

Effectiveness and Safety of Burr Hole Evacuation in Chronic Subdural Hematoma Patients – Experience from a Low-Income Country

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ABSTRACT

Objective: In contemporary neurosurgery, burr holes are fundamental in cranial procedures, primarily for the evacuation of chronic subdural hematomas (CSDH). CSDH is prevalent, and its clinical course, though not life-threatening, carries morbidity and mortality risks. This study evaluates the effectiveness and safety of Burr Hole Evacuation (BHE) for CSDH, aiming to assess clinical outcomes, immediate postoperative complications, and patient satisfaction.

Materials & Methods: This retrospective cohort study analyzed data from patients who underwent BHE for CSDH between March 2015 and August 2023. Inclusion criteria encompassed well-documented CSDH diagnoses, comprehensive medical records, and primary BHE cases, excluding previous neurosurgical interventions and pediatric cases. Data included patient demographics, clinical presentation, imaging findings, surgical details, postoperative outcomes, and patient satisfaction. Analysis was performed using SPSS version 25.

Results: The study included 86 patients, predominantly male (85%) with a mean age of 54 years. Clinical presentations varied, with headaches (85%) being the most common symptom. CT scans were pivotal for diagnosis, revealing hypodensities primarily over the convexity. BHE was performed without complications, resulting in favorable post-operative outcomes (93% significant recovery, 7% extended hospital stays). No intraoperative or postoperative mortality occurred, and there were no recurrent hematomas. Patient satisfaction with BHE was high (97%).

Conclusion: BHE is a viable primary surgical intervention for CSDH in low-income settings, with positive outcomes, safety, and patient satisfaction. Further studies and collaborative efforts are essential to enhance neurosurgical treatment in these settings and explore long-term outcomes.

Keywords: Burr Hole Evacuation, Chronic Subdural Hematoma, Low-Income Setting, Neurosurgery, Patient Satisfaction, Diagnostic Tools, Multidisciplinary Approach, Post-Operative Outcomes, Safety, Effectiveness.

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INTRODUCTION

The practice of burr holes, also known as trephination, has a rich historical legacy spanning, evolving significantly in style and technique over the centuries. In contemporary neurosurgery, burr holes have become a fundamental component of cranial procedures, serving as the initial step in various craniotomies. Among the diverse applications of burr holes, the most frequent indication is the evacuation of chronic subdural hematomas, where burr hole evacuation has been the standard choice of management for decades.¹⁻²

Chronic subdural hematoma is a prevalent neurosurgical condition with significant clinical implications. While it is not typically life-threatening, its clinical course is far from benign, with perioperative morbidity and mortality rates ranging from 0% to 25% and 0% to 32%, respectively. A generally accepted mortality rate hovers around 8%, and even after a successful evacuation, excess mortality can persist up to a year post-surgery.³

Despite the widespread use of burr holes, there exists a notable disparity among studies concerning the optimal number of burr holes required to achieve the best surgical and clinical outcomes. These variations persist not only between different medical centers but also among individual surgeons, influenced by their unique clinical experiences.⁴ Considering this clinical divergence, we conducted the present study to systematically evaluate the effectiveness and safety of Burr Hole Evacuation in Chronic Subdural Hematoma Patients. We aimed to rigorously assess the clinical outcomes associated with this surgical approach, shedding light on its post-operative immediate complications, and determine the patient satisfaction rate following Burr Hole Evacuation for CSDH.

MATERIALS AND METHODS

Study Design & Setting

This study was conducted as a retrospective cohort study, involving the analysis of patient records and data collected over a defined period. The retrospective cohort study included patients who underwent Burr Hole Evacuation (BHE) for Chronic Subdural Hematoma (CSDH) within the study period of 1st March 2015 to 1st August 2023. The retrospective approach allowed for the assessment of patients who had previously undergone Burr Hole Evacuation (BHE) for Chronic Subdural Hematoma (CSDH). Ethical approval was obtained from the Institutional Review and Ethics Board (IREB) of our institution before the initiation of data collection. Patient confidentiality and data protection were rigorously maintained throughout the study.

Data Collection

Data for this retrospective cohort study were sourced from medical records, imaging reports, surgical logs, and post-operative follow-up records maintained in the medical records department of Northwest General Hospital & Research Centre. The study period encompassed cases of patients who underwent Burr Hole Evacuation (BHE) for Chronic Subdural Hematoma (CSDH) during the period from 1st March 2015 to 1st August 2023. Since this was a retrospective study on patient records, consent was obtained as the hospital's policy for inclusion of a "consent statement on the admission form" and subsequently signed by the patients, that the patients grant permission to the hospital for their data to be used for research purposes.

Inclusion Criteria

The following inclusion criteria were employed to identify eligible patients for this study:

Patients with a well-documented diagnosis of CSDH based on clinical evaluation and imaging findings, who underwent Burr Hole Evacuation as the primary surgical intervention for CSDH were included in the study. Patients with comprehensive medical records, including pre-

operative evaluations, imaging reports, surgical notes, and postoperative follow-up data, were considered for inclusion.

Exclusion Criteria

Patients who met any of the following criteria were excluded from the study: Patients who had previously undergone neurosurgical interventions for CSDH were excluded from the analysis to focus on primary BHE cases. Patients with missing or incomplete medical records, making it impossible to assess their clinical history and outcomes, were excluded. Pediatric patients below the age of 18 years were excluded from the study, as CSDH primarily affects the elderly population.

Data Collection

Qualified healthcare professionals with expertise in neurosurgery extracted the relevant data from the medical records. A standardized data collection form was utilized to ensure consistency and uniformity in the process. The following data variables were extracted from the patient records:

- Patient Demographics: Age, gender, and comorbidities.
- Clinical Presentation: Recorded symptoms, neurological deficits, and cognitive changes.
- Pre-operative Imaging: Data encompassed CT and MRI scans, hematoma size, and laterality.
- Surgical Procedure: Detailed surgical notes, including information on Burr Hole Evacuation, any complications encountered during surgery, and any intraoperative decisions made.
- Post-operative Outcomes: Data included assessments of neurological improvement using the Glasgow Outcome Scale and MRC grading for limb weaknesses, complications post-surgery, length of hospital stay, and patient satisfaction.

Investigations and Surgical Procedure

Non-contrast Computed Tomography scan was done on all patients showing right or left-sided low-density areas over the convexity showing mass effect and midline shift. All patients underwent Burr Hole Evacuation (BHE) as the primary surgical intervention for CSDH. Two burr holes were carried out in all of these patients over the fronto-parietal convexity with thorough washing. No drains were left in situ.

Follow-up

Information regarding long-term outcomes, including any cases of hematoma recurrence, was recorded to date.

Data accuracy and reliability were ensured; double-checks and cross-references were performed to minimize errors in data entry and analysis. All data entries were conducted by qualified healthcare professionals and statisticians to maintain data integrity. Data was analyzed using SPSS version 25.

RESULTS

Patient Demographics and Baseline Presentation

Among enrolled 86 patients, 73 were male, and 13 were female. We cater to not only our province as a tertiary care unit with state-of-the-art facilities but also to several patients from across the border i.e., Afghanistan. We were able to perform BHE on 29 patients of CSDH from Afghanistan during this period. The rest of the 57 patients belonged to different parts of KPK i.e., 16 patients were from Peshawar, 12 from Mardan, 8 from Charsadda, 5 from Swat, 4 from Dir, 3 from Bannu, 3 from Bajour, 3 from Haripur, 2 from Swabi, and one from Dera Ismail Khan and Nowshera each (Table 1).

Table 1: City-wise distribution of patients undergoing Burr Hole Evacuation for Chronic Subdural Hematoma at Northwest General Hospital & Research Center.

City	Number of Patients	% of Total (n) = 86
Peshawar	16	18.60
Mardan	12	13.95
Charsadda	8	9.30
Swat	5	5.81
Dir	4	4.65
Bannu	3	3.48
Bajour	3	3.48
Haripur	3	3.48
Swabi	2	2.32
Dera Ismail Khan	1	1.16
Nowshera	1	1.16

The age distribution of the patients ranged from 18 to 80 years, with a mean age of 54 years. Patients were categorized into seven age groups (Table 2). Notably, all 13 female patients presenting with CSDH were above 58 years of age, whereas male patients exhibited a broader age distribution. As evidenced in multiple other studies, CSDH was seen more so in the elderly population as compared to the younger population.⁵

Presenting Symptoms

The clinical presentation of patients with CSDH varied considerably (Table 3). The predominant presenting symptom was a headache, observed in 85% of cases, except for 13 patients representing 15% who presented in a drowsy state and were admitted through the Emergency Room (ER). Other common presenting symptoms included vomiting in 80% and giddiness in 73%. Limb weakness, including right or left hemiparesis/hemiplegia, was observed in 51% of patients, with 29 of these cases representing 34% exhibiting aphasia in the presence of left-sided hematomas. Interestingly, none of the patients with bilateral hematomas presented with aphasia. Additional clinical presentations included confusion in 26%, sphincter disturbances in 16%, and seizures in 7%.

Among patients aged 70 and above, minor cognitive changes and behavioral disturbances were frequently noted.

CT scan was performed on all patients showing right-sided hematomas in 55% of patients (Figure 1), left-sided hematomas in 34% (Figure 2), while bilateral hematomas were observed in 11% of patients (Figure 3).

Table 2: Demographic data of patients undergoing Burr Hole Evacuation for Chronic Subdural Hematoma at Northwest General Hospital & Research Centre.

Variable	Frequency	Percentage
All Patients (N) = 86		
Gender		
Male	73	85
Female	13	15
Age Categories		
18-27 years	3	3.48
28-37 years	2	2.32
38-47 years	3	3.48
48-57 years	19	22.09
58-67 years	28	32.55
68-77 years	17	19.76
78-86 years	14	16.27

Table 3: The clinical presentation before undergoing surgery.

Variable	Frequency	Percentage
All Patients (N) = 86		
Presenting Symptoms		
Headache	73	84.88
Vomiting	69	80.23
Giddiness	63	73.25
Limb weakness	44	51.16
Aphasia	29	33.72
Confusion	22	25.58
Sphincter disturbances	14	16.27
Drowsiness	13	15.11
Seizures	6	6.97

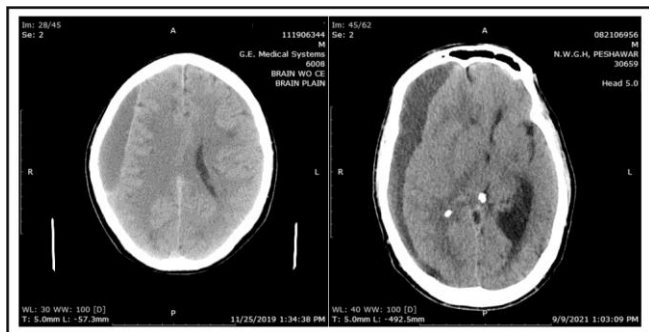


Figure 1: CT of Right-Sided Hematoma (scan included with patient's permission).

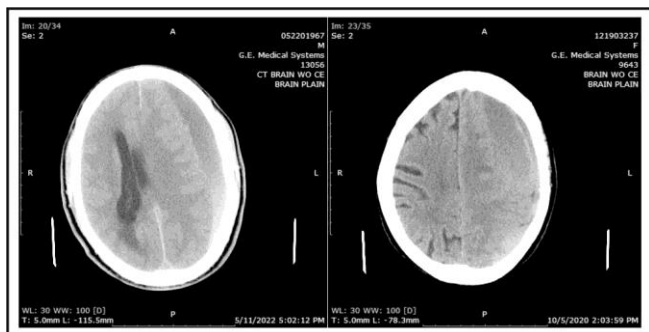


Figure 2: CT of Left-Sided Hematoma (scan included with patient's permission).

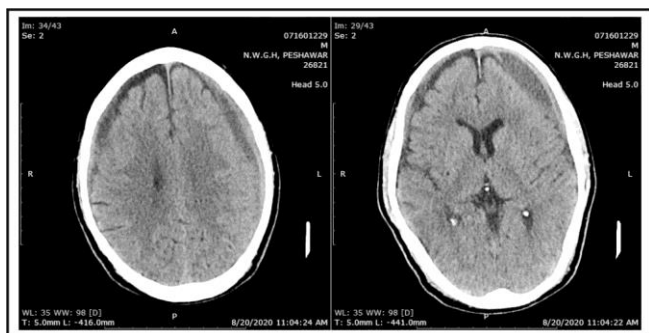


Figure 3: CT of Bilateral Hematoma (scan included with patient's permission).

Surgical Outcomes

No complications were encountered during surgery. Post-operative outcomes demonstrated encouraging results, with 93% of patients experiencing significant recovery, marked by improvements in pre-operative weakness. These patients were discharged home on the third-day post-surgery. In contrast, 7% of patients had

prolonged hospital stays due to concurrent medical conditions. Notably, one patient developed deep vein thrombosis (DVT), and another required the specialized care of a pulmonologist for chronic bronchitis. Remarkably, no patient experienced mortality during either the surgical procedure or the postoperative period until the point of discharge. No recurrent hematomas have been recorded in any case.

Patient Satisfaction

The overall patient satisfaction rate following Burr Hole Evacuation for CSDH was notably high, with 97% of patients expressing satisfaction with the surgical outcome and post-operative care.

DISCUSSION

This study provided insights into the management of chronic subdural hematoma using burr hole evacuation (BHE). The primary focus of the study is the effectiveness and safety of BHE in a diverse group of CSDH patients, as well as patient satisfaction in low-resource settings. The study population comprised 86 patients in total, 85% of whom were male, with a mean age of 54 years, which reflected the demographics of CSDH patients in low-income nations. This result agrees with other studies showing that CSDH, as a disorder, disproportionately affects people of old age in these areas. Notably, the diversity of patients seeking treatment for CSDH in low-income countries was highlighted by the inclusion of patients in our study from varied socioeconomic backgrounds.⁶⁻⁷

The fact that we can accommodate patients from Afghanistan, a close neighbor, and low-income country, highlights the crucial role that our tertiary care facility plays in offering specialist medical care to a larger regional population. Moreover, the findings from our study highlight the need for regional cooperation and knowledge

sharing in treating challenging neurosurgical conditions such as CSDH.

In low-income countries, the clinical manifestations of CSDH frequently pose unique challenges. Headache was the most common presenting symptom in our sample (85%), which is in line with general patterns.⁸ The Emergency Room (ER) was used to admit 15% of patients who arrived in a drowsy state. This finding might point to delayed presentation and inadequate access to healthcare services, which consequently leads to more advanced disease stages at the time of diagnosis.⁹

Additionally, frequently reported symptoms included vomiting (80%) and giddiness (73%), highlighting the significance of identifying these signs early in low-income settings where access to neuroimaging may be restricted. 51% of patients had neurological abnormalities such as limb weakness, and 34% of those patients had aphasia in the context of left-sided hematomas. These results highlight the complexity of CSDH presentations in low-resource environments, where pre-existing comorbidities and lack of adequate plus timely access to healthcare services often lead to a variety of clinical symptoms.¹⁰ Access to advanced diagnostic tools, such as non-contrast Computed Tomography (CT) scans, is restricted in low-income countries. However, our study highlighted the pivotal role of non-contrast CT scans in diagnosing CSDH in all patients. Global radiography patterns continued to be consistent with the typical hypodensity over the right or left convexity that causes mass effect and midline shift.¹¹ This emphasizes the significance of promoting adequate plus timely access to essential imaging technologies in low-resource settings to facilitate early diagnosis and management of conditions like CSDH.

Drug therapy optimization and surgical intervention were the two treatment options that our study examined. The goal of medication treatment optimization was to manage symptoms and get patients ready for surgery with the use of

tranexamic acid and corticosteroids. Additionally, Tranexamic acid has also been reported to be beneficial in regards to preventing the recurrence of hematoma.¹² The necessity for affordable and locally accessible treatment options is highlighted by the fact that access to some pharmaceuticals may be restricted in low-income countries.¹³⁻¹⁴ BHE, the main surgical strategy used in our study, is a workable and successful procedure for the management of CSDH in low-income settings. This method, which involves drilling two burr holes over the fronto-parietal convexity and thoroughly cleaning them, is consistent with accepted therapeutic techniques and has shown positive results even in situations with limited resources. Importantly, our study did not leave drains in situ, which may lower the likelihood of postoperative complications following drain placement and make it an appropriate choice for low-resource settings which is in contrast with some other studies that emphasize using In Situ drains for better surgical outcomes.¹⁵⁻¹⁶

The lack of intraoperative complications during BHE was one of our study's most important findings, affirming the safety of this surgical procedure even in low-resource settings. With 93% of patients enjoying considerable recovery and being sent home on the third day after surgery, post-operative results were quite positive. This implies that BHE, like in many developed parts of the World, can also be successfully implemented in low-resource settings, enabling shorter hospital stays and more effective resource management.¹⁷

Contrarily, 7% of patients required longer hospital admissions because of coexisting illnesses, underscoring the need to manage comorbidities and offer complete treatment in settings with limited resources. The requirement for specialist care, such as the treatment of chronic bronchitis or deep vein thrombosis (DVT), highlights the difficulties in managing patients with numerous medical conditions in low-income nations.

Remarkably, no patient died during surgery, anesthesia, or the healing process up until the time of discharge from the hospital. No recurring hematomas have been reported in any case. According to global trends, our findings highlight the safety and effectiveness of BHE as the primary surgical treatment for CSDH in low-income countries.¹⁸

Our study's findings are consistent with previous research on CSDH management in low-income countries.¹⁹ The absence of intraoperative complications, low mortality rate, and high patient satisfaction rate align with the safety and positive outcomes reported in other studies conducted in resource-constrained settings. These studies collectively signify the feasibility and efficacy of BHE as a practical and reliable treatment option in low-income countries, where access to advanced medical technologies and extensive healthcare resources may be limited.

Future Implications

The results of this study have several implications for how CSDH is managed in low-income nations. First, they emphasize the need for raising awareness and prompt recognition of CSDH symptoms, especially among elderly people. An early diagnosis can result in interventions that are more successful with better outcomes. Second, our study emphasizes the significance of encouraging low-resource settings to have access to crucial diagnostic technologies like non-contrast CT scans. Early and accurate diagnoses may be made possible by expanding access to this technology and making investments in healthcare infrastructure. Third, the success of BHE as a main surgical intervention for CSDH management in our study leads to the conclusion that it ought to be the standard of treatment in developing countries. Patient outcomes can be enhanced by training healthcare personnel on this method and making sure it is accessible at neurosurgical facilities. Finally, it is critical to

manage comorbidities and offer complete treatment for CSDH patients in low-income settings. Multidisciplinary approaches that involve specialists from various fields can enhance patient management and reduce complications.

However, it is essential to acknowledge the limitations of our study. While our results are promising, they are derived from a single-center retrospective cohort study, and larger, multicenter studies in low-income settings are needed to strengthen the evidence base. Additionally, our study did not explore long-term outcomes beyond hospital discharge, which is an area where further investigation is warranted.

CONCLUSION

In conclusion, this study offers insightful information about the BHE-based management of CSDH in low-resource settings. Our cohort's demographics, clinical manifestations, and treatment results are consistent with global trends. This study emphasizes the value of early detection, availability of diagnostic equipment, and BHE's viability as a main surgical intervention. These results highlight the potential for enhancing CSDH management in low-resource settings and encourage more extensive studies and collective efforts to improve neurosurgical treatment in these settings.

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Additional Information

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Ethical Review Board Approval: The study was conformed to the ethical review board requirements.

Human Subjects: Consent was obtained by all patients/participants in this study.

Conflicts of Interest:

In compliance with the ICMJE uniform disclosure form, all authors declare the following:

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AUTHORS CONTRIBUTIONS

Sr.#	Author's Full Name	Intellectual Contribution to Paper in Terms of:
1.	Faiqa Filza	1. Study design and methodology.
2.	Faiqa Filza & Almas Fasih Khattak	2. Paper writing.
3.	Faiqa Filza, Leena Ayesha & Almas Khattak	3. Data collection and calculations.
4.	Almas Fasih Khattak& Khial Jalal	4. Analysis of data and interpretation of results.
5.	Wajid Ali, Majid Ayaz & Zahid Khan	5. Literature review and referencing.
6.	Almas Fasih Khattak & Faiqa Filza	6. Editing and quality insurer.