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Epidemiological, demographic and clinical profile of traumatic brain injury patients. A prospective analysis at a level one trauma centre in northern part of India

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Keywords
epidemiology, head injury, road traffic accident, demography, pre-hospital

ABSTRACT

Context: Traumatic brain injury is a major public health problem worldwide with increasing incidence and severity in developing countries**.** In India, it becomes a huge burden on society with a lack of proper preventive measures, public awareness, traffic sense and pre-hospital care. Therefore, we studied the epidemiological profile and factors predicting outcome.

Aims: To study the epidemiological, demographic profile of TBI patients to help to improve the healthcare facilities.

Setting and design: It is an observational prospective study.

Methods and materials: Overall 2134 patients with TBI were enrolled. The data was collected according to the predesigned proforma. The demographic, epidemiological, clinical variables were analysed to determine the current trends and outcomes.

Result: The male: female ratio was 2.21:1 with most cases from the age group of 21-30 years (29.42%). RTA was the mode of injury in 64.48% of cases. Overall mortality was 10.91%. Overall descriptive data was suggestive of poor outcome in old patients, referred cases, acute SDH and brainstem lesions, hypoxic and hypotensive patients, associated injuries, pre-existing disease and with higher Rotterdam and ISS scores.

Conclusion: The outcome is dependent on factors like geographical, demographic, pre-hospital, and patient-related. With knowledge about the causes, patterns, and distribution the prognosis of TBI patients can be improved.

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INTRODUCTION

Traumatic head injury is one of the common causes of mortality and morbidity in the world. It has been estimated that, annually around 60-70 million people are affected globally. In India around 1.4-2 million

persons are affected and 1 million loose their life every year . A study at a tertiary care institute has reported that the occurrence of TBI is approximately 42.5% in rural and 57.5% in urban area .1 The incidence of head injury is increasing mostly due to excessive use of motor vehicles in low and middle income countries (LMIC) .2-3 It affects patients of all age groups with young aged persons between 20-40 yr being the majority . Males are more commonly affected than females . The most common cause is RTA (around 60%) followed by falls (20-30%), assault (10%) and sports injury(10%) .4 India is leading the world in deaths due to road accidents . Neurological status at the time of presentation is the most important prognostic factor with others being the age , CT finding , associated injury , vital parameters , mode of injury , and others . The outcome is dependent on severity of primary injury and is a reflection of secondary insult like hypoxia , hypotension , raised ICP , cerebral ischemia. So early recognition and prevention of secondary insult results improvement in neurological status . With detailed knowledge of the clinical and demographic profile of TBI , we can provide the appropriate management and thus get the desired favourable outcome.

The aim of this study is to determine epidemiology and demography of TBI , clinical status, severity of head injury , associated comorbid conditions and the final outcome . To our knowledge, this is one of the largest data registry in the world and certainly the largest in India.

Materials and Methods

This study was done at SMS medical college and hospital , Jaipur which is a tertiary care level 1 trauma center in northwestern part of India . It was conducted between april 2017 to march 2019 . A total no of 2134 patients were inducted into the study based on the inclusion criteria :1) Clinical diagnosis of TBI , 2) Clinical indication for CT scan and 3) informed consent obtained according to local and national requirements . The ethical clearance was obtained from the institutes ethical committee.

This was a prospective observational study . The data was collected and patients were followed upto final outcome . Data obtained was entered into a proforma . Data that was collected included demographic parameters , mode of injury ,GCS on admission and discharge ,associated findings , CT findings ,treatment given , duration of hospital and ICU stay and outcome including Glasgow outcome scale .Injury severity and Rotterdam score were calculated for every patient. Based on GCS ,TBI cases were graded as mild (13-15) , moderate (9-12) and severe (<8) and Glasgow Outcome Scale (GOS) was used to know the final outcome.

The data collected was analyzed and compiled with multiple variables showing current trends and demographic profile.

Results

A total no of 2134 patients were inducted into the study . Majority of the cases were from rural parts of jaipur . The no of cases from urban and rural areas were 45.82% and 54.17% respectively.

Age and Sex

The total no of male and female were 68.89% and 31.11% respectively . Most patients affected were in the age group of 21–30 years (29.42% cases) followed by 31–40 years (22.68% cases) (Table 1) . The mean age of patients who survived and died was 33.24 + 14.5 and 41.36 + 17.8 years respectively . The outcome was best in patients < 20 years of age and worst in patients >60 years age with 13.61 % of overall deaths.

Mode of injury

Figure 1. Distribution on basis of mode of injury

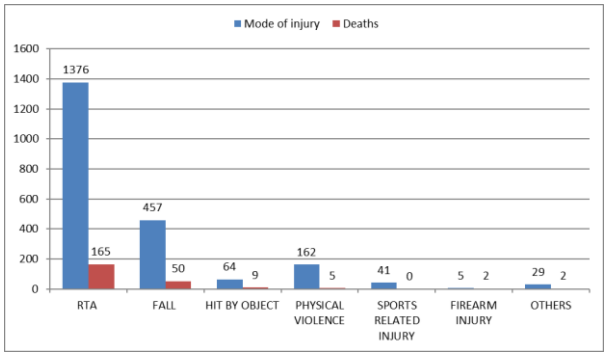

Table 1. Distribution of age adjusted mode of Injury and outcome

Age In yrs n (%)	Total cases n=2134	Mode of Injury RTA	Fall	Assault	Sports	others	Deaths n (%) Injury
0-10	191 (8.95)	41(21.47)	130(68.06)	nil	12(6.28)	8(4.19)	8(4.18)

11-20	233(10.91)	128(54.93)	54(23.17)	15(6.43)	24(10.30)	12(5.15) 12(5.15)
21-30	628(29.42)	511(81.36)	43(6.85)	29(4.61)	5(0.79)	40(6.36) 74(11.78)
31-40	484(22.68)	357(73.76)	69(14.26)	34(7.02)	nil	24(4.96) 56(11.57)
41-50	232(10.87)	144(62.06)	54(23.27)	26(11.20)	nil	8(3.44) 40(17.24)
51-60	153(7.16)	71(46.41)	35(22.87)	45(29.41)	nil	2(1.31) 14 (9.15)
>60	213(9.98)	124(58.21)	72(33.80)	13(6.10)	nil	4(1.88) 29(13.61)
Total	2134	1376(64.48)	457(21.41)	162(7.59)	41(1.92)	98(4.59) 233(10.91)

Severity of Injury

49.10% had mild, 31.02% had moderate and 19.86 % severe injury . Severe injury was more common with acute SDH, contusions , and brainstem lesions . 39.38% patients having severe injury died.

Clinical and radiological findings

CT finding;

The most common CT finding was multiple lesion with 60.82% cases followed by normal CT finding in 36.18% cases and acute SDH in 32.7% cases . Other findings were Skull bone fracture (34.3%), contusion (30.13%), acute EDH (24.5%), SAH (17.29%), ICH (11.57%), diffuse axonal injury (9.93) ,brainstem injury (8.76%), and chronic SDH (3.56%) cases (Table 2). Mortality with acute SDH was maximum in 20.99% cases.

Table 2. Description of Various CT findings with severity of injury and fatal outcome.

CT finding	Total no of cases	Severity of injury			Deaths
	no(%)n=2134	(GCS on admission) no(%)			no(%)
		mild	moderate	severe	
Normal CT	772 (36.18)	678(87.82)	86(11.13)	8(1.03)	13(1.68)
Acute EDH	523 (24.50)	381(72.84)	78(14.91)	64(12.23)	41(7.84)
Acute SDH	698 (32.70)	154(22.06)	299(42.83)	245(35.10)	176(25.21)
Contusion	643 (30.13)	218(33.90)	223(34.68)	202(31.41)	135(20.99)
ICH	247 (11.57)	116(46.96)	76(30.76)	55(22.26)	29(11.74)
SAH	369 (17.29)	265(71.81)	54(14.63)	50(13.55)	43(11.65)
Brainstem Lesion	187 (8.76)	32 (17.11)	94(50.26)	61(32.62)	19(10.16)
Skull bone fracture	732 (36.18)	465(63.52)	211(28.82)	56(7.65)	29(3.96)
Multiple lesion	1298(60.82)	708(54.54)	356(27.42)	234(18.03)	167(12.86)

Loss of consciousness was maximally associated with acute SDH , ICH , and brainstem lesions whereas normal CT and contusion mostly presented with history of headache. Hypotension and hypoxia was mostly associated with brainstem lesions with 34.75% and 40.55% incidence respectively. Pupillary reactivity was absent in patients with mass effect , uncal herniation and brainstem lesions. Seizure was seen in association with contusion in most (36.39%) cases. (Table 3)

Table 3. Association of CT finding with clinical spectrum

CT finding	LOC	SBP(mmHg)		SPO_2%	Pupil		Seizure	
	No	Yes	<90	>90	<90	>90	R	NR	No	Yes
										<5min	>5min
Acute EDH	220(42.06)	134(23.70)	169(32.31)	29(5.54)	494(94.45)	34(6.50)	489(93.49)	364(69.59)	159(30.40)	458(87.57)	65(12.42)
Acute SDH	145(20.77)	114(16.33)	439(62.89)	72(10.31)	626(89.68)	143(20.48)	555(79.51)	510(73.06)	188(26.93)	541(77.50)	157(22.49)
ICH	78(31.57)	69(27.94)	100(40.48)	34(13.76)	213(86.23)	57(23.07)	190(76.92)	169(68.42)	78(31.57)	202(81.78)	45(18.22)
Contusion	389(60.49)	90(13.99)	164(25.50)	62(9.64)	581(90.35)	65(10.10)	578(89.89)	501(77.91)	142(22.08)	409(63.60)	234(36.39)
SAH	102(27.64)	143(38.75)	124(33.60)	32(8.67)	337(91.32)	54(14.63)	315(85.36)	278(75.33)	91(24.66)	338(91.59)	31(8.40)
Brainstem Lesion	21(11.22)	34(18.18)	132(70.58)	65(34.75)	122(65.24)	76(40.55)	111(59.35)	62(33.15)	125(66.84)	175(93.58)	12(6.41)
Skull fracture	323(44.12)	132(18.03)	277(37.84)	12(1.63)	720(98.36)	76(10.38)	656(89.62)	701(95.76)	31(4.23)	709(96.85)	23(3.14)
Multiple lesion	780(60.09)	326(25.11)	192(14.79)	102(7.85)	1196(92.14)	231(17.79)	1067(82.20)	976(75.19)	322(24.80)	1154(88.90)	144(11.09)

R-Reactive,NR-Non Reactive

Clinical features

Loss of consciousness was most the most common presentation in 81.77% cases with vomiting and ENT bleed being the next two in 73.94% and 52.62% cases respectively. Spinal injury was present in 0.98%

cases. The overall seizure incidence was 32.28%. (Table 4)

Associated injuries

Associated injuries were found in 21.23% cases with facial injury being the most common in 61.58% followed by orthopedic injury 56.07 %. Among these 453 cases , 77(16.99%) expired . Out of the total 77 patients expired with associated injury most common were with orthopedic injury 41.55% followed by chest injury 25.97 %.

Complications

Chest infection was seen in 21.39 % patients especially in patients in ICU and on ventilator support . Post operative wound infection was seen in 3.56 % patients . About 7.87 % patients had CSF leak and of which 48.80 % developed meningitis and 8.33% patients died . Hydrocephalus was seen in 4.59% cases and CSF diversion was performed in 85.71% of these cases . Post traumatic epilepsy was diagnosed in 2.10% cases.

Table 4. Distribution of symptoms, frequency of Associated injuries and various complications

Clinical presentation Total no of cases no (%) n=2134	Associated injury Total cases (%) n=453	Complications Total no of cases no (%)n=2134
LOC 1745(81.77)	Orthopedic injury 254(56.07)	Chest Infection 456(21.39)
Vomiting 1578(73.94)	Chest injury 123(27.15)	Hemiparesis 297(13.91)
ENT bleed 1123(52.62)	Facial inury 279 (61.58)	Cognitive deficit 245(11.48)
Headache 726(34.30)	Abdominal injury 65(14.34)	Meningitis 82(3.84)
Seizure 689(32.28)	Spinal injury 21(4.63)	CSF leak 168(7.87)
Hypoxia 339(15.88)		Pressure ulcer 230(10.78)
Hypotension 249(11.66)		Hydrocephalus 98(4.59)
Spinal injury 21(.98)		Epilepsy 45(2.10)
Associated injury 453(21.23)		Wound infection* 23(3.56)
		Facial palsy 356(16.68)

LOC-loss of consciousness, *Percentage of Wound infection was calculated from no of operated patients (n=645).

Management and Outcome

Management

645 cases were operated out of which 16.74% patients died (Table 7) . Burr hole was done for 11.16% cases, craniotomy in 64.34% , Decompressive craniectomy for 20.47% and skull base repair in 4.03% cases .The outcome was poor in patients with decompressive craniectomy and craniotomy With evacuation of SDH (Table 5). Patients managed in ICU were 612(28.67%) with 54.72% operated patients and 42.32% conservatively managed patients . Deaths in ICU was seen in 209(89.70% of all deaths) of which 136(38.52%) were of operated patients.

Table 5. Description of operative intervention pone

Total no of cases% Associated Injury Management Conservative Deaths Operated Deaths
Normal CT 772(36.18) 213(27.59) 772(100) 13(1.68) nil nil
Depressed Fracture 279(13.07) 127(45.51) 96(34.40) 6(6.25) 210(75.26) 12(5.71)
Acute EDH 523(24.5) 148(28.29) 296(56.59) 13(4.39) 227(43.40) 28(12.33)
Acute SDH 698(32.7) 176(25.21) 274(39.25) 45(16.42) 424(60.74) 131(30.89)
ICH 247(11.57) 54(21.86) 165(66.80) 16(9.69) 82(49.69) 13(15.85)
Contusion 643(30.13) 45(6.99) 322(50.07) 57(17.70) 321(49.92) 78(24.29)
Multiple Lesion 1298(60.82) 348(26.81) 762(58.70) 124(16.27) 536(41.29) 43(8.02)

The numbers here are more than 645 because of multiplicity of the lesions in same patient.

Table 6. Overall outcome of all patients

Total no of cases % n=2134
Discharged Total= 1901 (89.08) GOS 5 1406 (65.89) 4 215 (10.07) 3 184 (8.62) 2 96 (4.49)
Deaths (GOS 1) Total= 233 (10.91) In ICU 209 (89.70)* In Ward 24 (10.30)*

*Percentage of deaths in ICU and ward are calculated with respect to total no of deaths n=233

The overall mortality was 10.91%. The mean ISS and Rotterdam were 11.3 and 2.1 respectively which were much higher for deceased patients. Patients with non reacting pupil, hypotension, hypoxia, history of alcohol/drug intoxication, pre-existing systemic disease and severe head injury performed poorer than others. (Table 7)

Table 7. Various parameters showing total survivals and deaths

Total Survived % Died % n=2134
Age year (mean) 31.65± 15.1 33.24 ± 14.5 41.36 ± 17.8
Sex Male 1470(68.89) 1311(89.18) 159(10.81) Female 664(31.11) 590 (88.85) 74(11.14)
ISS mean 11.3(10.2-12.4) 10.6 (10.0-11.2) 26.5(23.2-29.7)
Rotterdam score mean 2.1(1.6-2.8) 1.8(1.5-2.1) 3.9(3.5-4.3)
GCS on admission mean 13.4(12.1-14.7) 12.0(11.0-13.0) 5.2(4.5-5.9)
Pupil Reactive 1591(74.83) 1534(96.41) 57(3.58) Non reactive 543(25.44) 367(67.59) 176(32.41)
Blood pressure (SBP) <90 mmHg 249(11.69) 156(62.65) 93(37.35) >90 mmHg 1885(88.33) 1745(92.57) 140(7.42)
SPO_2 <90 % 339(15.89) 216(63.71) 123(36.28) >90% 1795(84.11) 1685(93.87) 110(6.12)
Alcohol/drug intoxication 310(14.52) 243(78.38) 67(21.61)
Pre-existing systemic disease 163(7.63) 131(80.36) 32(19.63)
Management Conservative 1489(69.78) 1364 (91.60) 125(8.39) Operated 645(30.22) 537 (83.26) 108(16.74)
Severity of injury* Mild (13-15) 1048 (49.10) 1036(98.85) 12 (1.1) Moderate(9-12) 662 (31.02) 608(91.84) 54 (8.15) Severe (<8) 424 (19.86) 257(60.61) 167 (39.38)

ISS-injury severity score,SBP-systolic blood pressure

*grading done on the basis of GCS on admission and percentage calculated for each subgroup.

Discussion

Traumatic brain injury is a major global public health issue. There is continous rise in incidence in developing countries accounting to increased industrialization and surge in vehicles without improving the infrastructure. It is also associated with huge socioeconomic losses. Therefore complete understanding of its epidemiology and characteristics is necessary. There has always been some limitation in catering proper healthcare services to these patients due to lack of detailed good quality data , inadequate policies , proper guidelines, funding and public awareness .

In our study , the patients from urban and rural areas were comparable . This was probably due to lack of high quality trauma care in rural India. The mortality among these cases was 25.89%. More than 85% cases were of low or middle income groups . The males outnumbered the females with male:female ratio of 2.21:1. The mean age was 31.65± 5.1 years reflecting the increase in TBI incidence among young adults in similar view as in other studies .[4-5]

RTA was the most common mode of injury followed by falls. It was the commonest mode in young adults and males and was responsible for more severe injuries. This was because of less traffic sense, overspeeding , not using helmet or seatbelt and drunk driving . While in pediatric and geriatric population fall was more common. Gururaj et al[6] also studied about the increasing trend of falls among children. Whereas fall remains the most common cause in developed world and with aging Indian population it has now emerged as most frequent cause in older individuals.[7] Mechanism of injury is an significant predictor of outcome in TBI.[8-9]

Acute SDH was the most common single intracranial lesion detected in 32.70% cases and was also associated with poor outcome with mortality of 25.21%. Narwade N et al[10] reported SDH in 16.83% cases. The severity of TBI was more in patients with cortical lesions and these patients also had more incidence of seizures, LOC, pupillary non reactivity. CT findings such as mass effect, midline shift, presence of cerebral edema and SAH also effect outcome.[11-12] Around 30.22% patients were operated, mostly with severe or moderate TBI. According to McHugh et al, hypotension, hypoxia and hypothermia were also an independent risk factors for poor outcome.[13]Prehospital care also determines the favourable outcome with early diagnosis and effective intervention.[14] We see a lack of prehospital care in this part of India. In India due to lack of emergency services majority of the patients do not get appropriate management in early periods and major deaths that occur, do so within first 2 hours after injury.[15] Severe injury is directly related to poor outcome. In our study 39.38% patients with severe injury died. The severity can be graded on the basis of GCS on admission, ISS, and Rotterdam score. Previous studies have also shown them as the major

determinant.[16,18-19] The overall mortality was 10.91% while other studies by Row Bothom[17] and khursheed et al[18] had mortality of 17.55 and 27.8% respectively. Mortality was more with severe injuries, operated and patients shifted to ICU. The prognosis of these patients is mostly dependent upon the prehospital factors, neurological status (GCS) at the time of admission[19] , age , mechanism of injury , ISS [18], Rotterdam score[18] , associated injuries , presence of hypoxia and hypotension[13,9] .

All patients with severe injury do not have poor outcome. In our study also, 60.61% patients with severe injury survived and thus aggressive and timely management of all patients is necessary. Also early and appropriate care is a major factor in avoiding secondary injuries and death .[20] With detailed understanding of these factors , we can develop new plans, formulate better policies, increase public awareness. This all will lead to improvement in early diagnosis and management. The data of this study may be used for prognostication, formulation of hypothesis, developing prognostic models[21].

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