Original contribution

Traumatic Brain Injuries and its Outcome at a Tertiary Care Hospital in Northwest Part of Bangladesh

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Traumatic brain injury (TBI) is a leading cause of death and disability globally as well as in Bangladesh; its incidences are growing with an increasing number of high-speed motor vehicles, more movement of the public and mechanization in industry. The aim of the study was to analyze the causes, risk factors and treatment outcomes of traumatic brain injuries in victims reported to emergency and casualty departments following intensive care with or without surgical intervention in a tertiary care hospital. This prospective type of observational study was conducted at the Neurosurgery ward of Rangpur Medical College Hospital, Bangladesh from March 2022 to February 2024. A total of 360 head injury patients with TBI were assessed with gender, age, cause, and type of trauma, Glasgow Coma Scale on admission, associated other injuries, time lapsed from trauma to hospitalization and care given. A total of 360 Cases (n=360) of TBI, male 273(n=273) and female 87(n=87) were included most common group was 16-30 years (45%) and Males (75.83%) victims were more than female (24.16%). Frequency percentage cause is RTA 190(52.7%) and intra-cranial injury (42.77%), Intra and extra-cranial injury 206(57.22%), pathophysiological cause (n=360), SDH 122(33.88%), EDH (28.33%), concussion (15.83%), cerebral contusion (14.16%), diffuse axonal injury (05%) and subarachnoid haemorrhage (2.77%). Traumatic brain injury was common among young adult males and RTA was the leading cause. Many factors influence the better outcome of TBI with reduced mortality and morbidity including the patient's age, the injury's severity, the time between TBI and the start of definitive treatment associated with other major injuries and facilities available for resuscitative care.

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Introduction

Traumatic brain injury (TBI), also known as an intracranial injury, is an injury to the brain that disrupts the normal functional activities of the brain caused by an external force like blunt trauma or penetrating injury, a form of acquired brain injury. TBI can be classified based on severity ranging from mild to severe traumatic brain injury. It is one of the most common causes of disability and death following trauma, particularly in low and middle-income countries (LMICs) like us. Traumatic brain injuries are losing their physical, mental, and intellectual performance which pushes the country and society toward a frustrating situation[1]. According to the report of the World Health Organization on road traffic injuries, approximately 1.19 million people die each year as a result of road traffic crashes, which has a bad impact on the economy of every country due to the loss of productive years to death and disability, the leading cause of brain damage in children and young adults. According to the Guardian, the country loses an estimated 1.2 billion pounds due to road traffic accidents per year, equivalent to 2% of GDP and all of the foreign aid that Bangladesh receives annually. According to UNICEF, roughly 38,000 children become orphans every year because of road fatalities.

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The incidence of TBI also varies by age, gender, region and other factors. Most of the world's fatalities on the roads due to RTA occur in most developing countries like Bangladesh, due largely to an increase in motor vehicle use faster than building up safety infrastructure road traffic injuries cause substantial economic losses to individuals, their families and to nations as a whole. TBI rates are higher in males. Men have twice as many TBIs as women do and have a fourfold risk of fatal head injury due to their job pattern and more external mobility. These losses arise from the expensive cost of TBI patients as well as lost productivity for those killed, who may be the only earning member of the family or disabled by their severe and major injuries, and for family members who need to take time to care for the injured as a Financial Burden[2]. TBI is one of the leading causes of death in Bangladesh; the annual incidence of head injury found was 814.8/100,000 people with a mortality rate of 23.39/100,000 population. Among the victims, about 67.3% and 32.7% were male versus female. Males are 2.05 times more at risk than females due to their job patterns. The three leading causes found were transport injury 30.6% followed by falls 26.2% and violence 14.9%[3]. The World Health Organization estimated that it kills over 21,000 people in the country annually despite no longer being perceived as unavoidable but largely preventable events[4]. Traumatic head injury is one of the major causes of death and disability as well as hospital admission in Bangladesh and RTA will become a major culprit[5]. Brain injuries involve contusions, intracranial injuries, skull fracture, bruising, hematomas, brain swelling, edema and hemorrhages[6,7] 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 multiple and various complaints like balance, motricity, headache, cognitive impairment, and neuropsychological symptoms such as behavioral and personality changes, anxiety, depression and obsessive-compulsive, substance abuse, dysthymia, Impact on mental health, loss of confidence, reduced quality of life and social and economic impact[8,9]. The diagnosis of TBI primarily focuses on any alteration of mental state at the time of the accident or even after the accident, sensory and motor examination with reflexes, associated cranial nerves, and other major injuries. In comatose patients, the examination consists of observing the patient closely and eliciting reflexes to assess the level of cerebral input[10]. TBI is any injury that disrupts normal functional activities when a sudden external physical assault damages the brain, a broad term that describes a vast array of injuries that happen to the brain. The damage can be focal or diffused and can manifest as any combination of cognitive, behavioral, motor, and sensory symptoms[11]. According to the Glasgow Coma Scale (GCS), Patients are classified as having mild TBI if GCS 13-15, moderate if GCS 9-12 and severe if GCS <9. Globally mild TBI accounts for 81.02% of injuries, moderate TBI for 11.04% and severe TBI for 7.95%[12]. The term 'moderate' itself is a misnomer. Mortality for patients with severe TBI is reported at a rate of up to 59.2%. For moderate TBI patients are 29.6%, among them[12] 75.0% of those deaths occur in patients with an initial GCS of 9-10. Regarding mild TBI the mortality accounts for 11.1%. TBI-related mortality is potentially dependent on age, gender, the mechanism of injury, severity of initial insult, level of consciousness, and the presence of other associated major injuries, cerebral contusions, epidural hematoma, or skull fractures with other co-morbidities[13]. In Bangladesh, the problem has become more acute over the last two decades, mainly due to increased vehicular traffic and poor maintenance on the road. The numbers of head injury cases are expected to increase further, due to urbanization, increased vehicular load and high-speed bikes. The analysis of the prognosis of head injury is crucial depending on the specialized care team involved in their management[14].

Methods

This prospective, observational study was carried out from March 2022 to February 2024 in the Department of Neurosurgery, Rangpur Medical College Hospital. A total of 360 patients with head injuries with evidence of TBI were included in this study. Data were collected by a predesigned data collection sheet with written informed consent from legal guardians. All patients with TBI were initially diagnosed clinically by history and examination including GCS, level of consciousness, hemodynamic status, pupillary activity and immediate CT scan of the brain and resuscitated according to Advanced Trauma Life Support (ATLS) guidelines as well as guidelines

of this hospital. Patients who require surgical intervention go for surgery and the rest are nursed conservatively in a dedicated critical care unit of a neurosurgical high-dependency unit. After competition of medical treatment patient underwent physiotherapy, speech therapy, rehabilitation, and occupation therapy to lead an independent life or back to the previous service life. The outcome was measured after 72 hours using Glasgow Outcome Scales as follows: 1, 2 and 3 as the poor outcome which included death, persistent vegetative state (unresponsiveness and unawareness), severe disability, and Glasgow Outcome Scale 4 and 5 as the 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 for the rest of their life were considered severe disability. In addition to returning to normal or near normal, good recovery included independent living only.

Inclusion criteria: i) Patients of feature of head injury with a history of trauma on the head, ii) Trauma on the head due to RTA and history of fall from height with low GCS, iii) Low GCS at scene or deteriorate during transfer to hospital or low on admission with symptoms of nausea and dizziness, iv) Patient symptoms of headache and vomiting and change of GCS and v) Patients with vomiting and altered level of consciousness.

Exclusion criteria: i) Patients are brought in dead, ii) Patients who died before the CT scan, iii) Arriving at the hospital 24 hours after trauma on the head.

Results

A total of 360 cases (n=360) of TBI, male 273 and female 87 were included in this study over 3 years of the study period, they were divided into 6 age groups, the most common group was 16-30 years (45.0%) and Male (75.83%) victims were more than female (24.17%).

Table I: Distribution by age (n=360)

Age Groups in Years	Frequency (n)	Percentage (%)
01-15	45	12.5
16-30	162	45.0
31-45	80	22.23
46-60	45	12.5
61-75	22	06.1
>75	06	1.67
Total	360	100

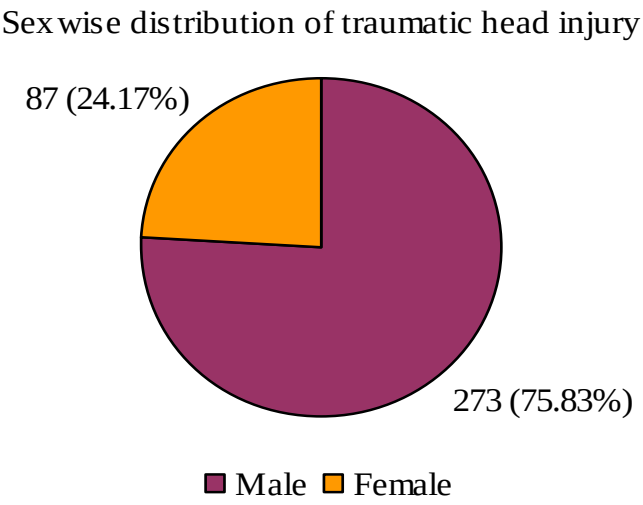

Figure l: Distribution by sex (n=360)

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

Etiological pattern		Frequency	
Categories	Subcategories	Categories	Subcategories
		190	52.78
	Motor Bike	89	46.84
	Car/Bus/Truck	58	30.52
	Pedestrian	38	20.0
	Train/others	05	2.64
Assault and violence		63	17.50
Fall from height		60	16.67
Contact sports		25	6.94
Bullet and blast injury		22	6.11
Types of Head Injury	Intra cranial injury	154	42.78
	Intra and extra-cranial injury	206	57.22
Associated Injured (n=152)		152	42.22
	Maxillofacial injury	70	46.05
	Chest injury	28	18.42
	Limb injury	19	12.50
	Spine injury	09	5.92
	Other injuries	26	17.11
Pathophysiology		360	100.0
	SDH	122	33.89
	EDH	102	28.33
	Concussion	57	15.83
	Cerebral contusion	51	14.17
	Diffuse axonal injury	18	05.00
	Subarachnoid haemorrhage	10	02.78

Characteristics Frequency Percentage Causes of TBI (n=360) RTA 190(52.78%), Assault and Violence 63(17.5%) Fall from height 60(16.67%) Contact sports 25(6.94%) Bullet and blast injury 22(6.11%). Types of head injury (n=360) Intra-cranial injury 154(42.78%) Intra and extra cranial injury are 206(57.22%). Associated injuries 152(42.22) among them maxillofacial injury 70(46.05%), Limb injury 19(12.5%), Chest injury 28(18.42%), Spinal injury 9(5.92%), Other injuries 26(17.11%), pathophysiological cause (n=360) SDH 122(33.89%), EDH 102(28.33%) Concussion 57(15.83%), cerebral contusion 51(14.17%), diffuse axonal injury 18(05.0%) and Sub-arachnoid haemorrhage 10(2.78%). Surgical interventions like Burr hole, craniotomy, craniectomy, the elevation of depressed skull fracture and decompressive craniectomy were commonly performed. Out of 360 patients with TBI, most patients (77.5%) had good outcomes which included recovery (50.56%) and moderate disability (26.94%). The poor outcome was observed in 22.5% of patients which included death (8.89%), persistent vegetative state (2.78%) and severe disability (10.83%) (Table IV). The poor outcome was found directly related to the age of the patient and the severity of the primary insult. The increased mortality rate and disability rate were found in patients with older age and severe primary insult recognized initially by low GCS (<8), loss of consciousness 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.

Table III: Distribution by GCS and required surgical intervention with indications

Characteristics	Severity	Frequency (n)	Percentage (%)
GCS (n=360)	3-8 (severe)	65	18.06
	9-12 (moderate)	84	23.33
	13-15 (mild)	211	58.61
Mode of Treatment	Surgically	242	67.22
	Conservatively	118	32.78
Indication of surgical intervention		154	42.78
	EDH	64	41.55
	SDH	87	56.50
	SAH	03	01.95

Severity of the TBI (n=360), mild 211(58.61%), moderate 84(23.33%) and severe 65(18.06%)

Table IV: Outcome of traumatic brain injury (n=360)

Criteria	Frequency (n)	Percentage (%)	GOS	Outcome
Death	32	8.89	1	
Persistent vegetative state	10	2.78	2	Poor (22.5%)
Severe disability	39	10.83	3	
Moderate disability	97	26.94	4	Good (77.5%)
Good recovery	182	50.56	5	

Discussion

This study was conducted in the Department of Neurosurgery, Rangpur Medical College Hospital, Rangpur, Bangladesh among 360 cases of traumatic head injury admitted to the emergency and casualty department. At present, in our modern busy life, TBI is considered a soundless epidemic in the post-industrialization and urbanization era. In developing countries like ours, males are the active earning persons for their families and in their third to fourth decades of life were the predominant victims of TBI, especially due to RTA, is their mobility for their daily activities and account for 60.0% of total victims. Similar observations were reported by the study of Patil et al.[15] which showed that most of the patients are at their active and productive age group are involved in RTAs, adding a serious economic loss to the community. In the demographic details of these 360 cases, 273(75.83%) are male and 87(24.17%) are female which is supported by M Srinivas et al.[16] and Suresh et al.[17] male and female ratio was found to be 3.13(75.83%):1(24.17%). Another study[15] shows male and female ratio of 4.6:1, which does not correlate with our observation probably due to the presence of more mobility of female garment workers in our community and domestic violence. The incidence of TBI was found to be high in young individuals 165(45.0%) in 16-30 years and 80(22.23%) in the 31-45 years age group is comparable to Lalit et al.[14] which represents the leading cause of mortality and disability among the young and reproductive population that similar to Islam MS et al.[18]. There are several causes of TBI. Bangladesh is the eighth-most populated country and most densely populated country with 1,342 people per km^2. The growing population and their mobility for daily activities in modern fast life increasing dependence on motorized vehicles and machinery, unhealthy competition among the vehicles, and reckless driving by drivers in violation of traffic laws are the major causes of increasing TBI cases. Modern highly demanding struggle life and competitive job patterns are also the reasons that lead to TBI. Our study showed that RTA is the commonest (52.78%:190 cases) cause of TBI among which motorbike accidents were in 46.84% (89) cases, bus/car/truck accidents were in 30.52% (58),

pedestrian accidents were in 20.0% (38) and accident by train and others were found in only 2.64% (5) cases, which is similar to the results of the study done by Patil et al.[15]. Motorbikes are very popular among the young age group, which less stable unprotected two-wheelers with less control system, unsafe lane changes, high speed, drooping, sudden stops and right-hand turns for hurried movements in densely populated very busy traffic areas in the city and rural area of Bangladesh causing a maximum of 46.84% (89) occurrence of the RTA. Bike crashes are more fatal than passenger car accidents due to Head-on Collisions. This may be due to high traffic density, lack of traffic rule awareness and negligence of safety measures (lack of helmet use). In the demographic details of these, types of head injury (n=360) intra-cranial injury 154(42.78%) intra and extra-cranial injury 206(57.22%). Associated injuries (n=152) maxillofacial injury 70(46.05%), limb injury 19(12.5%), chest injury 28(18.42%), spinal injury 9(5.92%), Others 26(17.1%) that corresponds with the study of Islam MS et al.[18]. All TBI patients are admitted through emergency and casualty and then shifted to male and female neurosurgery and are categorized based on GCS scores and findings of CT scan and magnetic resonance imaging of the brain in late cases to see details about brain damage. The most common pathophysiological cause of TBI was subdural haemorrhage (SDH) 122(33.89%). The next common causes are EDH 102(28.33%), concussion 57(15.83%), cerebral contusion 51(14.17%), DAI 18(5.0%) and SAH 10(2.78%). This result is near about to similar to Islam et al.[18]. Among them, mild TBI with a GCS score of 13 to 15 was in 58.16% (211), moderate TBI with a GCS score of 9 to 12 was in 23.33% (84) and severe TBI with a GCS score of 3 to 8 was 18.06% (65) of the cases. Similar findings were observed in some other studies Chakravarthi et al.[19] and Sukriti et al.[20]. Regarding treatment, this study showed that among the total admitted patients, 32.78% (118) patients were treated conservatively and the remaining 67.22% (242) patients underwent surgical intervention. Srinivas et al.[16] show 69.0% are managed surgically in the neurosurgical department while 20.0% are managed medically and management of the 11.0% cases is not available. This study has similarities with study. TBI patients mainly for the SDH, EDH or depressed skull fracture which had a significant positive effect on the patient's outcome. Here the patients who required surgical intervention underwent craniotomy and craniectomy was the most commonly performed. Regarding TBI outcomes of patients with morbidity and mortality depend on various factors like age of the patient, severity of primary injury, associated other injuries, adequacy of initial resuscitation, time to reach at hospital for getting definitive resuscitation or interventions, availability of expertise and equipment facilities to diagnose and treatment, availability of neurocritical supportive care. In this study factors that influence the outcome of TBI are also supported by Hawryluk et al.[21]. In this study 8.89% patients of with TBI died, 2.78% of patients developed a persistent vegetative state and 10.83% of patients developed severe disability accounting for poor outcomes (22.5%) and 51.56% of patients recovered, 26.94% of patients developed moderate disability accounting for a good outcome (77.5%). Yattoo G H et al.[22] studied 547 patients of TBI at a tertiary teaching hospital in India with a mortality rate of 6.40% and Sukriti et al. study had 8.64% mortality in total. 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 consciousness 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 hospitalization). In our study, we also found these same results with the poor outcome. In this study, the mortality rate was 42.0% among the patients with severe TBI which is supported by the study conducted by Andriessen TM et al.[23] showed the mortality rate low after mild (~1%), intermediate after moderate (up to 15.0%) and high (up to 40.0%) after severe TBI (GCS <8 on admission). The crucial factors like the age of injured patients, severity of initial insult, mode and duration of transfer of TBI patients related to the poor outcome have also been shown by the studies of Hawryluk et al.[21] and Yattoo G H et al.[22].

Conclusion

TBI is a major growing international global public health problem, the leading cause of morbidity,

mortality, disability and socio-economic losses in Bangladesh. It is observed that young men in the age group of 16 to 45 years are at an increased risk of brain injury, RTA was the leading cause, where motorbike accident is the commonest type of TBI, reflecting the poor road safety and traffic rules implementation in a developing country with alcohol consumption is a major risk factor. Proper steps like driver training, road maintenance, road visibility and lighting, Speed control, vehicle fitness checking, rigid traffic rule-following, compulsory wearing of crash helmets and seatbelts, road safety education for school children with use of child safety seats and strong legislation and law enforcement, all these can reduce RTAs and thereby reduce morbidity and mortality. At working place introducing protective headgear. Falls can be avoided in bathrooms and stairways by grab bars and handrails. Age of the patient, the severity of initial insult, presence or absence of associated major injuries, time lapse from trauma to hospitalization and adequacy of initial resuscitation at the spot of TBI, availability of expertise and equipment facilities to diagnose and treatment, availability of neurocritical supportive care all are influence the outcome of TBI patients. A timely diagnosis, adequate resuscitation, and interventions to prevent secondary brain injury and neuro-intensive care were paramount which strongly affected the outcome. Organized roadside trauma centre, advanced trauma life support training of service providers, rapid and appropriate triage, good referral system, and rehabilitation programs can minimize mortality and disability from TBI.

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