

Non Decompressive Single Stage Bilateral Craniotomy in Traumatic Brain Injury

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Traumatic brain injury (TBI) is a heterogeneous entity that remains a major health-care problem worldwide. Surgery is usually indicated for traumatic lesions such as hematomas, fractures, or malignant cerebral edema. Most cases of surgery are unilateral with bilateral indication usually reserved for severe cerebral edema or bilateral hematoma.

This is a prospective single center study of all cases that underwent Single stage bilateral craniotomy (SSBC) from January 2010 to January 2013. Computed tomogram images of all TBI cases were analyzed and those cases that met the inclusion criteria were included.

Out of all trauma cases there were 37 (4.6%) that met the inclusion criteria for SSBC. Males accounted for 33 (89%) of the total cases. There were almost equal numbers of cases in the mild, moderate and severe subtypes of TBI based on the initial GCS. The most common surgical procedures performed were bilateral frontal contusectomy followed by unilateral epidural hematoma (EDH) and contralateral contusion evacuation. There were four perioperative deaths (10.8%). At the end of one month all 29 cases were followed up and the majority were found in the good recovery group, followed equally in the other Glasgow outcome groups.⁹

SSBC is a safe, swift and cost effective technique in TBI with advantages of single anesthesia and surgical charges, postoperative care is the same for unilateral procedures, hospital stay is reduced, possible disastrous consequences of increase of opposite lesion avoided and is especially useful in developing countries where resources are limited.

Key Words: craniotomy, decompressive craniectomy, GCS, TBI

Traumatic brain injury (TBI) is a heterogeneous entity that remains a major health-care problem worldwide. TBI management includes both surgical and medical methods which in recent years have led to substantial improvements in outcome. Surgery is usually indicated for traumatic lesions such as hematomas, fractures, or malignant cerebral edema. Most

cases of surgery are unilateral with bilateral indication usually reserved for severe cerebral edema or bilateral hematoma.^{4,7,8,11} The majority of studies in literature pertain to bilateral decompressive craniectomy with few articles dealing with other bilateral neurosurgical procedures.^{4,7,8,11} This article is probably the first from Nepal to record the epidemiological profile and outcome

Inclusion criteria
A. Hematoma/contusion volume > 25 ml
B. Midline shift of > 5 mm
C. Localizing features of raised intracranial pressure- clinically/CT classification
D. Hematoma/contusion volume 15-20 ml with either B or C

Table 1: Showing the inclusion criteria for surgery

Age group	Male	Female	Total
<20	0	1	1
21-40	9	0	9
41-60	13	2	15
61-80	9	1	10
80+	2	0	2
Total	33	4	37

Table 2: Table showing the cases in age wise distribution along with sex in each age group.

GCS	On Admission	On Discharge	Expired/LAMA
<8	12	4	4/2
9-13	12	2	0/2
14-15	13	23	-
Total	37	29	4/4

Table 3: The GCS on admission and on discharge.

in cases that underwent single stage bilateral craniotomy (SSBC) in TBI.

Materials and Methods

This is a prospective single center study of all cases that underwent SSBC from January 2010 to January 2013. Computed tomogram (CT) images of all TBI cases were analyzed and those cases that met the inclusion criteria were included (Table 1). Those cases with burr holes alone and non-traumatic bilateral procedures were excluded from the study. All cases that were included underwent surgery within 2 hours of decision.

Surgical technique: The surgical method was either a bicoronal incision with bilateral craniotomies or isolated individual craniotomies. The patient was placed supine on

a head donut, bicoronal incision made and the flap raised forward. The incision may be extended few centimeters anterior or posterior depending on the findings. Two burr holes were placed bilaterally and the bone flap elevated individually with a high speed craniotome. The larger hematoma or the side with mass effect or the side with temporal lesion or the dominant side if lesions were equivocal, was evacuated first followed by the opposite side. Dural augmentation was done with artificial dura if a tense brain was encountered or with temporalis fascia in smaller defects, where needed. Head rotation was used with caution especially in the elderly and the table rotated for further convenience. In those with bilateral craniotomies similar principle were followed except that the flaps were elevated individually.

All cases were managed in the postoperative ward/neurosurgical intensive care unit (NICU) with or without a ventilator/ tracheostomy depending on the clinical profile on admission. Closed suction drains were used for 48 hours and the skin staples removed on the seventh postoperative day. The Glasgow coma scale (GCS) on admission and discharge, age, sex, site and type of lesion and the neurosurgical procedure performed was recorded. A repeat scan was done on the fifth day or earlier if any neurological deterioration was observed. Outcome was analyzed using the Glasgow Outcome Score (GOS) at one month.

Results

A total of 1370 cases were operated in this institute in the study period with trauma accounting for 795 (58%) of the total cases. Bilateral Chronic subdural hematoma and aneurysm clipping was excluded from the study as the former did not involve a craniotomy and the latter was not a case of TBI. Out of the 795 trauma cases operated there were 37 (4.6%) that met the inclusion criteria for SSBC (Table 1). Males accounted for 33 (89%) of the total cases. The late middle age (40-60 years) was the commonest age group of presentation in both the age groups (40%) (Table 2). There were almost equal numbers of cases in the mild, moderate and severe subtypes of TBI based on the initial GCS (Table 3).

Bi-frontal contusion was the commonest site of injury followed by a unilateral epidural hematoma with a contralateral contusion (Table 4). Epidural hematomas and contusion were the major pathologic types of injury and the frontal or temporal areas were the commonest site of injury. The most common surgical procedures performed were bilateral frontal contusectomy followed by unilateral epidural hematoma (EDH) and contralateral contusion evacuation (Figure 1). Tracheostomy for prolonged ventilation was done in five cases. Eight cases developed ventilator acquired pneumonia (VAP), five cases had urinary tract infection and one case had superficial wound infection. There were four perioperative deaths (10.8%) (all with GCS less than 8) secondary to VAP (3

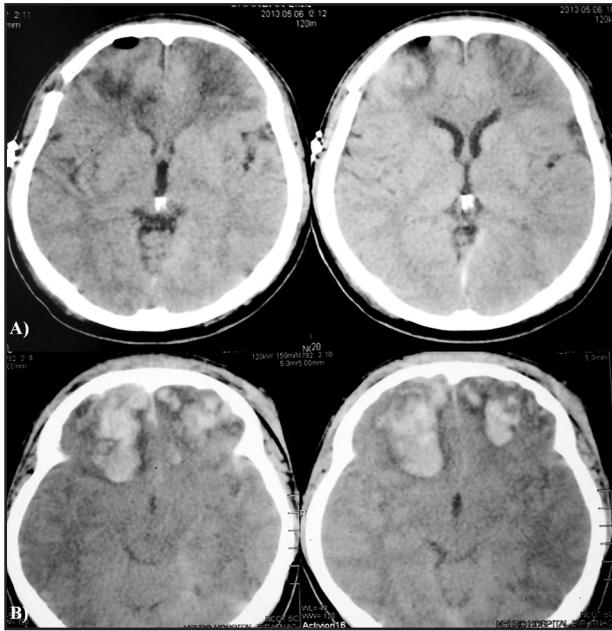


Figure 1: CT head showing bilateral frontal contusion, preoperative (A) and postoperative (B)

Diagnosis	Number
Bilateral Csdh	14
Bifrontal Contusion	7
Unilateral Edh With Contralateral Contusion	6
Bifrontal Edh	4
Bilateral Fronto-parietal Edh	3
Bilateral Temporal Contusion	2
Unilateral Asdh With Contralateral Edh	1

Table 4: The diagnosis of all cases and their number

Outcome	Males	Females	Total
Expired	3	1	4
LAMA	3	1	4
Discharged	27	2	29
Tracheostomy+ chest infection	4	1	5

Table 5: The outcome of surgery with individual age wise and final outcome

Glasgow Outcome Scale (1 month)	Number
Dead	6
Persistent vegetative state	2
Severe disability Moderate disability	3
	3
Good recovery	15

Table 6: The final outcome with respect to GOS at one month.

cases) and severe head injury. A total of four cases went against medical advice due to poor economic condition/ outcome prognosis to the family. The remaining 29 were discharged with the majority in the mild TBI group (62%) (Table 5). At the end of one month the GOS was analyzed which showed the majority in the good recovery group (15 cases) with the rest equally in the other Glasgow outcome groups. Two cases remained in persistent vegetative state and there were two further deaths due to chest infection/bedsore sepsis (Table 6).

Discussion

TBI remains a major health-care problem worldwide inspite of progress in pharmacological treatments, standardization of surgical indications and techniques, and combination of both.¹ Surgery for TBI includes those cases with significant acute or chronic hematomas, depressed fracture, penetrating injuries or those cases with severe brain swelling resistant to medical therapy.

There are no published data for patients with TBI undergoing SSBC in Nepal although reports for other procedures in TBI are found.^{6,9,10} Most articles or research in SSBC concern with decompressive craniectomy, the indications, outcome and methods of which are described in detail.^{2,3,5} SSBC pertaining to non decompressive craniectomy is difficult to find in the literature and most of them are related to EDH alone.^{3,5} Most cases of trauma can be managed with a single side craniotomy and the real incidence of bilateral craniotomy remains unknown but as seen in this article the incidence of SSBC remains very low at only 4.6 %. Although TBI is common in the younger age groups this study found the SSBC was commoner in the middle and elderly age groups. The common indications for SSBC were similar to neurotrauma and included hematoma, fractures and contusion. The frontal and temporal lobe was the most common site for injury which could explain a direct impact and contra coup type of injury.

GCS is a proven scoring/prognosticating system in the management of TBI but as seen in this series it was not an independent factor to decide on intervention for

bilateral procedures. Almost all the cases can be managed by the single bicoronal incision as most of the pathology is in the temporal, frontal and parietal region except those cases with isolated bilateral temporal contusion which require bilateral separate incisions. Intraoperative use of the metallic endotracheal tube, body strapping to the table, generous rotation of the table and care of the cervical spine all help to ease the surgery. Stiff neck in the elderly or short neck in the obese may lead to some difficulties in the surgery. The technique in this study was to place the burr holes bilaterally at the beginning so that pressure on the opposite craniotomy site was avoided due to a later contra lateral burr hole procedure. Due to the difficulty in the procedure some authors have advised for two neurosurgeons operating on both sides.³ Postoperatively the management remains as per the initial GCS and other systemic/medical conditions with either NICU or postoperative ward treatment.

With respect to the cost effectiveness, SSBC reduced the total cost to the patient by 50% mainly by reduction in the intraoperative procedural cost, hospital stay by 2-5 days, pathology charges and number of repeat CT scans as compared with a unilateral procedure. This means a saving of rupees 60-80,000 (USD 700-1000) which is significant in the developing countries. In selected cases the problem of sudden deterioration is also avoided especially where the lesions fulfill the inclusion criteria. This can be a major advantage in all those centers where intracranial pressure monitoring is not available.

Like any other surgical procedure there are both advantages and disadvantages of SSBC. The advantages are single anesthesia and surgical charges, postoperative care is the same for unilateral procedures, hospital stay is reduced, possible disastrous consequences of increase of opposite lesion avoided and single wound scar. There are also several possible disadvantages, namely, long operative time which could not be suitable for elderly/young, increase chances of infection/ morbidity, difficulty in positioning, compromise in the surgical evacuation and possibility of bilateral neurological deficit. The number of cases in this series is low and hence further research in a larger series or multicenter study will help to understand the results better. The drawback of this study is primarily that intracranial pressure monitoring was not used as this could possibly have led to either increase or reduction in the number of SSBC.

Conclusions

SSBC is a safe, swift and cost effective technique in TBI with advantages of single anesthesia and surgical charges, postoperative care is the same for unilateral

procedures, hospital stay is reduced, possible disastrous consequences of increase of opposite lesion avoided and there remains a single wound scar.

Conflict of interest: None

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