

# A combination of modified transnasal endoscopic maxillectomy via transnasal prelacrimal recess approach with or without radiotherapy for selected sinonasal malignancies

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**Abstract** An external approach for resection of sinonasal tumors is associated with increased morbidity. Therefore, we employed a modified transnasal endoscopic maxillectomy combined with pre and/or postoperative radiotherapy for early stage maxillary carcinomas. It aims to evaluate our early experience with endoscopic resection of selected malignant sinonasal tumors. The medical and radiology records of patients who underwent endonasal endoscopic resection of malignant sinonasal tumors between 2008 and 2012 were retrospectively reviewed. Ten cases of selected malignant tumor were performed to resect by modified transnasal endoscopic maxillectomy. All the patients were without evidence of disease at a mean follow-up of 26.8 months. No major complications were recorded. The mean hospitalization stay was 6.6 days. In very carefully selected cases of malignant tumors, modified transnasal endoscopic maxillectomy is acceptable. The postoperative complication rate is low, cosmetic outcome is excellent and patients do not require a long hospitalization.

**Keywords** Endoscopy · Maxillectomy · Sinonasal carcinomas · Transnasal · Prelacrimal recess

## Introduction

Malignant tumors of the sinonasal tract are extremely rare accounting for only 3–5 % of all head and neck malignant tumors [1, 2]. Multimodality therapy, including radiotherapy, chemotherapy and surgery, has been widely used in an attempt to improve survival and disease control. Traditionally, an open surgical approach has been used for sinonasal malignancies such as a lateral rhinotomy and total maxillectomy. However, such approaches are associated with several side effects, including cosmetic facial scars, intracranial and extracranial complications, a long hospitalization period and high costs.

Recent increased experience and success with endoscopic surgery has led to the utilization of this approach in the management of sinonasal tumors as well as inflammatory diseases [3–5]. Endoscopy provides a wide and clear surgical view even in the deep and narrow nasal cavity [3]. The improved morbidity and acceptable clinical outcomes suggest that this technique can be included among the surgical options available for the management of sinonasal malignant tumors.

On this basis, we employed modified transnasal endoscopic maxillectomy via transnasal prelacrimal recess approach combined with pre and/or postoperative radiotherapy for early stage maxillary carcinomas and to explore the treatment outcomes of sinonasal malignancies. Here, we review our early experience with this technique.

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## Patients and methods

Written informed consent was given by the patients for their clinical records to be used in this study. Ten patients with early stage (T1–T3) sinonasal malignant tumor were identified and reviewed (Table 1). Patients with invasion outside the bone of maxillary sinus (except for the medial wall) were excluded. Endoscopic maxillectomy was performed on these patients via transnasal prelacrimal recess approach at Anhui Provincial Hospital from 2008 to 2012. The patients' records were reviewed for demographic data, clinical presentation, operative procedures, preoperative and/or postoperative radiotherapy, histopathological findings, early and late complications, morbidity and mortality. Anhui provincial hospital ethics committee has approved this study.

Among the ten patients, nine patients were males. The average age of the cohort was 46 (39–70) years. Four patients underwent preoperative and postoperative radiotherapy, three patients underwent postoperative radiotherapy, and the other remainder received no radiotherapy. The mean follow-up period was 26.8 (6–60) months. The patients' outcomes and the radiological records were follow-up to evaluate the status of the patients.

### Surgical approach

The scope of the resection included the medial wall of the maxillary sinus, the anterior wall of the maxillary sinus, the tumor inside the nose and the maxillary sinus, the ethmoid sinus and part of the maxillary bone including the lateral

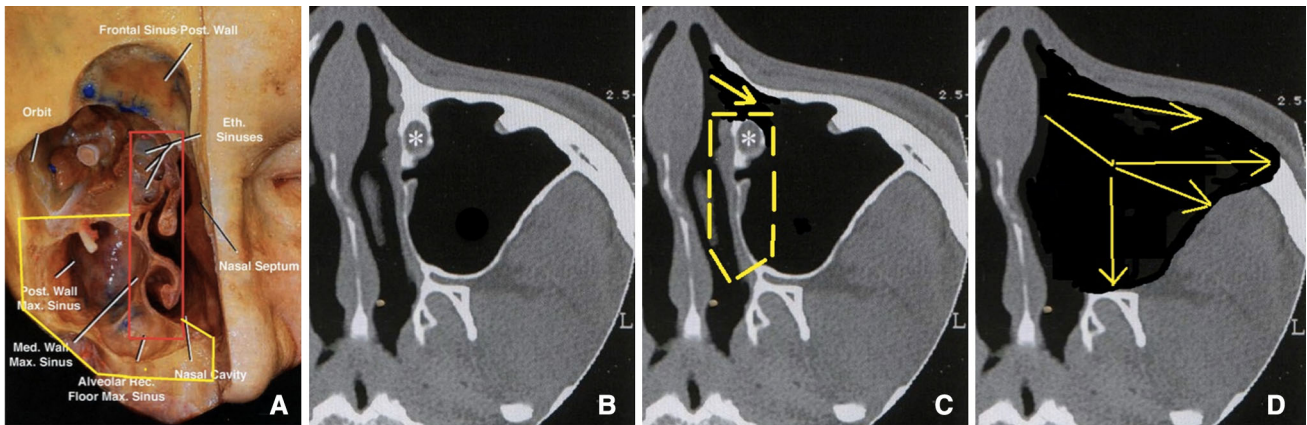
wall of maxillary sinus, part of zygoma, orbital floor, posterior wall of maxillary sinus and floor of maxillary sinus (Fig. 1).

Modified transnasal endoscopic maxillectomy via transnasal prelacrimal recess approach was performed under general anesthesia. Surgical pledgets soaked in 5 % adrenaline saline were applied in the nasal cavity to make nasal tissue shrinking. As seen in Fig. 2, a vertical incision was made in the lateral wall of the nasal cavity along the anterior margin of the inferior turbinate to the nasal floor. The nasal mucosal flap and the medial maxillary wall bone were removed. The nasolacrimal duct and the bone around the nasolacrimal duct were also removed. After osteotomy of the medial maxillary wall, the periosteum and mucosa in the maxillary sinus were completely resected. Resection of the anterior wall of maxillary sinus and the tumor inside maxillary sinus was performed after maxillary sinus exposure. The anterior wall of the maxilla was dissected out to the maxillary sinus lateral wall. After medial wall and anterior wall of the maxillary sinus were resected, the posterior wall, orbital floor, the lateral wall, part of the zygoma and the ethmoid sinus were also, respectively, removed. Lastly, the floor of maxillary sinus and horizontal plate of palatine bone were resected flatly by electronic drill. For better visualization, the angulated endoscopic and microdebrider drill was employed. Bipolar electrotonome was also used for better visual field if bleeding was experienced. After the maxillary bone was resected, the surgical cavity was flushed with distilled water and soaked for 3 min. Four patients also underwent selective neck dissections for nodal metastasis detected on preoperative imaging.

**Table 1** Patients' TNM classification, site, histopathology, adjuvant therapy and recurrence

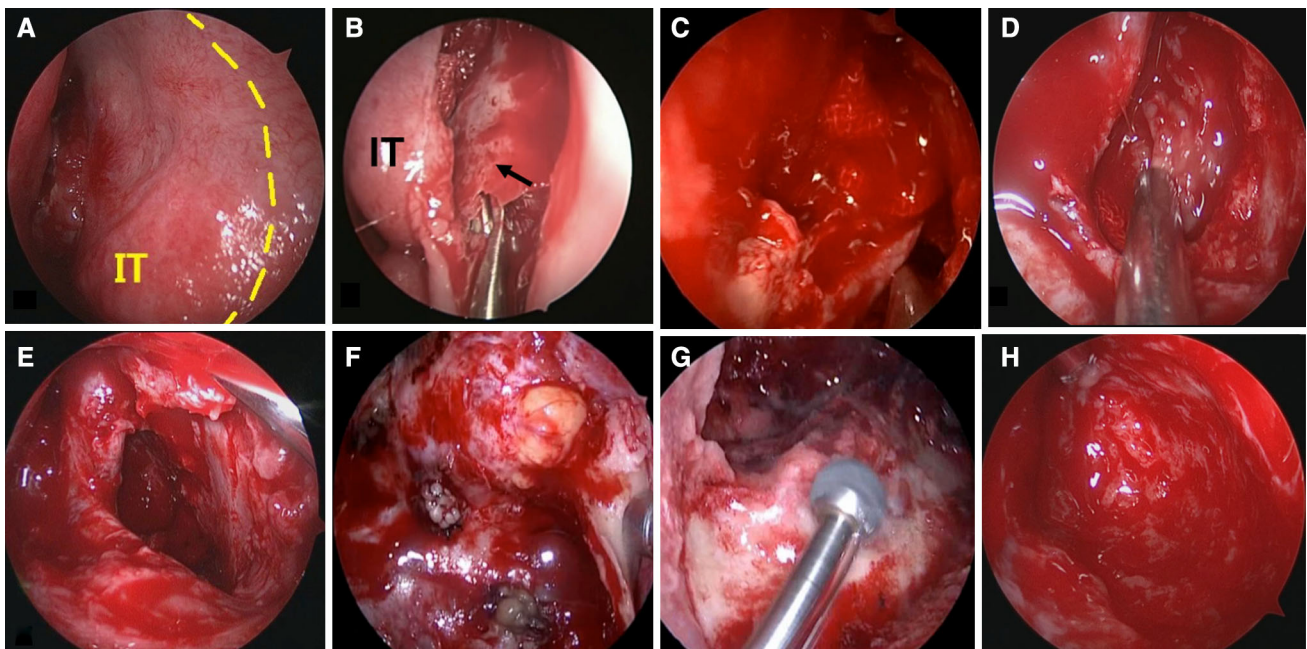
Patient no.	TNM classification	Site	Histology	Radiation	Dose/fraction number	Recurrence
1	T3N0M0	Nasal cavity, ethmoid sinus and maxillary sinus	SCC	Preoperative and postoperative	38 Gy/19 32 Gy/16	None
2	T2N0M0	Nasal cavity and maxillary sinus	Inverted papilloma canceration	None		Yes
3	T3N1M0	Nasal cavity, ethmoid sinus and maxillary sinus	Neuroendocrine carcinoma	Preoperative and postoperative	42 Gy/21 28 Gy/17	None
4	T2N0M0	Nasal cavity and maxillary sinus	Inverted papilloma canceration	None		None
5	T2N0M0	Nasal cavity and maxillary sinus	SCC	Postoperative	60 Gy/30	None
6	T1N0M0	Maxillary sinus	SCC	None		None
7	T3N1M0	Nasal cavity, ethmoid sinus and maxillary sinus	SCC	Preoperative and postoperative	40 Gy/20 30 Gy/15	None
8	T2N1M0	Nasal cavity and maxillary sinus	Adenocarcinoma	Preoperative and postoperative	40 Gy/20 30 Gy/15	None
9	T2N1M0	Nasal cavity and maxillary sinus	Inverted papilloma canceration	Postoperative	56 Gy/28	None
10	T2N1M0	Nasal cavity and maxillary sinus	Adenocarcinoma	Postoperative	64 Gy/32	None

SCC squamous cell carcinoma



**Fig. 1** Modified endoscopic maxillectomy via transnasal prelacrimal recess approach. **a** The gross extent of maxillectomy (the yellow line is the resection). The sinonasal malignancies invading to the ethmoid sinus, extensive resection was performed (including the red line). **b** Preoperative axial CT scan (asterisk is the nasolacrimal duct).

**c** Delineation of the planned resection of the maxillary median wall via transnasal prelacrimal recess approach (→: prelacrimal recess). **d** Postoperative CT scan after resection of the anterior, lateral and posterior walls of the maxillary sinus (the arrows mean the resection scope to the anterior, lateral and posterior wall of the maxillary sinus)



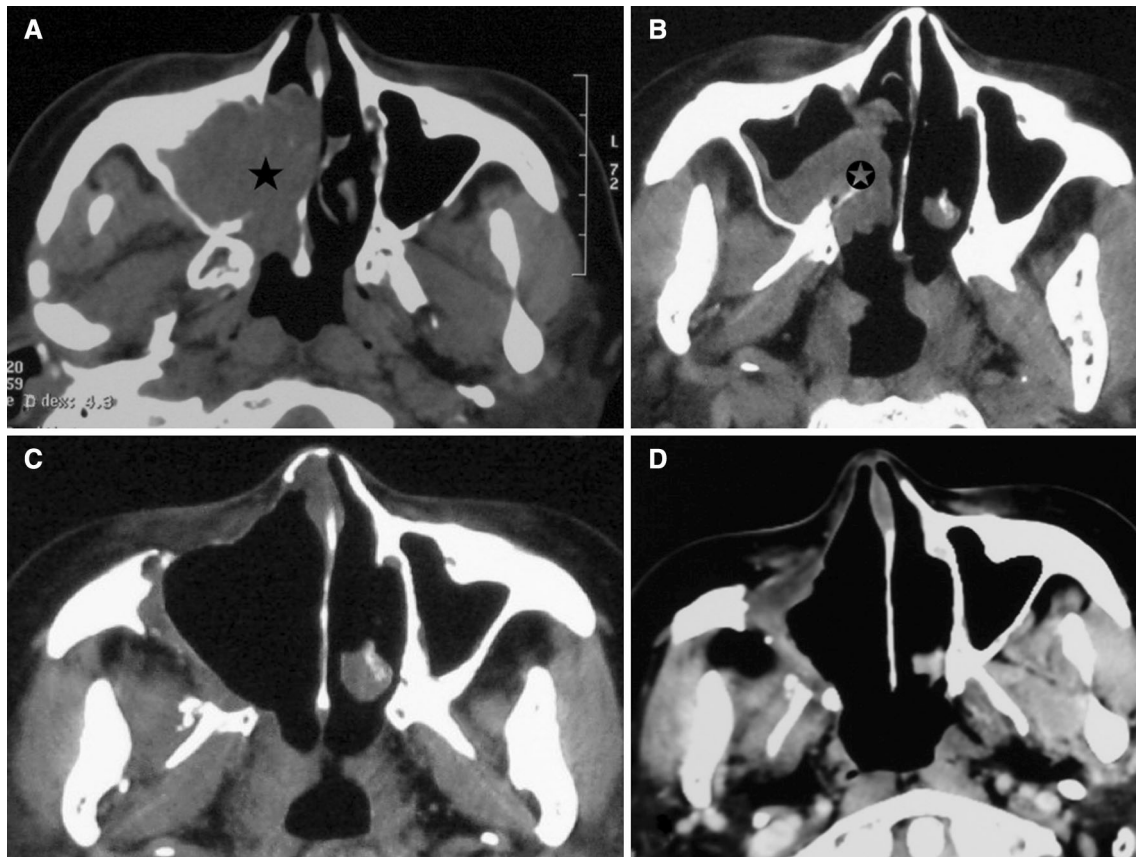
**Fig. 2** Endoscopic views of the surgical approach. **a** A vertical incision (yellow line) was made in the mucosa of the lateral wall along the anterior margin of the inferior turbinate (IT). **b** Resection of the median wall (→) of the maxillary sinus. **c** Resection of the anterior wall of the maxillary sinus. **d** Resection of the tumor inside

maxillary sinus with microdebrider. **e** Resection of orbital floor. **f** Resection of the lateral wall of maxillary sinus. **g** Resection of the floor of maxillary sinus and the horizontal plate of palatine bone. **h** Operative cavity

**Radiotherapy**

All patients underwent CT-based planning using 3-dimensional (3D) conformal radiotherapy or intensity-modulated radiation therapy (IMRT). In total, seven of the ten patients received radiation. Among them, four patients underwent endoscopic maxillectomy and neck dissection

after preoperative radiotherapy. The median preoperative dose was 40 Gy (38–42 Gy). All these patients also received postoperative radiotherapy within 3 weeks after surgery. In these four patients, the median postoperative dose was 30 Gy (28–32 Gy). In the remaining three patients, radiation was administered only postoperatively with a median dose of 60 Gy (56–64 Gy).



**Fig. 3** The role of preoperative radiotherapy. **a** Pre-radiotherapy CT showing the location of nasal cavity and maxillary SCC (*filled star*). **b** Preoperative CT showing the tumor shrinking after preoperative

radiotherapy (*open star*). **c** Postoperative CT showing the tumor was removed totally after 3 months postoperation. **d**. Postoperative CT showing no recurrence after 12 months postoperation

## Results

The most common clinical presentation included a history of nasal obstruction and unilateral epistaxis (7 patients). The average duration from symptom development to diagnosis was 5 months. In our cohort, either the nasal cavity, maxillary sinus and/or ethmoid sinus was involved. A list of the patient characteristics can be found in Table 1.

At a mean follow-up of 26.8 months, overall survival was 100 %. All patients were monitored with CT scans following completion of therapy (Fig. 3). Only one patient developed a local recurrence, 1 year following surgery. The site of recurrence was located in the lateral wall of maxillary sinus and the orbital floor. This patient had a nasal inverted papilloma and did not undergo any preoperative or postoperative radiation. This patient was successfully salvaged with an open surgery to resect the tumor and the remnant maxillary bone.

In the patients undergoing endoscopic resection, there were no major postoperative complications. Patients were discharged from the hospital at a mean of 6.6 days postoperatively. By contrast, the mean hospital stay utilizing an

open approach at our institution is 12 days. There were no grade 3 or higher late toxicities in our cohort.

## Discussion

Malignant tumors of the sinonasal tract are extremely rare with an estimated annual incidence of 1 in 100,000 people per year [5]. They are characterized by a significant histological diversity, nonspecific symptoms in the early growth phase frequently mimicking those of rhinosinitis, and a variable prognosis in relation to histology, site of origin and stage. In the past, lateral rhinotomy or craniofacial resection was often used for these patients, which can improve local control of the tumors. However, these open approaches have been associated with significant morbidity and perioperative mortality [6].

From the late 1990s, endoscopic surgery as an exclusive approach or in combination with an external approach has been performed for the treatment of malignant tumors of the sinonasal tract [7]. The current popularity of the endonasal approach can be attributed to recent technologic

advancement in endoscopic surgery and the widespread use of the angled endoscopes connected to a video camera. The angled scopes also allow visualization of areas that may otherwise be difficult to access. Thus, endoscopic endonasal sinus surgery has been performed for selected sinonasal tumors as well as for inflammatory diseases [3, 4]. The benefits including a lack facial incision, potential improvement in hemostasis, and improved visual magnification may help to decrease the morbidity of traditional open approaches. A greater experience with this approach has led to the application of these techniques to other disease processes, including the treatment of sinonasal malignant tumors [4].

Although there are a lot of advantages to treat the sinonasal malignancies with an endoscopic resection, there are limitations as well. In particular, there is concern about the lack of an en bloc resection using this technique [8, 9], which may carry a risk of tumor dissemination and disadvantages for local control of malignant tumor. However, with the utilization of preoperative or postoperative curative radiotherapy, the recurrence can be largely decreased. A majority of patients in our series were offered preoperative or postoperative intensity-modulated radiation therapy (IMRT) [10]. It is important to note that our one local failure developed in a patient who did not undergo radiotherapy. In comparison to open approaches, similar disease specific and overall survivals are achieved endoscopically with a lower complication rate [11]. Another disadvantage of this approach is the difficulty in determining the margin status because for an endoscopic surgery, it is difficult to delineate the margin. Our resection encompasses all the gross tumor tissue and adjacent normal appearing tissue; however, because this is done in a piecemeal fashion it is difficult to determine whether a margin is close or positive. Lastly, based on our early report, the use of an endoscopic approach warrants neo-adjuvant or adjuvant radiation, which may not be warranted with an open approach if negative margins are obtained; therefore, the cost of IMRT and potential for radiation associated toxicity should be factored into the decision regarding approach.

Careful selection of patients suitable for this approach is critical. We rely on preoperative imaging and endoscopy to determine if there is an invasion outside the bone of maxillary sinus, except for the medial wall. This approach allows easy to access the maxillary sinus in order to resect part of the maxillary bone, tumor, and adjacent tissue together and avoids the possibility of the recurrence of the malignant tumors. For T2 and T3 lesions where the tumor originated from the maxillary sinus and invades either the lateral wall of maxillary sinus, the posterior wall of maxillary sinus, the floor of maxillary sinus and the ethmoid sinus, we recommend preoperative radiotherapy to help achieve negative surgical margins.

Ongoing work and endoscopic techniques will allow surgeons to better delineate the possibilities and limitations of endoscopic tumor resection. Further studies are necessary to fully elucidate the optimal treatment regimen for the sinonasal malignancies. Long-term outcome studies, prospective data, and multi-institutional studies will be critical to determine the efficacy.

## Conclusion

Modified endoscopic maxillectomy via transnasal prelacrimal recess approach is a novel surgical approach for the treatment of malignant sinonasal tumors. Endoscopic visual magnification may help to reduce the morbidity of traditional open approaches. Based on our early experience, modified endoscopic maxillectomy via transnasal prelacrimal recess approach is feasible and can be used for early stage maxillary carcinomas when combined with pre and/or postoperative radiotherapy. Further, more cases and multi-institutional studies are needed to evaluate the feasibility of modified endoscopic maxillectomy via transnasal prelacrimal recess approach.

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**Conflict of interest** The authors declared we have no financial relationship with the organization that sponsored the research.

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