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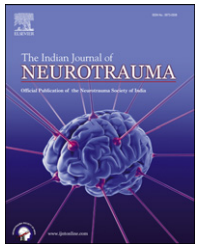

Original Article

Developing traumatic brain injury data bank: Prospective study to understand the pattern of documentation and presentation☆

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ABSTRACT

Background: There are few published research reports from scattered studies on traumatic brain injuries (TBI) from the developing countries.
Objectives: We attempted to identify the clinico-social correlates of TBI and to determine the efficiency of documentation to find out the pattern of presentation of TBI at a rural tertiary care teaching hospital.
Materials and methods: A descriptive observational prospective study was performed from January to June 2010 at a tertiary care rural teaching hospital. Based on WHO guidelines "Standards for Surveillance of Neurotrauma" a data collection tool was designed. After validation by pilot study this data collection questionnaire was subjected to collect information on the participants with diagnosis of traumatic brain injury reported at the Emergency Department (ED). The collected data was entered into the TBI registry database based on Microsoft (MS) excel that was developed for analytical conclusions.
Results: Out of a total 414 TBI cases, the mean age was 33.47 years, 78.98 percent were male; half of all the victims were in the age 21–40 years; children (6–10 years) (6.76%) and adolescent (11–20 years) (10.39%) comprised a large group; 10.23 percent required resuscitation on admission; the mean duration of hospital stay was 5.42 days. The overall fatality was 7.75 percent; females contributed higher among fatal cases; 10.39 percent were below 10 years and nearly one-fourths (24.40%) less than 20 years is alarming. In the secular trend, highest number (33.57%) of TBI cases was reported in the month of June, followed by March (18.84%). Road traffic injuries were the commonest injury mechanism (56.76%) and mainly in the highways (57.25%). Minor associated injuries were bruises (40.10%) and abrasions (50.97%) and cuts (44.69%). Major associated injuries were few; ear, nose or throat (ENT) Bleeding (2.17%), Limb fracture (5.07%). Alcohol was risk factor in 9.42 percent cases. Of the life threatening computerized tomography (CT) scan findings subarachnoid hemorrhage was noted in 5.59 percent cases.

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Conclusions: Early analysis of a TBI data can lead to useful information but presently there are many lacunae to collect comprehensive information in TBI cases. There is further need to understand the number of variables required and many other requirements for user-friendly secure web-based database system to maintain, analyze and to update continuously for a national TBI registry.

1. Introduction

TBI are one of the commonest injuries of all ages after a motor vehicle crash.[1–6] World Health Organization (WHO) recognized "Neurotrauma" as an important public health problem deserving the global attention for a surveillance system with uniform definitions and collection of data to compare the epidemiologic characteristics across time and space.[7] A national database on the causes and trends of traumatic injuries help to define public health priorities and many countries have established the necessary surveillance systems.[7] It has been agreed that a national level trauma registry provides a means of collecting and analyzing relevant epidemiologic data to improve trauma care even in the developing countries.[8–16] There are not much TBI registries, thus making documentation of injuries inadequate and accessibility of the data difficult. In the above state of affairs we conducted a prospective study to assess the impact of documentation to describe pattern of presentation of TBI and to identify the clinico-social correlates by analyzing precisely the intricacy of injury mechanism in this regard.

2. Material and methods

A descriptive observational prospective study was performed from January to June 2010 in a tertiary care rural teaching hospital. A data collection tool was designed based on WHO guidelines "Standards for Surveillance of Neurotrauma"[7] and was validated by pilot study to collect data on the subjects reported at the Emergency Department (ED). All the consecutive patients admitted to the neurosurgical facilities with the diagnosis of traumatic brain injury were enrolled in this study.[7] There were two neurosurgeons looking after these patients with facilities to provide basic as well as advanced neurosurgical care and to perform neurosurgical procedures round the clock. Institutional ethical committee approved the study. Informed consent was taken from the caregivers. Medical records of all the patients admitted under neurosurgical care were followed till the patient discharged or had in hospital mortality. The data regarding patient basic demographic characteristics, clinical findings on admission (including the post-resuscitative Glasgow Coma Scale (GCS),[17] pupillary signs, presence of multiple and cervical spine injuries, ingestion of alcohol and mechanism of injury) and computerized tomography (CT) scan findings, any surgical operations undertaken, and outcome at discharge. Data extraction was manually done by reviewing each case file and entered into a predesigned proforma, following that data were entered into a designed computerized traumatic brain injury registry. There were no facilities for intracranial pressure (ICP) monitor insertion and ICP monitoring. Abstraction of medical records included entering the following variables into an electronic database: age, gender, domiciliary status, GCS score,[17] mechanism of injury, severity of head injury [defined as mild (GCS-13–15), moderate (GCS-9–12) and severe (GCS-3–8)], associated injuries, length of hospital stay in days, CT results, type of management, surgical intervention (if any), and outcome, defined as either died or for discharged alive patients, the Glasgow Outcome Scale score.[18] All patients were evaluated and resuscitated based on standard operative procedure of the established hospital guidelines for management of TBI. CT scan findings were used as guidelines for interventions in the patients with TBI. When indicated, cervical spine X-rays were performed. Surgical procedures were conducted following clinical evaluation and appropriate radiological imaging. Indications for surgery included intracranial haematomas, cerebral contusions and depressed skull fracture. All patients with a GCS score $\leq$ 8 and/or hemodynamic instability underwent endotracheal intubation and ventilation, early tracheostomy (within 72 h) was performed where the patient's neurological status was poor and there was anticipation of prolonged intubation or ventilation and/or associated severe facial injuries.[19] Long term outcome data were not available as most patients were lost to follow-up.

2.1. *Statistical analysis*

The collected data was entered into the TBI registry database based on Microsoft (MS) excel that was developed by for analytical conclusions. Analysis of data was done using InStat 3 Graph Pad software generating simple frequencies for non-numeric variables. Chi Square and Fisher's exact test were used to compare the differences in the variables among TBI victims.

3. Results

Out of a total 414 TBI case series, the mean age was 33.47 years (SD $\pm$ 16.725, range 1–85 years), and 78.98 percent were male. The mean duration for hospital stay was 5.42 days (SD $\pm$ 8.312 days, range 1–79 days); 10.23 percent patients required resuscitation at the time of admission. Details of Glasgow coma scale were available. Further details on vital parameters and investigations included in the study were also collected. Among them highest number were 104 males (25.12%) in the age group of 21–30 years, followed by 65 males in 31–40 years age group (15.70%); incidentally half of all the victims were in the age 21–40 years (n = 207). Children (6–10 years) (6.76%)

and adolescent (11–20 years) (10.39%) also comprised a large group sustaining trauma. By and large fatality among the TBI cases was 30 (7.75%) and in different age groups was not significantly diverse (Chi square for independence 2.229, $p = 0.3282$; Chi square for trend 1.052, $p = 0.3049$). Out of 327 male TBI victims 23 (7.03%) died and of the 87 female victims 7 (8.05%) died. All the patients who died belonged to the severe traumatic brain injury group. Fatalities among females after sustaining injury were higher than males though the difference was not significant (Fisher's exact test $p = 0.8158$). Overall, the data of the TBI victims 10.39% below 10 years and nearly one-fourths (24.40%) less than 20 years was alarming. So we have to consider for battering and and/or DSH in all pediatric and adolescent cases of TBI. Further whole body X-ray may be needed in these age groups to exclude battering and during intervention the controversy of 'Conscious sedation versus General anesthesia' in this age group always needs ethical consideration. The sex distributions of total 30 cases of death are shown in Fig. 1 (number indicates 'age' and alphabet as 'sex'). In the secular trend, highest number ($n = 139$, 33.57%) of TBI cases was reported in the month of June, followed by March ($n = 78$, 18.84%) though the difference was not statistically significant (Chi square for independence 3.398, $p = 0.6389$; Chi square for trend 0.0006350, $p = 0.9799$). Data on 'Death' or 'Discharge' are grossly incomplete for the two months (March and June) [Table 1]. Among all the modes of trauma, commonest being the road traffic injuries ($n = 235$, 56.76%) while majority of the accidents took place on highways (57.25%). The most common diagnosis was acute subdural hematoma (45 cases), followed by cerebral contusion (29 cases), extradural hematoma (22 cases) and traumatic subarachnoid hemorrhage (11 cases). Minor injuries were mainly the associated trauma sustained; bruise ($n = 166$, 40.10%) and abrasion ($n = 211$, 50.97%) and cut ($n = 185$, 44.69%), few had major associated injuries, ENT Bleed ($n = 9$, 2.17%), Limb fracture ($n = 21$, 5.07%). Alcohol was the risk factor in 39 (9.42%) cases; of them 33 (7.97%) had sustained RTI. Injury other than TBI was noted in upper limbs ($n = 91$, 21.98%) and face ($n = 85$, 20.53%); in the outcome analysis of these associated injuries was followed by disabilities only in 5 cases (1.21%) [Table 2] Details of the investigations regarding CT scan findings were available for 291 patients. Of them normal findings were found in 130 (44.67%). Of the life threatening CT scan findings among the victims ($n = 161$), subarachnoid hemorrhage was noted in 11 (5.59%) cases, while subdural hematoma was 21.74 percent, extradural hematoma 10.56 percent and contusion 14.29 percent [Table 3].

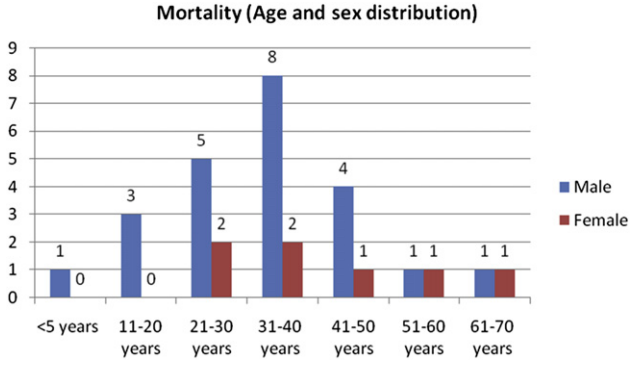

Fig. 1 – Details of mortality, age and sex distribution.

4. Discussion

Trauma is the cause of 10% of all deaths worldwide[20] and it is projected that road traffic deaths will increase by 83% between 2000 and 2020 in developing countries.[21] It is estimated that nearly 1.5 to 2 million persons are injured and 1 million succumb to death every year in India. Road traffic injuries are the leading cause (60%) of TBIs followed by falls (20%–25%) and violence (10%). Alcohol involvement is known to be present among 15%–20% of TBIs at the time of injury.[22] Severe head injury (HI) is known to be a major determinant of mortality in patients with multiple injuries but additional injuries also contribute to the clinical outcome. Reliable estimates of the burden of road traffic injuries are essential for rational priority settings and presently most low income countries apparently do not have national injury surveillance systems. Thus national estimates of the burden of injuries should be built by collating information from all existing information sources by appropriately correcting for source specific shortcomings.[23] Data collection as a trauma registry is of utmost importance for implementing a philosophy of continuous quality improvement regarding prevention, treatment and mortality reduction of road traffic injuries.[3] These registries also describe patterns of injury in a hospital setting and providing the unique demographic and outcome data, which can be used to identify trends in injury, to design prevention programs and further modify and improve existing programs.[16,24] The Trauma Registry of the German Society for Trauma Surgery offered sufficient data for comparative outcome analysis in relation to the injury patterns.[25] Greece's first head injury registry offered an important preliminary core data concerning brain trauma etiology, management, and long term outcome.[26]

The first step in planning for prevention is to collect data through registry surveillance systems[15] according to specific inclusion criteria.[8] The data collection realistically appraises the purposes, resource requirements, and limitations.[27] Accurate data are also needed to evaluate clinical outcomes, therapeutic modalities, and quality of care in trauma[28] and the successful registers are those in which the collected data are accurate, restricted to the essentials, and meet a need that cannot be satisfied by other means.[29] There can be many existing information sources in a country (e.g., death registers, hospital records, mortuary data, crematorium records, health surveys, and crime reports), but often, the data will not be population representative, have low coverage and completeness, and be of poor quality with large numbers of cases coded to poorly specified causes.[23] The information from these registries is limited to patients who access care and to the catchment area of the registry[24] and it was seen in the present study also that there may not be any information regarding those patients who did not seek the medical care or those who died before reaching the hospital. Although data from registries are known not to have the same quality level as data

Table 1 – Distribution of trauma in the study population ($n = 414$).

Age of subjects (%)	Injury		Deaths (%)			Missing outcome	
	Male (%)	Female (%)	Male (%)	Female (%)	Total (%)	Male (%)	Female (%)
≤5 years $n = 15$ (3.62)	14	01	01	00	01	02	00
6–10 years $n = 28$ (6.76)	24	04	00	00	00	06	00
11–20 years $n = 58$ (14.01)	43	15	03	00	03	07	01
21–30 years $n = 117$ (28.26)	104	13	05	02	07	20	01
31–40 years $n = 80$ (19.32)	65	15	08	02	10	12	03
41–50 years $n = 57$ (13.77)	41	16	04	01	05	09	03
51–60 years $n = 26$ (6.28)	18	08	01	01	02	02	00
61–70 years $n = 28$ (6.76)	24	04	01	01	02	06	00
>70 years $n = 5$ (1.21)	04	01	00	00	00	01	00
Total Injury = 414	327 (78.98)	87 (21.02)	23 (7.03) $n = 327$	07 (8.05) $n = 87$	30 (7.25)	65	08
Months of years (%)							
January $n = 61$ (14.73)	46	15	03	01		00	00
February $n = 37$ (8.94)	27	10	01	02		00	00
March $n = 78$ (18.84)	67	11	05	01		26	00
April $n = 63$ (15.22)	51	12	06	02		03	00
May $n = 36$ (8.70)	30	06	04	00		03	00
June $n = 139$ (33.57)	116	23	04	02		33	08

from prospective clinical trials, key information like pattern of injury, hospital stay, or outcome could be expected to be available with sufficient reliability.[25] Many studies have recognized the value of a comprehensive approach to trauma system evaluation in rural areas[30–32] and many clinically simple and easy to use variables including age, GCS score, and pupil score have been shown to be significant predictors of long term outcome after traumatic brain injury.[32–35]

Table 2 – Correlates of trauma in the study population ($n = 414$).

Parameters		Male	Female	Total
Mode of injury	Assault (Age 8, 18, 19, 20, 20, 25, 32, 36, 40, 40, 65, 72)	12	00	12
	Fall	48	11	59
	Road traffic accident	193	42	235
	Missing data	77	25	102
Location of injury	Highway	196	41	237
	Street	3 (6M, 10M, 30M)	1 (60F)	04
	Workplace	12	05	17
	Home	45	05	50
	Missing data	80	26	106
Nature of associated trauma	Bruise	135	31	166
	Abrasions	175	36	211
	Cut	156	29	185
	ENT bleed	06	03	09
	Limb fracture	20	01	21
Associated risk factors	Alcohol	33 (27RTA, 4 Fall)	06 (RTA)	39
	HTN/DM (with RTA)	04 (10,22,50,61)	01 (35 F)	05
Clinical assessments: injury noted in area	Head	257	53	310
	Neck	03 (9, 45, 65)	00	03
	Face	73	12	85
	Chest	01 (22)	01 (55 F)	02
	Abdomen & pelvis	02 (30, 80)	00	02
	Upper limb	71	20	91
	Lower limb	22	06	28
Outcome analysis	Fracture right radius	02 (25, 40)	01 (17)	03
	Fracture lateral condyle of femur	02 (22, 25)	01 (30)	03
	Right fronto-parietal craniotomy	02 (40, 40)	00	02
	Tracheostomy	03 (18, 20, 40)	00	03
	Moderate disability	04 (18, 20, 28, 40)	01 (35)	05

In parenthesis means the age in years of the cases.

Table 3 – Outcome of diagnostic investigations done.

Parameters		Male	Female	Total
Diagnostic investigation	Hemoglobin <7 gm%	02 (28,36)	02 (35,70)	04
	X-ray chest: fracture rib[a]	04 (5, 10, 10, 20)	00	04
CT Scan	Fracture and collection in maxillary sinus	03 (8, 27, 30)	00	03
Done 291	Subdural hematoma	35	10	45
Normal 130	Fracture Right sphenoid, intraventricular bleed	03	00	03
	Fracture Maxilla with haemosinus	03	00	03
	Extradural hematoma	17	05	22
	Contusion	23	06	29
	Subarachnoid hemorrhage	09	02	11

a None had injury to the chest.

4.1. *Limitations*

There were several limitations of the present study:

1. It could have been better if the data entry was done under direct supervision. Probably in the absence of concern in the data entry, problems happened to be inherent in the data sheet.
2. Full analysis of data is extremely difficult, if not impossible and those should be rectified for example
   a. Data have not been entered in uniform language or coding. This is extremely important. For example, 'Head injury due to assault' and 'Head injury in assault' in column 'W' meaning were probably same. On the contrary 'Head injury due to fall' or 'RTA with Head injury' in column 'W' i.e. 'Diagnosis' did not carry any advantage in analysis because they did not help in finding precise risk factors in TBI or its management.
   b. In present study many important data were missing as a good many cells in the MS excel sheet were vacant. Lots of important parameters were unfortunately gone astray. For example, 'Death' or 'Discharge'; 'FINAL_-DIAGNOSIS' (as code); Date and time of Surgery; Date of discharge/Death; P, Q, R, S, T, V were vacant.; In future studies we need to make sure that there should be accurate, complete and exhaustive data entry for the selected parameters.
3. In the investigations: none had positive findings in X-ray skull (Done 15), X-ray spine (Done 8), USG abdomen & pelvic organs (Done 20). ECG, X-ray abdomen (erect & supine): not done in any case.

4.2. *Improvements*

Establishing a multi-center national registry in a developing country is a formidable task and the main factors leading to the successful establishment of multi-center registries are the development of a concise data entry form, development of a user-friendly secure web-based database system and experienced personnel in trauma injuries and data analysis to continuously maintain and analyze the registry.[36] One of the major problems of registries is obtaining continuous funding to ensure the stability of data collection by trained personnel's.[9] Ongoing funding and dedicated personnel are essential for the success of a trauma registry whose staff should be considered as key members of the trauma team.[37]

5. Conclusion

Establishing a traumatic brain injury registry where none has previously existed in a developing country is a challenging task. Countries with limited resources have been able to establish useful trauma related registries.[9,16,38] Nevertheless, it is feasible and has the potential to be developed to a nationwide database. Early analysis of data will provide useful information which can have the potential for long term effects on the progress of trauma related research and prevention.[39] Early analysis of a TBI data can lead to useful information but presently there are many lacunae to collect comprehensive information in TBI cases. There is further need to understand the number of variables required and many other requirements for user-friendly secure web-based database system to maintain, analyze and to update continuously for a national TBI registry.

Sources of support

Nil.

Conflicts of interest

All authors have none to declare.

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Nil.

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