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CHRONIC SUBDURAL HEMATOMA: NECESSITY OF IRRIGATION AND PREDICTIVE FACTORS OF RECURRENCE

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ABSTRACT

Objective: Various factors that are related to the recurrence of chronic subdural hematomas have been described previously. The aims of this study were to identify the recurrence-related factors and determine if irrigation of the hematoma cavity is necessary.

Methods: The records of a sequential series of patients with chronic subdural hematomas who were treated over a period of 3 years were retrospectively reviewed. We analyzed the sex, age, past histories, and efficiency of the irrigation procedures in conjunction with recurrence.

Results: The records of 82 patients were reviewed. Recurrence occurred in eight patients. Bilateral hematoma and a history of liver dysfunction were the significant risk factors for recurrence. In contrast, anticoagulant intake, alcohol abuse, and apparent trauma history did not affect the recurrence rate. Drainage without irrigation did not affect the recurrence rate and significantly decreased the operation time.

Conclusions: Bilateral hematoma and liver dysfunction are predictive of recurrence in chronic subdural hematomas. Since drainage without irrigation did not affect the recurrence rate and significantly decreased the operation time, irrigation can be omitted from the surgical procedures for chronic subdural hematoma.

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INTRODUCTION

Chronic subdural hematoma (CSDH) is one of the most frequent diseases encountered by neurosurgeons.¹⁻¹¹ Surgical treatments of CSDH include single or double burr hole(s), small craniotomies, or twist drills.^{5-7,9-16} During these procedures, irrigation of the hematoma cavity with normal saline or artificial cerebrospinal fluid and the placement of drainage have been recommended, and various studies have shown that these techniques have preventative effects on recurrence.^{1-3,5-16}

The aims of this study were to characterize preoperative factors predictive of recurrence and determine the necessity of the irrigation procedure in CSDH surgery.

METHODS

Surgical techniques

Under modified neuroleptanesthesia and local anesthesia, the patients underwent single burr-hole surgeries. Hematoma aspiration and irrigation with warmed normal saline were performed through a silicon drainage tube. Finally, the drain was placed in the frontal position. The drain was removed the next day. Ambulation was allowed after drain removal, and the patients were discharged three to seven days after their surgeries.

Subjects and methods

We retrospectively analyzed the clinical records of patients who were treated over a period of three years (January 1st, 2013 to December 31st, 2015). Age, gender, medical history, including medication use, alcohol intake and smoking habits, and surgical procedures were recorded. Recurrence was defined as reappearance of neurological signs and/or symptoms with computed tomography evidence of increased hematoma cavity volume.

After July 2014, irrigation was omitted from the surgical procedures. This subgroup was compared to the cases in which irrigation had been performed.

The statistical analyses were performed with Bell Curve for Excel (Social Survey Research Information Co., Ltd., Tokyo, Japan). Student's two-tailed unpaired *t*-tests, Mann-Whitney tests, or χ^2 tests were used for the comparisons when appropriate. *P* values less than 0.05 were considered statistically significant.

RESULTS

The results are summarized in Tables 1 to 3. The data on 82 patients (mean age, 77.5 years; range, 56–97 years), consisting of 20 women and 62 men, were retrospectively reviewed (Table 1).

Table 1 Baseline characteristics

Male/Female	62/20
Age	77.5 y (56–97 y)
Left/Right/bilateral	40/27/15
Head trauma	50
Time from trauma to hospital	50.4 days
Drugs	19
Alcohol abuse	21
Liver dysfunction	5
Cancer carrier	3
Operation time	43 min (23 min–1 h 39 min)
Pre-/post-surgical modified Rankin Scale	2.2/1.4
Recurrence	8

There were 40 left-side, 27 right-side and 15 bilateral hematomas. Fifty patients (61.0%) had apparent traumatic head injury episodes. Nineteen patients (23.2%) received anticoagulant therapy. Eight patients experienced recurrence (9.8%, Table 2).

Table 2 Factors related to recurrence

	8	Relative Risk ratio	95% Confidence Interval
Male/Female	8/0		-
Age (>77.5 y)	4/40	1.03	0.43–1.70
Bilateral	5/15	4.6	1.94–7.74
Trauma	3/50	0.59	0.21–1.13
Anticoagulation	1/19	0.51	0.09–2.13
Alcohol abuse	4/21	2.18	0.86–3.87
Liver dysfunction	2/5	6.17	1.30–26.90
Smoking	2/7	3.7	0.87–13.2
Time (>42 min)	5/31	1.78	0.83–2.64
No irrigation	2/21	0.97	0.27–2.56
Surgeon	4/43	0.95	0.40–1.57

Significant values are shown in bold.

Bilateral hematoma and liver dysfunction were significant risk factors for recurrence (Relative Risk ratio/95% Confidence Interval: 4.63/1.94–7.74 and 6.17/1.30–26.90, respectively). Recurrence occurred only in men.

Alcohol abuse and smoking habit increased the risk for recurrence. Age, anticoagulant intake, and an apparent history of head trauma did not affect recurrence.

Twenty-one patients did not undergo the irrigation procedure (25.6%, Table 3). The omission of irrigation significantly shortened the surgical time compared with the rest of the cases (a decrease of 15 min) and other cases treated by the same surgeon (MH; a decrease of 10min), but did not affect the recurrence rate (Table 3).

Table 3 Comparison of irrigation and non-irrigation groups

	Irrigation	No irrigation	Total
Total	61	21	82
Male/Female	46/15	16/5	62/20
Age	77.1	78.6	77.5
Left/right/bilateral	31/18/12	9/9/2003	40/27/15
Trauma	38	12	50
Anticoagulation	13	6	19
Alcohol abuse	13	8	21
Liver dysfunction	3	2	5
Smoking	2	5	7
Cancer	2	1	3
Operation time	46 min	31 min	1E-07
Recurrence	6	2	Relative Risk Ratio 1.009

Significant values are shown in bold.

The annual incidence of CSDH is 1–5/100,000, but it increases to 8-58/100,000 in the elderly group (over 65 years of age).^{4,7,8,10} The annual incidence in Kudamatsu city as roughly calculated as 56/100000, which was within this range.

Most CSDH surgeries consist of burr-hole trephination and drainage with or without irrigation.¹⁵ The necessity and effectiveness of drainage have been well reported.^{2,5-7,9,11,15,16} The combination of drainage and burr-hole trephination and twist drills is definitively advantageous in the treatment of CSDHs.^{3,6,9} Even though drainage has a number of disadvantages, such as incomplete drainage for septate hematomas, drain occlusion by clots, cortical vessel injury, and vulnerability to infection, it is definitely useful in CSDH surgeries.^{3,7,11} The frontal placement of a drain for two days, which was our technique, has been shown to be preferable and effective.^{2,16}

The use of irrigation is controversial. Many studies have reported that it is necessary, favorable, or not useful.^{1,2,3,5,7,11,16} Irrigation washes out coagulation components and inflammatory factors and reduces fibrinolytic activity.^{1,3,5,11,13,14} However, it may also disturb coagulation due to the prevalence of the plasminogen system and drastic changes in intracranial pressure, which might lead to recurrence.^{3,11,13,14} Because irrigation with normal saline may be harmful for the hematoma and arachnoid membranes, the use of artificial cerebrospinal fluid has been recommended.¹ However, irrigation with a thrombin solution might prevent hematoma rebleeding and reaccumulation.² The irrigation times and solution volumes depend on the surgeons' perspective and experience. Gentle irrigation should be continued until the color of the fluid becomes less reddish. Irrigation itself introduces air influx, prevents re-expansion of the brain, and sometimes tears the inner hematoma membrane or arachnoid membrane.^{8,10-12} Continuous irrigation is an alternative procedure.¹⁴

The results of this study suggest that the simple removal of a hematoma might be sufficient for surgical treatment and that irrigation might be omitted, but the results differed among the studies and in the combination with and without drainage. Therefore, additional studies are needed to investigate this issue.

The postsurgical recurrence of CSDHs has occurred in 2.6 to 33% of the cases reported in the literature.^{6,8,12} Recurrence was detected in 0.36 to 33.3% of cases, and drainage decreased the incidence of recurrence.^{7,14,15} The results of the current study were in agreement with these results.

The prominent predictive factors for recurrence were age, coagulation abnormality (including drug intake), and bilateral hematoma formation,^{5,8,12,14} which was followed by brain atrophy and midline shift.^{5,6,9,10} Large hematoma volume, alcohol intake, long symptom duration, male sex, and air volume after surgery were additional factors.^{2,5,6,9,10}

The factors found to be predictive of recurrence in this study were bilateral hematoma and liver dysfunction. A tendency for recurrence was associated with alcohol abuse, smoking habit, and operation time over 1 h. There was no association of anticoagulant intake or apparent history of head injury with recurrence.

CSDH is an apparently male-dominant disease, which was reflected in the results of this study. However, we could not

conclude that male sex is a risk factor for recurrence, and further studies are needed to investigate this issue.

Liver dysfunction usually leads to a systemic anticoagulation status, which would theoretically result in a tendency for recurrence. Even though preoperative blood transfusions of platelets or fresh frozen plasma were performed routinely, these methods might be insufficient to prevent recurrence. For these cases, artificial cerebrospinal fluid or thrombin solution might be useful.^{1,2}

A history of an apparent head injury did not affect the recurrence rate because most natural head injuries that result in CSDH are minor and/or trivial and ignored by the patients and their relatives.⁸ Our results were in agreement with this theory. Bilateral hematoma was a positive factor for recurrence because aged patients and those receiving anticoagulants frequently present with this type of hematoma.¹⁰ In this study, bilateral hematomas (18.3%) and age and anti-coagulant intake were not associated (data not shown). Theoretically, bilateral hematomas have twice the hematoma volume and result in more brain compression than single hematomas.^{10,11}

Although we have never used the controversial techniques of twist drills, two burrholes, or artificial cerebrospinal fluid in CSDH surgeries, these techniques produce results that are as good as the results with single burr-hole trephination.^{1,2,5,6,13} Although local anesthesia is preferred, general anesthesia is used, but less extensively.^{7-10,12-15} From the perspective of invasiveness, reduced irrigation helps shorten the operation time and increase patients' comfort during local anesthesia.¹¹ The results of this study showed a significant 15-min decrease in operation time, and, to the best of our knowledge, this is the first study to report a decrease in actual surgery time.

There are several brain re-expansion factors and hematoma-related factors that affect recurrence. The former consists of brain atrophy, hematoma volume, septate hematoma, air influx, and arachnoid tears after surgery. The latter consist of liver dysfunction, anticoagulation medication, and inadequate drainage and/or irrigation. In order to cure CSDHs, these factors need to be considered.

This study had a few limitations. The first was the lack of precise computed tomography assessments of recurrence before and after the surgeries. Second, the number of patients was less than 100. Finally, this was a retrospective study that was conducted at a single center.

CONCLUSIONS

Bilateral hematomas and liver dysfunction were predictive factors for recurrence. Considering the shortening of the operation time, irrigation may be omitted from the surgical procedure for CSDHs, especially in aged and locally anesthetized CSDH patients. The results of this study suggest that irrigation does not need to be performed during CSDH surgeries.

Conflicts of Interest Disclosure

The authors have no conflicts of interest to disclose

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