Outcomes of SUBGALEAL Drain Placement after two Burr-Holes Craniectomy for Chronic Subdural Hematoma

Muhammad Shaheer Akhtar, Zahid Khan, Muhammad Kashif, Waheed Alam, Haider Ali and Irfan Ali

Department of Neurosurgery, Lady Reading Hospital, Peshawar, Pakistan

ABSTRACT

Objective: To evaluate the efficacy and complications of subgaleal drain placement after two burr-holes evacuation of chronic subdural hematoma (CSDH).

Study Design: Descriptive study.

Place and Duration of Study: The Neurosurgical unit of the Lady Reading Hospital, Peshawar, from April to November 2021.

Methodology: Sixty-four consecutive patients diagnosed with surgically significant unilateral chronic subdural hematoma were prospectively included after obtaining informed consent. All the patients underwent two burr-holes craniectomies and evacuation, followed by subgaleal drain placement. Patient demographics, pre- and postoperative clinical information including hematoma resolution and complications were collected.

Results: This study included 44 (69%) males and 20 (31%) females with a mean age of 70.1 ± 8 years. The most common presenting symptoms were headaches (70%) and confusion (68%). Eighteen patients (28%) were taking warfarin or other anticoagulants, whereas, 23 patients (36%) were taking antiplatelet medications at the time of presentation. Thirty-six (56.3%) patients had a history of head trauma. Warfarin use was statistically significant in the patients with no history of head injury. Fifty-five patients (85%) showed no significant recurrence on the 2 week postoperative computed tomography (CT) scan. None of the patients had intraparenchymal hematoma or contusion of iatrogenic origin on postoperative CT scans.

Conclusion: Subgaleal drain placement after two burr-holes craniectomy led to high-resolution rates. However, no parenchymal injuries were attributed to the procedure.

Key Words: *Chronic subdural hematoma, Subdural drain, Subperiosteal drain, Burr-hole craniostomy.*

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INTRODUCTION

Chronic subdural hematoma (CSDH) is a common neurosurgical condition. According to the American Association of Neurological Surgeons, 43000 burr-holes were performed only in 2006 for evacuation of subdural hematomas. It has been noted that the incidence is on the rise due to increasing life expectancy and the use of anticoagulant medications.[1] CSDH is most commonly present in the elderly male population, with the highest incidence in the age group of 70–79 years. It has a variable presentation, ranging from headaches, ataxia, and confusion to seizures, stroke, and coma. Brain CT without contrast is commonly used as the diagnostic modality of choice.[2]

A conservative nonsurgical approach is employed in asymptomatic patients. In symptomatic patients, surgical evacuation is preferred, followed by drain placement.[3]

Correspondence to: Dr. Zahid Khan, Department of Neurosurgery, Lady Reading Hospital, Peshawar, Pakistan
E-mail: neurosurgeonzahid@yahoo.com

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Burr-hole craniectomy is the most commonly used procedure for hematoma evacuation. Twist-drill craniectomy and craniotomy are performed under specific conditions.[4]

Drain placement reduces both the recurrence and mortality rates.[5] However, subdural drains are often accompanied by complications such as parenchymal damage, subdural empyema, and cerebral abscesses.[6] Overall resolution of CSDH with drain placement was reported to be 88% in one study.[7] Some studies have suggested that placement of subperiosteal/-subgaleal drainage systems after burr-hole evacuation may potentially reduce these risks without an increase in recurrence and reoperation rates.[4]

Hani *et al*. demonstrated that 2.8% of patients with subdural drain placement and none of those with subgaleal drain placement had parenchymal injuries. Half of these patients had a persistent neurological deficit postoperatively.[8] Brennan *et al*. noted no significant difference between the two drain groups in CSDH recurrence (13.1% in the subdural group *vs.* 11.2% in the subperiosteal group; or 6-month modified Rankin score (mRS) 27.2% with mRS 4-6 in the subdural group *vs.* 20.4% in the subperiosteal group.[6]

On the basis of emerging evidence, the authors changed the practice from subdural to subgaleal drain placement after CSDH

evacuation. This study aimed to determine the efficacy and safety of subgaleal drainage. This evidence will also help similar hospitals to transition from subdural drain placement to a safer alternative.

METHODOLOGY

This descriptive study was performed at the Neurosurgical unit of the Lady Reading Hospital, Peshawar, from April to November 2021. After obtaining approval from the institutional ethics board, 64 consecutive patients diagnosed with surgically significant unilateral chronic subdural hematoma were included in this study. Surgically significance included chronic subdural hematoma was either a maximum thickness of 10 mm and/or midline shift of 7 mm; and / or any thickness causing mass effect, midline shift, or neurologic signs and symptoms.

Patients who had previously undergone surgery, those with active neurosurgical issues other than CSDH, intractable thrombocytopenia, CSDH due to meningeal carcinomatosis, or pregnancy were excluded. Cases in which the surgeon made an intraoperative decision to convert surgery to craniotomy were also excluded.

The surgical procedure was similar to those described previously in the literature.[5,8,9] Two burr-holes, one overlying the frontal and parietal regions, were created in all the cases. After the incision of the dura mater, the subdural cavity was thoroughly irrigated with warm saline until the fluid became clear. A 16 French suction drain was then placed overlying both burr--holes in the subgaleal space and brought out *via* a separate skin incision in the parietal region. The drain was connected to a closed drainage system. The burr-holes were left open to drain into the overlying drainage catheter. The subdural space was filled with isotonic saline before closing the galea and the skin in an airtight fashion.

The drain was monitored and removed at 48 h postoperatively. Serial neurological examinations and repeat CT of the brain in the immediate postoperative period and at discharge were performed as part of standard protocols (Figures 1-3). If the patient was discharged, a standard 2 weeks post-operative follow-up CT scan was performed for the evaluation of surgically significant recurrence. Patients who were still hospitalised underwent a CT brain at 2 weeks postoperatively.

The data were analysed using SPSS version 23. Mean ± SD were calculated for continuous variables while categorical variables were reported as frequencies and percentages. The chi-squared test was used to compare resolution among patients based on gender, age, hematoma thickness, side, and medication use. The values of p less than 0.05 were considered significant.

RESULTS

A total of 64 patients were included in the study. All patients had surgically significant CSDH diagnosed by imaging. The mean age was 70.1 ± 8 years.

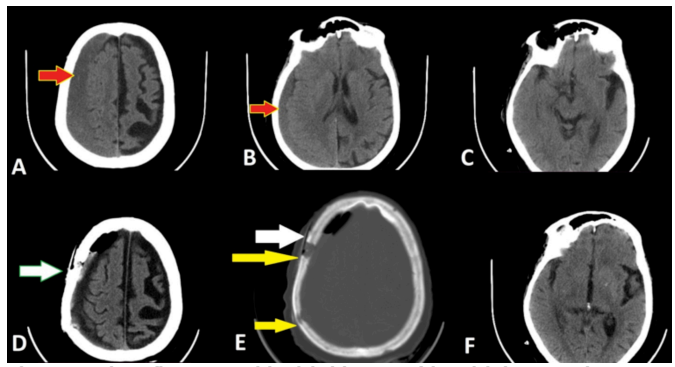

Figure I: Sixty-five year old with history of head injury 14 days ago, presented with headaches and altered mental status. A, B, C) Preoperative CT brain without contrast. Red arrow points to right-sided hypo to iso-dense collection in the subdural space. D, E) Postoperative CT brain shows reduced collection. White arrows point to position of subgaleal drain overlying burr-holes. Yellow arrows point to the two burr-holes used for evacuation of hematoma. There is mild pneumocephalus evident in the frontal region that was treated conservatively. F) CT brain performed at 14 days post-op. shows total resolution of hematoma and mass effect. Effacement of sulci noted in previous images is notably absent.

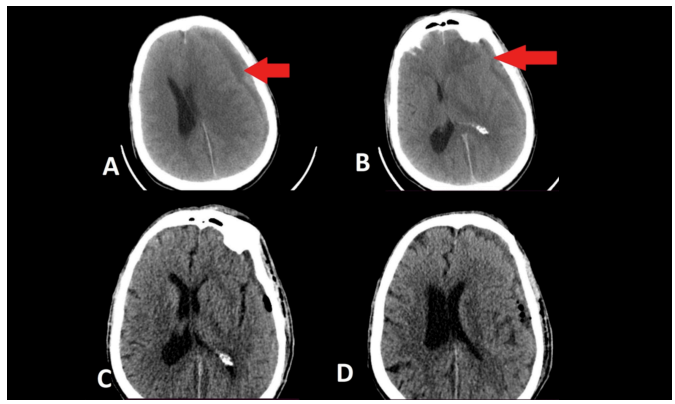

Figure 2: Fifty-eight year old with history of warfarin use. (A, B) Preoperative CT brain. Red arrows point to left-sided hypodense subdural collection with tense brain and midline shift. (C, D) Postoperative images after subgaleal drain placement shows significant reduction of mass effect and hematoma volume. The drain can be noted tracking in subgaleal space overlying the bone.

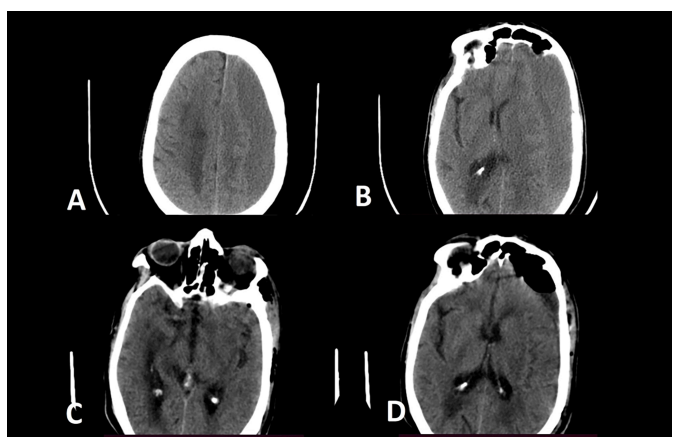

Figure 3: Sixty-two year old male with history of headaches and vomiting for 3 days presented with altered mental status. (A, B) preoperative images show a massive left-sided subdural collection with significant midline shift and mass effect. (C, D) Postoperative images on 14th day show total resolution of hematoma and mass effect. There is mild persistent pneumocephalus that was treated conservatively.

The most common presenting symptoms were headaches in 45 (70%) and confusion in 44 (68%) patients. Nine patients (14%) had GCS of 3-8. Seventeen patients (26%) had diabetes and 23 (35%) had a history of hypertension. Eighteen patients (28%) were taking warfarin or other anticoagulants, whereas 23 (36%) were taking antiplatelet medications at the time of presentation (Table I). Warfarin use was statistically significant in patients with no history of head injury (n=17 $p<0.05$). Forty-five patients (70%) had right-sided hematoma, whereas 19 (30%) had a left--sided hematoma. The average hematoma thickness was 19 ± 3.6 mm.

Table I: Clinical features on presentation (n=64).

Clinical feature		Number of patients	Percentage
Presentation	Headache	45	70.3
	Confusion	44	68.8
	Focal neurologic deficit	28	43.8
	Memory deficit	17	26.6
	Aphasia	17	26.6
	Vomiting	16	25
	Seizures	9	15
	History of head injury	36	56.2
Glasgow coma scale	3-8	9	14.1
	9-12	50	78.1
	13-15	5	7.8
Comorbid conditions	Diabetes	17	26.6
	Hypertension	23	35.9
Medication use	Antiplatelet	23	35.9
	Warfarin	18	28.1

Table II: Frequency of outcomes (n=64).

Feature		Frequency	Percentage
Hematoma resolution		55	85.9
Discharge	Overall	61	95.3
	Poor outcome (GOS 1-3)	8	12.5
	Good outcome (GOS 4-5)	53	82.8
Parenchymal hematoma		0	0
Recurrence	Overall	7	11
	Two surgeries	4	6.3
	Three surgeries	3	4.7
Pneumocephalus		19	29.7
Death		3	4.7

Nineteen (30%) patients had some degree of postoperative pneumocephalus on CT. All patients were managed conservatively. Four patients (6.3%) underwent a second surgical procedure due to recurrence, whereas three patients (4.7%) underwent third surgical drainage. Fifty-five patients (85%) showed no surgically significant recurrence on the 2 week postoperative CT scan. Fifty-three patients (83%) had good outcomes on the Glasgow Outcome Scale (4-5). Three (4.7%) patients died during the study period (Table II). The cause of death in two patients was sudden cardiopulmonary arrest, while the third patient died from complications of renal failure. Stratification of hematoma resolution according to sex, age, hematoma thickness, hematoma side, and medication used did not reveal any statistically significant differences between groups after the application of chi-square test.

DISCUSSION

Despite numerous advances in medical and endovascular management, surgical drainage *via* burr-hole craniectomy remains the most widely practiced treatment for symptomatic CSDH.[10] There is a lack of conclusive evidence regarding the differences in outcomes between single and multiple burr-hole drainage procedures. However, level 1 evidence suggests that drain placement reduces recurrence and length of hospital stay.[11] In this study, the authors used two burr-holes craniectomies as a standard procedure for chronic subdural hematoma drainage, followed by subgaleal closed-system drain placement.

A CSDH usually presents in the elderly population. A meta-analysis by Nathan *et al*. reported a mean age of 72.[12] The present patients had a mean age of 70 ± 8.3 years. This finding indicates a significantly older population with multiple comorbidities. Diabetes was present in 26% of patients, while 35% had hypertension, which is an independent predictor of poor outcomes.

The symptoms of subdural hematomas are often vague. In a study by Kitya *et al*., the most common presenting symptoms were headaches (89.6%), followed by confusion (71.7%), limb weakness (70.5%), urinary incontinence 103 (65.6%), memory loss (65.5%), and convulsions (11.5%).[13] Ishfaq *et al*. reported similar results in their quasi-experimental study.[5] Headache was the most common symptom in the present study, with an incidence of 70.3%. This was followed by confusion (68.8%), focal neurological deficits (43.8%), and memory deficits (26.6%).

In the past, most CSDH cases were attributed to head trauma. This trend has changed significantly over the past few decades, owing to the increasing use of antiplatelet and anticoagulant medications. Of the patients reported by Kitya *et al*., 69.8% had a history of significant trauma.[13] They did not report anticoagulant or antiplatelet use in their patient population. In another study, 53.4% of patients with CSDH had a history of trauma, which was associated with poor outcomes at the long-term follow-up.[14] More than half (56%) of the patients in this study reported head injury before symptom development. The remaining patients did not recall significant recent trauma to the head. It is also remarkable that 28.1% patients were using antiplatelet and 35.9% were using warfarin around the time of presentation. The use of warfarin in patients without a history of head trauma was statistically significant ($p<0.01$). Similar results were reported by Srivatsan *et al*., with 40% antiplatelet and anticoagulant use in one group and 25% use in the second group.[15] In this study, 60% of the patients without a history of head trauma were using anticoagulants at the time of presentation. These figures, together with a mean age of 70 years in this series, can explain the large percentage of CSDH patients without a history of head trauma.

Most patients had a GCS range 9-12 (78%). These findings are similar to those reported in Pakistan.[5] Studies from more developed parts of the world have reported a higher number of patients with GCS 13-15.[13] This trend might be representative of better healthcare access in contrast to the present study system. The majority of the patients in this study belonged to low-income populations from distant areas, who reached the specialised case setup very late after the initial symptoms developed. This also introduces potential bias in this study, as very sick patients may never have reached the study setup.

A major drawback of the subdural drain placement is the rate of permanent neurological deficits following iatrogenic cortical damage. Because these drains are placed blindly through the burr-holes, they can penetrate the parenchyma and lead to cerebral contusions, intraparenchymal hematomas, postoperative seizures, and lasting neurological deficits. Subgaleal drain placement, as opposed to subdural drain placement after burr--hole drainage, has no effect on the CSDH resolution rate. Despite this similarity, the rate of parenchymal damage is almost non-existent.[5,9] This series had a hematoma resolution rate of 85%, which is close to that reported in previous studies.[7] Routine postoperative CT showed no iatrogenic parenchymal injuries. Seven patients in the series experienced recurrences. Four underwent one additional drainage surgery while three patients had to undergo two additional surgeries. No significant association was found between hematoma recurrence and factors such as age, comorbidities, preoperative GCS score, or hematoma thickness. The mortality rate in this study was 4.6%, which was within the lower range reported in the literature.[1,5,7]

Recovery rates of 80-95% of the patients have been reported in recent studies.[9,13] Eighty-three percent of the patients in this series had a good outcome (Glasgow outcome score 4-5). The lower rates compared to the above studies can be explained by the fact that the majority of the patients received GCS 9-12 as compared to 13-15 in these studies.

Limitations of this study include an absence of direct comparison with subdural drainage and short-term follow-up period.

CONCLUSION

Subgaleal drain placement after two burr-holes drainage of CSDH leads to satisfactory hematoma resolution rates. In addition, there is a lack of parenchymal injuries and sequelae associated with this form of drain placement.

ETHICAL APPROVAL:
The study was approved by the Ethical Review Board of Lady Reading Hospital MTI, Peshawar.

PATIENTS' CONSENT:
Informed consent were obtained from all the patients for the procedure and enrollment in the study.

COMPETING INTEREST:
The authors declared no competing interest.

AUTHORS' CONTRIBUTION:
MSA: Study design and methodology, paper writing, referencing, data calculations, and analysis of data and interpretation.
ZK: Supervision and mentorship.
MK: Data collection and calculations, Literature review, and manuscript writing.
WA, IA: Analysis of data and quality insurer.
HA: Literature review and manuscript writing.
All the authors have approved the final version of the manuscript to be published.

REFERENCES

1. Yang W, Huang J. Chronic subdural hematoma: Epidemiology and natural history. *Neurosurg Clin N Am* 2017; **28(2)**:205-10. doi: 10.1016/j.nec.2016.11.002.
2. Kudo H, Kuwamura K, Izawa I, Sawa H, Tamaki N. Chronic subdural hematoma in elderly people: Present status on awaji island and epidemiological prospect. *Neurol Med Chir (Tokyo)* 1992; **32(4)**:207-9. doi: 10.2176/nmc.32.207.
3. Mehta V, Harward SC, Sankey EW, Nayar G, Codd PJ. Evidence based diagnosis and management of chronic subdural hematoma: A review of the literature. *J Clin Neurosci* 2018; **50**:7-15. doi: 10.1016/j.jocn.2018.01.050.
4. Chih AN, Hieng AW, Rahman NA, Abdullah JM. Subperiosteal drainage versus subdural drainage in the management of chronic subdural hematoma (a comparative study). *Malays J Med Sci* 2017; **24(1)**:21-30. doi: 10.21315/mjms2017.24.1.3.
5. Ishfaq A. Outcome in chronic subdural hematoma after subdural *vs.* subgaleal drain. *J Coll Physicians Surg Pak* 2017; **27(7)**:419-22.
6. Brennan PM, Kolias AG, Joannides AJ, Shapey J, Marcus HJ, Gregson BA, *et al*. The management and outcome for patients with chronic subdural hematoma: A prospective, multicenter, observational cohort study in the United Kingdom. *J Neurosurg* 2017; **127(4)**:732-9. doi: 10.3171/2016.8.JNS16134.
7. Oh HJ, Lee KS, Shim JJ, Yoon SM, Yun IG, Bae HG. Postoperative course and recurrence of chronic subdural hematoma. *J Korean Neurosurg Soc* 2010; **48(6)**:518-23. doi: 10.3340/jkns.2010.48.6.518.
8. Hani L, Vulcu S, Branca M, Fung C, Z'Graggen WJ, Murek M, *et al*. Subdural *versus* subgaleal drainage for chronic subdural hematomas: A post hoc analysis of the TOSCAN trial. *J Neurosurg* 2019:1-9. doi: 10.3171/2019.5.JNS19.
9. Yadav YR, Parihar V, Chourasia ID, Bajaj J, Namdev H. The role of subgaleal suction drain placement in chronic subdural hematoma evacuation. *Asian J Neurosurg* 2016; **11(3)**:214-8. doi: 10.4103/1793-5482.145096.
10. Link TW, Boddu S, Paine SM, Kamel H, Knopman J. Middle meningeal artery embolisation for chronic subdural hematoma: A series of 60 cases. *Neurosurgery* 2019; **85(6)**:801-7. doi: 10.1093/neuros/nyy521.
11. Santarius T, Kirkpatrick PJ, Ganesan D, Chia HL, Jalloh I, Smielewski P, *et al*. Use of drains *versus* no drains after burr-hole evacuation of chronic subdural hematoma: A

randomised controlled trial. *Lancet* 2009; **374(9695)**: 1067-73. doi: 10.1016/S0140-6736(09)61115-6.

12. Nathan S, Goodarzi Z, Jette N, Gallagher C, Holroyd-Leduc J. Anticoagulant and antiplatelet use in seniors with chronic subdural hematoma: Systematic review. *Neurology* 2017; **88(20)**:1889-93. doi: 10.1212/WNL.0000000000003918.
13. Kitya D, Punchak M, Abdelgadir J, Obiga O, Harborne D, Haglund MM. Causes, clinical presentation, management, and outcomes of chronic subdural hematoma at MBARARA regional referral Hospital. *Neurosurg Focus FOC* 2018; **45(4)**:E7. doi: 10.3171/2018.7.FOCUS18253.
14. Kim DH, Park ES, Kim MS, Park SH, Park JB, Kwon SC, *et al*. Correlation between head trauma and outcome of chronic subdural hematoma. *Korean J Neurotrauma* 2016; **12(2)**: 94-100. doi: 10.13004/kjnt.2016.12.2.94.
15. Srivatsan A, Mohanty A, Nascimento FA, Hafeez MU, Srinivasan VM, Thomas A, *et al*. Middle meningeal artery embolization for chronic subdural hematoma: Meta-analysis and systematic review. *World Neurosurg* 2019; **122**:613-9. doi: 10.1016/j.wneu.2018.11.167.