Section: Otorhinolaryngology

Original Research Article

A HOSPITAL BASED PROSPECTIVE STUDY TO EVALUATE THE ENDOSCOPIC ANATOMICAL VARIANT AND COMPARE WITH CT- PARANASAL SINUSES TO FIND THE ETIOLOGY OF SINUSITIS AT NEWLY ESTABLISHED TERTIARY CARE CENTER

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ABSTRACT

Background: The anatomical variations in osteomeatal complex (OMC) may obstruct the drainage pathway and play an important role in the etiology of acute and chronic sinusitis. Here we compare the CT-PNS in sinusitis patients with that of DNE findings and find the anatomical variations most commonly associated with etiology of chronic sinusitis. **Materials and Methods:** A hospital based prospective study done on 50 patients with symptoms of chronic sinusitis in the Department of Otorhinolaryngology, Government Bangur Hospital, Pali, Rajasthan, India during one year period. All the patients underwent CT scan paranasal sinus axial and coronal view and nasal endoscopy. **Result:** The most common anatomical variations were agger nasi cells (80 %), deviated nasal septum (72%) and concha bullosa (48%). Other anatomical variations seen in sinonasal region were uncinate process variations, paradoxical middle turbinate, haller cells, accessory ostia of maxillary sinus, multiseptated sphenoid. According to Lund Mackay scoring, the osteomeatal unit was found to be maximally involved in 68% and sphenoid sinus least involved in 8%. **Conclusion:** CT (PNS) scan and nasal endoscopy were complementary to each other to see mucosal disease patterns and planning of management. In view of the presence of these significant variations, we reemphasize the need for proper preoperative assessment in every patient in order to accomplish a safe and effective endoscopic sinus surgery.

INTRODUCTION

Chronic sinusitis is the inflammation of the nose and paranasal sinuses for more than 12 weeks. It impairs the quality of life and causes emotional dysfunction. According to the European position paper on rhinosinusitis and nasal polyps, rhinosinusitis is diagnosed on clinical grounds based on symptoms and mucosal inflammation. Primary symptoms like nasal obstruction, blockage, congestion or nasal discharge should be present. Additional symptoms like facial pain, pressure, olfactory dysfunction, anosmia or hyposmia should be present. For the diagnosis of rhinosinusitis at least one primary and one secondary symptom or two primary symptoms should be present. If symptoms are present for more than 10 days to less than 3 months, it is classified as acute and if symptoms are present for more than 3 months, it is chronic. Computerised tomography shows mucosal changes in osteomeatal complex or in sinus.[1]

Osteomeatal complex (OMC) is an important functional unit. OMC is a narrow anatomical region consisting of: Multiple bony structures—middle turbinate, uncinate process, bulla ethmoidalis; Air spaces—Frontal recess, ethmoidal infundibulum, middle meatus; Ostia—anterior ethmoidal, maxillary and frontal sinuses. The sphenoethmoidal recess and superior meatus is referred as the posterior osteomeatal unit. The osteomeatal complex is the key area for the pathogenesis of chronic rhinosinusitis.[2]

Chronic rhinosinusitis (CRS) is associated with ciliary impairment, allergy, asthma, aspirin insensitivity, immunocompromised state, genetic factors in cystic fibrosis and primary ciliary dyskinesia, pregnancy, anatomic variations like concha bullosa, deviated nasal septum and displaced uncinate, environmental factors like cigarette smoking, iatrogenic factors like failure of endoscopic

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sinus surgery, laryngopharyngeal reflex and osteitis. It is not clear weather anatomical variation contribute to the development of CRS. Some studies found variations while some studies failed to show significant variations in chronic sinusitis.[1]

Diagnostic nasal endoscopy (DNE) is done routinely in patients suspected to have sinusitis. It helps in deciding mode of treatment and find the lesion which is hidden from naked eye. All the patients who are suspected to have significant changes in DNE are subjected to computerised tomography of paranasal sinuses (CT-PNS).

With the advent of CT scan and nasal endoscopy, there have been tremendous changes in understanding osteomeatal complex anatomy and also in making diagnosis involving various diseases of this region.

Subtle anatomic variations such as Haller cell, pneumatization or paradoxical curvature of middle turbinate and variations in ethmoid bulla, uncinate process, agger nasi cells and frontal recess can now be imaged through CT scan with increased level of clarity and accuracy. As variations and anomalies of these anatomic structures have been implicated in etiology of chronic recurrent rhinosinusitis, axial and coronal plane CT Scan of paranasal sinuses is being routinely used now a days in evaluation of patients with sinus diseases, because even minor anatomical variation of OMC can be evaluated in details by using different plane of CT Scan i.e. axial, coronal and sagittal.

Stammberger and Hawke,[3] have shown that CT examination of the paranasal sinuses will provide an anatomic road map of the paranasal sinuses to identify the presence of significant anatomic abnormalities, their location, severity of the disease and also exact location of the obstruction. To avoid complications during endoscopic sinus surgery, CT scan should be studied thoroughly before surgery. Imaging in coronal plane is generally recommended. The coronal plane optimally shows the osteomeatal unit, the relationship of skull base, ethmoid roof and relationship of orbits to paranasal sinuses.[4]

The keystone of functional endoscopic sinus surgery is the ability to accurately treat even relatively minor changes in osteomeatal complex that interfere with mucociliary clearance of the frontal, ethmoid and maxillary sinuses. CT scan and nasal endoscopy provides the ability to accurately access this area for evidence of localized disease or any anatomic defect that compromise ventilation and mucociliary clearance.

CT-PNS is done routinely in CRS before surgery of paranasal sinuses. This is to know the anatomical variations and to avoid inadvertent complications. It is done in ARS when it doesn't respond to treatment. The anatomical variations in osteomeatal complex (OMC) may obstruct the drainage pathway and play an important role in the etiology of acute and chronic sinusitis.

Here we compare the CT-PNS in sinusitis patients with that of DNE findings and find the anatomical variations most commonly associated with etiology of chronic sinusitis.[5]

MATERIALS AND METHODS

A hospital based prospective study done on 50 patients with symptoms of chronic sinusitis in the Department of Otorhinolaryngology, Government Bangur Hospital, Pali, Rajasthan, India during one year period.

Inclusion Criteria

1. Patients with complaints suggestive of Chronic Sinusitis
2. Duration > 12 weeks
3. Patient willing to take CT and undergo Nasal endoscopy
4. Patient willing to give consent

Exclusion Criteria

1. Acute sinusitis
2. Patients who had undergone nasal surgery

Diagnostic Nasal Endoscopy

The modern endoscopes used now was developed by Harold Hopkins in 1971. He devised a rigid rod which had a glass tube and thin lenses. Fiberoptic light transmission was added by Karl Storz.[6,7] Diagnostic nasal endoscopy in done routinely to evaluate sinonasal disease. A 0 degree 4mm or 2.7mm rigid Hopkins endoscope is used.

Firstly, the nose is prepared by keeping a pack soaked in a mixture of 10 ml 4% lignocaine with decongestant like one ampule of adrenaline or oxymetazoline or xylometazoline drops. This helps in adequate analgesia and shrinkage of mucosa. It can be done in sitting or lying down supine position. It is done in three passes.[8,9]

First Pass

Endoscope is passed along the floor of the nasal cavity. Inferior turbinate, inferior meatus, nasopharynx, Eustachian tube orifice, fossa of Rosenmuller and adenoids are visualised.

Second Pass

Endoscope is passed along the medial wall of middle turbinate along the septum and sphenoethmoid recess, sphenoid ostium and superior turbinate are visualised.

Third Pass

When the endoscope is withdrawn, it is passed to the middle meatus. Osteomeatal complex, uncinate process, accessory ostium, frontal recess and bulla are visualised.[8,9]

CT - PNS

CT PNS was taken in patients with evidence of sinusitis. A course of oral antibiotics, nasal decongestants and antihistaminics were given to the patient for 2 weeks and asked to return. Nasal decongestant was instilled 15 minutes prior to taking CT. Patient was asked to blow the nose forcefully before taking CT. CT PNS coronal, axial and sagittal 5mm cuts were taken in all patients. All CTs were taken without contrast. Patient in prone position with extended chin. 5 mm cuts were taken.

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Anatomical variations were noted. Chronic sinusitis staging was done according to Lund-Mackay system.[10] In this system, the sinuses are made to six groups- maxillary, anterior ethmoids, posterior ethmoids, sphenoid, frontal and osteomeatal complex and each group is graded from 0 to 2. Grade 0 is no abnormality, grade 1 is partial opacification and grade 2 is total opacification. Each side maximum score 12 can be obtained and total score is for 24. Various anatomical variations are also noted in this. Number of anatomical variations is compared with the total Lund Mackay score.

The statistical analysis was useful to assess the relationship between common and uncommon anatomical variations and the presence of unilateral or bilateral sinusitis. Association were evaluated using the Fisher's exact test (where frequencies were <5) and Chi-Square test (where frequencies were more than 5).

RESULTS

A total of 50 patients were included in the study. Majority of the patients were males (70 %) with females (30 %). Maximum cases 27 (54%) were found in age group of 15–30 years. Post nasal drip was the most common symptom occurring in 84% cases followed by anterior nasal discharge (78%), headache (70 %), nasal obstruction (54%). CT scan paranasal sinuses coronal and axial views were done to see anatomical variations of sinonasal region and extent of mucosal hypertrophy. According to Lund Mackay scoring, the osteomeatal unit was found to be maximally involved in 68% and sphenoid sinus least involved in 8%.

The most common anatomical variation was agger nasi cell which was present in 40 (80 %) patients [(unilateral in 9 (18 %) and bilateral 31 (62%)]. Deviated nasal septum was present in 36 (72%) patients [(unilateral in 35 (70 %) and bilateral 1 (2%)]. Concha bullosa was present in 24 (48%) patients which was unilateral in 19 (38%) and bilateral in 5 (10 %). Uncinate process was found rotated medially in 10 (20 %) patients and lateral rotation in 6 (12%). Paradoxical curvature of middle turbinate was seen in 12 (24%) patients which was unilateral in 8 (16%) and bilateral in 4 (8%). Haller's cell was seen in 4 (8%) which was unilateral in 3 (6%) and bilateral in 1 (2%) (Table 1).

On endoscopy, mucosal hypertrophy was seen most commonly in maxillary sinus (39, 78 %) patients, followed by anterior ethmoid sinus mucosal hypertrophy (27, 54%) patients while posterior ethmoids were involved in (20, 40 %), Frontal sinus mucosal hypertrophy was present in (12, 24%), Sphenoid sinus involvement was seen in (8, 16%) (Table 2). It was observed that anatomical variations were same as with CT scan except deviated nasal septum which is (78%) on endoscopy and (72%) on CT scan.

Table 1: Incidence of anatomical variations on CT scan

Anatomical variations	Total no. of patients (N, %)	Unilateral (N, %)	Bilateral (N, %)
Agger nasi cell	40 (80%)	9 (18%)	31 (62%)
Deviated nasal septum	36 (72%)	35 (70%)	1 (2%)
Concha bullosa	24 (48%)	19 (38%)	5 (10%)
Uncinate process variations	16 (32%)	16 (32%)	0 (0%)
Paradoxical middle turbinate	12 (24%)	8 (16%)	4 (8%)
Haller's cells	4 (8%)	3 (6%)	1 (2%)
Septal cells	1 (5%)	1 (5%)	0 (0%)
Multiseptate sphenoid	1 (5%)	1 (5%)	0 (0%)

Table 2: Incidence of mucosal hypertrophy on nasal endoscopy

Diseased area	Total no. of patients (N, %)	Unilateral (N, %)	Bilateral (N, %)
Maxillary sinus	39 (78%)	11 (22%)	28 (56%)
Anterior ethmoid	27 (54%)	12 (24%)	15 (30%)
Posterior ethmoid	20 (40%)	8 (16%)	12 (24%)
Frontal sinus	12 (24%)	10 (20%)	2 (4%)
Sphenoid sinus	8(16%)	5 (10%)	3 (6%)

DISCUSSION

Obstruction in the osteomeatal complex because of the anatomical variations or hypertrophied mucosa can cause pooling of secretions in the sinuses. Osteomeatal complex forms the pathway for drainage of sinuses. When the pathway is blocked due to anatomical variations or hypertrophied mucosa, the mucociliary mechanism is impaired and this leads to infection of the retained secretions and sinusitis. This occurs most commonly in middle meatus and ethmoidal infundibulum.[11]

There is decrease in drainage space of the osteomeatal complex due to deviated septum and spur. Incidence of deviated septum was seen in 72% of patients in our study. In previous study by SK Koo et al, it was found in 43.9% of patients.[12] 65.2 % patients by Gupta et al,[13] more than 55.7 % in study by Maru and Gupta,[14] and 44 % by Dua et al,[15] However, during endoscopy and FESS deviated nasal septum was present in 78% of patients. The mere presence of a septal deviation does not suggest pathology. However, a marked deviation can force the middle turbinate laterally, thus narrowing the osteomeatal complex.

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Concha bullosa was found by CT scan in 48% of cases (unilateral in 38% and bilateral in 10 %) and were confirmed intraoperatively in same number of patients. Concha Bullosa is a ballooned out middle turbinate due to pneumatization. The pneumatization can grow to such an extent that the bulging end of turbinate completely fills the space between the septum and lateral wall resulting in the blockade to the entrance to the middle meatus. The incidence of concha bullosa was comparable to reported incidence of 49.3 % by Fadda et al,[16] more as compared to 42.6 % by Maru and Gupta,[14] and less as compared 53.6 % by Bolger et al.[17]

Haller's cell were seen in 8% patients (unilateral 6% and bilateral 2%) in CT scans confirmed by nasal endoscopy. Haller's cells are ethmoid air cells that project beyond the limits of the ethmoid labyrinth into the maxillary sinus. They are considered as ethmoid cells that may grow into the floor of orbit and may narrow the adjacent ostium of maxillary sinus especially if they become infected. It was comparable to 3.62 % by Gupta et al,[13] but less than reported by Maru and Gupta,[14] 36 %.

Paradoxical curvature of middle turbinate was seen in 24% cases unilaterally in 16% and bilateral in 8%. This anomaly consists of a reversal of the normal outward concavity of middle turbinate. The inferior edge of middle turbinate may have various shapes which excessive curvature which in turn may obstruct the nasal cavity, infundibulum and the middle meatus. The incidence was comparable to Bolger et al,[17] (27 %) and Gupta et al,[13] (1.44 %) but less as compared to Tonai and Baba18 (29.8 %).

It was observed that while CT scan has got better diagnostic abilities to diagnose anatomical variations like multiseptate sphenoid, it is highly sensitive and over diagnose mucosal disease patterns, while nasal endoscopy is more sensitive to diagnose deviated nasal septum because of inability of CT to detect deviations of cartilaginous part of nasal septum.

CONCLUSION

CT (PNS) and nasal endoscopy were complementary to each other to see mucosal disease patterns and planning of management. Deviated nasal septum, Inferior turbinate hypertrophy and agger nasi cells were the common anatomical variations seen. Maxillary sinus was the commonest sinus affected. There was correlation between agger nasi and frontal cell with frontal sinusitis. There was no correlation between any other sinus infection with any anatomical variation. In view of the presence of these significant variations, we reemphasize the need for proper preoperative assessment in every patient in order to accomplish a safe and effective endoscopic sinus surgery.

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