Original Article

Patterns and Outcome of Traumatic Brain Injury Patients: A Study in a Tertiary Level Military Hospital

Islam MS[1], Rahman MF[2], Islam MA[3]

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Abstract

Introduction: A traumatic brain injury (TBI) is an injury to the brain caused by an impact to the head. TBI represents a huge global medical and public health problem across all ages and in both civilian and military populations. TBI is characterized by great heterogeneity in terms of etiology, mechanism, pathology, severity and treatment with widely varying outcomes.

Objective: To determine the pattern and outcome of traumatic brain injuries in victims reported to emergency and casualty (E&C) department following intensive care with or without surgical intervention.

Materials and Methods: This prospective type of observational study was conducted at Neurosurgery department of Combined Military Hospital, Dhaka from October 2013 to March 2017. A total of 675 head injury patients with TBI were assessed with gender, age, cause and type of trauma, GCS on admission, associated other injuries, time lapsed from trauma to hospitalization and care given. The outcome was measured after 72 hours using Glasgow Outcome Scale (GOS).

Results: The incidence of TBI was 47.03% among the head injury patients. Common age group was 21-30 years (43.7%) and male victims (66.55%). RTA was the most frequent cause (50.05%) of TBI and the most common pathophysiological cause of TBI was subdural haemorrhage (SDH)(35%) followed by extradural haemorrhage (EDH)(27%). Most patients (45%) had mild TBI. Surgical intervention was required in 45% patients of TBI mainly for the SDH, EDH which had significant positive effect on the TBI patient's outcome. The majority of patients (77%) had good outcome which included recovery (51.85%) and moderate disability (25.48%). The poor outcome was observed in 23% patients which included death (7.40%), persistent vegetative state (3.11%), severe disability (12.14%) and it was associated with older age, severe TBI (GCS<8 on admission), associated other injuries and delayed resuscitative care and interventions.

Conclusion: TBI was common among the young adults male. The RTA was the leading cause of TBI. The factors that influence the outcome of TBI include patient's age, severity of TBI, associated injuries and delayed resuscitative care.

Key-words: Head Injury, Extracranial injury, Traumatic brain injury, Incidence, Outcome.

Introduction

A traumatic brain injury (TBI) is an injury to the brain caused by an impact to the head. Traumatic brain injury represents a huge global medical and public health problem across all ages and in both civilian and military populations[1]. TBI is characterized by great heterogeneity in terms of etiology, mechanism, pathology, severity and treatment with widely varying outcomes. Worldwide the incidence of TBI is increasing due to the increased use of motor vehicle[2], physical assault and violence. Traumatic brain injury is a frequent cause of death and disability among the young adults[3]. The common causes of TBI are the road traffic accidents, falls, physical assault and violence, bullet and blast injury. Immediately after TBI, patients present with alteration of consciousness, memory loss, headache, confusion, nausea and focal neurological deficits. In the long term patients with TBI report cognitive impairment and neuropsychological symptoms such as behavioral and personality changes, depression and suicidal tendency, speech and gait abnormality[4,5]. For diagnosis of TBI, the American Congress of Rehabilitation Medicine defines TBI as any alteration of mental state at the time of accident. Alexander Luria studied injured soldiers during World War II and his rehabilitation work centered on focal brain injury and how it affected cognition, language and motor functioning[6,7].

TBI itself is divided into two separate but related categories: primary brain injury and secondary brain injury. Primary brain injury occurs at the time of trauma resulting directly from external mechanical forces transferred to intracranial contents. These include a combination of focal contusions and hematoma (SDH, EDH etc.) as well as shearing of white matter tracts (diffuse axonal injury) along with cerebral edema and swelling[8]. Focal cerebral contusions are the most frequently encountered lesions. Secondary brain injury results from a cascade of molecular mechanisms that are initiated at the time of the first contact and may sustain for hours or days if not prevented[9-12]. The most common causes of secondary brain injury are hypotension, hypoxia, raised intracranial pressure, pyrexia. TBI has traditionally been classified using injury severity score, the most common of which is the Glasgow Coma Scale (GCS)[13]. A GCS score of 13 to 15 is considered mild injury, 9 to 12 is considered as moderate injury and 8 or less as severe traumatic brain injury. Mild TBI is defined by loss or alteration of consciousness for up to 30 min after injury, a confused or disoriented state less than 24 hours, normal structural brain imaging on computed tomographic (CT)

1. **Lt Col Md Shohidul Islam**, MBBS, FCPS, Associate Professor of Surgery, AFMC, Dhaka (*E-mail:* dr.shohid@gmail.com) 2. **Maj Gen Md Fashiur Rahman**, *SPP, ndc,* MBBS, MPH, LLB, FCGP, MBA, MSS, PhD Fellow, Director General of Medical Services, Bangladesh Armed Forces 3. **Col Md Aminul Islam**, MBBS, MS (Neurosurgery), Head, Neurosurgery Center, CMH, Dhaka.

scanning and a Glasgow Coma Scale score of 13-15 which is commonly termed as concussion. Moderate/severe TBI is defined by a traumatically induced physiological disruption of brain function as manifested by either loss of consciousness for greater than 30 min, an initial GCS of 12 or less after 30 min or post-traumatic amnesia for greater than 24 hours.

Resuscitation and early management of TBI is a crucial stage, which influence mortality and morbidity. Early management is to be given by Advanced Trauma Life Support (ATLS) guideline. In particular, the prevention of secondary brain injury by correction of hypoxaemia and hypotension and rapid diagnosis and evacuation of an expanding intracranial haematoma, are the key determinants of outcome[14]. The intensive care management of TBI is complex and requires a coordinated and stepwise approach providing general intensive care support and interventions targeted to the injured brain[15]. For mild TBI, the mainstay of treatment is rest, observation for at least 24 hours[16] and targeted treatment of clinical symptoms. Hospital admission is recommended for patients with GCS<15, seizures, suspected or established depressed/ skull base fractures, focal neurological deficit, abnormal CT findings and co-morbid coagulopathy[14,17] Surgical treatment is indicated in patients with progressive neurological deterioration due to large or expanding EDH, SDH, obstructive hydrocephalus, depressed skull fracture. For moderate/severe TBI without surgical indications, the goal of treatment is to limit the likelihood of post-traumatic hypotension, hypoxia, both of which markedly increases mortality and morbidity by maintaining BP (systolic >90 mm Hg) and oxygenation (PaO_2 >60 mm Hg) in ICU[16,17].

Materials and Methods

This prospective, observational study was carried out from October 2013 to March 2017, in the department of Neurosurgery, Combined Military Hospital, Dhaka. A total of 675 patients of head injury with evidence of TBI were included in this study. Data were collected by a predesigned data collection sheet with appropriate ethical clearance and consent from legal guardians. The distribution and relationships of TBI were assessed with gender, age of patient, cause and type of trauma, GCS on admission, associated other injuries, time lapsed from trauma to hospitalization. All patients with TBI were initially diagnosed clinically by history and examination including GCS, level of consciousness, haemodynamic status, pupillary activity and immediate CT scan of brain and resuscitated according to Advanced Trauma Life Support (ATLS) guidelines. Those who required underwent surgical intervention and the rest are nursed conservatively in a dedicated neurosurgical critical care unit. Patients recovering from TBI underwent intensive rehabilitation therapy, physical therapy, occupational therapy, speech therapy. The outcome was measured after 72 hours using Glasgow Outcome Scales as follows: 1, 2 and 3 as poor outcome which included death, persistent vegetative state (unresponsiveness and unwareness), severe disability and Glasgow Outcome Scale 4 and 5 as good outcome which included recovery and moderate disability. Permanent motor and or sensory loss, loss of bowel & bladder control and speech loss required continued rehabilitative/ supportive care in rest of their life were considered as severe disability. Forgetfulness, amnesia, confusion, gait disturbances, incoordination and behavioral changes were considered as mild severity. In addition to return to normal or near normal, good recovery included independently living only.

Results

Incidence of TBI among the head injury patients was 47.03%. Common age group was 21-30 years (43.7%) and Male (66.55%) victims were more than female (33.44%). RTA was the leading cause (50.05%) of TBI followed by physical assault and violence (17.77%), fall from height (15.33%), contact sports (12%), bullet and blast injury (5%). Associated other injuries were present in 30% patients with TBI. Most patients (45%) had mild TBI and the most common pathophysiological cause of TBI was SDH (35%) (Table-I). About 35% patients was hospitalized by 1-2 hours, 36.4% patients by 3-4 hours, 15.2% patients arrived at hospital within an hour and 14% patients arrived after 4 hours (Table V). Surgical interventions were required in 307 cases (45%) mainly for SDH (35%) and EDH (27%) (Table-II).

Burrhole, craniotomy, craniectomy, elevation of depressed skull fracture and decompressive craniectomy were the common surgical interventions performed. Out of 675 patients with TBI, most patients (77%) had good outcome which included recovery (51.85%) and moderate disability (25.48%). The poor outcome was observed in 23% patients which included death (7.40%), persistent vegetative state (3.11%) and severe disability (12.14%)(Table-III) . The poor outcome was found directly related to the age of the patient and severity of the primary insult. The increased mortality rate, disability rate was found in patients with older age and severe primary insult recognized initially by low GCS (<8), loss of unconsciousness more than 24 hours, amnesia more than 7 days and by CT scan findings (severe TBI) and in those patients who received delayed resuscitative care and interventions. Among the patients with severe TBI (116) mortality rate was 42% (Table-IV).

Table-I: Causes, types, associated injuries, pathophysiology and severity of TBI

Characteristics		Frequency	Percentage
Causes of TBI (n=675)	RTA	338	50.05
	Assault and violence	120	17.77
	Fall from height	102	15.33
	Contact sports	81	12
	Bullet and blast injury	34	5
Types of head injury (n=675)	Intra-cranial injury	285	42.22
	Intra and extracranial injury	390	57.78
Associated injuries (n=202)	Maxillofacial injury	87	43
	Limb injury	42	21
	Chest injury	24	12
	Spinal injury	8	4
	Others	41	20
Pathophysiological cause (n=675)	SDH	235	35
	EDH	185	27
	Concussion	100	15
	Cerebral Contussion	95	14
	Diffuse axonal injury	40	6
	Sub-arachnoid haemorrhage	20	3
Severity of the TBI (n=675)	Mild	304	45
	Moderate	255	37
	Severe	116	18

Table-II: Time lapse between trauma and hospitalization and methods of patient transfer to tertiary care hospital (n=675)

Characteristics		Frequency	Percentage
Time lapse between trauma and hospitalization	< 1 hour	101	15.2
	1-2 hour	235	35
	2-3 hour	241	36.4
	3-4 hour	59	8.8
	> 5 hours	35	5.2
Methods of patient transfer to tertiary care hospital	Direct transfer (Helicopter/ Ambulance) to definitive care hospital	324	48
	Indirect transfer after resuscitation at primary care hospital (Helicopter/Ambulance)	351	52

Table-III: Distribution of patients required surgical intervention with their indications

Characteristics		Frequency	Percentage
Number of patients required surgical intervention (n=675)	Treated surgically	307	45
	Treated conservatively	368	55
Indications for surgical intervention (n=307)	SDH	170	55.4
	EDH	134	43.6
	Sub-arachnoid haemorrhage	3	0.98

Table-IV: Distribution of outcome of TBI patients (n=675)

Criteria	Frequency	Percentage	GOS	Outcome
Mortality	50	7	1	Poor (23%)
Persistent vegetative state	21	3	2	
Severe disability	82	12	3	
Moderate disability	172	25	4	Good (77%)
Recovery	350	51	5	

Discussion

A total number of 675 TBI patients were researched in this study. Head injury accounts for 3.01 percent of all Emergency and Casualty attendance patients. Incidence rate of traumatic brain injury among the head injury patients was 47.03%. The incidence of TBI was found to be high in young adult individuals (43.7%) which were observed in 21-30 years age group and majority are of male gender (66.55%) representing the leading cause of mortality and disability among the young and productive population. Maas AI et al[1] and Roozenbeek B et al[2] showed in their study that 25% and 29% young adults were the victims of TBI. Road Traffic Accident (50.05%) was the most common cause of traumatic brain injury which was related to the movement of the military vehicle, Armed Forces personnel and their relatives in both cantonment and civil area. had Associated other injury such as maxillofacial, limb injuries, chest injury were present in 30% patients which had significant negative effects on patient's outcome.

The most common pathophysiological cause of TBI was subdural haemorrhage(SDH) (35%). Next common casuses are EDH (27%), concussion (15%), cerebral contusion (14%), DAI (6%) and SAH (3%). In this study 45% patients had mild TBI, most of them were treated conservatively in a specialized neurocritical centre. Surgical interventions were required in 45% TBI patients mainly for the SDH, EDH or depressed skull fracture which had significant positive effect on patient's outcome. Craniotomy and craniectomy were the most commonly performed procedures. Outcome of a patient with TBI depends on multiple factors which includes age of the patient, severity of primary insult (GCS on admission), presence or absence of other major injury, adequacy of initial resuscitation, delay in getting initial resuscitation or definitive interventions which is greatly affected by time or distance to reach a hospital, availability of expertise and equipment facilities to diagnose and treatment, availability of neurocritical supportive care[17,18].

In this study 7% patients of TBI were died, 3% patients developed persistent vegetative state and 12% patients developed severe disability accounting for poor outcome (23%) and 51% patients recovered, 25% patients developed moderate disability accounting for good outcome (77%). Yattoo G H et al18 studied 547 patients of TBI at a tertiary teaching hospital in India with a mortality rate of 6.40% and they showed that the poor outcome was found in patients with older age, severe primary insult determined initially by low GCS at admission (<8), loss of unconsciousness more than 24 hours, amnesia more than 7 days and by CT scan findings, associated other injuries and in those patients who received delayed resuscitative care and interventions due to time distance to reach a trauma centre (time elapsed between trauma and hospitailsation). In our study, we also found these same correlations with the poor outcome. In our study, the mortality rate was 42% among the patients with severe TBI. The study conducted by Andriessen TM et al[19], Darnoux E et al[20] showed higher incidence of mortality (46% and 51% respectively) in patients with severe TBI (GCS <8 on admission). The association of age of the patient, severity of the TBI, mode of transfer of injured patient with poor outcome of TBI patients has also been shown by the studies[17,18]. Rehabilitation programme played an important role to improve quality of life who survived[20].

Conclusion

TBI was common among the young adults of male gender. The RTA was the leading cause of TBI reflecting the poor road safety and traffic rules implementation in a developing country. The major factors that influence the outcome of TBI patients include patient's age, severity of TBI, associated injuries, time lapse from trauma to hospitalization and adequacy of initial resuscitation. A timely diagnosis, adequate resuscitation and interventions to prevent secondary brain injury and neurointensive care were paramount which strongly affect the outcome. Organized trauma center, skilled manpower and rehabilitation programme can minimize mortality and disability from TBI.

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