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Investigating Anatomical Variations in Paranasal Sinuses: A Comprehensive Analysis through Retrospective CT among the Indigenous Population at Multi - Speciality Hospital, Shillong

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Abstract: ***Introduction****: The anatomy of the nasal cavity and paranasal sinuses is one of the most frequently diverse in the human body. (Papadopoulou et al., 2021) . Deviations in the pneumatization of ethmoid sinuses can effect sinus ventilation and drainage pathways, probably serving as etiological factors for sinusitis and the spread of infection to adjacent structures. (Qureshi & Usmani, 2020). The Anatomical variations can occur due to race, environmental adaptation, geographical region, and exposure to chemicals or radiation. (Alraddadi, 2021) It is critical to evaluate these anatomic differences of the paranasal sinuses. (Akbar Ali etal., 2022) Anatomic variation knowledge proves crucial for sinus surgeons as it minimizes surgical complication rates during Functional Endoscopic Sinus Surgery (FESS), describes illness recurrence, and enables one to modify operative approach. (Tbassum, 2017) Different types of imaging modalities are available for evaluation of paranasal sinuses. While Conventional radiography provides useful information in the diseases of maxillary and frontal sinuses however, it has some limitation role in evaluation of nasal cavity, ethmoid and sphenoid sinuses. Conventional radiography does not show osteomeatal complexes. Multi detector computed tomography (MDCT) offer the details of a bony, soft tissue and air in the paranasal sinuses and accurate outline of the anatomy, and the anatomical variants and the extent of the pathology in and around the paranasal sinuses. The preferred method for examining the paranasal sinuses and nearby structures at the moment is Computed Tomography. (Lingaiah et al., 2016)*

Keywords: nasal cavity, paranasal sinuses, sinusitis, anatomical variations, computed tomography

1. Main Problem

Major sinus variants were found in 56.7% of the cases under study to have an Agger nasi cell, 3.5% to have a Haller cell, 7% to have an Onodi cell, 63% to have a nasal septal deviation, 35% to have a Concha bullosa, and 4.9% to have dental anomalies. (Talaiepour et al., 2005) It was reported that the most common anatomical variation in PNS was DNS (88.5%), which comes second the inferior turbinate hypertrophy (76.2) and agger nasi cell (67.7%) and Optic nerve variation type I (160/260 sinuses; 61.5%) and Keros type II, for olfactory depth (162/260 sinuses; 62.3%), were most common.

Even though the functional endoscopic sinus surgery is an effective way for treating patients with recurrent and refractory sinusitis, but there is a chance that the procedure will result in major surgical complications. Radiologists can prospectively identify anatomic variants that predispose patients to significant surgical problems with preoperative computed tomography (CT); however, these critical variants are not effectively evaluated or documented on preoperative imaging reports. (O'Brien Sr et al., 2016). An in - depth knowledge of these variances is crucial for both diagnosis and surgical planning to prevent harm to nearby important structures, such as the brain and orbit. There is a limitation in the literature about the anatomical variations of nose and PNS in our population.

Objective of the Study:

- To determine the different types anatomical variants and the most common occurring variants observed on routine CT PNS
- To identify the frequency across different age group distribution and gender among patient undergoing CT PNS
- To evaluate the correlations between reported symptoms and clinical findings.

2. Material and Method

This retrospective study was conducted at Supercare Hospital, Shillong for a period of 4 months 250 patients were included. The study obtains relevant demographic information, including age, gender, and clinical history document reported symptoms such as nasal congestion, headache, facial pain, and others and extract reports for analysis. Cross - reference reported symptoms with CT PNS findings to establish correlations. Employ statistical methods to determine the strength and significance of associations between symptoms and anatomical variants. The data in this research is analysed using Microsoft excel worksheet.

3. Results

Nasal Septal Deviation was notably higher 90.8% and inferior turbinate hypertrophy is 88.6 which is similar to the result done by (Farhan et al., 2020) in which the total number of patients was 113, DNS was observed in 115 of 13 (88.5%), and Inferior Turbinate Hypertrophy 99 of 130 (76.2%), 0 case were found as in case of Superior turbinate hypertrophy. Moreover the obliterated osteomeatal complex patent were seen 62% (155 0f 250) patients which agree to the study done by (Agrawal et al., 2022) which is 69% (69 0f 100 patients). Out of 250 cases, 133 patients were male (53.2%) and 117 female (46.8%). The most common effected age group is 21 - 30 years with a mean age is 22.5 years. In this study male population is highest compare to female (male 53.2%, female

- 46.8%) this is close to the study done by (Shrestha et al., 2019) were (56.6%) were male and (43.4%) female. A correlation was done between the most reported symptoms and the most occurrence variation and it shows there is a positive correlation between these variables it gives the value of r - 1. According to (Alghamdi et al., 2022) It was found that people with NSD had a higher frequency of headaches. Following a ten - year follow - up period and after adjusting for age, sex, and socioeconomic level, this conclusion was made.

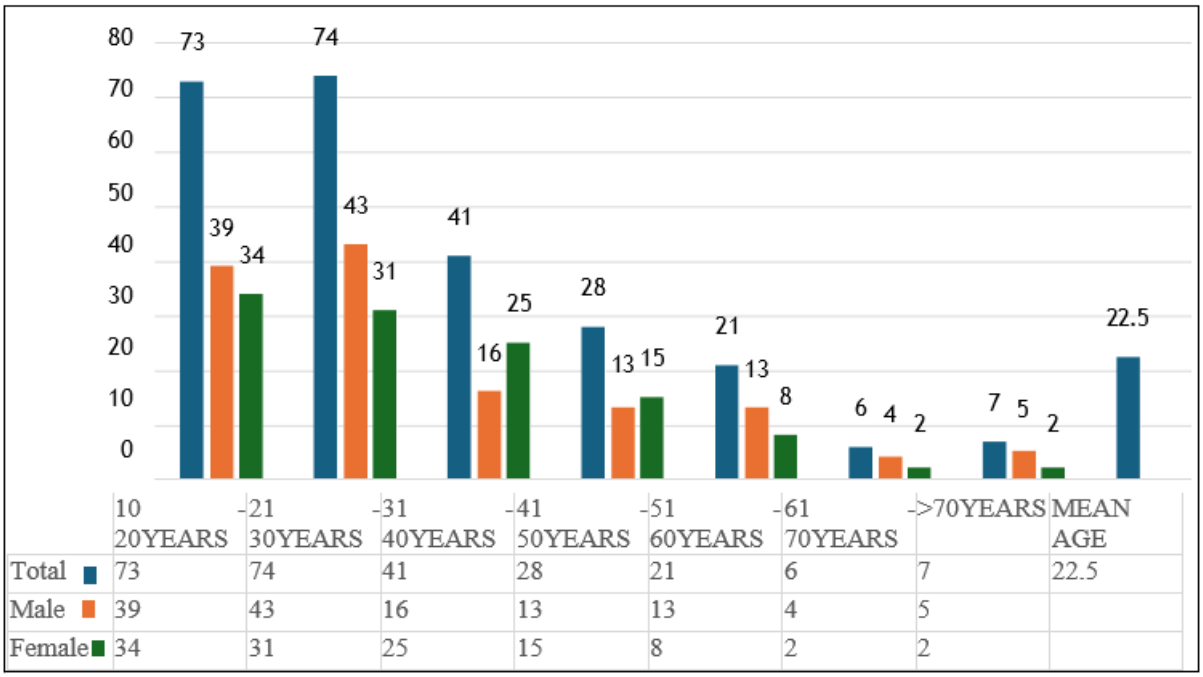

Figure 2: Distribution of age group

In figure 02, showing the bar diagram, A total of 250 cases were collected from the age range of 10 - 70 years above, this figure shows that out of 250 (250=n), the total number of male patients is 133 (53.2%) and the total of female patient is 117 (46.8%) and the mean age is 22.5 years.

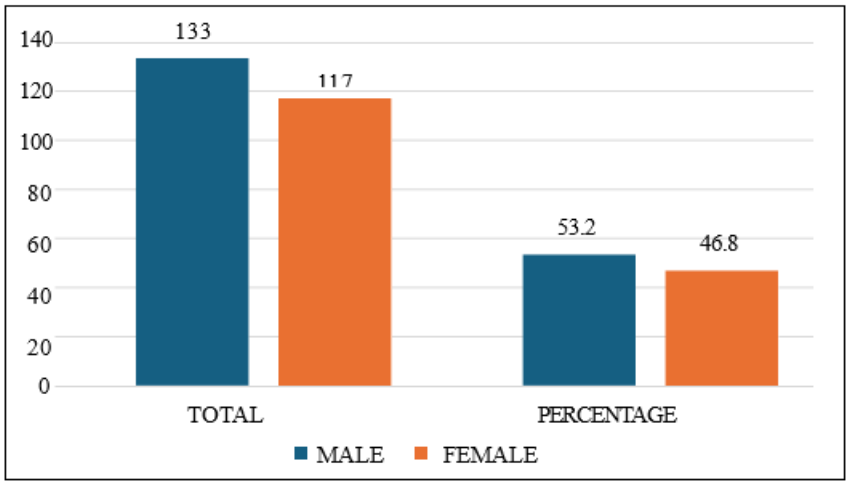

Figure 3: Gender Distribution.

The figure 03, bar chart shows the total number of males is 133 (53.2%) and female is 117 (46.8%).

Symptoms	Percentage
Nasal Obstruction	90.4
Epistaxis	7.4
Swelling	1.2
Nasal Discharge	19.2
Facial Pain	2.4
Headache	78
Cough	2.4
Other	1.2

Table shows the total percentage of the different reported symptoms the most common reported symptoms are nasal obstruction (90.4%), headache (78%). nasal discharge (19.2)

Correlation Between Reported Symptoms and CT Findings

Table 4: Correlation Between Symptoms and CT Findings

Symptoms		CT Findings		Correlation (r)
Nasal Obstruction	226=n	DNS	227=n	1
Headache	195=n	Inferior Turbinate Hypertrophy	199=n	

The table 04, shows correlation between reported symptoms and CT scan reports or findings was done and it shows the r value is 1. However not all variables are calculated because of the limitation in number between the two variable the correlation was calculated between highest reported symptoms and those variation with high occurrence.

Table (C): Anatomical variations observed on routine CT PNS

Anatomical Variation	Percentage
RT SIDE DNS	38.4
LT SIDE DNS	38.8
S SHAPE	13.8
TOTAL DNS	90.8
MIDDLE TURBINATE HYPERTROPHY	68.8
INFERIOR TURBINATE HYPERTROPHY	88.8
FRONTAL RECESSES OBLITRATED	64
SPHENOETHMOIDAL RECESSES OBLITRATED	55.6
LT SIDE BONY NASAL SPUR	18.4
RT SIDE BONY NASAL SPUR	12
PARADOXICAL MIDDLE TURBINATE	4
PARADOXICAL INFERIOR TURBINATE	0.4
OBLITRATED OSTEOMEATAL COMPLEX PATENT	62
SPHENOID PNEUMATIZATION(SELLER)	34
SPHENOID PNEUMATIZATION(PRESELLER)	33.2
SPHENOID PNEUMATIZATION(CONCHAL)	4.8
CONCHA BULLOSA MIDDLE TURBINATE	12.8
KEROS TYPE I	25.6
KEROS TYPE II	45.6
KEROS TYPE III	0.8
ONIDI CELL	1.2
AGGER NASI CELL	1.6
Table (C)Over all distribution of anatomical variation IN PNS	

The Table (C) shows that highest frequency among the anatomical variation is DNS (90.8%), followed by inferior turbinate hypertrophy (88.8), middle turbinate hypertrophy (68.8%), frontal recesses obliterated (64%), obliterated osteomeatal complex patent (62%), sphenoethmoidal recesses obliterated (55.6%).

4. Conclusion

This study was conduct in Supercare Hospital, Shillong for a period of 4 months. In this study a total data of 300 were collected, out of which 250 samples met the sampling criteria were taken, patients were enrolled have at least one or two anatomical variants of the nose and PNS which is similar to (Farhan et al., 2020) .

The most common anatomical variation was found to be the deviated nasal septum (DNS) which followed by inferior turbinate hypertrophy. The most common symptoms occur were Nasal obstruction and headache. A statistical correlation was found between the presence of DNS and turbinate hypertrophy, nasal obstruction and headache is r - 1, which shows that there is a positive relationship between these two reported symptoms and DNS and turbinate hypertrophy. CT of PNS has allows greater accuracy in evaluating of anatomical variation of PNS.

Overall considering the variability of the anatomical variation of paranasal sinuses it's crucial that this anatomical variation of paranasal sinuses be studied thoroughly before any FESS procedure involving the sinuses.

Limitation of the Study

Since this is a retrospective study clinical indication is limited, causation of the anatomical variation is not documented.

References

[1] Agrawal, N., Agrawal, C., Anand Sharma, D. P. A., Narang, S., Maheshwari, M., Bharagawa, A., Maheshwari, R., & Dudhat, H. (2022). Anatomical Variations Of Osteomeatal Complex In Chronic Rhinosinusitis Patients. Journal of Pharmaceutical Negative Results, 933–939.

[2] Ahmed, T. E. M., Ahmed, S., Mohammed, H. A., & Fadlalla, M. A. (2024). Anatomical Variations of the Nose and Paranasal Sinuses in Sudan. Sudan Journal of Medical Sciences, 19 (1), 41–53.

[3] Akbar Ali, M., Manish Jaiswal, D., Sameer Ahamed, D. B., Kumari, V., & Alam, S. (2022). A Study of Anatomical Variations of Sphenoid Sinus on CT PNS: Our Experience. Indian Journal of Otolaryngology and Head and Neck Surgery: Official Publication of the Association of Otolaryngologists of India, 74 (Suppl 2), 1690–1693. https: //doi. org/10.1007/s12070 - 021 - 02842 - z

[4] Alghamdi, F. S., Albogami, D., Alsurayhi, A. S., Alshibely, A. Y., Alkaabi, T. H., Alqurashi, L. M., Alahdal, A. A., Saber, A. A., & Almansouri, O. S. (2022). Nasal Septal Deviation: A Comprehensive Narrative Review. Cureus, 14 (11), e31317. https: //doi. org/10.7759/cureus.31317

[5] Alraddadi, A. (2021). Literature review of anatomical variations: clinical significance, identification approach, and teaching strategies. Cureus, 13 (4).

[6] Aramani, A., Karadi, R. N., & Kumar, S. (2014). A study of anatomical variations of osteomeatal complex in chronic rhinosinusitis patients - CT findings. Journal of Clinical and Diagnostic Research: JCDR, 8 (10), KC01.

[7] B D Chaurasia's. (2004). human anatomy regional and applied dissertation and clinical (4th editio). CBS publisher and distributor.

[8] Basti, R. S., Braggs, A. V., Mynalli, S., & Silva, R. M. (2018). Anatomical variations of olfactory fossa according to kero's classification in dakshin Karnataka: A comparison study with other races. Int J Contemp Med Surg Radiol, 3 (1), 19–22.

[9] Connor, S. E. J., Hussain, S., & Woo, E. (2007). Sinonasal imaging. Imaging, 19, 39–54. https: //doi. org/10.1259/imaging/

[10] Devaraja, K., Doreswamy, S. M., Pujary, K., Ramaswamy, B., & Pillai, S. (2019). Anatomical Variations of the Nose and Paranasal Sinuses: A Computed Tomographic Study. Indian Journal of Otolaryngology and Head and Neck Surgery : Official Publication of the Association of Otolaryngologists of India, 71 (Suppl 3), 2231–2240. https: //doi. org/10.1007/s12070 - 019 - 01716 - 9

[11] Devareddy, M. M., & Devakar, S. (2019). Evaluation of anatomical variations in nose and paranasal sinuses by using multidetector computed tomography. Int J Contemp Med Surg Radiol, 4 (3), C146–C151.

[12] Farhan, N., Naqvi, S. U., Rasheed, B., Sattar, A., Khan, M., Rahim, A., & Murtaza, G. (2020). Identification of significant anatomical variations in the nose and anterior skull base using computed tomography: a cross - sectional study. Cureus, 12 (6).

[13] Fikir, M., Treviño - González, J. L., González Andrade, B., & Morales Del Angel, J. A. (2023). Anatomical Variants of the Uncinate Process: A Challenge in the Endoscopic Surgery of the Nose and Paranasal Sinuses. Cureus, 15 (12), e50914. https: //doi. org/10.7759/cureus.50914

[14] Gendeh, H. S., & Gendeh, B. S. (2022). Paranasal Sinuses Anatomy and AnatomicalVariations. Paranasal Sinuses Anatomy and Conditions.

[15] Gruszka, K., Aksoy, S., Różyło - Kalinowska, I., Gülbeş, M. M., Kalinowski, P., & Orhan, K. (2022). A comparative study of paranasal sinus and nasal cavity anatomic variations between the Polish and Turkish Cypriot Population with CBCT. Head & Face Medicine, 18 (1), 37. Gupta, A. K., Bansal, S., & Sahini, D. (2012). Anatomy and its variations for endoscopic sinus surgery. Clin Rhinol An Int J, 5 (2), 55–62.

[16] Lingaiah, R. K., Puttaraj, N. C., Chikkaswamy, H. A., Nagarajaiah, P. K., Purushothama, S., Prakash, V., Booma, P., & Isma, M. (2016). Anatomical variations of paranasal sinuses on coronal CT - scan in subjects with complaints pertaining to PNS. Int J Anat Radiol Surg, 5 (04), R027–R033.

[17] Mudgade, D. K., Motghare, P. C., Kunjir, G. U., Darwade, A. D., & Raut, A. S. (2018). Prevalence of anatomical variations in maxillary sinus using cone beam computed tomography. Journal of Indian Academy of Oral Medicine and Radiology, 30 (1), 18–23.

[18] O'Brien Sr, W. T., Hamelin, S., & Weitzel, E. K. (2016). The preoperative sinus CT: avoiding a "CLOSE" call with surgical complications. Radiology, 281 (1), 10–21.

[19] Papadopoulou, A. - M., Chrysikos, D., Samolis, A., Tsakotos, G., & Troupis, T. (2021). Anatomical variations of the nasal cavities and paranasal sinuses: a systematic review. Cureus, 13 (1).

[20] Parihar, P., Patel, S., Banssal, M., Patel, A., Parihar, A., & Mohod, S. (2020). Evaluation of Anatomical Variants in Paranasal Sinuses with Computed Tomography in Central India Region. Journal of Datta Meghe Institute of Medical Sciences University, 15 (3).

[21] https: //journals. lww. com/dmms/fulltext/2020/15030/evaluation_of_anatomical_variants_in_paranasal.7. aspx

[22] Qureshi, M. F., & Usmani, A. (2020). Clinically significant variation of paranasal sinuses on CT - scan. Journal of Bahria University Medical and Dental College, 10 (2), 152–157.

[23] Reddy, U. D. M. A., & Dev, B. (2012). Pictorial essay: Anatomical variations of paranasal sinuses on multidetector computed tomography - How does it help FESS surgeons? Indian Journal of Radiology and Imaging, 22 (04), 317–324.

[24] Shrestha, K. K., Acharya, R., Joshi, R. R., Maharjan, S., & Adhikari, D. (2019). Anatomical variations of the paranasal sinuses and the nasal cavity. Nepal Medical College Journal, 21 (1).

[25] Sidle, D., & Hicks, K. (2018). Nasal obstruction considerations in cosmetic rhinoplasty. Otolaryngologic Clinics of North America, 51 (5), 987–1002.

[26] Tabassum, M. sarfaraz & A. (2017). An Observational Study on Anatomic Variations of Paranasal Sinuses in Patients Undergoing CT Scan Evaluation at Vardhman Institute of Medical Sciences, Pawapuri, Bihar. International Journal of Current Medical and Applied Sciences, 14 (3), 113–118.

[27] Talaiepour, A. R., Sazgar, A. A., & Bagheri, A. (2005). Anatomic variations of the paranasal sinuses on CT scan images. Frontiers in Dentistry, 142–146.

[28] Tandon, S., Giridher, V., & Juneja, A. (2019). Symptomatic Septal Deviation: Its Nasal Endoscopy and Computed Tomography - aided Correlation with Chronic Rhinosinusitis. Group, 1, 0–6.

[29] Tiwari, R., & Goyal, R. (2015). Study of anatomical variations on CT in chronic sinusitis. Indian Journal of Otolaryngology and Head & Neck Surgery, 67, 18–20.

[30] Whyte, A., & Boeddinghaus, R. (2020). Imaging of adult nasal obstruction. Clinical Radiology, 75 (9), 688–704.

[31] Yaprak, F., Çoban, İ., Sarıoğlu, O., Özer, M. A., & Govsa, F. (2023). Computed Tomography Based Evaluation of the Anterior Group of the Paranasal Sinuses. European Journal of Therapeutics, 29 (3), 341–351.

[32] YAZİCİ, D. (2018). Evaluation of anatomical variations on paranasal sinus CT. ENT Updates, 8 (3), 175–179.