http://www.banglajol.info/index.php/JNINB

DOI: https://doi.org/10.3329/jninb.v6i2.50779

Original Article

Journal of National Institute of Neurosciences Bangladesh,
July 2020, Vol. 6, No. 2, pp. 124-128

ISSN (Online) 2518-6612
ISSN (Print) 2410-8030

Severe Head Injury Management at a Tertiary Care Hospital in Dhaka City

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[**Received:** 12 April 2020; **Accepted:** 20 May 2020; **Published:** 1 July 2020]

Abstract

Background: Severe traumatic brain injury can be a serious condition. **Objective:** The purpose of the present study was to see the decompressive craniectomy (DC) of severe traumatic brain injury. **Methodology:** This clinical trial was conducted in the Department of Neurosurgery at Dhaka Medical College Hospital, Dhaka, Bangladesh from January 2012 to December 2013 for a period of two (02) years. Patients with the age of 18 years and above, GCS of the patients 8 to 4, severe traumatic brain injury (TBI) with multiple hemorrhagic contusions and midline shift, on CT scan and severe TBI with gradual neurological deterioration were included for this study. Total 60 patients were included. **Result:** A total of 60 patients were included in this study. Almost two third 18 (60.0%) patients had favorable outcome (GOS 4 and 5) in group A and exactly two third 20(66.7%) patients had Unfavorable outcome (GOS 1,2 and 3) in group B ($p<0.05$). In this study 8 patient died among which 5 had GCS 4 and 3 had GCS 5. One patient with GCS 5 became persistent vegetative. Eight patient with good recovery had GCS 8, 7 and 6. Death occurred at mean GCS 9±2.mm of midline shift followed by 8± mm in persistent vegetative, 5.67±2.08 mm in severe disability, 4.5±2.88 mm in moderate disability and 3.38±1.06 mm in good recovery. **Conclusion:** Group A had better clinical outcome than group B. So based on statistical analysis it can be concluded that DC is preferable to conservative management in case of severe TBI. *[Journal of National Institute of Neurosciences Bangladesh, July 2020;6(2):124-128]*

Keywords: Post-Operative outcome; decompressive craniectomy; severe traumatic brain injury

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Conflict of interest: There is no conflict of interest relevant to this paper to disclose.

Funding agency: This research project was not funded by any group or any institution.

Contribution to authors: Haque MM, Ahmed M, Haque F contributed from the protocol preparation, data collection, statistical analysis up to report writing. Manuscript writing was performed by Islam MS, Modhu RA, Sarker AC involved in supervision of the research work and revision of manuscript.

How to cite this article: Haque MM, Ahmed M, Haque F, Islam MS, Modhu RA, Sarker AC. Severe Head Injury Management at a Tertiary Care Hospital in Dhaka City. J Natl Inst Neurosci Bangladesh, 2020;6(2): 124-128

Introduction

The heterogeneity of TBI is considered one of the most significant barriers of finding effective therapeutic protocol for either conservative management or early surgical intervention[1]. The management of severe TBI is aimed at controlling the intracranial pressure (ICP) and to maintain optimum cerebral perfusion pressure (CPP) and cerebral blood flow (CBF) and thus preventing cerebral ischemia[2]. Current management protocol for of TBI is divided into two tires. Tire one consists of high

flow oxygen inhalation, positioning head end 300 up, infusion of 20.0% mannitol, adequate sedation, proper muscle relaxation, controlled hypothermia, intramuscular barbiturate injection, controlled hyperventilation, intramuscular analgesic , external ventricular drainage and endotracheal intubation. Non responders to tier one are given tire two which consists of barbiturate coma, hypothermia, and decompressive craniectomy (DC)[3].

Outcome of DC varies among patients. Later on after recovery these patients have to go through an additional cranial procedure, that is cranioplasty. It is the process by which the skull gap, created by DC is covered by bone, which is preserved in the subcutaneous pocket of the anterior abdominal wall of the patient or by making an artificial bone flap. The time between DC and cranioplasty varies between 1 to 12 months depending on the patient's condition to undergo a second procedure and reduction of brain edema[4-5]. During this time brain, though covered by scalp, is exposed to the atmospheric pressure that causes local vascular dysfunction and CSF flow alternation which delay recovery. Cranioplasty should also be considered early as it prevents brain from local injury[6].

Gradual decrease in mortality and increase in number of patients that have good outcome after early decompressive craniectomy (DC) was reported by several authors[7]. DC is comparatively inexpensive and easy procedure which may be adopted by the developing countries as a first line measure for controlling impending cerebral swelling with intracranial hypertension[8]. Most of the studies done so far with severe traumatic brain injuries treated with DC were in developed countries with optimum neuromonitoring system and well trained manpower with round the clock follow up. An optimum working protocol is to be standardized for countries. Intracranial hypertension is the most dreadful consequences of severe TBI, which if prolong, leads to death. Severe traumatic brain injury is common in the neurosurgery ward of this country, especially in Dhaka Medical College Hospital, where moribund patents are referred from all over the country. Early surgical intervention in severe traumatic brain injury (TBI) with features of raised ICP brings good outcome. Appropriate, effective and easy procedure, like DC in severe TBI, is necessary to get optimum benefit. Clinical judgment made on GCS and CT scan, is the method of choice for selecting patient for early intervention. The purpose of the present study was to find out the post-operative outcome of decompressive craniectomy (DC) in the management of severe traumatic brain injury.

Methodology

Study Design and Settings: This was a clinical trial which was conducted in the Department of Neurosurgery at Dhaka Medical College Hospital, Dhaka, Bangladesh from January 2012 to December 2013 for a period of two (02) years. Purposive sampling was done according to availability of patients strictly considering the inclusion and exclusion criteria. Patients with the age of 18 years and above, GCS of the patients 8 to 4, severe traumatic brain injury (TBI) with multiple hemorrhagic contusions and midline shift, on CT scan and severe TBI with gradual neurological deterioration were included for this study. GCS of the patients 3, intracerebral hematoma more than 3 cm diameter, acute subdural, epidural hematoma more than 5 mm thickness, intracranial mixed hemorrhagic contusion more than 5 cm in long axis, compound depressed skull fracture without brain injury, patients with primary fatal brainstem injury, penetrating brain injury and critically ill patient with multiple associated injury, unlikely to survive were excluded from this study.

Allocation and Grouping of the Patients: Enrollment of patients for the study started from July, 2012. Total 60 patients were included. The first 30 consecutive patients' attendant agreed to go through decompressive craniectomy surgery were included in group A and the first 30 consecutive patients' attendants refused to go through surgery were included in group B. Patient of severe TBI were usually associated with multiple system injury. For that reason ATLS (Advanced Trauma Life Support) protocol were followed for each of the patients. Simultaneously with resuscitation, immediate medical management for severe head injury was initiated according to hospital or respective unit protocol. After the patient was hemodynamically stable, investigation, like non contrast CT head was done for planning further management. If CT scan and clinical evaluation suggested, patients were enrolled for the study and simultaneously surgery (DC) was done without delay (Group A). If investigation did not suggest such immediate intervention, medical management was continued and patients were not enrolled for the study. Those patients attendant refused surgery were given medical management only (Group B). Treatment goal of group B was maintenance of cerebral perfusion pressure above 60 mmHg and intracranial pressure below 20 mmHg. All patients who did not go through immediate neurosurgical decompressive procedure after hospital admission were routinely monitored clinically by measuring GCS,

pulse, respiration, pupil, and focal neurological sign. Operative group or Group A were divided into early craniectomy group who underwent craniectomy within the first 24 hours after hospital admission and Late craniectomy group who underwent craniectomy later than the first 24 hours after hospital admission, due clinical and radiological feature of raised intracranial pressure, observed later in repeat CT. These patients developed the indications of surgery later on. Decompressive Craniectomy Surgical Procedure was performed under general anesthesia. Unilateral frontotemporoparietal craniectomy was approached by a reverse question mark incision.

Statistical Analysis and Ethical Issue: Follow-up of the patients was accomplished and the outcome was recorded. The data was entered into SPSS Statistical Package for Social Sciences, version 17.0 computer software programs. For statistical analysis, Chi-square test, Fisher exact t test, paired't' test, Unpaired 't' test were done to determine the significant differences between the groups. Differences were considered statistically significant at $p < 0.05$. Data were presented in table and bar chart. Prior to commencement of the study, the research protocol was approved by Ethical Review Committee.

Results

A total of 60 patients were included in this study, they were divided into 7 groups. Age range was 19 to 80 in operative group and 21 to 85 in conservative group. It was observed that majority, 9 patients were from 21-30 years of age in operative group whereas conservative treatment was given in 7 patients in 51-60 years of age. The mean age was found 44.8±16.72 years in operative group and 46.13±16.55 years in conservative group. The mean age difference was not statistically significant ($p>0.05$) in the two groups (Table 1).

Table 1: Age Distribution of the Patients (n=60)

Age Group	Types of treatment		Total
	Group A	Group B	
Below 20 Years	2	0	2
21 to 30 Years	9	4	13
31 to 40 Years	1	3	4
41 to 50 Years	7	6	13
51 to 60 Years	6	7	13
61 to 70 Years	3	4	7
Above 70 Years	2	6	8
Total	**30**	**30**	**60**
Mean± SD	44.8±16.72	46.13±16.55	
Min-Max	19 to 80	21 to 85	

Group A= operative; Group B= conservative or non-operative group; p value=0.757

Figure I shows a comparison of GOS at 6 month with admission GCS of the study patients. It was observed that 8 patient died among which 5 had GCS 4 and 3 had GCS 5. One patient with GCS 5 became persistent vegetative. Eight patient with good recovery had GCS 8, 7 and 6.

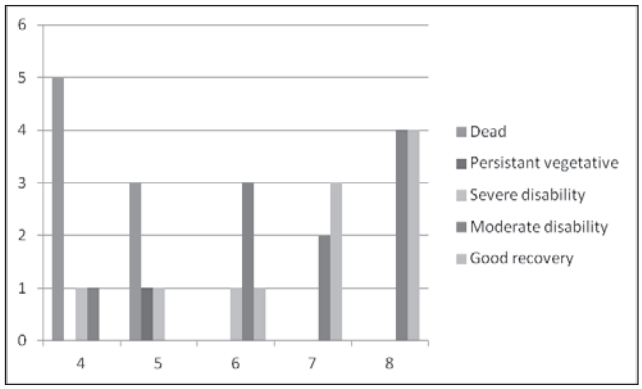

Figure I: Distribution of comparison between GOS at 6 month with admission GCS

Table 2 shows GOS at 6 months with midline shift, in mm, of the study patients. It was observed that death occurred at mean GCS 9±2.mm, followed by 8± mm in persistent vegetative, 5.67±2.08 mm in severe disability, 4.5±2.88 mm in moderate disability and 3.38±1.06 mm in good recovery.

Table 2: Comparison between GOS at 6 month with midline shift in mm (Operative group, n=30)

GOS at 6 month with midline shift in mm	n	Mean±SD	Min - Max
Dead	8	9±2	6,12
Persistent vegetative	1	8±2.01	8,8
Severe disability	3	5.67±2.08	4,8
Moderate disability	10	4.5±2.88	1,11
Good recovery	8	3.38±1.06	2,5

Discussion

Although decompressive craniectomy (DC) is a lifesaving procedure, controversy exists about patient selection and timing of the procedure[7]. However, there are no clearly defined indications or specified guidelines for patient selection and timing for the procedure[9].

This study was carried out with an aim to determine the outcome of decompressive craniectomy (DC) in patients of severe traumatic brain injury by Glasgow outcome scale (GOS) and also to assess the prognostic factors that affects outcome in this particular group of patients. Out of the 60 patients 30 patients were operated by DC. An equal number of patients were treated by conservative management. A total of 60 patients were included in this study, they were divided into 7 age groups. Age range was 19 to 80 in group-A and 21 to 85 in group-B. It was observed that majority, 9(33.0%) patients were age 21 to 30 years in group A. The mean age was found 44.8±16.72 years in group A and 46.13±16.55 years in group B. The mean age difference was not statistically significant ($p>0.05$) in unpaired t-test between the two groups. Similar observation is found in the study by Cooper et al[3] where the age ranged from 15 to 65 years. The study of Adeleye[10] comprised of patients with age ranged 23 to 78 years. The study of Mezue et al[11] comprised of patients with age ranged 15 to 80 years.

The present study enrolled 60 patients into two groups. Group A consists of 30 patients who underwent decompressive surgery and group B consists of 30 patients who were managed by conservative management. Cooper et al[3] studied total 155 patients of which 73(47.096%) patients underwent DC while 82(52.90%) had medical management, which correlates with this present study. GOS at discharge of the patients showed that almost one fourth 8 (26.7%) died in group A (Operative group) whereas two third 20 (66.7%) patient in Group B. The difference of GOS at discharge was statistically significant between two groups. Adeleye[10] had mortality in 7(44%) cases. GOS at 6 months follow up of the study patients showed that one fourth 8(26.7 %) died in group A (Operative group) whereas two third 20(66.7%) patient in Group B. The difference of GOS at discharge was statistically significant between two groups. Cianchi et al[12] in his study observed mortality of 29(48%) operated patient and 36(29%) of the conservatively treated patients. Mortality in this study is very high in conservatively treated group.

Overall functional outcome of the study patients showed that almost two third 18 (60.0%) patients had favorable outcome (GOS 4 and 5) in group A and 20(66.7%) patients had Unfavorable outcome (GOS 1, 2 and 3) in group B. The overall functional outcome difference was statistically significant between the two groups. This suggests that surgery has a better role to play in severe TBI patients than medical management group. Study of Kersh and El-Gendy[13] reported favorable outcome in 14(46.7%) of their cases and 16(53.33%) unfavorable outcome undergoing surgery.

Comparing the GOS at 6 months with admission GCS, showed that death was inevitable at admission GCS 4 and 5, followed by GCS 5 in persistent vegetative state, GCS 6 with severe disability and moderate disability and GCS 7 and 8 mostly in good recovery. So it may be concluded that higher the GCS at admission, better the outcome. Similar findings were observed in the study of Kersh and El-Gendy[13]. 6(20.0%) cases with GCS 4 either died or remained persistent vegetative. 6(20%) cases with GCS 5 suffered severe disability or remained persistent vegetative. 5(16.7%) cases with GCS 6 suffered moderate disability or had good recovery. 6(20%) cases with GCS 7 had good recovery or moderate disability.

Correlating the GOS at 6 months with midline shift, in mm, of the study patients it was observed that death occurred at mean shift of 9±2 mm, followed by 8±2.01 mm in persistent vegetative, 5.67±2.08 mm in severe disability, 4.5±2.88 mm in moderate disability and 3.38±1.06 mm in good recovery. Similar findings were observed in the study of Kersh and El-Gendy[13] where functional recovery with shift <10mm was 10/11 (90.9%) patients and non-functional recovery was in 1/11(9.1 %) patient. While functional recovery with shift > 10mm was 4/19(21.05%) patients and non-functional recovery was in 15/19(78.95 %) patient. From this study statistically significant difference between the two study groups were found. Chi-square test provided the test of significance for the correlation the post operative outcome measured by GOS at discharge, GOS at 6 months follow up. Overall functional outcome in respect of GOS between the groups. There was better outcome in group A regarding GCS on admission and GOS at 6 months, midline shift with GOS at 6 months.

There are some limitation of the study. Sample size was small. For all critical patients we could not provide ICU support. It was a single centre study. Follow up after discharge was short, a longer follow up might bring a better result. Shortage of trained manpower and proper infrastructural backup for every comprehensive care and periodic follow up of a patient of S.TBI before and after surgery.

Conclusion

It can be concluded that there is a good correlation between the early intervention by DC and favorable outcome. Keeping in mind of the important variables

that affects outcome a better result can be expected. A randomized controlled trial may be done in the same institute by allocating the patients of severe TBI in a group where conservative management is given and another group where early decompressive craniectomy (DC) is done. It may be recommended that when monitoring is not possible or feasible, early DC is a better option in the management of severe TBI.

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