EPIDEMIOLOGICAL ANALYSIS AND CLINICAL CHARACTERISTICS OF TRAUMATIC BRAIN INJURIES IN RURAL JAIPUR: THE FIRST SINGLE CENTRE EXPERIENCE

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ABSTRACT

BACKGROUND

Trauma is one of the leading causes of death and disability in the Indian Population.

OBJECTIVE

To evaluate and describe the epidemiological and clinical characteristics of patients with traumatic brain injury and their clinical outcomes following admission to a rural tertiary care teaching hospital in India.

STUDY DESIGN

Retrospective, cross-sectional, hospital based analysis of 1713 patients of Traumatic Brain Injury [TBI] admitted to the Department of Neurosurgery in a tertiary health centre in Jaipur from January 2014 to August 2015.

METHOD

The medical records of all eligible patients were reviewed and data collected on age, sex, mechanism of injury, severity of injury Glasgow Coma Scale (GCS) and Outcome (GOS) score, Computed Tomography (CT) scan results, modality of management and type of surgical intervention and outcome.

RESULTS

Among the 1713 patients admitted, age of patients varied >1 year to 92 years (mean age 21 years), majority of TBI's were reported in the age group 20–29 years (34.38%), followed by 30–39 years (26.97%), 40–49 years (16.70%), p value <0.05. Most of the patients were male (63.46%), mostly unmarried. Majority lived in sub-urban areas (51.26%) followed by rural (26.85%) and urban (21.89%). Patients were mostly from middle class (46.58%) and poor socio-economic background (42.62%), upper class only accounted for 10.8% of the cases. In terms of occupation, servicemen and farmers accounted for the majority (54.73%). Patients were brought to the hospital mainly by known persons (68%) and rest by bystanders and policemen. The most common mechanism of injury was road traffic accidents (RTA) 1199 (69.99%), followed by assault 251 (14.65%), 15.35% accounted for fall from height and fall of object on head. Mean hospital stay was 7.6±9.3 days (range <1 day to 87 days). In our study, patients were classified by GCS as mild TBI in 983(57.38%) patients; moderate in 488 (28.48%) and severe in 242 (14.12). 1481 (86.46%) patients experienced loss of consciousness; 788 (46%) had one or more episodes of vomiting; 312 (18.21%) patients presented with bleeding from ear, nose or throat, seizures were noted in 282 (16.46%) patients and vertigo in 411 (23.99%). Clinical examination also revealed abnormal pupils in 208 (12.14%) patients, abnormal motor response in 211 (12.32%) patients, only 3–5% patients showed cranial nerve deficit, racoon eyes or battle's sign. CT scan revealed contusions (42.50%) and fractures (35.14%) were the most common findings followed by sub dural hematoma (32.87%), extradural hematoma (18.21%). 85% patients were managed conservatively and 27% managed surgically. The overall mortality was 149 (8.69%). In a 6 month follow-up, 54 patients were persistently vegetative, 37 were severely disabled (dependent for day to day activities). 1452 patients recovered to be healthy.

CONCLUSION

Traumatic brain injury is a serious challenge to the community. With rapid modernization, growth in the country has been sporadic, boosting only segments of the population. Presently, there is no adequate consensus on the magnitude of TBI. A multi-disciplinary and multi-modal approach is necessary. Development of a computerized system, better reporting and documentation is essential to understand the true incidence of

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TBI. Development of trauma services in secondary health centres in the rural setting will be a big step towards the development of a nation-wide protocol in this transient phase of the country.

KEYWORDS
Traumatic Brain Injury, Glasgow Outcome Score.

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INTRODUCTION: Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness.[1] The prevalence (i.e., the existing cases at any given time) of TBI is not well documented, because most cases (i.e., mild TBI) are not fatal, and patients may not have been hospitalized. Estimates often are based on existing disabilities. Segments of the population like men, young people, low income individuals, unmarried individuals and individuals with history of substance abuse are considered at high risk.[2]

In India, it is estimated that about 1.5 to 2 million persons are injured and more than a million succumb to death every year. Road traffic accidents 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.[3]

Due to rapid surge in urbanization, motorization and economical liberation, many Asian countries have an increased risk of TBI.[4] Motor vehicle accidents, history of fall from height, fall of object on head and road traffic injury associated with substance abuse like alcohol accounts for majority of patients seeking emergency medical care in sub-urban Jaipur and surrounding rural areas, whereas injury due to assault, firearms and occupational hazards are not common.

There is a lack of reliable data regarding TBI in rural settings.[5] Moreover there is no reliable data yet analysed in our region. The present study, one of the first in the region is to determine the present epidemiological status of TBI, correlation with the clinical status, understanding the severity of head injury and the associated co-morbid conditions with the final outcome and developing an effective protocol for the management of this complex injury in our institution.

MATERIALS AND METHODS: The study included 1713 patients from less than 1 year of age to 92 years, with clinical/radiological evidence of traumatic brain injury admitted to the Department of Neurosurgery, Mahatma Gandhi Medical College & Hospital, Jaipur from January 2014 to August 2015. The study was approved by the Ethical Committee, Mahatma Gandhi University of Medical Sciences & Research.

Mahatma Gandhi Hospital, a 1000 bed super-specialty hospital is located in RIICO Industrial and Institutional area of suburban Jaipur, Rajasthan and is the principle tertiary care and referral centre for sub districts (Sanganer, Phulera, Bassi, Chaksu and numerous villages like Shivdaspura upto district Tonk) and is home to approximately 8 million people [India, Census 2011]. The location along the national highway 12 is home to mostly industry workers, agricultural workers and college students. With a per-capita income of rupees 42,434 the state ranks number 22 out of 32 (including union territories), and considering there are approximately 1 million two wheelers plying the roads in comparison to only about one hundred thousand four wheelers[6] and with the rapid urbanization, the national highway and more two wheelers touring the roads the general consensus in the emergency setting reveals that TBI is on the rise, with an alarming fact that most two wheelers carry about 3–4 people with disregard for helmets and other safety measures. Due to the far spaced locations and small number of specialty medical centres, primary care at site is still a dream.

The study is retrospective, cross-sectional, hospital based analysis of 1713 patients. Data was collected from the medical records department specified under the International Code of Diseases (2015/16 ICD-10-CM) S00–S09. Data collected included patient profile, type of injury, clinical analysis, radiological findings, and neurological analysis and management details. Data was recorded in Microsoft Excel. Statistical analysis of the compiled data was analysed using Microsoft Excel and Epi Info™ and presented in proportion and mean values. Proportions were analysed using the Chi Square test, error value set at <5%.

Injury was classified by the Glasgow Coma Scale (GCS), at the time of admission. Patients under the age of 5 years were classified under Pediatric Coma Scale (Simpson and Riley). Based on GCS, TBI cases were graded as mild (13-15), moderate (9-12) and severe (<8). Glasgow Outcome Scale {(GOS, Teasdale, G et al.) [5] was used to know the final outcome. Long term outcome data was not available as patients were lost on follow-up.

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	*Best response*	15
	Comatose client	8 or less
	Totally unresponsive	3

Fig. 1: Glasgow Coma Scale

GOS 1	Good recovery
GOS 2	Moderate disability (disabled but independent), no assistance with activities of daily living
GOS 3	Severe disability (conscious but disabled), needing assistance with activities of daily living
GOS 4	Persistent vegetative state
GOS 5	Death

GOS = Glasgow outcome scale

Fig. 2: Glasgow Outcome Scale

RESULTS: Among the 1713 patients admitted to the Department of Neurosurgery, Mahatma Gandhi Hospital during year 2014 to 2015, the age of patients varied from 1 month to 92 years (Median age of 21 years). The majority of TBI's were in the age group of 20–29 years (34.38%), followed by 30–39 years (26.97%), followed by 40–49 years (16.70%), p value <0.05.

Age Group	Number of Patients	Percentage
<1 year	9	0.53%
1 – 9 years	37	2.16%
10 – 19 years	135	7.88%
20 – 29 years	589	34.38%
30 – 39 years	462	26.97%
40 – 49 years	286	16.70%
50 – 59 years	136	7.94%
>60 years	59	3.44%

Table 1: Age Distribution

Most of the patients were male (1087/63.46%), females accounted for the rest 36.54%. Majority of the patients were unmarried. Majority of the patients lived in sub-urban areas (51.26%) followed by rural (26.85%) and urban (21.89%).

Most of the patients were from a middle class (46.58%) and lower class/poor socio-economic background (42.62%). Upper class only accounted for 10.8% of the cases. In terms of occupation, servicemen and farmers accounted for the majority (54.73%), housewives (35.67%) and students accounted for 9.57%.

Age Group	Number of Patients	Percentage
Sex		
Male	1087	63.46%
Female	626	36.54%
Location		
Urban	375	21.89%
Sub Urban	878	51.26%
Rural	460	26.85%
Occupation		
Servicemen	526	30.71%
Farmer	412	24.05%
Housewife	611	35.67%
Others	164	9.57%
Socio-Economic Status		
Upper Class	185	10.80%
Middle Class	798	46.58%
Lower Class	730	42.62%

Table 2: Demographic Profile

Patients were brought to the hospital mainly by known persons (68%), and rest by bystanders and policemen. Ambulance was available for about 28% patients and the rest being brought in by private vehicles. The reason for this alarming fact is that the highway is not covered actively by any critical care service provider and the delay in acquiring services leads to increased morbidity and mortality, moreover with a literacy rate of 45.45%–64.02%[7] there is a significant appreciation by the population towards first-aid leading to improper patient care at the site of accident.

Age Group	Mode of Injury				
	Fall from Height	Road Traffic Accident	Assault	Fall of object on head	Total
<1 year	5	2	0	2	9
1–9 years	22	10	3	2	37
10–19 years	43	70	13	9	135
20–29 years	14	480	72	23	589
30–39 years	29	322	78	33	462
40–49 years	14	188	58	26	286
50–59 years	16	89	23	8	136
60–69 years	12	38	4	5	59
Total	**155**	**1199**	**251**	**108**	**1713**

Table 3: Mode of Injury

The most common mechanism of injury was Road Traffic Accidents (RTA) 1199 (69.99%), followed by assault 251 (14.65%). The rest 15.35% accounted for fall from height and fall of object on head. Most patients (90%) presenting with TBI resided within a 50 kilometre radius of the hospital and the mean hospital stay was 7.6±9.3 days (range <1 day to 87 days). Majority of injuries (47%) were two wheeler users.

Patients were initially evaluated on the basis of history, presenting symptoms and signs. Classified under Glasgow Coma Scale and followed up on Glasgow Outcome Scale twenty four hours later. Patients were subject to non-contrast computerized tomography, and patients suspected to having associated spinal injuries underwent an x-ray of the spine; x-ray chest and ultra-sonogram of the abdomen were not performed routinely unless indicated.

Literature suggests that the GCS be used to assess the seriousness of head injury and a total GSC score of 8 or less for 6 hours be used to set the boundaries of patient study groups and that the GCS be used as the initial end-point at a specified time from injury for measuring morbidity and mortality. In our study, patients were classified by GCS as mild TBI in 983 (57.38%) patients; moderate in 488 (28.48%) and severe in 242 (14.12) patients. Patients' history analysis and clinical examination revealed that 1481 (86.46%) patients experienced loss of consciousness; 788 (46%) had one or more episodes of vomiting; 312 (18.21%) patients presented with bleeding from ear, nose or throat. Seizures were noted in 282 (16.46%) patients and vertigo in 411 (23.99%). Clinical examination also revealed abnormal pupils in 208 (12.14%) patients, abnormal motor response in 211 (12.32%) patients, only 3–5% patients showed Cranial Nerve Deficit, Racoon eyes or Battle's sign.

Symptoms	**Number**	**Percentage**
Loss of Consciousness	1481	86.46%
Vomiting	788	46.00%
Ear Nose Throat Bleed	312	18.21%
History of Seizures	282	16.46%
Vertigo	411	23.99%
Signs	**Number**	**Percentage**
Racoon Eyes	42	2.45%
Battle's Signs	78	4.55%
Abnormal Pupillary examination	208	12.14%
Abnormal Motor Response	211	12.32%
Abnormal plantar response	162	9.46%
Cranial Nerve Deficit	61	3.56%

Table 4: Clinical Details

CT Scan Outcomes	**Number**	**Percentage**
Normal	243	14.19%
Fractures	602	35.14%
Extra Dural hematoma	312	18.21%
Sub Dural hematoma	563	32.87%
Contusion	728	42.50%
Sub Arachnoid Haemorrhage	152	8.87%
Intra Ventricular Haemorrhage	68	3.97%
Diffuse Axonal Injury	221	12.90%
Pneumocephalus	411	23.99%

Table 5: CT scan findings

Computerized tomography is an essential mode of investigation and all patients underwent CT at time of admission and those who required a repeat CT on basis of GCS underwent CT in the next 24 hours to assess whether the condition was deteriorating or improving. Contusions (42.50%) and fractures (35.14%) were the most common findings followed by sub dural hematoma (32.87%), extradural hematoma (18.21%). To summarize, CT revealed abnormal findings in about 85% patients, however most were managed conservatively and only 27% patients were managed surgically (burr hole/craniotomy/crainectomy). In suspected polytrauma cases, radiological evaluation of other body parts by HRCT Chest/Ultra-sonogram abdomen/ Contrast enhanced CT abdomen were also done and evidence of injury was noted in 12% cases out of which only 2% cases survived (data not mentioned). Other delayed complications like bed sores, meningitis etc. was not considered as a variable in this study.

The overall mortality was 149 (8.69%); mostly in the severe GCS category (121), patients with moderate and mild GCS expired due to other associated injuries like compound fracture pelvis, hemo-peritoneum and blunt/perforating trauma chest. In a 6 month follow-up of patients (most patients initially with moderate disability and good on recovery were lost on follow up in the 6 month period and thus pre-emptively considered as good recovery). 54 patients were persistently vegetative (usually on tracheostomy tube and aided by supportive care at home) and 37 patients were graded as severely disabled (dependent for day to day activities). 1452 patients recovered to be healthy (independent for day to day activities). Multivariate logistic regression for risk of mortality suggests that increased TBI severity had a significant association with mortality and every additional day of hospital stay was associated with decrease in mortality.

GCS Severity	**Glasgow Outcome Scale - at 6months**				
	Death	**Persistent Vegetative**	**Severe Disabislity**	**Moderate Disability**	**Good Recovery**
Severe	121	52	35	20	51
Moderate	21	2	2	1	602
Mild	7	0	0	0	799
Total	**149**	**54**	**37**	**21**	**1452**

Table 6: Glasgow Outcome Scale

DISCUSSION: The study reveals that in our region of sub-urban and rural jaipur traumatic brain injury mostly affects the young and productive population. Patients present to the emergency in a poor state, with negligible first-aid mostly due to the improper understanding of the serious nature of the injury.

This retrospective review of this sample size is the first of its kind in the region in the state of Rajasthan and included all cases of TBI which presented to our institution.

A Medline/ Google/Google Scholar/SCOPUS review for case reports in our region revealed only a few cases.

Our study reveals that the productive age group is the most affected, majority being males. The IMPACT study has concluded that outcome in TBI cases are dependent on age,[7] which is consistent with our study. The plausible reason may be that the male population is the earning member of the family. There was no correlation of sex with treatment outcome in our study (P value >0.05) with observations corresponding with those made by other studies. Also alcohol use related data was not available in our study and we contemplate that identifying alcohol related TBI rates is crucial to develop public health intervention programs in India.

A. Pathak, et al[8] in their study analysed 120 cases of death injury brought to S.M.S. hospital, Jaipur and iterated that 65.83% cases occurred due to road traffic accident [commonly due to two wheelers (49.37%) and pedestrians (32.91%)], 23.33% due to fall from height, 1.6% due to assault. Autopsy findings revealed that 10% cases had extra dural haemorrhage, 94.94% had sub-dural haemorrhage, 83.54% had sub-arachnoid haemorrhage and 20.25% had intra-cerebral haemorrhage. Even with the small sample size, the data is consistent with our findings.

M. K. Goyal, et al[9] reviewed 140 cases of acute head trauma in S.M.S. Hospital, Jaipur and assessed the age distribution, mode of injury and CT findings. They concluded that majority of injuries occurred in the age group of 21–40 years (66% males) due to road traffic accident and patients less than 10 years suffered TBI due to fall from height. CT findings revealed abnormal findings in 67% patients with TBI due to RTA, 26% with TBI due to fall. Fractures were detected in 84% cases.

Due to poor understanding of indicators for admission, the study has its limitations i.e., there is no data available on location where the injury occurred, velocity on impact and whether first aid was provided or not and post discharge status. There are no statistics available at the state level on incidence of TBI. It is also plausible that many patients with TBI do not reach tertiary centres and may have sought care in primary and secondary health centres or may have succumbed to injuries at site. Moreover, this is an independent and single centre analysis which may not be able to provide a generalised data with respect to other settings.

Road traffic injury is an increasing health problem globally and especially in Southeast Asia.[10] In India, majority of the data available is based either on post mortem, forensic analysis or medico-legal reports, thus it may not reveal the true picture.[11] Furthermore, highways are not segregated and pass through rural areas and in a resource constrained country like India standard safety measures, improved safety engineering like airbags, antilock brakes are not available and the local population neglects use of seat belts and helmets; locally manufactured vehicles are not compliant to international safety standards.[12,13]

Mock, et al., (2003)[14] concluded in their study that good outcome is seen in trauma patients receiving proper life-saving care within a few minutes of injury. Thus, pre-hospital care and triage is utmost necessary for the stabilization of patients in terms of adequate airway protection, prevention of excess blood loss and subsequent trauma during transportation to proper hospital setup for definitive care. There is a dire need to create awareness among the general public on how to provide initial care to a trauma patient and need of well-trained paramedics on ambulances placed at strategic locations along the highway and accident-prone regions for swift action.

CONCLUSION: Traumatic brain injury is a serious challenge to the community. With rapid modernization, growth in the country has been sporadic, boosting only segments of the population. Presently, there is no adequate consensus on the magnitude of TBI, and with increasing research in the segment, the reality is coming to the centre of attention. The government has to undertake appropriate surveillance and implementation programs. Understanding evidence based analysis of TBI is crucial to develop new strategies and implement core legislative changes, keeping in mind that incidence and aetiology of TBI varies in extremes in the country.

A multi-disciplinary and multi-modal approach is necessary. Development of a computerized system, better reporting and documentation is essential to understand the true incidence of TBI. Educating the general population on TBI can be considered as the first step of the ladder. Development of trauma services in secondary health centres in the rural setting will be a big step towards the development of a nation-wide protocol in this transient phase of the country.

Primary resuscitation and patient care during transport is a reverie which has to become a reality to avoid the devastating consequences of TBI, with a mortality rate of 8.69%. Improvement and/or development of trauma services, from installing a CT machine to educating the medical staff about Acute Trauma and Life Support (ATLS) guidelines in primary and secondary health centres and most importantly to decide when to refer a patient is crucial.

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