Emergency Department Management of Mild Traumatic Brain Injury in New Delhi–A Single Institute Cohort Management Data

Ajay Choudhary[1,*] Ashok Kumar[1,*] Rajesh Kumar Sharma[1] Rahul Varshney[1] Satya Shiva Munjal[1] Kaviraj Kaushik[1] Laxmi Narayan Gupta[1]

[1]Department of Neurosurgery, Atal Bihari Vajpayee Institute of Medical Sciences, Dr. Ram Manohar Lohia Hospital, New Delhi, India

Address for correspondence Rajesh Kumar Sharma, MBBS, MS, MCh, Department of Neurosurgery, Atal Bihari Vajpayee Institute of Medical Sciences, Dr. Ram Manohar Lohia Hospital, New Delhi 110001, India (e-mail: drsrk22@gmail.com).

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Abstract

Introduction The purpose of this study is to compare the current clinical management practices and decision guidelines of the Brain Trauma Foundation (BTF) for mild traumatic brain insult with line of treatment followed at our center to identify the clinically significant treatment outcome in pediatric to elderly patients.

Materials and Methods This is a questionnaire-based prospective observational study at the emergency department of neurosurgery in Dr. Ram Manohar Lohia (RML) Hospital, New Delhi. A registry questionnaire was administered to all the eligible subjects by the neurosurgery resident in emergency department (ED) to correlate clinical status, severity of traumatic brain injury (TBI) and associated comorbid conditions and its outcome after management.

Results Out of 154 mild TBI cases attending ED, 115 (74.7%) were males and 39 (25.3%) were females, with average age of 27 years. Of the patients with mild TBI, road traffic accidents (RTA) were the main cause (50.6%), followed by fall from height (42.9%), assault and sports-related injury (6.4%). Of the total, 96.1% underwent CT. Of these, 31.8% found abnormal CT results, 27.5% received wound treatment care, and 9.1% received emergency care. Nearly 30.5% were admitted and 1.3% patients were died in the hospital, 75.3% patients were discharged and 23.4% were referred to other department for associated co morbid conditions.

Conclusion The present study identified deficiencies in and variation around several important aspects of ED care. The development of BTF guidelines specific for mild TBI could reduce variation and improve emergency care for this injury.

Keywords
- mild traumatic brain injury
- emergency care
- clinical management

Introduction

Glasgow coma scale (GCS) score of 13 to 15 is indicative of mild traumatic brain injury (TBI) with clinical symptoms of loss of consciousness (LOC), amnesia or peri-injury disorientation. Approximately, 70 to 90% of extra and intracranial insults that occur worldwide are diagnosed as mild TBI.[1,2] The World Health Organization (WHO) in the year 1997 suggested the significance of research efforts to cut down the consequences of mild TBI.[3]

According to the National Institute of Health, mild TBI is a leading public health condition, and efforts should be made to diminish the rate of disability after a mild TBI. These efforts should be a national research priority.[4] As much as 5% of

* *Both authors contributed equally to this work.*

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patients with so-called "mild" TBI depict traumatic abnormalities on initial head CT scan, with 1% requiring neurosurgical intervention in the acute stage of injury.[5] Disability after mild traumatic brain insult occurs due to cognitive, physical, psychological, and social impairment and results in significant malady and redundancy.[4,6,7] As far as 50% of patients with mild TBI are affected by postconcussion symptoms after 1 month of injury and 15 to 20% at 1-year duration.[8,9] The emergency department (ED) is the "shop window" of any hospital. It is the most critical and life-saving area, providing urgent care to critically ill patients. In the case of mild TBI care, ED is an important component of the hospital; albeit, the most overlooked. Although the ED is the fulcrum for most of the patients with mild TBI, its management in the ED has not been described. Since the follow-up rate of these patients is quite low, therefore their only contact with the medical system is the ED.[10]

Currently, there are no mild TBI specific therapies; the diagnostics and line of management administered to the patient have the potential to affect the outcome.[11,12] The clinical management of these patients is variable, and despite the availability of the clinical guidelines, the majority of patients will undergo CT imaging and most of the interpretation is normal.[13]

If the patient is directly referred to the neuropsychological specialists, once they are discharged from the ED, it reduces the long-term cognitive disability.[14,15] Serotonin reuptake inhibitors and benzodiazepines are given soon after the injuries have been known to reduce postconcussion symptoms after mild TBI.[16] For good recovery outcome after mild TBI, identification of lacunae in the care and complete description of the ED are considered the initial vital steps in the care of mild traumatic brain insult.

A wide range of variations in some aspects of emergency care has been reported in the case of mild TBI. Several centers in Europe and Canada have described variations in the use of CT after a mild TBI.[15-18] In countries like Sweden and Norway, a disparity of 15% to 94% has been reported in the hospital admission rates for mild TBI.[13,16,17]

The main objective of this study is to describe the emergency management plan in the ED of Dr. Ram Manohar Lohia Hospital (RML) Hospital, New Delhi, for mild TBI. We sought to identify the lacunae in the care around ED for mild TBI cases to determine the specific guidelines for its management.

Materials and Methods

This study was approved by the ethics committee of Atal Bihari Vajpayee Institute of Medical Sciences and RML Hospital (no-176(45/2016) IEC/PGIMER/RMLH), and consent for participation was obtained from each participant enrolled in this study. The study included all the patients with trauma, having clinical/radiological evidence of head injury alone or in association with other injuries admitted in the ED of RML Hospital, New Delhi, for one year (June 2017 to June 2018).

A questionnaire was administered to each participant by the neurosurgery resident on call in the ED. The form included details like patient demographics, cause of injury, clinical history, Glasgow coma score (GCS) on arrival to the study center, prehospital care, clinical findings, neurological examination, and radiological findings. The severity of TBI was diagnosed according to the GCS score. Early CT scan was done to understand the type of injury to administer the appropriate line of treatment. The progress and outcome in the ED room were recorded by neurology examination. GCS was used for the age group more than 5 years, and the pediatric coma scale (by Simpson and Reilly) was used for pediatric age group less than 5-year cases. Based on GCS, TBI cases were graded as mild (13–15), moderate (9–12) and severe (< 8).

Data Analysis

Statically analysis was performed using statistical software SPSS version 17. The data were presented as no. (%) and median (interquartile ranges). All analysis was performed at the 95% confidence interval.

Result

A total of 154 patients of mild head injury attended the neurosurgery ED of RML Hospital during 2017–2018. The median ages of patients attended were 27 years (►**Table 1**).

There were 115 (74.7%) males and 39 (25.3%) females. Most of the patients were healthy 141 (91.6%) with mild systemic diseases 13 (8.4%) before the injury happened. Of the patients with mild TBI, predominant mode of TBI was road traffic accidents (RTA) (50.6%), followed by fall from height (42.9%), assault and sports-related injury (6.4%). Of the total, 92.9% were from blunt injury, and injury at outermost were absent in 7.1% of patients. Most of the injuries occurred while at home and were accidental (40.9%) and were directly referred (83.1%) from the primary center (►**Table 1**).

First aid for pain management was provided by trained personnel (doctors/paramedics) in 27.5% cases only and no care was provided in the rest of the cases (72.5%) (►**Table 2**). The events following the injury included episode of loss of consciousness (LOC) in 7.1% cases, vomiting in 3.95% cases, LOC with ear nose throat (ENT) bleed in 0.6%, and LOC with vomiting in 19.5 cases. The rest (68.8%) of the patients presented with no history of event after injury. On examination, 5.9% cases had abnormal pupillary response, but in 94.1% patients, pupillary responses were found normal. The majority (46.8%) of TBI cases showed some form of upper body injury on head/face and neck region, and 46.1% cases showed upper body injury on cervical, pelvic and lower limb skin lesions (►**Table 3**).

On radiological examinations, 96.1% of patients with mild brain injury underwent CT scan, in which 54.1% were done between 2 to 4 hours after attending the ED room and 45.9% were performed between 4 to 6 hours. On CT scan of head, 31.8% of cases revealed abnormal findings; however, all of these patients were given conservative treatment and discharged later (►**Table 4**).

On the basis of clinical examination, average median GCS score of all attending mild TBI patients were 14, while blood pressure and spo2 level at the ED room during clinical assessments were found to be normal (►**Table 5**). The patients were brought to hospital mainly by people

Table 1 Demographic characteristics of the patients

Demographic characteristics	Frequency (*n*)	Percent (%)
Age (years, median range)	27 (18–38)	
Gender		
Female	39	25.3
Male	115	74.7
Preinjury condition		
A normal healthy	141	91.6
A patient with mild systemic disease	13	8.4
Mechanism of injury		
Assault	5	3.2
Fall from height	66	42.9
RTA	78	50.6
Sports-related injury	5	3.2
Type of injury		
Blunt	143	92.9
Outermost absent	11	7.1
Location of incident		
On pedestrian near home	63	40.9
Other, please specify Fall from train	1	0.6
Public place	4	2.6
Street	4	2.6
Street/traffic	81	52.6
Workplace	1	0.6
Referral condition		
Primary referral	128	83.1
Secondary referral from other hospital	26	16.9

Abbreviation: RTA, road traffic accident.
Note: Table values represent as number of participants in frequency (*n*), percentage (%) and median (*iqr*).

known to them with no professional care 124 (80.5%), and only a few (30, 19.4%) cases were accompanied by medical and ambulance vans. In suspected polytrauma cases, radiological evaluation of other body parts was also done, and evidence of injury was noted in 37% cases, of which 1.3% cases expired (►**Table 2**).

Disposition

The disposition of patients with mild TBI is shown in ►**Table 2**. Most of them were discharged with instructions to follow-up with the referring doctor or were referred to another, unspecified doctor or clinic. However, approximately 37.2% of patients with isolated mild TBI per year were instructed either to return to the ED "as needed" or not undergo any follow-up at all.

Table 2 Types of care provided, and treatment given in ER.

	Frequency (*n*)	Percent (%)
Care provided to reach hospital		
Ambulance service	21	13.6
Medical mobile team	9	5.8
No professional care	124	80.5
Emergency care in ED		
No	140	90.9
Yes	14	9.1
Pain treatment given in ED		
No	111	72.5
Yes	42	27.5
Admission in hospital		
No	107	69.5
Yes	47	30.5
Status on discharge		
Dead	2	1.3
Discharged home	116	75.3
Refer to other department for other comorbidities	36	23.4

Abbreviation: ED, emergency department.
Note: Table values represent as number of participants in frequency (*n*), percentage (%).

Table 3 Clinical history related to injury

Clinical history	Frequency (*n*)	Percent (%)
Sensorium after injury		
LOC	11	7.1
Vomiting	6	3.9
LOC, ENT bleed	1	0.6
LOC, vomiting	30	19.5
No history	106	68.8
Pupils		
Both reacting	144	94.1
Left pupil reacting	1	0.7
None reacting	4	2.6
Right pupils' dilatation	4	2.6
Upper body abnormality		
Brain injury	28	18.2
Brain injury with face injury	3	1.9
Face injury	2	1.3
Head with neck, face injury	4	2.6
Head and neck injury	3	1.9

(*Continued*)

Table 3 (*Continued*)

Clinical history	Frequency (*n*)	Percent (%)
Brain injury with neck injury	32	20.8
No injury	82	53.2
Lower body abnormality		
Abdomen/pelvic girdle pain	11	7.1
Cervical pain	18	11.7
External skin lesions	17	11.0
Wound on lower limbs	3	1.9
Lower extremities pain	11	7.1
Lower extremities/ external skin wound	11	7.1
No abnormality	83	53.9

Abbreviations: ENT, eye nose throat; LOC, loss of consciousness.
Note: Table values represent as number of participants in frequency (*n*), percentage (%).

Table 4 CT examination for mild TBI

	Frequency (*n*)	Percent (%)
CT procedure		
Not performed	6	3.9
Performed	148	96.1
CT time after attending in ED		
Between 2 to 4 hours	80	54.1
Between 4 to 6 hours	68	45.9
CT findings		
Abnormal	47	31.8
Normal	101	68.2

Abbreviations: CT, computed tomography; ED, emergency department, TBI, traumatic brain injury.
Note: Table values represent as number of participants in frequency (*n*), percentage (%).

Table 5 Clinical examination of the patients

Clinical examination	Median (*n* = range)
GCS at the time of arrival	14 (13–15)
Systolic blood pressure at arrival (mm Hg)	120 (110–130)
Diastolic blood pressure arrival (mm Hg)	74 (70–80)
Spo2 level at arrival (mm Hg)	100 (98–100)

Abbreviations: GCS, Glasgow coma score; Spo2, peripheral capillary oxygen saturation.
Note: Table values represent as number of participants in frequency (*n*), percentage (%).

Variation in ED Care for Mild TBI

Of the 154 patients, 34 patients were care variables, and we were unable to analyze 15, because too few patients received them. These variables were MRI scan, blood alcohol level, admitted to intensive care unit, left ED without being seen by a doctor, and triaged out of the ED. The geographical region and increasing age were supposed to be a significant independent predictors of receiving analgesics for pain in the ED and receiving other blood tests (that is, a blood test other than a full blood count or blood alcohol level). This is not mentioned in the table.

Discussion

This study demonstrated that substantial ED resources are dedicated to the care of mild TBI patients. On an average per year, over 2000 patients with mild TBI underwent CT, apparently of the head and brain, and a nonextremity, nonchest X-ray, such as that of a skull or cervical spine, for over 500 patients.

There are many teething problems and lacunae which have been identified in the ED care for isolated mild traumatic brain insults. These include improper documentation such as that of pain score, less than 44% of patients had pain score documented in their records. Since headache is thought to be a prime contributing symptom of postconcussion syndrome and considered a primary cause of long-term disability and morbidity after a mild TBI, therefore, accurate pain score documentation is a necessary mandate and is of utmost significance. Since 2000, routine assessment of pain is necessary and required in all the hospitals to be accredited.[19]

The present data of our study precedes the release of these standard protocols; efforts to ameliorate the documentation process should be continued as a quality improvement measure in the EDS that provide care to the patients with mild TBI. Only 27.5% of patients with documented pain score received a dose of analgesia. Substandard treatment of pain in the ED, especially among children, has been reported by others.[20,21]

Postmild TBI headache is known to be treatable with a wide range of therapeutic agents, from nonsteroidal anti-inflammatory drugs (NSAIDS) to dihydroergotamine.[16] Aftereffects of early analgesic use on long-term outcome after a TBI is not known, and it would be a fruitful area for future investigation. 1200 patients with isolated mild TBI per year were discharged from EDs without any recommendation for any specific follow-up. Some of the patients were asked to turn up to the ED only when needed. On the other hand, the rest were told not to come up to the ED as they do not need any follow-up sessions.[22]

There are very few referral centers in New Delhi for the evaluation of mild TBI, which may partially responsible for such findings. According to a survey of 68 levels, one trauma center in the US, only 35% of referred patients with mild TBI turn up for follow-up evaluation after being discharged from ED (22). Since the patient may experience postconcussion symptoms even after 1 year of mild TBI, therefore follow-up care is of utmost significance.[9-12,23]

In two randomized controlled trials, routine follow-up was shown to diminish the severity and the number of symptoms occurring postconcussion after a mild traumatic insult.[14,15] The Medical Disability Society in Britain recommended routine follow-up for all TBI patients. However, no such protocol exists in India. Across ages, there are several lacunae identified in the ED management of TBI.[24] For younger patients, the frequency of analgesic administration and blood testing is quite less due to the high-tendency of vomiting postconcussion and also because of a belief held by parents and healthcare givers that analgesics may cause unwanted effects and mask other specific symptoms. Exploring the barriers to the administration of analgesics in the case of a mild TBI would surely be an important area of future research works.

Limitations of the Study

Other limitations include data documentation. Since data are extracted from ED charts after care is delivered, it is most of the time cumbersome to differentiate a care item not performed from the one which is administered but not documented in the pro forma.

Conclusion

Substantial ED resources are prerequisites for the care of mild TBI in the ED. However, the current study identified a plethora of deficiencies in the care plan. Many patients were discharged without any specific discharge advice and recommendations. Pain, an important symptom, was unreported and undertreated. Documentation errors were found in many of the ED records. There were several other parameters such as delayed initial CT scan, incomplete history recording, documentation of a case as medicolegal or nonmedicolegal. All these findings suggest that there is a need for the development of guidelines specific for mild TBI care in the ED.

Conflict of Interest
None declared.

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