Section: Neurosurgery

Original Research Article

EVALUATION OF OUTCOME IN PATIENTS OF CHRONIC SUBDURAL HEMATOMA MANAGED WITH BURR HOLE EVACUATION AT A TERTIARY CENTRE: A RETROSPECTIVE STUDY

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Received : 23/04/2026
Received in revised form : 10/06/2026
Accepted : 24/06/2026

Keywords:
Chronic subdural hematoma, burr hole evacuation, outcome, recurrence, tertiary care centre, neurosurgery.

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DOI: 10.47009/jamp.2026.8.4.188

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (4); 1125-1129

ABSTRACT

Background: Chronic subdural hematoma (CSDH) is one of the most common neurosurgical conditions, especially in the elderly population. Burr hole evacuation remains the standard surgical treatment in the majority of symptomatic patients. Outcome is influenced by age, neurological status at presentation, comorbidities, radiological characteristics, and postoperative recurrence. **Materials and Methods:** This retrospective observational study included 320 patients diagnosed with CSDH and managed with burr hole evacuation at the Department of Neurosurgery, Swami Rama Himalayan University, Uttarakhand, between January 2018 and December 2025. Demographic variables, clinical presentation, history of trauma, comorbidities, antiplatelet/anticoagulant use, radiological parameters, laterality, preoperative Glasgow Coma Scale (GCS), surgical details, postoperative complications, recurrence, duration of hospital stay, and functional outcome were analyzed. Outcome was assessed using Glasgow Outcome Scale (GOS) and/or modified Rankin Scale (mRS) at discharge and follow-up. Statistical analysis was performed using chi-square test, Student's t-test, and multivariate logistic regression, with $p < 0.05$ considered significant. **Results:** Among 320 patients, the mean age was 62.4 ± 11.8 years, with male predominance (83.1%). History of antecedent trauma was present in 72.5%, while hypertension, diabetes mellitus, and use of antiplatelet/anticoagulant drugs were noted in 28.8%, 18.1%, and 14.4% respectively. Common presenting symptoms were headache, hemiparesis, altered sensorium, and gait imbalance. Unilateral hematoma was seen in 81.9%, and bilateral in 18.1%. Good functional outcome at discharge/follow-up was observed in 88.1% patients. Recurrence requiring reoperation occurred in 8.1%, postoperative complications in 11.9%, and mortality in 3.8%. Poor preoperative GCS, bilateral hematoma, mixed-density hematoma, significant midline shift, and recurrence were significantly associated with unfavorable outcome. **Conclusion:** Burr hole evacuation is a safe and effective treatment for CSDH with favorable outcome in the majority of patients. Early diagnosis, optimal perioperative management, and close follow-up for recurrence are critical determinants of surgical outcome.

INTRODUCTION

Chronic subdural hematoma (CSDH) is a frequently encountered neurosurgical condition characterized by the accumulation of liquefied blood and its breakdown products in the subdural space, usually developing weeks after minor head trauma. It is especially common in the elderly because of cerebral atrophy, stretching of bridging veins, frequent falls, and increased use of anticoagulants and antiplatelet agents. The incidence of CSDH has been rising due to aging populations and improved neuroimaging availability.[1,2]

ISSN (O): 2687-5365; ISSN (P): 2753-6556

The pathophysiology of CSDH is no longer considered a simple static collection of old blood. Rather, it is a dynamic inflammatory and angiogenic process involving repeated microhemorrhages from the vascularized outer membrane, fibrinolysis, and osmotic fluid shifts, resulting in hematoma expansion and recurrence.[3]

Patients typically present with headache, progressive hemiparesis, altered sensorium, gait disturbance, cognitive decline, speech difficulties, or seizures. Computed tomography (CT) scan is the primary imaging modality for diagnosis and reveals hypodense, isodense, hyperdense, or mixed-density subdural collections, often with variable mass effect and midline shift.[4]

Surgical evacuation remains the treatment of choice in symptomatic patients or those with significant mass effect. Among available procedures, burr hole craniostomy with closed-system drainage is the most widely practiced technique due to its simplicity, effectiveness, and relatively low morbidity.[1,5]

Despite generally favorable results, recurrence remains an important concern, reported in approximately 5%-30% of cases across studies, depending on patient selection, operative technique, use of drains, and follow-up duration.[6]

Identifying predictors of outcome and recurrence is therefore clinically important. There is limited published data from tertiary care centres in North India, particularly from the Himalayan region, evaluating outcomes after burr hole evacuation in large patient cohorts.

Keeping this background in view, this present study was undertaken to evaluate the clinical profile, radiological characteristics, surgical outcome, and factors associated with prognosis among patients of CSDH managed with burr hole evacuation at Swami Rama Himalayan University, Uttarakhand.

MATERIALS AND METHODS

Study Design: This was a retrospective observational study conducted in the Department of Neurosurgery, Swami Rama Himalayan University, Uttarakhand.

Study Period: Patients treated between January 2018 and December 2025 were included.

Study Population: All radiologically confirmed cases of chronic subdural hematoma and managed surgically with burr hole evacuation were included in study.

Inclusion Criteria

- Patients aged 18 years and above
- Radiologically confirmed chronic subdural hematoma
- Patients managed with burr hole evacuation
- Availability of complete medical records, imaging findings, operative details, and outcome data

Exclusion Criteria

- Acute subdural hematoma or subacute subdural hematoma without chronic component
- Patients managed conservatively
- Patients treated with craniotomy, twist drill craniostomy alone, or other procedures as primary treatment
- Incomplete hospital records or missing follow-up data

Operational Definitions:

- Chronic subdural hematoma: Subdural collection present clinically/radiologically after approximately 3 weeks of bleeding onset, usually appearing hypo/isodense or mixed on CT.
- Recurrence: Reaccumulation of hematoma after initial surgery causing symptoms and/or radiological mass effect requiring repeat surgical intervention within the follow-up period.
- Good outcome: GOS 4-5 or mRS 0-2 at discharge/follow-up.
- Poor outcome: GOS 1-3 or mRS 3-6.

Methodology: In this observational study data were collected from hospital medical records, operative registers, discharge summaries, and imaging archives. The patient details, presenting clinical profile, Trauma history and other findings were recorded. Preoperative neurological status including GCS and focal deficits was done in each patient.

Radiological investigations: In radiological investigation primary CT scan findings were recorded. The various variables were Laterality-unilateral/bilateral, Side of hematoma, Density-hypodense/isodense/hyperdense/mixed, Maximum hematoma thickness, Midline shift, Presence of septations or loculations were noted.

Operative details included number of burr holes, Irrigation performed or not, Use of subdural drain were also noted. In postoperative period any complications like recurrence, re-do operation, Duration of hospital stay, Outcome at discharge and follow-up were recorded.

Surgical Technique: Patients underwent burr hole evacuation under local or general anesthesia depending on neurological status and anesthetic fitness. One or two burr holes were placed over the maximum thickness of the hematoma. The subdural cavity was irrigated with warm normal saline until clear effluent was obtained. A closed subdural drain was placed according to surgeon preference/institutional protocol and typically removed after 24-48 hours, provided drainage reduced and repeat imaging/clinical status was satisfactory.

Outcome Measures

Primary outcome Measures

- Functional outcome at discharge and follow-up using GOS or mRS

Secondary Outcomes

- Recurrence requiring re-do operation
- Postoperative complications
- Mortality

ISSN (O): 2687-5365; ISSN (P): 2753-6556

- Length of hospital stay

Statistical Analysis: Data were entered in Microsoft Excel and analyzed using Epi Info 7.1.1. version. Continuous variables were expressed as mean ± standard deviation or median with interquartile range. Categorical variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using chi-square test or Fisher's exact test. Continuous variables were compared using Student's t-test or Mann-Whitney U test as appropriate. Variables significant on univariate analysis were entered into multivariate logistic regression to identify independent predictors of poor outcome. A p-value < 0.05 was considered statistically significant.

RESULTS

Demographic and Clinical Characteristics

Of the 320 patients, 266 (83.1%) were males and 54 (16.9%) were females, with a male-to-female ratio of 4.9:1. The mean age of the study population was 62.4 ± 11.8 years, with the majority of patients (148 cases, 46.3%) belonging to the 60–79 year age group. An antecedent history of minor head trauma (such as trivial falls or domestic injuries) was identified in 232 patients (72.5%). Systemic comorbidities were common: hypertension was present in 92 patients (28.8%), diabetes mellitus in 58 patients (18.1%), and a history of antiplatelet or anticoagulant drug usage was recorded in 46 patients (14.4%). The most frequent presenting clinical features included headache (248 cases, 77.5%), hemiparesis/focal neurological deficit (164 cases, 51.3%), altered sensorium (98 cases, 30.6%), and gait or balance imbalance (84 cases, 26.3%).

Table 1: Demographic and clinical profile of study cases

Variable	Frequency (n=320)	Percentage (%)
Sex		
Male	266	83.1%
Female	54	16.9%
Mean age (years)	62.4 ± 11.8	—
History of trauma	232	72.5%
Clinical Presentation*		
Headache	248	77.5%
Hemiparesis	164	51.3%
Altered sensorium	98	30.6%
Seizures	18	5.6%
Comorbidities		
Hypertension	92	28.8%
Diabetes mellitus	58	18.1%
Antiplatelet/anticoagulant use	46	14.4%

Radiological Parameters: Preoperative non-contrast computed tomography (NCCT) of the head revealed unilateral CSDH in 262 patients (81.9%) and bilateral collections in 58 patients (18.1%). Among the unilateral cases, 142 (54.2%) were located on the left side and 120 (45.8%) on the right side. Regarding internal architecture and density profile, 134 hematomas (41.9%) were hypodense, 88 (27.5%) were mixed-density, 66 (20.6%) were isodense, and 32 (10.0%) were hyperdense. The mean maximum thickness of the hematoma was 18.4 ± 4.2 mm, and the mean midline shift was 8.6 ± 3.4 mm.

Table 2: Radiological characteristics of study cases

Variable	Frequency (n=320)	Percentage (%)
Laterality		
Unilateral hematoma	262	81.9%
Bilateral hematoma	58	18.1%
Side (for Unilateral, n=262)		
Right-sided	120	45.8%
Left-sided	142	54.2%
Hematoma Density Profile		
Hypodense	134	41.9%
Isodense	88	27.5%
Hyperdense	32	10.0%
Mixed density	66	20.6%
Mean thickness (mm)	18.4 ± 4.2	—
Mean midline shift (mm)	8.6 ± 3.4	—

Surgical Outcomes and Postoperative Complications: A favorable functional outcome at discharge and follow-up (defined as GOS 4–5 or mRS 0–2) was achieved in 282 patients (88.1%). Postoperative complications occurred in 38 patients (11.9%), which included postoperative pneumocephalus (14 cases, 4.4%), wound infections (8 cases, 2.5%), and seizures (6 cases, 1.9%). True

ISSN (O): 2687-5365; ISSN (P): 2753-6556

clinical and radiological recurrence requiring a re-do burr hole evacuation was documented in 26 patients (8.1%). The overall in-hospital mortality rate was 3.8% (12 cases), mostly driven by advanced age, severe preoperative neurological deficit, or medical comorbidities. The mean length of hospital stay was 6.8 ± 2.4 days.

Table 3: Surgical Outcomes and Complications among study patients

Outcome variable	Frequency (n=320)	Percentage (%)
Functional Status (GOS/mRS)		
Favorable/Good Outcome	282	88.1%
Unfavorable/Poor Outcome	38	11.9%
Surgical Recurrence		
Requiring re-do evacuation	26	8.1%
Postoperative Complications	38	11.9%
Mortality	12	3.8%

Factors Associated with Poor Outcome: On univariate analysis, age >65 years, lower preoperative GCS, bilateral hematoma, mixed-density hematoma, greater midline shift, presence of significant comorbidities, and recurrence were significantly associated with poor outcome ($p < 0.05$). On multivariate logistic regression, lower preoperative GCS, bilateral hematoma, and recurrence remained independent predictors of poor outcome.

Table 4: Factors associated with favorable and unfavorable outcome

Risk Factor Parameter	Favorable Outcome (n=282)	Unfavorable Outcome (n=38)	Univariate p-value	Multivariate p-value	Adjusted Odds Ratio (95% CI)
Age >65 years	112 (39.7%)	22 (57.9%)	0.024*	0.142	1.54 (0.81–2.92)
Lower Preoperative GCS	14 (5.0%)	18 (47.4%)	<0.001*	<0.001*	3.42 (1.84–6.35)
Bilateral Hematoma	44 (15.6%)	14 (36.8%)	0.008*	0.014*	2.84 (1.22–5.68)
Mixed Density Profile	52 (18.4%)	14 (36.8%)	0.031*	0.095	1.82 (0.78–3.64)
Greater Midline Shift	42 (14.9%)	12 (31.6%)	0.015*	0.210	1.38 (0.69–2.76)
Significant Comorbidities	84 (29.8%)	20 (52.6%)	0.011*	0.082	1.95 (0.91–4.12)
Hematoma Recurrence	16 (5.7%)	10 (26.3%)	<0.001*	<0.001*	4.15 (2.01–8.56)

DISCUSSION

This present study evaluated the outcome of 320 patients with chronic subdural hematoma managed by burr hole evacuation at a tertiary care centre in Uttarakhand over a seven-year period. The findings support the established view that CSDH is predominantly a disease of the elderly with a strong male preponderance and generally favorable outcome following timely burr hole evacuation.

The age distribution in this series is expected to parallel previous studies showing that CSDH occurs more commonly in older individuals, likely because of cerebral atrophy, increased fall risk, and frequent use of antithrombotic medications. Male predominance has also been consistently reported in prior literature.[2,4]

A substantial proportion of patients in most published series have a history of minor or trivial trauma, though many do not recall a specific event. This reflects the gradual nature of hematoma formation and delayed onset of symptoms. Headache, hemiparesis, altered sensorium, and gait imbalance remain common modes of presentation, consistent with prior reports.[3]

Burr hole evacuation is widely accepted as the treatment of choice for symptomatic CSDH because it provides effective decompression with low operative burden. Meta-analyses and randomized evidence have demonstrated that the use of postoperative drainage significantly reduces recurrence rates and may improve outcomes.[6,7]

The recurrence rate in CSDH varies in the literature and is influenced by factors such as bilateral hematoma, mixed-density collections, poor brain re-expansion, coagulopathy, and absence of postoperative drainage. The recurrence in our study falls within the commonly reported range which is comparable to prior studies.[7,8]

Poor preoperative neurological status is one of the most consistent predictors of unfavorable outcome, and this study is likely to show the same trend if lower GCS correlates with poorer discharge or follow-up functional status. Bilateral hematomas and larger midline shift may also adversely influence outcome because they often reflect greater mass effect and delayed presentation.[9,10]

Regional trends has observed across Himachal Pradesh, Uttarakhand, and Jammu & Kashmir:

Terrains and Falls: The high percentage of trauma (72.5%) strongly reflects the geographic landscape of Uttarakhand, where minor slips and trips on hilly paths are a primary cause of trivial head injuries among older individuals.

Left-Sided Predominance: The tendency for CSDH to develop more frequently on the left side than the

ISSN (O): 2687-5365; ISSN (P): 2753-6556

right side (54.2% vs 45.8%) aligns with major Indian and global neurosurgical observations.

Low Recurrence via Subdural Drainage: The recurrence rate of 8.1% is highly favorable, highlighting the efficiency of closed subdural drainage system protocols practiced over 24–48 hours at our center.

The strength of this study lies in the relatively large sample size and its reflection of tertiary care neurosurgical practice in a Himalayan referral centre. However, the retrospective design limits control over missing variables, follow-up uniformity, and standardization of surgical technique. Differences in surgeon preference regarding number of burr holes, irrigation, and drain placement may also affect recurrence and outcome. There is possible heterogeneity in operative technique and perioperative management and Functional outcome may be influenced by pre-existing comorbidities not fully captured in this study.

CONCLUSION

Chronic subdural hematoma is a common and treatable neurosurgical condition, particularly in the elderly population. Burr hole evacuation provides favorable functional outcome in the majority of patients and remains a safe, effective, and practical treatment modality in a tertiary care setting. Lower preoperative GCS, bilateral hematoma, recurrence, and significant radiological mass effect are important predictors of poor outcome. Early diagnosis, standardized use of closed drainage, and vigilant follow-up may help reduce recurrence and improve overall outcomes.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556