International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Clinicopathological Study of Traumatic Brain Injury in Juvenile, Middle-Aged and Elderly Individuals

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Abstract: ***Background**: Traumatic Brain injuries (TBI) are a real social problem with an upward trend worldwide. For these reason prognostic factors in head injury are of major importance to all surgeons who treat patients with severe head injury especially for countries like India for better targeting of limited health care resources and implementation of specific methods of treatment to patients and to determine the incidence of age, sex, distribution, etiological factors, clinical presentation, neurologically assessment and mode of brain injuries with particular reference to severe head injury. **Methods**: This study was conducted in the Neurosurgery department of JLNMCH Bhagalpur from January 2020 to December 2020. In this study 260 patients of Traumatic brain injury were included The patients were divided into 3 age groups: elderly (>59 years), middle-aged (19–59 years), and juvenile (<18 years) individuals. Mortality was assessed at 1 month. Appropriate statistical analyzes (details in article) were performed. **Result**: Among 260 hospitalizations for traumatic brain injury (201 males and 59 females, 51 died (19.61%), the highest and lowest mortality rates were in the elderly and juvenile groups, respectively. Fall was the most common cause in juvenile and elderly individuals (32.79% and 43.95%, respectively), while traffic injury was most common in the elderly group (35.08%). The manners of injury differed considerably among the 3 age groups. Scalp injury, skull fracture, intracranial hematoma, and cerebral injury were the most common mechanisms in juvenile (67.32%), middle-aged (63.50%), elderly (69.56%) and middle-aged (90.44%) individuals, respectively. Scalp injury and skull fracture types differed among the groups. Epidural, subdural, and intra cerebral hematomas were most common in juvenile, middle-aged, and elderly individuals, respectively. Cerebral contusion showed the highest frequency in the 3 groups, and concussion the lowest. **Conclusions**: Age is a strong prognostic factor following traumatic brain injury (TBI), with discrepancies defining the critical prognostic age threshold.*

Keywords: Prognostic, severe brain injury, CT scan & radiological

1. Introduction

Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain from an external mechanical force, perhaps foremost to permanent or temporary impairment of cognitive, International Journal of Surgery Science~ 27 ~physical and psychological functions with an associated diminished or changed state of consciousness. Trauma is the most vital origin of fatality in people from 1st year to 44 years of life. It is the main determinant of morbidity, disability & mortality in this group [3]. Severe TBI is related with 30 to 70% mortality rate [4] & recovery of survivors is marked by severe neurological sequels therefore impairing quality of life [5] . TBI epidemiology is well reported worldwide [5,6]. However, differences in clinical and pathological features in HI among juvenile, middle-aged, and elderly individuals remain undefined. Thus, the purpose of this study was to assess the descriptive epidemiology and characteristic trends of HI among juvenile, middle-aged, and elderly subjects in the Neurosurgery department of JLNMCH Bhagalpur from January 2020 to December 2020. The findings could help determine how HI occurs, and identify its cause and manner in different age groups

2. Material and Methods

Subjects and grouping

The subjects were patients who underwent standardized systematic treatment for first-time hospitalization after TBI. Medical records were obtained for the period from January 2020 to December 2020 in the Affiliated Hospital of JLNMCH Bhagalpur

Inclusion criteria were: complete medical records, including the diagnosis of craniocerebral trauma, brain contusion or skull fracture, and other diagnostic parameters related to traumatic TBI.

Exclusion criteria were: (1) rehabilitation treatment for TBI; (2) hospital readmission for TBI; (3) a previous history of TBI and hospitalization for other reasons.

The subjects were divided into 3 groups, including the juvenile (0–17 years), middle-aged (18–64 years), and elderly (65 years and older) groups.

The data collected included general patient information (e.g., hospitalization, medical records, gender, age) and inpatient medical records (e.g., injury pattern, manner, and type; type and location of skull fracture; intracranial hematoma, cerebral injury).

Methods

This was a retrospective study. By reviewing the medical records of all subjects, the required information was collected using a pre-established questionnaire. The data were input into computers and SPSS 21.0 software was used for analysis.

Data collection

According to the above inclusion and exclusion criteria, eligible subjects were screened and their original hospitalization records retrieved to fill out the questionnaire.

3. Results

Age & Sex Specific

From January 2020 to December 2020 in the Department of Neurosurgery JLNMCH Bhagalpur there were 260 patients with TBI, including 201 males (77.30%) and 59 females (22.70%). There were 3.40 times more males than females (Table 1). The male-to-female ratios in the juvenile, middle-aged, and elderly groups were 1.66, 5.34, and 2.44, respectively.

Among the 260 cases of TBI, 51 died (19.49%). The highest mortality rate was found in elderly individuals and the lowest in the juvenile group (Table 1).

Table 1: Sex ratios in different age groups.

Age	Male	Female	Total	P value	χ2(Pvalue
<18	40 (63.04%)	24 (36.96%)	64	P<0.05	162.78
19-59	139 (84.13%)	26 (15.87%)	165	P<0.05	
>59	22 (70.36%)	9 (29.64%)	31	P<0.05	
Total	201 (77.30%)	59 (22.70%)	260	-	

*P<0.05versus≤18; #P<0.05versus19~59.

Mode of injury in different age groups

A total of 260 patients of TBI were included for the study. Their ages ranged from 1 to 70 years (median 35.5 years). There were 201 males and 59 females, with the ratio of 3:1. The predominant mode of injury was motor vehicle accidents involving 67% of patients, followed by falls from height (28%), and the rest 5% included assault, fall of objects, etc. The distribution of various modes of injury in different age groups is as shown [Figure 1]. Falls were more frequent in children and elderly, compared with others ($P < 0.001$). This may be due to ignorance of risks in children, and in coordination in elderly.

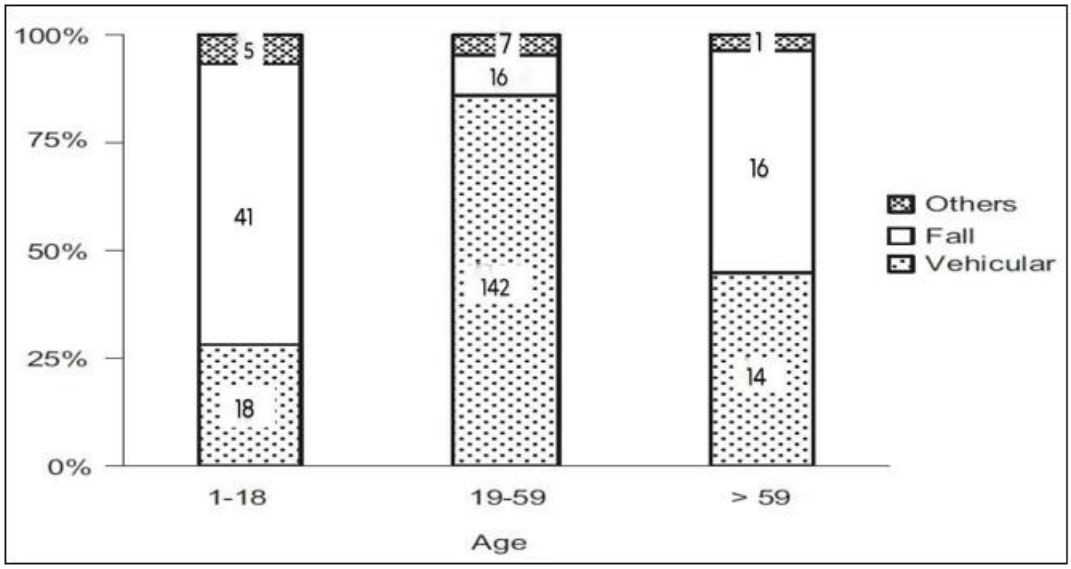

Figure 1: Mode of injury in different age groups ($P < 0.001$)

TBI types

For Traumatic Brain injury types, cerebral injury was the most common, accounting for 79.38%, followed by intracranial hemorrhage (65.44%), skull fracture (58.10), and scalp injury (57.48%). Scalp injury and intracranial hematoma were the most common types in the juvenile (67.32%) and elderly (69.56%) groups. Both cerebral injury and skull fracture were the most common type in middle-aged subjects (90.44% and 63.50%, respectively) (Table 5)

Table 2: Types of Traumatic Brain injuries in different age groups.

Age	Scalp injury	Skull fracture	Intracranial hematoma	Cerebral injury	P value	x2 (P value)
<18	43 (67.32%)	37 (58.63%)	35 (55.62%)	333 (53.88%)	P<0.05	151.01
19-59	94 (57.29%)	104 (63.50%)	113 (68.65%)	148 (90.44%)	P<0.05	
>59	13 (41.13%)	10 (35.48%)	22 (69.56%)	25 (79.23%)	P<0.05	
Total	150 (57.48%)	151 (58.10%)	170 (65.44%)	206 (79.38%)	-	

*P<0.05versus≤17; #P<0.05versus18~64.

Maximum number of head injury was caused due to road traffic accidents 174(67%). Road traffic accident was the most common cause of associated systemic injury affecting the long bone or pelvis 86(81%) followed by major chest injury and maxillary or mandibular fracture. (Table 3)

Table 3: Relationship between mode of head injury and associated systemic injuries

S. No.	Type of Injury	Mode of Injury	Fall from	Other
		Road traffic accident	height	Injury
1.	Long bone or pelvic fracture	86 (81%)	18 (10%)	7 (9%)
2.	Maxillary or mandibular fracture	19 (50.0%)	15 (25.0%)	6 (25.0%)
3.	Major chest injury	30 (75.0%)	20 (25.0%)	-
4.	Abdominal visceral injury	29 (100%)	-	-
5.	Spinal injury	10 (42.0%)	20 (58.0%)	-

Among the total 244 patients, 25% patients had mild, 16% patients had moderate and 59% patients had severe TBI, respectively. The age of patients was significantly associated with the severity of an injury with severe grade, more frequent with increasing age ($P = 0.006$). The mean age of patients with mild, moderate and severe grades of injury were 26, 33 and 35 years, respectively [Figure 2].

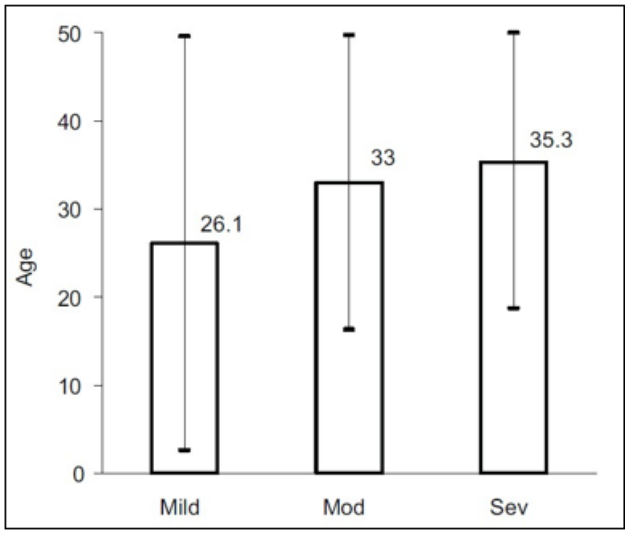

Figure 2: Mean age in different grades (P = 0.006) (Error bars indicate standard deviation)

Based on admission CT scan, 16%, 23%, 18%, 25% and 18% of patients belonged to TCDB CT category 1,2,3,4 and 5, respectively. As age increased, there was a significant increase in TCDB CT category, with category 5 more common in elderly, compared with category 1 being more frequent in young patients ($P < 0.001$) [Figure 3].

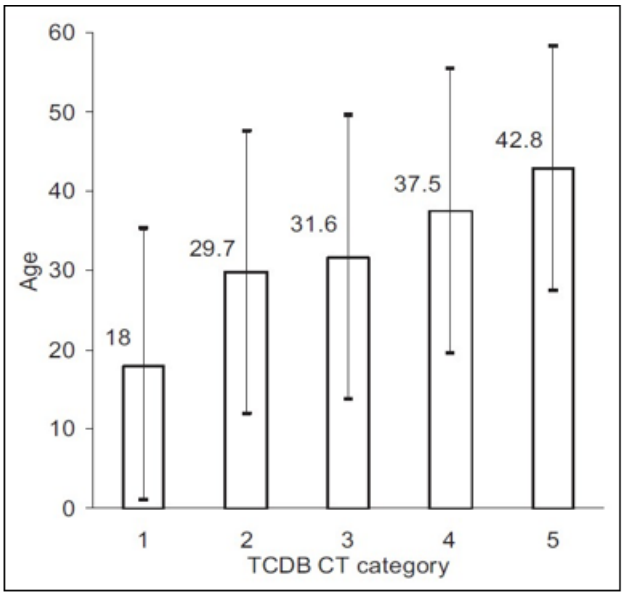

Figure 3: Mean age across TCDB CT category (P < 0.001)

Of the total 260 patients, 188 patients required surgical intervention as per the mass effect, noted in CT scans. Out of 196 adult patients, 104 (53%) patients required surgical intervention, compared to 14 (22%) out of the 60 patients who were 1 to 18 years old [Figure 4]. The difference was statistically significant with an odds ratio of 4.1 ($P < 0.001$).

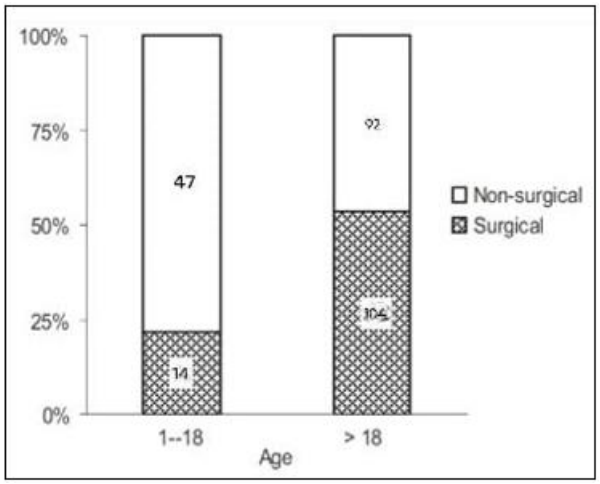

Figure 4: Surgical intervention in different age groups (P < 0.001)

Among the 260 cases of TBI, 51 died (19.49%). The highest mortality rate was found in elderly individuals and the lowest in the juvenile group (Table 4). Mortality at 1 month was

significantly associated with increasing age with 9.37%, 21.23% and 31.65% of patients dead at 1 month in the age groups < 18, 19 - 59 and > 59 years, respectively ($P < 0.001$)

Table 4: Mortality rate in different age groups

Age	Cases	Mortality	P value	χ2(Pvalue
<18	64	06 (9.37%)	P<0.05	117.56
19-59	165	35 (21.23%)	P<0.05	
>59	31	10 (31.65%)	P<0.05	
Total	260	51 (19.49%)	-	

* P<0.05 versus ≤17; # P<0.05 versus 18~59.

4. Discussion

TBI is a major health burden on our society.[12]. [7] As early as in 1970, Heiskanen *et al*[11] noted 78% mortality in patients over 60 years of age with severe TBI and recommended discretion before embarking on any special treatment. Since then, an increasing age has been noted in various studies to be associated with poorer outcome in patients with TBI. [3-6] However, it remains unclear how an association between patient age and outcome after TBI can be described best.[7] Several authors have noted varied age thresholds for poor prognosis. Our study noted stepwise worsening of outcome centered around 30 - 50 years with the best fitting threshold of 40 years in logistic regression, similar to the results of the meta-analysis, performed by Hukkelhoven *et al*. [17] Most of these studies were performed in severe TBI, whereas the present study includes patients with mild, moderate and severe TBI. Gomez *et al*,[4] Bricolo *et al*,[12] Signorini *et al* [13] and Vollmer *et al* [14] noted age thresholds 35, 40, 50 and 55 years, respectively, while Braakman *et al*,[3] Heiskanen *et al* [11] and others [7] noted 60 years as the critical threshold. However, there are still many authors who noted the effect of age to be continuous [51516] and not discrete. Narayan *et al*[5] noted 57% and 78% unfavorable outcome in the age groups 41 - 60 and over 60 years, respectively.

The preponderance of falls, noted in the elderly in our study, has been observed in many previous studies.[14] Also, there was an age-related trend towards increasing intracranial hematomas with the larger lesions observed more in older patients, similar to other studies.[7]

Our study had noted an impact of age of a person with TBI on poor outcome to be independent of the confounding effect of worsening TCDB CT category, diminishing GCS and surgical intervention. The limitations of this study are the relatively small number of patients in a single institution with inherent admission bias, and the crude outcome measure utilized.

The impact of age on outcome is probably due to the decreased capacity of adult brain for recovery as it ages, due to decreasing number of functioning neurons and greater exposure to subclinical insults.[20] The future area of research would be to explore the capacity for learning in the adult brain and how that is influenced by TBI. It would also be interesting to see how functional ability in everyday life is related to the age of patients with TBI.

5. Conclusions

This was the Retrospective study assessing clinicopathological characteristics of traumatic Brain Injury among juvenile, middle-aged, and elderly patients. The current findings might provide novel insights into the clinicopathological and epidemiological characteristics of traumatic brain injury in different age groups and help improve the clinical diagnosis and treatment of TBI. TBI compared elderly and young subjects. This study provides more detailed results by including middle-aged subjects. The findings could help determine how TBI occurs as well as its cause and manner of injury in relation to age.

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