Section: ENT

Original Research Article

STUDY THE IMPORTANCE OF PRE-OPERATIVE COMPUTED TOMOGRAPHY EVALUATION OF ANATOMICAL VARIANTS IN CHRONIC RHINOSINUSITIS

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ABSTRACT

Background: Anatomical variations studied on CT scan have been found to obstruct the osteomeatal complex (OMC), leading to chronic sinusitis. Detecting these variants and hence preventing potential hazards is essential and is an indication for endoscopic sinus surgery. The objective is to study the importance of pre-operative computed tomography evaluation of anatomical variants in chronic rhinosinusitis. **Materials and Methods:** This prospective study was conducted among 50 patients attending the ENT OPD at Vinayaka Missions Kirupananda Variyar Medical College & Research Institute, with symptoms and signs suggestive of Chronic Rhinosinusitis. Duration of study was July 2021 to July 2023. **Result:** Among 50 cases studied 58 %(29) of patients are male and 42 %(21) of patients are female, The most common age group to be between 21 – 25yrs. 44(88%) patients presented with nasal obstruction among which 20(45.4%) patients presented with bilateral nasal obstruction and 24(54.5%) presented with unilateral nasal obstruction. Concha bullosa is the most common anatomical variation of the osteomeatal complex , present in about 29 (58%) of patients. Of which unilateral presentation seen in 23(79.3%) and bilateral presentation seen in 6(20%) of patients. Among which 17(58.6%) patients are male and 12(41.4%) patients are female. Agger nasi seen in about 2(6%) patients. Of which unilateral presentation seen in 2(4%) patients. Among which 1(50%) are male and 1(50%) are female patients. Onodi cells seen in about 1(2%) patient which is of bilateral presentation. All 50 patients underwent endoscopic sinus surgery and they are followed up in 3 visits among them 45(90%) patients are relieved from symptoms postoperatively. For 2(4%) patients symptoms persists and about 3(6%) didn't come for follow up. **Conclusion:** Visualization of paranasal sinus anatomy is more improved by the use of computarized tomography para nasal sinus. It helps in evaluating the exact osteomeatal complex anatomy which is not possible to evaluate in plain radiographs.

INTRODUCTION

CT is currently the modality of choice in the evaluation of the paranasal sinuses and adjacent structures. Its ability to optimally display bone, soft tissue, and air provides an accurate picture of both the anatomy and the extent of disease in and around the paranasal sinuses. In contrast to standard radiographs, CT clearly shows the fine bony anatomy of the osteomeatal channels.

Performing the initial CT scan after an adequate course of medical therapy and pre-treatment with a sympathomimetic nasal spray 15 minutes prior to scanning in order to eliminate or diminish reversible mucosal inflammation and reduce nasal congestion (mucosal edema), improve the display of the fine bony architecture and any irreversible mucosal disease.

Since the osteomeatal unit (OMU) is best represented in the coronal plane, it is the primary imaging orientation for evaluation of the sinonasal tract. This can be accomplished by direct coronal scanning or by reformatting data acquired in the axial plane into coronal plane images. Coronal study is optimally performed with the patient in the prone position so that any remaining sinus secretions do not obscure the OMU. In patients who cannot tolerate prone positioning (children, patients of advanced age, etc.), the hanging head technique can sometimes be utilized. In this technique, the patient is placed in the supine position and the neck is maximally extended. A pillow placed under the

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patient's shoulders facilitates positioning. The CT gantry is then angled to be perpendicular to the hard palate. However, it is not always possible to obtain true direct coronal images with this technique.

When direct coronal study becomes difficult due to patient's positioning, spiral scanning or thin section, contiguous axial CT images with coronal reconstructions are performed. Axial images complement the coronal study, particularly when there is severe disease (opacification) of any of the paranasal sinuses and surgical treatment is contemplated. The axial studies are needed, as the posterior walls of the various sinuses are not well seen, if at all, in the coronal plane. Axial images are particularly important in visualizing the frontoethmoid junction and the sphenoethmoid recess. For the axial scans, which are 5 mm thick, the orbitomeatal line is taken as reference. The introduction of spiral CT and multidetector CT scanners has allowed even more refined reconstruction in planes other than the primary scan plane.

Computed tomography (CT scan) has now supplemented plain radiographs because endoscopic sinus surgery requires much greater anatomic detail and precision. The anatomy of the osteomeatal complex in detail as displayed by CT scan helps surgeons immensely prior to endoscopic sinus surgery, helping to identify the presence of significant anatomic abnormalities, the location and severity of the disease and the exact location of the obstruction. Imaging assessment must be based on identification of variants, definition of their dimensions, as well as on their association with obstruction of drainage ostia and tomographic signs of sinus disease.

Hence this study was conducted to study the importance of pre-operative computed tomography evaluation of anatomical variants in chronic rhinosinusitis.

MATERIALS AND METHODS

This prospective study was conducted among 50 patients attending the ENT OPD at Vinayaka Missions Kirupananda Variyar Medical College & Research Institute, with symptoms and signs suggestive of Chronic Rhinosinusitis. Duration of study was July 2021 to July 2023

Inclusion Criteria

1. Patients with complaints suggestive of chronic sinusitis including those with acute exacerbation of chronic sinusitis.
2. Patients who fulfill the criteria for chronic sinusitis clinically.

Exclusion Criteria

1. Patients with acute sinusitis
2. Patient with nasal mass or polyps
3. Patients who were previously operated

Methodology: Detailed history and clinical examination was done for all the 50 patients and a diagnosis of Chronic Rhinosinusitis was made and the findings were recorded on a proforma. After obtaining informed and written consent from the patients, plain radiographs of paranasal sinuses (Water's view) was taken and the patients underwent Diagnostic Nasal Endoscopy. Following this, CT scan Paranasal sinuses were taken, and blood investigations were sent. The patients were treated with antibiotics, antihistamines and topical nasal decongestants.

Anaesthetic fitness was obtained and the patients were subsequently taken up for Functional Endoscopic Sinus Surgery. Post-operatively, daily saline nasal douching and topical decongestant drops (0.1% Xylometazoline) were given to keep the nasal cavities clear and patent. Regular follow up was done upto 6 months and findings were recorded on the proforma.

The monitored parameters included clinical examination findings, X-ray Paranasal sinuses (Water's view), Diagnostic Nasal Endoscopy and CT scan Paranasal sinuses Coronal view findings.

Blood investigations: Preoperative blood investigations included estimation of Complete Blood Counts, Bleeding Time, Clotting Time, Random Blood Sugar, Blood Urea and Serum Creatinine.

Plain Radiograph Paranasal Sinuses (Water's View): This is performed with the patient seated facing the skull unit cassette holder and the patient's nose and chin are placed in contact with the midline. The head is adjusted to a 45 degree angle to the cassette holder. It is ensured that the median sagittal plane is at right angles to the cassette holder by checking that the outer canthi of eyes and external auditory maetuses are equidistant.

The patient should open his mouth as wide as possible before exposure.

Mucosal thickening of more than 5mm is taken as significant and turbinate hypertrophy is taken into account.

CT scan paranasal sinus:

Patient's preparation before CT scan:

- A course of antibiotics, nasal decongesants and antihistaminics given for a period of 4 weeks
- Nasal decongesants (xylometazoline) – 15 minutes prior to CT scan.
- Patient asked to blow the nose forcefully just prior to CT scan.

CT scan was performed in a Toshiba CT scanner in Department of Radiology MGMCR&I.

Direct coronal sections were done in all patients.

Limited axial scans parallel to the orbitomeatal line , with the patients in supine position, were also done whenever required.

All films are taken without contrast. No intravenous contrast was used.

Parameters:

- Patients position: prone with chin extended
- Gantry angulation: perpendicular to hard palate
- Section thickness: 4 mm
- Scan limits: from glabella to the dorsum sella.

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RESULTS

Among 50 cases studied 58 % (29) of patients are male and 42 % (21) of patients are female.

The demographic profile shows the most common age group to be between 21 – 25yrs.

[Figure 1] shows distribution of our study patients according to their symptoms. 44(88%) patients presented with nasal obstruction among which 20(45.4%) patients presented with bilateral nasal obstruction and 24(54.5%) presented with unilateral nasal obstruction.

45(90%) patients presented with nasal discharge. Among which 9(20%) patients having bilateral discharge and 36(80%) patient having unilateral discharge.

47(97%) patients presented with headache, 29(58%) presented with halithosis and 28(56%) patients presented with cough.

Concha bullosa is the most common anatomical variation of the osteomeatal complex, present in about 29 (58%) of patients. Of which unilateral presentation seen in 23(79.3%) and bilateral presentation seen in 6(20%) of patients. Among which 17(58.6%) patients are male and 12(41.4%) patients are female.

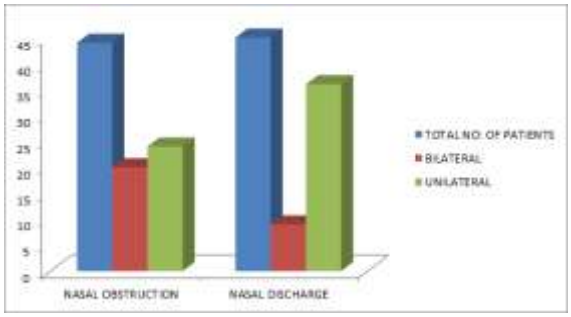

Figure 1: symptoms.

Table 1: Sex Distribution

Sex	Total no of patients
Male	29(58%)
Female	21(42%)

Table 2: Age Distribution

Age Distribution (years)	No. of Patients	Percentage (%)
15–20	2	4%
21–25	15	30%
26–30	11	22%
31–35	8	16%
36–40	6	12%
41–45	5	10%
46–50	2	4%
51–55	1	2%

Table 3: Medialized Uncinate

Medialized uncinate	Right	Left	Bilateral	Total
Male	3	2	2	7
Female	2	1	1	4

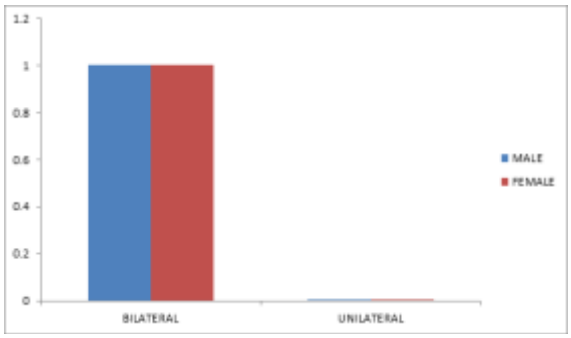

Figure 2: AGGAR NASI

Our next common anatomical variation medialized uncinate present in 11(22%) patients. Of which unilateral presentation seen in 8(72.7%) patients and bilateral presentation seen in 3(27.2%) patients. Among which 7(63.6%) patients are male and 4(36.3%) of patients are female.

Paradoxical middle turbinate comes next seen in about 6(12%) patients. Of which unilateral presentation seen in 5(83.3%) patients and bilateral presentation seen in 1(16.6%) patients. among which 4(66.6%) patients are male and 2(33.4%) patients are female.

Agger nasi seen in about 2(6%) patients. Of which unilateral presentation seen in 2(4%) patients. Among which 1(50%) are male and 1(50%) are female patients.

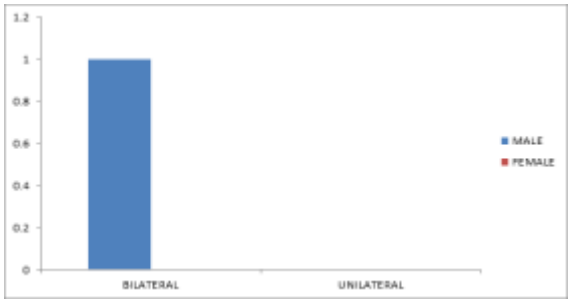

Figure 3: Haller Cells

Haller cells seen in about 1(2%) patients which is of bilateral presentation.

Onodi cells seen in about 1(2%) patient which is of bilateral presentation.

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According to CT SCAN findings 34(68%) patints are having maxillary sinusitis, 10(20%) Patients are having ethmoidal sinusitis, 5(10%) patients are having frontal sinusitis and 1(2%) patient is having sphenoidal sinusitis.

Table 4: CT Findings

	No of patients	Percentage (%)
Maxillary sinusitis	34	(68%)
Ethmoidal	10	(20%)
Frontal sinusitis	5	(10%)
Sphenoid	1	(2%)

DISCUSSION

Stenosis of the osteomeatal complex, either due to the anatomical configuration or due to hypertrophied mucosa, may cause obstruction and hence, stagnation of secretions that may thereby, become infected or perpetuate infection.[1,2]

The osteomeatal complex acts as a drainage pathway for the maxillary, anterior ethmoid and frontal sinuses. They considered the posterior osteomeatal unit to be a part of the sphenoid sinus. In various regions of the osteomeatal complex, overcrowding due to anatomical variation occurs, and thus, two mucosal layers come into contact with each other, thus increasing the likelihood of obstruction to mucociliary clearance. Thus, secretions may then be retained at these sites, producing increased potential for infection, even without ostial closure. The most likely areas of mucosal contact anatomically are in the narrow mucosa lined channels of the middle meatus and the ethmoidal infundibulum.[3]

Concha bullosa (pneumatised middle turbinate) is noted as the possible aetiological factor in the causation of chronic sinusitis. It is due to its negative influence on paranasal sinus ventilation and mucociliary clearance in the middle meatus region as quoted by Tonai.[4] The incidence of concha bullosa was 58 %, which is higher as compared to the reported incidence of 24% by Llyod.5 and 42.6% by Maru et al.[5,6]

The middle turbinate may be paradoxically curved (i.e) bent in the reverse direction. Which may lead to the obstruction of the middle meatus and thus to sinusitis. It was found in 12 % in our study. The incidence is same to that of 12% by Asruddin et al.[7]

Uncinate process may be bent or curved as observed by zinreich. Which can lead to impairment of sinus ventilation especially in the frontal recess, anterior ethmoid, and infundibulum regions. The medialised uncinate was found in 22 % patients in our study. It is higher than that of 9.8% by Maru et al.[6]

Onodi cells are posterior ethmoid cells that extend laterally, posteriorly, and rarely superior to sphenoid sinus, medially lying to the optic nerve. onodi cells are found in 2 % of patients in our study. More higher incidence was found by Arslan in 12/200 patients and higher than the study by Jones in 8/ 200 patients.[8]

Haller cells are ethmoid air cells that extends beyond the limits of the ethmoid labyrinth into the maxillary sinus. Haller cells are considered as ethmoid cells that extends into the floor of orbit and which causes narrowing of the adjacent ostium of the maxillary sinus mostly if they become infected.[5]

The incidence of Haller cells in our study was 2%. It was less than that reported by Maru 36%, and Llyod 15%.

The osteomeatal unit was found to be involved in all the patients in our study. Maxillary sinus is the most common sinus involved in chronic sinusitis in our study. Zinreich et al 9 noted middle meatus opacification in 72% of the patients with chronic sinusitis, and of these patients 65% had mucoperiosteal sinus thickening of maxillary region. According to Yousem et al when the meatus was opacified, the ethmoid sinuses and maxillary shows inflammatory changes in82% and 84% respectively. Another study shows frontal or maxillary sinus disease in 84% patients having OMC opacification.[10] Thus these findings support the contention that the anatomical variation in osteomeatal complex will lead to obstruction of the narrow drainage pathways, which in turn lead to subsequent sinus inflammation.

The evidence found in several studies following the outcomes of endoscopic sinus surgery supports an improvement in the quality of life in most patients post operatively. In our study 90% of patients show symptomatic relief. Whereas study conducted by Gliklich and Metson,[11] shows symptomatic relief in about 82% of patients. Welch and Stankiewicz58 shows symptomatic relief in about 85% of patients. Lazar and colleagues found improvement in 80% of adult patients.

CONCLUSION

Anatomical variations found on the computarized tomography scan leads to impaired drainage of paranasal sinuses by blocking the osteomeatal complex and thus causing chronic sinusitis. Visualization of paranasal sinus anatomy is more improved by the use of computarized tomography para nasal sinus. It helps in evaluating the exact osteomeatal complex anatomy which is not possible to evaluate in plain radiographs.

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