

# Effect of Partial Middle Turbinectomy on the Recurrence of Allergic Fungal Sinusitis: A Comparative Study

Original  
Article

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## ABSTRACT

**Objectives:** To evaluate the role of partial middle turbinectomy (PMT) in patients with allergic fungal sinusitis (AFS) managed by endoscopic sinus surgery (ESS) in the prevention of recurrence and adequate management of residual disease.

**Patients and Methods:** This prospective study, conducted on 60 patients, suffering from AFS diagnosed clinically and radiologically after presenting to the Otolaryngology clinic at faculty of medicine Cairo University and Misr University for Science and Technology during the period of March 2021 to August 2022. Patients were randomly divided into 2 equal groups. All Patients underwent ESS. The middle turbinate was preserved in Group A patients while PMT was performed in group B patients. Both the groups were compared postoperatively in the outpatient clinic in a period of up to 9 months in the outpatient clinic to detect recurrence of allergic fungal sinusitis, patency of sinuses was assessed endoscopically.

**Results:** In the current study we found that recurrence was less frequent in PMT group at 6 months follow up 0.0% (n=0) (Group B turbinectomy Group) compared to recurrence 20.0% (n=6) in (Group A preserved Group) the differences started to be statistically significant after the 6 months assessment point. And was still significantly lower at 13.3% (n=4) compared to 36.7% (n=11) after 9 months. Also, there were no significant incidences of bleeding or orbital injury in either group.

**Conclusion:** This study demonstrated that PMT decreased the chances of recurrence of disease.

**Key Words:** Allergic fungal sinusitis, partial middle turbinectomy, recurrence of allergic fungal sinusitis.

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## INTRODUCTION

Over the past few decades, allergic fungal sinusitis (AFS) has become increasingly defined<sup>[1]</sup>. 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<sup>[2]</sup>.

This contrasts with 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 identify. Thick fungal debris and mucin are developed in the sinus cavities, with characteristic radiologic findings, 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<sup>[3, 4]</sup>.

It is advocated that poor mucociliary clearance of the sinuses due to anatomical abnormalities plus antibiotic abuse are pivotal factors in developing AFS<sup>[5]</sup>.

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 bent 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<sup>[6]</sup>.

Nasal irrigation has become an integral part of the postoperative care after sinus surgery. It assists in the mechanical removal of debris, mucin, and inflammatory products and is also a means of topical drug delivery<sup>[7, 8]</sup>.

This study aims to evaluate the role of partial middle turbinectomy (PMT) in patients with AFS managed by endoscopic sinus surgery (ESS) in the prevention of recurrence and adequate management of residual disease.

#### **PATIENTS AND METHODS:**

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This prospective study was conducted from the period of March 2021 to August 2022 on 60 patients, suffering from Allergic fungal sinusitis, presenting at Otolaryngology clinic at faculty of medicine, Cairo University and Misr University for Science and Technology. This was randomized comparative study allocated to 2 groups according to sealed enveloped 1:1. Group A patients underwent conventional endoscopic sinus surgery with preservation of middle turbinate and Group B PMT was added to endoscopic sinus surgery. The Research ethics committee (REC) permit number MD-55-2021. Study location at Faculty of Medicine, Cairo University and Misr University for Science and Technology.

**Inclusion criteria:** Patients aged 16 to 60 years with Allergic Fungal Sinusitis with no previous surgical intervention to the condition were included

**Exclusion criteria:** Patients below 16 and above 60 years old, patients with recurrence as revision surgeries have marked fibrosis and synechia, were excluded, patients with contraindications for general anesthesia and not fit for surgery.

#### **Methodology in details:**

A definite protocol for evaluation followed in all patients, detailed medical and surgical history obtained from all patients, all patients underwent complete general and local examination, imaging by computed tomography scanning or MRI to exclude tumors, intracranial or orbital invasion, written consent was taken after full explanation of the procedure and other alternatives, Patients meeting inclusion criteria were randomly allocated to 2 groups according to sealed enveloped 1:1. Group A patients underwent conventional endoscopic sinus surgery with preservation of middle turbinate and Group B PMT was added to endoscopic sinus surgery.

#### **• Operative technique:**

General anesthesia induced via an oral endotracheal tube and through the utilization of deliberate hypotension maintained by the anesthesiologist. The nose packed with cotton pledges soaked in 4% xylocaine and adrenaline (1:200000). The patient lied supine with the head slightly

tilted to the right, facing the operating surgeon. Steps were tailored individually for each patient according to the extent of the disease. Nasal endoscopy with different deflections of view from 0 to 70° and endoscopic sinus instruments used. The 0-angle telescope used for visualization during surgery and simplicity of instrument manipulation. Other deflections used for access to the recesses in the operative field.

Before beginning the surgical procedure, a routine endoscopic examination done to visualize and assess the extent of polyposis and the presence of fungal mud. 2% xylocaine with 1: 10,000 adrenaline used as local hemostatic to inject the infundibular wall under endoscopic visualization. If necessary, the middle turbinate displaced slightly medially to allow better visualization of the middle meatus. We did polypectomy by microdebrider in cases suffers from nasal polyposis to allow better access to middle meatus. An infundibulotomy then performed by incising the uncinate process with a sickle knife 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. After exposure of the ethmoidal bulla. The anterior ethmoid cells and ethmoidal bulla removed with straight forceps.

Further exenteration of ethmoid air cells can be carried out step by step as necessary. The path leading to the frontal recess was usually explored using upward bent forceps. In this area, the 30-70 telescopes were usually required for visualization. The posterior ethmoid cells were entered by opening the ground lamella. These cells were opened under direct vision by placing the telescope in the posterior ethmoid cells. Finally, the maxillary sinus ostium was 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 was done. Usually, surgery entails removal of nasal polypi with obstructive diseased mucosa from the isolated diseased cells and/or from the frontal recess and ethmoidal infundibulum. A complete endoscopic ethmoidectomy with sphenoidotomy was sometimes required. Step by step polyp removal and excision of fungal concretions by suction and copious irrigation of the affected sinuses were carried out. All the steps mentioned above were done in both groups A and B; however, in group B an additional step was added during the surgery. PMT was done through resection anterior inferior hanging portion of middle turbinate to allow significant widening of the middle meatus and prohibit the turbinate from being displaced laterally to obstruct the maxillary and anterior ethmoid out flow tracks operatively and postoperatively<sup>[9,10]</sup>.

Any intraoperative complications were documented.

### **Post-operative assessment:**

In the form of proper observation of any bleeding or evidence orbital complications, the pack was removed on the 2<sup>nd</sup> postoperative day, nasal cleaning and lavage were done by using hypertonic saline solution, parenteral broad-spectrum antibiotics was administered for 4-5 days followed by oral antibiotics for another 1 week, local steroids was given for six months after surgery, systemic steroids was administered for one month after surgery in patients from both groups, 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 follow up examination was done on a monthly basis with a duration up to 9 months, all the patients that completed follow-up duration was taken in this study. The patients were asked for any nasal obstruction or smell disorders during follow up visits. Nasal endoscopy was done in the outpatient clinic with suction of any secretions and assessment of accessibility of the nasal sinuses by endoscopist postoperatively. In case

of nasal polyposis or fungal mucin detected by endoscopy during follow up this was considered as recurrence. First, it was dealt with if possible, in the outpatient clinic conservatively. If not accessible a CT PNS was ordered and patients were scheduled for reoperation.

### **Statistical analysis:**

The collected data were coded, tabulated, and statistically analyzed using IBM SPSS statistics (Statistical Package for Social Sciences) software version 28.0, IBM Corp., Chicago, USA, 2021. Quantitative data tested for normality using Shapiro-Wilk test, then described as mean±SD (standard deviation) as well as minimum and maximum of the range, then compared using independent t-test. Qualitative data described as number and percentage and compared using Chi square test and Fisher's Exact test for variables with small expected numbers. Log rank test was used to compare recurrence rate. The level of significance was taken at *p-value* <0.050 was significant, otherwise was non-significant.

### **RESULTS:**

**Table 1:** Demographic characteristics among the studied group

Variables		Turbinectomy (N=30)	Preserved (N=30)	<i>p-value</i>
Age (years)	Mean±SD	36.4±11.4	35.1±9.9	*0.629
	Range	17.0–56.0	19.0–53.0	
Sex (n, %)	Male	17 (56.7%)	16 (53.3%)	**0.795
	Female	13 (43.3%)	14 (46.7%)	

\*Independent t-test \*\*Chi square test

There was no significant difference in between demographic between the two study arms (Table 1).

**Table 2:** Intraoperative complications in the two studied groups

Complications	Turbinectomy (N=30)	Preserved (N=30)	<i>p-value</i>
Bleeding	3 (10.0%)	1 (3.3%)	§0.612
Orbital injury	0 (0.0%)	0 (0.0%)	NA
CSF rhinorrhea	0 (0.0%)	0 (0.0%)	NA
Smell disorder	0 (0.0%)	0 (0.0%)	NA

Fisher's Exact test.

Intraoperative bleeding statistically was non-significantly more frequent in turbinectomy group. Orbital injury, CSF rhinorrhea and smell disorders were not recorded in either group. Table (2)

**Table 3:** Comparison of cumulative recurrence in studied groups over time

Time	Turbinectomy (N=30)	Preserved (N=30)	<i>p-value</i>
Week 1	0 (0.0%)	0 (0.0%)	NA
Week 2	0 (0.0%)	0 (0.0%)	NA
Week 3	0 (0.0%)	0 (0.0%)	NA
Week 4	0 (0.0%)	0 (0.0%)	NA
Week 6	0 (0.0%)	0 (0.0%)	NA
Week 8	0 (0.0%)	0 (0.0%)	NA

**EFFECT OF PMT ON RECURRENCE OF AFS**

Month 3	0 (0.0%)	0 (0.0%)	NA
Month 4	0 (0.0%)	3 (10.0%)	0.237
Month 5	0 (0.0%)	3 (10.0%)	0.237
Month 6	0 (0.0%)	6 (20.0%)	0.024*
Month 7	1 (3.3%)	8 (26.7%)	0.026*
Month 8	2 (6.7%)	10 (33.3%)	0.010*
Month 9	4 (13.3%)	11 (36.7%)	0.034*

\*Significant (Chi square test &Fisher’s Exact test).

Recurrence was less frequent in turbinectomy group. The differences started to be statistically significant after 6 months assessment point. Table (3)

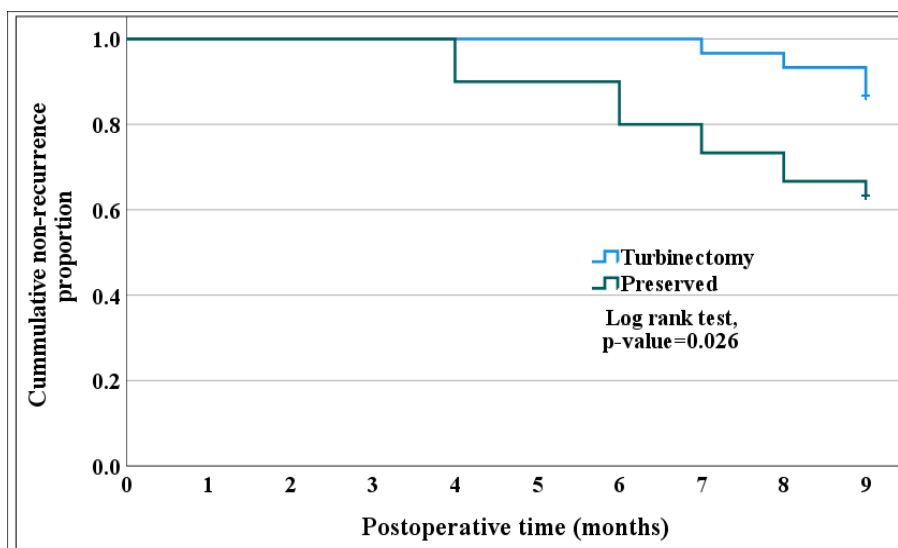
**Table 4:** Comparison of the timing of recurrence of the two study groups.

Time	Turbinectomy (N=4)	Preserved (N=11)	p-value
Month 4	0 (0.0%)	3 (27.3%)	0.703
Month 6	0 (0.0%)	3 (27.3%)	
Month 7	1 (25.0%)	2 (18.2%)	
Month 8	1 (25.0%)	2 (18.2%)	
Month 9	2 (50.0%)	1 (9.0%)	

Fisher’s Exact test.

The timing of recurrence started later in the turbinectomy compared to preserved group (month-7 and month-4, respectively). However, the differences were not statistically significant. Table (4)

Rate of recurrence was significantly lower in turbinectomy group. Fig. (1)



**Fig. 1:** Kaplan-Meier curve for the rate of recurrence in the studied groups

**Table 5:** Comparison regarding severity of recurrent cases among the studied groups

Severity	Turbinectomy (N=4)	Preserved (N=11)	p-value
Reoperation	0 (0.0%)	11 (100.0%)	<0.001*
Conservation	4 (100.0%)	0 (0.0%)	

Fisher’s Exact test. \*Significant

Recurrence in turbinectomy group needed only conservative method in outpatient clinic while those in preserved group needed reoperation. Table (5)

**Table 6:** Comparison regarding ease of accessibility of para nasal sinuses ostium for irrigation and suction at follow-up among the studied groups

Grade	Turbinectomy (N=30)	Preserved (N=30)	<i>p-value</i>
Easy	24 (80.0%)	4 (13.3%)	<i>0.001*</i>
Moderate	6 (20.0%)	18 (60.0%)	
Difficult	0 (0.0%)	8 (26.7%)	

Fisher's Exact test. \*Significant

Accessibility of follow up was statistically easier in turbinectomy group. Table (6)

## DISCUSSION

Allergic fungal sinusitis AFS incidence is between 6 and 9% of all rhinosinusitis requiring surgery. Regional variation in incidence has been reported<sup>[11]</sup>.

Allergic fungal rhinosinusitis (AFRS) is a distinct subset of chronic rhinosinusitis with nasal polyposis (CRSwNP) usually encountered in immunocompetent individuals, which is associated with bony expansion and remodelling of the involved paranasal sinuses (PNS), resulting in proptosis and possible optic nerve compression<sup>[12]</sup>.

The mechanical pressure over the optic nerve may lead to irreversible damage if not addressed promptly. During the COVID-19 pandemic, few AFRS patients presented with vision impairment<sup>[13]</sup>.

Over the past few decades, AFS has become increasingly defined<sup>[14]</sup>.

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 butter' visco-elastic eosinophil-rich material called 'allergic mucin' which is histopathologically consists of mucinous material with abundant eosinophils and Charcot-Leyden crystals that contains sparse numbers of fungal hyphae<sup>[15]</sup>.

It is advocated that poor mucociliary clearance of the sinuses due to anatomical abnormalities plus antibiotic abuse are pivotal factors in developing AFS<sup>[16]</sup>.

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<sup>[17]</sup>.

After surgery, nasal endoscopists are 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 PMT as an added step during ESS for AFS. In a 9 months prospective comparative study upon 60 patients randomized into two equal groups, group A underwent ESS only, while group B underwent ESS plus PMT.

Until the production of this study, few publications could be obtained addressing this problem from our point of view, but many studies were conducted on IT and PMT. IT 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<sup>[18]</sup>. 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, decreased rates of synechia formation and enhanced surgical exposure, also with minimal or no effect on nasal airflow resistance compared with middle turbinate preservation in ESS for nasal polyposis<sup>[19]</sup>.

Anterior part of middle turbinate has been found to be an important area in secretion of vasoactive neuropeptides which predispose mucosal oedema. The unmyelinated sensory fibres in nasal mucosa secretes neuropeptides, calcitonin gene related peptides, substance P and neurokinin A. Mechanical or contact stimulation of anterior part of middle turbinate mucosa provokes secretion of these substances<sup>[19]</sup>.

PMT facilitates drug delivery to frontal and sphenoid sinuses postoperatively, thus decreasing formation of polypoidal mucosa. Middle turbinate acts as important anatomical landmark in functional endoscopic sinus surgery partial antero-inferior resection of middle turbinate leaves behind the bulk of middle turbinate as useful anatomical landmark<sup>[20]</sup>.

When comparing demographic characteristics among the studied groups we found no significant difference between two groups regarding age and sex. The patient sample in our study is similar to the profile described by Martin *et al*, with a mean age of 40 years and had fewer female's ratio (43.8%) undergoing sinus surgery<sup>[21]</sup>. And this contrary to Schubert *et al* which hypothesis a female preponderance 58%<sup>[22]</sup> there was no sex predilection in the above mentioned studies.

In the current study, there were no significant incidences of bleeding or orbital injury in either group. Choby and colleagues had also shown no significant differences in the incidence of complications like epistaxis requiring return to operation theatre, orbital haematoma or CSF rhinorrhoea in either group<sup>[23]</sup>.

Also, there was no significant incidence of smell disorder. Kaluskar showed that simple wedge resection of the anterior part of the middle turbinate achieves decreased rate of synechia formations and recommend its use as an adjunct to the FESS and none of the patients suffered any post-operative olfactory dysfunction or excessive crusting as a result of this procedure<sup>[24]</sup>.

Also, we found that accessibility of paranasal sinuses for suction and irrigation during post-operative follow up was significantly easier among group B than group A. and this similar Halderman *et al* in 2016 which showed improved nebulized drug delivery to maxillary, sphenoid, and frontal sinuses after PMT<sup>[25]</sup>.

The recurrence of nasal polyposis in general and allergic fungal sinusitis specifically is a commonly encountered scenario in clinical practice and may occur up to 40-90% of cases<sup>[26]</sup>. It has been described that the interval to revision surgery is longer in patients who underwent FESS with PMT<sup>[21]</sup>. In the current study we found that recurrence was less frequent in PMT group 0.0% (n=0) (Group B turbinectomy Group) compared to recurrence 20.0% (n=6) in (Group A preserved Group) the differences started to be statistically significant after 6 months assessment point.

Similar to the current study Roy and Lade in 2019 showed that both the partial resected and the preserved middle turbinate groups showed improved endoscopic assessment of nasal mucosa. When comparing middle turbinate resection and preservation, a statistically significant outcome regarding recurrence of allergic fungal sinusitis. Also, the group in which the middle turbinate was resected showed a statically significant symptomatic improvement than the group in which middle turbinate was preserved with no increased risk of complications. So, partial resection of middle turbinate may be relevant in cases of endoscopic

sinus surgery resulting in symptomatic improvement without affecting the course of the disease or increased risk of complications<sup>[20]</sup>.

In contrary to this study Ahmed and Osman in 2016 showed that no statistically significant differences were observed in the recurrence of nasal polyp, adhesions, smell affection or overall nasal patency between findings in either group<sup>[27]</sup>.

Also Hudon *et al* in 2018 showed that no sustained objective endoscopic benefit of routine middle turbinectomy, at least within the first six postoperative months, in patients undergoing primary ESS for CRS with polyposis<sup>[28]</sup>.

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 PMT in which only four patients have got recurrence versus eleven 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. while those in preserved group needed reoperation.

Hence, this study supports that PMT resection remains a safe procedure with surgical competency. It is important to consider the limitations of the study as well. The study was conducted with a sample size of 60 patients which was sufficient for carrying out a quantitative analysis but a larger sample size is necessary to ensure that the sample is representative of the population. The follow-up was limited to 9 months. Therefore, a larger sample and prolonged follow-up may be considered for further evaluation of efficacy of PMT.

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## CONCLUSION

This study demonstrated that PMT decreased the chances of recurrence of the disease. Therefore, a larger sample considering and a prolonged follow-up may be considered for further evaluation of efficacy of PMT.

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## CONFLICT OF INTEREST

There are no conflicts of interest.

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