

Retrospective Analysis of Re-operated Patients after Chronic Subdural Hematoma Surgery

Chul An Jeong, M.D., Tae Wan Kim, M.D., Kwan Ho Park, M.D.,
Moon Pyo Chi, M.D., Jae O Kim, M.D., Jung Chul Kim, M.D.

Department of Neurosurgery, Seoul Veterans Hospital, Seoul, Korea

Objective : The aim of this study is to analyze the clinical symptoms, radiological changes, interval from first operation to symptom recurrence and to propose the proper treatment method for re-operated patients following chronic subdural hematoma surgery.

Methods : Between January 1992 and April 2003, 18 of 138 patients of chronic subdural hematoma repeatedly underwent surgical treatment. The symptoms, mental status by Bender grade, radiological hematoma size and midline shifting, interval from symptom onset to diagnosis, surgical method and prognosis by Glasgow outcome scale (GOS) between the first attack and the recurrence were compared.

Results : The symptoms at the time of recurrence were nearly the same as with the first attack, but two patients (2/18, 11.1%) showed a more declined mentality. In addition, the recurred hematoma sizes were the same or large than those previously found. Many patients were recurred within two weeks (13/18, 72.2%). Most patients were operated on using the previous burr hole, with the exception of one patient who recurred at a different site. All patients had a good prognosis more than GOS 4 (GOS 4:4, GOS 5:12), but two died due to extracranial complication and infection.

Conclusion : These results suggest that the early diagnosis and treatment are important, mostly recurred same symptoms within two weeks. Re-operation using the previous burr hole site is a good method.

KEY WORDS : Chronic subdural hematoma · Recurrence · Re-operation.

Introduction

Chronic subdural hematoma is known as a neurosurgical disease which has a good prognosis with relatively simple surgical treatment.

The rate of occurrence of chronic subdural hematoma in males seems to be higher than that in females, owing to the different frequency of exposure to traumatic injury and estrogen's defensive effect on the blood vessels¹⁸⁾. There are several reasons why this type of hematoma occurs frequently among the aged, including the increase in antithrombotic usage, and venous fragility, the augmentation of the subdural space (6~11% of the whole intracranial space)^{1,17)}, and the increased exposure to traumatic injury resulting from frequent falls. Although bad prognosis has been reported in those cases where the patients were admitted to hospital with a decreased level of consciousness, in the case of patients with

asymmetry of the pupils, large hematoma, and a previous history of antithrombotic treatment¹⁵⁾, it is considered that there is no difference in prognosis between cases of trauma and those of natural hemorrhage⁷⁾.

Those factors which interrupt the fast brain expansion are old age, a reduced level of consciousness when admitted to hospital, chronic alcoholism, hematoma appearing as a low density shadow on CT, bilateral hematoma, reduced brain pulsation after surgery, and a long interval between the trauma and the occurrence of symptoms. Among these different factors, the age of the patient is considered to play the most significant role¹²⁾. In the case of older patients, a long period of trace-observation is required. The recurrence of hematoma originates from the pressure difference between the inside and outside of the inner membrane of the hematoma, and it is also related to the increased pressure inside the hematoma, low pressure in the subdural space, and brain atrophy. The former

• Received : November 26, 2004 • Accepted : January 31, 2005

• Address for reprints : Tae Wan Kim, M.D., Department of Neurosurgery, Seoul Veterans Hospital, 6-2 Dunchon-dong, Gangdong-gu, Seoul 134-791, Korea Tel : +82-2-2225-1363, Fax : +82-2-2225-1366, E-mail : colloseum@freechal.com

occurs when there is a large amount of air remaining in the subdural space, a remnant of the subdural hematoma, or the continuous expansion of the hematoma cavity, while the latter is related to the excessive loss of water as a result of dehydration, anemia, and hemorrhage⁹⁾. The most well-known recurrence factors are coagulopathy and intracranial hypotension (the practice of shunting or leakage of cerebrospinal fluid), and the possibility of recurrence is high in the case where the time period between the onset of symptoms and the patient's hospitalization is short, air remains for a long time in the operated area after surgery, or there is a mixed or layered density on CT before surgery. It was also reported that the thickness of the hematoma, the age of the patient, and a history of alcohol consumption or anticoagulant and antiplatelet agent treatments were only marginally related to the recurrence rate^{9,10,14)}.

The recurrence of subdural hematoma requiring re-operation was noted in 2.3~13% of the patients^{5,14,16)}. Recurrence detected on radiologic imaging without the reappearance of symptoms is not considered to be an indication for reoperation. Few studies have been conducted on patients who experience a recurrence of symptoms and need to be re-operated. Therefore, this study targeted those patients who needed to be re-operated due to the recurrence of symptoms after subdural hematoma surgery, and a comparison was made between the situation at the first diagnosis and the moment when the symptoms reappeared due to recurrence, from the following four viewpoints, 1) the change in the clinical symptoms, 2) the amount of hematoma and the degree of midline shift at the diagnosis, 3) the time interval from symptom onset to diagnosis, and 4) the treatment method and prognosis.

Materials and Methods

Retrospective research was conducted on 18 recurrent cases among 138 patients who were operated due to chronic subdural hematoma in our hospital (recurrence rate : 13%). In the 18 cases of recurrence, the ratio of males to female was 5 : 1 and all of the patients were in their sixties or older except for one who was a teenager and had undergone a V-P shunt. The hemorrhage site was almost unilateral (left : 9, right : 8) in the 18 recurrent cases, except for one case in which burr hole drainage was conducted bilaterally for bilateral hemorrhage, and the young patient also had recurrence on one side. The amount of hematoma and the degree of midline shift in the 18 patients were compared between the first diagnosis and recurrence. Also, the clinical symptoms and the time period from the onset of symptoms to the diagnosis were evaluated by examining the patient's records.

The Bender grade was utilized to evaluate the degree of

consciousness of the patients, the thickness of the severest part of the hematoma on radiologic images was used to indicate the amount of hematoma and the most severe parts of the hematoma were compared in order to assess the degree of midline shift. Those patients with a history of anticoagulant medication, chronic renal failure, alcoholism, or coagulopathy were excluded from this study. In the first operation, burr hole drainage was performed on the thickest part of hematoma and two burr hole drainage was conducted in those cases where there was a septum in the hematoma. Burr hole drainage was conducted in all symptomatic recurrent cases except one. In all cases, irrigation was performed through a drainage catheter during surgery, with the drainage catheter being inserted and maintained for only 2~3 days, regardless of the amount of drainage, because extended maintenance of a drainage catheter after surgery increases the possibility of infection and tension pneumocephalus¹⁰⁾. The head of the patient was placed at the same height as his or her heart, and enough fluid was supplied to accomplish the temporary swelling of the brain, which resulted in the rapid closure of the subdural space. The patients were discharged from hospital about 2 weeks after surgery, provided no complications occurred.

Non-periodical CT scans were conducted according to the patient's symptoms, with the primary goal being a change in the level of consciousness of the patient, rather than a periodical change in the amount of hematoma on the CT scans which were performed two days, one week, and two weeks after surgery. The prognosis of these reoperated patients by using GOS was assessed following their trace observation for a period ranging from 6 months to one year after surgery.

Results

The comparison of symptoms between first diagnosis and recurrence

In this study, we compared only one major symptom of patients and in the case of consciousness change or hemiparesis, that symptom was more focused. In most patients, the symptoms at the first diagnosis and recurrence were similar, but 2 patients who possessed clear consciousness at the first diagnosis showed declined consciousness of Bender grade 2 upon recurrence. Three patients, who were admitted to hospital due to declined consciousness at the time of the first diagnosis, showed declined consciousness again at recurrence, and these patients constituted an exception to the general rule, wherein most patients complained of headache at recurrence, however this difference might have resulted from our comparing only the main symptom (Table 1). Older patients (more than 65) tended to have symptoms of incre-

ased intracranial pressure such as headache less often, but in the case of recurrence, they tended to suffer from headache frequently^{7,14,15,17}, but in our study patients were complained headache less frequently.

The amount of hematoma and midline shift at the first diagnosis

When the amount of hematoma and midline shift were analyzed at recurrence, as follows (Table 2). Two cases had a smaller amount as compared to the first diagnosis (Fig. 1). One case in which hematoma broke out on the opposite side was excluded. In some cases, the patients complained of similar symptoms even if they had less hematoma than at the first diagnosis. This happened because the hematoma tended to have a relatively high density on the CT scan at recurrence, which led to bleeding into the subdural area that had not been dilated faster than the first attack, because patients' insight of the disease had increased, and because they were diagnosed sooner, since they were already in hospital.

The period from symptom onset to diagnosis

This study showed that in the 18 cases of recurrence, the reappearance of the symptoms occurred within 1 to 44 days

Table 1. Symptomatic difference between first attack and recurrence (n=18)

Chief complaint	1st attack	Recurrence
Mentality change	3	5
Motor weakness	4	4
Headache	6	5
Dizziness	3	2
Speech disturbance	2	2

Table 2. Radiological change of computed tomography findings at recurrence (n=17)

Hematoma maximum width		Midline shift	
Increased	7	Increased	4
No change	8	No change	9
Decreased	2	Decreased	4

One patient which occurred contralateral side is excluded

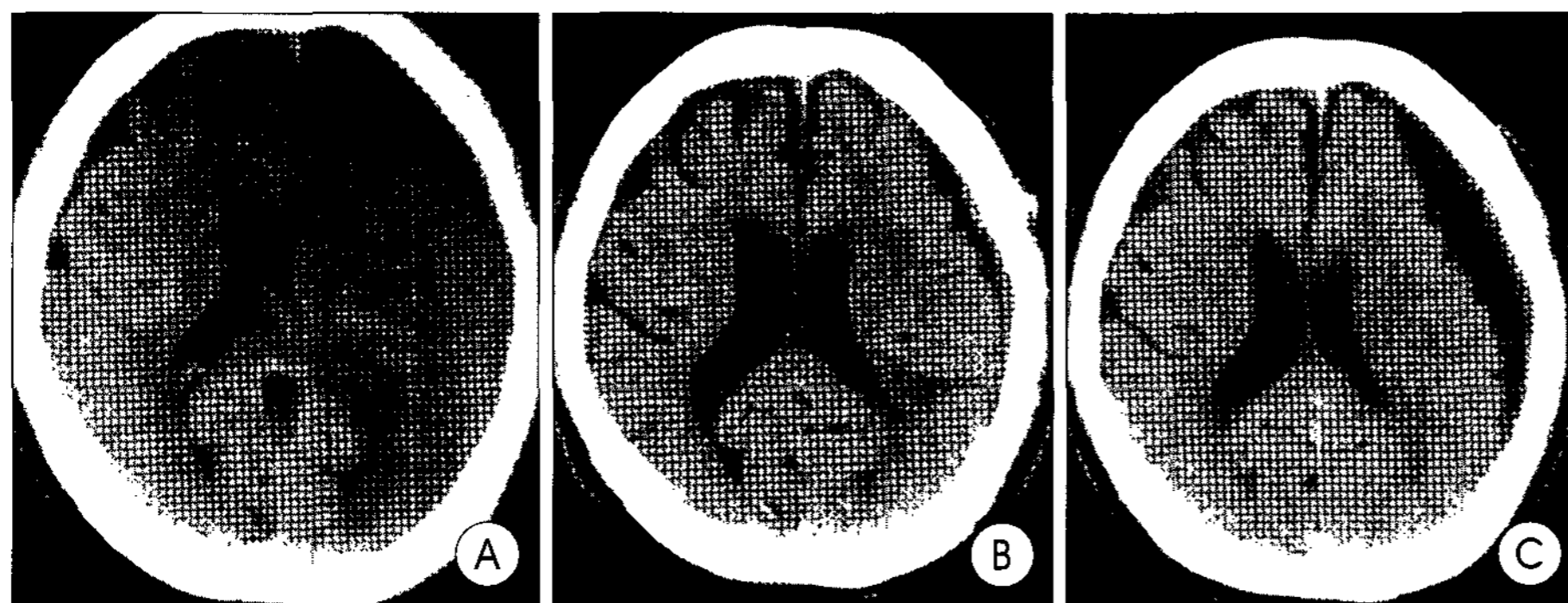


Fig. 1. A : Preoperative computed tomography(CT) showing mixed density hematoma with 2.7cm in depth. B : Postoperative CT showing near-total removal of hematoma. C : After 14 days, hematoma is re-collected with 2.0cm in depth, but the patient complaining right hemiparesis again.

(14.6 days on average). Many patients were recurred within two weeks (Table 3). The appearance of chronic subdural hematoma caused by traumatic injury was reported to take 3~4 months on average⁷, from the initial attack to its diagnosis, and all of the recurrent patients reportedly experienced reappearance within 1 month¹⁰. Our results showed the same results. The standard for the diagnosis of recurrence included not only reaccumulation of hematoma on the radiologic imaging, but also symptomatic recurrence as experienced by the patients. In many cases, the patients underwent reoperation because of symptomatic reappearance during hospitalization, but three of them were readmitted to hospital after being discharged.

The proper surgical treatment method and prognosis

In this study, the repeat burr hole drainage was practiced at the first operation site, except in one case in which the hematoma recurred on the opposite side. This case was included in the recurrence category, because air scaped on the opposite side of the cranium in relation to the newly operated area (Fig. 2), where a small amount of the initial hematoma remained after the first burr hole site, and the patient experienced no special trauma during hospitalization and had no history of special disease or medication in the past. The reconduction of burr hole drainage gave rise to good results (more than GOS 4), in the sense that the patients were able to resume their normal lives, as before the onset of the hematoma, except in 2 cases in which the patients died of pneumonia and infection related to the wounds inflicted during the operation. It is generally considered that craniotomy is desirable only if burr hole drainage fails³. Our study was also showed burr hole drainage using the previous burr hole was preferred at recurred patients.

Discussion

Chronic subdural hematoma is sometimes misdiagnosed, because it's symptoms are similar to those of other CNS diseases such as dementia and cerebral infarction. The symptoms include headache resulting from an increase in cerebral pressure, decreased muscle power resulting from a decline in local movement and sensory function, dysarthria, and a change in the level of consciousness and personality¹⁵. However, it should be noted that headache is not prevalent in the elderly population¹⁷. In the case where chronic subdural hematoma recurs, headache is the commonest sym-

ptom and the hematoma appears as a high density area on the CT image due to the vulnerability of the capillary of the neomembrane¹⁴. It has been reported that recurrence is rare in those cases in which the preoperative hematoma appears in the form of a high signal on the T1-weighted MRI scan^{7,10}. The recurrence rate of the cranial base type of chronic subdural hemorrhage was high and that of the convexity type was low⁸. The location and usage of a drainage catheter after surgery is related to recurrence, and in those cases where the drainage catheter is located in the frontal area, recurrence is less likely, because the drainage catheter can diminish the amount of air inside the cerebrum. Recurrence is also less likely when a drainage catheter is used than when one is not used, whereas recurrence is more likely if the intracerebral air is not removed within 7 days or if the subdural space is larger than 10mm^{4,6,9,10}. There is less likelihood of recurrence when the drainage catheter is used without irrigation than after irrigation^{10,11} and when a larger amount of hematoma is removed¹³. The thickness of the hematoma and midline shift are not correlated with recurrence⁹ and, in many surveys, the criterion for the diagnosis of hematoma recurrence is said to be the reaccumulation of subdural hematoma after operation and the reappearance of neurological symptoms within 6 months^{7,10,13}.

Although it has been reported that there is less likelihood of recurrence in cases of chronic subdural hematoma resulting from trauma¹⁴, no significant difference was found in our study, since recurrence occurred in 7 of the 56 patients whose initial hematoma resulted from trauma (12.5%), 9 of the 63

patients whose etiology was non-traumatic (14.3%) and 2 of the 19 patients in whom the origin of the initial hematoma was unclear (10.5%). However, the classification of the patients into the trauma and non-trauma groups is likely to be inexact, because many of the patients were not able to remember their trauma history precisely and, consequently, they gave a negative response, whether or not they had in fact experienced trauma.

In the re-operation, 4 of the 18 patients had septum and these patients had a higher recurrence rate than those without septum. Since MRI was not usually used, it was difficult to make a clear distinction between monolayer and multilayer. According to Tanikawa²⁰, the recurrence rate is higher if the structure of the hematoma is multilayer, and the existence of a septum is considered to be associated with a high recurrence rate. There have been some proposals in favor of performing craniotomy in order to accomplish the complete removal of the hematoma and the eradication of the inner membrane of the hematoma, but this remains controversial. Therefore, at present, it is generally considered that there is no significant difference between burr hole trephination and craniotomy.

The reason the age of the patients is closely related to brain parenchymal expansion is that, with age degenerative changes occur in the brain and cerebral resilience factors, such as the volume of the cerebral vasculature, cerebral meninges, and subpial brain tissue, all decrease. It has been argued that at least 6-weeks of trace-observation is needed if brain expansion does not occur rapidly after the operation and recommended stop anticoagulant which used before operation until the brain was fully expanded¹⁹.

Based on the results of this study, we suggest that a 6-week period of careful trace-observation should be made in such cases, because almost all cases of recurrence occurred within 6 weeks¹². In the 18 cases of recurrence, the period from operation to re-operation was 1-44 days (14.6 days on average)

Table 3. Interval from first operation to symptom recurrence (n=18)

Interval	Cases
1 day to 3 days	1
4 days to 2 weeks	12
2 weeks to 4 weeks	4
more than 4 weeks	1

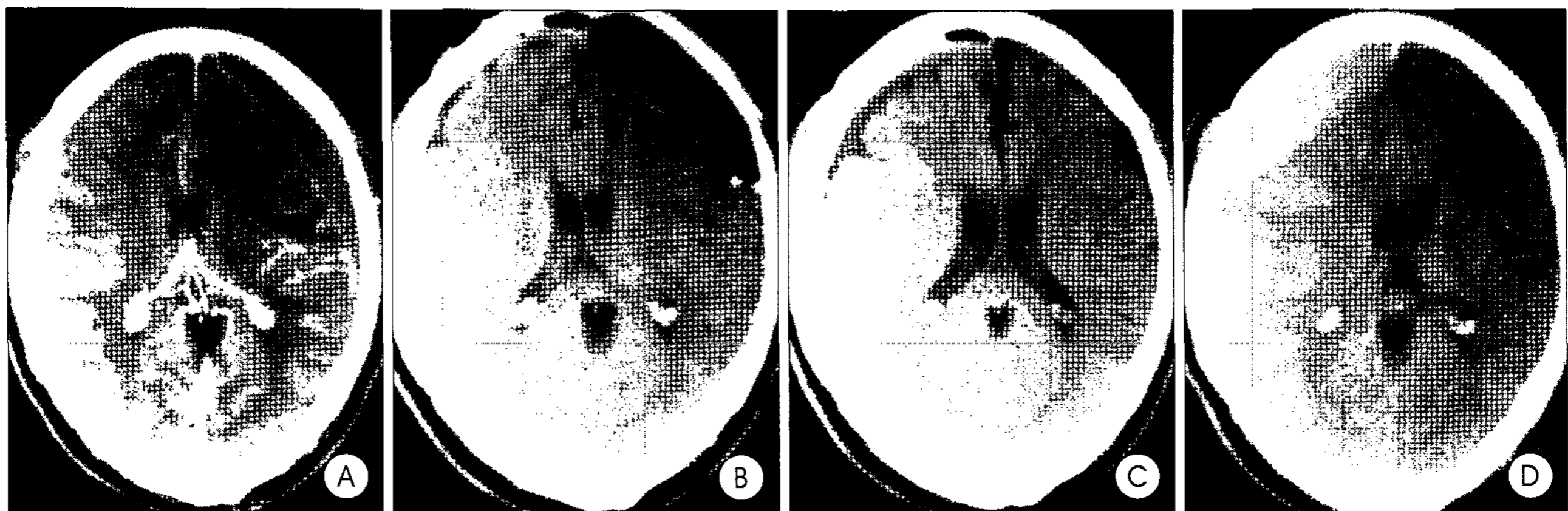


Fig. 2. A : Preoperative computed tomography(CT) showing isodense hematoma and small hematoma on contralateral side. B : Postoperative CT showing a large air collection. C : After 7 days, the air is completely absorbed on operative site but still remained contralateral side. D : After 10 days, CT showing high density hematoma on air-remaining side. The patient had no additional trauma and specific medication history.

and the result was similar to the findings of Alexander²⁾ 1~7days(2~3days on average), Møllergaard¹⁶⁾ average 11days, and Adhiyaman¹¹⁾ average 12days. In this study, burr hole drainage was conducted in 17 of the 18cases of recurrence, with the one exception being a case in which the patient had a substantial amount of hematoma, severe midline shift and experienced a sudden change in his level of consciousness.

In contrast to the assertion made in previous studies, that the recurrence rate tends to be higher after re-operation and a different surgical method should be selected for the re-operation¹⁶⁾, our patients had no recurrence after re-operation and generally had a good prognosis, and there was a temporary improvement in their symptoms after the first operation. The potential complications arising from the surgical treatment of chronic subdural hematoma are mainly extracranial in nature, consisting of the recurrence of hematoma, epileptic seizure, intracerebral hemorrhage, epidural hemorrhage, tension pneumocephalus, infection and pulmonary embolism^{1,2,5)}. Our two patients died because of infection and pneumonia.

Conclusion

The number of patients who experienced recurrence in this study was relatively low. But some patients can have recurrence of symptoms with a smaller amount of hematoma than that at the first diagnosis, and some patients' mental status is lower than at the first diagnosis. Most of patients recur within one month, especially two weeks. Both careful observation of the patients during hospitalization and sufficient education when they are discharged are needed.

Burr hole drainage using previous burr hole is a proper surgical method and patients treated rapidly have good prognosis.

References

1. Adhiyaman V, Asghar M, Ganeshram KN, Bhowmick BK : Chronic subdural haematoma in the elderly : *Postgrad Med J* 78 : 71-75, 2002
2. Alexander DK, Leonid BL, Alexander AP, Hikmat E : Postoperative complications of chronic subdural hematomas : *Neurosurg Clin N Am* 11 : 547-552, 2000
3. Benzel EC, Bridges RM, Hadden TA, Orrison WW : The single burr hole technique for the evacuation of non-acute subdural hematomas. *J Trauma* 36 : 190-194, 1994
4. Choi CH, Moon BG, Kang HI, Lee SJ, Kim JS : Factors affecting the reaccumulation of chronic subdural hematoma after burr-trephination and closed-system drainage : *J Korean Neurosurg Soc* 35 : 192-198, 2004
5. Choudhury AR : Avoidable factors that contribute to complications in the surgical treatment of chronic subdural hematomas : *Acta Neurochir (Wien)* 129 : 15-19, 1994
6. Christopher RPL, Christina JL, Edward WM : Reduction in the number of repeated operations for the treatment of subacute and chronic subdural hematomas by placement of subdural drains : *J Neurosurg* 99 : 44-46, 2003
7. Hikmat E, Vincent JM, Howard HK : Prognosis of chronic subdural hematomas : *Neurosurg Clin N Am* 11 : 553-567, 2000
8. Hiroshi N, Takeo T, Norio Y : Factors in the natural history of chronic subdural hematomas that influence their postoperative recurrence : *J Neurosurg* 95 : 256-262, 2001
9. Hiroshi N, Takeo T, Norio Y : Relationship between drainage catheter location and postoperative recurrence of chronic subdural hematoma after burr-hole irrigation and closed-system drainage : *J Neurosurg* 93 : 791-795, 2000
10. Kazuo T, Keiichirou M, Akira I, Masaaki U, Yoshihumi O, Takaaki K : The relationship of preoperative magnetic resonance imaging findings and closed system drainage in the recurrence of chronic subdural hematoma : *J Neurosurg* 87 : 870-875, 1997
11. Kuroki T, Katsume M, Harada N, Yamazaki T, Aoki K, Takasu N : Strict closed-system drainage for treating chronic subdural haematoma : *Acta Neurochir (Wien)* 143 : 1041-1044, 2001
12. Lee SC, Kang JK, Jung HT, Dho JO : Factors affecting brain re-expansion after simple burr hole drainage in chronic subdural hematomas : *J Korean Neurosurg Soc* 27 : 757-762, 1998
13. Lim DJ, Park YK, Chung YG, Kim BR, Chung HS, Lee KC : The relationship of preoperative computerized tomographic scan image and amount of postoperative closed system drainage in the recurrence of chronic subdural hematomas : *J Korean Neurosurg Soc* 27 : 1402-1407, 1998
14. Makoto O, Makoto T, Shinichi T, Tomoji K, Masatsune S : Clinical factors of recurrent chronic subdural hematoma : *Neurol Med Chir (Tokyo)* 41 : 382-386, 2001
15. Mark RI, Richard HS : Chronic subdural hematoma in adult and elderly patients : *Neurosurg clin N Am* 11 : 447-454, 2000
16. Møllergaard P, Wisten O : Operations and re-operations for chronic subdural hematomas during a 25-year period in a well defined population : *Acta Neurochir(Wien)* 138 : 708-713, 1996
17. Muhammad A, Vedamurthy A, Greenway MW, Bhimal KB, Bates A : Chronic subdural haematoma in the elderly- a north wales experience : *J R Soc Med* 95 : 290-292, 2002
18. Sambasian M : An overview of chronic subdural hematoma : Experience with 2300 cases : *Surg Neurol* 47 : 418-422, 1997
19. Stroobandt S, Fransen P, Thauvoy C, Menard E : Pathogenetic factors in chronic subdural haematoma and causes of recurrence after drainage : *Acta Neurochir (Wien)* 137 : 6-14, 1995
20. Tanikawa M, Mase M, Yamada K, Yamashita N, Matsumoto T, Banno T : Surgical treatment of chronic hematoma based on intrahematoma membrane structure on MRI : *Acta Neurochir (Wien)* 143 : 613-619, 2001