

## THE PROSPECTIVE STUDY OF SURGICAL OUTCOMES OF FESS WITH PARTIAL AND TOTAL UNCINECTOMY

K. Sowjanya Kumari<sup>1</sup>, G.S. Keerthi<sup>1</sup>, M. Meena Kumari<sup>1</sup>

<sup>1</sup>Associate Professor, Department of ENT, Osmania Medical College, Hyderabad, India

Received : 12/01/2025  
Received in revised form : 02/03/2025  
Accepted : 17/03/2025

**Keywords:**

Chronic sinusitis, Functional endoscopic sinus surgery (FESS), Uncinectomy, Partial uninectomy (PU), Total uninectomy (TU).

**Corresponding Author:**

**Dr. G.S. Keerthi,**  
Email: keerthy3531@gmail.com

DOI: 10.47009/jamp.2025.7.2.32

Source of Support: Nil,  
Conflict of Interest: None declared

*Int J Acad Med Pharm*  
2025; 7 (2); 151-156



### Abstract

**Background:** It is a prospective comparative study to evaluate if partial uninectomy is as effective as total removal of uncinat process in patients with chronic rhinosinusitis. **Materials and Methods:** The patients attending as outpatients in Govt. E.N.T. Hospital, Koti Hyderabad, for 2 years were taken up for study. All cases of chronic sinusitis were admitted and detailed study was carried out. Chronic rhinosinusitis patients were studied in detail and data of 60, patients collected was analysed with respect to: The age of the patient Sex distribution, Symptomatology and clinical features. Response to treatment and follow up Relevant routine haematological, biochemical and radiological Investigations including CT scan were done In all patients to supplement physical examination. Patients Preparation before CT scan: A Course of antibiotics, nasal decongestants and antihistaminic given for a period of 4 weeks. **Result:** It was observed that in group 1 (PU) maximum patients are in their 2nd decade with 46.66%. In group 2 (TU) maximum patients are in their 3rd decade with 46.6%. In group 1 (PU) male to female ratio is 2:1 in group 2(TU) male to female ratio is 1:1.4. In group1 (PU) 80% had Nasal obstruction, 86.66% had Nasal discharge. In group 2 (TU) 86.66% had Nasal obstruction, 93.33% had Nasal discharge. Operative time for partial uninectomy was around 3-5 minutes whereas for complete uninectomy was around 5-7 minutes. In Partial Uncinectomy group healing time was around 1.5 to 2 weeks whereas in total Uncinectomy group healing time was 2.5 to 3 weeks. Synechia was the only complication that was seen post operatively in 13.33% of cases in Group 1(PU) whereas 20% in group 2(TU). Improvement of symptoms is seen in both the groups. In Group 1(PU) persistence of post-operative Nasal obstruction and Nasal discharge is seen in 6% each, persistence of headache in 13.33% and postnasal discharge in 13.33%.  $t=4.804$  and  $p$  value is 0.0168. Statistically significant paired  $t$  test. In Group 2(TU) persistence of post-operative Nasal obstruction in 20% of cases Nasal discharge in 13.33% cases. Persistence of headache in 6% of cases and postnasal discharge in 13.33%.  $t=5.4678$  and  $p$  value is 0.0120. Statistically significant paired  $t$  test. **Conclusion:** Computed Tomography of the para nasal sinuses has improved the visualization of para nasal sinus anatomy and has allowed greater accuracy in evaluating para nasal sinus disease. It evaluates the osteomeatal complex anatomy which is not possible to such an extent with plain radiographs. Diagnostic nasal endoscopy also helps in better visualization of the middle meatus area and any discharge from the ostium. The surgical technique of partial uninectomy is not widely used. However, the method can be useful in patients with pathological conditions within the maxillary sinus. In short, partial uninectomy had shorter operative time, more rapid healing, and lower possibility of complications when compared to total uninectomy. Both are effective in resolving symptoms with slight better effectiveness in this regard for complete uninectomy.

## INTRODUCTION

Chronic sinusitis is one of the most common chronic diseases affecting different age groups. Interestingly, it had been reported that. People affected have lower

life quality when compared to the people affected by congestive heart failure, chronic obstructive pulmonary disease and chronic low back pain.<sup>[1]</sup>  
Definition: American Academy of Otorhinolaryngology Head and Neck surgery

formulated certain working definitions. Clinically, sinusitis is defined as the condition manifested by an inflammatory response of the mucous membrane of the nasal cavity and paranasal sinuses, fluid within the cavity, and / or underlying bone. Also defined as a group of disorders characterised by inflammation of the mucosa of the nose and paranasal sinuses lasting for at least 12 weeks.<sup>[2]</sup> At present diagnostic nasal endoscopic evaluation of nose and para nasal sinuses is a routine component for evaluating patients with evidence of suspected nose and para nasal sinus disease. Arrival of endoscopes has helped us in many ways to recognize the lesion or changes that are hidden from the naked eye or even from inspection under microscopes. With this, provisional diagnosis may be confirmed, expanded or revised. Also it helps the otorhinolaryngologist in deciding the mode of treatment All the patients who have significant findings in diagnostic nasal endoscopy are subjected to CT scan para nasal sinus evaluation. The initial treatment of chronic sinusitis is usually medical and those unresponsive to medical therapy are treated surgically.<sup>[3]</sup> In the last years, with improved imaging and surgical techniques in chronic rhinosinusitis, in patients who are unresponsive to medical treatment, functional endoscopic sinus surgery (FESS) has been performed. With this surgical treatment 75-90% success rates have been reported.<sup>[4,5]</sup>

Uncinectomy is the first step in functional endoscopic sinus surgery.<sup>[6,7]</sup> The uncinata is a curved bone with length between 19 and 32mm. Anteriorly, it is continuous with the ethmoid bone and superiorly may attach to the lamina papyracea, skull base or middle turbinate. Postero-inferiorly, it articulates with the medial wall of Maxillary Antrum via its maxillary process and with the ethmoid process of the inferior turbinate bone. The gap between the upper end of the uncinata and bulla ethmoidalis is the hiatus semilunaris. Uncinectomy and a middle meatal antrostomy are usually performed to eradicate the pathological condition in the affected maxillary sinus. Total uncinectomy is usually performed. However, it may not be necessary to perform total uncinectomy, as it may delay healing, cause injury to the lamina papyracea or nasolacrimal duct, or risk [iatrogenic stenosis of the frontal recess].<sup>[8]</sup>

With the advancement of high-resolution Computed Tomography [CT], it is possible to show how close the surgeon can get to the orbital wall when addressing the uncinata process. The Lamina papyracea, which separates the orbital cavity from the nasal cavity, can itself be very thin and in some occasions, touching the uncinata process. Entering the orbital cavity can cause damage to its vital contents including the medial rectus, the optic nerve and the eye itself causing blindness which is an extremely rare, but documented complication of endoscopic sinus surgery [ESS].<sup>[9]</sup> It is hypothesized that, the removal of the lower half of the uncinata may be sufficient to improve the entire maxillary sinus. In addition, partial uncinectomy is stated to be easier to perform and the associated mucosal injury

is less severe. However, it is not practiced on a wide scale, as it is not sufficiently studied."

**Epidemiology:** Chronic sinusitis is a common disease worldwide, particularly in places with high levels of atmospheric pollution. In the Northern Hemisphere, damp temperate climates along with higher concentrations of pollens are associated with a higher prevalence of chronic sinusitis. Rhinosinusitis is more common in the paediatric population because this term includes both acute and chronic infection and both viral and bacterial disease. This is likely secondary to an increased frequency of exposure to upper respiratory tract infections in the paediatric population.

(1) Study of Clinical Material A) Clinical Study in the patients-60 cases of chronic sinusitis patients admitted and treated at Govt. ENT Hospital, Hyderabad. The patient's history of illness recorded and thorough clinical examination was made. After making clinical diagnosis, the following investigations were carried out. 1 Complete blood picture Urine examination. Anterior rhinoscopy 4 Blood urea 5 Random blood sugar Electro Cardiogram Diagnostic nasal endoscopy 8 Viral screening 9. Computerised tomography axial and coronal sections of paranasal sinuses.

Having confirmed the diagnosis and after adequate preoperative preparations the patients were operated with total uncinectomy and without total uncinectomy. The post-operative course of the patient was studied and they were followed for 6 months-1 year after discharge.

(2) Results Personal study and discussion Statistical records of all cases of chronic sinusitis admitted and treated at Govt. E.N.T. hospital, Hyderabad were studied. Finally, the findings of this study of 60 cases have been discussed.

## MATERIALS AND METHODS

The patients attending as outpatients in Govt. E.N.T. Hospital, Koti Hyderabad, for 2 years were taken up for study. All cases of chronic sinusitis were admitted and detailed study was carried out. Chronic rhinosinusitis patients were studied in detail and data of 60 patients collected was analysed with respect to

- The age of the patient
- Sex Distribution
- Symptomatology and clinical features
- Response to treatment and follow up

Relevant routine haematological, biochemical and radiological Investigations including CT scan were done in all patients to supplement physical examination. Patients Preparation before CT scan: A Course of antibiotics, nasal decongestants and antihistaminic given for a period of 4 weeks.

### Inclusion criteria

1. Patients with mucopurulent, purulent or Watery rhinorrhoea
2. Patients with unilateral. partial or total nasal obstruction

3. Anterior rhinoscopy and nasal endoscopic examination showing pus in the middle meatus

#### Exclusion criteria

1. Acute sinusitis
2. Oral corticosteroid treatment during the last two months prior to surgery
3. Previous sinus surgery
4. Benign or malignant tumour
5. Immune deficiency or immunosuppressed status

## RESULTS

The results are mentioned as follows:

The demographic profile shows the most common age group in Partial uncinectomy cases is 20-30 years and in total uncinectomy Cases is 30-40 years. In group 1, males were 20 and females were 10. In group 2 males were 16 and females are 14. In the present study, age ranged from 20-50 years. Males represented 60% of all studied cases and females represented 40% with male: female ratio of 3:2. Presenting symptoms were in the form of post nasal discharge in 14 cases (46.66%), headache in 16 cases (53.33%), anterior nasal discharge in 26 cases (86.66%) and nasal obstruction in 24 cases (80%) of patients in group 1 and post nasal discharge in 18 cases (60%), headache in 12 cases (40%), anterior nasal discharge in 28 cases (93.33%) and nasal obstruction in 26 cases (86.66%) of patients in group 2. There was no statistically significant difference between first and second group with regard to age, sex, and presenting symptoms.

As regard to surgical indications, it is chronic sinusitis limited to maxillary sinus in all cases. Operative time ranged from 3-5 minutes in group 1 and 5-7min in group 2 and there was significant shortening of operative time in Partial uncinectomy group when compared to total uncinectomy group. Healing time was ranged from 1.5 - 2 weeks in group 1 and 2.5 – 3 Weeks in group 2 with total of 1-3 weeks and there is no Significant difference between group 1 and group 2. Complications were in the form of middle meatus synechiae in 4 cases, 13.33% of all cases in group 1 and 6 cases (20%) of cases in group 2 Orbital injury and nasolacrimal duct injury was seen in both the groups. There is no significant difference between both groups as regard to any of studied complications. Postoperatively, post nasal discharge was noted in 4 cases (13.33%) of cases, headache in 4 cases (13.33%), anterior nasal discharge in 2 cases (6%) and nasal obstruction in 2 cases (6%) in group 1. Post nasal discharge in 4 cases (13.33%), headache in 2 cases (6%), anterior nasal discharge in 4 cases (13.33%) and nasal obstruction in 5 cases (20%) in group 2. There is no significant difference between both the groups. When compared to both groups with regard to effectiveness in relieving symptoms, both groups were effective nearly to the same extent, as the difference was statistically significant in both the groups. However, group 2 showed better effectiveness in relieving headache, anterior nasal discharge and nasal obstruction while partial uncinectomy group had better effect on post nasal discharge.

**Table 1**

S. No	Age Group	Group 1 (PU)	Group 2 (TU)
1	21-30	14(46.66%)	10(33.33%)
2	31-40	8(26.66%)	14(46.66%)
3	41-50	8(26.66%)	6(20%)

In group 1 (PU) maximum patients are in their 2nd decade with 46.66%, 3rd and 4th decade 26.66 each. In group 2 (TU) maximum patients are in their 3rd decade with 46.6%, 2nd decade 33.33% and 5th decade with 20%.

**Table 2**

S. No	Gender	Group 1 (PU)	Group 2 (TU)
1	Male	20(66.66%)	16(53.33%)
2	Female	10(33.33%)	14(46.66%)

In group 1 (PU) male to female ratio is 2:1 in group 2(TU) male to female ratio is 1:1.4

**Table 3: ?**

S. No	Presenting Complaint	Group 1 (PU)	Group 2 (TU)
1	Nasal obstruction	24(80%)	26(86.66%)
2	Nasal discharge	26(86.66%)	28(93.33%)
3	Headache	16(53.33%)	12(40%)
4	Post nasal discharge	14(46.66%)	18(60%)

In group1 (PU) 80% had Nasal obstruction, 86.66% had Nasal discharge, 53.33% had headache and 46.66% had postnasal discharge where as in group 2 (TU) 86.66% had Nasal obstruction, 93.33% had

Nasal discharge, 40% had headache and 60% had postnasal discharge as presenting complaints. T test value is 0.2166 and p value is 0.8394. Statistically not significant.

**Table 4: Operative Time.**

S. No	Group 1 (PU)	Group 2 (TU)
1	3-5 min	5-7 min

Operative time for partial uncinectomy was around 3-5 minutes whereas for complete uncinectomy was around 5-7 minutes.

**Table 5: Healing Time.**

S. No	Group 1 (PU)	Group 2 (TU)
1	1.5-2 Weeks	2.5-3 Weeks

In Partial Uncinectomy group healing time was around 1.5 to 2 weeks whereas in total Uncinectomy group healing time was 2.5 to 3 weeks.

**Table 6**

S. No	Complications	Group 1 (PU)	Group 2 (TU)
1	Orbital injury	0	0
2	NLD injury	0	0
3	Synechia	4(13.33%)	6(20%)

Synechia was the only complication that was seen post operatively in 13.33% of cases in Group 1(PU) whereas 20% in group 2(TU). Improvement of symptoms is seen in both the groups.

**Table 7: Group 1(PU).**

S. No	Symptoms	Pre-operative	Post-operative
1	Nasal Obstruction	24(80%)	2(6%)
2	Nasal discharge	26(86.66%)	2(6%)
3	Headache	16(53.33%)	4(13.33%)
4	Postnasal discharge	14(46.66%)	4(13.33%)

In Group 1(PU) persistence of post-operative Nasal obstruction and Nasal discharge is seen in 6% each, persistence of headache in 13.33% and postnasal discharge in 13.33%.  $t=4.804$  and  $p$  value is 0.0168. Statistically significant paired  $t$  test.

**Table 8: Pus Group 2(TU)**

S. No	Symptoms	Pre-operative	Post-operative
1	Nasal Obstruction	26(86.66%)	6(20%)
2	Nasal discharge	28(93.33%)	4(13.33%)
3	Headache	12(40%)	2(6%)
4	Postnasal discharge	18(60%)	4(13.33%)

In Group 2(TU) persistence of post-operative Nasal obstruction in 20% of cases Nasal discharge in 13.33% cases.

Persistence of headache in 6% of cases and postnasal discharge in 13.33%.  $t=5.4678$  and  $p$  value is 0.0120. Statistically significant paired  $t$  test.

## DISCUSSION

Clinically sinusitis is defined as the condition manifested by an inflammatory response of the following: the MUCOUS Membrane of the nasal cavity and para nasal sinuses, fluid within the cavity, and / or underlying bone. Also defined as a group of disorders characterized by inflammation of the mucosa of the nose and Para nasal sinuses lasting for at least 12 weeks.

Criteria for Chronic Rhinosinusitis: (sinus and allergy health partnership in January 2002)

1. Continuous symptoms that persist for 12 consecutive weeks or longer and physical findings of chronic sinusitis on examination or radiographic sinus imaging.
2. One of these signs of inflammation must be present and identified in association with on-

going symptoms consistent with chronic Sinusitis,

- Discoloured nasal drainage arising from the nasal passage, nasal Polyp or polypoidal swelling on physical examination.
- Edema / Erythema of Middle Meatus of ethmoid bulla as identified on endoscopy. Generalized or localized erythema or edema or Granulation tissue, if the middle meatus or bulla ethmoidalis are not involved

Radiological imaging is required to confirm the diagnosis.

- Imaging modalities for Confirming the diagnosis,
- CT scan demonstrating isolated or diffuse Mucosal thickening, bone changes, air fluid level Plain sinus radiograph (waters view) revealing mucous membrane thickening of 5 mm or greater or complete Opacification of one or more sinuses.
- MRI Scan is not recommended as an alternative to CT scan for routine diagnosis of chronic sinusitis because of its excessive high sensitivity and lack of specificity.

Factors associated with diagnosis of Chronic Rhinosinusitis:

**Major:**

1. Facial pain / pressure
2. Nasal obstruction / blockage
3. Nasal discharge / purulence
4. Discoloured post nasal discharge
5. Hyposmia / anosmia
6. Purulence in nasal cavity on examination

**Minor:**

Headache

2. Fever
3. Halitosis
4. Fatigue
5. Dental pain
6. Cough
7. Ear pain / pressure / fullness.

The factors responsible for sinusitis are,

- Ostial patency
- Ciliary activity
- Quality of mucous.

About 2 litres of mucous secreted every day in paranasal sinuses. Its physical property (viscosity) is more important than its biochemical constituents. Normal mucous is 98% water and rest is composed of Ig A, lysozymes, mast cells, polymorphs, eosinophils, albumin and globulin.

Ciliary activity is highly directional and independent of the body position. It moves the mucous at the rate of 1 cm / minute. In the maxillary sinus mucociliary movement originates from the floor of the sinus and radiates along the walls of the sinus superiorly to reach the ostium. This upward movement is maintained even in the presence of the more inferior surgical Naso antral window. The mucous blanket normally contains mast cells, polymorphs, eosinophils, lysozyme, and immunoglobulin A. The upper layer (gel layer) is highly viscous, which enables the cilia to move the blanket forward. The system captures 80 % of the inspired particles larger than 3-5 microns and 60% of those larger than 2 microns and exposes them to mast cells, polymorphs, etc. while sweeping them into the pharynx to be swallowed. In the frontal sinus ciliary clearance proceeds along the septa! wall to the roof and medially along the floor to reach the ostium. There is also some recirculation in the frontal recess. Ciliary activity in sphenoid and ethmoid air cells is towards their respective ostium Quinlan (1969), Puchelle (1981) and Sakakura (1985) described the relation between sinonasal dysfunction and impaired mucociliary clearance. Anatomical variations can compromise the ostia and drainage channels of the paranasal sinuses. When there is superadded inflammation, it leads to mucosal swelling and apposition, which causes ostial occlusion. This impairs the ventilation and drainage of the sinus leading to decreased pO<sub>2</sub>, increased pCO<sub>2</sub>, increased pH and retained secretions. This environment decreases ciliary motility and bacterial overgrowth resulting in viscid secretions, bacterial exotoxins are also released, further decreasing the ciliary activity

resulting in a vicious cycle, which ends in sinusitis. Hence comes the basic concept of preserving normal ventilation and drainage of sinuses, to assist the diseased mucosa to recover and regenerate.

**Nasal Cycle:** Thickening and congestion of the nasal mucosa is a cyclical phenomenon occurring normally. Cycle may repeat in every 50 minutes-6-hour period. It is controlled by the suprachiasmatic nucleus in the hypothalamus and this control decreases with age. Thickening is seen along the nasal septum, turbinate, and ethmoid sinuses, sparing the maxillary, frontal and sphenoid sinuses. Hence during interpretation of CT scan, unilateral thickening up to 3mm in those areas should be considered as physiological and not misinterpreted as pathological thickening. According to Mackay and Lund, the osteomeatal complex acts as a drainage pathway for maxillary, anterior ethmoids and frontal sinuses. Posterior osteomeatal unit was considered as part of the sphenoid sinus. In several areas of the osteomeatal complex overcrowding due to anatomical variation, two mucosal layers contact each other, thus increasing the likelihood of local impairment of mucociliary clearance. Secretions may then be retained at the site, creating the potential for infection even without ostial closure. Anatomically, the most likely areas of mucosal contact are in the narrow mucosa lined channels of the middle meatus and the ethmoidal infundibulum.<sup>[10]</sup> Chronic rhinosinusitis is defined as an inflammation of the nose and paranasal sinuses lasting more than 12 weeks. Diagnosis was done by typical symptoms and/or computed tomography [CT] scan and/or endoscopic changes<sup>10</sup>. When conservative treatment failed, endoscopic sinus surgery [ESS] aims to restore mucociliary clearance and ventilation through the natural ostia. Endoscopic sinus surgery is based on the theory that the maxillary sinus ostium is the most important area in the pathogenesis of chronic and recurrent rhinosinusitis. Obstruction of the ostium is believed to lead to chronic inflammation and eventually to pathologic alterations of the maxillary sinus mucosa. Therefore, surgical opening of the ostium and thus improved drainage and ventilation of the sinus might restore the normal mucosa. There are different opinions concerning the extent of surgery of the ostiomeatal complex. It is considered that removal of the uncinat process alone would be enough to restore the ventilation of the maxillary sinus. In addition, partial uncinectomy was hypothesized to provide the same results as the total uncinectomy without the complications associated with total uncinectomy.<sup>[11]</sup> The present study was designed to evaluate if partial uncinectomy is effective as much as total removal of the uncinat process in patients with localized maxillary sinus disease. Results of the present study revealed that, both partial and total uncinectomy were comparable as both safety and effectiveness. However, partial uncinectomy had significantly shorter operative time. In addition, partial uncinectomy had lesser complications when compared to total uncinectomy.

However, the difference was statistically non-significant. Also, partial uncinectomy was more effective in relieving anterior nasal discharge, nasal obstruction while total uncinectomy was more effective in relieving headache, anterior nasal discharge and nasal obstruction. The difference was statistically significant in both the groups. Injury to the lamina papyracea occurred in one patient who underwent total uncinectomy, but it was minimal and there were no sequelae. Partial uncinectomy removes only a small portion of the uncinete process and has a lower probability of lamina injury than a total uncinectomy. In addition, partial uncinectomy may be helpful to reduce the incidence of synechia between the lateral nasal wall and the middle turbinate. Six patients in group 2 showed partial synechia formations. Although the synechiae were divided in the office, such a procedure may cause discomfort, inconvenience, and additional medical cost to the patients. In the present study, nasolacrimal duct obstruction was not reported in both the groups. These results are comparable to those reported by Friedman et al. [2000],<sup>[12]</sup> who reported that, Nasolacrimal duct obstruction or stenosis of the frontal recess is theoretically possible, but it is also an uncommon side effect. In addition, complications reported in the present study were comparable to those reported by Kamel [1989],<sup>[13]</sup> who reported that, the operative and post-operative complications of the 94 operations performed included injury to the lamina papyracea [one case], subcutaneous emphysema [one case], subcutaneous infection after trans canine fossa sinuscopy [one case], empyema of the maxillary sinus [four cases] and post-operative adhesions [three cases]. All these problems were faced in the early cases and dealt without any long-lasting effects. These data are comparable to surgical indications in the present study which is only chronic sinusitis.

## CONCLUSION

Computed Tomography of the para nasal sinuses has improved the visualization of para nasal sinus anatomy and has allowed greater accuracy in evaluating para nasal sinus disease. It evaluates the osteomeatal complex anatomy which is not possible to such an extent with plain radiographs. Diagnostic nasal endoscopy also helps in better visualization of the middle meatus area and any discharge from the ostium.

The surgical technique of partial uncinectomy is not widely used. However, the method can be useful in patients with pathological conditions within the maxillary sinus.

In short, partial uncinectomy had shorter operative time, more rapid healing, and lower possibility of complications when compared to total uncinectomy. Both are effective in resolving symptoms with slight better effectiveness in this regard for complete uncinectomy.

## REFERENCES

1. Benninger MS, Ferguson BJ, Hadley JA, Hamilos DL, Jacobs M, Kennedy DW, et al. Adult chronic rhinosinusitis: definitions, diagnosis, epidemiology, and pathophysiology. *Otolaryngol Head Neck Surg* 2003; 129: S1-32.
2. *Otolaryngologic Clinics of North America: chronic sinusitis*; vol.38December 2005 issue, page no.: 1144-1145
3. Caminha GP, Melo Junior JT, Hopkins C, Pizzichini E, Pizzichini M. SNOT- 22: psychometric properties and cross-cultural adaptation into the portugues language spoken in Brazil. *Braz J Otorhinolaryngology* 2012; 78:34-9.
4. Jakobsen J, Svendstrup F. Functional endoscopic sinus surgery in chronic sinusitis a series of 237 consecutively operated patients. *Acta Otolaryngology Suppl* 2000; 543:158-161
5. Kutluhan A, Salviz M, Bozdemir K, Kanbak O, Ulu M. The effects of uncinectomy and natural ostial dilatation on maxillary sinus ventilation: a clinical experimental study. *Eur Arch Otorhinolaryngology* 2011; 268:569-573
6. Senior BA, Kennedy DW, Tanabodee J, Kroger H, Hassab M, Lanza D. Long-term results of functional endoscopic sinus surgery. *Laryngoscope* 1998; 108[2]: 151-7.
7. Moses RL, Cornetta A, Atkins JP Jr, Roth M, Rosen MR, Keane WM. Revision endoscopic sinus surgery: The Thomas Jefferson University experience. *Ear Nose Throat J* 1998; 77[3]: 190-202
8. Cohen NA, Antunes MB, Morgenstern KE. Prevention and management of lacrimal duct injury. *Otolaryngol Clin North Am* 2010; 43:781-8.
9. Hopkins C, Slack R, Lund V, Brown P, Copley L, Browne J. Long-term outcomes from the English national comparative audit of surgery for nasal polyposis and chronic rhinosinusitis. *Laryngoscope* 2009; 119[12]:2459-65.
10. Hastan D, Fokkens WJ, Bachert C et al. chronic rhinosinusitis in Europe-an underestimated disease. A GA 2LEN study. *Allergy* 2011; 66(9): 1216-1223.
11. Catalano PJ. Minimally invasive sinus technique: What is it? Should we consider it?" *Current Opinion in Otolaryngology and Head and Neck Surgery* 2004; 12 [1]:34-37.
12. Friedman M, Landsberg R, Schults RA, et al. Frontal sinus surgery: endoscopic technique and preliminary results. *Am J Rhinol* 2000; 14:393-403.
13. Kamel RH. Endoscopic trans nasal surgery in chronic maxillary sinusitis. *The Journal of Laryngology and Otology* 1989; 103: 492-501.