Role of Maximal Endoscopic Sinus Surgery Techniques in Chronic Rhinosinusitis

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- Maximum techniques • Topical irrigations
- Wide maxillary antrostomy • Endoscopic modified Lothrop
- Intraoperative computed tomography • Nasalization

Since its introduction into North America in the mid-1980s, techniques of endoscopic sinus surgery (ESS) have continued to evolve as further understanding is gained in the pathogenesis of chronic rhinosinusitis (CRS). Although the fundamental concepts of improving sinus ventilation and mucociliary function remain paramount in treatment efforts, there remains a continued debate regarding the extent of ESS required for patients. Various studies have shown that ESS achieves symptomatic success rates ranging from 74% to 97.5%.[1–5] This, however, leaves upward of 26% of patients with persistent disease despite surgical treatment, with approximately 10% of patients requiring revision surgery within 3 years.[6] Patient symptoms recalcitrant to primary surgery is often secondary to persistent mucosal disease, such as polypoid edema, biofilm colonization, and the pooling of thick, allergic mucin. To minimize these failures as well as to offer a surgical alternative to the treatment of CRS recalcitrant to primary surgery, this article aims to highlight some of the reasons for performing maximal techniques in ESS. In addition, the authors hope to expand this concept in various surgical maneuvers that may help in the long-term management of patients with CRS.

REASONS FOR MAXIMAL TECHNIQUE

Although this article emphasizes the utility of maximal techniques in ESS, it should be mentioned that normal nasal physiology and mucociliary clearance mechanisms are not neglected. Instead, the indications for maximal surgery reflect the reasons why

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patients fail primary ESS and ultimately have recalcitrant CRS. These reasons can be divided in 3 main categories: anatomic, etiologic, and postoperative factors.

ANATOMIC FACTORS

There have been numerous studies that have evaluated anatomic findings in patients who require revision surgery. Musy and Kountakis[7] evaluated a prospective series of patients undergoing revision ESS and reported that the most common postsurgical alterations include lateralization of the middle turbinate (78%), incomplete anterior ethmoidectomy (64%), scarred frontal recess (50%), retained agger nasi cell (49%), incomplete posterior ethmoidectomy (41%), middle meatal antrostomy stenosis (39%), and a retained uncinate process (37%). These findings are further substantiated in a case series by Chiu and Vaughan,[8] which demonstrated that patients requiring revision frontal sinus surgery often have residual agger nasi cell or ethmoidal bulla remnants, retained uncinate process, lateralized middle turbinate, and unopened frontal recess cells. With the exception of a destabilized middle turbinate, all these anatomic findings are suggestive of incomplete surgery that has led to persistent sinus obstruction and surgical failure. Hence, one of the basic tenets of maximal technique is to ensure complete removal of all obstructing bony partitions and to maximally enlarge diseased sinus ostia to help reduce this risk of scarring and stenosis.

ETIOLOGIC FACTORS

Maximal techniques in ESS are also supported by an increased understanding of the pathogenesis of recalcitrant CRS. Kennedy and colleagues[9–12] have previously described histologic and endoscopic evidence of underlying bony inflammation in patients with persistent mucosal disease. These features can be appreciated on computed tomography (CT) scans where there is increased bone density or thickening in the paranasal sinuses. Both animal and clinical experiments have shown increased bone remodeling in these regions. Although bacteria have never been demonstrated within the bone itself, these areas of bony osteitis may be a significant source of persistent mucosal inflammation. Although areas of bony thickening along the skull base and medial orbital wall should be left intact, one should attempt to remove all osteitic bony partitions in the ethmoid labyrinth or in the frontal recess to help prevent disease recurrence. Minimal techniques aimed at only opening transition spaces do not address this potential contributing factor in recalcitrant CRS.

More recently, there have been numerous studies that have implicated biofilms as a potential etiologic factor in CRS.[13] Biofilms are a ‘‘structured community of bacterial cells enclosed in a self-produced polymeric matrix.’’[14] One of their unique and challenging characteristics is their adherent nature on sinus mucosa and their ability to resist systemic antibiotics and evade host defenses.[15] Consequently, new strategies including delivery of topical antibiotics to achieve high local minimum inhibitory concentrations as well as surfactants to increase mucociliary clearance have been employed, with promising results both in in vitro and limited clinical studies.[16–20] Most of these medications are delivered to the nasal cavity as an irrigation wash with topical saline. However, the effectiveness of these treatments is based on the premise that irrigations efficiently reach and coat the paranasal sinuses. This concept has recently been investigated by a cadaver study performed by Harvey and colleagues.[21] In this experiment, the effectiveness of sinus irrigation was studied in the nonoperated state and also