

**Outcomes after partial middle turbinate resection in surgical treatment of extensive sinonasal polyposis.**

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**Abstract: Objectives:** The study aimed to compare two different techniques of middle turbinate (preservation versus resection) in endoscopic surgical treatment of extensive sinonasal polyposis and analyzing its effect on recurrence rates and postoperative nasal airflow resistance. **Study design:** A prospective study was performed. **Patients & Methods:** Forty patients with a mean age of 35.3 years, with sinonasal polyposis stage 3 at endoscopic evaluation and a Kennedy score of (IV) were recruited in this study. The patients had been classified into two groups; group (A) with middle turbinate preservation, which include 20 patients and group (B) with middle turbinate resection, which include also 20 patients. Recurrence rates were evaluated in a 2-year follow-up. For functional evaluation, we applied anterior active rhinomanometry one week preoperatively and 6 months postoperatively to determine nasal airflow resistance (NAR) and to compare the difference between the two groups. **Results:** Postoperative synechia was reported in 6 cases of group (A), while in group (B) no cases were detected. The difference in the two groups was strongly statistically significant ( $P < 0.05$ ). Regarding to recurrence of polyposis, in group (A), 12 patients showed recurrence, while in group (B), 6 patients showed recurrence. The difference in the two groups was statistically significant ( $z$  test 1.9,  $p < 0.005$ ). The patients of both groups showed significant reduction of mean NAR after surgery in both nostrils ( $p < 0.001$ ). **Conclusion;** A better control of relapse of sinonasal polyposis in patients subjected to resection compared with patients subjected to conservative surgery on middle turbinate. By leaving the superior and posterior parts of the turbinate, the anatomical landmarks are preserved. No significant short or long-term complications have resulted from our partial resection of the middle turbinate. We recommended partial middle turbinate resection in endoscopic surgical management of extensive sinonasal polyposis.

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**Key words:** Nasal polyposis, ESS, Middle turbinate.

**1. Introduction**

The prevalence of nasal polyposis is estimated to be between 1% and 4% of the general population, **Holmstrom et al.** <sup>(10)</sup>. Nasal polyps can often recur after medical and/or surgical therapy, and factors influencing this tendency have to be investigated further, **Marchioni et al.** <sup>(22)</sup>.

The effect of middle turbinate resection on normal sinus and nasal physiology remains uncertain. The nasal turbinates are thought to function collectively to direct and assist in lamination of nasal airflow, humidify and warm inspired air, and provide a mechanical defense against particulate matter.

As compared to the inferior turbinate, the MT is significantly smaller, contain less vascular and erectile tissue, account for a negligible portion of nasal airway resistance, and is believed to have less functional significance, **LaMear et al.** <sup>(18)</sup>. The anterior part of the middle turbinate, lying just medial to the ostiomeatal complex, may exhibit anatomic deformity and mucosal hyperactivity, exacerbating restriction to sinus ventilation. After surgery to the OMC, adhesion or synechia formation between the middle turbinate and the

lateral nasal wall is a common complication, **Kinsella et al.** <sup>(16)</sup>, and **Schaefer et al.** <sup>(28)</sup> and may lead to restenosis of the region and recurrent disease, **Kennedy** <sup>(14)</sup> and **Vleming et al.** <sup>(36)</sup>. The surgical fate of the middle turbinate has remained a point of contention throughout the history of sinus surgery. Early teaching was divided, with Wigand advocating routine middle turbinate resection, whereas Messerklinger taught routine preservation, **Stewart** <sup>(32)</sup> and **Messerklinger** <sup>(23)</sup>.

Many rhinologists agree that a diseased, destabilized, or obstructing MT should be partially resected. However, the potential benefit of partial MT resection in the absence of these indications is not as clear. Those who advocate partial MT resection report their observations of decreased incidence of both synechia formation and postoperative lateralization of the middle turbinate, higher long-term patency rates of the middle meatal antrostomy, **LaMear et al.** <sup>(18)</sup> and **Davis et al.** <sup>(5)</sup>, improved nasal airflow, and decreased nasal resistance, **Cook et al.** <sup>(4)</sup>. They also suggest that access to the ethmoid labyrinth is improved both intraoperatively and postoperatively, **Stewart** <sup>(32)</sup>. The arguments against MT resection relate primarily

to the loss of an important anatomic landmark as well as the potential alteration of nasal function, development of atrophic rhinitis, promotion of frontal sinusitis, and hyposmia, **Swanson et al.** (33).

The aim of our study was to compare two groups of patients affected by extensive nasal polyposis undergoing endoscopic sinus surgery (ESS) and with different approaches adopted regarding the middle turbinate (preservation or resection). Recurrence rates and nasal air flow resistance (NAR) in the groups were evaluated in a 2-year follow-up study.

## 2. Patients and methods:

Forty-six (46) consecutive patients who had sinonasal polyposis (with bilateral disease) and were scheduled to have endoscopic sinus surgery (ESS) for extensive sinonasal polyposis were enrolled from otolaryngology clinic at Benha faculty of medicine during the period from October 2008 to October 2011. The ages of the patients ranged from 15 to 60 years, with a mean of 35.3 years. There were 26 male and 20 female patients in this study.

Sinonasal polyposis was studied on the basis of nasal endoscopic office examination and classified into three stages where (0) no polyps, (1) mild polyposis (small polyps not reaching the upper edge of the inferior turbinate), (2) moderate polyposis (medium sized polyps reaching between the upper and lower edge of the inferior turbinate) and (3) severe polyposis (large polyps reaching below the lower edge of the inferior turbinate). In addition, the patients were classified into four stages on basis of computed tomography (CT) of paranasal sinuses by means of the Kennedy CT stage system, **Kennedy**<sup>(13)</sup>: stage (I), opacity of a single sinus or bilateral opacity limited to the middle meatus; stage (II), opacity of both middle meati and one adjacent sinus; stage (III), bilateral ethmoidal opacity with involvement of one or two adjacent sinuses; stage (IV), diffuse opacity in all of the paranasal sinuses.

### -Inclusion criteria:

All patients are stage (3) sinonasal polyposis at endoscopic evaluation and with a Kennedy score of stage (IV) and not responsive to medical treatment was recruited.

### -Exclusion criteria:

Patients suffering from antrochoanal polyp, mycotic sinusitis or inverted papilloma and revision cases were excluded.

- Computed tomography study (coronal and axial views without contrast) for the nose and paranasal sinuses were performed for all patients in this study preoperatively.

- According to the surgical techniques the patients were classified into two groups:

○ Group (A): 22 patients undergoing endoscopic sinus surgery for sinonasal polyposis with preservation of the middle turbinate bilaterally.

○ Group (B): 24 patients undergoing endoscopic sinus surgery for sinonasal polyposis with middle turbinate resection bilaterally.

The technique of middle turbinate resection was similar at each site, utilizing through-cutting instruments to remove the antero-inferior two thirds of the turbinate preserving the superior and lateral attachments as a landmark and a small stump posteriorly in the region of the sphenopalatine foramen (Figs. 1 and 2). The decision to resect or preserve the middle turbinate was taken during surgery as a limitation of this study. No other method of preoperative assignment to resection or preservation was utilized.

Postoperatively, nasal saline irrigation for 2 months was prescribed to all patients. Topical corticosteroid therapy was administered to every patient in both groups, with a constant dose of 400 UG in 2 separate doses (50 UG X 2 in each nostril twice daily) for 4 months.

Post operative nasal endoscopy for follow-up every 1 month for the 1<sup>st</sup> 6 months and every 3 months for the following 2 years. The presence of polyps in the nasal fossa (even micro polyps) at endoscopic evaluation was considered to indicate polyposis recurrence. A comparison between both groups was carried out, and the rate of recurrence in relation to the surgical technique was evaluated. The time of recurrence for both groups was reported and noted if it occurred within 6 months, 1, or 2 years from surgery.

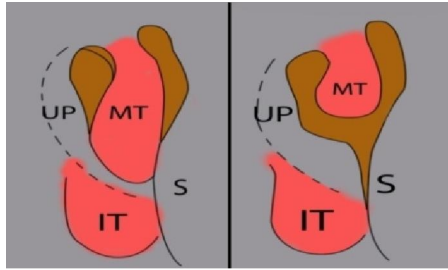
For functional evaluation, we applied anterior active rhinomanometry (The Mercury Electronic Ltd rhinomanometer nr 7d, Scotland) for every patient in this study one week preoperatively and 6 months postoperatively to determine nasal airflow resistance (NAR) and to compare the difference between the two groups. Data for each nostril were registered at 150 Pa and expressed in Pa/cm<sup>3</sup>/s.

### Statistical analysis:

The statistical analysis was done by SPSS 16: the data were presented in Mean & SD and the comparison was done by:

1. Paired t test (in comparison of pre and postoperative finding in the same group)
2. Independent t test (in comparison of post operative finding in the 2 different groups)

$P < 0.05$  = significant (S)       $P > 0.5$  = non significant (NS)



**Figure 1** **Figure 2**  
**(Diagram showing middle turbinate before and after resection)**

**3.Results**

Six of 46 patients (2 of group A and 4 of group B) were lost during the follow up period, so the final study groups comprised 40 patients. The average age at the time of operation for group A (20 patients) was 32.2 years (range 15-60 years), of which 12 patients {60%} were males and 8 patients {40%} were females. While in group B (20 patients) the average age was 39.1 years (range 24-58 years) of which 6 were males {30%} and 14 {70%} were females.

Postoperative bleeding after pack removal occurred in one patient (5%) in group (B), and in two patients (10%) in group (A). Bleeding in all cases was stopped by conservative treatment. Postoperative synechia was reported in 6 cases (30%) of group (A), while in group (B) no cases were detected. The difference in the two groups was strongly statistically significant ( $P < 0.05$ ).

Postoperative crusting was marked in Group (B) than Group (A) but after 3 months no crusting was detected.

Regarding to recurrence of polyposis during the 2-years follow up, 18 patient (45%) of the 40 patients had a recurrence of nasal polyposis, In group (A), 12 patient showed recurrence (3 cases had a recurrence after 9 months (z test 1.8,  $p < 0.005$ ), 5

cases after 15 months (z test 0.8,  $p > 0.005$ ), and 4 cases after 18 months (z test 0.9,  $p > 0.005$ ). While in group (B), 6 patients showed recurrence (1 case after 12 months (z test 1.01,  $p > 0.005$ ), 3 cases after 15 months (z test 0.8,  $p > 0.005$ ) and 2 cases after 18 months (z test 0.9,  $p > 0.005$ ). The difference in the two groups was statistically significant at 9 months and not statistically significant at 12 & 15 & 18 months. The difference in the total recurrence was statistically significant, the patients in group (A) had a risk of recurrence two times higher than the patients in group (B) (z test 1.9,  $p < 0.005$ ), Table (1).

Regarding to functional rhinomanometric data, the patients who had undergone ESS with resection of middle turbinate, group (B) showed a preoperative mean NAR of  $(2.09 \pm 0.21 \text{ Pa/cm}^3/\text{s})$  for right nostril and  $(1.66 \pm 0.12 \text{ Pa/cm}^3/\text{s})$  for left nostril, while 6 months postoperatively NAR was  $(0.52 \pm 0.05 \text{ Pa/cm}^3/\text{s})$  for right nostril and  $(0.5 \pm 0.12 \text{ Pa/cm}^3/\text{s})$  for left nostril respectively. Significant reduction of mean NAR after surgery was confirmed for both nostrils (group B) by statistical analysis (preoperative NAR vs. 6 months postoperative NAR, (t test,  $p < 0.001$ ). The patients who had undergone ESS with middle turbinate preservation group (A), showed a preoperative mean NAR of  $(1.96 \pm 0.13 \text{ Pa/cm}^3/\text{s})$  for right nostril and  $(2.07 \pm 0.32 \text{ Pa/cm}^3/\text{s})$  for left nostril, while 6 months postoperatively NAR was  $(0.55 \pm 0.05 \text{ Pa/cm}^3/\text{s})$  for right nostril and  $(0.65 \pm 0.04 \text{ Pa/cm}^3/\text{s})$  for left nostril respectively. Significant reduction of mean NAR after surgery was confirmed for both nostrils (group A) by statistical analysis (preoperative NAR vs. 6 months postoperative NAR, (t test  $p < 0.001$ ). Mean preoperative NARs were not significantly different between both groups (t test  $p > 0.5$ ). On the other hand, the mean postoperative NARs were not statistically different comparing these two surgical techniques (t test  $p > 0.5$ ). Tables (2,3,4).

Table (1): Postoperative recurrence of sinonasal polyposis

Polyp recurrence Time	Group (A)	Group (B)	z	P
9 Months	3 cases (15%)	-----	1.8	< 0.005 (S)
12 Months	-----	1 case (5%)	1.01	> 0.005 (NS)
15 Months	5 cases (25%)	3 cases (15%)	0.8	> 0.005 (NS)
18 Months	4 cases (20%)	2 cases (10%)	0.9	> 0.005 (NS)
TOTAL	12 cases (60%)	6 cases (30%)	1.9	< 0.005 (S)

Table (2) : comparison between preoperative and postoperative NAR in patients with middle turbinate resection (group B).

	Preoperative	Postoperative	t	P
RT. side NAR (pa/Cm <sup>3</sup> /S)	2.09	0.52	30.2	<0.001
Mean±SD	± 0.21	± 0.05		(S)
LT. side NAR (pa/Cm <sup>3</sup> /S)	1.66	0.5	21.8	<0.001
Mean±SD	±0.12	± 0.12		(S)

Table (3): comparison between preoperative and postoperative NAR in patient without turbinate resection (group A).

Items	Preoperative	Postoperative	t	p
RT. side NAR. (pa/Cm <sup>3</sup> /S)	1.96	0.55	78.9	<0.001
Mean±SD	± 0.13	± 0.05		
LT. side NAR. (pa/Cm <sup>3</sup> /S)	2.07	0.65	21.6	<0.001
Mean±SD	±0.32	± 0.04		

Table (4) : comparison between postoperative NAR in patients with and without middle turbinate resection.

	with resection	without resection	t	P
RT. t side NAR (pa/Cm <sup>3</sup> /S)	0.52	0.55	1.8	> 0.05
Mean±SD	± 0.05	± 0.05		
LT. side NAR... (pa/Cm <sup>3</sup> /S)	0.5	0.65	1.9	> 0.05
Mean±SD	± 0.12	± 0.04		

#### 4. Discussion:

Surgery represents the gold standard in treatment of nasal polyposis when medical therapy fails to control the pathology, **Alobid et al.**<sup>(1)</sup>. There are different opinions among rhinologists regarding the potential benefits of whether the middle turbinate, the crucial structure lying medially to the OMC, should be resected or should be preserved as much as possible in the treatment of sinonasal polyposis. Some surgeons favor middle turbinate preservation, believing that the middle turbinate can play a part in directing airflow, humidifying inspired air, providing defense against offending particulate matter, and possibly providing a local hematological response with secretion of IgA, **Thornton**<sup>(34)</sup>. A decreased risk of complications (such as lamina papyracea lesion, bleeding, CSF rhinorrhea, orbital hematoma, nasolacrimal duct stenosis, anosmia/hyposmia, frontal or sphenoidal sinusitis, drying, crusting and atrophic rhinitis, **Vleming et al.**<sup>(36)</sup>, and the loss of an important landmark also favors its preservation, **Thornton**<sup>(34)</sup>.

On the other hand, some others authors prefer middle turbinate resection, believing that the aerodynamic and protective role of the middle turbinate in the diseased state is not clearly understood, **Friedman**<sup>(6)</sup>. The middle turbinate could play a role in the pathogenesis of inflammatory

sinonasal disease secreting vasoactive sensory neuropeptides, **Havas and Lowinger**<sup>(9)</sup>. Moreover, it is often destabilized, altered by the pathology, **Friedman**<sup>(6)</sup> or some abnormalities can be present (paradoxical curvature or concha bullosa), **Morgenstien and Kreieger**<sup>(24)</sup>. Partial middle turbinate resection leaving the superior part of the turbinate with its attachment ( axilla), the landmark might improve the long-term Patency of middle meatus antrostomy and might facilitate the endoscopic visualization of the intranasal anatomy, sphenoidal region intraoperatively and diagnosis of postoperative occurrence of polyposis relapse, **Morgenstein and Krieger**<sup>(24)</sup>, and **Zhang**<sup>(39)</sup>.

In view of the different opinions about preservation or resection of the middle turbinate during ESS, the aim of our study was to compare two different techniques of middle turbinate (resection versus preservation) in endoscopic surgical treatment of extensive sinonasal polyposis and analyzing its effect on recurrence rates and postoperative nasal airflow resistance.

In our study, we have analysed for the first time, to our knowledge this controversial subject with objective parameters, excluding subjective parameters as most of the previous studies reported measurements based on subjective improvement of

the symptoms, not supported by endoscopic findings and functional measurements, **Giger et al.**<sup>(7)</sup>, **Kaplan, and Kountakis**<sup>(12)</sup>, **Stankiewicz and Chow**<sup>(31)</sup>, **Lanza and Kennedy**<sup>(21)</sup>.

Our result showed postoperative bleeding after pack removal in one patient (5%) in group (B), and in two patients (10%) in group (A). Bleeding in all cases was stopped by conservative treatment. Our results go in hand with, **Brescia et al.**<sup>(3)</sup> who did not encounter any such problem.

Our result showed Postoperative synechiae in 6 cases (30%) of group (A), while in group (B) no cases were detected. The difference in the two groups was strongly statistically significant ( $P < 0.05$ ). Our results concur with, **Havas and Lowinger**<sup>(9)</sup> who found 0% synechiae in resection cases compared to 8.5% in turbinate preservation, and with, **Vleming et al.**<sup>(36)</sup> who found no synechiae after middle turbinate resection. This may be due to the fact that middle turbinate resection prevents lateralization of turbinate over antrostomy site and thus decreases the synechiae.

Our results showed marked crustation in Group (B) than Group (A) but after 3 months postoperatively no crustation was detected and it was not significant. These results coincide with, **Morgenstein and Krieger**<sup>(24)</sup>, and **Cook et al.**<sup>(4)</sup> who failed to show significant deleterious effects related to turbinate resection such as crustation or atrophic rhinitis. Also, **Lawson**<sup>(20)</sup> in his study reported no cases of crustation or atrophic rhinitis.

Our result showed recurrence of sinonasal polypi in 12 cases (60%) of group (A) and 6 cases (30%) of group (B). So, the resection of middle turbinate is associated with a lower rate of recurrence, this result coincides with, **Marchioni et al.**<sup>(22)</sup> who reported a better control of nasal relapse in patients who underwent middle turbinate resection compared with those who underwent middle turbinate preservation who tended to relapse more frequently, and with, **Havas and Lowinger**<sup>(9)</sup> who found a very low rate of polyp recurrence in patients with turbinate resection when compared with turbinate preservation patients. Also our results go in hand with, **Zachary et al.**<sup>(38)</sup> who reported that patients undergoing middle turbinate resection did show greater improvement in endoscopy score which persisted after controlling confounding factors. Also our results go in hand with, **Kidder et al.**<sup>(15)</sup> who concluded that removal of the middle turbinate yielded a lower rate of polyp recurrence without any increase in postoperative morbidity. To explain this, it has been reported that resection of the middle turbinate reduces vasoactive neuropeptide secretion, **Havas and Lowinger**<sup>(9)</sup>. The persistence of middle turbinate could give an altered airflow into the

surgical cavity, causing an augmented risk of postoperative nasal synechiae formation and contributing to the higher rates of recurrence, **Paulsson et al.**<sup>(25)</sup>. Also, resection of the middle turbinate in cases of polypectomy prolongs the time to symptomatic recurrence by decreasing mucosal surface area on which polyps may grow and later obstruct the sinonasal cavities, **Zachary et al.**<sup>(38)</sup>.

The analysis of data concerning postoperative NAR after 6 months demonstrates a statistically significant improvement of mean NAR in patients of both groups. We found no significant statistical differences between the two techniques and this may be due to the sample size and only few patients with recurrence. This result goes in hand with that reported by, **Brescia et al.**<sup>(3)</sup>, who found that partial middle turbinectomy does not have short- or mid-term negative effects on nasal airflow and resistances, and also matches the results obtained by, **Giger et al.**<sup>(8)</sup> and **Cook et al.**<sup>(4)</sup>.

### Conclusion

A better control of relapse of sinonasal polyposis in patients subjected to resection compared with patients subjected to conservative surgery on middle turbinate, who relapsed more frequently.

Enhanced access for office endoscopic examination and cleaning of surgical site was also achieved. By leaving the superior and posterior parts of the turbinate, the anatomical landmarks are preserved. No significant short or long-term complications have resulted from our partial resection of the middle turbinate.

We conclude that partial middle turbinate resection appears to be promising and to be considered in patients with extensive sinonasal polyposis.

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