Case Report

Tension Pneumocephalus after Transsphenoidal Surgery : Report of Two Cases

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Tension pneumocephalus is an uncommon complication of transsphenoidal surgery. This rare complication may be caused by an external lumbar subarachnoid drainage (ELD) which is placed for the treatment of a cerebrospinal fluid (CSF) fistula. Most of the tension pneumocephalus which cause severe neurologic deterioration in itself require surgical treatment. However, the pneumocephalus may be resolved after removal of the spinal subarachnoid catheter in some cases. We report two cases of tension pneumocephalus which developed after transsphenoidal surgery for the pituitary adenoma and craniopharyngioma, and fully recovered with conservative treatment.

KEY WORDS : Tension pneumocephalus · Transsphenoidal approach · Cerebrospinal fluid fistula · External lumbar subarachnoid drainage.

Introduction

Transsphenoidal approach (TSA) is considered less invasive and safer than transcranial approach for the removal of sellar and parasellar lesions[7]. Tension pneumocephalus is a rare complication after the transsphenoidal surgery. The possible mechanism of this unusual complication is an influx of air into the intracranial cavity through the cerebrospinal fluid fistula which was developed during the operation or after the surgery[3,5].

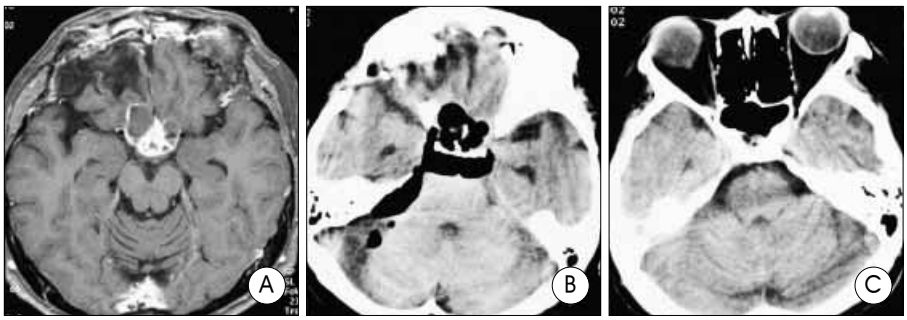

Fig. 1. A : Preoperative axial gadolinum-enhanced T1-weighted magnetic resonance image shows a multiple nodular enhancing solid and cystic mass that extend to the third ventricle, and encephal-omalatic lesions in right frontal lobe due to the previous operation. B : Computed tomographic scan obtained on the 9th postoperative day shows a large collection of air in the prepontine cistern and the basal cistern. C : Follow-up computed tomography scan reveals complete resolution of the intracranial air.

CSF diversion techniques such as an ELD have been shown to be efficacious for the treatment of a CSF fistula. Because such techniques decrease the intracranial pressure, those methods eventually attribute to the development of tension pneumocephalus. It has been known that the prompt diagnosis and the management, most likely surgical intervention, are required when the tension pneumocephalus causes neurologic deteriorations by a mass effect. However, a resolution of the tension pneumocephalus has been reported after removal of the spinal catheter without surgical interventions[2].

Here, we report two cases of symptomatic tension pneumocephalus associated with transsphenoidal surgery for pituitary adenoma and craniopharyngioma, which were treated conservatively.

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Case 1

A thirty-year old male patient had undergone transcranial removal of suprasellar craniopharyngioma and received the external radiation therapy in 1985. He did well with replacing hormones due to panhypopituitarism until the recurrence of tumor with visual disturbance on April 2001. Radical subtotal removal of the recurrent tumor was performed via a transcranial approach on May 2001 and the vision was recovered. One year later, bilateral hemianopsia reappeared. Sellar MRI revealed an intrasellar and suprasellar multicystic enhancing mass with encephalomalatic changes in right frontal lobe caused by the previous transcranial surgery (Fig. 1A).

Sublabial transsphenoidal operation was performed. On 1 day after surgery, the patient developed a CSF rhinorrhea, and

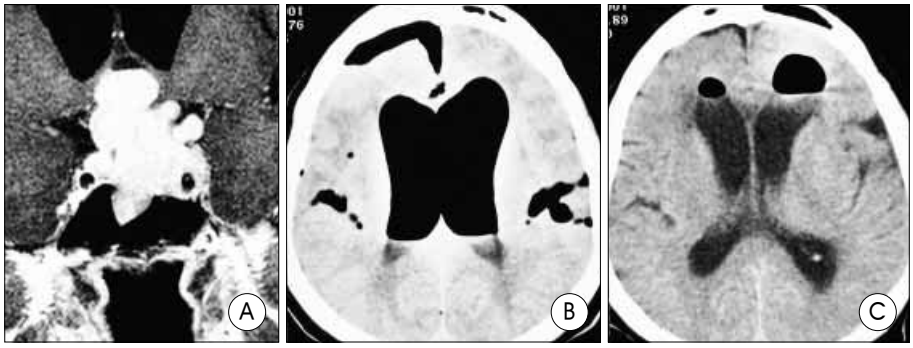

Fig. 2. A : Preoperative coronal gadolinum-enhanced T1-weighted magnetic resonance image shows a multilobulated mass in the sellar and suprasellar region. Secondary hydrocephalic distension of the lateral ventricles are demonstrated. B : Computed tomography(CT) scan obtained on the sixth postoperative day shows a large collection of air in both lateral ventricles and subdural space. C : Follow-up CT scan demonstrates a marked reduction of pneumocephalus.

then an ELD catheter was inserted. CSF rhinorrhea stopped at the 2nd day after insertion of an ELD catheter. On the 6th postoperative day, the authors removed the ELD catheter. On the 9th postoperative day, the patient complained of a severe headache. An emergent cerebral computed tomography(CT) scan demonstrated the presence of a large air collection in subarachnoid spaces such as the prepontine cistern, the cerebropontine cistern and the right side of cerebellopontine cistern (Fig. 1B). By administration of the analgesics, his headache could be controlled. Prophylactic antibiotics were administered with absolute bed rest. The patient showed good recovery. Follow-up CT scan taken on the 16th postoperative day showed that subarachnoid space was free of air (Fig. 1C). The patient was discharged without any neurological deficits on the 19th postoperative day.

Case 2

A fifty one-year old female patient suffered from dizziness was admitted to our hospital on September 2001. Preoperative magnetic resonance images(MRI) revealed a large multi-lobulated contrast enhancing mass in sellar and suprasellar regions invading a left portion of the cavernous sinus, and secondary hydrocephalic distension of the lateral ventricles(Fig. 2A). This finding suggested a pituitary macroadenoma most likely. The neurological examination revealed bilateral hemianopsia and papilledema. Visual acuity was 4/10 in both eyes. The level of pituitary hormones was within normal limits except an increased level of prolactin, up to 141.49ng/ml(normal 1.4-19.4ng/ml). The tumor was removed subtotally by transsphenoidal surgery. Inadvertently the subarachnoid space was entered and the clear CSF oozed during operation. The sella and sphenoid sinus were packed with pieces of fat and surgicel. Postoperatively, an ELD catheter was inserted to prevent CSF rhinorrhea. CSF was drained through the catheter 160-180cc a day. Three days later, the ELD catheter was rem-oved. On the sixth postoperative day, she became drowsy. An emergent CT scan was obtained. It revealed a large amount of air collection in whole ventricles and the basal cistern (Fig. 2B). The patient was taken prophylactic antibiotics administration with absolute bed rest. Skull lateral films which obtained periodically revealed a decrease in air gradually. A CT scan obtained on the 14th day after operation showed that the intracranial air decreased markedly. She recovered uneventfully and discharged, 5 days later.

Discussion

Pneumocephalus is a relatively common complication of basal skull fractures, neoplasms eroding the skull base, infections with gas forming organisms in the brain, CSF diversion procedures, and craniofacial surgery[1,4,6,8]. TSA is a well defined and widely used method for the removal of sellar and supra-sellar tumors. During the operation, a CSF fistula may occur as a result of inadvertent opening of the arachnoid. The treatment commonly involves surgical repair of the site of leakage, usually packing the sella and sphenoid sinus with fat or muscle grafts. In some cases in which the site of the fistula is not easily defined, CSF diversion techniques such as an ELD have been widely used and shown to be efficacious in treating CSF fistula. However, such methods may cause a low intracranial pressure and eventually predispose to the development of pneumocephalus. Pneumocephalus after TSA is not uncommon, because the subarachnoid space may be entered on TSA. Usually pneumocephalus is of little clinical significance, as the air is absorbed gradually from the subarachnoid space. However, a large air collection, so-called tension pneumocephalus, may be dangerous and life-threatening. Tension pneumocephalus after TSA is extremely rare. Two factors are necessary for the development of tension pneumocephalus after TSA[5]. These factors are a one-way valve (ball-valve) mechanism and low intracranial pressure and/or forced air[5]. The second factor, low intracranial pressure was attributable to a CSF fistula and to some form of CSF diversion. In fact, most reported cases of tension pneumocephalus were

related to some form of CSF diversion[2,5,9]. In our cases, tension pneumocephalus was probably precipitated by the placement of an ELD catheter.

Tension pneumocephalus usually requires prompt diagnosis and surgical interventions[3]. Usually, direct removal of the intracranial air is a treatment of choice. However, in some cases, good recovery from the pneumocephalus was obtained by removal of the ELD catheter[2]. Such a conservative treatment may be effective if there were no shift of midline structures on a CT scan[10]. Frequent x-ray examinations should be performed to ensure a constant reabsorption of intracranial air. The authors performed cross table lateral skull x-ray examinations frequently. Serial x-ray films revealed a decrease in the intracranial air. Both patients recovered uneventfully. Although many neurosurgeons do not perform skull x-ray examinations during CSF diversion procedures, these cases remind us that skull x-ray is necessary to detect complications such as pneumocephalus. Such a conservative therapy in a patient with pneumocephalus may be injustified and even dangerous. However, it may be helpful in selected cases such as our patients.

Conclusion

We report two cases of tension pneumocephalus which developed after TSA. CSF diversion for the treatment of a CSF leak may predispose to the development of tension pneumocephalus. These two cases were successfully treated conservatively. Meticulous care of the ELD system is very important to avoid complications such as a pneumocephalus. Frequent skull x-ray examinations are necessary to avoid further process of this complication.

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