

## Comprehensive Management of the Paranasal Sinuses in Patients Undergoing Endoscopic Endonasal Skull Base Surgery

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### Key words

- Endoscopic skull base surgery
- Pituitary
- Pituitary adenoma
- Sinusitis
- Skull base
- Transsphenoidal

### Abbreviations and Acronyms

CRS: Chronic rhinosinusitis



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### INTRODUCTION

Evaluation and treatment of the paranasal sinuses are essential in the overall comprehensive management of patients with skull base lesions. Early endoscopic approaches to the skull base concentrated more on safety than preservation of nasal function resulting in significant sinonasal morbidity. Now that the safety of these procedures has been established, it is important to concentrate on preservation of sinonasal function. The preservation of sinonasal function requires careful evaluation of the sinuses preoperatively, meticulous intraoperative dissection with preservation of sinonasal structures not directly involved with the pathology, and long-term follow-up postoperatively. General goals include optimizing the sinuses preoperatively to allow for a safe surgical corridor to enter the intracranial cavity and adhering to established principles in endoscopic sinus surgery for inflammatory disease. Endoscopic sinus surgery consists of techniques that promote mucosal preservation and mucociliary clearance,

■ **OBJECTIVE:** The endonasal route often provides the most direct and safe approach to skull base pathology. In this article we review the literature with regard to management of the paranasal sinuses in the setting of skull base surgery.

■ **METHODS:** We describe our institutional experience and review the literature of concurrent management of the sinusitis in patients undergoing endoscopic skull base surgery.

■ **RESULTS:** Patients should be optimized preoperatively to ensure the endonasal route is a safe corridor to enter the intracranial cavity. Often the paranasal sinuses can be surgically addressed at the same time as endoscopic skull base surgery. We describe the technical details of management of the paranasal sinuses when addressing skull base pathology.

■ **CONCLUSIONS:** Careful management of the paranasal sinuses throughout the peri-operative course is paramount to optimizing sinonasal function and safety.

maintain ostia patency, minimize crusting, and prevent scar formation (II). In this article, we discuss current knowledge with regard to management of the sinuses in patients undergoing skull base surgery.

### MATERIALS AND METHODS AND RESULTS

Institutional review board approval for this study was obtained through the Jefferson Medical College of Thomas Jefferson University.

#### Preoperative Evaluation

The otolaryngologist plays a pivotal role in the care of the paranasal sinuses. This role begins with a careful preoperative assessment that includes a history and physical evaluation. Previous sinus surgery or a history of sinusitis does not preclude an endonasal corridor to the skull base. Most patients with rhinosinusitis are good candidates for an endoscopic endonasal approach to the skull base with preoperative optimization.

Nasal endoscopy is essential preoperatively to evaluate the sinonasal cavity and create a surgical plan. Information from the endoscopy helps determine the need for a

nasal septoplasty and turbinate reduction, decide whether additional sinuses need to be surgically addressed for inflammatory disease, choose the best surgical corridor to the target pathology, and plan for the skull base reconstruction. Tackling these variables can improve the patient's quality of life with regard to nasal function, while treating the primary skull base pathology. Computed tomography is a second important diagnostic tool and can be used intraoperatively for image guidance. CT provides the best information to evaluate the bony anatomy and is the "gold standard" radiologic technique to assess for rhinosinusitis, whereas magnetic resonance imaging is usually the best imaging modality to evaluate the primary lesion. We prefer both preoperative computed tomography and magnetic resonance imaging to understand the disease process best and assess for concurrent management of the paranasal sinuses. We also prefer to have both modalities available for intraoperative image guidance.

Rhinosinusitis is a complex inflammatory disease that develops secondary to multiple etiologies including infectious causes, allergic disease, immune dysfunction, cilia disorders, and anatomic abnormalities.

Optimizing patients with rhinosinusitis preoperatively is critical; this may include the use of antibiotics, allergy medications, immunotherapy, irrigations of the nose, antihistamines, decongestants, and steroids depending on the nature of the disease. The literature is sparse with data regarding management of patients with rhinosinusitis before undergoing an endoscopic endonasal skull base surgery. Similar to any elective surgery requiring general anesthesia, patients with acute rhinosinusitis (< 4 weeks) should be treated appropriately, and surgery should be delayed until the patient is completely recovered. Patients with nasal polyps and eosinophilic mucin should be optimized perioperatively with steroids similar to routine endoscopic sinus surgery because this decreases inflammatory swelling, makes the surgery less technically difficult, and improves postoperative outcomes with regard to polyp regrowth (17, 23). Patients with chronic rhinosinusitis (CRS) with or without polyps can be surgically addressed at the time of skull base surgery. A review of 250 consecutive cases since March 2009 in our database revealed 20 (8%) patients who underwent concurrent surgery for CRS with or without nasal polyps and skull base pathologies. None of the patients developed an intracranial infection. Only 1 patient (5%) continued to have rhinosinusitis, and she required additional endoscopic sinus surgery, which is consistent with the need for revision endoscopic sinus surgery in the setting of CRS as reported in the literature (18). An additional 2 patients were staged and underwent endoscopic sinus surgery before undergoing endonasal skull base surgery. One patient was found to have acute purulent sinusitis, and another had a sinus fungal ball (sinus mycetoma), and it was decided to stage the procedures. Surgery is curative for a sinus mycetoma, and once the sinus cavity has healed and the fungus has cleared, an endonasal approach to the skull base is possible. Both patients who were staged underwent successful endoscopic endonasal surgery for a pituitary macroadenoma without an infection or complication. No patients required a transcranial approach secondary to sinus inflammatory disease. For most patients with CRS, the affected sinuses can be surgically addressed at the time of skull base surgery without an increased risk of infection.

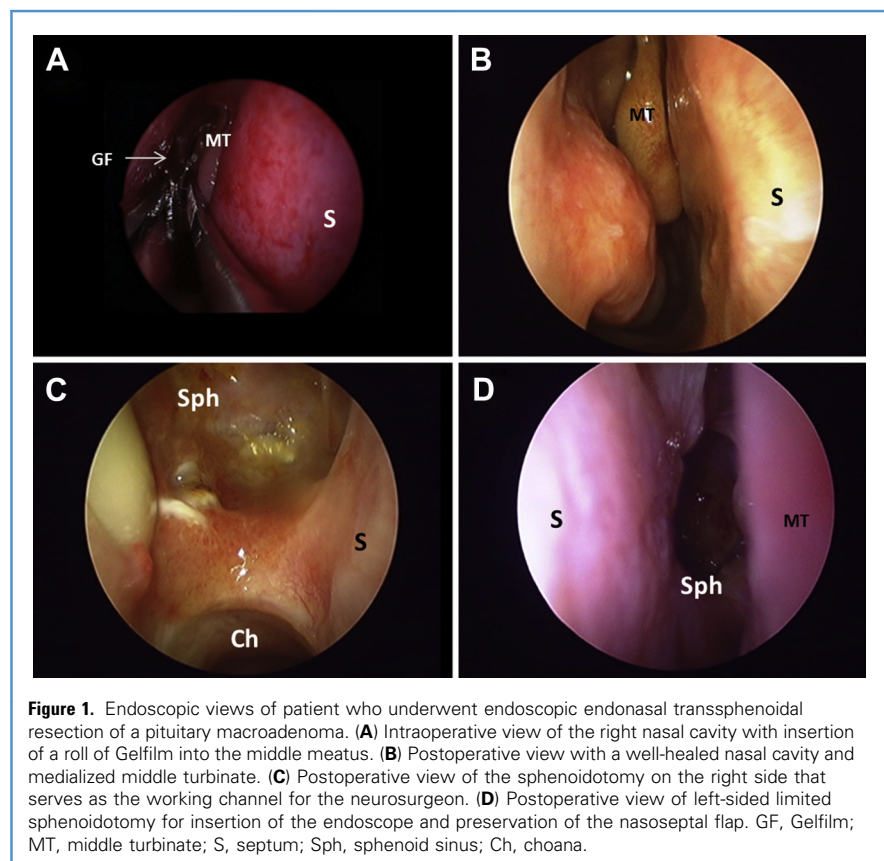
### Perioperative Care

Meticulous attention to the sinonasal anatomy preserves function and translates to improved quality of life compared with other approaches and allows patients to return to their baseline nasal function more quickly postoperatively (1, 15). The primary goals, similar to goals for inflammatory disease, include mucosal preservation techniques that maintain ostia patency and prevent scar formation. Mucosal stripping is avoided except in areas immediately around the skull base defect to allow the skull base reconstruction to adhere directly to the bony skull base. Permanent reconstructive materials that cover mucosa are likely to result in mucocele formation and are avoided (2, 22). Otherwise, the mucosa should be preserved.

We preserve all turbinates unless they are directly involved with the primary pathology; this helps preserve sinonasal function and ensures that these structures are available as a backup plan in the future for cranial base repair if critically needed. A review of a 163 consecutive endoscopic

transsphenoidal surgeries for multiple pathologies revealed that the middle turbinate could be gently lateralized and preserved in 98% of cases without compromising access (16). We gently medialize the middle turbinates at the conclusion of the case and routinely place a roll of Gelfilm (Pfizer, New York, New York, USA) in the middle meatus to help maintain patency of the natural sinus drainage pathways and protect the skull base defect within the sphenoid sinus from inadvertent penetration (e.g., a nasogastric tube) (Figure 1) (9). In addition, a very limited posterior septectomy is performed for routine transsphenoidal cases to limit crusting and anosmia. A flat sheet of Gelfilm is also placed between the nasal septum and inferior turbinates to reduce synechia. Excessive crusting from free mucosal edges increases the incidence of bleeding, obstruction, and synechia formation and the need for additional débridements (7, 10, 11).

We described the use of a “button graft” for repair of skull base defects (14). Fascia



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