Postoperative recurrence rates in chronic subdural hematoma patients who underwent burr-hole trephination with parietal or occipital drainage compared to frontal drainage

Jae Hwan Tae, Myung-Hyun Kim, Young Goo Kim, Sung-Kyun Hwang
Department of Neurosurgery, Ewha Womans University Mokdong Hospital, Seoul, Korea

Objective: We conducted a retrospective study involving 348 patients with suspected chronic subdural hematoma who underwent burr-hole trephination. The primary objective was to examine the relationship between the postoperative subdural drainage catheter's position and the recurrence rate.

Methods: In a retrospective study conducted at Ewha Womans University Mokdong Hospital between September 2020 and August 2023, patients diagnosed with chronic subdural hematoma underwent surgical intervention. We defined the recurrence of chronic subdural hematoma as an increase in the volume of subdural fluid on the treated side compared to the volume measured just before the computed tomography scan was performed.

Results: The recurrence rates were not significantly different between these 2 groups (20.3% vs. 20.5%, P = 0.594). Additionally, there was no significant difference in mean age (74.9 vs. 75.8 years, P = 0.733), male-to-female ratio (3.29 vs. 3.25, P = 0.478), or maximum depth (13.5 mm vs. 12.7 mm, P = 0.323) between the 2 groups.

Conclusion: There was no significant difference in the recurrence rates between the 2 groups. This suggests that the location of the burr-hole trephination and the subdural catheter tip location might have had no significant impact on patients' prognosis. In order to reduce the recurrence rate of chronic subdural hematoma, making efforts to minimize other factors like subdural air collection is important.

Keywords: Chronic subdural hematoma; Catheter tip location; Recurrence rate
In our study, we defined chronic subdural hematoma as a subdural age reoperation. Through outpatient follow-up, avoiding the need for immediate neurological deficits or had only a small residual hematoma were managed through outpatient follow-up, avoiding the need for immediate reoperation. The primary objective was to examine the association between the postoperative subdural drainage catheter’s position and the recurrence rate.

We calculated the postoperative recurrence rates for confirming our experience and suggesting more effective operation method to patients.

**Material and Method**

**Study design**

In a retrospective study conducted at Ewha Womans University Mokdong Hospital between September 2020 and August 2023, the following methods were applied. All patients diagnosed with chronic subdural hematoma underwent a surgical intervention, which included the drilling of a single burr hole using 14 mm drill. Closed-system drainage was implemented. The burr-hole site was either at the stephanion or the peri-parietal eminence. And the tip of the catheter placement was parietal, occipital or frontal respectively. In all cases, the tip of the drainage catheter was randomly placed either in the frontal or parietal, occipital region. All drainage catheters were removed within 7 days after surgery, regardless of whether residual hematoma was observed on computed tomography (CT) scans. This decision was made out of concern for potential complications associated with catheter-induced central nervous system infection. In situations where there was suspicion of recurrent chronic subdural hematoma like worsen Glasgow coma scale score, we promptly conducted a CT scan to assess and confirm the presence of recurrence. Additionally, CT scanning was routinely performed on the 7th day after surgery, and on the day of discharge, and 1 month after discharge.

We defined the recurrence of chronic subdural hematoma when the volume of subdural fluid on the treated side increases compared to the volume measured just before the CT scan was performed. Patients who met the criteria for chronic subdural hematoma recurrence, as defined in our study, were scheduled for reoperation if they exhibited neurological symptoms or if CT scans indicated that the recurrent hematoma was causing compression of the cerebral sulci. In contrast, individuals who did not display neurological deficits or had only a small residual hematoma were managed through outpatient follow-up, avoiding the need for immediate reoperation.

**Patient selection**

In our study, we defined chronic subdural hematoma as a subdural hematoma surrounded by a thin capsule that appears gray at CT scan and contain dark red liquefied blood during surgery. In the 348 patients with suspicion of chronic subdural hematoma, 59 patients were diagnosed with Subacute subdural hematoma and were excluded. Fifty-nine patients were excluded from the study because drainage catheter was not inserted at intended space as mentioned before. It appears that there might have been a mistake in the placement of the catheter. It was positioned in the frontal or frontotemporal area when it should have been placed in the parietal or occipital area or vice versa. Sixty-two patients were excluded because of follow-up loss. Total 167 patients were included in our study.

**Statistical analysis**

Descriptive statistics, including percentage, mean, and range, were employed to summarize variables and characteristics within subgroups. In the assessment of the univariate relationship with chronic subdural hematoma recurrence, categorical variables were analyzed using Pearson chi-square test, Fisher exact test, while non-categorical variables were assessed using a Student t-test. Logistic regression analysis was conducted to examine independent associations between recurrence and contributing factors. The value of P < 0.05 is considered statistically significant.

**Results**

The placement of the chronic subdural hematoma catheter tip was verified using a CT scan conducted immediately after surgery. Characteristics of 167 patients with chronic subdural hematoma underwent burr-hole trephination are in Table 1. Among the 167 patients included in the study, 133 had the catheter tip positioned in the parietal or occipital area, while in 34 patients, it was located in the frontal area. In the study, the mean age of the 133 patients who underwent burr-hole trephination at the stephanion (group A) was 74.9 years. In contrast, the mean age of the 34 patients who underwent burr-hole trephination at the peri-parietal eminence (group B) was 75.8 years. Importantly, there was no significant difference in age between these 2 groups (P = 0.733).

Additionally, in group A, there were 102 men and 31 women, while in group B, there were 26 men and 8 women, showing sex ratio 3.29 and 3.25 respectively. There is no significant difference of sex ratio between the 2 groups (P = 0.478). However, it is clear that the incidence rate was higher among men in both groups. The preoperative maximum depth of chronic subdural hematoma in group A was 13.5 mm, while in group B, it was 12.7 mm. Importantly, there was no significant difference in the preoperative maximum depth between the 2 groups (P = 0.323). The postoperative
maximum depth of chronic subdural hematoma on the 7th day after surgery in group A was 1.9 mm. In group B, it was 1.5 mm. Also, there was no significant difference between the 2 groups (P = 0.246).

The clinical outcome is in Table 2. In group A, 27 out of 133 patients were diagnosed with a recurrence of chronic subdural hematoma, which represents 20.3% of the group. In group B, 7 out of 34 patients were diagnosed with a recurrence of chronic subdural hematoma, which represents 20.6% of the group. There was a very similar recurrence rate observed in both groups (P = 0.594). Twenty-one patients who were diagnosed with a recurrence of chronic subdural hematoma (Figs. 1, 2) underwent additional burr-hole trephination as part of treatment. Seventeen patients were in group A and 4 patients were in group B (P = 0.86).

### Discussion

Chronic subdural hematoma is a relatively prevalent condition, particularly among the elderly population, and is frequently encountered in neurosurgical practice [10]. The prevailing understanding suggests that the accumulation of subdural blood, leading to chronic subdural hematoma, primarily occurs due to direct or indirect cranial trauma resulting in damage to the bridging veins [11]. The increased use of anti-coagulants and anti-platelet has had an impact on the rising incidence of intracranial hematomas [11]. In patients with symptoms, surgical treatment is the standard approach, and the commonly used surgical technique is the straightforward and effective burr-hole trephination and closed-system drainage [12,13]. Several risk factors for the recurrence of chronic subdural hematoma have been identified in prior research. These include old age, cerebral atrophy, bleeding tendencies, chronic alcohol consumption, bilateral location of the hematoma, and postoperative pneumocephalus [10,13]. Nakaguchi et al. [8] mentioned that patients who had drainage in the parietal or occipital regions experienced a higher recurrence rate compared to those with frontal drainage after undergoing burr-hole surgery and closed-system drainage for chronic subdural hematoma. The lower recurrence rate observed in patients with frontal drainage can be primarily linked to the minimized development of subdural air collection which lead to an imbalance in pressure across the inner membrane of the chronic subdural hematoma [8,13,14].

However, in our study there was no significant difference of recurrence rate between 2 groups. In our study, we noticed that patients who still have subdural air collections 7 days after surgery tend to have a higher postoperative recurrence rate than those without such collections. Eliminating the subdural space is essential approach to preventing recurrence. In our study, we took routine procedure to avoid the occurrence of postoperative pneumocephalus. As a result, we successfully minimized the development of the subdural space. We paid particular attention such as irrigation at the time of dura incision and subdural catheter insertion. Additionally, if we needed to pause the operation during the instrument preparation stage, we would block the incision site with wet gauze to avoid making pneumocephalus. Thanks to our efforts to minimize the development of the subdural space, there was no significant difference between the 2 groups. However, the recurrence rate remained high at 20%. The observed high recurrence rate in our study can likely be attributed to several contributing factors, including old age, male gender, the use of anti-platelet medication, alcohol consumption, and the presence of underlying diseases such as hypertension (HTN) and diabetes mellitus (DM). Specifically, a significant portion of our study population comprised elderly people, males, and patients with underlying medical conditions like HTN, DM. These factors may have collectively contributed to the elevated recurrence rate. In these cases, the embolization of the middle meningeal artery can reduce the recur-

### Table 1. Characteristics of 167 patients with chronic subdural hematoma undergoing burr-hole trephination

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Location of catheter tip</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Parietal or occipital (n = 133)</td>
<td>Frontal (n = 34)</td>
</tr>
<tr>
<td>Male</td>
<td>102</td>
<td>26</td>
</tr>
<tr>
<td>Female</td>
<td>31</td>
<td>8</td>
</tr>
<tr>
<td>Male-to-female ratio</td>
<td>3.29</td>
<td>3.25</td>
</tr>
<tr>
<td>Mean age (yr)</td>
<td>74.9</td>
<td>75.8</td>
</tr>
<tr>
<td>Maximum depth (mm)</td>
<td>Preoperative</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>Postoperative (day 7)</td>
<td>1.9</td>
</tr>
</tbody>
</table>

### Table 2. Relationship between the location of catheter tip and the recurrence rate

<table>
<thead>
<tr>
<th>Location of catheter tip</th>
<th>No. of patients</th>
<th>No. of cases of recurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parietal or occipital</td>
<td>133</td>
<td>27 (20.3)</td>
</tr>
<tr>
<td>Frontal</td>
<td>34</td>
<td>7 (20.6)</td>
</tr>
</tbody>
</table>
Link et al. [14] reported that a technique known as embolization of the middle meningeal artery has been documented as an effective method. While embolization of the middle meningeal artery disrupts the blood supply to the outer membrane and thus prevents hematoma enlargement, it sometimes falls short in preventing recurrences.

There were several limitations in our study. Firstly, the sample size was relatively small, and the follow-up period was insufficient. This limitation may have led to overestimation or underestimation of outcomes due to the limited number of patients. To further validate the impact of this approach on the clinical characteristics of chronic subdural hematoma, additional studies with sufficient sample size and more extended periods are necessary. This will provide a more comprehensive understanding of the matter.

**Conclusion**

The development of subdural air collections can indeed lead to an imbalance in pressure across the inner membrane of chronic subdural hematoma, potentially contributing to recurrence. However, in our surgical treatment study, there was no significant difference in recurrence rates between the 2 groups. This suggests that the location of the burr-hole trephination and the subdural catheter tip location might had no significant impact on the patient’s prognosis.

What appears to be more important, from the perspective of reducing the recurrence rate of chronic subdural hematoma, is making efforts to minimize subdural air collection during the surgical procedure.

To reduce the recurrence rates of chronic subdural hematoma, a combination of burr-hole trephination with the embolization of the middle meningeal artery may be necessary.

**Conflicts of interest**

No potential conflict of interest relevant to this article was reported.
REFERENCES


