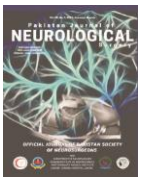

PAKISTAN JOURNAL OF NEUROLOGICAL SURGERY (QUARTERLY) – OFFICIAL JOURNAL OF PAKISTAN SOCIETY OF NEUROSURGEONS

Original Article (BRAIN)

# Comparison of the Efficacy of Multi Dural Stab Craniectomy with Open Dural Flap Craniectomy in Patients Having Acute Subdural Hematoma

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## ABSTRACT:

**Background/Objective:** We compared the efficacy of multi-dural stab craniectomy with open dural flap craniectomy in patients having acute subdural hematoma.

**Materials and Methods:** A randomized controlled trial was conducted in the Department of Neurosurgery, Allied hospital, Faisalabad. 70 patients having acute subdural hematoma were included. All of the patients were randomized in two groups: group A received a multi-dural stab craniectomy, while group B received an open dural flap craniectomy. Efficacy was assessed after 3 months of treatment in terms of a good recovery.

**Results:** Out of 70 patients, the mean age was 34.51 ± 8.712 years. Because of similar age and presenting GCS, the data show a non-significant difference in clinical outcomes between patients undergoing multi dual stab and open dural flap operations. However, a significant difference between the clinical results occurred at 3 months after the surgery (p-value 0.004). The efficacy of the multi-dural stab procedure was significantly higher from the open dural flap surgery (p-Value 0.006). The efficacy of the multi-dural stab surgery was significantly higher in the under 35 years age group of patients compared to open dural flap surgery. The results highlight those better results were seen in both surgeries when the presenting GCS of patients was higher (GCS= 6 – 8) compared to poor outcomes in patients with GCS of less than 5/15.

**Conclusion:** Multi-dural stabs are a safer alternative to the open dural flap for removing acute SDH with satisfactory recovery.

**Keywords:** Acute Subdural Hematoma, Arachnoid, Intracranial Pressure.

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Date of Submission: 10-11-2021
Date of Revision: 01-02-2022
Date of Acceptance: 15-03-2022
Date of Online Publishing: 31-03-2022
Date of Print: 31-03-2022

**DOI: 10.36552/pjns.v26i1.622**

## INTRODUCTION

Acute subdural hematoma (SDH) is a space-occupying lesion that causes an increase in intracranial pressure (ICP). It is sometimes worsened by co-existing cerebral lesions, such as

diffuse injuries, contusional hematomas, and edemas.[1] The goal of open dural flap surgical decompression is to obtain intracranial additional space to modify the constant of fixed intracranial volume and immediately reduce the elevated intracranial pressure. With a midline shift in multi-dural stab, the anatomical link between the arachnoid, pia, brain tissue, and its vasculature is retained. Acute SDH is one of the worst types of traumatic brain injury (TBI), with fatality rates ranging from 40 to 60%.[2] SDH is a lesion that takes up space in the brain and elevates intracranial pressure (ICP). Co-existing brain lesions, such as diffuse traumas, contusional hematomas, and edemas, might make it worse.[1] The purpose of open dural flap surgical decompression is to create extra intracranial space to change the fixed intracranial volume and lower the increased intracranial pressure instantly. The anatomical relationship between the arachnoid, pia, brain tissue, and its vasculature is preserved with a midline shift in multi-dural stab. SDH is one of the most deadly types of traumatic brain injury (TBI), with fatality rates ranging from 40 to 60%.[2]

Various investigations have supported decompressive craniectomy in the care of patients with SDH, however, complications related to surgical decompression are likely to have a negative impact on outcome.[5] Using open dural flaps to decompress the brain after a severe traumatic brain injury is a successful procedure. The goal of this operation is to obtain additional cerebral space by decompression to modify the constant intracranial volume in rigid and inelastic skulls and immediately reduce elevated intracranial pressure (ICP). Multi-dural stab helps in relieving severe brain edema and reverses the midline shift to preserve the anatomical integration of the brain. The solid clot disappears over a few days without causing an increase in ICP. According to the literature, excellent recovery was 42.02 percent with multi dural stab craniectomy and 15.09 percent with open dural flap craniectomy.[6]

We conducted this study to prove that multi dural stab craniectomy is beneficial in treatment of acute subdural hematoma when compared to open dural flap craniectomy. As there is no local study available on the comparison of multi dural stab craniectomy compared to open dural flap craniectomy in the treatment of acute subdural hematoma in terms of good recovery based on the Glasgow outcome scale. Therefore, we conducted this study on the comparison of these two treatment modalities to prove that multi dural stab craniectomy is beneficial in the treatment of acute subdural hematoma when compared to open dural flap craniectomy in terms of good recovery based on the Glasgow outcome scale and to reduce the fatality the of conventional procedure.

## MATERIAL AND METHODS

### Study Design and Setting

This randomized control trial was conducted in the Department of Neurosurgery, Allied hospital, Faisalabad six months after approval from the hospital ethical review committee.

### Inclusion Criteria

Patients of age between 20 – 50 years of both genders and patients having acute subdural hematoma as per operational definition with Glasgow coma score (GCS) 3 – 8 within 30 minutes to 6 hours of injury were included in the study. Acute SDH was defined on CT scan (Brain) as extraaxial, hyper dense, crescent shape lesion between the dura, and brain parenchyma. Patients have an acute subdural hematoma measuring more than one centimeter in thickness or causing a midline displacement of more than 0.5 centimeters on CT scan (Brain). Efficacy was defined as assessment in terms of good recovery on the Glasgow outcome scale after 3 months of treatment. Good recovery Score on Glasgow outcome scale was 5.

## Exclusion Criteria

Patients with penetrating injuries (such as a gunshot wound), cerebrovascular injury, epidural hematoma, and intraparenchymal hemorrhage greater than 30 ml were excluded from the study.

## Distribution of Patients

Using a computer-generated random number table, all of the patients were split into two groups at random. Patients in group A had a multi dural stab craniectomy, whereas those in group B had an open dural flap craniectomy. A consultant neurosurgeon conducted these surgeries. After three months of therapy, the Glasgow outcome score was calculated.

## Data Collection

Efficacy was measured according to the operational definition. All of the data was gathered on a proforma. A total of 70 patients were chosen using a non-probability, sequential sampling method using the WHO sample size calculator for two proportions: P1 = 42.02 percent [6] and P2 = 15.09 percent [6], with a power of research of 80 percent and a level of significance of 5%. N = 70 people were included in the study (35 in each group).

## Statistical Analysis

SPSS Version 26 was used to record and analyze all data. For age and Glasgow coma score at presentation, as well as **Glasgow outcome score** after 3 months of therapy, the mean standard deviation was computed. For gender and efficacy, frequency and percentages were computed. To compare the efficacy of the two groups, the Chi-square test was performed. Age, Glasgow coma score, and gender were used to stratify effect modifiers, and a post-stratification chi-square test was used. A p-value of less than 0.05 was deemed significant.

# RESULTS

## Age Distribution

Of 70 patients enrolled in the study, 20 – 5 0years of age with acute sub dural hematoma were included in the study. The patients' average age was 34.518.1212 years. The minimum age was 20 and the highest age was 49. The average Glasgow coma score was 5.631.5 among 70 individuals.

## Glasgow Coma Scale (GCS)

The minimum Glasgow coma score was 3 while maximum Glasgow coma score was 8. Out of 70 patients, mean Glasgow outcome score after 3 months was 3.44 ± 1.21. Minimum Glasgow outcome score after 3 months was 1 while maximum Glasgow outcome score after 3 months was 5 **(Table 1)**.

**Table 1:** Quantitative variable descriptive statistics.

| Variable | N | Min. | Max. | Mean ± SD |
|---|---|---|---|---|
| Age | 70 | 20 | 49 | 34.51 ± 8.712 |
| Glasgow coma scale at presentation | 70 | 3 | 8 | 5.63 ± 1.496 |
| Glasgow outcome score after 3 months | 70 | 1 | 5 | 3.44 ± 1.21 |

## Distribution of Quantitative Variables in Patients Groups

Out of 35 patients in multi dural stab group, the mean age of the patients was 34.49 ± 7.6 years while in the open-dural flap group out of 35 patients, the mean age of the patients was 34.54 ± 9.8 years with a p-value = 0.978. Out of 35 patients in multi dural stab group, the mean Glasgow coma score was 5.71 ± 1.64 while in the open dural flap group out of 35 patients, the mean Glasgow coma score was 5.54 ± 1.36 with a p-value = 0.635. Out of 35 patients in multi dural stab group, the mean Glasgow outcome score after 3 months was 3.86 ± 1.17 while in the open dural flap group out of 35 patients, the mean

Glasgow outcome score after 3 months was 3.03 ± 1.12 with p-value = 0.004 **(Table 2)**.

## Age Distribution in Multi Dural Stab/Open Dural Flap Groups

Out of 70 patients, there were 39 (55.7%) patients who had age ≤ 35 years and 31 (44.3%) patients had age > 35 years. In multi dural stab group, out of 35 patients, there were 20 (57.1%) patients had age ≤ 35 years, and 15 (42.9%) patients had age > 35 years. In open dural flap group, out of 35 patients, there were 19 (54.3%) patients had age ≤ 35 year and 16 (45.7%) patients had age > 35 years with p-value = 0.81 (**Table 3**).

## Gender Distribution in Multi Dural Stab/Open Dural Flap Groups

Out of 70 patients, there were 52 (74.3%) patients were male and 18 (25.7%) patients were female. In multi dural stab group, out of 35 patients, there were 27 (77.1%) patients were male and 8 (22.9%) patients were female. In the open dural flap group, out of 35 patients, there were 25 (71.4%) patients were male and 10 (28.6%) patients were female with a p-value = 0.584 (**Table 4**).

## GCS Distribution in Multi Dural Stab/Open Dural Flap Groups

Out of 70 patients, there were 32 (45.7%) patients who had 3 – 5 Glasgow coma scores and 38 (54.6%) patients had 6 – 8 Glasgow coma scores. In multi dural stab group, out of 35 patients, there were 16 (45.7%) patients who had 3 – 5 Glasgow coma scores and 19 (54.6%) patients had 6 – 8 Glasgow coma scores. In the open dural group, out of 35 patients, there were 16 (45.7%) patients who had 3-5 Glasgow coma scores and 19 (54.6%) patients had 6 – 8 Glasgow coma scores with p-value = 1 **(Table 5)**.

**Table 2:** Both groups' descriptive statistics of quantitative variables.

| Variable | Groups | | p-value |
|---|---|---|---|
| | Multi Dural Stab | Open Dural Flap | |
| Mean Age (years) | 34.49 ± 7.6 | 34.54 ± 9.8 | 0.978 (insignificant result) |
| Glasgow coma scale at presentation | 5.71 ± 1.64 | 5.54 ± 1.36 | 0.635 (insignificant result) |
| Glasgow outcome score after 3 months | 3.86 ± 1.17 | 3.03 ± 1.12 | 0.004* (*significant result) |

**Table 3:** Distribution of age.

| Age Distribution | Groups | | Total | Statistical Calculations |
|---|---|---|---|---|
| | Multi Dural Stab | Open Dural Flap | | |
| ≤ 35 years | 20 (57.1%) | 19 (54.3%) | 39 (55.7%) | $\chi^2$= 0.058 |
| > 35 years | 15 (42.9%) | 16 (45.7%) | 31 (44.3%) | p-value = 0.81 |
| Total | 35 | 35 | 70 | (insignificant result) |

**Table 4:** Gender distribution.

| Gender | Groups | | Total | Statistical Calculations |
|---|---|---|---|---|
| | Multi dural stab | Open dural flap | | |
| male | 27 (77.1%) | 25 (71.4%) | 52 (74.3%) | $\chi^2$ = 0.299 |
| female | 8 (22.9%) | 10 (28.6%) | 18 (25.7%) | p-value = 0.584 |
| Total | 35 | 35 | 70 | (insignificant result) |

**Table 5:** Distribution of Glasgow coma score.

| Glasgow Coma Score at Presentation | Groups | | Total | Statistical Calculations |
|---|---|---|---|---|
| | Multi Dural Stab | Open Dural Flap | | |
| 3 – 5 | 16 (45.7%) | 16 (45.7%) | 32 (45.7%) | $\chi^2 = 0$ |
| 6 – 8 | 19 (54.3%) | 19 (54.3%) | 38 (54.3%) | p-value = 1 |
| Total | 35 | 35 | 70 | (insignificant result) |

**Table 6:** Efficacy among both groups.

| Efficacy | Groups | | Total | Statistical Calculations |
|---|---|---|---|---|
| | Multi Dural Stab | Open Dural Flap | | |
| Yes | 14 (40.0%) | 4 (11.4%) | 18 (25.7%) | $\chi^2 = 7.479$ |
| No | 21 (60.0%) | 31 (88.6%) | 52 (74.3%) | p-value = 0.006* |
| Total | 35 | 35 | 70 | (*significant result) |

**Table 7:** Efficacy among both groups in the different age group.

| Age Distribution | Efficacy | Groups | | Total | p-value |
|---|---|---|---|---|---|
| | | Multi Dural Stab | Open Dural Flap | | |
| ≤35 years | Yes | 10 (50.0%) | 1 (5.3%) | 11 (28.2%) | 0.002* (*significant result) |
| | No | 10 (50.0%) | 18 (94.7%) | 28 (71.8%) | |
| | Total | 20 | 19 | 39 | |
| > 35 years | Yes | 4 (26.7%) | 3 (18.8%) | 7 (22.6%) | 0.598 (insignificant result) |
| | No | 11 (73.3%) | 13 (81.2%) | 24 (77.4%) | |
| | Total | 15 | 16 | 31 | |

## Comparison of Efficacy in Multi Dural Stab/Open Dural Flap Groups

Out of 70 patients, overall efficacy was observed in 18 (25.7%) patients and no efficacy was observed in 52 (74.3%) patients. Out of 35 patients in multi dural stab group, efficacy was observed in 14 (40%) patients and no efficacy was observed in 21 (60%) patients. Out of 35 patients in the open dural flap group, efficacy was observed in 4 (11.4%) patients and no efficacy was observed in 31 (88.6%) patients with a p-value = 0.006 **(Table 6)**.

## Efficacy in Patients' Groups Concerning Age Groups

Out of 39 patients having age ≤ 35 years, in the multi dural stab group, efficacy was observed in 10 (50%) patients and no efficacy was observed in 10 (50%) patients. While in the open dural flap group, efficacy was observed in 1 (5.3%) patients and no efficacy was observed in 18 (94.7%) patients with a p-value = 0.002. Out of 31 patients having age > 35 years, in the multi dural stab group, efficacy was observed in 4 (26.7%) patients and no efficacy was observed in 11 (73.3%) patients. While in the open dural flap group, efficacy was observed in 3 (18.8%) patients and no efficacy was observed in 13 (81.2%) patients with a p-value = 0.598 **(Table 7)**.

## Efficacy among Patients' Groups Concerning Gender Distribution

Out of 52 male patients, in multi dural stab group efficacy was observed in 12 (44.4%) patients and no efficacy was observed in 15 (55.6%) patients. While in the open dural flap group, efficacy was observed in 4 (16%) patients and no efficacy was observed in 21 (84%) patients with a p-value =

0.26. Out of 18 female patients, in multi dural stab group efficacy was observed in 2 (25%) patients and no efficacy was observed in 6 (75%) patients. While in the open dural flap group, efficacy was observed in 0 (0%) patients and no efficacy was observed in 10 (100%) patients with a p-value = 0.094 **(Table 8)**.

## Efficacy among Patients' Groups Concerning GCS

Out of 32 patients having Glasgow coma scores between 3 – 5, in the multi dural stab group, efficacy was observed in 1 (6.2%) patients and no efficacy was observed in 15 (93.8%) patients. While in the open dural flap group, efficacy was observed in 0 (0%) patients and no efficacy was observed in 16 (100%) patients with a p-value = 0.31. Out of 38 patients having Glasgow coma scores between 6 – 8, in the multi dural stab group, efficacy was observed in 13 (68.4%) patients and no efficacy was observed in 6 (31.6%) patients. While in the open dural flap group, efficacy was observed in 4 (21.1%) patients and no efficacy was observed in 15 (78.9%) patients with a p-value = 0.003 **(Table 9)**.

**Table 8:** Efficacy among both groups according to gender.

| Gender | Efficacy | Groups | | Total | p-value |
|---|---|---|---|---|---|
| | | Multi Dural Stab | Open Dural Flap | | |
| Male | Yes | 12 (44.4%) | 4 (16.0%) | 16 (30.8%) | 0.26 (insignificant result) |
| | No | 15 (55.6%) | 21 (84.0%) | 36 (69.2%) | |
| | Total | 27 | 25 | 52 | |
| Female | Yes | 2 (25.0%) | 0 (0.0%) | 2 (11.1%) | 0.094 (insignificant result) |
| | No | 6 (75.0%) | 10 (100.0%) | 16 (88.9%) | |
| | Total | 8 | 10 | 18 | |

**Table 10:** Efficacy among both groups among different Glasgow coma scores.

| Glasgow Coma Scale at Presentation | Efficacy | Groups | | Total | p-value |
|---|---|---|---|---|---|
| | | Multi Dural Stab | Open Dural Flap | | |
| 3 – 5 | Yes | 1 (6.2%) | 0 (0.0%) | 1 (3.1%) | 0.31 (insignificant result) |
| | No | 15 (93.8%) | 16 (100.0%) | 31 (96.9%) | |
| | Total | 16 | 16 | 32 | |
| 6 – 8 | Yes | 13 (68.4%) | 4 (21.1%) | 17 (44.7%) | 0.003* (*significant result) |
| | No | 6 (31.6%) | 15 (78.9%) | 21 (55.3%) | |
| | Total | 19 | 19 | 38 | |

## DISCUSSION

Head injuries are a serious health issue that is the main reason for death and disability, as well as a significant drain on medical resources. Accident rates in developing nations are increasing in general and traumatic brain injury rates in particular, as traffic rises, as well as other variables such as industrialization, falls, and ballistic trauma. Head injuries are responsible for one-quarter to one-third of all unintentional deaths, as well as two-thirds of all trauma deaths in hospitals. TBI is the greatest cause of death in patients under the age of 45 in the United States, accounting for more than a third of all injury-related deaths. Every year, 52,000 individuals die, with an additional 80,000 people suffering from morbidity and traumatic brain damage. Although more severe injuries are linked to worse outcomes, people who are moderately damaged are equally at risk. Road traffic injuries are becoming more

common across the world, particularly in Southeast Asia. Trauma involves a wide range of injuries and issues that need prompt assessment, discussion, improvisation, and action to preserve lives and avoid lasting damage. During times of conflict, gunshot and explosion injuries are major causes of brain damage, with an increasing prevalence during times of peace. Civilians have been the primary targets in previous wars, accounting for more than 80% of those wounded and killed.[7] The most fatal of all head injuries is traumatic acute subdural hematoma, in which the initial brain damage is more important than the clot. The capacity to regulate ICP, rather than the removal of the subdural clot, determines the result. Although removing the clot after four hours of the damage reduced mortality to 30% and increased functional rate to 65%, ICP management has been a crucial element. Acute subdural hematoma has a significant fatality rate due to its frequent correlation with initial brain trauma, such as contusions and brain edema. The nature and causes of brain swelling following a traumatic brain injury, on the other hand, are complex and little understood.

The results of the present study revealed that the majority of the patients (55.7%) had age ≤ 35 years. 74.3% of patients were male. Most patients (54.3%) had 6 – 8 Glasgow coma scores at presentation. In multi dural stab group, efficacy in terms of good recovery after 3 months of treatment was observed in 40% of patients while in the open dural flap group, it was observed in 11.4%. The results suggest an insignificant difference in the clinical outcome between patients compared to the multi dual stab and open dural flap surgeries because of similar age and presenting GCS. However, a significant difference between the clinical results occurred 3 months after the surgery (P-value 0.004). The majority of the patients (57.1%) underwent multi-dural stab surgery as compared to slightly lesser 19 patients (54.3%) who had open dural flap surgery. The efficacy of the multi-dural stab procedure was significantly higher than the open dural flap surgery (P-Value 0.006). The efficacy of the multi dual stab surgery was significantly higher in the under 35 years age group of patients compared to open dural flap surgery. The efficacy was not much different in the two surgeries in the above 35 years aged patients. The difference in the Efficacy of the two types of surgeries (multi dural stab and open dural flap) was insignificant among the male and female groups. The results highlight that better results were seen in both surgeries when the presenting GCS of patients was higher (GCS = 6 – 8) compared to poor outcomes in patients with GCS of less than 5/15.

Decompressive craniectomy with multi-dural stabs (SKIMS) approach to evacuate acute subdural hematoma with underlying severe traumatic brain edema was studied by Bhat et al.[6] According to his findings, the majority of the patients (65 percent) were between the ages of 21 and 40. In the multi-dural stab group, 42.02 percent of patients had a good recovery, whereas, in the open-dural flap group, 15.09 percent had a good recovery. They determined that the SKIMS-Technique or Combined Technique, i.e., "decompressive craniectomy with multi-dural stabs," was very helpful in improving survival in patients with poor GCS and severe traumatic brain edema and acute subdural hematoma, which supports the findings of my investigation. Bhat et al[7] looked at the use of dural–stabs as an alternative to an open dural flap to decompress acute subdural hematoma in patients with severe traumatic brain edema. The bulk of the patients is between the ages of 21 and 40, according to the findings of their inquiry. Patients in the multi-dural stab group recovered well 43.33 percent of the time, whereas patients in the open-dural flap group recovered well 11.67 percent of the time. They found that dural-stabs surgery is the quicker, safer, slowly decompressive, and effective approach for eliminating acute subdural hematoma and obtaining extra-space

intracranially in the presence of severe cerebral edema, with good results, which backs up my findings.

## CONCLUSION

The multi-dural stabs are a new technique for removing acute subdural hematomas in the presence of severe traumatic brain edema to gain intracranial space. It results in a better clinical outcome than the open dural flap. It is faster, safer, preserves the parenchyma, and is a more effective decompressive procedure.

## RECOMMENDATIONS

Based on our experience from undertaking 70 patients for the two types of surgeries, the results were significantly promising if patients with higher GCS at presentation were operated on compared to lower GCS. The results were also significantly more favorable in patients under the age of 35 years compared to senior patients.

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## Additional Information

**Disclosures:** Authors report no conflict of interest.

**Ethical Review Board Approval:** As the study is retrospective in nature so ethical committee approval was not required.

**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.

## AUTHORS CONTRIBUTIONS

| Sr.# | Author's Full Name | Intellectual Contribution to Paper in Terms of: |
|---|---|---|
| 1. | Anum Wahab | Study design and methodology. |
| 2. | Inam Ullah Asghar | Paper writing and data calculations. |
| 3. | Muhammad Abdur Rehman | Data collection and calculations. |
| 4. | Taimoor Anwar | Analysis of data and interpretation of results etc. |
| 5. | Muhammad Akmal Hussain | Literature review and manuscript writing. |