

Postoperative cerebrospinal fluid leak after septoplasty: A potential complication of occult anterior skull base encephalocele

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ABSTRACT

Postoperative cerebrospinal fluid (CSF) rhinorrhea after septoplasty is a known entity resulting from errors in surgical technique and improper handling of the perpendicular plate of the ethmoid bone. When these occur, urgent management is necessary to prevent deleterious sequelae such as meningitis, intracranial abscess, and pneumocephalus. Encephaloceles are rare occurrences characterized by herniation of intracranial contents through a skull base defect that can predispose patients to CSF rhinorrhea. In this report, we present a case of CSF rhinorrhea occurring 2 weeks after septoplasty likely from manipulation of an occult anterior skull base encephalocele. To our knowledge, no previous similar case has been reported in the literature. Otolaryngologists should be aware of the possibility of occult encephaloceles while performing septoplasties because minimal manipulation of these entities may potentially result in postoperative CSF leakage.

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Cerebrospinal fluid (CSF) rhinorrhea is a known entity resulting from congenital malformations, postinfectious hydrocephalus, and skull base erosion from intracranial tumors.^{1–3} Within the realm of endoscopic endonasal surgery, CSF leakage is a well-known and dreaded complication due to potential for serious sequelae such as meningitis, intracranial abscess formation, and pneumocephalus.^{4,5} Septoplasty, one of the most common operations performed in otolaryngology, carries a well-documented risk of CSF rhinorrhea, particularly as a result of errors in surgical technique.⁶ We present a unique case of a patient who underwent septoplasty and turbinate reduction and soon after developed postoperative CSF leakage likely secondary to a small occult encephalocele at the anterior skull base. The protocol for this study was reviewed and approved by the Institutional Review Board of the University of Medicine and Dentistry of New Jersey–New Jersey Medical School, Newark, NJ.

ILLUSTRATIVE CASE

A 67-year-old woman was referred to our tertiary care center for profuse left-sided rhinorrhea beginning 2 weeks after a septoplasty and bilateral inferior turbinate reduction. Physical examination showed an obese woman with a body mass index of 32. Nasal endoscopy revealed bilateral nasal crusting and a midseptal perforation. Valsalva maneuver elicited marked left-sided watery rhinorrhea. CSF leakage was confirmed by a positive β_2 -transferrin testing. Paranasal sinus computed tomography (CT) scan was suspicious for a bony defect of the roof of the left sphenoid sinus (Fig. 1 A). There was also evidence of asymmetrical anterior skull base height (lamina lateralis) fairly suspicious for a small left cribriform encephalocele (Fig. 1 B). Subsequent CT cisternogram showed contrast extravasation into the left sphenoid sinus (Fig. 1, C and D). The patient underwent endoscopic exploration with intraoperative intrathecal fluorescein (0.25%) injection (without lumbar drain placement). To localize the area of leakage, the left anterior skull base was exposed by performing a left maxillary antrostomy, total ethmoidectomy, and sphenoidotomy. Evaluation of the sphenoid sinus failed to show extravasation of fluorescein from the roof or lateral aspect of the sinus. However, on further inspection of the skull base, a small left posterior cribriform encephalocele was noted with fluorescein-tainted CSF egress (Fig. 2, A and B). The encephalocele was cauterized using an endoscopic bipolar device. The area around the encephalocele was demucosalized and cauterized to prevent postoperative intracranial mucocoele formation.⁵ The skull base defect was repaired

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Figure 1. Preoperative coronal paranasal sinus computed tomography (CT) scans show (A) a left sphenoid roof bony defect and (B) an asymmetrical anterior skull base height (lamina lateralis) fairly suspicious for a small left cribriform encephalocele. (C) Preoperative axial and (D) coronal CT cisternograms reveal contrast extravasation in the left sphenoid sinus.

using thick acellular dermal allograft (LifeCell Corp., Branchburg, NJ) intracranially (Fig. 2 C), followed by an overlay of middle turbinate mucosal autograft. The repair was subsequently bolstered by multiple large pieces (1- to 2-cm diameter) of gentamicin-soaked Gelfoam (Pharmacia, Kalamazoo, MI) (Fig. 2 D). This repair was further buttressed by a Meroceel nasal tampon (Medtronic Xomed, Jacksonville, FL) covered with bacitracin ointment.

The patient's postoperative course was uneventful. She had an unremarkable CT scan of the head the next day and was discharged home on postoperative day 1 on a penicillin-based antibiotic with a β -lactamase. She was placed on stool softeners and was instructed to avoid any activity that raises intracranial pressure such as straining or nose blowing. At her 22-month postoperative follow-up, she denied rhinorrhea and had an otherwise uncomplicated recovery (Fig. 3).

DISCUSSION

CSF leak is a well-recognized and equally dreaded complication of otolaryngologic and neurosurgical procedures. Any case of rhinorrhea in combination with a recent history of endonasal or skull base surgery warrants further investigation because of the high incidence of CSF leakage stemming from iatrogenic causes. However, this should not exclude other possible causes such as a previously undiagnosed encephalocele, as was the scenario in our patient. Noticeably, then, accurately identifying the underlying cause of CSF leakage becomes critical to optimally guide treatment, evade life-threatening complications, and prevent recurrence.

To date, CSF rhinorrhea after septoplasty has mainly been attributed to iatrogenic damage to the cribriform plate. Nyquist *et al.* conducted a prospective, observational study of 32 surgeries in 28 patients undergoing

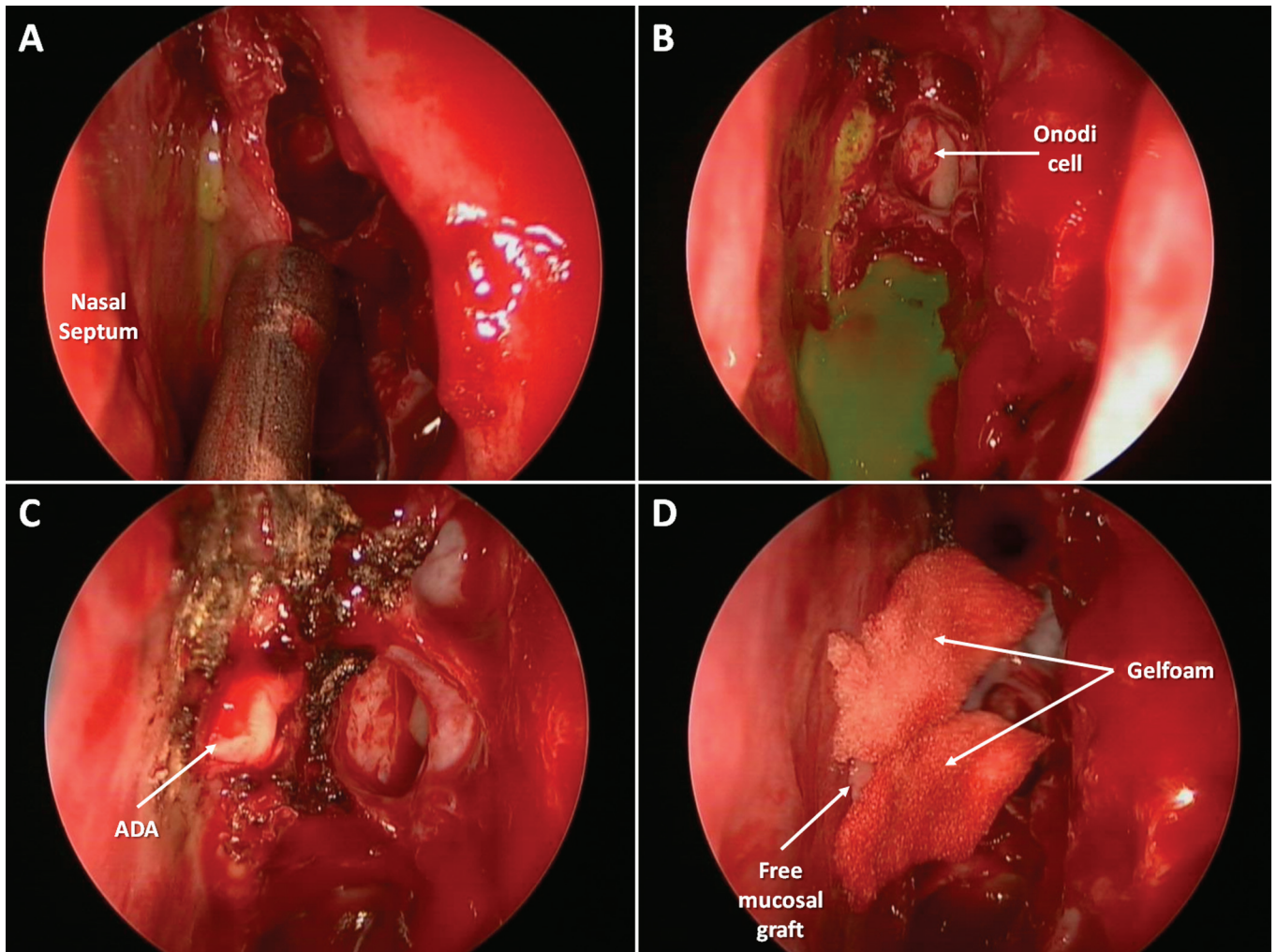


Figure 2. (A) Intraoperative photograph using a 4-mm 30° endoscope after left middle turbinectomy and ethmoidectomy shows the left cribriform encephalocele with fluorescein tainted CSF extravasation. (B) After complete exposure of the encephalocele, cerebral spinal fluid (CSF) egress can be seen filling the dependent sphenoid cavity. (C) The defect is subsequently repaired using acellular dermal allograft inlay, (D) followed by an overlay free middle turbinate mucosal graft covered with gentamicin-soaked Gelfoam pledgets (Pharmacia, Kalamazoo, MI), which is subsequently bolstered by a Meroceel tampon (Medtronic Xomed, Jacksonville, FL) covered with bacitracin ointment. The Meroceel packing is inflated with gentamicin solution. ADA, acellular dermal allograft.

repair of CSF leakage after various causes, including sinus surgery and remote endoscopic skull base surgery. They found that 22% of leaks could be anatomically localized to the cribriform plate, making this a critical structure for evaluation. They further report that nine of the surgeries were performed for CSF leakage secondary to iatrogenic surgical trauma, whereas 23 were undertaken to repair protrusions of the brain and meninges through a skull base defect. All patients in their study experienced CSF rhinorrhea as a presenting symptom, similar to our patient.⁴

According to Ketcham *et al.*, CSF leakage after septoplasty is a relatively rare complication related to a defect in the cribriform plate caused during the operation.⁷ They associate postoperative leakage with poor angling of dissection forceps and stress forces trans-

mitted to the cribriform with removal of the bony ethmoid plate.⁷ Thakar *et al.*⁶ similarly discusses how a forceful operative technique with removal of the perpendicular plate of the ethmoid resulted in injury to the cribriform plate in the three cases they investigated. They found that in all three cases, iatrogenic CSF leakage occurred 12–22 weeks after septoplasty. This is in contrast to the leakage observed in our patient, which occurred 2 weeks postoperatively. Furthermore, they found all three cases had slit-shaped dehiscences at the horizontal lamella of the cribriform plate. This particular finding, however, was not noted in our patient.

Onerci *et al.*⁸ discuss how operative damage to the cribriform plate is ultimately the underlying culprit for postoperative CSF leakage. They investigated two cases in which CSF rhinorrhea occurred after septo-

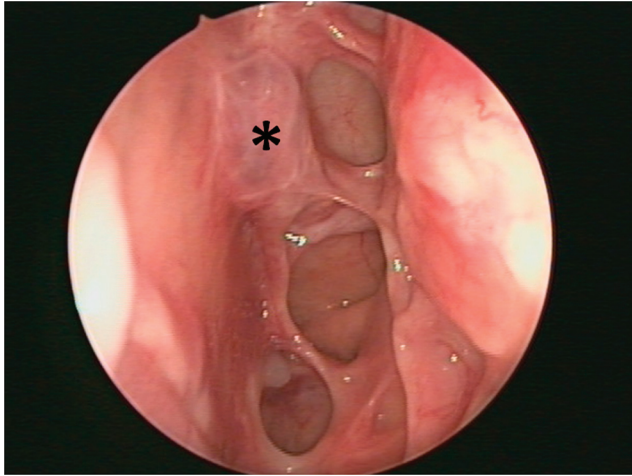


Figure 3. Twenty-two month postoperative 4-mm 30° nasal endoscopy shows a well-healed and mucosalized repair site. *Repair site.

plasty. In accordance with the aforementioned studies by Ketcham *et al.* and Thakar *et al.*, mechanisms causing the leakage once again focused on perforation of the cribriform by poor forceps technique or inadvertent fracture occurring with removal of the perpendicular plate of the ethmoid. Similarly to the three cases investigated by Thaker *et al.*, slit-type defects at the skull base were identified in these two patients.⁸ They propose these defects likely resulted from overly aggressive forces applied for removal of the ethmoid plate, ultimately leading to CSF leakage.

In our current patient, the CSF rhinorrhea likely occurred from disturbance of a previously undiagnosed anterior skull base encephalocele. No slit-like alterations of the cribriform plate (usually seen with mechanical manipulation) were visualized in this patient. We believe that this obese female patient was at risk for benign intracranial hypertension and encephalocele formation. Although a CT scan before the septoplasty would have been ideal in proving that the anterior skull base defect did not occur during that procedure, it is unlikely that the asymmetrical anterior skull base height (lamina lateralis) noted (Fig. 1) after the septoplasty and the small encephalocele seen intraoperatively were the result of the septoplasty. Previous literature has identified female gender and obesity as a

statistically significant risk factor for development of an encephalocele or CSF leak.⁴ To our knowledge, CSF leakage after disturbance of an occult anterior skull base encephalocele has not been documented previously. Such knowledge implies how meticulous attention to unique anatomy is essential, especially when considering potential reasons for postoperative complications.

Another important lesson from this report is the usefulness of intraoperative intrathecal fluorescein for CSF leak site identification. Although preoperatively the CT cisternogram could not definitively identify the leak site, intraoperatively, the intrathecal fluorescein was paramount in determining the defect location.

CONCLUSION

Encephaloceles are rare occurrences characterized by herniation of intracranial contents through a skull base defect. Although many cases of CSF rhinorrhea after septoplasty occur because of iatrogenic alteration of the cribriform plate, otolaryngologists should consider the possibility of a previously undiagnosed encephalocele in their differential diagnosis.

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