RESEARCH ARTICLE

Nasal airway patency after endoscopic middle turbinate trimming versus partial lateral middle turbinectomy in treating Concha Bullosa; a comparative non-randomised study

Ahmed Salah Ahmed[a], Riyadh Sagban Abdul-Aziz[b], Mustafa Salman Hamed[c]

ABSTRACT

INTRODUCTION: Middle Turbinate (MT) pneumatisation is an anatomical variation called Concha Bullosa (CB), with an incidence of 5 to 25% in normal persons. It causes over-crowding with obstruction of the middle meatus and nasal cavity and has many surgical techniques applied for its treatment.

OBJECTIVE: to compare the nasal airway patency improvement after endoscopic middle turbinate trimming versus partial lateral middle turbinectomy in the treatment of concha bullosa.

METHODS: A prospective non-randomised comparative clinical trial study was conducted at the Otorhinolaryngological Department of Al-Yarmouk Teaching Hospital and Al-Numan Teaching Hospital from January 2020 to September 2022. One Hundred Eighteen (118) patients of both gender who suffered from long-standing unilateral or bilateral nasal obstruction due to Concha Bullosa confirmed by endoscopic examination and CT scan of the nose and nasal sinuses. Patients were allocated either to receive trimming of the middle turbinate or partial lateral middle turbinectomy. Assessment of improvement in the patency of the nasal airways was done subjectively three months after the surgery.

RESULTS: Improvement in the patency of the nasal airway was reported in 60/62 (96.8 %) patients who underwent trimming of the middle turbinate compared to 46/56 (82.1%) of those who underwent partial lateral middle turbinectomy; the difference was statistically significant, with a p-value of 0.027.

CONCLUSION: More patients who underwent trimming of the middle turbinate felt improvement in the nasal airway patency than those who underwent partial lateral middle turbinectomy.

Key words: Concha bullosa, Partial Lateral Middle Turbinectomy, Middle Turbinate Trimming.

INTRODUCTION

Middle turbinate (MT) is a medial structure to the ethmoid bulla and uncinate processes. Anteriorly, it attaches to the medial wall of the agger nasi cell and the superior edge of the uncinate process. Superiorly, MT adheres to the cribriform plate. As it extends posteriorly, MT emits a laterally coursing bony structure (the Basal or Ground Lamella) which fuses with the Lamina Papyracea posterior to the Ethmoid Bulla.[1]

MT pneumatisation is an anatomical variation called Concha Bullosa (CB) with an incidence of 5 to 25% in the normal population, causing over-crowding with obstruction of the middle meatus and nasal cavity, either on the same side or, with a corresponding Septal deviation, on the opposite side.[2]

CB has three types depending on the degree of pneumatisation; **(1)** Lamellar type (localised in the vertical lamella), **(2)** Bulbous type (localised in the inferior portion) and **(3)** Extensive type (localised in both the vertical lamella and inferior portion).[3]

Also, CB is classified into four Endoscopic grades according to its size and the relationship with neighbouring structures; **(1)** the sphenoethmoid recess and uncinate process are both clearly visible, **(2)** the sphenoethmoid recess is invisible, but the uncinate process is visible, **(3)** the sphenoethmoid recess and unci-

a: MBChB, FIBMS. Otolaryngology Specialist. Al-Yarmouk Teaching Hospital, Baghdad, Iraq. *b:* MBChB, CABMS. Otolaryngology Specialist. Al-Yarmouk Teaching Hospital, Baghdad, Iraq. *c:* MBCHB, FIBMS, Otolaryngology Specialist. AL-Numan Teaching Hospital, Baghdad, Iraq.

Corresponding Author: **Ahmed Salah Ahmed**, E mail: **drahmedsalah1985@gmail.com**.

nate process are both invisible and **(4)** giant CB occupying the entire middle meatal area and extending to the inferior meatus.[4], [5]

One of the main indications of surgery in CB is to relieve nasal airway obstruction, especially in extremely large middle turbinates.[6]

Many surgical techniques are applied to treat CB, including partial lateral middle turbinectomy (lateral marsupialisation), partial medial middle turbinectomy (medial marsupialisation), crushing, trimming of the middle turbinate (or transverse excision) and conchoplasty.[7],[8],[9] Preference of which technique to use is dependent on the surgeon's experience, and there is no specific work comparing all techniques. CB surgery aims to decrease the MT size by applying a technique with minimal surgical morbidity. Routinely in adults, middle turbinate partial transverse excision during endoscopic sinus surgery has been suggested as a method to improve nasal airflow with an increase in the chance of prolonged middle meatal antrostomy patency and reduce the occurrence of adhesion between MT and the lateral nasal wall and develop a visualisation of the maxillary sinus ostium as well as the posterior ethmoid and sphenoid sinuses. Others recommend against partial turbinectomy because of the loss of an important surgical landmark and the risk of atrophic rhinitis or loss of olfactory acuity. Therefore, management of the CB should be conducted to maintain as much of the pre-operative anatomy as possible. [3], [9]

This study compared the improvement in the patency of the nasal airway subjectively between endoscopic middle turbinate trimming and partial lateral middle turbinectomy in patients with Concha Bullosa.

METHODS

Setting and study design: A prospective non-randomised comparative clinical trial was executed in the Otorhinolaryngological department of Al-Yarmouk Teaching Hospital and Al-Nuaman Teaching Hospital and in private hospitals from January 2020 to September 2022.

Ethical consideration: The ethical approval obtained from the hospitals' administrations. The details, types of the surgeries, their complications, and the risk of general anaesthesia were explained to the patients and their families and asked to provide written informed consent.

Definition of cases, inclusion and exclusion criteria: We included patients with CB who fulfilled the following criteria: Has a long-standing history of unilateral or bilateral nasal obstruction, not responding to topical steroids, decongestants, antihistamines, analgesics, alkaline nasal wash, and antibiotics; nasal endoscopic examination showed an enlarged middle turbinate; and nasal and paranasal CT scans confirmed the presence of pneumatisation inside the middle turbinate.

Patients who had the following were excluded from the study:

- Nasal and paranasal sinus revision surgery.
- Moderate to severe or impacted septal deviation requires septoplasty or an enlarged inferior turbinate, which needs submucosal diathermy, inferior turbinoplasty or turbinectomy.
- Nasal polyps or masses.
- Immune-compromised status.
- Medical disease interferes with general anaesthesia or conditions that prevent elective operation like bleeding tendency or pregnancy.
- Patients refused surgery itself.

Sampling and randomisation: Patients who fulfilled the inclusion criteria and visited the ENT consultancy clinics on Mondays and Thursdays of each week during the period of patient recruitment were enrolled in this study. The patients were allocated to each group sequentially, where the first patient was allocated to Group I, Trimming of Middle Turbinate, and the second to Group II, Partial Lateral Middle Turbinectomy, and so on.

Procedure: Each patient was subjected to full medical history, comprehensive ENT examination, 0° rigid nasal endoscopy, and radiological examination, including nasal and paranasal sinuses CT scan (bone window; coronal and axial

views), as shown below in figure 1.

Patients of both groups were prepared for the operation under general anaesthesia according to a similar protocol. The surgeries were conducted under general anaesthesia with endotracheal intubation, anti-Trendelenburg position, and throat packing, using endoscopic guidance of zero degrees (4mm in diameter and 180 mm in length) rigid Endoscope and camera display system. After induction of anaesthesia, a nasal pledge of local nasal decongestant, Xylometazoline 0.1%, was inserted in the nasal cavity near the middle meatus for 10 minutes.

Group I (Trimming of Middle Turbinate): contained Sixty Two (62) patients with One hundred (100) CB. We resected the lower third of MT and its mucosa using endoscopic sinus surgery scissors.

Group II (Partial Lateral Middle Turbinectomy); contained Fifty-six (56) patients with Ninety Four (94) CB. We performed PLMT using the sickle knife to make a vertical incision, continuing the incision along the inferior margin of the MT to the lateral attachment on the lateral wall of the nose. Then utilise endoscopic sinus surgery scissors to extend the superior incision posteriorly with gradual moving inferiorly to the posterior part of the MT and to remove the lateral lamella of the MT with its mucosa.

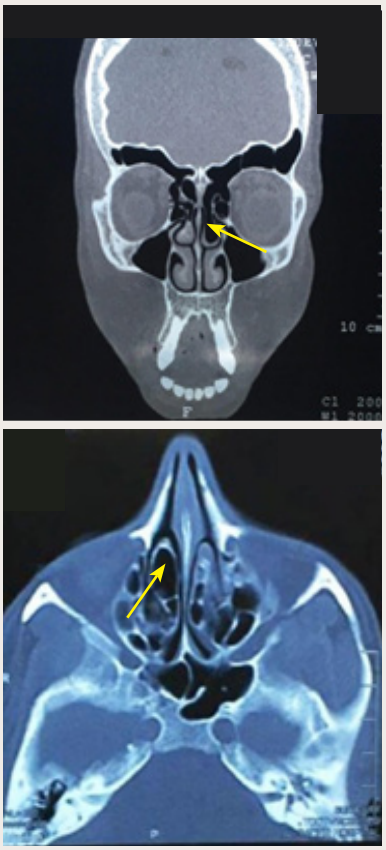

Figure 1 | CT scan of the nose and para-nasal sinuses (coronal and axial views) showing Concha Bullosa.

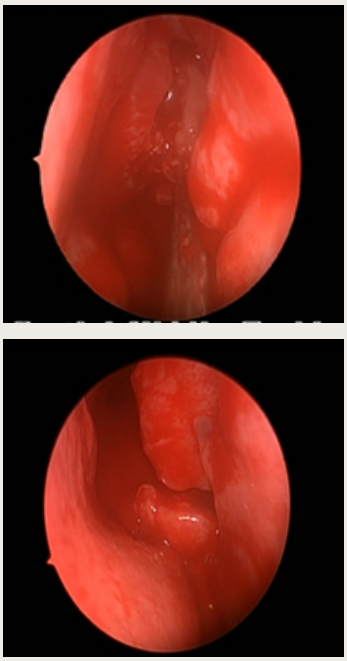

Figure 2 | Endoscopic surgical management of CB (MTT versus PLMT).

After the surgery, we packed the middle meatus with polyvinyl acetate (Merocel) packs for five days. Patients of both groups received similar post-operative medication; we used intravenous antibiotics for five days with proper analgesia as required.

After removing the packs, all patients were given oral antibiotics, decongestants, analgesics, alkaline nasal wash, and topical steroids for three weeks. Follow-up was done one week after the surgery, then every two weeks for three months. Between the visits, patients may contact the surgeon via phone on need.

Outcomes: The outcome was the improvement in the patency of the nasal airways. We subjectively assessed the improvement by asking the

patient three months after the surgery to quantify it either into no, partial, or total improvement. Although subjective assessment may be biased, its simplicity and lack of more accurate methods of assessing nasal airway patency, like nasal rhinomanometry when conducting the study, forced us to choose this method.

Statistical analysis: The data has been managed and analysed with computer software Statistical Packages for Social Sciences (SPSS) version 24. The chi-square test was used to define the association between the categorical variables. A confidence level of 95% with a P-value equal to or less than 0.05 was considered significant.

RESULTS

In the present research, the age of the patients ranged from (18 to 50) years old, with a mean age of 27.3±9.64 years. The total number of patients was (118) patients; 70 (59%) were females, and 48 (41%) were males. See table 1.

The most common type of CB was extensive in 92 (47%) patients, followed by bulbous in 66 (34%) and lamellar in 36 (19%). We found bilateral Concha Bullosa in 76 (64.4%) patients and unilateral Concha Bullosa in 42 (35.6%); 22 of them (18.6%) were on the right side and 20 (17%) on the left side, as shown in table 1.

Nasal airway improvement, total and partial, after MTT was reported by 60 (96.8%) patients compared to 46 (82.1 %) reported by those who underwent PLMT, with a p-value of 0.027, table 4. The relative risk was 1.17.

DISCUSSION

Our study compared two kinds of endoscopic surgical operations for treating CB, trimming of middle turbinate versus partial lateral middle turbinectomy, on their effect on improving the patency of nasal airways.

In our study, extensive was the most common CB type (47 %). Many studies found similar results; Tayfun Apuhan et al.[8] (51.9%), Hatice Gül Hatipoğlu et al.[10] (46.95%) and Tonai A et al.[11] (52%). While Lamellar CB was the most common type in UYGUR et al.,[12] Bolger et al.,[13] and Maru et al.[14] Also, we found that 64.4 % of the CB were bilateral. Many studies come up with nearly similar results; Uygur et al.[12] (60%), Hatipoğlu et al.[10] (70.58%), and Devrim Bektas et al.[15] (76.4%). While Cannon et al. ,[7] Apuhan et al.,[8] Mehta et al.,[16] Badran et al.,[17] Maru et al.,[14] and Vincent et al.,[18] found unilateral CB more common than bilateral.

Table 1 | Gender, laterality and number of Concha Bullosa distributed in both treatment groups

Parameters		Group I (Trimming of the Middle Turbinate) Total = 62 patients		Group II (Partial Lateral Middle Turbinectomy) Total = 56 patients		Total	%
		No.	%	No.	%		
Gender	Female	36	58.1	34	60.7	70	
	Male	26	41.9	22	39.3	48	
Laterality	Bilateral	38	61.3	38	67.8	76	
	Unilateral	24	38.7	18	32.2	42	
	Right	12	50	10	55.6	22	
	Left	12	50	8	44.4	20	
Total number of patient		62	52.6	56	47.4	118	100
Total number of Concha Bullosa		100	51.6	94	48.4	194	100
Type of Concha Bullosa:							
	Extensive	41	41	51	54.25	92	47
	Bulbous	34	34	32	34.05	66	34
	Lamellar	25	25	11	11.7	36	19

Table 2 | Relationship between the operation type and post-operative Nasal airway patency at the end of the third post-operative month

	Post-operative nasal airway patency			Total	Statistics
	Total improvement	Partial improvement	No improvement		
Group I (Trimming of the Middle Turbinate)					Chi square = 7.222
No.	56	4	2	62	Degree of freedom = 2
%	90.3	6.5	3.2	100	P = 0.027*
Group II (Partial Lateral Middle Turbinectomy)					
No.	34	12	10	56	
%	60.7	21.4	17.9	100	

We found that the improvement of nasal airway patency, partial and total, was more in patients who underwent Trimming of the Middle Turbinate than those who underwent Partial Lateral Middle Turbinectomy, 96.8 % versus 82.1%, respectively. This difference is statistically significant, with a p-value of 0.027. Perhaps, the changes in direction and turbulence of airflow in the nasal cavity, with increasing airspace in the nose and reduction of the nasal resistance, led to more improvement of nasal airway patency after MTT compared to PLMT.

Gulati et al.[19] reported that 88% of the patients who underwent partial resection of the MT reported subjective improvement in nasal obstruction.

Cook et al.[20] stated that 87% of the patients showed improvement in total nasal airflow after partial middle turbinate resection without septoplasty.

Dayal et al.[21] noted that MT resection increased the nasal airflow allocation to the middle nasal area (the middle part of the septum and middle meatus) by 75±7% due to an increment of nasal airspace followed by reducing of nasal resistance, which led to increasing nasal airflow.

Zhao et al.[22] described an increment in the nasal airflow rate to 38% after the resection of MT.

Alam et al.[23] mentioned that the total nasal airflow significantly increased following bilateral MT resection in all patient models with a P-value of < 0.05 and associated with a decrement in the nasal resistance following resection of the MT.

Richtsmeier et al.[7] and Eren et al.[4] found that the lateral excision of MT facilitates drainage from the frontal sinus into the middle meatus. Still, there is a potential problem of adhesions (Synechia), especially if the endoscopic sinus surgery is done in the same session. Synechia formation may cause nasal obstruction or obstruction of the osteo-meatal complex, olfactory dysfunction, and headaches. This result may be due to the creation of two opposed raw surfaces area in partial lateral middle turbinectomy leading to an increase in the incidence of adhesion to the lateral nasal wall with decreasing the airspace area of the nose, causing Nasal obstruction, which could be avoided by trimming of middle turbinate technique where no raw areas facing each other.

Adhesions (Synechia) following PLMT were reported in 27%, 24.4% and 21% in Dogˇru et al.,[3] Belli et al.,[24] and Sigston et al.,[2] respectively. While after MTT, Synechia was not seen (Zero %) in studies conducted by Havas et al.,[25] and Vleming et al.,[26] and minimally reported 4%, 5%, and 5.3% by Giacchi et al., [27] Gulati et al.,[19] Ramadan et al.,[28] respectively.

Limitation of the study: A study is needed to include more cases and to use a more objective way of assessing the patency of the nasal airways. In addition, complications expected to develop after each surgery should be measured.

CONCLUSION

Middle Turbinate Trimming showed better improvement in the patency of the nasal airways as assessed subjectively compared to Partial Lateral Middle Turbinectomy.

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Abbreviations list: Computerized Tomography (**CT**), Concha bullosa (**CB**), Ear, Nose, and Throat (**ENT**), Middle Turbinate (**MT**), Partial Lateral Middle Turbinectomy (**PLMT**), Trimming of Middle Turbinate (**TMT**).

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