Acta Scientific Neurology (ISSN: 2582-1121)

Volume 3 Issue 1 January 2020

Research Article

The Corelation Between Epidemiology, Glasgow Coma Scale and Computed Tomography Findings in Patient with Traumatic Brain Injury : A Prospective Analysis from A Tertiary Care Centre in A Developing Country

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DOI: 10.31080/ASNE.2020.03.0136

Received: September 16, 2019

Published: December 30, 2019

Abstract

Aims and Objectives: To study the correlation between the epidemiological factors (age, sex, occupation, mode of injury), risk factors, clinical indicators (GCS), requirement of mechanical ventilation, and mortality rate with the cranial computed tomographic findings in patients with traumatic brain injury.

Materials and Methods: A prospective, clinical observational study was developed with 203 patients at department of EMERGENCY medicine, Government medical college and new civil hospital, Surat, Gujarat, India. Eligible patients were given a Glasgow coma score and submitted to computed tomography within the first 12 hours following injury.

Results: The maximum number of cases was within the age group of 21 - 30 years (38%). The minimum age of the patient in our series was 18 year and the maximum age was 72 year. The mean age was 34 year, with prevalence of male patients (86%). Maximum number of patients were labourers (35%) followed by farmers (20%). Road traffic accident was the most common mechanism of injury (55%), followed by pedestrian struck by vehicle (20%), fall from height (13%), and assault (12%). Blast injury or firearm related traumatic brain injury was not reported in our study. Road traffic accident was the most common mechanism of injury (66%) in young age group. Most common risk factor related to trauma found in our study was unconsciousness (67%). Most common risk factor which is not related to trauma found in our study was Alcohol intake/smoking habit (24%). 51% patients presented with scalp laceration. 49% patients presented with had mild TBI, 25% patients presented with moderate TBI and 26% patients with severe TBI while in patients above 50 years of age, 53% patients had severe head injury, 31% patients had mild head injury and 16% patients had moderate head injury. Out of 203 patients, 31% patients had no abnormality on CT scan. All patients with severe TBI had abnormal findings on CT scan. 60% patients with mild TBI and 6% of patients with moderate TBI had normal CT scan findings. Over all Most common CT findings are skull fractures (36%), subarachnoid haemorrhage (31%), brain contusions (30%), brain oedema (28%), and subdural haemorrhage (18%). Out of all skull fractures, linear fractures were more common. Only 17% of patients below 50 years of age had 3 or more findings on CT scan as compared to about 71% of patients above 50 years of age. Requirement of mechanical ventilation was found in 3% of patients with mild TBI, 20% patients with moderate TBI and 70% patients with severe TBI. 92% patients were managed conservatively and 8% patients required operative management. 72% patients showed improvement and were discharged, 21% patients were expired during the course of treatment. Follow up was not possible for 7% of patients.

Conclusion: Statistical significance was observed in the correlation between the Glasgow Coma Scale, Age > 50 years ($p = 0.0001$), Need for mechanical ventilation ($p = 0.0001$), CT findings and mortality rate ($p = 0.001$).

Keywords: Traumatic Brain Injury; Glasgow Coma Scale; Epidemiology; Computed Tomography

Introduction

Injuries claim approximately 5 million lives every year worldwide [1]. India with its billion populations has a large share of this. Traumatic brain injury (TBI) constitutes one of the major health problems worldwide, currently with a high and increasing incidence, representing an important cause of morbidity and mortality among adolescents and young adults. Traumatic brain Injury is a leading cause of mortality in patients younger than 45 years accounting for more than a third of all injury related deaths in United State [2].

Loss of young people at their productive age is a great financial loss for family as well as for the country. In India, problem has become more acute over last two decades, basically due to increased vehicular traffic and poor maintenance of the road. The number of TBI is expected to increase further, due to urbanization, industrialization and increase in vehicular population.

Globally, thousands of people attend their local Emergency Department daily after suffering a head injury. Early diagnosis and appropriate management improves outcomes but is sometimes more difficult to achieve than might be imagined. Of all types of injury, those to the brain are among the most likely to result in death or permanent disability. Estimates of TBI incidence, severity, and cost reflect the enormous losses to individuals, their families, and society.

Currently the imaging method of choice for the diagnosis and prognosis of TBI is Computed Tomography (CT). India is a developing country and CT scan facility is available only in major cities and some towns. In internal areas of the country where CT scan facility is not available we have to rely on clinical examination of TBI patients to decide the need for urgent CT scan. The aim of this study is to understand the correlation between the risk factors, clinical indicators (GCS), requirement of mechanical ventilation, and mortality rate with the cranial computed tomographic findings in patients with traumatic brain injury.

Material and Methods

A prospective clinical observation study on correlation between Glasgow coma scale (GCS) and computed tomography (CT) findings in patients with traumatic brain injury (TBI) has been done at Department of Emergency Medicine, Government medical college and New civil hospital, Surat from 1st September 2015 to 29th February 2017.The study design was approved by the Institutional review board, and informed and written consent was obtained from all the patients and their relatives.

All Patients of TBI presenting to the Emergency department with age more than 18 years and within 12 hours of trauma were included in this study. The patients were evaluated with respect to GCS and admission CT findings and finally correlated with clinical data. Risk factors related to the trauma (vomiting, amnesia, loss of consciousness, convulsion and ear/ nose/ oral bleeding) and risk factors not related to trauma (age > 50 years, drugs or alcohol use, smoking epilepsy, previous neurological surgery, previous head injury, systemic illness) are also documented.

Traumatic brain injuries with GCS scores between 14 and 15 were classified as mild TBI, while those between 9 and 13 were classified as moderate TBI, and those between 3 and 8 were classified as severe TBI. All the patients included in the study were submitted to cranial CT without intravenous administration of a contrast agent.

All the cranial CT scans were performed with the patient in dorsal decubitus, with a single slice, helical Somaton Balance CT equipment (Siemens Medical Solutions; Erlangen, Germany), utilizing 130 kVp and 80 mAs. Axial, sections were performed, parallel to the infraorbitomeatal line, with 6 mm-thick slices in the region of the posterior fossa and 10 mm at the other areas of the skull.

We performed a descriptive analysis of the collected variables to understand the age-group, mode of injury, time elapsed since injury, GCS on admission, requirement of mechanical ventilation and imaging findings among patients. We also described the outcome with respect to the Glasgow coma scale on admission. Appropriate tests of significance were used (chi- square test, fisher's exact test). Age, Severity of TBI as per GCS score, Computed tomography finding, Requirement of mechanical ventilation, and outcome were analysed.

Results

In our Cross-sectional clinical observational study, 203 cases were selected. The minimum age of the patient in our study was 18 years and the maximum age was 72 years. Out of these, the maximum number of cases were within the age group of 21 - 30 years (38%). The mean age was 34 years. 165 (81%) patients were below the age of 50 and 38 (19%) patients were above 50 years of

age. There were 175 (86%) males and 28 (14%) females in the study. Occupation wise maximum number of patients were labourers (35%) followed by farmers (20%), students (13%) and housewives (12%).

It was observed that 51% of patient came to medical facility within 3 hours, while 29% of patients took up to 6 hours and 20% patients took more than 6 hours to get medical consultation. Average time spent before getting medical care was 3.8 hours. Road traffic accident due to collision of vehicles was the most common mechanism of injury (55%), followed by pedestrian struck by vehicle (20%), fall from height (13%), and assault (12%). Blast injury or firearm related traumatic brain injury was not reported in our study. Out of 112 (55%) cases of road traffic accident, most commonly involved vehicle was 2 wheeler (88%), followed by 4 wheeler (8%). 3 wheeler was involved in 4% cases. Pedestrian struck by vehicle was the most common mechanism of injury (47%) in elder age group (> 50 years), followed by RTA (34%) and fall from height (18%).

Most common symptoms related to trauma found in our study was unconsciousness (67%) followed by ear/nose/throat bleeding (50%), vomiting (30%), amnesia (14%) and convulsion (6%). 85 (41%) patients presented with one or more risk factors related to trauma. Most common risk factor which is not related to trauma found in our study was Alcohol intake/smoking habit (24%) followed by age > 50 years (19%), systemic illness (5%), epilepsy/psychiatric illness (2%) and history of previous head injury/Neurological surgery (1%). Out of 203 patients, 60 patients (30%) had associated facial bone fractures, 20 patients (10%) had associated long bone fractures, 4 patients (2%) had associated spine injury, and 2 patients (1%) had associated abdominal injury, while 7 patients (3%) had associated chest injury. Out of 203 patients, 99 patients (49%) had mild head injury, 51 patients (25%) had moderate head injury and 53 patients (26%) had severe head injury. Out of 203 patients, 62 (31%) patients had no abnormality on CT scan. All patients with severe TBI had abnormal findings on CT scan. 60% patients with mild TBI and 6% of patients with moderate TBI had normal CT scan findings. Over all Most common CT findings were skull fractures (36%), subarachnoid haemorrhage (31%), brain contusions (30%), brain oedema (28%), Extra dural hematoma (EDH) (10%) and subdural hematoma (SDH) (18%). Out of all skull fractures, linear fractures were more common (67% of all fractures).

3 out of 99 patients (3%) with mild TBI required mechanical ventilation while 10 out of 51 patients (20%) with moderate TBI required mechanical ventilation. 37 out of 53 (70%) patients with severe TBI required mechanical ventilation in our study. Out of 203 total patients, 186 patients were managed conservatively and 17 patients required operative management. Most common indication for operative management were SDH and EDH. Out of 203 total patients, 146 patients (72%) showed improvement and were discharged, 43 patients (21%) were expired during the course of treatment. 14 patients (07%) were lost from the follow up. Among patients with mild TBI, 92% patients showed improvement and were discharged. 71% patients with moderate TBI showed improvement and were discharged, while only 36% patients with severe TBI showed improvement and were discharged. Follow up was not possible for 6% patients with mild TBI, 14% patients with moderate TBI and 7% patients with severe TBI.

Discussion

In present study, maximum numbers of patients were from age group of 21 - 30 years followed by 31 - 40 years with 81% of patients were under 50 years of age. Mean age of patients in our study was 34 years. In an indian study [3], maximum number of patients was from age group of 21-30 years with mean age of 31 years. In a brazilian study [4], mean age of patients was 37 years while 79.4% patients were below 50 years of age. In our study 86% patients were male and 14% were female, with male: female ratio of 6:1. In an indian study [3], 75.9% patients were male. In a similar brazilian study [4] 80.4% patients were male with male: female ratio 4:1.

In present study, 51% of patient came to medical facility within 3 hours, while 29% of patients took up to 6 hours and 20% patients took more than 6 hours to get medical consultation. Average time spent before getting medical care was 3.8 hours. In an indian study [3] it is about 8.6 hours. The shorter time span between time of injury and time of medical consultation is due to better ambulance service in Gujarat since initiation of 108 project [5].

Almost all of the patients (100%) presented with one or more risk factors related to the trauma, and 41% presented with one or more unrelated risk factors which corresponds well with a brazilian study [4] study where 86.3% patients presented with one or more risk factors related to trauma and 24.5% patients presented with one or more unrelated risk factors.

In our study, out of 203 patients, 49% patients had mild TBI, 25% patients had moderate TBI while only 26% patients had severe TBI.

Comparision of severity of TBI

Severity of TBI	In our study	GH Yattoo., *et al.* [6]
Mild TBI	99 (49%)	493 (90%)
Moderate TBI	51 (25%)	29 (5.4%)
Severe TBI	53 (26%)	25 (4.6%)
Total	203 (100%)	547 (100%)

Table 1

Comparison of computed tomographic finding in different studies

	SDH	EDH	SAH	ICH	IVH	CNT	BE	LF	DF	CF	N	≥3 F
Our study	36	20	62	03	18	60	56	50	12	12	62	55
	18%	10%	31%	01%	09%	30%	28%	25%	6%	6%	31%	27%
GHYattoo., *et al* [6]	23	18	2	2	-	48	7	32	16	-	272	-
	5%	4%	0.4%	0.4%		10%	1.5%	7%	3.4%		59%	
Morgado FL., *et al.* [4]	5.9%		18.6%	-	-	10.8%	5.9%	34.3%			20.5%	18.6%
Agarwal., *et al*	79	45	59	3	-	118	-	71			280	-
	5%	2.8%	3.7%	0.2%		7.2%		4.3%			17.3%	

Table 2: SDH SDH= subdural hematoma, EDH= Extradural hematoma, ICH= Intracerebral haemorrhage, IVH= Intraventricular haemorrhage, SAH= Subarachnoid haemorrhage, BE= Brain edema, CNT= Brain contusions, LF= Linear fracture, DF= Depressed fracture, CF= Comminuted fracture, ≥3F= greater than or equal to 3 findings.

Most common CT findings among patients with mild TBI were skull fractures, brain contusions and subarachnoid haemorrhage. Most common CT findings among patients with moderate TBI were skull fractures, subarachnoid haemorrhage, brain contusions, and brain oedema.

In severe TBI there was a significant increase in the incidence of all CT findings, with a rate of 100% of abnormalities, the most common ones corresponding to: haemorrhagic contusions, brain edema and subarachnoid haemorrhage. In Morgado FL., *et al*. [4] study common findings in patients with severe TBI are subarachnoid hemorrhage in 62.5% (10/16), skull fractures in 62.5% (10/16). Such data demonstrate that the CT findings with worst prognosis present a higher incidence in cases of severe TBI.

In present study, three or more findings on CT seen in 6% of patients with mild TBI, 33% of patients with moderate TBI and 60% of patients with severe TBI. Our finding correspond well with Morgado FL, Rossi Study. In Morgado FL, Rossi study [4], there were only 2 patients with moderate TBI with one of them above 50 years of age and 15 out of 16 patients of severe TBI were above 50 years of age, thats why the percentage of patients with 3 or more findings in moderate and severe TBI was high.

In our study, 50 patients (25%) required mechanical ventilation out of which 74% patients (37/50) were having severe TBI. Morgado FL., *et al*. [4] described 18 (18%) patients required mechanical ventilation out of which 83% patients (15/18) were having severe TBI.

In our study, out of 203 total patients, 92% were managed conservatively while 8% patients required operative management. The most common indications for operative management were acute subdural hematomas, extradural hematomas. In an indian study [3] 89.5% patients were managed conservatively while 10.5% patients required operative management and the main indications for surgery were acute subdural hematomas, extradural hematomas, cerebral contusions and compound depressed fractures.

In present study, overall mortality rate was 21% (43/203). Only 2% of patients with mild head injury died as compared to 62% patients with severe head injury. So More severe the brain injury is higher is the expiry rate.

In patients above 50 years of age, the overall expiry rate was 55% (21/38) as compared to 13% (22/165) for patients below 50 years of age. Follow up was not possible for 14 patients.

Multivariate logistic regression for risk of mortality suggests that increased TBI severity had a significant association with mortality. Our observation corresponds well with other studies shown in below table.

Total Number of patients and expired patients according to severity of TBI in different studies

	Mild TBI		Moderate TBI		Severe TBI	
	Total	**Expired**	**Total**	**Expired**	**Total**	**Expired**
Our study	99	02(2%)	51	8(15%)	53	33(62%)
GH Yattoo., *et al.* [6]	493	03(0.6%)	29	07(24%)	25	25(100%)
Agarwal., *et al.* [3]	744	19(3%)	314	17 (5.41%)	238	67 (28%)

Table 3

In our study 77% (33/53) of total death occurs in patients with severe brain injury which corresponds well with GH Yattoo., *et al*. [6] (25/35 = 71%) and Agarwal., *et al*. [3] (67/103 = 65%).

In present study, elder age is associated with increased TBI severity, increased requirement of mechanical ventilation, increased computed tomography findings and increased mortality. Low GCS scores (Severe TBI) were considered as a severity risk factor in association with a greater number of tomographic findings, increased requirement of mechanical ventilation and increase mortality rate. Patients with TBI and low GCS scores are affected by cerebral injuries with more devastating effects and present with a tendency for hemodynamic instability as observed in other studies [7-9]. Statistical significance was observed in the correlation between the Glasgow Coma Scale, Age greater than 50 years, Need for mechanical ventilation, CT findings and mortality rate.

There is a need to improve pre-hospital care to reduce morbidity and mortality [10]. Apart from safety laws, prompt transport to a hospital after an accident is another important measure to reduce mortality [11]. The majority of patients in India are brought to the emergency department by relatives or bystanders in private vehicles, and pre-hospital emergency medical services remain under-organized. Field triage often relies on bystanders who transport injured victims to the nearest clinic, which is often unable to provide appropriate treatment [12]. Major urban areas also have a loosely networked trauma system, untrained emergency medical services personnel and unequipped ambulances [12]. Our observation of family and bystander transport supports the notion that pre-hospital care in India requires much improvement This study also has certain limitations. It is plausible that only a certain proportion of all traumatic brain injuries will reach the hospital, and many of those with severe injuries may have died in the pre-hospital setting, and many with mild injuries may not have sought clinical care. Further, as this was the only neurosurgery equipped government hospital in the district at the time of the study, referral bias is also possible. Also being a single centre study the findings may not be generalizable to other settings.

Financial support/sponsorship

Nil.

Conflicts of Interest

Nil.

Bibliography

1. Injuries-violence-facts-2014-WHO (2014).

2. Ake Grenvik., *et al*. "Management of Traumatic Brain Injury in the Intensive Care Unit". *Critical Care* (2000): 322-326.

3. Agrawal A., *et al*. "Epidemiology and clinical characteristics of traumatic brain injuries in a rural setting in Maharashtra, India. 2007-2009". *International Journal of Critical Illness and Injury Science* 2 (2012): 167- 171.

4. Morgado FL and Rossi LA. "Correlation between the Glasgow Coma Scale and computed tomography imaging findings in patients with traumatic brain injury". *Radiologia Brasileira* 44.1 (2011): 35-41.

5. A Study of Referral System for EmOC in Gujarat. Mona Gupta, Dileep Mavalankar, Poonam Trivedi W.P. No (2009).

6. GH Yattoo and Amin Tabish. "The profile of head injuries and traumatic brain injury deaths in Kashmir". *Journal of Trauma Management and Outcomes* 2 (2008): 5.

7. Tien HC., *et al*. "Do trauma patients with a Glasgow Coma Scale score of 3 and bilateral fixed and dilated pupils have any chance of survival?" *Journal of Trauma* 60 (2006): 274-278.

8. Signorini DF., *et al*. "Predicting survival using clinical variables: a case study in traumatic brain injury". *Journal of Neurology, Neurosurgery, and Psychiatry* 66 (1999): 20-25.

9. Schreiber MA., *et al*. "Determinants of mortality in patients with severe blunt head injury". *The Archives of Surgery* 137 (2002): 285-290.

10. Bhatoe HS. "Brain Injury and prehospital care: Reachable goals in India". *Indian Journal of Neurotrauma (IJNT)* 6 (2009): 5-10.

11. Knudson P., *et al*. "Improving the field triage of major trauma victims". *The Journal of Trauma* 28 (1988): 602-606.

12. Bhole AM., *et al*. "Demographic profile, clinical presentation, management options in cranio-cerebral trauma: An experience of a rural hospital in Central India". *Pakistan Journal of Medical Sciences* 23 (2007): 724-727.