Chapter 4
Radiologic Anatomy of the Paranasal Sinuses
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Core Messages
- The endoscopic modified Lothrop procedure is an alternative to an osteoplastic flap procedure.
- The procedure involves endoscopic intranasal removal of the frontal intersinus septum, frontal sinus floor, nasal beak and, anterior superior nasal septum.
- The accessible dimension is the distance between two parallel lines that lie in the parasagittal plane through the midportion of the internal frontal ostium with the first line tangential to the skull base and the second line tangential to the posterior margin of the nasal beak. An accessible dimension less than 5 mm would preclude the patient’s candidacy for the endoscopic modified Lothrop procedure.
- Drilling on the posterior area of the frontal recess is avoided in order to prevent postoperative circumferential stenosis, injury to the skull base with possible CSF leak, or injury to the anterior ethmoid artery.
- A large septectomy is made to provide surgical access of instruments from both sides of the nose as well as to help prevent postoperative crusting.

Chapter 9
Endoscopic Modified Lothrop Procedure
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Introduction

The complex and variable anatomy of the frontal sinus and recess makes the surgical treatment of chronic disease in this area both dangerous and challenging. Pneumatization of the frontal bone by numerous anterior ethmoid air cells during development may effectively block the already narrowed outflow tract of the frontal sinus. In addition, the area of the frontal recess is particularly poorly visualized during endoscopic sinus surgery owing to its anterior and cephalad position. These factors together increase the predilection for scarring and stenosis causing complete sinus obstruction that may be refractory to conventional endoscopic techniques [14, 19]. As well, the potential for injury to intimately associated structures such as the lamina papyracea, cribiform plate, and anterior ethmoidal artery is greater and can make surgery in this area a daunting task for the novice endoscopic surgeon.

Because of the anatomic complexity of the region, Lothrop advocated an external approach for frontal sinus drainage and discouraged an intranasal approach. The Lothrop procedure consisted of bilateral external ethmoidectomy, removal of the frontal sinus floor with communication of both frontal sinuses through a large nasal septectomy. This external procedure required the removal of the lacrimal bone and a portion of the lamina papyracea, which caused medial collapse of the orbital contents and subsequent stenosis of the nasofrontal communication [1]. The procedure did not gain much popularity and with the advent of the osteoplastic flap procedure in the 1960s, the Lothrop procedure was largely abandoned amongst surgeons. Despite being the “gold standard,” the osteoplastic procedure with or without frontal sinus obliteration has a reported failure rate of approximately 10%, with a range of 6–25% [3, 15, 16]. It is also associated with postoperative morbidities such as frontal bossing, supraorbital neuralgia, donor site complications, and scarring [17].

In the early 1990s, new advances in endoscopic sinus surgery technology allowed surgeons to revisit
the management of recalcitrant frontal sinus disease through a completely intranasal approach. In 1995, Gross et al. [9] first introduced the modification of the Lothrop procedure as an alternative to the osteoplastic flap procedure. Their modification involved a complete endoscopic intranasal removal of the frontal intersinus septum, frontal sinus floor, and anterior or superior nasal septum, thus allowing a more precise surgical management of frontal sinus outflow obstruction using advanced drilling technology. Since the first description of the procedure, several surgeons have reported success with the endoscopic modified Lothrop procedure comparable to that with the osteoplastic flap procedure in the management of frontal sinus disease [2, 4, 6, 10, 12, 13, 18]. Because of its numerous advantages, such as improved cosmesis, decreased morbidity, and shorter hospitalization, this procedure is slowly becoming the procedure of choice over the osteoplastic flap procedure in the management of persistent frontal disease after failure of maximal medical management and conservative endoscopic sinus surgery. Indications have also expanded to include other conditions as listed below:

1. Indications
   (a) Failure of appropriate medical therapy and primary endoscopic frontal sinusotomy in the treatment of persistent chronic frontal sinusitis
   (b) Mucoceles of the frontal sinus
   (c) Inverted papilloma invading the frontal recess and sinus
   (d) Select osteomas
   (e) Trauma of the frontal sinus
   (f) Alternative to osteoplastic frontal sinus obliteration
   (g) Revision of a previous endoscopic modified Lothrop procedure in a symptomatic patient demonstrating stenosis

2. Contraindications
   (a) Hypoplastic frontal sinus and frontal recess
   (b) Surgeon inexperience
   (c) Proper instrumentation unavailable
   (d) Sinus disease confined to supraorbital ethmoid air cells and not to the frontal sinus

Preoperative Workup

The endoscopic modified Lothrop procedure is recommended as a surgical option when an external osteoplastic flap procedure is contemplated for the surgical treatment of frontal sinus disease [6, 9]. Candidate patients generally have failed more conservative limited endoscopic sinus surgery and, ideally, have progressed through a protocol of increasingly complex surgeries. In order of more to less conservative, these procedures are as follows: ethmoidectomy with medial maxillary antrostomy without surgery in the frontal recess, frontal recess surgery, endoscopic frontal sinusotomy, unilateral extended frontal sinus surgery (Draf II procedure), endoscopic modified Lothrop procedure, and osteoplastic flap procedure with frontal sinus obliteration [11].

Tips and Pearls

Prior to surgery, the patient’s underlying condition causing frontal sinus disease is optimized medically.

A selective combination of nasal irrigations, antibiotics, leukotriene antagonists, topical, nebulized and/or oral steroids is often required. Such aggressive preoperative care is mandatory postoperatively as well to prevent restenosis of nasofrontal drainage leading to disease recurrence. This is especially important for patients with more aggressive disease, such as hyperplastic rhinosinusitis, sarcoidosis, Wegener’s granulomatosis, and Samter’s triad.

Tips and Pearls

Anatomic evaluation of the frontal sinus region with a computed tomography (CT) scans is key to the feasibility and safety of the endoscopic modified Lothrop procedure.

The number and the location of frontal recess air cells should be determined as they will dictate the number of barriers that will require removal to reach the internal frontal sinus ostium [5, 19]. Sagittally reconstructed views of the frontal recess are required to determine the important anatomic dimensions needed to allow safe introduction of the drill. The original recommended dimensions [6] were an anteroposterior dimension at the cephalad margin of the frontal recess of at least 1.5 cm, and a nasal beak no thicker than 1 cm. With newer, less bulky powered drills, a recent cadaver study demonstrated that these instruments can be safely introduced into a frontal recess anteroposterior dimension that was less than 1.5 cm [5]. It was determined that an accessible dimension of at least 5 mm is required to allow safe removal of the nasal beak and frontal sinus floor. This accessible dimension is the distance between two parallel lines that lie in the parasagittal plane through the midportion of the internal frontal ostium with the first line tangential to the skull base and the second line tangential to the posterior margin of the nasal beak (Fig. 9.1).