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Original Research Article

Surgical Outcome of Acute Subdural Hematoma: Clinical and Outcome Analysis

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Conflict of interest: Nil

Abstract:

Background: Acute subdural haematoma is a major clinical entity in traumatic brain injury. Mainly, SDHs occur by rupture of dural bridging veins that lie in subdural space and drain cortical blood into dural sinuses. Acute SDH may also result from bleeding from superficial cortical vessels. It may have an underlying burst lobe (complex of SDH and damaged brain cortex). The associated brain damage occurs because of local ischemia due to mass effect, direct or indirect brain injury, or hampered venous outflow. With regard to surgical procedures, decompressive craniectomy and cisternostomy seem to be effective. This study aims to analyze the clinical presentation and surgical outcomes of acute subdural haematoma.

Methods: A one year study was conducted at the Department of Neurosurgery at Gauhati Medical College and Hospital involving 100 patients who undergone cisternostomy and decompressive craniectomy for acute SDH. The parameters analyzed were demographic details, clinical presentation and surgical outcomes.

Results: The majority of patients were aged between 20-40 years (60%) and had a male preponderance (71%). Clinical presentation were marked by headache/vomiting(42%), altered sensorium(88%), neurodeficit (23%), anisocoria (43%), pupillary changes (22%), black eye (15%), bradycardia (11%), hypoxia/hypotension (6%).The surgeries done were decompressive craniectomy (50%) and cisternostomy (50%) with no difference in outcome. The post-operative period witnessed a (35%) complication rate, predominantly with wound infection (10%).

Conclusion: The study highlights the critical need for early detection and intervention in acute subdural haematoma. The preference of one operative procedure over the other did not impact the overall mortality and outcome.

Keywords: Acute Subdural Haematoma; Cisternostomy; Decompressive Craniectomy, Surgical Outcome.

Introduction

Acute subdural hematoma constitutes 55% to 60% of all subdural hematomas [1]. They are mainly post traumatic [2] but may occur spontaneously in patients taking anticoagulation therapy, bleeding disorders [3] or after rupture of a posterior communicating artery aneurysm [4]. Clinically acute SDH mainly occurs within 3 days of injury.

Importantly acute SDHs are caused by rupture of bridging dural veins that lie in subdural space and drain cortical blood into dural sinuses but may also result from bleeding from superficial cortical vessels [1]. The brain damage is mostly caused by local ischemia due to mass effect, direct brain injury, or hampered venous outflow. Clot evacuation (within 4 hrs) usually results in improved neurological outcome [6]. Operative outcome of acute SDH depends on multiple factors like multiple comorbidities, add on brain injury, cerebral ischemia, antithrombotic therapy, geriatric age group, etc. A proper identification of outcome predictive factors is crucial for appropriate neurosurgical intervention.

In this article, we analyzed the clinical presentation and surgical outcome of operated cases of acute SDH at our tertiary care centre. Most of the studies done earlier are on both conservative and surgically managed patients. In this study, we studied only the operated case.

Aim

1. To analyze the clinical presentation of acute subdural haematoma.
2. To analyze the surgical outcome and post-operative complications of acute subdural

haematoma with comparison between decompressive craniectomy and cisternostomy.

Materials and Methods

Study Setting: The study was conducted retrospectively at the Department of Neurosurgery, Cardio-Thoracic and Neuroscience centre, Gauhati Medical College and Hospital, a reputed medical institution equipped with the necessary infrastructure to facilitate extensive research on acute subdural haematoma.

Duration of Study: The study is done over a period of 1 year, providing a substantial timeframe to gather, analyze and interpret data pertinent to the clinical presentation and surgical outcomes of acute SDH.

Sample Size: A total of 100 cases were selected for the study, maintaining a focus on detailed individual case evaluations.

Study Design: A Retrospective study design was employed to scrutinize the medical records of patients who underwent surgical intervention for acute SDH within the stipulated study period.

Data Collection

The data collected included

1. **Demographic Presentation:** Age, gender and other relevant demographic details of the patients.
2. **Clinical Presentation:** Details pertaining to symptoms and signs at time of presentation and other relevant clinical indicators.
3. **Diagnostic Procedures:** Information on the diagnostic procedures employed, including non-contrast CT scan.
4. **Surgical Details:** Records of the surgical procedures, including surgical techniques and any intraoperative complication.

Surgical Outcome Evaluation : Evaluation of surgical outcomes were conducted based on post-operative recovery, hospital stay and complications associated with each of the procedure and follow up was conducted at 6 months and one year post surgery.

Data Analysis: Data obtained were organized and analyzed using appropriate statistical tools. The analysis included-

1) Descriptive Statistics which was used for summarizing the demographic data and clinical presentation of the patients.

2) Outcome Analysis which was used to evaluate the surgical outcome and its complications.

Ethical Consideration: The study is conducted following the ethical guidelines pertaining to retrospective studies, ensuring the confidentiality of patient data.

Results and Observations

Table 1:

	Number of patients	Percentage
Age in years		
<20 years	18	18%
20-40 years	60	60%
40-60 years	21	21%
>60 years	1	1%
Total	100	

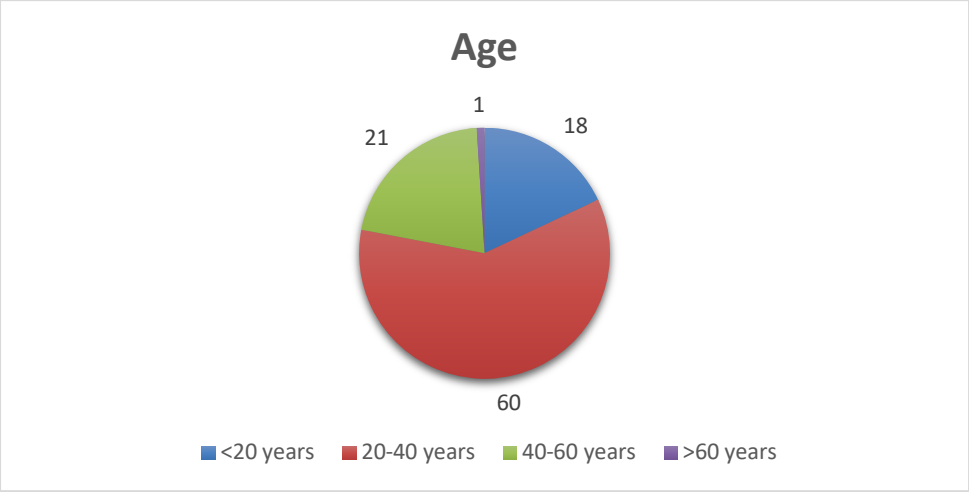

Figure 1: Age

In our study we found high number of patient having acute sdh between the age of 20-40 years followed by patients between 40-60 years. Study says that patients of younger age group suffer from acute SDH on bigger scale compared to older population.

Table 1: Sex

	Number	Percentage
MALE	**71**	**71%**
FEMALE	**29**	**29%**

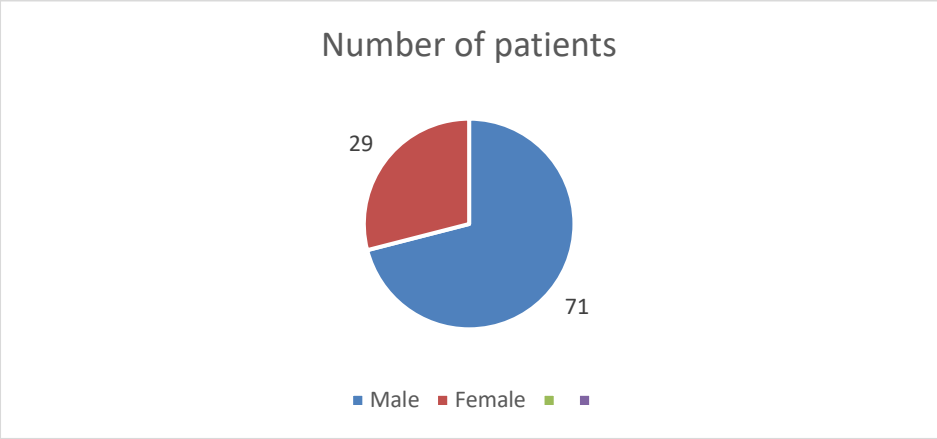

Figure 2: Number of Patients

The study has shown male preponderance regarding patients suffering from Acute SDH with number as high as 71% as per our population group.

Table 3: Sign/Symptoms

	Patient number	Percentage
Lucid interval	**3**	**3%**
Bradycardia	**11**	**11 %**
Headache/vomiting	**42**	**42 %**
Altered sensorium	**88**	**88 %**
Neurodeficit	**23**	**23 %**
Anisocoria	**43**	**43 %**
Pupillary changes	**22**	**22 %**
Black eye	**15**	**15 %**
Hypoxia/hypotension	**6**	**6 %**

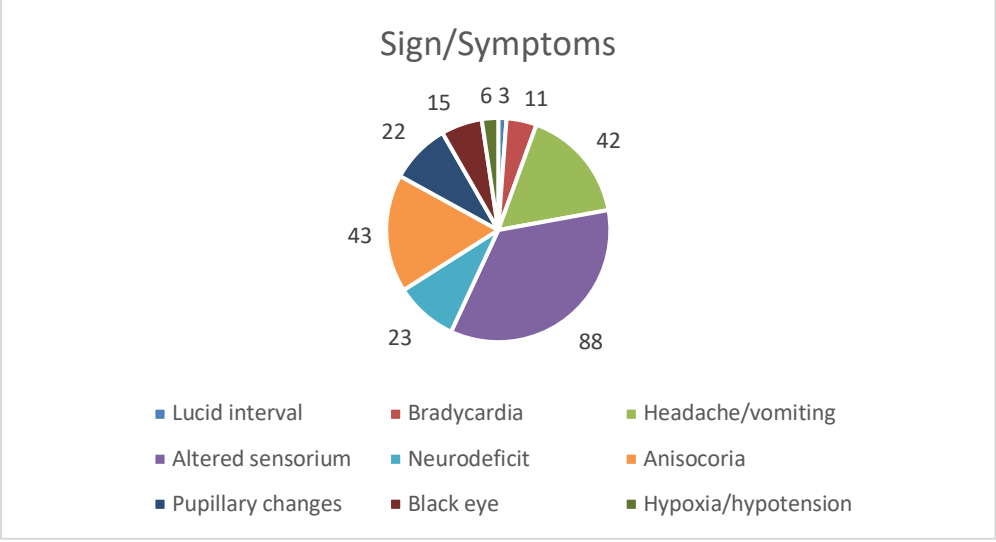

Figure 3: Sign/Symptoms

The study has shown that patients coming to our opd and emergency came with altered sensorium as major symptoms with as high as 88% in study population.

Other symptoms were headache and vomiting in about 42% of study population, black eye around 15%, bradycardia in about 11% patients. Around 6% of patients came with severe hypotension and hypoxia and were managed accordingly and resuscitated. Anisocoria was the major sign seen in about 43% of patients with acute SDH followed by neuro-deficit like weakness of limbs, hemiplegia In about 23% of patients. Many patients had pupillary changes seen in about 22% with pupils reactive being the major sign seen.

Around 3% of study population experienced lucid interval before having altered sensorium as the chief complaint.

Table 4: Best Motor Response/GCS scale:

Best motor response	No. of Patients	Percentage
M6	23	23%
M5	21	21%
M4	28	28%
M3	21	21%
M2	2	2%
M1	5	5%

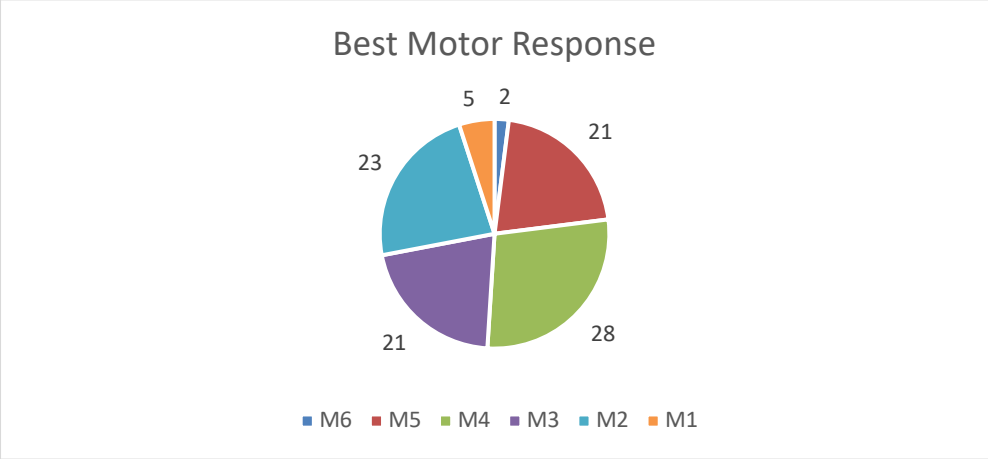

Figure 4: Best Motor Response

Table 5:

Severity (GCS)	No. of Patients	Percentage
Mild (14–15)	9	9%
Moderate (9–13)	67	67%
Severe (3–8)	24	24%

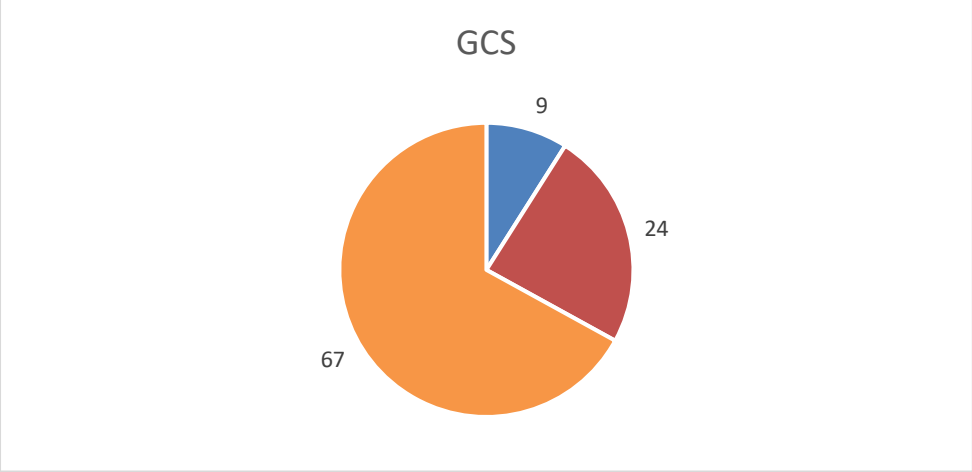

Figure 5: GCS

The study says that majority of patients (67%) on the time of admission had a GCS score between 9-15 with best motor response of M4(28%), M5(21%) and M6(23%) respectively. 9% of patient were between GCS 14-15 and around 24% had severe injury with GCS of less than 8. 21% of patient had motor response of M3 while 5% fell into M1 category.

Table 6: Mode of Injury:

	No. of Patients	Percentage
RTA	81	81%
Assault	3	3%
Fall from height	13	13%
Spontaneous/trivial trauma	3	3%

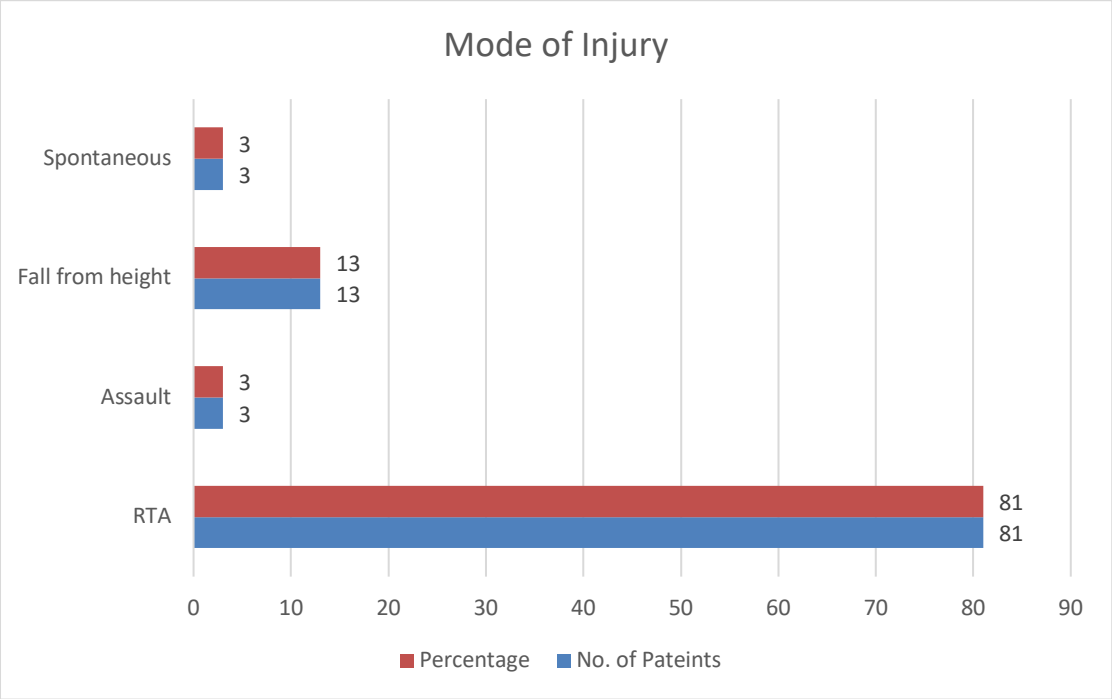

Figure 6: Mode of Injury

Majority of patient came to the opd and emergency had history of trauma ie, road traffic accident being the major cause in about 81% of study population. Other patients had self-fall around 13% and assault in about 3% study population. Around 3% study population had spontaneous SDH without any other cause as per the history.

Table 7: Site, side and CT findings of Acute SDH:

Site	Number of patients	Percentage
Fronto-temporo-parietal	80	80%
Posterior fossa	3	3%
Temporoparietal	2	2%
Frontotemporal	8	8%
Temporal	2	2%
Parietal	1	1%
Frontoparietal	4	4%

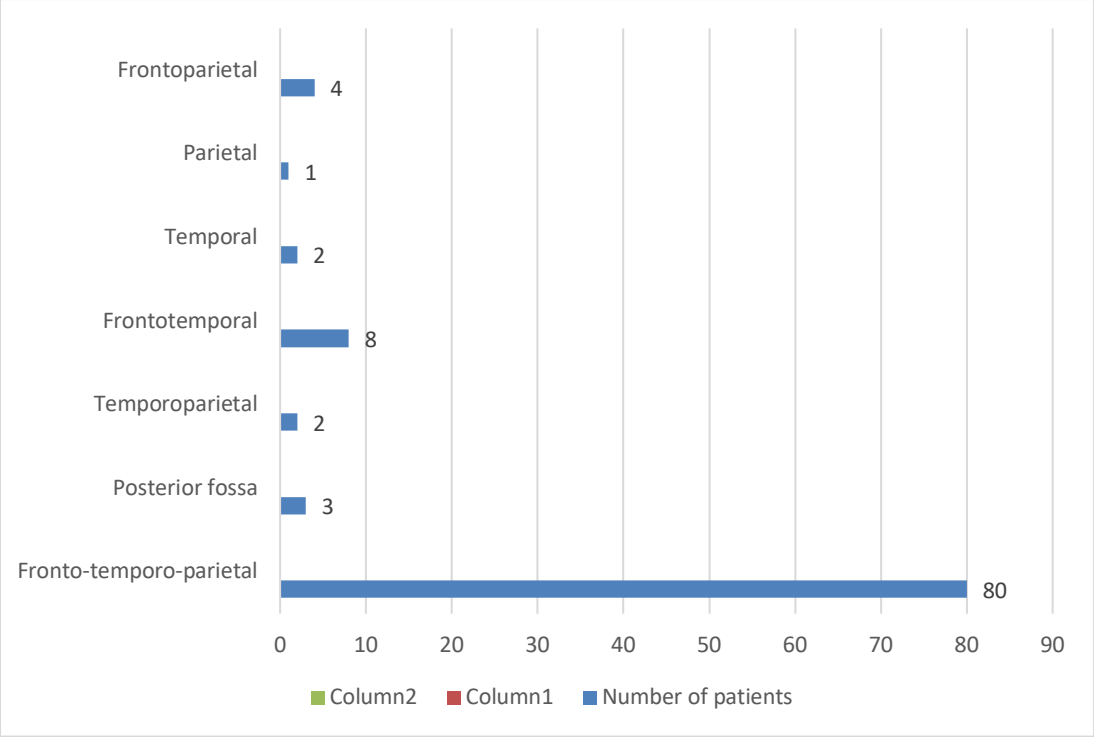

Figure 7:

Table 8:

Side of SDH		
Left	57	57%
Right	43	43%

Table 9:

Clot thickness (mm)	
< 10	2
10–15	24
15–20	38
≥ 20	36
MLS > 5 mm	95
Herniation	51

Study shows that majority of patients around 80% had SDH located in Fronto-temporo-parietal region. With 8% having Fronto-temporal and 4% having Fronto-parietal SDH. Most of the patients had SDH on the left hemi-cranium around 57% compared to 43% to the right side. As per Non contrast CT of head, majority of patients had clot thickness of 15-20 mm around 38% study population where as 36% had clot thickness of more than 20mm. Midline shift more than 5 mm was the main CT finding seen in almost all of the study population around 95% patients.

Table 10: Associated Injury:

Blunt chest trauma	4
Blunt Abdomen trauma	5
Pelvic fracture	2
Bladder rupture	1
Limb fracture	25

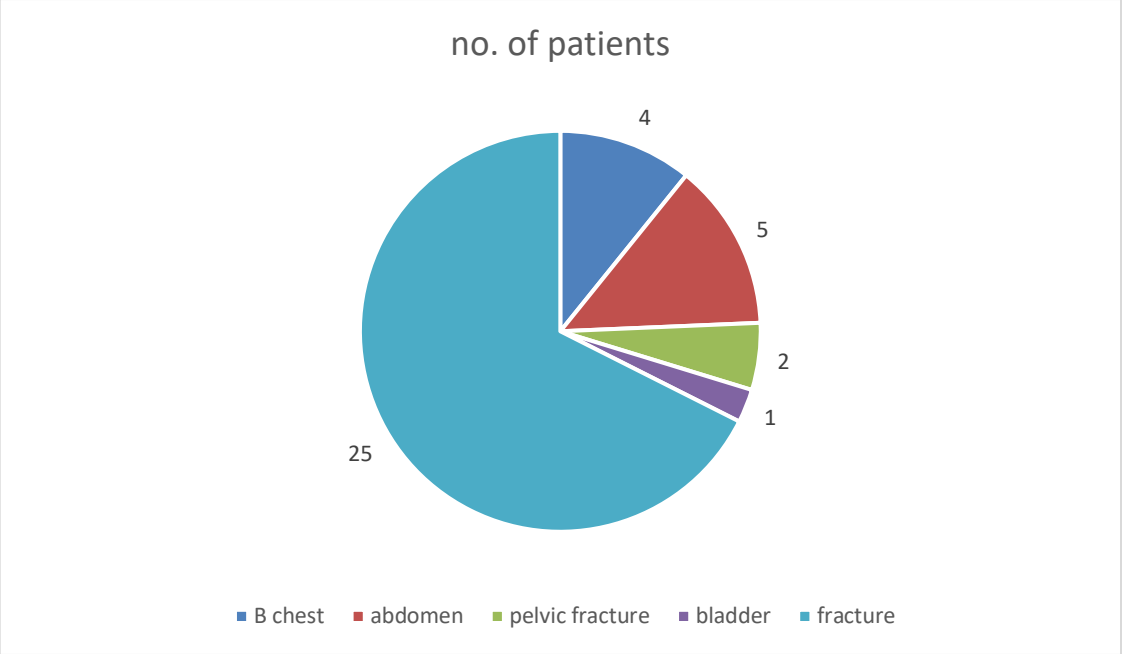

Figure 8: No. of patients

Post-operative Analysis:

Table 11: Glasgow Outcome scale

GOS	5(good recovery)	4(moderate disability)	3(severe disability)	2(persistent vegetative state)	1 (Dead)
Decompressive craniectomy	26	18	1	3	2
Cisternostomy	24	17	3	4	2

Chi, df= "1.251, 4", p= 0.8696

In this study, we compared two operative procedures, Decompressive craniectomy and cisternostomy in regards to Glasgow outcome scale, hospital stay, time of surgery and post-operative complication. Majority of patients around 26(13%), under decompressive craniectomy group had GOS of 5, good recovery compared to 24(12%) under cisternostomy group which is not statistically significant as P>0.05 using Chi square test. 18(9%) patients who undergone decompressive craniectomy compared to 17(8.5%) patients with cisternostomy faced moderate disability such as mild limb weakness on opposite side which was statistically not significant.

Other patients suffered from severe disability and persistent vegetative state which was again not statistically significant. 2 patients from each group expired.

Table 12: Hospital stay

	5-10 days	10-15 days	>15 days
Decompressive craniectomy	18	20	10
Cisternostomy	20	24	8

Chi, df="0.5320, 2", p= 0.7664

18(9%) patients from decompressive craniectomy group and 20(10%) patients from cisternostomy group had hospital stay of around 5-10 days whereas 20(10%) patients and 24(12%) patients from either group respectively had hospital stay between 10-15 days. Statistically hospital stay in both study group was not significant as P>0.05. 10(5%) patients from decompressive craniectomy group and 8(4%) patients from cisternostomy group had longer hospital stay more than 15-20 days.

Table 13: Post-operative complications

	Infection	Rebleed	CSF leak	Disability	Dead
Decompressive craniectomy	10	2	1	22	2
Cisternostomy	8	1	0	24	2

Chi, df="1.588, 4", p= 0.8109

Comparing the post-operative complications in both study groups Post-operative wound infection found to be the major complication, 10(5%) from craniectomy and 8(4%) from cisternostomy group respectively. There was no statistical significance found in these groups comparing post-operative infection with was tackled with higher antibiotics and daily dressings. 2(1%) patients and 1(0.5%) patient from each group suffered rebleed following surgery which was managed conservatively as per GCS scale. Again rebleed in both the groups was not statistically significant. CSF leak was seen in 1(0.5%) patient of craniectomy group compared to 0 from cisternostomy group. Post-operative disability was also compared, wherein 22(11%) and 24(12%) patients from each group respectively suffered moderate to severe disability which was not statistically significant as p>0.05. 2(1%) patients each from craniectomy and cisternostomy group expired during study.

Table 14: Time of surgery

	<6 hr	6– 24 hr	>24 hr
Decompressive Craniectomy	16	17	17
Cisternostomy	17	16	17

Chi, df="0.06061, 2", p=0.9702

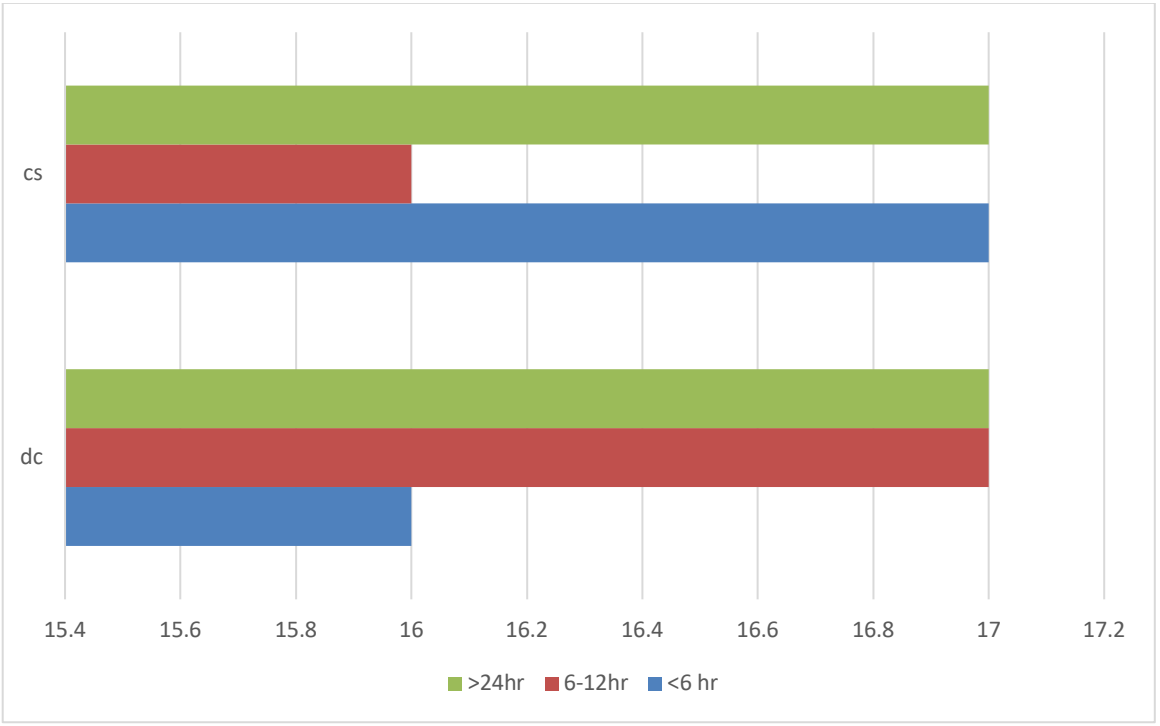

Figure 9:

Outcome measure:

Table 15: 1-Decompressive craniectomy

	Time		
	< 6hr	6 – 24 hr	>24 hr
Infection	0	3	7
Re-Bleeding	0	1	1
Csf leak	0	0	1
Disability	4	8	10
Death	0	1	1

Chi, df= "4.589, 8", p= 0.8005

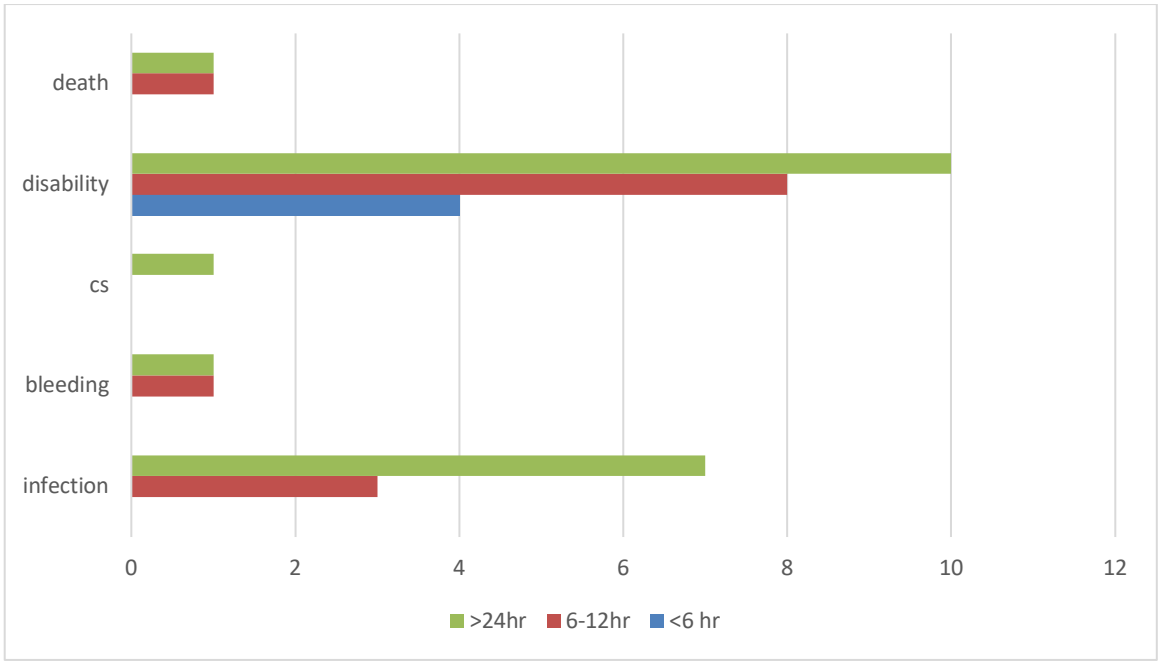

Figure 10:

Table 16: 2-Cisternostomy:

	Time		
	< 6hr	**6 – 24 hr**	**>24 hr**
Infection	0	2	6
Bleeding	0	0	1
Csf leak	0	0	0
Disability	6	6	12
Death	0	1	1

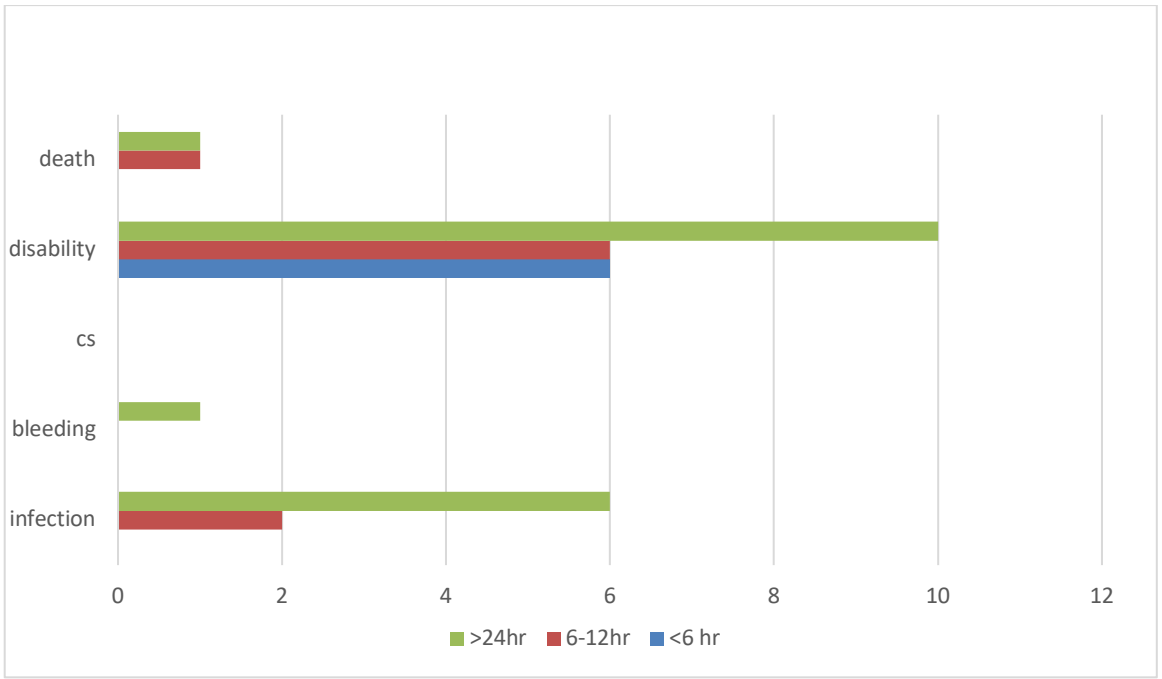

Figure 10:

Chi, df= "4.472, 6", p= 0.6130

Total 16(8%) patients were operated within 6 hrs of injury with decompressive craniectomy and 17(8.5%) underwent cisternostomy which had minimal complication rate with disability (2-3%) being the only one which was statistically not significant ($p>0.05$). These patients had faster recovery rate as compared to patients operated within 6-24 hrs period with less complication rate performing any of the two surgeries. Choice of surgery was statistically not significant but recovery was seen faster in patients operated within 6hrs of injury compared to patients operated after 24hrs.

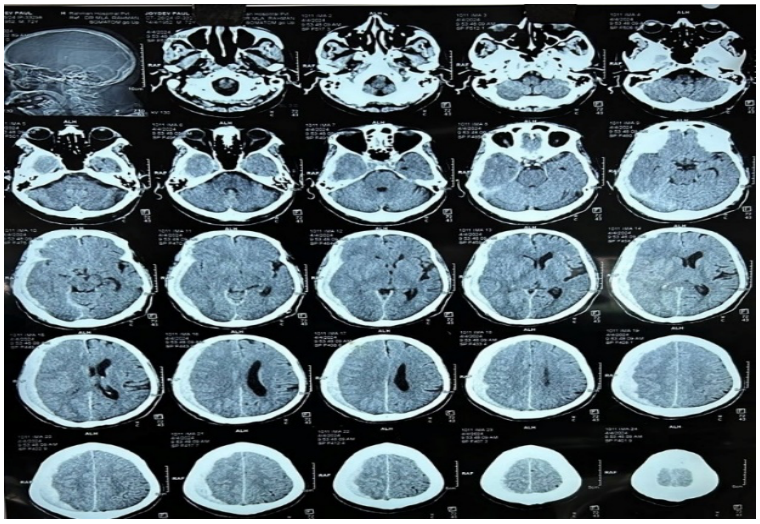

Figure 11: NCCT head showing right FTP Acute SDH

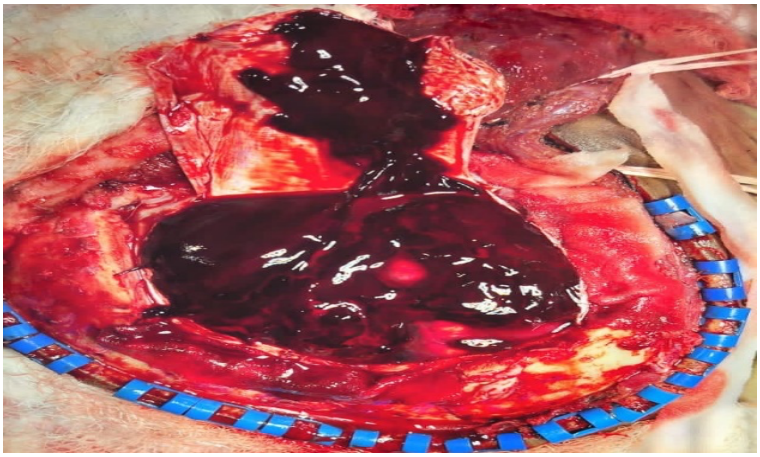

Figure 12: Showing hematoma after reflecting dura

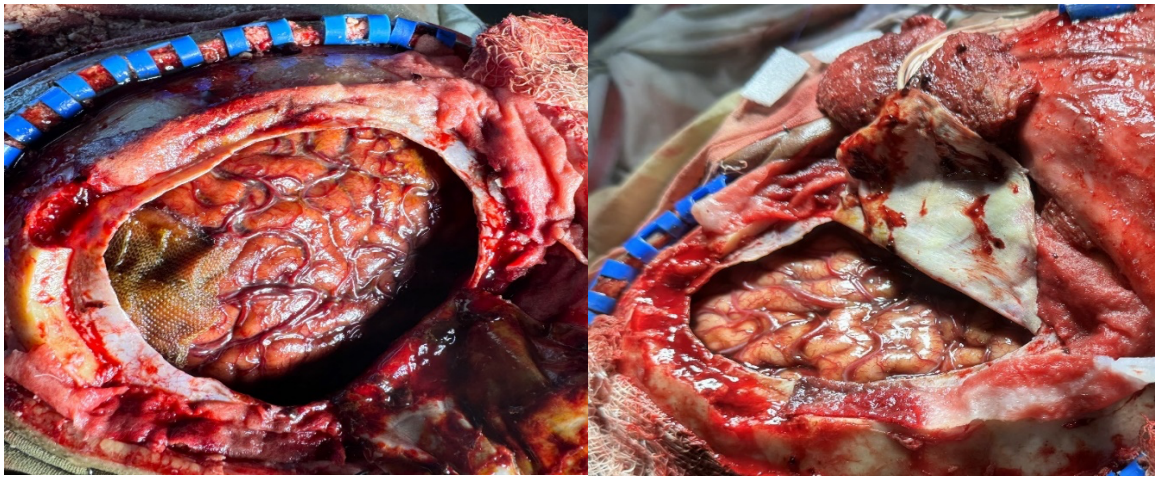

Figure 13,14: Showing normal brain after hematoma evacuation

Discussion

Operated cases were included of acute SDH. Common age group operated in this study was 20 to 40 years (n = 60), closely followed by 40 to 60 years (n = 21), thus affecting the most productive working population. Acute SDH is more common in geriatric patients due to age-related cerebral atrophy, increased subdural space, stretching of bridging veins, and higher risk for trauma due to gait or orthopedic-related problems [7,8]. As the age increases, acute SDH too increases in its frequency [9].

In this study, males (n = 71) were affected more than females (n = 29) with male is to female ratio of 2.44:1. Studies in operated acute SDH have shown male predominance [10].

In this study, RTA (n =81) was the most common mode of injury. Studies with comatose patients have demonstrated RTA as the mechanism of injury in most acute SDH cases11. Most acute SDHs are caused by RTA and falls [12]. Frequency of other mechanisms is very less. RTA is frequent in 15 to 30 years age group while Injury due to falls is frequent in the 45 to 80 years age group [13].

Most of the operated cases of acute SDH were moderate (GCS 9-13) (n=67). M4 (n = 28) followed by M3/M5 were the most common best motor response in this study. It is not similar to earlier studies having 35% to 80% of patients with acute SDH, presenting with GCS score of 8 or less [14,15].

The most common clinical presentation was altered sensorium (n = 88), followed by headache/vomiting (n = 42) which may be attributed to poor GCS score and raised ICP due to acute SDH mass effect and secondary brain injury.

The most common site of operated acute SDH cases was fronto-temporo-parietal region (n =80) with left side predilection (n =57). It is usually hemispheric over convexity of brain. In this study, clot thickness of 15 to 20 mm (n = 38) was found commonly. Most of the operated cases had a midline shift (n =95) and herniation (n = 51) before surgery.

In this study, a GOS score of 5 was common (n = 50), followed by a GOS score of 4 (n = 35). There were 4 mortalities in this study. Many studies had shown mortality between 30 to 60% in acute SDH patients with a GCS score of 3–1516,17 or mortality between 55 to 70%with a GCS score of 8 or less [11,18]. However, a GOS score of 3(severe disability) (n=4) and 2 (persistent vegetative state) (n=7) was present (11%) showing average morbidity rate in this study.

On analyzing variables on GOS, we found that GCS at admission, severity of injury, pupillary changes, and best motor response were significantly ($p < 0.05$) associated with outcome following surgery for acute SDH. However age and gender of patients were not significantly associated with outcome. Studies had shown that patient with age more than 65 years are associated with poorer outcomes [18].

Studies have shown gender influence on prognosis in TBI [19]. Poorer outcome had been reported in females surviving severe TBI when compared with males20. In this study, gender is not associated with poor patient outcome in the GOS.

Acute SDH due to spontaneous mechanism of injury was a poor prognostic factor in various studies. Oral anticoagulation therapy and bleeding disorders are the most common causes related to spontaneous Acute SDH [21-23].

Motor response is the most reproductive element in trauma patients, as the other responses maybe blunt [24]. GCS was evaluated at the time of hospital admission and was significantly associated with outcome in GOS, Hospital stay, time of surgery and post-operative complications.

Pupillary reactivity changes or abnormalities reflect brainstem compression or lesion and are indicative of poorer outcome [25]. Many studies have shown that pupillary reactivity when compared with GCS is more reliable after TBI, as it is less effected by sedation and paralysis [26].

Some studies recommend prompt evacuation of acute SDH with indications for surgery, as this reduces brain damage resulting from secondary ischemic injury, due to mass effect and/or raised ICP5, [27,28] However, most studies done to evaluate correlation between early surgery and outcome have not shown a correlation with outcome [11,14,17,29,30].

Cognitive and neurological changes following large craniectomy have been attributed to many factors including atmospheric pressure, venous return obstruction, cerebral blood flow, metabolic changes and cerebrospinal fluid (CSF) changes. There is reduction in cerebral blood flow due to atmospheric pressure and reduced cerebral metabolic rate [31]. This may certainly affect the outcome, producing a bias in the presented results [31,32].

We also found not difference in hospital stay as well as GOS when compared to both groups. Also post-operative complications were seen similar in either group when compared with infection rate, csf leak, disability and Rebleed.

In this study we also compared the time of surgery related to both the surgeries performed within 6 hrs of injury, irrespective of the type, had better outcome as well as faster recovery compared to surgeries which were performed after 24hrs time.

Surgeries performed after 24 hrs had worst outcome irrespective of the type of surgery performed. We also had poor outcome which patients having multiple associated injuries like blunt trauma abdomen and blunt chest trauma. Many of the patients having these severe forms of injuries did not survive or had permanent disability as complication.

Conclusion:

Acute SDH is a frequent neurosurgical emergency responsible for significant mortality as well as morbidity. It affects the working age group between 20–60 years, with males getting affected more than females. RTA was the most common mode of injury and Altered sensorium the common clinical presentation. GCS at admission, severity of injury, pupillary changes, and best motor response were significantly ($p < 0.05$) associated with outcome. However, age and gender were not found to be associated with outcome after surgery. Also conclude that there was no difference in outcome compared to GOS, hospital stay, time of surgery and post-operative complications compared to any surgery performed from above two, hence as per this study we could say that no surgery is superior to other and any surgery could be performed in a case of Acute SDH.

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