



Original Article

## Minimal Invasive Surgery for Chronic Subdural Hematoma

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### ABSTRACT

**Objective:** To assess significant improvement in terms of the Glasgow Coma Scale in patients subjected to minimally invasive surgery for a chronic subdural hematoma.

**Materials and Methods:** A total of 80 patients with chronic subdural hematoma (CSDH) were enrolled in a sequential fashion using a retrospective study design. The patients were treated with minimally invasive surgery (MIS) and assessed at the end of the 2<sup>nd</sup> postoperative day (POD) for any significant improvement in the Glasgow coma scale (GCS).

**Results:** There were 76.25% male and 23.75% female patients. A maximum number of patients (42.5%) were found with a GCS ranging from 9/15 – 11/15 (Class B) followed by Class A having GCS 12-13 (36.25%) and then Class C with GCS 5 – 8 (21.25% patients). In 86.2% and 13.7% of the patients, positive and negative outcomes were recorded. Maximum favorable surgical outcome was observed in 51-60 years of age group. In the majority of male patients, a favorable surgical outcome was reported. Similarly, a favorable surgical outcome was observed in Class B (GCS 9-11). There existed an insignificant difference between favorable surgical outcome vs. age groups, gender, and GCS class at baseline.

**Conclusion:** This study found that CSDH using the MIS approach is linked to a high frequency of positive outcomes in terms of GCS improvement. A lower admission GCS score and older age are linked to a lower frequency of favorable outcomes and a higher likelihood of bad outcomes.

**Keywords:** Glasgow Coma Scale, Chronic Subdural Hematoma, Minimal Invasive Surgery.

**Abbreviations:** CSDH: Chronic Subdural Hematoma. (POD) Postoperative Day. GCS: Glasgow Coma Scale. CT Scan: Computed Tomography Scan.

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Date of Submission: 21-07-2021

Date of Revision: 08-08-2021

Date of Acceptance: 08-09-2021

Date of Online Publishing: 30-09-2021

Date of Print: 30-09-2021

**DOI:** 10.36552/pjns.v25i3.572

### INTRODUCTION

Chronic intracranial bleeding between the dura and arachnoid maters of the brain is known as CSDH.<sup>1</sup> It is a slowly increasing encapsulated collection of blood and its breakdown products generated by ripping of the bridging veins, which is most commonly caused by moderate head injury and has risk factors of brain atrophy and coagulopathy. The frequency is about 5/100,000

per year in the general population, but it jumps to 58/100,000 per year among individuals aged 70 and beyond.<sup>2</sup> Because of an aging population and increased usage of anti-platelet and anticoagulant medicines, the incidence of CSDH is projected to rise dramatically over the next 25 years. Mortality ranges from 0% to 6%, whereas morbidity ranges from 0% to 76%.<sup>3</sup> In 60 to 80 percent of patients, a minor head injury is observed to precede the onset of CSDH.<sup>4</sup> Chronic alcohol use, anti-platelet intake, and oral anticoagulation medication are all predisposing variables in 21% of cases, anti-platelet intake in 11%, and oral anticoagulant therapy in 10% of cases, respectively. Unilateral hematoma occurs in 82 percent of subjects, with the left side (57.2%) accounting for the bulk of instances, and bilateral distribution in 18 percent of patients.<sup>5</sup>

Due to advances in imaging techniques, early and prompt management of CSDH is now with reduced morbidity and mortality rates. There are still controversies, however, with regards to the pathophysiology and methods of treating CSDH. It is usually a disease of the elderly, particularly after minor head injury.<sup>6</sup> Symptomatology consists of altered consciousness, headache, motor deficit, ataxic gait, cognitive dysfunction or memory loss, aphasia, and behavior problems. The examination of choice for validating the diagnosis of CSDH is a non-enhanced CT brain, which appears as a hypodense crescentic lesion close to the inner table and causes a mass effect in the form of mid-line shift, effacement of lateral ventricles, sulci, cisterns, and fissures. On MRI appears as a hypointense crescentic mass on both T1 and T2 weighted sequences and causing mass effect.<sup>7</sup>

Surgical and non-surgical treatment methods are available for CSDH. Non-surgical treatment, such as steroids, analgesics, and antiepileptics, is usually reserved for asymptomatic individuals, whereas surgical treatment is advised for those who are experiencing neurological symptoms.<sup>8</sup>

The widely accepted gold standard of treatment and management for CSDH is surgical decompression, whenever indicated. Craniotomy, or twist drill craniostomy with burr holes, endoscopically assisted evacuation and other various surgical techniques are employed. A craniotomy is associated with much higher morbidity than with craniostomy (12.3% vs. 3 – 4%), and recurrence with twist drill craniostomy is much higher compared to burr hole craniostomy (33% vs. 12.1%) and craniotomy (33% vs. 10.8%) respectively. Recurrence rates following surgical evacuation for CSDH range from 9.2% to 26.5%. Inserting the subdural catheter can lower the recurrence rate, but seldom used.<sup>9-10</sup>

The rationale of the current study is to find out the degree of improvement in GCS after minimal surgical intervention for CSDH in our hospital setup. Surgical treatment for CSDH maybe surgical decompression for CSDH under local anesthesia is compared for results with the other techniques used, as it is less complicated, effective, uses less time and expertise of operation, costs less, and is cosmetically more appealing too.

## MATERIALS AND METHODS

This study was conducted from January 01, 2016, to December 31, 2018, and carried out at the Neurosurgery Department, Lady Reading Hospital's Peshawar. A total of 80 patients with CSDH were sequentially enrolled in the study using a retrospective study design, subjected to MIS, and assessed at the end of the 2<sup>nd</sup> POD (post-operative day) for any significant improvement in GCS.

### Inclusion Criteria

Patients aged 40 to 70 years old, of either gender, who report within 24 – 48 hours of the onset of neurological symptoms (GCS 5-13) and have a clear diagnosis of CSDH on neuroimaging.

## Exclusion Criteria

We did not include patients having mixed density lesions or those with septations, or having the same side hematomas within 6 months of shunting. Also, patients with recurrent hematomas requiring other evacuation techniques were removed from the study.

## Data Collection

Patients with CSDH who presented to the Neurosurgery Department LRH through outpatient and emergency departments were treated after receiving approval from the hospital ethical council. Those who met the requirements for inclusion were chosen. Informed consent was taken from all patients, followed by a detailed account of history including history of falls, minor head injuries, any heart-related issues, coagulopathies, use of drugs or alcohol, examination for signs and symptoms, and blood tests. A pre-designed proforma was used to record the data.

## Surgical Procedure

The procedure was performed under aseptic conditions and either general or local anesthesia based on the clinical status of the patient. A 1cm linear scalp incision was made, followed by an electrical burr hole of about 5mm in the skull bone right on top of the maximum thickness of the hematoma. A linear durotomy was done. The tip of a 10 F Foley catheter was placed in the subdural space and secured with 2 ml of saline in the balloon. The other end was tunneled and brought out through a minor stab wound about 5 cm away from the original incision, which was connected to a closed drainage system implanted at the patient's foot end for passive hematoma drainage. After completing a post-op CT scan on the 2nd POD, the closed drainage system was removed and nursing of the patient was done in the supine position. At the end of the second

POD, the patients' GCS was evaluated to see if they had improved.

## Statistical Analysis

The descriptive statistics of all the variables was conducted in SPSS v.25. Favorable surgical outcome was stratified among gender, age, and GCS class at baseline, through chi-square test keeping p-value less than or equal to 0.05 was considered significant.

## RESULTS

A total of 80 patients with CSDH were included in the study.

### Gender Distribution

There were 61 male and 19 female patients.

### Age Distribution

The patients' average age ranged from 40 to 70 years. Patients were separated into three groups based on their age. There were 21.25 percent of patients in the age range 40.01 to 50.00 years, 43.75 percent in the age group 50.01 to 60.00 years, and 35.00 percent in the age group 60.01 to 69.90 years, respectively (Table 1).

**Table 1:** Age Groups of the Patients (n = 80).

Ages (Years)	Frequency	Percent
40.01 to 50.00	17	21.25
50.01 to 60.00	35	43.75
60.01 to 69.90	28	35.00
Total	80	100.0

### Baseline Glasgow Coma Scale

There were 80 patients in total. The maximum number of patients (42.5%) were found with a GCS ranging from 9/15 -11/15 (Class B) followed by Class A having GCS 12-13 (36.25%) and then Class C with GCS 5-8 (21.25% patients) See Table 2.

**Table 2:** Baseline Glasgow Coma Scale (n = 80).

Classes of GCS	Frequency	Percent
Class C (GCS 5 – 8)	17	21.25
Class B (GCS 9 – 11)	34	42.50
Class A (GCS 12 – 13)	29	36.25
Total	80	100.0

### Frequency of Favorable Outcome

In 86.2 percent and 13.7 percent of the patients, positive and negative outcomes were recorded (Table 3). The surgery site pain and immobility, until the catheter was in place, were the most serious postoperative consequences. On post-operative CT brain scans, 2 and 5 patients, respectively, had clinically insignificant pneumocephalus and residual hematoma.

**Table 3:** Frequency of Favorable Outcome (n = 80).

Favorable Surgical Outcome	Frequency	Percent
Yes	69	86.2%
No	11	13.7%
Total	80	100.0%

### Favorable Surgical Outcome among Gender, Age and GCS Class at Baseline

Maximum favorable surgical outcome was observed in 51 – 60 years of age group (Table 4). In the majority of male patients, a favorable surgical outcome was reported (Table 5).

**Table 4:** Age Groups & Favorable Surgical Outcome (n = 80).

Age Groups	Favorable Surgical outcome			p-value	Chi-Square
	Yes	No	Total		
40 to 50 years	13	4	17	0.299 insignificant	2.4101
51 to 60 years	30	5	35		
61 years & above	26	2	28		
Total	69	11	80		

Similarly, a favorable surgical outcome was observed in Class B (GCS 9 – 11) (Table 6). There

existed an insignificant difference between favorable surgical outcome vs. age groups, gender, and GCS class at baseline.

**Table 5:** Gender & Favorable Surgical Outcome (n = 80).

Gender of the Patient	Favorable Surgical outcome			p-value	Chi-Square
	Yes	No	Total		
Male	55	6	61	0.0685 insignificant	3.3177
Female	14	5	19		
Total	69	11	80		

**Table 6:** Baseline GCS Class & Favorable Surgical Outcome (n = 80).

GCS Class at Baseline	Favorable Surgical outcome			p-value	Chi-Square
	Yes	No	Total		
Class C (GCS 5 – 8)	12	5	17	0.1056 insignificant	4.4955
Class B (GCS 9 – 11)	31	3	34		
Class A (GCS 12 – 13)	26	3	29		

## DISCUSSION

CSDH is an enclosed collection of dark crimson liquefied blood that takes around 3 weeks to form. The most common causes are alcohol and coagulopathies, and patients frequently have a history of mild traumatic brain damage. The death rate ranges from 8% to 15.6 percent.

However, a higher death risk was found in populations with coagulopathies.<sup>11</sup> The preferred surgical therapy is puzzling. There is a lack of agreement among various surgeons on treatment methods for CSDH. The practice of putting drains, performing irrigation, and steroids is also controversial.<sup>12</sup>

Twist drill craniotomies (usually made with drills measuring 3 – 5mm in diameter), burr hole craniotomies (usually made with drills measuring 9 – 22mm in diameter), craniotomies (openings > 30mm in diameter), craniotomies (openings

> 30 mm in diameter), craniotomies (openings > 30 mm in diameter), craniotomies (openings larger than (raising a bone flap)<sup>13</sup>. Generally, one or two burr holes over the hematomas are drilled.

Irrigation for cleansing the hematoma is also practiced while others believe it causes air entry in the brain and therefore we avoid it.<sup>14</sup> For simple and uncomplicated chronic SDH burrhole craniostomy is the best method of surgical drainage of the hematoma with low recurrence rates or sequelae. Under local anesthesia, draining CSDH under local anesthesia is straightforward, poses less complexity and complications, and is successful. One or two burr holes are variably preferred.<sup>15</sup> Higher mortality is seen in older patients and those with recurrent and bilateral hematomas especially if they present with lower GCS.

Antunes et al, reported 15.6% mortality rate in patients above 75 years of age, compared to 0.5% mortality in other series of patients of lesser ages. Ramachandran et al. and Gonzalez et al. found that fatality was not related to recurrence of CSDH.<sup>16-17</sup> A retrospective study conducted by Tsai et al. found a similar postoperative outcome in the patients who had bilateral and unilateral CSDH. GCS plays an important role as a determinant of outcome.<sup>18</sup> These results are following our data, showing that patients with a GCS score  $\geq 9$  on admission present favorable outcomes.

Some of the post-operative complications seen in the study were intracerebral bleed, the collapse of the brain parenchyma, pneumocephalus, and recurrence of hematoma. Mortality can vary between 0 – 8% depending on the clinical status before surgery. Subdural empyema occurred in 2% of patients when the drain was left in situ. Seizures rarely occurred and did not require medication.<sup>19,20</sup> Complications include lack of cortical re-expansion, tension pneumocephalus, and intracerebral bleeds. A permanent deficit can be as high as 10% of patients.

## CONCLUSION

In the immediate postoperative phase, CSDH handled with the MIS approach is associated with a high frequency of good outcomes in terms of GCS score improvement. A lower admission GCS score and older age are linked to a lower likelihood of positive outcomes and a higher likelihood of negative outcomes.

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## Additional Information

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

**Ethical Review Board Approval:** The study was retrospective so ethical committee approval was not required.

**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.

### **AUTHORS CONTRIBUTIONS**

<b>Sr.#</b>	<b>Author's Full Name</b>	<b>Intellectual Contribution to Paper in Terms of:</b>
1.	Hanif-ur-Rehman	Study design and methodology.
2.	Sohail Amir	Paper writing, referencing, and data calculations.
3.	Mumtaz Ali	Data collection and calculations.
4.	Shahid Ayub	Analysis of data and interpretation of results etc.
5.	Anisa Sundal	Literature review and manuscript writing.
6.	Muhammad Ishaq	Analysis of data and quality insurer.