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Original Article

Comparative study of subdural drain (SDD) versus sub periosteal drain (SPD) in treating patient with chronic subdural hematoma (CSDH)

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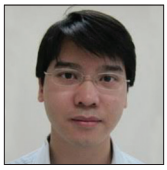

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Received : 13 June 2021
Accepted : 30 July 2021
Published : 24 August 2021

DOI
10.25259/SNI_592_2021

Quick Response Code:

ABSTRACT

Background: Chronic subdural hematoma (CSDH) is common neurosurgical condition encountered in daily practice. Burr holes evacuation is standard treatment for symptomatic cases. Both subdural drain (SDD) and subperiosteal drain (SPD) have been reported to lower the recurrence rate when used in conjunction with burr holes. A randomized controlled trials were done to see if there were any differences in clinical and radiographic outcomes between the two types of drains.

Methods: A total of 42 CSDH patients were enrolled and allocated to one of two groups: SDD (n = 21) or SPD (n = 21). Demographic data, perioperative imaging characteristics, clinical outcome, and recurrence rate were recorded for comparison.

Results: In both groups, demographic characteristics such as sex ratio, mean age of patients, concomitant disease, and antithrombotic agent use were similar. At 6 months, 20 (95.2%) and 21 (100%) cases in the SDD and SPD groups, respectively, had a favorable outcome (mRS 0–3). Complete hematoma resolution at 6 months was achieved in 21 (100%) and 19 (90.5%) cases of the SDD and SPD groups, respectively. The amount of drain within 48 h was not difference between the two groups. None of the SDD recurred, but two of the SPD group did, necessitating reoperation, which had no effect on the final outcome.

Conclusion: These findings indicate that the drain type (SDD or SPD) has no effect on the outcome. The surgeon's preference determines which procedure is used. Except in symptomatic circumstances, routine postoperative imaging may not be required.

Keywords: Burr hole, Chronic subdural hematoma, Drain

INTRODUCTION

Chronic subdural hematoma (CSDH) has been defined as liquefied hematoma in the subdural space with a characteristic outer membrane, predominantly hypodense or isodense crescentic collection along the cerebral convexity on cranial computed tomography (CT).[12] CSDH is a common disorder primarily affecting elderly people which associated with substantial morbidity and mortality.[9,15] Various operating procedures are mentioned, with the majority of them based on the surgeon's preference.[3,22] Most surgeons choose burr hole evacuation over other surgical procedures.[16,17,20] Drainage after burr hole evacuation of the hematoma is known to give a better

outcome than burr hole without drainage, however, there is a controversy in the method of drain placement which includes subdural drain (SDD) and subperiosteal drain (SPD).[2,7,11] Despite many studies comparing the two methods, there is still no agreement on which is superior.[1,4,5,6,13,18,21,23] In the present study, we aim to describe the experience of a single center as a tertiary referral hospital. When treating a patient with CSDH with SDD and SPD, the clinical and radiographic outcomes, as well as the complications of each technique, were compared and investigated.

MATERIALS AND METHODS

Study design and data analysis

This was a prospective randomized controlled trial study in CSDH patients treated by burr hole evacuation. Patients were randomly assigned to one of two groups (by a block of four randomization): patients with CSDH treated by burr hole evacuation with SDD placement or patients with CSDH treated by burr hole evacuation with SPD. The study protocol was approved by the Institutional Review Board (Study Code: SUR-2561-05431/Research ID: SUR-2561-05431). To compare primary and secondary outcomes, the Chi-square test and *t*-test were used in statistical analysis. Statistical significance was considered as $P < 0.05$.

Setting and selection criteria

This study included all adults over the age of 18 who were diagnosed with symptomatic CSDH between April 2019 and May 2020. The diagnosis was confirmed by CT scan or magnetic resonance imaging (MRI). We excluded nonsymptomatic patients and those who received conservative treatment; patients with CSDH due to a shunt over drainage; and all patients who had or required a craniotomy to remove CSDH, including those who were planned before surgery and those for whom we made a decision during surgery.

Data collection

We collect demographic data such as age, sex, duration of symptoms, Glasgow Coma Scale (GCS), modified Rankin score (mRS), concomitant diseases, anticoagulant/antiplatelet use, hematoma thickness, midline shift (MLS), and hematoma appearance of CSDH on CT scan/MRI.

The appearance of a hematoma before and after surgery was divided into five types, including homogenous hypodense, homogenous isodensity, trabeculae, layering (separated), and laminar type [Figure 1]. Bleeding, residual hematoma, pneumocephalus, infection (wound or intracranial), GCS, quantity of drain, mRS within 48 h, 3 months, and 6 months, and recurrence were all recorded as postoperative data.

The recurrence of CSDH was defined as initial clinical recovery followed by the development of CSDH-related symptoms with the radiographic appearance of hematoma. The primary outcome of this study was recurrence within 6 months, while the secondary outcomes were reoperation and complications (both intraoperative and postoperative). When the mRS was 0–3, the clinical outcome was considered favorable, and when the mRS was >4, it was considered unfavorable.

Operative procedure and perioperative care

Before surgical evacuation, patients with coagulopathy (INR >1.4, platelet 100,000) or who had previously required antithrombotic or anticoagulant medication

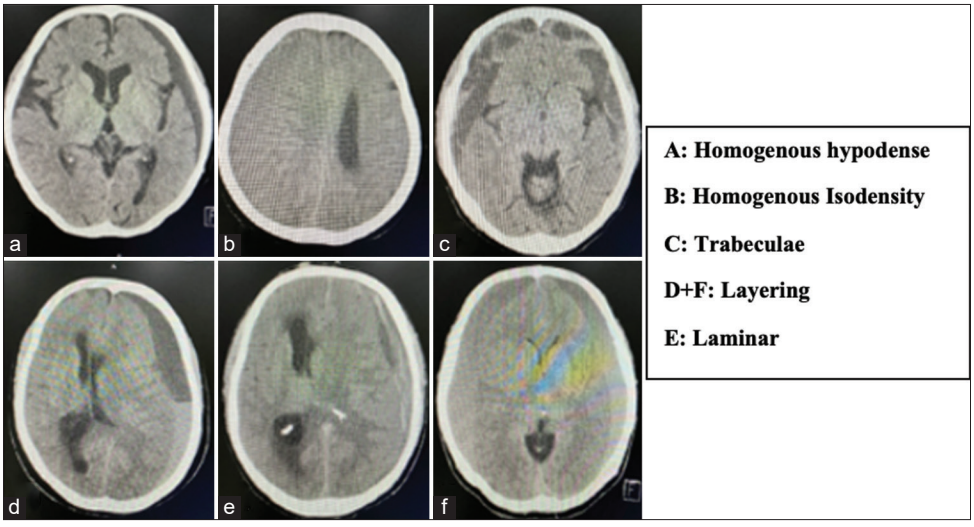

Figure 1: Chronic subdural hematoma classification based on hematoma appearance.[3]

were treated. For surgical removal, all of the patients were put under general anesthesia. On the operation table, the patient was positioned supine on a doughnut headrest. Patients were administered a prophylactic antibiotic (single dosage) right before the skin incision and for 24 h afterward. Over the hematoma's maximal thickness, two (13–15 mm) burr holes were drilled around 6–8 cm apart. The dura was opened in a cruciate fashion. The subdural collection was drained and the area was irrigated with warm saline until it was clear. Drain placement was done when hemostasis was obtained. For the SDD group, the nasogastric tube number 8 was inserted into the subdural space through a frontal burr hole <2 cm in depth and tunneled for 4–6 cm away from the frontal incision and the drain was connected to a ventriculostomy collection bag and was kept below the patient's head level for gravity drainage. For the SPD group, a Redivac drain number 8 was placed subperiosteally and positioned to cover both burr holes, and it was connected to a suction drain with approximately 50% suction force applied [Figure 2]. Before skin closure, the drain was secured in place. To prevent pneumocephalus, the lower incision was closed first, then warm saline was then filled into the subdural space, followed by quick skin closure. In cases of bilateral CSDH, both sides were treated with the same drain insertion procedure. All patients received standard postoperative treatment, including antiepileptic medication prophylaxis for 7 days and a 24 h period in a supine position with their heads at 0°. The drain was left in place for 48 h before being removed and a noncontrast CT scan was performed. We also scheduled follow-up CT scans on an outpatient basis at 3 and 6 months.

RESULTS

Patient demographic data

This study involved a total of 42 patients (n = 21 each group) and included 46 CSDH (4 of them had bilateral CSDH). In terms of demographic features, the two groups were comparable [Table 1]. The SDD group included 12 males (57.1%) and 9 females (42.9%), while the SPD group included 16 males (76.2%) and 5 females (23.8%). The average age of the participants was 65.33 years. Headache was the most prevalent clinical presentation (57.1%), followed by altered mental status (35.7%), dizziness (11.9%), loss of consciousness (4.8%), and seizure (4.8%), while only 23.8% of patients had a history of head trauma. At the time of presentation, the majority of patients had GCS of >12 (85.7%) followed by GCS 9–12 (14.3%) and none had a GCS of <9. Preoperatively, 42.9% of patients had mRS = 1, followed by 33.3% with mRS = 2,9.5% with mRS = 3,7.1% with mRS = 4, and 7.1% with mRS = 5. About 45.2% (n = 19) of the participants had previously received antithrombotic medications, with warfarin accounting for 47.4%, aspirin 36.8%, clopidogrel 5.3%, and rivaroxaban 10.5%. There was no statistically significant difference in demographic data across groups.

Perioperative imaging

In both the preoperative and postoperative periods, imaging characteristics such as hematoma appearance, MLS, and thickness were comparable across the two groups. Preoperative hematoma appearance included homogenous hypodensity 2.4% (n = 1), homogenous isodensity 33.3 % (n = 14), laminar 19 % (n = 8),

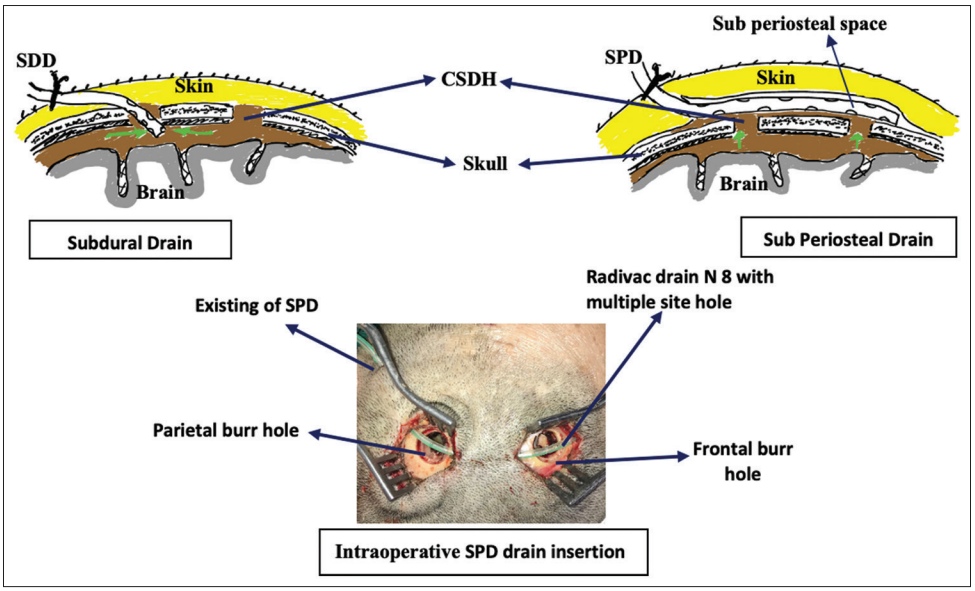

Figure 2: Drawing illustration of drain insertion technique and operative image for subperiosteal drain.

Table 1: Patient characteristics and demographic data.

Demographic data	Group I (SDD) 21 patients *n* (%)	Group II (SPD) 21 patients *n* (%)	Total 42 patients *n* (%)	*P*-value
Sex				
Male	12 (57.1)	16 (76.2)	28 (66.7)	0.326
Female	9 (42.9)	5 (23.8)	14 (33.3)	
Glasgow Coma Scale				
<9	0	0	0	
9–12	5 (23.8)	1 (4.8)	6 (14.3)	0.184
>12	16 (76.2)	20 (95.2)	36 (85.7)	
Clinical presentation				
Headache	11 (52.4)	13 (61.9)	24 (57.1)	0.223
Weakness	4 (19)	3 (14.3)	7 (16.7)	
Alteration of mental status	6 (28.6)	9 (42.9)	15 (35.7)	
Loss of conscious	2 (9.52)	0 (0)	2 (4.8)	
History of head trauma	5 (23.8)	5 (23.8)	10 (23.8)	
Dizziness and vertigo	1 (4.8)	4 (19)	5 (11.9)	
Seizure	1 (4.8)	1 (4.8)	2 (4.8)	
Concomitant disease				
No concomitant disease	4 (19)	4 (19)	8 (19)	
Hypertension	11 (52.4)	12 (57.1)	23 (54.8)	
DM	1 (4.8)	5 (23.9)	6 (14.3)	
Dyslipidemia	4 (19)	7 (33.3)	11 (26.2)	
Renal disease	4 (19)	3 (14.3)	7 (16.7)	
Heart disease	6 (28.6)	5 (23.8)	11 (26.2)	
Other	4 (19)	8 (38.1)	12 (28.6)	
Use of antithrombotic agent				
No	12 (57)	11 (52.4)	23 (54.8)	1.000
Yes	9 (33)	10 (47.6)	19 (45.2)	
Warfarin	6 (66.7)	3 (30)	9 (47.4)	
Aspirin	2 (22.2)	5 (50)	7 (36.8)	
Clopidogrel	0 (0)	1 (10)	1 (5.3)	
Rivaroxaban	1 (11.1)	1 (10)	2 (10.5)	
Preoperative mRS				
mRS 1	11 (52.4)	7 (33.3)	18 (42.9)	0.186
mRS 2	5 (23.8)	9 (42.9)	14 (33.3)	
mRS 3	1 (4.8)	3 (14.3)	4 (9.5)	
mRS 4	1 (4.8)	2 (9.5)	3 (7.1)	
mRS 5	3 (14.3)	0 (0)	3 (7.1)	

SDD: Subdural drain, SPD: Subperiosteal drain, mRS: Modified Rankin scale

layered 23.8 % (n =10), and trabeculae type 21.4 % (n = 9) [Table 2]. In 69% ((n = 29) of the participants, a preoperative MLS of 5–10 mm or more than 10 mm found [Table 3]. Preoperative maximal CSDH thickness was >10 mm in 92.7% of patients (n = 39), with only 7.1% (n = 3) having a thickness of 5–10 mm [Table 4].

In both groups, the 48 h postoperative CT scan revealed improvement in hematoma density, MLS, and thickness. We found no statistically difference between the two groups (P = 0.443, P = 1.00, and P = 0.448, respectively). We noted that 83.3% (n = 35) of the patients had postoperative pneumocephalus but no clinical symptoms [Table 5].

In most patients, the postoperative 3- and 6-month CT scans revealed interval resolution as expected. Only 4.8% (n = 2) of patients had a remnant hematoma < 5 mm thick at 6 months.

Clinical outcomes

In this study, we found two cases of recurrence and unfavorable outcome in the SPD group, but none in the SDD group. They needed to be reoperated within 48 h, but the final follow-up resulted in a favorable outcome. Between the SDD and SPD groups, there was no statistically significant difference in the rate of complete resolution at 3 and 6 months (66.7% vs. 66.7%, P = 0.733 and 100% vs. 90.5%,

Table 2: Perioperative and follow-up CT scan appearance.

Hematoma density	Group I (SDD) 21 patients *n* (%)	Group II (SPD) 21 patients *n* (%)	Total 42 patients *n* (%)	*P*-value
Preoperative				
Homogenous hypodensity	1 (4.8)	0 (0)	1 (2.4)	0.416
Homogenous isodensity	5 (23.8)	9 (42.9)	14 (33.3)	
Laminar	5 (23.8)	3 (14.3)	8 (19)	
Layered	4 (19)	6 (28.6)	10 (23.8)	
Trabecular	6 (28.6)	3 (14.3)	9 (21.4)	
Postoperative 48 h				
Homogenous hypodensity	15 (71.4)	10 (47.6)	25 (59.5)	0.443
Homogenous isodensity	1 (4.8)	2 (9.5)	3 (7.1)	
Laminar	4 (19)	8 (38.1)	12 (28.6)	
Layered	0 (0)	0 (0)	0 (0)	
Trabecular	1 (4.8)	1 (4.8)	2 (4.8)	
Postoperative 3 months*				
Homogenous hypodensity	4 (19)	1 (4.8)	5 (11.9)	0.266
Homogenous isodensity	0 (0)	0 (0)	0 (0)	
Laminar	3 (14.3)	5 (28.6)	9 (21.4)	
Layered	0 (0)	0 (0)	0 (0)	
Trabecular	0 (0)	0 (0)	0 (0)	
Postoperative 6 months*				
homogenous hypodensity	0 (0)	1 (4.8)	1 (2.4)	-
Homogenous isodensity	0 (0)	0 (0)	0 (0)	
Laminar	0 (0)	1 (4.8)	1 (2.4)	
Layered	0 (0)	0 (0)	0 (0)	
Trabecular	0 (0)	0 (0)	0 (0)	

*There are 28 of 42 patients (66.6%) who have complete resolution of chronic subdural hematoma on postoperative CT scan at 3 months (14 patients have residual hematoma). And at 6 months imaging, only two patients have residual hematoma without any clinically significant. SDD: Subdural drain, SPD: Subperiosteal drain

P = 1.000, respectively). The amount of drain appeared to be greater in the SPD group, but the difference was not statistically significant (P = 0.257). At 48 h, 3 months, and 6 months, the majority of patients had a positive result (mRS 0–3), with 85.7%, 97.6%, and 97.65%, respectively [Table 6].

We looked at potential factors that could influence the unfavorable outcome, such as the appearance of CSDH (preoperative and 48 h postoperative), the amount of drain, and pneumocephalus, but none of them were statistically significant [Table 7].

DISCUSSION

In neurosurgical practice, CSDH is a common condition. For symptomatic patients, surgical therapy is required. According to Level I evidence, burr hole evacuation with drain placement can greatly reduce the rate of recurrence.[2,7] Based on an international survey of practice among surgeons worldwide, the discrepancy in drain insertion method was reported, the SDD placement was the most preferred technique (50%), whereas 27% of respondents used the SPD and 23% used an SDD primarily and SPD otherwise.[22] There is also considerable diversity among surgeons at our institution. There have been several researches comparing the efficacy of SDD with SPD, but only a handful have been well-designed randomized controlled trials. The purpose of the current study is to provide our personal single-center experience comparing the efficacy of two techniques.

The current study found no statistically significant differences between SDD and SPD in terms of clinical outcomes (as defined by mRS), postoperative imaging characteristics, complication rate, or recurrence rate. Despite this, we found two cases of symptomatic recurrence in the SPD group that required reoperation within 48 h of surgery. In one case, the preoperative CT appearance was laminar, while in the other case, it was layered. We decided to reexamine the burr holes and we discovered and broke all remaining thin subdural membranes. SPD was placed after copious irrigation. Both of them have obtained favorable outcome (mRS 0) after 3 and 6 months of follow-up. We observed no clinical characteristics that could increase the likelihood of recurrence; nevertheless, other than the manner of drain insertion, the plausible explanation could be related to surgical skill or the surgeon's experience.

Table 3: Midline shift from CSDH in each group.

MLS	Group I (SDD) 21 patients *n* (%)	Group II (SPD) 21 patients *n* (%)	Total 42 patients *n* ()	*P*-value
Preoperative				
No MLS	4 (19)	3 (14.3)	7 (16.7)	0.849
< 5 mm	3 (14.3)	3 (14.3)	6 (14.3)	
5–10 mm	6 (28.6)	9 (42.9)	15 (35.7)	
>10 mm	8 (38.1)	6 (28.6)	14 (33.3)	
Postoperative 48 h				
No MLS	10 (47.6)	9 (42.9)	19 (45.2)	1.000
<5 mm	8 (38.1)	8 (38.1)	16 (38.1)	
5–10 mm	3 (14.3)	4 (19)	7 (16.7)	
>10 mm	0 (0)	0 (0)	0 (0)	
Postoperative 3 months*				
No MLS	7 (33.3)	6 (28.5)	13 (30.9)	1.000
<5 mm	0 (0)	1 (4.7)	1 (2.4)	
5–10 mm	0 (0)	0 (0)	0 (0)	
>10 mm	0 (0)	0 (0)	0 (0)	
Postoperative 6 months*				
No MLS	1 (4.8)	1 (4.8)	2 (4.8)	-
<5 mm	0 (0)	0 (0)	0 (0)	
5–10 mm	0 (0)	0 (0)	0 (0)	
>10 mm	0 (0)	0 (0)	0 (0)	

*In 14 patients with residual CSDH, there is one patient who has MLS <5 mm showed on 3 months imaging, and MLS was turned to normal at 6 months imaging. CSDH: Chronic subdural hematoma, MLS: Midline shift, SDD: Subdural drain, SPD: Subperiosteal drain

Table 4: Thickness of CSDH in each group.

Hematoma thickness	Group I (SDD) 21 patients *n* (%)	Group II 21 patients (SPD) *n* (%)	Total 42 patients *n* (%)	*P*-value
Pre				
<5 mm	0 (0)	0 (0)	0 (0)	0.232
5–10 mm	3 (14.3)	0 (0)	3 (7.1)	
>10 mm	18 (85.7)	21 (100)	39 (92.7)	
Postoperative 48 h				
<5 mm	9 (42.9)	5 (23.8)	14 (33.3)	0.448
5–10 mm	8 (38.1)	11 (52.4)	19 (45.2)	
>10 mm	4 (19)	5 (23.8)	9 (21.4)	
Postoperative 3 months*				
<5 mm	5 (23.8)	7 (33.3)	12 (28.6)	0.200
5–10 mm	2 (9.5)	0 (0)	2 (4.8)	
>10 mm	0 (0)	0 (0)	0 (0)	
Postoperative 6 months*				
<5 mm	1 (4.8)	1 (4.8)	2 (4.8)	-
5–10 mm	0 (0)	0 (0)	0 (0)	
>10 mm	0 (0)	0 (0)	0 (0)	

*At 3 months imaging, 12 patients in 14 patients with residual CSDH have the maximum thickness <5 mm, and two patients have 5–10 mm. On 6 months imaging follow-up, only two patients still have CSDH thickness < 5 mm. CSDH: Chronic subdural hematoma, SDD: Subdural drain, SPD: Subperiosteal drain

Our findings were consistent with those of other studies. A nonrandomized prospective study by Chih *et al.* compared the efficacy of SDD versus SPD for the treatment of 30 symptomatic CSDH patients per group and found no significant statistical differences between the two groups in pre- and post-operative symptoms, postoperative hematoma

Table 5: Presence of postoperative pneumocephalus (postoperative 48 h).

	Group I (SDD) 21 patients *n* (%)	Group II (SPD) 21 patients *n* (%)	Total 42 patients *n* (%)	*P*-value
Pneumocephalus thickness	17 (81)	18 (85.7)	35 (83.3)	0.334
<10 mm	14 (82.3)	10 (55.5)	24 (68.6)	
10–20 mm	0 (0)	6 (33.3)	6 (17.2)	
>20 mm	3 (17.7)	2 (11.1)	5 (14.3)	

SDD: Subdural drain, SPD: Subperiosteal drain

Table 6: Comparison of clinical outcomes between SDD and SPD groups.

	Group I (SDD) 21 patients *n* (%)	Group II (SPD) 21 patients *n* (%)	Total 42 patients *n* (%)	*P*-value
Recurrence, *n* (%)	0 (0)	2 (4.8)	2 (4.8)	
Complete resolution at 3 months, *n* (%)	14 (66.7)	14 (66.7)	28 (66.7)	0.733
Complete resolution at 6 months, *n* (%)	21 (100)	19 (90.5)	40 (95.2)	1.000
Amount of drain (ml)				
<100 ml	10 (47.7)	6 (28.6)	16 (38.1)	0.257
100–200 ml	7 (33.3)	6 (28.6)	13 (30.9)	
>200 ml	4 (19)	9 (42.9)	13 (30.9)	
Preoperative mRS score				
Favorable (mRS 0–3), *n* (%)	17 (80.9)	19 (90.5)	36 (85.7)	0.663
Unfavorable (mRS>4), *n* (%)	4 (19)	2 (9.5)	6 (14.3)	
48 h mRS score				
Favorable (mRS 0–3), *n* (%)	17 (80.9)	19 (90.5)	36 (85.7)	0.663
Unfavorable (mRS>4), *n* (%)	4 (19)	2 (9.5)	6 (14.3)	
3 months mRS score				
Favorable (mRS 0–3), *n* (%)	20 (95.2)	21 (100)	41 (97.6)	1.000
Unfavorable (mRS>4), *n* (%)	1 (4.8)	0 (0)	1 (2.4)	
6 months mRS score				
Favorable (mRS 0–3), *n* (%)	20 (95.2)	21 (100)	41 (97.6)	0.488
Unfavorable (mRS>4), *n* (%)	1 (5)	0 (0)	1 (2.4)	

SDD: Subdural drain, SPD: Subperiosteal drain, mRS: Modified Rankin scale

volume and recurrence, mortality, or functional outcome at discharge and at the 3-month follow-up. In their study, they used a single burr hole technique and concluded that while both the SDD and SPD are equally effective, the SPD eliminates the risk of unintentional brain parenchymal penetration.[4] Kaliaperumal *et al.* (2012), they conducted a prospective randomized study, which comprised 25 patients in each arm. They used the same two burr holes techniques as we did in our study. They reported that patients treated with SPD had better mRS scores before and after surgery, and at 3 and 6 months postoperatively, no recurrence showed in both groups. They also highlighted the risk of unintentional brain parenchymal penetration of the SDD.[8] Soleman *et al.* (2019), on the other hand, recently published a large multicenter, prospective RCT that comprised 120 SPD against 100 SDD. They found that the recurrence rate was lower in the SPD group (8.33%, 95% confidence interval [CI] 4.28–14.72) than in the SDD group (12.00%, 95% CI 6.66–19.73). Furthermore, the SPD group had significantly decreased rates of postoperative infections ($P = 0.0406$) and iatrogenic morbidity ($P = 0.0184$) due to drain placement.[19] It's worth mentioning that the SDD group had a misplaced drain rate of up to 17%; this could be due to their SDD insertion technique, which entails inserting the SDD all the way between the anterior and posterior burr holes. This point differs from ours in that the SDD is inserted into anterior burr hole not exceed 2–3 cm and the drain is usually removed within 48–72 h. Then, in the present study, we found that neither the SPD nor the SDD groups had any misplaced drains or infections.

All of our patients underwent follow-up imaging at 48 h, 3 months, and 6 months, which were an interesting aspect of our study. It is possible to examine the temporal profile of

Table 7: Comparison of the unfavorable outcome at postoperative 48 h between groups.

	Group I (SDD)	Group II (SPD)	*P*-value
	Unfavorable 4 patients *n* (%)	Unfavorable 2 patients *n* (%)	
Preoperative density			
Homogenous hypodensity	0 (0)	0 (0)	0.221
Homogenous isodensity	1 (25)	0 (0)	
Laminar	0 (0)	1 (50)	
Layered	2 (50)	1 (50)	
Trabecular	1 (25)	0 (0)	
Postoperative density at 48 h			
Homogenous hypodensity	3 (75)	0 (0)	0.400
Homogenous isodensity	0 (0)	0 (0)	
Laminar	0 (0)	2 (100)	
Layered	1 (25)	0 (0)	
Trabecular	0 (0)	0 (0)	
Amount of drain (ml)			
<100 ml	4 (100)	1 (50)	0.537
100–200 ml	0 (0)	0 (0)	
>200 ml	0 (0)	1 (50)	
Pneumocephalus thickness			
<10 mm	2 (0)	0 (0)	0.096
10–20 mm	0 (0)	1 (100)	
>20 mm	0 (0)	0 (0)	

SDD: Subdural drain, SPD: Subperiosteal drain

postoperative hematoma appearance. At 48 h, all patients had a remnant hematoma that was radiographically identified as homogeneous hypodensity (59.5%), homogenous isodensity (7.1%), laminar (28.6%), and trabecular type (4.8%). In 45.2% of cases, the MLS was resolved, 38.1% remained at 5 mm, and 16.7% remained at 5–10 mm. Our data suggest that postoperative residual hematoma and MLS that persist at 48 h do not necessitate reoperation and have no effect on the clinical outcome. Furthermore, because the majority of patients had complete radiographic remission after 3 months (66.6%) and 6 months (95.2%), we then propose that routine postoperative imaging is unnecessary, unless the patient remains symptomatic. In terms of amount of drain, the SPD group had considerably more patients with >200 ml drainage. (The SPD and SDD groups had nine and four patients, respectively.) This could be due to the suction effect of the Redivac suction drain in SPD versus the gravity drain in SDD. Many clinical and imaging factors that associated with recurrence have been reported in the literature, such as diabetic mellitus, preoperative headache, anticoagulant and preoperative MLS,[9] preoperative hematoma volume, high density, separated or locution CSDH on preoperative CT scan,[13,14,22] postoperative pneumocephalus >15 mm,[21,22] and postoperative amount of drainage <200 ml,[10] but all of them were not identified in our study.

The current study's disadvantage is that we only had a limited sample size, therefore, the differences between the two groups were not significant. As a result, in the future, we advocate doing a prospective, randomized, multicenter study with a larger sample size to confirm our findings. In conclusion, the surgical technique for both types of drain placement is typically simple; most surgeons are more familiar with the SDD; but, for patients with limited subdural space following hematoma evacuation, the SPD may be the preferred option to avoid iatrogenic brain injury.

CONCLUSION

Our findings revealed that both SDD and SPD are equally effective in the treatment of CSDH patients, with no differences in final clinical and radiographic outcomes. The surgeon's preference will determine which procedure is used. It is more crucial to have a good surgical technique. If the patient has no signs or symptoms of recurrence, postoperative imaging is not required. To reach a precise conclusion, a prospective, randomized, multicenter study with a larger sample size may be required.

Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Jetjumnong C, Pathoumthong K. Comparative study of subdural drain (SDD) versus sub periosteal drain (SPD) in treating patient with chronic subdural hematoma (CSDH). Surg Neurol Int 2021;12:421.