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ORIGINAL ARTICLE

Anatomical Variations In Paranasal Sinuses Of Chronic Rhinosinusitis Patients

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ABSTRACT:

OBJECTIVE: To study the frequency of anatomical variations in paranasal sinuses of patients presenting with symptoms of chronic rhinosinusitis at a tertiary care hospital.

METHODS: A cross sectional study was carried out from January 2023 to June 2023 at department of ENT and head & neck surgery, Liaquat National Hospital, Karachi. Total 111 patients were included.

METHODOLOGY: Patients presented with symptoms of nasal blockage, nasal discharge, hyposmia/anosmia, headache and facial pain or pressure and having endoscopic signs of polyps, mucopurulent discharge, edema, and hyperaemia of middle meatus were diagnosed clinically. The findings of CT scan were noted. Descriptive statistics were calculated. Stratification was done and Chi-square test was applied. P-value =0.05 was taken as significant.

RESULTS: Out of 111 patients, there were 69.4% male and 30.6% female patients. Nasal blockage was the most common symptom present in 61.3%, followed by nasal discharge 51.4%, facial pain or pressure was 45.9%, hyposmia or anosmia was 49.5%, and headache was 53.2%. Polyps were present in 55%, mucopurulent discharge was 48.6%, edema in middle meatus was 56.8%, and hyperaemia in middle meatus was 44.1%. In our study, 27.9% patients were found with deviated nasal septum, 14.4% with concha bullosa, and 9.9% with onodi cell. Age and duration of chronic rhinosinusitis were observed as significant factors.

CONCLUSION: Knowledge of the anatomical variations of the nose/paranasal sinuses through CT and naso-endoscopy enables the better understanding of the limits of surgical dissection during the treatment of chronic rhinosinusitis sphenoid sinus surgeries

Keywords: Anatomical Variations, Paranasal Sinuses, Symptoms, Chronic Rhinosinusitis

INTRODUCTION: At least 11 percent of world's population is being affected by chronic rhinosisusitis, and leads to one of the major cause for health disease burden.(1, 2) The inflammation of mucosa of nose and paranasal sinuses for more than 12 weeks is defined as chronic rhinosinusitis (CRS). Patients with chronic rhinosinusitis may present with myriad of symptoms including nasal obstruction, nasal discharge, hyposmia/anosmia, facial pain or headache.(1, 3) Anterior rhinoscopy and nasal endoscopy may reveal the presence of polyps. The radiological investigation of choice to analyze the sinonasal anatomy and to assess the extent of disease is Computed tomography of paranasal sinuses.

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Accurate knowledge of extent of disease and the normal drainage pathways is necessary for complete clearance of the disease.(3) CT- scan is a painless, noninvasive procedure which provides with good bony and soft tissue details and helps the surgeon in planning further management. CT-Scan Paranasal sinuses is a pre- requisite of Functional endoscopic sinus surgery and is considered as a diagnostic modality of choice for evaluating the osteomeatal complex. Zinreich et al. has considered coronal plane to be the imaging plane that best displays the osteomeatal unit.(4). The purpose of functional endoscopic sinus surgery is to re-establish ventilation and mucociliary clearance of the sinuses. This goal is achieved primarily by the endoscopic removal of disease from key areas.(5) As paranasal sinuses are closely related to vital structures such as orbit and base of skull, a surgeon must be fully aware of the normal anatomy and any anatomical variations, if present, preoperatively to avoid intra operative and post-operative complications.

CT scan Paranasal sinuses can give us a detailed information of sinonasal variations which include deviated nasal septum, presence of concha bullosa, paradoxical middle turbinate, haller cells, onodi cells and pnuematized uncinate process. Dua et al. reviewed the CT scans of 50 patients for sinonasal anatomical variations in Indian Population.(6) A similar study done by Adeel,M et.al stated that the prevalence of one or more anatomical variations in Pakistani population was about 51.9% with the most common variation being deviated nasal septum (26%) and cocnha bullosa (18.2%). (7). Same study reports the prevalence of Onodi cells to be 7.8%.(7) The purpose of this study is to determine the frequency of anatomical variations such as deviated nasal septum, concha bullosa and onodi cells in our population. Very less literature is available on anatomical variations in nose and paranasal sinuses, especially in our population. It will help us to anticipate and avoid intra operative and post-operative complications and maximize the patient benefit.

STUDY METHODS: An approval from ethical and review committee was taken before commencement of the study. A cross sectional study was carried out from January 2023 to June 2023 at department of ENT and head & neck surgery, Liaquat National Hospital, Karachi. It was non-probability consecutive sampling. The sample size was calculated using WHO Sample size calculator, by taking prevalence of onodi cells (P) =7.8% with margin of error (d) = 7% and confidence interval 95%.(). All the patients, that were being presented in out-patient department with symptoms of nasal blockage, nasal discharge, hyposmia/anosmia, headache and facial pain or pressure and had endoscopic signs of polyps, mucopurulent discharge and edema and hyperaemia of middle meatus were diagnosed clinically as chronic rhinosinusitis were included in the study. However, those who had any malignancy related to nose and paranasal sinuses, any past history of facial trauma and previous sinonasal surgery, were being excluded from the study. The patients who full filled the inclusion criteria were then sent radiology department of Liaquat National Hospital for CT scan Paranasal sinuses, plain, 3mm cuts coronal view. All CT Scans were obtained with Toshiba Activion 16 slicer and viewed using Picture Archiving Communication System (PACS) software. An informed verbal & written consent was taken from each patient. Patient demographical data collection (name, age, gender and MR number) along with obtaining clinical history and performing physical examination was done by the principal investigator. The findings of CT scan were confirmed by a senior radiologist of more than 5 years of experience. Confounding variables as well as bias were controlled by strictly following the inclusion and exclusion criteria. Data were compiled and analyzed using Statistical package of social sciences (SPSS) version 21. The descriptive statistics were calculated. The quantitative variables e.g. age, symptoms duration were presented through mean±SD. The frequency and percentage were calculated for qualitative variables i.e. gender, symptoms, endoscopic signs and CT scan Findings of anatomical variations. Stratification was done for CT scan Findings (i.e. DNS, concha bullosa and Onodi cell) with respect to age, gender, duration of symptoms and endoscopic signs. Post stratification chi-square test was applied. P value = 0.05 was taken as significant.

RESULTS: Total 111 patients with 77 (69.4%) were male and 34 (30.6%) were female were evaluated in the study. Among 111 patients, age from 18 years to 65 years with mean age of 32.13±7.77 years. The age was further stratified in two groups. The percentages of patients among these groups are presented in Figure- 1.

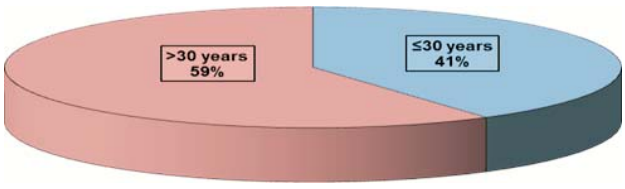


FIGURE: 1 Percentage of patients according to age groups (n=111)

The overall mean CRS duration was 23.13±5.80 weeks. Among 111 patients, 61.3% were found with nasal blockage, 51.4% with nasal discharge, 45.9% with facial pain or pressure, 49.5% with hyposmia or anosmia and 53.2% with headache. The detailed frequency distribution of symptoms is presented in Figure- 2.

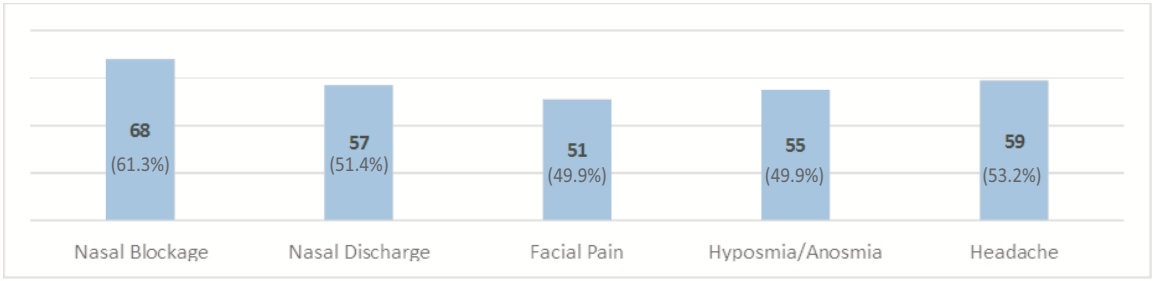


Figure 2: Frequency distribution of symptoms (n=111)

Out of total study patients, 55% were found with polyps, 48.6% with mucopurulent discharge, and 56.8% with edema in middle meatus and 44.1% with hyperemia in middle meatus, shown in figure 3. In our study, 27.9% were found with deviated nasal septum, 14.4% with concha bullosa and 9.9% with onodi cell on CT scan as presented in figure 4.

Figure 3: The detailed frequency distribution of endoscopic signs

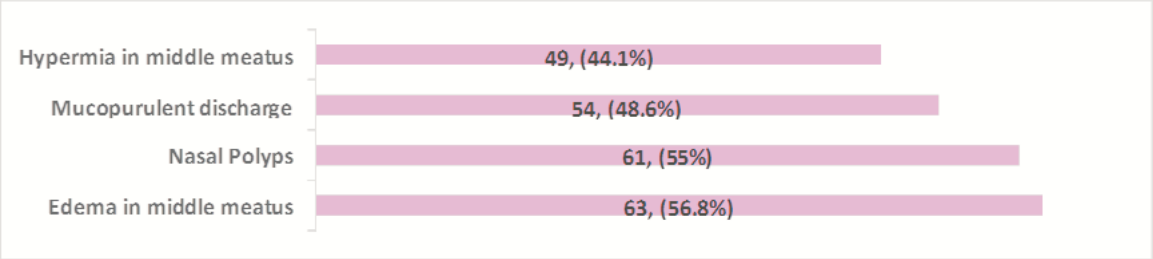
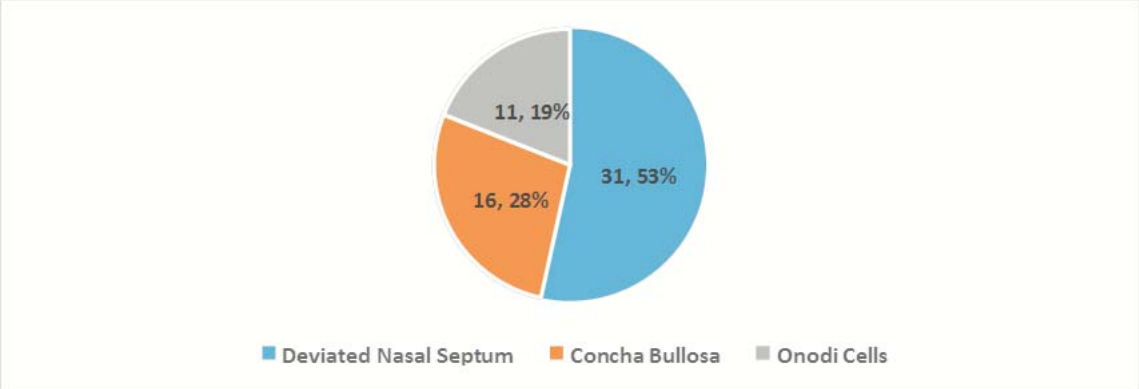


Figure 4: The detailed frequency distribution of CT scan findings



Stratification with respect to gender, age group, CRS duration and endoscopic signs (polyps, mucopurulent discharge, edema in middle meatus and hyperaemia in middle meatus) was done to observe effect of these modifiers on CT scan findings (deviated nasal septum, concha bullosa and onodi cell). Chi Square Test was applied. P-value =0.05 was considered as significant. The results showed significant association of deviated nasal septum with age group (p=0.005), concha bullosa with age group (p=0.003), shown in table 1 and onodi cell with CRS duration (p=0.006), shown in table 2.

Table 1: Frequency of Deviated Nasal Septum and Concha Bullosa according to age group

AGE GROUP	DEVIATED NASAL SEPTUM		TOTAL	P-Value
	Yes	No		
=30 years	6 (13.3)	39 (86.7)	45	0.005*
>30 years	25 (37.9)	41 (62.1)	66	
TOTAL	31	80	111	
=30 years	1 (2.2)	44 (97.8)	45	0.003*
=30 years	15 (22.7)	51 (77.3)	66	
TOTAL	16	95	111	

Table 2: Frequency of Onodi Cell according to CRS duration group

CRS DURATION GROUP	ONODI CELL		TOTAL	P-Value
	Yes	No		
≤24 weeks	1 (1.9)	53 (98.1)	54	0.006*
>24 weeks	10 (17.5)	47 (82.5)	57	
TOTAL	11	100	111	

DISCUSSION:

The importance of the anatomic variations of the paranasal sinus as predisposing patients to CRS is debatable.(8-10). In this regard, many studies failed to show a specific association between the anatomic variants of paranasal sinuses and CRS Kim et al. and Stallman et al. claimed that local, systemic, environmental factors or intrinsic mucosal disease were more significant factors in the pathogenesis of rhinosinusitis.(11, 12).

In a study, the most common anatomic variant was the Agger nasi cell, which was present in 87.5% of the sample.(8) This value is similar to the results found in the literature (70-90%).(12, 13). There were difference in mean LM score between subjects with and without the Agger Nasi, particularly on the right side; however, this difference was not statistically significant.(8, 9) Previous studies did not find an association between frontal sinus disease and Agger nasi cells.(14)

The second most common variant was the nasal septum deviation which was present in 77.7 % of the subjects, a value concordant within the previously reported range of 19.4%–79%. (11, 15, 17). A study did not find any significant association between the nasal septum deviation and the prevalence of rhinosinusitis or even with an increase in the Lund Mackay score.() Similarly, other studies did not show an ssociation between septal devition and CRS.(11, 16, 17).

Sphenoethmoidal cell (Onodi cells) is defined as a posterior ethmoidal cell which develops lateral and/or superiorly to the sphenoid sinus.(8) It was present in 33 (29.5%) patients 8 (24.2 %) on the rhinosinustis group and 23 (29.1 %) on the control group. The difference between the Lund Mackay score in the two groups was not significant. On previous studies, the reported prevalence is 1.3%-65%.(11, 16, 18)

Infraorbital cell (Haller cell) is an anterior or posterior ethmoidal cell that develops into the orbital floor where it may narrow the adjacent maxillary sinus ostium or infundibulum. It may be defined as any ethmoidal cell which pneumatizes inferior to the orbital floor and lateral to a line parallel with the lamina papyracea.(19)

In a study, it was present in 36 (32,1 %) of patient 13 (39,4%) on the rhinosinusitis group and 23 (29,1%) on the control group.() These values were within the 10%-62% reported range.(11, 16, 20). The difference between the Lund-Mackay score in both groups was not significant. The middle turbinate insertion was also investigated. A higher percentage of subjects had a lateral wall insertion on the rhinosinusitis group (75.8 % vs. 56.3 %). Concurrently, the Lund-Mackay score seems to be increased on these patients but this difference was not statistically significant when compared to other insertions.(8,21).

No significant difference was found in the Lund-Mackay score of the paranasal sinus or the nasal cavity anatomic variants. However, we did not study the association between groups of variations and the presence of rhinosinusitis which can be a limitation of this study. At the same time the small sample size may have limited the results of this study. Further studies with larger samples may be important to better understand the impact of sinonasal anatomic variants on the rhinosinusitis pathogenesis and the difference between CRS with and without Nasal Polyps.(21)

It is known that in some cases, patients can have symptoms related with the anatomic variants

without rhinosinusitis expression on CT scan.(20). Therefore, the anatomic knowledge of the paranasal sinuses is of great importance. At the same time it is known that patients with clinically significant sinusitis many have no evidence of sinusitis at imaging.(22).

That is the reason why is so important to evaluate clinically these cases and not blindly agree on the CT scan. This anatomic knowledge is key on the pre-surgical evaluation, since some variants are related with an increase in the complication rates of sinus surgery. Although surgical complications may occur for a variety of reasons, failure to recognize certain anatomic variants is one of the most important. In fact, the complication between the surgeon and the radiologist is crucial.

Study Limitations:

The main limitation of our study was the small sample size. Other limitations of the present study include a single-center experience and nonrandomized study design. It was conducted with urban environment therefore, the results might not be generalizable to larger populations.

CONCLUSION:

The sinus CT scan is a major tool for evaluating CRS helping to assess the mucosal disease on the sinus and to study the extent of the disease. Our study results showed that deviated nasal septum was 27.9%, concha bullosa was 14.4%, onodi cell was 9.9%. Further, age and duration of chronic rhinosinusitis were observed as significant factor.

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