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Correlations between Symptoms, Nasal Endoscopy and Computed Tomography in Patients with Chronic Rhinosinusitis

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Abstract

Background Rhinosinusitis is the inflammation of nasal and paranasal sinus mucosa and is associated with mucosal alteration ranging from inflammatory thickening to gross nasal polyp formation. Concha bullosa is the term used for an aerated middle turbinate or a cell found within the middle turbinate. These structures appear as a widened area of the middle turbinate, and they may obstruct the ostio meatal complex. In the absence of a history of sinusitis, the incidental finding of widened middle turbinate during endoscopy or concha bullosa on computed tomography (CT) does not mandate further investigation.

Objectives To determine the symptoms described at presentation, radiological findings, endoscopy and to compare endoscopy and computed tomography scan findings of the nose and paranasal sinuses in patients with chronic rhinosinusitis before endoscopic sinus surgery.

Methods Forty three patients with chronic rhinosinusitis were studied. Physical history, ear, nose and throat examinations plus endoscopic examinations of nose and paranasal sinuses were performed. Computed tomography scan of the sinuses and ostiomeatal complex were done for all patients.

Results The patients aged 17 to 53 years (32.44 ± 9.83 years), and male to female ratio was 1.15:1. Headache is the commonest symptom (69.76%). The duration of symptom was 1-5 years in 44.18% of patients. Septal deviation was the most common finding 46.51% by endoscopic examination. Mucosal thickening present in all patients (100%) by CT-scan. Between endoscopic and CT scan findings There is a significant statistical difference for enlarged ethmoid bulla but not for septal deviation, abnormal uncinate proces and hypertrophy of inferior turbinate.

Conclusion Endoscopy and CT-scan of the nose and paranasal sinuses are mandatory before endoscopic sinus surgery of nose and paranasal sinuses in patients with chronic rhinosinusitis.

Keywords Chronic sinusitis, endoscope, CT-scan

List of abbreviation: OMC = ostio meatal complex, CT = computed tomography, RS = rhinosinusitis, CRS = chronic rhinosinusitis, ESS = endoscopic sinus surgery

Introduction

The cilia of the maxillary and frontal sinuses transport mucus in specific patterns only toward the natural Ostia, despite the presence of accessory Ostia. Rhinosinusitis (RS) is usually preceded by a viral upper respiratory infection that impedes mucociliary clearance, causing blockage of the natural sinus Ostia. Allergies, likewise, can cause mucosal inflammation and edema. Anatomic obstruction of the Ostia can be caused by septal deviations, concha bullosa, paradoxical middle turbinate, infraorbital cells, agger nasi cells, and nasal polyps. Cystic fibrosis, ciliary dyskinesia, and immunodeficiency can impair mucociliary clearance and predispose to chronic rhinosinusitis (CRS) [(1)].

Messerklinger pioneered the study of the endoscopic anatomy and pathophysiology of the

paranasal sinuses, publishing his experience with endoscopic sinus surgery (ESS) in 1978. He highlighted the role of the ostiomeatal complex (OMC) in the pathophysiology of rhinosinusitis and directed attention to it during surgery [2]. The Caldwell-Luc procedure remained popular as the primary choice of treatment in CRS through the early 20th century; although Hirschman conducted the first endoscopic examination of the nose with a modified cystoscope in 1901.

Understanding of the anatomy and pathophysiology of each disease process is necessary before one can embark on surgery [3]. Each patient is individually assessed to determine the site of pathology and obstruction, and surgery is tailored to address them [4].

Anatomic Variations

Anatomic variations include structures such as a concha bullosa, agger nasi cells, infraorbital (Haller) cells, sphenoethmoid (Onodi) cells, and paradoxical middle turbinate. Concha bullosa is the term used for an aerated middle turbinate or a cell found within the middle turbinate. These structures appear as a widened area of the middle turbinate, and they may obstruct the OMC. In the absence of a history of sinusitis, the incidental finding of widened middle turbinate during endoscopy or concha bullosa on CT does not mandate further investigation [5].

Most patients with such variations remain asymptomatic. In a review of 172 coronal sinus CT scans, a concha bullosa was found in 28% of patients with sinus disease and in 26% of patients without sinus disease [6].

The objectives of this study were to determine the symptoms described at presentation, radiological findings, endoscopy and to compare endoscopy and computed tomography scan findings of the nose and paranasal sinuses in patients with chronic rhinosinusitis before endoscopic sinus surgery.

Methods

A prospective study of 43 selected patients at Al-Imamain Al-Kadhymain Medical City (Baghdad) for one year duration. A thorough history, ear, nose and throat examinations and endoscopic examinations of the nose and paranasal sinuses under local anesthesia were performed in the outpatient clinic. All patients were sent for CT scan within one week after endoscopy.

CT scan was done using (Seimens multi detector 64 slices (Germany), coronal and axial view 4 mm slices thickness for imaging the sinuses and 2 mm coronal view for ostiomeatal complex were done for all patients.

Each patient who is diagnosed as having chronic rhinosinusitis was included in this study after failure of medical treatment for at least 4 weeks (Amoxicillin + Clavulanic acid 625 mg/three times daily. Clarithromycin 250 mg /twice daily in penicillin sensitive patients, Budesonide intranasal spry /2 times daily) and these patients prepared for Endoscopic Sinus Surgery.

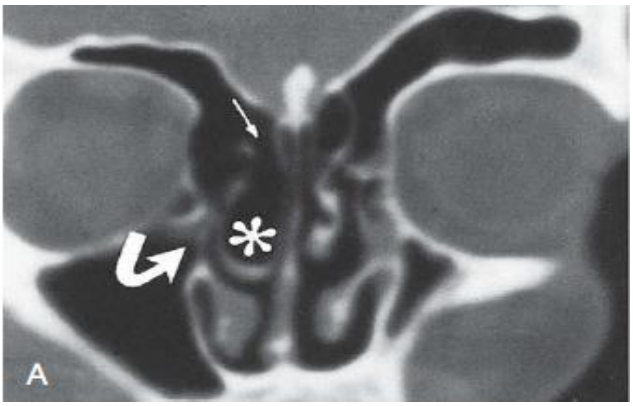

Fig. 1. CT scan- Concha bullosa [7]

Endoscopic technique

Under local anesthesia and vasoconstriction: (Lidocaine nasal spray 4% and Xylometazoline) nasal spray for few minutes. The patient was in a sitting position, the nasal cavity examined with 0^o, 30^o and 70^o 4 mm rigid endoscope sometimes with fiberoptic nasopharyngoscpe. The endoscope examinations were done by classic 3 passes.

First pass carefully along the floor of the nose, while the septum, inferior meatus, inferior turbinate, middle turbinate and nasopharynx are inspected.

Second pass the endoscope is reinserted between the inferior and middle turbinate.

While advancing in a posterior direction, the inferior portion of the middle turbinate and middle meatus, the fontanelles and any accessory maxillary Ostia are examined. The sphenoethmoid recess is visualized by passing the scope medial to the posterior aspect of the middle turbinate and rotating it superiorly. The examiner will often be able to visualize the superior turbinate and the natural sphenoid ostium.

The telescope is then gently withdrawn and re-passed again in a direction directly toward the middle meatus passing between the middle turbinate and lateral wall of the nose inspecting the uncinate process, bulla ethmoidalis, hiatus semilunaris and maxillary ostium (OMC area).

Third pass while withdrawing the endoscope. The scope is rotated laterally beneath the posterior aspect of the middle turbinate to gain access to the deeper areas of the middle meatus. Visualization of the bulla ethmoidalis, hiatus semilunaris and infundibular entrance is obtained, and as the scope is withdrawn even further, an excellent view of the uncinate process and its overlying mucosa is obtained.

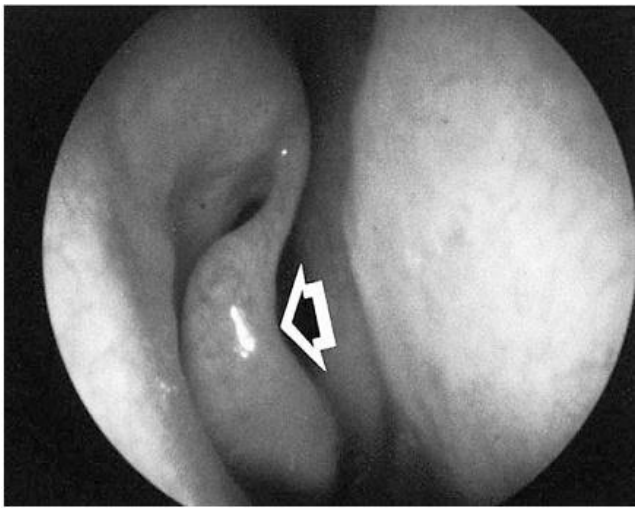

Fig. 2. Endoscopy - Paradoxical Middle Turbinate [7]

Statistical analysis

The chi-square (x^2) test was used to evaluate the association between categorical variables; to determine whether association was significant, the *P* value was calculated for the results as follow; significant (S) when it equals ≤ 0.05 and not significant (NS) when it equals ≥ 0.05

Result

The age range of the patients studied was 17 to 53 years, the mean age is (32.44 ± 9.83years) the commonest age group affected was between 31-40 years (34.88%) as seen in table 1.

Table 1. Age distribution

Age (years)	No.	%
11-20	4	9.3
21-30	13	30.23
31-40	15	34.88
41-50	8	18.6
51-60	3	6.97

The males to females ratio was 1.15:1 (Table 2).

Table 2. Gender distribution

Gender	No.	%
Male	23	53.48
Female	20	46.51

The duration of symptoms was between 1-5 years in 44.18% of the patients (Table 3).

Table 3. Duration of Symptoms

Duration (years)	No.	%
<1	16	37.2
1-5	19	44.18
6-10	6	13.95
>10	2	4.65

Headache was the commonest symptom and encountered in 30 patients (69.76) and cacosmia was the least symptom noticed in only 2 patients (4.65%) as seen in table 4.

Septal deviation was the commonest endoscopic finding (20 patients 46.51%) and paradoxical middle turbinate was the least findings (one patient 2.32%) as shown in table 5.

Diseased OMC and mucosal thickening of the sinuses was the CT-scan finding in all patients 43 (100%) and the least was Haller's cells 3 patients 6.97% as observed in table 6. Septal deviation by

endoscopy was observed in 46.5% versus 48.8% by CT scan while enlarged ethmoid bulla in 4.65% by endoscopy versus 20.93% by CT scan (Table 7).

Table 4. Occurrence of symptoms

Symptoms	No.	%
Headache	30	69.76
Nasal obstruction	29	67.44
Postnasal drip	18	41.86
Sore throat	9	20.93
Facial pain/ pressure	17	39.53
Rhinorrhea	13	30.23
Sneezing	11	25.58
Snoring	8	18.60
Hyposmia	14	32.55
Cacosmia	2	4.65
Otalgia	2	4.65

Table 5. Endoscopic examination findings

Finding		No.	%
Mucopus within OMC		10	23.25
Abnormal uncinate pross.		2	4.65
enlarged middle turbinate		13	30.23
Septal deviation	Mild	9	46.51
	Moderate	6	
	Severe	5	
Enlarged ethmoid bulla		2	4.65
Polyps		14	32.55
Paradoxical mid. turbinate		1	2.32
Hypertrophy inf. turbinate		18	41.86

OMC = ostio meatal complex

Discussion

The average age of our patients was low as compared to the study done by Ling and Kountakis (2007) (8) which was 49.4 years (range 18-80 years). This difference because the older ages in our study carries some medical co-morbidity that makes the surgical operation risky on their life while the male-to-female ratio was 1.1:1 which is similar to our findings. On the contrary, Abdul Aziz et al (9) when 160 male, 68 female and 18 pediatric found that the adult male: female ratio was 2.35:1 which was higher than in the present study which may be due to large number of patients they studied while their patients' age was in accordance with this study.

In the current study, the common symptoms in order of frequency was headache in 30 patients (69.76%); nasal obstruction in 29 patients (67.44%); post nasal drip in 18 patients (41.86%); rhinorrhea in 13 patients (30.23%); hyposmia in14 patients (32.55%); facial pain/pressure in 17 patients (39.53%); sore throat in 9 patients (20.93%); sneezing in 11 patients (25.58%); snoring in 8 patients (18.60%); and otalgia in 2 patients (4.65). In study by Netkovski J, *et al* [10] the leading symptom were nasal obstruction in 93.7% and post nasal discharge in 86.2% of the patients. Furthermore, patients reported anterior nasal discharge (Rhinorrhea) in 72.5%, headache in 65% and hyposmia in 62.5% of the patients. This may be due to the fact that their patients are more concerned with nasal obstruction that lead***s*** to sleep disturbance and its impact on the daily activity. While headache is the commonest problems that obligate the patients for seeking a medical advice in our society.

In a study performed by Chester *et al* [11], they noticed facial pain/pressure in 35%; facial congestion / fullness in 10%; nasal obstruction / blockage in 42%; nasal discharge / purulence /discolored postnasal discharge in 47%; hyposmia/anosmia in 35%; and ear pain / pressure/fullness in 6%.

These differences may be due to variation in the Demography in which these studies were done and the large sample size of the study of patients selected.

Endoscopic findings

Endoscopic findings in this study were as following: Septal deviation in (46.51%), polyps (32.55%), enlarged middle turbinate (30.23%), Mucopus within ostiomeatal complex in (23.25%), abnormal uncinate process (4.65%), enlarged ethmoid bulla (4.65%) and paradoxical middle turbinate (2.32 %).

In study done by Danielsen and Olofsson [12] included 230 patients, enlarged middle turbinate

8.69%, prominent ethmoidal bulla 38.69%, paradoxically bent middle turbinate 15.21 % and septal deviation 5.65% were the commonest finding, the difference from current study is likely due to larger number of patients were included in the last study.

In 1989, Kamel [13] studied 100 patients and reported that Mucopus within ostiomeatal complex found in 27.21%, abnormal uncinate process 17.72%, enlarged middle turbinate 5.69% enlarged ethmoid bulla 19.62% polyps 33.53% (polyp in frontal recess, ant. ethmoid region, maxillary ostium 9.49%, 15.18%, 8.86% respectively) paradoxical middle turbinate 6.65% (1.89% diseased sinus, 4.76% disease free sinuses).

Table 6. CT-scan findings

Finding		No.	%
Septal deviation		21	48.83
Mucosal thickening of sinuses	Total	43	100
	Maxillary	34	79.06
	Ethmoid	39	90.69
	Sphenoid	8	18.6
	Frontal	10	23.25
Concha bullosa		12	27.90
Abnormal uncinate process		5	11.62
Enlarged ethmoid bulla		9	20.93
Haller's cells		3	6.97
Diseased OMC		43	100
Hypertrophied inferior turbinate		18	41.86

Table 7. Comparison between endoscopic and CT-scan findings

Finding	Examination	
	Endoscopic	CT-scan
Septal deviation	46.5%	48.8%
Enlarged ethmoid bulla	4.65%	20.93%*
Abn. uncinate process	4.65%	11.62%
Hypertro. inf. turbinate	41.86%	41.86%

* $P = 0.024$

CT-scan findings

All the patients (100%) in the current study had diseased OMC and mucosal thickening of sinuses (maxillary 79.06% ethmoid 90.69% sphenoid 18.6% frontal 23.25%), septal deviation (48.83%), hypertrophied inferior turbinate (41.86%), concha bullosa (27.90%), and abnormal uncinate process (11.62%), enlarged ethmoid bulla (20.93%), and Haller's cells (6.97%).

Tezer *et al* (2006)[14] in their study on 399 patients, the CT findings was maxillary sinus opacification (48.85%) ethmoidal sinus opacification (43.60%) frontal sinus opacification (27.56%) and sphenoid sinus (18.8%), OMC disease (38.09%), concha bullosa (31.07%) and Haller's cell (12.78%).

In other study done by Bernholz (2000) [15], finds mucosal thickening in 43% of the patients, septal deviation in 65% and concha bullosa in 20%.

Comparison between endoscopic and CT scan findings

In the current study, there is significant difference for enlarged ethmoid bulla but not significant for septal deviation, abnormal uncinate process and hypertrophy of inferior turbinate (Table 7). Shahizon *et al* [16], in a study of 40 patients found eighteen patients (45%) had concha bullosa detected on CT and only 10 patients (25%) were detected to have concha bullosa on nasal endoscopy. Three patients (8%) presented with paradoxical turbinate on CT all of which were not detected endoscopically. Seven patients were noted to have paradoxical turbinate on endoscopy. None of these patients had paradoxical turbinate on CT. Of these patients, five had concha bullosa and two patients had normal middle turbinate. Eighteen patients (45%) had nasal polyps on endoscopy of which only five patients were reported to have polyps on CT. Ten patients (25%) were noted to have septal deviation on endoscopy, of these patients; nine patients had nasal septal deviation on CT-scan. On CT-scan, the diseased mucosa, polyps and Mucopus are non specific findings which are better assessed endoscopically.

It was clearly evident that CT was superior in detecting OMC involvement, presence of concha bullosa, and paradoxical turbinate. Paradoxical turbinate was not easily detected on nasal endoscopy and was easily mistaken for concha

bullosa by an inexperienced endoscopist. This study also found that polyps, diseased mucosa and Mucopus in the middle meatus had no specific features on coronal CT, while endoscopy had an essential role in accurately diagnosing these pathologies. Understanding of the disease process and its presentation in correlation to nasal endoscopic findings will assist radiologist in interpreting the CT findings. Functional interactive partnership between the radiologist and otolaryngologist is likely to yield a positive outcome.

In conclusion, endoscopy and CT-scan of the nose and paranasal sinuses are mandatory before Endoscopic Sinus Surgery of nose and paranasal sinuses in patients with chronic rhinosinusitis.

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Conflict of interest

The author declare no conflict of interest

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