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Clinico-Epidemiological Study in Admitted Patients with Traumatic Brain Injury (TBI) in two selected Tertiary Care Centers in Dhaka City

Md. Joynul Islam[1], Md. Shafiqul Islam[2], Fariha Haseen[3], ATM Ashadullah[4], Md. Zahed Hossain[5], Md. Abdus Salam[6], Kalim Uddin[7], Mirza Md. Hafizur Rashid[8], Md. Golam Mustofa[9]

[1]Associate Professor, Department of Clinical Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [2]Associate Professor, Department of Neurosurgery, Dhaka Medical College Hospital, Dhaka, Bangladesh; [3]Associate Professor, Department of Public Health & Informatics, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh; [4]Associate Professor, Department of Neurosurgery-Spine, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [5]Professor, Department of Clinical Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [6]Associate Professor, Department of Neurotrauma, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [7]Assistant Professor, Department of Neurotrauma, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [8]Professor, Department of Clinical Neurosurgery, National Institute of Neurosciences & Hospital, Dhaka, Bangladesh; [9]Deputy Secretary, Ministry of Science & Technology, Dhaka, Bangladesh

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Abstract

Background: Traumatic brain injury is a significant public health problem. **Objective:** This study was aimed to clinical characteristics of traumatic brain injury patients by collection of detailed data on demography, clinical, injury patterns, co-morbidities, laboratory findings, and outcome of mild and moderate TBI. **Methodology:** This cross-sectional study was conducted from September 2019 to June 2020. Patients attending Department of Trauma Neurosurgery of National Institute of Neurosciences & Hospital, Dhaka, Bangladesh and Department of Neurosurgery of Dhaka Medical College Hospital, Dhaka, Bangladesh with a history of having mild or moderate traumatic brain injury and patients of 18 years and above irrespective of their sex were included in the study after informed written consent. The study included socio-demographic information and history of injury, mechanism of injury, information of physical examination, clinical features including cognitive change and co-morbidities were recorded. **Results:** A total number of 210 patients were included in this study. Motor vehicle related accident was 56.2% cases. About 21.4% cases of them were assaulted (physically), 12.9% cases of them were fall from the height. About 58.0% patients were normal cognition; 22.0% cases were mild cognitive impairment; 17.6% cases were moderate cognitive impairment and only 2.0% cases were severe cognitive impairment during discharge. Glasgow Coma Scale (GCS) during admission after resuscitation around 78.0% cases were moderate head injury and 22.0% cases were mild head injury. About 47.14% patients had single or multiple cerebral hemorrhagic contusion; 13.8% patients had traumatic subarachnoid hemorrhage; 8.6% cases had thin layer of subdural hematoma; 6.2% cases had epidural hematoma; **Conclusion:** Traumatic brain injury patients have mostly due to road traffic accidents and are presented with cerebral hemorrhagic contusion, subarachnoid hemorrhage and subdural hematoma *[Journal of National Institute of Neurosciences Bangladesh, July 2022;8(2):105-111]*

Keywords: Traumatic brain injury; Glasgow Coma Scale (GCS); Mini-Mental Status Examination (MMSE); World Health Organization

Correspondence: Dr. Md. Joynul Islam, Associate Professor, Department of Clinical Neurosurgery, National Institute of Neurosciences and Hospital, Sher-E-Bangla Nagar, Agargaon, Dhaka-1207, Bangladesh; **Email:** joynul67@gmail.com; **Cell No:** +8801711 135961; **ORCID ID:** https://orcid.org/0000-0001-6402-8668

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Introduction

Traumatic brain injury is a significant public health problem andit is a leading cause of disability and mortality in all regions of the globe despite advancements in prevention and treatments[1].Traumatic brain injuryis the main cause of one-third to one-half of all trauma deaths and the leading cause of disability in people under forty, severely disabling 15 to 20/100,000 populations per year[2]. The World Health Organization estimates almost 90.0% cases of deaths due to injuries occur in low- and middle-income countries[3].

Traumatic brain injury is a highly prevalent condition, affecting male and female of all ages and socioeconomic status worldwide[4-6]. The annual incidence of Traumatic brain injuryis estimated in 295 for 100,000 people. Most traumatic brain injuryoccurs in males and are mild4. Traumatic brain injuryis a major cause of mortality and morbidity in patients in the age between 18 and 45 years. Major cause of death and disability among young individuals in developed countries. In the world, the incidence of traumatic brain injuryhas risen sharply, mainly due to increased use of motorized vehicles in countries with low and middle income[7].

Traumatic brain injury can be mild, moderate, or severe, depending on the extent of the damage to the brain. Disabilities resulting from a traumatic brain injury depend upon the severity of the injury, the location of the injury, and the age and general health of the individual. Some common disabilities include problems with cognition, sensory processing, communication like expression and understanding, and behavior or mental health such as depression, anxiety, personality changes, aggression, acting out, and social inappropriateness[8-9].

Road traffic injuries are the leading cause (60.0%) of traumatic brain injury followed by falls (20.0% to 25.0%) and violence (10.0%). Almost half of the deaths in 10 to 25 years age group are due to injuries and traumatic brain injuryis the most common injury leading to death[10]. About 1.35 million people globally die every year in road traffic accidents (RTA), and more than one-fourth of these fatalities are estimated to happen in South Asia. The World Health Organization (WHO) and the World Bank have noted that, by 2020, deaths from RTAs would become a main cause of mortality in many countries[11]. The number of road traffic deaths continues to rise steadily from 1.15 million in 2000 to 1.35 million and of the 56.9 million deaths worldwide, road traffic injuries account for about 2.37% and are the eighth cause of global death[12-13].

There has been an alarming rise in road traffic accidents (RTAs) in Bangladesh over the past few years, which has become a national problem. Every day about eight people die in RTAs, but the actual rate of fatality is likely to be higher. The number of accidents has increased by 43.0% between 1982 and 2000, while the number of fatalities has increased by around 400% within the same period1.It increases more on the eve of festivals. In the last 21 years 84 thousand road traffic accidents occurred, 56 thousand people died and 63 thousand injured[14]. At least 5227 people were killed and 6953 injured in 4702 road accidents across the country, with accompanying increased healthcare costs for Bangladesh[11]. Road traffic accidentsalone costs 1.0% cases, 1.5% cases and 2.0% cases of the gross national product (GNP) of low-, middle, and high-income countries respectively. Bangladesh loses 1.2 billion pounds per year due to road traffic accidents, which is equivalent to 2.0% of GDP and all of the foreign aid it receives annually[11].

Patients with mTBI may experience cognitive deficits in the first hours following the trauma[15-16]. It has been reported that at 3 to 5 days after injury, patients with traumatic brain injury performed significantly worse compared to orthopedically injured patients and healthy controls in different cognitive tasks, such as immediate recall, short-delayed recall, long-delayed recall, attention, working memory, processing speed and other executive functions[17]. Importantly, some deficits may be detected even 1 year after the trauma[18].

Hospital-based studies are important for two reasons to identify attributes associated with disease and the population that seeks care for their neurological symptoms; and to improve care outcomes. In Bangladesh, information about the hospital-based epidemiology of neurological and neurosurgical disorders is extremely limited[19]. In Dhaka city, Dhaka Medical College Hospital (DMCH) and National Institute of Neurosciences & Hospital (NINSH) are the country's largest public hospitals that have to face a huge number of neurotrauma patients every day.

The importance of continuous evaluation of traumatic brain injury-related epidemiology and clinical findings are emphasized in this study. This study was aimed to characteristics, and clinical characteristics of Traumatic brain injury patients admitted to the Neurosurgery ward, Dhaka Medical College Hospital and National Institute of Neurosciences by the collection of detailed data on demography, clinical, injury patterns, co-morbidities, laboratory findings, and outcomes of mild and moderate traumatic brain injury[8]. This study was aimed to the clinical characteristics of traumatic brain injury patients by the collection of detailed data on demography, clinical, injury patterns, co-morbidities, laboratory

findings, and outcomes of mild and moderate traumatic brain injury.

Methodology

Study Settings and Population: The cross-sectional study was conducted from September 2019 to June 2020 to provide detailed information on traumatic brain injury-related variables and clinical characteristics.The study was approved by the Institutional Ethics Committee of National Institute of Neurosciences and Hospital. Patients attending Department of Trauma Neurosurgery of National Institute of Neurosciences & Hospital, Dhaka, Bangladesh andDepartment of Neurosurgery of Dhaka Medical College Hospital, Dhaka, Bangladesh with a history of having mild or moderate traumatic brain injury and patients of 18 years and above irrespective of their sex were included in the study after informed written consent. Patients, who did not give consent and having severe head injury (GCS <8) and patients with associated major abdominal, thoracic or bony injury were excluded from the study.

Study Procedure: Using a pretested questionnaire, the data was collected from study participants. We obtained history including socio-demographic information and history of injury (duration, site etc.), mechanism of injury, information of physical examination, clinical features including cognitive change and co-morbidities were recorded. The examination included general examination, systemic examination for any other injuries. For evaluation of head injury at the time of admission, GCS, neurological deficits were assessed. Laboratory investigations were ordered as necessary. X-rays were done as per injuries and trauma protocol. Non contrast computed tomography (NCCT) of head was ordered on admission of all patients and repeated as per need. Outcome of respondents was assessed at the time of discharge using Mini Mental Score Test.

Statistical Analysis: The data were presented as mean and frequency distribution and analyzed using Chi-square or Fisher's exact test, with p value < 0.05 as statistically significant.

Results

In the present study, we included a total of 210 patients. In the age section we found that 28.6% of respondents were 18 to 27 years. About 21.0% respondents were 28 to 37 years old, 18.6% of patients were 38 to 47 years old, 13.8% of them were 48 to 57 years old and 18.1% rest of the respondents were 58 years and above. The mean age of the patients was 40.39±17.43 years (Table 1).

Table 1: Age Distribution among the Study Population (n=210)

Age Group	Frequency	Percent
18 To 27 Years	60	28.6
28 To 37 Years	44	21.0
38 To 47 Years	39	18.6
48 To 57 Years	29	13.8
More Than 58 Years	38	18.1
Total	**210**	**100.0**
Mean±SD	40.39±17.43	

Among them 91.4 % were males and 8.6 % were females (Table 2).

Table 2: Gender of the Respondents (n=210)

Gender	Frequency	Percent
Male	192	91.4
Female	18	8.6
Total	**210**	**100.0**

Education Qualification: About 39.0% of patients completed their primary education level, 26.7% of patients did not know about reading and writing, 17.1% of them completed SSC level, 11% of respondents were university graduate, 5.2% respondents were completed HSC level and 1% of patients were categorized as others where we found that those patients completed their education level (Hafez) from madrasa (Qaumi) (Table 3).

Table 3: Distribution of Study Population according to Education (n=210)

Education	Frequency	Percent
Illiterate	56	26.7
Primary level	82	39.0
SSC	36	17.1
HSC	11	5.2
University Graduate	23	11.0
Others	2	1.0
Total	**210**	**100.0**

Occupation: About 17.1% cases of patients involved with the business, 15.2% cases of them are service holder, 12.4% cases of patients involved with others occupation. About 10.5% cases of them unemployment respondents, 9.5% cases of patients were students, 9.5% cases of them were farmer, 8.6% cases of patients were farmer, 4.6% cases of them brick masons, 4.6% cases of them day labour. About 43% cases of them were involve with teaching and 3.3% cases of respondents are housewife (Table 4).

Table 4: Distribution of Study Population according to Occupation (n=210)

Occupation	Frequency	Percent
Service	32	15.2
Business	36	17.1
Teaching	9	4.3
Students	20	9.5
Unemployment	22	10.5
Farmer	20	9.5
Driver	18	8.6
Brick mason	10	4.8
Day labor	10	4.8
Housewife	7	3.3
Others	26	12.4
Total	**210**	**100.0**

Time of Injury occurred: About 70.5% injury occurred 6.0 am-6.0pm, 24.3% injury occurred 7.0 pm-5.0 am and 5.2% respondent didn't remember when the injury occurred (Table 5).

Table 5: When the Injury Happened

Response Category	Frequency	Percent
6.0 am to 6.0pm	148	70.5
7.0 pm to 5.0am	51	24.3
Not remember	11	5.2

Mode of the injury: A large number of patients injured by motor vehicle related accident and it was 56.2%. 21.4% of them were assaulted (mentally or physically), 12.9% of them were fall from the height, 9.5% of them had others cases (Table 6).

Table 6: Mode of the injury (n=210)

Mode of Injury	Frequency	Percent
Motor vehicle accident	118	56.2
Fall from height	27	12.9
Assault	45	21.4
Others	20	9.5
Total	**210**	**100.0**

Standardized Mini Mental Status Examination was done to evaluate the cognitive status:Mini Mental-State Examination (MMSE) test evaluates global cognitive status. It includes tasks that evaluate temporal and spatial orientation, memory, attention, naming, following verbal and written commands, writing and copy. It was found that 58% of patients were Normal cognition, 22% were Mild cognitive impairment, 17.62% were Moderate cognitive impairment and only 2% were severe cognitive impairment during discharge.In Dhaka city, Dhaka Medical College Hospital (DMCH) and National Institute of Neurosciences & Hospital (NINSH) are the country's largest public hospitals that has to face a huge number of neuro trauma patients every day (Table 7).

Table 7: MMES - Standardized Mini Mental Status Examination (n=210)

MMES	Frequency	Percent
Normal cognition (24-30)	123	58.57
Mild cognitive impairment (19-23)	46	22.00
Moderate cognitive impairment (10-18)	37	17.62
Severe cognitive impairment (≥ 9)	4	2.00
Total	**210**	**100.0**

Glasgow Coma Scale (GCS) during Admission after Resuscitation: Around 78.0% cases were moderate head injury and 22.0% cases were mild head injury. The severely injured patients were not interviewed (Table 8).

Table 8: Glasgow Coma Scale (GCS) during Admission after Resuscitation (n=210)

Glasgow Coma Scale (GCS)	Frequency	Percent
Mild head injury (13-15)	164	78.0
Moderate head injury (9-12)	46	22.0
Severe head injury (≤ 8)	0	0.0
Total	**210**	**100.0**

Comorbidity: About11.4% respondent had others co-morbidity, 25.2% had no any co-morbidity and 63.3% said they didn't know about any co-morbidity (Table 9).

Table 9: Other Comorbidity among Study Population (n=210)

Co-Morbidity	Frequency	Percent
Yes	24	11.4
No	53	25.2
Don't know	133	63.3
Total	**210**	**100.0**

CT Brain Findings in Traumatic Brain Injury Cases: In CT scan of brain, 47.14% patients had single /multiple Cerebral Hemorrhagic contusion, 13.8% patients had traumatic subarachnoid hemorrhage, 8.57% had thin layer of subdural hematoma, 6.195 had epidural hematoma 4.28% had compound depressed skull fracture and 20.0% had normal CT scan finding with extracranial soft tissue swelling.Epidural Hemorrhage 13(6.19%), thin subdural hemorrhage 18(8.6%), subarachnoid hemorrhage 29(13.8%), cerebral hemorrhagic contusion 99(47.14%),depressed

skull fracture 9(4.28%), normal CT-scan with extracranial soft tissue swelling 42(20.0%) cases (Table 10).

Table 10: Other Comorbidities of the Respondents (n=210)

Other Co-Morbidities	Frequency	Percent
Hypertension	12	5.7
Diabetes	7	3.3
Kidney Disease	4	1.9
Heart Disease	8	3.8
Drug abuse	1	0.5
I do not know	134	63.8
No disease	52	24.8
Other	2	.95

Diagnosis: About 71.4 % of patients who felt moderate head injury, another 23.8% of respondents had mild head injury, 4.3% of them had compound depressed fracture in their skull and rest 5.0% of the respondent's cases appeared other diagnosis (Table 11).

Table 11: Diagnosis of the Study Population (n=210)

Diagnosis	Frequency	Percent
Mild Head Injury	50	23.8
Moderate Head Injury	113	53.8
Skull Fracture	9	4.3
Severe Head injury	37	17.6
Other	1	0.5
Total	**210**	**100.0**

Discussion

The most common age group which is vulnerable to traumatic brain injuryis between 18 and 27 years which accounts to about 28.6% followed by 28 to 37 years of age group which accounted for 21.0% and between 38 to 47 years age group which accounted for13.8%. According to this study, traumatic brain injurypredominated in young men in the form of mild and moderate traumatic brain injuryand mostly occurred due to RTAs. A very large number ofpatients with mild or moderate traumatic brain injury were being admittedto NINSH and DMCH and these admissions werenot affected with seasonal variation. These results canalso be interpreted in the context of a very low degreeof public health awareness about vehicular trauma, decreased legislation regarding violations for speeding, jumping red lights, restraining devices, helmets, anddrink-driving and road conditions.

Similar statistics were observed in several epidemiological studies available in the literature[20]. Such a fact is attributed to a greater exposure of male individuals to risk factors for traumatic brain injurysuch as accidents with motor vehicles and violence. In general, the number of men with access to automobiles is higher than the number of women, and more men work away from home than women, thus being more exposed to risk conditions. Also, the higher incidence of traumatic brain injuryin male individuals is related to locations with higher urban violence rates[21].

Das et al[22] found, males in their third and fourth decades of life were the predominant victims of TBI, specially RTA, as they are out for their daily activities and account ~60% of total victims. Similar observations were reported by the study of Patil et al, which showed that the people in their most active and productive age group are involved in RTAs, adding a serious economic loss to the community[21].

The male and female ratio was 10.6:1, and this figure was also observed in other studies of the world including neighboring countries like India. Nath et al[23] also found that males contributed to a major part of the fraction amongst the injured (98.0%), and most patients (36.0%) were in 3rd decade of their life. Das et al[22] also found, male-to female ratio was found to be 2.57(72%):1 (28%). Another study[19] shows male-to-female ratio of 4.6:1, which does not correlate with our observation probably due to presence of more female workers like garment workers and day laborers in the community. Khan and colleagues[24] studied the epidemiologic profile of patients with TBI admitted to a trauma center in Jaipur, India and found 84.6% were males, with an overall mean age of 36 years.

In addition, the most common mode of injury in this study was RTAs. Similar observations were made by Khan et al[23]and Kamal et al[1]. However, being a world's largest youthful country, this study indicated that road traffic injuries are the leading cause of mild and moderate traumatic brain injury followed by assault and falls. Almost similar distribution was reported in various parts of the country as well as in other parts of the world.Das et al[22] found that RTA is the commonest (58.3%) cause of traumatic brain injury. Fall from height scored 25.0% following assaults was in 15.3% cases.

About 70.5% mild or moderate traumatic brain injuryhas occurred during 0600to 1800 hours[24]. As the majority of these injuries were due to RTA, it could be due to increased movement,greater speeds of vehicles, and rush for returning destinations. Cranial CT-scan is the most frequently performed radiological investigation in developed countries. Stein and Ross[27] recommended routine and immediate cranial CT-scan scanning of all

head injury patients who have lost consciousness and were amnesic, even if all other physical findings were normal. They reported a high risk of intracranial lesions (12.9%) in mild head injury. In subsequent prospective studies[24].

GCS score at the time of admission play a vital role in selecting the type of management procedure. There are 49.5% in mild group, 28.5% in moderate group[8]. Das et al[22] found on admission, all traumatic brain injurypatients are categorized on the basis of GCS scores Among them, mild traumatic brain injurywith GCS score 13 to 15 was in 60.0%, moderate traumatic brain injurywith GCS score 9 to 12 was in 25.0%. The incidence of mild traumatic brain injurywas 82.4% (84/102), while moderate traumatic brain injurywas observed in 2.0% (2/102), and severe TCI in 15.6% of the patients (16/102), in agreement with the study developed by Bruns and Hauser[25], where mild traumatic brain injuryincidence represented 80.0% of all their cases, while moderate and severe traumatic brain injury represented 10.0% cases each.

In another study, among alterations associated with mild traumatic brain injury, subgaleal hematomas were present in 66.6% (56/84) of the cases and craniofacial fractures in 28.5% (24/84). Some authors have reported that the most frequent lesions in mild TBI were subgaleal and palpebral hematomas, fractures and cerebral contusions, others described craniofacial fractures as the most frequent lesions, and one study demonstrated the prevalence of cerebral contusions (26.8%), extradural hematomas (6.8%), subarachnoid hemorrhage (5.7%) and subdural hematomas (4.4%) in patients with mild traumatic brain injury[26].

Das et al[22] found on the basis of CT-scan of head, diagnoses of traumatic brain injury were AEDH in 42.3% (1,974) cases, depressed skull fracture in 28.9% cases, ASDH in 12.3% cases, brain contusion in 10.20% (476) cases, and SAH or combination in 6.34% (296) cases of the total study population. It was found that 58.0% patients were normal cognition, 22.0% cases were mild cognitive impairment, 17.62% cases were moderate cognitive impairment and only 2.0% were severe cognitive impairment during discharge. Khan and colleagues[23] found cognitive dysfunction in a significant percentage of people with mTBI, especially in general cognitive ability (26.4%), learning memory (22.6%), and immediate memory (18.9%). Neuropsychological measures at the acute phase were also significantly associated with changes in white matter integrity in brain regions such as the splenium of corpus callosum and cingulum[23]. A more recent study showed impairment in selective attention/inhibitory control, divided attention, and working memory in acute mTBI (<7 days). These deficits were associated with gray matter morphological changes. Taken together, these studies reinforce our findings by providing evidence of impairment in several cognitive domains in the acute phase of mTBI[4].

It is worth mentioning that other characteristics such as baseline GCS may also influence traumatic brain injury-associated cognitive impairment. Another study found that patients with GCS of 15 and abnormal findings on CT-scan presented significant impairment in episodic memory and functional outcome.Cognitive performance was even more impaired in patients with GCS 13-14 and abnormal CT-scan findings, with significant deficits in episodic memory, attention, inhibitory control, cognitive flexibility, processing speed, motor performance, verbal intelligence, and functional outcome[19]. In sum, it has been found that patients with mTBI present cognitive deficits at the acute stage (<24 h), mainly in episodic memory and executive function. Factors such as LOC and previous traumatic brain injury seem to have a minor influence during this period. On the other hand, factors such age and years of education may influence cognition, with younger ages and higher education level playing protective roles[4].

Conclusion

This is the first study of its kind from Dhaka city that gave the epidemic profile of head trauma in 2 (two) selected hospitals of Dhaka city, Bangladesh. Most of the injuries occurred due to RTAs, more common among the economic productive age group and mostly in males. Knowledge about the causes, pattern, and distributions about TBI patients from this study will be extremely helpful in policymaking, research, health management, and rehabilitation at the national level in Bangladesh and other developing nations. Further studies to identify which mild head injury patients are at higher risk of significant cerebral injury are warranted in order to optimize its prevention.

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