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Original Article

A Comparative study between Decompressive Craniectomy with Multidural Stabs and Craniotomy with Durotomy in Acute Subdural Hematoma

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Abstract:

Introduction: *An acute subdural hematoma (SDH) is one of the most lethal of all head injuries. A good number of patients are encountered in Dhaka medical college and hospital with acute subdural hematoma. There are many modalities for the treatment of acute subdural hematoma, such as decompressive craniectomy with multidural stabs, craniotomy with durotomy. This comparative study was carried -out in the Department of Neurosurgery, Dhaka Medical College and Hospital, Dhaka, during Jan 2016 – Dec 2017, to compare the effect of the decompressive craniectomy with multidural stabs and craniotomy with durotomy in respect to the post operative GCS and GOS. As well as to assess and compare the post operative complications. The type of the study is prospective randomized controlled clinical trial.*

Materials and Methods: *For this purpose, a total of 56 patients of both sex and any age with acute subdural hematoma attended in the above hospital were included in this study. Among them 28 patients underwent decompressive craniectomy with multidural stabs and rest 28 underwent craniotomy with durotomy. Data were collected and analyzed by different variables like age, sex, GCS on admission, GCS on 7th POD, GOS at one month and some complication like operative recurrence, seizure and mortality. Patients or attendants who refuse interview, who managed conservatively and patient who didn't give consent, patients having severe respiratory distress and or shock, who came after 24 hours of trauma and who had no history of trauma were excluded from the study.*

Results: *The following observations and results were obtained in this study. Nearly two third (63.0%) patients of DC MDS group and 18 (64.3%) in CT DT group age belonged to 21 to 40 years. Most (85.7%) of the patients of DC MDS group and 22 (78.6%) in CT DT group were male. Almost a half (46.4%) patient of DC MDS group and 12 (42.8%) patients of CT DT group GCS on admission belonged to 4 to 8 scale. The differences between two groups were not significant (p>0.05). Nearly a half (46.4%) patient of DC MDS group and 6 (21.4%) patients of CT DT group GCS on 7th POD belonged to 9 to 12 scale. Mortality observed almost one third (32.1%) and 12 (42.9%) in patients of DC MDS group and CT DT group respectively. Regarding the GOS at one month follow up, it was observed 12 (42.9%) patients of DC MDS group and 2 (7.1%) patients of CT DT group had good recovery. About the relation between GCS (on admission) with GOS at one month, we saw that 10(37.7%) patient. GCS was*

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≥8 where GOS was 4+5 and compare to CT with DT group 9 (32.1%) patients. The difference was statistically significant (p<0.05) and GCS (7th POD) with GOS, it was seen 15 (53.3%) patients GCS was e"8 where GOS was 4+5 and compare to CT with DT group 9 (32.1%) patients. About the complications 4 (14.3%) patients of DC MDS group had both surgical recurrence and seizures. 12 (42.9%) patients of CT DT group had seizures and 11 (39.3%) patients had surgical recurrence.

Conclusion: *Though mortality between these two groups was not significant, GCS on 7th POD and GOS on 30th POD were significantly better in decompressive craniectomy with multidural stabs group and operative recurrence and seizure was less in decompressive craniectomy with multidural stabs group and was statistically significant.*

Keyword: *An acute subdural hematoma (ASDH), Decompressive craniectomy with multidural stabs, craniotomy with durotomy, Post operative GCS, Post operative GOS,Operative recurrence, seizure and mortality.*

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Introduction:

An acute subdural hematoma (SDH) is a clot of blood that develops between the surface of the brain and the dura mater, the brain's tough outer covering, usually due to stretching and tearing of veins on the brain's surface. These veins rupture when a head injury suddenly jolts or shakes the brain. It is the most lethal head injury and presents the most challenging surgical problems. Rapid and aggressive neurosurgical intervention for evacuation of ASDH proved beneficial for critically ill patient[1]. SDHs are seen in 10 percent to 20 percent of all traumatic brain injury cases and occur in up to 30 percent of fatal injuries[2]. Most SDH are caused by motor vehicle-related accidents (MVA), falls, and assaults. In one study, 56% of SDH in the younger group (18–40 yr) were caused by MVA and only 12% were caused by falls, whereas, in the older groups (65 yr), these mechanisms were responsible for 22% and 56% of SDH, respectively[3].The risk of SDH increases with the use of anti-thrombotic agents[4]. Overall, subdural hematomas are more common in men than in women, with a male-to-female ratio of 2:1[5]. Acute subdural hematoma has a high mortality despite intensive treatment. In a study of patients with acute subdural hematoma, a midline shift exceeding the thickness of the hematoma by 3 mm or more at the initial CT predicted mortality 50.0% in all cases[6]. Patients with SDH presenting with a clot thickness greater than10 mm or an MLS greater than 5 mm should undergo surgical evacuation, regardless of their GCS[3]. The present study was conducted to evaluate the effect of "Multi-dural stabs" in the complete removal of acute subdural hematoma for quick relief of raised ICP and to prevent any further secondary brain damage due to opening of dural flaps, where the deeper edematous white matter swelling pushes itself and the overlying cortex with vital vasculature out of the cranial cavity causing lacerations and further compound the brain insult.

Materials and Methods:

The current study was Prospective randomized controlled clinical trial held in the department of neurosurgery of Dhaka medical college and hospital, Dhaka with in the period of Jan 2016 – Dec 2017. Patients with acute subdural hematoma who underwent decompressive craniectomy were included in the study. Other selection criteria were GCS 4-13, hematoma thickness > 1 cm, midline shift > 5mm, within 24 hours of trauma or event and lastly patients who consented. A total of 56 (28 x 2= 56) sample were enrolled in this study distributed in two groups – one with multidural stabs and the other without. Postoperatively, CT-scans were done to evaluate intracranial extra space gain and whenever indicated such as the worsening of GCS on 7th POD score. The outcome was assessed by applying Glasgow Outcome Scale on 30th POD[7]. Bone flaps were implanted in the abdominal fat or stored in deep freezer for 3 months for re-implantation in craniectomy group.

Results:

Table I shows age distribution of the study patients. It was observed that almost two third (63.0%) patients of DC with MDS group and 18(64.3%) patients of CT with DT group belonged to age 21 to 40 years. The differences between two groups were statistically not significant (p>0.05).

Table II shows sex distribution of the study patients. It was observed that majority (85.7%) patients of DC with MDS group and 22(78.6%) patients of CT with DT group were male. The differences between two groups were statistically not significant (p>0.05)

Table III shows GCS on admission distribution of the study patients. It was observed that almost half (46.4%) patients of DC with MDS group and 12 (42.8%) patients of CT with DT group belonged to 4 to 8 scale. The differences between two groups were statistically not significant (p>0.05).

Table IV shows GCS on 7th POD distribution of the study patients. It was observed that

more than one third (42.9%) patients of DC with MDS group and 6(21.4%) patients of CT with DT group belonged to 9 to 12 scale. The differences between two groups were statistically significant (p<0.05).

Table V shows distribution of the study patients by outcome. It was observed that almost one third (32.1%) patients of DC with MDS group and 12(42.9%) patients of CT with DT group were dead. The differences between two groups were statistically not significant (p>0.05).

Table VI shows distribution of the study patients by GOS at one month follow up and expressed by Karnofsky performance status scale. It was observed that more than more than one third (42.9%) patients of DC with MDS group and 2(7.1%) patients of CT with DT group had good recovery. The differences between two groups were statistically significant (p<0.05).

Table-I

Age distribution of study population (n=56)

Age (Years)	DC With MDS(n=28)		CT With DT(n=28)		*p* Value
	n	%	n	%	
16-20	5	19.3	6	21.0	
41-60	3	11.8	3	10.7	
21-40	18	63.0	18	64.3	0.935
60-66	2	5.9	1	3.6	

p Value reached from chi square test

DC with MDS= Decompressive craniectomy with multidural stabs CT with DT= Craniectomy with durotomy

Table-II

Sex distribution of study population (n=56)

Sex	DC With MDS (n=28)		CT With DT (n=28)		*p* Value
	n	%	n	%	
Male	24	85.7	22	78.6	0.485
Female	4	14.3	6	21.4	

p Value reached from chi square test

Table-III

Distribution of study population by GCS on admission (n=56)

GCS on admission	DC With MDS (n=28)		CT With DT (n=28)		*p* Value
	n	%	n	%	
4-8	13	46.4	12	42.8	
9-12	6	21.4	8	28.6	0.825
13	9	32.1	8	28.6	

p Value reached from chi square test

Table-IV

Distribution of study population by GCS on 7th POD (n=56)

GCS on 7th POD	DC With MDS (n=28)		CT With DT (n=28)		*p* Value
	n	%	n	%	
3-8		6	21.4	14	50.0
9-12	12	42.9	6	21.4	0.029
13-15	10	35.7	8	28.6	

*Note: 3-8= Severe, 9-12= Moderate and 13-15= Mild TBI (Traumatic Brain Injury) (Mena et al. 2011)
p Value reached from chi square test

Table-V

Distribution of study population by outcome (n=56)

Outcome	DC With MDS (n=28)		CT With DT (n=28)		*p* Value
	n	%	n	%	
Survival	19	67.9	16	57.1	0.408
Mortality	9	32.1	12	42.9	

p Value reached from chi square test

Table-VI

Distribution of study population by GOS at one month follow up (n=56)

Recovery status	DC With MDS(n=28)			CT With DT(n=28)			*p* Value
	n	kf	%	n	kf	%	
Death	9	0	32.1	12	0	42.9	
Vegetative state	2	30-120-1	7.1	2	30-2	7.1	0.023
Severe disability	3	40-250-1	10.7	4	40-350-1	14.3	
Moderate disability	2	60-2	7.1	8	60-570-3	28.6	
Good recovery	12	80-490-3100-5	42.9	2	80-190-1	7.1	

Note: kf= Karnofsky performance status scale
p Value reached from chi square test

Table VII shows relation between GCS (on admission) with GOS, it was observed that most of the patients of DC with MDS group 10(37.7%) GCS was ≥8 where GOS was 4+5 and compare to CT with DT group 9 (32.1%). The difference was statistically significant (p<0.05)

Table VIII shows relation between GCS (7th POD) with GOS, it was observed that most of the patients of DC with MDS group 15(53.3%) GCS was ≥8 where GOS was 4+5 and compare to CT with DT group 9 (32.1%). The difference was statistically significant (p<0.05)

Table IX shows distribution of the study patients by complications. It was observed that 4(14.3%) patients of DC with MDS group and 11(39.3%) patients of CT with DT group patients had surgical recurrence. The differences was statistically significant (p<0.05).

Table-VII

Relation between GCS (on admission) with GOS (n=56)

GOS	DC With MDS(n=28) GCS			CT With DT(n=28) GCS		
	<8	≥8	*p* Value	<8	≥8	*p* Value
1	2(7.1%)	0(0.0%)	0.015	3(10.7%)	1(3.6%)	0.026
2+3	9(32.1%)	5(17.8%)		8(28.5%)	6(21.2%)	
4+5	2(7.1%)	10(37.7%)		1(3.6%)	9(32.1%)	

*Note: 1= Death, 2= Vegetative State, 3= Severe Disability, 4= Moderate Disability and 5= Good Recovery (Ahn et al. 2017 and Akyuz et al. 2010)

p Value reached from chi square test

Table-VIII

Relation between GCS (7th POD) with GOS (n=56)

GOS	DC With MDS (n=28) GCS			CT With DT (n=28) GCS		
	<8	≥8	*p* Value	<8	≥8	*p* Value
1	2(7.1%)	0(0.0%)	0.004	3(10.7%)	1(3.6%)	0.007
2+3	2(7.1%)	8(28.5%)		10(35.7%)	4(14.2%)	
4+5	1(3.6%)	15(53.8%)		1(3.6%)	9(32.1%)	

*Note: 1= Death, 2= Vegetative State, 3= Severe Disability, 4= Moderate Disability and 5= Good Recovery[9,15]. *P* Value reached from chi square test

Table-IX

Distribution of study population by complications (i) (n=56)

Complications:	DC With MDS (n=28)		CT With DT (n=28)		*p* Value
Surgical recurrence	n	%	n	%	
Present	4	14.3	11	39.3	0.035
Absent	24	85.7	17	60.7	

p Value reached from chi square test

Table-X

Distribution of study population by complications (ii) (n=56)

Complications:	DC With MDS (n=28)		CT With DT (n=28)		*p* Value
Seizures	n	%	n	%	
Present	4	14.3	12	42.9	0.018
Absent	24	85.7	16	57.1	

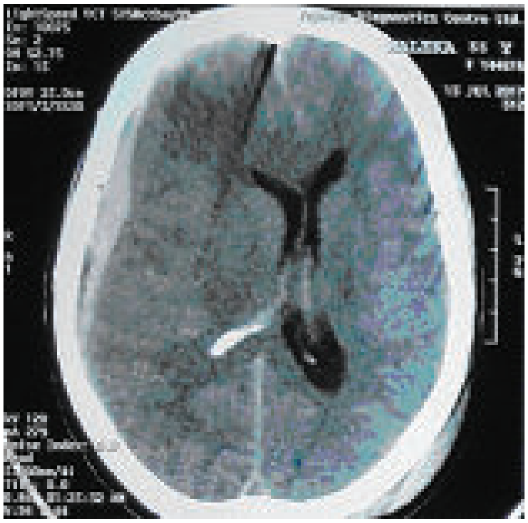

Fig.-1: *Pre-operative axial CT scan of showing rightfronto-parietal acute subdural hematoma*

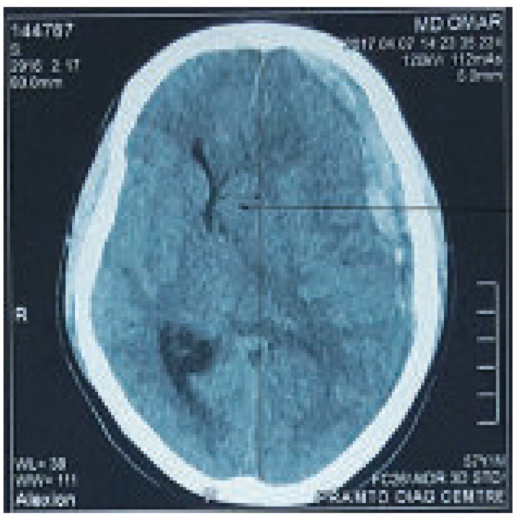

Fig.-2: *Pre-operative axial CT scan of 57 years male showing left fronto parietal acute subdural hematoma with midline shift.*

Fig.-3: *Planning and marking of scalp incision of 55 years female*

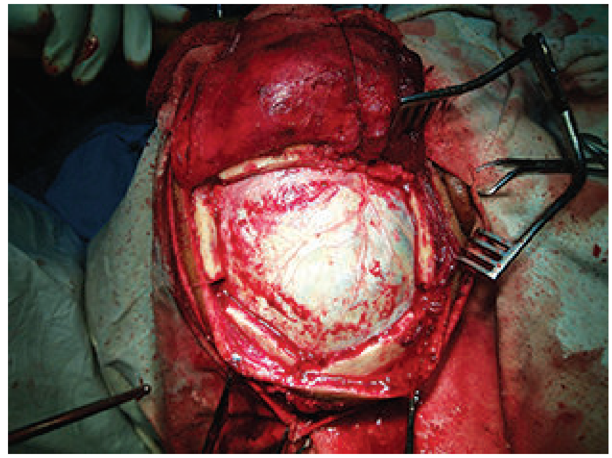

Fig.-4: *30 years old male decompressive craniectomy, subdural blood with prominent dural vessels is seen.*

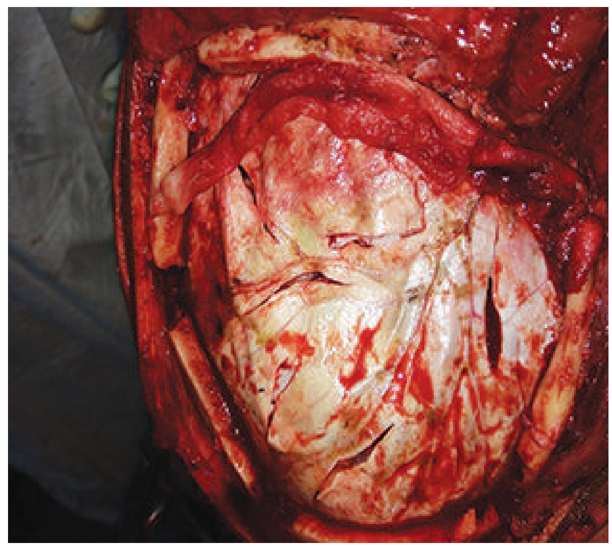

Fig.-5: *Decompressive craniectomy with multi dural stabs of 30 years male*

Fig.-6: *Layered closure of scalp with subgaleal drain of a 30 years male*

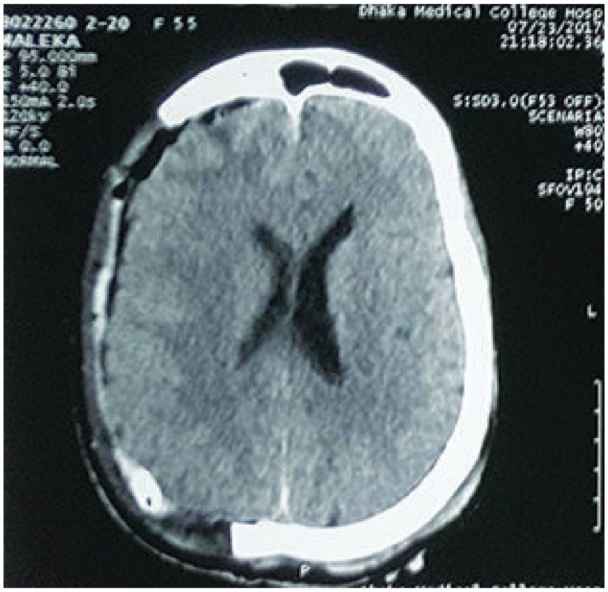

Fig.-7: *Post operative axial CT scan of head of 55 years female after decompressive craniectomy almost correction of midline shift.*

Discussion:

Acute subdural hematoma is one of the most lethal of all head injuries in which primary brain injury is more critical factor than a clot. The outcome depends upon the ability to control ICP rather than removal of subdural clot. Although timing of clot removal within four hours of injury has lowered mortality to 30% with functional rate of 65%, but ICP control has been a critical factor[8]. The high mortality of acute subdural hematoma is largely explained by its frequent association with primary brain damage consisting of contusions and brain swelling. However, the nature and causes of brain swelling after traumatic brain injury are multifactorial and poorly understood. Brain swelling associated with acute subdural hematoma is caused by secondary insult to brain in addition to primary parenchymal injury.

In this present study, it was observed that 63.0% and 64.3% of the patient's age belonged to 21 to 40 years in DC with MDS and CT with DT group respective, which were almost alike between two groups (p>0.05). Prahaladu et al.[9] showed the maximum (63.0%) patients suffering from ASDH were in these group of 20 to40 years with male predominance (73.0%).Also Bhat et al.[10] showed the comparative results of the multi-dural stabs and the open-dural flap revealed similar age distribution in both the groups, where nearly two third patients (65%) were in the age group of 21-40 years both from case as well as control groups, which is consistent with the current study. In this current study, it was observed that 85.7% patients of DC with MDS group and 78.6% patients of CT with DT group were male. The differences between two groups were statistically not significant (p>0.05), which is closely resembled with Bhat et. al.[10] study, where they found more than 80% were males in both groups. In another study Khan et al.[11] study showed that 89.8% patients with ASDH were male whereas incase of female it was 10.2%. Also reported that 79.8% patients with ASDH were male which was related to this study[12].

In this present study, it was observed that 46.4% patients of DC with MDS group and 42.8% patients of CT with DT group belonged to 4 to 8 scale. The differences between two groups were statistically not significant (p>0.05). Khan et. al.[11] found in their study that 39.0% patients presented with GCS of 3-5, 47.0% patients presented with GCS 6-8 and 13.6% patients GCS was 9-11. Bhat et al.[10] found in multi-dural stabs group, 25.21% patients were in the GCS 3-4 group and25.47%in open dural flap group. GCS7-8 was observed 39.50% in the multi-dural stab group and 41.51% in open-dural flap group, which is comparable with the current study.

In this current study, it was observed that 46.4% patients of DC with MDS group and 21.4% patients of CT with DT group belonged to 9 to 12 scale on 7th POD. The differences between two groups were statistically significant (p<0.05).

In this current study, it was observed that 42.9% patients of DC with MDS group and 7.1% patients of CT with DT group had good recovery. The differences between two groups were statistically significant (p<0.05).

Khan et al.[11] study showed that 6.5% of patients were in GOS-5, 9.7% of patients were in GOS-4, 29% of patients were in GOS-3, and 9.7% of patients ended up in vegetative state in craniectomy with dural flap group and in decompressive craniectomy with multidural slits group 14.3% of patients GOS were 5, 10.7% of patients were in GOS-4, 14.3% of patients were in GOS-3, and 7.1% of in vegetative state.[11]

Bhat et al.[10] study the multi-dural stab had an overall and better survival of 77.31% and a good-recovery of 42.02%, especially 30.25% good recovery in the age group 21-40 years, 15.09% good recovery in the open-dural flap, while age group of 21-40 years also showed a more 7.55% good recovery.Outcome of acute subdural hematoma associated with brain swelling as poor even when treated with early surgical evacuation. The mortality rate of such patients was over 75.0%[12].

At Neurosurgical center, Kashmir, the outcome of such patients with early and open dural flap was similar i.e., poor with 53.77% mortality. But multi-dural stabs had favorable outcome of 48.74% and survival rate of 77.31% with only 22.69% mortality. Li et al.[13] study presented the overall mortality rate was 32.0% in the craniotomy group and 38.0% in the DC group. In this present study, it was observed that 32.1% patients of DC with MDS group and 42.9% patients of CT with DT group were dead.

In this present study, it was observed that 14.3% patients of DC with MDS group had surgical recurrence and 39.3% patients of CT with DT group had surgical recurrence. The differences between two groups were statistically significant (p<0.05). In this current study, it was observed that the relation between GCS (on admission) with GOS, 37.7% patients GCS was e”8 where GOS was 4+5 and compare to CT with DT group 32.1%. The difference was statistically significant (p<0.05). Akyuz et al.[14] study showed that GCS score was strongly related to outcome, those which GCS score of 6 or above was significantly better than that in patients with an initial GCS lower than 6. Kodliwadmath et al.[15] reported that that there was a statistically significant correlation between the GCS recorded at admission and at 6 hours and the GOS at day 7 and 28 following the trauma. Patients with a GCS of >10 at presentation had a good prognosis and recovered with no residual deficits. A GCS of <4 had a poor prognosis. Six deaths occurred during the course of the study. All these patients had GCS <7 at presentation which further reiterates the prognostic ability of GCS which was comparable with this study.

In this present study, it was observed that the relation of GCS (7th POD) with GOS at one month 53.3% patients GCS was $\geq$8 where GOS was 4+5 and compare to CT with DT group 32.1%. The difference was statistically significant (p<0.05). Saha et al.[16] observed that GOS score at discharge (on 10th post operative day) after operation in head injured patients showed that majority had favorable outcome (good recovery and moderate disability) and 31.4% of patients had unfavorable outcome (severe disability, persistent vegetative state and death altogether). The percentage of death after operation in head in injured patient was 11.4. The best motor response on admission and GOS score at discharge (on 1Oth post-operative day) had significant correlation, (p-value <0.05) in head injured patients who underwent surgical intervention. The GCS score also had significant correlation with GOS at discharge in head injured patient who underwent surgical intervention. This study result was similar to our study result.

In this present study, it was observed that 14.3% patients of DC with MDS group had seizure and 42.9% patients of CT with DT group had seizures. The differences between two groups were statistically significant (p<0.05). Prahaladu et al.[9] obtained in their study that when post traumatic seizures were present the mortality was 35%, and when they were not present the mortality is 18.18%. Which were closely related with this study. In another study Honeybul[17] observed that 34 patients who survived, five (17%) developed post-traumatic seizures which was comparable with this study.[17]

Conclusion:

This study was undertaken to examine the outcome of acute subdural hematoma by decompressive craniectomy with multidural stabs and craniotomy with durotomy. Though mortality between these two groups was not significant GCS on 7thPOD and GOS on 30th POD were significantly better in Decompressive craniectomy and MDS group and operative recurrence and seizure was less in DC with MDS group and was statistically significant. So, decompressive craniectomy with multidural stabs is a better treatment option over craniotomy with durotomy for acute subdural hematoma.

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