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The Technical Factors that Influence Recurrence of Chronic Subdural Hematoma: A Review of 140 Consecutive Surgical Cases

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Objective: The purpose of this study is to evaluate several technical factors of treatment that seemed to influence the recurrence of chronic subdural hematoma (CSDH). **Methods**: 140 patients with surgically treated CSDH between January 2004 and June 2009 were retrospectively reviewed. Patient's age and sex, the location of the burr-hole, the location and the length of the subdural catheter tip, and the amount of the postoperative subdural air accumulation were analyzed in relation with the recurrence rate. **Results**: This study revealed that the location of burr-hole trephination and the presence of postoperative subdural air accumulation had statistical significance in association with the recurrence whereas the location and the length of subdural catheter tip did not have statistical significance. **Conclusion**: We believe the greatest possible care to reduce chance of subdural air accumulation is required for preventing the recurrence of CSDH. (J Kor Neurotraumatol Soc 2009;5:79-82)

KEY WORDS: Chronic subdural hematoma · Technical factors · Subdural air accumulation.

Introduction

Chronic subdural hematoma (CSDH) is a common type of intracranial hemorhage particularly in old patients with a recurrence rate after burr-hole surgery raging up to 30%.[2, 3,5-7,9,10,13,14,17,18)]

Although numerous factors have been investigated to be associated with the recurrence, the results have not always been consistent.

Among these inconsistent numerous factors which can hardly be modified by physicians at the time when the patients presented with CSDH, we only focused on the technical factors of operative and postoperative treatments associated with recurrence of CSDH which can be modified for better outcomes.

Materials and Methods

140 patients with CSDH who were surgically treated in our hospital between January 2004 and June 2009 were retrospectively reviewed. All patients underwent operations including trephination of single burr-hole, repeated irrigation of hematoma with normal saline solution, and insertion of the closed system drainage tube in the subdural cavity. Postoperative CT scanning was performed between the 1st and 3rd day after surgery. In all cases, we examined the patient's age and sex, the location of the burr-hole, the location and the length of the subdural catheter tip, and extent of the postoperative subdural air collection. We defined the location of the burr-hole as "anterior" when the hole was located anterior to the imaginary line between vertex and external auditory canal, and "posterior" when posterior to the line. The volume of the subdural air collection was calculated in each patient from the postoperative CT scans. The area was automatical measured from each slice of CT scan using (ICM, Seoul, Korea) after drawing the outline of air density. Then, the number and the thickness of the slice was put into calculation to measure the exact volume of air accumulation. The drainage catheter tip was randomly assigned to be located in the frontal, temporal, parietal, or occipital region. Since the catheter was blindly inserted into the subdural space at surgery and it was unclear where the tip was actually placed, we determined the precise location of the drainage catheter

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tip by inspection of skull X-ray obtained just after surgery. We defined recurrence as a subsequent increase in hematoma volume in the ipsilateral subdural space or reaccumulation of the hematoma within the postoperative hematoma cavity, which was followed by repeated operation. Data analysis was performed using the Chi-square test and student t-test and the statistical significance was set at a p value of less than 0.05.

Results

The characteristics and clinical findings were summarized in Table 1. There were 97 men (69.3%) and 43 women (30.7%). CSDH recurred in 17 patients and the recurrence rate was 12.1%. 11 out of 97 men (11.3%) and 6 out of 43 women (14.0%) eventually had recurrent CSDH, but there was no statistical difference. Mean age of the patients in the recurrence group (70.9±7.0 years) was not significantly different from that in the non-recurrence group (65.7±13.4 years).

Analysis of the location of the subdural drainage catheter tip showed that patients in whom the tip resided in the frontal region had the lowest recurrence rate. The tip was located in the frontal region in 71 patients with the post-operative recurrence rate of 8.5% (6 out of 71, p=0.175), the temporal region in 20 patients with the recurrence rate of 15.0% (3 out of 20, p=0.673), the parietal region in 46 patients with the recurrence rate of 15.2% (7 out of 46, p=0.436), and the occipital region in 3 patients with the recurrence rate of 33.3% (1 out of 3, p=0.256). However, these results were not statistically significant.

The effect of catheter length in the subdural space on the recurrence rate was also evaluated. The subdural catheter length was longer than 3 cm in 109 patients, and shorter than 3 cm in 31 patients. 15 patients with longer catheter had recurrence (13.8%) whereas 2 patients with shorter catheter had recurrence (6.5%). These result were not statistically significant.

The extent of the post-operative subdural air collection in the recurrence group was much larger than in non-recurrence group. Mean volume of the post-operative subdural air collection was 16.3±19.87 cm^3 in all patients who received operation. In recurrence group, the volume was 51.59±24.07 cm^3 whereas in non-recurrence group, it was 11.39±13.27 cm^3. The result showed significant difference between the two groups (p<0.001).

The location of the burr-hole trephination was associated with CSDH recurrence in this study. The recurrence rate was 8.0% (7 out of 88) in anterior location and 19.2% (10 out of 52) in posterior location, and the result had statistical significance (p=0.048).

Discussion

Several literatures have reported the risk factors for the recurrence of CSDH. Advanced age, bleeding tendency, brain atrophy, alcohol abuse, diabetes, intracranial hypotension from previous shunt operation, and so forth are commonly regarded as the risk factors for recurrence.[1,4,12,16,18] However, these factors can hardly be modified by physicians at the time when the patients presented with CSDH. Therefore, the technical aspects of operative and post-opera-

TABLE 1. Factors in relation with recurrence

	NRG (n=123)	RG (n=17)	Total (n=140)	p value
Sex				0.662
Male	86 (69.9%)	11 (64.7%)	97 (69.3%)	
Female	37 (30.1%)	6 (35.3%)	43 (30.7%)	
Mean age	65.7±13.4	70.9±7.0	66.3±12.9	
Locaton of catheter tip				
Frontal	65 (52.8%)	6 (35.3%)	71 (50.7%)	0.175
Temporal	17 (13.8%)	3 (17.6%)	20 (14.3%)	0.673
Parietal	39 (31.7%)	7 (41.2%)	46 (32.9%)	0.436
Occipital	2 (1.6%)	1 (5.9%)	3 (2.1%)	0.256
Catheter length				0.272
Catheter >3 cm	94 (76.4%)	15 (88.2%)	109 (77.9%)	
Catheter <3 cm	29 (23.6%)	2 (11.8%)	31 (22.1%)	
Amount of air collection (cm^3)	11.39±13.27	51.59±24.07	16.27±19.87	<0.001
Location of the burr-hole				0.048
Anterior	81 (65.9%)	7 (41.2%)	88 (62.9%)	
Posterior	42 (34.1%)	10 (58.8%)	52 (37.1%)	

NRG: non-recurrence group, RG: recurrence group, ( ): percentage of cases in each group

tive treatments to reduce the recurrence rate are the matters of utmost concern. In this study, we evaluated several technical factors that seemed to influence the recurrence of CSDH. The result of this study revealed that the location of burr-hole trephination and the presence of post-operative subdural air accumulation had statistical significance in association with the recurrence whereas the location and the length of subdural catheter tip did not have statistical significance.

Several reports have supported that the presence of post-operative subdural air accumulation may play an important role in the recurrence of CSDH. Nakaguchi et al.[13] showed that a large amount of residual subdural air on CT scans obtained at 7 days postsurgery had a higher recurrence rate than those with little or no subdural air. Choi et al.[4] also revealed that post-operative wide subdural space caused by air may cause rebleeding tendency. Nagata et al.[11] reported that the amount of subdural air had negative correlation with the resolution rate of CSDH although they did not directly refer to the recurrence rate. Our study also showed the similar result that the presence of post-operative subdural air accumulation was the major technical factor that influenced the recurrence. According to the recent reports, widely accepted mechanism of recurrence is the pressure imbalance between the outside and inside of the inner membrane of hematoma.[13] The high pressure state outside the inner membrane includes massive subdural air accumulation and residual hematoma from inadequate drainage whereas the low pressure state inside the inner membrane includes severe brain atrophy and previous shunt placement. Prolonged widening of subdural space disturbs adhesion between the inner and outer membrane of hematoma. Among these pressure imbalance conditions, massive subdural air accumulation is thought to be the major technical factor that may affect the rate of recurrence.[13,15]

The location of burr-hole trephination was another factor that affected the recurrence. Anteriorly located burr-hole resulted in less recurrence rate than posteriorly located burr-hole. When the outer membrane of hematoma is penetrated, the liquified hematoma superior to the level of burr-hole trephination gushes out and the cavity is replaced by air. Therefore, it is logical to think that anteriorly located burr-hole warrants less chance of massive air accumulation.

In our study, the location and the length of subdural catheter tip did not show statistical significance. However, several authors have reported that the location of subdural catheter tip is an important factor related to the recurrence.[4,8,13] They concluded that catheter tip in the frontal convexity was the most effective location to remove subdural air. The reason for the different result from our study is maybe that those authors strictly kept the patients in supine position with the heads at the level of heart all day long until the drainage catheter was removed. In our study, the patients were allowed to change positions lying in bed and the drainage was clamped only before ambulation. We agree that the frontal convexity location of catheter tip is helpful to remove air if the patients are strictly kept on supine posi-tion even when lying in the bed.

In all situation, the prevention of air accumulation seems to be much more important than the effort made to remove air after air accumulation occurs.

Therefore, prior to starting the operation, the patient's position must be rechecked, and the point where the burr-hole is to be made needs to be at the highest position by placing a roll under the shoulder and rotating the head. We believe the greatest possible care to reduce chance of subdural air accumulation is required for preventing the recurrence of CSDH.

Conclusion

We evaluated several technical factors of treatments that seemed to influence the recurrence of CSDH. Anteriorly located burr-hole resulted in less recurrence rate than posteriorly located burr-hole. Post-operative subdural air accumulation had statistical significance in association with the recurrent CSDH. The location and the length of subdural catheter tip did not affect the result. The prevention of subdural air accumulation seems to be the major factor related to the recurrence.

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