ORIGINAL ARTICLE

Evaluation of Midline Shift and GCS as an Outcome in Severe Traumatic Brain Injury (TBI)

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ABSTRACT

Objectives: *We determined the frequency of mortality in patients with traumatic brain injury and to compare frequency of midline shift and poor motor response in traumatic brain injury patients with and without mortality.*

Materials & Methods: *Total 108 patients with severe TBI aged between 18 to 60 years were included. Admission GCS and motor response of post-nonsurgical resuscitation were recorded, along with midline shift on initial CT-scan. All patients were followed for the mortality up to 2 weeks. Chi square test applied for the frequency comparisons of 'midline shift' and 'poor motor response'.*

Results: *Mean age was 38.88 ± 8.94 years. Out of the 108 patients, 68 (62.96%) were males and 40 (37.04%) were females. Mean admission GCS was 3.39 ± 1.87. Mean motor response was 3.12 ± 1.68. Mean midline shift was 7.37 ± 2.09 mm. Mortality was found in 66 (61.11%) patients, whereas, there was no mortality in 42 (38.89%) patients. High mortality percentage (60%) was found in age group: 20-30 years. In male patients, high mortality percentage was found (63.24%) as compared to female patients. Comparable differences were found in the frequencies of 'midline shifts' and 'poor motor response' in patients with mortality.*

Conclusion: *The frequency of mortality in patients with severe TBI was found high. The 'motor scores' and 'midline shifts' can predict the outcome of severe TBI, because, comparable differences were found in the frequencies of 'midline shifts' and 'poor motor response'.*

Keywords: *Severe Traumatic Brain Injury (TBI), Motor Response, Mortality.*

INTRODUCTION

About one-and-a-half million people die yearly, secondary to traumatic brain injury worldwide. It poses a massive dilemma in terms of morbidity, mortality and economic drain.[1,2] Pakistan also has a high incidence rate of TBI injuries.[3,4] In Pakistan, about one-third of people attached TBI from road accidents and among 10% of them had severe TBI.[3] The early diagnosis, treatment of traumatic brain injury and anticipation of the prognosis is emphasized. A proper emergency treatment and timely diagnosis of traumatic brain injury can prevent chronic disabilities.[5,6] Severe TBI is a major head, which is trauma linked with a (Glasgow Coma Scale) GCS scores: 3-8. Its prognosis and management is challenging in emergency medicine from last 20 years. Brain Trauma Foundation had first disseminated the guidelines on managing severe traumatic brain injuries.[7] These guidelines are approved by both American Association of Neurological Surgeons and Neurotraumatology Committee of World Health Organization.[7] Neurosurgeons around the world, have adopted these managing procedures for TBI's outcomes and treatments.[8,9] Many studies have reported better outcomes in terms of functional outcome scores, duration of hospital admission and mortality rates.[10,11]

It still remains an uncertainty to accurately predict

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the course of events in a TBI patient, but a progressive research has improved the clinicians' confidence in predicting the events for prognosis. Clinical information and scans taken for the nature of lesion to identify the impacts on an intracranial dynamics are the most common factors to report prognostics of TBI. There is a paucity of data regarding the predictive value of motor response along with midline shift as a predictor of outcome in patients with severe TBI in Pakistan. The aim of this study was to establish a relationship of motor score along with midline shift with outcome in patients with severe TBI to recognize the patients with an expected poor outcome earlier and subsequent allocation of the resources. The objective of the study was to find the frequency of mortality in patients with traumatic brain injury and to compare frequency of midline shift and poor motor response in traumatic brain injury patients with and without mortality.

MATERIALS & METHODS

Study Design

A descriptive, case series study was done at the Neurosurgery Department, Jinnah Hospital, Lahore from 01 January 2017 to 31 December 2017. The data of 108 cases was calculated with 95% confidence interval, 9% margin of error and expected percentage of mortality in patients with TBI as 65%. A non-probabilistic, consecutive sampling was considered.

Inclusion Criteria

All severe traumatic head injury patients, both male and female, aged between 18 to 60 years were included. Patients presenting within 12 hours of injury were included.

Exclusion Criteria

Patients with polytrauma, penetrating brain trauma, chronic medical illness e.g., hypertension, diabetes mellitus, chronic liver and kidney diseases were excluded.

Data Collection Procedure

A total of 108 patients were enrolled in this study from the Emergency Department after informed consents. Admission Glasgow Comma Scale (GCS) and motor responses after the post-nonsurgical resuscitation were recorded along with the midline shift on the initial CT-scan. All measurements were made by the same physician. All patients were followed for the mortality up to two weeks. All of the data was taken on the pre-designed Proforma.

Data Analysis Procedure

Qualitative variables like gender, poor motor response, midline shift and mortality were analyzed along with the calculating of frequencies and percentages in SPSS 22. Quantitative variables like age and motor response were analyzed by calculating their means and standard deviations. Both groups were compared by applying the Chi square tests for the frequency comparisons of 'midline shift' and 'poor motor response' in severe traumatic brain injury patients with and without mortality. Effect modifiers like age, gender and admission GCS were addressed though stratification, post-stratification and chi-square tests were applied to check the significance. A p-value < 0.05 was regarded as a significant.

RESULTS

The age range was from 18 to 60 years with mean age of 38.88 ± 8.94 years. The majority of the patients 60 (55.56%) were between 18 to 40 years of age (**Table 1)**. Out of the 108 patients, 68 (62.96%) were male and 40 (37.04%) were females, with a male to female ratio of 1.7:1. Mean admission GCS was 5.39 ± 1.87. **Table 2** shows the distribution with respect to modifiers such as 'midline shift' and 'poor motor response'. 64 (59.26%) patients were found with midline shift and 59 (54.63%) were found with poor motor response. Mean motor response was 3.12 ± 1.68. Mortality was found in 66 (61.11%) patients, whereas, there was no mortality in 42 (38.89%) patients (**Table 2a)**. Comparisons of frequencies of midline shift and poor motor response in severe traumatic brain injury patients with and without mortality are shown in **Tables 3-5** respectively. Comparable differences were found in the frequencies of 'midline shifts' and 'poor motor response' in patients with mortality. However, no significant difference (p-value: 0.118) was found between 'midline shifts' in groups: with mortality and without mortality (**Table 3**). Similarly, no significant difference (p-value: 0.243) was found between 'poor motor responses' in groups: with mortality and without mortality (**Table 4**). **Tables 5 and 6** show stratifications of mortality with respect to 'age' and 'gender' groups. High mortality percentage (36

patients, 60%) was found in age group: 20-30 years as compared to age group: 31-41 years. In male patients, the high mortality percentage was found (43 patients, 63.24%) as compared to female patients. No significant differences were found in these groups.

Table 1: *Age distribution of patients (n = 108).*

Age (in years)	No. of Patients	%age
18 – 40	60	55.56
41 – 60	48	44.44

Table 2: *Distribution of patients with respect to other effect modifiers.*

Effect modifiers		Frequency	%age
Midline shift	Yes	64	59.26
	No	44	40.74
Poor motor response	Yes	59	54.63
	No	49	45.37

Table 2a: *Frequency of mortality in patients of severe traumatic brain injury (n=108).*

Mortality	Frequency
Yes	66 (61.11%)
No	42 (38.89%)

Table 3: *Comparison of frequency of midline shift in severe traumatic brain injury patients with and without mortality.*

Midline Shift	Mortality		p-value
	Yes (n = 66)	No (n = 42)	
Yes	43 (65.15%)	21 (50%)	0.118
No	23 (34.84%)	21 (50%)	

Table 4: *Comparison of frequency of poor motor response in severe traumatic brain injury patients with and without mortality.*

Poor Motor Response	Mortality		p-value
	Yes (n = 66)	No (n = 42)	
Yes	39 (59.09%)	20 (47.61%)	0.243
No	27 (40.90%)	22 (52.38%)	

Table 5: *Stratification of Mortality with respect to age groups.*

Age (Years)	Mortality		p-value
	Yes	No	
20 – 30	36 (60.0%)	24 (40.0%)	0.791
31 – 40	30 (62.50%)	18 (37.50%)	

Table 6: *Stratification of Mortality with respect to gender.*

Gender	Mortality		p-value
	Yes	No	
Male	43 (63.24%)	25 (36.76%)	0.555
Female	23 (57.50%)	17 (42.50%)	

DISCUSSION

The prediction of outcome of severe traumatic brain injury (TBI) is still controversial, as there are no fixed variables which can depict the outcome. Therefore, this study evaluated the frequency of mortality in patients with traumatic brain injury (TBI) and compared the frequencies of midline shift and poor motor response in traumatic brain injury patients with and without mortality. We found that the percentage mortality of severe traumatic brain injury (TBI) patients was high. Such associated disability can impact a person's social life and employment and hence an economic burden would on the entire family. Although, the results were statistically insignificant, our study showed that the 'motor score' and 'midline shift' can be used to predict the outcome of severe traumatic brain injury (TBI). Because, a comparable difference was found in the frequencies of 'midline shifts' and 'poor motor response' in patients with mortality.

We found that the percentage mortality of severe traumatic brain injury (TBI) patients was high (61%). Although, an ample amount of data is available for severe TBI outcomes in closed head injuries or in moderate closed head injuries. The outcome data is not consistent with regard to the outcome prediction in

severe TBI. A mortality of up to 50% has been calculated due to severe TBI, especially in case of intracranial hypertension or cerebral edemas.[12,13] The mortality in GCS score of 3, in patients with post resuscitation was found up to 76%, whereas, with GCS between 6-8, the mortality was found 18%. The morality was 31% in patients with non-surgical mass lesions as compared to those patients who required craniotomy. [12,14] Ratnasingam et al. (2015)[12] mentioned that 32% patients after a severe closed TBI present disability and after three months they show some improvement. It was also mentioned that 20% of severe TBI patients and 40% of survivors can show a satisfactory recovery. It was estimated that up to 37% patients returned to their work after closed head injury.[12,15] In our study, comparison of frequency of midline shift and poor motor response in severe traumatic brain injury patients with and without mortality had shown a remarkable difference, with a poorer outcome in patients with poor motor score and midline shift on CT scan. A study mentioned that mild TBI patients usually present a manageable, satisfactory prognosis,[16] but many patients with moderate-severe injuries present a significant morbidities and worst prognoses.[17] It was anticipated that around 40% patients with GCS > 8 will eventually die and resuscitation could be raised to 9%.[18] A study concluded that field GCS scores as well as arrival GCS scores correlated together to predict the survival of severe TBI. An approximate linear association ship was found between a field GCS and survival.[19] GCS scores can provide profound prediction related to severe TBI patients, because it includes the verbal responses and responses from eyes. Marmarou et al (1999)[20] mentioned about profound association of outcome in patients with hyper motor response as compared to patients with an absent motor response. They found a good outcome with motor score greater than 4.[20] Shifted midline anatomies also found correlated with outcome with other CT signs. Fearnside et al (1993)[21] mentioned the correlation strengths of midline shift and other CT parameters as prognostic variables.

RECOMMENDATION

We recommend that that 'motor score 'and 'midline shift' variables can be used in patients with severe TBI for early recognition of patients with poor outcome and subsequent allocation of resources.

CONCLUSION

Our study showed that the 'motor score' and 'midline shift' can be used to predict the outcome of severe traumatic brain injury (TBI), but the results were not statistically significant, which emphasized that a sub study should be carried out with larger sample size in order to generalize the results over the local population. We recommend that motor score and midline shift can be scrutinized further to validate their role in the early recognition of a poor outcome of severe traumatic brain injury patients and subsequent allocation of resources. Frequency of mortality in patients with severe traumatic brain injury was high. Comparisons of 'midline shifts' frequencies and 'poor motor responses' frequencies in severe traumatic brain injury (TBI) patients with mortality have shown comparable differences.

ROLE OF AUTHORS

Dr. Syed Shahzad Hussain, Dr. Usaman Kamboh, Dr. Asif Raza: Surgeries and literature review.
Dr. Zaeem Sultan: Data Collection, Paper Writing.
Dr. Saman Shahid. Paper Editing and Results Writing.
Prof. Naveed Ashraf: Study Design.

Additional Information
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