

Tension Pneumocephalus Following Eyebrow Aneurysmal Surgery

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We report a rare case of tension pneumocephalus after eyebrow surgery for the treatment of a saccular aneurysm at posterior communicating artery. The patient's consciousness was suddenly aggravated due to the tension pneumocephalus on fifth postoperative day, which was treated by repairing the frontal sinus. The patient was recovered completely and uneventfully after this revision surgery.

KEY WORDS : Tension pneumocephalus · Eyebrow surgery · Frontal sinus repair.

Introduction

The pneumocephalus is described as a presence of intracranial air and it commonly occur in head trauma, skull defect after neurological operation and gas-forming organism in which result from brain abscess^{2,5,14}. Most of pneumocephalus does not need a surgical treatment, but a mass effect resulting from gradual collection of intracranial air make brain compression sometimes. As a result of brain compression, the first symptom of neurological deterioration is a change in conscious level. Rapid neurological deterioration can be developed, that described as a tension pneumocephalus^{3,5,14}. For the successful treatment, it is necessary to perform brain computed tomography(CT) scan promptly, removal of collected intracranial air and repair of the air entry route is very important^{2,14}.

We report a rare case of tension pneumocephalus following eyebrow surgery for the treatment of a saccular aneurysm on left posterior communicating artery.

Case Report

A 59-year-old women who had suddenly developed mental deterioration was admitted through emergency room. Past history included diabetes mellitus and essential hypertension more than 5years. The patient's mental status was drowsy

(Hunt and Hess grade III) and both pupil size, light reflex, motor and sensory function revealed within normal limits. Brain CT scan demonstrated an evidence of thick subarachnoid hemorrhage on basal cistern and ambient cistern (Fisher grade III). Cerebral angiography revealed a 10-mm in size, posterolaterally in direction, saccular aneurysm on left posterior communicating artery (Fig. 1). The superior orbital rim craniotomy was performed after eyebrow incision, and then aneurysmal clipping was done on left posterior communicating artery successfully. The hair shaving was not done and blood transfusion was not given. During the operation, opened frontal sinus was neglected. On fourth postoperative day, CSF rhinorrhea developed with headache and fever. Emergent brain CT scan showed a pneumocephalus on both frontal area. Both nostrils were packed with nasal tampon. On fifth postoperative day, patient's consciousness was worsened and more enlarged air density was seen on follow-up brain CT scan (Fig. 2). On emergency operation, opened frontal sinus was demonstrated and the mucosa of frontal sinus was removed. The frontal sinus was filled with multiple pieces of gelfoam and bone wax. The patient recovered uneventfully after surgery and discharged without neurological deficits.

Discussion

The intracranial pneumocephalus was described first by Lecat in 1741, and after that Chiari in 1884, Lockett who introduced a method which localize the lesion by means of x-ray in 1913 and Dandy who made comprehensive report on the pneumocephalus in 1926 described it^{5,7,15}. Dandy explained the etiologies of pneumocephalus as advanced by

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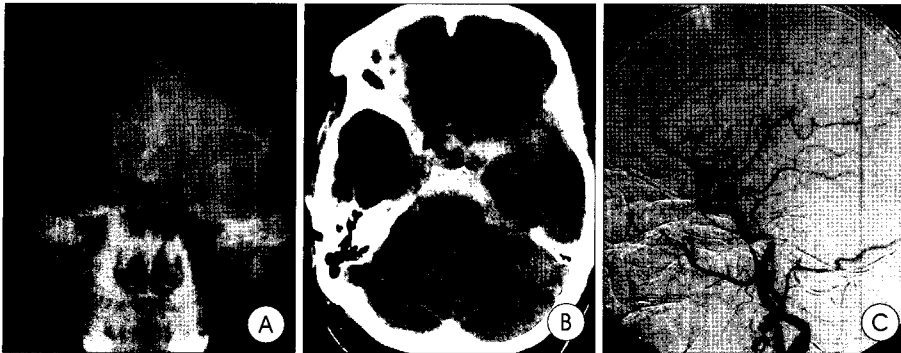


Fig. 1. A : Preoperative skull anterior-posterior view showing a prominent frontal sinus (black arrow). B : Non-contrast computed tomography axial image showing a thick subarachnoid hemorrhage in the basal cistern. C : Cerebral angiography showing a saccular aneurysm on the posterior communicating artery, left posterolateral direction, 10-mm in size.

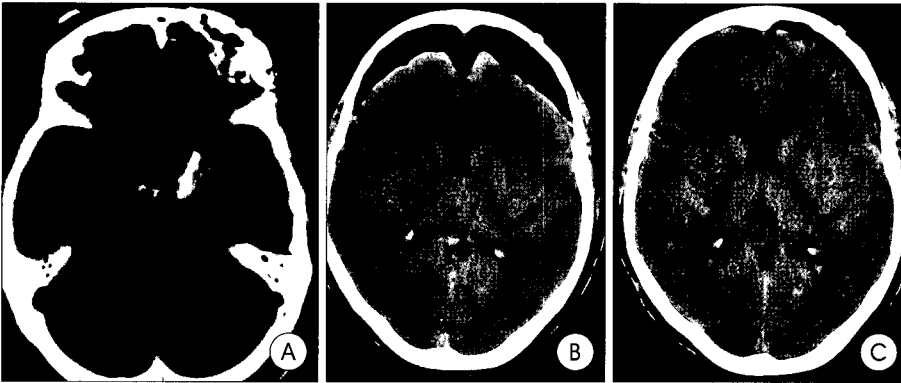


Fig. 2. A : Immediate postoperative computed tomography(CT) scan showing no definitive tension pneumocephalus. B : Follow-up CT scan showing a subdural air density on both frontal area, known as Mountain Fuji sign. C : CT scan on third postoperative day after revision surgery showing almost disappearance of tension pneumocephalus.

head trauma, bone erosion of intracranial tumor or gasforming organisms⁵. Courville in 1943 discussed the matter of classification, mechanism, pathogenesis and surgical management¹⁴.

The incidence of pneumocephalus is 0.5~0.88% and it may occur in patients with skull fractures mostly, skull base surgery, epidural hematoma, posterior fossa surgery in sitting position and N2O anesthesia. Markham has reviewed the subject of pneumocephalus and found that a surgical procedure was the cause in 3.7% of the cases of pneumocephalus¹⁴. He illustrated two mechanism for the entry of air into intracranial space^{14,17}. First, “ball valve” mechanism requires a pressure differential from atmosphere to intracranial space ; once air is forced in, its exit is prevented by brain or meninges that seal off the leak site temporarily. Second, “inverted bottle” mechanism is associated with a cerebrospinal fluid leak in which air replaces the lost fluid volume. When the connection between the cerebrospinal fluid spaces and the atmosphere is large, the intracranial pressure equalizes with atmospheric pressure. As in a ball valve mechanism, air may enter the intracranial space without a reciprocal loss of cerebrospinal fluid and

tension pneumocephalus can develop. Cerebrospinal fluid loss by lumbar puncture facilitate the entry of air by releasing the tamponade and it may produce serious complications¹⁷.

In our case, cerebrospinal fluid rhinorrhea occurred on fourth postoperative day. It was likely that rapid mental deterioration could be developed by not “ball valve” mechanism but “inverted bottle” mechanism. This mechanism explained that air into intracranial space produce a mass effect and the mass effect increase intracranial pressure continuously and suddenly.

For diagnosis of the tension pneumocephalus or other postoperative complications, it is important early detection of cerebrospinal fluid rhinorrhea and also radiologic examinations. The size of air volume and location are demonstrated on plain skull lateral x-ray and brain CT scan.

In this case, brain CT scan presenting subdural tension pneumocephalus on both frontal area, early detected cerebrospinal fluid rhinorrhea and worsen of consciousness gave us that emergency operation for seal off cerebrospinal fluid leak site and entrance of air was necessary.

In eyebrow aneurysmal surgery, frontal sinus could be opened in the patients with large frontal sinus during the removal of orbital roof and frontal bone. Although the frontal sinus of this patient was slightly prominent, a tension pneumocephalus was unexpectedly developed after operation. Therefore surgeon must detect the frontal sinus margin by means of preoperative radiologic studies. If frontal sinus was opened regardless of skillful procedure, operation was required for the repair of frontal sinus and frontal bone. First of all, a mucus membranes were removed completely to prevent serious complication and frontal sinus was closed and filled by means of gelfoam and bone wax.

In this case, proper closure of frontal sinus was performed and no air on frontal area was seen in plain skull x-ray lateral view postoperatively.

We had performed an eyebrow surgery in 78 cases of intracranial cerebral aneurysms and the frontal sinus were opened in 9 cases, showing a large frontal sinus in 8 cases except one, which were repaired during operation. Although Perneczky, Hans-J, Jane and Ko made extraordinary reports about eyebrow surgery but there was no case report for tension pneumocephalus^{8-10,12,13,15,16}. Our patients was interesting because that tension pneumocephalus was a very rare complication in eyebrow surgery and it was treated successfully without complication.

Conclusion

We had experienced a case of tension pneumocephalus after eyebrow surgery for the clipping of aneurysmal sac on left posterior communicating artery, and it was diagnosed and treated correctly in a proper time without any complication.

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