

# Modified endoscopic inferior meatal fenestration with mucosal flap for maxillary sinus diseases

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## Abstract

**Introduction:** This is a novel minimally invasive surgical method for maxillary sinus mucocoeles and antrochoanal polyps.

**Aim:** To describe a modified technique of inferior meatal fenestration with a mucosal flap for maxillary sinus diseases and to present a case series of subjects who underwent this procedure. The novel surgical technique and indications for this approach are also discussed.

**Material and methods:** The authors analyzed data from 32 cases involving patients who underwent resection of maxillary sinus mucocoeles and antrochoanal polyps via modified endoscopic inferior meatal fenestration with a mucosal flap in the period from January, 2011 to January, 2016. The group included 19 men and 13 women, and the patients' mean age was 36.2 years (range: 11–56 years). Preoperative and postoperative imaging studies were available in all cases and were reviewed.

**Results:** Thirty-two cases are included in this study. The appearance of nasal and (or) maxillary sinus mucosa was observed in the follow-up at 1 month, 3 months and 6 months using endoscopes. Postoperative computed tomography was performed for only 9 patients in this study. The mean follow-up period was 56 (range: 10–82) months in these cases. All patients had an uneventful post-operative period. Postoperative symptoms were relieved gradually for 1 to 2 weeks after the operation. No patients experienced recurrent symptoms related to the mucocoele. Mucocoele and polyps recurrence was not observed. No patient showed re-stenosis and obstruction of the nasal cavity, facial pain or numbness during follow-up.

**Conclusions:** Maxillary sinus mucocoeles and antrochoanal polyps are completely excised via modified endoscopic inferior meatal fenestration with a mucosal flap. It could keep the nasal lateral wall intact.

**Key words:** modified, inferior meatal fenestration, maxillary sinus mucocoeles, maxillary sinus antrochoanal polyp.

## Introduction

Maxillary sinus mucocoeles and antrochoanal polyps are benign, common lesions. Before the era of endoscopic surgery, the Caldwell-Luc operation had been proposed for the resection of maxillary sinus mucocoeles and polyps. However, this approach always resulted in some form of morbidity, such as facial numbing and maxillary bone thickening after

the procedure [1–3]. The endoscopic approach has gained popularity over the past 15 years for treatment of maxillary sinus mucocoeles [4, 5]. After the introduction of endoscopic techniques, many papers were published describing an intranasal endoscopic approach to enlarge the maxillary ostium and/or inferior meatal fenestration for maxillary sinus mucocoeles or antrochoanal polyps and its application [4–6].

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Maxillary ostium enlargement is a commonly used procedure to excise mucocèles or antrochoanal polyps, especially those located in the posterolateral wall of the maxilla. Nevertheless, postoperative recurrence of the lesion is reported to be relatively high [5], and this was also observed in our clinical practice.

To tackle this problem, endoscopic approaches to the maxilla through an inferior meatal fenestration creating a permanent communication between the nasal cavity and the maxilla have been described [6]. Based on this concept, we developed a modified surgical method with an inferior meatal fenestration, which can lead us directly to the maxillary sinus and also keep the lateral nasal wall intact postoperatively. Here we report 32 cases including maxillary sinus mucocèles and antrochoanal polyps resected by modified endoscopic inferior meatal fenestration with a mucosal flap. We also discuss the other indications for this procedure.

## Aim

The aim of the study was to describe a modified technique of inferior meatal fenestration with a mucosal flap for maxillary sinus diseases and to present a case series of subjects who underwent this procedure. The novel surgical technique and indications for this approach are also discussed.

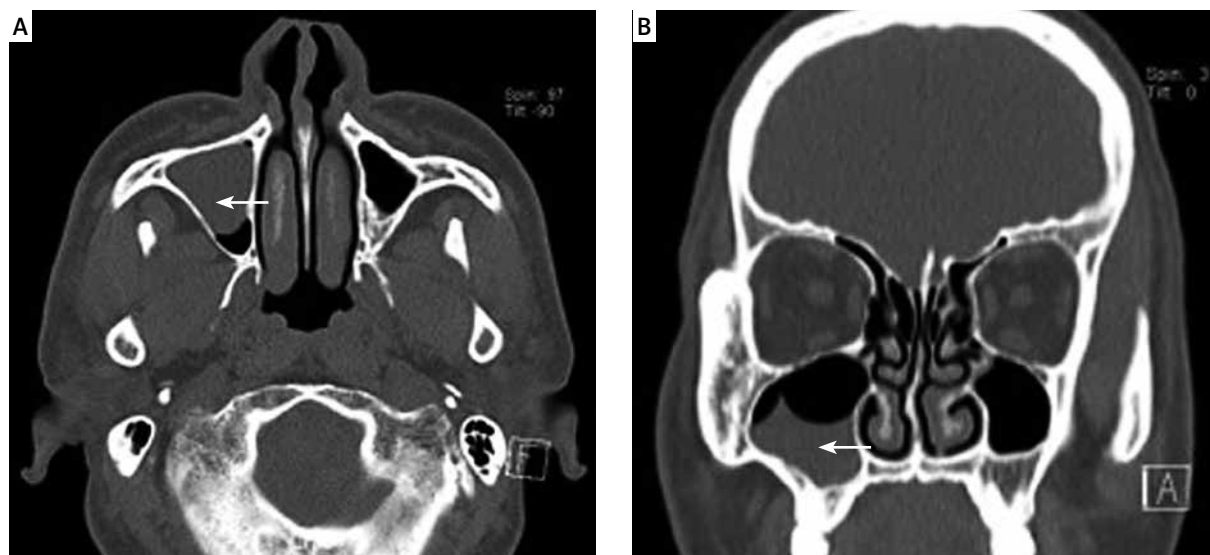
## Material and methods

This retrospective study included 23 patients with maxillary sinus mucocèles and 9 patients with antrochoanal polyps who were operated on between January 2011 and January 2016. There were 19 males and 13 females, with a mean age of 36.2 years (range: 11–56 years). Preoperative evaluation included computed tomography of the paranasal sinuses studies and routine laboratory examinations. All patients underwent modified endoscopic inferior meatal fenestration with a mucosal flap with or without maxillary ostium enlargement under general anesthesia with controlled hypotension.

Image guidance was used to confirm the location of the mucocèle or antrochoanal polyp. On the computed tomography (CT) scan it was seen that the mucocèles and antrochoanal polyps were located on the anteromedial wall or anterolateral wall or floor of the maxillary sinus. The bony wall of the maxillary sinus cannot be absorbed (Photo 1). We used Karl Storz high definition endoscopy with 0°, 30° and 70° endoscopes (Karl Storz), and a unipolar electric knife and other power instrumentation made by Medtronic.

### Surgery 1. Simply modified endoscopic inferior meatal fenestration with mucosal flap

The patient is placed under general anesthesia. A curved incision of about 12 mm is made starting



**Photo 1.** **A** – Axial CT scans showing only maxillary sinus with soft tissue density shadows on the right (white arrow). **B** – Coronal CT scans of a patient with soft tissue density shadows located inferiorly in the right maxillary sinus (white arrow)

below the cephalic end of the inferior turbinate to the nasal floor after infiltrating the area with 1 : 10 000 epinephrine and saline. After elevation of the mucosal flap, a chisel and bone forceps are used to remove part of the bony lateral wall of the inferior meatus about 10 mm to the rear of the incision, exposing the maxillary sinus. The window size is about 10 mm × 10 mm. The maxillary sinus mucocoeles and polyps are visualized through this fenestration using 4-mm-diameter 0°, 30° and 70° endoscopes. The lesions are then cleared out using straight and upturned Blakesley forceps and a powered microdebrider (Medtronic). The mucosal flap is repositioned and the incision is closed with an absorbable suture, thus covering the window made in the bony lateral nasal wall and restoring lateral nasal wall continuity (Figure 1 and Photo 2). No postoperative packing was done.

### Surgery 2. Maxillary ostium enlargement combined with modified endoscopic inferior meatal fenestration with mucosal flap

In patients with antrochoanal polyps, functional endoscopic sinus surgery is performed on the affected side. Under general anesthesia the middle turbinate is medialized and middle meatal structures are identified using a 0° endoscope. After making an incision on its mucosa, the uncinete process is resected using a Blakesley forceps. The maxillary sinus natural ostium is visualized using a 30° endoscope and probed with a curved probe. The ostium is enlarged with forceps and a backbiting bone punch. The polyps are then removed using maxillary sinus forceps and a powered

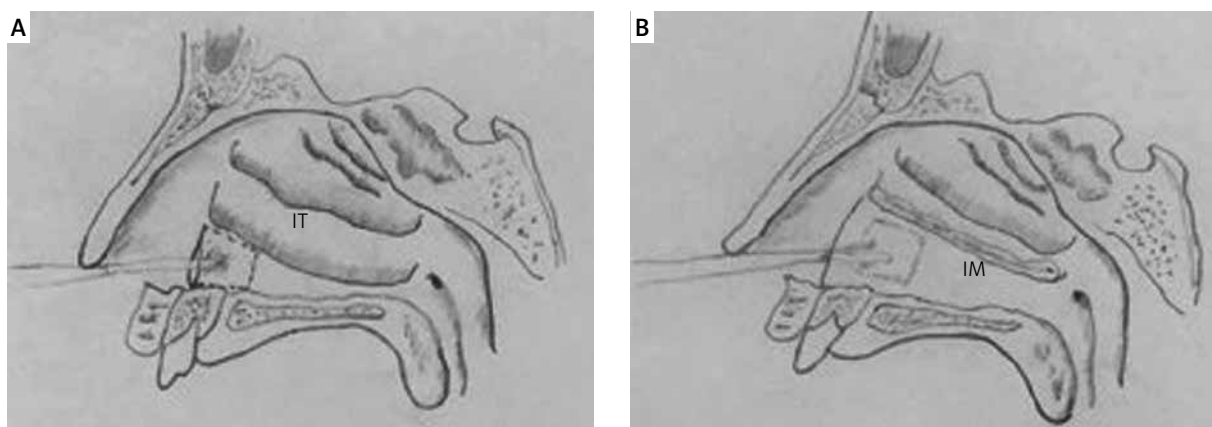
microdebrider. If the polyps are seen to be located in the anteromedial wall, anterolateral wall or floor of the maxillary sinus, an additional endoscopic modified inferior meatal fenestration with a mucosal flap is also done to remove the remnant polyps (surgery 1). After the incision is sutured, a bioresorbable nasal dressing (Nasopore, Polyganics) is placed in the middle meatus.

### Results

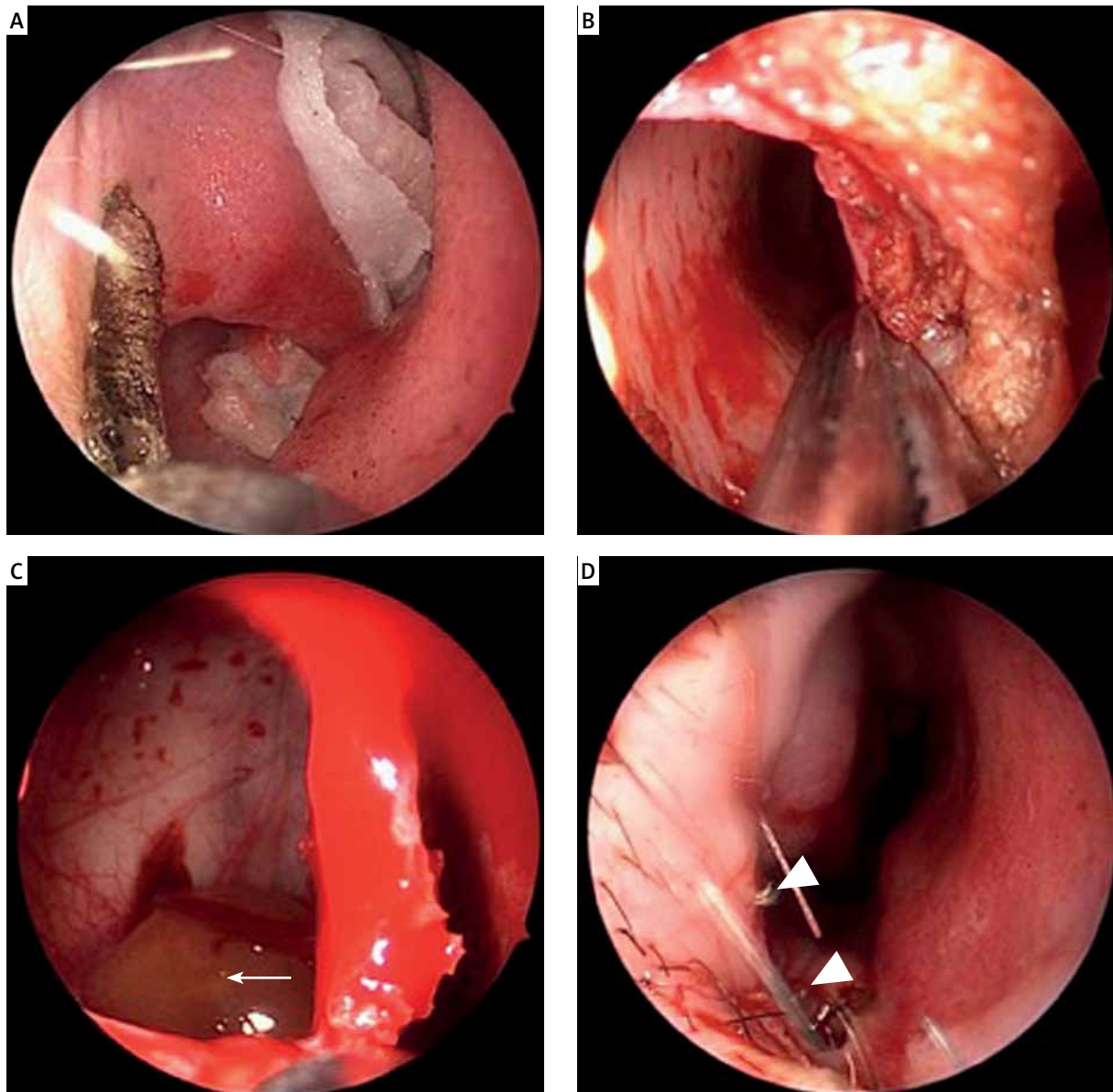
Patient demographics are summarized in Table I. In the postoperative period patients had facial swelling, facial and/or dental pain and nasal obstruction. These symptoms gradually decreased in 1–2 weeks.

Patients were discharged on the same day after the procedure. They were followed up in the clinic at 1, 3 and 6 months postoperatively. The appearance of nasal and/or maxillary sinus mucosa was observed at follow-up using 4-mm-diameter 0°, 30° and 70° endoscopes. Postoperative CT was performed for only 9 patients in this study. The mean follow-up period was 56 (range: 10–68) months in these cases. The surgical outcome was based on the appearance of nasal and/or maxillary sinus mucosa, no nasal obstruction, rhinorrhea, headache and resolution of clinical symptoms.

Among the 23 cases with maxillary sinus mucocoeles, 5 patients had a recurrent disease. There were 3 cases of recurrence among the 9 antrochoanal polyps. All the 8 recurrent cases had a history of previous endoscopic middle meatal antrostomy to remove the lesion. We performed endoscopic modified inferior meatal fenestration with a mucosal flap in all recurrent cases and it was seen that 3 cases



**Figure 1.** Diagrams of modified endoscopic inferior meatal fenestration with mucosal flap approach  
IT – inferior turbinate, IM – inferior meatus.



**Photo 2.** Intraoperative endoscopic images. **A** – The incision is made vertically below the cephalic end of the inferior turbinate to the nasal floor. **B** – After elevation of the mucosal flap, the nasal lateral bony wall was observed using the 0° endoscope. **C** – The medial bony wall of the maxillary sinus is removed. Mucocoeles located inferiorly was observed through the opening (white arrow). **D** – The flap is repositioned and sutured in place (white arrowheads)

**Table 1.** Summary of demographics and clinical characteristics of patients who underwent resection of mucocoeles and antrochoanal polyps

Disease	Number		Location			Surgery 1	Surgery 2	Complications	Recurrence
	Primary	Recurrent	AM	AL	I				
Mucocoeles	18	5	5	7	10	9	14	No	0
Polyps	6	3	5	2	2	0	9	No	0

AM – anteromedial wall of maxillary sinus, AL – anterolateral wall of maxillary sinus, I – inferior wall of maxillary sinus.

of mucocèles were located anteromedially, 2 cases antero-inferiorly, and 3 cases of antrochoanal polyps anteromedially in the maxillary sinus.

**Follow up**

Postoperatively, all patients who underwent modified inferior meatal fenestration with a mucosal flap with or without middle meatal antrostomy had an intact lateral nasal wall and a patent middle meatal antrostomy at the follow-up visits. No patient showed re-stenosis and obstruction of the nasal cavity, facial pain or numbness during the follow-up (Photos 3 and 4). None of the patients with mucocèles or antrochoanal polyps had a recurrence. However, the maxillary sinus of patients with antrochoanal polyps showed evidence of mucosal edema when observed with a 30° and 70° endoscope.

In addition, there were no major complications, such as profuse or delayed bleeding, wound infection, or orbital or nasolacrimal duct injury following the procedure.

**Discussion**

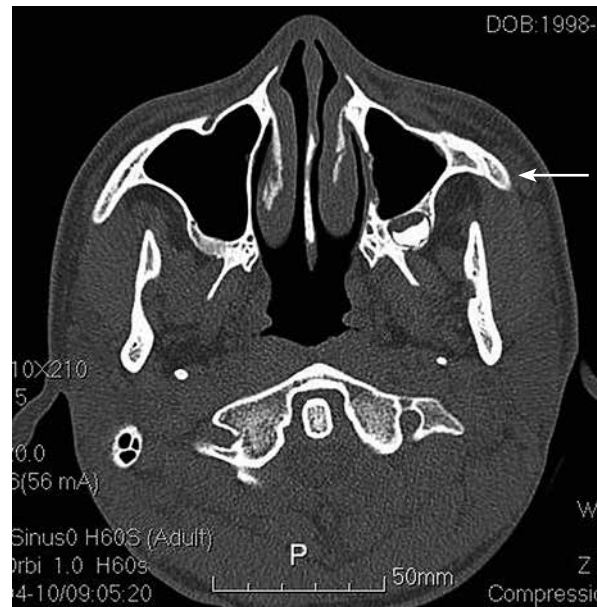
Maxillary sinus mucocèles and antrochoanal polyps can be resected by several surgical methods. Historically, the recommended approach for maxillary sinus mucocèles was complete excision through

a simple Caldwell-Luc (CL) operation or a lateral rhinotomy incision [1, 2]. The Caldwell-Luc procedure was first described over 100 years ago. Esther Kim reported that 10% of patients undergoing a CL operation with mucosa removal require a second CL operation due to either mucocèle formation or granulation tissue formation causing blockage to secretions with continued infection, and other complications include inferior orbital nerve paresthesia, dental numbness, and maxilla pain with weather change [3]. DeFreitas reported facial asymmetry, dacryocystitis, and devitalized teeth [7].

Since the introduction of endoscopic techniques in the 1990s, functional endonasal sinus surgery (FESS) have been performed to resect maxillary sinus mucocèles and antrochoanal polyp, instead of the Caldwell-Luc procedure, such as endoscopic partial medial maxillectomy and endoscopic middle meatal antrostomy and endoscopic inferior meatal antrostomy [4–6]. The endoscopic technique has gained popularity with its advantages of avoiding external incisions, being a minimally invasive technique and having a shortened postoperative recovery period [1, 5]. However, endoscopic surgery for maxillary sinus mucocèles and antrochoanal polyps does have limitations. A study by Saito *et al.* described 26 cases of postoperative maxillary sinus mucocèles, and reported inability to endoscopically treat mucocèles



**Photo 3.** Image of nasal cavity at follow-up 1 month using 0° endoscopes



**Photo 4.** Axial CT scans showing left maxillary sinus at 3 months postoperatively (white arrow) (another patient)



located in areas distant from the nasal cavity. Mucoceles could not be sufficiently opened to the middle meatus. Four of the 26 (15%) subjects even required extranasal surgery, via sublabial incision, due to difficulty accessing the mucocele endonasally [8].

In our clinical experience, if lesions were located in the anteromedial wall or anterolateral wall or floor of the maxillary sinus, the endoscopic enlarging maxillary sinus ostium approach can still be difficult, even if an angled endoscopic is used. To fully expose the media and inferior aspect of the maxillary sinus, inferior meatal fenestration was performed to resect these lesions. However, the medial wall of the postoperative maxillary via the inferior meatal fenestration approach formed a permanent window through which the maxillary sinus and the nasal cavity communicate. The result may lead to the circulation of the secretions of the maxillary sinus. Consequently, we improved inferior meatal fenestration. The incision is made vertically below the cephalic end of the inferior turbinate to the nasal floor; the whole mucosa of inferior meatus is carefully stripped and preserved before exposing the medial wall of the maxillary sinus. Before we finished the operation, the inferior turbinate flap was repositioned to its previous orientation (lateral wall) and the incision sutured, with the aim of this approach being to keep the nasal lateral wall intact. This entrance to the maxillary sinus looks narrow, but it is wide enough for lesions located medially, inferiorly or anterolaterally in the maxillary sinus. The only blind spot is the anterior wall of the maxillary sinus in this approach. Lesions in this region were excised via the prelacrimar recess approach (PLRA) [9]. Compared with endoscopic PLRA, the advantage of modified endoscopic inferior meatal fenestration with a mucosal flap is less damage of the nasal lateral wall.

In our retrospective analysis of cases, 8 of 34 cases were recurrences and were treated by second surgery – modified endoscopic inferior meatal fenestration with a mucosal flap, mostly located in the anteromedial wall or anterolateral wall or inferior wall. The lesions in these areas are relatively easy to relapse. The youngest is 11 years old in these patients. She was a patient with a recurrent antrochoanal polyp, located in the anteromedial wall of the maxillary sinus. Endoscopic middle meatal antrostomy was performed in the first operation. So the second surgery was used this approach. Recurrence, re-stenosis and obstruction of the nasal cavity were

not observed during 12-month follow-up. Therefore, we recommend that the lesions could be resected via modified endoscopic inferior meatal fenestration with a mucosal flap. It allows for preservation of maxillary sinus structure and function. Based on our experience with 32 cases, this modified procedure is easy and safe, and wound healing is rapid.

## Conclusions

Correctly selected ways of surgery are critical. Modified endoscopic inferior meatal fenestration with a mucosal flap is a novel minimally invasive procedure for maxillary sinus mucoceles and antrochoanal polyps. Provided that indications for this approach are selected correctly, with appropriate endoscopic surgical technique, this procedure is suitable for clinical application.

## Conflict of interest

The authors declare no conflict of interest.

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