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EFFECT OF SUBDURAL DRAIN PLACEMENT ON RECURRENCE AND POSTOPERATIVE OUTCOMES IN CHRONIC SUBDURAL HEMATOMA: A COMPARATIVE STUDY

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ABSTRACT

Background: Chronic subdural hematoma (CSDH) is a common neurosurgical condition in elderly patients and is associated with significant morbidity and recurrence following surgical evacuation. Postoperative subdural drain placement following burr-hole evacuation, including the use of negative suction, has been advocated to reduce recurrence and improve postoperative outcomes. However, controversy persists regarding its routine use, particularly in resource-limited healthcare settings. The aim & objective is to compare recurrence, mortality, and postoperative outcomes in patients undergoing burr-hole evacuation of chronic subdural hematoma with standard subdural drain placement, without postoperative subdural drain placement, and with postoperative negative suction drain placement.

Materials and Methods: This study included 90 patients with chronic subdural hematoma undergoing burr-hole craniostomy between 2022 and 2025. Patients were divided into three groups: standard drain group (n = 30), no-drain group (n = 30), and negative suction drain group (n = 30). Additionally, an equal number of cases requiring craniotomy and membranectomy along with evacuation of subdural hematoma were retrospectively compared. The indication for craniotomy was the presence of septations on MRI imaging, in which membranectomy is mandatory to avoid recurrence. Demographic, clinical, radiological, and postoperative outcome variables were analyzed. Recurrence, mortality, duration of hospital stay, and predictors of recurrence were evaluated using univariate and multivariate analyses.

Results: The mean age was comparable across all three groups (standard drain: 63.4 ± 9.2 years; no-drain: 64.1 ± 8.8 years; negative suction drain: 63.8 ± 9.0 years; $p = 0.72$). Recurrence was significantly lower in the negative suction drain group (3.3%) compared with the standard drain group (10.0%) and the no-drain group (26.7%; $p < 0.05$). Mortality was also lowest in the negative suction drain group (0.0%), followed by the standard drain group (3.3%) and the no-drain group (6.7%; $p = 0.08$). Early brain expansion was observed most frequently in the negative suction drain group. The mean duration of hospital stay was significantly shorter in the negative suction drain group (4.2 ± 1.2 days) compared with the standard drain group (5.6 ± 1.8 days) and the no-drain group (6.9 ± 2.2 days; $p < 0.01$). Bilateral hematoma (OR: 3.42; 95% CI: 1.12–10.48; $p = 0.03$) and absence of drain placement (OR: 3.76; 95% CI: 1.18–11.92; $p = 0.02$) were identified as independent predictors of recurrence.

Conclusion: Postoperative subdural drain placement, particularly with negative suction, following burr-hole evacuation of chronic subdural

hematoma was associated with significantly lower recurrence rates, early brain expansion, earlier hospital discharge, and better overall health outcomes. Bilateral hematoma and absence of drain placement were identified as significant predictors of recurrence.
Keywords: Subdural Drain Placement, Chronic Subdural Hematoma, Burr-hole craniostomy, membranectomy.

INTRODUCTION

Chronic subdural hematoma (CSDH) is one of the most commonly encountered neurosurgical disorders in elderly patients and is characterized by the accumulation of blood and liquefied hematoma within the subdural space between the dura mater and the arachnoid membrane.[1] CSDH predominantly affects older adults, and its incidence has increased substantially over recent decades because of increasing life expectancy, the widespread use of anticoagulant and antiplatelet medications, and improved access to neuroimaging techniques.[2,3] The condition represents a significant cause of morbidity and healthcare utilization in aging populations.[2]

The pathophysiology of CSDH is multifactorial and involves the rupture of bridging veins, inflammatory responses, angiogenesis, and repeated microhemorrhages within the hematoma membranes.[4] Age-related cerebral atrophy predisposes elderly individuals to stretching and rupture of fragile bridging veins even after trivial head injury.[5] In addition, anticoagulant therapy, alcohol abuse, coagulopathy, recurrent falls, and seizure disorders further increase the risk of hematoma formation and recurrence.[3,5]

Clinically, patients with CSDH may present with headache, cognitive decline, gait disturbances, focal neurological deficits, altered sensorium, or hemiparesis.[6] Because symptom onset is often gradual and nonspecific, diagnosis may be delayed, particularly in elderly individuals whose symptoms may mimic dementia or cerebrovascular disease.[6] Non-contrast computed tomography (CT) remains the imaging modality of choice for diagnosis and typically demonstrates crescent-shaped hypodense or mixed-density collections associated with varying degrees of mass effect and midline shift.[7]

Surgical evacuation remains the standard treatment for symptomatic CSDH and for lesions producing significant neurological compromise or radiological mass effect.[8] Burr-hole craniostomy is the most widely performed surgical procedure because it is technically simple, minimally invasive, and associated with satisfactory clinical outcomes.[8] However, recurrence following surgical evacuation remains a major concern, with reported recurrence rates ranging from 10% to 20%.[9] Residual hematoma cavity, inadequate brain re-expansion, persistent subdural space, and recurrent bleeding from neomembranes are believed to contribute to postoperative recurrence.[4,10]

To reduce recurrence, postoperative placement of a closed subdural drainage system following burr-hole evacuation has increasingly been advocated. Recently, the use of negative suction drainage has gained attention as a potential modification that may further enhance subdural fluid evacuation, promote earlier brain re-expansion, and reduce recurrence rates. Several studies have demonstrated that drain placement decreases recurrence rates, improves brain re-expansion, and reduces the need for reoperation.

Despite the widespread use of postoperative drains, controversy persists regarding their routine use following burr-hole evacuation of CSDH. Evidence from developing countries and rural healthcare settings remains limited. Therefore, the present study was undertaken to compare the outcomes of chronic subdural hematoma surgeries performed with three management strategies: standard subdural drain placement, no drain placement, and negative suction drain placement, with emphasis on recurrence, mortality, morbidity, and postoperative recovery.

MATERIALS AND METHODS

Study Design and Setting: This retrospective study was conducted in the Department of General Surgery at Seth GS Medical College & KEM Hospital, Mumbai, India, between 2022 and 2025. The study compared postoperative outcomes in patients with chronic subdural hematoma (CSDH) undergoing burr-hole evacuation with three management strategies: standard postoperative subdural drain placement, burr-hole evacuation without drain placement, and postoperative negative suction drain placement. Additionally, an equal number of cases requiring craniotomy and membranectomy along with evacuation of subdural hematoma were retrospectively compared. The indication for craniotomy was the presence of septations on CT or MRI imaging, in which membranectomy is mandatory to avoid recurrence.

The study protocol was approved by the Institutional Ethics Committee prior to the commencement of the study, and written informed consent was obtained from all participants or their legally authorized representatives.

Study Population:

Patients diagnosed with chronic subdural hematoma based on clinical presentation and radiological findings were screened for eligibility. Diagnosis was confirmed using non-contrast computed tomography (CT) or MRI of the brain demonstrating hypodense or mixed-density subdural collections consistent with chronic subdural hematoma.

Inclusion Criteria

- Patients aged ≥ 18 years.
- Patients diagnosed with unilateral or bilateral chronic subdural hematoma.
- Patients undergoing burr-hole craniostomy or craniotomy for surgical evacuation.
- Patients willing to provide informed consent.

Exclusion Criteria

- Acute or subacute subdural hematoma.
- Patients managed conservatively without surgery.
- Recurrent chronic subdural hematoma previously operated elsewhere.
- Associated intracranial pathologies such as intracerebral hemorrhage or brain tumors.
- Patients with incomplete clinical records or inadequate follow-up.

Group Allocation: A total of 90 patients fulfilling the eligibility criteria for burr-hole craniostomy were included in the study. Patients were divided into three groups:

- **Standard drain group:** Patients undergoing burr-hole evacuation with postoperative subdural drain placement connected to a gravity drainage bag (n = 30). An atraumatic Jackson-Pratt drain was inserted through the posterior (parietal) burr hole without using undue force.
- **No-drain group:** Patients undergoing burr-hole evacuation without drain placement (n = 30).
- **Negative suction drain group:** Patients undergoing burr-hole evacuation with postoperative subdural drain placement connected to a closed negative suction system (n = 30). An atraumatic Jackson-Pratt drain was similarly inserted through the posterior (parietal) burr hole without undue force.

Preoperative Assessment: Detailed demographic and clinical information, including age, sex, presenting symptoms, history of trauma, comorbidities, use of anticoagulant or antiplatelet medications, and neurological examination findings, were recorded. Baseline Glasgow Coma Scale (GCS) scores were assessed for all patients. Routine laboratory investigations, including complete blood count, renal function tests, coagulation profile, blood sugar levels, and serum electrolytes, were performed preoperatively.

Radiological parameters assessed on CT scan included:

- Hematoma thickness
- Midline shift
- Hematoma laterality (right, left, or bilateral)
- Density characteristics of hematoma

Midline shift and hematoma size have been identified as important radiological parameters influencing postoperative outcomes and recurrence in previous studies.[8,9]

Surgical Procedure: All patients underwent burr-hole craniostomy under appropriate anesthesia. Equal numbers of patients requiring craniotomies were also studied in each group. Following the evacuation of liquefied hematoma and irrigation with normal saline, patients in the standard drain group underwent placement of a closed subdural drainage system through the burr-hole site connected to a gravity drainage bag. An atraumatic Jackson-Pratt drain was inserted through the posterior (parietal) burr hole without using undue force. Patients in the negative suction drain group underwent placement of a closed subdural drainage system connected to a negative suction apparatus maintaining continuous low-grade negative pressure, with the Jackson-Pratt drain similarly inserted through the posterior (parietal) burr hole without undue force. The placement of postoperative drainage following burr-hole evacuation has been reported to reduce recurrence rates and improve postoperative outcomes.

In the standard drain group, the drain was connected to a sterile closed drainage bag and maintained postoperatively according to institutional protocol. In the negative suction drain group, the drain was connected to a closed negative suction system maintaining continuous low-grade suction and was monitored for suction level and drain output. In the no-drain group, burr-hole evacuation and irrigation were performed without postoperative drain placement. The surgical wound was closed in layers using standard aseptic precautions in all groups.

Postoperative Management and Follow-Up

All patients were monitored postoperatively for neurological improvement, complications, recurrence, and mortality. Postoperative CT brain imaging was performed when clinically indicated or during follow-up assessment.

Patients with subdural drains were additionally monitored for:

- Drain output volume
- Duration of drain placement
- Drain-related complications
- Suction level (in the negative suction drain group)
- Rate of brain re-expansion on follow-up imaging

The drain was removed following a satisfactory reduction in drainage output and adequate neurological recovery. Previous studies have shown that prolonged drainage may reduce the recurrence of chronic subdural hematoma.[10]

Outcome Measures

Primary Outcomes

- Recurrence of chronic subdural hematoma
- Mortality

Secondary Outcomes

- Duration of hospital stay
- Postoperative morbidity
- Early brain re-expansion
- Association of clinical and radiological factors with recurrence

Recurrence was defined as the reaccumulation of hematoma requiring repeat surgical intervention during the follow-up period.

Sample Size: The sample size for the present study was calculated based on the recurrence rates reported in the randomized controlled trial conducted by Santarius et al.[11] Considering feasibility, study duration, and availability of eligible patients, a total of 90 patients undergoing burr-hole craniostomy were included in the present study, with 30 patients allocated to each of the three groups.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were expressed as frequency and percentage.

Student's t-test was used for continuous variables, and the chi-square test was used for categorical variables. One-way analysis of variance (ANOVA) was used to compare continuous variables across the three groups. Variables associated with recurrence on univariate analysis were further evaluated using multivariate logistic regression analysis to identify independent predictors of recurrence. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A p-value of <0.05 was considered statistically significant.

RESULTS

This study included 90 patients with chronic subdural hematoma undergoing burr-hole craniostomy between 2022 and 2025. Patients were divided into three groups: standard drain group (n = 30), no-drain group (n = 30), and negative suction drain group (n = 30).

[Table 1] demonstrates comparable baseline demographic and clinical characteristics across all three groups. The mean age was comparable (standard drain: 63.4 ± 9.2 years; no-drain: 64.1 ± 8.8 years; negative suction drain: 63.8 ± 9.0 years; p = 0.72). Male patients constituted 76.7%, 73.3%, and 80.0% of the standard drain, no-drain, and negative suction drain groups, respectively (p = 0.81). Hypertension was present in 46.7%, 50.0%, and 43.3% of patients (p = 0.87), while diabetes mellitus was observed in 26.7%, 23.3%, and 30.0% (p = 0.79). History of trauma was noted in 70.0%, 63.3%, and 73.3% of patients (p = 0.63). Right-sided hematoma was the most common presentation across all groups (p = 0.85).

[Table 2] reveals that Overall, radiological characteristics including hematoma thickness, midline shift, and laterality were comparable among all three groups.

[Figure 1] illustrates the postoperative outcomes in patients undergoing burr-hole evacuation across the three study groups. The recurrence rate was significantly lower in the negative suction drain group (3.3%; 1/30) compared with the standard drain group (10.0%; 3/30) and the no-drain group (26.7%; 8/30; p < 0.05). Mortality was lowest in the negative suction drain group (0.0%; 0/30), followed by the standard drain group (3.3%; 1/30) and the no-drain group (6.7%; 2/30; p = 0.08). Early brain expansion was observed in 90.0% of patients in the negative suction drain group compared with 66.7% in the standard drain group and 0% in the no-drain group (p < 0.01). The mean hospital stay was significantly shorter in the negative suction drain group (4.2 ± 1.2 days) compared with the standard drain group (5.6 ± 1.8 days) and the no-drain group (6.9 ± 2.2 days; p < 0.01).

[Table 3] demonstrates the postoperative outcomes across all three groups. The recurrence rate was significantly lower in the negative suction drain group (3.3%) compared with the standard drain group (10.0%) and the no-drain group (26.7%; p < 0.05). Mortality was lowest in the negative suction drain group (0.0%), followed by the standard drain group (3.3%) and the no-drain group (6.7%; p = 0.08). Early brain expansion was observed most frequently in the negative suction drain group (90.0%), followed by the standard drain group (66.7%); no early brain expansion was observed in the no-drain group. The mean duration of hospital stay was significantly shorter in the negative suction drain group (4.2 ± 1.2 days) compared with the standard drain group (5.6 ± 1.8 days) and the no-drain group (6.9 ± 2.2 days; p < 0.01).

[Table 4] demonstrates the univariate analysis of factors associated with the recurrence of chronic subdural hematoma. Patients aged ≥ 65 years constituted 66.7% of the recurrence group compared with 42.3% of the non-recurrence group (p = 0.13). Bilateral hematoma was significantly associated with recurrence, being present in 41.7% of recurrence cases compared with 12.8% of non-recurrence cases (p = 0.02). The absence of drain placement was also significantly associated with recurrence (p = 0.01). Hematoma thickness >20 mm (p = 0.04) and anticoagulant therapy (p = 0.03) were also significantly associated with recurrence.

[Table 5] presents the multivariate logistic regression analysis of predictors of recurrence. Bilateral hematoma emerged as a significant independent predictor of recurrence with an odds ratio (OR) of 3.42 (95% CI: 1.12–10.48; p = 0.03). Similarly, the absence of drain placement was independently associated with recurrence, with an OR of 3.76 (95% CI: 1.18–11.92; p = 0.02). Antiplatelet therapy, hematoma thickness >20 mm, and midline shift >5 mm demonstrated increased odds of recurrence; however, these associations did not reach statistical significance.

[Table 6] summarizes the drain characteristics and outcomes in both drain groups. The mean drain output was comparable between the two groups (128 ± 46 ml vs. 142 ± 38 ml; p = 0.22). The mean duration of drain placement was shorter in the negative suction drain group (1.8 ± 0.5 days vs. 2.1 ± 0.6 days; p = 0.05). Recurrence in the standard drain group occurred in 22.2% of patients with drain output >150 ml compared with 4.8% of patients with drain output ≤150 ml, suggesting a trend toward higher recurrence with increased postoperative drainage volume. In the negative suction drain group, no recurrence was observed among patients with drain output >150 ml.

Table 1: Baseline Demographic and Clinical Characteristics of Study Participants

Variable	Standard Drain Group (n = 30)	No-Drain Group (n = 30)	Negative Suction Drain Group (n = 30)	p-value
Age (years), mean ± SD	63.4 ± 9.2	64.1 ± 8.8	63.8 ± 9.0	0.72
Male, n (%)	23 (76.7)	22 (73.3)	24 (80.0)	0.81
Female, n (%)	7 (23.3)	8 (26.7)	6 (20.0)	-
Hypertension, n (%)	14 (46.7)	15 (50.0)	13 (43.3)	0.87
Diabetes mellitus, n (%)	8 (26.7)	7 (23.3)	9 (30.0)	0.79
Antiplatelet therapy, n (%)	6 (20.0)	5 (16.7)	7 (23.3)	0.78
Anticoagulant therapy, n (%)	2 (6.7)	3 (10.0)	2 (6.7)	0.82
History of trauma, n (%)	21 (70.0)	19 (63.3)	22 (73.3)	0.63
Right-sided hematoma, n (%)	13 (43.3)	14 (46.7)	12 (40.0)	0.85
Left-sided hematoma, n (%)	12 (40.0)	11 (36.7)	13 (43.3)	0.83
Bilateral hematoma, n (%)	5 (16.7)	5 (16.7)	5 (16.7)	1.00

Table 2: Radiological Characteristics of Hematoma

Radiological Parameter	Standard Drain Group (n = 30)	No-Drain Group (n = 30)	Negative Suction Drain Group (n = 30)	p-value
Hematoma thickness (mm), mean ± SD	18.6 ± 4.3	19.1 ± 4.7	18.8 ± 4.5	0.84
Midline shift (mm), mean ± SD	6.2 ± 2.1	6.5 ± 2.4	6.3 ± 2.2	0.76
Right-sided hematoma, n (%)	13 (43.3)	14 (46.7)	12 (40.0)	0.85
Left-sided hematoma, n (%)	12 (40.0)	11 (36.7)	13 (43.3)	0.83
Bilateral hematoma, n (%)	5 (16.7)	5 (16.7)	5 (16.7)	1.00

Table 3: Comparison of Postoperative Outcomes

Outcome	Standard Drain Group (n = 30)	No-Drain Group (n = 30)	Negative Suction Drain Group (n = 30)	p-value
Recurrence, n (%)	3 (10.0)	8 (26.7)	1 (3.3)	<0.05*
Mortality, n (%)	1 (3.3)	2 (6.7)	0 (0.0)	0.08
Early brain expansion, n (%)	20 (66.7)	0 (0.0)	27 (90.0)	<0.01*
Hospital stay (days), mean ± SD	5.6 ± 1.8	6.9 ± 2.2	4.2 ± 1.2	<0.01*

*Significant

Table 4: Univariate Analysis of Factors Associated with Recurrence

Variable	Recurrence (n = 12)	No Recurrence (n = 78)	p-value
Age ≥ 65 years	8 (66.7)	33 (42.3)	0.13
Male gender	10 (83.3)	59 (75.6)	0.53
Hypertension	7 (58.3)	35 (44.9)	0.40
Diabetes mellitus	5 (41.7)	19 (24.4)	0.17
Antiplatelet therapy	5 (41.7)	13 (16.7)	0.05*
Anticoagulant therapy	3 (25.0)	4 (5.1)	0.03*
Bilateral hematoma	5 (41.7)	10 (12.8)	0.02*
Hematoma thickness >20 mm	7 (58.3)	22 (28.2)	0.04*
Midline shift >5 mm	8 (66.7)	31 (39.7)	0.08
No drain placement	8 (66.7)	22 (28.2)	0.01*

*Significant

Table 5: Multivariate Logistic Regression Analysis of Predictors of Recurrence

Variable	Adjusted OR	95% CI	p-value
Age ≥ 65 years	2.15	0.68–6.82	0.19
Antiplatelet therapy	2.34	0.71–7.72	0.16
Anticoagulant therapy	2.89	0.52–16.08	0.23
Bilateral hematoma	3.42	1.12–10.48	0.03*
Hematoma thickness >20 mm	2.21	0.78–6.24	0.13
Midline shift >5 mm	1.89	0.67–5.32	0.21
No drain placement	3.76	1.18–11.92	0.02*

*Significant

Table 6: Drain Characteristics and Outcomes

Variable	Standard Drain Group (n = 30)	Negative Suction Drain Group (n = 30)	p-value
Mean drain output (ml), mean ± SD	128 ± 46	142 ± 38	0.22

Duration of drain placement (days), mean ± SD	2.1 ± 0.6	1.8 ± 0.5	0.05*
Drain output >150 ml, n (%)	9 (30.0)	6 (20.0)	0.37
Drain output ≤150 ml, n (%)	21 (70.0)	24 (80.0)	0.37
Recurrence with drain output >150 ml, n (%)	2 (22.2)	0 (0.0)	0.14
Recurrence with drain output ≤150 ml, n (%)	1 (4.8)	1 (4.2)	0.92

*Significant

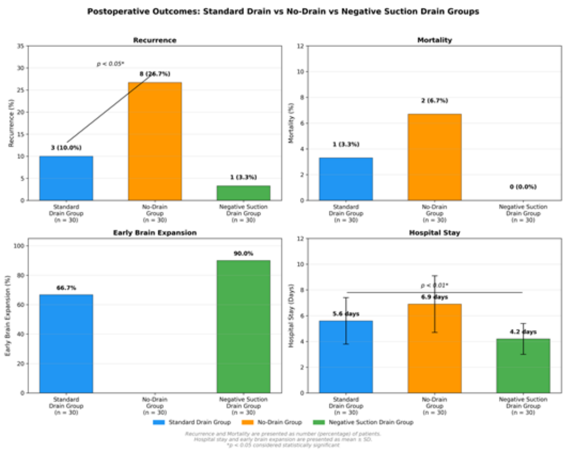

Figure 1: Comparison of Postoperative Outcomes Across Three Groups

DISCUSSION

The present study compared postoperative outcomes in patients undergoing burr-hole evacuation with three management strategies: standard subdural drain placement, no drain placement, and negative suction drain placement, with special emphasis on recurrence, mortality, duration of hospital stay, and brain re-expansion. An atraumatic Jackson-Pratt drain was used in both drain groups, inserted through the posterior (parietal) burr hole without undue force. Additionally, an equal number of cases requiring craniotomy and membranectomy along with evacuation of subdural hematoma were retrospectively compared. The indication for craniotomy in these cases was the presence of septations on CT/MRI imaging, where membranectomy is mandatory to avoid recurrence. In such septated chronic subdural hematomas, burr-hole evacuation alone may be insufficient due to the presence of fibrous septations and multiloculated collections that prevent complete drainage. Craniotomy with membranectomy allows direct visualization and complete removal of the hematoma membranes and septations, thereby reducing the risk of recurrence in these complex cases.

In the present study, the mean age of patients was approximately 64 years, with a predominance of male patients across all three groups. Similar demographic findings have been consistently reported in previous studies. Baechli et al. observed that CSDH predominantly affects elderly males because of cerebral atrophy and increased susceptibility to minor trauma.[3] Sousa et al. also reported a higher incidence among elderly men and attributed this to greater exposure to trauma and vascular risk factors.[5] Age-related cerebral atrophy increases tension on bridging veins, thereby predisposing elderly individuals to hematoma formation even after trivial trauma.[4]

History of trauma was present in the majority of patients in the present study. Minor head injury remains the most common precipitating factor in the development of CSDH.[6] However, hematoma enlargement occurs gradually because of recurrent microhemorrhages and inflammatory changes within the hematoma membranes.[7] The significant prevalence of hypertension and diabetes mellitus in the present study reflects the comorbidity burden commonly observed in elderly neurosurgical patients.[3, 4]

Radiological parameters, including hematoma thickness and midline shift, were comparable among all three groups. Previous studies have demonstrated that larger hematoma size, greater midline shift, and bilateral hematomas may influence postoperative recurrence and neurological outcomes.[8, 9] In the present study, bilateral hematoma was significantly associated with recurrence on univariate analysis and remained an independent predictor of recurrence on multivariate logistic regression analysis. Similar findings have been reported by Ohba et al., who identified bilateral hematoma as an important predictor of recurrence following surgical evacuation.[12]

The most important observation in the present study was the significantly lower recurrence rate in the negative suction drain group compared with both the standard drain group and the no-drain group. Recurrence was observed in only 3.3% of patients in the negative suction drain group, compared with 10.0% in the standard drain group and 26.7% in the no-drain group. This difference was both clinically and statistically meaningful. Similar findings were reported in the landmark randomized controlled trial conducted by Santarius et al.[11], which demonstrated significantly lower recurrence rates and reoperation rates in patients treated with postoperative subdural drains.

The beneficial effect of postoperative drainage may be explained by continuous evacuation of residual hematoma fluid, reduction in subdural dead space, and facilitation of gradual brain re-expansion. The additional benefit of negative suction may be attributed to enhanced negative pressure promoting more rapid and complete drainage of residual hematoma fluid, thereby facilitating earlier brain expansion and reducing the residual subdural space. A large systematic review and meta-analysis by Almenawer et al.[9] involving more than 34,000 patients concluded that postoperative drainage significantly decreases recurrence rates and improves postoperative outcomes in patients with CSDH.

Mortality in the present study was low across all three groups, with the lowest mortality observed in the negative suction drain group (0.0%). Previous studies have similarly demonstrated relatively low mortality rates following burr-hole evacuation of CSDH.[10, 11] Mortality in such patients is more commonly related to advanced age, pre-existing systemic illness, neurological status at presentation, and associated medical comorbidities rather than the surgical procedure itself.[13]

An important finding in the present study was the significantly shorter hospital stay in patients managed with postoperative drain placement, with the negative suction drain group demonstrating the earliest discharge. The mean duration of hospitalization was 4.2 ± 1.2 days in the negative suction drain group, 5.6 ± 1.8 days in the standard drain group, and 6.9 ± 2.2 days in the no-drain group ($p < 0.01$). Reduced recurrence, better postoperative brain re-expansion, and improved neurological recovery may contribute to shorter hospitalization among patients receiving postoperative drainage, particularly with negative suction.

In the present study, antiplatelet therapy and larger hematoma thickness demonstrated increased odds of recurrence, although statistical significance was not achieved for antiplatelet therapy on multivariate analysis. Antithrombotic therapy has been recognized as an important risk factor for recurrence because of impaired hemostasis and increased tendency for recurrent bleeding within hematoma membranes.[14, 12] Rust et al. demonstrated that anticoagulant and antiplatelet therapy were associated with increased recurrence risk following surgical treatment of CSDH.[15]

Drain-related outcomes in the present study demonstrated that the negative suction drain group had the lowest recurrence rate and the best functional outcomes. Patients in the negative suction drain group showed early brain expansion on postoperative imaging in 90.0% of cases, compared with 66.7% in the standard drain group. Higher drain output volumes were associated with greater recurrence rates in the standard drain group. Patients with drain output >150 ml showed recurrence in 22.2% of cases compared with 4.8% among those with lower drainage volume. Larger postoperative drainage volumes may reflect greater residual hematoma cavity and delayed brain re-expansion. However, further studies are necessary to validate this association.

Despite the advantages of postoperative drainage, concerns regarding drain-related complications remain. Potential complications include infection, seizures, pneumocephalus, intracerebral hemorrhage, and over-drainage. In the negative suction drain group, the level of negative pressure was carefully monitored and maintained at a low grade to minimize the risk of over-drainage. Clinically significant complications were relatively uncommon when closed drainage systems and strict aseptic precautions were employed. No major drain-related complications were observed in any of the three groups in the present study.

The findings of the present study support the growing evidence favoring postoperative subdural drain placement following burr-hole evacuation of chronic subdural hematoma. Furthermore, the use of negative suction drain placement appears to provide additional benefits in terms of further reducing recurrence, promoting earlier brain expansion, and enabling earlier discharge. In resource-limited and rural healthcare settings, reducing recurrence and repeat surgeries is particularly important because repeat interventions increase financial burden, hospital occupancy, and patient morbidity.

The present study has certain limitations. The study was conducted at a single center with a relatively small sample size, which may limit the generalizability of the findings. The follow-up duration was also limited, and long-term neurological outcomes were not extensively assessed. The retrospective inclusion of craniotomy and membranectomy cases requires cautious interpretation, and the findings should be validated through prospective randomized studies. Larger multicentric randomized studies with longer follow-up are required to further establish standardized recommendations regarding postoperative drain placement, drain type, and the role of craniotomy with membranectomy in septated chronic subdural hematoma.

Overall, the present study demonstrates that postoperative subdural drain placement following evacuation of chronic subdural hematoma is associated with lower recurrence rates and shorter duration of hospital stay, with favorable postoperative outcomes and an acceptable safety profile.

CONCLUSION

Postoperative subdural drain placement, particularly with negative suction, significantly reduces recurrence and promotes early brain expansion following burr-hole evacuation of chronic subdural hematoma. Patients in the negative suction group experienced a significantly lower recurrence rate (3.3%), earlier hospital discharge, and better overall health outcomes compared to the standard drain and no-drain groups. Routine use of negative suction drains is recommended to improve surgical outcomes and reduce the need for repeat surgeries. Further multicentric studies are recommended to validate these findings and establish standardized negative suction protocols.

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