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ORIGINAL ARTICLE

Partial Resection Versus Preservation of Middle Turbinate in Surgery for Chronic Rhinosinusitis with Nasal Polyposis

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ABSTRACT

Background: The Ostiomeatal Complex (OMC) is a functional concept rather than an anatomic structure with defined boundaries. The aim of this study is to compare between partial resection of middle turbinate and middle turbinate preservation in surgery for chronic rhinosinusitis with nasal polyposis.

Methods: This prospective interventional study was conducted on two groups of patients diagnosed with chronic rhinosinusitis with nasal polyposis who did not respond to medical treatment. These patients underwent endoscopic sinus surgery and were categorized into two groups. Group A with bilateral resection of the middle turbinate and group B with careful preservation, The follow-up period extended up to three months after surgery.

Results: Total mean age (39 ±14) years. At the end of the follow-up period, the patency of the middle meatal antrostomy was (96.15%) in group A and (73.08%) in group B. The adhesion was 7.7% in group A and 23% in group B, at the end of the first postoperative month the crustation was 76% in group A and 61.5% in group B and at the end of follow-up there is an improvement in nasal obstruction in both groups with a significant improvement in group A (p-value= 0.017).

Conclusion: Partial resection of the middle turbinate during endoscopic sinus surgery improves the patency of the middle meatal antrostomy, better access, and improved ability for endoscopic clearance and debridement of the crustation postoperatively, also associated with a lower risk of adhesion to the lateral nasal wall and a significant improvement in postoperative nasal obstruction compared to patients who undergo endoscopic sinus surgery with preservation of the middle turbinate.

Key words: Nasal polyposis; Middle turbinate resection; Middle turbinate preservation.

INTRODUCTION

The ostiomeatal complex (OMC) is a functional concept rather than an anatomic structure with defined boundaries. Structures within ostiomeatal complex include the uncinate process, ethmoid bulla, hiatus semilunaris, infundibulum, middle turbinate, and the maxillary sinus ostium. Rather than rigidly defined structures, these components work together to maintain the health and functionality of the nasal and sinus passages.

Chronic rhinosinusitis (CRS) is a prevalent clinical condition marked by inflammation of the nose and paranasal sinus mucosa, causing symptoms that persist for 12 weeks or longer and are confirmed by objective means [1].

Chronic rhinosinusitis was divided into CRS with nasal polyps (CRSwNP) and CRS without polyps (CRSsNP). It is now clear that multiple clinical phenotypes exist, including aspirin exacerbated respiratory disease (AERD), cystic fibrosis (CF), and allergic fungal sinusitis (AFS) [2, 3]. Nasal polyps (NPs) represent the end stage local manifestation of chronic inflammatory disease of the sinonasal tract. Despite the prevalence of polyps, the long history of recognition and extensive research and literature, their etiology remains elusive and poorly understood [4]. Endoscopic sinus surgery is reserved for the percentage of patients with CRS who fail medical management. The primary objective of functional endoscopic sinus surgery (FESS) is to restore paranasal sinus function by reestablishing the physiologic pattern of ventilation and mucociliary clearance. Normal mucociliary transport is necessary to maintain ostiomeatal patency [5].

The techniques for Middle Turbinate reduction are varied. Kennedy and Sinreich describe a technique where the turbinate is split in the middle and only the lateral portion is removed, leaving the medial portion intact to function physiologically. Wigand describes resecting the posterior third of the middle turbinate when performing any retrograde sphenoethmoidectomy. Morgenstein and Krieger describe a technique that involves cutting the superior attachment of the Middle turbinate and then snaring the anterior two-thirds. Freedman and Kern describe resection of the middle turbinate to within 0.5 cm of the skull base as an integral part of all headlights intranasal sphenoethmoidectomies. In the majority of patients, this maneuver addresses disease involving the turbinate (e.g., polyposis or osteitis); turbinate resection is advocated regardless of the amount of pathology involving the middle turbinate [6].

The Visual Analog Scale (VAS) is a psychometric response scale employed in questionnaires to gauge subjective characteristics or attitudes that are not readily quantifiable. In this study, all patients underwent preoperative and postoperative (VAS) assessments to record the severity of nasal obstruction, with scores ranging from 0 (indicating no episodes of nasal obstruction) to 10 (representing constant and unremitting complete nasal obstruction) [7].

MATERIALS AND METHODS

This is a prospective interventional study that carried out over the period between November 2019 and January 2021 for 26 patients were complaining from long standing nasal obstruction, history taken from them with details regarding nasal obstruction, and after that examination started by general and local examination [examination of the face, external nose, columella, vestibule, patency of nasal cavities, anterior rhinoscopy, posterior rhinoscopy, after that endoscopic examination done by use of zero angle rigid Hopkins rod nasal endoscope after explanation to the patients the maneuver for examination and preparation of the nasal cavity by (nasal decongestant drops xylometazoline 0.1%, topical lidocaine spray 4% for 5-10 minutes)]. All of them diagnosed as chronic rhinosinusitis with nasal polyposis. The included patients admitted to hospital for endoscopic sinus surgery. Patients included in this study were divided into two groups: **Group A**: 13 patients underwent Endoscopic Sinus Surgery (ESS) with partial resection of the middle turbinate (MTR) bilaterally. **Group B**: 13 patients underwent (ESS) with preservation of middle turbinate (MTP). The decision to resect or preserve the middle turbinate was done intraoperatively based on several factors such as reduced access to the middle meatus, polypoidal hypertrophy of middle turbinate mucosa, and the presence of structural abnormalities of the middle turbinate like concha bullosa or paradoxical conditions.

- Surgical Technique

Under general anesthesia with an endotracheal tube and pharyngeal pack in Reverse Trendelenburg position (head up, tilted toward the surgeon) with hypotensive technique, nasal pledge inserted into the nasal cavities (pledge soaked by xylometazoline 0.1%) for 5 minutes. After removal of the pledge and with the aid of a camera system and use of 00,300 Rigid Hopkins rod endoscopy debulking of the polyp was started by using the microdebrider to identify the posterior choanae, middle turbinate, and axilla.

In group A : Medialization of the middle turbinate was done by Freer's elevator, followed by resection of the antero-inferior

part of it by use of a turbinectomy scissor. lnfundlbulotomy was done, then middle meatal antrostomy was done started by using ball probe to identify the natural maxillary ostium and then enlarge it. Any polyp removed from the maxillary antrum. The bulla ethmoidalis is opened inferomedially by the use of straight forceps (Blacksley forceps) and removing any polyp. The posterior ethmoids are entered by piercing the inferomedial basal lamella by using through-cutting forceps of various angles. The sphenoid and frontal sinuses opened if involved. And finally, a merocele nasal pack was inserted in the middle meatus, as show in **(Figure 1)**. **Group B :** The same operative steps that done in Group A but with the preservation of middle turbinate, as shown in **(Figure 2)**.

The collected data were entered into Microsoft Excel 2016. Subsequently, a computerized statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Statistical significance was determined with a p-value threshold of <0.05. The analysis encompassed descriptive statistics, including the calculation of means and standard deviations, and the application of statistical tests such as paired t-tests for comparing pre- and post-operative (VAS) scores and independent samples t-tests for comparing variables between different surgical groups. Additionally, the normality of the data distribution was assessed using the Shapiro-Wilk test.

RESULTS

Twenty-six patients were involved in this study, 13 patients out of them underwent ESS with partial resection of MT (MTR) bilaterally (26 sides) group A, and the rest underwent ESS with preservation of MT (MTP) group B. Age ranged from (20-65) years. Total Mean and SD of age (39 ±14) years. Mean and SD of age (43±14) years for group B. Mean and SD of age (36± 13) years for group A.

Nasal obstruction was analyzed statistically depending on the finding of the (VAS) score by mean and standard deviation for both groups pre-and post-operatively. **(Table 1 , 2)**

Middle meatal antrostomy patency was evaluated in patients who underwent sinusotomy types II and III during the follow-up period. Endoscopic assessments were conducted, and after 3 months of follow-up, the results indicated a patency rate of 46.1% in group A and 15.3% in group B. The p-value between the two groups was calculated as 0.003, signifying a statistically significant difference. **(Table 3)**

The presence of crustation was assessed endoscopically at each follow-up visit, and the results were recorded at the end

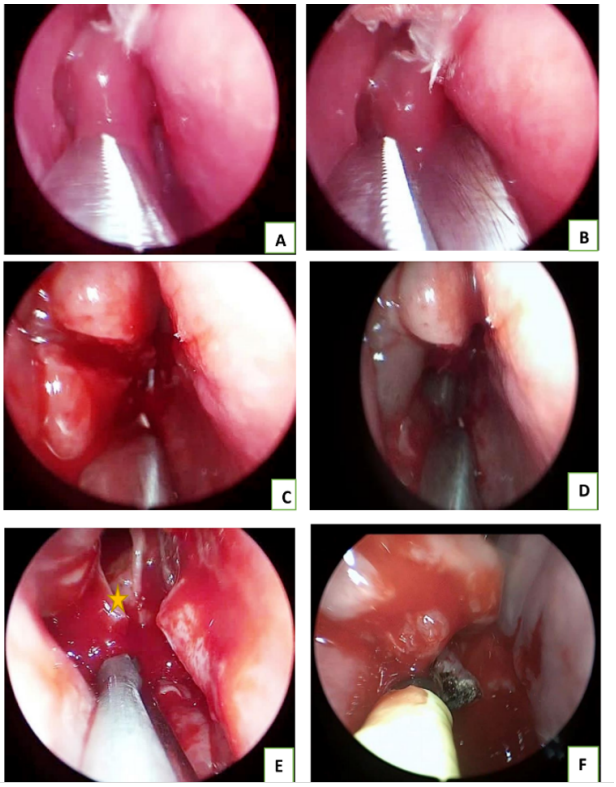

Figure 1. Intraoperative steps of middle turbinate resection on Right side: A=Identification of middle turbinate and medially fractured; B=Vertical attachment incised; C,D=Head of the turbinate dissected inferiorly and posteriorly along the length of the turbinate; E=Ostium of the middle meatus as indicated by the star; F=Suction cautery applied to the posterior attachment remnant

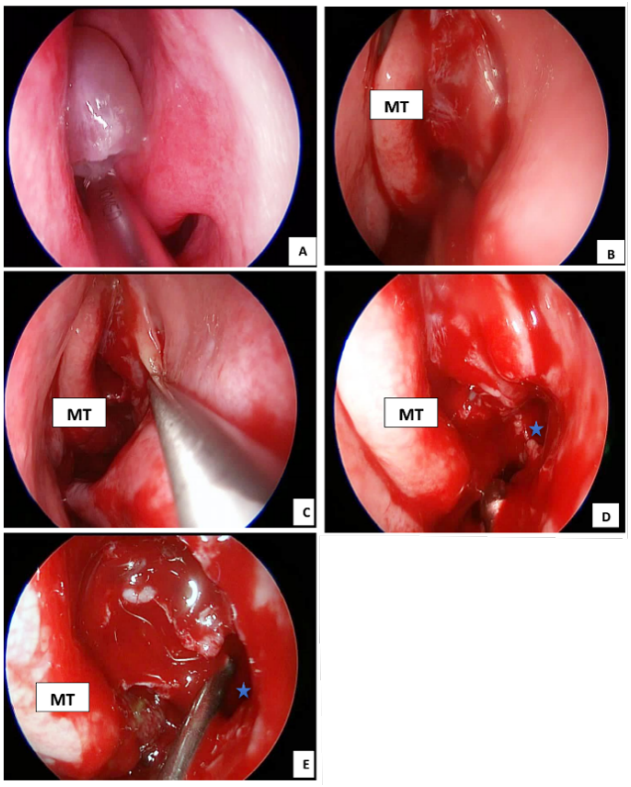

Figure 2. Intraoperative steps of middle turbinate preservation on left side: A=Debulking of polyp; B=Identifying the middle turbinate; C=Identifying the ostium by ball probe; D,E=Middle meatal antrastomy as indicated by the star.

Table 1. Comparison of nasal obstruction scores (VAS) before and after surgery in both groups

Operation type	Pre-op (Mean ± SD)	Post-op (Mean ± SD)	p-value *
MTR	7.08 ± 1.7	3.08 ± 1.9	**0.0001**
MTP	6 ± 1.2	4.23 ± 1.1	**0.0001**

* Paired t-test (Significant<0.05); MTP=Middle turbinate preservation; MTR=Middle turbinate resection.

Table 2. Variations in nasal obstruction based on the type of surgical procedure

Operation type	Mean ± SD	p-value *
MTR	3.08 ± 1.9	**0.017**
MTP	4.23 ± 1.1	**0.017**

* Independent samples t-test (Significant<0.05); MTP=Middle turbinate preservation; MTR=Middle turbinate resection.

Table 3. Variations in patency, adhesion, and crust formation based on the type of surgical procedure.

Surgical complications Total no. 26	Operation type	No. (%) Yes	No	P-value
Patency	MTR	12 (46.1)	1(3.8)	**0.003***
	MTP	4 (15.3)	9 (34.6)	
Crustation	MTR	8 (30.7)	7 (26.9)	0.715†
	MTP	7 (26.9)	8 (30.7)	
Adhesion	MTR	2 (7.6)	11 (42.3)	0.160*
	MTP	6 (23)	7 (26.9)	

† Chi square t-test (Significant<0.05)
* Exact Fisher's test (Significant<0.05); MTP=Middle turbinate preservation; MTR=Middle turbinate resection.

of the 4th week postoperatively. In group A, crustation was observed in approximately 30.7% of cases, while in group B, it was noted in about 26.9% of cases. **(Table 3)** The adhesion formation between the middle turbinate or its remnant and the lateral nasal wall was assessed at the 12th week postoperatively. The findings were as follows: In the case of middle turbinate resection (MTR), one patient (3.8%) exhibited adhesion on the right side, and one patient (3.85%) had adhesion on the left side, while for middle turbinate preservation (MTP), four patients (15.38%) had adhesion on the right side, and two patients (7.69%) experienced adhesion on the left side. **(Table 3)**

Regarding immediate postoperative epistaxis, no severe cases were reported that necessitated a return to the operating room for both groups. Minor bleeding occurred in both groups, manifesting as postnasal staining. However, it was mild in nature, not significant, and did not require any intervention, only necessitating regular monitoring.

DISCUSSION

Many controversies and debates regarding resection of middle turbinate during Endoscopic Sinus Surgery and its outcome, as the middle turbinate has a very important physiological and surgical anatomical landmark [8]. Multiple studies have shown that wider sinus openings result in better outcomes for Chronic Rhinosinusitis with Nasal Polyps (CRSwNP), and that MTR with ESS may improve clinical outcomes [9].

Many surgeons refrain from performing middle turbinate resection, even in extensive cases of CRSwNP. This caution may stem from concerns about potential complications, such as postoperative epistaxis. However, in our study, none of the patients in either the MTR or MTP groups experienced severe epistaxis that necessitated a return to the operating room. In a retrospective assessment by Miller et al [10], the incidence of major and minor epistaxis following MTR in ESS was examined. Their findings revealed that only one out of 288 patients (0.44%) developed severe epistaxis, requiring a return to the operating room. Importantly, there was no significant difference in the occurrence of severe epistaxis between MTR and MTP procedures (p = 0.570). Pinther et al [9] also reported a 0% occurrence of severe epistaxis necessitating a return to the operative room after middle turbinate resection. As such, our study aligns with the findings of these previous studies regarding the incidence of postoperative epistaxis.

This study investigated the preservation of middle meatal antrostomy (MMA) patency, with a specific focus on comparing the pMTR and MTP groups. The findings revealed that MMA patency was notably higher in the MTR group, where 46.1% of cases maintained patency, compared to the MTP group, where it was observed in approximately 15.3% of cases. These results indicate a statistically significant difference in MMA patency between the two groups, with a p-value of 0.003. Our results were consistent with the findings of Gulati S. et

al [11], who reported higher MMA patency in the MTR group compared to the MTP group. Likewise, similar outcomes were observed in studies conducted by LaMear et al. [12], Beidlingmaier [13], and Ramdan Aleen [14], all indicating that MTR improved middle meatal antrostomy patency. Additionally, our study aligned with the research of Roy et al. [8], which showed improved maxillary antrostomy patency in the MTR group compared to the MTP group. Scangas et al. [15] also reported enhanced sinonasal passage patency when the middle turbinate was resected.

Crustation assessment was conducted during each post-operative visit, with initial recording taking place at the one-month post-op mark. Following this, a noticeable decrease in crustation occurred, and by the third month post-op, it was nearly absent. In the pMTR group, access to the middle meatus by endoscope and debridement proved to be easier. Within this study, crustation was found to be approximately 30.7% in the pMTR group and 26.9% in the MTP group. Notably, the difference between these two groups was not statistically significant (p-value=0.715). Tan et al. [16] similarly demonstrated a non-significant difference (p-value 0.702) between partial MTR and MTP groups, with slightly more crustation observed in the partial MTR group (1.41±1.72). Hudon et al. [17] reported that crusting was slightly more prevalent at one month of follow-up in the resection group (1.0 ±0.7 vs. 0.4 ± 0.6, P =0.02), with this difference being statistically significant, although relatively small. Ahmed HSA and Osman MM.[18] also reported a non-significant difference between the two groups concerning crustation at one month post-op. Consequently, the findings in this study align with other research in terms of crustation at the one-month post-op mark. Moreover, this study is in agreement with the work of Ahmed Hussien MD.[19] , who noted that crustation was more prominent in the MTR group compared to the MTP group, but after three months, no crustation was detected.

Adhesion between the middle turbinate (or its remaining portion) and the lateral nasal wall was assessed at the 12-week post-operative mark. In group A, 7.6% of sides exhibited adhesion, whereas in group B, adhesion developed in 23% of sides. The calculated p-value was 0.160, signifying that this difference was not statistically significant. This study's findings were consistent with the research conducted by Roy et al. [8], who reported that 3.33% of the pMTR group had synechiae, while 20% had synechiae in the MTP group. However, this study did not align with the results of Zhu et al.[20], who found that at the 6-month follow-up, seven out of 60 sides developed intranasal adhesion in the MTR group, whereas only two sides developed intranasal adhesion in the MTP group. This discrepancy might be attributed to the multi-approach middle conchoplasty (including surgery, packing, and removal) used in the surgical management of CRS in the MTP group in Zhu et al.'s study. Hudon et al. [16], observed synechiae in three patients on the preserved side in comparison to none on the resected side, which aligns with the findings of this study. Furthermore, the rates of adhesion in this study were in agreement with the results of Havas et al.[21] and Brescia et al. [22], as both of these studies demonstrated a higher incidence of adhesion in the MTP group. The findings on adhesion in this study were also consistent with those of Ahmed Hussien MD [18], who reported post-operative synechia in approximately 30% of the MTP group and none in the MTR group, with this difference being statistically significant.

Nasal obstruction assessment and its postoperative improvement were subjectively evaluated using the VAS (Visual Analog Scale) score. This study demonstrated a significant improvement in nasal obstruction in both groups after the surgery, with a noteworthy improvement observed in the MTR group compared to the MTP group (p = 0.017). In the study by Gopi et al. [23] , approximately two-thirds of the patients in the MTR group experienced improved nasal obstruction after a 6-month follow-up, whereas only half of the patients in the MTP group exhibited a similar improvement during the same follow-up period. These findings indicated a statistically significant improvement following partial middle turbinectomy. Similarly, in Gulati S. et al.'s study [11], 88% of patients in the MTR group reported postoperative improvement in nasal obstruction, in contrast to a 50% improvement rate in the MTP group. These results underscore the significant enhancement in nasal obstruction following partial middle turbinectomy. Roy et al. [8] also reported a higher level of symptomatic improvement in the MTR group, and this difference was statistically significant (p = 0.001). Therefore, this study's results align with the findings of other studies in terms of the postoperative improvement in nasal obstruction.

CONCLUSION

Partial resection of the middle turbinate during endoscopic sinus surgery offers several advantages. It enhances the patency of the middle meatal antrostomy, facilitates better access, improves the ability for endoscopic clearance and debridement of crustation. Additionally, partial resection of the middle turbinate is associated with a lower risk of adhesion to the lateral nasal wall, and it leads to a significant improve-

ment in nasal obstruction.

ETHICAL DECLARATIONS

- **Acknowledgements**

  None.

- **Ethics Approval and Consent to Participate**

  This study was approved by the Otolaryngology Council of the Iraqi Board for Medical Specializations, the concept of the study was discussed and informed consent was taken from each participant.

- **Consent for Publication**

  Non.

- **Availability of Data and Material**

  The datasets are available from the corresponding author upon reasonable request.

- **Competing Interests**

  The authors declare that there is no conflict of interest.

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- **Authors' Contributions**

  All stated authors contributed significantly, directly, and intellectually to the work and consented it to be published.

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