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Turbinate Reduction in Endoscopic Surgery for Allergic Fungal Sinusitis: A Comparative Study

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Abstract

Background: Proper eradication of allergic fungal sinusitis (AFS) depends on three factors: First is proper preoperative evaluation and mapping via computed tomography and MRI. Second is the availability of adequate surgical tools in experienced hands. Third is the proper postoperative endoscopic follow-up to detect and remove recurrence if possible.

Aim of Study: To evaluate the role of inferior turbinectomy (IT) and partial middle turbinectomy (PMT) in patients with AFS managed by endoscopic sinus surgery (ESS) for the prevention of recurrence and adequate management of residual disease (postoperative salvage).

Subjects and Methods: A prospective, comparative, randomized study conducted from February 2017 to January 2019. In all, 32 patients suffering from AFS were included. All patients have been presented and managed at the Department of Otolaryngology, Hearing and Speech Institute. Patients have been randomized into two groups of 16 patients each (groups A and B). The patients in group A have undergone ESS only, while the patients in group B have undergone ESS plus bilateral IT and PMT. Regular follow-up visits were done every 2 months for at least 6 months for both groups.

Results: In group A, there was difficulty in proper assessment in 12 patients out of 16. Recurrence occurred in seven patients who showed rigorous assessment, which was managed via ESS adding to the maneuver bilateral IT and PMT. In group B, only two patients were difficult out of the 16. Recurrence occurred in three patients only and was managed easily in the outpatient office. No significant complications were detected in both groups.

Conclusion: IT and PMT may be considered as essential steps in the surgery for AFS as they play a role in lowering the recurrence rate and facilitating better, more comfortable, and more effective postoperative management of recurrence if happened.

Key Words: *Turbinate reduction - Recurrent allergic fungal sinusitis.*

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Introduction

OVER the past few decades, allergic fungal sinusitis (AFS) has become increasingly defined [1]. Once mistaken for a paranasal sinus tumor, it is now believed to be an allergic reaction to aerosolized environmental fungi, usually of the dematiaceous species, in an immunocompetent host [2]. This is in contrast to invasive fungal infections that affect immunocompromised hosts, such as patients with diabetes mellitus and patients with AIDS. Most patients with AFS have a history of allergic rhinitis, and the exact timing of AFS development can be difficult to discern. Thick fungal debris and mucin (Fig. 1) are developed in the sinus cavities, with characteristic radiologic findings (Fig. 2), which must be surgically removed so that the inciting allergen is no longer present. Recurrence is not uncommon, once the disease is removed; anti-inflammatory medical therapy and immunotherapy are being used to help in the prevention of recurrence [3,4]. It is advocated that poor mucociliary clearance of the sinuses due to anatomical abnormalities plus antibiotic abuse are pivotal factors in developing AFS [5]. The anatomical abnormalities which predispose to the pathogenesis also predispose to the recurrence of the disease or residual pathology are of two main types, the first one is a fixed persistent abnormality such as marked septal deviation or thickening, concha bullosa, or paradoxically pent middle turbinate. These fixed abnormalities can be identified clinically or radiologically during the preoperative assessment and by logic should be adequately managed during surgery to reach the hidden areas of the disease, so these abnormalities are beyond the scope of this study. The second type of abnormalities includes the allergic hypertrophied inferior turbinates which have an (on and off) effect due to its erectile tissue which responds to allergic and

vasomotor stimuli, also the allergic thickened mucosa on the middle turbinate. These abnormalities are easily masked intraoperatively by the effect of local decongestants applied in high doses with meticulous distribution for a relatively long time (which is usually inapplicable in the same way during outpatient visits). Being not addressed intraoperatively, they form a hindering element during the postoperative follow-up.

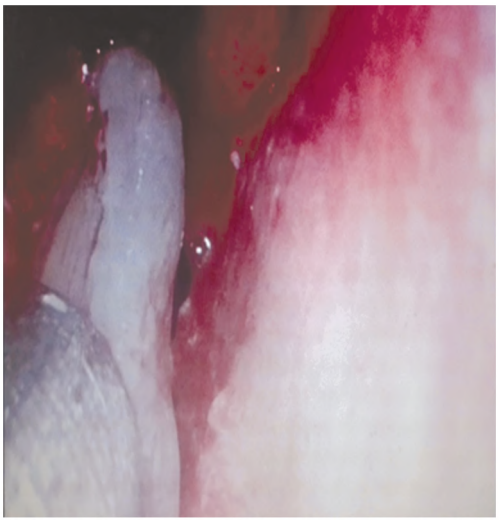

Fig. (1): Allergic mucin (thick, tenacious eosinophilic secretion).

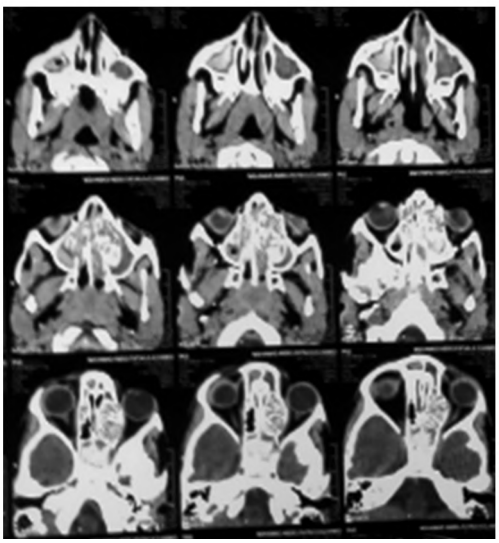

Fig. (2): Computed tomographic scan axial cuts paranasal sinuses soft tissue window showing hyperdense and heterogeneous sinus opacity due to fungal concretions.

Subjects and Methods

Ethics:

The study and data collection confirmed to all local laws and were compliant with the principles of the Declaration of Helsinki. The study was approved by the local ethics committee. Written informed consent was obtained from each patient accepting to participate in the study. A randomized, comparative, controlled study was conducted in the period between February 2017 and January 2019. Thirty two patients diagnosed with AFS with no previous surgical intervention to the condition were included. All patients have been presented and managed at the Department of Otolaryngology, Hearing and Speech Institute. The patients have been randomized into two equal groups of 16 patients each. The two groups are groups A and B. Randomization was envelope based. All patients in group A have undergone endoscopic sinus surgery (ESS), while all patients in group B have undergone ESS plus bilateral inferior turbinectomy (IT) and partial middle turbinectomy (PMT). Regular follow-up visits were done for at least 6 months.

Exclusion criteria:

Patients with multiple recurrences and revision surgeries having marked fibrosis, synechia, and disturbed anatomy were excluded.

Methods:

All patients underwent a detailed medical and surgical history, and complete general and local examination. Also, the protocol of diagnosis included imaging by computed tomography scanning or MRI to exclude other possible differential diagnoses.

Operative technique:

General anesthesia was induced via an oral endotracheal tube. The nose was packed with cotton pledgets soaked in 4% xylocaine and adrenaline. Care was taken to squeeze the pledgets well before introducing them. The patient lies supine with the head slightly tilted to the right, facing the operating surgeon. Steps are tailored individually for each patient according to the extent of the disease. Hopkins rod optical telescopes with deflections of view from 0 to 70° and the Messerklinger endoscopic sinus instruments are used. The 0° angle telescope is most commonly used for visualization during surgery and simplicity of instrument manipulation. Other deflections are mainly used for access to the recesses in the operative field. Before beginning the surgical procedure, a routine endoscopic examination is done to visualize and assess the extent of polyposis and the presence of fungal mud (Fig. 3). The infundibular wall is first injected with 2% xylocaine with 1: 10 000 adrenaline under endoscopic visualization. If necessary, the middle turbinate is displaced slightly medially to allow better visualization of the middle meatus. An in-

fundibulotomy is then performed by incising the uncinate process with a sickle knife. The knife is inserted into the uncinate process precisely in front of and immediately below the beginning of the insertion of the middle turbinate. The uncinate process is then removed with a pair of straight forceps, thereby gaining access to the anterior ethmoid area. The ethmoidal bulla now comes into view. The anterior ethmoid cells and ethmoidal bulla are removed with Henkel's straight forceps. Further exenteration of ethmoid air cells can be carried out step by step as necessary. The path leading to the frontal recess is seen above, and this region is now explored using an upward bent forceps. In this area, the 30-70 telescopes are usually required for visualization. The posterior ethmoid cells are entered by opening the ground lamella. These cells are opening the ground lamella. These cells are opened under direct vision by placing the telescope in the posterior ethmoid cells. Finally, the maxillary sinus ostium is identified with a 30 telescope. Since it is often blocked by edematous polypoid inflamed mucosa, it is first sounded with a curved probe and then enlarged with a curette and an Ostrom's reverse cutting forceps. At the end of surgery, nasal packing may be done. Usually, surgery entails removal of the obstructive diseased mucosa from the isolated diseased cells and/or from the frontal recess and ethmoidal infundibulum. A complete endoscopic ethmoidectomy with sphenoidotomy may be required. Step by step polyp removal and excision of fungal concretions by suction and copious irrigation of the affected sinuses are required (Figs. 4,5). All the steps mentioned above have been done in both groups A and B; however, in group B an additional step was added at the end of the surgery. Bilateral partial IT (Fig. 6) and PMT (the anterior end to facilitate access to the maxillary and frontal osteotomies operatively and postoperatively, and also the posterior end to facilitate access to sphenoid osteotomy) were done. Postoperative care in the form of proper observation of any bleeding or evidence orbital complications was done; the pack was removed on the 3rd postoperative day. Parenteral broad-spectrum antibiotics were administered for 4-5 days followed by oral antibiotics for another 1 week Patients from both groups were given follow-up visit appointments in the outpatient clinic on weekly bases after pack removal for 1 month, then every 2 weeks for another month, then on monthly bases. Endoscopic examination was done on a monthly basis.

Statistical analysis:

Data management and analysis were performed using the statistical analysis systems. Numerical data were summarized using means and SDs or mean and ranges. Categorical datawere summarized as percentages. The χ^2 test was used to compare between the groups concerning categorical data. All p-values are two-sided. p-values less than 0.05 were considered significant.

Fig. (3): Endoscopic examination as a first step in surgery showing nasal polyp and hypertrophied inferior turbinate.

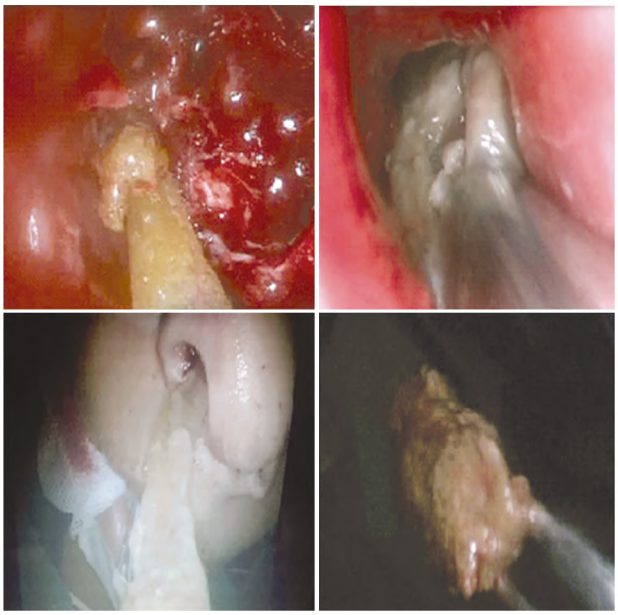

Fig. (4): Step by step polyp removal and excision of fungal concretions by suction and copious irrigation.

Fig. (5): Sounding the left sphenoid sinus to show the suction cannula tip in the right sphenoid sinus after removal of fungal mass destroying the intersphenoid septum.

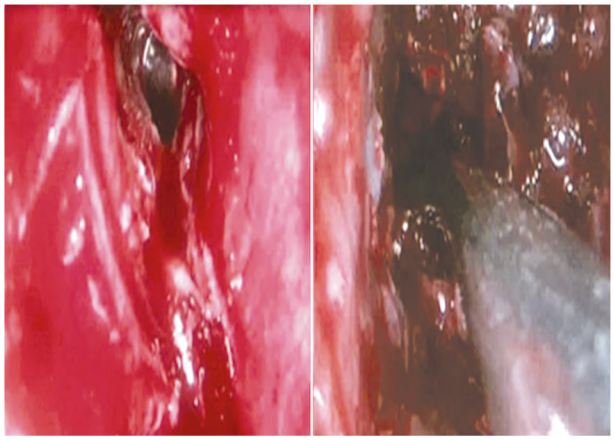

Fig. (6): Inferior turbinate assessment and then surgical excision in a patient of group B.

Results

The mean age was 36.4+5.2 in group A and 28.3+7.1 in group B; the difference was statistically not significant (p=0.5). Age ranged from 14 to 54 in both groups. Group A included 52.9% men while group B included 67.2% men; both groups were comparable (p=0.6).

Operative results:

In group A, the operative time ranged from 1.8 to 2.4h with a mean of 1.8h. Blood loss has a range of 134-195ml with a mean of 155ml. Hospitalization was 1 day in all patients of this group with discharge in the second postoperative day. As regards complications, there were no significant complications in the form of injury to adjacent critical structures or massive hemorrhage. Return to regular life activity or work was possible in all patients after 10 days (Table 1).

As regards the final outcome (Table 2), all patients were subjected to periodic regular endoscopic monthly assessment. There was difficulty in proper assessment in 12 (75%) patients out of the 16 patients of this group. The difficulty was in two forms, the first was painful examination and suction maneuver, which was mild in three patients, and moderate in nine patients. The second form of difficulty was the inability to assess particular sites to exclude residual disease or recurrence (Fig. 7). The difficult assessment was toward the sphenoid sinusotomy in six patients and the maxillary sinusotomy in two patients and toward both sphenoid and maxillary sinuses in two patients and frontal sinus in two patients. As regards recurrence of the disease, it occurred in seven (21.875%) patients who showed the problematic assessment. The recurrences were managed endoscopically in the operative theater as a completion surgery adding to the maneuver bilateral IT and PMT.

Fig. (7): Postoperative endoscopic view of a patient in group A showing the narrow field of assessment due to hypertrophied inferior turbinate.

In group B, the operative time ranged from 2.2 to 2.9h with a mean of 2.4h. Blood loss has a range of 175-232ml with a mean of 198ml. Hospitalization was 1 day in all patients of this group with discharge in the second postoperative day. As regards complications, there were no significant complications in the form of injury to adjacent critical structures or massive hemorrhage, except one patient, which was repacked twice after pack removal due to moderate epistaxis. Return to regular life activity or work was possible in all patients after 12 days (Table 1).

As regards the final outcome (Table 2), the periodic regular endoscopic monthly assessment showed no rigorous assessment in 12 patients out of the 16 patients of the group (Fig. 8). The difficulty was in two (6.25%) patients. There were a painful examination and suction maneuver which was mild in these two patients; there was no problematic assessment of all target areas. Regarding recurrence of the disease, it occurred in three (9.375%) patients in the sphenoid sinus in two patients and the maxillary sinus in one patient. Their recurrence was managed easily in the outpatient office.

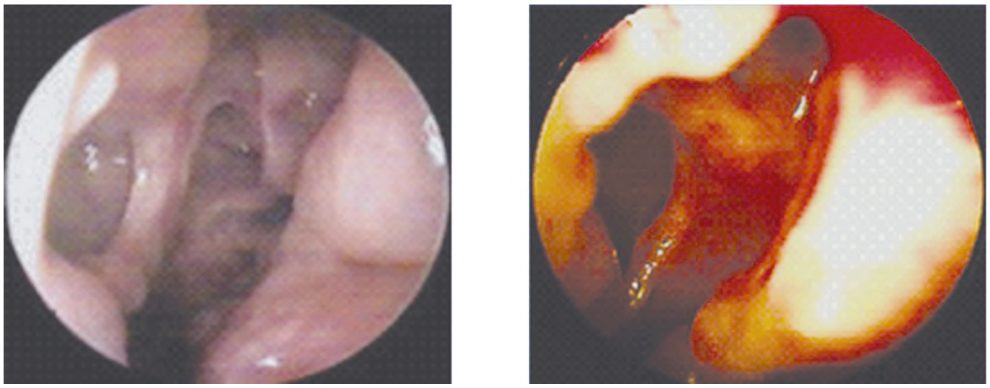

Fig. (8): Postoperative endoscopic view of patients in group B showing the full field of assessment due to excision of inferior turbinate and middle turbinate partially with a visible and controllable sinus osteotomy and cavity.

Table (1): Comparison between group according to operative time, blood loss, complications, hospitalization and return to normal life activities.

Patient groups	Item				
	Operative time (h)	Blood loss (ml)	Complications	Hospitalization	Return to normal life
Group A	Range 1.8-2.4 Mean 1.8	134-195 155	No complications	1 day	10 days
Group B	Range 2.2-2.9 Mean 2.4	175-232 198	One case of epistaxis after pack removal and repacked	1 day	12 days

Table (2): Final outcome through periodic endoscopic assessment and recurrence.

Patient groups	Item			
	Final outcome through periodic endoscopic assessment		Recurrence	
	Painful examination	Unreachable areas	Number of patients	Management
Group A	12 (75%) out of 16 patients	Sphenoid in 8 patients Maxillary in 2 patients Both sphenoid and maxillary in 2 patients Frontal in 2 patients	7 (21.875%) out of 16 patients	Revision endoscopic surgery + bilateral inferior turbinectomy and partial middle turbinectomy
Group B	2 (6.25%) out of 16 patients	Sphenoid in 2 patient Maxillary in 1 patient	3 (9.375%) out of 16 patients	Suction and debride

Discussion

AFS incidence is between 6 and 9% of all rhinosinusitis requiring surgery. Regional variation in incidence has been reported [6]. Patients with AFS commonly present with chronic rhinosinusitis with nasal polyps, inhalant atopy, elevated total serum immunoglobulin E, and sinus-obstructing inspissates of a characteristic extramucosal 'peanut buttery' visco-elastic eosinophil-rich material called 'allergic mucin' that contains sparse numbers of fungal hyphae [7,8]. Sinus computed tomography shows findings of chronic rhinosinusitis that often include central areas of increased contrast (hyperattenuation) that represent the presence of fungal-containing allergic mucin [9].

In our practice, we were encountered by the problem of difficult follow-up and assessment of patients postoperatively due to surprise anatomical obstruction in the form of hypertrophied inferior turbinates and thickened middle turbinate mucosa. So a study was designed to assess the role of IT and PMT as an added step during ESS for AFS. In a 2-year prospective comparative study upon 32 patients randomized into two equal groups, group A underwent ESS only, while group B underwent ESS + IT and PMT. Inferior turbinectomy is one of the most studied procedures in nasal surgery, its techniques, effects, and complications are the subject of the study until now. In a systematic review published in 2009 which included 96 studies showed an overwhelming data supporting procedure efficacy on index disease with positive results in 93 studies **[10]**. Serving as a surgical solution for nasal obstruction it can also serve as an access to the posterior part of the nasal cavity after ESS for AFS. Publications on the effect of PMT denotes: being safe, with minimal complications even frontal sinusitis **[11]**, decreased rates of synechia formation and enhanced surgical exposure **[12]**, also with minimal or no effect on nasal airflow resistance compared with middle turbinate preservation in ESS for nasal polyposis **[13]**.

In our study, the recurrence figure of the disease had two main limbs. The first one is the recurrence rate, which showed marked improvement in group B of IT and PMT in which only three patients have got recurrence versus seven patients in group A. The second limb of recurrence figure is the severity or the extent of recurrence and how easy to manage. In group B we have managed the recurrent cases endoscopically in the outpatient clinic in a more straightforward manner, where we found a full patent nasal cavity and reachable sinus ostia and cavities and also minimal recurrence in the form of allergic mucin only and very occasional fungal mud. This minimal recurrence may be attributed to the better ventilated nasal cavity and more effective nasal wash. This condition is very similar to the philosophy of radical mastoidectomy in which we create a cavity and exteriorize the disease.

Conclusion:

From this study, we conclude that bilateral IT and PMT are essential steps for any patient with AFS managed endoscopically. These steps are mandatory to reach effectively to all affected sinuses and for proper visualization of all sinuses during the postoperative assessment visits with the ability to clear sinus cavities from any residual or recurrent fungal infection by suction and irrigation in a full patent nasal cavity.

Recommendation:

We recommend to perform bilateral inferior turbinectomy and partial middle turbinectomy routinely in all cases of allergic fungal sinusitis managed endoscopically to obtain a higher success rate and minimize the recurrence.

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تصغير غضاريف الأنف وأهميته فى الجراحة الوظيفية بالمنظار لحالات الالتهابات الفطرية للجيوب الأنفية

أن الاستئصال الجزئى للغضاريف السفلية والوسطى للأنف يعتبر خطوة أساسية فى الجراحة الوظيفية بالمنظار لحالات الالتهابات الفطرية للجيوب الأنفية. حيث أنه يساعد على التخلص التام واستئصال التكوين الفطرى من الأنف نتيجة للوصول السهل للأماكن المختبئة بالجيوب الأنفية كما أنه يقلل نسبة الانتكاسات للالتهابات الفطرية من خلال الاستئصال التام ومن خلال سهو لة المتابعة الدورية بالمنظار فى العيادة حتى يكون الفحص غير مؤلم ويمكن من خلاله الوصول إلى جميع الأماكن الصعبة والمختبئة كما أنه يسهل إكتشاف وجود تكوين فطرى فى مراحله المبكرة والتمكن من ازالته بالشفط أو الغسيل. ومن خلال تلك الدراسة ننصح بعمل الاستئصال الجزئى للغضاريف السفلية والوسطى أثناء الجراحة الوظيفية بالمنظار لحالات الالتهابات الفطرية للجيوب الانفية للحصول على نسبة نجاح أعلى وأقل نسبة انتكاسات.