ORIGINAL ARTICLE

Comparison of Outcome of Decompressive Craniectomy with Wide Dural Flap Duraplasty Versus Dural Slits in the Management of Post Traumatic Acute Subdural Hematoma in Terms of Postoperative CSF Leak

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ABSTRACT

Objective: *To compare the frequency of postoperative cerebrospinal fluid (CSF) leak after decompressive craniectomy with wide dural flap duraplasty versus dural slits in patients with post traumatic acute subdural hematoma.*

Material and Methods: *The study was conducted from August 2017 to February 2018 in the Department of Neurosurgery, PIMS, Islamabad. A total of ninety-two (n = 92) adult patients of either gender between age 15-55 years presented with isolated, unilateral traumatic acute sub dural hematoma (ASDH) with midline shift of 5mm were categorized into 2 groups; Group A (DC with open dural flap) and Group B (DC with dural slits). Patients were observed for CSF leakage for four weeks.*

Results: *Results showed that the overall frequency of CSF leak was not significantly different in both groups and revealed that the CSF leak was observed in 10.9% (n = 5/46) in group A (DC plus open dural flap) and in 21.7% (n = 10/46) in group B (DC plus dural slits) (P = 0.158). The difference was not significant in terms of frequency of CSF leak in both groups when results were stratified with respect to gender, age, duration of trauma and baseline GCS. P value (chi-square) was found to be > 0.05 in all cases.*

Conclusions: *The postoperative CSF leak was observed in higher percentages in patients who underwent DC with dural slits as compared to the patients who underwent DC with open dural flaps for surgical management of ASDH. The difference, however, was not statistically significant.*

Keywords: *Decompressive craniectomy, acute subdural hematoma, CSF leak.*

INTRODUCTION

Acute Subdural hematoma (SDH), is caused by tearing of the bridging vessels usually veins that runs from the brain surface to the dural sinuses. Trauma to the head being the commonest of SDH, with the majority of cases related to Road traffic accidents, assaults and fall from height.[1] In Cases with closed head trauma, sudden acceleration/deceleration force causes injury to critical vessels including arteries, veins, or brain parenchyma. Coma is an initial presentation in approximately 50% of cases at the time of injury. And with approximately 12 to 38% of patients having transient "lucid interval" after the initial insult which is followed by a progressive neurologic deterioration to coma.[2]

CT scan head being the most commonly prescribed imaging modality for the diagnosis of acute subdural hematoma, which is seen as a high-density subdural crescent shape collection. Acute symptomatic subdural hematoma is a neurosurgical emergency requiring surgical intervention to prevent secondary brain injury and death due to expansion of hematoma,

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raised intracranial pressure and brain herniation.[3]

Most of the studies recommend urgent evacuation of hematoma in patients with midline shift of >5 mm or clot thickness of > 10 mm.[4] Different techniques can be employed for evacuation of symptomatic acute SDH, including decompressive craniectomy (DC), burr hole trephination or simple craniotomy and evacuation of hematoma, however, only few studies compares different surgical methods.[5] DC involves removal of skull bone along with clot, but without replacing the bone due to possible expansion of brain due to edema. In one technique Dura matter is widely opened in C shaped manner. This procedure gives advantage to the surgeon by immediately lowering raised intracranial pressure by providing more space to the edematous brain and allowing surgeon with the proper exposure of hematoma.[6] However, herniation of edematous brain was observed in many cases through the craniectomy defect. In another technique multiple linear dural slits are made parallel to the dural vessels. The multi-dural slits allowed slow removal of acute subdural hematoma by oozing of hematoma and CSF preventing herniation of brain, thus preventing secondary injury to the brain. However, this technique is associated with higher risk of post-operative CSF leaks.[7] In a recent study, Khan B et al reported that patients who undergone decompressive craniectomy with expansile duraplasty for evacuation of ASDH, CSF leak was observed in 6.5% of patients during the post-operative follow up period, while in patients who undergone decompressive craniectomy with dural slits CSF leak was observed in 28.6% of patients during the follow up period.[8] The risk of life threatening bacterial meningitis persists as long as the CSF leak is active. The reported incidence of meningitis in patients with post-operative CSF leak is around 10% and antibiotic prophylaxis should be given or not is still a controversy.[9]

This study will be helpful in identifying the better technique in terms of lesser risk of post-operative CSF leak after surgical management of acute SDH.

MATERIALS AND METHODS

Study Design and Sampling

This RCT was conducted at Neurosurgery department, PIMS, Islamabad for Six months (05-08-2017 to 04-02-2018)**.** WHO sample size calculator (2.2 b)was used for sample size with Power of test 80%, Level of significance 5%, anticipated population proportion I: 6.5%and Anticipated Population Proportion II: 28.6%.[8]

The sample size calculated came out to be 46 patients in each group. Total sample size was 46+46 = 92. Consecutive non probability was used as sampling technique.

Inclusion Criteria

Patients with both genders who presented with unilateral isolated, traumatic Acute Subdural hematoma with midline shift of 5mm (diagnosed on CT scan) in an age group from 15 to 55 years were included.

Exclusion Criteria

Patients excluded were those with GCS of ≤ 4/15 or those who presented more than 12 hours after the injury or those with H/O previous brain surgery or patients with H/O of comorbid like hypertension and diabetes.

Data Collection

Hospital ethical committee permission and approval were taken for the study. All Head injury patients presenting to the ER were enrolled in this study who fulfil the inclusion criteria and were reviewed by senior neurosurgeon for appropriate management. Informed consent taken in written form from the patient/guardian. All patients were randomly allotted to two separate groups using the lottery method. Patients in group A underwent craniotomy with open dural flap while patients in Group B were operated via dural slits. The patients were observed for CSF leakage for four weeks after the surgery in both groups. Antibiotics were given to all the patients to reduce the risk of infection. If a CSF leak occurred, it was managed either conservatively (head-end elevation, pressure dressings, hyper-osmolar/diuretic therapy) or through interventions (frequent lumbar puncture, continuous lumbar drainage, EVD placement, local drain placement, revision) where necessary. All the information was written down on the prescribed Proforma. Exclusion criteria who referred consent for study.

Data Analysis

The data entered using 22.0 version of SPSS. Quantitative variables like, duration of trauma, age and baseline GCS were measured as mean ± SD.

Frequencies and percentages were calculated for gender and frequency of CSF leak in both groups. Frequency of CSF leak in both groups was compared by employing Chi-square test. *P*-value considered significant at ≤ 0.05. Effect modifiers like age, gender, duration of trauma and baseline GCS was controlled by stratification. Poststratification Chi-square test was applied and *P*-value ≤ 0.05 was considered significant.

Table 1: *CSF leak in both of the study groups.*

CSF Leak	Groups		Total	*P*-Value Chi-Square
	DC with Open Dural Flap	DC with Dural Slits		
Present	5 10.9%	10 21.7%	15 16.3%	0.158
Absent	41 89.1%	36 78.3%	77 83.7%	
Total	46 100.0%	46 100.0%	92 100.0%	

RESULTS

A total of ninety-two (n = 92) adult patients of either gender between age 15 – 55 years presented with unilateral isolated traumatic ASDH with midline shift of 5mm (diagnosed on CT scan) were enrolled and equally divided into two groups. Table 1 shows that the overall frequency of CSF leak was not significantly different in both groups and revealed that the CSF leak was observed in 10.9% (n = 5/46) in group A (DC with open dural flap) and in 21.7% (n = 10/46) in group B (DC with dural slits) (P = 0.158). Frequency of CSF leak in both groups did not show

Table 2: *Stratification based on gender.*

Gender	CSF Leak	Groups		Total	*P*-Value Chi-Square
		DC with Open Dural Flap	DC with Dural Slits		
Males	Present	4 10.3%	10 25.6%	14 17.9%	0.077
	Absent	35 89.7%	29 74.4%	64 82.1%	
	Total	39 100.0%	39 100.0%	78 100.0%	
Females	Present	1 14.3%	0 .0%	1 7.1%	0.299
	Absent	6 85.7%	7 100.0%	13 92.9%	
	Total	7 100.0%	7 100.0%	14 100.0%	

Table 3: *Stratification based on age.*

Age	CSF Leak	Groups		Total	*P*-Value Chi-Square
		DC with Open Dural Flap	DC with Dural Slits		
15 – 30 Years	Present	1 5.9%	7 18.9%	8 14.8%	0.210
	Absent	16 94.1%	30 81.1%	46 85.2%	

	Total	17 100.0%	37 100.0%	54 100.0%	
31 – 55 Years	Present	4 13.8%	3 33.3%	7 18.4%	0.186
	Absent	25 86.2%	6 66.7%	31 81.6%	
	Total	29 100.0%	9 100.0%	38 100.0%	

Table 4: *Stratification based on duration.*

Duration of Trauma	**CSF Leak**	**Groups**		**Total**	***P*-Value Chi-Square**
		DC with Open Dural Flap	**DC with Dural Slits**		
< 6 Hours	Present	4 10.3%	10 23.8%	14 17.3%	0.107
	Absent	35 89.7%	32 76.2%	67 82.7%	
	Total	39 100.0%	42 100.0%	81 100.0%	
6-12 Hours	Present	1 14.3%	0 .0%	1 9.1%	0.428
	Absent	6 85.7%	4 100.0%	10 90.9%	
	Total	7 100.0%	4 100.0%	11 100.0%	

Table 5: *Stratification based on baseline GCS.*

Baseline GCS	**CSF Leak**	**Groups**		**Total**	***P*-Value Chi-Square**
		DC with Open Dural Flap	**DC with Dural Slits**		
5 – 9	Present	5 14.3%	8 25.0%	13 19.4%	0.268
	Absent	30 85.7%	24 75.0%	54 80.6%	
	Total	35 100.0%	32 100.0%	67 100.0%	
10 – 15	Present	0 .0%	2 14.3%	2 8.0%	0.191
	Absent	11 100.0%	12 85.7%	23 92.0%	
	Total	11 100.0%	14 100.0%	25 100.0%	

any significant difference when results were stratified with respect to age, gender, duration of trauma and baseline GCS (table 2-5). *P* value (chi-square) was found to be > 0.05 in all cases.

DISCUSSION

The surgical intervention required for evacuation of symptomatic acute subdural hematoma include different techniques, like, simple craniotomy and evacuation, burr-hole trephination or decompressive craniectomy. The DC involves removal of skull bone along with clot, but without replacing the bone due to possible expansion of the brain due to edema. This procedure has the advantage that it immediately decreases the raised intracranial pressure by giving space in the brain and allowing surgeon with the proper exposure of hematoma. However, a marked herniation of edematous brain was observed in many cases through the craniectomy. In another technique multiple linear dural slits are made parallel to the dural vessels. The multi-dural slits allowed slow removal of acute subdural hematoma by oozing of hematoma and CSF preventing herniation of the brain, thus preventing secondary injury to the brain. However, this technique is associated with higher risk of post-operative CSF leaks. In the current analysis, we planned to compare the frequency of postoperative CSF leak after decompressive craniectomy with wide dural flap duraplasty versus dural slits in patients with post traumatic acute subdural hematoma. Our results showed that the overall frequency of CSF leak was not significantly different in both groups and revealed that CSF leak was observed in 10.9% (n = 5/46) in group A (DC with open dural flap) and in 21.7% (n = 10/46) in group B (DC with dural slits) (*P* = 0.158).

Our results are in similar with already published data. Khan B, et al in their randomized control study reported that patients who underwent decompressive craniectomy with expansile duraplasty for evacuation of ASDH, CSF leak was observed in 6.5% of patients during the post-operative follow up period, while in patients who underwent decompressive craniectomy with dural slits CSF leak was observed in 28.6% of patients during the follow up period.[8]

Bhat et al prospectively assessed 120 patients during a duration of 3 years with severe traumatic acute SDH, with one group using wide DC with dural-stabs in 60 cases with another group using conventional dural opening (open dural flap) and removal of acute subdural hematoma in 60 controls. They found the overall survival of 78.3% with the dural-stab group (case-study), with43.3% of good recovery and with the mortality (13/60) of 21.6% as compared to open dural flap (control) group with 40% survival, good recovery of 11.6% and with the mortality (36/60) of 60%. The open dural flap technique proved dangerous in a traumatic and edematous brain. This dural-stabs technique proved to be much effective in increasing overall survival of patients with low GCS. In conclusion, a simple decompressive craniectomy alone does not provide more benefit and an open dural flap is full of risk in such patients.[0-12]

In a recent systematic literature review Barthélemy et al has evaluated decompressive craniectomy after severe TBI, by comparing the literature with first major RCT on this topic (DECRA). They found that when a comparison was done between Decompressive Craniectomy with multiple dural stabs and DC with open dural flap, dural stab group was found to have a significant advantage in mortality and GOS. They did not analyze the early complications like a CSF leak in different DC techniques.[7, 3-16]

Subsequently, Bhat et al analyzed evacuation of acute SDH by a combination of DC and multi-dural stabs (SKIMS-Technique) without brain herniation and lacerations in low GCS score patients. Survival in multi-dural stab group was 77.31% (92/119) with 42.02% (50/119) good recovery and 22.69% (27/119) mortality as compared with survival of 46.23% (49/106) in open dural flap (control) group with good recovery in15.09% (16/106) and 53.77% (57/106). They found DC with multi-dural stabs, much effective in terms of survival. They did not consider the early complication like CSF leaks in those patients.[7]

In summary, several studies have proved that DC with dural slits is associated with better treatment outcome and overall survival when compared with DC with open dural flaps. There are not much studies available on comparing the rate of CSF leak among both the techniques. In our study, the CSF leak has been observed in higher percentages in patients who underwent DC with dural slits as compared to the patients who underwent DC with open dural flaps. However, the difference was not statistically significant. Keeping in view the fact that DC with dural slits prevented herniation and thus preventing secondary insult to the brain, this technique could be a safer choice in surgical management of acute SDH.

Further studies, nonetheless, are needed to validate it in routine clinical practice.

CONCLUSIONS

CSF leak was observed in higher percentages in patients who underwent DC with dural slits as compared to the patients who underwent DC with open dural flaps. The difference, however, was not statistically significant.

Additional Information

Disclosures: Authors report no conflict of interest.
Human Subjects: Consent was obtained by all patients/ participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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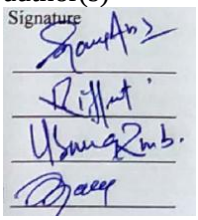
1.	**Ghayur Abbas** (Main/Principal Author).	1. Proposed topics and Basic Study Design, methodology.	Signature by the author(s) 
2.	**Riffatullah Khan** (2nd Author)	2. Data collection and calculations and methodology	
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