# Free Nasoseptal Mucosal Flap for Endoscopic Endonasal Transsphenoidal Skull Base Surgery: Results and Operative Technique

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## Introduction

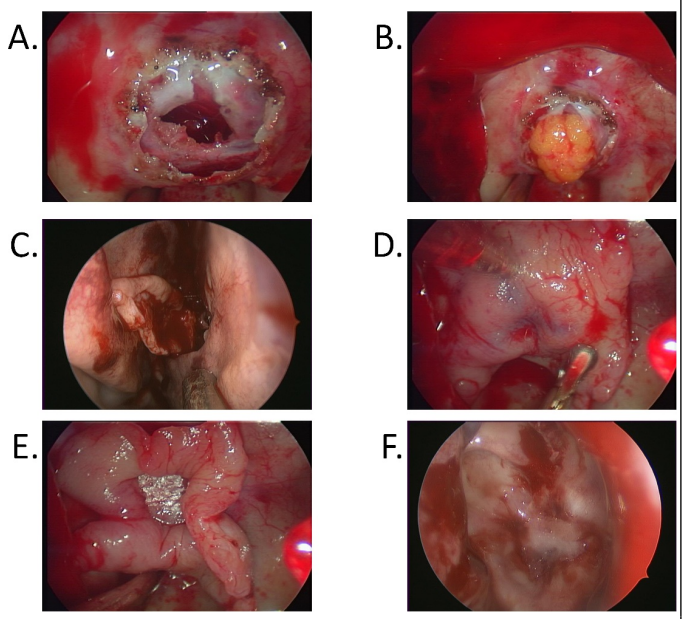
Cerebrospinal fluid (CSF) leak remains a major challenge for the endoscopic endonasal transsphenoidal approach to anterior skull base lesions, and numerous closure techniques have been described using both autologous and synthetic materials [1-6]. Here, we utilized a three-layer closure technique with a free nasoseptal mucosal flap harvested via an endoscopic approach, with each component of the closure being derived from autologous tissue.

## Methods

*Patient population*: We retrospectively analyzed 148 consecutive patients (60% female) who underwent an entirely endoscopic endonasal transsphenoidal procedure to treat anterior skull base lesions at New York-Presbyterian-Cornell between April 2006 and November 2011. Their mean age was 47, and their mean follow-up time was 14.2 months. They presented with a variety of lesions: pituitary adenomas (66%), other pituitary lesions (22%), craniopharyngiomas (3%), meningiomas (3%), CSF leaks (4%), and other lesions (5%). The mean diameter of these lesions was 2cm, with more than half >1cm.

*Surgical technique*: A skull reference array was fixed to the patient, and laser surface scanning was used for patient registration [7-8]. After resection of the tumor, we performed a multi-layered reconstruction of the anterior skull base consisting of a subdural umbilical fat autograft (layer 1), onlay nasoseptal mucosal flap (layer 2), and nasal perichondrum (layer 3) that was secured with dural sealant (see Figure 1). The typical extent and size of the graft was the same as the dimensions of the controlled posterior septal perforation. The anterior and inferior borders of the middle tubinate and anterior wall of the sphenoid sinus defined the borders of the septal mucosal graft.

**Figure 1**




Construction of the three-layer nasoseptal flap. A. Skull base defect after endoscopic endonasal transsphenoidal resection of sellar tumor. B. In-lay graft of periumbilical fat as first layer of closure. C. Endoscopic harvest of septal mucosa to the inferior aspect of the nasal septum. D. Free nasoseptal mucosa overlay graft with the mucosal side facing the nasal cavity. E. Perichondrium graft placed on top of mucosa with its edges underneath the border of the skull base defect as the third layer of closure. F. Endoscopic examination of multi-layer closure reveals watertight seal.

### Learning Objectives

By the end of this presentation, participants will better understand: (1) the challenges inherent to anterior skull base surgery, particularly post-operative complications like CSF leak, (2) the advantages of using an endoscopic, endonasal approach to meet these challenges, and (3) the benefits of the nasoseptal flap in mitigating post-operative CSF leak following this approach.

## Results

The post-operative CSF leak rate of our technique was 3%. Of these leaks, 60% resolved spontaneously and 40% resolved after 3 days of lumbar drainage. Only 1 patient required permanent CSF diversion, but this case was confounded by the development of delayed communicating hydrocephalus following the resection of a 3.8 cm craniopharyngioma extending well into the third ventricle. There were no infectious or wound complications relating to graft harvest or closure.

## Discussion

Our three-layered free nasoseptal mucosal flap closure method offers a safe, easy, and effective method for ensuring proper healing and preventing CSF leak after endoscopic endonasal anterior skull base surgery for a variety of lesions in a realistic cross-section of patients. In the literature, post-operative CSF leak rates for pituitary adenomas, the most common type of lesion treated with this approach, have ranged from 2-4% [1,9-11]. Our post-operative CSF leak rate compares favorably to these outcomes even though 10% of the tumors we treated were types with historically higher rates of post-operative CSF leak, 50% were >1cm, and 24% of our patients had co-morbid conditions that may have impaired wound healing. Moreover, our closure technique offers the added benefit of using autologous tissue with minimal risk of tissue incompatibility that would have otherwise been discarded.

**References**

(1) Komotar et al. Brit J Neurosurg 2012; Early online: 1-12.
(2) Cavallo et al. J Neurosurg 2007; 107: 713-20.
(3) De Divitiis et al. Neurosurg 2007; 60: 46-59.
(4) Hadad et al. Laryngoscope 2006; 116: 1882-6.
(5) Laufer et al. J Neurosurg 2007; 106: 400-6.
(6) Yano et al. Surg Neurol 2007; 67: 59-64.
(7) Greenfield et al. Minim Invasive Neurosurg 2008; 51: 244-6.
(8) Raabe et al. Neurosurg 2002; 50: 797-803.
(9) Sciarretta et al. Minim Invasive Neurosurg 2010; 53: 55-9.
(10) Cappabianca et al. Neurosurg 2002; 51: 1365-71.
(11) Spaziante et al. Neurosurg 1985; 17: 453-58.