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Comparative Results of Surgical Treatment of Chronic Subdural Hematoma with Single and Double Burr Hole

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ABSTRACT

Introduction: Chronic subdural hematomas (CSDH) are intracranial hematomas that are usually seen in the middle and advanced age. They are seen as a result of bleeding from the parasagittal bridging veins. The results of patients who were surgically treated with single- and double-burr hole drainage due to CSDH in our clinic were investigated. It has been tried to decide which of these two methods is more suitable for surgical treatment.

Methods: We retrospectively reviewed 146 patients hospitalized with CSDH and treated with burrhole drainage in our clinic between 2011 and 2021. Informed consent forms were obtained from each patient. We divided the surgical treatments that we applied to the patients; into two groups: single burrhole without irrigation (group A, n=41) and double burrhole with irrigation (group B, n=105). The results were compared as radiological and clinical factors. The width of hematomas was determined by magnetic resonance imaging and defined as the maximal diameter in the coronal orientation perpendicular to the skull curvature. The thickness of inner membrane was measured on constructive interference steady state images. The imaging characteristics of hematomas on computed tomography, if available, were also reviewed and defined as hypodense, hyperdense, and inodense in comparison with cerebral paraenchyma.

Results: The change in subdural hematoma thickness was 68.38±10.10% in group A and 53.7%±31.9% in group B. The change in midline shift was 58.6%±24.5 in group A and 53.7%±31.9% in group B. There was no statistically significant difference in hematoma evacuation and recovery of midline shift between the two groups. Recurrence occurred in 5 (12.1%) cases in group A and 8 (7.6%) cases in group B. In terms of recurrence, both groups were similar.

Conclusion: Similar hematoma evacuation and midline shift improvement were observed between the two surgical techniques. We think that both methods have similar efficacy for treating CSDH.

Keywords: Subdural, burr hole, surgery, hematoma

Introduction

Chronic subdural hematomas (CSDH) are one of the most common types of intracranial hemorrhages and show a good prognosis when properly diagnosed and treated (1,2).

CSDH is an intracranial hemorrhage that is usually seen in middle and old age and develops as a result of minor head trauma. While its incidence is 3.4/100,000 before the age of 65, this rate increases to 8-58/100,000 after the age of 65. The most important etiological cause is bleeding due to trauma of the parasagittal bridging veins, which are stretched as a result of cerebral atrophy, which is age-related. Although most of these cases do not remember the trauma, trauma is included in the history of 60-80% of them (3,4).

Among the signs and symptoms, the most common symptom is headache, which usually occurs due to increased intracranial pressure. In addition, clinical findings that can be seen in CSDH include fainting, memory impairment, apathy, sleepiness, focal neurological deficit, and seizures (5).

Surgery is usually the chosen treatment for CSDH, and evacuation of the hematoma by burr hole or craniotomy is the most commonly preferred surgical method. The regression or disappearance of bleeding that is not surgically drained in CSDH is a rare condition, and the blood may remain calcified in the intracranial space (6).

In elderly and high-risk patients, hematoma drainage with a burr hole is preferred and is a less invasive method. However, the high recurrence rate of hematoma is a disadvantage of this surgical method (4). The choice of surgical method should be decided according to the tomographic finding of the hematoma, the clinical condition of the patient, and the age and presence of additional disease conditions (5).

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In this study, the surgical treatment of patientsdiagnosed with CSDH in our clinic with single and double burr holes and the clinical results are comparatively presented.

Methods

The study was approved by the Sakarya University Faculty of Medicine Ethics Committee (approval number: E-71522473-050.01.04-214486_07, date: 25.01.2023). Informed consent forms were obtained from each patient.

Case

Patients treated with burrhole drainage (BHD) with the diagnosis of CSDH between January 1, 2011 and February 1, 2021 in our clinic were retrospectively evaluated. The age of the patients, the size of the bleeding, and the additional diseases that could be detected were examined. A total of 155 patients with subdural hematoma bleeding underwent a surgical procedure. Because 9 of 155 patients underwent craniotomy, these patients were not included in the study. The remaining 146 patients were treated with BHD. The patients were divided into two groups according to the surgical technique performed: Group A (n=41) single BHD without irrigation, group B (n=105) double BHD with irrigation. The chosen surgical method was determined according to the surgeon's habits and preferences.

Surgical Procedure

Thirty-six (88%) patients with single BHD were under local anesthesia (LA) and sedation, 5 (12%) were under general anesthesia, and 83 (79%) patients with double BHD were under LA and sedation. and 26 of them were operated under general anesthesia. According to the side of the hematoma (right-left-bilateral): a burrhole hole was opened in the parietal bone; directly over the parietal eminence, in patients with single BHD without irrigation (group A), and in the frontal (in the mid pupillary line behind the hairline) and parietal bone in patients with double BHD with irrigation (group B). After the dura was coagulated as plus, it was opened with a scalpel no. 15. In group A, a 12 N silicone catheter was placed to drain the hematoma without irrigation. In group B, after irrigation with saline, a 12 N silicone catheter extending from the burrhole in the parietal bone to the frontal region was placed. In all patients, the catheters were connected to the drainage bag and fixed at the head level. The catheters were removed after it was concluded that the hematoma was sufficiently drained in the neurological status of the patients and in the computerized brain tomography (CCT). This period was between 24 and 48 h on average. Postoperative (within 24 h), 10th day and 2nd month CT scans were performed on all patients.

Clinical Factors

In comparison of group A and group B, age, gender, hypertension status, diabetes, chronic kidney or heart failure, smoking, and coagulopathy disorders were investigated. When the additional diseases of CSDH patients were examined, it was observed that hypertension in 47 (44%) patients, diabetes mellitus type 2 in 34 (23%) patients, coagulopathy in 16 (10%) patients, chronic renal failure in 13 (12%) patients, and smoking in 39 (37%) patients were found to have a history. To compare the clinical outcomes of the two groups, the length of the hospital stay, mortality, and recurrence rates were evaluated.

Radiological Factors

Radiological parameters of the patients were evaluated preoperatively, postoperative first 24 h, early postoperative 10th day, and late postoperative 2nd month CBT. The thickness of the subdural hematoma and the length of the midline shift were evaluated preoperatively, early, and late postoperatively. The changes consist of percentages obtained by subtracting the postoperative values from the pre-operative values and dividing the pre-operative values (Figure 1, 2).

Statistical Analysis

Before data analysis, the normality of all variables was evaluated. For parametric variables, to summarize patient data, means and frequencies were used for continuous and categorical variables, respectively. If required, non-parametric counterparts of parametric tests were used. To test differences between means, independent samples t-test and to compare frequencies, chi-square test was used. The alpha value was set at 0.05. SPSS version 25 (IBM) was used (Table 1-3).

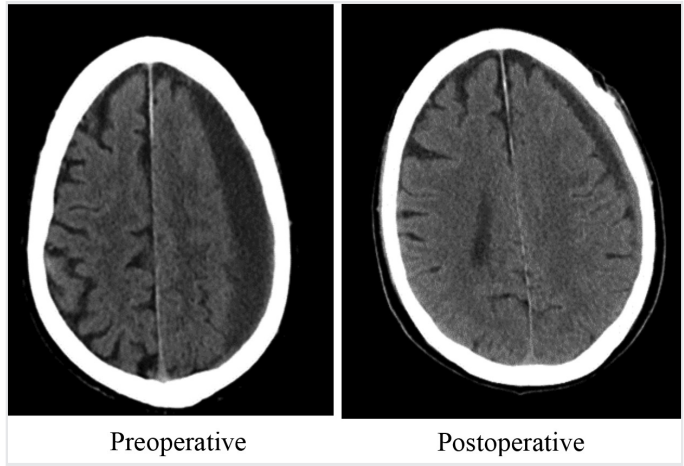

Figure 1. Double burr hole

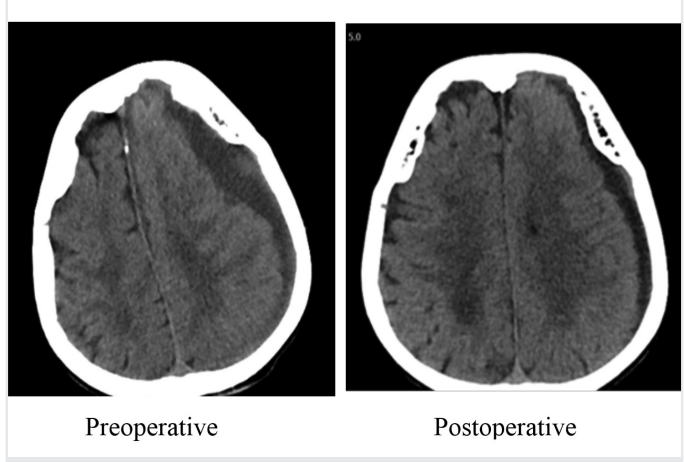

Figure 2. Single burr hole

Table 1. The summary of baseline demographics of patients with chronic subdural hematoma			
	Single burr-hole, (n=41)	**Double burr hole, (n=105)**	**p**
Age	72.71±1.50	72.02±1.68	0.790
Sex			
Male	10 (24.4%)	84 (80%)	**<0.001***
Female	31 (65.6%)	21 (20%)	
Comorbidities			
Hypertension	13 (31.7%)	34 (32.4%)	0.813
Diabetes mellitus	7 (17.1%)	27 (25.7%)	
Coagulopathy	4 (9.8%)	12 (11.4%)	
CKD	3 (7.3%)	14 (13.3%)	
Tobacco use	9 (22%)	30 (28.6%)	0.416
*Statistically significant (p-value <0.05). CKD: Chronic kidney disease			

Table 2. Pre- and postoperative radiological outcomes			
	Single burr-hole (n=41)	**Double burr-hole (n=105)**	**p**
Midline shift			
Pre	0.97±0.33	0.99±0.37	0.803
Early	0.72±0.25	0.77±0.34	0.448
Late	0.40±0.26	0.41±0.21	0.950
(%) change	58.6±24.5	53.7±31.9	0.430
Thickness			
Pre	2.33±0.52	2.62±0.76	0.029*
Early	1.32±0.30	1.40±0.46	0.269
Late	0.72±0.21	0.84±0.93	0.450
(%) change	68.38±10.10	62.90±62.83	0.621
*Statistically significant (p-value <0.05)			

Table 3. Recurrences and mortality rates			
	Single burr-hole (n=41)	**Double burr-hole (n=105)**	**p-value**
Recurrence (n, %)	5 (12.1%)	8 (7.6%)	0.382
Death	1 (2.4%) 1 (2.4%)	6 (5.71%) 1 (0.95%) 2 (3.81%) 1 (0.95%) 1 (0.95%) 1 (0.95%)	0.405
COVID-19			
Pneumonia			
Pulmonary embolism			
Heart failure			
Intracerebral hematoma			
COVID-19: Coronavirus disease-2019			

Results

Baseline demographic characteristics of patient data are summarized in Table 1. The total number of patients was 41 (28%) of patients were operated with a single burr-hole and 105 (72%) of them were operated with a double burr-hole approach. Mean age of single and double burrhole groups were not different (72.71 vs. 72.02, p=0.790). Sex distribution was not balanced, and the majority of the patients were females (65.6%) for single and males (80%) for double burr-hole groups. The comorbidities of patient groups were comparable and did not show any statistical difference (p=0.813).

With regard to radiological parameters, midline shift and hematoma thickness were calculated. Midline shift in the pre-operative period was equal for both groups and the percent change in midline shift did not differ between two different burrhole approaches (58.6 vs. 53.7, p=0.430). Thickness of subdural hematoma was higher in the double burr-hole group (p=0.029), but the percent change in thickness measured from pre-operative to late postoperative period did not show any statistical difference (p=0.621).

Recurrences occurred in 12.1% (n=5) and 7.6% (n=8) of all cases for single and double burrhole groups, respectively. Both groups were similar with

regard to recurrence rates (p=0.382). In the single burr hole group, only one patient died from coronavirus disease-2019 (COVID-19) infection (2.4%), whereas in the double burr hole group, there were 6 deaths (5.71%) caused by COVID-19 infection (n=1), pulmonary embolism (n=1), heart failure (n=1) and pneumonia (n=2). Another patient from the double burr-hole group died because of an intracerebral hematoma during the early postoperative period. Two groups did not differ with regard to mortality rates (2.4% vs 5.71%, p-value=0.405). Summary data on recurrences and mortality rates can be found in Table 3.

Discussion

CSDH is a type of intracerebral hematoma that is frequently seen in elderly patients with a systemic disease and is caused either because of a head trauma or spontaneously (5,6). In cases with previous cerebral trauma in the etiology of chronic subdural hemorrhage clinical findings are usually seen in almost 20 days and afterwards (7).

CSDH is bleeding between the inner and outer layers of the dura caused by recurrent multifocal hematomas of fragile sinusoidal vessels in the outer layer of the dura. It is a disease with low mortality and morbidity and generally good treatment results (5,8).

In the literature, it has been reported that the mean age of incidence is between 56 and 63 years, and 80% of the cases are above 50 years old (9,10).

Because most of the cases are elderly, their development on an atrophic brain background causes the clinical findings to appear more silently (11).

They reported that the most common presenting symptoms in patients with CSDH under 40 years of age are headache, nausea, and vomiting, but focal neurological findings constitute the most common complaint in patients over 75 years of age (12).

In cases of CSDH, the first radiological examination should be computed tomography of the brain (CCT). CCT should be preferred because it can show the bleeding, the shift caused by the bleeding, the probable duration of the bleeding, and it can be accessed quickly. In CCT, bleeding can be observed as hypodense, inodense, or hyperdense according to the time spent (13). Although CCT is usually the first choice as a diagnostic test in cases of CSDH, it has been reported that magnetic resonance imaging is beneficial for patients with recurrent bleeding at different stages, in cases with underlying tumor formation, and in cases where the duration of bleeding cannot be differentiated (14).

In CSDH, surgical evacuation of the hemorrhage should generally be the treatment modality. Surgical treatment options include twist drill craniotomy, craniotomy, and hematoma drainage with burr hole. Craniotomy was the preferred surgical approach, especially in periods when imaging methods were not very developed. In particular, this approach has been used in the foreground because it creates a wide area of intervention for the surgeon. However, the use of craniotomy in the surgical treatment of patients with CSDH has gradually decreased due to the long duration of the surgery and high blood loss. Still, it is applied especially in cases with thick membranes, in cases where brain expansion is incomplete and recurrent with burr hole drainage, and in bleedings where the hematoma is calcified (15).

Generally, in current surgical approaches to CSDH, it is recommended to perform bleeding drainage with a single or double burr hole, especially in cases with liquefied blood and without membrane and calcified hematoma. Bleeding drainage with a burr hole is a surgical method that is easier and has a low complication rate (16,17).

When studies in the literature are examined, the superiority of hematoma drainage with a single or double burr hole has not been proven. No matter which surgical method is preferred, it has been reported that the use of closed system drainage reduces recurrence. Surgical procedures with burr holes are preferred in advanced elderly patients with a high risk of mortality because they do not require anesthesia and can be performed at the bedside (18-21).

Old age, poor performance at presentation, cerebral atrophy, large hematoma, alcohol or anticoagulant use, renal failure, liver dysfunction, septum formation, or multiple membrane formation in the hematoma space are important risk factors for hematoma recurrence (12). Intraoperative or postoperative inadequate drainage and air collection in the hematoma space during surgery also increase the risk of recurrence (4).

The most common complication after surgical treatment for patients with CSDH is the recurrence of bleeding. It has been reported that the most important reason for this situation is the incomplete resection of the membrane and the lack of expansion of the atrophic brain (12). Another important problem is that the rapid evacuation of the hematoma during surgery may cause a sudden decrease in the intracranial pressure, causing brain shifts and acute hemorrhages in the opposite hemisphere (22).

Among the patients who were operated in our clinic, 2 patients had postoperative early rebleeding complications. These 2 patients underwent early craniotomy.

One of the common complications after surgery is tension pneumocephalus, which is seen at a rate of 0-10% (23). Another complication is postoperative epilepsy, reported at a rate of 2-19% (24). For the latter, the use of prophylactic antiepileptics for 6 months after the diagnosis of CSDH is recommended. Other complications that are observed after surgery are intracranial hypotension, subdural empyema, and intracranial acute hematoma (17).

No cases of pneumocephalus or early epilepsy were encountered in patients operated in our clinic. The patients were given prophylactic antiepileptic treatment for 3-6 months postoperatively.

The results were evaluated statistically. In the study, no difference was found in terms of subdural hematoma diameter in both preoperative and postoperative early and late periods between patients who underwent unilateral and bilateral procedures (p>0.05 for each).

Study Limitations

This study has potential limitations. There is very little prior research on this topic. More studies should be conducted on this method and contribution to the literature should be made.

Conclusion

Regarding the results of the surgical treatment performed with a single burr hole and the ones performed with a double burr hole in our clinic, both showed clinically significant improvement and a significant variability was statistically observed because of the patientstreatment. In addition, when single burr hole and double burr hole surgical treatments were compared, there were no statistically significant difference between them. However, the surgical method should be decided by considering the patient's age, clinic, history of anticoagulant use, and imaging methods.

Ethics Committee Approval: The study was approved by the Sakarya University Faculty of Medicine Ethics Committee (approval number: E-71522473-050.01.04-214486_07, date: 25.01.2023).

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References

1. Baechli H, Nordmann A, Bucher HC, Gratzl O. Demographics and prevalent risk factors of chronic subdural haematoma: results of a large single-center cohort study. Neurosurg Rev 2004; 27: 263-6.
2. Forster MT, Mathé AK, Senft C, Scharrer I, Seifert V, Gerlach R. The influence of preoperative anticoagulation on outcome and quality of life after surgical treatment of chronic subdural hematoma. J Clin Neurosci 2010; 17: 975-9.
3. Frati A, Salvati M, Mainiero F, Ippoliti F, Rocchi G, Raco A, et al. Inflammation markers and risk factors for recurrence in 35 patients with a posttraumatic chronic subdural hematoma: a prospective study. J Neurosurg 2004; 100: 24-32.
4. Okada Y, Akai T, Okamoto K, Iida T, Takata H, Iizuka H. A comparative study of the treatment of chronic subdural hematoma--burr hole drainage versus burr hole irrigation. Surg Neurol 2002; 57: 405-9; discussion 410.
5. Celikoglu E, Is M, Yilmaz M, Kiraz İ, Ramazanoğlu AF, Alkan B. Surgical Results of Our Chronic Subdural Hematoma Cases. J Nervous Sys Surgery 2014; 4: 36-41.
6. Watts C. The management of intracranial calcified subdural hematomas. Surg Neurol 1976; 6: 247-50.
7. Su TM, Shih TY, Yen HL, Tsai YD. Contralateral acute subdural hematoma occurring after evacuation of subdural hygroma: case report. J Trauma 2001; 50: 557-9.
8. Tugcu B, Tanriverdi O, Baydin S, Gunaldi O, Ofluoglu E, Demirgil BT. Can recurrent chronic subdural hematomas be predicted? Retrospective analysis of 136 cases. Thinking Man Journal of Psychiatry and Neurological Sciences 2010; 23:44-9.
9. Ernestus RI, Beldzinski P, Lanfermann H, Klug N. Chronic subdural hematoma: surgical treatment and outcome in 104 patients. Surg Neurol 1997; 48: 220-5.
10. Sambasivan M. An overview of chronic subdural hematoma: experience with 2300 cases. Surg Neurol 1997; 47: 418-22.
11. Liliang PC, Tsai YD, Liang CL, Lee TC, Chen HJ. Chronic subdural haematoma in young and extremely aged adults: a comparative study of two age groups. Injury 2002; 33: 345-8.
12. Gelabert-González M, Iglesias-Pais M, García-Allut A, Martínez-Rumbo R. Chronic subdural haematoma: surgical treatment and outcome in 1000 cases. Clin Neurol Neurosurg 2005; 107: 223-9.
13. Markwalder TM. Chronic Subdural Hematomas: a review. J Neurosurg 1981; 54: 637-45.
14. Lee JY, Ebel H, Ernestus RI, Klug N. Various surgical treatments of chronic subdural hematoma and outcome in 172 patients: is membranectomy necessary? Surg Neurol 2004; 61: 523-7; discussion 527-8.
15. Imaizumi S, Onuma T, Kameyama M, Naganuma H. Organized chronic subdural hematoma requiring craniotomy--five case reports. Neurol Med Chir (Tokyo) 2001; 41: 19-24.
16. Cenic A, Bhandari M, Reddy K. Management of chronic subdural hematoma: a national survey and literature review. Can J Neurol Sci 2005; 32: 501-6.
17. Rohde V, Graf G, Hassler W. Complications of burr-hole craniostomy and closed-system drainage for chronic subdural hematomas: a retrospective analysis of 376 patients. Neurosurg Rev 2002; 25: 89-94.
18. Han HJ, Park CW, Kim EY, Yoo CJ, Kim YB, Kim WK. One vs. Two Burr Hole Craniostomy in Surgical Treatment of Chronic Subdural Hematoma. J Korean Neurosurg Soc 2009; 46: 87-92.
19. Kansal R, Nadkarni T, Goel A. Single versus double burr hole drainage of chronic subdural hematomas. A study of 267 cases. J Clin Neurosci 2010; 17: 428-9.
20. Wakai S, Hashimoto K, Watanabe N, Inoh S, Ochiai C, Nagai M. Efficacy of closed-system drainage in treating chronic subdural hematoma: a prospective comparative study. Neurosurgery 1990; 26: 771-3.
21. Ozgen U, Dolas I, Unal TC, Sabanci PA, Aydoseli A, Aras Y, et al. A Comparison of Subgaleal Active Drainage and Subdural Passive Drainage and an Analysis of Factors Affecting Chronic Subdural Hematoma Outcomes. Turk Neurosurg 2022; 32: 688-96.
22. Moon KS, Lee JK, Kim TS, Jung S, Kim JH, Kim SH, et al. Contralateral acute subdural hematoma occurring after removal of calcified chronic subdural hematoma. J Clin Neurosci 2007; 14: 283-6.
23. Lavano A, Benvenuti D, Volpentesta G, Donato G, Marotta R, Zappia M, et al. Symptomatic tension pneumocephalus after evacuation of chronic subdural haematoma: report of seven cases. Clin Neurol Neurosurg 1990; 92: 35-41.
24. McKissock W, Richardson A, Bloom WH. Subdural haematoma: a review of 389 cases. Lancet 1960; 1: 1360-5.