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A PROSPECTIVE STUDY OF ANATOMICAL VARIATION OF OSTEO MEATAL COMPLEX IN CHRONIC SINUSITIS PATIENTS

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Aims: To study the incidence of anatomical variations of osteo meatal complex common in chronic sinusitis patients.

Materials and methods: This is a Prospective Study in patients attending to ENT op, who had symptoms of Chronic rhinosinusitis, who are not responding to medical management . A total number of 50 patients who had clinical symptoms suggestive of Chronic rhinosinusitis, sent for evaluation following a standard proforma and the patients are examined with standard diagnostic procedures systematically and when needed. Details of patients regarding were recorded.

Results: All patients have at least one variation from normal anatomy.88%patients had more than one anatomical variation and the remaining 12% had one anatomical variation. About 68%of patients had bilateral involvement.Nasal septal deviation is the commonest anatomic variation and onodi cell, pneumatised septum are the least variants. Also there were a strong correlation between the unilateral concha bullosa and contra lateral septal deviation, which was evident based on studies. Concha bullosa, bulla ethmoidalis and septal deviation account for more than 90% of all the anatomical variations.

Conclusions: By evaluating anatomical variations prior to surgery, we may both assure that the condition is completely cleared up and avoid unintended problems during surgery.

Keywords: Nasal septal deviation, Concha bullosa, Bulla ethmoidalis

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INTRODUCTION

Sinusitis is one of the major health care problems now-a-days, increasing in both incidence and prevalence. Several articles were published regarding etiopathogenesis, microbiology, anatomical variations and management aspects. American Academy of Otorhinolaryngology Head and Neck Surgery formulated certain working definitions. Clinically, Sinusitis is a condition manifested by an inflammatory response of mucous membrane of the nasal cavity and para nasal sinuses, fluid within the cavity, and / or underlying bone. Also defined as group of disorders characterized by inflammation of mucosa of the nose and para nasal sinuses lasting for more than 12 weeks.At present diagnostic nasal endoscopic evaluation of nose and para nasal sinuses is a routine component for evaluating patients with evidence of suspected nose and para nasal sinus disease. Arrival of the endoscopes has helped us to recognize the pathologies which are hidden from the naked eye or even from inspection under microscopes. With this, provisional diagnosis may be confirmed, expanded or revised. It also helps the Otorhinolaryngologist in deciding the mode of treatment. All the patients who have significant findings in diagnostic nasal endoscopy are subjected to CT Scan of Para nasal sinus evaluation. [1]

Except in cases of complications or failure to respond to medical management, a CT of the paranasal sinuses is not frequently recommended in patients with clinical features of acute sinusitis. Before performing sinus surgery, a CT scan of the paranasal sinus is essential, regardless of the diagnosis. This is done to prevent unintentional complications during surgery. Patients who had persistent sinusitis symptoms for more than 12 weeks and those in whom improvement is not seen with medical treatment should have computed tomography.

Given that the history and clinical indicators suggest the presence of any disease, we do computed tomography even if the diagnostic nasal endoscopic result is negligible, because a number of lateral nasal wall disorders cannot be recognised and detected by endoscope. Due to the narrowing of the para nasal sinuses drainage pathway, which results in the stagnation of secretions, infection, and inflammation of the mucosa lining the sinuses, the anatomical variations of the lateral nasal wall and para nasal sinuses are significant from a surgical and pathophysiological standpoint. Diseases in severely pneumatized sinuses expose vital structures, such as optic nerve and internal carotid artery, to infection and inflammation. They also raise risk of complications following surgery.

Consequently, in order to assess the detailed anatomy (normal anatomy, anatomical variation, and the extent of disease process, that are frequently observed in the osteo meatal complex and lateral nasal wall in general, endoscopic evaluation and CT Scan evaluation of the nose and Para nasal sinuses are mandatory in patients with chronic sinusitis. This will assist the endoscopic surgeon with preoperative evaluation and surgery planning, complete disease elimination, and a reduction in intraoperative and postoperative problems.

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METHODOLOGY

This is a Prospective Studyin patients attending to ENT op, who had symptoms of Chronic rhinosinusitis, who are not responding to medical management at Government General Hospital, Guntur, between April 2021 to December 2022. A total number of 50 patients who had clinical symptoms suggestive of Chronic rhinosinusitis, sent for evaluation following a standard proforma and the patients are examined with standard diagnostic procedures systematically and when needed.

Inclusion Criteria: Male and Female patients of age up to 10-60 years of age patients who have chronic rhinosinusitis, and not responding to medical treatment for more than 12 weeks.

Exclusion Criteria: patients with an acute attack of sinusitis, sinus malignancies, which are confirmed with histopathology.

Patients attending ENT op at Government General Hospital, Guntur, clinically diagnosed as having chronic rhinosinusitis are taken as sample. Details of patients regarding age, sex, presenting features, medical history and history of relevant medical conditions, such as Diabetes mellitus, Hypertension, Renal disease, Coronary artery disease and Cerebrovascular diseases were recorded.
Clinical examination of the patient, including a detailed general physical examination should be done. The patient is subjected to specified lab investigations which include CBP, platelet count, Bleeding time, clotting time, Blood sugar levels, Lipid profile and ECG. Each patient should undergo Anterior rhinoscopy, posterior rhinoscopy, clinical examination of paranasal sinuses, Diagnostic nasal endoscopy and CT PNS.

RESULTS

This study is a prospective analysis of anatomical variations of osteo meatal complex that were commonly encountered in 50 chronic sinusitis patients, by doing endoscopic evaluation and CT scan of the nose and paranasal sinuses.

The Demographic cycle shows that, the common age group to be between 40 to 50 yrs. Among the 50 cases studied 60% (30) of the patients are male and 40% (20) are females.

Table-1: Anatomical Variations present in study

Anatomical Variation	Male	Female	Total
Single	7	3	10
Multiple	25	15	40
Deviated nasal septum	20	17	37
Concha bullosa	20	14	34
Bulla ethmoidalis	18	12	30
Agger nasi cell	14	11	25
Paradoxical middle turbinate	11	12	23

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Medialized uncinate process	6	4	10
Haller cell	1	2	3
Onodi cell	2	0	2
Pneumatized septum	2	1	3

The majority of patients in the current study had more than one anatomical variations. Out of the 50 patients studied, 80% (40) had more than one anatomical variation, of these 62.5% (25) were males and 37.5% (15) are females. Only minor group of patients presented with single anatomical variation 20% (10). In my study, all the patients are having at least one anatomical variation. Anatomical variations may present either unilaterally or bilaterally. In my study76% (38) patients out 50 patients had bilateral anatomical variation. Only 24% (12) patients had unilateral disease.

Table-2: Side of Anatomical Variation in present study

	Right	**Left**	**Bi-lateral**	**Total**
Deviated nasal septum				
Male	12	8	-	20
Female	13	4	-	17
Concha Bullosa				
Male	7	3	9	19
Female	5	4	6	15
Paradoxical MT				
Male	3	4	6	13
Female	3	3	4	10
Agger nasi				
Male	5	3	6	14
Female	4	3	4	11
Bulla ethmoidalis				
Male	6	6	4	16
Female	4	7	3	14
Medialised Uncinate Process				
Male	2	2	1	5
Female	1	2	2	5
Haller cells				
Male	1	1	0	2
Female	1	0	0	1
Onodi cells				
Male	0	2	0	2
Female	0	0	0	0

Most common anatomical variation of OMC per se is Concha bullosa, which is present in about 34 (68%) patients. Of which unilateral presentation is 19 (55.9%) and bilateral

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presentation 15 (44.1%). Of the unilateral presentation, right side is more common 12 patients and left side 7 patients.

Next common anatomical variation was Bulla ethmoidalis seen in about 30(60%) of the patients, pf which unilateral presentation is more common 23 (76.7%) patients bilateral presentation is 7 (23.3%). Of the unilateral presentation, left sided bulla is present in 13 patients and right sided bulla is present in 10 patients.

Agger nasi comes next seen in about 50% of patients (25). of which unilateral presentation is 15 (60%) and bilateral is 10 (40%). Of the unilateral presentation, right side is more common in 9 patients and left side is present in 6 patients.

Deviated nasal septum though it is not a part of OMC, contributes to anatomical crowding of OMC area. DNS was present in about 74% (37) patients, of which right side deviation is more common about 25 and left deviation in 12 patients.

Paradoxical middle turbinate present in 46% (23) patients, of which unilateral is 13 (56.5%) bilateral in 10 (43.5%) right side PMT is more and seen in 8 patients.

Medialised Uncinate process presented in 20% (10) of the patients, of which unilateral presentation is more common 7 patients.

Frontal cell presented in 18% (9) patients, of which unilateral presentation is more common about 5 patients. Haller cell was noted in 6% (3) of patients, of which all are presented unilaterally. Onodi cell presented in 4% (2) of patients, of which all presented with unilateral presentation.

Table-3: Most common sinus involvement

SINUS involved	**Anatomical variation commonly associated with it**
Maxillary sinus	Concha bullosa
Frontal sinus	Agger nasi cells
Anterior ethmoid cells	Concha bullosa
Posterior ethmoid cells	Septal deviation
Sphenoid sinus	Onodi cell

DISCUSSION

This study was conducted on 50 patients who came to ENT OPD during the above said time period with Chronic sinusitis without any comorbidities. Studies proposed that the Osteo meatal complex can become obstructed, due to anatomical variations or oedematous mucosa, which can impede and stagnate secretions and increase the risk of infection. According to Mackay and Lund[2], Maxillary, anterior ethmoids and frontal sinuses will be drained into

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anterior osteo meatal complex. Posterior osteo meatal unit was considered as part of the sphenoid sinus. In several areas of the osteo meatal complex overcrowding due to anatomical variation, two mucosal layers in close proximity to one another raise the possibility of localised muco ciliary clearance impairment. Even without ostia closure, secretions may then be retained at the region, enhancing the risk of infection. Anatomically, the most likely areas of mucosal contact are in the narrow mucosa lined channels of middle meatus and ethmoidal infundibulum.

In our study, a total number of 50 patients between age of 10 to 60 years who came with clinical features of chronic rhino sinusitis without any comorbidities have taken into the study. Seniappan S, et al[3] conducted a study on chronic sinusitis patients, of age between 17 to 50 years with the mean age of 32.2 years participated in this study. Chauhan, et al.[4] conducted a study on patients above age of 18 years, with the mean age 50.07 years. In a study conducted by Narendra kumar and Subramanian,[5] patients of age between 17 to 66 years with chronic rhino sinusitis were considered in this study. Tiwari and Goyal[6] studied on 85 patients of age more than 21 years.

In our study, out of 50 patients studied, 30 were male patients while 20 were females, with Sex ratio 1.5:1. Male preponderance is more than female patients.In a study by Seniappan S, et al.[3], out of 138 patients, 72 patients were males and 66 were females with sex ratio 1.09:1. In a study by Chauhan, et al[4]., out of 61 patients, 38 patients were males while 23 patients were females, with sex ratio of 1.65:1. Out of 100 patients, in a study conducted by Narendrakumar and Subramanian[5], 57 patients were male patients while 43 patients were females with sex ratio of 1.32:1. In a study by Tiwari and Goyal, out of 85 patients, 58 were males while 27 were female patients, with sex ratio of 2.14:1

In our study, out of 50 patients studied, 37 patients (74%) had deviated nasal septum. In a study done by Seniappan S, et al.[3], 98 patients (71%) out of a total number of 138patients had nasal septum deviation. Chauhan, et al[4]. done a study on 61 patients out of which 34 patients (77%) had deviated nasal septum. Out of100 patients who participated in a study done by Narendrakumar and Subramanian,[5] 76 patients had nasal septum deviation. A study done by Tiwari and Goyal [6]on 85 patients, the commonest anatomical variation found was nasal septum deviation, which was seen in 75 patients (88.2%).

Table-4: Comparision of patient details with other studies

Age Distribution (Mean)	**Results**
Seniappan S, et al. [3]	17 – 50 years (32.2)
Chauhan, et al. [4]	>18 years (50.07)
Narendrakumar& Subramanian [5]	17 – 66 years
Tiwari & Goyal [6]	21 - >50 years
Present study	20 – 60 years
Sex Distribution	

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Seniappan S, et al. [3]	1.09:1
Chauhan, et al. [4]	1.65:1
Narendrakumar& Subramanian [5]	1.32:1
Tiwari & Goyal [6]	2.14:1
Present study	1.5:1
Patients having DNS (%)	
Seniappan S, et al. [3]	98 (71%)
Chauhan, et al. [4]	34(77%)
Narendrakumar& Subramanian [5]	76 (76%)
Tiwari & Goyal [6]	75(88.2%)
Present study	37 (74%)
Concha Bullosa (%)	
Seniappan S, et al. [3]	79 (57.2%)
Chauhan, et al. [4]	36 (59.01%)
Narendrakumar& Subramanian [5]	61 (61%)
Tiwari & Goyal [6]	65 (76.4%)
Present study	34 (64%)
Bulla Ethmoidalis(%)	
Seniappan S, et al. [3]	65 (47%)
Chauhan, et al. [4]	16 (26.2)
Narendrakumar& Subramanian [5]	41 (41%)
Tiwari & Goyal [6]	54 (63.5)
Present study	30 (60%)
Agger Nasi (%)	
Seniappan S, et al. [3]	86 (62.3%)
Chauhan, et al. [4]	31 (50.8%)
Narendrakumar& Subramanian [5]	71 (71%)
Tiwari & Goyal [6]	6 (7%)
Present study	25 (50%)
Paradoxical middle turbinate(%)	
Seniappan S, et al. [3]	63 (45.6%)
Chauhan, et al. [4]	6 (9.83%)
Narendrakumar& Subramanian [5]	33 (33%)
Tiwari & Goyal [6]	9 (10.58%)
Present study	23 (46%)
Medialized uncinate process(%)	
Seniappan S, et al. [3]	36 (26%)
Chauhan, et al. [4]	0

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Narendrakumar& Subramanian [5]	48 (48%)
Tiwari & Goyal [6]	9 (10.5%)
Present study	10 (20%)
Haller cells(%)	
Seniappan S, et al. [3]	6 (4.3%)
Chauhan, et al. [4]	4 (65.5%)
Narendrakumar& Subramanian [5]	12 (12%)
Tiwari & Goyal [6]	3 (3.5%)
Present study	3 (6%)
Onodi cell	
Seniappan S, et al. [3]	12 (8.6%)
Chauhan, et al. [4]	7 (11.47%)
Narendrakumar& Subramanian [5]	7 (7%)
Tiwari & Goyal [6]	1 (1.6%)
Present study	2 (4%)
Pneumatized septum	
Seniappan S, et al. [3]	36 (26%)
Tiwari & Goyal [6]	7 (8.2%)
Present study	10(20%)

In our study, out of 50 patients studied, 34(68%) patients were found to have concha bullosa. In the study done by Seniappan S, et al.[3], out of 138 patients, 79 (57.2%) patients were found to have Concha bullosa. In a study done by Chauhan, et al.[4], out of 61 patients, 36 patients (59.01%) had concha bullosa. Out of 100 patients who underwent the study conducted by Narendrakumar and Subramanian[5], 61 patients were having concha bullosa. In a study done Tiwari and Goyal,[6] out of 85 patients, 65 patients had concha bullosa.

In our study, 30 (60%) patients out of50 patients, were found to have bulla ethmoidalis. In the study done by Seniappan S, et al.[3], 65 patients (47%) out of 138 patients were found to have bulla ethmoidalis. Chauhan, et al[4]. done a study on 16 patients out of which 34 patients (26.2%) had bulla ethmoidalis. Out of a total number of 100 patients, who participated in a study done by Narendrakumar and Subramanian[5], 41 patients had bulla ethmoidalis. In a study carried by Tiwari and Goyal[6] on 85 patients, 54 patients were having bulla ethmoidalis. (63.5%).

In our study, out of 50 patients studied, 25 (50%) patients were found to have agger nasi . In the study done by Seniappan S, et al.[3], out of 138 patients, 86 (62.3%) patients were found to have agger nasi. In the study done by Chauhan, et al.[4], out of 61 patients, 31 patients (50.8%) had agger nasi A study done by Narendrakumar and Subramanian[5], 100 patients took part in

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the study, and agger nasi was seen in 71 patients. In a study done by Tiwari and Goyal, out of 85 patients, 6 (7%) patients had agger nasi.

In our study, 23 (46%) patients out of a total 50 patients were found to have paradoxical middle turbinate. In a study done by Seniappan S, et al.[3], 63 (45.6%) patients out of 138 patients had paradoxical middle turbinate. Chauhan, et al. done a study on 6 (9.83%) patients out of which 34 patients had paradoxical middle turbinate. Out of100 patients who participated in a study done by Narendrakumar and Subramanian,[5] 33 patients were having paradoxical middle turbinate. In the study done by Tiwari and Goyal[6] on 85 patients, 9 (10.58%) patients were having paradoxical middle turbinate.

In our study, out of 50 patients studied, 10 (20%) patients found to have medialized uncinate process. In the study done by Seniappan S, et al[3], out of 138 patients, 36 (26%) patients were found to have medialized uncinate process. In the study done by Chauhan, et al., out of 61 patients, not even a single patient had medialized uncinate process. 100 patients took part in the study done by Narendrakumar and Subramanian[5], medialized uncinate process was seen in 48 patients. In a study done by Tiwari and Goyal, out of 85 patients, 9 (10.58%) patients had medialized uncinate process.

In the present study, 3 (6%) patients out of a total number of 50 patients found to have Haller cells. In the study done by Seniappan S, et al.,[3] 6 (4.3%) patients out of a total of 138 found to have Haller cells. Chauhan, et al[4]. conducted a study on 34 patients out of which, 4 (65.5%) patients had Haller cells. Out of100 patients who participated in a study done by Narendrakumar and Subramanian[5], 12 patients had Haller cells. In the study conducted by Tiwari and Goyal[6] on 85 patients, Haller cells was seen in 3 (3.5%) patients. while Dutra et al,[7]Fadda et al [8]and Krzeski. [9]

In the present study, out of 50 patients studied, 2 (4%) patients were found to have onodi cell. In the study conducted by Seniappan S, et al[3]., out of 138 patients, 12 (8.6%) patients were found to have onodi cell. In the study conducted by Chauhan, et al., out of 61 patients, 7 (11.47%) patients had onodi cell. Out of 100 patients who participated in the study conducted by Narendrakumar and Subramanian,[5]onodi cell was seen in 7 patients. In a study conducted by Tiwari and Goyal, out of 85 patients, 1 (1.6%) patients had onodi cell.

In the present study, out of 50 patients studied, 10 (20%) patients found to have pneumatized septum. In the study done by Seniappan S, et al[3]., out of 138 patients, 36 (26%) patients found to have pneumatized septum. In a study done by Tiwari and Goyal[6], out of 85 patients, 7 (8.2%) patients had pneumatized septum. Pneumatized uncinate process was seen in 5% in our study consistent with Perez et al,[10] 4% cases and Fadda et al, [8] 2.8% of patients.

In our study, out of 50 patients, Maxillary 45 (90%) was the most commonly affected sinus, followed by the anterior ethmoid38(76%), posterior ethmoid sinus 34(68%), frontal sinus in 28(56%) patients and the least was sphenoid sinus 15(30%). Kim et al[11] showed that

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maxillary sinus was the most common sinus involved. In the study done by Seniappan S et al[3], out of 138 patients studied, maximum number of patients had Maxillary sinusitis 80(91.9), anterior ethmoid sinus in 64(84.2), frontal sinus in 61(84.7), posterior ethmoid sinus 56(86.1) followed by sphenoid sinus 20(66.6). In the study conducted by Chauhan, et al.[4] out of a total 61 patients, maximum no of patients had Maxillary (95%) followed by anterior ethmoid sinusitis (67.2%), frontal sinusitis (60.6%), posterior ethmoid sinusitis (59.01%), sphenoid sinusitis (45.9%). Shankar D et al[12]. conducted a study on 100 patients of chronic rhinosinusitis in which most common sinuses involved was maxillary sinuses. The second most common was frontal (28.0%) followed by anterior ethmoid (27.0%) and posterior ethmoid (20.0%). Sphenoid (9.0%) was the least commonly involved sinus.

Table-5: Most common sinuses involved in comparision with other studies

Study	**Most common sinuses involved**
Chauhan, et al. [4]	Maxillary (95%) > anterior ethmoid sinus (67.2%) > frontal sinus (60.6%) > posterior ethmoid sinus (59.01%) > sphenoid sinus (45.9%)
Shankar D, et al. [12]	maxillary sinusitis (60.0%) > frontal (28.0%)>anterior ethmoid (27.0%)>posterior ethmoid (20.0%) >sphenoid (9.0%)
Seniappan S et al [3]	Maxillary sinus80(91.9)> anterior ethmoid sinus 64(84.2)> frontal sinus 61(84.7)> posterior ethmoid sinus 56(86.1)> sphenoid sinus 20(66.6).
Present study	Maxillary sinus 45(90%)> anterior ethmoid sinus 38(76%)> posterior ethmoid sinus 34(68%)> frontal sinus 28(56%)> sphenoid sinus 15(30%).

CONCLUSION

Computed tomography of paranasal air sinuses has improved the visualization of anatomy of sinuses and allowed greater accuracy in evaluating para nasal sinus disease. It evaluates the anatomy of osteo meatal complex which is not possible to such an extent with plain radiographs. On a CT scan, anatomical variations can be identified, that obstruct the osteo meatal complex, resulting in poor drainage of para nasal sinuses which are causing chronic sinusitis. The present prospective study of osteo meatal complex, anatomical variations reveal many parameters as More than one anatomical variation is frequently encountered in patients with chronic rhino sinusitis who have osteo meatal complex abnormalities and are not responsive to medical therapy. Majority of the variations were caused by ethmoid sinus air cells. By evaluating anatomical variations prior to surgery, we may both assure that the condition is completely cleared up and avoid unintended problems during surgery.

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