

Effect of Septoplasty on Inferior Turbinate Hypertrophy

*Farhad Jalil Khayat (M.D, Ph. D)

**Hawar Mazhar (M.B.Ch.B)

Abstract

Background: Septal deviation usually associated with compensatory hypertrophy of the contralateral inferior nasal turbinate. The current treatment of anterior septal deviation is septoplasty but there is controversy about surgery for the hypertrophied inferior turbinate.

Objectives: This study aims to determine the effect of septal surgery alone (septoplasty) on the hypertrophied inferior turbinate.

Patients & Methods: This prospective study was done on 36 patients attended ENT department at Rizgary Teaching Hospital during the period from 1st August 2010 through 31st January 2011, their age ranged from 18-38year with septal deviation and inferior turbinate hypertrophy. All of them underwent septoplasty alone without turbinate surgery. The thickness of the hypertrophied inferior turbinate was measured before and after surgery by CT scan of paranasal sinuses coronal section.

Results: Septoplasty significantly decreased the thickness of the medial mucosa of hypertrophied inferior turbinate by 1.14mm at the anterior part, 0.75mm at the middle part and 0.59mm at the posterior part, and it decreased the thickness of the lateral mucosa as well but to a lesser extent.

Conclusion: Inferior turbinate hypertrophy, especially in the medial mucosa, reverses 4-6 months after septoplasty without turbinate surgery.

Keywords: septal deviation, turbinate hypertrophy, septoplasty, turbinectomy

*College of Medicine / Hawler Medical University/Arbeel / Iraq.

**Rizgari Hospital/ Arbeel Health Governorate/Arbeel / Iraq.

Introduction

Septal deviation usually associated with varying degree of compensatory hypertrophy of the contralateral inferior nasal turbinate, for which turbinate surgery is commonly performed in association with septoplasty but the indication for turbinate surgery is not clear because of evidence that degree of satisfaction of patients who undergo septoplasty alone is similar to those who undergo septoplasty and turbinectomy [1, 2, 3]. Three turbinates (conchae) attached to the lateral wall of the nose [1]. Normally they are thin, curved, shell like bones covered by

ciliated respiratory mucosa (figure 1). They divide the nasal airway into three major air passages or meatuses and helping in creating the high inspiratory resistance necessary for normal breathing, insuring the negative intrathoracic pressure needed for inspiration. The nasal cavity is divided into several parts, each having a specific influence on the inspiratory airflow: the vestibulum nasi, the isthmus nasi, the area of the turbinate and the choana. The isthmus is the narrowest part of the airway and the site of highest resistance to airflow, insuring laminar flow throughout this segment which is often referred to as the

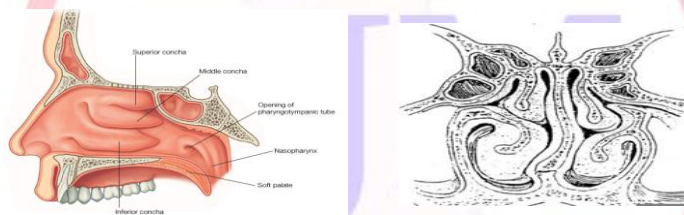


nasal valve. It extends from the internal ostium to the first few millimeters of the pyriform aperture [4]. The congestion state of the anterior part of the inferior turbinate influences this segment [5]. As the nasal cavity increases in cross sectional area, a diffuser effect takes place resulting in turbulence of airflow and a decrease in flow velocity [6]. The area and configuration of the inferior and middle turbinates facilitates the maximum contact of the air with the mucosa. Humidification, warming and cleansing the air is maximized by the turbulent flow and large mucosal surface area, as well as the rich blood supply, especially on the inferior turbinate. The nasal defense systems, including mucociliary transport, cellular and humoral defense are mainly carried out by the mucosa of the turbinates [1]. The bone and/or the mucosa of the turbinates may be enlarged, but what constitutes pathologic or normal is not well defined and therefore there is controversy over the management of the turbinates in symptomatic subjects [7]. Swelling of the nasal mucosa is part of the normal process known as the 'nasal cycle'. There are data indicating that the periodical changes which occur 4 hourly may be alternating from side to side, may change at the same time in both sides of the nasal cavity or may be completely irregular.[8,9,10,11]. The main functions of the nose (olfaction, heating, humidification and defense) require good interaction between the inspired air and the mucous membranes or the sensory cells of the olfactory system. This is achieved by complicated aerodynamics that depends on the geometry of the internal nose. The septum helps to preserve this geometry and supports the dorsum, columella and the tip of the nose and as such it contributes to cosmesis. The success of functional nasal surgery, as well as cosmetic nasal surgery, depends heavily on the correction of the septum. This explains why nasal surgery

almost always involves both function and aesthetics as pointed out by Maurice Cottle in the 1960s. [12] Nasal blockage is nonspecific and often misinterpreted as a sign indicating airflow obstruction. In fact, it is rather nonspecific finding associated with disturbed function and not necessarily caused by mechanical obstruction to airflow. There are clear-cut indications for septoplasty such as a complete or nearly complete obstruction of the airflow, impaired drainage of the sinus or inaccessibility of the nasal cavity for surgery, for example in nasal polyposis. The indications for septal corrections for aesthetic reasons are in general more straightforward than those for functional reasons [13]. The Current treatment of anterior septal deviations and nasal obstruction is septoplasty, but there is controversy about turbinate surgery in these cases [1]. Inferior turbinate hypertrophy: The osseous part of the middle and inferior turbinates may have enlarged, as a developmental process on the wider side of the nose, contralateral to marked septal deviations. This phenomenon is known as compensatory turbinate hypertrophy (figure 2), which may be skeletal or mucosal [1]. Its existence has been shown objectively, but there is no evidence that it should be treated as a supplementary procedure to septoplasty [2]. The long-term results of septoplasty have not commonly been reported, probably because of the difficulty in objectively evaluating nasal function [14, 15, 16]. Factors other than septal deviation may also contribute to a subjective perception of nasal obstruction, e.g., allergy or turbinate hypertrophy. Since a true definition of turbinate hypertrophy has never been established and the assessment of nasal congestion is generally highly subjective, long-term results of inferior turbinate surgery in compensatory turbinate hypertrophy have also not been reported [17]. When performed as an adjunct to septoplasty, inferior turbinate surgery is

associated with an increased risk of morbidity, primarily hemorrhage, intranasal adhesions, and atrophic rhinitis [18]. Computed Tomography (CT) scan is well suited to the investigation of the sinonasal cavities. Because CT scanning is as sensitive to soft tissue disease as to bony changes, each scan can be photographed at an appropriate window width and level to optimally see insidious soft tissue differences in attenuation and fine bony detail. To study soft tissue, the window widths range from 150 to 400 Hounsfield units. Conversely, the bony detail is best observed at wide window settings—from 2000 to 4000 Hounsfield units. The basic CT scanning protocol should include all of the nasal cavity, paranasal sinuses, hard plate, anterior skull base, orbits, and nasopharynx. The brain should be included if central causes of olfactory

dysfunction are suspected. The scans are commonly performed in both the axial and coronal planes for optimal assessment of the complex paranasal anatomy, but coronal scans are the most valuable for the anterior nasoethmoid (ostiomeatal) region. Alternatively, thin sections in one plane with multiplanar reconstructions may be adequate. For practical purposes, slice thicknesses of 3-5 mm are often employed. For the evaluation of the ostiomeatal complex (the maxillary sinus ostium, infundibulum, uncinate process, and middle meatus). Intravenous contrast enhancement is usually reserved for the identification of vascular lesions, tumors, meningeal or parameningeal processes, and abscess cavities [19]. This study aims to determine the effect of septal surgery alone (septoplasty) on the hypertrophied inferior turbinate.



Figure(1): lateral wall of the nasal cavity showing superior, middle and inferior turbinates (Gray's anatomy) [20].

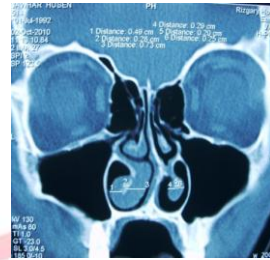
Figure2: Septal deviation with compensatory inferior turbinate hypertrophy (Bennett G.H.) [21]

Patients and methods

This prospective study was done on 36 patients, 32 male (88%) and 4 female (12%). Their age range from 18 to 38 years (mean 24.5years). They attended ENT department in Rizgary Teaching Hospital for the period from 1st August 2010 to 31st January 2011, complaining of nasal obstruction. Patients with symptoms of allergic rhinitis and those with history of previous septoplasty/turbinate surgery were excluded. Patients with chief complaint of nasal obstruction included in this study. History of hyposmia and previous trauma to

the nose were recorded. On examination they had septal deviation with contralateral inferior turbinate hypertrophy which was documented by preoperative computed tomography (CT) scan of the paranasal sinuses. The computed tomography scans of the paranasal sinuses were performed with 3mm slice thickness in coronal plane. The measurements were made by electronic caliber at the anterior, middle, and posterior thirds of the inferior turbinate in coronal sections. For standardization, anterior measurement was performed on the first image in which the entire inferior turbinate

bone could be identified (figure3). The middle measurement was performed on the section in which the uncinate process and maxillary sinus ostium were visualized



(Figure4).The posterior measurement was performed on the last image in which the entire inferior turbinate bone could be identified (figure 5)[18].

Figure (3): CT scan of paranasal sinuses (coronal section) showing anterior measurements which are taken on the first image where the inferior turbinate bone can be identified.

Figure (4): CT scan of paranasal sinuses (coronal section) showing middle measurements which are taken where the uncinate process and maxillary sinus ostium can be identified.

Figure (5): CT scan of paranasal sinuses (coronal section) showing posterior measurements which are taken in the last image where the inferior turbinate bone can be identified.



Figure (6): CT scan of Paranasal sinuses (coronal section) showing septal deviation with left inferior turbinate hypertrophy (before and after surgery).

Measurement of the thickness of the medial mucosa, conchal bones and lateral mucosa were taken separately on the anterior, middle and posterior portions of inferior nasal conchae at a place perpendicular to the mucosal surface with the aid of a cursor on the screen using computed tomography. Functional septoplasty was done for all the patients without turbinate surgery. Follow up time ranged from 2 to 6 months (mean 4 months), during follow up the patients were reviewed regarding symptoms of nasal obstruction and hyposmia, and they were examined for septum and inferior turbinate. Postoperative CT scan was done 4-6 months after surgery and the same measurement were taken. All these documented on a data sheet. The mean thicknesses of the medial mucosa, conchal bone, and lateral mucosa of inferior

turbines before and after septoplasty were compared using T test.

Results

Out of the 36 patients with nasal deviation 22 were deviated to the left (20 male and 2 female) and 14 were deviated to the right (12 male and 2 female) with contralateral inferior turbinate hypertrophy (table 1). Hyposmia was present in 8 patients (7 male and 1 female) and history of trauma was present in 4 patient (all male) (Table 2).

Regarding the inferior turbinates, in the concave side of the septum septoplasty significantly decreased the mean thickness of the anterior part of medial mucosa (n=36) by 1.14 mm (p value <0.05), middle part of medial mucosa by 0.75 mm (p value <0.05) and posterior part of medial mucosa by 0.59

mm (p value <0.05) (figure 6 and 7) and (table 3). Septoplasty also decreased the mean thickness of the anterior part of lateral mucosa (n=36) by 0.24mm (p value <0.05), middle part of lateral mucosa by 0.38 mm (p value <0.05) and posterior part of lateral mucosa by 0.34 mm (p value <0.05) (figure 8) and (table 3). While the changes in conchal bone were decrease in mean thickness of anterior part by 0.03 mm (p value 0.59), increase in the middle part 0.08 mm (p value 0.45), decrease in the posterior part by 0.1mm (p value 0.35) (figure 9) and (table 3). While on the convex side septoplasty increased the mean thickness of anterior part of medial mucosa by 0.42mm (p value <0.05), middle part of medial mucosa by 0.19 mm (p value 0.16) and posterior part of medial mucosa by 0.13mm (p value 0.53). While it

decreased the mean thickness of lateral mucosa at anterior part by 0.14mm (p value 0.26), increased at middle part by 0.01mm (p value 0.8) and increased at posterior part by 0.26mm (p value 0.08). The conchal bone thickness increased by 0.13mm (p value 0.054) in anterior part, decreased in middle part by 0.04mm (p value 0.38) and increased in posterior part by 0.14mm (p value 0.3) (table 4). Among the patients complaining of nasal obstruction before the surgery 34 patients (94%) improved while 2 patients (6%) did not satisfy, 8 patients (22%) had hyposmia after septoplasty 6 patients (75%) improved while 2 patients (25%) did not improve.

Table (1): Distribution of cases according to the side of septal deviation and inferior turbinate hypertrophy.

Type of nasal deviation	Side of inferior turbinate hypertrophy	No. of patients	Male	Female
Deviated to left	Right	22(61%)	20(90%)	2(10%)
Deviated to right	Left	14(39%)	12(85%)	2(15%)

Table (2): No. of patients with history of hyposmia and trauma.

	No. of patients	male	female
Hyposmia	8(22%)	7(87.5%)	1(12.5%)
Trauma	4(11%)	4(100%)	0
Total	12(33%)	11(91.6%)	1(8.4%)

Table (3): showing mean thickness of medial mucosa, conchal bone and lateral mucosa on the concave side before and after surgery.

	Part	Before	After	Mean difference	P value
Mean Thickness of the medial mucosa in mm	Anterior	6.54	5.40	1.14	<0.05
	Middle	6.16	5.41	0.75	<0.05
	Posterior	6.12	5.53	0.59	<0.05
Mean Thickness of conchal bone in mm	Anterior	1.97	1.94	0.03	0.59
	Middle	2.34	2.42	0.08	0.45
	Posterior	2.30	2.2	0.1	0.35
Mean Thickness of the lateral mucosa in mm	Anterior	2.46	2.22	0.24	<0.05
	Middle	3.75	3.37	0.38	<0.05
	Posterior	4.00	3.66	0.34	<0.05

Table(4): showing mean thickness of medial mucosa, conchal bone, and lateral mucosa on the convex side before and after surgery.

	Part	Before surgery	After surgery	Mean difference	P value
Mean Thickness of the medial mucosa in mm	Anterior	3.06	3.48	0.42	<0.05
	Middle	3.42	3.61	0.19	0.16
	Posterior	4.32	4.45	0.13	0.53
Mean Thickness of conchal bone in mm	Anterior	1.41	1.54	0.13	0.054
	Middle	2.06	2.02	0.04	0.38
	Posterior	2.02	2.16	0.14	0.3
Mean Thickness of lateral mucosa in mm	Anterior	2.03	1.89	0.14	0.26
	Middle	2.89	2.90	0.01	0.8
	Posterior	3.3	3.56	0.26	0.08

Discussion

This prospective study included 36 patients, their age ranged between 18 - 38 years (mean 24.5 years). Out of these 32(88%) were male and 4 female (12%), this result was close to the result of a study done by Behnoud et al which showed 70% male predominance this higher incidence in male patients is related to the fact that male patients are more prone to nasal trauma [22].

In this study deviated nasal septum to the left side was found in 22 patients (61%) and to the right side in 14 patients (39%), this result was close to the result of a study conducted by Daghistani [23] in 2002 who found that 55.6% of the patients had left side septal deviation. History of trauma in this study was present in 12% of the patients and this is close to the result of Daghistani[23] that was 19.3% but was less than the result of a study done by Hossam et al[24] in 2005 who found that 54 % of his patients had nasal trauma. Also our result was less than the result of Seung et al[25] which was 69.2%. This may be because many cases of minor nasal trauma during childhood may pass unnoticed and the patient may not recall it.

In our study we found the hypertrophied inferior turbinate regressed after septoplasty and the thickness of the medial mucosa and lateral mucosa decreased 2 -6 months after surgery. Our results were in consistence with a study done by Kim et al [18] in 2008 with a follow up period of 1-3 years.

We found that medial mucosa of the inferior turbinate on the concave side decreased in thickness at anterior part by 1.14mm which was close to the result of Kim et al [18] in which the decrease in the thickness of the medial mucosa was 1 mm. This result can be explained by the result obtained by Graaman et al [26] who postulated that the reduction of mucosal edema after septal surgery was probably the result of diminished submucosal blood circulation. In our study the medial

mucosa of the inferior turbinate on the convex side increased at anterior part by 0.42 mm which was less than the result reported by Kim et al which was 1mm, this may be because the follow up period of their study was longer than our study. Hilberg et al[27] who found that the tendency of the turbinate to adapt and fit into the new spatial conditions created after septoplasty is associated with bone resorption[28]. A process that probably develops many months and even years after surgery, this explains the insignificant change of conchal bone which we recorded 0.03mm that was close to result of Kim et al [18] 0.06mm. Out of 36 patients who underwent septoplasty, 34 patients (94 %) were satisfied regarding improvement of their nasal obstruction, our results was close to the result obtained by Gandomi et al [29] done at 2008 who stated that 89.5% of his patient have reported a subjective improvement in their nasal obstruction. One of the major differences between these two results from the results obtained by other studies is the mean age of patients undergoing surgery which was 24.5 years in our study and 22.44 years in Gandomi,s study versus more than 40 years in most studies [30,31,32].

This high success rate in our study and Gandomi,s study shows that younger patients who have nasal obstruction with septal deviation get benefit more from septoplasty because their nasal obstruction may be more anatomical dependent, while in older patients dynamic causes are more important as it was reported by Stewart et al [30] who conducted his study on 62 patients with mean age of 44.7 years whom beside septal deviation complained of allergic rhinitis, he reported success rates of 63% only.

Illum et al [3] reported that, 5 years after turbinate surgery, the impact of turbinate reduction was reduced and the satisfaction of patients with the procedure was similar to that of patients who underwent septoplasty



only. Gandomi et al[29] had the same result and concluded that in the group of patients who had turbinate manipulation with septoplasty, and those patients who had septoplasty alone no significant difference in patient satisfaction was observed between these 2 groups at follow up period of 3 and 6 months. The result of our study was in consistence with the studies done by Illum[3] and Gandomi[29] in the fact that nasal obstruction improved with septoplasty alone without turbinate surgery. In this study out of the 36 patients 8(22%) of them had hyposmia preoperatively 6 (75%) of them improved that was in consistent to the result reported by Smith et al [33] which was 71%. This study has several limitations, including the lack of evaluation of the nasal cycle; however, we showed that septoplasty alone can reverse hypertrophy of inferior turbinate. Conclusion: Hypertrophy of the inferior turbinate was decreased by septoplasty alone. In particular, hypertrophy of the medial mucosa was reversed and the mucosa adapted to the new nasal cavity created by septoplasty.

Recommendation: In this study there was no significant change in the thickness of conchal bone additional follow-up studies for longer periods are recommended for evaluations of conchal bone changes after septoplasty.

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