FACTORS ASSOCIATED WITH TRAUMATIC BRAIN INJURY IN PATIENTS PRESENTING TO INTENSIVE CARE UNIT OF HAYATABAD MEDICAL COMPLEX PESHAWAR, PAKISTAN

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ABSTRACT

OBJECTIVES

This study aimed to investigate the correlation between falls, motor vehicle accidents, and sports-related injuries with occurrences of traumatic brain injury. Additionally, the research aimed to examine the relationships among age, gender, and occupational factors in traumatic brain injury.

METHODOLOGY

A cross-sectional study was conducted in the intensive care unit of Hayatabad Medical Complex in Peshawar. A purposive sampling technique, accompanied by a structured questionnaire, was employed to collect data. The Chi-square test was applied with the type of group (CT scan findings of TBI) as the outcome variable, while all other independent variables were considered. Data analysis was performed using SPSS version 22.

RESULTS

Most patients with extradural hematoma were male (29, 24.6%, p-value 0.59), primarily aged 15-29, with 16 (33.3%, p-value 0.09) identified as students. Notably, road traffic accidents affected 21 patients (30.4%, p-value 0.03), mainly in the frontal brain area. Vital signs showed 21 patients (28.0%, p-value 0.88) with low blood pressure and 25 (36.8%, p-value 0.08) with low respiratory rates. Most had a GCS score below 8 (25 patients, 30.9%, p-value 0.20), with many (44 patients, 32.6%, p-value 0.007) having reactive pupils and no prior alcohol use. Additionally, 45 patients (27.3%, p-value 0.02) were not wearing protective gear, 40 (31.3%, p-value 0.17) reported headaches and dizziness, 27 patients (42.9%, p-value 0.10) took over 90 minutes to seek care, and 33 patients with multiple findings (35.9%, p-value 0.009) required invasive ventilation.

CONCLUSION

TBI was common in males who had a history of road traffic accidents and their CT scan finding shows most of the patients had extradural Hematoma with severe traumatic brain injury.

KEYWORDS: *Traumatic Brain Injury, Glasgow Coma Scale, Extradural Hematoma, Computed Tomography*

INTRODUCTION

Injury is one of the top five causes of mortality and disability worldwide, making it a serious public health concern.[1] Traumatic brain injury (TBI) is the primary cause of mortality, disability, and cognitive impairment in young people globally.[2] The term "alteration in brain function or other evidence of brain pathology, caused by an external force" refers to traumatic brain injury (TBI).[3] Traumatic brain injury (TBI) is a non-congenital brain injury caused by an external mechanical force that can affect cognitive, physical, and psychosocial abilities either permanently or temporarily. Around the world, traumatic brain injury (TBI) is a significant cause of death and disability for people of all ages. The burden of TBI is highest in low- and middle-income countries (LMICs) because these nations have high rates of risk factors and inadequate health systems for providing both acute and long-term care. The increased usage of motor vehicles, especially in developing countries, is leading to an increase in the incidence of traumatic brain injury (TBI), which is on the rise globally. The increasing usage of motor vehicles, physical assault, and violence are contributing factors to the global rise in TBI incidence. Among young people, traumatic brain injury is a common cause of mortality and disability. Traffic accidents, falls, physical attack, violence, and explosion and gunshot injuries are the most common causes of traumatic brain injury (TBI). Patients often experience altered consciousness, focal neurological impairments, headaches, nausea, and confusion right after a traumatic brain injury. The American Congress of Rehabilitation Medicine defines a traumatic brain injury (TBI) as any change in mental state that occurs at the moment of an accident. After studying wounded troops in World War II, Alexander Luria focused his rehabilitation efforts on focal brain injury and its effects on language, motor skills, and cognition. A traumatic brain injury is classified as mild if the GCS score is between 13 and 15, as moderate if it is between 9 and 12, and as severe if it is 8 or lower.[4] According to a retrospective study carried out at eight level 1 trauma centres in the western United States, the patients admitted to ICU were only 5% their GCS score was 15 and they had mild TBI.[5] About 25% of patients with traumatic brain injuries who are hospitalized in hospitals pass away within six months of the accident.[6] Worldwide, traumatic brain injuries (TBIs) affect about 50 million individuals annually, and half of all people are expected to experience one or more TBIs in their lifetime.[7] The inaugural Lancet Neurology Commission on TBI emphasized the massive public health burden caused by TBI.[8] According to the World Health Organization's (WHO) global burden of injury estimation, injuries are among the top ten causes of mortality globally. Among them, TBI is responsible for about 30% of injury-related fatalities and is the main cause of death and disability. Traumatic brain injury (TBI) is the leading cause of mortality and disability in the United States of America (USA).[9] More than 2.8 million TBI cases were reported annually, with a 2% fatality rate(10). Over the past forty years, advancements in intensive care unit (ICU) and prehospital resuscitation have reduced mortality by 12% and raised positive outcomes by 6%, respectively.[2] There is evidence linking the quality of life (QOL) of TBI survivors to demographic variables such as age, marital status, and occupational status. A new study that included 337 adult TBI patients looked at community integration and quality of life from one to more than twenty years following the injury. The findings showed a strong connection between perceived QOL and employment. Individuals with full- or part-time employment reported greater quality of life scores than those without employment.[11] At roughly three years after the injury, 25 interviews were performed with nine TBI participants and sixteen closes-others (CO) of TBI participants (note: These close relatives of 16 other TBI participants were their spouses or other family members) the primary leading factor for injury was car accident (40%) and was followed by falls (16%), pedestrian collisions (16%), motorcycle crashes (12%), assaults (12%), and other sources (4%).[12] The TBI severeness was defined as a GCS score of 3-8 and was considered severe in 2804 (21%) cases, moderate (GCS score of 9-12) in 2930 (22%) cases, and mild (GCS 13-15) in 7404 (56%) cases. The average GCS score was 13.[13] A record of the mechanism of injury was kept for 329 individuals. Among the 329 patients, attack with a stick accounted for 124 cases, or 37.7% of all injuries. 64 patients (19.5%) suffered from falls, whereas 103 patients (31.3%) had head injuries as a result of RTAs. Of the victims of RTAs, 24 (23.3%) were car occupants and 46 (44.7%) were pedestrians. Patients vital signs were evaluated per how they arrived. 50 (34.7%) of the 144 patients who arrived by ambulance and had documented vital signs had low blood pressure or low oxygen saturation. From the patient charts, computed tomography (CT) results for 320 individuals were obtained. The primary finding from which the patients' treatment plans were developed was the basis for recording the CT findings. In most cases, depressed skull vault fractures (DSFs) were noticed. 51 patients (15.9%) developed acute epidural hematoma (AEDH), while 94 patients (29.4%) had DSFs. 42 patients (13.1%) had a chronic subdural hematoma. 12 individuals (3.8%) experienced an acute subdural hematoma. Of the patients, 38 (11.9%) had contusions.[14] To identify the most common associated factors of head injuries such as falls, sports injuries and car accidents to inform prevention strategies and to reduce the relevant disease burden in the community. The objective of the study is to determine the association of falls, motor vehicle accidents and sports injuries with Traumatic brain injury, and to find the association of age, gender and occupation with Traumatic brain injury.

METHODOLOGY

This cross-sectional study was carried out at Hayatabad Medical Complex (HMC) in Peshawar, where all the patients suffering from Traumatic brain injury in the intensive care unit of Hayatabad Medical Complex were selected. Using Open Epi an online tool for sample size calculations, the total sample size was 174 with an anticipated frequency of 13% by keeping 95% confidence interval and 4% margin of error. A purposive non-probability sampling technique was used. Selected patients were admitted to the intensive care unit (ICU) for Traumatic brain injury in Hayatabad Medical Complex, Peshawar. Written and oral consent was taken from the attendants of the selected patients. They were guided for the study objectives and confidentiality of the data. Inclusion and exclusion criteria were strictly followed to avoid biases. An ethical approval (Approval No: 1989) was taken from the ethical committee of Hayatabad Medical Complex (HMC) Peshawar, Pakistan. SPSS version 22 was used for data analysis. Numerical variables were presented in the form of mean and standard deviation while categorical variables were presented in the form of frequency and percentages. Chi-square tests were applied by taking the type of group (CT scan finding of TBI) as the outcome variable with all other independent variables. A significant p-value of ≤ 0.05 was taken as significant.

RESULTS

Table 1a: Descriptive Statistic of a Categorical Variable

Variable	Categories	Frequency	%age
Age of the patient in categories	15-29	80	46
	30-44	59	33.9
	45-59	22	12.6
	60-74	12	6.9
	>74	01	0.6
Gender	Male	118	67.8
	Female	54	31
	Transgender	02	1.1
Occupation	Housewife	42	24.1
	Teacher	13	7.5
	Student	48	27.6
	Healthcare worker	07	4.0
	Labour	34	19.5
	Business	27	13.2
	Other	07	4.0
Injury Pattern	Road traffic accident	69	39.7
	History of fall	49	28.2
	Sport injury	16	9.2
	Blast injury	02	1.1
	Assault	15	8.6
	Being stuck by an object	15	8.6
	Other	08	4.6
Location of Injury	Frontal	44	25.3
	Temporal	27	15.5
	Parietal	23	13.2
	Occipital	34	19.5
	Multiple locations	46	26.4
CT Scan Finding of TBI	Subdural Hematoma	24	13.8
	Extradural Hematoma	46	26.4
	Subarachnoid Hemorrhage	23	13.2
	Cerebral Contusion	37	21.3
	Multiple finding	44	25.3
GCS Score or Severity of Injury	Mild	22	12.6
	Moderate	71	40.8
	Severe	81	46.6
Alcohol Use before Injury	Yes	07	4.0
	No	167	96
Use of Protective Gear, Helmet or Seatbelt at The Time of Injury	Yes	09	5.2
	No	165	94.8

Table 1b: Descriptive Tables for Continuous Variable

Variable	Mean	Standard deviation	Min-Max
Age in years	32.86	14.11	15-75
Total household income	52040.23	40064.30	10000-300000
Time taken to reach initial health care setting after injury	159.41	263.19	5-2040

Table 2: Comparison of different CT scan findings of TBI with other associated factors

Variable	Categories	Subdural Hematoma	Extradural Hematoma	Subarachnoid Hemorrhage	Cerebral contusion	Multiple finding	P-Value
Age	15-29	11(13.8%)	24(30.0%)	07(8.8%)	19(23.8%)	19(23.8%)	0.69
	30-44	08(13.6%)	14(23.7%)	08(13.6%)	11(18.6%)	18(30.5%)	
	45-59	02(9.1%)	07(31.8%)	05(22.7%)	04(18.2%)	04(18.2%)	
	60-74	03(25.0%)	01(08.3%)	03(25.0%)	03(25.0%)	02(16.7%)	
	>74	0(00.0%)	0(00.0%)	0(00.0%)	0(00.0%)	01(100.0%)	
Gender	Male	16(13.6%)	29(24.6%)	19(16.1%)	25(21.2%)	29(24.6%)	0.59
	Female	07(13.0%)	17(31.5%)	04(07.4%)	12(22.2%)	14(25.9%)	
	Transgender	01(50.0%)	0(00.0%)	0(00.0%)	0(00.0%)	01(50.0%)	
How did the injury occur	RTA	08(11.6%)	21(30.4%)	07(10.1%)	14(20.3%)	19(27.5%)	0.03
	History of fall	07(14.3%)	18(36.7%	07(14.3%)	09(18.4%)	08(16.3%)	
	Sport injury	03(18.8%)	02(12.5%)	01(6.3%)	03(18.8%)	07(43.8%)	
	Blast injury due to explosion	01(50.0%)	0(00.0%)	01(50.0%)	0(00.0%)	0(00.0%)	
	Assault	04(26.7%)	0(00.0%)	01(6.7%)	05(33.3%)	05(33.3%)	
	Being stuck by an object	01(6.7%)	04(26.7%)	04(26.7%)	01(6.7%)	05(33.3%)	
	Other	0(00.0%)	01(12.5%)	02(25.0%)	05(62.5%)	0(00.0%)	
Location of injury	Frontal	06(13.6%)	14(31.8%)	03(6.8%)	13(29.5%)	08(18.2%)	0.13
	Temporal	05(18.5%)	10(37.0%)	04(14.8%)	02(7.4%)	06(22.2%)	
	Parietal	04(17.4%)	07(30.4%)	04(17.4%)	05(21.7%)	03(13.0%)	
	Occipital	06(17.6%)	07(20.6%)	07(20.6%)	07(20.6%)	07(20.6%)	
	Multiple locations	03(6.5%)	08(17.4%)	05(10.9%)	10(21.7%)	20(43.5%)	
	High	03(10.0%)	05(16.7%)	05(16.7%)	07(23.3%)	10(33.3%)	
Severity of TBI (GCS) score	Mild	05(22.7%)	08(36.4%)	02(9.1%)	06(27.3%)	01(4.5%)	0.20
	Moderate	10(14.1%)	21(29.6%)	11(15.5%)	11(15.5%)	18(25.4%)	
	Severe	09(11.1%)	17(21.0%)	10(12.3%)	20(24.7%)	25(30.9%)	
Pupil reactivity	Reactive	18(13.3%)	44(32.6%)	15(11.1%)	29(21.5%)	29(21.5%)	0.007
	Non-reactive	06(15.4%)	02(5.1%)	08(20.5%)	08(20.5%)	15(38.5%)	
Use of alcohol before injury	Yes	2(28.6%)	02(28.6%)	0(00.0%)	0(00.0%)	03(42.9%)	0.33
	No	22(13.2%)	44(26.3%)	23(13.8%)	37(22.2%)	41(24.6%)	
Use of protective gear, helmet and seatbelt	Yes	0(00.0%)	01(11.1%)	02(22.2%)	0(00.0%)	06(66.7%)	0.02
	No	24(14.5%)	45(27.3%)	21(12.7%)	37(22.4%)	38(23.0%)	
	>90 Minutes	04(6.3%)	27(42.9%)	06(9.5%)	12(19.0%)	14(22.2%)	
Complete blood count	Normal	20(20.8%)	26(27.1%)	11(11.5%)	20(20.8%)	19(19.8%)	0.009
	Low	01(2.6%)	10(25.6%)	04(10.3%)	06(15.4%)	18(46.2%)	
	High	03(7.7%)	10(25.6%)	08(20.5%)	11(28.2%)	07(17.9%)	
Use of invasive ventilation during hospitalization	Yes	13(14.1%)	13(14.1%)	12(13.0%)	21(22.8%)	33(35.9%)	0.000
	No	11(13.4%)	33(40.2%)	11(13.4%)	16(19.5%)	11(13.4%)	

DISCUSSION

The objective of the study is to determine the association of falls, motor vehicle accidents and sports injuries with Traumatic brain injury, to find the association of age with Traumatic brain injury and to identify the association of gender and occupation with Traumatic brain injury. In our study, we found that the majority of TBI patients 69 (39.7%) had a Road traffic accident, 49 (28.2%) had a history of falls, 16 (9.2%) had assault, and 15 (8.6%) had blast injury. Similarly, in a study conducted in Addis Ababa, the capital of Ethiopia, the most frequent cause of trauma was road traffic accidents (RTA), which affected 43 patients (30.7%), Fall accidents and stick injuries affected 41 patients (29.5%) and 40 patients (286.6%), respectively. Road traffic accident was the common cause of traumatic brain injury (TBI). In our study, RTA was higher due to not use of protective gear, helmet and seatbelt.[15] In our study majority of the patients, 118 (67.8%) were male, 54 (31%) were female and 02 (1.1%) were transgender. Age distribution in our study in which the majority of the patients 80 (46%) were in the age of 15-29 years. Similarly, in a study conducted in St Mary's Hospital, Lacor, northern Uganda which161 patients (83·0%) were male, and 129 patients (66·5%) belonged to the reproductive age group. In total, 155 patients, or 79% of the total, were younger than 40 years old. Both the study show that the majority of male are involved in traumatic brain injury and their ages were less than 40 years.[16] In our study majority of the TBI patients, 46 (26.4%) had extradural hematoma. Similarly, a study was conducted in Karachi in which 127 TBI patients participated. There were 116 (91.3%) men and 11 (8.7%) women. Motorcycle accidents were the most common cause of TBI 78 (61.4%). Contusions were the most common type of TBI on CT imaging, accounting for 55 (43.3%), followed by extradural haemorrhage (EDH) 48 (37.7%), subdural haemorrhage (SDH) 46 (36.2%), skull fracture 33 (26.0%), subarachnoid haemorrhage (SAH) 30 (23.6%), intracranial (IC) bleed 14 (11.0%), intraventricular haemorrhage (IVH) 8 (6.3%), and diffuse axonal injury (DAI) 8 (6.3%). In both the study, there are no significant differences in extradural hematoma patients which leads to TBI. In majority of the extradural hematoma patients, RTA is one of the common causes which lead to TBI.[17] Alcohol use before injury in which majority of the patients 167 (96%) in our study did not use alcohol while 7 (4%) had used alcohol before injury. Similarly, a study conducted in New Zealand in which the procedure for selecting cases, led to 425 cases being included. All patient's baseline characteristics are shown, along with a comparison between the groups with and without alcohol involvement. Out of 425 cases, 97 were found. Alcohol-related incidents were 22.8%, whereas alcohol-free incidents were 328/425, or 77.2%. Both studies show that the majority of the participants did not use alcohol use before injury.[18]

LIMITATIONS

The study has several limitations. It was conducted at a single center, limiting the generalizability of the findings. The use of purposive sampling may introduce selection bias, while self-reported data on alcohol use, protective gear, and healthcare timing could be subject to recall bias. The study focused on a limited number of variables, excluding broader socioeconomic and environmental factors. Its cross-sectional design prevents establishing causality between variables and outcomes. Despite appropriate sample size calculation, it may lack power for detecting smaller effects. Lastly, the absence of follow-up data restricts insights into long-term recovery patterns.

CONCLUSIONS

The majority of the patients were between the ages of 15-29 years, TBI was more common in males, students experienced more TBI than other occupation groups, the majority of the patients had a history of road traffic accident, CT scan finding of the patients shows that majority of the patients had extradural Hematoma, GCS score of the TBI patients was recorded in which most of the patients had severe traumatic brain injury. Thus our result indicates in the study that traumatic brain injury is common in young male students having road traffic accidents which lead to traumatic brain injury mainly extradural hematoma.

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