Intracranial diverticulum of the frontal sinus as a complication of frontal craniotomy

Case report

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A large air-filled intracranial extradural diverticulum of the frontal sinus mucosa was removed from the anterior cranial fossa of a 47-year-old man 2 years after fracture of the posterior sinus wall during craniotomy.

KEY WORDS • craniotomy complication • extradural aerocele

Unrepaired damage to the posterior wall of the frontal sinus during a craniotomy can cause serious delayed neurological problems. Unrecognized intraoperative injury to the frontal sinus has been reported as the cause of a large symptomatic intracranial mucocele. The present report documents the occurrence of a large symptomatic extradural diverticulum of the frontal sinus mucosa caused by unrecognized intraoperative damage to the frontal sinus during craniotomy.

Case Report

This 47-year-old man underwent clip placement on a ruptured aneurysm of the anterior communicating artery 2 years before his present admission. The operating surgeon described an uncomplicated left frontal craniotomy, successful clip placement on the aneurysm neck, closure of the dura, and replacement of the bone. The patient had a stable neurological deficit and complained of no additional symptoms until 3 months before the present admission, when he began to have intermittent headaches.

Examination. Physical examination on admission revealed a right hemiparesis and hypesthesia, right homonymous hemianopsia, and expressive aphasia. These findings had been present before aneurysm treatment, and persisted without change. Subsequently there were no findings consistent with cerebrospinal fluid leak, and the patient was not anosmic.

Skull films showed a collection of air, 6 cm broad, dorsal to a left frontal craniotomy flap, which extended through the lateral portion of the left frontal sinus (Fig. 1 left). The lateral skull radiographs showed a funnel-shaped fenestration 1-cm wide in the posterior wall of the frontal sinus at the margin of the craniotomy flap (Fig. 1 right). Computerized tomography (CT) scans demonstrated compression and displacement of the left frontal lobe by the large extracerebral gas collection (Fig. 2).

Operation. The left frontal craniotomy was reopened and a large air-filled extradural mucosal cyst was found in the left anterior cranial fossa. The cyst was opened and its mucosal lining separated from the frontal bone and dura. A communicating channel could then be seen running from the left frontal sinus through the posterior sinus wall fenestration to the extradural intracranial cyst. The mucosal lining of this channel was removed, with that of the intracranial cyst. The fenestration was sealed by a fascial graft, and the frontal sinus was exenterated and obliterated with fat. Microscopic examination of the cyst wall revealed respiratory mucosa with focal calcifications and hyalinization of the submucosal connective tissue.

Postoperative Course. The patient recovered uneventfully from surgery. A neurosurgical consultation 5 months later established that he was free of headache. His postoperative CT scan demonstrated resolution of the aerocele and normal position of the left frontal lobe.
Frontal sinus mucosal diverticulum

**Fig. 1.** Skull radiographs. *Left:* Frontal view. Arrow marks the medial calcified wall of the air-filled frontal sinus diverticulum. The arrowhead indicates the point at which the previous frontal craniotomy entered the frontal sinus. *Right:* Lateral view. Arrowheads mark the posterior wall of the air-filled frontal sinus diverticulum. Arrows indicate the funnel-shaped erosion of the posterior wall of the frontal sinus produced by the enlarging diverticulum.

**Discussion**

The delayed appearance of air within the extradural space following trauma or surgery is a rare event. The operative findings in this patient suggest that intracranial herniation of the intact sinus mucosa through a fracture in the posterior sinus wall produced a mucosal diverticulum that enlarged the bone defect in the posterior sinus wall, and increased in size during times of increased intrasinusoidal pressure. The entrapped air in the extradural mucosal cyst eventually displaced the frontal lobe from the anterior cranial fossa and caused headache. The occurrence of a large mucosal diverticulum following inadvertent surgical injury to the frontal sinus is a rare complication, but one that emphasizes the delayed consequences of inattention to injury of the frontal sinus wall.

**References**


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**Fig. 2.** Computerized tomography scan demonstrating compression and posterior displacement of the left frontal lobe by the large frontal sinus diverticulum. Atrophic change secondary to the left anterior cerebral artery infarction is also noted.