CLINICAL ARTICLE

J Korean Neurosurg Soc 40: 441-444, 2006

Surgical Experience of Acute Traumatic Posterior Fossa Subdural Hematoma : Study of 6 Cases and Review of the Literatures

Jong Tae Park, M.D., Dae Won Kim, M.D.

Department of Neurosurgery, School of Medicine, Institute of Wonkwang Medical Science, Wonkwang University, Iksan, Korea

Objective : The goal of this study is to evaluate the clinical results in six patients who underwent surgical decompression for the acute subdural hematomas(ASDH) of posterior cranial fossa.

Methods : Six patients (five males and one female) who had undergone surgery for ASDH of posterior cranial fossa between 2000 and 2005, were evaluated retrospectively with regard to clinicoradiological findings and surgical outcomes. The mean age was 45.8 years (range 9~67 years).

Results : Preoperative computed tomography showed ASDH on cerebellar hemisphere in four patients and on midline in two. All patients had the associated lesions such as subarachnoid hemorrhage, epidural or subdural hematoma, intraventricular hemorrhage, contusion or pneumocephalus in supratentorial area. Fracture of occipital bone was noted in two patients. Of the four patients who had 13 to 15 of Glasgow coma scale score at the time of admission, three were deteriorated within 24 hours after trauma. Of these three patients, delayed subdural hematoma developed 1 hour after initial normal CT finding in one patient and increased in thickness in another one. Postoperative outcome showed good recovery in three patients and moderate disability in one. Two patients were expired.

Conclusion : This study supports that early diagnosis based on strict observation and prompt surgery in the patients with ASDH in posterior fossa will lead to the best results.

KEY WORDS : Head injury · Subdural hematoma · Posterior fossa · Outcome.

Introduction

Most of the traumatic intracranial pathologies are located in supratentorial area. Acute subdural hematoma (ASDH) is the most rarely encountered post-traumatic pathology in posterior fossa[1,2,4]. It has been reported that those located in the posterior fossa constitute only 0.3~0.8% of all ASDH, but the incidence seems to have increased with awareness of the possibility of acute traumatic posterior fossa subdural hematoma(ATPFSDH)[1,2,4,5,8].

It may cause rapid and fatal deterioration of the patient by compression of the brain stem, usually without prior warning signs. Early recognition before clinical signs occur and surgical evacuation of the hematoma are therefore extremely important. It has become much easier to diagnose and since the introduction of computed tomography(CT) into clinical practice[1,3,6,11].

Because of the rarity of these lesions, individual neurosurgeons and single institutions could not gain considerable experience in their management. We present our clinical experiences of ATPFSDH with review of the literatures.

Materials and Methods

We retrospectively reviewed 6 patients who underwent surgical decompression for ATPFSD at our hospital between January 2000 and December 2005. Clinical characteristics, associated supratentorial and posterior fossa lesions detected in CT, and outcomes were evaluated though the medical recordings during their admission periods.

CT scans were routinely performed in all injured patients even when they did not have any neurological symptoms and signs as soon as they arrived at emergency room. Subsequent

• Received : April 26, 2006 • Accepted : August 22, 2006

• Address for reprints : Jong Tae Park, M.D., Department of Neurosurgery, School of Medicine, Institute of Wonkwang Medical Science, Wonkwang University, 344-2 Sinyong-dong, Iksan 570-711, Korea Tel : +82-63-850-1261, Fax : +82-63-852-2606, E-mail : jtpark@wonkwang.ac.kr

scans were obtained as indicated by clinical events. Features on CT scans that were assessed included the location of the hematoma and its thickness (defined as the maximum thickness of the extracerebellar hyperdense component of the lesion on CT scans), co-existing posterior fossa lesions, the status of fourth ventricle and posterior fossa cisterns, and associated a supratentorial traumatic lesion or hydrocephalus.

Table 1. Patient's summary of posterior fossa subdural hematoma

Case	Age(yrs)/sex	Type of injury	GCS and its change	Time interval of deterioration (hrs)	Surgical treatment	GOS*
1	9/M	TA-pedestrian	4	-	craniectomy	1
2	36/M	TA-pedestrian	15→13	15	craniotomy & EVD	5
3	45/M	falling	13	-	craniotomy	5
4	58/F	slippage	14→8	5	craniectomy & EVD	1
5	60/M	TA-pedestrian	14→8	4.5	craniectomy	5
6	67/M	TA-pedestrian	6	-	craniectomy	4

TA : traffic accident, GCS : Glasgow coma scale, EVD : extraventricular drainage, GOS* : Glasgow outcome scale (5 : good recovery, 4 : moderate disability, 3 : severe disability, 2 : persistent vegetative state, 1 : death). Arrow (→) indicates the change from initial to preoperative state

Results

During the last 6 years, total of six patients underwent decompressive surgery for ATPFSDH. It constituted 0.9% of all intracranial subdural hematoma which underwent surgery during the same period in our institutes.

The cases are summarized in Table 1. There were five men and one woman and the age range was 9 to 67 years. The causes of injury were traffic accident (pedestrian injury) in four, falling in one, and slippage in one patient case. Except for one patient who was secondary referral, five patients were admitted to our hospital within 4 hours after the injury. The first CT scan was obtained an average of 1 hour and 50 minutes after injury (range, 30~210 min). GCS ranged between 4 and 15 at presentation. Four patients had an initial GCS score greater than 12, but three of them deteriorated rapidly or slowly after trauma. Two patients were known to have talked at some time before going into coma and one who had referred from local clinic was aggravated 12 hours after injury from initial GCS 15 to 13. In these two patients, subdural hematoma developed newly 1 hour after initial normal CT finding in one (Fig. 2) and increased in hematoma thickness in the other one.

The initial CT scans showed ASDH with thickness of 10mm or more in five patients and normal finding in one. The location of ASDH was hemisphere in four and midline in two patients (Fig. 1). Occipital fracture was noted in two patients. All patients had the associated supratentorial pathologies. CT findings and associated lesions are summarized in Table 2. All patients underwent the emergent surgical decompression for the SDH of posterior fossa (Table 1).

After posterior fossa decompre-

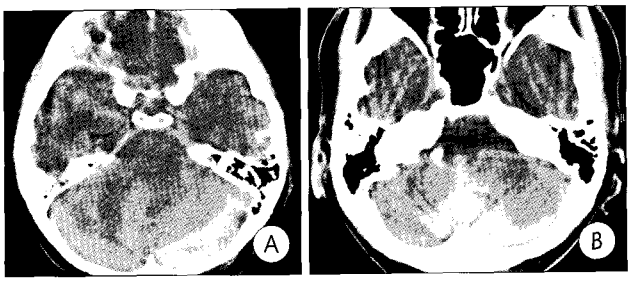

Fig. 1. Case 1 and 2. A : Initial noncontrast computed tomography(CT) showing the subdural hematoma(SDH) with 2cm thickness in the left cerebellar hemisphere. Both 4th ventricle and cisterns around the brain stem are not visible (case 1). B : Initial noncontrast CT showing the midline SDH in the posterior fossa (case 2).

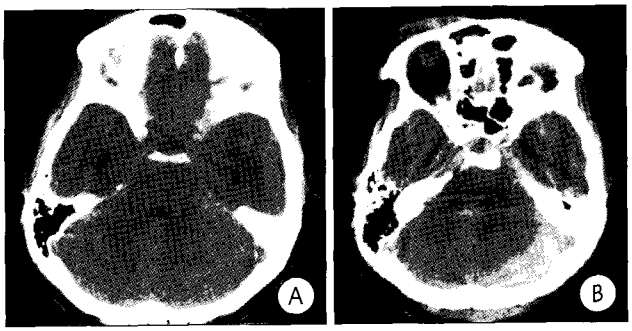

Fig. 2. Case 4. Sequential noncontrast computed tomography(CT) scans showing the delayed subdural hematoma(SDH) in the left cerebellar hemisphere. A : CT scan showing the normal appearance at the time of admission. B : repeat CT scan obtained at 5 hours after injury, showing the SDH of 1.8cm thickness in the left cerebellar hemisphere.

Table 2. Findings of computed tomography in posterior fossa subdural hematoma

Case	Hematoma thickness (mm)	Location	Brainstem cistern	Other lesion (posterior fossa)	Fracture (occiput)	Supratentorial lesion
1	20	hemisphere	obliterated	low density	-	SAH
2	20 & cistern	midline	intact→ obliterated	none	-	3rd, 4th IVH Hydrocephalus*
3	23	hemisphere	obliterated	none	+	EDH*
4	0→18	hemisphere	obliterated	none	-	IVH frontal contusion Hydrocephalus*
5	10→11	hemisphere	intact→ obliterated	none	+	contusion
6	13 & cistern	midline	obliterated	vermis contusion	-	SDH* pneumocephalus

EDH : epidural hematoma, SDH : subdural hematoma, SAH : subarachnoid hemorrhage, IVH : intraventricular hemorrhage, *: lesions which performed surgical intervention. Arrow (→) indicates the change from initial to preoperative state

ssion, four patients underwent the second surgery for supratentorial lesions. One patients who had associated an intraventricular hemorrhage underwent ventriculostomy because of an obstructive hydrocephalus. Another one patient who had initially associated a contusional hemorrhage had to evacuate contusional hemorrhage 2 days after initial operation. In the remaining two patients, supratentorial subdural hematomas were evacuated consecutively following initial operation.

The outcome showed good recovery in three patients and deaths in two (33.3%). The remaining one remained a moderate disability at 2 years after accident. Of the two patients who had been dead, one had subdural hematoma on the follow-up CT scan obtained 1 hour after an initial confirmation of normal CT finding (Fig. 2). After surgical decompression, patient's neurological status showed a nearly complete recovery immediately. However, the patient was dead because of an unexpectedly sudden respiratory arrest 13 days after surgery.

Discussion

Posterior fossa traumatic hematomas are rare lesions, and most reviews indicate that their incidence among patients who have CT scans for acute head injuries is approximately 3%[2,3,5,11]. The relative incidence of ATPFSDH, constituting the most rare type of posterior fossa traumatic hematoma, is estimated to fall below those of extradural and intracerebellar hematomas of the posterior fossa, accounting for approximately 10% of posterior fossa traumatic lesions and is roughly 0.3 to 0.8% of supratentorial subdural hematomas[2,4,6]. Recently Karasawa et al.[6] reported an incidence of 0.27% (5 cases) in their series of 1,802 patients with acute head trauma, and d'Avella et al.[2] observed an incidence of 0.21% in a series of 2,350 patients who underwent CT scanning for acute head trauma.

According to the early reports, it has known that the main clinical features are coma or significant depression of consciousness[1,5]. However, they have diverse and unpredictable clinicoradiological features and an acute clinical course within 24~48 hours is a dominant and important feature of ATPFSDH[2,5]. Progressive or sudden clinical deterioration has been observed frequently within the first several hours after injury. In this study, 50% showed clinical deterioration within 24 hours after trauma.

It is a typical CT finding of subdural hematomas in the posterior fossa that shows the presence of high attenuation extracerebellar/retrocerebellar collection in a concave-convex shape based in the posterior fossa[2,11]. An association of occipital fracture, hydrocephalus, subarachnoid hemorrhage, and co-existing supratentorial lesions could be seen in these patients[2,5,7,8]. Because the impact on the occipital/suboccipital area produces contrecoup lesions supratentorially in the frontal and/or temporal region, the presence of co-existing supratentorial lesions are common findings in traumatic posterior fossa hematoma patients[12]. In this study, five of all six patients had various type of co-exiting supratentorial lesions and a surgical decompression was needed in two patients.

Delayed or evolving traumatic hemorrhagic lesions of the posterior fossa have been reported previously in the literature[10]. As was emphasized for the supratentorial compartment, such patients with ATPFSDH should be considered at risk of developing an evolving clinical course[2,9,10]. Thus acute traumatic lesions in posterior fossa have been recommended to be re-scanned at least daily until the lesion stabilizes[2,3]. In our series, there were two patients, of whom one had a subdural hematoma which was increased in thickness later and the other got a new development of hematoma in an area that appeared normal on first CT scans. These two patients required an urgent decompression.

The standard treatment consists of surgical evacuation of the hematoma by suboccipital craniectomy[1,5]. Several papers indicated the possible favorable outcome without surgery was gained in the limited cases[2,6]. In the absence of clinical deterioration indicating the need for rapid evacuation of a subdural hematoma, several findings of the CT scan play an important role in deciding whether or not surgery is indicated. Such CT parameters are thickness of hematoma, appearance of the cisterns surrounding the brainstem, and co-existing posterior fossa lesions[2,9,11]. The thickness of hematoma, although reflecting only in part the course of the disease, is an important parameter since large hematomas generally need prompt evacuation, whatever the clinical status of the patient[2,7]. Unlike spontaneous hemorrhage, traumatic posterior fossa lesions may coexist with brainstem damage, and we sometimes have not found a correlation between the thickness of the hematoma and the clinical condition, the possible brain stem damage being responsible for this discrepancy[3,6-8,12]. In many cases, obliteration of posterior fossa cisterns was found to be a reliable indicator of concomitant brainstem injury and of poor prognosis[2,11]. However, even in comatose patients with complete obliteration of the brainstem cisterns, dramatic improvement and acceptable outcomes were achieved after prompt decompression and adequate management[2,5]. Consequently, this CT finding is not necessarily a predictor of a poor outcome.

Many authors have thought that the most important factor determining the prognosis is level of consciousness just before surgery[1,2,10]. Early diagnosis before neurological deterioration develops and a prompt surgical evacuation of hematoma lead to satisfactory outcome in the treatment of ATPFSDH patients. In early diagnosis, early CT scanning is very important and should never be delayed. Control CT scanning is also critical for evaluating whether the hematoma is getting larger or not,

especially within the first 24 hours[2,3,10,11]. In our series, an overall mortality rate of 33.3% could be considered a relatively good result when compared with the other series in the literature mostly related to early diagnosis by CT.

Conclusion

The possibility of a progressive course of the lesion or a delayed hematoma should be kept in mind when dealing with an trauma or fracture, even though initial CT was normal. The most important factor determining the prognosis is level of consciousness just before surgery. Early diagnosis and a prompt surgical evacuation lead to excellent recovery in patients with ATPFSDH.

• Acknowledgement
This paper was supported by Wonkwang University in 2005.

References

1. Borzone M, Rivano C, Altomonte M, Bladini M : Acute traumatic posterior fossa subdural hematomas. **Acta Neurochir (Wien) 135** : 32-37, 1995
2. d'Avella D, Servadei F, Scerrati M, Tomei G, Brambilla G, Massaro F, et al : Traumatic acute subdural hematomas of the posterior fossa : clinicoradiological analysis of 24 patients. **Acta Neurochir (Wien) 145** : 1037-1044, 2003
3. d'Avella D, Servadei F, Scerrati M, Tomei G, Brambilla G, Angileri FF, et al : Traumatic intracerebellar hemorrhage : clinicoradiological analysis of 81 patients. **Neurosurgery 50** : 16-27, 2002
4. Dirim BV, Oruk C, Erdogan N, Gelal F, Uluc E : Traumatic posterior fossa hematomas. **Diagn Interv Radiol 11** : 14-18, 2005
5. Hecimovic I, Blagus G, Kristek B, Rukovanjski M, Vrankovic D : Successful treatmentof traumatic acute posterior fossa subdural hematoma : report of two cases. **Surg Neurol 51** : 247-251, 1999
6. Karasawa H, Furuya H, Naito H, Sugiyama K, Ueno J, Kin H : Acute hydrocephalus in posterior fossa injury. **J Neurosurg 86** : 629-632, 1997
7. Kim YD, Park HK, Chang JC, Cho SJ, Choi SK, Byun PJ : Traumatic Intracerebellar Hematomas. **J Korean Neurosurg Soc 37** : 213-216, 2005
8. Pozzati E, Grossi C, Padovani R : Traumatic intracerebellar hematomas. **J Neurosurg 56** : 691-694, 1982
9. Servadei F : Prognostic factors in severely head injured patients with subdural haematoma's. **Acta Neurochir (Wien) 139** : 273-278, 1997
10. Servadei F, Nanni A, Nasi MT, Zappi D, Vergoni G, Giuliani G, et al : Evolving brain lesions in the first 12 hours after head injury : Analysis of 37 comatose patients. **Neurosurgery 37** : 899-907, 1995
11. Tsai FY, Teal JS, Itabashi HH, Huprich JE, Hieshima GB, Segall HD : Computed tomography of posterior fossa trauma. **J Comput Assist Tomogr 4** : 291-305, 1980
12. Vrankovic D, Splavski B, Hecimovic I, Kristek B, Dmitrovic B, Rukovanjski M, et al : Anatomical cerebellar protection of contrecoup hematoma development. Analysis of the mechanism of 30 posterior fossa coup hematomas. **Neurosurg Rev 23** : 156-160, 2000

Commentary

The authors describe their experiences in the management of six patients who had acute subdural hematomas of the posterior fossa. Three patients were deteriorated within 24 hours of trauma due to a newly developed subdural hematoma in one, the enlarged hematoma in another one, and the delayed brain stem compression causing from the midline location of subdural hematoma in the remaining one. In all patients, subdural hematomas were emergently evacuated and the thickness of subdural hematoma was less than 23mm. Preoperative CT scans showed obliteration of brain stem cistern and were associated with supratentorial lesions in all patients. Four patients underwent second surgery for supratentorial lesions after the posterior fossa decompression. Two patients were dead due to lesion severity in one and unexpectedly respiratory arrest in the other one. In this small series, the authors stress an emergent surgery following the early diagnosis based on strict observation in patients with posterior fossa subdural hematoma.

Posterior fossa subdural hematoma is extremely rare. Because it is frequently associated with brain stem damage or supratentorial lesions and because warning sings to compress the brain stem can not be found, clinicoradiological features of posterior fossa subdural hematoma are highly unpredictable. Thus, many questions from a practical point of view are remained. How to predict the enlarged subdural hematoma or newly formed subdural hemorrhage? Which cases should be operated before deterioration? How to monitor these patients? Concomitant presence of supratentorial lesion and admission GCS scores can predict the outcome? Even though effacement of cisterns is a reliable indicator of poor prognosis, it also can be a good candidate for decompressive surgery. Medical and surgical interventions may be implemented more rapidly before clinical deterioration. Because of the tendency for such lesion to enlarge soon after injury, early preemptive repeat CT scanning can be a life saving measure in these patients with often rapidly evolving conditions. The presence of the posterior fossa subdural hematoma sufficient to cause coma or any type of mass effect is necessary to mandate intracranial pressure monitoring during the period of observation although the authors mentioned strict observation. I think these patients should be aggressively managed.

Hack-Gun Bae, M.D.
Department of Neurosurgery
Soonchunhyang University Chonan Hospital