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Endoscopic Evacuation of Chronic Subdural Hematoma

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ABSTRACT
Chronic subdural hematoma (CSDH) poses significant challenges in treatment due to high recurrence rates and variable efficacy of surgical interventions. While traditional methods such as burr-hole evacuation are commonly used, there is ongoing exploration of newer techniques like endoscopic evacuation. This study aims to evaluate the effectiveness and safety of neuroendoscopic surgery for CSDH. A prospective study was conducted over three years, involving 43 adult patients with CSDH scheduled for neuroendoscopic surgery. Data on demographics, medical history, hematoma characteristics, surgical techniques, intraoperative findings, complications and postoperative outcomes were collected. Patients were followed up for six months post-surgery. The study cohort comprised predominantly elderly patients, with trauma being the leading cause of CSDH. Neuroendoscopic surgery resulted in successful hematoma evacuation, with a median operative time of 107 minutes. Postoperative outcomes were favorable, with a decrease in midline shift and minimal recurrence. Complications were rare, with most patients discharged to rehabilitation facilities or home. Neuroendoscopic surgery offers a safe and effective alternative for evacuating CSDH, particularly in selected patients. While further research is needed to compare its efficacy with traditional methods, this technique shows promise in reducing complications and improving outcomes.

INTRODUCTION

Chronic subdural hematoma (CSDH) is a medical term used to describe the accumulation of blood products beneath the dura, a condition frequently observed in cases of traumatic brain injury[1]. Incremental hematoma can produce compression of the brain parenchyma and intracranial hypertension, leading to clinical symptoms including motor disturbance, gait abnormalities, headache, cognitive disturbance and aphasia[1]. Surgery is the primary treatment for chronic subdural hematoma (CSDH). Various surgical procedures, such as twist drill evacuation, burr-hole aspiration, mini-craniotomy are used to efficiently remove CSDH[1,2]. Nevertheless, the most effective treatment approach for chronic subdural hematoma (CSDH) has remained a mystery, despite extensive research efforts. The fact that there are high recurrence rates of up to 70%, with 10-20% of cases requiring a second surgery, serves as evidence of this[3]. Despite its widespread use, burr-hole evacuation is favored due to its minimum invasiveness and very short duration[1]. Nevertheless, the frequency of burr-hole evacuation recurring is somewhat more than that of osteoplastic craniotomy because to restricted visibility or unintentional harm[1].

Furthermore, if there is a lack of visual perception during the insertion of the drain tube or irrigation, there is a possibility of encountering complications such as bridging vein rupture or hematoma . In addition, subacute and chronic blood clots may not be effectively treated by irrigation alone and may require suction performed with visual guidance. Furthermore, there is currently no clearly defined surgical technique for managing septated chronic subdural hematoma (CSDH) with numerous neo-membranes[2]. The formation of neo-membranes within the septations hinders the removal of clots through burr holes. Additionally, the few residual spaces filled with clots will gradually expand over time, leading to the reoccurrence of the hematoma. Recently, it has been revealed that endoscopic evacuation is a viable way for removing blood clots in patients with subacute and chronic subdural hematomas across different age groups. This procedure can be performed under general or local anesthesia, using a minimally invasive tiny opening in the skull. The outcomes of this approach have been favorable[1-6]. According to reports, the presence of haematoma clots, trabecular formations and stretching of the cortical vessels, whhematoma can only be observed during neuroendoscopy, are significant factors that increase the chance of CSDH recurrence[1].

In this report, we present our initial encounter with a common case involving an elderly patient with chronic subdural hematoma. We describe the removal of the hematoma using both a rigid and flexible endoscope. The patient's condition showed improvement following the surgical procedure and there were no subsequent instances of symptom recurrence.

MATERIAL AND METHODS

In this prospective study 43 patients to evaluate the effectiveness and safety of neuroendoscopic surgery for chronic subdural hematoma.. The study was conducted in three years from Sept 2022 – Sept 2024 in the department of Neurosurgery J.A. Group of Hospitals and G.R. Medical College, Gwalior, MP. All adult patients (18 years or older) with chronic subdural hematoma on imaging (CT/ MRI brain) who are scheduled to undergo neuroendoscopic surgery at the study center.were included while Patients with secondary CSDH that occurred within six month of other neurosurgical operations or accompanied by specific causes such as meningitis and Patient in whom the interval between the injury and procedure was <15 days were excluded.

Data Collection: Data will be collected prospectively from electronic medical records, imaging studies and patient interviews. Collected data will include demographic information , medical history, hematoma characterstics (size, location and thickness) and surgical techniques, intraoperative findings, perioperative complications, length of hospital stay and postoperative outcomes. Patients will be followed up at regular intervals for upto 6 months after surgery to access long term outcomes and complications.

Procedure: All surgeries were performed in general anesthesia as these surgeries requires complete immobility of head. The patients head was slightly raised and turned towards the contralateral side of the lesion to facilitate better angulation of the telescope in CSDH cavity. The incision was marked at the initial part of the CSDH usually 3-4 cm in length. One burr hole was made usually 1.5-3 cm in size. Dura was opened after complete hemostasis,and part of hematoma came out spontaneously. Zero degree telescope was introduced into the cavity and the status of outer membrane, inner membrane, type of clot, adhesion and bridging vessels and anchored brain were noted. Angled suction tube were introduced into the cavity and suction of the remaining CSDH cavity and suction of remaining CSDH was done. The CSDH cavity was irrigated with normal saline. A biocompatible sialistic tube external ventricular drain was inserted through the frontal burr hole into the CSDH cavity and postoperatively connected with drainage bag. The output of drainage bag was noted. Repeat NCCT head was done after 24 hours of surgery to ensure the amount of hematoma removal, resolution of midline shift and expansion of brain tissue. The subdural drain is removed if the brain gets expanded . if the brain is not expanded then the subdural drain is kept for five days to ensure complete removal of remaining CSDH. the patient discharged 3 to 5 days from the day of surgery depending on the postoperative course.

RESULTS

The age-wise distribution of study participants depicts a diverse range of ages. Among the participants, 16.27% fall within the younger age bracket of 18 to 40 years (Table 1). Another 18.60% are between 41 and 60 years old, representing a slightly larger proportion. The majority of participants, comprising 65.11%, are aged over 60 years. This distribution underscores a significant presence of older individuals in the study, possibly indicating a focus on age-related conditions or reflecting the demographic composition of the population under examination.

The gender distribution among study participants reveals a slight majority of males, constituting 62.8% of the sample. Females make up the remaining 37.2%, indicating a smaller but still notable presence in the study group. This distribution suggests a relatively balanced representation of both genders within the research cohort, which could be important for ensuring gender diversity in the study's findings and conclusions (Table 2).

Table 1: Age wise Distribution of study participants

Age group	Frequency	%
18-40	7	16.27
41-60	8	18.60
>60	28	65.11

Table 2: Gender Distribution of study participants

Sex	Frequency	%
Male	27	62.8
Female	16	37.2

Table 3: Postoperative outcomes and characteristics after the operation and during discharge

Characteristics	n (%)
Age (Median [CI 95%])	69.5 [67.42-71.58]
Sex (Female)	16 (37.5)
Antiplatelet/anticoagulation therapy	
Antiplatelet	27(62.5)
Anticoagulation	8 (18.75)
Both	7 (15.63)
Cause	
Fall	31 (71.88)
Others	12 (28.12)
Presenting symptoms	
AMS	11 (25)
Aphasia	5 (12.5)
Focal motor deficit	13 (31.25)
Headache	13 (31.25)
Others	9 (21.88)
Baseline mRS (Median [CI 95%])	0 [0.00-0.76]
GCS at presentation	
GCS 13-15	38 (87.5)
GCS 8-12	5 (12.5)
Intubated at presentation	3 (6.25)
Age of hematoma	
Sub Acute on chronic	9 (21.88)
chronic	34 (78.12)
Admission to surgery (days) (Median [CI 95%])	1 [0.77-1.23]
Preoperative midline shift (Median [CI 95%])	7 [6.34-7.66]

The study cohort consisted of elderly patients with a median age of 69.5 years (95% CI: 67.42-71.58), predominantly female (37.5%). Most patients were on antiplatelet therapy (62.5%), with a smaller proportion on anticoagulation (18.75%) or both (15.63%). Trauma is the leading cause of hematoma in 71.88% of cases, while other causes accounted for 28.12%. Common presenting symptoms included altered mental status (25%), focal motor deficits (31.25%) and headaches (31.25%), with aphasia (12.5%) and other symptoms also observed (21.88%). The baseline modified Rankin Scale (mRS) score indicated minimal disability (median 0, 95% CI: 0.00-0.76) and most patients presented with a Glasgow Coma Scale (GCS) score of 13-15 (87.5%). A minority required intubation on presentation (6.25%). Hematomas were predominantly acute on chronic (78.12%), with a median time to surgery of 1 day (95% CI: 0.77-1.23) and a median midline shift of 7 mm (95% CI: 6.34-7.66). This profile characterizes a cohort of elderly patients with HEMATOMA, highlighting the common risk factors, clinical presentation and management timelines observed in this study population (Table 3).

In Table 4 detailing surgical demographics, the median operative time was 107 minutes (95% CI: 100.94-113.06). Craniotomy side distribution showed a majority on the right (62.50%), followed by the left (31.25%) and bilateral procedures (6.25%). Active bleeding was noted in a small subset (6.25%) of cases. The estimated blood loss had a median of 100 ml (95% CI: 85.46-114.54). Postoperatively, drains were utilized in the majority of cases (87.50%). This summary provides an overview of key surgical characteristics

Table 4: Surgical demographic data

Characteristics	Median (CI 95%)	n (%)
Operative time (min)	107 [100.94-113.06]	NA
Craniotomy side		
Right	27 (62.50)	NA
Left	13 (31.25)	
Bilateral		3 (6.25)
Active bleeding	NA	3 (6.25)
Estimated blood loss (ml)	100 [85.46-114.54]	NA
Presence of postoperative drain	NA	38 (87.50)

Table 5: Postoperative outcomes and characteristics after the operation and during discharge

Characteristics	Median (CI 95%)	n (%)
Postoperative midline shift (mm)	3.5 [2.99-4.01]	NA
Days with drain	2 [1.83-2.17]	
Length of stay (days)	8.5 [7.06-9.94]	
GCS at discharge	15	
Disposition		NA
Home	NA	9 (21.87)
Rehab		23 (53.12)
SNF		7 (15.63)
LTAC		3 (6.25)
Hospice		1 (3.13)
In-hospital recurrence	NA	1 (3.13)
Postoperative complications		NA
Surgical site infection		0 (0)
Medical complications	NA	1 (3.13)
Postoperative seizure		8 (18.75)
In-hospital mortality	NA	0 (0)
Outpatient follow-up (weeks)	12 [9.92-14.08]	NA
Follow-up GCS	15	NA
Follow-up mRS	1 [0.71-1.29]	NA

including operative duration, craniotomy laterality, bleeding status, blood loss and drain usage within the study cohort.

Postoperative outcomes analyzed are the midline shift of imaging, the median number of days of having a drain placed, length of total hospital stay and GCS at discharge. Additionally, the location of discharge and postoperative complications (including infection, medical complications and seizures) and in- hospital mortality are noted. The GCS and modified Rankin Score at the first follow-up visit are also reported (Table 5).

Table 5 summarizes the postoperative outcomes and characteristics following surgery and during discharge for the study cohort. The median postoperative midline shift was 3.5 mm (95% CI: 2.99-4.01), indicating a reduction from the preoperative midline shift. Patients typically had drains in place for a median of 2 days (95% CI: 1.83-2.17) and stayed in the hospital for a median of 8.5 days (95% CI: 7.06-9.94). At discharge, most patients had a Glasgow Coma Scale (GCS) score of 15. Disposition after hospitalization varied, with the majority of patients discharged to rehabilitation facilities (53.12%), followed by home (21.87%), skilled nursing facilities (SNF) (15.63%) and long-term acute care (LTAC) settings (6.25%). A small percentage were discharged to hospice care (3.13%). In-hospital recurrence of hemorrhage occurred in one case (3.13%), while postoperative complications included postoperative seizures (18.75%) and one medical complication (3.13%) without surgical site infections. There were no in-hospital mortalities. Outpatient follow-up typically occurred at a median of 12 weeks (95% CI: 9.92-14.08), with favorable neurological outcomes observed based on follow-up GCS (15) and modified Rankin Scale (mRS) score (median 1, 95% CI: 0.71-1.29). This summary provides insights into the recovery trajectory and outcomes of patients following surgical intervention for hematoma .

DISCUSSION

Our findings from our study on endoscopic-assisted evacuation of subacute and chronic subdural hematoma indicate that this method is both safe and beneficial for specific patients. Utilizing an endoscope through a tiny craniotomy at the superior temporal line provides a distinct advantage in the straightforward removal of the hematoma and membranes. The study placed significant emphasis on the inclusion criteria, whhematoma consisted of noncritical overall clinical status of the patients, radiographic evidence of clot stability and the absence of any other intracranial lesions. Furthermore, within our series, the primary cause of injury was predominantly a low-velocity mechanical fall that led to head trauma. This may have contributed to the occurrence of an isolated chronic subdural hematoma, while the neurological examination yielded rather positive results.

Given that the majority of the patients were over the age of 65, the advanced age may have made it easier to employ this procedure. This is because age-related brain shrinkage could have created more space for the endoscope and surgical equipment to be used within the limited operating area. These characteristics likely reduced the probability of experiencing postoperative cerebral edema and facilitated the development of a less intrusive treatment. The surgical approach was successfully conducted even though 75% of the patients were receiving antithrombotic medication or anticoagulation at the time of presentation. Both procedures were reversed before the surgical intervention. The technique of reversal was determined by the surgeon's desire and advice from the blood bank. This study's descriptive character precludes the formulation of recommendations about a systematic approach for antithrombotic or anticoagulation reversal.

The median duration of the surgical procedure in our investigation, whhematoma lasted for 107 minutes, was comparable to the operative time reported in prior studies on endoscopic-assisted subdural hematoma evacuations documented in the literature[4,7-10]. Neurosurgeons who are not accustomed with using the endoscope in their everyday practice may experience a learning curve that will initially affect the duration of their operations. However, like any other newly acquired technique, consistent use is likely to enhance the efficiency of surgical procedures over time. The literature reports a wide range of operational periods for routine craniotomy/craniectomy for chronic subdural hematoma evacuation, ranging from as short as 49 minutes to greater than two hours[8,11-13].

In our series, the median midline displacement decreased to 3.5 mm, compared to a preoperative median of 7 mm. The median length of stay (LOS) in our investigation was 8.5 days, whhematoma was superior to the only other series that used endoscopic-assisted evacuation and published LOS data (mean 23.4 days). However, it is important to note that the group in that study had a higher average age and baseline modified Rankin Scale (mRS) score and the Glasgow Coma Scale (GCS) score at presentation was lower[14]. The length of stay (LOS) in our series was shorter compared to the LOS reported in studies on the conventional evacuation of chronic subdural hematomas. However, it is important to note that a large amount of the available data on standard evacuation comes from extremely ill patients, whereas our investigation focused on chosen patients. In a comprehensive retrospective study published in 2012, Ryan et al. presented their findings on the mortality and functional outcomes of persons who had chronic traumatic subdural hematoma. Among the individuals who received the normal surgical evacuation, 49% of them had a Glasgow Coma Scale (GCS) score ranging from 13 to 15. Additionally, their average length of stay (LOS) was 15.1 days. The mean length of stay (LOS) recorded in national databases for patients who underwent a routine craniotomy or craniectomy to remove subdural hematomas is typically between 10 and 13 days[15,16]. The importance of patient selection for the effectiveness of this relatively new therapy is clear.

Like in prior series[14,9,10], a subdural drain was inserted into the subdural space to facilitate rapid fluid re-accumulation after surgery in nearly all instances. There was only one instance of recurrence among the patients in this series. The patient suffered from an chronic subdural hematoma due to a mechanical fall. Additionally, the patient had a medical history of end-stage renal illness requiring hemodialysis and alcoholic liver disease, whhematoma caused a low platelet count. Prior to the surgery, the patient underwent a platelet transfusion and did not have a subdural drain inserted during the procedure. A recurrence was detected on a scan acquired on the first day after the surgery, before removing the breathing tube. The recurrence was handled with a sense of cautious anticipation. The patient's condition worsened in the following days after removing the breathing tube, primarily due to lung congestion and a gradual deterioration in neurological function. As a result, the patient required a tracheostomy and a percutaneous endoscopic gastrostomy. The patient was transferred to a Long-Term Chronic Care facility after a total Length of Stay of 14 days. The incidence of postoperative complications in our study was minimal. Out of the total number of patients, six individuals (19%) experienced seizures after their surgery. These same six patients had a Glasgow Coma Scale (GCS) score of 15 during their most recent follow-up appointment. Additional research has documented that the occurrence of seizures in adults ranges from 15% to 25%[17,18], whereas elderly patients experience seizures at a rate of 40% during the immediate postoperative period following a typical craniotomy procedure for the removal of an chronic subdural hematoma. No individuals experienced a surgery site infection. Out of all the patients, just one (3.13%) experienced a medical issue after the surgery, specifically a bladder infection due to the catheter. The findings obtained are superior to the reported data on routine craniotomy/craniectomy, whhematoma indicate infection rates as high as 19%, including urinary tract infections, ventilator-associated pneumonia, cellulitis and other related complications[15,17,19].

A majority of our patients (53%) were released to a rehabilitation institution. This outcome is not surprising given that the median age was 69.5 years and a minimum of 40% of the patients exhibited a focal motor deficiency and/or aphasia that necessitated additional therapy. However, a total of 22% of the patients were released to their homes. The median duration of the most recent postoperative outpatient follow-up was 12 weeks. Upon further examination, it was found that the median mRS score was 1, indicating that patients were capable of maintaining independent living.

Burr holes are an excellent treatment for patients with chronic-on-chronic subdural hematoma. However, the chronic aspect of the collection can sometimes pose a difficulty for efficient evacuation with this method, due to its consistency. It is fairly unusual for burr holes to be converted into a larger craniotomy in cases where this specific complication arises. Due to the expected difficulty, surgeons in our institution commonly chose to use the endoscope-assisted technique with a small craniotomy. This technique offers excellent visibility and maneuverability, allowing them to reach distant clot remnants and directly confirm the successful removal of the hematoma. The craniotomy site located at the superior temporal region was crucial for accessing the distant remnants of the clot mentioned earlier, using a rigid endoscope. We contend that the skillful utilization of an inflexible endoscope necessitates less time to become proficient compared to the flexible endoscope and it can achieve a similar level of removal provided the precise placement of the craniotomy is meticulously prepared. All patients in our series who had acute-on-chronic subdural hematoma had a documented history of head trauma within three days of their presentation. our supported our choice to include them in this analysis. This study does not include direct comparisons between the endoscope-assisted and burr hole procedures, or between rigid and flexible endoscope techniques. The utilization of the endoscope-assisted approach has demonstrated its value in the removal of persistent subdural hematomas. The benefits of this method, as outlined in other articles, can surely be utilized for the removal of chronic subdural hematomas in patients who are carefully selected and meet specific criteria. These patients typically present after a low-velocity head trauma, such as a fall from ground level and have a high Glasgow Coma Scale (GCS) score. This paper describes our early experience of using the endoscope-assisted approach in this group of patients. It is crucial to highlight that the endoscope-assisted procedure should not be the preferred way for treating an chronic subdural hematoma caused by a high-velocity trauma in a patient with a low Glasgow Coma Scale (GCS). The decompressive craniectomy and subdural hematoma evacuation will continue to be the established procedure for patients of this nature. There are various constraints in our investigation. The study's retrospective design does not permit control over presurgical care or standardized follow-up. Although this is the most extensive sample available on this particular technique for evacuating chronic subdural hematoma, a larger, prospective and controlled trial is necessary to provide recommendations supported by strong evidence and reliable outcome data. This will enable a proper comparison with well-established techniques.

CONCLUSIONS

Evacuating subacute and chronic subdural hematomas with a minor craniotomy with the aid of an endoscope could be a secure and effective alternative for patients who fit particular criteria for this less invasive treatment. Additional research conducted in a highly regulated environment and using a bigger sample size is necessary to assess its effectiveness in comparison to the conventional craniotomy procedure, as well as to potentially broaden its range of applications.

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