Journal of Rawalpindi Medical College (JRMC); 2017;21(4): 339-343

Original Article

Comparison of Decompressive Craniectomy and Multi-Dural Stabs with Decompressive Craniectomy and Open-Dural Flap Method, in the Treatment of Acute Subdural Hematomas

Adil Aziz Khan, Soban Sarwar Gondal, Muhammad Mujahid Sharif, Muhammad Ali Tassaduq
Department of Neurosurgery, DHQ Hospital and Rawalpindi Medical University, Rawalpindi

Abstract

Background: To compare the functional outcome between decompressive craniectomy and multi-dural stabs, with decompressive craniectomy and open-dural flap, in the removal of acute subdural hematomas .

Methods : In this randomized controlled trial, 64 patients, with acute sub-dural hematomas were included. Patients were divided into two groups on the basis of lottery method. All patients gave informed written consent. In group A, all patients were operated upon by multi-dural stab technique and in group B, patients were operated upon by open-dural flap technique. The objective degree of recovery in the patients treated by both craniectomy techniques was assessed by Glasgow Outcome Score (GOS), having maximum of 5 and minimum of 1 score. Favourable outcome was at points 4-5 and Un-favourable at 1-3 points, at 2 weeks. GOS attached as annexure A. Favourable outcome was assessed at 2 weeks according to GOS.

Results : The mean age in group-A and group-B was 59.09 ± 9.39 years and 59.56 ± 9.98 years. Males constituted the main in both groups. Mean GOS in group A and in group B, was 3.06 ± 1.24 and 2.69 ± 0.82 respectively. Statistically mean GOS was same in this study groups, p-value 0.159, > 0.05. There were 37.5% patients in group A and 9.4% patients in group B who had favourable results, while in group A and group B, 62.5% and 90.60% patients had unfavourable results. Favourable results were statistically more in group A as compared to group B, p-value =0.008.

Conclusion: Treatment of acute subdural hematoma by decompressive craniectomy with multi dural stabs technique has more favourable results (using GOS) than decompressive craniectomy with open-dural flap technique.

Key Words: Acute Subdural hematoma, Glasgow outcome score, Craniectomy, Dural stab incision.

Introduction

Acute sub dural hematomas are notorious for being associated with massive brain swelling, intraoperatively. The hematomas that are extracerebral, hyperdense, crecentic collections between the parenchyma and the dura are known as subdural hematomas.[1] They are regarded as acute when diagnosed within 14 days of traumatic brain injury.[2-4] 56% of acute SDH (subdural hematomas) in the younger group were caused by MVAs (motor vehicle accidents) and only 12% were caused by falls whereas in elderly 56% were due to falls.[5,6] Intracranial injuries occur in more than 50% of patients with acute SDH and have significant prognostic implications.[7,8] Extra-cranial injuries like facial fractures, limb fractures, thoracic and abdominal trauma occurs in 18-51%.[9,10] Radiological assessment includes measuring the exact thickness of the SDH by taking the CT scan brain images with a wide window to distinguish the hyper dense clot from the bone.[11,12] Conservative treatment should be considered in those patients who are fully conscious, the hematoma is a single lesion, the midline shift is not greater than 3 mm and the lesion is less than 10 mm at the thickest point, however, if more than 10mm thick it should be surgically evacuated.[13-15] Surgical option for acute SDH are decompressive craniectomy and craniotomy.[16,17] If an acute SDH is composed of solid clots a large craniotomy cantered over the hematoma is recommended.[18-20] If hematoma is fronto-temporal, a craniectomy cantered over a temporal burr hole may be performed the dura is opened and clots are removed.[21,22] Removal of acute subdural, extradural hematomas and contused infarcted brain is successful method especially after severe traumatic brain injury by open dural flaps. [23,24,25]

Patients and Methods

A randomized controlled trial (RCT) was done at Department of Neurosurgery, RMC & Allied Hospitals. Data was collected over 6 months, from January 2014 to June 2014. The sample size was 64 and was collected by Non-probability consecutive sampling. Patients with Acute SDH on non-contrast CT scan brain,those with significant midline shift more than 5mm and volume of hematoma more than 25 ml, on non-contrast CT scan brain were included. Patients whose guardian and attendants did not give consent to participate in the study, bilateral acute subdural hematoma, chronic subdural hematomas, diagnosed on CT scan brain, were excluded from the study. After taking permission from the hospital ethical committee all the patients fulfilling the criteria were enrolled in the study. Written informed consent was taken from the relatives. All patients fulfilling the inclusion criteria were admitted through the out patients and emergency department of Neurosurgery at RMC & Allied Hospitals. Patients were divided into two groups on the basis of lottery method. In both groups, decompressive craniectomy was performed but in group A, all patients was operated upon by multi-dural 3 stab technique and in group B, patients was operated upon by open-dural flap technique. In both groups surgery was performed under general anesthesia and bone flap raised. In group A multiple linear dural incisions of about 5-8 mms long, in horizontal lines, parallel to vessels and 2-2.5 cm apart from each other,was made but in group B dural flap was opened and raised. In both groups hematoma was evacuated and remaining clots removed by irrigating with warm saline through a silastic catheter. In both groups bone was not put back rather placed in abdominal fat, to be replaced at a later time (4 weeks to 3 months). Wound was closed in layers in both the groups. The patients were assessed at 2 weeks according to GOS. Frequencies and percentages were calculated for qualitative data i.e., Gender, GOS, favourable and un-favourable outcome. Pie chart were made for qualitative data, mean and standard deviation was calculated for quantitative data i.e., age. Chi square test was applied to compare the difference between two groups in terms of favorable outcome. A p-value ≤ 0.05 was considered statistically significant

Results

The mean age in group-A and group-B was 59.09 ± 9.39 years and 59.56 ± 9.98 years (table 1) . Males constituted the main (Table 2).The mean Glasgow outcome score (GOS) was as follows: 2.87 ± 1.06 with

Table – 1: Comparison of age (years)

	Age (years)	
	Group-A	Group-B
N	32	32
Mean	59.09	59.56
Std. Deviation	9.39	9.98
Minimum	38.00	43.00
Maximum	76.00	80.00
p-value	0.847	

Group-A = multi dural stab incisions and Group-B = Open Dural flap

Table – 2: Comparison of gender

		Study groups		Total
		Group-A	Group-B	
Sex	Male	23	25	48
		71.9%	78.1%	75.0%
	Female	9	7	16
		28.1%	21.9%	25.0%
Total		32	32	64
		100.0%	100.0%	100.0%
p-value		0.564		

Group-A = multi dural stab incision and Group-B = Open Dural flap

Table – 3: Descriptive Statistics of Glasgow outcome score (GOS)

	Total
N	64
Mean	2.87
Std. Deviation	1.06
Minimum	1.00
Maximum	5.00

Table – 4: Comparison of Glasgow outcome score (GOS) in both study groups

	Group-A	Group-B
N	32	32
Mean	3.06	2.69
Std. Deviation	1.24	0.82
Minimum	1.00	1.00
Maximum	5.00	5.00

	Group-A	Group-B
N	32	32
Mean	3.06	2.69
Std. Deviation	1.24	0.82
Minimum	1.00	1.00
p-value	0.159	

Group-A = multi dural stab incisions, Group-B = Open Dural flap

minimum and maximum GOS score 1 and 6(Table 3&4).There were 12 (37.5%) patients in group A and 3 (9.4%) patients in group B who had favourable results, while in group A and group B, 20(62.5%) and 29(90.60%) patients had unfavourable results(Table-5)

Table – 5: Comparison of Final Results in both study groups

		Study groups		Total
		Group-A	Group-B	
Results	Favourable	12	3	15
		37.5%	9.4%	23.4%
	Unfavourable	20	29	49
		62.5%	90.6%	76.6%
Total		32	32	64
		100.0%	100.0%	100.0%
p-value		0.008		

Group-A = multi dural stab incisions and Group-B = Open Dural flap

Discussion

Men are four times likely to be affected than women with an acute SDH.[1-3]Acute SDH often occur in the 5th and 6th decade of life.[4-7] The nature and reasons of brain edema after traumatic brain are poorly understood.[8] Research has highlighted that secondary insult to brain is also considered an important cause of brain swelling, in addition to primary parenchymal injury.[9,10] Even after operative decompression, the outcome of subdural hematoma remains poor in most of the cases due to compression of the microcirculation which in part may be due to the constrictive effects of the dural flaps .[11,12] Nevertheless, there is documentary evidence to recommend that it may be secondary to ischemia produced by the compressive hematoma as well. [13,14]

The increased death rate of acute subdural hematoma patients is explainable by the principle of Monro-Kellie doctorine and its frequent association with primary brain damage consisting of contusion and brain swelling.[15,16] The concept of utilizing wide decompressive craniectomy in severe traumatic brain injury, is due to the fact that intracranial volume is fixed, because of rigid and inelastic nature of skull . [17-19]

Acute subdural hematomas usually accumulate after traumatic brain injury and become symptomatic within 24-72 hours of injury.[20,21] If the lesion is more than 10mm thick and midline shift is more than 5mm on CT scan brain, it is evacuated surgically.[22,23] Conventional surgery could not avoid pouting and laceration of the brain and cortical vasculature. This headed in unfavorable results. [1] Conversely, patients who belonged to the multi-dural stab group had favorable outcomes. Multi-dural stabs allow evacuation of acute subdural hematoma (SDH), by oozing of blood clots and fluid, as well as simultaneously preventing the pouting and laceration of the brain. In contrast to the, open-dural flap method, there was no control on the pouting and subsequent laceration of brain, which became the reason of secondary brain injury and resulted in much more morbidity and mortality. When researchers measured the effect of fast and late surgical evacuation on brain edema formation and its physiological effects in a rat model of acute subdural hematoma, in combination with hypoxemia or diffuse brain injury, they found that rapid evacuation was not in favor of a better clinical outcome. [11]

As an established fact, decompressive craniectomy, is performed in patients in whom GCS is worsening or those with a low GCS on presentation.[11] At SKIMS ,60.50% (72/119) of multi-dural stabs and 58.49% (62/106) of open-dural flaps were having a low admission GCS of 3-6 and none of all patients (225) had a GCS above 8 , the results were still better, when multi-dural stabs method was performed. [11]

The final results in terms of favorable and unfavorable results were calculated as per GOS, there were 37.5% patients in group A and 9.4% patients in group B who had favourable results, while in group A and group B, 62.5% and 90.60% patients, respectively, had unfavourable results. Similar findings are also reported in another study i.e. favourable outcomes were observed in 42.02% of multi-dural stab group versus 15.09% in open dural flap group. An earlier study on severe traumatic brain injury, showed a mortality of 52.5%. However at SKIMS, the survival rate was 77.31%, with only 22.69% mortality in patients with multi-dural stabs.[8]

In a study by Barthélemy EJ et al, after one year follow up mortality rate was 58 (40.8%) and 8 (5.6%) patients were persistent vegetative state. [2] The final outcome was found to be unfavorable in 77 (54.2%) patients. These are the results of decompressive craniotomy while in our study in group A and group B, 20(62.5%) and 29(90.60%) respectively patients had unfavorable results. In present study there were 12 (37.5%) patients in group A and 3 (9.4%) patients in group B who had favorable results signifying the importance of multiple dural slits technique.

Phan K et al conducted a literature search using major online databases and a manual search of references on the topic of craniotomy and craniectomy for evacuation of subdural hematoma . The outcome variables were analyzed which included residual SDH, revision rate, and clinical outcome. [4]Six comparison studies, with a total number of 2006 craniotomy and 451 craniectomy patients, fulfilled the inclusion criteria. Patients who underwent craniectomy scored significantly lower on the Glasgow Coma Scale at the time of initial presentation. Postoperatively, the rate of residual SDH was significantly lower in the craniectomy group than the craniotomy group (p = 0.004), with no difference in the revision rate. The odds of a poor outcome at follow-up was found to be lower in the craniotomy group (50.1% vs. 60.1%, respectively; p = 0.004). Similarly, mortality rates was lower in the craniotomy group than the craniectomy group (p = 0.004).

Hutchinson PJ et al performed a study on patients with traumatic brain injury and refractory elevated intracranial pressure (>25 mm Hg), who underwent decompressive craniectomy. [7] The primary outcome was the rating on the Extended Glasgow Outcome Scale (GOS-E) (an 8-point scale, ranging from death to "upper good recovery" (no injury-related problems) at 6 months. The primary-outcome measure was analyzed with an ordinal method based on the proportional-odds model. If the model was rejected, that would indicate a significant difference in the GOS-E distribution, and results would be reported descriptively. The GOS-E distribution differed between the two groups (p<0.001). The proportional-odds assumption was rejected, and therefore results are reported descriptively. At 6 months, the GOS-E distributions showed 26.9% deaths among 201 patients in the surgical group versus 48.9% among 188 patients in the medical group. At 12 months, the GOS-E distributions revealed deaths 30.4% among 194 surgical patients versus 52.0% among 179 medical patients. Surgical patients had fewer hours than medical patients with intracranial pressure above 25 mm Hg after randomization (median, 5.0 vs. 17.0 hours; p<0.001) but had a higher rate of adverse events (16.3% vs. 9.2%, P=0.03).so this study also shows the importance of decompressive craniectomy in reducing the mortality rate among head injury patients.

Kurland DB et al showed in their study that decompressive craniectomy is an effective means of controlling elevated ICP and is life saving, which accounts for the dramatic rise in the use of this procedure . [9] This study is in agreement in present study which suggests that decompressive craniotomy, when combined with multiple dural slits, then it is helpful in increasing the favourable outcome of head injuries.Optimal selection of surgical modality is unclear and decision may vary with surgeon's experience. [21]

In selective cases of few unfavorable clinical findings, CO may also be an effective surgical option for ASDH. Although DC remains to be standard of surgical modality for patients with poor clinical status, CO can be an alternative considering the possible complications of DC.

Conclusion

Treatment of acute subdural hematoma by decompressive craniectomy with multi dural stabs technique has more favorable results (using GOS) than decompressive craniectomy with open-dural flap technique.

References

1. Bhat AR, Kirmani AR, Wani MA. Decompressive craniectomy with multi-dural stabs–a combined (SKIMS) technique to evacuate acute subdural hematoma with underlying severe traumatic brain edema. Asian Journal of Neurosurgery 2013;8(1):15-19.
2. Barthélemy EJ, Melis M, Gordon E, Ullman JS, Germano IM. Decompressive craniectomy for severe traumatic brain injury: a systematic review. World Neurosurgery 2016;88:411-20.
3. Khan B, Khan Afridi EA, Khan B, Khan SA. Decompressive Craniectomy For Acute Subdural Haematoma With Expansile Duraplasty Versus Dural-Slits. J Ayub Med Coll Abbottabad 2016 ; 28(2):285-88.
4. Ghosh AK, Piek J, Balan C, Alliez B, Cushing H, Guerra WK. Different methods and technical considerations of decompressive craniectomy in the treatment of traumatic brain injury. Indian Journal of Neurosurgery 2017;6(01):36-40.
5. Fountain DM, Kolias AG, Lecky FE, Bouamra O, Lawrence T. Survival trends after surgery for acute subdural hematoma in adults. Annals of Surgery 2017;265(3):590-95.
6. Melo JR, Di Rocco F, Bourgeois M, Puget Se C. Surgical options for treatment of traumatic subdural hematomas in children younger than 2 years of age. Journal of Neurosurgery: Pediatrics 2014;13(4):456-61.
7. Hutchinson PJ, Kolias AG, Timofeev IS, Corteen EA. Trial of decompressive craniectomy for traumatic intracranial hypertension. New England Journal of Medicine 2016;375(12):1119-30.

8. Kolias AG, Kirkpatrick PJ, Hutchinson PJ. Decompressive craniectomy: past, present and future. Nature Reviews Neurology 2013 ;9(7):405-15.
9. Kurland DB, Khaladj-Ghom A, Stokum JA, Carusillo B. Complications associated with decompressive craniectomy. Neurocritical Care 2015 ;23(2):292-304.
10. Rumalla K, Bijlani P, Reddy AY, Mittal MK. Decompressive craniectomy reduces inpatient mortality in subdural hematoma. Annals of Neurology 2015 1;78:69-72.
11. Kramer AH, Deis N, Ruddell S, Couillard P, Zygun DA. Decompressive craniectomy in patients with traumatic brain injury: are the usual indications congruent with those evaluated in clinical trials?. Neurocritical Care 2016;25(1):10-19.
12. Phan K, Moore JM, Griessenauer C, Dmytriw AA. Craniotomy versus decompressive craniectomy for acute subdural hematoma: systematic review and meta-analysis. World Neurosurgery 2017 ;101:677-85.
13. Karibe H, HayasHi T, Hirano T, KaMeyaMa M, Nakagawa A. Surgical management of traumatic acute subdural hematoma in adults: a review. Neurologia Medico-Chirurgica. 2014;54(11):887-94.
14. Chaturvedi J, Botta R, Prabhuraj AR, Shukla D, Bhat DI, Devi BI. Complications of cranioplasty after decompressive craniectomy for traumatic brain injury. Br J Neurosurg 2016;30:264–68.
15. Shiomi N T,Echigo H, Oka M, Nozawa M, Okada S. Emergency decompressive craniotomy in the emergency room was effective in severe acute subdural hematoma treatment. Neurological Surgery 2017; 45(2): 155-58.
16. Barret R, Rousseau J, Mypinder S, Donald E. Craniotomy versus craniectomy for acute traumatic subdural hematoma in the United States: a national retrospective cohort analysis. World Neurosurgery 2016; 88: 25-31.
17. Edoardo P, Caspani ML,Iaccarino C, Pastorello G, Salsi P,Viaroli E.Intracranial pressure monitoring after primary decompressive craniectomy in traumatic brain injury: a clinical study.Acta Neurochirurgica 2107; 159(4): 615-22.
18. Honeybul S, Janzen C, Kruger K, Ho KM. Decompressive craniectomy for severe traumatic brain injury: is life worth living? Clinical article. Journal of Neurosurgery 2013;119(6):1566-75.
19. Sam Z, Soon S, Lin CK, Iao KS, Yang LH.Intracranial pressure monitoring alone: Not an absolutely reliable tool after decompressive craniectomy for traumatic acute subdural hematoma.Journal of Medical Sciences 2016;36(6): 217-21.
20. Piedra MP, Nemecek AN, Ragel BT. Timing of cranioplasty after decompressive craniectomy for trauma. Surgical Neurology International 2014;5::25-29
21. Kwon R, Sub Y, Yang KH,Lee YH.Craniotomy or decompressive craniectomy for acute subdural hematomas: surgical selection and clinical outcome.Korean Journal of Neurotrauma 2016;2,(1): 22-27.
22. Essen V, Thomas A, Godard CW, Ruiter D.Neurosurgical treatment variation of traumatic brain Injury: Evaluation of acute subdural hematoma management. Journal of Neurotrauma 2017; 34 (4): 881-89.
23. Bonadio LE[1], Mello RG[1], Haas LJ, Boer HT.Decompressive Craniectomy (DC)-Comparative Study of 30-Day Mortality in Surgeries of Severe Brain Trauma with Subdural Hematoma, with and without DC. Brazilian Neurosurgery 2017;36(01): 21-25.
24. Grindlinger GA, Skavdahl DH, Ecker RD, Sanborn MR. Decompressive craniectomy for severe traumatic brain injury: clinical study, literature review and meta-analysis. SpringerPlus. 2016;5(1):1605.
25. Kolias A G,Adams H,Timofeev I,Czosnkya M.Decompressive craniectomy following traumatic brain injury: developing the evidence base. British Journal of Neurosurgery 2016;30(2): 246-50.