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Original Article

Retrospective Review of Bilateral Decompressive Craniectomy of 51 Patients after Severe Traumatic Head Injury

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Abstract:

Background: *Decompressive craniectomy (DC) is one of the commonly used treatment modalities for refractory intracranial hypertension after severe traumatic brain injury.*

Objective: *To assess the functional outcome following bilateral decompressive craniectomy (DC) in traumatic head injury based on Glasgow Outcome Scale (GOS).*

Materials and methods: *This is a retrospective study conducted at Enam Medical College & Hospital, from January 2019- December 2020. Data of the patients who had undergone bilateral DC for severe traumatic head injury were reviewed from medical record files. Data were collected pre-designed data collection sheet. Data were analyzed using computer based program statistical package for social science (SPSS) for windows version 25.0 software.*

Results: *This study shows maximum (56.9%) were 16-30 years. The average age was 29.70±14.78 years. Majority were male (94.1%) and only 5.9% were female. Road traffic accidents (RTA) were the most frequent causative event of traumatic injury. Most of the patients (88.2%) were hospital stay 1-5 days then 9.8% were 6-10 days and only 2% were >10 days. The average hospital stays were 3.26±2.43 days. Majority (60.7%) were good recovery, 13.7% were moderate disability, 5.9% were severe disability, 2% were persistent vegetative state and 13.7% were death at home.*

Conclusion: *This study recommends a larger prospective study to assess the long-term functional outcome of bilateral decompressive craniectomy after severe traumatic head injury.*

Keywords: *Severe head injury, Bilateral DC, Bilateral decompressive craniectomy, Outcome, RTA, Physical assault*

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Introduction:

Traumatic brain injury (TBI) remains one of the most serious public health problems worldwide, and in particular in low- and middle-income countries (LMICs).[1] According to World Health Organization (WHO) estimates, each year around 5.8 million deaths

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occur worldwide that are due to or associated with traumatic injuries.[2] Traumatic brain injury (TBI) stands out among other injuries for its significant contribution to mortality, disability.[3,4]

Severe head trauma can lead to brain swelling, increased intracranial pressure (ICP), reduced cerebral blood flow, inadequate oxygen delivery, ischemia, metabolic failure, and brain edema. Strategies to control ICP and maintain an adequate cerebral perfusion pressure (CPP) comprise a central principle in managing severe TBI.[5] In some cases, hypertension is refractory to first- and second-level therapeutic measures, and requires emergency surgical intervention with decompressive craniectomy (DC).[2]

Decompressive craniectomy (DC) has been used for the management of intracranial pressure (ICP) with severe TBI patients as a primary or prophylactic intervention, or as a secondary intervention when first-line therapies fail.[6] Some studies in TBI populations have shown that DC improves ICP and cerebral perfusion pressure (CPP), contributing to improved long-term functional outcomes and reduction in costs.[7-9] This study aimed to evaluate the decompressive craniectomy after traumatic head injury

Methods:

This study was designed a retrospective study. After taking permission from hospital to collect data. A consecutive cohort of patients who had undergone DC for traumatic head injury between January 2019-December 2020 at Enam Medical College & Hospital, was identified from medical record files. Patients were selected according to predesigned selection criteria. Data collected from medical record files included age, sex, mode of injury, vital signs, Glasgow Coma Scale (GCS) score and pupillary light reflexes at presentation. The data analysis considered sociodemographic factors, mechanism of injury, Glasgow Coma Scale (GCS) score at hospital admission, pupillary alterations, lesions on computed tomography (CT) of the head, timing from hospital admission to surgery, duration of the surgery, post-surgical destination and length of stay, occurrence of cerebrospinal fluid (CSF) leakage, and surgical site infection. The neurological outcome was determined according to the Glasgow Outcome Scale (GOS) score at the time of discharge, and the duration of hospitalization was also analyzed. Data were collected pre-designed data collection sheet. Data were analyzed using computer based program statistical package for social science (SPSS) for windows version 25.0 software. The level of significance was set at 0.5%.

Inclusion Criteria:

Patient with severe traumatic head injury determined from history, clinical examination and radiology.

Exclusion Criteria:

1. Minimal, mild head injury on initial evaluation
2. Stroke (Haemorrhagic, Ischemic)
3. Brain tumor

Results:

Table-I

Demographic characteristics of the study subjects (n=51)

Characteristics	Frequency	Percentage
Age in years		
≤15	4	7.8
16-30	29	56.9
31-45	10	19.6
46-60	6	11.8
>60	2	3.9
Mean±SD	29.70±14.78	
Sex		
Male	48	94.1
Female	3	5.9

Table-II

Mode of injury of study subjects (n=51)

Mode of injury	Frequency	Percentage
RTA	40	78.4
Physical Assault	5	9.8
Fall From Height	6	11.8

Table-III

Clinical findings of study subjects (n=51)

Head Injury	Frequency	Percentage
Moderate	17	33.4
Severe	30	58.8
Critical	4	7.8

Table-IV
Hospital stay of study subjects (n=51)

Hospital stay	Frequency	Percentage	Mean±SD
1-5	45	88.2	3.26±2.43
6-10	5	9.8	
>10	1	2.0	

Table-V
Outcome (Glasgow Outcome Scale) of study subjects (n=51)

Outcome	Frequency	Percentage
Good recovery (GOS 5)	31	60.7
Moderate disability (GOS 4)	7	13.7
Severe disability (GOS 3)	3	5.9
Persistent vegetative state (GOS 2)	1	2.0
Death (GOS 1)	7	13.7
Discharge Against Medical Advice	1	2.0
Did not came to follow up	1	

Table-VI
Complication of study subjects (n=51)

	Frequency	Percentage
CSF Leakage	2	3.9
Wound Infection	2	3.9
Ventilator Associated Pneumonia	1	2.0
Oral	1	2.0
Candia	1	2.0

Table-VII
Association of outcome (GOS) and age of study subject ((n=51)

Age in years	Outcome				P value
	GOS=5		GOS ≥5		
	No	%	No	%	
≤50 years	13	76.5	29	93.5	0.087
>50 years	4	23.5	2	6.5	

Discussion:

Decompressive craniectomy DC is a surgical procedure for refractory intracranial hypertension following severe TBI. DC has been shown to decrease ICP and increase brain compliance, cerebral blood flow and oxygen perfusion[10] Decompressive craniectomy after TBI may clarify many aspects of the clinical application of this technique. However, some important pathophysiological issues, that is, the timing of DC, its effect on brain edema formation, and the role of secondary brain damage must be taken into consideration.[11]

This study shows maximum (56.9%) were 16-30 years. The average age was 29.70±14.78 years. This finding consistent with Silva et al.[2] Similar study Prasad et al.[12] reported the mean age was 38.3 years (range 1–-68 years).

In this study found majority were male (94.1%) and only 5.9% were female. These findings are well agreement with other studies Silva et al.[2] Similar study Shah et al.[13] reported 33 (71.7%) were male and 13 (28.3%) were female.

This study shows road traffic accidents (RTA) were the most frequent causative event of traumatic injury. Since significantly more traffic accidents involved motorcycles compared to other types of vehicles, motorcycle accidents were analyzed separately from other traffic accidents. These findings are well agreement with other studies Silva et al.[2]

This study shows 33.4% were moderate traumatic head injury, 58.8% were severe traumatic head injury and 7.8% were critical head injury. Similar study Silva et al.[2] reported 23.3% were mild traumatic head injury, 27.9% were traumatic head injury and 48.8% were severe traumatic head injury.

This study shows most of the patients (88.2%) were hospital stay 1-5 days then 9.8% were 6-10 days and only 2% were >10 days. The average hospital stays were 3.26±2.43 days. This finding consistent with Prasad et al.[12] they reported most patients stayed less than 5 days (45%). Another study Silva et al. most of the patients (57%) were <5 days. The mean postoperative hospital stay was 4.8 days.

This study shows (60.7%) were good outcome. Similarly, a retrospective study by Laghari *et al*. from Pakistan found that 51.4% had favorable outcome after DC at 3-month follow-up.[14] Aarabi *et al*. reported 40% favorable outcome (GOS 4 or 5) among TBI patients who were followed up for at least 3 months after DC.[15]

This study shows 76.6% were GOS score <5 in <50 years age group and 93.5% were GOS score =5. On the other hand, in >50 years age group 23.5% were

GOS <5 and only 6.5% were GOS =5. It indicating that d"50 years were found to be associated with better outcome. This finding consistent with Shah et al.[12] Choudhary and Bhargava from Indian reported that younger patients had more favorable outcome (64% vs. 19%) than patients of age >50 years, and also, mortality was higher among the elderly (above 50 years).[16] Similar to the above findings, other previous studies have also reported age as one of the predictors of better outcome, age being more than 50 years associated with unfavorable outcome and higher complications. [17,18,19]

This study shows the complication rate was 9.8% (5 of 51) due to case of CSF leakage (3.9%), only 2 (3.9%) case developed wound infection and 1 patient developed ventilator associate pneumonia oral and candida which was consistent with prasad et al.[12] they reported the complication rate was 10.7% (10 of 93). Klinger *et al*. analyzed 258 cranioplasties over a 10-year period and noted a 10.8% complication rate in their series.[20] Schuss et al.[21] conducted a retrospective analysis reported the overall complication rate was 16.4%, which included epidural or subdural hematoma (6%), wound healing disturbance (5.7%), abscess (1.4%), hygroma (1.1%), and cerebrospinal fluid fistula (1.1%).

Chaturvedi et al. analyzed 74 cases of CP performed after DC over a 10-year period including only patients with traumatic etiology. They reported a complication rate of 31%, of which infections constituted 14% and 10%.[22] Liang *et al.* analyzed 88 cranioplasties over a 7-year period and noted a 6.8% complication rate.[23] Walcott *et al.* conducted an 8-year retrospective analysis of 239 CP procedures and noted an overall complication rate of 23.85%.[24]

A variety of differently designed studies indicate that DC should significantly decrease the mortality of patients with severe TBI,[25,26] TBI remains a substantial source of morbidity and mortality, mainly in areas with limited resources to adhere to Level 1 recommendation protocols, and particularly in those regions that have a higher burden of TBI mortality.[27]

Conclusions:

This study shows majority of these patients were young adult males involved in road traffic accidents. Majority were good recovery. Age <50 years were associated with favorable outcome. Improving patient selection and having a provision of ICP monitoring may optimize the outcome of decompressive craniectomy. This study recommends a larger prospective study to assess the long-term functional outcome of bilateral decompressive craniectomy after sever traumatic head injury.

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