The role of intranasal prelacrimal recess approach in complete removal of anterior maxillary sinus lesions

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Objective
The aim of the study was to assess the role of the intranasal prelacrimal recess approach (PLRA) in complete removal of anterior maxillary lesions.

Study design
This was a prospective study in which 20 patients were recruited between July 2013 and September 2014 from the Otorhinolaryngology outpatient clinic, Cairo University.

Patients and methods
Patients with anterior maxillary sinus (MS) lesions underwent endoscopic sinus surgery and had their lesions removed through the maxillary ostium. The PLRA was then performed to assess the presence of any anterior maxillary remnants, which were then removed.

Results
The intranasal pathologies included sinonasal polyposis (four patients), recurrent sinonasal polyposis (four patients), antrochoanal polyps (four patients), allergic fungal sinusitis (five patients), inverted papilloma (one patient), lymphoma (one patient), and cancer maxilla (one patient). After the PLRA 45% of the patients showed remnants. These included antrochoanal polyp (two patients), recurrent sinonasal polyposis (one patient), allergic fungal sinusitis (three patients), inverted papilloma (one patient), lymphoma (one patient), and cancer maxilla (one patient).

Conclusion
Our preliminary study demonstrated that without the PLRA 45% of the cases will have remnants missed in hidden areas of the MS. The PLRA is a minimally invasive technique to deal with anterior MS lesions.

Introduction

Functional endoscopic sinus surgery is the gold standard surgical treatment in patients with chronic rhinosinusitis. It has an 80–90% success rate in primary surgeries [1].

However, the success rate drops to 50–70% in revision surgeries. The approach to the severely diseased sinus, especially the maxillary sinus (MS), is still controversial. Because of the anatomy of the MS and the characteristics of diseases originating in it, as assessed with multiangled telescopes, there are still some areas that cannot be viewed and handled [2].

Although a good visualization is provided for complete excision of the lesion, from the viewpoint of minimal invasion, a drawback still exists in both external and intranasal surgical procedures. Compromise of the inferior turbinate (IT) and nasolacrimal duct (NLD) is often unavoidable [3].

The endonasal endoscopic prelacrimal recess approach (PLRA) provides a clear view. It enables us to accurately, mini-invade and completely remove benign MS lesions. It is a physiological and functional surgery, and has great advantages in treating the diseases of the nasal cavity [4].

Prelacrimal recess is a concavity in the medial, anterosuperior part of the MS. It is located in front of the eminence of the lacrimal passages on the medial sinus wall (Fig. 1) [2].

As reaching hidden areas in the MS is still problematic, this study was conducted to assess the role of the PLRA in dealing with anterior lesions of the MS.

Patients and methods

This is a prospective study in which 20 patients with anterior MS lesions were recruited between July 2013 and September 2014 from the Otorhinolaryngology outpatient clinic, Kasr Al-Ainy Hospital, Cairo University. Cairo University Ethical Review Committee approval was obtained according to guidelines for conducting this study.

Patients were subjected to full history taking and nasal examination by nasal endoscopy. Axial and coronal computed tomography of the nose and paranasal sinuses was performed with intravenous contrast when indicated. MRI was performed in selected cases.
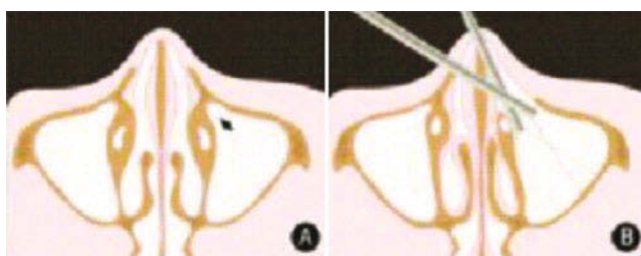
Inclusion criteria
(1) Age more than 17 years,
(2) any sex,
(3) presence of MS tumours such as inverted papilloma,
(4) incidence of extensive recurrent sinonasal polyposis,
(5) a history of revision endoscopic nasal surgery in which anterior maxillary remnants are suspected, such as in antrochoanal polyp cases,
(6) having no contraindications for surgery under general anaesthesia.

Exclusion criteria
(1) Age less than 17 years,
(2) presence of vascular tumours,
(3) presence of an aggressive tumour extending out of the MS,
(4) having contraindications for surgery.

The operation was performed under general hypotensive anaesthesia, in supine head-up position. The nasal cavity was decongested and the middle meatus lesion was removed. Uncinectomy was performed and the MS ostium identified, which was then widened posteroinferiorly and also anteriorly using backbiting forceps while ensuring that the NLD was not injured. After complete removal of the sinus

lesion using different angled nasal endoscopes, the PLRA was performed.

The incision
The incision site was infiltrated with 1% lidocaine (xylocaine) with 1 : 100 000 epinephrine solution. A curved mucosal incision was made on the lateral wall of the nasal cavity between the anterior aspect of the IT and the posterior end of the nasal vestibule, so that the depth of the incision reached the underlying bone (Fig. 2).

Mucoperiosteal elevation
Using a chisel, the mucoperiosteum was lifted posteriorly until the attachment of IT to the lateral nasal wall and then the bony attachment of IT were disconnected (Fig. 3).
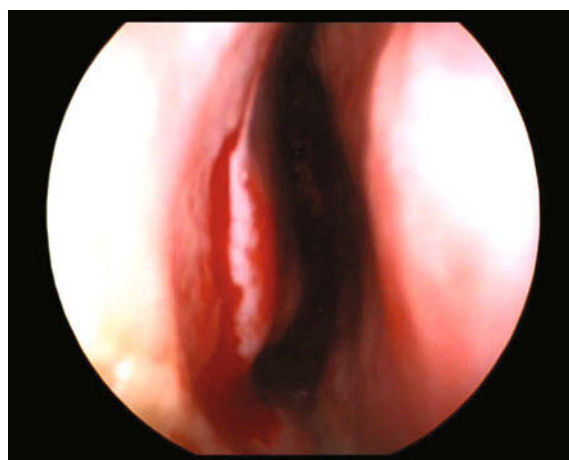
Bone removal
Bone removal was achieved using a gauch and hammer and a high-speed electric drill (supplemented by Kerrison rongeurs). Taking the bony attachment of the IT as a landmark, the anterior bony portion of the medial wall of the MS (parts of the frontal process of the maxilla) was chiseled off, as this part of the frontal process of the maxilla forms the medial part of the prelacrimal recess (Fig. 4).

Inferior turbinate–nasolacrimal duct flap medialization
Chiseling the bone posteriorly exposed the NLD and then the IT–NLD flap was formed. It was pushed medially because of which the medial mucosal wall of the MS was exposed (Fig. 5).

Figure 1

Schematic diagram shows the cavity of the maxillary sinus, which can be easily observed under a 0° rigid endoscope through the prelacrimal recess approach. Arrow: prelacrimal recess 2.

Figure 2

A curved mucosal incision between the anterior end of the inferior turbinate (IT) and posterior end of the nasal vestibule.

Figure 3

Mucoperiosteum elevated posteriorly until the attachment of inferior turbinate (IT).

Figure 4

Bone removed using an electric drill.

Figure 5

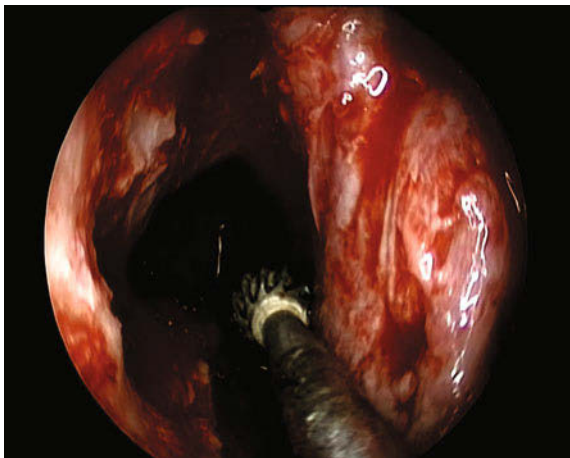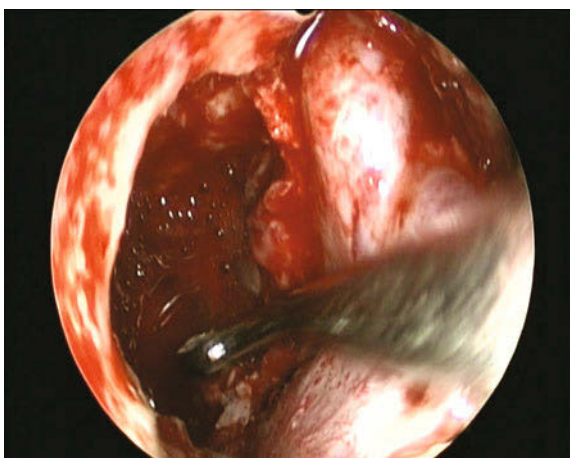Medial mucosal wall of the maxillary sinus (MS) was exposed and removed.

Widening the prelacrimal recess

The anteromedial bony wall of the MS was partially removed on the basis of the extent of pneumatization or location of the lesion. The prelacrimal recess was opened while removing the medial mucosal wall of the MS, and thus the MS was entered. At this step we checked for remnant pathological lesions. The whole MS pathology can be eradicated under the clear and wide view provided by an endoscope inserted from the opening of the prelacrimal recess.

Repositioning of the mucosal flap

At the end of the operation the IT–NLD mucosal flap was repositioned. No stitches were needed.

Other sinuses were managed accordingly, depending upon the underlying pathological status of each patient, along with supplemental septoplasty if necessary. Finally, the nasal cavity was packed with a nasal tamponade for 48 h.

Follow-up visits were weekly during the first month, and then monthly for over 3 months.

Results

Twenty MS of 20 patients were included in this prospective study. Eleven (55%) patients were men, and nine (45%) were women. The male to female ratio was 11 : 9. Their ages ranged from 24 to 71 years with an average age of 27.8 ± 11.5 years. The patient demographics according to each disease are shown in Table 1.

After performing the PLRA, 11 (55%) patients showed no remnants. The remaining nine (45%) patients were found to have residual lesions in the anterior maxillary compartment. The diagnoses of these nine lesions were as follows: one patient was diagnosed with an inverted papilloma (5%), one patient with lymphoma (5%), one patient with cancer maxilla (5%), three patients with allergic fungal rhinosinusitis (15%), two with antrochoanal polyp (10%),and one with recurrent allergic sinonasal polyposis (5%) (Table 2).

On performing the PLRA the operation time increased by a mean of 30 min; postoperatively, the inferior turbinate stability was compromised in three (15%) patients; facial pain was present in two (10%) patients after a 3-month follow-up period; persistent epiphora was present in one (5%) patient 3 months after the operation; and inferior meatus adhesions were found in two (10%) patients.

No difference in intraoperative or postoperative nasal bleeding was noticed.

Table 1 Patient demographics according to each disease

Diseases	Number of patients (n)	Percentage (%)	Age range
Allergic sinonasal polyposis	4	20	27–71
Recurrent sinonasal polyposis	4	20	35–56
Antrochoanal polyp	4	20	24–52
Allergic fungal rhinosinusitis	5	25	27–37
Inverted papilloma	1	5	38
Lymphoma	1	5	66
Cancer maxilla	1	5	55

Table 2 Pathology of cases and presence of remnant after prelacrimal recess approach

Category	Case (n)	Percentage (%)	Remnants
Allergic sinonasal polyposis	4	20	No
Recurrent sinonasal polyposis	1	5	Yes
	3	15	No
Antrochoanal polyp	2	10	Yes
	2	10	No
Allergic fungal rhinosinusitis	3	15	Yes
	2	10	No
Inverted papilloma	1	5	Yes
Lymphoma	1	5	Yes
Cancer maxilla	1	5	Yes

One patient (inverted papilloma) complained of upper incisor numbness.

Discussion

According to the anatomy of MS and the characteristics of the diseases originating from it, which were assessed with multiangulated telescopes, including 30 and 70° telescopes, with different kinds of curved instruments, there are still some areas that cannot be viewed and handled [2].

Deep maxillary antrum pathologies can be reached with the aid of curved forceps, curved suction tips and angled endoscopes. However, extensive mucosal disease can be difficult to handle, especially in the anterior and inferior regions [5].

Diffuse diseases in the MS, such as inverted papilloma or recurrent polyposis, cannot be removed thoroughly with middle meatal antrostomy endoscopically, even with some curved instruments and angled endoscopes or with a wide antrostomy [2]. These observations are in agreement with the results of our study. After wide middle meatal antrostomies and using angled endoscopes and instruments, following the PLRA, remnants were found in nine (45%) patients. The pathologies included inverted papilloma and extensive recurrent polyposis.

In such conditions the traditional Caldwell–Luc operation is necessary to reach blind areas. However, this approach is associated with significant morbidity and complications such as postoperative bleeding, buccal swelling, infraorbital nerve paraesthesia, dental numbness and devitalized teeth [6]. The PLRA technique proved to be advantageous over the Caldwell–Luc operation because PLRA reaches the anterior areas of MS and overcomes all morbidities. In our study none of these morbidities were encountered, except dental numbness in one patient.

It is shown that total turbinectomy is associated with a significant risk of severe haemorrhage. If the IT tail is not injured, epistaxis is less likely to occur because of preservation of the IT artery [7]. Garth et al. [8], in a study in which 214 patients underwent bilateral turbinate surgery, observed postoperative haemorrhage in 0.9% of patients who underwent anterior turbinectomy and in 5.8% of patients who underwent radical turbinectomy. In our study, epistaxis was not encountered as a complication in any case, and the PLRA aimed to eradicate the MS lesion with preservation the IT.

Recently, a group of authors who analysed 79 patients with primary papillomas reported a recurrence rate of 18% [9]. In our study the case with an inverted papilloma was among the cases where remnants were detected after performing the PLRA. This explains the high recurrence rates.

Endoscopic medial maxillectomy is advocated because the main area where the disease is difficult to treat endoscopically is the anterior wall and floor of the MS [10].

All areas of the MS can be accessed endoscopically and diseased mucosa removed with endoscopic medial maxillectomy, which has become the golden standard for management of the inverted papilloma of the MS [11]. Medial maxillectomy compromises the IT and/or NLD. In our study with the PLRA, inverted papilloma was dealt with radically with preservation of both the IT and the NLD.

Zhou et al. [12] stated that, by means of the PLRA, all areas of the MS should be easy to reach under a 0° rigid nasal endoscope. This is in agreement with our current study in that the 0° endoscope could be used successfully in most parts of the operation.

Suzuki et al. [13] stated that the modified transnasal endoscopic medial maxillectomy had the following advantages: (a) preservation of the IT, NLD and lateral nasal mucosa; (b) wide access to the MS by shifting the IT, NLD and lateral nasal mucosa in the medial

direction; and (c) direct access to the MS, resulting in an easier operation with a straight endoscope and instruments. These advantages were encountered and are in agreement with our assessment of the PLRA.

In transnasal endoscopic medial maxillectomy, the lateral nasal wall is fully resected to the level of the floor of the nose inferiorly. Anteriorly, it is resected beyond the nasolacrimal canal to include the canal and NLD up to the anterior maxillary wall junction. However, the nasolacrimal sac is preserved [14]. In our study the PLRA turned out to be superior to transnasal endoscopic medial maxillectomy as it overcame the limitation of access with an additional advantage of preservation of the NLD and IT in all cases.

It has been reported that the incidence of epiphora is as high as 30% when performing medial maxillectomy [11]. In our study, epiphora as a complication was minimal. Only one case showed persistent epiphora.

On using medial maxillectomy with preservation of the IT, the IT remains fixed to the lateral nasal wall with an appropriate size, showing a level of vascularization enough to maintain its function in all cases [7]. This is in agreement with the results of our study as the majority of patients had a stable IT without resecting any part of it. Therefore, its vascularization and function remained intact. Only three (15%) cases showed minimal IT instability.

Numbness of the frontal teeth is caused by a lesion of the superior alveolar nerve, which runs through the bone of the anterior MS wall and can be damaged if the piriform aperture is resected (Denker operation) [15]. In our study only one individual had numbness in the upper central incisors after PLRA. Superior alveolar nerve affection may explain this numbness. This patient also had facial pain. These symptoms are probably related to the extensive use of the electric drill.

There were three common complications found after a Caldwell–Luc procedure: facial swelling (61.9%), pain and/or numbness of the face (46.0%) and pain and/or numbness of the teeth/gums (30.9%). The rare complications include postoperative epistaxis (0.4%), oroantral fistulae (0.4%), epiphora (0.4%) and dental discolouration (0.4%) [16].

After performing the Caldwell–Luc procedure, paraesthesia due to damage to the infraorbital nerve has been reported in 21% of cases. In the long term, patients may complain of significant neuralgia in the distribution of the infraorbital nerve. Damage to the teeth and their innervations can lead to alteration in dental sensation and occasionally devitalization and discolouration of the teeth. An oroantral fistula occasionally occurs if care is not taken while determining the site of the incision, requiring subsequent surgical intervention [17,18].

The operation time was prolonged by a mean of 30 min, which may be due to lack of experience and practice with the new approach.

Most of the previous studies assessed the PLRA for inverted papilloma only, although their approaches were addressed by different names. Our current study used this approach for any extensive lesion reaching the anterior wall of the MS, and assessed whether the PLRA added more access than wide middle meatal antrostomy.

Conclusion
Our preliminary clinical study demonstrated that without the PLRA 45% of cases will have remnants missed in hidden areas of the MS. Therefore, it is an ideal and minimally invasive technique to deal with the problems of the MS. It also proved advantageous with the preservation of IT and NLD.

All the areas could be observed and managed under a 0° rigid endoscope. As the lateral nasal wall was kept intact, the nasal physiological functions, such as humidity, warming and cleaning, may well be preserved.

Our follow-up data showed no major intraoperative or postoperative complications. The diffuse or severe diseases of the MS, especially a tumour originating from the MS, may be the potential indication for using the PLRA. Whether or not it could be used for dealing with malignancy of the MS needs further study. The short follow-up period indicates that additional study with long-term follow-up in a larger number of patients is necessary to validate these issues.

Conflicts of interest
There are no conflicts of interest.

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