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Paediatric traumatic brain injury: Presentation, prognostic indicators and Outcome analysis from a tertiary care center in a developing country

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SHORT REPORT

Paediatric traumatic brain injury: Presentation, prognostic indicators and Outcome analysis from a tertiary care center in a developing country

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Abstract

Traumatic brain injury (TBI) is the leading cause of morbidity and mortality in children worldwide. This study was conducted to report the presentation, management, outcomes and prognostic indicators in a large series of patients from a tertiary care centre in a developing country. It is a review of prospectively collected data of paediatric patients with TBI admitted at our centre between July 2010 and December 2013. A total of 291 patients with a mean age of 7.2±5.0 years were dichotomised into survivors and non-survivors, and variables were compared between the two groups. The mean post-resuscitation Glasgow coma scale (GCS) score was 11.6±3.9, mean Marshall Score was 2.26±0.95 and the mean revised trauma score at presentation was 10.58±1.7. Younger age, lower GCS score after resuscitation, lower revised trauma score, absent cisterns on imaging, associated subarachnoid haemorrhage (SAH) and intraventricular haemorrhage (IVH) and a lower Marshall score were associated with higher mortality.

Keywords: Traumatic brain injury, Paediatrics, Prognostic factors, Outcomes, Developing country.

Introduction

Traumatic brain injury (TBI) is the leading cause of morbidity and mortality around the world.[1,2] Variable incidence rates of TBI have been reported in literature, but the peak incidence has consistently been reported in children and young adults.[3] Moreover, 75-97% of trauma-related mortality occurs in the paediatric age group.[4] TBI is also associated with significant long-term sequelae, including delayed development milestones, as well as emotional, cognitive and social dysfunction.[5] Thus, paediatric TBI represents a significant public health concern.

Paediatric TBI has been well-documented in literature from the developed countries.[2] However, there are significant differences in the management protocols and procedures between the developed and the developing countries due to a dearth of human and material resources in the later which lead to a lack of satisfactory injury preventive programmes, emergency transport to hospitals, hospital care and rehabilitation therapies.

Despite the importance of TBI and expected salient differences in patient admission and discharge characteristics between the developed and the developing countries, very few reports are available from the developing countries on this subject. The current study was planned to report the presenting characteristics, management details, outcomes and complications in a large series of patients from a tertiary care centre in a developing country. Further, we present our analysis of prognostic indicators in paediatric TBI as the first report of its kind from our region.

Methods and Results

This study was conducted at Aga Khan University Hospital (AKUH), Karachi, and of prospectively collected data of all paediatric patients with a TBI admitted between July 2010 and December 2013. Informed consent was taken from the parents or guardians of all patients. Data was collected on a questionnaire covering patient demographics, mechanism of injury, pre-hospital care, neurological and radiological findings on admission, hospital course and outcome.

Most of the children with TBI in our setting were brought to our Emergency Room (ER) by friends or relatives, and were not initially managed and stabilised at the site of injury by paramedics. On presentation at ER, patients were managed according to the current paediatric Advanced Trauma Life Support (ATLS) guidelines.[6] Following resuscitation and hemodynamic stabilisation, a complete neurological examination was performed, and a computed tomography (CT) scan was performedwhen required. Some patients also received mannitol/ hypertonic saline to lower intracranial pressure, along

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Table-1: Prognostic indicators associated with mortality in paediatric TBI patients.

Factors	Non-Survivors-GOS = 1 (n = 13)	Survivors-GOS = 2-5 (n = 262)	P value
Mean Age	3.68 ± 3.7 years	7.12 ± 5.0 years	0.015*
Gender	Male = 8 Female = 5	Male = 192 Female = 70	0.353
Incident to Arrival Delay	14.14 ± 20.58 hours	11.29 ± 33.1 hours	0.769
Post resuscitation GCS	6.08 ± 3.59	11.82 ± 3.7	< 0.001*
Revised Trauma Score	8.33 ± 1.5	10.66 ± 1.7	< 0.001*
Mechanism of Injury	Fall = 10 RTA = 1 TV Trolley = 1 Firearm = 0	Fall = 115 RTA = 94 TV Trolley = 12 Firearm = 10 Other = 19	0.473
Surgical Intervention	Yes = 5 No = 8	Yes = 103 No = 159	0.951
Length of Stay	5.23 ± 10.1 days	6.83 ± 7.0 days	0.431
Cisterns	Compressed = 2 (15.3%) Absent = 4 (30.7%)	Compressed = 32 (12.2%) Absent = 8 (3.05%)	< 0.001*
Midline Shift > 5mm	4 (30.7%)	32 (12.2%)	0.136
Epidural haemorrhage	6 (46.1%)	147 (56.1%)	0.776
Subarachnoid haemorrhage ±	9 (69.2%)	64 (24.4%)	< 0.001*
Intraventricular haemorrhage			
Marshall Score	2.9 ± 0.99	2.2 ± 0.95	0.017*

TBI: Traumatic brain injury
GOS: Glasgow outcome score
GCS: Glasgow coma scale.

Table-2: Summary of surgical interventions and outcomes of paediatric TBI patients.

Intervention/Outcomes	Number (n)	Percentage (%)
Craniotomy for hematoma	56	19.24
Decompressive Craniectomy	17	5.84
Elevation of depressed skull fracture	10	3.43
Suturing and debridement	8	2.75
Others	21	7.22
Mortality	13	4.5
Vegetative state	3	1.03
Excellent Recovery	224	76.98

TBI: Traumatic brain injury.

with prophylactic anticonvulsants. We used the Marshall Score for assessment of severity of head injury and post-resuscitation Glasgow coma scale (GCS) score was used to stratify the severity of TBI into five categories: minimal (GCS: 15), mild (GCS: 14), moderate (GCS: 9-13), severe (GCS: 5-8) or critical (GCS: 3-4). Depending on the assessment, patients were either managed conservatively or taken for surgical intervention. Functional outcome assessment was done in terms of the Glasgow outcome scale (GOS) at the last follow-up visit to neurosurgery clinics. A GOS of 4-5 was regarded as favourable while a score of 3 or less was considered unfavourable.

The data was analysed using SPSS 20. Variables were compared between the groups using student's t-test for continuous variables and chi-square test for categorical variables. P< 0.05 was taken as significant.

There were 291 patients with a mean age of 7.2±5.0 years; 210 (72.2%) male and 81 (27.8%) female. TBI causes were noted in each case (Table-1).

Mean post-resuscitation GCS was 11.6±3.9, mean Marshall Score was 2.26 ± 0.95 and mean revised trauma score at presentation was 10.58±1.7. Overall, 120(41%) patients had minimal head injury, 21(7%)had mild, 76(26%) had moderate, 57(20%) had severe and 17(6%) had critical head injury. The initial CT scan findings revealed epidural hematoma in 162(55.7%) patients, intraventricular haemorrhage (IVH) with or without subarachnoid haemorrhage (SAH) in 76 (26.1%), midline shift >5mm in 37(12.7%), effacement of cisterns in 35(12%) and absent cisterns in 12(4.1%) patients. The mean duration of hospital admission was 6.5±7.05 days which included a mean intensive care unit (ICU) stay of 1.38±3 days. Patient's age, post-resuscitation GCS score, revised trauma score, compressed or absent cisterns, combination of SAH and IVH and Marshall Score were significantly associated with mortality (p<0.05).

Surgical intervention was done in 112(38.5%) cases (Table-2). The mean duration of follow-up was 5.8±3.2 months and the mean GOS on last follow-up was 4.6±1.1.

Conclusion

TBI is the leading cause of mortality after trauma, and accounts for about half of the deaths at the site of accident.[7] About 25-30% of all the patients admitted with a TBI are in the paediatric age group.[8] It is commonly believed that children can cope better with TBI because of increased neuronal plasticity in the early years. However, clinical reports have repeatedly indicated that significant post-traumatic residual problems occur in a range of skills, including intellectual ability, attention and memory after TBI, which further adds to the menace of TBI in children.[1,5,9]

It has been shown previously that prognosis in severe head injury in paediatric age group is time-sensitive, with better outcomes when patients arrive early at hospital.[7] In our series, non-survivors had a longer delay between the trauma incident and hospital admission, but the differences were not statistically significant. This could be explained by reduced power of the statistical test due to a relatively smaller sample size and also because due to under-developed healthcare facilities, the mean arrival time was high for both groups.

A bimodal age distribution with peak incidence between 0-3 years and 7-10 years has been reported previously.[10] However, we did not observe similar trends in our study where the mean age of children of children was just over 7 years, with a peak incidence observed at 5 years. Thus, our data adds to the existing literature by showing that all children are susceptible to TBI and care needs to be provided uniformly across all ages rather than focussing on specific age groups.

Upwards of 40% of the children in our series had minimal head injury with a post-resuscitation GCS score of 15 which is consistent with international literature.[10] Post-resuscitation GCS score was significantly prognostic of clinical outcome in our series which has also been shown in other studies.[11] In our series, a low Marshall Score, absent cisterns and the presence of SAH or IVH on imaging were associated with a worse outcome. The most common mode of injury in our series was fall from height followed by road traffic accidents (RTAs). Other reports cite either falls or RTAs as the most common mode of injury.[1,10]

There are several potential biases with the findings of this study. The most important is that the data is not true representative of the whole population as certain strata of population are more likely to visit the hospital. Also within this population the groups are disproportionate in terms of the severity of injury.However, the relatively large sample size of the study gives a good indication of the problem.

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