ORIGINAL ARTICLE

Maxillary Sinus and Nasal Cavity Anatomical Variants Evaluation in Adult Karachi Population, A CBCT Based Analysis

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ABSTRACT

Objective: To determine the common anatomical variants of maxillary sinus and nasal cavity on cone beam computed tomography.

Study Design: Retrospective cross-sectional study.

Place and Duration of Study: This study was carried out at Anatomy and Radiology Department of Liaquat National Hospital & Medical College, Karachi, from 11th Nov 2022 till 22nd Nov 2023.

Materials and Methods: Cone-Beam Computed Tomography (CBCT) scans of 353 adults were evaluated retrospectively, who had scan for sinusitis for anatomical variations of maxillary sinus and nasal anatomy were included in study. Data analysis was done by SPSS v27.

Results: There were 52% male and 48% female patients, with the majority (43.5%) being in the 26–35 age range. During the course of our investigation, we discovered that 27.8% of patients had a right deviated nasal septum with chonca bullosa, 25.5% had a left deviated nasal septum, and 19.9% had a nasal septal spine. In contrast, 56.3% of patients had hyper pneumatize maxillary sinuses, and 29.3% had hypoplasia of the maxillary sinuses. Anatomical variations in the nasal cavity were significantly associated with age (p = 0.001) and gender (p = 0.002).

Conclusion: Based on our findings, although there was no significant association detected between the anatomical variations in the maxillary sinus and age (p = 0.641). The anatomical variation from the study's results of the nasal cavity is a deviated nasal septum on the right side, followed by a deviated nasal septum on the left, and that the most common variation in the maxillary sinus is hyper pneumatize maxillary sinus, which was followed by hypoplasia.

Key Words: *Anatomical Variation, Cone-Beam Computed Tomography, Maxillary Sinus.*

Introduction

Paranasal sinuses are air filled chambers separated from orbit and cranial fossae by very thin plate of bone.[1] Maxillary sinuses are bilateral pyramidal shaped structures lateral to nasal cavity. Because the nasal cavity and maxillary sinus have a role in the drainage of the sinonasal region and might cause sinusitis, anatomic variations of these structures are highly significant to be considered.[2] In addition for planning any clinical procedures especially endoscopic surgeries in which accurate evaluation is required for the success and safety of patient. Detailed anatomy of nasal cavity and maxillary sinus is required by surgeons otherwise incomplete knowledge can lead to major complications e.g. visual problems, meningitis, oral cavity pathologies and CSF leakage.[3]

Anatomical variations of nasal cavity and maxillary sinus should be carefully evaluated before performing any surgical procedure. They both are important for two reasons (1) Variants of nasal cavity and maxillary sinus have strong correlation with the nasal drainage and proper ventilation of maxillary sinus. (2) These two sites can be visualized in 3 dimensions by using Cone Beam computed tomography (CBCT) resulting in understanding their anatomical variations which will produce significant impact on surgical procedures.[4] Most common disorder related to nasal septum is nasal septum deviation. Deviated nasal septum has been explained as due to developmental cause (mostly C-shaped deformity or S-shaped nasal septum with

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inclination more related to anterior nasal septum) or traumatic (mostly no proper shape, septal angulation or dislocated in origin). Deviated nasal septum can result in displacement of middle turbinate, limiting the middle meatus, developing difficulty in surgical approach and resulting impedance of normal mucus flow as a consequence infection resulted.[5] Deviated nasal septum can cause infection of all four paranasal sinuses due to poor mucociliary clearance, inappropriate mucus drainage, and airway narrowing.[6]

CBCT is the most progressing modality initially originated in the early decades of 1980's with high standard images. It captures anatomic structures providing the 3-dimensional information with slice thickness of less than 0.4mm regarding the morphology, anatomic variations & pathology for both maxillary sinus & nasal cavity.[7] Over the last few decades CBCT is preferred to traditional CT images because it yields high contrast bone scans.[8] Moreover CBCT provides sufficient knowledge to identify diagnostic problems related to this region as compared to Multidetector computed tomography (MDCT) images due to its flat designed panel and due to its few artifacts and it is cost effective.[9,10]

Literature contains large number of studies detailing paranasal sinuses anatomical variants though not specifically designed to evaluate nasal cavity and maxillary sinus anatomical variations in Karachi population on CBCT. Prevalence of nasal cavity and maxillary sinus were concha bullosa 35.3%, Haller cells 25%, and modifications of uncinated process 5% according to Raluca's study performed on 130 patients in 2016 on CBCT. The present study was planned to determine the common anatomical variants of maxillary sinus and nasal cavity on CBCT.

Materials and Methods

This retrospective cross-sectional study was performed at Liaquat National Hospital and Medical College in Department of Anatomy in collaboration with the Department of Radiology. The period of study was one year after obtaining Ethical Review Committee approval (Ethical ref no: #0848-2022 LNH-ERC). Total 353 patient's medical records and CBCT images were reviewed during the period of 11th Nov 2022 till 22nd Nov 2023. CBCT images (16 slice Toshiba) of both male & female patients with clinical suspicion of sinusitis (all symptomatic patients were included by non-probability convenience sampling technique and were categorized into three age groups 20-25 years, in between 26-35 years and ≥ 35 years of age.[1] Exclusion criteria for all patients included the following (1) Previous history of any trauma or surgery (2) Benign or malignant tumors, (3) Clefts that can cause change in sinonasal mucosa resulting in anatomical change of maxillary sinus and nasal cavity (4) Patients under 19 years of age due to not proper and complete development of maxillary sinus. CBCT scan of all patients were captured with (CBCT Machine: Lightning Aquilion Canon model no C16S). Scanning was done in supine position, in cranio-caudal direction for all patients. Maxillary sinus anatomical variants, such as accessory maxillary sinus, maxillary septa & nasal cavity anatomical variants including deviated septum, any septal spur, were interpreted by an anatomist. At the same time radiological findings, any trauma or pathologic lesions of maxillary sinus and nasal cavity, were evaluated through axial images along with coronal reconstruction by radiologist. All images were reviewed retrospectively on Syngobia workstation and all findings were recorded on predesigned proforma for details of patients including age, gender, maxillary and nasal sinus anatomical variants. Data was entered and analyzed on SPSS version 27. Association of anatomical variations (nasal cavity, maxillary sinus) with age and gender was checked by chi-square test. The *p* value of < 0.05 was considered statistically significant.

Results

CBCT images for anatomical variability of nasal cavity revealed in n = 72 females and n = 114 males respectively. Mean age of patients was 30.40±8.99 years with the majority (43.5%) being in the 26–35 age range. During the course of investigation, we discovered that 27.8% of patients had a right deviated nasal septum with chonca bullosa, 25.5% had a left deviated nasal septum, and 19.9% had a nasal septal spine. In contrast, 56.3% of patients had hyper pneumatized maxillary sinuses, and 29.3% had hypoplasia of the maxillary sinuses as presented in Table I.

Table IIA, shows, right deviated nasal septum was found among 51(39.2%) females and 63(28.3%) males. Among males left deviated nasal septum was found in 43 (19.3%) followed by nasal septal spine in

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4 (1.8%), and right and left deviated nasal septum with concha bullosa both having same number of 2(0.9%). No chonca bullosa revealed on CBCT of males. Table IIA, shows that, in females second most frequently occurring nasal septal defect was left deviated nasal septum among 10 (7.7%) patients, followed by concha bullosa in 4 (3.1 %), left deviated nasal septum with concha bullosa in 3 (2.3%), right deviated nasal septum with concha bullosa in 2 (1.5%) and nasal septal spine in 2 (1.5%) patients.

Right deviated nasal septum was more common in 26-35 years (n = 54, 51.4%), followed by ≥35 years (n = 34, 26.6%) and 20-25 years (n = 26, 21.7%). Left deviated nasal septum was more common in ≥35 years age groups (n = 27, 21.1%) followed by 20-25 years (n = 23, 19.2%) and 26- 35 years (n = 3, 2.9%) as presented in Table II B.

Nasal septal spine found among patients in age group 20-25 years was n =2 (1.7%), in 26-35 years was n =2 (1.9%) and in ≥35 years was n =2 (1.6%). Right deviated nasal septum with concha bullosa was found only in 4 patients in age group ≥35 years. Concha Bullosa was observed in 4 (3.8%) patients in the age group 26-35 years. A total number of 3 (2.5%) and 2 (1.6%) patients were noticed in the age group 20-25 years and ≥35 years respectively. (Table II B). Results were summarized in table III A and table III B for anatomical variations of maxillary sinus association with age and gender respectively.

Anatomical variations in the nasal cavity were significantly associated with age (p = 0.001) and gender (p = 0.002), although there was no significant association detected between the anatomical variations in the maxillary sinus and age (p = 0.641). Detailed results of association by Chi square test is presented Table IIA, Table II B, Table III A and Table IIIB

Discussion

In the present study it was found that deviated nasal septum (right side) is the most common anatomical variation followed by deviated nasal septum (left side), supported by Shahidi S *et al.,*[12,13] and Al-Ani RM *et al.,*[14] which had similar findings. A similar conclusion was reported by another study where nasal septal deviation is reported to be a common anatomical variation for nasal region.[15]

Concha bullosa associated with right or left deviated nasal septum is explained as the pneumatization or

Table No I: Demographic Characteristics, Anatomical Variation of Nasal Cavity & Maxillary Sinus among Adult Urban Karachi Population (n= 353)

	Variable	Frequency, n (Percentage, %)
Gender	Male	223 (63 %)
	Female	130 (36%)
Age years	20-25 years	120 (34.09%)
	26- 35 years	105 (29.7%)
	≥35 years	128 (36.2%)
Anatomical variation of nasal cavity	Deviated nasal septum (Right side)	114 (32.3%)
	Deviated nasal septum (Left side)	53 (15.0%)
	Nasal septal spine	6 (1.7%)
	Right deviated nasal septum with concha bullosa	4 (1.1%)
	Left deviated nasal septum with concha bullosa	5 (1.4%)
	Concha bullosa	4 (1.1%)
Anatomical Variation of Maxillary Sinus	Hyperpneumatize maxillary sinus	94 (56.3%)
	Maxillary Sinus Hypoplasia	49 (29.3%)
	Accessory maxillary sinus	18 (10.8%)
	Maxillary sinus septa	6 (3.6%)

Table II (A): Frequency Distribution of Anatomical Variations of Nasal Cavity According to Gender, (n=186).

Gender	Anatomical variations of Nasal cavity Frequency, n Percentage, %					
	Deviated nasal septum. (Right side)	Deviated nasal septum (Left side)	Nasal septal spine	Right deviated nasal septum with concha bullosa	Left deviated nasal septum with concha bullosa	Concha Bullosa
Male (n=114)	63 28.3%	43 19.3%	4 1.8%	2 0.9%	2 0.9%	0 0.0%
Female (n=72)	51 39.2%	10 7.7%	2 1.5%	2 1.5%	3 2.3%	4 3.1%
Total (n=186)	114 32.3%	53 15.0%	6 1.7%	4 1.1%	5 1.4%	4 1.1%

Table II (B): Association Between Anatomical Variations of Nasal Cavity in Relation to Age, (n=186).

Age Group	Anatomical variations of Nasal cavity Frequency Percentage						*p* value
	Deviated nasal septum (Right side)	Deviated nasal septum (Left side)	Nasal septal spine	Right deviated nasal septum with concha bullosa	Left deviated nasal septum with concha bullosa	Concha Bullosa	
20-25 years (n=54)	26 21.7%	23 19.2%	2 1.7%	0 0.0%	3 2.5%	0 0.0%	0.001*
26-35 years (n=63)	54 51.4%	3 2.9%	2 1.9%	0 0.0%	0 0.0%	4 3.8%	
≥35 years (n=69)	34 26.6%	27 11.1%	2 1.6%	4 3.1%	2 1.6%	0 0.0%	

*The *p* value was considered significant at 0.05 levels.

Table III (A): Frequency Distribution of Anatomical Variations of Maxillary Sinus According to Gender (n=167)

Gender	Anatomical variations of Maxillary sinus Frequency Percentage			
	Hyperpneumatize maxillary sinus	Maxillary Sinus Hypoplasia	Accessory maxillary sinus	Maxillary sinus septa
Male (n=109)	61 56.0%	35 32.1%	9 8.3%	4 3.7%
Female (n=58)	33 56.9%	14 24.1%	9 15.5%	2 3.4%
Total (n=167)	94 56.3%	49 29.3%	18 10.8%	6 3.6%

Table No III (B): Association Between Anatomical Variations of Maxillary Sinus in Relation to Age, (n=167).

Age Group	Anatomical variation of Maxillary sinus Frequency Percentage				*p* value
	Hyperpneumatize maxillary sinus	Maxillary Sinus Hypoplasia	Accessory maxillary sinus	Maxillary sinus septa	
20-25 years (n=66)	37 56.1%	19 28.8%	8 12.1%	2 3.0%	0.641
26-35 years (n=42)	23 54.8%	16 38.1%	2 4.8%	1 2.4%	
≥35 years (n=59)	34 57.6%	14 23.7%	8 13.6%	3 5.1%	

*The *p* value was considered significant at 0.05 levels.

presence of air cells in middle turbinate. The findings of this research study did not coincide with the results of previous studies by Katibe *et al.,* [16] in which it was reported left deviated nasal septum with concha bullosa is more common than right deviated nasal septum with chonca bullosa. According to our findings concha bullosa with right deviated nasal septum (n=2) was found in males as well as in females. Concha bullosa with left deviated nasal septum in males (n=2) and in females (n=3). Concha bullosa alone was found only in females (n=4).

Anatomical variants of nasal cavity and maxillary sinus found in this research are significant because they may be source of complication for sinus surgical procedures or can develop pathological consequences at times. CBCT can provide accurate information regarding maxillofacial anatomy. Most frequently involving sinus according to location is maxillary sinus. Similar results were obtained by Teuku Husni *et al.,* [17]. In our study CBCT scans of 353 patients, maxillary sinus analysis for anatomical variations revealed hyper pneumatized maxillary sinus as the most common in order of frequency (n= 61 males) and (n=33) in females followed by maxillary sinus hypoplasia (MSH), accessory maxillary sinus ostium, and maxillary sinus septa. These statements are not in contrast with Maria A. *et al.,* [18] which revealed maxillary sinus hypoplasia as the commonest anatomical variation. MSH can develop dental problems due to elevation of canine fossa. It was found dehiscent of bone over roots of maxillary tooth both molars and premolars along with mucosal lining between the maxillary antrum and roots. These can result in the formation of oroantral fistula following tooth extraction and it can also predispose to recurrent sinusitis as a consequence of dental infection. Accessory ostium of maxillary sinus is defined as additional aperture rather than single primary ostium and is generally located in nasal fontanelle or hiatus semilunaris. In our study total 9 scans both in male and in female had maxillary sinus ostium which is not in line with the study of Rashi's *et al.,* [19] which found accessory maxillary ostium as the common anatomical variation of maxillary sinus.

Deep understanding of anatomy, anatomical features and anatomic variations of the sino-nasal region is the essence and requirement for constructive and successful functional endoscopic sinus surgery (FESS).[20] Advanced imaging modalities as well as experienced skillful person can discuss in detail the pathology and anatomical variations of nasal cavity and maxillary sinus.[21] Comparing our study results with the study done in Nigerian population, they found that most common anatomical variation was pneumatization of middle

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nasal turbinates (32.3%) followed by agger nasi cells (23.64%), haller's cell (20.9%) and septal deviation (20.16%). In our study, the most common anatomical variation according to three different age groups was deviated nasal septum (right side) (n=26), followed by deviated nasal septum of the left side (n=23), left deviated nasal septum with chonca bullosa (n=3), and nasal septal spine (n=2).[22]

In a study done by Adem Bora on adults and pediatric age groups they found that septal deviation (79.9%), concha bullosa (40.9%) and ethomoid bulla (21.0%) were the most frequently detected variations. It was also observed in same study that nasal septal deviation was more frequently observed in males than in females, which is in line with our study.[23]

The study sample was divided into three groups 20-25, 26-35 years, and ≥ 35years for evaluation of maxillary sinus anatomical variations and their frequencies were evaluated. Hyper pneumatized maxillary sinus was the most regularly experienced maxillary sinus variation in the age group 20- 25 n=37 (56.1%), 26-35 years n= 23 (54.8%) and ≥ 35years n=34 (57.6%) followed by maxillary sinus hypoplasia n= 19 (28.8%) in the age group 20-25 and n=16 (38.1%) in the age group 26-35 years ,n= 14 (23.7%) in the age group followed ≥ 35years by accessory maxillary sinus n= 8 (12.1%) in 20-25 and n=2 (4.8%) in the age group 26-35 years, followed by maxillary sinus septa n=2 (3.0 %) in the age group 20-25, and n=1 (2.4%) in the age group 26-35 years.

A highly significant association was found between gender and anatomical variations of nasal cavity *p* value (0.002) as shown in Table II A. We can conclude that anatomical variations of nasal cavity are more common in females than males, whereas frequency of anatomical variations of maxillary sinus same in both genders according to this study. A significant association was found between patient's age and anatomical variations of nasal cavity *p* value (0.001) as shown in Table II B. However, a significant association was noticed between gender plus age and anatomical variations of maxillary sinus as shown in Table III A & III B.

Conclusion

In the light of results found in our study it can be concluded that deviated nasal septum (right side) is the most common anatomical variation of nasal cavity followed by deviated nasal septum (left side) and in maxillary sinus hyper pneumatize maxillary sinus is the most common experienced variant found in our research study followed by maxillary sinus hypoplasia. CBCT should be done before any sinus surgical intervention.

Limitations

It was a single institution study and mainly urban population was included. Since it was a non-contrast study, it was not beneficial for the diagnosis/ detection of tumors. Contrast enhanced CBCT full study is needed in these situations.

REFERENCES

1. Shokri A, Faradmal MJ, Hekmat B. Correlations between anatomical variations of the nasal cavity and ethmoidal sinuses on cone-beam computed tomography scans. *Imaging Sci. Dent.* 2019 Jun; 49(2):103-113. doi:10.5624/isd.2019.49.2.103.
2. Khojastepour L, Mirhadi S, Mesbahi SA. Anatomical variations of ostiomeatal complex in CBCT of patients seeking rhinoplasty. *J Dent.* 2015 Mar; 16(1):42.
3. Drakhshan M, Panahi R. Sabz Gh. Anatomic variations of paranasal sinuses and nasal cavities from CBCT images in the Iranian population. *J. Oral Maxillofac. Surg. Med* 2021; 10(3):10-5. 5. doi:10.32598/3dj.7.4.145.
4. Aramani A, Karadi RN, Kumar S. A study of anatomical variations of osteomeatal complex in chronic rhinosinusitis patients-CT findings. *J Clin Diagn Res* 2014 Oct; 8(10):KC01.
5. Balikci HH, Gurdal MM, Celebi S, Ozbay I, Karakas M. Relationships among concha bullosa, nasal septal deviation, and sinusitis: Retrospective analysis of 296 cases. *Ear Nose Throat J*. 2016 Dec; 95(12):487-91. doi:10.1177/014556131609501209.
6. Thakker KN, Parikh SJ, Ruparelia PB. Computed Tomographic Study of Variants of Deviated Nasal Septum in Adult Population: A Descriptive, Cross-sectional, Hospital-based Study. *J. Adv. Oral Res.* 2023 Nov; 14(2):210-7. doi:10.1177/23202068231205080.
7. Mallya S, Lam E. White and Pharoah's Oral radiology E-book: principles and interpretation: second South Asia Edition E-Book. Elsevier India; 2019 Feb 13.
8. Roman RA, Hedeşiu M, Gersak M, Fidan F, Băciuţ G, Băciuţ M. Assessing the prevalence of paranasal sinuses anatomical variants in patients with sinusitis using cone beam computer tomography. *Clujul med*. 2016; 89(3):423. doi:10.15386/cjmed-598.
9. Khojastepour L, Mirhadi S, Mesbahi SA. Anatomical variations of ostiomeatal complex in CBCT of patients seeking rhinoplasty. *J. Dent*. 2015 Mar; 16(1):42.
10. Shokri A, Miresmaeili A, Farhadian N, Falah-Kooshki S, Amini P, Mollaie N. Effect of changing the head position on accuracy of transverse measurements of the maxillofacial region made on cone beam computed tomography and conventional posterior-anterior cephalograms. *Dentomaxillofac Radiol. 2*017 Jul; 46(5):20160180. doi:10.1259/dmfr.20160180.

11. Roman RA, Hedeşiu M, Gersak M, Fidan F, Băciuţ G, Băciuţ M. Assessing the prevalence of paranasal sinuses anatomical variants in patients with sinusitis using Cone Beam Computer Tomography. *Clujul medical*. 2016;89(3):423 doi:10.15386/cjmed-598
12. Shahidi S, Zamiri B, Danaei SM, Salehi S, Hamedani S. Evaluation of anatomic variations in maxillary sinus with the aid of cone beam computed tomography (CBCT) in a population in south of Iran. *J. Dent.* 2016 Mar; 17(1):7.
13. Deva Sooria N. Anatomical Variations of Nasal Cavities in Relation with Multidetector Computed Tomography. *J. Pharm. Negat. Results*. 2022 Nov 3;1079-81. doi:10.47750/pnr.2022.13. S05.170.
14. Al-Ani RM, Khalaf GM. Prevalence of sinonasal anatomical variations and their effect on chronic rhinosinusitis in Al-Ramadi Teaching Hospital, Ramadi City, Iraq. *Muthanna J* 2021; 8(1):35-43. doi:10.18081/2410-4590/2021-35-43.
15. Mostafa RA, Samir SM. Do Nasal Anatomical Variations Affect the Maxillary Sinus? A CBCT Volumetric Analysis. *J. Dent. Indones* 2023; 30(1):1-7. doi:10.14693/jdi.v30i1.1415.
16. Tuğçe TK, Evlice B, Öztunç H. Evaluation of paranasal sinus anatomic variations and mucosal changes with cone beam computed tomography. 2 *B J. Dent. Med.* 2022;26(1):27-32.
17. Putra TR, Teuku Husni TR, Sariningrum HA, Endalif D. Characteristics of chronic sinusitis based on non-contrast ct scan at the ent-head and neck surgery Polyclinic of Regional General Hospital Dr. Zainoel Abidin Banda Aceh. *Indones J Trop Infect Dis*. 2022 Jan;10(1):55-61. doi:10.20473/ijtid.v10i1.33535.
18. Papadopoulou AM, Bakogiannis N, Skrapari I, Bakoyiannis C. Anatomical variations of the sinonasal area and their clinical impact on sinus pathology: A systematic review. *Int. Arch. Otorhinolaryngol*. 2022 Nov 4;26:491-8. doi:10.47750/pnr.2022.13. S05.170.
19. Kakade AG, Chaudhari NH, Baviskar SM, Bagga RR, Patni ZM. Evaluation of variations of maxillary sinus on computed tomography. *MVP J. Med. Sci.* 2018 Dec 17;172-7. doi: 10.18311/mvpjms/2018/v5i2/18660.
20. Qureshi MF, Usmani A, Mehwish A, Rehman F, Ahmed RR. Use of Computed Tomography for Nasal and Paranasal Anatomic Variants. *Pak. j. med. dent*. 2023 Aug 18;12(3). doi:10.36283/PJMD12-3/010.
21. Gruszka K, Aksoy S, Różyło-Kalinowska I, Gülbeş MM, Kalinowski P, Orhan K. A comparative study of paranasal sinus and nasal cavity anatomic variations between the Polish and Turkish Cypriot Population with CBCT. *Head Face Med.* 022 Nov 26;18(1):37. doi:10.1186/s13005-022-00340-3.
22. Abdulhussein Al-Ali AA, Al-Waely NK. Normal Anatomical Variants of the Paranasal Sinuses at Computed Tomography Scanning. *Indian J. Public Health Res.Dev.* 2020 Feb 1;11(2). doi:10.37506/v11/i2/2020/ijphrd/195194.
23. Bora A, Koç M, Durmuş K, Altuntas EE. Evaluating the frequency of anatomical variations of the sinonasal region in pediatric and adult age groups according to gender: computed tomography findings of 1532 cases. *Egypt. J. Otolaryngol* 2021 Dec;37(1):58. doi:10.1186/s43163-021-00122-9.

CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.