MODESTUM
OPEN ACCESS
Eurasian Journal of Analytical Chemistry
ISSN: 1306-3057
2018 13(3):em19
DOI: 10.20933/ejac/85017

Comparing Clinical Responses to Using One Burr Hole and Two Burr Holes to Treat Chronic Subdural Hematoma

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Received 30 July 2017 ▪ Revised 15 November 2017 ▪ Accepted 24 December 2017

ABSTRACT

The therapeutic strategies currently used to treat chronic subdural hematoma (CSDH) include various methods such as craniotomy and twist drill or utilizing Burr hole. The present research seeks to make a clinical comparison between using one burr hole and two burr holes to treat CSDH. This is a randomized, double-blind clinical trial conducted on 70 patients suffering from CSDH candidated for using burr hole. The participants were divided into two equal groups and underwent treatment with 1 burr hole or 2 burr holes. The primary and secondary outcome variables were compared across the two groups prior to and 48 hours following the operation. A total number of 5 death cases were (7.14%) were reported among patients. 2 patients (5.71%) were in the 1 burr hole group, while 3 (8.57%) were in the 2 burr hole group (P = 0.514). The need for undergoing a secondary operation in the 2 burr holes group (1 case, i.e. 2.85%) was significantly less than what was reported in the other group (6 cases, i.e. 17.14%) (P = 0.012). The mean time of hospitalization (1 burr hole: 4.98, 2 burr holes: 3.1, P = 0.001), the pneumosephalus levels 48 hours following the operation (1 burr hole: 9.38, 2 burr holes: 5.91, P = 0.012) and hematoma levels 48 hours following the operation (1 burr hole: 41.57, 2 burr holes: 30.85, P = 0.0001) in the 2 burr holes group were significantly less than what were reported in the other group. 48 hours after the operation, the hematoma volume (1 burr hole: P= 0.031, 2 burr holes: P= 0.002) in both groups exhibited a significant reduction compared to what was observed before the operation. Using 1 or 2 burr holes are quite useful methods to treat CSDH patients. However, the clinical outcome of those patients in the 2 burr holes group was much more favorable.

Keywords: chronic subdural hematoma, burr hole, treatment

INTRODUCTION

Chronic subdural hematoma (CSDH) is a common type of bleeding in the interior space of human skull mostly observed among the elderly [1]. As various observations have shown, the frequency of this neurosurgical disease is 3 in every 100 thousand people [2]. Chronic subdural hematoma consists of blood serum and blood degradation products formed in the potential space between Arachnoid and dora along with a new membrane [3-5]. Blood in the subdural space results in an inflammatory response and culminates in the cascade progress of the disease [3, 6]. Although trauma is the most common cause of CSDH and this phenomenon is observed from a few days to a few weeks following the trauma, other factors such as coagulation disorder, arachnoid cyst, vascular disorders, metastatic cancers, and rain meningioma also influence its occurrence [5, 7, 8]. The therapeutic measures currently taken against CSDH include craniotomy operation or utilizing burr hole. There are many evidences indicating the advantages and preference of burr hole method over craniotomy in treating CSDH [1, 6, 9]. Although Butt-hole method is unable to completely remove the new membrane, it disrupts the cascade path of CSDH formation and results in its damage and absorption of this new membrane [7, 10, 11]. Few complications and little chance of

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Table 1. The demographic and basic information of patients in 1 and 2 burr hole groups

Variable	Group	1 burr hole (35 patients)	2 burr holes (35 patients)	P-value
Age (mean ± SD) (years)		54.12 ± 42.2	56.4 ± 13.8	0.211
Gender (female) number (%)		16 (45.71)	18 (51.42)	0.41
CSDH location Number (%)	Left	14 (40)	15 (42.85)	0.703
	Right	17 (48.57)	17 (48.57)	
	Bilateral	4 (11.42)	3 (8.57)	
Pre-operation GCS (mean ± SD)		11.14 ± 23.1	10.10 ± 88.2	0.13
Hematoma volume (mean ± SD)		87.12 ± 43.3	99.20 ± 89.2	0.74

bleeding recurrence and its relative ease along with the possibility of its practical application for old patients are some factors that indicate the advantages of this method over craniotomy [1, 12, 9, 14]. The number of studies conducted on burr hole utilization (such as the difference in patients' outcome as a result of using one or multiple burr holes) are quite limited [10]. A study by Taussky P et al. [10] showed that utilization of one burr hole to treat patients suffering from CSDH is associated with higher levels of recurrence, longer periods of hospitalization, and greater possibility of ulcer infection. The present research seeks to make a comparison between utilization of one burr hole and two burr holes in treating chronic subdural hematoma in terms of post-operation Pneumosephalus and reduction of hematoma volume after operation.

MATERIALS AND METHODS

This is a randomized, double-blind clinical trial conducted on patients hospitalized in the Neurosurgery unit of Vali Asr Hospital of Arak diagnosed with chronic subdural hematoma. Based on the diagnosis of our projects neurosurgeon, they possess the indication of internal treatment (burr hole utilization). The patients were randomly selected and with due observation of inclusion and exclusion criteria. Having selected the patients and obtained their consent to take part in the research, the primary checklists of their demographic and clinical information were completed. Following a 1:1 pattern, the patients were randomly assigned to group 1 (35 patients: the group undergoing treatment with one burr hole) and group 2 (35 patients: the group undergoing treatment with two burr holes). The short term clinical responses of patients were recorded as the primary and secondary outcomes in their clinical information checklist. The initial diagnosis, investigation of operation indication, and selection of patients and type of operation were all conducted by the research team surgeon. The research team resident who was completely blind about the group of patients undergoing burr hole and had undergone the necessary training for the project was charged with the task of filling out the demographic and clinical information checklists of patients before and after operation and while they were being discharged from hospital. SPSS v.18 (version 18, SPSS Inc, Chicago, IL) and chi square, Mann-Whitney, and T-test were used to analyze the collected data.

Inclusion criteria: 1) patients from both genders, 2) patients suffering from chronic subdural hematoma with burr hole treatment indication, 3) informed consent to take part in the research.

Exclusion criteria: 1) those patients for whom craniotomy is prescribed in order to treat chronic subdural hematoma, 2) background disorders such as underlying brain aneurysm, active leukemia, Ventriculoperitoneal Shunt, 3) disagreement to take part in the research, and 4) existence of underlying coagulation disorder.

Sample size:

$$n_1 = n_2 = \frac{\left(Z_{1-\alpha/2} + Z_{1-\beta}\right)^2 [2\bar{P}(1-\bar{P}) + P_1(1-P_1) + P_2(1-P_2)]}{(P_1 - P_2)^2} = 35$$

$$\alpha = 0.05$$
$$p_1 = 0.079$$
$$p_2 = 0.5$$
$$\beta = 0.2$$

RESULTS

The average age of patients was 55.27 ± 5.8 years old. Of the whole 70 patients studied in both groups, 34 patients (48.75%) were female and the remaining 36 (51.42%) male. The mean FCS prior to operation in the 1 burr hole and 2 burr holes groups was 11.23 and 10.88 respectively (P = 0.13). CSDH was observed on the right in 29 patients (41.42%), while its frequency on the right side was 34 (48.57%). CSDH was bilateral in 7 patients (10%). As the results indicate, the mean age (P = 0.211) and gender distribution (P = 0.41) was similar among the two groups. No significant difference was observed between the two groups in terms of CSDH location (P = 0.703) and mean GCS (P = 0.13) before the operation. No significant difference was reported between the two groups in terms of pre-operation hematoma volume (87.12 ± 43.3 for 1 burr hole and 99.20 ± 89.2 for two burr holes) (P = 0.74) [**Table 1**].

Table 2. The primary outcome information for both groups

Variable \ Group	1 burr hole (35 patients)	2 burr holes (35 patients)	P-value
Death toll (%)	2 (5.71)	3 (8.57)	0.514
Secondary operation (%)	6 (17.14)	1 (2.85)	0.012 (significant)

Table 3. Information concerning the secondary outcome in the patients of both groups

Variable \ Group	1 burr hole (35 patients)	2 burr holes (35 patients)	P-value
Hospitalization length (mean ± SD)	4.10 ± 98.1	3.2 ± 1.1	0.001
Pneumosephalus level 48 hours after operation (mean ± SD)	9.5 ± 38.4	5.1 ± 91.3	0.012
Hematoma level 48 hours after operation (mean ± SD)	41.12 ± 57.6	30.10 ± 85.5	0.0001
GCS 48 hours after operation (mean ± SD)	14.8 ± 88.2	14.7 ± 9.1	0.61
Surgical site infection number (%)	5 (14.28)	3 (8.57)	0.88

The cases requiring a second operation in 2 burr holes group (1 case, 2.85%) were significantly less than what was observed in the 1 burr hole group (6 cases, 17.14%) [**Table 2**].

The length of hospitalization, hematoma volume, pneumosephalus volume in the 2 burr holes group was were significantly less than what was observed in the 1 burr hole group. However, the mean level of GCS 48 hours after operation exhibited no significant difference between the two groups (P = 0.61). There was no significant difference between the 2 burr holes group (3 cases, 8.57%) and the 1 burr hole group (5 cases, 14.28%) in terms of surgical site infection [**Table 3**].

DISCUSSION

As the majority of patients suffering from CSDH are elderly and considering the fact that they usually suffer from cardiovascular diseases, the surgeon always tries to keep the operation process as short as possible [1, 11, 12, 15]. As the operation using 1 burr hole takes half the time required for a 2 burr hole operation, the present research seeks to make a comparison between these two methods. Although plenty of researches have made a comparison between craniotomy methods (such as mini-craniotomy) and utilization of burr hole in the outcome of patients suffering from CSDH [1, 10, 13], few researches have focused on patients' outcome difference in using one or multiple burr holes [10]. Allahdini et al. [7] have studied the factors that influence the clinical outcome of patients suffering from chronic subdural hematoma following burr hole operation. In this prospective, cross-sectional research, the whole 59 patients diagnosed with chronic subdural hematoma hospitalized in the neurosurgery ward of Be'sat Hospital of Sanandaj who underwent operation (within the last 1 year following the project) were studied. Following Finney and Odom criteria, the patients were initially divided into 4 groups. Then, they were further divided into two groups with good and unfavorable clinical outcomes. Based on the results achieved in that research, the clinical outcome of patients exhibited no significant correlation with the time spent from occurrence of trauma to operation, the time gap from hospitalization and operation, the blood contents of hematoma, the anatomical site of drain, recurrence symptoms in CT scan, and treatment of recurrence in post-operation hematoma. On the other hand, other variables such as age (those older than 65 years old), gender (female), using anti-coagulation medicines, how long the drain is kept in the place, type of complication, existence of internal complication or surgeries after the operation, GCS at the time of hospitalization, while the patient is being discharged and after it are significantly correlated with patients' clinical output. As a result, female gender and old age have a negative effect on the clinical output of surgery among patients suffering from chronic subdural hematoma. Taussky P et al. [10] studied the difference between using 1 and 2 burr holes in the clinical output of patients suffering from chronic subdural hematoma. In this retrospective study, 76 patients with chronic subdural hematoma and an average age of 60 ± 2 years old who were hospitalized because of CSDH from 2004 to 2005 were investigated. Based on the surgeon's diagnosis, 21 patients underwent bilateral craniotomy. Of the whole 97 cases of hematoma, 63 (65%) were treated with 2 burr holes and 34 (35%) were treated using 1 burr hole. The results pointed to the fact that the recurrence rate (5% for 2 burr holes and 29% for 1 burr hole group) and the ulcer infection rate (0%, 9%) in 1 burr hole group was significantly more than what was observed in the other group. The average length of patients' hospitalization in the 1 burr hole group (11 days) was significantly more than what was reported for the 2 burr hole group (9 days). The results of this research (higher recurrence rate and longer period of hospitalization in the 1 burr hole group) were in line with the results achieved in the present research. Although higher rates of surgical site infection were reported for 1 burr hole group in our research, this difference was far from being significant (in line with Taussky P) [10]. Regan JM et al. [1] compared the outcome of patients suffering from CSDH undergoing treatment with drainage using burr hole and craniotomy from 2011 to 2014. This was a retrospective research conducted on 119 patients with CSDH. 58 patients underwent craniotomy and 61 were

treated using burr hole. The results showed that the length of hospitalization, the recurrence rate, and the total clinical output of patients undergoing treatment with burr hole is significantly more favorable than the group undergoing treatment with craniotomy. It also turned out that 6.6% of the patients in burr hole group and 24.1% of the surgery group required a second operation and this rate in the burr hole group was significantly less than what was reported in the other group (P = 0.0156). Contrary to the research by Regan HM [1], our research made a comparison between the two types of burr hole. However, comparing operation methods with burr hole and craniotomy could have provided us with more comprehensive information in treating the patients suffering from CSDH.

CONCLUSION

Utilizing 1 or 2 burr holes are really useful strategies to treat patients suffering from CSDH. Patients, however, experienced a more favorable clinical output using 2 burr holes treatment. Considering the small number of researches that compare various methods of CSDH treatment using burr hole, further researches in this field are recommended.

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