Original Article

Helical CT evaluation of sinonasal inflammations in the era of FESS

Varsha Rathi[*], Sharad Ghatge[**], Kalyani Patankar[***], Sachin Tadas[****], Shivraj Ingole[**]

[*]Professor, [**]Associate Professor, Department of Radiology Grant Medical College and Sir JJ Group of Hospitals, Mumbai, INDIA.
[***]Junior Resident, [****]Senior Resident, Department of Radiology, IGGMC, Nagpur, Maharashtra, INDIA.
Email: drsharadghatge@gmail.com

Abstract

Aims and Objectives: We conducted retrospective analysis of our patients for the evaluation of Helical CT scan of Sinonasal region and is application in Functional endoscopic sinus surgery. **Materials and Methods:** Total 100 patients with recurrent sinusitis were evaluated over a period of two years with detailed information of the variations in bony framework of the sinuses as well as the spectrum and extend of the inflammatory disease. Coronal cuts in prone position were taken in bony algorithms and 3 D reconstructions were done. **Result:** There were 68 Males and 32 females with age ranging from 11yrs to above 50 yrs. The age group of 2nd to 3rd decade were more commonly affected. Left side and maxillary sinus were more frequently involved. Various anatomical variation were encountered in the study cases and about 90% of these cases were associated with inflammatory disease. Local complications included polyp, Mucocele and regional complications included intraorbitalextension, bony involvement and even intracranial extension. Out of the studied patients based on the CT Imaging findings, 44 were subjected to FESS, 23 were operated upon,11 underwent diagnostic endoscopy and the rest followed up with medical line of management. The majority of findings of endoscopy correlated with those reported by us on Helical CT. **Conclusion:** We concluded that helical CT is presently indispensable as an imaging modality for diagnosis and preoperative assessment of sinonasal inflammations in the era of FESS
Keywords: Helical CT, FESS.

[*]**Address for Correspondence:**
Dr. Varsha Rathi, Professor, Department of Radiology Grant Medical College and Sir JJ Group of Hospitals, Mumbai, INDIA.
Email: drsharadghatge@gmail.com
Received Date: 13/05/2016 Revised Date: 08/06/2016 Accepted Date: 02/07/2016

Access this article online	
Quick Response Code:	Website: www.statperson.com
	DOI: 04 July 2016

INTRODUCTION

Functional endoscopic sinus surgery (FESS) is the popular therapeutic modality for sinonasalin flammations. Cross sectional imaging with helical CT provides a guiding map for the procedure increasing its success rate and reducing complications. The study was aimed at assessing the role of Helical CT in evaluating sinonasal inflammations and its importance for preoperative workup prior to endoscopic surgery. There is a complete change in the scenerio of management of sinonasal inflammations with Functional endoscopic sinus surgery (FESS) becoming a popular modality[1]. Coronal helical CT imaging simulates the endoscopist's view of the sinonasal cavity and provides a road map of its bony framework for surgery. FESS technique is based on the hypothesis that osteomeatal complex[2,3] is a key area in the pathogenesis of chronic sinus disease. Conventional radiology does not permit a detailed study of nasal cavity and paranasal sinuses and has now been replaced bycrosssectional imaging of Computed tomography[4,5]. The anatomical variations in the bony framework can complicate[6,7] the endoscopic procedure with medicolegal impact. CT imaging[7,8,9] accurately displays the bony architecture of PNS along with its mucosal coverings with excellent depiction of the osteomeatal complex as well as its boundries with orbits and the intracranial compartment. This information will lead to more focussed[10] endoscopic surgical proceedures with reduced patient morbidity.

MATERIALS AND METHODS

This was a Retrospective study wherein 100 patients of recurrent rhinosinusites referred from Dept of E.N.T of

How to site this article: Varsha Rathi, Sharad Ghatge, Kalyani Patankar, Sachin Tadas, Shivraj Ingole. Helical CT evaluation of sinonasal inflammations in the era of FESS. *International Journal of Recent Trends in Science and Technology*. July 2016; 19(3): 365-372. http://www.statperson.com (accessed 06 July 2016).

our institute were evaluated done over a period of two years

Sample size: 100 pts with recurrent sinusitis.

Study period: Jan 2006 to Dec 2007

Study setting: Department of Radiology, IGGMC, Nagpur.

Equipments

- Siemens Emotion Duospiral CT scanner
- Karl Storz endoscopes with 0^0 and 30^0 angulations.

Exclusion Criteria

1. Pts with nose/PNS tumors
2. Previous nose/PNS surgery
3. Injury
4. Paediatric patients

Methodology:

- **Premedication**:
- Nasal decongestants like Xylometazolin or oxymetazolin (0.05%);2-3 drops bilaterally, few minutes prior to the study.
- Pseudoephedrine 30mg orally, 6hrs prior to study.
- With prior valid consent and filling the requisition form, the procedure was explained to the patients.

CT Protocol:

- Coronal plane-simulates endoscopistsview(11). Hence after obtaining scout projection continuous coronal cuts were taken with the patient in prone position with gantry angulation perpendicular to infra orbitomeatal line
- Position: Prone - extended neck and plane perpendicular to hard palate.
- Sections - 3x2.5mm from anterior wall of frontal sinus up to posterior wall of sphenoid sinus.
- Single set of images in bony algorithms.
- kVp-130
- mAs -200
- Scan time 5sec
- Images were reconstructed in VRT,MPR,MIP

The images were interpreted in detail with special emphasis on anatomical variations and extend of mucosal disease. The left and right sides of each frontal, ethmoid, sphenoid and maxillary sinuses were assessed separately.

RESULTS

Table 1: Age Distribution InSinonasal Inflammatory Lesions

Age (Years)	Male	Female	% (Total)
11 – 20	13	4	17
21 – 30	25	9	34
31 – 40	13	7	21
41-50	6	4	10
Above 51 Years	11	8	19
Total	**68**	**32**	**100**

Table 2: Sidewise Incidence of Inflammatory Conditions

Sinus Involved	Right	Left	Bilateral
Frontal	9	11	21
Anterior Ethmoid	11	15	28
Posterior Ethmoid	9	12	28
Maxillary	16	20	44
Sphenoid	3	3	22

Table 3: Spectrum of Sinonasal Inflammation

Etiology	Unilateral	Bilateral	Total	% Of Total
Chronic Sinusitis	Infundibular type	46	18	64
	Osteomeatal thickening	31	15	46
Pansinusitis	20	7	27	27
Air fluid level	10	5	15	15
Polyposis	24	23	47	47
Mucocele	4	3	7	7
Bony involvement	4	2	6	6

Table 4: Incidence Of Anatomical Variants

Anatomical Variants	Unilateral	Bilateral	Total	%
DNS	45	29	74	74
Aggernasi	37	14	51	51
Concha bullosa	16	9	25	25
Haller cell	8	6	14	14
Onodi cell	8	4	12	12
Sup.turb.pneumatn.	2	2	4	4
Ant.clen. pro.pneu	4	1	5	5
Par.mid.turbinate	2	4	6	6
Acc.max.ostium	3	2	5	5
Overpneumati.Ethmoid bulla	2	2	4	4
Aplasia a. Frontal	3	0	3	3
b. Maxillary	0	0	0	0
c. Sphenoid	1	0	1	1
Hypoplasia a. Frontal	1	0	1	1
b. Maxillary	1	0	1	1
c. Sphenoid	2	0	2	2

Table 6: Relationship of Anatomical variants with inflammation

Anatomical variants	Total Occurrence	No. of cases of inflammation	%
D.N.S.	74	69	93
Aggernasi cell	51	42	82
Concha bullosa	25	15	60
Haller cell	14	3	21
Onodi cell	12	4	33
Pneum. Sup. turbinate	4	1	25
Ant. Clen. pro. pneumatization	5	1	20
Para. middle turbinate	6	2	33
Acc. maxillary ostium	5	1	20
Overpneumatized Ethmoid Bulla	4	1	25
Sinus Aplasia	4	1	25
Sinus Hypoplasia	4	1	25

Table 7: Incidence of Complications

Complication	Males	Females	%
Polyp	24	23	47
Mucocele	8	5	13
Intraorbital extension	3	1	4
Abscess with bony invovement	1	1	2
Intracerebral extension	1	0	1

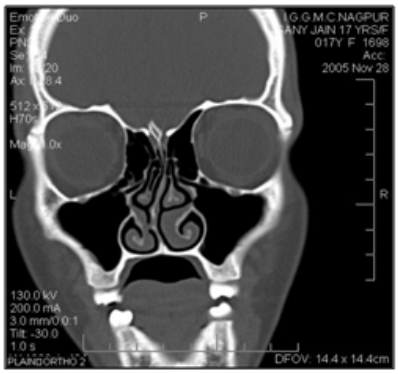

Figure 1

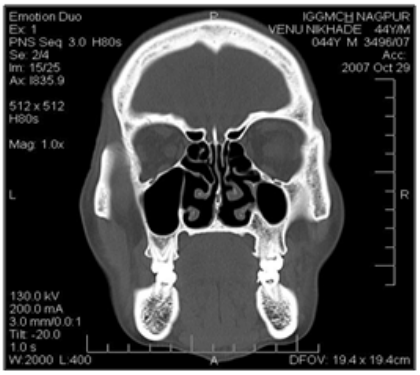

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

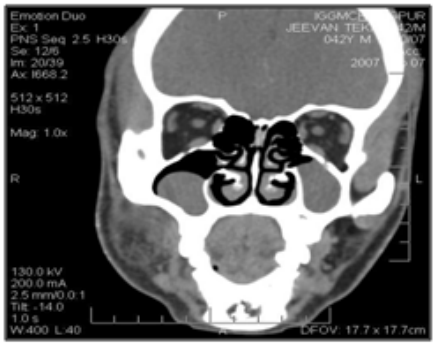

Figure 8

Association of anatomical variants with sinusites

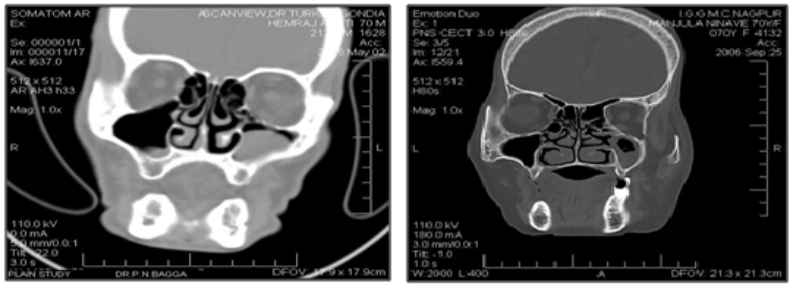

Figure 9

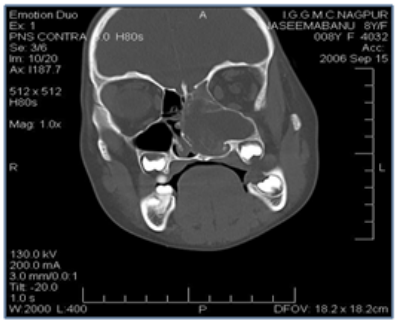

Figure 10

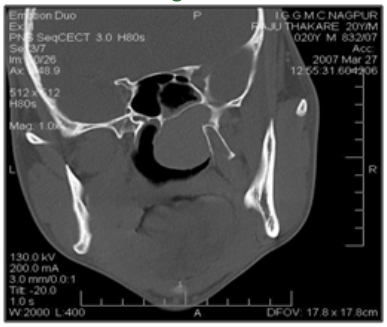

Figure 11

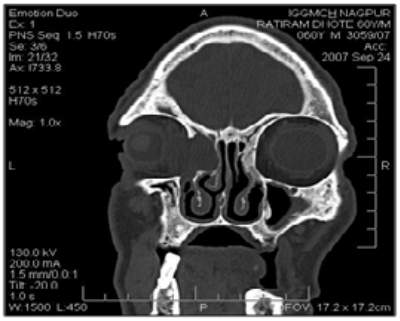

Figure 12

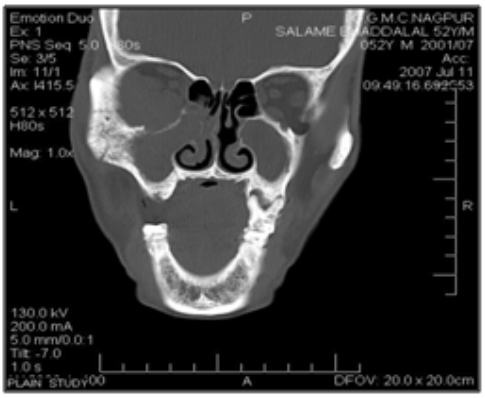

Figure 13

Figure 14

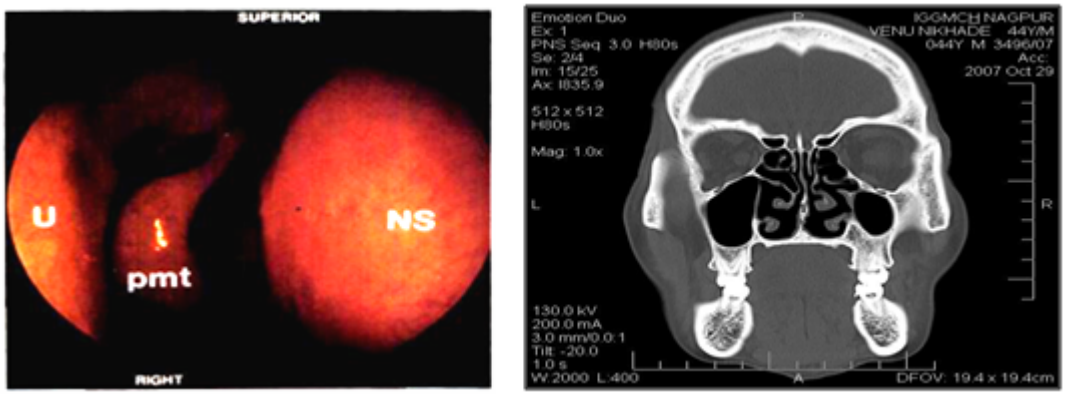

Figure 15

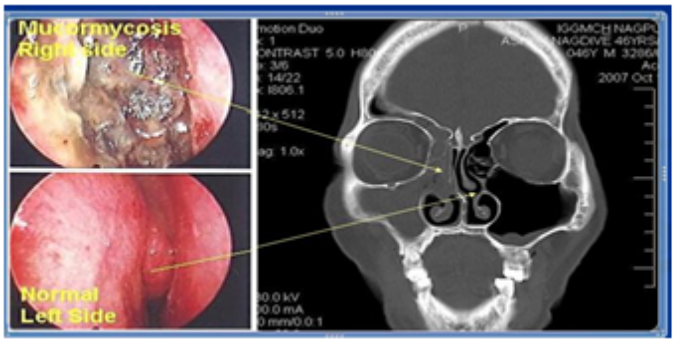

Figure 16

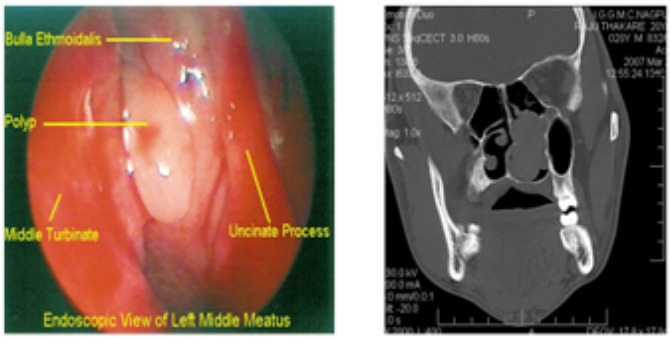

Figure 17

Legend

Figure 1: Concho bullosa with DNS to Left
Figure 2: Right paradoxical middle turbinate
Figure 3: Aggernasi air cells
Figure 4: Haller cells
Figure 5: Onodi air cells
Figure 6: Acute sinusites
Figure 7: Chronic sinusitesPansinusites
Figure 8: Allergic sinusites Fungal Sinusites Atrophic Sinusites
Figure 9: Local and Regional complication of sinonasal inflammations
Figure 10: Antrocoanal polyp
Figure 11: Sphenochonal polyp
Figue 12: Left Mucocele
Figure 13: Intraorbital extension with bony destruction
Figure 14: Bony destruction with infra temporal extension
Figure 15: Corelation of Helical CT images on FESS

DISCUSSION

Helical CT scan with multiformat reformations has revolutionised the imaging of nasal and paranasal sinus and provided the road map for functional endoscopic sinus surgery. In most cases, the endoscopic surgery aims at removing the obstruction of main drainage pathways-the osteomeatal complex based essentially on the concept that such obstruction perpetuates the sinus disease[12,13,14] The present prospective study was carried out in the Department of Radiodiagnosis, IGGMC, Nagpur from August 2005 to November 2007with the objective of assessing the role of Helical CT in evaluating sinonasal inflammations in corelation with FESS. Helical CT of nasal vault and paranasal sinuses was done in 100 patients with presenting with recurrent sinusites in prone position. Pretreatment of patients with appropriate medical therapy and adequate preparation of patients enable the best CT assessment of mucosal disease of nasal and paranasal sinuses. Coronal cuts in bony algorithms with patient in prone position is ideal. The soft tissue window allows better evaluation of inspissated secretion, as well as of the soft tissues of orbit, face and brain. The procedure was well tolerated by the patients and was easy to perform. The age distribution of the patients in our study ranged from 11 to 75 years.The commonest age group was second to third decade. Males were found to be more affected with sinonasalinflammations. Left side was more commonly affected than right. The maxillary sinus was most commonly affected and the sphenoid sinus was the least affected paranasal sinus.

Spectrum of sinonasal inflammations

Sinonasal inflammations usually are associated with upper respiratory tract infections or even secondary to dental infection. Asymmetrical sinusitis is the hall mark of bacterial infection. Since Allergy is a systemic process, Pansinusites is the common presentation as well as nasal poypoisis. Chronic sinusitis results from either persistent acute inflammation or repeated episodes of subacute sinusitis. Chronic disease can result in atrophic, sclerosing or hypertrophied polypoid mucosa.[16]There is loss of ciliary function resulting in a sinus that is less resistant to infection. The bony changes is probably due to secondary periosteal involvement. Acute sinusites was diagnosed when there was presence of air fluid level whereas chronic sinusites was suggested when the sinuses showed decrease in volume with sclerosis and thickening of its walls. In our study chronic sinusites was diagnosed in 64% of the cases.Amongst100 cases, 7 cases of fungal etiology were diagnosed by using the typical CT features of hyperostosis and non enhancinghyperdense foci in the sinuses particularly in maxillary and ethmoid sinus. Ct features of hyperostosis are well described by Knon J *et*

al[15].Wegener's granulomatosis was found in two cases of maxillary sinusites.

Anatomical Variations

DNS was the most common anatomical variant (74%) followed by aggernassicells (51%) and Choncho bullosa (25%).DNS was also most frequently associated with sinonasalinflammations. In 90% of cases with anatomical variations were associated with inflammatory pathologies due to compromise of Osteomeatal complex[13] and hence the draining pathways. Information about anatomical variations of Ethmoid complex were of paramount signicance for the success of FESS as they frequently result in bony transgresson with severe complications. Critical analysis of prevalence of various anatomical variations is done by lot of studies in literature, some of which have made no distinction between symptomatic and asymtomatic group or have analysed just the symptomatic group[17]

Complications

A polyp is a mass of paranasal sinuses composed of edematus, hyperplastic submusocal connective tissue. Since they are hypocellular, they are hypoattenuating on CT. Complications of sinusites in present study were polyp (47%),Mucocele (13%), Inraorbital spread (4%), Abscess formation (2%), Intracranial extension (1%).Commonest antrochonal polyp was found in maxillary (93%) while sphenochonal polyp was least common (7%).

Functional endoscopic sinus surgery(FESS)

The basic principle of FESS is that the sinus mucosa will return to normal if adequate drainage can be established by removal of obstructing mucosal disease in the osteomeatalregion. No attempt is made to remove (curettage) the sinus mucosa[18]. The safety of this procedure requires a clear understanding of the anatomic relationships of the paranasal sinuses to the surrounding structures. Recognition of the importance of the osteomeatal complex has given the radiologists a pivotal role in preoperative evaluation. Hence Radiologists have to be well versed with the principles of this operative procedure making a careful examination particularlyof the ethmoid bone and the osteomeatal region[19]. Panje and Anand[20] have developed a classification system to standardize the types of FESS technique that is appropriate based on the preoperative extend of the sinus disease as determined by CT imaging. Type I involves uncinatectomy with or without aggernasi cell exenteration. Type II involves Uncinatectomy, bulla ethmoidectomy, removal of sinus lateralis mucosa and exposure of the frontal recess or frontal sinus. Type III is TypeII plus maxillary sinus antrostomy through the natural sinus ostium. Type IV is Type III plus complete posterior ethmoidectomy. Type V involves all of Type IV plus sphenoidectomy and stripping of the mucous membrane. Inpractide, type II and III are the most commonly performed techniques. This procedure is contraindicated in cases with previous surgery, invasive mycotic infections and whenever there is orbital extension, osteomyelitis or intracranial complications. Previous. Out of the studied patients based on the CT Imaging findings,44 were subjected to FESS,23 were operated upon,11 underwent diagnostic endoscopy and the rest followed up with medical line of management. The majority of findings of endoscopy corelated with those reported by us on Helical CT.

CONCLUSIONS

- Helical CT is a high end imaging modality, which has expanded the diagnostic horizon of cross sectional Imaging of nasal vault and paranasal sinuses.
- The nasal anatomy and variations of sinus structure as well as the pathologic appearances and complications of sinus disease are exquisitely delineated by the high-resolution images and 3D reformats.
- Moreover, the coronal image simulates the endoscopist's view and provides a guiding 'road map'for FESS.
- Thus, to conclude Helical CT is presently indispensable as an imaging modality for diagnosis and preoperative assessment of sinonasal inflammations in the era of FESS

REFERENCES

1. Kennedy DW, Zenreich J, Rosenbaum AE, Johns ME, Functional endoscopic approach to Inflammatory sinus disease: current prespective and technical modifications. Am J Rhinol 1988; 2:89-96.
2. Fred J.Lame and Wendy R.K>Smoker TheOsteiomeatal Unit and Endoscopic Surgery: Anatomy, Variations, and Imaging findings in Inflammatory Diseases, AJR October 1992 159:849-857.,
3. Gotwald T.F., ZinreichS.J., Fishman E.K. Three dimensional Volumetric Display of the Nasal Ostiomeatal Channels and Paranasal Sinuses. American Journal of Roentgenology, January 2000; Vol.176:241-245.
4. Chow J, Mafee ME Coronal section computed tomographic imaging of the paranasal sinuses for endoscopic sinus surgery. OpertechniqOtolaryngol Head neck Surg 1993;3:134-138
5. Royal college of Radiologists working party. Making the best use of a Department of clinical Radiology: Guidelines for Doctors. The Royal college of Radiologists, London 3rd 1995;1-96
6. MafeeM ; Preoperative imaging anatomy of the naso-ethmoid complex for functional endoscopic sinus

surgery. Radiologic Clinics of North America January1993; Vol 31(1) 1-20.
7. Hudgins p, complications of endoscopic sinus surgery; the role of Radiologist in prevention. RadiolClin North Amer 1993 993; 31:21-31.
8. Lanzieri C.F; Haaga: The Sinonasal Cavity Computed Tomography and Magnetic Resonance Imaging of the Whole Body, Vol 1,471-493.
9. Maniglia A, Fatal and other complications of endoscopic paranasal sinus surgery, laryngoscope 1991; 101: 349-354.
10. Zinreich JS, Kennedy DW, Rosenbaum AE, Gayler BW, Paranasal sinuses: CT imaging requirements for endoscopic surgery. Radiology 1987; 163: 769-775.
11. Sarana A, Hayman LA, Laine F.J, Coronal imaging of osteomeatal unit. anatomy 24 variants. J Comp Assist Tomogr.2002; 26:153-157.
12. Tonai A, Baba S. Anatomic variations of the bone in sinonasal CT. ActaOtolaryngol.(Stockh) Supplement 1996; 525: 9-13.
13. Lloyd G. Sutton: The Sinuses. Textbook Of Radiology and Imaging, Vol 2, Fifth Edition, 1297-1306.
14. Yousem DM, Imaging of sinonasal inflammatory disease. Radiology 1993; 188:3403-314.
15. Kwon J, Park KH, PsarkSl, JinSY.Aspergillosis of the paranasal sinuses- diagnostic significance of the computed tomography. S Yonsei Med. J. 1989 Sep; 30 (3): 294-7.
16. Som PM, Curtin HD. Chronic inflammatory sinonasal diseases including fungal infections.:role of imaging. Radiology clinics of North America 1993; Vol 88: 279-288.
17. Arslan H, Aydinhoglu A, Buzkurt M. Anatomic examination for endoscopic sinus surgey, AurisNasus Larynx 1999;26: 39-48
18. Rice DH, Basic surgical techniques and variations of endoscopic sinus surgery. Otolayrngoclin North America 1989; 22: 713-726.
19. Terrier F, Weber W, Ruefenacht D, Anatomy of the ethmoid:CT, endoscopic and macroscopic. AJNR 1985; 6:77-84.
20. Panje WR, Ananad VK. Endoscopic sinus surgery indication, diagnosis and technique.In: Anand VK, Panje WR, eds.Practical Endoscopic Sinus Surgery. New York: McGraw-Hill, 1993; 68-86.

Source of Support: None Declared
Conflict of Interest: None Declared