# Posttreatment Imaging of the Paranasal Sinuses Following Endoscopic Sinus Surgery

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**KEYWORDS**

• Radiology • Paranasal sinuses • Surgery • Endoscopic • Imaging • Complications • Posttreatment

**KEY POINTS**

- Postoperative sinonasal diagnostic imaging techniques and protocols are reviewed.
- The different types of endoscopic sinus surgery techniques are described and the corresponding expected postoperative findings are presented.
- Complications resulting from endoscopic sinus surgery are summarized and selected examples of diagnostic imaging are presented.

## INTRODUCTION

Endoscopic sinus surgery is a minimally invasive option for the treatment of several nonneoplastic indications, particularly for medically refractory sinusitis and polyposis. Numerous interventions can be performed through endoscopic sinus surgery (**Box 1**), many of which may be performed together during the same procedure. There are also a variety of complications that can result from endoscopic sinus surgery (**Box 2**).[1–10] Radiological imaging plays an important role in the evaluation of patients after endoscopic sinus surgery. Thus, it is important to be familiar with the expected and complicated imaging findings associated with endoscopic sinus surgery, which are reviewed in this article.

## POSTOPERATIVE IMAGING TECHNIQUES AND PROTOCOLS

The main radiological imaging modalities available for evaluating patients following endoscopic sinus surgery include computed tomography (CT), MR imaging, and angiography. High-resolution CT with multiplanar reconstructions is invaluable for a detailed depiction of the changes in bony anatomy and the presence of implants after surgery and can provide an overview of the extent of sinonasal opacification. CT can also be useful for screening orbital and intracranial complications. The administration of intravenous contrast with sinus CT is generally unnecessary, but can be helpful in cases of suspected orbital, facial, or intracranial infection. MR imaging often serves a complementary role to CT for optimal soft tissue characterization, particularly for delineating certain intracranial complications and further elucidating nonspecific findings on CT that are otherwise not readily amenable to endoscopic examination. Angiography, either in the form of CT angiography (CTA), MR angiography (MRA), or catheter angiography, is indicated for the evaluation of vascular complications. Notably, catheter angiography can serve as both a diagnostic and therapeutic modality in certain cases of

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**Box 1**
**Types of endoscopic sinus surgery and related procedures**

- Uncinectomy/uncinotomy
- Inferior and middle meatus antrostomy/fenestration
- Ethmoidectomy (anterior and/or posterior)
- Turbinectomy/turbinate medialization
- Frontal sinusotomy
- Sphenoidotomy/sphenoid drill-out/marsupialization
- Polypectomy
- Sinus stenting
- Mucocele drainage
- Sinonasal debridement
- Balloon sinuplasty
- Turbinate reduction/turbinoplasty
- Septoplasty/septorhinoplasty
- Approach for ophthalmic procedures, such as orbital wall decompression, and anterior skull base cerebrospinal fluid (CSF) leak repair

**Box 2**
**Complications of endoscopic sinus surgery**

- Brain parenchymal injury and intracranial hemorrhage
- Encephalocele and CSF leakage
- Intracranial infection
- Gossypiboma
- Vascular injury (pseudoaneurysm)
- Ophthalmic injury (intraorbital hemorrhage, extraocular muscle injury, optic nerve transection, nasolacrimal system disruption)
- Periorbital lipogranuloma
- Recurrent rhinosinusitis and polyposis
- Retained septations
- Neo-osteogenesis
- Adhesions
- Mucus recirculation phenomenon
- Mucocele
- Nasal septal perforation
- Empty nose syndrome

postoperative hemorrhage. Fluoroscopy is mainly limited to guiding and verifying the completion of certain endoscopic procedures, such as balloon sinuplasty. Additional guidance for determining the appropriate imaging modalities can be found in the American College of Radiology Appropriateness Criteria for sinonasal disease.[11] Protocol details for sinonasal CT and MR imaging techniques in adults are listed in **Table 1**.

## TYPES OF SURGERY AND IMAGING FINDINGS

### *Ostiomeatal Unit Endoscopic Sinus Surgery*

The goal in treating an obstructed ostiomeatal unit via endoscopic surgery is to improve mucociliary clearance by removing anatomic obstacles. The procedure most typically involves uncinectomy and middle meatal antrostomy, which creates a wide neoinfundibulum that is best delineated on coronal CT images (**Fig. 1**). Variable degrees of ethmoidectomy and middle turbinectomy may also be performed, depending on the extent of disease; for example, medial deviation of the lamina papyracea with or without posterior repositioning of the globe frequently occurs after ethmoidectomy because of the loss of buttressing effects ordinarily provided by the ethmoid septations.[11] The medial bowing of the lamina papyracea can be observed on postoperative CT and is generally on the order of a 1-mm to 3-mm decrease in the interorbital distance (**Fig. 2**). Another less commonly implemented option for treating patients with ostiomeatal unit complex diseases is inferior antrostomy, which provides an alternate drainage pathway and can be useful in cases of severe disease that cannot be addressed through the usual uncinectomy and middle meatal antrostomy.[12] This procedure results in a defect in the inferior nasoantral wall that can mimic a secondary ostium (**Fig. 3**).

### *Frontal Sinusotomy and Stenting*

Frontal sinusotomy is indicated when frontal sinus disease persists despite more conservative endoscopic approaches directed at the infundibulum and anterior ethmoid region. The Draf classification describes various types of endoscopic frontal sinusotomy based on the extent of surgical resection of the regional sinonasal skeleton (**Table 2**).[13] The postoperative status of the frontoethmoid recess is best delineated on sagittal and coronal CT images. For example, frontal sinus stenting is indicated if the neo-ostium measures less than 5 mm in width,[14] and CT can be useful for verifying the position of the stents (**Fig. 4**) and assessing surrounding anatomy if further surgery is contemplated.