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증설2

원저1

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원저5

증례1

증례2

두개저 외과수술에서 뇌척수액 비루의 치료

연세대학교 의과대학 신경외과학교실 이승준, 심유식, 홍창기, 장종희, 안정용, 이규성

Treatment of Cerebrospinal Fluid leakage in Skull Base Surgery

Department of Neurosurgery, Brain Research Institute, Yonsei University College of Medicine, Seoul, Korea
Seong Jun Lee, Yu Shik Shim, Chang Ki Hong, Jong Hee Chang, Jung Yong Ahn, Kyu Sung Lee

Objective : In various skull base approaches, the risk of cerebrospinal fluid (CSF) leakage exists and the leakage may lead to a life-threatening condition such as meningoencephalitis. The incidence of its occurrence varies in previous literatures and the management dealing the leakage was not established. In this study, we reviewed our experiences dealing CSF leakage after a skull base surgery and suggest a guideline of managing CSF leakage.

Patients and Methods : From 2001 to 2007, 273 patients who underwent skull base surgery for managing tumor were reviewed retrospectively. The charts were analyzed for the date of surgery, age and sex of the patient, the presence or absence of CSF leak, and when present, its managements.

Results : Among the 273 patients, six patients had CSF leakage after surgery. The incidence of CSF leakage in this series was 2.19%. The risk of CSF leakage was highest in the retrosigmoid and combined approaches (3.03%). Two of these patients with CSF leakage developed bacterial meningitis, and these two patients with meningitis were treated with intravenous antibiotics. Among the six patients, the CSF leakage had improved without a direct surgical repair of dural defect in four patients; the others underwent a surgical repair.

Conclusions : Our results indicate that postoperative CSF leakage can be managed activity restriction, and lumbar-subarachnoid drainage, but in case of refractory leakage, wound revision and surgical dural defect repair enables the patients to reduce hospital days and further complications.

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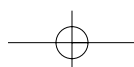
연세대학교 의과대학 영동세브란스병원

신경외과

전화 : 02-2019-3391

전송 : 02-3461-9229

E-mail : jyahn@yuhs.ac

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Introduction

In surgeries approaching to the skull base including the transoral, subfrontal, pterional transsylvian, subtemporal, petrosal, transtentorial occipital, retrosigmoid and midline suboccipital approach, the risk of cerebrospinal fluid (CSF) leakage exists and the leakage may lead to a life-threatening condition such as meningoencephalitis. The incidence of its occurrence varies in previous literatures and the management dealing the leakage was not established. In this study, we reviewed our experiences dealing CSF leakage after a skull base surgery and suggest a guideline of managing CSF leakage.

Patients and Methods

From 2001 to 2007, 273 patients who underwent skull base surgery for managing tumor were reviewed retrospectively. The charts were analyzed for the date of surgery, age and sex of the patient, the presence or absence of CSF leak, and when present, its managements.

We diagnosed CSF leakage clinically. A CSF rhinorrhea was diagnosed when an intermittent, clear nasal discharge occurred on straining, leaning forward, or lowering of head. A wound CSF collection was diagnosed when fluid with a similar character was seen exuding through the wound of the operation or palpable fluid collection beneath the wound. All patients with CSF leakage had lumbar-subarachnoid drainage and activity restriction initially. If the CSF leakage stopped after lumbar-subarachnoid drainage, lumboperitoneal shunt or ventriculoperitoneal shunt was performed. And if CSF leakage continued, direct surgical repair for dural defect was performed (Fig. 1).

Results

From January 2001 to December 2007, 273 patients underwent skull base surgeries at department of neurosurgery in our institution. There were 116 male and 157

female patients. The mean age was 45 years (range 2-78). The surgical approach included the subfrontal, pterional transsylvian, transpetrosal, transcondylar, transtentorial occipital, retrosigmoid and midline suboccipital approach (Table 1). Among the 273 patients, six patients had CSF leakage after surgery. The clinical characteristics of these patients were listed at Table 2. The incidence of CSF leakage in this series was 2.19%. The risk of CSF leakage was highest in the retrosigmoid and combined approaches (3.03%). Two of these patients with CSF leakage developed bacterial meningitis, and these two patients with meningitis were treated with intravenous antibiotics. Among the six patients, the CSF leakage had improved without a direct surgical repair of dural defect in four patients; the others underwent a surgical repair.

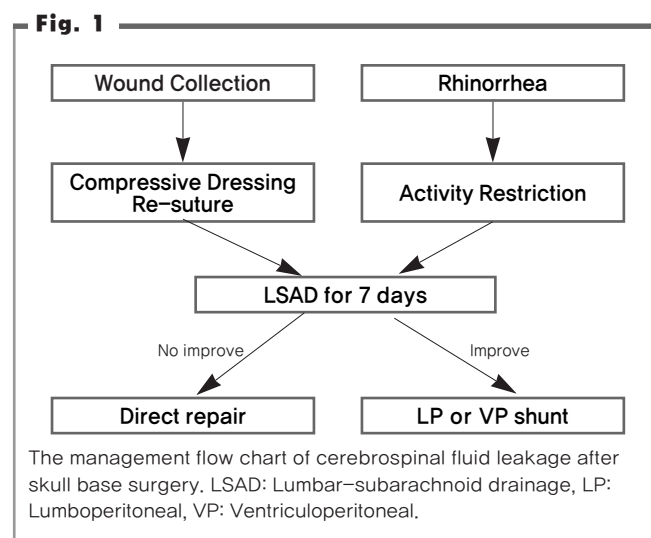
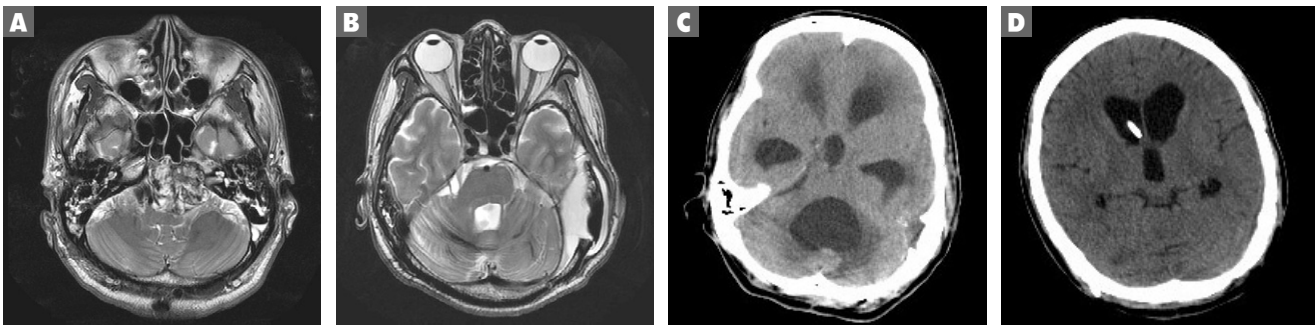


Table 1. Surgical approaches to skull base and cerebrospinal fluid leakage (n=273)

Approach	n	CSF leakage
Pterional	71	2
Retrosigmoid	66	2
Subfrontal	46	1
Transpetrosal	28	1
Transcondylar	23	0
Midline suboccipital	19	0
Occipital transtentorial	7	0
Other	13	0

Fig. 2



Patient 1. Preoperative MRI

- A. demonstrates a clival tumor. Postoperative MRI
- B. and CT scan
- C. show wound CSF collection and hydrocephalus. Final CT scan
- D. after ventriculo-peritoneal shunt reveals improved hydrocephalus and no wound collection.

Illustrative cases

Patient 1

(Fig.2. A-D) A 32-year-old male patient admitted to our hospital suffered from dizziness and diplopia. He had diagnosis of chordoma of clivus 5 years ago and took a tumor removal with transoral approach. The MRI scan demonstrated recurrence of tumor, and he underwent surgical removal of tumor with combined far lateral and posterior petrosal approach. The pathology was chordoma. After the operation, the wound was swollen and he had headache. Postoperative MRI scan and CT scan revealed mild

CSF collection and hydrocephalus. After repeated lumbar-subarachnoid drainage, the CSF collection was improved but hydrocephalus was still last. So, he underwent ventriculo-peritoneal shunt and no more hydrocephalus and CSF leakage happened.

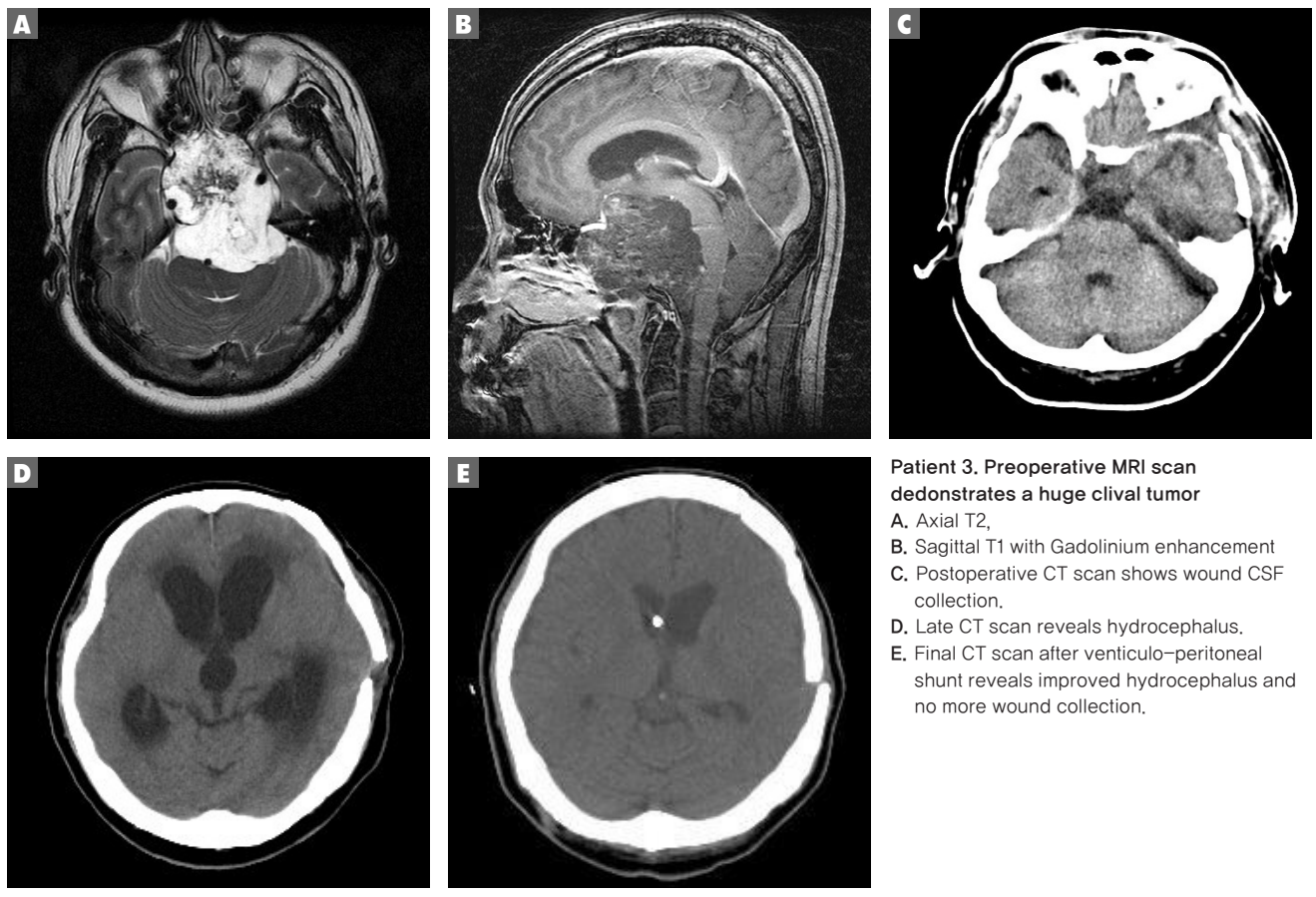
Patient 2

A 34-year-old male patient admitted to our hospital for headache. The MRI scan revealed a huge tumor around the clivus and cavernous sinus, and he underwent surgical removal of tumor with pterional intradural and extradural approach. The pathology was chordoma. Three days after

Table 2. Clinical Characteristics of six patients with postoperative cerebrospinal fluid leakage and their management

Sex/ Age	Pathology	Location	Surgical approach	Postoperative presentation	Initial management of cerebrospinal fluid leak	Results and additional treatments
1 M/32	Chordoma	Clivus	Combined far lateral and posterior petrosal	Wound collection	VP shunt after LSAD	No further leakage
2 M/48	Meningioma	Sphenoid wing	Pterional transsylvian	Rhinorrhea	LP shunt after LSAD	No further leakage
3 M/34	Chordoma	Clivus	pterional intradural and extradural	Rhinorrhea	VP shunt after LSAD	No further leakage
4 M/39	Meningioma	Olfactory groove	Subfrontal	Rhinorrhea Meningitis	LSAD	Need direct repair
5 F/54	Schwannoma	Cerebellopontine angle	Retrosigmoid suboccipital	Wound collection	Aspiration VP shunt after LSAD	No further leakage
6 F/54	Schwannoma	Cerebellopontine angle	Retrosigmoid suboccipital	Wound collection Meningitis	Aspiration LSAD	Need direct repair

LSAD : Lumbar-subarachnoid drainage ; VP shunt : ventriculoperitoneal shunt ; LP shunt : Lumboperitoneal shunt

Fig. 3

Patient 3. Preoperative MRI scan dedonstrates a huge clival tumor

A. Axial T2,

B. Sagittal T1 with Gadolinium enhancement

C. Postoperative CT scan shows wound CSF collection.

D. Late CT scan reveals hydrocephalus.

E. Final CT scan after ventriculo-peritoneal shunt reveals improved hydrocephalus and no more wound collection.

operation, clear CSF rhinorrhea developed and the CT scan revealed hydrocephalus. He underwent ventriculo-peritoneal shunt surgery after repeated lumbar-subarachnoid drainage. After shunt surgery, the CSF rhinorrhea did not happened any more.

■ Discussion

There are variable approaches that enable to reach skull base and to extirpate skull base tumors safely.⁷ Despite the improvement of these approach, the risk of CSF leakage after surgery is still as high as 20%.¹⁰ The CSF leakage can be life-threatening, because it can bring about meningitis and encephalitis.

In this series of 273 patients, the incidence of CSF leakage was 2.19% and it is highest in the retrosigmoid

approach. This result was not quite defferent from previous reports.^{1-6, 9, 11, 12, 13}

We prefer to manage wound CSF collection initialy with aspiration, re-suture of skin, replacement of a compressive dressing, activiry restriction and lumbar-subarachnoid drainage. Leonetti et al, reported 15 patients of wound collection and after these initial management, only two patients underwent additional wound revision surgery.⁸ We had 3 patients with wound collection, and after these initial management, only one patient needed additional wound revision. In three patients with CSF rhinorrhea, two patients showed improvement of leakage after lumbar-subarachnoid drainage, and one needed wound revision surgery. After initial management and direct surgical repair, all patients recovered from CSF leakage. But eventually all of these six patients underwent CSF shunting surgery a few months or

years later due to hydrocephalus. We suggested that the cause of delayed development of hydrocephalus was the violations of arachnoid granulation.

■ Conclusions

In the surgeries approaching skull base, there is a CSF leakage which can develop life-threatening meningitis. It can be managed activity restriction, and lumbar-subarachnoid drainage, but in case of refractory leakage, wound revision and surgical dural defect repair enables the patients to reduce hospital days and further complications.

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