CLINICAL ARTICLE

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Clinical Analysis of Recurrent Chronic Subdural Hematoma

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Objective : Chronic subdural hematoma(CSDH) is usually treated by burr hole trephination and hematoma evacuation with closed drainage and the surgical result is relatively good in most reported series. But, some patients experience the recurrence of CSDH. We study the clinical factors related to the recurrence of CSDH.

Methods : 213 consecutive patients with CSDH who were treated with burr hole trephination and hematoma evacuation with closed drainage. The medical records, radiologic findings were reviewed retrospectively and clinical factors associated with the recurrent CSDH were analysed statistically.

Results : 8.4%(18 cases) of the 213 patients who were treated due to CSDH were recurred. The demographic variables such as age, sex, coexisting diseases were not related to the recurrence. The preoperative hematoma thickness and postoperative hematoma thickness were not associated with the recurrence. The only factor related to the recurrence is postoperative hematoma density in this study.

Conclusion : This study shows that postoperative hematoma density was strongly related to the recurrence of CSDH. However, several factors associated with the recurrent CSDH were reported in the liletrature. Thus, further study will be needed to uncover the factors related to the recurrence of CSDH.

KEY WORDS : Chronic subdural hematoma(CSDH) · Recurrence · Postoperative hematoma density.

Introduction

Chronic subdural hematoma(CSDH) is a relatively common disease encountered in the neurosurgical field. Burr hole trephination and hematoma evacuation with closed drainage system has been widely accepted as the optimal treatment for CSDH[2,5,6,13,20]. Many neurosurgeons agreed that burr hole trephination and hematoma evacuation is a safe, relatively noninvasive procedure and results in a satisfactory outcome for majority of patients with CSDH. However, some patients suffered from the recurrence of CSDH. The reported recurrence rate of CSDH is ranged from 9.2 to 26.5%[1,19]. Several factors associated with the recurrence of CSDH have been reported in the literatures[8-12,23,25].

In this study, we describe our consecutive series of 213 patients treated with burr hole trephination and hematoma evacuation with closed drainage, and retrospectively analyze the clinical factors associated with the recurrence of CSDH.

Materials and Methods

213 consecutive patients with CSDH were treated surgically at the Department of Neurosurgery, Sanggye Paik hospital between January 2001 and December 2005. Simple burr hole trephination and hematoma evacuation with closed drainage were done in all patients. Burr hole was made on parietal eminence. Subdural drain catheter was inserted into cavity of CSDH with minimal intraoperative drainage of CSDH to avoid air accumulation in subdural space. Subdural drain catheter had kept for 1 to 10 days after operation (mean duration was 4.57 days). Careful history taking, neurological examinations, and routine computed tomography(CT) scan for patients with CSDH were performed to diagnosis and follow up. Postoperative CT scan was routinely performed on the 7th day after surgery. The patients with recurrence of CSDH were treated by burrhole drainage using previous burrhole. Any repeated recurrence of CSDH wasn't observed during follow up.

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We analyzed the age, sex, causes of CSDH, locations of CSDH, preoperative and postoperative hematoma density on CT scans, subdural air collection after surgery on skull X-rays, and brain re-expansion rate by student T-test or Pearson's chi-square test.

Results

The clinical data of 213 consecutive patients were summarized in Table 1. There were 147 males and 66 females ranging in age from 3 to 88 years. The male / female ratio was 2.2:1. The mean age was 66±16 years for not recurred group (n=195) and 60±11 years for recurred group(n=18).

ON Table 2, demonstrated the coexisting diseases in the 213 patients with CSDH. Hypertension was the most common coexisting disease, followed by DM and previous pulmonary tuberculosis. The causes of CSDH were listed in Table 3. Trauma was most common cause of CSDH and followed by previous neurosurgery, alcoholism, and anticoagulation. 60 out of 213 patients did not have any causes of CSDH but these included the patients who could not remember any episode of head trauma. Coexisting diseases and causes of CSHD were not associated with the recurrence of CSDH. All patients with CSDH in this study, underwent burrhole trephination and hematoma evacuation with closed drainage. 8.4%(18 cases) of the 213 patients who were treated due to CSDH were recurred. Demographic variables such as age, sex, causes of CSDH, and preoperative mental status were not related to the recurrence of CSDH. Preoperative CT findings were summarized in Table 4. Preoperative hematoma locations, hematoma thickness, and hematoma density were not asssociated with the recurrence of CSDH in our study (Table 4). Duration of subdural catheter indwelling was 4.94±1.89 days in not recurred

Table 1. Clinical data of 213 patients with chronic subdural hematoma

Factors	Not recurred group	Recurred group	Total	P-value
Sex				0.758*
Male	134(68.7%)	13(72.2%)	147(69.0%)	
Female	61(31.3%)	5(27.8%)	66(31.0%)	
Age(years)				0.096**
	60±16	66±11		
Mental status				0.304*
Alert	139(71.3%)	12(66.7%)	151(70.9%)	
Confusion	13(6.7%)	2(11.1%)	15(7.0%)	
Drowsy	30(15.3%)	1(5.5%)	31(14.6%)	
Stupor	11(5.7%)	3(16.7%)	14(6.6%)	
Semicoma	2(1.0%)	0(0.0%)	2(0.9%)	

* Pearson's chi-square test, ** student T-test

Table 2. Underlying disease in 213 parients with chronic subdural hematoma

Underlying Disease	No. of patients
Hypertension	69(32.3%)
DM*	28(13.1%)
Previous pulmonary tuberculosis	7(3.2%)
Previous Spontaneous ICH**	2(0.9%)
Chronic alcoholism	4(1.8%)
Hepatitis	4(1.8%)
Coronary heart disease	1(0.45%)
Chronic renal failure	1(0.45%)

*DM : diabetes mellitus, **ICH : Intra-cerebral hematoma

Table 3. The causes of chronic subdural hematoma in 213 patients

Cause	No. of patients		
Trauma	Severity of head injury		
	GCS(15~13)* 142		
	GCS(12~9) 3		
	Total	145	68.07%
Alcoholism		4	1.87%
Neurosurgery		2	0.93%
Anticoagulation		2	0.93%
Unknown		60	28.20%

*GCS : Glasgow coma scale

Table 4. Preoperative computed tomographic findings in 213 patients with chronic subdural hematoma

	Preoperative CT findings		
	Not recurred group	Recurred group	P value
Hematoma locations			0.859*
Right	80(41.0%)	8(44.4%)	
Left	108(55.4%)	9(50.0%)	
Bilateral	7(3.6%)	1(5.6%)	
Hematoma thickness			0.412**
	18.05±8.62	16.34±6.40	
Hematoma density			0.863*
High	10(5.1%)	1(5.6%)	
Iso	100(51.3%)	8(44.4%)	
Low	47(24.1%)	4(22.2%)	
Mixed	38(19.5%)	5(27.8%)	

* Pearson's chi-square test, ** student T-test

Table 5. Postoperative CT findings in 213 patients with chronic subdural hematoma

	Postoperative CT findings		
	Not recurred group	Recurred group	P-value
Hematoma thickness	3.86±4.75	5.72±5.15	0.115*
Subdural air accumulation			0.27**
Yes	50(25.6%)	9(50.0%)	
No	145(74.4%)	9(50.0%)	
Hematoma density			<0.05**
High	1(0.5%)	3(16.7%)	
Iso	14(7.2%)	5(27.8%)	
Low	176(90.3%)	7(38.9%)	
Mixed	4(2.1%)	3(16.7%)	
Reexpansion rate			0.031*
	78.01±24.61	59.11±33.56	

* student T-test, ** Pearson's chi-square test

group and 5.39±2.03 days in recurred group. There was no significant difference in the duration of subdural catheter indwelling between two groups (student t-test, p value = 0.338).

We performed brain CT scan routinely on the 7th day after operation. In Table 5, we summarized the characteristics of postoperative CT scans. In postoperative CT scan, the hematoma thickness was not significantly different statistically between the two groups (student t-test, p value=0.115). Subdural air accumulation was verified by immediate postoperative simple skull X-ray. Immediate postoperative subdural air didn't influence on the recurrence of CSDH (Pearson's chi-square test, p value=0.027). Re-expansion rate of brain was calculated by a formula which was (preoperative hematoma thickness - postoperative hematoma thickness) / preoperative hematoma thickness X 100[10]. Re-expansion rates of brain was 78.01± 24.61 in not recurred group and 59.11±33.56 in recurred group. This factor seemed to be not related to the recurrence of CSDH (student t-test, p value = 0.31). We classified the density of CSDH into 4 catagories : high density than brain parenchyme, iso density, low density, and mixed density (Fig. 1). Table 6 shows significant relationship between high, iso, and mixed density and the recurrence of CSDH (Pearson's chi-square test, p value<0.05). Therefore, postoperative hematoma density was strongly associated with recurrence of CSDH.

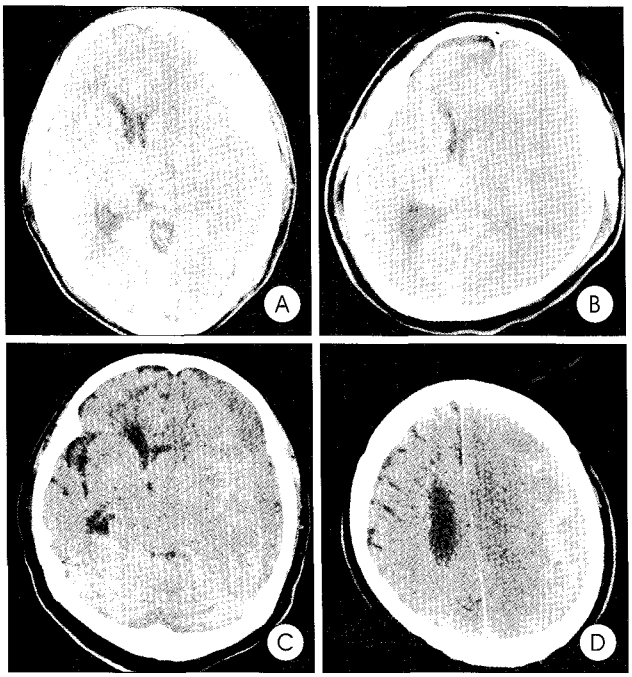

Fig. 1. 4 categories of hematoma density(High, Iso, Low, and Mixed). A : High density B : Iso density C : Low density D : Mixed density.

Table 6. Hematoma densities on postoperative CT scan that was performed in 7th day after surgery

	Postoperative hematoma density		
	Low	High+Iso+Mixed	P-value
Not recurred group	176(90.3%)	19(9.7%)	<0.05*
Recurred group	7(38.9%)	11(61.1%)	

* Pearson's chi-square test

Discussion

Recurrence of CSDH after burr hole trephination and closed drainage is not rare. Reported incidence was ranged 9.2% to 26.5% and our series showed a recurrence rate of 8.4%[1,19]. The etiology, pathphysiology and mechanism of recurrent CSDH were not completely understood. Several studies reported the risk factors influence on the recurrence of CSDH[3,8-12,14,15,19,23,25]. Clinical factors related to the recurrence of CSDH are divided into two categories. First category is the factors related to the patient characteristics, such as advanced age[8], coagulopathy[3,14], atrophy of brain parenchyme[8,13,20,23,24], chronic alcoholism[15], and bilateral hematoma locations[25]. Second category is the factors related to the surgical procedures, such as presence of pneumochphalus after surgery[11], re-expansion rate of brain[11], and postoperative hematoma density on CT scans[1,4,6,11,12,22,23,25].

In many studies, advanced age increased recurrence rate of CSDH[8]. In our study, age was not related to the recurrence of CSDH. However, older patients had a higher tendency to recur. Coagulopathy induced by anticoagulation drug and hemophilia are well known risk factor of the recurrence of CSDH[3,14]. Atrophy of brain parenchyme is one of the sequelae of previous cerebrovascular accident. Relative small volume of brain parenchyme causes enlargement of subrachnoid space and stretching of the bridging veins. This condition interrupts the expansion of brain after hematoma drainage. Thus, sustained rebleeding into hematoma cavity causes the recurrence of CSDH[8,13,20,23,24]. In the same fashion, the patient with larger hematomas have a higher tendency to recur because postoperative subdural space is larger than those with smaller subdural hematoma[8,12]. In our cases however, the thickness of hematoma(amount of hematoma) had no significant relation to recurrence.

The chronic alcoholism increases the risk of recurrence of CSDH[15], no significant difference was found in our study.

The pathophysiology of CSDH is not established definitely. But, in many studies, traumatic cerebrospinal fluid leakage into subdural space induces formation of outer membrane of CSDH[7,9,21]. Blood vessels grow into this membrane and these vessels permit plasma leakage into subdural space[16-18]. The leaked fluid contains plasminogen which could be transformed into plasmin by tissue plasminogen activator that is rich in the outer membrane of CSDH[18]. The plasminogen liquifies the blood clots. This results in the increased permeability of liquified hematoma[8]. By this mechanism, CSDH develops and increases in size.

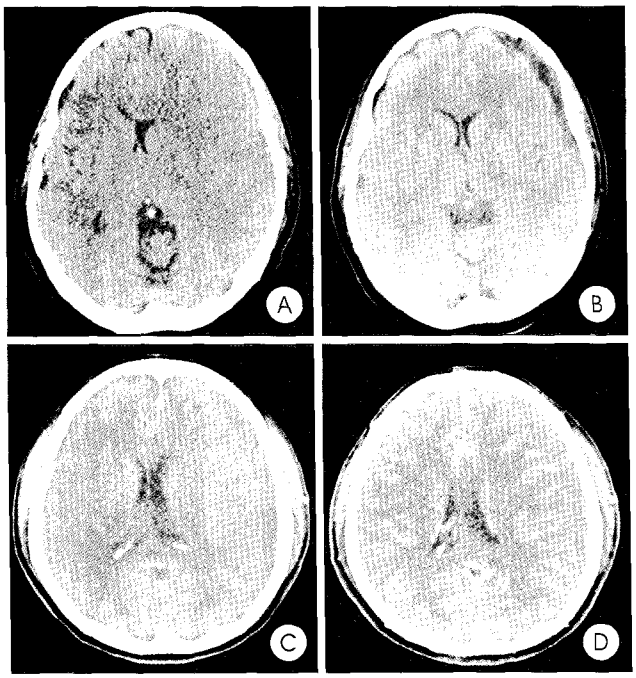

Fig. 2. Illustrated cases of no-recurrent(A,B) and recurrent(C,D) patients. A : preoperative CT scan shows low density hematoma. B : postoperative CT scan shows low density hematoma with almost same amount of hematoma compared with preoperative hematoma. C : preoperative CT scan shows iso density hematoma. D : postoperative CT scan shows iso density hematoma with decreased amount compared with preoperative hematma.

The density of CSDH on CT scan is classified into 4 categories : high, iso, low, mixed. Our series showed significant relationship between high, iso, and mixed density and the recurrence of CSDH. The density of CSDH reflects the proportion of fresh blood clots in hematoma cavity[1,22]. High proportion of fresh blood clots means the active growth of blood vessels into membrane of CSDH and rebleeding into hematoma cavity. In consequence, hematoma densities other than low density reflects active neovascularization into CSDH membrane and rebleeding into hematoma cavity. As seen in the results of our series, the amount of postoperative hematoma was not related to the recurrence of CSDH. Fig. 2 demonstates that a case of patient with large amount of postoperative CSDH with low density showed no recurrence and other case with small amount of postoperative CSDH with iso density showed recurrent CSDH.

Poor re-expansion rate of brain, in patients undergoing burr hole trephination and hematoma evacuation with closed drainge is risk factor of recurrence[11]. But, in our study, re-expansion rate of brain is not associated with the recurrence of CSDH (Table 5).

Makoto O et al designated subdural air accumulation after surgery as risk factor of the recurrence of CSDH[12]. The presence of postoperative subdural air interrupts re-expansion of brain[1].

Conclusion

The demographic variables such as age, sex, causes of CSDH, and preoperative mental status were not related to the recurrence of CSDH. The preoperative radiologic findings such as hematoma thickness, hematoma density did not correlated with the recurrence of CSDH.

Postoperative hematoma density on CT scan taken at 7th day after surgery was strongly related to the recurrence of CSDH. Hematoma densitiy other than low density means that hematoma contains a propotion of fresh blood clots. This results in continous rebleeding into hematoma cavity. Conseqeuntly, postoperative hematoma density other than low density means that CSDH could be recurred. So, Clinicians should pay more attention inspect the postoperative hematoma density, rather than the amount of postoperative hematoma.

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Commentary

I read with great interest this article which discusses about the clinical analysis of recurrent chronic subdural hematoma (CSDH). The authors statistically analysed 213 patients with CSDH to identify those factors leading to recurrent CSDH requiring repeated surgery.

The causative factors influencing recurrence have been investigated in several studies. These include the elderly, chronic alcoholics, patients with bilateral operations, patients with a suspected bleeding tendency and so on. However, it seems to be interesting that the demographic variables such as age, sex, coexisting disease were not related to the recurrence in this study. They statistically demonstrated that postoperative hematoma density was only related to the recurrence of CSDH. In my opinion, the separate or homogenous type is more important factor to predict recurrence in CSDH. The separate type of CSDH, which in several studies, is associated with a high risk of recurrence and homogenous type is associated with low risk of recurrence.

I think that this article may offer novel issue and seems to provide useful information to facilitate successful treatment of CSDH.

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