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Neuroendoscopic Technique for Recurrent Chronic Subdural Hematoma with Small Craniotomy

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ABSTRACT

AIM: To present a case series describing an endoscopic technique with a small craniotomy for recurrent chronic subdural hematoma (rCSDH) treatment.

MATERIAL and METHODS: A total of 17 patients with rCSDH underwent neuroendoscopic hematoma removal with a small craniotomy under local or general anesthesia. The skin incision of the initial surgery on the convexity of the skull was extended, and a burr hole was created for a small craniotomy. After the removal of the outer membrane and hematoma through a small craniotomy, the hematoma was evacuated with a suction tube using the rigid endoscope. The entire hematoma cavity circumference was irrigated, while septations and trabeculae in the hematoma were cut. After hematoma evacuation, the inner membrane was incised and removed to allow brain expansion. Postoperative follow-up was performed for at least 6 months.

RESULTS: The regrowth rate of rCSDH after the neuroendoscopy was 5.9%. One patient with recurrent chronic subdural hematoma regrowth required neuroendoscopy again, but no re-recurrence was observed for the next 6 months. All cases were successfully managed using this technique and the postoperative seizure rate was 23.5%.

CONCLUSION: This neuroendoscopic technique with a small craniotomy could be useful for recurrent chronic subdural hematoma because the hematoma and septations can be visualized and evacuated along the entire circumference of the hematoma cavity, and the inner membrane can be torn to allow brain expansion.

KEYWORDS: Chronic subdural hematoma, Neuroendoscopy, Recurrence, Small craniotomy

INTRODUCTION

The incidence of chronic subdural hematoma (CSDH) increases with increasing age and the widespread use of antithrombotic agents (26). Burr-hole surgery with closed-system drainage is the most commonly performed surgery for CSDH (1,9,26,32,33,37,38). The rate of recurrent CSDH is 10%–15% (4,16,25,28,30,33,35,37). A total of 5%–30% of patients with CSDH who undergo surgery require reoperation (33,38), and 24% of these patients experience a secondary recurrence that demands further surgery (32). Although it is not widely used, endoscopic evacuation for CSDH is an established technique (7,26). We present a case series describing an endoscopic technique with a small craniotomy for CSDH treatment.

MATERIAL and METHODS

External drainage using burr-hole craniotomy under local anesthesia was performed for the initial CSDH treatment in our hospital. The external drainage tube was removed within a day of hematoma drainage. After the initial surgery, endoscopic hematoma removal with a small craniotomy was performed in 17 cases of rCSDH from November 2016 to January 2019 (Table I). Our criteria for rCSDH surgery included the emergence or worsening of symptoms (headache,

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Table I: Summary of Patients who Underwent Neuroendoscopic Removal of Recurrent Chronic Subdural Hematoma Using Small Craniotomy

Patients	Age(year)/Sex	Side	Medication	Period of recurrence (day)	Maximum diameter (mm)
1	75/F	R	-	5	26
2	76/M	L	Clopidogrel	15	15
3	86/M	R	Warfarin	20	35
4	90/F	L	-	15	17
5	78/M	L	Warfarin	21	18
6	62/M	R	-	15	19
7	91/M	R	-	16	22
8	85/F	R	-	5	37
9	89/M	L	-	38	18
10	80/M	L	Rivaroxaban	14	25
11	87/M	L	-	16	18
12	88/M	L	-	17	20
13	88/M	R	-	36	18
14	86/M	L	-	9	27
15	96/M	L	-	38	12
16	77/F	L	-	14	20
17	74/M	L	-	9	33

***R:** Right, **L:** Left.*

hemiparesis, and aphasia) and hematoma regrowth as observed in the postoperative imaging. A total of 13 males and 4 females with an average age of 82.8 years (range, 62–96 years) were included. There were 6 right-sided and 11 left-sided recurrent CSDHs. Four patients were undergoing treatment with antiplatelet or anticoagulant agents. The average period between initial CSDH and recurrence was 17.8 days (range, 5–38 days). The maximum diameter of the hematoma ranged from 15–37 mm (average, 22.4 mm). All patients underwent unilateral surgery. Consent was obtained from all patients and their families. The study was reviewed and approved by ethical committee board.

Neuroendoscopic Technique

Surgery was performed under local or general anesthesia. The skin incision of the initial surgery on the convexity of the skull was extended to approximately 5 cm, and a burr hole was created to perform a small craniotomy that measured approximately 4 cm (Figure 1). After the removal of the outer membrane and hematoma, a rigid neuroendoscope (Olympus, Tokyo, Japan) was inserted. The hematoma was evacuated using a suction tube and the entire circumference of the hematoma cavity was irrigated, while the septations, which formed multiple loculated compartments in the hematoma) were cut (Figure 2). The visible hematoma was cleared using suction. After the hematoma evacuation, the inner membrane was incised and removed to allow for brain expansion (Figure 3). Prior to securing the bone flap using two titanium plates (Lorenz® plating system, Biomet, Jacksonville, USA) and autologous bone dust (17), the draining catheter was inserted in the hematoma cavity under endoscopic guidance (Figure 4).

■ RESULTS

Patients were operated under general or local anesthesia (11/17 and 6/17, respectively) (Table II). Septations were intraoperatively observed in 10/17 patients (58.8%). The postoperative follow-up period was for an average of 11.5 months (range, 6–23 months). One patient developed rCSDH and required neuroendoscopy again after 23 days; however, no re-recurrence was observed for the next 6 months. All patients were successfully managed with this neuroendoscopic technique, and none of the patients experienced cosmetic skin depression. Postoperative seizures occurred in 4/17 patients (23.5%); of these, 3 patients with left-sided hematoma experienced focal seizures presenting with aphasia, while one patient experienced generalized seizures. Postoperative seizures in all patients were controlled using an anticonvulsant, such as levetiracetam or lacosamide.

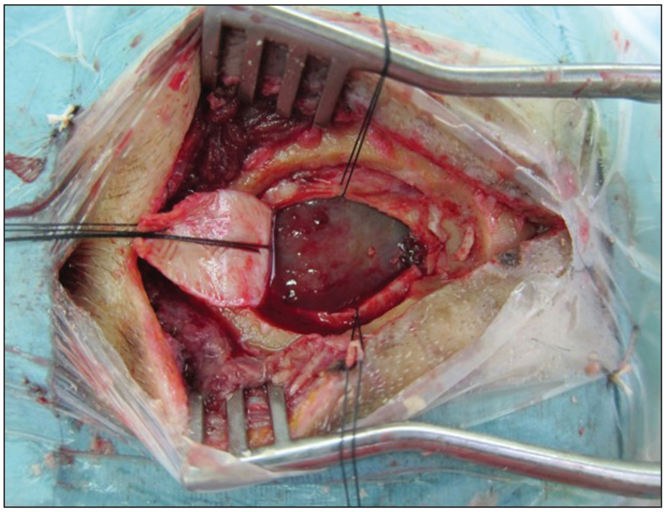

Figure 1: A small craniotomy of approximately 3 cm is performed to insert the neuroendoscope and neurosurgical instruments.

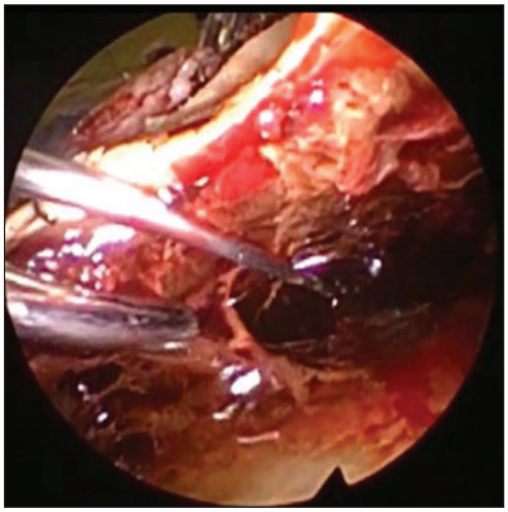

Figure 2: The hematoma is evacuated and septation is incised using a suction tube; irrigation is performed using isotonic isothermal saline solution.

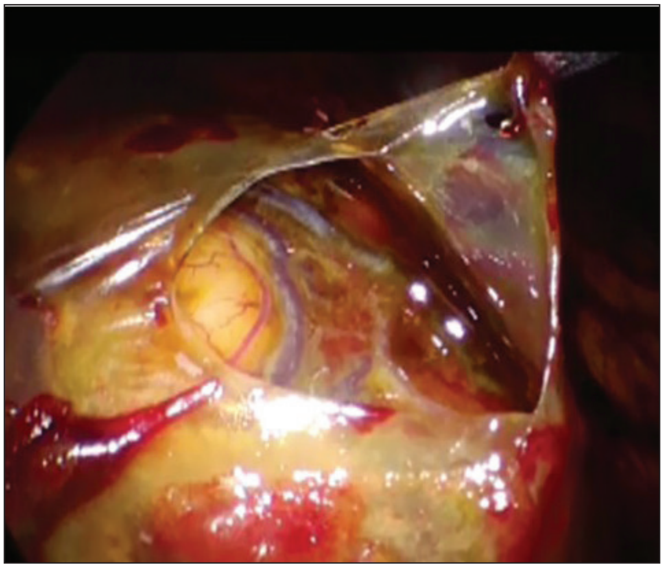

Figure 3: The inner membrane of the subdural hematoma was incised and removed to allow for brain expansion.

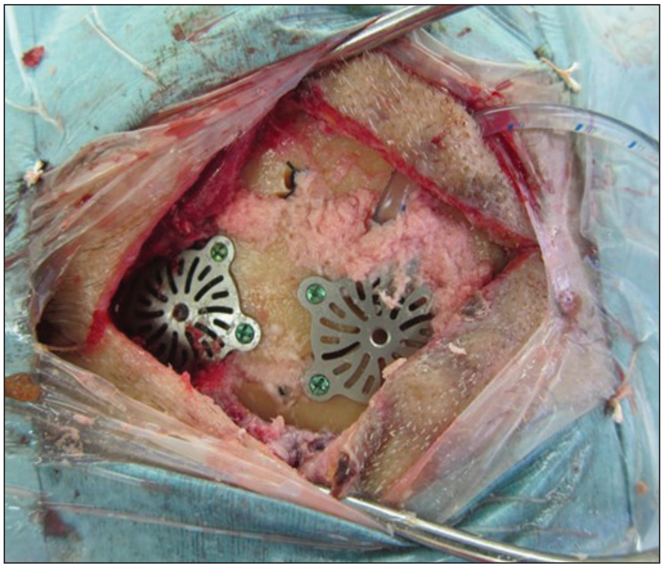

Figure 4: After inserting the draining catheter, the bone flap is fixed with titanium plates and autologous bone dust to cover the bone defect.

DISCUSSION

CSDH is among the most common diseases treated by neurosurgeons with an incidence of 8.2–14.1/100,000 person-years (3,6,10,21,24,26). Since burr-hole craniotomy is associated with a low recurrence rate and few complications, it is the primary treatment of choice for CSDH (8,26). Although it is a frequently occurring disease, there is no accepted standardized treatment for rCSDH (2,12). For rCSDH treatment, the Chinese herb gore-san, steroids, and carbazochrome have been used (37,42); moreover, embolization of the middle meningeal artery for treatment was first described by Mandai et al. in 2000 (27).

Karakhan reported the first use of neuroendoscopy for CSDH treatment in 1988 (19), and a neuroendoscopic technique for *acute* subdural hematomas was reported more recently (18,22,25,26,36,37). For patients with rCSDH, an endoscopic technique of cutting the trabeculae and separating the membranes in the hematoma cavity was reported (15,26,29). Majovsky et al. described a technique of flexible neuroendoscopic evacuation of CSDH and found a low recurrence rate (1,26).

The advantages of neuroendoscopy include trabeculae and septations visualization, larger exposure for resection of the outer capsule and neomembranes, and proper hemostasis (18,26). This technique can be performed under either local or general anesthesia (18). General anesthesia carries high risks for elderly patients and those with multiple comorbidities; therefore, local anesthesia can be used. Previous studies have

Table II: Result of Patients Who Underwent Neuroendoscopic Removal of Recurrent Chronic Subdural Hematoma with Small Craniotomy

Patients	Anesthesia	Septation	Follow-up period (months)	Regrowth	Postoperative seizure	Anticonvulsant
1	Local	+	8	-	-	-
2	General	-	23	-	-	-
3	General	-	8	-	Focal (aphasia)	Levetiracetam
4	Local	-	18	-	-	
5	General	-	13	-	-	
6	General	-	16	-	-	
7	General	+	13	-	-	-
8	Local	+	13	-	-	
9	General	+	12	-	-	
10	General	+	10	-	-	
11	General	+	10	-	-	
12	General	-	10	-	-	
13	General	+	10	-	-	
14	Local	-	10	-	Focal (aphasia)	Lacosamide
15	Local	+	10	-	-	
16	General	+	6	-	Focal (aphasia)	Levetiracetam
17	Local	+	6*	+	Generalized	Lacosamide

***:** *Followed after the second neuroendoscopic surgery.*

recognized a significant correlation between multiseptated or multilayered CSDH and recurrence (40). A small craniotomy allows advantages such as enabling complete hematoma cavity visualization (18) and providing sufficient working space for insertion of the endoscope and manipulation of non-specialized endoscopy instruments (18).

One of the concerns of neuroendoscopic removal of CSDH is the injury to the brain cortex caused by the endoscope (26). However, there are no reports of increased morbidity as a result of neuroendoscopy. Neurosurgeons must use both hands on the endoscope to avoid injuring the brain cortex (13,15,29). Yan et al. suggest that even though endoscopic surgery allows the removal of the hematoma cavity with a small craniotomy, especially for septated CSDH, there was no difference between neuroendoscopy and burr-hole craniotomy in terms of reduction of rCSDH (41). Large craniotomy and membranectomy with tearing of the inner membrane is used to reduce the recurrence of septated CSDH (40). An enlarging craniotomy is not required, thus minimizing patient discomfort.

The method of tearing the inner membrane for septated CSDH was described by Kayaci et al. (20). Yan et al. hypothesized that the inner membrane is more significant than the outer membrane as a factor in rCSDH (40). However, cutting and removing the inner membrane might increase cortical damage (5,40).

The incidence of postoperative seizures after the first surgery for CSDH was 1.8%–10% (23,31,39). Hellwig et al. insisted that aggressive membranectomy induced postoperative seizures, brain contusion, and hemorrhage (14). The decomposition of hemoglobin on the cortical surface is strongly associated with epilepsy (39). Intracranial decompression by craniotomy may induce brain injury through sudden negative deceleration, and is epileptogenic (11,34,35,39). Our study had some limitations being a retrospective case series including patients operated on by one neurosurgeon from a single institute, and comprised a few patients. Further larger, comparative multicenter studies are required to accumulate further evidence of the benefits of neuroendoscopy for recurrent CSDH.

CONCLUSION

This neuroendoscopic technique with a small craniotomy could be useful for recurrent CSDH because the hematoma and septations can be visualized and evacuated along the entire circumference of the hematoma cavity, and the inner membrane can be incised to allow brain expansion. It can also enable sufficient working space to insert and use neurosurgical instruments to safely and effectively evacuate the hematoma and septations.

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