ORIGINAL ARTICLE

DECOMPRESSIVE CRANIECTOMY FOR ACUTE SUBDURAL HAEMATOMA WITH EXPANSILE DURAPLASTY VERSUS DURAL-SLITS

Baynazir Khan, Ehtisham Ahmed Khan Afridi, Bushra Khan*, Shahbaz Ali Khan, Ahsan Aurangzeb, Abdul Aziz Khan, Wajiha Khan

Department of Neurosurgery, *Gynaecology and Obstetrics, Ayub Medical College, Abbottabad-Pakistan

Background: Traumatic subdural hematoma is one of the lethal injuries to brain. Various surgical techniques are used to evacuate the acute subdural hematoma. The hematoma evacuation can either be done by opening of dura by multiple slits or by opening of dura in single large c shape and then doing the expansile duraplasty. Present study aimed to compare both these techniques.
Methods: This randomized control study was conducted in department of neurosurgery, Ayub Medical College, Abbottabad from July 2011 to July 2013. A total of 59 patients were included in this study, which were randomly allocated in two groups (i.e., group A and group B) for decompressive craniectomy. Thirty-one patients were operated by craniectomy with full dural flap opening (Group A), and 28 patients were operated by craniectomy with multidural-slits (Group B). Glasgow Outcome score (GOS) at 6 weeks after the surgery was used to determine the outcome.
Results: Mean age of the patients was 33.4±12.8 years. Majority were males. In group A 51.6 % (16) of the patients survived out of which a favourable outcome (GOC 3-5) was observed in 41.9% of the patients, and 9.1% of patients ended up in vegetative state. While in group B 46.4% (13) of the patients survived among which favourable outcome was seen in 39.3% of patients and 7.1% of patients ended up in vegetative state. The difference in outcome measure is insignificant.
Conclusion: There was no statistically significant difference among the two groups as regards the mortality, GOS, frequency of complications and hospital. While the duration of surgery was significantly shorter in patients operated with dural slits.

Keywords: acute subdural hematoma, decompressive craniectomy, multidural-slits

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INTRODUCTION

Traumatic brain injury accounts for significant mortality and permanent disability among adult population. The most common dreadful sequel of traumatic brain injurie is the development of intracranial hematomas and the most lethal of these intracranial bleeds is acute subdural hematoma (ASDH). ASDH is a collection of fresh blood between the dura matter and the arachnoid layer of the brain, which is often large enough in size to compress the brain leading to deterioration of conscious level of the patients, ASDH commonly occurs due to trauma, leading to tearing of bridging veins in the para-sagital space, with mortality remaining in the range of 60–80%.[1, 2]

Incidence of acute subdural hematoma among severe head injured patients' remained in the range of 12–29%, with mean age of patients being 31–47 years, and most commonly involving males.[3,4]

This high mortality rate has been attributed to the characteristics of hematoma itself, due to primary insults to the brain like brain parenchymal injury, and to the secondary insults like due to hypoxia and hypotension in severe head injured patients.[5]

Regarding evacuation of acute subdural hematoma, procedures varies from single burr hole evacuation[6] to craniotomies and decompressive procedures[7]. This study is based on two different surgical procedures, used for evacuation of ASDH and to see their outcome in the management of acute subdural hematoma.

MATERIAL AND METHODS

This is randomized control study was carried out in the department of neurosurgery, Ayub Medical College, Abbottabad from July 2011 to July 2013. A total of 63 patients with isolated, unilateral traumatic ASDH with midline shift of 5mm or more were included in the study. Patients with GCS of 3–4/15 and those presenting more than 12 hours were excluded from the study. After resuscitative measures and radiological workup, patients were subjected to decompressive craniectomy. Informed consent was taken from the attendants of the patients regarding the study. Patients were randomly divided into two groups using blocked method of randomization into two groups for decompressive craniectomy. Group-A patients were exposed to decompressive craniectomy with expansile duraplasty, and group B patients underwent decompressive craniectomy with dural slits.

Decompressive craniectomy was done by removing the parts of frontal, temporal, parietal, and

occipital bone resulting in a large bone flap (diameter >12cm). The bone flap was buried in the abdomen for 6 months. In expansile duraplasty, dura was opened in C-shape towards the base of skull, ASDH was removed, haemostasis secured, and expansile duraplasty either with temporalis fascia or pericranium was done. The advantage of this procedure is that it immediately lowers the intracranial pressure by giving space to the brain to expand.

In group-B dural slits, multiple dural slits were made linear in the direction of vessels after decompressive craniectomy. Each slit was about 2–3 cm apart from each other and about 4-5 cm in length. Evacuation of ASDH was done with the help washing the sub-dural space through 6 size N/G tube. The patients in the Group-A were operated by using a C-shaped incision in the dura with evacuation of the ASDH followed by expansile duroplasty. All the patients were managed in neurosurgical intensive care unit for at least five days post-operatively.

Clinical characteristics of patients like Age, Sex, Mechanism of Trauma, and Glasgow Coma Scale on admission, and Site of ASDH were recorded in pre-designed *pro forma*. Patients were followed up for a duration of 6 weeks to assess the outcome in terms of Glasgow outcome score (GOS). The Glasgow Outcome Scale differentiated the outcome into 5 groups: good recovery (GOS-5), moderate disability (GOS-4), severe disability (GOS-3), vegetative state (GOS-2), and death (GOS-1).SPSS 16.0 was used for statistical analysis, and statistical significance was assigned to *p*-value of <0.05.

RESULTS

A total of 63 patients were recruited in the study out of which two from each group were lost in follow-up. 59 patients completed this study. The age of the patients ranged from 8-65years with mean age of 33.4±12.8 years. There were 31 patients in group A while 28 Patients in group B. Out of these 53(89.8%) patients were male, while 6(10.2%) patients were females. Majority of patients presented with traumatic head injury secondary to road traffic accidents, that was in 35 (59.3%) of patients, followed by history of fall from height in 17(28.8%) of patients, followed by assaults in 7 (11.9%) of patients.

Most common location of acute subdural hematoma was frontoparietal region in 42 (71.2%) of patients followed by temporparietal, frontoparietotemporal, and parieto-occipital regions in 8 (13.6%), 5 (8.5%), and 4 (6.8%) respectively. Among these patients 23 (39%) presented with GCS of 3–5, 28 (47.5%) presented with GCS 6–8, and only 8 (13.6%) of patients presented with GCS of 9–11 (Table-1)

In group A 54.8% (17) survived while 45.2% (14) patients expired. While in Group B 46.4% (13) of patients survived while 53.6% (15) patients expired. The difference being insignificant (*p*-value .519).

In group A, (2) 6.5% of patients were in GOS-5, (3) 9.7% of patients were in GOS-4, (9) 29% of patients were in GOS-3, and (3) 9.7% of patients ended up in vegetative state, while in group B, (4) 14.3% of patients were in GOS-5, (3)10.7% of patients were in GOS-4, (4) 14.3% of patients were in GOS-3, and (2) 7.1% of patients ended up in vegetative state. The difference again being insignificant as tabulated in table-2.

The most common complication seen in expansile duraplasty group is external cerebral herniation in 35.5% of patients, followed by subdural effusion in 25.8% of patients, followed by infection, hematoma formation, CSF leak, meningitis, and hydrocephalus were present in 9.7%, 9.7%, 6.5%.6.5%, and 6.5% respectively. While on comparison of group A with group B, the most common complication seen was CSF leak in 28.6% of patients, followed by infections, meningitis, subdural effusion, hematoma formation, and hydrocephalus were present in 17.9%, 17.9%, 14.3%, 7.1%, and 3.6% respectively. (Table-3)

In group A majority of the patients were operated in 3–4 hours. 54.8% were operated in 3 hours while 38.7% of the patient in four hours and only small quantity, i.e., 6.5% got operated in 2 hours. In group B major difference is that majority of patients' i.e., 53.6% were operated in 2 hours. 39.3% in three hours and 7.1% in four hours. (Table-4) The difference in the duration of surgery among the two groups being statistically significant with a *p*-value of .000.

The duration of post-operative stay among the two groups was also found to be insignificant with a *p*-value of .662 as shown in table-5.

Table-1: General characteristics of the patients

Gender	Male	53 (89.8%)
	Female	6 (10.2%)
Mode of injury	RTA	35 (59.3%)
	Fall	17 (28.8%)
	Assault	7 (11.9%)
GCS at presentation	3-5	23 (39.0%)
	6-8	28 (47.5%)
	9-11	8 (13.6%)

Table-2: GOS in patients among both groups

Procedure groups	Glasgow outcome scale					Total	*p*
	GOS 1	GOS 2	GOS 3	GOS 4	GOS 5		
group A duraplasty	14	3	9	3	2	31	
group B dural slits	15	2	4	3	4	28	.613
Total	29	5	13	6	6	59	

Table-3: Frequency of various complication among the two groups

Procedure groups	Complications							Total
	External cerebral herniation	subdural effusion	Infection	Haematoma	CSF leak	meningitis	hydrocephalous	
Group A duraplasty	11	8	3	3	2	2	2	31
Group B dural slits	3	4	5	2	8	5	1	28
Total	14	12	8	5	10	7	3	59

p-value=.069

Table-4: Duration of surgery among the groups

Procedure groups	Surgery timing			Total
	2 hours	3 hours	4 hours	
Group A duraplasty	2	17	12	31
Group B dural slits	15	11	2	28
Total	17	28	14	59

p-value=.000

Table-5: Duration of hospital stay of patients

Procedure groups	Hospital stay					Total
	1–7 days	8–14 days	15–21 days	22–28 days	29 or more days	
Group A duraplasty	3	4	4	12	8	31
Group B dural slits	2	8	3	10	5	28
Total	5	12	7	22	13	59

p-value .662

DISCUSSION

The purpose of this study was to compare the outcome of two different surgical techniques used for the evacuation of acute subdural hematoma in terms of Glasgow outcome score. Decompressive craniectomy with expansile duraplasty provides relief in raised ICP, The expansile segment of the duroplasty act as a vector of expansion to the cerebral hemisphere which relieves brain herniation and second it allows thorough exposure of the sub-dural space with evacuation of acute sub-dural hematoma. In addition to these it helps in quick tapering of the medical treatment like barbiturates, osmotic diuretics, and prolonged hyperventilation.[8] But still the mortality of acute sub-dural hematoma is high, which can be explained by frequent association of acute sub-dural hematoma with primary brain parenchymal injury like contusions, diffuse axonal injury, and edematous white matter, that leads to poor outcome in patients with acute sub-dural hematoma. Thus sudden decompression exaggerates the underlying edema and also may induce hemorrhage within the parenchyma.[9] So in such situation multiple slits in the dura made in the dura, slowly decompress the brain with good results.

Our study showed that males most commonly presents with acute sub-dural hematoma in 89.8% of cases, while females was having sub-dural hematoma in only 10.2% of cases, which closely resembles to the results of studies done by Faleiro *et al*[10] and Taussky *et al*[9], who showed in their study males were involved in 87% and 73% respectively. This high incidence in males may be due that males are socially more active and expose to trauma more than females. Main mechanism of trauma in our study in patients presented with acute sub-dural hematoma was road traffic accident, i.e., in 56% of cases followed by fall and assault in 28.8% and 15.3% of cases respectively, and the same results have been showed by Koc *et al*[11], that road traffic accident is involved in 63.7%, followed by fall assault in 28.3% and 7.9% respectively.

Our study showed that mortality in group A (expansile duraplasty) was 48.4%, while closely remains in the range of the results of studies done by Bhat *et al* [11], Chobak *et al*[12], and Faleiro *et al*[8], who showed it to be 60%, 33.3%, and 54.5% respectively. 42% patients in our study after 6 months were in GOS 3-5, while the studies done by Bhat *et al* , Chobak *et al*, and Faleiro *et al* showed it to be 26.6%, 66.7%, and 43% respectively. Similarly 9% of our patients ended up in vegetative state, while none of the patients in the study done by Chobak *et al* ended up in vegetative state, but Bhat *et al* and Faleiro *et al* showed it to be 2.3% and 13.3% respectively. Mortality of group B (dural slits) in our study was 53.6%, which on comparison to the studies done by Bhat *et al* and Faleiro *et al* showed it to be 21.6% and 33.3% respectively. 39.3% patients in dural slits group ended up in GOS 3-5, While Chobak *et al* and Faleiro *et al* showed it to be 66.6% and 61.6% respectively. This high mortality in Group B in our study might be due to late presentation and low GCS at

presentation, because patients came to this tertiary care hospital from very remote areas and it took them a long time to reach the hospital.

On comparison of both the procedures, there were 51.6% of patients survived in duraplasty group while 48.4% of patients survived in dural slits group. Similarly in group A 41.9% of patients ended up in GOS [3-5], While in group B 39.3% of patients ended up in GOS 3–5. 9.1% of patients in group A ended up in vegetative state after 6 months of trauma, while in group B 7.1% of patients ended up in vegetative state. On comparison of both groups, No statistically significant difference in terms of outcome was observed, except on comparison of complications of both groups there was more marked complications in duraplasty group like external cerebral herniation in 29% of patients, sub-dural effusion in 22.5% of patients, and infection in 9.6% of patients, while in group B the most common complication seen was CSF leak that was in 10.7% of patients, so that's why when comparing the percentages of patients of both groups in terms of GOS 4–5, the maximum patients seen in GOS 4–5 was in dural-slits group that was in 25% of patients while in group B there were only 19% of patients in GOS 4–5.

Age, Gender, Type of trauma, and location of ASDH also didn't affect the outcome. Only the preoperative GCS was observed to have statistically significant influence on the outcome. Outcome of both the groups were same statistically, i.e., the *p* value was >0.05. Operating time in dural slits group was much lower than the duraplasty, so one can use any procedure with equal outcome but the benefit of dural slits is that is less time consuming, having lesser complications as compared to duraplasty group. And at the time of reversal of bone flap it gives a lot of help to the surgeon that dura is there with granulation tissue in between the slits, so just clear the bone edges and put the bone flap again with low chance of CSF leak.

CONCLUSION

There was no statistically significant difference among the two groups as regards the mortality, GOS, frequency of complications and hospital. Clear difference was observed in the operating times in patients who were operated by multi-dural slits technique than the full dural flap opening technique. However, the choice of operative techniques depends on the surgeon's training and expertise. It is necessary to use techniques that can be easily performed in a shorter time and that can reduce patients' average length of hospital stay without compromising the outcome.

AUTHOR'S CONTRIBUTION

BK, EAK, SAK, AA: Conceived the idea, literature search, data collection, performed or supervised the procedures, and write-up BK, AAK, WK, SNB: write-up, data analysis, proof reading.

REFERENCES

1. Cosar M, Eser O, Aslan A, Ela Y. Rapid resolution of acute sub-dural hematoma and effects on the size of existent sub-dural hygromas: A case report. Turk Neurosurg 2007;17(3):224–7.
2. Vilela M, West GA. Traumatic Intracranial Hematomas. In; Rengachary SS, Ellenbogen RG. edi. Principles of Neurosurgery. 2nd ed. USA; Elsevier 2005;361–2.
3. Felciano CE, De Jesus O. Conservative management outcomes of traumatic acute sub-dural hematomas. P R Health Sci J 2008;27(3):220–3.
4. Taussky P, Widmer HR, Takala J, Fandino J. Outcome after acute traumatic sub-dural and epidural haematoma in Switzerland: a single-centre experience. Swiss Med Wkly 2008;138(19-20):281–5.
5. Chabok SY, Safaie M, Moghadam AD, Behzadnia H, KhaliliRad M, Larimi SR. Acute subdural hematoma: A comparative study of 2 types of operative techniques. Neurosurg Q 2011;21(2):103–6.
6. Yanagawa Y, Sakamoto T. Results of single burr-hole drainage for acute sub-dural hematoma with non-reactive pupil. Turk Neurosurg 2012;22(2):196–9.
7. Bhat AR, Wani MA, Kirmani AR. Acute sub-dural hematoma with severe traumatic brain edema evacuated by Dural-Stabs- A new brain preserving technique. Biomed Res 2010;21(2):167–73.
8. Wani AA, Dar TI, Ramzan AU, Malik NK, Kirmani AR, Bhatt AR, *et al* . Decompressive Craniectomy in head injury. Indian J Neurotrauma 2009;6(2):103–10.
9. Sawauchi S, Marmarou A, Beaumont A, Signorett S, Fukui S. Acute Sub-dural Hematoma associated with diffuse brain injury and hypoxemia in the Rat: Effect of surgical evacuation of the hematoma. J Neurotrauma 2004;21(5):563–73.
10. Faleiro RM, Faleiro LC, Caetano E, Gomide I, Pita C, Coelho G, *et al* . Decompressive Craniectomy: prognostic factors and complications in 89 patients. Arq Neuropsiquiatr 2008;66(2B):369–73.
11. Koc RK, Akdemir H, Oktem IS, Meral M, Menku A. Acute sub-dural hematoma: outcome and outcome prediction. Neurosurg Rev 1997;20(4):239–44.

Address for Correspondence:

Dr Baynazir Khan, Department of Neurosurgery, Ayub Medical College, Abbottabad-Pakistan
Email: hallianfjite@yahoo.com