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Original Article

DOI: https://doi.org/10.3329/jninb.v11i2.92418

Journal of National Institute of Neurosciences Bangladesh,
July 2025, Vol. 11, No. 2, pp. 114-120

ISSN (Online) 2518-6612
ISSN (Print) 2410-8030

Comparative Study on Recurrence of Chronic Subdural Haematoma Operated by Burr Hole Evacuation with or without Partial Cortical Membranectomy

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Abstract

Background: Chronic subdural hematoma (CSDH) is a common neurosurgical condition, particularly in the elderly, with a remarkable risk of post-operative recurrence. Burr hole evacuation (BHE) with or without partial cortical membranectomy is frequently used, but comparative evidence on recurrence and outcomes remains limited. **Objective:** The purpose of the present study was to compare the recurrence rate of chronic subdural hematoma (CSDH) operated by burr hole evacuation (BHE) with or without partial cortical membranectomy. **Methodology:** This randomized, controlled study was conducted in the Department of Neurotrauma at National Institute of Neurosciences & Hospital, Dhaka, Bangladesh from July 2016 to December 2017. A total 74 adults (≥18 years) with clinically and radiologically confirmed CSDH were enrolled and randomized to Group A (BHE with partial cortical membranectomy, n=37) or Group B (BHE alone, n=37). Patients with intracerebral hematoma, other mass lesions, or multi-organ failure were excluded. Pre- and postoperative evaluations included Glasgow Coma Scale (GCS), Markwalder Grading Scale (MGS), and CT imaging to assess hematoma characteristics and midline shift (MLS). **Results:** The mean age was 61.9 ± 12.4 years in Group A and 67.1 ± 11.7 years in Group B (p=0.078); males predominated in both groups. Trivial falls were the most common cause of injury, limb weakness the predominant symptom, and hypertension the most frequent comorbidity, with no significant intergroup differences (p>0.05). Pre-operative MLS, hematoma characteristics, and admission neurological status were comparable. Post-operatively, complete MLS resolution occurred in most patients (Group A: 75.7%, Group B: 73.0%), but mean post-operative MLS was lower in Group B (0.14 ± 0.34 cm vs 1.56 ± 0.39 cm, p=0.001). All patients achieved full neurological recovery (MGS G-0, GCS 15) and favorable functional outcomes (GOS 4–5). Post-operative complications, hospital stay, and three-month recurrence rates were similar between groups (p>0.05). **Conclusion:** BHE with or without partial cortical membranectomy resulted in comparable clinical outcomes and low recurrence rates. BHE alone achieved slightly better midline shift reduction, but both techniques were safe and effective. *[Journal of National Institute of Neurosciences Bangladesh, July 2025;11(2):114-120]*

Keywords: Chronic subdural haematoma; burr hole evacuation; partial cortical membranectomy

Introduction

Chronic subdural hematoma (CSDH) is a common neurosurgical condition, particularly in the elderly, and is associated with considerable morbidity and mortality[1,2]. It is defined as encapsulated liquefied intracranial bleeding between the dura and arachnoid mater persisting for more than three weeks, usually following minor head trauma[3,4]. The incidence of CSDH ranges from 8 to 58 per 100,000 individuals over 65 years of age[5], with a peak in the sixth and seventh decades of life. Increasing

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life expectancy and widespread use of anticoagulants and antiplatelet drugs have contributed to its growing incidence.

CSDH often results from brain atrophy, hydrocephalus, subdural hygroma, or multiple strokes, which create space between the dura and brain surface, allowing traction on bridging veins and predisposing to bleeding[6-8]. It is also recognized as one of the reversible causes of dementia[9]. Surgical evacuation remains the cornerstone of management, with options including twist-drill craniostomy (TDC), burr hole evacuation (BHE), craniotomy with membranectomy, and endoscopic evacuation[10-12]. Despite several techniques, the optimal surgical approach remains debated because of variations in recurrence and complication rates.[13,14] Although rupture of bridging veins is a classical explanation, newer evidence implicates fragile neocapillaries, inflammatory mediators, and angiogenic factors in the neomembrane as contributors to recurrence[3,6]. In a comparison of TDC, BHE, and craniotomy, finding higher morbidity and mortality with craniotomy but lower recurrence, whereas BHE provided good outcomes with shorter hospital stays[10,15].

Recurrence rates of CSDH range from 9.2% to 26.5%, with symptomatic recurrence occurring within three months after surgery[5,16]. Risk factors include advanced age, brain atrophy, comorbidities, anticoagulant therapy, mixed-density hematoma, postoperative pneumocephalus, and poor brain re-expansion[17,18]. Compared outcomes among BHE alone, BHE with partial membranectomy, and craniotomy with total membranectomy show higher recurrence with BHE alone[19-22]. However, the efficacy of BHE with partial cortical membranectomy in preventing recurrence remains uncertain[23]. The ideal surgical approach should ensure minimal recurrence, faster recovery, fewer complications, and shorter hospital stay.

In Bangladesh, CSDH is a frequent cause of neurosurgical admission, yet local evidence on optimal surgical management is limited. Conducting this study at the National Institute of Neurosciences and Hospital (NINS&H), where sufficient cases and facilities exist, may help identify the most effective technique for minimizing recurrence and improving outcomes.

Methodology

Study Design and Settings: This prospective, randomized, controlled interventional study was conducted to compare the recurrence rate of CSDH operated by BHE with or without partial cortical membranectomy in the Department of Neurotrauma, National Institute of Neurosciences and Hospital (NINS&H), Dhaka, Bangladesh, from July 2016 to December 2017.

Study Population: All patients admitted with a clinical and radiological diagnosis of CSDH during the study period who met the predefined inclusion and exclusion criteria were prospectively enrolled after obtaining written informed consent. Eligible participants were randomly assigned to one of two treatment arms using a lottery-based randomization technique: Group A, undergoing BHE with partial cortical membranectomy, and Group B, undergoing BHE without membranectomy. The inclusion criteria consisted of patients aged 18 years or older with a diagnosis of CSDH confirmed by computed tomography (CT) of the head and those who provided informed consent following appropriate counseling. The exclusion criteria included patients with intracerebral hematoma or other intracranial mass lesions, as well as critically ill patients with multi-organ failure. The sample size was determined using a standard formula, assuming a 5% level of significance and 80% statistical power, yielding a minimum requirement of 37 participants per group. Therefore, a total of 74 patients were included in the study. Participant recruitment was conducted purposively from eligible admissions based on clinical and radiological criteria.

Data Collection Procedures: All participants underwent detailed history taking, neurological and general examination, and relevant investigations. Anticoagulant and antiplatelet medications were discontinued five days before surgery. The diagnosis of CSDH was confirmed by CT imaging, and surgical decisions were made in consultation with senior neurosurgeons. Group A patients underwent BHE with partial cortical membranectomy, while Group B underwent BHE alone. All surgeries were performed under local anesthesia with sedation (monitored anesthesia). Postoperative monitoring included neurological assessments and CT imaging on the first postoperative day (POD 1), at discharge, and after three months. Preoperative and postoperative Glasgow Coma Scale (GCS) and Markwalder Grading Scale (MGS) scores were recorded. Recurrence was defined as reappearance of clinical symptoms with radiological evidence of CSDH at the same site within three months post-surgery. Data were collected on patient characteristics (age, comorbidities), radiological parameters (hematoma density, midline shift, postoperative pneumocephalus), and outcome measures (GCS, MGS, and recurrence rate).

Statistical Analysis: Data were gathered using a structured questionnaire, face-to-face interviews, clinical examinations, and imaging results. All information was compiled in case record forms. Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Chicago, IL, USA). Categorical variables were expressed as frequencies and percentages, and continuous variables as mean and standard deviation. Independent t-test and Chi-square test were applied, with a p-value <0.05 considered statistically significant.

Ethical considerations: Ethical approval was obtained from the institutional review board of NINS&H. Written informed consent was obtained from all participants or their legal guardians prior to inclusion in the study.

Results

The mean age was 61.86 ± 12.35 years in Group A and 67.06 ± 11.69 years in Group B, with no statistically significant difference (p= 0.078). Males predominated in both groups (Group A: 70.3%; Group B: 59.5%), while females comprised 29.7% in Group A and 40.5% in Group B. No significant differences in sex distribution were observed between the groups (p = 0.891) (Table 1).

Table 1: Demographic characteristics between the study groups

Variables	Group A (n=37)	Group B (n=37)	P value
Age (years)			
Mean ± SD	61.86 ± 12.35	67.06 ± 11.69	0.078
Range	22 to 90	40 to 93	
Gender			
Male	26 (70.3%)	22 (59.5%)	0.891
Female	11 (29.7%)	15 (40.5%)	

Independent t-test and Chi-square test done, p<0.05 considered as a significant value

Trivial falls were the most common cause of injury (Group A: 43.2%; Group B: 40.5%), followed by trivial head trauma and road traffic accidents, with no significant differences between groups (p = 0.957). Limb weakness was the predominant presenting symptom (Group A: 64.9%; Group B: 51.4%), while headache, altered consciousness, and absence of complaints were less frequent; all differences were statistically non-significant (p > 0.05). Hypertension was the most common co-morbidity (Group A: 37.8%; Group B: 40.5%), followed by diabetes mellitus and ischemic heart disease, with no significant differences observed between groups (p > 0.05) (Table 2).

Table 2: Clinical characteristics between the study groups

Variables	Group A (n=37)	Group B (n=37)	P value
Mode of injury			
Trivial fall	16 (43.2%)	15 (40.5%)	0.957
RTA	3 (8.1%)	2 (5.4%)	
Trivial head trauma	6 (16.2%)	4 (10.8%)	
Nil	12 (32.4%)	11 (29.7%)	
Clinical presentation			
Limb weakness	24 (64.9%)	19 (51.4%)	0.639
Headache	10 (27.0%)	9 (24.3%)	0.919
Altered consciousness	2 (5.4%)	4 (10.8%)	0.297
No complaint	1 (2.7%)	0 (0.0%)	0.349
Co-morbidities			
HTN	14 (37.8%)	15 (40.5%)	0.853
DM	10 (27.0%)	4 (10.8%)	0.109
IHD	1 (2.7%)	2 (5.4%)	0.564
Nil	17 (45.9%)	14 (37.8%)	0.590

Chi-square test done, p<0.05 considered as a significant value

Fronto-parieto-occipital hematomas were more common in both groups (Group A: 62.2%; Group B: 45.9%), while fronto-parietal hematomas accounted for the remainder, with no significant difference between groups (p = 0.448). Regarding hematoma density, homogeneous hematomas predominated in Group A (70.3%) and mixed density in Group B (48.6%), but the difference was not statistically significant (p = 0.061). Hematoma width ranged from 0.5 to 2 cm, with most cases between 1–1.5 cm, and no significant intergroup differences were observed (p = 0.065) (Table 3).

Table 3: Radiological findings on CT scan

Radiological parameter	Group A (n=37)	Group B (n=37)	P value
Location of CSDH			
Fronto-parietal	14(37.8%)	15(40.5%)	0.448
Fronto-parieto-occipital	23(62.2%)	17(45.9%)	
Hematoma Density			
Mixed	11(29.7%)	18(48.6%)	0.061
Homogeneous	26(70.3%)	19(51.4%)	
Hematoma Width			
0.5 cm	6(16.2%)	0(0.0%)	
1 cm	13(35.2%)	11(29.7%)	0.065
1.5 cm	14(37.8%)	13(35.1%)	
2 cm	4(10.8%)	8(21.6%)	

Chi-square test done, p<0.05 considered as a significant value

Pre-operatively, mean MLS was similar between Group A (1.23 ± 0.43 cm) and Group B (1.16 ± 0.55 cm), showing no significant difference (p = 0.559). Post-operatively, complete resolution of MLS (0 cm) was observed in most patients (Group A: 75.7%; Group B: 73.0%). The mean post-operative MLS was significantly lower in Group B (0.14 ± 0.34 cm) compared to Group A (1.56 ± 0.39 cm) (p = 0.001), indicating greater midline shift reduction in patients undergoing BHE alone (Table 4).

Table 4: Pre- and post-operative MLS

MLS (cm)	Group A (n=37)	Group B (n=37)	P value
Pre-operative MLS			
Mean ± SD	1.23 ± 0.43	1.16 ± 0.55	0.559
Range	0.5–2.0	0.5–2.0	
Post-operative MLS			
0	28 (75.7%)	27 (73.0%)	*0.000
0.5	2 (5.4%)	1 (2.7%)	
1.0	6 (16.2%)	4 (10.8%)	
1.5	1 (2.7%)	0 (0.0%)	
Mean ± SD	1.56 ± 0.39	0.14 ± 0.34	*0.001

Independent t-test and Chi-square test done, p<0.05 considered as a significant value

On admission, most patients had moderate neurological impairment (MGS G-II: Group A 64.9%, Group B 51.4%), with no significant difference (p = 0.583). By discharge, all patients in both groups achieved full neurological recovery (MGS G-0, GCS 15). Admission GCS was comparable between groups (Group A: 13.73 ± 2.18; Group B: 13.53± 2.42; p = 0.719), and discharge GCS showed complete recovery (p = 0.547). Functional outcomes were uniformly favorable (GOS 4–5) in all patients, with no significant intergroup difference (p = 0.547) (Table 5).

Table 5: Neurological Status and Functional Outcomes

Parameters	Group A (n=37)	Group B (n=37)	P value
MGS on Admission			
G-II	24 (64.9%)	19 (51.4%)	0.583
MGS on discharge (G-0)	37 (100.0%)	37 (100.0%)	-
Admission GCS			
(Mean ± SD)	13.73 ± 2.18	13.53 ± 2.42	0.719
Discharge GCS	15 (100.0%)	15 (100.0%)	0.547
Favorable GOS (4–5)	37 (100.0%)	37 (100.0%)	0.547

Chi-square test done, p<0.05 considered as a significant value

The incidence of complications was comparable between the groups: pneumocephalus occurred in 24.3% of patients in both groups, acute SDH in 13.5% of Group A versus 5.4% of Group B, ICH in 8.1% of Group A versus none in Group B, and infection in 2.7% versus 5.4%, with no statistically significant differences (p > 0.05). Most patients were discharged within one week (Group A: 83.8%, Group B: 75.7%; p = 0.662). Recurrence within three months was rare and identical in both groups (5.4%), showing no significant difference (p = 0.881) (Table 6).

Table 6: Post-Operative Complications, Hospital Stay, and Recurrence

Variables	Group A (n=37)	Group B (n=37)	P value
Complications			
• Pneumocephalus	9 (24.3%)	9 (24.3%)	0.720
• Acute SDH	5 (13.5%)	2 (5.4%)	0.993
• ICH	3 (8.1%)	0 (0.0%)	0.099
• Infection	1 (2.7%)	2 (5.4%)	0.471
• Nil	16 (43.2%)	17 (45.9%)	0.413
Hospital stay			
• < 1 week	31 (83.8%)	28 (75.7%)	0.662
• > 1 week	6 (16.2%)	9 (24.3%)	
Recurrence (≤ 3 months)			
• Yes	2 (5.4%)	2 (5.4%)	0.881
• No	35 (94.6%)	35 (94.6%)	

Chi-square test done, p<0.05 considered as a significant value

Discussion

The demographic and clinical characteristics of the study population were consistent with findings from other studies. The mean age in Group A was 61.86 ± 12.35 years, and in Group B, it was 67.06 ± 11.69 years, with no statistically significant difference between the groups (p = 0.078). This aligns with a study which reported a mean age of 61.4 years in their cohort of 264 patients with CSDH[24]. The male predominance observed in both groups (Group A: 70.3%, Group B: 59.5%) is consistent with the literature, as CSDH is more prevalent in males[25].

Regarding the clinical characteristics, trivial falls were the most common cause of injury in both groups (Group A: 43.2%, Group B: 40.5%), followed by trivial head trauma and road traffic accidents. These findings are in agreement with the study, which identified minor head trauma as a significant risk factor for CSDH in the elderly population[26]. Limb weakness was the predominant presenting symptom in both groups (Group A: 64.9%, Group B: 51.4%), which is

consistent with the clinical presentation of CSDH, as patients often exhibit focal neurological deficits[27]. Hypertension was the most common comorbidity in both groups (Group A: 37.8%, Group B: 40.5%), which is consistent with the literature, as hypertension is a known risk factor for CSDH27.

In terms of radiological characteristics, fronto-parieto-occipital hematomas were more common in both groups (Group A: 62.2%, Group B: 45.9%), which is consistent with the literature, as this location is frequently observed in CSDH cases[27]. Regarding hematoma density, homogeneous hematomas predominated in Group A (70.3%), while mixed density was more common in Group B (48.6%). Although this difference was not statistically significant ($p = 0.061$), it suggests a possible variation in hematoma characteristics between the groups. Hematoma width ranged from 0.5 to 2 cm, with most cases between 1 to 1.5 cm, and no significant intergroup differences were observed ($p = 0.065$). These findings are consistent with the study, which reported similar hematoma characteristics in their cohort[26].

Regarding midline shift (MLS), preoperative mean MLS was similar between Group A (1.23 ± 0.43 cm) and Group B (1.16 ± 0.55 cm), with no significant difference ($p = 0.559$). Postoperatively, complete resolution of MLS (0 cm) was observed in most patients (Group A: 75.7%, Group B: 73.0%). The mean postoperative MLS was significantly lower in Group B (0.14 ± 0.34 cm) compared to Group A (1.56 ± 0.39 cm) ($p = 0.001$), indicating greater midline shift reduction in patients undergoing BHE alone. This finding is in contrast to the study, which reported that old age (≥75 years) and coexisting hydrocephalus were significantly predictive factors for CSDH, irrespective of their medical comorbidities[26].

In terms of neurological status and functional outcomes, on admission, most patients had moderate neurological impairment (Markwalder Grading Scale G-II: Group A 64.9%, Group B 51.4%), with no significant difference ($p = 0.583$). By discharge, all patients in both groups achieved full neurological recovery (Markwalder Grading Scale G-0, Glasgow Coma Scale 15). Admission Glasgow Coma Scale was comparable between groups (Group A: 13.73 ± 2.18; Group B: 13.53 ± 2.42; $p = 0.719$), and discharge Glasgow Coma Scale showed complete recovery ($p = 0.547$). Functional outcomes were uniformly favorable (Glasgow Outcome Scale 4–5) in all patients, with no significant intergroup difference ($p = 0.547$). These findings are consistent with the study, which reported similar outcomes in elderly patients following chronic subdural hematoma evacuation[28].

Regarding postoperative complications, the incidence was comparable between the groups: pneumocephalus occurred in 24.3% of patients in both groups, acute subdural hematoma in 13.5% of Group A versus 5.4% of Group B, intracerebral hemorrhage in 8.1% of Group A versus none in Group B, and infection in 2.7% versus 5.4%, with no statistically significant differences ($p > 0.05$). Most patients were discharged within one week (Group A: 83.8%, Group B: 75.7%; $p = 0.662$). Recurrence within three months was rare and identical in both groups (5.4%), showing no significant difference ($p = 0.881$). These findings are consistent with the study, which reported similar outcomes in elderly patients following chronic subdural hematoma evacuation[28].

This study provides valuable insights into the demographic, clinical, radiological, and postoperative characteristics of patients with chronic subdural hematoma undergoing BHE with or without partial cortical membranectomy. The findings are consistent with existing literature and contribute to the understanding of this condition in the Bangladeshi population. Further studies with larger sample sizes and longer follow-up periods are recommended to validate these findings and explore the long-term outcomes of these treatment modalities.

Conclusion

This study demonstrates that BHE with or without partial cortical membranectomy is an effective and safe treatment for CSDH in adults. Both groups showed comparable demographic, clinical, and radiological characteristics, with no significant differences in preoperative status. Postoperatively, midline shift improved in all patients, with BHE alone showing slightly greater MLS reduction. Neurological recovery and functional outcomes were excellent in both groups, with all patients achieving full recovery by discharge. Postoperative complications, hospital stay, and recurrence rates were low and comparable between groups. These findings suggest that partial cortical membranectomy does not significantly alter clinical outcomes or recurrence rates, supporting BHE alone as a safe and effective option. Larger, long-term studies are recommended to further evaluate recurrence patterns and optimize surgical management of CSDH.

Acknowledgements
The patients and hospital authorities are acknowledged by the authors for their gracious cooperation.

Conflict of interest: The authors declared no competing interest.

Financial Disclosure
This study did not receive any fund from anywhere.

Contribution to authors: The study was conceptualized and designed, including methods and literature review, by Haque MM and Ahmed MF. Data collection was carried out by Haque MM and Ahmed MF. Statistical analysis was performed by Haque MM, Ahmed MF, and Nurunnabi M. The draft manuscript was prepared by Haque MM, Ahmed MF, Ahmed M, Islam MM, Hossain MZ, and Nurunnabi M, and the final version of the manuscript was finalized by the same group of authors. All authors reviewed and approved the final manuscript.

Data Availability
The datasets generated and analyzed during this study are not publicly available due to patient confidentiality and institutional data protection policies. However, anonymized data may be made available from the corresponding author upon reasonable request, subject to approval by the institutional ethics committee.

Ethics Approval and Consent to Participate
Ethical approval for the study was obtained from the Institutional Review Board. As this was a prospective study the written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

How to cite this article: Haque MM, Ahme MF, Ahmed M, Islam MM, Hossain MZ, Nurunnabi M. Comparative Study on Recurrence of Chronic Subdural Haematoma Operated by Burr Hole Evacuation with or without Partial Cortical Membranectomy. J Natl Inst Neurosci Bangladesh, 2025;11(2):114-120

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Article Info
Received on: 7 March 2025
Accepted on: 24 May 2025
Published on: 1 July 2025

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