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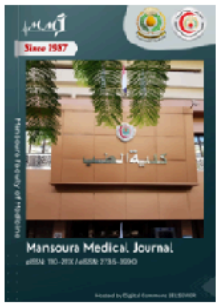

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The Value of Suction Drainage for a Chronic Subdural Hematoma in Elderly Patients: A Retrospective Cohort study

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ORIGINAL STUDY

The Value of Suction Drainage for a Chronic Subdural Hematoma in Elderly Patients: A Retrospective Cohort Study

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Abstract

Background: **The use of suction in the subgaleal drainage system after the burr-hole evacuation of chronic subdural hematoma (CSDH) is still debatable. This study aimed to investigate the value of adding suction to the drainage system of CSDH in elderly patients.**

Methods: **This cohort study retrospectively reviewed the data of the CSDH patients operated on at our university hospital in the last eight years. The inclusion criteria were elderly patients who underwent evacuation of a unilateral CSDH through two burr holes followed by placing a subgaleal drainage tube. Two hundred seventy-three consecutive patients met the inclusion criteria. Seventy-six patients (27.8%) received suction drainage. The comparison between groups with qualitative data was done using the chi-square test. The comparison between groups with quantitative data was done using the *t*-test. The statistical analyses were conducted using SPSS software version 21 (IBM Corp., Armonk, New York, USA).**

Results: **There were no statistically significant differences between the suction and the nonsuction drainage groups regarding the hospitalization period, the postoperative seizures, or the recurrence rate. However, the postoperative pneumocephalus volume in the suction drainage group was significantly lower than in the non-suction drainage group. None of the patients developed acute subdural or intracerebral hemorrhage.**

Conclusions: **Suction drainage did not add statistically significant value to the closed drainage system regarding the hospitalization period, postoperative seizures, or recurrence rate of the CSDH. A prospective controlled study is needed to increase the evidence for this finding.**

Keywords: Burr-hole, Chronic subdural hematoma, Pneumocephalus, Recurrence rate, Subgaleal drain

1. Introduction

Chronic subdural hematoma (CSDH) is a common disorder in neurosurgery and mainly affects elderly individuals. Its surgical treatment usually results in rapid improvement of neurological symptoms. The most commonly used surgical procedure in the treatment of CSDH is burr-hole evacuation, followed by closed-system drainage (Xu et al., 2016; Liu et al., 2014; Yuan et al., 2018).

The draining catheters are placed either in the subdural or the subgaleal spaces. Although the subdural drains are effective for evacuating CSDHs, they can be associated with iatrogenic injuries and postoperative morbidity in 4% of patients (Kaliaperumal et al., 2012). A subgaleal drain is a valid option in the management of CSDH because it is relatively less invasive (Kaliaperumal et al., 2012; Soleman et al., 2019). Häni et al. (2019) emphasized that subgaleal drains did not have a negative impact on the clinical or radiological outcomes of CSDH patients (Häni et al., 2019).

The use of suction in the subgaleal drainage system is still debatable. Suction drainage of CSDH,

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according to some authors, may cause rebleeding into the subdural space and the formation of acute subdural hematoma, particularly in elderly patients (Mehta et al., 2018).

Other authors believe that applying negative pressure to the closed drainage system decreases the postoperative subdural air and helps brain re-expansion, thus limiting CSDH recurrence (Gazzeri et al., 2007).

This study aimed to investigate the value of adding suction to the drainage system after the burr-hole evacuation of CSDH in elderly patients.

2. Methods

This retrospective cohort study was reported under the "Strengthening the Reporting of Observational Studies in Epidemiology" guidelines. It followed the Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

The study was approved by the Research Ethics Committee of the Faculty of Medicine at our university. Informed consent was obtained as required.

2.1. Patient selection

This study reviewed the data of the patients operated on for unilateral CSDH at our university hospital between January 2014 and December 2021.

The inclusion criteria were elderly patients (≥65 years) with unilateral diffuse convexity CSDH evacuated through two burr holes and a subgaleal drainage tube.

Two hundred seventy-three consecutive patients met the selection criteria of the study. Their mean age was 74.1 years (ranging from 65 to 87 years). The study divided the included patients into two groups according to the application of suction to the subgaleal drainage.

2.2. Data collection

The collected clinical data includes patients' demographics, comorbidities, Markwalder's grades (Markwalder et al., 1981), history of head trauma, preoperative computed tomography (CT) head findings, operative details, postoperative course, follow-up CT scan findings, and the progressive notes in the follow-up visits six months after evacuation.

The hematoma and pneumocephalus volumes were measured on CT scans using the iPlan software (Brainlab Inc., Felkirchen, Germany).

The midline shift was measured as the distance from the septum pellucidum point between the anterior horns of the lateral ventricles to a perpendicular line connecting the anterior and posterior insertions of the falx cerebri.

2.3. Operative techniques

Two burr holes were drilled and enlarged by Kerrison rongeur to a diameter of at least 15 mm. After incising the dura and the outer membrane of the subdural hematoma, the hematoma cavity was gently washed with warm saline till the wash became clear. No subdural catheter was inserted.

A subgaleal drainage tube was placed over each burr hole. The drainage tube is connected to a closed drainage system. The drainage was put under suction according to the surgeon's preference. When suction drainage was preferred, the collecting chamber was compressed to about 25% of its height to create a vacuum suction in the closed system.

The patients were then extubated and transferred to the intensive care unit for monitoring.

Postoperatively, patients remained flat in bed for 48 h. The drainage tube was removed 48 h after surgery. A postoperative CT scan was done on the third postoperative day.

After discharge, follow-up visits were every two weeks for two months, then monthly afterward. A follow-up CT scan was performed upon the recurrence of symptoms.

CSDH recurrence was defined as the reappearance of symptomatic ipsilateral subdural recollection.

2.4. Statistical analysis

Quantitative data was described by the mean and range, while qualitative data was described by frequencies. The comparison between groups with qualitative data was done using the chi-square test. The comparison between groups with quantitative data was done using the t-test. The statistical analyses were conducted using SPSS software version 21 (IBM Corp., Armonk, New York, USA). Statistical significance was set at a P value < 0.05.

3. Results

A total of 273 consecutive elderly patients met the inclusion criteria of the study. Their mean age was 74.1 years (ranging from 65 to 87 years). Seventy-six patients (27.8%) received suction drainage.

The flow diagram of the patient selection is shown in Fig. 1.

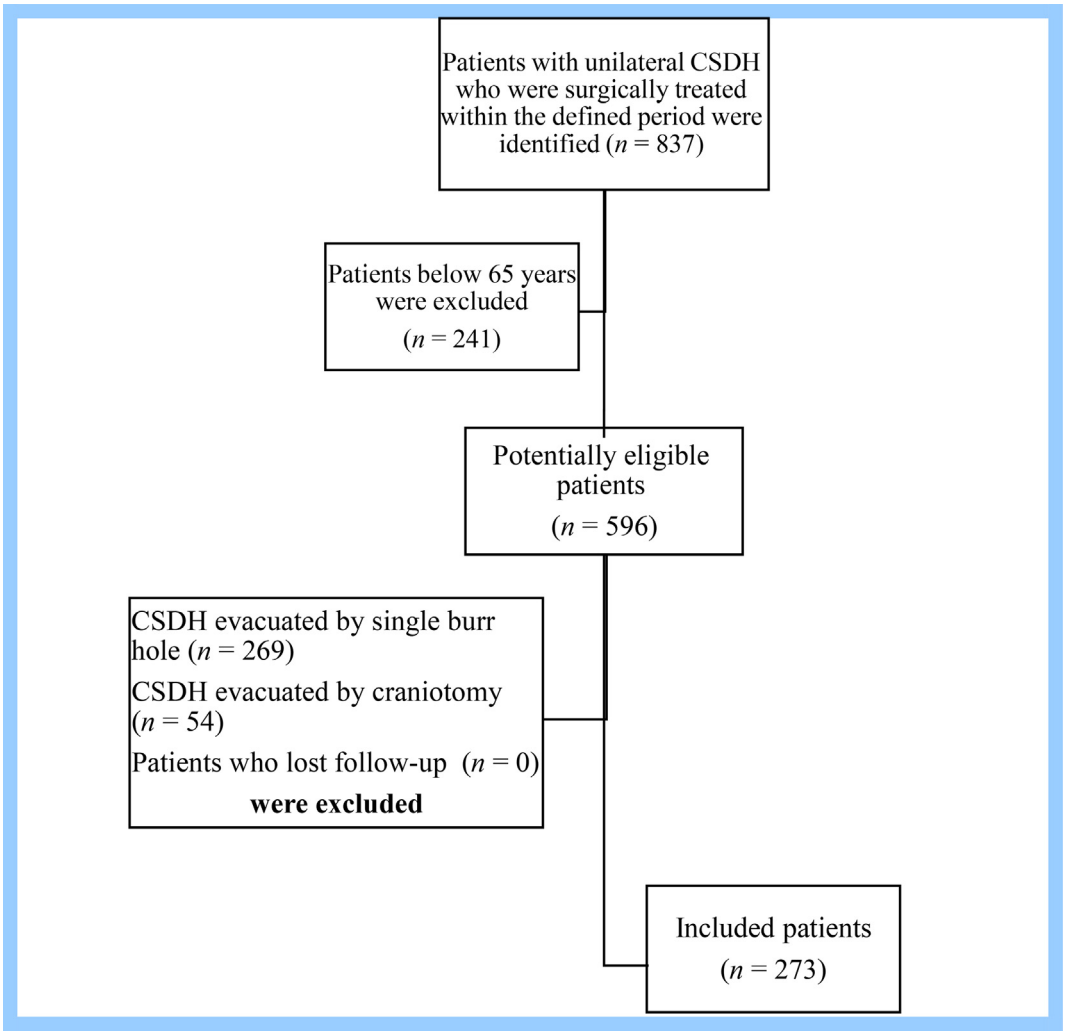

Fig. 1. Flow diagram of patient selection. CSDH: chronic subdural hematoma, n: number of patients.

Table 1. Baseline characteristics of the included patients.

Characteristics	Suction group $n = 76$	Without suction $n = 197$	*P* value
Mean Age (years)	73.4	74.5	0.633*
Gender	Male: Female	Male: Female	0.77**
	59:17	156:41	
Preoperative Markwalder's grades			
Grade 0	0	0	
Grade 1	5	12	
Grade 2	36	113	0.18*
Grade 3	35	72	
Grade 4	0	0	
Medical diseases			
Hypertension	36	110	1.06**
Diabetes mellitus	28	69	0.77**
Ischemic heart disease	7	25	0.41**
Liver cirrhosis	5	11	0.78**
Coagulopathy	33 (43.4%)	103 (52.2%)	0.18**
Radiological findings			
Mean CSDH volume (mL)	132.6	139.1	0.38*
Mean thickness of the CSDH (mm)	28.3	27.1	0.44*
Mean midline shift (mm)	15	14.3	0.37*
Side of the hematoma	Right ($n = 27$)	Right ($n = 90$)	0.12**
	Left ($n = 49$)	Left ($n = 107$)	

CSDH, chronic subdural hematoma * *t*-test ** Chi-square test.

Table 2. The clinical and radiological outcomes of the two study groups.

Variables	Suction group ($n = 76$)	Without suction ($n = 197$)	P value
Markwalder's grades (Postoperative Day 5)			
Grade 0	12	51	
Grade 1	29	74	0.06[a]
Grade 2	35	39	
Grade 3	0	33	
Grade 4	0	0	
The mean postoperative pneumocephalus volume (mL)	22.6	27.3	0.03[a]
Acute subdural hematoma formation	0%	0%	
Mean hospitalization period	12.5	13.9	0.07[a]
Postoperative seizures	3 (3.9%)	9 (4.5%)	0.82**
Six-months recurrence rate	5 (6.5%)	18 (9.1%)	0.48**
Six-months mortality rate	0%	0%	

[a] *t*-test **: chi-square test.

The baseline characteristics of the study groups are illustrated in Table 1. The preoperative clinical and radiological findings of the two study groups were similar without any statistically significant differences.

Two hundred forty-three patients (89%) had a head injury within two months of admission.

Seventeen patients (6.2%) presented with headaches and dizziness for a few days before admission (Markwalder's grade 1). One hundred forty-nine patients (54.5%) presented in a confusional state and suffered from mild hemiparesis a few days before admission (Markwalder's grade 2). One hundred and seven patients (39.1%) were stuporous on admission with dense hemiplegia (Markwalder's grade 3).

The subdural hematomas were left-sided in 156 patients (57.1%). The preoperative volume of the CSDH ranged between 98.4 and 178.7 ml, with a mean volume of 141.3 ml. The maximum thickness of the subdural hematoma ranged between 21 mm and 36 mm, with a mean thickness of 27.9 mm.

The midline shift ranged between 8 mm and 22 mm. The clinical and radiological outcomes of the two study groups are stated in Table 2.

The volume of the subdural air ranged between 16 ml and 35 ml, with a mean volume of 26.1 ml.

The postoperative pneumocephalus volume in the suction drainage group was significantly lower than the non-suction drainage group (P value = 0.0003).

There were no statistically significant differences between the two groups regarding the hospitalization period, the postoperative seizures, or the recurrence rate.

No acute subdural or intracerebral hemorrhage developed in any patient.

All the patients improved clinically and were discharged in an alert and oriented state. The hospitalization period ranged between 6 days and 21 days, with a mean duration of 12.4 days.

Twenty-three patients (8.42%) suffered from a symptomatic recollection of the subdural hematoma within a mean interval of 42.4 days (ranging from 27 to 75 days).

The 250 patients (91.5%) who did not develop hematoma recurrence had Markwalder's grade zero 6 months after hematoma evacuation.

Twelve patients developed generalized seizures within 2 months of surgery.

All the patients were strictly adherent to the postoperative follow-up visits. There was no mortality in the included patients during the defined follow-up period.

4. Discussion

This study found no statistically significant differences between the suction and the non-suction drainage groups regarding the hospitalization period, the postoperative seizures, or the recurrence rate of the CSDH.

The postoperative pneumocephalus was significantly lower in the suction drainage group than in the non-suction drainage group. However, this finding did not have a statistically significant effect on the hospitalization period, the incidence of postoperative seizures, or the recurrence rate of the CSDH.

Similarly, Stanisic et al. (2005) and Ohba et al. (2013) did not find a significant correlation between postoperative air collection and the recurrence of CSDH (Stanisic et al., 2005; Ohba et al., 2013).

However, some authors found a correlation between the postoperative pneumocephalus volume and the rate of CSDH recurrence (Rovlias et al., 2015; Oishi et al., 2001; Mori and Maeda, 2001).

In the present study, the six-month recurrence rates in the suction and the non-suction drainage groups were 6.5% and 9.1%, respectively.

Similarly, Gazzeri et al. (2007) stated that 7.6% of the operated CSDH patients experienced a

recurrence with subgaleal suction drainage (Gazzeri et al., 2007).

Yadav et al. (2016) found a 2.4% recurrence rate of the CSDH with subgaleal suction drainage, but they did not mention the follow-up period (Yadav et al., 2016).

The results of our study suggest that the suction drainage did not add statistically significant value to the closed drainage system. In addition, suction drainage did not appear to harm CSDH patients. A prospective randomized controlled study is needed to increase the evidence for these findings.

One of the limitations of the present study is its retrospective nature. However, all the patients were strictly adherent to the follow-up visits, and there was no lost data.

In addition, this study reviewed the data of the CSDH patients in one tertiary neurosurgical center, which may have formed a selection bias. Moreover, this study did not include bilateral CSDH, patients younger than 65 years, or cases operated by a single burr hole, which may limit its generalization. Bilateral CSDH was excluded because each hematoma side may have a different course after evacuation, which may create difficulty in assessment. This study included only elderly patients who usually suffer from brain atrophy with difficult re-expansion after hematoma evacuation. Thus, suction drainage was proposed in these patients to help brain re-expansion, decrease hospital stay, and limit hematoma recurrence.

4.1. Conclusions

Suction drainage did not add statistically significant value to the closed drainage system regarding the hospitalization period, postoperative seizures, or recurrence rate of the CSDH. A prospective controlled study is needed to increase the level of evidence for this finding.

Conflicts of interest

The authors declare that they have no competing interests.

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Not applicable.

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