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Original Research Article

Histopathological Study of Hypertrophied Inferior Turbinate

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ABSTRACT

Background: Prolonged perceived nasal obstruction resulting from inferior turbinate hypertrophy (ITH) is a common complaint encountered in Otorhinolaryngology practice. A wide variety of surgical procedures like partial resections, submucous resection, electrocautery, submucous diathermy, cryosurgery, laser ablation and endoscopic resection have been performed but results have been universally unsatisfactory. There is very less literature available regarding Histopathological aspects of hypertrophied inferior turbinate which can throw more light on appropriate management of hypertrophied inferior turbinate. Hence this study was undertaken to provide quantitative and qualitative information on various soft tissue and bony constituents of hypertrophic inferior turbinate.
Objective: Comparison of Histopathological features between inferior turbinate hypertrophy in allergic rhinitis, non-allergic rhinitis and deviated nasal septum.
Materials and methods: A total of 100 patients who presented with nasal obstruction due to hypertrophied inferior turbinate were chosen for study. All patients underwent partial turbinectomy of hypertrophied inferior turbinate under general anesthesia with or without septoplasty. Turbinectomy included anterior 2/3rd of turbinate and all the layers including the bone were excised during the procedure. The turbinate specimens were processed in standard manner in the department of pathology and slides were prepared from sectioning anterior 1/3rd of the specimen taking care to include all the three layers of the turbinate.
Results: In our study mean total thickness of inferior turbinate in DNS with ITH group was 5.27±0.98 mm and in allergic rhinitis group was 5.05±0.60 mm. Mean thickness of medial mucosal layer in DNS with ITH group was 1.58±0.33mm where as its thickness in allergic rhinitis group was 2.30±0.43mm. Thickness of bony layer was 2.54±0.53mm and 1.55±0.44mm in DNS with ITH group and allergic rhinitis group respectively. Mean thickness of lateral mucosal layer was 1.16±0.38mm in DNS with ITH group and 1.19±0.22mm in allergic rhinitis group.
Conclusion: With these results we conclude that bone should be the target of surgery in treatment of hypertrophied inferior turbinate secondary to deviated nasal septum where submucous resection of bone or turbinoplasty is adequate to relieve the symptoms of nasal obstruction where as in cases of allergic rhinitis with hypertrophied inferior turbinate where only medial mucosal layer is hypertrophied, limited resection of the mucosa either by diathermy or by other conservative methods may suffice.

Keywords: Inferior Turbinate, Turbinectomy, nasal obstruction

INTRODUCTION

Prolonged perceived nasal obstruction resulting from inferior turbinate hypertrophy (ITH) is a common complaint encountered in Otorhinolaryngology practice. Several causes may induce significant hypertrophic changes of the inferior turbinate (IT) including perennial allergic rhinitis and non-allergic rhinitis also the clinical observation of contralateral inferior turbinate enlargement in patients with compensatory septal deviations is supposedly common.

Inferior turbinate hypertrophy can result from mucosal hypertrophy, bony hypertrophy or both. The cause of chronic nasal obstruction due to hypertrophic inferior turbinate is usually perennial allergic rhinitis or vasomotor rhinitis. The turbinate enlargement in these patients is usually bilateral and is caused by thickening of the mucosa without hypertrophy of underlying structures, whereas in patients with compensatory inferior turbinate hypertrophy secondary to septal deviation the main cause of inferior turbinate expansion is the bone.

Many measures, medical and surgical have been tried in order to relieve nasal obstruction. Medical therapy is the first the approach which includes antihistamines, topical and systemic steroids, desensitization and allergen avoidance but if the measures fail surgery is advised.

A wide variety of surgical procedures like partial resections, submucous resection, electrocautery, submucous diathermy, cryosurgery, laser ablation and endoscopic resection have been performed but results have been universally unsatisfactory. [1]

There is long standing controversy among those who perform inferior turbinate by over where and how much to excise. All above mentioned procedures are traumatic and are often complicated by postoperative bleeding, infections dryness crusting and adhesions.

There is very less literature available regarding Histopathological aspects of hypertrophied inferior turbinate which can throw more light on appropriate management of hypertrophied inferior turbinate. Hence this study was undertaken to provide quantitative and qualitative information on various soft tissue and bony constituents of hypertrophic inferior turbinate

Objective

Comparison of Histopathological features between inferior turbinate hypertrophy in allergic rhinitis, non-allergic rhinitis and deviated nasal septum.

MATERIALS AND METHODS

Source of data: Data for this study was collected from patients attending department of otorhinolaryngology of our institution

This study was approved by ethical committee of our institution

Type of study: Time bound cross sectional study was done among the patients presenting with nasal obstruction

Inclusion criteria:

- Patients presenting with nasal obstruction due to hypertrophied inferior turbinate

Exclusion criteria:

- Patients below age of 10 years
- Patients associated with nasal polyposis, tumors of nose and granulomatous diseases of nose and paranasal sinuses
- Any patient not willing to undergo surgery

Method of data collection:

A total of 100 patients who presented with nasal obstruction due to hypertrophied inferior turbinate were chosen for study. All cases were diagnosed after taking a detailed history regarding nasal obstruction and

associated symptoms like nasal discharge, headache and sneezing.

A thorough clinical examination was done. Severity of nasal obstruction was assessed subjectively. Only patients who have diagnosed to have hypertrophied inferior turbinate secondary to deviated nasal septum, allergic rhinitis and non-allergic rhinitis not resolving after initial therapy with antihistamines, nasal decongestant drops and intranasal steroids were included in the study.

Patients were then subjected to various routine investigations Fitness for surgery was taken from physician whenever necessary. Written informed consent was taken from all the patients undergoing surgery.

All patients underwent partial turbinectomy of hypertrophied inferior turbinate under general anesthesia with or without septoplasty. Turbinectomy included anterior 2/3rd of turbinate and all the layers including the bone were excised during the procedure. During the procedure turbinate architecture was preserved by gentle handling and care was taken not to damage the mucosal layer during turbinectomy, then specimen was preserved in 10% buffered formaldehyde and sent for histopathological examination. In cases with bilateral turbinectomy it was agreed to send left inferior turbinate.

The turbinate specimens were processed in standard manner in the department of pathology and slides were prepared from sectioning anterior 1/3rd of the specimen taking care to include all the three layers of the turbinate (Onlyanterior 1/3rd of specimen sections were studied as anterior part of the turbinate is the one which comes in nasal valve area and exerts maximal resistance to airflow). Then slides were examined in various magnifications with a micrometer attached to eye piece of the microscope. Micrometer measurements were calibrated before actual measurements were made. Each layer of the turbinate were measured along with study of architecture of venous sinuses and presence of inflammatory cells

Statistical method: Micrometric measurements of inferior turbinate in cases with deviated nasal septum, allergic rhinitis (only two groups were studied as none of patients were diagnosed with non-allergic rhinitis in our study) were compared using unpaired t test and the p value was calculated. p value of <0.05 was considered statistically significant and p value >0.05 was considered statistically not significant

RESULTS

Table.1: Total Mean Thickness (Width) Of ITH In Different Conditions

Conditions causing ITH	Total thickness(mean)
DNS with ITH	5.27±0.98 mm
Allergic rhinitis	5.05±0.60 mm

In our study mean total thickness of inferior turbinate in DNS with ITH group was 5.27±0.98 mm and in allergic rhinitis group was 5.05±0.60 mm (Table.1). Mean thickness of medial mucosal layer in DNS with ITH group was 1.58±0.33mm where as its thickness in allergic rhinitis group was 2.30±0.43mm. Thickness of bony layer was 2.54±0.53mm and 1.55±0.44mm in DNS with ITH group and allergic rhinitis group respectively. Mean thickness of lateral mucosal layer was 1.16±0.38mm in DNS with ITH group and 1.19±0.22mm in allergic rhinitis group (Table.2).

Table.2: Mean Length Of Layers Of Hypertrophied Inferior Turbinates In Different Pathology

Conditions causing ITH	Medial mucosal layer	Bony layer	Lateral mucosal layer
Compansatoryith in DNS	1.58±0.33mm	2.54±0.53mm	1.16±0.38mm
Allergic rhinitis	2.30±0.43mm	1.55±0.44mm	1.19±0.22mm

In our study along with thickness of hypertrophied inferior turbinate condition of venous sinusoids in each condition was also studied. In both conditions there were congested venous sinusoids. In DNS with ITH group 20 patients out of 66 i.e. 30.3% had engorged sinusoids where (Fig.1) as in allergic rhinitis group 12 patients out of 34 i.e. 35.2% had engorged sinusoids.

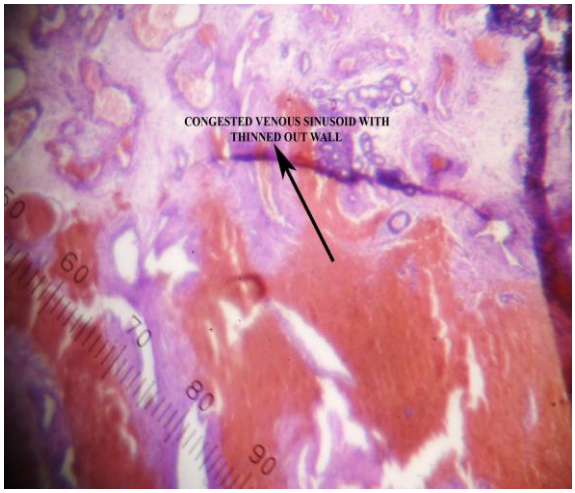

Figure 1: Congested venous sinusoids with thinned out wall

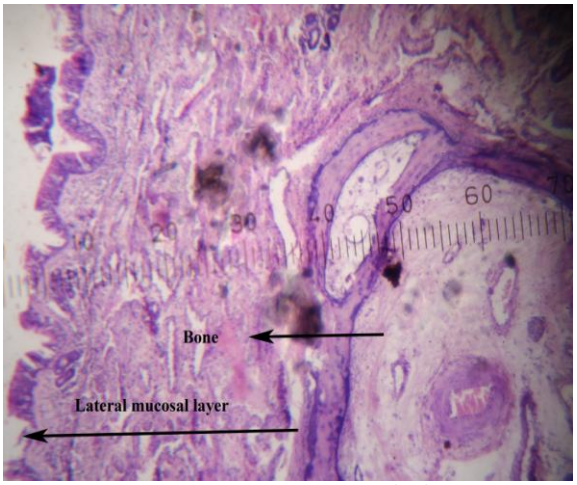

Figure 2: lateral mucosal and bony layer of inferior Turbinate

Mast cells and lymphocytes mainly eosinophils were prominent inflammatory cells in allergic rhinitis group, where as in DNS with ITH group lymphocytes were prominent inflammatory cells and mast cells were uncommonly encountered. 39 patients i.e. 50.09% in DNS with ITH group showed inflammatory cells in the specimen studied; most common among them were lymphocytes, where as in allergic rhinitis group 23 i.e. 63% patients showed inflammatory infiltrate in the specimen, eosinophils and plasma cells being the common inflammatory cells.

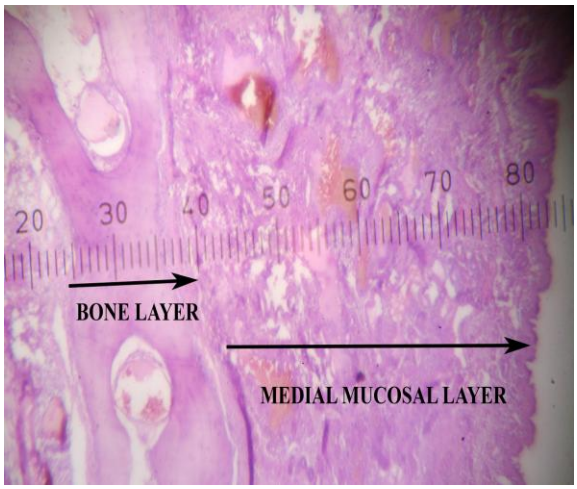

Figure 3: Medial mucosal and bony layer of inferior Turbinate

Only 18 specimens i.e. 27.2% in DNS with ITH group showed fibrosis in lamina propria whereas only 4 patients i.e.11% in allergic rhinitis group showed fibrosis in lamina propria of the inferior turbinate.

None of the specimens examined in this study showed dysplasia, malignant changes or chronic granulomatous changes.

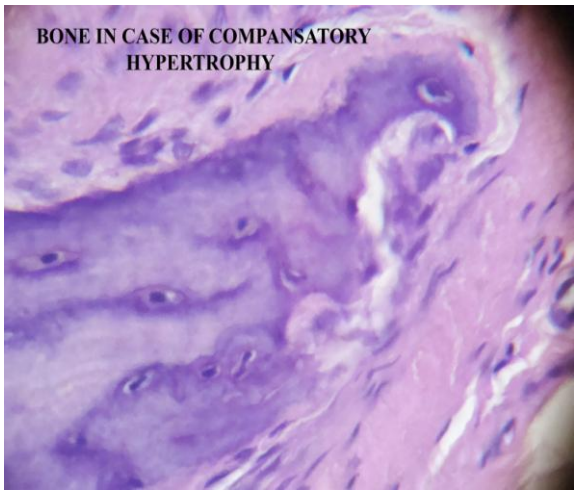

Figure 4: Bony Hypertrophy in case compansatory Hypertrophy

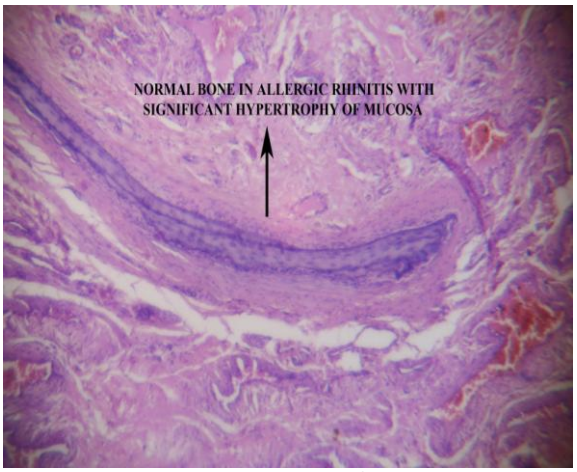

Figure 5: Normal bone in case of allergic rhinitis

DISCUSSION

The inferior turbainte (IT) is an elongated scroll like paired structure situated at the lateral nasal wall and made of a central are of an irregular osseous structure covered on each side by a mucosal layer. The inferior turbinate bone articulates along its superior border with maxilla, lacrimal, ethmoid and palatinebones. [2]

The inferior turbinate is composed of three layers: medial mucosal layer (MML), lateral mucosal layer (LML) and a central osseous layer in between them (Fig.2-3). [3] The mucosal layer resembles each other except the medial layer is considerably thicker than the lateral one.

The bony layer of IT is attached to the lateral wall superiorly and laterally. Inferiorly it is wall circumscribed by an ellipse shaped mucosa.

The inferior turbinate is covered with a pseudostratified ciliated columnar epithelium and in addition to deeply situated basal cells and superficially ciliated and non ciliated cells, comprises approximately 10% goblet cells. A thin layer of basement membrane separates the epithelium from the lamina propria which extends to the periosteum of the central osseous layer. The medial side of the lamina propria is thicker than that of the lateral one, a difference that explains the disparity between the widths of the mucosal layers. The lamina propria is built of loose connective tissue and superficially houses on inflammatory cells infiltrate (ICI) with lymphocytes and other inflammatory cells. The outer one third of LP in habits many seromucous glands whose excretory ducts are open to the epithelium. A rich network of thin walled venous sinusoids occupies its deeper portion as well as few large arteries that lie adjacent to the bone. The central osseous layer is a cancellous(spongy) bone made of interwoven bony trabaculae separated by a labyrinth of interconnecting spaces containing in adult life, fatty tissue and blood vessels.

In Haemotoxilin and Eosin (H&E) staining mucous cells are stained clear, whereas serous cells appear as darkly stained crescents surrounding the edge of mucous cell tubules. A rich network of thin walled venous sinusoids is also present along large portions of lamina propria (LP).

Small caliber venous sinusoids are superficially located from the epithelial surface, whereas many of the large venules extend to deeper portion of LP reaching at times the variety of bone.

The main arterial supply to the inferior turbinate emerges from the bone and lies in the deepest portions of MML and the LML close side the upper half of bone which usually consist of one artery on each side. Which run along the turbinate anteriorly, becomes smaller and branch to supply the mucosa unlike the MLL and the LML, the LML lacks a major artery but has smaller tributaries that split off the medial and lateral branches.

Controversies in Management of ITH: The primary controversy in inferior turbinate surgery revolves around inferior turbinectomy and risk of atrophic rhinitis. Several large series of inferior turbinectomy have not demonstrated evidence of rhinitis sicca or atrophic rhinitis as a complication.

However, concern over this potential complication which can be devastating, remain and is used by many as an argument for a more conservative surgical approach. Continued development of new technologies, such as radiofrequency ablation, has added to the available armamentarium in addressing mucosal turbinate hypertrophy. However these techniques do not supplant surgical resection when indicated. Additionally the deviated nasal septum should be addressed surgically when indicated for nasal airway obstruction. [4-5]

In our study mean total thickness (width) of inferior turbinate in DNS with ITH group was 5.27±0.98 mm and in allergic rhinitis group was 5.05±0.60 mm. Difference in width of the turbinate in both conditions were statistically insignificant ($p < 0.05$)

In study conducted by Berger G^3 et al mean length of the turbinate in control group was 7.75±1.91mm whereas length in cases of ITH with DNS was 8.03±2.16mm. In same study the mean width of turbinate was 3.82±0.48mm and 5.16±0.82mm in control group and DNS with ITH group respectively.

In another study conducted by Berger G et al [6] histopathological aspects of hypertrophied inferior turbinate in cases of allergic rhinitis were studied. In this study mean total height of the inferior turbinate in control group was 6.95±1.64mm and mean height of inferior turbinate in allergic rhinitis group was 7.82±1.53mm. In same study the mean width of turbinate in control and allergic rhinitis group was 3.42±0.57mm and 5.19±0.60mm respectively. In above study it was shown that difference in thickness of bone when correlated to age of the patient is not significant. It was also shown that length and width of the turbinate is almost equal in anterior, middle and posterior parts.

In our study when total width of hypertrophied inferior turbinate was assessed in DNS with ITH and allergic rhinitis patients it was found to be statistically insignificant ($p>0.05$). it shows that in both conditions overall thickness is the same and pathology of nasal obstruction is the obstruction of airway is by hypertrophied inferior turbinate though the etiology of both conditions are different.

In present study mean thickness of medial mucosal layer in DNS with ITH group was 1.58±0.33mm where as its thickness in allergic rhinitis group was 2.30±0.43mm. Thickness of bony layer was 2.54±0.53mm and 1.55±0.44mm in DNS with ITH group and allergic rhinitis group respectively. Mean thickness of lateral mucosal layer was 1.16±0.38mm in DNS with ITH group and 1.19±0.22mm in allergic rhinitis group

In accordance study by Berger G et al showed mean thickness of medial mucosal layer, bony layer and lateral mucosal layer was 1.76±0.26mm, 1.03±0.54mm and 1.03±0.36mm respectively in control group and it was 1.87±0.37mm, 2.03±0.50mm and 1.26±0.38mm respectively in DNS with ITH group. This study showed that in case of hypertrophy secondary to deviated nasal septum enlargement of bony layer of the turbinate exceeds other layers and accounts for three fourths of the entire growth of the turbinate (Fig.4). Contribution of mucosal layer was insignificant according above study.

Berger G et al showed thickness of medial mucosal layer, bone layer and lateral mucosal layer was 1.39±0.28mm, 1.16±0.22mm and 0.91±0.26mm respectively in normal subjects and it was 2.53±0.56mm, 1.40±0.44mm and 1.26±0.31mm respectively in cases of allergic rhinitis. This study showed that medial mucosal layer contributes significantly to the thickness of turbinate in

cases of inferior turbinate hypertrophy secondary to allergic rhinitis. It was also shown that bony layer does not contribute significantly to hypertrophy (Fig.5).

In our study thickness of medial mucosal layer in DNS with ITH group when compared to thickness of medial mucosal layer in allergic rhinitis group shows statistically very significant difference ($p< 0.0001$) i.e. thickness in allergic rhinitis significantly more than in DNS with ITH. Which means that medial mucosal layer contributes significantly in hypertrophy of inferior turbinates in allergic rhinitis patients, whereas bone thickness when compared between DNS with ITH group and allergic rhinitis group shows significant difference ($p< 0.0001$) i.e. thickness of bony layer is significantly more in DNS with ITH group. Which means that bone is the prime contributor in case ITH secondary to deviated nasal septum.

In our study it is shown that difference in thickness of lateral mucosal layer is not statistically significant so is total width of the turbinate in DNS with ITH and allergic rhinitis.

When present study is compared to above two studies by Berger G et al it can be noted that our study includes examination of hypertrophied inferior turbinate secondary to deviated nasal septum and also due to allergic rhinitis. Controls were not included in our study as our aim is to compare significant difference in thickness each layers of hypertrophied inferior turbinate in above conditions and to qualitatively examine other pathological changes.

Results of our study are on par with the results of study by Berger G et al and show significant difference in thickness of medial mucosal layer ($p< 0.0001$) and bony layer ($p< 0.0001$) in turbinates of DNS with ITH and allergic rhinitis. The lateral mucosal layer ($p>0.05$) contribution to hypertrophy was similar in both conditions.

CONCLUSION

In this study histopathological features of the hypertrophied inferior turbinate in deviated nasal septum as well as allergic rhinitis were also studied. Results of micrometric analysis showed significant hypertrophy of bony layer of inferior turbinate in cases of compensatory hypertrophy when compared to allergic rhinitis cases. There was also significant hypertrophy of medial mucosal layer in cases of allergic rhinitis cases when compared to compensatory hypertrophy cases. With these results we conclude that bone should be the target of surgery in treatment of hypertrophied inferior turbinate secondary to deviated nasal septum where submucous resection of bone or turbinoplasty is adequate to relieve the symptoms of nasal obstruction but in some cases partial turbinectomy can also be performed where technical expertise for turbinoplasty or submucous resection are not available, where as in cases of allergic rhinitis with hypertrophied inferior turbinate where only medial mucosal layer is hypertrophied, limited resection of the mucosa either by diathermy or by other conservative methods may suffice. Total or partial removal of turbinates in these cases may not be necessary and avoidance of these radical procedures may avoid long term complications such as empty nose syndrome or atrophic rhinitis.

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