

A STUDY OF ANATOMICAL VARIATIONS OF OSTEOMEATAL COMPLEX IN CHRONIC RHINOSINUSITIS PATIENTS: TOMOGRAPHIC FINDINGS

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Conflict of interest: Nil

Abstract

Background: The osteomeatal complex (OMC) is a common channel that links the frontal sinus, anterior ethmoid air cells and the maxillary sinus to the middle meatus, allowing airflow and mucociliary drainage. Anatomical variations of it can cause obstruction and allow the occurrence of rhinosinusitis (CRS) and have an imperative role in surgical treatments. Knowledge of its variations is very important for radiologists as well as endoscopic sinus surgeons for preoperative evaluation to avoid damage to adjacent vital structures. The purpose of this study was to find the incidence of anatomical variations in the OMC among CRS patients. **Methods:** This present study titled was conducted in the Department of head neck surgery, Boarder guard hospital, Dhaka from April 2019 to April 2021. A total of 140 patients with chronic sinusitis not responding to the medical treatment and who were willing to undergo Endoscopic Sinus Surgery were included in his study. **Results:** In the present study single or more types of anatomical variations were observed 135 (96.42%) patients. Among the various types of anatomical variations were observed Deviated nasal septum was found to be the most common in 106 (75.71%), followed by Inferior turbinate hypertrophy in 64(45.71%) and Concha bullosa in 54 (38.57%) patients. Other anatomical variation including variation of Uncinate process, Agar nasi cell, Onodi cell, presence of Haller cell are less common. **Conclusion:** There are many variations in the anatomy of the osteomeatal complex. The presence of these may predispose to sinus pathology and increased risk of intra-operative complications. It is important to pay close attention to anatomical variations in the preoperative evaluation to avoid possible complications.

Keywords: Anatomic Variation, Paranasal Sinus, Computed Tomography.

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Introduction

The Osteomeatal Complex (OMC) is the functional unit of the anterior ethmoid complex, which includes ostium, infundibulum, uncinate process, hiatus semilunaris, ethmoidal bulla and middle meatus [1]. Basically OMC is the usual pathway for drainage and ventilation of the frontal, maxillary and anterior ethmoid sinuses. The health and normal function of nose and paranasal sinuses and their lining mucus membranes depends primarily on two important factors: ventilation and drainage. Normal ventilation of the paranasal sinuses requires both a patent sinus ostium and a patent pathway connecting the ostium to the nasal cavity [2]. There are many anatomical variations which cause problems in drainage pathway and reduced ciliary activity. Septal deviation is one of them and represents a divergence of septum from midline which could be C or S shape and associated with multiple deformities of lateral nasal wall. Pneumatized cavity within a nasal concha or Concha Bullosa may cause mucosal thickening, polyp formation, mucous retention cyst, empyema and pyocele formation. When middle turbinate shows concavity towards septum it's known as paradoxical curvature of middle turbinate, it may lead to polyp formation and mucosal changes. Uncinate process shows various anatomical variations, most commonly encountered is marked medial curvature, which causes significantly narrowing of the hiatus semilunaris. Other variations includes secondary middle turbinate, turbinate to turbinate attachment, Haller's cell, agger nasi

cells, onodi cells, aerated crista galli, asymmetry of ethmoid roof and hypoplasia of frontal sinus [5]. These variations may cause problems in drainage pathway, reduced ciliary activity and lead to decreased oxygen and increased carbon dioxide concentrations. It is followed by epithelial dysfunction, which predisposes to infections causing edema and mucosal hypertrophy of OMC, with deterioration in sinus ventilation, drainage and increase the risk for chronic rhinosinusitis (CRS) [6,7]. The presence of anatomic variants of the OMC is a common finding and may occur in a population ranging from 67% to 83.5%, with the highest degree of variability seen for the nasal septum followed by the middle nasal concha, uncinate process and other sites [7]. Currently, computed tomography of the paranasal sinuses (PNS) is the method of choice for assessment of paranasal sinuses, nasal fossae, their anatomical variants and sinus diseases [10, 8]. Compare to plain radiography, sinus CT is best to know about anatomical soft tissue and bony details, which helps in the diagnosis, and provides detail of sinonasal anatomy and pathology for safe surgery [8]. Surgical clearance of these chronically infected sinuses while maintaining their ventilation and drainage is the treatment of choice [9]. A fundamental knowledge of the paranasal sinus anatomy is essential not only for the diagnosis of CRS but also for the preoperative planning prior to sinus surgery. However, orientation of the paranasal sinus still remains a challenge among otolaryngologists owing to the anatomic variations and diversity of

prevalence among different ethnicity [11]. This study was designed to find the incidence of Anatomical abnormalities in the osteomeatal complex among chronic rhinosinusitis patients.

II Material and Methods

This present study titled “A Study of Anatomical Variations of Osteomeatal Complex in Chronic Rhinosinusitis Patients: Tomographic Findings” was conducted in the Department of head neck surgery, Boarder guard hospital, Dhaka from April 2019 to April 2021. A total of 140 patients attending the department of head neck surgery, who had chronic sinusitis not responding to the medical treatment and who were willing to undergo Endoscopic Sinus Surgery and with no previous history of surgery were included in his study.

Patients with malignancy, pregnancy, polyps, surgical or traumatic history in nasosinusal region, facial disturbances, acute infections, fungal sinusitis, kartageners syndrome, down syndrome and cystic fibrosis and did not give consent were excluded from the study. As per

the protocol, chronic sinusitis was defined as nasal blockade anterior nasal discharge, post nasal drip, headache or facial pain, these patient were refractory to medical treatment for more than 3 month duration. All the patients were underwent to detailed clinical examination, routine investigation & subsequently for CT scan of PNS in axial, sagittal and coronal plane. Each scan was reviewed for the presence of haller cell, onodi cell, paradoxical middle turbinate, deviated nasal septum (DNS), pneumatization in the nasal septum, superior and middle turbinate and uncinat process.

III Results

Of the 140 cases studied, 81 (57.85%) were male and 59 (42.14%) were female and between the ages of 18 and 70 years. In the present study, we have found that there was no anatomical variation detected in 05 (3.57%) patients, single anatomical variation was found in 18 (12.85%) patients, two anatomical variations in 34 (24.28%) patients and three or more anatomical variations in the remaining 83 (59.28%) patients (Table-I).

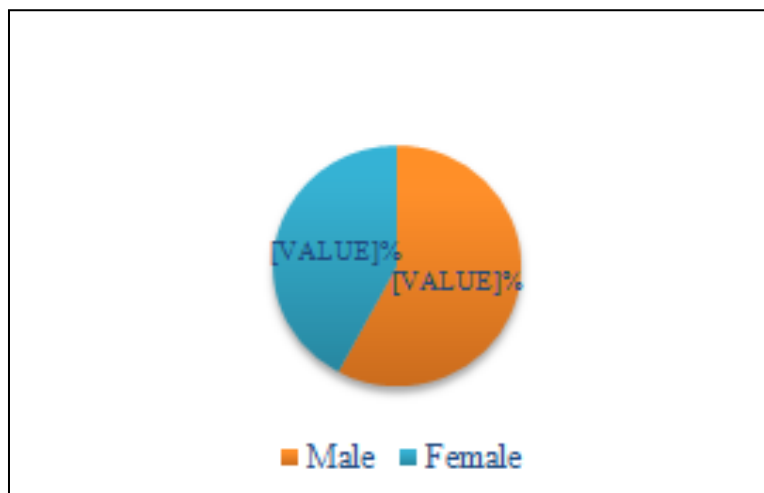


Figure.-I: Sex distribution of patients.

Table-I: Number of variation in a single image patients.

Number of variation in a single image	Number of case	percentage
No anatomical variation	05	3.57%
Single anatomical variation	18	12.85%
Two anatomical variations	34	24.28%
Three or more anatomical variations	83	59.28%

Among the cases, bilateral osteomeatal complex abnormality was seen in 79 (56.42 %) and unilateral abnormality was in 61 (43.57 %) patients (Table-II).

Table-II: Distribution of patients according to osteomeatal complex abnormality.

Type of Variations	No of Patients	Percentage
Unilateral	61	43.57 %
Bilateral	79	56.42 %

In the table – III, we showed the distribution of patients according to anatomical variations. In the present study Deviated nasal septum was found to be the most common anatomical variation 106 (75.71%) followed by Inferior turbinate hypertrophy 64(45.71%), Concha

bullosa 54 (38.57%), Septal spur 48 (34.28%), retention cyst 43 (30.71%), AggerNasi cells 33 (23.57%) and Paradoxical Middle Turbinate 31(22.14%). Uncinate hypertrophy was found in lowest 19 (13.57 %) patients.

Table- III: Distribution of patients according to anatomical variations.

Anatomical variations	Number	Percentage
Deviated nasal septum (DNS)	106	75.71
Inferior turbinate hypertrophy	64	45.71
Concha bullosa	54	38.57
Septal spur	48	34.28
Retention cyst	43	30.71
AggerNasi cells	33	23.57
Paradoxical Middle Turbinate	31	22.14
Haller cells	26	18.57
Onodi cells	23	16.42
Uncinate process	19	13.57
Uncinate hypertrophy	10	7.1

IV Discussion

Of the 140 cases studied, we found 81 (57.85%) were male and 59 (42.14%) were female and between the 18 to 70 years of age. In a study Jyothi AC *et al* found that 53 (53%) were males and 47 (47%) were females and the patients were between 18 to 54 years of age [12]. While Abesi F *et al* found, female more than male. They found 76 (47.8%) were male and 83(52.2%) were female and between the ages of 18 and 80 years [2].In the present study, we have found that there was no anatomical variation detected in 05 (3.57%) patients, single anatomical variation was found in 18 (12.85%) patients, two anatomical variations in 34 (24.28%) patients and three or more anatomical variations in the remaining 83 (59.28%) patients.Adeel M *et al* reported no anatomical variation in 37 (48.1%) images. Single variation in 16 (20.7%), two variations in 18 (23.3%) and in 6 (7.7%) scans more than three variations were present [13].In other study Alshaikh N *et al* found that there was no anatomical variation in 05 (2.3%) patients, single anatomical variation in 17 (7.8%) patients, two anatomical variations in 36 (16.4%) patients and three or more anatomic variations in the remaining 161 (73.5%) patients [3, 4].In the present study, bilateral osteomeatal complex abnormality was seen in 79 (56.42%) and unilateral abnormality was in 61 (43.57%) patients. In a study by Grewal DS and Chaturvedi reported bilateral osteomeatal complex abnormality was seen in 58.7% and unilateral was in 41.3% patients [9].In the present study we found deviated nasal septum was the most common anatomical variation in 106 (75.71%) followed by inferior turbinate hypertrophy in 64(45.71%), concha bullosa in 54 (38.57%) patients. Uncinate hypertrophy was found in lowest 19 (13.57%) patients.In a study done

by Jyothi AC *et al* showed septal deviation was the most common variation in 30 (30%) patients followed by concha bullosa in 26 (26%) patients, haller cells were observed in 8 (8%) patients. Retroverteduncinate process was found in a single (1%) patient [12].In another study byAdeel M *et al* reported that DNS was the most common variation in 20 (26%), followed by concha bullosa in 14 (18.2%), paradoxical middle turbinate in 11 (14.3%) and haller's cell in 7 (9.1%) patients. They found onodi cells 6 (7.8%); and pneumatizationof uncinat process is lowest [13].

V Conclusion

There are many variations in the anatomy of the osteomeatal complex. The presence of these may predispose to sinus pathology and increased risk of intra-operative complications. It is important to pay close attention to anatomical variations in the preoperative evaluation to avoid possible complications.

References:

1. ShivakumarSenniappan, Komathi Raja, Ammu LizbethTomy, ChinnuSudha Kumar, Anjali MahendraPanicker, Shankar Radhakrishnan. Study of anatomical variations of ostiomeatal complex in chronic rhinosinusitis patients. International Journal of Otorhinolaryngology and Head and Neck Surgery 2018; 4 (5):1281-1286.
2. Abesi F, Haghanifar S, Khafri S, Montazeri A. The evaluation of the Anatomical Variations of Osteomeatal Complex in Cone Beam Computed Tomography Images. J BabolUniv Med Sci. 2018; 20 (4): 30 - 4.
3. RaktimBandyopadhyay, Romy Biswas, SharmisthaBhattacharjee, Narayan Pandit, Somnath Ghosh. Osteomeatal Complex: A Study of Its Anatomical

- Variation among Patients Attending North Bengal Medical College and Hospital. *Indian J Otolaryngol Head Neck Surg*(July–Sept 2015) 67(3):281–286; DOI 10.1007/s12070-015-0874-z
4. Aramani A, Karadi RN, Kumar S. A Study of Anatomical Variations of Osteomeatal Complex in Chronic Rhinosinusitis Patients-CT Findings. *J ClinDiagn Res.* 2014; 8(10): KC01-KC4.
doi:10.7860/JCDR/2014/9323.4923
 5. TapendraNath Tiwari,Narendra Kumar Kardam. CT evaluation of anatomical variations of paranasal sinus region and their clinical importance. *International Journal of Research in Medical Sciences* 2019; 7 (6): 2260-2264.
 6. Kulkarni V, ThakurP, Nishad R.Osteomeatal ComplexVariations and its Clinical Importance –OurExperience. *ArchCranOroFacSc* 2014; 3(1):8-12.
 7. Sandhu R, Kheur MG, Lakha TA, Supriya M, Valentini P, Le B. Anatomic variations of the osteomeatal complex and its relationship to patency of the maxillary ostium: A retrospective evaluation of cone-beam computed tomography and its implications for sinus augmentation. *J Indian ProsthodontSoc* 2020;20:371-7
 8. Pradeep Kumar, Rakesh BS, Rajendra Prasad. Anatomical variations of sinonasal region, a coronal ct scan study. *International Journal of Contemporary Medical Research* 2016; 3 (9): 2601-2604.
 9. Grewal DS and Chaturvedi A. A study on the incidence of Anatomical abnormalities in the osteomeatal complex among chronic rhinosinusitis patients. *JMSCR* 2019; 7 (8): 397 – 402.
 10. Severino Aires de AraújoNeto^I; Paulo de SáLeiteMartins^{II}; AntônioSoaresSouza^{III}; Emílio Carlos Elias Baracat^{IV}; LívioNanni. The role of osteomeatal complex anatomical variants in chronic rhinosinusitis. *RadiologiaBrasileira* 2006; 39 (3): 1-9.
 11. Espinosa W, Genito R, Ramos RZ. Anatomic variations of the nasal cavity and paranasal sinus and their correlation with chronic rhinosinusitis using Harvard staging system. ***Journal of Otolaryngology-ENT Research*** 2018; 10(4):190–193.
 12. Jyothi AC, Shrikrishna BH, Sanjay G, Sandeep Samson G. ANATOMICAL VARIATIONS OF THE OSTEOMEATAL COMPLEX TOMOGRAPHIC FINDINGS IN 100 PATIENTS. *Journal of Evolution of Medical and Dental Sciences* 2013; 2 (22): 3966-3977
 13. Mohammad Adeel, Muhammad Shaheryar Ahmed Rajput, Shabbir Akhter, MubasherIkram, Asif Arain, YasirJameelKhattak. Anatomical variations of nose and para-nasal sinuses; CT scan review. *J Pak Med Assoc* 2013; 63 (3): 317 – 319.