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ORIGINAL ARTICLE

Assessment of The Prelacrimal approach for Removal of Anteriorly Located Maxillary Sinus Lesions

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ABSTRACT

Background: Prelacrimal approach to maxillary sinus provides a wide access to all walls of maxillary sinus while still preserving the nasolacrimal duct and inferior turbinate. This study aimed to assess prelacrima approach outcome in anterior maxillary lesion according to completeness of removal and surgical morbidity.

Methods: This prospective cohort study included 12 patients with maxillary sinus lesions. The study included 8 (55%) patients were men, and 4 (45%) were women. Their ages ranged from 12 to 60 years with an average age of (35.9±18.8) and (75%) of them were above forty years old. The study work was done in Otorhinolaryngology Department in Zagazig University Hospitals in the period from March 2019 to March 2020. The patients were clinically evaluated by history, endoscopic and radiological examination. All surgeries were done under general anesthesia and the pre lacrimal recess approach was used after failure of complete removal of the lesions through widened Middle Meatal Antrostomy (MMA).

Results: The intranasal pathologies included antrochoanal polyp (ACP) which was present in six patients (50.0%) followed by Inverted papilloma (IP) in three patients (25.0%) then dental cyst among two patients (16.7%) and the least one was maxillary cyst present in one patient (8.3%).

Conclusions: This study showed that the PLRA was successful in complete removal of the lesions in all cases with minimal morbidity and no recurrence.

Keywords: prelacrimal recess approach (PLRA), maxillary sinus, nasal endoscope, nasolacrimal duct.



INTRODUCTION

Functional endoscopic sinus surgery is the gold standard surgical treatment in patient with chronic sinusitis [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 maxillary sinus and characteristics of diseases originating in it, as assessed with multiangled telescopes, there are still some areas that cannot be viewed or angled [2]. Maxillary sinus mucocoeles and antrochoanal polyps are benign, common lesions. Before the era of endoscopic surgery, the Caldwell-Luc operation has been proposed for the resection of maxillary sinus mucocoele and polyps. However, this approach always resulted in some form of morbidity, such as facial numbing and maxillary bone thickening after the procedure [3].

The endonasal endoscopic pre-lacrimal recess approach (PLRA) provides a clear view. It enables us to accurately, mini invade and complete remove benign maxillary sinus lesion. It is a physiological and functional surgery and has great advantages in treating the disease of nasal cavity [4]. This study is aimed to assess prelacrimal approach outcome in anterior maxillary lesion according to completeness of removal and surgical morbidity.

METHODS

This prospective cohort study included 12 cases undergoing removal of anteriorly located maxillary sinus lesions through prelacrimal approach. The study included 8 (55%) patients were men, and 4 (45%) were women. Their ages ranged from 12 to 60 years with an average age of (35.9±18.8) and (75%) of them were above forty years old. The study work was done in Otorhinolaryngology Department in Zagazig

University Hospitals in the period from March 2019 to March 2020.

We considered the following Inclusion criteria: Presence of maxillary sinus lesion encroaching upon the ant, wall of maxillary sinus, adequate pneumatization of the prelacrima recess, primary and revision cases were included and having no contraindication for surgery under general anesthesia. Our exclusion criteria were: Presence of malignant tumors, absence of pneumatization of the prelacrima recess, hypoplastic maxillary sinus, not fit for surgery and patients whose pathology could be completely removed through a widened middle meatal antrostomy.

The patients were clinically evaluated by history, endoscopic and radiological examination. The operation was performed under general hypotensive anaesthesia, in supine head-up position. Decongestion of the nasal mucosa was achieved by application oxymetazolin 0.05% spray to the nose 1/2 hour before surgery. Following infiltration of the lateral nasal wall, the lesion in the nasal cavity or middle meatus were first resected with the aid of the 0° telescope, uncinectomy (infundibulotomy) was performed. The natural maxillary ostium was then identified at bulla-uncinate angle. After that a wide middle meatal antrostomy was created to address intrasinus pathology, taking care to avoid injury of the nasolacrimal duct. Additionally, a 45° telescope was used for angle visualization of anterior wall and floor of maxillary sinus. When the maxillary sinus was completely clear from the pathology, the procedure is terminated. If there is doubt about any residual in unseen corner or the residual can be seen but couldn't be reached by the available instrument, a pre lacrimal approach was done.

The incision:

The incision site was infiltrated with 1% lidocaine (xylocaine) with 1: 200 000 epinephrine solution. A curved mucosal incision was made on the lateral wall of the nasal cavity between the anterior aspect of the inferior turbinate (IT) and posterior end of nasal vestibule, the depth of incision reached to the underlying bone (**Figure 1**).

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 was disconnected (**Figure 2**).

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.

Bone removal was achieved by using high -speed electric drill. Taking the bony attachment of

inferior turbinate as a landmark the anterior bony portion of the medial wall of the maxillary sinus (parts of the frontal process of maxilla) was chiseled off, as this part of frontal process of maxilla forms the medial part of the prelacrima recess (PLR) (**Figure 3**).

Widening the prelacrima recess:

The anteromedial bony wall of maxillary sinus was partially removed according to the extent of maxillary sinus pneumatization or the location of lesion. The prelacrima recess was opened while removing the medial mucosal wall of the maxillary sinus, thus the maxillary sinus was entered. At this step we assessed if there is a remnant pathological lesion or not. The whole maxillary sinus pathology can be eradicated under the clear and wide view provided by an endoscope inserted from the openings of prelacrima recess (**Figure 4**).

Repositioning of the mucosal flap:

At the end of the operation the IT-NLD mucosal flap was repositioned and sutured by one or two 04 vicryl suture. inferior meatal antrostomy was done or not according to the nature of the lesion and the necessity of drainage (**Figure 5**).

Postoperative follow up:

All patients had a nasal pack placed in the form of two lubricated finger gloves in the middle meatus and the other on the floor of the nose to support the flap and removed 24 hours postoperative.

Follow up was scheduled after 1 week, 2weeks, one month and monthly after that. In each visit endoscopic examination and removal of any crusts or synechia was performed. At 6 months postoperative a CT was performed to assess the condition of the maxillary sinus mucosa and any recurrence.

Ethical Clearance: Written Informed consent was taken from the patient to participate in the study. Approval for performing the study was obtained from Otorhinolaryngology Departments, Zagazig University Hospitals after taking Institutional Review Board (IRB) approval. The work has been carried out in accordance with the code of ethics of the world medical association (Declaration of Helsinki) for studies involving humans

STATISTIC ANALYSIS

Data were checked, entered and analyzed using SPSS version 23 for data processing. The data were presented as number and percentages for the qualitative data, mean, standard deviations. The comparison was done using Chi- square test (X^2). The threshold of significance was fixed at 5% level (P-value). The smaller the P value obtained the more significant are the results.

RESULTS

Table 1, showed that nasal obstruction was the commonest complain present in 10 patients (83.3%) of the studied group followed by nasal

discharge in nine patients (75.0%) and the least symptoms were facial pain & headache which were present in six patients (50.0%) of the studied group. The commonest pathological lesion was antrochoanal polyp (ACP) which was present in six patients (50.0%) of the studied group followed by Inverted papilloma (IP) in three patients (25.0%) of the studied group then dental cyst among two patients (16.7%) of the studied group and the least one was maxillary cyst present in one patient (8.3%). **Table 2**, showed that the distance between the anterior wall of the maxillary sinus and the superior most part of the NLD ranged from (3.2 to 6.2 mm) with a mean of (4.8±0.91), from the anterior wall of the maxillary sinus to the middle part ranged from (6.1 to 9.3 mm) with a mean of (7.6±0.93) and from the anterior wall of the maxillary sinus to the inferior most part ranged from (6.9 to 10.2 mm) with a mean of (8.6±0.98). Operation time was more when prelacrimal recess approach was done. Mean increase was about 33 minutes. **Table 3**, showed that eight patients (66.7%) of the studied group had primary lesions and four patients (33.3%) of the studied group were revision cases; three from them (25.0%) were ACP and one case (8.35) was inverted papilloma with no dental nor maxillary cysts. That eleven patients (91.7%) of the studied group had residual lesions detected by PRLA while in one patient with ACP no residual was found but only thickened mucosa of the anteromedial maxillary sinus wall. That nasolacrimal duct was identified in eight cases of

the studied group and there was no necessity for its identification in four cases as the pathology could be removed after entering the maxilla from an anteroinferior window. That the commonest maxillary sinus lesions origin was Antero-inferior wall (41.7%) of the studied group followed by Lateral wall in four patients (33.3%) of the studied group and the least origin was postero-medial wall found only in three patients (25.0%).

Table 4 showed that there was statistically significant improvement in facial pain at the side of which lacrimal recess approach was done and high improvement in epiphora. Only one patient (8.3%) had epiphora after six months as this patient's lesion was extending to the medial wall of the nasolacrimal duct and medial maxillectomy was done with removal of the lower part of the nasolacrimal duct.

Table 5 showed that eleven cases (91.7%) of the studied group had the flap in place and only one patient (8.3%) had a tear that presented as anteroinferior hole in the maxilla that spontaneously closed in three weeks. That nine cases (75.0%) of the studied group didn't show any crustation or granulation tissue in place of prelacrimal recess incision while three patients (25.0%) had crustation for only few weeks. That no cases had any bleeding or blood clots. That eleven cases (91.7%) of the studied group didn't have synechia and only one patient (8.3%) had an adhesion between middle turbinate and the lateral nasal wall which was removed endoscopically.

Table (1): Preoperative symptoms and Pathological findings among the studied group.

Variable	NO (12)	%
Preoperative symptoms:		
Nasal obstruction		
Yes	10	83.3%
No	2	16.7%
Nasal discharge		
Yes	9	75.0%
No	3	25.0%
Facial pain & headache		
Yes	6	50.0%
No	6	50.0%
Pathological findings:		
Antrochoanal polyp	6	50.0%
Inverted papilloma	3	25.0%
Dental cyst	2	16.7%
Maxillary cyst	1	8.3%

Table (2): The depth of pre-lacrimal recess in relation to the upper, middle and lower part of naso-lacrimal duct (NLD) among the studied group.

Variable	The studied group (12)	
	mean ± SD (Range)	median
Superior most	4.8±0.91 (3.2-6.2 mm)	4.7
Middle	7.6±0.93 (6.1-9.3 mm)	7.4
Inferior most	8.6±0.98 (6.9-10.2 mm)	8.8
Operative time (minutes)	56.3±11.4 (45-70)	58

Table (3): Pathology of cases and presence of remnant after prelacrimal recess approach.

Variable	NO (12)	%
Type of lesion (Primary or revision):		
Primary	8	66.7%
Revision	4	33.3%
ACP	3	25.0%
Dental cyst	0	0.0%
Maxillary cyst	0	0.0%
Inverted papilloma	1	8.3%
Residual lesions:		
Absent residual lesions	1	8.3%
ACP	1	8.3%
Present	11	91.7%
ACP	5 (2 primary & 3 revision)	
Dental cyst	2	
Maxillary cyst	1 (revision)	
Inverted papilloma	3	
Manipulation and Medialization of nasolacrimal duct:		
Nasolacrimal duct identification	8	66.7%
Yes	4	33.3%
No		
Origin of maxillary sinus lesions:		
Antero-inferior	5	41.7%
Lateral wall	4	33.3%
Postero-medial	3	25.0%

Table (4): Comparing post-operative follow up of epiphora and facial pain among the studied group.

Symptoms	Post-operative No (%)			χ ²	p-value
	1 st month	3 rd month	6 th month		
Facial pain	5 (41.7%)	1 (8.3%)	0.0 (0.0%)	3.6	0.03*
Epiphora	2 (16.7%)	1 (8.3%)	1 (8.3%)	2.3	0.04*

* Statistically significant difference (P ≤ 0.05)

Table (5): post-operative:

	NO. (12)	%
Post-operative endoscopic evaluation for IT- NLD flap position		
Flap in place	11	91.7%
Unintended tear in the inferior meatus	1	8.3%
Crustation & granulation tissue formation		
Present for the 4 th week then disappear	3	25.0%
Absent	9	75.0%
Bleeding		
Yes	0.0	0.0%
No	12	100.0%
Synechia		
Yes	1	8.3%
No	11	91.7%

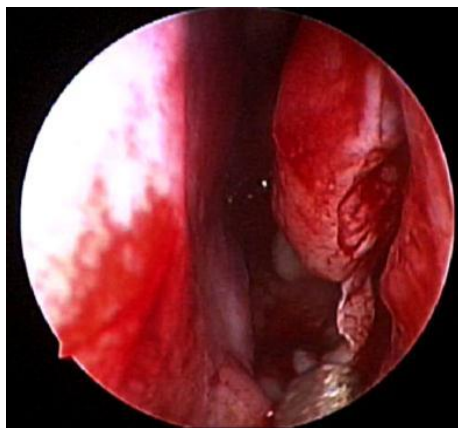


Figure (1): The incision site posterior to the head of inferior tuobinate

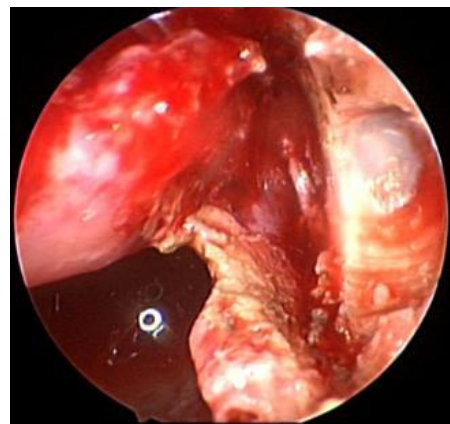


Figure (2): Nucoperiostium elevation posteriorly

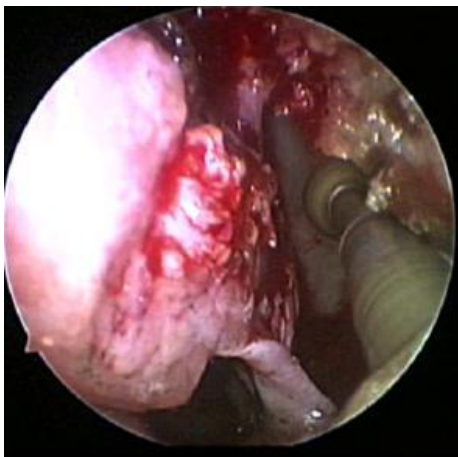


Figure (3): Bone removal by using drill with IT-NLD flap medicalization.

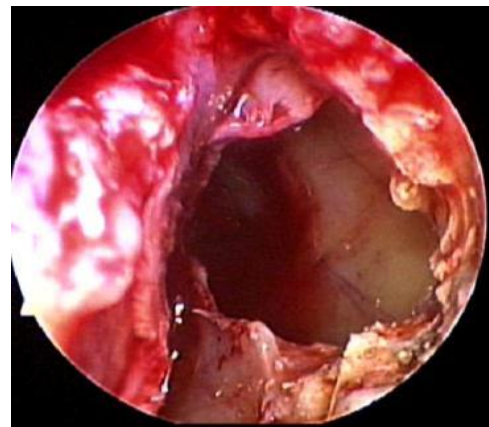


Figure (4): Widening of PLR and entering the maxillary sinus through its anterior part of the medial wall.

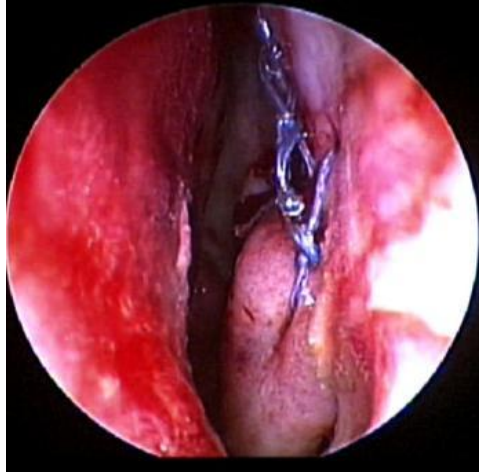


Figure (5): Reposition of mucosal flap with 04 vicryl suture.

DISCUSSION

Considering the preoperative symptoms among the studied group, nasal obstruction was the commonest complain being present in 10 patients (83.3%) of the studied group followed by nasal discharge in nine patients (75.0%) and the least symptoms were facial pain & headache which was present in six patients (50.0%) of the studied group. These data were in agreement with that of **Comoglu et al.** [5] who found that the most common symptoms were nasal obstruction (12/12) (100.0%), snoring (9/12) (75.0%), rhinorrhea (7/12) (58.3%), and hyposmia (6/12) (50.0%) among their studied patients.

Similarly, **Ismaeil & Abdelazim** [6] whose study included 32 patients with antrochoanal polyp, divided into two equal groups the 1st group underwent endoscopic middle meatal antrostomy (EMMA), and the 2nd group underwent a combined surgical technique using EMMA together with endoscopic transnasal prelacrimal recess approach aiming to assess the effectiveness of ETPRA approach in preventing the recurrence of antrochoanal polyps. They found that the most common symptoms were unilateral nasal obstruction in 32/32 (100%), snoring 24/32 (75%), rhinorrhea 19/32 (59.38%), headache 31/32 (96.88%), and hyposmia 17/32 (53.13%). Nasal polyp protrusion into the MS was found in 27 (84.38%) patients. Regarding the pathological lesion, the commonest pathological lesion in the present study was antrochoanal polyp (ACP) which was present in six patients (50.0%) of the studied group followed by Inverted papillomas (IP) in three patients (25.0%) and dental cyst which was present among two patients (16.7%) and the least one was maxillary retention cyst present on one patient (8.3%). In this study, an important step in planning surgery is the study of the depth of the prelacrimal recess which will orient the surgeon to the amount of bone to be removed. The distance between the pyriform aperture and the superior

most part of the NLD ranged from (3.2 to 6.2mm) with a mean of (4.8±0.91), between PA and the middle part of the NLD ranged from (6.1 to 9.3 mm) with a mean of (7.6±0.93) and from PA to the inferior most part of the NLD ranged from (6.9 to 10.2 mm) with a mean of (8.6±0.98).

That was consistent with **Kashlan and Craig** [7] who found that the distance between the PA and the superior part of NLD ranged from 0-11.9 mm with a mean of 5.5 mm, between the PA and middle part of NLD ranged from 0-13.6 mm with a mean of 7.6 mm, between PA and inferior part of NLD ranged from 1.9 – 14.2 with a mean of 8.4 mm.

These observations directed us that the safest entry to the maxillary sinus along the prelacrimal approach would be in the inferior part of the maxillary sinus because it has the maximum depth away from the nasolacrimal duct.

Lin et al. [8] performed middle meatal antrostomy before the prelacrimal recess approach technique because middle meatal antrostomy provides a better drainage route for the MS and wider access to the MS for postoperative treatment.

In the same manner we performed wide MMA in all cases as we tried first to remove the lesions through the widened ostium and only the prelacrimal approach was performed if there is doubt about the completeness of removal.

The operation time was more when prelacrimal recess approach was done after doing MMA Mean increase about 33 minutes.

Near results were reported by **Al Ayadi, et al.** [9] where 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 and also in agreement with **Ismaeil & Abdelazim** [6] who reported that the operative time was longer when ETPRA was used. However, with this increase in time, there is the ability of complete removal of the polyp with no recurrence rate, which makes prolonged time a great benefit and is not to be considered a disadvantage. On the other hand, **Lee,**

et al. [10] found that the prelacrimal recess approach had less operation time ($P=0.825$), more bleeding amount ($P=0.999$) and the same hospital stay ($P=0.397$) than other approaches.

Of the twelve patients operated by PLRA in our study, the approach was of benefit to eleven of them as residual pathology that, could not be removed through the wide MMA, was found and removed. However, in one patient with antrochoanal polyp no residual lesion was found and only thickened mucosa was removed from the anteromedial wall of the maxillary sinus through the approach.

Suzuki et al. [11] & Al Ayadi, et al. [9] described the approach the modified transnasal endoscopic medial maxillectomy” and stated that it 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. However, our work differs from their work in that we were able to remove the lesions without medial displacement of the nasolacrimal duct in eight cases and we only displaced it medially in four cases.

Regarding the lesion’s attachment site, our study demonstrated that the commonest maxillary sinus lesions origin was the antero-inferior wall (41.7%) of the studied group followed by the lateral wall in four patients (33.3%) of the studied group and the least origin was postero-medial wall which was found on three patients (25.0%).

This is in agreement with **Lee, et al. [10]** study where the attachments in 10 cases of benign maxillary sinus tumor were found at the anterior wall (30.0%), lateral wall (10.0%), medial wall (20.0%), inferior wall (10.0%), and diffuse attachment (30.0%).

Regarding postoperative complications, our present study showed five cases had minimal facial pain at the side of which Prelacrimal recess approach was done which completely improved after two weeks and two cases had epiphora which persisted on only one patient after six months. This patient had an inverted papilloma that necessitated sacrifice of his NLD. Concerning post-operative endoscopic evaluation, the present study showed that eleven cases (91.7%) of the studied group had the flap in place and only one patient (8.3%) had a small perforation of the inferior meatal flap that spontaneously healed in two weeks. Nine cases (75.0%) of the studied group didn’t show any crustation or granulation tissue in place of prelacrimal recess incision while three patients (25.0%) had a minimal granulations and crustation

for only four weeks. Eleven cases (91.7%) of the studied group didn’t have synechia and only one patient (8.3%) had an adhesion between middle turbinate and the lateral nasal wall. No cases showed any bleeding or blood clots.

In **Al Ayadi, et al. [9]**, study the inferior turbinate stability was compromised in (15%) of patients; facial pain was present in (10%) of patients after a 3-month follow-up period; persistent epiphora was present in (5%) of patient 3 months after the operation; and inferior meatus adhesions were found in two (10%) patients.

Similarly, **Comoglu et al. [5]** nearly found the same results. NLD injury occurred in two patients during operation but neither had epiphora postoperatively. Three (3/12; 25%) patients had synechia formation between the lateral nasal wall (particularly on the inferior edge of the mucosal flap) and septum just superior to the inferior turbinate. One of the three (1/12; 8.3%) patients with synechia was symptomatic and required surgical treatment under local anesthesia. No patients developed recurrence during follow-up.

In the present study, there was no recurrence of the lesions during the follow up period. These findings are in similarity with the results of **Chaiyasate et al. [12]** who suggested that patients should be followed up for at least 2 years postoperatively to detect recurrence. In their study, no recurrence was seen, and no postoperative delayed complications were detected during the follow-up period (range: 24–36 months).

In **Yu, et al. [13]** study Postoperative follow-up period was 3–10 years, with an average of 5.5 years. Of the 71 patients, 6 (8.5%) had postoperative recurrence. Among the 20 patients with PLRA, 1 had recurrence, in which the lesion was located on the anterior-medial wall of maxillary sinus cavity and recurred 8 months after surgery. After surgery by PLRA, there was no vision disorder, diplopia or epiphora; no facial numbness, pain or swelling; and no nasal complications such as dry nose.

At re-examination at 3 months after surgery, the operated cavity was completely epithelialized and no tumor recurred. In 4 cases, cystic vesicles or granuloma hyperplasia occurred in the operated cavity, which were removed by nasal endoscopy, and disappeared 2–4 weeks after flushing the nasal cavity, and no recurrence was found. Stenosis of the middle meatal antrostomy and scarification were observed in 2 cases. The low recurrence rate in our study is due to the fact that we only had 3 IP patients while Yu, et al. study was mostly on patients with IP.

Also, a study conducted by **Lee, et al. [10]** in comparison of surgical outcomes according to surgical approach. There were no cases of failure

of gross total removal during surgery, and no recurrences were observed during the follow-up period for either group.

Additionally, **Ismaeil & Abdelazim [6]** Recurrence rate of antrochoanal polyp has been reduced with the usage of ETPRA in comparison with EMMA alone. And their results reported bleeding was found in only one (6.25%) patient in ETPRA group, and it was moderate bleeding and managed by anterior nasal pack in the outpatient clinic. However, one patient in the EMMA group had synechia formation between the middle meatus and the septum, whereas three patients in ETPRA group had synechia formation between the lateral nasal wall and the septum just superior to the inferior turbinate; the four patients in both groups were not complaining and needed no surgical interference. Recurrence was found in three (18.75%) patients in EMMA group, and there was no recurrence in the ETPRA group. They showed a statistically highly significant value ($P < 0.001$). However, NLD injury was found in two patients in ETPRA group, and postoperative lacrimation presented in only one (6.25%) patient of the same group; they were statistically insignificant ($P > 0.05$).

CONCLUSIONS

Transnasal endoscopic PLRA is a minimally invasive, safe and effective method for removal of benign maxillary sinus lesions that cannot be adequately removed through a widened MMA.

The PLRA achieves the exposure range of medial maxillectomy and the Caldwell-Luc surgery, and retains the integrity of the IT and lacrimal duct system. While fully exposing the lesions for complete removal, the nasal function is well preserved.

In most cases, the PLRA can replace the Caldwell-Luc surgery and is an ideal surgical method in treating maxillary sinus IP under endoscopy. The approach has no major intraoperative or postoperative complications.

Endoscopic Transnasal Prelacrimal Recess Approach (ETPRA) is a novel, reliable, and useful method for the treatment of primary or recurrent MS lesions. It ensures good exploration of the maxillary antrum and easy access to the origin on the maxillary wall without the need of additional approaches.

Declaration of interest:

The authors report no conflicts of interest. The authors along are responsible for the content and writing of the paper.

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