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Original article

Preservation versus Partial Resection of The Middle Turbinate in Allergic Fungal Sinusitis Surgery: A Prospective Cohort Study

Ahmed S. Elkady , Hamada F. Hashim, Islam A. Kamal,
Alaa M. Abdel Samie

Otorhinolaryngology Department, Faculty of Medicine Benha University, Egypt.

Corresponding to:
Dr. Islam A. Kamal.
Otorhinolaryngology Department, Faculty of Medicine Benha University, Egypt.
Email: Ceislam93@gmail.com

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Abstract:

Background: Over the past few decades, allergic fungal sinusitis (AFS) has become increasingly defined. This study aimed to evaluate the definite outcomes of preservation vs partial resection of the middle turbinate in AFS surgery. **Methods:** This cross-sectional study included prospective study, carried out on 40 patients, suffering from AFS. Patients were allocated into 2 groups according to sealed enveloped 1:1. Group A: Patients were subjected to endoscopic sinus surgery with preservation of middle turbinate. Group B: Partial middle turbinate resection (PMTR) was be added to endoscopic sinus surgery. **Results:** The Lund-Kennedy score was significantly lower in group B compared to group A at 3 and 6 months (P=0.040, <0.001), with no significant difference between both groups regarding the preoperative Lund-Kennedy score and Lund-Kennedy score at 4 weeks. SNOT-22 score at 6 months was significantly lower in group B compared to group A (P <0.001) with no significant difference between both groups regarding the preoperative SNOT-22 score. Regarding outcome, 1 (5%) in group A and 2 (10%) patients in group B had bleeding. Orbital injury, CSF rhinorrhea and smell disorder not reported in any of the studied groups. 6 (30%) patients in group A and only 1 (5%) patient in group B showed recurrence. The incidence of recurrence was significantly lower in group B compared to group A (P =0.037) with no significant difference between both groups regarding the incidence of bleeding. **Conclusion:** The additional PMTR to endoscopic sinus surgery provides superior clinical outcomes compared to middle turbinate preservation alone in the management of AFS.

Keywords: Preservation; Partial Resection; Middle Turbinate; Allergic Fungal Sinusitis Surgery.

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)].

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 [(3, 4)].

The role of the middle turbinate—a key anatomical structure within the nasal cavity—has been a subject of considerable debate in the context of AFS surgery [(5)].Traditionally, surgeons have aimed to preserve the middle turbinate due to its important physiological functions, including airflow regulation, humidification, filtration, and its role in olfaction. Moreover, it serves as a landmark for surgical orientation during endoscopic procedures [(6)].

Nonetheless, in cases of extensive sinonasal disease such as AFS, the middle turbinate may become markedly enlarged, distorted, or displaced due to mucosal inflammation and polyp formation. This can potentially hinder surgical access to the sinuses and compromise postoperative drainage and surveillance. Moreover, the presence of diseased or obstructive turbinate tissue may contribute to postoperative recurrence. Consequently, some surgeons advocate for partial or complete resection of the middle turbinate in select cases, particularly when it is significantly diseased or obstructing the natural drainage pathways [(7)].

The purpose of this study was to evaluate the definite outcomes of preservation vs partial resection of the middle turbinate in AFS surgery.

Patients and methods

This cross-sectional study included prospective study, carried out on 40 patients suffering from AFS, presenting at Otolaryngology clinic at Faculty of Medicine, Benha University from the period of November 2023 to October 2024.

An informed written consent was obtained from the patients. Every patient received an explanation of the purpose of the study and had a secret code number. The study was done after being approved by the Research Ethics Committee, Faculty of Medicine, Benha University.

Inclusion criteria were AFS, patients older than 18 years old, both sexes, no history of malignancy or facial trauma and patients without surgical intervention.

Exclusion criteria were patients with known or suspected to surgical intervention in the region of the mid- face, patients with known or suspected traumatic or malignancy, tumor and patients below 18 years old.

Randomization: This was randomized comparative study allocated into 2 groups according to sealed enveloped 1:1. Group A (n=20): Patients were subjected to endoscopic sinus surgery with preservation of middle turbinate. Group B (n=20): Partial middle turbinate resection (PMTR) was be added to endoscopic sinus surgery.

All studied cases were subjected to Full history taking, General examination and Diagnostic nasal endoscopy

Preoperative assessment

Based on Lund Kennedy scores, endoscopic grading was done. A paranasal sinus CT examination was performed, and the patients were scored based on the Lund Mackay scoring system. The 22-item Sino-Nasal Outcome Test (SNOT-22) questionnaire was used to assess patients'

symptomatology and health-related quality of life. **(Figure 1)**

Operative technique

Surgery entailed 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. PMTR 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. (**Figure 2,3)**

Post operative assessment

the pack was removed on the 2nd 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 6 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 and the grading was done based on Lund Kennedy scores and documented at 4 weeks, 3 and 6 months. SNOT-22 scores were recorded at the 6th month visit. 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.

Approval code: Ms 42-9-2023

Statistical analysis

Statistical analysis was done by SPSS v26 (IBM©, Armonk, NY, USA). The Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD) and were analyzed by unpaired student t-test. Qualitative variables were presented as frequency and percentage (%) and analyzed using the Chi-square test or Fissure exact when appropriate. A two-tailed *P* value < 0.05 was considered statistically significant.

Results

In this study, 69 patients were assessed for eligibility, 17 patients did not meet the criteria and 12 patients refused to participate in the study. The remaining 40 patients were randomly allocated into two equal groups (20 patients in each). All allocated patients were followed-up and analysed statistically. (**Figure 4)**

There was an insignificant difference between both groups regarding the patients' characteristics including age and sex. There was an insignificant difference between both groups regarding the associated comorbidities (HTN, DM and history of asthma). (**Table 1)**

In group A, there was a significant difference among the different measurements regarding the Lund-Kennedy score (P<0.001). The Lund-

Kennedy score at 4 weeks, 3 months and 6 months was significantly lower compared to preoperative score (P<0.001, <0.001, <0.001), was significantly lower at 3 and 6 months compared to 4 weeks (P<0.001, P<0.001) and was significantly lower at 6 months compared to 3 months (P<0.001). In group B, there was a significant difference among the different measurements regarding the Lund-Kennedy score (P<0.001). The Lund-Kennedy score at 4 weeks, 3 months and 6 months was significantly lower compared to preoperative score (P<0.001, <0.001, <0.001), was significantly lower at 3 and 6 months compared to 4 weeks (P<0.001, P<0.001) and was significantly lower at 6 months compared to 3 months (P<0.001). The Lund-Kennedy score was significantly lower in group B compared to group A at 3 and 6 months (P=0.040, <0.001), with no significant difference between both groups regarding the preoperative Lund-Kennedy score and Lund-Kennedy score at 4 weeks. (**Table 2)**

In group A, the SNOT-22 score at 6 months was significantly lower compared to preoperative score (P <0.001). In group B, the SNOT-22 score at 6 months was significantly lower compared to preoperative score (P <0.001). SNOT-22 score at 6 months was significantly lower in group B compared to group A (P <0.001) with no significant difference between both groups regarding the preoperative SNOT-22 score. **(Table 3)**

Regarding outcome, 1 (5%) in group A and 2 (10%) patients in group B had bleeding. Orbital injury, CSF rhinorrhea and smell disorder not reported in any of the studied groups. 6 (30%) patients in group A and only 1 (5%) patient in group B showed recurrence. The incidence of recurrence was significantly lower in group B compared to group A (P =0.037) with no significant difference between both groups regarding the incidence of bleeding. **(Table 4)**

Table 1: Patients' characteristics and comorbidities of the studied groups

			Group A (n=20)	Group B (n=20)	P value
Patients' characteristics	**Age (years)**	**Mean± SD**	40.13± 11.63	42.65± 10.81	0.314
		Range	21-60	20-59	
	Sex	**Male**	7(35%)	9(45%)	0.518
		Female	13(65%)	11(55%)	
Comorbidities	**HTN**		6(30%)	8(40%)	0.507
	DM		5(25%)	3(15%)	0.492
	History of asthma		4(20%)	6(30%)	0.465

Data presents as mean ± SD or frequency (%). HTN: Hypertension, DM: Diabetes mullites.

Table 2: Lund-Kennedy score in group A and group B and comparison of Lund-Kennedy of the studied groups

		Preoperative	4 weeks	3 months	6 months	*P* value
Lund-Kennedy score (group A)	**Mean± SD**	7.58± 0.5	6.05± 0.68	4.55± 0.93	3.55± 1.48	**<0.001***
	Range	7-8	5-7	3-6	1-6	
	P1		**<0.001***	**<0.001***	**<0.001***	
	P2			**<0.001***	**<0.001***	
	P3				**<0.001***	
Lund-Kennedy score (group B)	**Mean± SD**	7.63± 0.49	5.98± 0.77	4.05± 1.15	2.63± 1.08	**<0.001***
	Range	7-8	4-7	2-6	1-5	
	P1		**<0.001***	**<0.001***	**<0.001***	
	P2			**<0.001***	**<0.001***	
	P3				**<0.001***	
		Group A (n=20)		**Group B (n=20)**		**P value**
Preoperative	**Mean± SD**	7.58± 0.5		7.63± 0.49		0.650
	Range	7-8		7-8		
4 weeks	**Mean± SD**	6.05± 0.68		5.98± 0.77		0.640
	Range	5-7		4-7		
3 months	**Mean± SD**	4.55± 0.93		4.05± 1.15		**0.040***
	Range	3-6		2-6		
6 months	**Mean± SD**	3.55± 1.48		2.63± 1.08		**<0.001***
	Range	1-6		1-5		

Data presents as mean ± SD or frequency (%) *: statistically significant P value ≤ 0.05, P1: p value compared to preoperative, P2: p value compared to 4 weeks, P3: p value compared to 3 months.

Table 3: SNOT-22 score in group A and group B

		Preoperative	6 months	*P* value
SNOT-22 score group A	**Mean± SD**	73.45± 3.21	40.75± 9.62	**<0.001***
	Range	69-80	24-59	
SNOT-22 score group B	**Mean± SD**	74.45± 3.45	30.8± 8.02	**<0.001***
	Range	69-80	13-45	
P value between 2 groups		0.180	**<0.001***	---

Data presents as mean ± SD or range. SNOT-22: Sino-nasal Outcome Test, *: statistically significant P value ≤ 0.05.

Table 4: Outcome of the studied groups

	Group A (n=20)	Group B (n=20)	*P* value
Bleeding	1 (5%)	2(10%)	0.548
Orbital injury	0 (0%)	0 (0%)	---
CSF rhinorrhea	0 (0%)	0 (0%)	---
Smell disorder	0 (0%)	0 (0%)	---
Recurrence	6 (30%)	1 (5%)	**0.037***

Data presents as frequency (%). CSF: Cerebrospinal fluid, *: statistically significant P value ≤ 0.05

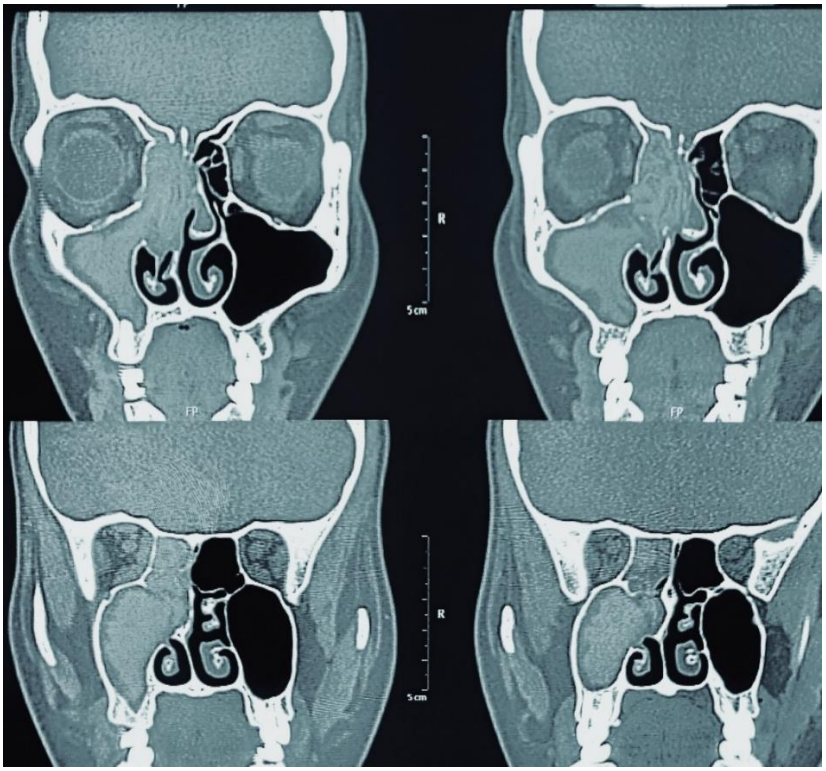

Figure 1: Coronal noncontrasted CT imaging from a patient with AFS. Expanded right maxillary antrum, right ethmoidal complexes. They show complete inhomogeneous opacification with hyperdense material is seen located centrally surrounded by hypodense mucosa

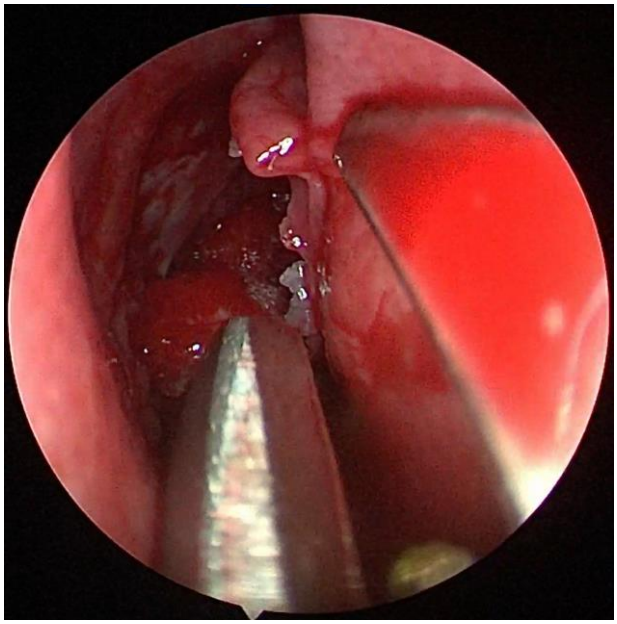

Figure 2: Intraoperative endoscopic image of a patient with right sided allergic fungal rhinosinusitis, showing resection of middle turbinate

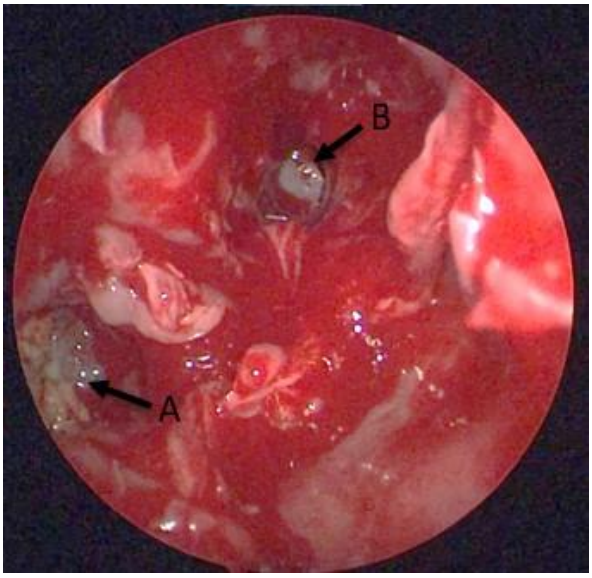

Figure 3: Intraoperative endoscopic image of a patient with right sided allergic fungal rhinosinusitis, showing (A) fungal mud at maxillary sinus (B) fungal mud at posterior ethmoidal sinus.

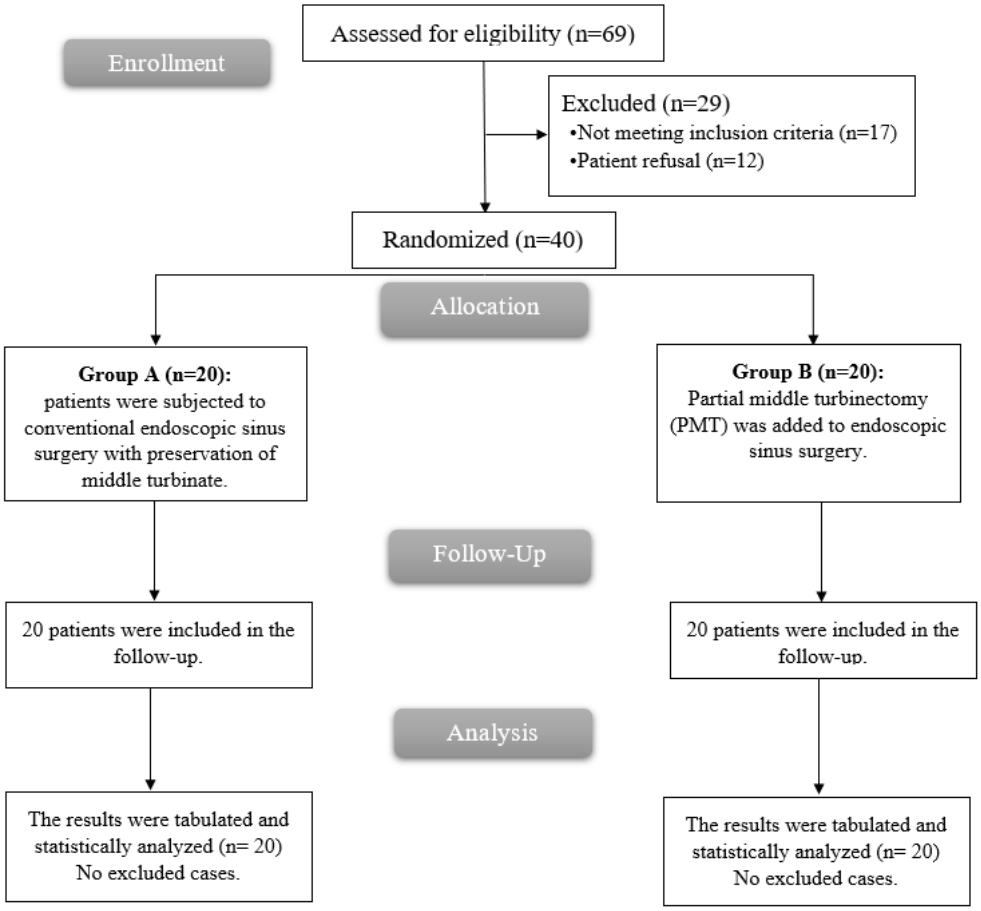

Figure 4: CONSORT flowchart of the enrolled patients

Discussion

AFS is a distinct form of chronic rhinosinusitis characterized by a hypersensitivity reaction to fungal elements in immunocompetent individuals. It is most commonly observed in warm and humid climates and is marked by the presence of eosinophilic mucin, nasal polyposis, and often extensive sinus opacification [8]. AFS is considered a non-invasive disease, yet it can behave aggressively, resulting in extensive sinus involvement, bony expansion, and, in some cases, orbital or intracranial complications. Despite its benign histopathology, the inflammatory process in AFS is often persistent and prone to recurrence, which presents a major challenge in long-term management [9].

The present study revealed that according to demographic data in the studied groups, there was an insignificant difference between both groups regarrding the patients' charcteretsics including age and sex.

Our results in consistent with Nabil Lashin et al., [10] found that there were no statistically significant differences between two groups regarding demographic characteristics. The mean age was comparable between the two groups (36.4 ± 11.4 years vs. 35.1 ± 9.9 years, $p = 0.629$). Similarly, the gender distribution showed no significant difference, with males comprising 56.7% in the turbinectomy group and 53.3% in the preserved group ($p = 0.795$).

Regarding comorbidities, we revealed that there was an insignificant difference between both groups regarding the associated comorbidities (HTN, DM and history of asthma).

Our results in consistent with Tan et al., [11] reported that history of asthma was reported in 67 patients and 57 reported allergies to common aeroallergens such as grass, house dust mite, and molds.

In the current study, we determined that in group A, there was a significant difference among the different measurements regarding the Lund-Kennedy score (P<0.001). The Lund-Kennedy score at 4 weeks, 3 months and 6 months was significantly lower compared to preoperative score (*P*<0.001, <0.001, <0.001), was significantly lower at 3 and 6 months compared to 4 weeks (*P*<0.001, *P*<0.001) and was significantly lower at 6 months compared to 3 months (*P*<0.001).

Our results in consistent with Hudon et al., [12] reported that at baseline, LKES scores were 4.8 ± 1.2. The Lund-Kennedy Endoscopic Scoring system (LKES) scores showing better endoscopic appearance for both sinus cavities after surgery at 3 and 6 months as compared to pre-operatively ($p < 0.001$.

In the current study, we determined that in group B, there was a significant difference among the different measurements regarding the Lund-Kennedy score (P<0.001). The Lund-Kennedy score at 4 weeks, 3 months and 6 months was significantly lower compared to preoperative score (*P*<0.001, <0.001, <0.001), was significantly lower at 3 and 6 months compared to 4 weeks (*P*<0.001, *P*<0.001) and was significantly lower at 6 months compared to 3 months (*P*<0.001).

This came in accordance with Abdelsamie et al., [13] reported that the Lund-Kennedy score at 1 months and 6 months was significantly lower compared to preoperative score.

In our study we reported that the Lund-Kennedy was significantly lower in group B compared to group A at 3 and 6 months (P=0.040, <0.001), with no significant difference between both groups regarding the preoperative Lund-Kennedy score and Lund-Kennedy score at 4 weeks.

This came in accordance with Hudon et al., [12] determined that the Lund-Kennedy Endoscopic Scoring system (LKES) values were lower (better) at 3 months on the resected side (1.2 ± 1.5 vs 1.8 ± 1.3, $p = 0.05$, n = 12.

In contrast, our findings disagreed with Byun et al., [14] who aimed to evaluate

baseline disease burden and surgical outcomes between middle turbinate resection and preservation groups consisting of patients diagnosed with chronic rhinosinusitis. They revealed that Lund-Mackay scores for the two main symptoms were significantly greater in the resection group than in the preservation group.

Unlike the present study also, Tan et al., [11] reported that preoperative Lund-Mackay scores were significantly higher in the PMTR cohort (p = 0.0236, Mann-Whitney test). Mean Lund-Mackay scores were 12.1 ± 4.93.

The present study reported that in group A, the SNOT-22 score at 6 months was significantly lower compared to preoperative score (P <0.001).

Our findings in agreement with Elbasty et al., [15] demonstrated that there was a significant SNOT-22 individual item-level improvement postoperatively in all items in both groups **)**.

The present study reported that in group B, the SNOT-22 score at 6 months was significantly lower compared to preoperative score (P <0.001).

This came in accordance with Delarestaghi et al., [16] reported that the mean SNOT-22 scores were 52.51±16.95 before surgery and after endoscopic surgery these scores changed to 11.13±5.55, there was a significant difference

Also, our findings in line with Abdelsamie et al., [13] reported that the in partial group, SNOT-22 score at 6 months was significantly lower compared to preoperative score**.**

As well, our findings in line with Elbasty et al., [15] demonstrated that patients had a significant improvement in the total mean SNOT-22 score in the resected group (60.48±20.87 before surgery to 19.16±7.436 after surgery)**.**

In the current study, we determined that SNOT-22 score at 6 months was significantly lower in group B compared to group A (P <0.001) with no significant difference between both groups regarding the preoperative SNOT-22 score.

Our findings in agreement with Byun & Lee [14] showed that SNOT-20 scores were improved significantly at 12 months postoperatively in both groups, and the improvement did not differ significantly between the groups.

As well, our findings in line with Tan et al., [11] reported that there was no significant difference between the preoperative symptom scores of the 2 cohorts in the SNOT-22 (p = 0.4460).

Regarding outcome, 1 (5%) in group A and 2 (10%) patients in group B had bleeding. Orbital injury, CSF rhinorrhea and smell disorder not reported in any of the studied groups. 6 (30%) patients in group A and only 1 (5%) patient in group B showed recurrence. The incidence of recurrence was significantly lower in group B compared to group A (P =0.037) with no significant difference between both groups regarding the incidence of bleeding.

In concordance with the present study, Nabil Lashin et al., [10] determined that postoperative complications were infrequent and showed no statistically significant difference between two groups. Minor bleeding occurred in 10% of patients in the turbinectomy group compared to 3.3% in the preserved group (p = 0.612), but this difference was not statistically significant. No cases of orbital injury, CSF rhinorrhea, or smell disorder were reported in either group. Recurrence was less frequent in PMT group at 6 months follow up (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-month assessment point.

Similar to the current study Roy & Lade [17] 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 AFS. 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.

The limitations of the study were that the sample size was relatively small, which may limit the generalizability of the results, the follow-up period was limited to six months; a longer follow-up may be needed to assess long-term recurrence and complications and finally, the study was conducted at a single center, which may introduce location-specific bias.

Conclusion

From the findings of our study, it can be concluded that the additional PMTR to endoscopic sinus surgery provides superior clinical outcomes compared to middle turbinate preservation alone in the management of AFS. Patients in the PMTR group showed significantly better endoscopic findings, improved symptom scores, and a notably lower recurrence rate, with no increase in intraoperative or postoperative complications. These findings support the use of PMTR as a safe and effective technique that may enhance long-term outcomes in patients with AFS.

Therefore, based on the findings of this study, it is recommended to consider PMTR as an effective adjunct to endoscopic sinus surgery in patients with AFS, particularly in cases with high risk of recurrence. Further studies with larger sample sizes and longer follow-up periods are recommended to confirm these results and assess long-term outcomes and safety.

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Conflicts of interest

No conflicts of interest

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