The Surgical Correction of Frontal Sinus Pneumoceles

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ABSTRACT

Objectives:
Frontal sinus pneumocele is a rare condition characterized by abnormal expansion of the air-containing sinus beyond the normal margins of the frontal bone. The etiology remains unclear but has been associated with developmental, neoplastic, inflammatory, and post-traumatic causes. Few reports in the literature describe the surgical management of frontal sinus pneumocele. We focus on describing the evaluation, work-up and surgical treatment of this condition.

Study Design:
A comprehensive review of the literature and retrospective case series of 3 patients with frontal sinus pneumocele.

Methods:
A case series and literature review on the surgical management of frontal sinus pneumocele.

Results:
We present a case series of patients who presented with frontal sinus pneumocele in which there was thinning of the overlying anterior table of the frontal bone. Conventional methods that aim to contour the external surface of the frontal bone cannot be applied in this clinical situation. We describe a surgical method in which correction of frontal bossing was performed by the creation of an osteoplastic flap with recession of the anterior table into the sinus and fat obliteration of the remaining cavity.

Conclusions:
Frontal sinus pneumocele is a rare condition that presents a diagnostic and surgical challenge. Few reports in the literature describe the surgical management of the cosmetic deformity. We describe a novel technique of surgical correction utilizing the osteoplastic flap and recession of the anterior table of the frontal sinus.

INTRODUCTION

Pneumocele of the frontal sinus is a rare entity characterized by an aerated sinus that is expanded beyond the normal boundaries of the frontal bone with either thinning or erosion of the bony sinus wall.1 It is important to differentiate this entity from pneumosinus dilatans, which does not demonstrate loss of integrity of the sinus wall, because the surgical management is different for each disease. The purpose of this paper is to present three cases and review the literature to describe the appropriate evaluation, work-up, and management of this condition.

CASE 1

A healthy 21-year-old male presented with left nasal obstruction, progressively worsening left frontal bossing, and displacement of the eyebrow inferiorly. On nasal endoscopy, the patient had a deviated septum and a large concha bullosa on the left side. A CT scan revealed a well aerated left frontal sinus expanding beyond the normal sinus boundaries. There was marked thinning of the anterior table consistent with a diagnosis of a left frontal sinus pneumocele (Figure 1). The patient elected to proceed with surgery to correct the cosmetic defect caused by the pneumocele.

After four months of post-operative follow-up (Figure 2), the patient is satisfied with his improved cosmesis and nasal breathing. There is no evidence of recurrent disease.

SURGICAL TECHNIQUE

• A coronal approach to the frontal sinus was used to raise a coronal flap in a subgaleal plane.

• With the guidance of a sterilized Caldwell view plain film template (Figure 3a), the borders of the left frontal sinus were identified.

• A left hemi-osteoplastic flap was raised and an oscillating saw was used to remove the anterior table.

• The internal lining of the sinus was removed and diamond drill was used to remove remnant mucosa (Figure 3b).

• An abdominal fat graft was used to obliterate the sinus (Figure 3c).

• The bony plate of the anterior table was recessed into the obliterated sinus to obtain improved contour of the forehead (Figure 3d).

• The bone was wired in place, and acrylic was used to smoothen and contour the recessed frontal sinus.

DISCUSSION

The frontal sinus pneumocele is a rare condition that can be treated safely and with excellent cosmetic outcomes through the use of a coronal approach to the frontal sinus. In contrast, the pneumocele refers to an aerated frontal sinus that is abnormally expanded beyond the normal boundaries of the frontal bone and is characterized by either focal or generalized thinning of the bony sinus walls.

Both pneumoceles and pneumosinus dilatans are most common among males in the third and fourth decades of life and typically present with frontal bossing, forehead masses, or intracranial extension. However, because pneumoceles have bony erosion, they may also present with spontaneous pneumocephalus and air in the orbit.2 Although the etiology of disease has eluded researchers, the most common theory is that the expanded frontal sinus is the result of a “ball-valve” effect.3 Obstruction of the frontal sinus allows air to enter the sinus without the ability to escape. Other proposed etiologies of the frontal sinus pneumocele include hormonal influences, ex-vacuo response to cerebral volume loss and intracranial hypotension; associations have been found with intracranial meningioma and congenital disorders that cause hydrocephalus.

Our patients presented with frontal bossing, and all three chose to proceed with surgical intervention. Unlike cases of pneumosinus dilatans in which the anterior table is thick enough to allow for remodeling procedures, our pneumocele patients required complete reconstruction of their thinned anterior tables in order to obtain a desirable cosmetic outcome. The frontal recess outflow tract was relieved of obstructions and obliterated with fat to prevent recurrence.

REFERENCES


