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Use of balloon-assisted nasal access to augment endoscopic endonasal transsphenoidal approach: illustrative case

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BACKGROUND Pituitary adenoma is a neurosurgical pathology commonly resected via endoscopic endonasal approach. Septal and nasal passage anatomy can affect the surgical corridor and may require septoplasty or other techniques for expansion.

OBSERVATIONS The authors presented a case of pituitary macroadenoma with septal deviation with use of balloon-assisted nasal access for surgery.

LESSONS This technique enhanced surgical width of field and instrument maneuverability via septal medialization for successful tumor resection.

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KEYWORDS assisted nasal access; endoscopic endonasal approach; pituitary; septal deviation; transsphenoidal

Pituitary lesions, specifically adenomas, affect approximately 17% of the population and have various neurological and endocrinological effects.[1,2] Resection is typically offered, with the most common modern surgical approach being an endoscopic endonasal transsphenoidal route. Historical approaches to the sellar region included transcranial and transfacial routes, which were associated with significant morbidity and mortality.[3,4] Evolution of technique resulted in the less invasive submucosal and sublabial microscopic approaches. With the development of lighted retractors and increasing popularity of endoscopic visualization, the endoscopic endonasal approach (EEA) through the sphenoid sinus has become mainstay of surgical access to pituitary lesions.[3–5] This approach affords a minimally invasive technique with wide angles of visualization and more degrees of freedom for the surgeon. Volumetric cadaveric studies show greatest degrees of surgical maneuverability with the binostril endoscopic approach in multiple dimensions when compared to microscopic sublabial, endonasal, and mononostril endoscopic approaches.[6] Although tumor resection is often performed solely by neurosurgeons after EEA has been completed, sinonasal anatomy can have notable effects on the ability to visualize a trajectory to sellar pathology. Typically, the otolaryngologist or approach surgeon achieves an adequate surgical corridor by resecting or shifting the middle turbinates laterally, performing a posterior septectomy and possibly an ethmoidectomy.[3,7] Despite these standard maneuvers, the nasal septum may still intrude on the surgical field and trajectory of instruments for tumor resection, especially if altered shape or deviation is present. Standard septoplasty can take 15 to 30 minutes of additional surgical time. In select cases, access to the posterior nasal cavity can be achieved by placing a 16-mm-diameter balloon into the nasal cavity between the septal deflection and the lateral nasal wall structures, inflating the device to 8 atm, and leaving it in position for approximately 2 minutes. The balloon is then deflated and removed, leaving the septum in a more medial position. A repeat application can be performed if necessary. We present a patient case with use of this method during EEA for pituitary macroadenoma resection to provide greater width of field in the surgical corridor.

Illustrative Case

History and Examination

A 60-year-old man with no significant medical or family history presented with transient symptoms of imbalance and vertigo. No neurological deficits were detected on examination. He was found to have a 1.4-cm pituitary adenoma eccentric to the right side with

ABBREVIATIONS EEA = endoscopic endonasal approach; FDA = Food and Drug Administration.

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cavernous sinus invasion on magnetic resonance imaging, with nasoseptal deviation (Fig. 1). Preoperative endocrine laboratory results were unremarkable. He had no previous cranial or sinus surgery, and EEA and transsphenoidal resection of this lesion were planned.

Surgical Procedure

Surgical approach was performed via approach team (otorhinolaryngology), including the balloon septoplasty access. The neurosurgical team performed resection after sellar access had been obtained via a four-handed binostril technique.

A 16 $\times$ 40 Acclarent balloon was advanced into the left nasal cavity and positioned at the apex of the septal spur (Fig. 2). The balloon was inflated to 8 atm and left in position for 2 minutes. It was then deflated and withdrawn. The balloon was then reinserted lower in the nose along the septal spur. It was inflated again to 8 atm and left in place for 2 minutes, and the balloon was then withdrawn. Total surgical time for the septal medialization was approximately 6 minutes. Photographic documentation of the nasal passage before and after medialization of the nasal septum was performed (Fig. 3).

After septal medialization, a posterior septectomy and wide bilateral sphenoidotomies were performed to access the sellar region. A cruciate dural incision was performed, and a combination of ringcurets, rongeurs, and microdissectors was used to remove the pituitary adenoma. Dural substitute and fibrin-glue sealant were placed over the dural defect prior to nasal passage packing and closure.

The patient had an uneventful postoperative stay and was discharged from the hospital on postoperative day 2. Laboratory studies and surgical pathology revealed nonsecretory gonadotroph adenoma. No complications were identified on postsurgical follow-up.

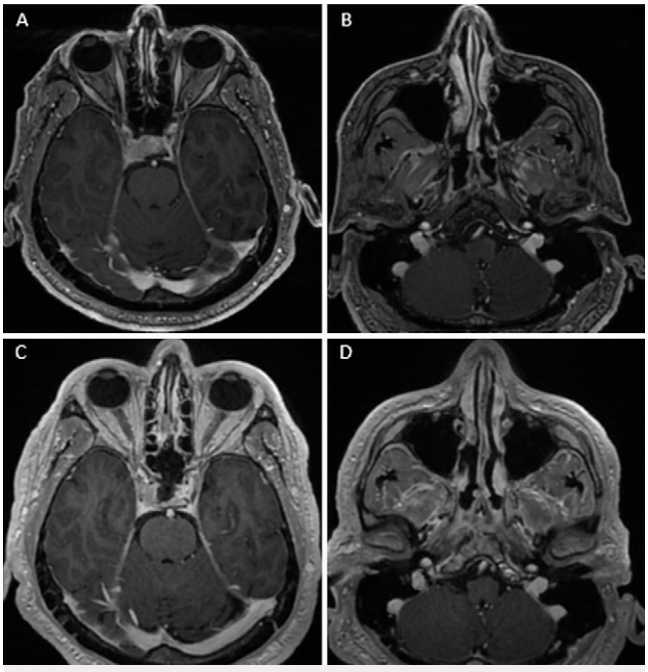

FIG. 1. Pre- and postoperative magnetic resonance imaging. **A:** Pituitary lesion prior to resection. **B:** Septal deviation before septoplasty. **C:** Pituitary lesion after resection. **D:** Corrected septal deviation after septoplasty.

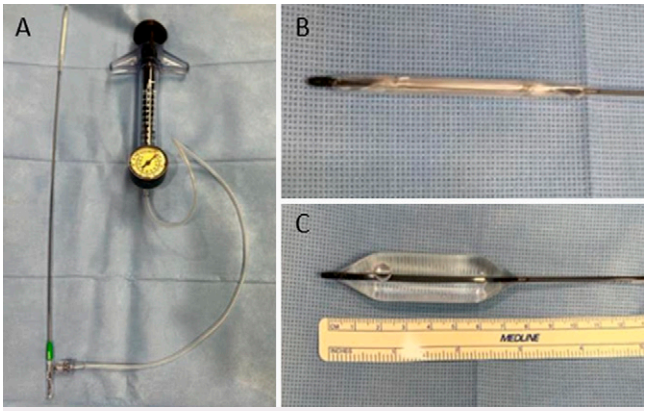

FIG. 2. Balloon device with and without saline inflation. **A:** Acclarent balloon inflation device used for septoplasty. **B:** Uninflated device tip. **C:** Inflated device tip filled with sterile saline.

Discussion

Observations

Sellar lesions, including pituitary adenomas, are common neurosurgical lesions that are typically approached via an EEA and transsphenoidal route with otolaryngologist surgical assistance. EEA affords the surgeon enhanced visualization without the same degree of invasiveness as historical transcranial, transfacial, and submucosal approaches. A greater extent of instrument maneuverability and tumor corridor access can be achieved with a binostril approach. Individual nasal anatomy is an important surgical consideration. We have noted that in using this balloon septoplasty technique, less trauma is induced while retaining the same degrees of freedom, which is essential in resecting lateral or superior situated pathology. With the absence of the incised septum, we have also observed less hemorrhage during surgery, which tends to obscure the endoscope lens via rundown along the septum. Indeed, in quality-of-life studies, septoplasty results in complications including synechiae and anosmia at a higher rate.

Septal deviation and resultant nasal airway obstruction is exceedingly common in adults, leading to the commonality of septoplasty procedures. Our patient had notable septal deviation. Combined cartilaginous and bony septal deviation is reported in up to 37% of the population.[8] Endoscopic sinus surgery and septal modification are also effective treatments for chronic rhinosinusitis.[9] Major components of the nasal septum include cartilage, the vomer extending upward from the hard palate, and the perpendicular plate of the ethmoid bone extending downward from the anterior skull base. Septal deviation and individual anatomy can lead to difficulty visualizing operative trajectories in transsphenoidal surgery.[7,8] Remodeling of the nasal septum and correction of deviation, or septoplasty, can help correct this visualization and may be performed via open or endoscopic techniques.

Open septoplasty can be performed by first raising a mucoperichondrial flap and then incising septal cartilage and bone for various degrees of removal.[10] Risks associated with this technique include compromise of mucosal vascular supply with resultant septal ischemia/perforation and small chance of visible external deformity following surgery.[5,10] Provision of nasal access using a balloon has been approved by the Food and Drug Administration (FDA)-since April 2019 and may afford additional advantages from this perspective. The balloon and inflation device are not reusable. However, we believe that the cost of the disposable balloon septoplasty

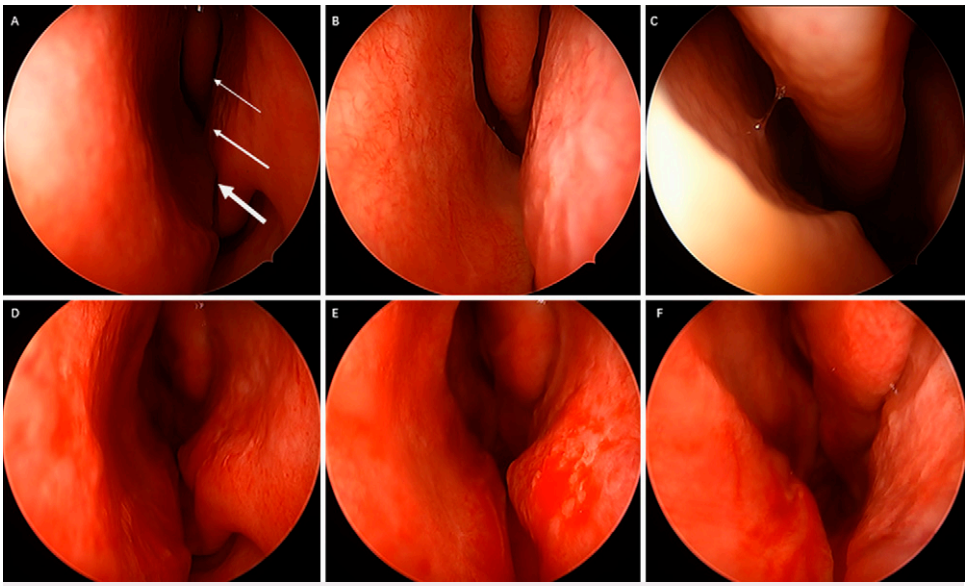

FIG. 3. Intraoperative endoscopic surgical corridor before and after balloon septoplasty. Left-side nasal cavity before septoplasty (**A–C**) and after septoplasty (**D–F**). The *white arrows* represent the directionality of balloon placement, with the *thicker arrow* being more superficial and the *thinner arrow* being more distal.

equipment offsets the cost of additional operating room time for open septoplasty.

Limitations

Being a single patient report, the information in our case is limited by several other factors. Because it was not standard to perform postoperative sinus imaging, we have no radiographic volumetric measurement demonstrating the effects of septoplasty on the nasal passage. It is unknown whether balloon septal medialization has any impact on specific variables in the postoperative course of patients with pituitary tumor such as influence on postoperative pain level or ability to treat cerebrospinal fluid leak with a nasoseptal flap. Our patient did not suffer a cerebrospinal fluid leak or other evident respiratory or sinonasal symptoms in the immediate postoperative course.

We present a case of pituitary macroadenoma resection via EEA in which balloon septoplasty was used to correct a deviated septum and enhance the width of the surgical field. Balloon septoplasty is less traumatic than conventional septoplasty and offers a minimally invasive, efficient way of expanding visualization during endoscopic endonasal surgery. It should be considered in individuals with significant septal deviation or nasal obstruction from altered anatomy.

Lessons

The technique is performed by inserting a balloon catheter into the nare between the deviated portion of the septum and the lateral nasal wall. The balloon is then filled with sterile saline (or iodinated contrast if fluoroscopic confirmation of location is desired) to a specific pressure and left for a variable amount of time before deflation and withdrawal. Some of the clinical benefits attributed to sinuplasty include shorter recovery time, less postoperative pain, and potentially less blood loss.[8] It is reasonable to expect similar benefits, in addition to decreased operative room time, with use of balloon-assisted septal medialization. Long-term follow-up of patients receiving balloon septoplasty for chronic maxillary rhinosinusitis suggested that balloon septoplasty may have less long-term durability than traditional endoscopic endonasal surgical septoplasty. However, this finding is likely not relevant to surgical access to the sella and skull base region.[9] Melroy et al. reported a complication rate of 0.0035% per sinus when reviewing balloon septoplasty for nasal access in an FDA database.[11] Our patient had a successful tumor resection and did not note any postoperative complications.

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Disclosures

Dr. Klemens reported personal fees from Acclarent outside the submitted work. No other disclosures were reported.

Author Contributions

Conception and design: Winslow, Klemens, Tsung. Acquisition of data: Winslow, Garst, Tsung. Analysis and interpretation of data: Winslow, Garst, Tsung. Drafting the article: Winslow, Garst. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Winslow. Administrative/technical/material support: Garst. Study supervision: Tsung.

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