

## The major obstructive inflammatory patterns of the sinonasal diseases in 200 candidates of functional endoscopic sinus surgery.

Naimi M<sup>1</sup>, Bakhshaei M<sup>2</sup>

<sup>1</sup>Associated professor of Otorhinolaryngology, <sup>2</sup>Assistant professor of Otorhinolaryngology

### Abstract

**Introduction:** Coronal CT is the imaging modality of choice in patients with sinus diseases. CT provides and initial screening of these patients and can display anatomic causes of recurrent sinusitis when they exist, CT is essential for planning surgery, and it provides an operative road map for subsequent FESS.

**Materials and Methods:** Coronal sinus CT scan of 200 candidates of FESS reviewed for the major inflammatory patterns and anatomic variations which may attribute to inflammatory disease.

**Results:** Five recurring patterns of inflammation, including infundibular 6%, ostiomeatal unit (OMU) 34%, sphenoethmoidal recess (SER) 24%, polyposis 16%, and sporadic 32% were seen. Some cases have more than one pattern. Anatomic variations included septal deviation (40%), Concha bullosa (24%), paradoxical middle turbinate (4%), atelectatic uncinat process (6%), Haller cell (12%), giant ethmoid bulla (8%), agger nasi cell (8%), onodi cells (2%).

**Conclusion:** Higher incidence of more severe patterns and anatomic variations in our study may be due to socioeconomic states of patients, study on surgical cases, and that our center is a referral center.

**Keywords:** Paranasal sinuses, Chronic sinusitis, Computed tomography (CT), Functional Endoscopic Sinus Surgery (FESS).

### Introduction

Functional endoscopic sinonasal surgery (FESS) has in recent years been used widely for the evaluation and treatment of inflammatory sinonasal disease(1,2).

In patients with chronic inflammatory sinonasal disease, this surgical technique is a successful method restoring the normal mucocilliary drainage to the paranasal sinuses(1,3,4,5).

Dramatic increases in the use of FESS has produced on equally impressive increase in the volume of CT examinations obtained in the presurgical assessment of the paranasal sinuses and nose.

The keystone of FESS is its ability to diagnose accurately and treat even relatively

minor changes in areas of mucocilliary drainage(3).

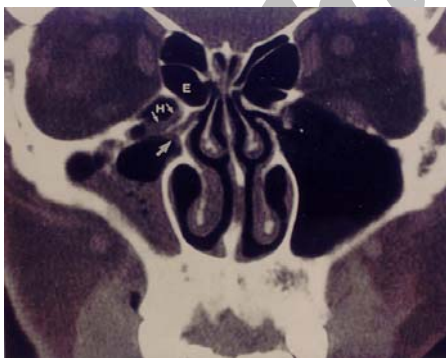
CT in the form of coronal screening sinus CT (SSCT) detects even more sinonasal inflammatory disease than diagnostic endoscopy. Patterns of inflammatory sinonasal pathology are recognizable on screening sinus CT (SSCT), and when identified, allow endoscopic surgical technique to be tailored to a specific pattern of disease.

As a result, SSCT has emerged as the diagnostic study of choice for patients under consideration for possible FESS. Five major patterns of inflammatory sinonasal disease are readily identifiable on SSCT (6,7).

These include the infundibular (I), ostiomeatal unit (OMU) (II), sphenothmoidal recess (SER) (III), sinonasal polyposis (IV), and the sporadic or unclassifiable (V) patterns. The first three of these patterns, the infundibular, OMU, and SER patterns, are related to obstruction of the mucociliary drainage routes of the paranasal sinuses. These obstructive patterns are responsible for the majority of inflammatory sinus disease(1,8).

#### Methods and Materials:

Coronal nose and paranasal sinuses CT scans of 200 candidates of FESS in Ghaem Hospital of Mashhad University under radiologist supervision was evaluated. The object was assessment of major patterns of inflammatory sinonasal disease and predisposane anatomic variants for inflammatory disorders. Five patterns of sinonasal inflammation according to Babbel's view were in consideration. The infundibular pattern (I) is assigned when isolated maxillary sinusitis due to ipsilateral obstruction of the inferior aspect of the infundibulum is identified (Fig.1).



**Fig.1:** Infundibular pattern  
E. ethmoid      H. haller cell

The OMU pattern (II) is designated when the ipsilateral middle meatus is opacified, resulting in sinusitis within some or all of the ipsilateral frontal, maxillary, and anterior and middle ethmoid sinuses (Fig. 2).



**Fig.2:** Coteomeatal unit pattern  
E. ethmoid sinus C. concha P. polgr

The designation SER pattern (III) is applied when obstruction is present posteriorly within the region of the SER, resulting in sphenoid and posterior ethmoid sinusitis (Fig.3).



**Fig.3:** Sphenoethmoidal recess pattern  
S. sphenoid sinus

The sinonasal polyposis pattern (IV) is diagnosed when a combination of polypoid soft tissue densities are present throughout the nasal vault and paranasal sinuses in association with variable diffuse sinus opacification (Fig.4).

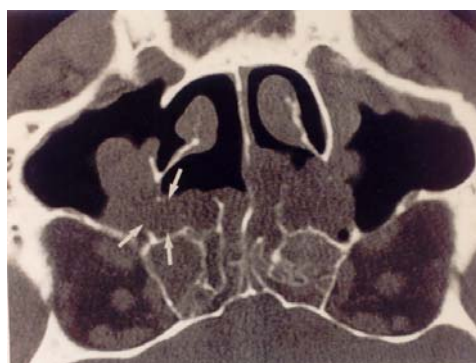


Fig.4: Sinonasal polyposis

The final major pattern of sinonasal inflammatory disease is sporadic or unclassified pattern (V) (Fig.5).

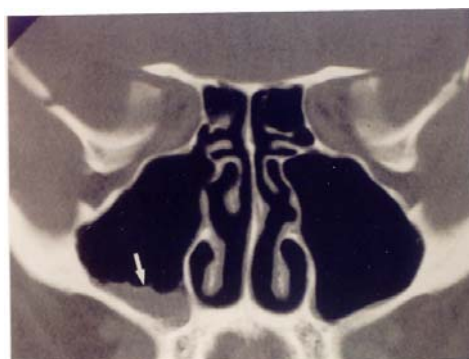


Fig.5: Sporadic pattern (Mucosal thickening)

Included in this category are sporadic inflammatory sinus findings such as retention cysts, mucocèles, and mild mucoperiosteal thickening without coexistent OMU or SER obstruction. Also included in this pattern are SSCT scans demonstrating postoperative changes. CT scans are generally provided by simense and General Electric scanes units. For eliminating reversible disease and better delineation of anatomy and definition of chronic disease requiring endoscopic surgery; all patient completion of antibiotic course; continuation of oral antihistamines and decongestants; consideration of steroids in allergic patients. The majority of patients (185) were in prone position with head hyperextended, resting on chin (keeps free fluid out of infundibulum).

In patients unable to maintain prone position or in cases where questions arise from prone images, use supine coronal position with head hyperextended over edge of table. Gantry angle was perpendicular to hard palate to obtain direct coronal images; actual coronal angle is not critical. Scan extent was posterior margin of sphenoid sinus to anterior margin of frontal sinus. CT scan done with 5-mm contiguous slices 120 kilovolt, 200 milliampere (100 mA 2-second scan time) or less, bone imaging algorithm, window width: 2000-2500 Hu; window center: 100-300 Hu range. Both bone and soft tissues visualised on the single set of images. interavenous contrast was not used.

#### Results

200 candidates of FESS (58% male and 42% females) with average of 37.8 years were studied. Each side of nose and paranasal sinuses were assessed separately, so we have 400 units to study. Five recurring patterns of inflammatory sinonasal disease, including infundibular (6%), OMU (34%), sphenothmoidal recess (24%), sinonasal polyposies (16%) and sporadic or unclassifiable diseases (32%) were defined. These patterns were seen solely or as a combinations and so total percent was more than 100 (Table.1).

**Table 1:** Frequency of major obstructive inflammatory patterns.

Inflammatory Pattern	Percent
Infundibular	6%
Ostiomeatal unit	34%
Sphenothmoidal recess	24%
Polyposies	16%
Sporadic	32%

The sinonasal polyposis pattern was caused by diffuse nasal and paranasal sinus polyps. Associated radiographic findings included infundibular enlargement, bulging ethmoid sinus walls, and attenuation of the bony nasal septum and ethmoid trabeculae. In sporadic unclassified pattern, retention cysts (4%), antrochoanal cyst (8%), mucosal

thickening (4%) , and postoperative changes (16%), were seen. Anatomic variations in CT scan of patients were included nasal septal deviation (40%), concha bullosa (24%), paradoxical middle turbinate (4%) , atelectatic uncinata process (6%), Haller cell (12%), giant ethmoid bulla (8%), agger nasi cell (8%), onodi cell (2%), extensive pneumatization of the sphenoid sinus (12%).

### Discussion

At present computed tomography (CT) is one of the best non-invasive diagnostic methods for delineating the extent of sinus disease (9).

Inflammatory sinonasal pathology is recognizable on screening sinus CT, and when identified, allows endoscopic surgical technique to be tailored to a specific pattern of disease. Five major patterns of inflammatory sinonasal disease are readily identifiable on CT scan (8,10). These include the infundibular, ostiomeatal unit (OMU), sphenoidal recess (SER), sinonasal polyposis, and the sporadic or unclassifiable patterns.

In a series of 500 consecutive patients undergoing CT scan, the infundibular pattern was seen in 26% of the scans. The OMU pattern was identified in 25%, with 6% of the scans demonstrating the SER pattern.

Sinonasal polyposis was present in 10% of CT scans, and in 24% the sporadic or unclassifiable pattern was designated. Normal scans were present in 27% of the 500 (6). In our survey the five major patterns including infundibular, OMU, SER, polyposis, and sporadic were seen in 6%, 34%, 16%, and 32%, respectively. The total of all percentages is greater than 100, due to simultaneous occurrence of more than one pattern in some patients. By applying these patterns to the radiological report, more tailored endoscopic sinus surgery is possible. The differences between our study and Babbel's is due to different socioeconomic state of our patients and that our study was on a group of patients with severe complain-

ts who were candidates for surgery not just those who were symptomatic; Therefore we did not have any normal cases.

Important incidental findings noted on CT scan examinations include tumor or tumorlike conditions that can be seen in 5% of scans (6). We found 14 (7%) non-inflammatory benign and malignant lesions, including two cases of antrochoanal polyps, SCCs, osteomas, and one case of ossified fibroma, juvenile nasopharyngeal angiofibroma, nasal melanoma, Wegener's granulomatosis, nasal lymphoma, inverted papilloma, fibrous dysplasia, and esthesioneuroblastoma. These fourteen cases, in addition to two complicated inflammatory cases (OMU pattern with orbital abscess), required extended sinonasal CT scans (both the axial and coronal planes) for full characterization of the lesions.

Additional incidental sinonasal CT abnormalities and anatomic variants are frequently encountered. Bolger et al found bony anatomic variations in 64.8% of patients in their series (10). Babbel et al reported high frequency of variations including some degree of septal deviation (40%), septal spur (15%), synechiae or intranasal adhesions (16%), and concha bullosa (14%)<sup>6</sup>. In our study of 200 patients we also noted a high frequency of this variations including 40% septal deviation, 12% synechiae, 24% concha bullosa, 12% haller cell, 8% agger nasi cell, 4% paradoxical middle turbinates, and 2% atelectatic uncinata process. In a study on 47 children with chronic sinus disease on coronal and axial computed tomographic scans by Sivash et al, the anatomic variations of the lateral nasal wall were assessed (12). Recognition of these abnormalities and anatomic variants is crucial since they may be the causal agent of the patient's inflammatory disease and frequently need to be addressed at the time of endoscopic surgery; for example a complicated concha bullosa seems to -

predispose to an OMU pattern of inflammatory disease, although some dispute the cause and effect of this finding(13).

### Conclusion

Anatomical descriptions of the sinuses are critical in pathological diagnosis and the treatment planning of surgical procedures (14). In this introductory article, we have introduced the concept of inflammatory sinonasal disease patterns and discussed the optimal preendoscopic CT scan. Armed with this knowledge and using these principles, the radiologist is able to define a surgical road map for the endoscopic surgeon, detailing the important sinonasal anatomy and pathology. The surgical technique can then be tailored to the specific disease processes of the individual.

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خلاصه

## الگوهای اصلی انسداد التهابی ناحیه سینونازال در ۲۰۰ بیمار کاندید جراحی آندوسکوپی سینوس

دکتر محمد نعیمی، دکتر مهدی بخشایی

**مقدمه:** تصویرنگاری انتخابی برای بیمارانی که بیماری سینوس دارند، CTS در مقطع کروئال می باشد. CTS برای بررسی علل آناتومیکی سینوزیت عودکننده، برنامه ریزی جراحی و شیوه مناسب انجام FESS ضروری است.

**مواد و روش کار:** در این مطالعه، CTS ۲۰۰ بیمار کاندید عمل جراحی FESS از نظر الگوهای اصلی التهابی بررسی شد.

**نتایج:** براین اساس نوع آنفاندیولار ۶٪، استئوماتال کمپلکس (OMU) ۳۴٪، اسفنوئتموئیدال رسس ۲۴٪، پولیپوز ۱۶٪ و اسپورادیک ۳۲٪ موارد را تشکیل می داد. البته گاه بیش از یک الگوی انسدادی در یک فرد دیده می شد. واریاسیون های آناتومیکی مشاهده شده شامل انحراف تیغه بینی ۴۰٪، کونکابولوز ۲۴٪ شاخک میانی پارادوکس ۴٪ آنسیت پروسس آتلکتاتیک ۶٪، سلول هالر ۱۲٪، بولای بزرگ ۸٪ و سلول آگرنازی ۸٪ و سلول آنودی ۲٪ بود.

**نتیجه گیری:** بالا بودن شیوع الگوهای پیشرفته و واریاسیون های آناتومیکی در این مطالعه با توجه به وضعیت اجتماعی - اقتصادی بیماران و این که تمام موارد به عنوان کاندید عمل جراحی به این ارجاع شده بودند، قابل توجه است.

**واژه های کلیدی:** سینوس های پارانازال، سینوزیت مزمن، سی تی اسکن، جراحی سینوس آندوسکوپیک