

THE RATIONALE FOR ENDOSCOPIC INFERIOR METAL ANTROSTOMY: A REVIEW

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ABSTRACT

Background: Complete removal of some maxillary sinus pathologies may be challenging. We describe our experience in performing endoscopic inferior meatal antrostomy (EIMA) when approaching certain chronic maxillary sinus disease. **Methods:** Retrospectively reviewing charts of all patients whose surgery included EIMA between the years 2012 and 2015. EIMA was performed either after routine endoscopic middle meatal antrostomy (EMMA) failed to completely resect the lesion, or as the sole selected approach for specific maxillary pathologies. **Results:** A total of 56 patients were included in the study. Indications for EIMA included antrochoanal polyps (ACP), maxillary sinus chronic inflammatory disease, maxillary sinus pathology before sinus lift, and odontogenic maxillary sinusitis. In nearly one third of the patients, sinus surgery included only EIMA, of which, the majority were resection of ACP. Follow up time ranged between 12 and 34 months (mean 14). Residual EIMA opening was variable in size. In the vast majority of our patients, the maxillary sinus cavities were cleared of disease. No major complications and no recirculation were observed in any of the patients. **Conclusion:** EIMA should be considered for various maxillary sinus pathologies. It provides better access to anteroinferior lesions of the maxillary sinus. EMMA is not mandatory for every maxillary sinus disease.

KEYWORDS: Antrochoanal polyp, Endoscopic inferior meatal antrostomy, Maxillary sinus cyst, Maxillary sinusitis, Middle meatal antrostomy.

INTRODUCTION

The inferior meatal nasoantral window is traditionally part of the Caldwell-Luc procedure^[1, 2], a surgery that involves a direct transoral-transcanine fossa approach to the maxillary sinus cavity through its anterior wall. In patients with chronic maxillary sinusitis, the naso antral window was used to improve sinus drainage based on gravitation.^[3] Following Messerklinger's^[4] observation in the 1980s, the concept of a natural sinus ostium, with its relevant draining pathways, was recognized and accepted, and the functional endoscopic sinus surgery (FESS) technique became internationally accepted.

FESS has evolved over the years and is now considered the standard approach for surgical management of chronic rhinosinusitis.^[5] With the growing recognition that an opening in the inferior meatus is not relevant to improve sinus drainage, approaches via endoscopic middle meatal antrostomy (EMMA) are routinely used to improve drainage and as the port of entry to the sinus cavity.

Consequently, Caldwell-Luc procedures using the

nasoantral window have been largely abandoned in the treatment of maxillary sinusitis and are rarely used today. Although the FESS technique is appropriate in the vast majority of chronic rhinosinusitis patients, performing EMMA for maxillary disease is questionable in two scenarios.

The first case involves resecting maxillary sinus lesions that are not secondary to ostiomeatal complex (OMC) mucosal disease. The second case involves removal of maxillary sinus lesions located at the anteroinferior or anteromedial aspect of the maxillary sinus. Due to the superior position of the maxillary ostium, these lesions might be difficult to approach with a routine EMMA, and may be better accessed endoscopically through antrostomy that is located more inferiorly and anteriorly. Based on these considerations, we have modified the inferior meatal nasoantral window to a transnasal endoscopic technique that avoids violation of the OMC and provides better access to anterior-inferior maxillary sinus lesions.

In the current study, we aim to describe our experience in using transnasal EIMA in the management of chronic

lesions involving the maxillary sinus. Materials and Methods Patients. We retrospectively reviewed the files of all patients whose surgery included EIMA from 2012 to 2015.

Reviewed were age, surgical indications, surgical approach, follow-up period, complications, and endoscopic postoperative appearance. Special attention was given to the detection of late recirculation occurrence, defined as thick mucus seen moving between the inferior antrostomy and the middle meatal opening. Due to the technical nature of this study, the follow-up concentrated on objective findings and not on the patient's subjective report. The study was approved by the local institutional ethics committee.

Surgical Techniques

An initial meticulous review of the preoperative CT scan was performed. Particular care was given to precisely define the lesion's location inside the maxillary sinus, and the height of sinus floor relative to its medial wall.

EMMA Surgical Technique

Following retrograde uncinate process resection, identification and enlargement of the natural maxillary sinus ostium were performed. Once a satisfactory endoscopic visualization of the maxillary sinus was achieved, resection of the sinus lesion was initiated. Complete disease elimination was attempted using 45- or 70-degree endoscopes, irrigation, curved instruments such as House Middleton forceps, 90-degree curettes, and 45- or 60-degree microdebriders.

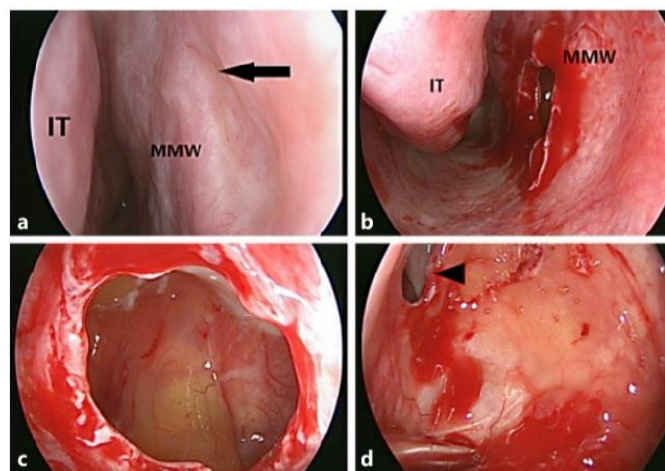


Fig. 1. Endoscopic inferior antrostomy stages. **a** A 0-degree endoscopy of the left inferior meatus, inferior turbinate (IT), Hasner's valve (arrow), and medial maxillary wall (MMW) is shown. **b** A 0-degree endoscopy of the left inferior meatus is shown. IMA was performed 0.5 cm posterior to Hasner's valve. **c** A 45-degree endoscopic view through the IMA to the left maxillary sinus cavity is shown. ACP is seen emerging from the anterolateral sinus wall. **d** A 45-degree endoscopic view through the IMA following ACP excision. The accessory ostium of the maxillary sinus is seen from inside the maxillary sinus cavity (arrowhead). IMA, inferior meatal antrostomy.

EIMA Surgical Technique

A 0.5 × 3-inch neuropatty soaked in 1: 1,000 adrenalin was inserted lateral to the inferior turbinate. The inferior turbinate was gently medialized with a freer elevator. The inferior opening of the nasolacrimal duct, or Hasner's valve, was identified (Fig. 1a). About 5 mm posterior to the valve, the medial maxillary wall was penetrated by a 3-mm curved suction cannula. The small hole was widened using cutting forceps posteriorly and a pediatric backbiter anteriorly, taking care not to injure the nasolacrimal duct. An 8–10-mm antrostomy was created (Fig. 1b). A 0-degree endoscope was used to view the posterior maxillary wall, and a 45-degree endoscope was then used to view the lateral and anterior portions of the sinus (Fig. 1c, d). Straight and curved instruments, including curved shavers, were used to access the relevant areas. Following lesion removal, the inferior turbinate was lateralized to its original position.

Tamponade was not required.

RESULTS

Overall, 56 patients underwent ESS procedures that included EIMA. Patient's age ranged from 17 to 77 years (mean 52 ± 13). Indications for ESS included antrochoanal polyp (ACP) in 25 (45%) patients, maxillary sinus pathology before sinus lift (large retention cysts) in 13 (23%), chronic maxillary sinus inflammatory disease (fungal balls or tenacious secretions) in 11 (20%), odontogenic maxillary sinusitis in 6 (11%), and a detached dental implant in the sinus cavity in 1 (2%) patient. In 38 (68%) patients, EIMA was performed only after failure to reach or completely clear the lesion through MMA, while in 18 (32%) patients, only EIMA was performed to remove the lesion. Among these 18 patients, 12 (71%) presented with ACP, 5 (28%)

presented with maxillary sinus pathology before sinus lift (4 with large retention cysts and 1 with a maxillary sinus ectopic tooth), and 1 patient presented with a dental implant that was unintentionally inserted into the sinus cavity. In all EIMA-only cases, completion of resection by EMMA was Patient follow-up time ranged from 12 to 34 months (mean 14). The patients were followed 10 days, 3 weeks, 3 months, 1 year, and yearly or as needed postoperatively. The postoperative cleaning and examining of the inferior meatus was short and easy.

The residual EIMA opening diameter ranged from 0 to 15 mm (mean 6.2 ± 4.7), EIMA openings were closed in 8 patients (14%). The average postoperative diameter was 6.6 mm for the EIMA only group and 5.8 mm for the EMMA+EIMA group. In a follow-up of at least 1 year, 52 of 56 (93%) patients had clear maxillary sinus cavities. Recurrent fungal ball and recurrent ACP were not observed. Recirculation was not observed during the follow-up period. Recurrent small cysts were observed in 4 (7%) patients but their significance is uncertain.

Minor synechiae between the inferior turbinate and the maxillary sinus medial wall were observed in 4 (7%) patients. No major complications such as nasolacrimal duct injury or bleeding were observed in any of our patients. Two patients reported palatal paresthesia that subsided after several months.

DISCUSSION

Since the introduction of FESS at the end of the 20th century, a paradigm shift has occurred.^[5-7] Messerklinger's characterization of the mucociliary clearance mechanism led to a change in surgical management from addressing the sinus cavities themselves to a focus on the sinus ostia and their drainage pathways in the middle and superior meati.^[4] Following many years of experience with the traditional endoscopic techniques, we pose the question again: can we reach, and even improve patient outcomes with less intervention and lower morbidity?

In this study, we introduce our experience in treating some maxillary sinus pathologies by approaching the sinus cavity via inferior antrostomy performed in the medial wall of the sinus beneath the inferior turbinates. In 38 of 56 (68%) patients, EIMA following EMMA improved the accessibility to the lesion within the sinus and enabled complete resection. Moreover, in 18 of 56 (32%) patients, EIMA was the only performed approach and was found to be successful in clearing the sinus pathology. In patients who underwent EIMA-only surgery, the postoperative endoscopic treatment was short and minimal, as middle turbinate scarring and middle meatal patency were not shown to be a concern. Inferior antrostomy is performed significantly lower and anterior to the middle antrostomy, and hence provides an easier access to the anteroinferior portions of the maxillary sinus. Using this technique, we could efficiently access almost all corners of the maxillary

sinus, though anterior medial lesions may be challenging.

One may doubt the accessibility of the instruments to reach the prelacrimar region. It is important to remember here that Hasner's valve is located well above the nasal floor, at the junction of the inferior turbinate with the medial maxillary wall. As such, when needed, it is possible to anteriorly enlarge the inferior antrostomy below Hasner's valve, for full exposure of the sinus anteromedial corner, using Kerrisons or angled drills. There are no absolute contraindications for EIMA, however, severe adhesions and distorted anatomy due to previous intervention should be dealt with caution. Rarely, an hyperostotic medial maxillary wall requires the use of an angled diamond drill. Several endoscopic surgeons had tried before to improve their surgical approach to the maxillary sinus. Nour^[8] described their successful experience in resection ACP located anteriorly, inferiorly, or medially within the maxillary sinus, by expanding the EMMA inferiorly. They fractured and downward displaced the inferior turbinate and performed submucosal resection of the lateral bony skeleton of the inferior meatus. Zhou et al.^[9] describe the intra nasal endoscopic prelacrimar recess approach, addressing the maxillary sinus anteriorly after removing the anterior bony portion of the nasal lateral wall, dissecting the nasolacrimal duct. Compared to the approaches described above, we find our EIMA technique for approaching the maxillary sinus easier, less aggressive, and it preserves the inferior turbinate as well as the nasolacrimal duct, and is associated with removing a relatively smaller area of bone.

Moreover, EIMA can be performed alone without performing EMMA for some pathologies all while improving significantly the accessibility to the maxillary sinus. Our modification of EIMA is far from resembling the nasoantral window as described and performed in the Caldwell-Luc procedure. In the era of angled instruments and endoscopes, the advantages of a direct intramaxillary approach via the inferior meatus cannot be overlooked. This is especially true when considering the alternative approaches mentioned, such as the canine fossa approach, mega antrostomy, or medial maxillectomy.^[13, 14] In view of the unfavorable angle for reaching the inaccessible areas of the sinus using the MMA approach, an endoscopic canine fossa approach to the maxillary sinus in severe disease and nasal polyposis has been recently described in detail.^[15,16] However, to avoid the known disadvantages of the transcanine approach (facial swelling, facial numbness, teeth/gum numbness, and the need for surgical assistance), we prefer to use the routine transnasal endoscopic approach to reach these remote areas. Moreover, using the natural nasal corridor avoids violation of the oral anatomy, enabling future maxillary dental implantation, with or without sinus lift, in an anatomical field with no previous intervention.

We believe that EIMA is a safe and effective procedure for various maxillary sinus pathologies. We suggest

considering EIMA for the following diagnoses: ACP, maxillary sinus pathology (large retention cyst) before sinus lift, chronic maxillary sinus inflammatory disease (fungal ball or tenacious secretion), odontogenic maxillary sinusitis, and foreign body (such as detached dental implant) in the sinus cavity. The decision of whether to use EIMA alone or following EMMA depends upon the surgeon's experience and whether the disease is secondary to OMC mucosal thickening or not. This study challenges the dogma of surgically approaching the middle meatus in every patient with chronic maxillary sinus disease.

When performed alone, EIMA avoids violation of the OMC. A classic example for such a surgery is the excision of the ACP. Usually, the ACP root is located in one of the maxillary sinus walls, and only rarely in the OMC region. Therefore, ACP involvement is usually not secondary to OMC mucosal disease. Previously, we started ACP surgery using EMMA, and continued with EIMA only in cases where the root was inaccessible. Later on, in view of our good results, we abandoned EMMA in most cases, and we currently use EIMA only for total resection of the ACPs. Our long-term follow-up has not shown increased recurrence, and a separate study is now being conducted to evaluate the outcome of the ACP patients. Furthermore, for foreign bodies in the maxillary sinus cavity, such as the detached dental implant in the current series, the EIMA approach is especially suited, and opening the normal mucosal OMC is obviously unnecessary in these cases.

Despite a careful and targeted endoscopic examination, recirculation was not detected in any of our patients. Recirculation usually involves the maxillary sinus natural ostium and an accessory Ostium at the posterior fontanelle.^[17] When the additional antrostomy is anterior and inferior, we assume that due to the ciliary known pathways, the secreted sinus mucus bypasses the iatrogenic hole on its way to the natural ostium and nasal cavity. Every surgical technique has limitations, and EIMA is no exception. There is a learning curve in performing EIMA, while the endoscope and the surgical tools are positioned in the narrow space lateral to the inferior turbinate. Although none of our patients had epiphora following surgery, the risk for severing the nasolacrimal duct should be taken into consideration, especially in the pediatric population due to the smaller corridor and in anteromedially located lesions with unfavored working angle. In the latter group, a prelacrima approach with removal of the medial buttress is required and even if this is performed beneath the Hasner's valve, it still carries the risk for nasolacrimal duct injury. In addition, during the endoscopic follow-up of the maxillary sinus, it is hard to identify that a surgical procedure has taken place due to the hidden and small residual inferior antrostomy.

To overcome this limitation, we found the 2.7-mm pediatric flexible endoscope very efficient for full

assessment of the maxillary sinus cavity through the inferior antrostomy. In addition, in the case of ACP, the usually preserved accessory ostium can assist the pediatric endoscope. Although a prospective study comparing a group of patients undergoing EMMA without EIMA to those operated using this window would be ideal, we have come to find that it is unjustified to avoid the EIMA approach and probably leave residual disease behind in cases where the pathology is found in remote and inaccessible areas of the sinus cavity. We would like to clarify that although this study recommends EIMA for selected patients, the vast majority of maxillary sinus pathologies are preferably addressed by the traditional EMMA.

CONCLUSION

EIMA should be considered for various maxillary sinus pathologies. In selected patients, it provides better access to anteroinferior lesions of the maxillary sinus, and in certain pathologies, it avoids unnecessary violation of the OMC. Although indicated for most cases, EMMA is not mandatory for every maxillary sinus disease.

Statement of Ethics

The study was approved by the local Institutional Review Board and was conducted in accordance with the Helsinki Declaration. Disclosure Statement The authors declare that they have not received any financial support and that they do not have any relationship that may pose a conflict of interest.

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