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Comparison of Burr Hole Drainage and Mini-Craniotomy in the Management of Chronic Subdural Hematoma: A Retrospective-Prospective Study at Dr. Zainoel Abidin General Hospital

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Keywords
chronic subdural hematoma; burr hole drainage; mini craniotomy; postoperative complications; mortality clinical outcomes.

Abstract

Burr hole drainage and mini craniotomy are two commonly used surgical techniques in the management of cSDH, but their effectiveness on clinical outcomes is still debated. This study aims to compare the effectiveness of burr hole drainage and mini craniotomy based on the incidence of postoperative complications and mortality in chronic subdural hematoma patients at dr. Zainoel Abidin Banda Aceh Hospital. This study used a comparative analytical observational design with a retrospective-prospective approach. The study sample consisted of 30 cSDH patients who underwent burr hole drainage or mini craniotomy during the period January 2024–December 2025 and were selected using consecutive sampling techniques. Data were obtained from the patient's medical records and analyzed using the Chi-square test or Fisher's Exact Test with a significance level of $p<0.05$. The average age of patients was 63.5±12.1 years with the majority being male (83.3%). A total of 22 patients (73.3%) underwent burr hole drainage and 8 patients (26.7%) underwent a mini craniotomy. Postoperative complications occurred in 1 patient (4.5%) of the burr hole drainage group and 1 patient (12.5%) of the mini craniotomy group. The results of the analysis showed that there was no significant difference between the two actions on the incidence of complications ($p=0.469$). Mortality was found in 1 patient (4.5%) in the burr hole drainage group and not found in the mini craniotomy group, with no significant difference ($p=1,000$).

INTRODUCTION

Chronic subdural hematoma (cSDH) is one of the intracranial hemorrhages that is often found in neurosurgical practice, especially in the elderly population (Dziho et al., 2025; Mehmandoost et al., 2025; Peters et al., 2023; Rickard et al., 2025; Sundblom et al., 2022). The incidence of cSDH is estimated to range from 8–14 cases per 100,000 population per year and increases at the age of over 70 years (Rahal et al., 2023). Increasing life expectancy, geriatric population, and the use of anticoagulants and antiplatelets are expected to increase the incidence of cSDH in the future. This condition is an important problem because it is related to high morbidity, mortality, and decreased quality of life of patients (Shah & George, 2021).

Patho physiologically, cSDH generally occurs due to bridging veins that cause blood buildup in the subdural space. The collected blood will form fibrous membranes that undergo fragile neovascularization so that it is easy to rehearse and cause the hematoma to enlarge (Shah & George, 2021). Clinical manifestations of cSDH develop slowly and often non-specific, such as headaches, changes in mental status, hemiparesis, balance disorders, decreased consciousness, and seizures. This condition often leads to a delay in diagnosis, especially in elderly patients (Nouri et al., 2021).

The primary management of cSDH is surgical action to evacuate the hematoma and reduce the effect of mass on the brain. The two most commonly used surgical techniques are burr hole drainage and mini craniotomy (Firdaus & Untoro, 2025). Burr hole craniotomy (BHC) is the most common procedure performed because it is minimally invasive, the surgical technique is simple, and it has a relatively low complication rate. However, the postoperative recurrence rate is still quite high, which is around 9.2–26.5% (Kim et al., 2017).

Mini craniotomy is a surgical technique with a small bone flap of about 4–6 cm in size that allows a wider visualization of the subdural cavity, so that hematoma evacuation, membrane excision, and hemostasis control can be carried out more optimally (Rao et al., 2024). Some studies have shown that mini craniotomy has a lower recurrence rate than burr hole drainage, especially in hematomas with septation or thick membranes (Shim et al., 2019; Syahrul et al., 2020). However, this procedure has the disadvantages of longer operating duration, higher invasiveness, and greater maintenance costs (Moghib et al., 2025).

The urgency of this research is underscored by the increasing incidence of cSDH in the aging population and the need for evidence-based surgical decision-making. At Dr. Zainoel Abidin General Hospital, which serves as a major referral center in Aceh province, there is a growing number of cSDH cases requiring surgical intervention. Understanding the comparative effectiveness of the two surgical techniques in this specific clinical setting is essential for optimizing patient outcomes, reducing complications, and guiding resource allocation. The novelty of this study lies in its focus on the Indonesian context, providing the first comparative analysis of these two surgical techniques at this hospital, and its use of a combined retrospective-prospective design to capture both historical and recent clinical data.

Until now, the selection of the best surgical method for chronic subdural hematoma (SDHK) is still a debate because each technique has its advantages and disadvantages. In addition, the results of studies related to the effectiveness of burr hole drainage and mini craniotomy still show varying results, especially on the rate of complications, recurrences, and mortality. Data on the comparison of the two methods in Indonesia, especially at dr. Zainoel Abidin Banda Aceh Hospital, is also still limited. Therefore, this study was conducted to compare the effectiveness of burr hole drainage and mini craniotomy on the clinical outcomes of chronic subdural hematoma patients. The formulation of the problem in this study is whether there is a difference in effectiveness and postoperative clinical outcomes, including the incidence of complications and mortality, between SDHK patients undergoing burr hole drainage and mini craniotomy at dr. Zainoel Abidin Banda Aceh Hospital. This study aims to compare the effectiveness of burr hole drainage and mini craniotomy surgical procedures in the management of SDHK patients, with the specific aim of comparing the incidence of postoperative complications, mortality, and assessing the effectiveness of the two methods based on these outcomes. The results of this study are expected to provide insight into the comparison of the effectiveness of the two surgical techniques in the management of SDHK, become a consideration for the medical team in determining the most appropriate surgical technique, become a basis for further research related to the management of SDHK, contribute to the development of neurology and neurosurgery, and become a reference for other hospitals in choosing the most effective surgical techniques for the treatment of SDHK.

RESEARCH METHODS

Types of Research

This study was a comparative analytical observational study with a retrospective design that aims to compare the effectiveness of burr hole drainage and mini craniotomy in patients with chronic subdural hematoma (SDHK). Retrospective data was obtained from the medical records of patients undergoing surgery at Dr. Zainoel Abidin Banda Aceh Hospital during the period from January 1, 2024 to December 31, 2025, while prospective data were used to trace or confirm patients' clinical outcomes, especially postoperative complications and mortality. This study was conducted to evaluate the effectiveness and safety of both surgical techniques based on available clinical data without direct intervention on patients.

Population and Sample

The study population was all patients diagnosed with chronic subdural hematoma (SDHK) and underwent burr hole drainage or mini craniotomy at Dr. Zainoel Abidin Banda Aceh Hospital during the period from January 1, 2024 to December 31, 2025. The research sample was taken using the consecutive sampling technique, where all patients who met the inclusion criteria and did not meet the exclusion criteria would be included sequentially until the sample number was met. Based on the calculation of the two-proportion difference test, the minimum number of samples required is 30 patients, consisting of 15 patients each in the burr hole drainage and mini craniotomy groups.

Data Collection Techniques

The research data was collected through tracing the medical records of patients who met the study criteria. The variables collected included the demographic characteristics of the patient, clinical history, results of radiological examinations, type of surgical procedure, and clinical outcomes in the form of postoperative complications and mortality. Data collection is carried out using a recorded form that has been prepared, then the completeness and accuracy of the data are checked before entering the processing and analysis stage.

Data Analysis Techniques

The data obtained is processed through the stages of cleaning, editing, coding, tabulating, and entry using the SPSS program. Univariate analysis is used to describe the characteristics of the research sample in the form of averages, standard deviations, frequencies, and percentages. Bivariate analysis was performed to compare postoperative complications and mortality between the burr hole drainage and mini craniotomy groups using the Chi-square test or Fisher's Exact Test if the Chi-square test requirements were not met. The results of the analysis are considered statistically significant when a p value is obtained < 0.05.

RESULTS AND DISCUSSION

Characteristics of Research Respondents

In this section, the characteristics of the research respondents are presented as an overview of the subjects included in the analysis. The characteristics displayed included demographic and clinical variables, namely age, gender, history of head trauma, comorbidities, preoperative neurological status based on *the Glasgow Coma Scale* (GCS), lesion side, thickness of subdural hematoma (SDH), presence of *midline shift*, and type of *burr hole* surgery or *mini craniotomy*. Details of the characteristics of the study respondents can be seen in Table 1 below.

Table 1 Characteristics of the study respondents

Variabel	Red ± SD	n (%)
Age (years)	63.5 ± 12.1	
Gender		
1. Male		25 (83,3)
2. Women		5 (16,7)
History of head trauma		
1. None		3 (10,0)
2. Ada		27 (90,0)
Komorbid		
1. Hypertension (HT)		19 (63,3)
2. HT and DM		9 (30,0)
3. No history of comorbidities		2 (6,7)
GCS *pre-op*	14,5 ± 0,5	
Side of the lesion		
1. Dextra		10 (33,3)
2. Left		20 (66,7)
SDH thickness (in millimeters)	16.0 ± 4,1	
1. ≥2 cm		24 (80,0)
2. <2 cm		(20,0)
Midline shift	6,0 ± 1,9	
Types of actions		
1. *Burr hole drainage*		22 (73,3)
2. *Mini craniotomy*		8 (26,7)

Based on Table 1, the number of respondents in this study was 30 patients with chronic subdural hematoma. The average age of patients was 63.5 ± 12.1 years, indicating that most patients were in the elderly age group. Based on gender, the majority of patients were male as many as 25 people (83.3%), while women amounted to 5 people (16.7%).

Based on the history of head trauma, most patients had a history of head trauma, which was as many as 27 people (90.0%), while patients with a history of no head trauma were only 3 people (10.0%). In the comorbid variable, the most common comorbidity was hypertension, which was 19 people (63.3%), followed by patients with hypertension and diabetes mellitus as many as 9 people (30.0%), while patients without a history of comorbidities were 2 people (6.7%).

The average preoperative GCS score of patients was 14.5 ± 0.5, indicating that most patients came in with a relatively good level of consciousness. Based on the lesion side, chronic subdural hematoma is more commonly found on the *sinistra side*, which is as many as 20 people (66.7%), compared to the *dextra* side of 10 people (33.3%). The average thickness of SDH is 16.0 ± 4.1 mm. After being categorized, most patients had a hematoma thickness of <2 cm, which was 24 people (80.0%), while patients with a thickness of ≥2 cm were 6 people (20.0%). The average *midline shift* is 6.0 ± 1.9 mm.

Based on the type of surgery, most patients underwent *burr hole drainage*, which was 22 people (73.3%), while patients who underwent *mini craniotomy* were 8 people (26.7%). In general, the characteristics of the respondents showed that SDHK patients in this study were dominated by elderly men, without a clear history of head trauma, had comorbid hypertension,

with a hematoma thickness of mostly less than 2 cm, and were more managed using *burr hole drainage*.

Postoperative Clinical Externalities

Postoperative complications in this study were analyzed by comparing the proportion of patients who experienced and did not experience complications in the *burr hole* and *mini craniotomy groups*. The results of the comparison between the type of procedure and the incidence of postoperative complications are presented in Table 4.2 below.

Table 2 Comparison between types of action and complications

Complications	*Burr hole*		*Mini craniotomy*		p
	n	%	n	%	
Complications (*Rebleeding*, infection, seizures)	1	4,5%	1	12,5%	0,469
None	21	95,5%	7	87,5%	

Based on Table 2, it was found that postoperative complications occurred in 2 respondents (6.7%) of the entire study sample. In the *burr hole drainage* group, complications were found in 1 respondent (4.5%), while in the mini craniotomy group, complications were found in 1 respondent (12.5%). Meanwhile, the majority of respondents in both groups did not experience postoperative complications, namely 21 respondents (95.5%) in the *burr hole drainage* group and 7 respondents (87.5%) in the *mini craniotomy group*. The results of *the Fisher's exact* test showed a value of p = 0.469, so it can be concluded that there was no statistically significant difference between the type of surgery and the incidence of postoperative complications in patients with chronic subdural hematoma in this study.

Table 3. Comparison between action types and mortality

Mortalities	Burr hole		Mini craniotomy		p
	n	%	n	%	
Life	21	95,5%	8	100%	1,000
Died	1	4,5%	0	0%	

Based on Table 3, it was found that of all the study respondents, there was 1 respondent (3.3%) who died after surgery. In the burr hole drainage group, 1 respondent (4.5%) died and 21 respondents (95.5%) lived. Meanwhile, in the mini craniotomy group, all respondents survived (100.0%) and no deaths were found. The results of statistical analysis showed a value of p = 1,000, so it can be concluded that there was no statistically significant difference between the type of surgery and mortality in patients with chronic subdural hematoma in this study.

Characteristics of Research Respondents

This study evaluated patients with chronic subdural hematoma (SDHK) who underwent surgery *burr hole* and *mini craniotomy* at dr. Zainoel Abidin Banda Aceh Hospital. In general, *burr hole* more often than *mini craniotomy.* This pattern is in line with broad clinical practice because *burr hole* is known as a minimally invasive procedure that is prevalent in most SDHK cases, while *mini craniotomy* It is usually considered in certain conditions when wider access

is required, for example in more complex or organized hematomas. These findings are in line with the COMPACT randomized trial conducted by Duenrick in 2022, where he compared several surgical techniques in SDHK and showed that several technique options could be used, with differences in certain outcomes such as the need for reoperation in some studies (Duerinck et al., 2022).

In this study, the average age of respondents was 63.5 ± 12.1 years. These findings are in line with the common characteristics of chronic subdural hematoma (SDHK/cSDH) which is more common in old age. Recent clinical reviews and reports by Beck, et al. confirm that SDHK is a higher risk condition in the elderly, and the incidence trend has increased in recent decades.(Rahal et al., 2023) Other literature by Sadhegian, et al. also emphasizes that SDHK is a disease that mainly affects the elderly, with variations in incidence rates that tend to increase in the age group >70 years (Sadeghian et al., 2023).

Based on gender, this study showed male dominance (83.3%). These results are also in accordance with literature reports that SDHK is more often found in men, even some studies report a male, female ratio of around 3:1. Male dominance is thought to be associated with higher risk exposure to trauma, physical activity, as well as possible differences in biological factors and comorbidities that affect susceptibility to chronic subdural hemorrhage (Maeda et al., 2024; Nouri et al., 2021). In addition, in this study, most patients had comorbidities of hypertension, some accompanied by diabetes
Mellitus. In the modern SDHK population, cardiometabolic comorbidities are often found because old age is a major risk factor, and comorbidities can affect perioperative conditions and recovery although the effect on comparisons between techniques is not always direct (Rahal et al., 2023).

A pre-operative average GCS value of 14.5 ± 0.5 indicates that the majority of patients come in with relatively good neurological conditions. This may reflect that most of the cases in this study were diagnosed in a phase when a severe decrease in consciousness has not yet occurred. The clinical presentation of SDHK does vary, ranging from headaches, gait disorders, decreased cognitive function, hemiparesis, to decreased consciousness. In patients with milder symptoms and still good neurological status, postoperative clinical outcomes tended to be better than those in patients who came in with severe neurological conditions (Muneeb et al., 2026; Nouri et al., 2021).

The mean midline shift in this study was 6.0 ± 1.9 mm, with a preoperative GCS mean of 14.5 ± 0.5, thus clinically describing that the patient had a radiological mass effect, but not accompanied by a decrease in severe consciousness. These findings are in line with a 2021 review by Nouri et al. that stated that most patients with chronic subdural hematoma come with GCS 13–15, and CT examination plays an important role in assessing cerebral compression, including hematoma thickness, ventricular collapse, herniation, and midline shift; The review also reported a post-therapy recurrence of about 9–33% (Nouri et al., 2021). The midline shift parameter itself is important because the evaluation of the success of SDHK therapy relies heavily on radiological measures such as hematoma volume, hematoma width, and midline shift, although validated midline shift measurement standards are still not uniform.(Zanolini et al., 2022) The results of the 2024 study by Grübel et al. also reinforce the relevance of this parameter, as an increase in preoperative midline shift is reported as one of the independent predictors of SDHK recurrence after surgical therapy (Grübel et al., 2024). In addition, Foppen

et al. in 2025 in SDHK patients with mild–moderate symptoms reported that of the 114 patients who were initially treated conservatively, 49 patients (43%) eventually switched to surgery, while 330 patients underwent surgical therapy; The study found that early surgical therapy was associated with a higher rate of complications than conservative approaches in the mild–moderate symptom group, although operative therapy remained relevant in patients with neurological symptoms or more significant mass effects (Foppen et al., 2025). Thus, in this study, the combination of an average midline shift of 6.0 mm and a high GCS showed a radiologically significant urgency effect, but the patient's neurological condition was still relatively good; This may explain why postoperative outcomes appear to be quite good, with low complications and mortality rates.

Comparison of Surgical Procedures to Postoperative Complication and Mortality Outcomes

In this study, postoperative complications were found in 2 patients (6.7%), 1 patient each in the group *burr hole drainage* (4.5%) and *mini craniotomy* (12,5%). Descriptively, the proportion of complications appears to be higher in the *mini craniotomy*, but the difference was not statistically significant (p = 0.469). These findings are in line with the meta-analysis of Huang et al. (2022) who reported that there was no significant difference in postoperative complications between burr hole and *mini craniotomy*, although *burr hole* It has advantages in recurrence, reoperation and lower operating duration. In general, both techniques have a relatively comparable safety profile (Huang et al., 2022).

Theoretically, *mini craniotomy* Provides a broader visualization of the hematoma and membrane, so it can be more appropriate in certain cases such as septate, recurrent, or with solid components. However, this procedure is also more invasive than burr holes. Instead, *burr hole* less invasive and more technically simple, so it is more often chosen in typical SDHK cases (Huang et al., 2022). The insignificance of the results in this study needs to be interpreted carefully because the number of samples is relatively small, especially in the *mini craniotomy*. In addition, the low rate of total complications may also be influenced by the patient's relatively good preoperative neurological condition and proportions *midline shift* low. Thus, the results of this study show that although the complications are descriptively higher in mini craniotomy, the two techniques still have relatively comparable complication profiles.

In this study, the total postoperative mortality was 1 patient (3.3%). Deaths were only found in groups *burr hole drainage* as many as 1 patient (4.5%), while in the *mini craniotomy* No deaths were found. However, statistically there was no significant difference between the two groups (p = 1,000). These findings are consistent with several literature reports. The meta-analysis of Huang et al. showed no significant difference in mortality between *burr hole craniotomy* and *Mini craniotomy* (OR 1.22; 95% CI 0.92–1.61; p = 0.16). Thus, although the two techniques have different operative characteristics, their effect on short-term mortality does not appear to be markedly different (Huang et al., 2022).

The mortality rate in this study is also still within the range reported in operated SDHK patients. Recent systematic reviews and recent reviews indicate that mortality in SDHK patients who receive surgery is generally relatively low, around 2–5%, although it may increase in patients who are very old, frail, or with late diagnosis or recurrence. Thus, the mortality rate

of 3.3% in this study is still in accordance with the mortality profile reported in the literature (Muneeb et al., 2026).

The FINISH study showed that mortality at 6 months after SDHK surgery reached 6.6%, and increased to 13.9% at a median follow-up of 16.4 months, with the risk of death increasing in patients with more comorbidities. The numbers in your study appear to be lower, but this is reasonable because your results seem to reflect perioperative or short-term mortality in a relatively small cohort, with fairly good early neurological status. Differences in the definition of external, old *follow-up*, and population characteristics are very likely to influence the magnitude of mortality rates reported between studies (Tommiska et al., 2025). The absence of deaths in the mini craniotomy group in this study does not necessarily indicate that the technique is superior to burr hole drainage. These outcomes are more likely to be influenced by small sample counts, variations in clinical characteristics between groups, and low overall mortality rates. Therefore, scientifically it is more accurate to conclude that in this study there is no evidence of a difference in mortality between *burr hole drainage* dan mini craniotomy.

CONCLUSION

Based on the results of this study, there was no statistically significant difference between burr hole drainage and mini craniotomy on the incidence of postoperative complications or mortality in patients with chronic subdural hematoma. Subsequent studies should be conducted with a larger sample count, a longer data collection period so that the comparative analysis between *burr holes* and *mini craniotomy* can be more robust. In addition, it is necessary to consider the addition of more detailed radiological variables, as well as perioperative factors such as the use and duration of drains. A *clear follow-up* period is also needed to catch recurrences or complications that arise after the patient discharges.

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