

# Endoscopic medial maxillectomy with preservation of inferior turbinate and nasolacrimal duct

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## ABSTRACT

**Background:** Endoscopic medial maxillectomy (EMM) is a safe and effective procedure for treatment of inverted papilloma (IP) originating from the maxillary sinus. However, EMM usually removes the inferior turbinate and nasolacrimal duct. The inferior turbinate has a critical function in conditioning of the nasal airflow, and resection of the nasolacrimal ducts has a risk of epiphora. We developed a newly derived surgical technique, endoscopic modified medial maxillectomy (EMMM), which enables preservation of the inferior turbinate and nasolacrimal duct.

**Methods:** A retrospective case series of six patients with IP and nine patients with mucocoeles of the maxillary sinus after a Caldwell-Luc operation, who underwent surgery using the EMMM technique, were reviewed.

**Results:** In patients with IP, there were no recurrences for a mean follow-up of 16.7 months. Eight of nine patients with mucocoeles of the maxillary sinus showed patency. All patients showed preservation of the inferior turbinate. One patient with mucocoele was referred for dacryocystorhinostomy because of epiphora.

**Conclusion:** EMMM produces access to the maxillary sinus identically to conventional EMM, despite preservation of the inferior turbinate and nasolacrimal duct.

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**I**nverted papilloma (IP) is a benign sinonasal tumor with the ability to recur after removal and a risk of malignant conversion. An external approach, such as lateral rhinotomy or midfacial degloving, has traditionally been recommended for this disease. However, with recent development of endoscopic sinus surgery, the endoscopic approach has become the gold standard.<sup>1</sup>

Endoscopic medial maxillectomy (EMM) is a safe and effective procedure for treatment of IP originating from the maxillary sinus, especially from the anteromedial and anterior walls.<sup>2,3</sup> EMM usually removes the inferior turbinate and nasolacrimal duct. However, the inferior turbinate has a critical function in conditioning of the nasal airflow. Extensive turbinate resection may impair the normal function of temperature adjustment<sup>4</sup> and alter nasal airflow, resulting in abnormal aerodynamics.<sup>5</sup> Once empty nose syndrome arises in patients, it is very difficult to treat.<sup>6</sup> Recent years have seen reports of EMM with preservation of the inferior turbinate.<sup>7,8</sup> The authors dissect the inferior turbinate, including the bone. We regard these as invasive and incomplete surgical procedures. It has been reported that the incidence of epiphora is as high as 30% when performing medial maxillectomy.<sup>3</sup> Recently, Nakamaru<sup>9</sup> advocated a new technique of preservation of the nasolacrimal duct when performing EMM. We devised EMM to preserve both the inferior turbinate and the nasolacrimal duct. We applied this endoscopic modified medial maxillectomy (EMMM) to IP of the maxillary sinus. In addition, we applied EMMM to mucocoeles of the maxillary sinus after Caldwell-Luc operations, which exist in superior anterior lesions (Fig. 1 A).

## METHODS

### Subjects

This study was a retrospective case series conducted between April 2010 and March 2011 at Jikei University Hospital, Tokyo, Japan. We

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The authors have no conflicts of interest to declare pertaining to this article

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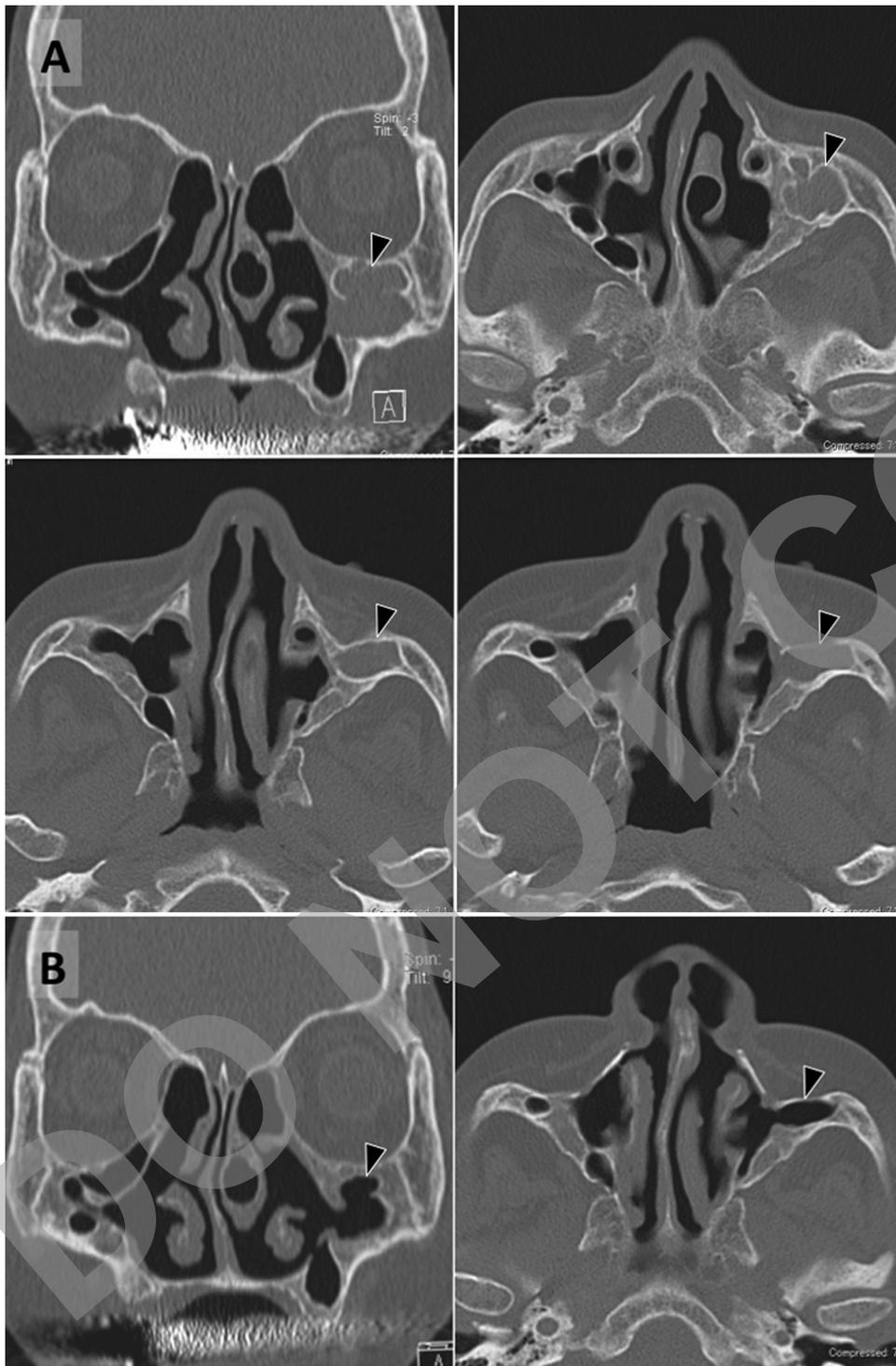
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performed EMMM on four patients with primary IP of the maxillary sinus, two patients with recurrent IP in which the tumor could not be sufficiently removed *via* a middle meatal antrostomy, and nine patients with mucocoeles of the maxillary sinus. In all of the mucocoeles patients, the nasal cavity was separated by a bone fragment and lesions existed in a superior anterior location. This study was approved by the Ethics Committee of Jikei University School of Medicine.

### Surgical Technique

EMMM was performed under general anesthesia (Fig. 2, A–E). In patients with IP, we first debulked the tumor by a powered microdebrider for better visualization. We created a mucosal incision in the lateral nasal wall parallel to the mucocutaneous junction directly behind the pyriform aperture. The incision was continued to the floor of the nose. The nasal mucosa was elevated from the lateral nasal wall, including the mucosa of the inferior turbinate. We cut the part of the inferior turbinate that was attached to the lateral nasal wall with a chisel or diamond burr. At that time, the inferior half of the inferior turbinate was preserved and we identified the nasolacrimal duct posteriorly. We removed the lateral nasal wall and exposed the nasolacrimal duct extensively with a diamond burr. The inferior turbinate posterior to the nasolacrimal duct was completely preserved. The nasal mucosa and nasolacrimal duct were then displaced medially and sutured to the nasal septum. In patients with mucocoeles of the maxillary sinus, we performed marsupialization for drainage into the inferior meatus. For IP, we drilled away the medial wall of the maxillary sinus with a diamond burr and identified the mucosa of the maxillary sinus so that we could enter the maxillary sinus. If the tumor was attached to the anterior wall of the maxillary sinus, we drilled away the posterior part of the pyriform aperture with a 70° diamond burr. It was then possible to observe and reach all regions of the maxillary sinus. A 0° endoscope was used for most parts of the maxillary sinus, while a 70° endoscope was used only for the inferior and anterior walls of the maxillary sinus. After removal of the tumor, the normal mucosa around the origin of the tumor was removed, and the underlying bone was drilled with a diamond burr. Finally, the transposed nasal mucosa and nasolacrimal duct were replaced; the anterior head of the transposed nasal mucosa was sewn to the lateral nasal wall. In patients with mucocoeles, the mucosa was used as pedicle flap to cover the exposed bone.



**Figure 1.** (A) Mucocoele of the maxillary sinus after Caldwell-Luc operation is shown on the left side (arrowhead). (B) Postoperative computed tomography reveals patency and preservation of the inferior turbinate 6 months after surgery (arrowhead).

## RESULTS

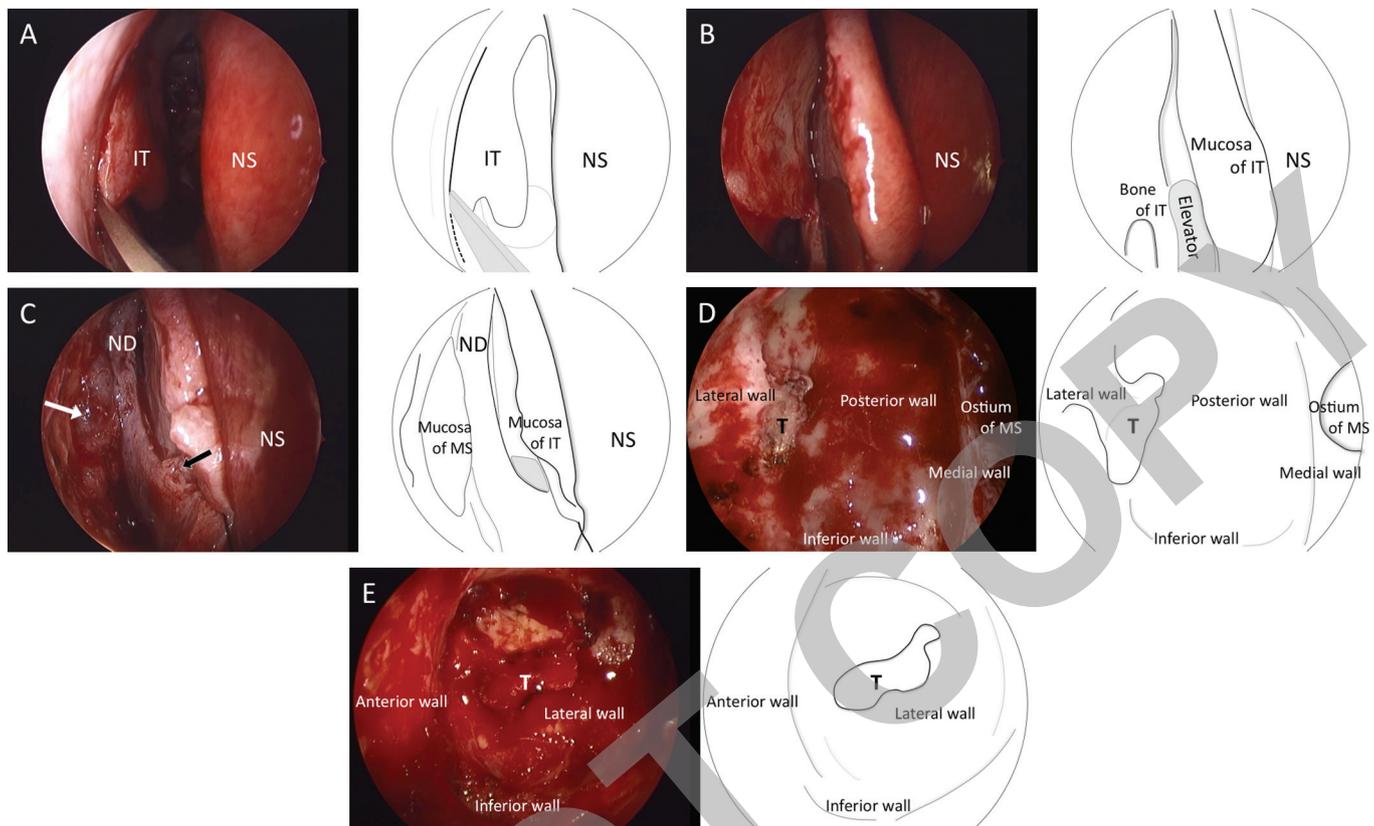
### Inverted Papilloma

Six patients had IP that originated from the maxillary sinus. The average age was 51.7 years (range, 36–72 years). Five of the patients were men. According to Krouse’s staging system,<sup>10</sup> one patient was in T2 and five patients were in T3. The average follow-up time was 16.7 months (range, 10–24 months). Patient characteristics are shown in Table 1. Postoperative endoscopy and/or imaging test (computed

tomography or magnetic resonance imaging) revealed no recurrence in any patient.

### Mucocèles of the Maxillary Sinus after Caldwell-Luc Operations

The average age of patients with mucocèles of the maxillary sinus after Caldwell-Luc operations was 60.4 years (range, 49–74 years). Five of the patients were men. Previous surgery had been performed 1.9 times (range, 1–4 times). The average follow-up time was 8.7



**Figure 2.** (A) Incision of the lateral nasal wall. (B) The nasal mucosa is elevated from the lateral wall. (C) Resection of the lateral nasal wall; part of the IT is attached to the lateral nasal wall. The ND and mucosa in the MS (white arrow) are identified. The anteroinferior part of the IT (black arrow) is preserved. The elevated mucosa is sutured to the nasal septum. (D) Endoscopic view (0°) inside the MS. (E) Endoscopic view (70°) inside the MS. The anterior wall of the MS is clearly visible. NS, nasal septum; IT, inferior turbinate; ND, nasolacrimal duct; MS, maxillary sinus.

**Table 1 Characteristics of patients with inverted papilloma**

No.	Age (yr)	Gender	Origin	Stage	Current Status	Follow-up (mo)
1	72	M	Lateral and anterior wall	T3	Disease free	24
2	51	M	Medial wall	T2	Disease free	22
3	43	M	Lateral wall	T3	Disease free	22
4	53	M	Anterior wall	T3	Disease free	13
5	55	F	Anterior wall	T3	Disease free	10
6	36	M	Anterior, medial, and inferior wall	T3	Disease free	10

months (range, 5–15 months). Postoperative endoscopy revealed that eight of nine mucoceles were patent after marsupialization (Fig. 1 B).

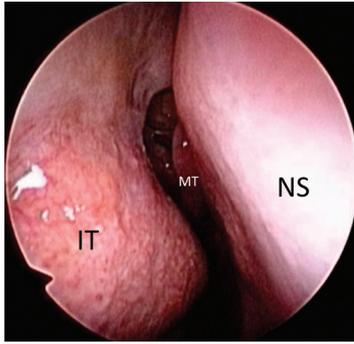
### Complications

One patient with a mucocele was referred for evaluation of epiphora within the first 2 months after surgery. Epiphora developed because an adhesion occurred between the preserved inferior turbinate and the mucocele. This patient had undergone submucosal turbinatectomy. We could not adequately preserve the mucosa of the inferior turbinate, and the adhesion obstructed the nasolacrimal duct. We performed a revision surgery including dacryocystorhinostomy. One patient had cheek swelling caused by slight postoperative bleeding, and discharge penetrated under the skin because of crammed nasal packing. The cheek swelling resolved after removal of the nasal packing. In all patients, the inferior turbinate was preserved, endoscopic findings showed a normal appearance (Fig. 3), and nasal breathing was satisfactory.

### DISCUSSION

In addition to preservation of the inferior turbinate and nasolacrimal duct, EMM produces access to the maxillary sinus identical to that of conventional EMM. It can maintain the morphology of the nasal cavity. Tsuta<sup>11</sup> performed the “swing technique” for chronic rhinosinusitis. This procedure is performed to reach the maxillary sinus ostium after complete resection of the inferior turbinate bone; some surgeons apply this procedure to IP.<sup>12</sup> However, we believe that preservation of the inferior turbinate is important to avoid empty nose syndrome.<sup>13</sup> Thus, we developed a modified surgical technique for IP and mucoceles of the maxillary sinus.

EMM has become a standard procedure for treatment of IP involving the maxillary sinus.<sup>2,3</sup> Some patients who underwent EMM complain of empty nose syndrome.<sup>14</sup> Recent years have seen reports of EMM with preservation of the inferior turbinate.<sup>7,8</sup> Those methods may be invasive, cutting the inferior turbinate, including the bone. In addition, Weber’s technique involves resection of the nasolacrimal



**Figure 3.** Postoperative endoscopic view reveals preservation of the IT 18 months after surgery. NS, nasal septum; IT, inferior turbinate; MT, middle turbinate.

duct and requires dacryocystorhinostomy.<sup>7</sup> The technique of Gras-Cabrerizo can not reach the anteromedial wall.<sup>8</sup> Our method preserves the mucosa of the inferior turbinate and nasolacrimal duct completely and the bone of the inferior turbinate as much as possible to avoid empty nose syndrome. The difficulty in endoscopic resection of IP involves the anteromedial, anterior, and inferior walls of the maxillary sinus.<sup>3,15</sup> Although we kept most of the inferior turbinate, we were able to observe the entire maxillary sinus. In addition, we can reach the anterior wall of the maxillary sinus by resection of part of the pyriform aperture. Since we did not resect the anterior edge of the pyriform aperture, it did not cause deformity. Recessus prelacrimalis, the angle between the medial and anterior walls, is a very difficult site to reach by the conventional approach. Although EMM can approach it, resection of the nasolacrimal duct is required. On the other hand, EMMM enables reaching this site while preserving the nasolacrimal duct. In patients in whom the floor of the maxillary sinus is lower than the floor of the nose, however, removal from the inferior medial wall is slightly difficult. We do not have an instrument to sufficiently reach it. EMMM does have some limitations. It is a bit difficult to perform a two-surgeon transnasal approach<sup>16</sup> and septal dislocation approach<sup>17</sup> because the nasal mucosa and nasolacrimal duct are displaced medially and are sutured to the nasal septum. It requires further modification when applied to resection of tumors that extend into the pterygopalatine and infratemporal fossae.

EMMM should be applied to IP that originate from not only the anterior and inferior walls, but also the lateral and posterior walls, even though we can reach these by middle meatal antrostomy. These maxillary sinus sites can be observed and reached with a 0° endoscope during EMMM. This makes this surgery easier than middle meatal antrostomy, and the recurrence rate may decrease. However, if the IP involves the inferior turbinate and inferior meatus, EMMM can not be performed, because the inferior turbinate and nasolacrimal duct need to be resected. In the postoperative period, it is difficult to direct endoscopic surveillance of the anterior and inferior wall of the maxillary sinus to detect any recurrences because of preservation of the inferior turbinate. Imaging surveillance should be recommended.

One limitation of our study was the number of subjects was small and the follow-up time was short, particularly in patients with IP. A larger series of patients and long-term follow-up are needed before definite conclusions can be drawn.

## CONCLUSION

EMMM is appropriate for those patients with maxillary sinus disease at any site. This approach preserves the morphology of the nasal cavity and nasolacrimal duct with reduced surgical morbidity.

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