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Original Article

Outcome of a Single Burr Hole Drainage in the Management of Chronic Subdural Hematoma

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Abstract

Background: Chronic subdural hematoma (CSDH) is a common intracranial bleed especially in elderly people. It is management especially if symptomatic involves surgical drainage. There are various surgical methods from invasive to minimally invasive for draining hematoma. The aim of this study was to assess the efficacy of single burr hole craniostomy in the surgical management of CSDH.

Methods: Data of 60 patients with CSDH operated in the neurosurgery department, which were in the inclusion criteria of our study, from June 2021 to July 2022, were collected, master chart was made in Microsoft Excel spreadsheet, and results were interpreted and analyzed.

Results: Out of 60 patients the majority of them were male (66.67%) and females were 33.3%. The mean age of patients was 63.13 years with a standard deviation of 12.8%. The majority of patients had unilateral CSDH (78.33%) and bilateral in 21.67% of patients. In cases of unilateral CSDH the left side was more common. Glasgow outcome score was used to assess outcome of surgery. Complications included tension pneumocephalus in two cases, residual hematoma in one case, recurrence in two cases, and post-operative seizure in one case. Two patients died in our study, one patient died due to a severe chest infection, and second patient died due to myocardial infarction.

Conclusion: Single burr hole craniostomy is less invasive, easy, efficacious, safe, and reliable technique in the drainage of CSDH.

Key words: Chronic subdural hematoma, Recurrence rate, Single burr hole drainage

INTRODUCTION

Chronic subdural hematoma (CSDH) is one of the most common types of intracranial bleeds, which needs neurosurgical specialty for treatment and management.[1]

SDH that develops from 3 days to 3 weeks after initial bleed or head injury is called sub-acute, and one that appears later than 3 weeks after injury is called chronic.[1,6,7] Despite affecting the elderly population, it has a good surgical prognosis.[2,8,12] Incidence of the condition is reported to be about 8–14/100,000 persons yearly.[3,4] An American study observed progressive increase in incidence with age, quoting more than 200 cases per 100,000 population per year in people above the age of 85.[13] Presenting symptoms include headache, seizures, altered mental status, paresis, sensory alterations, dysarthria, gait disturbance, nausea and vomiting, stroke, and coma.[12]

CSDH is dark altered liquified blood collected between dural layers (i.e., dura mater and arachnoid mater. It is formed by bleeding from sagittal bridging veins due to trauma.[5] Other conditions in which minor trauma can cause bleeding and favor the formation of CSDH include, chronic alcohol abuse, anticoagulants, bleeding diathesis, epilepsy, atrophy of brain tissue, seizures, CSF shunts, and diabetes.[1,2,5,8,10]

Concept of pathogenesis of CSDH was ever changing. In 1857, Virchow described "pachymeningitis hemorrhagic interna," assuming the origin of hematoma as inflammatory

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response of brain.[12] Trotter in 1914 suggested the role of trauma, later his theory was supported by Putnam and Cushing, suggesting the differences in neo membranes formed in these two scenarios, that is, traumatic and inflammatory.[15] Separation of dural border cell layer creating potential subdural space allowing acute hygroma or hematoma to evolve into CSDH is the recent understanding in studies.[16] Separation of subdural border cell layer can occur due to many causes, such as brain shrinkage, dehydration, any brain surgery requiring opening of skull, and CSF shunts.[9,14,16,17]

MATERIALS AND METHODS

In this retrospective study, inclusion criteria included all patients diagnosed as case of CSDH on NCCT Head with midline shift and specific associated neurodeficit admitted from June 2021 to July 2022.

Exclusion criteria were:

- Patients <18 years of age
- Patients with acute/subacute SDH
- Patients with membranous chronic SDH
- Patients with coagulation disorders.

Patients referred from physician, general surgeon, or from peripheral hospitals with radiographic evidence of chronic SDH with operative indications were operated at our hospital. All baseline investigations were done. All clinical parameters were documented, such as presenting GCS, pupillary status, vitals, weakness or paresis, and associated comorbidities. Most of the patients were operated under local anesthesia with sedation, some were operated under intubation due to their low GCS or positive serology. Patients were shifted to the operating room after proper consent and arranging one unit of blood. Proper position of patients on OT table was assured. The part was prepared by trimming hairs on head. Area was painted with 10% of betadine and draped with sterile sheets. Scalp incision was made with 15 no. blade after proper marking and infiltrating with 2% of lignocaine. Hemostasis achieved by bipolar electrocautery. Burr hole was made with Hudson brace drill at the desired site. Saline irrigation used during drilling for heat dissipation. Curet with spatula used to break inner table of skull. Dura breached after coagulating with electrocautery to avoid potential bleed from edges. Subdural bleed was allowed to drain on its own, then warm saline irrigation was done gently until clear saline came out from the same burr hole. Ventricle external drainage catheter was placed in the remnant cavity with tip toward frontal region to avoid air trapping. Cavity was filled with saline to expel any remnant air. Closed drainage system drain was placed in subdural space, fixed to scalp at a different site from main incision and scalp incision closed with skin stapler. Antiseptic dressing was done and patients shifted to observation cabin. Intraoperative findings, operative time, and post-operative instructions were documented. Assessment of patients was done on 1st post-operative day. NCCT Head was not routinely done if improvement was satisfactory as per GCS outcome score. Second assessment was done on 1st follow-up, 1 week after discharge.

RESULTS

In our study, majority of patients were in the age group of 61–70 years with a range of 31–85 years [Figure 1]. Males were 66.6% and females were 33.3% [Figure 2].

Chief complaints of patients included headache in 58.33%, altered sensorium was present in 60% of patients, vomiting in 48.33%, giddiness in 25%, seizure in 10%, paresis in 41.6%, and urine incontinence in 16.6% of patients [Table 1].

In patients with weakness or paresis of extremities, unilateral weakness was present in 31.67% and bilateral weakness in 10% [Table 2].

History of trauma was present in 38.33%. Majority of them had trivial trauma with duration from a few weeks to months.

History of alcohol intake was present in 23.33% of the patients, out of which 40% of patients were in the young age group of 31–40 years, and the second peak was noticed in 51–60 years age group [Figure 3].

Patients presented with GCS in the range of 8–15. Presenting GCS in majority of patients (50%) was between 14% and 15.45% of patients had GCS between 9 and 13 and GCS of 8 in 5% of patients [Table 3].

About 60% of patients presented with altered sensorium.

Unilateral SDH was present in 78.33% of patients, and bilateral in the rest 21.67% of patients [Figure 4].

In cases of unilateral SDH, the maximum thickness of hematoma was in the range of 16–38 mm, mean value of 24.47 and a standard deviation of 5.32 [Table 4].

In cases of bilateral CSDH, the maximum midline shift noted was <5 mm, whereas the upper limit of midline shift in cases of unilateral SDH was up to 22 mm [Table 5].

Out of 60 patients, 53.33% underwent left burr hole drainage, in 31.67% right, and in 15% of cases, bilateral burr hole craniostomy was done [Table 6].

Table 1: Chief complaints of patients on presentation

Symptoms	Frequency	Percentage
Headache	35	58.33
Giddiness	15	25.00
Vomiting	29	48.33
Seizure	6	10.00
Urinary incontinence	10	16.6
Weakness/paresis	25	41.67

Table 2: Number of patients with weakness and side affected

Weakness	Frequency	Percentage
Total patients with weakness	25	41.67
Bilateral weakness	6	10.00
Unilateral weakness	19	31.67

Table 3: Glasgow-coma scale score of patients on presentation

Glasgow coma scale on admission	Frequency	Percentage
Mild (14–15)	30	50.00
Moderate (9–13)	27	45.00
Severe (3–8)	3	5.00
Mean±SD	13.03±2.22	
Median (25^{th}–75^{th} percentile)	13.5 (12–15)	
Range	8–15	

Table 4: Thickness of SDH in (mm) on NCCT head

Thickness of CSDH (mm)	Frequency	Percentage
NCCT Head finding (mm) (Unilateral)		
16–20 mm	15	31.91
21–25 mm	11	23.40
26–30 mm	16	34.04
>30 mm	5	10.64
Mean±SD	24.47±5.32	
Median (25^{th}–75^{th} percentile)	25 (20–28)	
Range	16–38	

CSDH: Chronic subdural hematoma

Table 5: Extent of midline shift to opposite side on NCCT head

MLS	Frequency	Percentage
≤5	3	5.56
5.1–10	23	42.59
10.1–15	19	35.19
>15	9	16.67
Mean±SD	11.01±4.31	
Median (25^{th}–75^{th} percentile)	11 (8–13.625)	
Range	2–22	

Hypertension was the most common associated comorbidity in these patients, other comorbidities were diabetes mellitus, hypothyroidism, history of antitubercular treatment, cerebrovascular accident, ischemic heart disease, chronic obstructive pulmonary disease, parkinsonism, and psychosis [Table 7].

Table 6: Side of burr hole craniostomy

Burr hole	Frequency	Percentage
Bilateral	9	15.00
Left	32	53.33
Right	19	31.67
Total	60	100.00

Table 7: Associated comorbidities of patients

Comorbidities	Frequency	Percentage
ATT	2	3.33
Hypertension	15	25.00
Type II diabetes mellitus	10	16.67
CVA	2	3.33
Parkinsonism	1	1.67
Hypothyroid	2	3.33
IHD	1	1.67
COPD	1	1.67
Psychosis	1	1.67

CVA: Cerebrovascular accident, IHD: Ischemic heart disease, ATT: Anti-tubercular treatment, COPD: Chronic obstructive pulmonary disease

Table 8: Glasgow outcome scoring of patients on follow-up

Score	Frequency	Percentage
5	55	91.67
4	2	3.33
3	1	1.67
2	0	0.0
1	2	3.33

Table 9: Post-operative complications

Complications	Frequency	Percentage
Wound infection	4	6.67
Tension pneumocephalus	2	3.33
Residual hematoma	1	1.67
Seizure	1	1.67
Recurrence	2	3.33

Table 10: Post-operative day on which subdural drain was removed

Drain removed on post-operative day	Frequency	Percentage
1	11	18.33
2	31	51.67
3	10	16.6.00
4	4	6.67
5	1	1.67
6	2	3.33

On Glasgow outcome score, 91.67% of patients showed full recovery on follow-up. Out of patients with Glasgow

Table 11: Post-operative day on which patients were discharged

Discharged on post-operative day	Frequency	Percentage
2	9	15
3	20	33.3
4	19	31.67
5	4	6.67
6	3	5
10	2	3.33
34	1	1.67

outcome score of 4, one had residual hematoma and another had pneumocephalus [Table 8]. Both were managed conservatively and improved on follow-up. One patient with score of 3 had post-operative tension pneumocephalus which was managed conservatively and showed improvement on follow-up.

Wound infection occurred in four patients, that is, 6.67%, tension pneumocephalus in two patients, residual hematoma in one patient, and seizure in post-operative period in one patient. One patient with recurrence needed hematoma drainage from the same burr hole, the second patient was managed conservatively. Both patients with tension pneumocephalus were managed conservatively [Table 9].

Out of 60 patients, four patients needed ICU care in post-operative period. Blood transfusion was done in 26.6% of patients, all of them having pre-operative hemoglobin levels <8 g/dL.

Drains were removed once output was nil or <10 cc. In the majority of patients (51.67%), drains were removed on 2nd post-operative day [Table 10].

Majority of patients were discharge on 3rd and 4th post operative day [Table 11].

Out of 60 patients, two died. One patient was 65 years old with GCS of 8/15 with bilateral SDH, he was a known case of hypertension and diabetes on erratic treatment. Patient could not be extubated postoperatively and was shifted to ICU. He died on 10th post-operative day due to a severe chest infection. The second patient was a 50-year-old female, known case of hypothyroidism, not on regular treatment. Postoperatively, she developed arrhythmias and died of cardiac arrest due to severe myocardial infarction on 5th post-operative day.

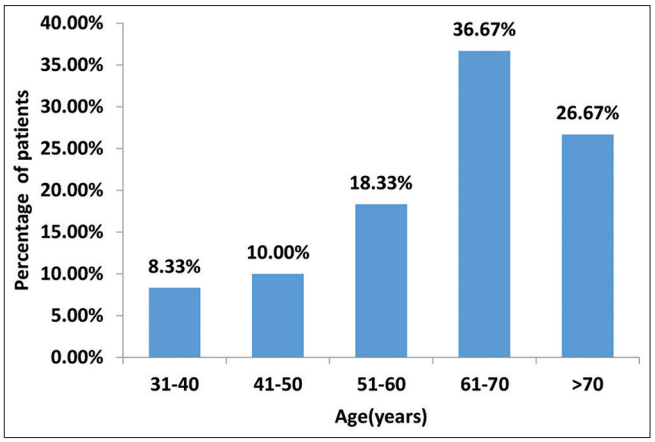

Figure 1: Number and percentage of patients in different age groups

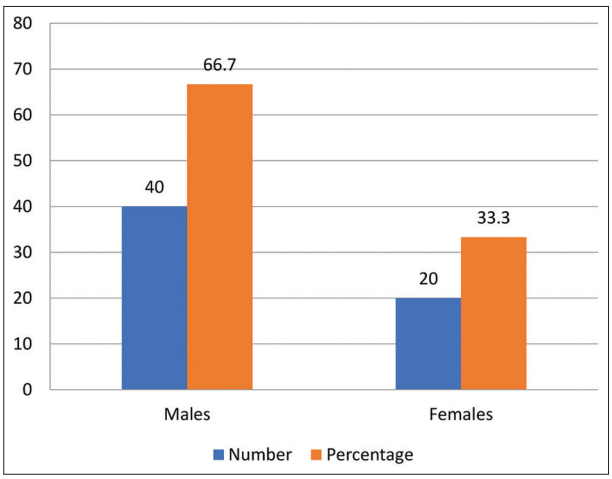

Figure 2: Numbers and percentage of males and females

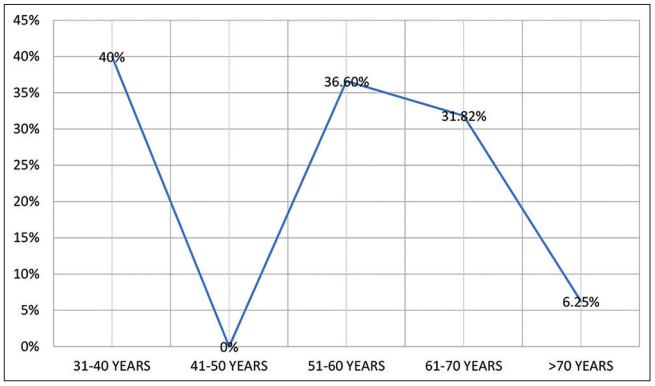

Figure 3: Percentage of patients with a history of alcohol intake in various age groups

DISCUSSION

CSDH is a common intracranial bleed, mostly effecting elderly population, can be managed conservatively but surgery is indicated when condition of the patient does not improve or neurodeficit is present.[2,8,18,19,28] Burr hole drainage being less invasive than craniotomy is preferred method of surgical management of SDH.[20]

Male patients were most commonly affected with 66.67% of total patients in our study. Similar data is reported with

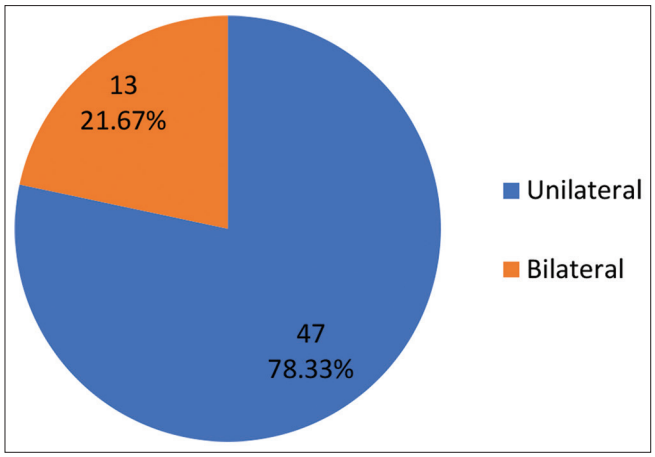

Figure 4: Side of involvement on NCCT head of patients

male predominance from studies done by Mersha *et al.*, 2020;[1] Ahmed *et al.*, 2021[3] and Salama, 2019.[21]

Mean age of patients in our study was 63.13 years with a standard deviation of ±12.8. Ahmed *et al.*, 2021[3] reported a study with mean age of patients 67.37 years.

The most common presenting symptom was headache (58% of patients) in our study. Similar observation was mentioned by Mersha *et al.*, 2020[1] in their study, while in the study conducted by Tripathy *et al.*, 2015[5] 33.3% of patients presented with headache.

Majority of patients in our study had unilateral SDH. Bilateral SDH was present in 15% of patients, while left-sided SDH in 53.33% and right-sided in 31% of patients.

Higher incidence of bilateral SDH is reported in other study by Ahmed *et al.*, 2021.[3]

In our study, the majority of the patients (i.e., 95%) had midline shift more than 5 mm, out of which 51.86% had MLS of more than 10 mm. There was a significant association between weakness on presentation and MLS more than 10 mm (with $P = 0.03$).

Patients presenting with CSDH may have a history of fall or trivial trauma to the head. In our study, 38.33% of patients had positive history, while Adhiyaman *et al.*, 2017[13] reported a positive history of trauma in 74% of patients.

Hypertension was the most common associated comorbidity in our study with incidence of 25%. Fernández *et al.*, 2022[2] reported the incidence of hypertension in 58% of patients in a single burr hole study group.

We used irrigation with warm saline to drain hematoma and it was effective in clearing it, comparative study by Xu *et al.*, 2016[27] between drainage and irrigation noted no significant difference between the two methods. While another study concluded by Okada *et al.*, 2002[26] observed that drainage procedure was associated with better outcomes and lesser recurrences.

The recurrence rate in our study was 3.33% which is comparable to observation by Salama, 2019[21] in their study and reported incidence of 2.98%. A study done by Elshanawany *et al.*, 2020[6] had a higher recurrence rate of 7.9%. Khursheed *et al.*, 2013[7] recorded recurrence rate of 6.15% in the single burr hole craniotomy group.

In our study, the incidence of tension pneumocephalus was 3.33% and its main cause was misplaced drains, while documented incidence of pneumocephalus after SDH evacuation is 2.5–16% in the literature Thapa and Agrawal, 2009.[22] Elshanawany *et al.*, 2020[6] noticed a lower incidence of 1.8% in their study. Single burr hole craniotomy was used in our study. A study done by Belkhair and Pickett, 2013[23] comparing single versus double burr holes did not notice any significant difference in outcome. In literature Yamamoto *et al.*, 2003[25] observed a single burr hole, adequate in draining SDH with even multiple cavities. Han *et al.*, 2009[29] reported higher recurrence rate in the case of double burr hole craniostomy compared to single burr hole craniostomy.

We used subdural closed drain system in our study and we did not notice any inadequacy in its functionality. A study done by Yadav *et al.*, 2020[11] and Häni *et al.*, 2020[24] noticed similar outcomes for subgaleal and subdural drains.

Left-sided SDH was more common than right-side in our study. Similar observation was documented by Mersha *et al.*, 2020[1] and Salama, 2019.[21]

The mean operative time for a single burr hole craniotomy in our study was 33.25 min, which is comparable to a study by Salama, 2019[21] while Elshanawany *et al.*, 2020[6] reported a lesser mean operative time of 23 min.

Mortality rate in our study was 3.33%, in which two patients died both were above 50 years. One male patient died on 10th post-operative day due to a severe chest infection and the second patient was a female who died on 5th post-operative day due to myocardial infarction. A similar mortality rate of 3% was reported by (Kotwica and Brzeziński, 1991)[8] in their study. While higher mortality of 10% has been reported in a study by Ahmed *et al.*, 2021.[3]

CONCLUSION

Surgical outcome of single burr hole drainage of CSDH in our study was satisfactory as per patients' compliance,

especially in elderly patients and in those with associated comorbidities. Similar outcomes and results are also available in the literature on this topic. Single burr hole craniotomy is less invasive compared to craniotomy, with lesser operative time and lesser post-operative morbidity burden. Keeping in view all these observations, we conclude that single burr hole craniotomy is efficacious, safe, easy, and reliable in CSDH drainage.

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