age and sex of the survived victims are in agreement with the results of the present study (Table 7, 8).

In the study done by Akkas et al [6] among the 37 survivors out of total 44 victims of train accidents 68 % were males and 32 % females. The mean age was 31.8 years. The results of this study in relation to age and sex of the survived victims are in agreement with the results of the present study (Table 8).

Table 8: Comparison of mean age in the victims between different studies

Studies	Mean age
Present study	37.5
Spaite et al ⁵	31.2
Akkas ⁶	31.8
Shapiro et al ⁷	30.6
Davis et al ⁸	39
Agalar et al ⁹	32
Bhatti and Razak ¹⁰	35.6

Similar findings were found in study of Prabhakar and Sharma [11]. Although the author has only considered the victims of train crashes whereas the present study took cases like pedestrians, persons falling from trains, where no train crashes were involved.

The present study differs from the study done by

Rautji and Dogra [12]. The reason is, the study was done with smaller sample size including only South Delhi region, where very less numbers of train accidents were reported. Higher numbers of hospital deaths may be because the victims of train accidents hospitalized in South Delhi hospitals where most of the cases were referred cases from other hospitals.

Table 9: Comparison between different studies in relation to survival period

Survival period	Prabhakar and Sharma ¹¹	Present study	Rautji and Dogra ¹²
Spot death	46 (30.86%)	40 (40%)	28 (22.01%)
0-6 hours	--	50 (50%)	71 (55.91%)
6-12 hours	--	06 (6%)	
12-24 hours	--	06 (6%)	
1-7 days	--	24 (24%)	
7-14 days	67 (44.97%)	14 (14%)	
14-60 days	29 (19.46%)	--	
>60 days	6 (4.03)	--	

Pattern of Injuries

In the victims who survived train accidents, lower limbs injuries were seen in a large number of cases (62.5%) followed by upper limbs injuries (55%). Head involvement was seen only in 5 victims (12.5%) and chest injuries were found in 9 victims (25%). The reason for higher involvement of the lower extremity may be due to the victim falling between the train and the elevated platform while boarding or deboarding the train.

All the victims showed associated external injuries. Most common external injuries were lacerations and abrasions.

In the study done by Akkas et al [6] among the 37 survivors out of total 44 victims of train accidents the most common region of the body involved was the lower extremity. 19 limb amputations were performed in 14 patients. This finding was in agreement with the present study.

New Injury Severity Score

Fourty victims (70%) were found in 0-25 NISS

group, 18 victims (30%) belonged to 25-50 NISS group and 42 victims in the 50 – 75 NISS group. The reason is this group (50 -75) constitutes the serious and non survivable injuries.

The findings were also found Similar in study by Howells NR [4]. In their study, maximum victims (90.16%) were under <16 NISS group and 9.86% victims were in >16 NISS group.

Similar findings were found in study of Spaite et al⁵. In their study, maximum victims (75%) were under Injury Severity Score 15 and rest 25 % were above Injury Severity Score 15.

Duration of Hospital stay in Survivors

In 82.5% of survivors, the duration of stay in hospital was more than 24 hours (1 day). 16 victims were in 72-168 hours group (3-7 days), comprising 40% and 12 victims were in >168 hours group (>7 days), comprising of 30% of total victims. Only one victim was in 0-6 hour's group.

Table 10: Duration of hospital stay in survivors

Duration of hospital stay (in hours)	Number of victims	Percentage
0-6	1	2.5
6-12	3	7.5
12-24	3	7.5
24-72	5	12.5
72-168	16	40
>168	12	30
Total	40	100

Table 11: Comparison of TRISS in Different Studies

Studies	TRISS groups		
	<80	>80	>95
Present study	30%	70%	--
Howells NR ⁴	--	100	--

Trauma and Injury Severity Score (TRISS) for the Survivors

The probability of survival was found up to 80% in 12 victims (30% of cases) and more than 80% in 28 victims (70% of cases) (Table 11).

Similar findings were found in study of Howells NR et al [4]. In both the studies maximum victims were in >80 TRISS group.

The finding in the survivors indicate that greater

the TRISS value better the probability of survival. Hence, TRISS is a good prognostic indicator.

References

1. Kumar M, Kohli A, Tyagi AK. Injury Pattern and Injury Severity Scores in Railway Accidents in Delhi. *International Journal of Medical Toxicology & Legal Medicine*. 2015; 18(1):42-7.
2. National criminal record bureau. [Homepage on internet]. Railway crossing accidents. [cited 2015 Aug 20]. Available from: <http://ncrb.nic.in/ADSI2014/table-1.9.pdf>.
3. Injury Severity Score [homepage on internet]. The document contains a thorough review of different injury severity scores employed in trauma care, their classification based on anatomic and physiologic scales [Cited 2015 Aug 20]. Available from: <https://www.meddium.com/content/Assets900000-949999/asset947024/filemetadata/958706.pdf>.
4. Howells NR, Dunne N, Reddy S. The causality profile from the Reading train crash, November 2004: proposals for improved major incident reporting and the application of trauma scoring systems. *Emerg Med J*. 2006; 23:530-3.
5. Spaite D, Criss E, Valenzuela T, Meislin HW, Ogden JR. Railroad accidents; A Metropolitan experience of death and injury. *Ann Emerg Med*. 1988; 17(6): 620-5.
6. Akka M, Ay D, Metin Aksu N, Günalp M. 10-year evaluation of train accidents. *Ulus Travma Acil Cerrahi Derg*. 2011; 17(5):440-4.
7. Shapiro MJ, Luchtefeld WB, Durham RM, Mazuski JE. Traumatic train injuries. *Am J Emerg Med*. 1994; 12(1):92-3.
8. Davis GG, Alexander CB, Brissie RM. A 15-Year review of Railway related deaths in Jefferson County Alabama. *Am J Forensic Med Pathol*. 1997; 18(4):363-8.
9. Agalar F, Cakmakci M, Kunt MM. Train-Pedestrian accidents. *Eur J Emerg Med*. 2000; 7(2):131-3.
10. Bhatti JA, Razzak JA. Railway associated injuries in Pakistan. *Int J Inj Contr Saf Promot*. 2010; 17(1):41-4.
11. Prabhakar T and Sharma Y. Ghaisal train accident. *Indian J. Anaesth*. 2002; 46(5):409-413.
12. Rautji R, Dogra TD. Rail traffic accidents: A retrospective study. *Med Sci Law*. 2004; 44(1):67-70.
13. Mohanty MK, Panigrahi MK, Mohanty S, Patnaik KK. Death due to traumatic railway injury. *Med Sci Law*. 2007; 47(2):156-60.