Paranasal sinuses in patients with chronic rhinosinusitis,Tanzania

Enica R.Massawe[1], Happy E Somboi[1], Asterius Muganyizi[2] and Petra Joseph[2]

Author Affiliations:
1. Department of Otorhinolaryngology, Muhimbili University of Health and Allied Sciences, School of Medicine, Dar es Salaam, Tanzania. 2. Muhimbili National Hospital, Department of Otorhinolaryngology, Dar es Salaam, Tanzania

Correspondence:
Enica Richard Massawe
eningowi18@gmail.com

Submitted: December 2022
Accepted: September 2023
Published: February 2024

Citation: Massawe et al., Paranasal sinuses in patients with chronic rhinosinusitis, Tanzania, South Sudan Medical Journal, 2024;17(1):17-21 DOI: https://dx.doi.org/10.4314/ssmj.v17i1.4

ABSTRACT

Introduction: Chronic rhinosinusitis is inflammation of the nasal cavity and paranasal sinuses that lasts for at least twelve weeks. Paranasal sinus variations account for various pathologies, including chronic rhinosinusitis. This study assessed the anatomical variations of paranasal sinuses among patients with chronic rhinosinusitis attending otorhinolaryngology services in a tertiary hospital in Tanzania.

Method: This was a descriptive prospective cross-sectional study of 120 patients aged 15 years and above who fulfilled the Rhinosinusitis Task Force criteria. A structured checklist was used to collect socio-demographic characteristics and clinical presentations. Cone-beam computed tomography scan and the Lund-Mackay scoring system were used. Data analysis was done using SPSS version 26, and p-values <0.05 were considered statistically significant.

Results: A total of 120 patients were enrolled with a median age of 37 (IQR 27-52) years, with 40% aged 30-49 years. There were 65 (54.2%) males, and 55 (45.8%) females. Maxillary sinuses were affected in 85.8% of all patients with chronic rhinosinusitis. The overall proportion of anatomical variation was 53.3%, with concha bullosa, deviated nasal septum, Onodi cells, and septal spur being the most common, accounting for 40.6%, 25.0%, 23.4%, and 20.3%, respectively. Twenty-four patients with concha bullosa had chronic maxillary rhinosinusitis, with 14 (58.3%) having ipsilateral rhinosinusitis.

Conclusion: Half of the patients had one or more paranasal sinus anatomical variations. The most common variants were concha bullosa followed by deviated nasal septum. Onodi cells and septal spurs were rarely identified. Most patients with concha bullosa had ipsilateral maxillary sinusitis.

Keywords: anatomical variations. paranasal sinuses, rhinosinusitis, laterality, Tanzania

Introduction

Chronic rhinosinusitis (CRS) is inflammation of the paranasal sinuses (PNS) and nasal cavity that lasts for at least twelve weeks. Its pathophysiology is complex, with bacterial, viral, fungal, and infectious mechanisms all contributing. It's also

linked to allergic reactions, nasal polyposis, and mucosal vasomotor dysfunction. It is one of the most prevalent conditions and has a negative impact on quality of life.[1-3] Anatomical variation of paranasal sinuses plays a significant role in the pathogenesis of chronic rhinosinusitis.[4]

The global prevalence ranges from 2% to 15%, with a high prevalence of 24.7% in Nigeria and 1.1% in Tanzania[5-7] with a male-to-female ratio of 1:1.5.[5,8]

Paranasal sinus variations are responsible for numerous pathologies, including CRS, which is caused by a mechanism that blocks or interferes with mucociliary clearance, and the sinus drainage system, causing increased mucus viscosity, ostium obstruction, and decreased mucosal resistance to sinus infections.[1,8] Concha bullosa, deviated nasal septum (DNS), paradoxical middle turbinate, Haller cells, Onodi cells, and Agger nasi cells are the most prevalent, though their frequency varies by region.[9,10]

Variations are classified based on their impact on sinus drainage and surgical significance. The first category includes anatomical variations obstructing the drainage system: concha bullosa, paradoxical middle turbinate, congenital absence of middle turbinate, pneumatized or absent uncinate process, septal pneumatization, and bulla ethmoidalis. The second category of variations that has an impact on surgical safety includes Haller cells, anterior clinoid process pneumatization, Onodi cells, and supraorbital recess.[2,12] Some uncommon anatomical variations such as sphenoethmoidal cells, pneumatization of anterior clinoid process and pneumatization of dorsum sellae can occasionally increase the risk of surgical complications.[11,13]

The Rhinosinusitis Task Force (RSTF) created a list of major and minor clinical diagnostic criteria. The RSTF major symptoms are facial pain or pressure, nasal obstruction or blockage, decreased sense of smell, and discoloured or purulent nasal or postnasal secretion. The RSTF minor symptoms are fever, halitosis, fatigue, dental pain, cough, ear pain or pressure, or fullness.[11]

Chronic rhinosinusitis is probable if the patient has two or more major factors or one major and two or more minor factors for more than twelve weeks.[11] CRS can be caused by several risk factors including allergy, infections, mucociliary dysfunction, mucosal oedema, PNS anatomical variations, genetic disorders like cystic fibrosis, autoimmune diseases, and sarcoidosis.[12]

CRS is diagnosed through multi-slice computed tomography (MSCT) of the PNS. Additionally, it is useful in identifying additional risk factors for CRS, including trauma and tumours.[8,11] The current treatment for CRS is functional endoscopic sinus surgery (FESS). Understanding the complex anatomy of the PNS is a requirement for a successful FESS.[11]

Method

This was a prospective cross-sectional study among patients with CRS attending the ORL Department. Cone Beam Computed Tomography Scan with a 128-slice detector (gantry rotation 0.33, slide thickness 0.5mm, gantry bore 7mm) was used.

Participants were patients aged 15 years and above who fulfilled the RSTF criteria of CRS. The exclusion criteria were patients with sinonasal tumours, previous sinus surgery, or trauma. Inclusion criteria were patients with the RSTF criteria, that is, two or more major symptoms or one major and two or more minor symptoms that lasted for more than 12 weeks.

Each CT scan was assessed using the Lund-Mackay CT scoring system. Diagnostic evidence of CRS was defined by a Lund-Mackay score of four or more. Data were analysed using SPSS version 26.

Ethical considerations

Ethical approval was granted by the MUHAS institutional review board (IRB). Informed consent was obtained from each participant and confidentiality was maintained.

Results

Table 1 shows that 53.3% of participants had PNS anatomical variations, and there was no significant difference in the proportion by age or sex.

Figure 1 shows that the most common site of CRS was the maxilla (85.8% of participants), with 69.2% having ethmoid CRS. The least common site was the sphenoid (20%).

Concha Bullosa was the most common anatomical variation, accounting for 26 (40.6%) patients with anatomical variations, followed by DNS 16 (25.0%), and Onodi cells 15 (23.4%) (Figure 2).

The 64 patients with anatomical variations had between them 86 variations. Twenty-four participants with maxillary CRS had concha bullosa, for 14 (58.3%) of which it was ipsilateral. In eight (72.7%) of the 11 subjects with a maxillary CRS with DNS, the variation was contralateral (Table 2)

Table 1. Demographic characteristics and PNS anatomical variations

		PNS anatomical variation		
	Total n (%)	Yes n (%)	No n (%)	p-value
Age in Years				
15-29	38 (31.7)	21 (55.3)	17 (44.7)	0.899
30-49	48 (40.0)	26 (54.2)	22 (45.8)	
50-69	31 (25.8)	16 (51.6)	15 (48.4)	
≥70	3 (2.5)	1 (33.3)	2 (66.7)	
Sex				
Male	65 (54.2)	35 (53.8)	30 (46.2)	0.903
Female	55 (45.8)	29 (52.7)	26 (47.3)	
	120 (100.0)	64 (53.3)	56 (46.7)	

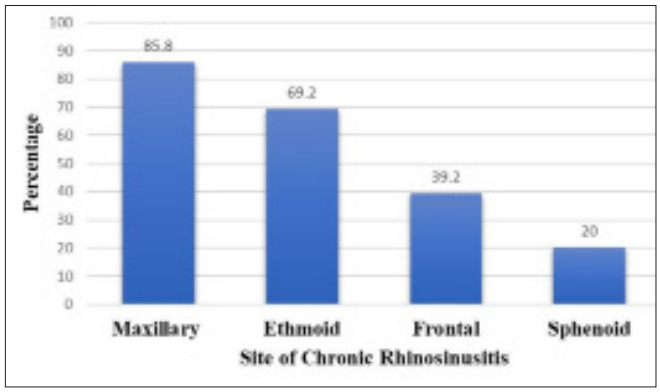

Figure 1. Sites of CRS among study participants

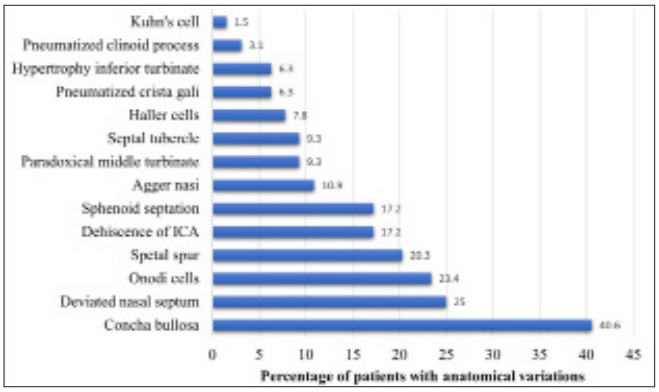

Figure 2. Anatomical variations among patients with CRS having anatomical variations

For ethmoid CRS, concha bullosa, DNS, PMT, and Haller cells had higher proportions of contralateral CRS than ipsilateral (69.2%, 75.0%, 75.0%, and 100% respectively).

Discussion

The overall proportion of anatomical variations in patients with CRS was 53.3%. Depending on which sinus is involved the anatomical variation can block the drainage of affected sinus e.g Haller cells which is a variation in the pneumatisation of ethmoid cells near the maxillary sinus ostium can lead to maxillary sinusitis and during surgery if they are not addressed can lead to recurrence. The Onodi cells, which is a variation in pneumatisation of posterior ethmoid cells on the superolateral region of the sphenoid sinuses can pose a challenge during endoscopic sinus surgeries whereby the internal carotid artery and optic nerve can be dehiscent leading to intraoperative complications if injured. Furthermore, there can be residual sinusitis for inexperienced surgeons where multiple cavities exist in the sphenoid sinuses. In this study, there were no significant differences in the occurrence of anatomical variations by age group or gender. Ipsilateral concha bullosa (pneumatisation of middle turbinate) was the most common anatomical variation among patients with chronic maxillary sinusitis accounting for 13.6% of patients who had chronic maxillary sinusitis. For ethmoid sinusitis, the most common variation was contralateral concha bullosa (13.6%). These findings were similar to other studies.[1,6,9] The commonest site affected by CRS was maxillary sinuses (85.8%) and the least identified site was sphenoid sinuses (20%).

Table 2. Laterality of anatomical variations in relation to the site of CRS

Anatomical variation	Contralateral CRS n (%)	Ipsilateral CRS n (%)	Total(N=86)
Maxillary CRS			
Concha Bullosa	10 (41.7)	14 (58.3)	24
Deviated nasal septum	8 (72.7)	3 (27.3)	11
Paradoxical middle turbinate	3 (50.0)	3 (50.0)	6
Haller cells	3 (100)	0 (0.0)	3
Ethmoid CRS			
Concha Bullosa	9 (69.2)	4 (30.8)	13
Deviated nasal septum	6 (75.0)	2 (25.0)	8
Paradoxical middle turbinate	3 (75.0)	1 (25.0)	4
Haller cells	1 (100)	0 (0.0)	1
Sphenoid CRS			
Onodi cells	2 (66.7)	1 (33.3)	3
Dehiscence of ICA	1 (50.0)	1 (50.0)	2
Sphenoid septation	2 (66.7)	1 (33.3)	3
Frontal CRS			
Concha Bullosa	1 (33.3)	2 (66.7)	3
DNS	1 (100)	0 (0.0)	1
Paradoxical middle turbinate	1 (50.0)	1 (50.0)	2
Agger nasi	0 (0.0)	2 (100)	2

Conclusion

The majority of patients (53.3%) with CRS had PNS anatomical variations. Chronic maxillary sinusitis was the commonest affected site. The most common variant identified was concha bullosa which was associated with chronic maxillary, ethmoid and frontal sinusitis in descending order of frequency. Healthcare providers treating patients with CRS should consider evaluating them for anatomical variations using CT Scan of PNS, to ensure better outcomes by addressing the primary problem.

Conflicts of interest: None

References

1. 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. J Otolaryngol Res. 2018;10:190–3.
2. Sarkar PS, Bhosale PR, Bharthi AR, Ananthasivan R. Computed Tomography Scan Correlation between Anatomic Variations of Paranasal Sinuses and Chronic Rhinosinusitis. Int J Sci Study. 2016;4(4):122–8.
3. Piromchai P, Kasemsiri P, Laohasiriwong S, Thanaviratananich S. Chronic rhinosinusitis and emerging treatment options. Int J Gen Med. 2013;6:453–64.
4. Madani SA, Hashemi SA, Kianejad AH, Heidari S. Association between anatomical variations of the sinonasal region and chronic rhinosinusitis: A prospective case series study. Acta Fac Medicae Naissensis. 2013;30(2):73–7.
5. Abraham ZS, Gabriel R, Kahinga AA, Ntunaguzi D, Mapondella KB, Massawe ER. Prevalence of chronic rhinosinusitis at Muhimbili National Hospital, Dar es Salaam. South Sudan Med J. 2020;12(3):97–100.

6. Kaygusuz A, Haksever M. Sinonasal Anatomical Variations : Their Relationship with Chronic Rhinosinusitis and Effect on the Severity of Disease — A Computerized Tomography Assisted Anatomical and Clinical Study. Indian J Otolaryngol Head Neck Surg. 2014 Sep;66(3):260-6. https://doi.org/10.1007/s12070-013-0678-y . Epub 2013 Oct 15. PMID: 25032111; PMCID: PMC4071417

7. Nair S. Correlation between symptoms and radiological findings in patients of chronic rhinosinusitis: a modified radiological typing system. Rhinology. 2009 Jun;47(2):181-6. PMID: 19593976.

8. Nouraei SAR, Elisay AR, DiMarco A, Abdi R, Majidi H, Madani SA, et al. Variations in paranasal sinus anatomy: Implications for the pathophysiology of chronic rhinosinusitis and safety ofendoscopic sinus surgery. J Otolaryngol - Head Neck Surg. 2009;38(1):32–7.

9. Adeel M, Rajput MSA, Akhter S, Ikram M, Arain A, Khattak YJ. Anatomical variations of the nose and paranasal sinuses; CT scan review. J Pak Med Assoc. 2013;63(3):317–9.

10. Abdi R, Holloway R, Majidi H, Andrews P. Variations in Paranasal Sinus Anatomy : Implications for the Pathophysiology of Chronic Rhinosinusitis and Safety of Endoscopic Sinus Variations in Paranasal Sinus Anatomy : Implications for the Pathophysiology of Chronic Rhinosinusitis and Safety of Endo. 2009.

11. Nair S. Correlation between symptoms and radiological findings in patients of chronic rhinosinusitis: A modified radiological typing system. Rhinology. 2009;47(2):181–6.

12. Cho JH, Park MS, Chung YS, Hong SC, Kwon KH, Kim JK. Do anatomic variations of the middle turbinate have an effect on nasal septal deviation or paranasal sinusitis? Ann Otol Rhinol Laryngol. 2011;120(9):569–74.

13. Daniel SC, Doshi AH, Lawson W, Som PM. CT of Anatomic Variants of the Paranasal Sinuses and Nasal Cavity: Poor Correlation With Radiologically Significant Rhinosinusitis but Importance in Surgical Planning. AJR Am J Roentgenol. 2015 Jun;204(6):1255-60. https://doi.org/10.2214/AJR.14.13762 PMID 26001236.