# PARANASAL ANATOMICAL VARIATIONS BEFORE ENDOSCOPIC SINUS SURGERY USING COMPUTED TOMOGRAPHY (CT) SCAN

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***ABSTRACT***

***OBJECTIVES***

*To illustrate the various causes of Paranasal sinusitis and anatomical variations and assist ENT specialists in visualizing anatomical variations of paranasal sinuses.*

***METHODOLOGY***

*A cross-sectional study was conducted in the Radiology department of Allied Hospital and Faisal Hospital Faisalabad on 50 patients (20-70 years) using TOSHIBA 16 slice helical CT for four months through a convenient sampling technique. Data was collected by Performa and analyzed by SPSS version 22.*

***RESULTS***

*Paranasal anatomical variations were found in 30 out of 50 patients. Among the anatomical variable patients, 23 were male, and 7 were female. The most common anatomical variation was Nasal Septum Deviation (28%), while the least common was Agger Nasi Cells (5%). The study found an association between chronic sinusitis and anatomical variations; 22 patients with mild sinusitis were treated with antibiotics, while 8 patients with severe sinusitis were treated with endoscopic sinus surgery.*

***CONCLUSION***

*Paranasal sinus anatomical variations were found in 60% of patients in the study. The most common was Nasal Septum Deviation (28%), while the least common was Agger Nasi Cells (5%). CT scan is an excellent modality for surgeons to evaluate paranasal sinusitis before endoscopic sinus surgery.*

***KEYWORDS:*** *Paranasal Anatomical Variations, Nasal Septum Deviation, Heller Cells, Paradoxical Middle Turbinate*

## INTRODUCTION

Paranasal sinuses are small holes in facial bones that help drain fluid from the nasal cavity.[1] They are associated with the nose on the facial part of the skull where air passes and mucus drains.[1,2] There are four pairs of sinus cavities, and their names are given by where they are located on the face; frontal sinuses, maxillary sinuses, ethmoid sinuses, and sphenoid sinuses.[2] Frontal sinuses are pockets of space above the perimeter of each eye (dipole space between the outer and inner tables) on the anterior bone, separated by a bony septum in the middle.[1,3] They are coated with a mucous membrane, which removes fluids and protects the covering area.[2] Frontal sinus variants are of two types: Extended and Hypoplastic.[4] The maxillary sinus is the most prominent paranasal sinus.[3] The maxillary sinuses are shaped like a pyramid with an apex in the zygomatic process of the maxilla bone and the base in the lateral wall of the nose.[1,2] They reduce the weight of the skull, produce mucus and affect the quality of human voice tone.[2] Maxillary sinus variants are; Septation, Hypoplasia, and Extended sinus.[4] Ethmoid sinuses are part of the paranasal sinus system and are located between the nose and eyes.[1,2] The primary function of the ethmoid sinus is to lower the overall skull weight and make the human voice more vibrant as it grows during puberty.[2] Ethmoid sinus variants are Frontal cells, Supra orbital cells, Agger nasi, and Haller's cells.[4] The sphenoid sinuses are located in the sphenoid bone near the optic nerve and the pituitary gland on the side of the skull.[1,2] The sphenoid sinus is known as the most flexible part of the human body (Shankar). The function of the sphenoid sinus is to filter and purify the nasal airway and lighten the skull bones.[2] Sphenoid sinus variants are Septation, Extensions, Anterior Onodi cells, and clinoid pneumatization.[4] Sino-nasal diseases, which viruses and bacteria can cause, are common health problems in rhino-logic practice.[5] Although sinusitis is clinically visible, imaging studies are used to diagnose the disease.[6] Currently, computed tomography (CT), especially in the coronal plane, is the most common method surgeons use because of its similarity to the surgical procedure.[6,7] Heller Cells are the most common anatomical variation in the maxillary sinus. Haller cells (infra-orbital ethmoid cells) are airborne ethmoid cells that appear at the bottom of the orbit, appearing frequently from the anterior ethmoids.[1] In some cases, they may reverse the uniqueness of the maxillary sinus infundibulum. In some cases, they may be involved in chronic polypoid fever, which will cause

them to open.[8] The agger nasi (agger meaning "mound or heap") is a small ridge on the lateral nasal of the nasal cavity.[2] Agger nasi cell pneumatization with shrinking sinus outflow is a significant cause of persistent frontoethmoid pain and chronic sinusitis.[7] Nasal Septum Deviation is a condition in which the nasal septum (bone and cartilage that separates the nasal cavity in half) is either in the middle or crooked, making breathing difficult.[9] Some people are born with a defective septum, while some may form a deformed septum after an injury or trauma to the nose.[10] Concha bullosa is a widespread variant. It is one of the most diverse forms of Sino nasal anatomy, found in 35% of patients.[11] Concha bullosa is associated with degeneration of the nasal septum, which has also been present in some studies on the spread of sinus disease.[9] Paradoxical Middle Turbinate refers to the medial turbinate edges of the concave curve with a concave surface facing the nasal septum and usually occurs at the junction.[12] These anatomic variations alone can significantly reduce the medial margin and prevent normal paranasal sinuses due to complex ostiomeatal obstruction.[13]

## METHODOLOGY

A cross-sectional (descriptive) study was performed in Faisal Hospital, Pakistan. A total of 50 patients (30 males and 20 females) aged between 20-70 years having PNS anatomical variations were selected via a purposive sampling technique. However, Post-traumatic and postoperative patients were excluded from the study. A TOSHIBA 16-slice helical CT machine examined all the patients. A CT Scan for paranasal sinuses is a non-contrast examination of the paranasal sinuses, anatomical structures, and surrounding tissues. The gantry is then angulated (perpendicular to the infraorbitomeatal line) with a slice thickness of 3 mm per slice while the patient is in the prone position with the head extended and the chin supporting the head. Radiologists examined all patients completing admission conditions for the cause of paranasal sinuses. CT scans were viewed in coronal planes, and the result was compiled by the self-modified questionnaire divided into demographic, clinical symptoms, and radiological imaging revelation (anatomical variations). The results were analyzed by SPSS V22, expressed in frequency and percentage. Informed consent was obtained from the patients after explaining the procedure. Moreover, the ethics committee of Faisal Hospital (FIHS), Faisalabad, Pakistan, duly approved the study dated 16/09/2022, numbered FIHS/22/28.

## RESULTS

**Table 1: Frequency Distribution of Gender of Patients**

| Gender | Frequency | %Age |
|---|---|---|
| **Male** | 30 | 60 |
| **Female** | 20 | 40 |
| **Total** | 50 | 100 |

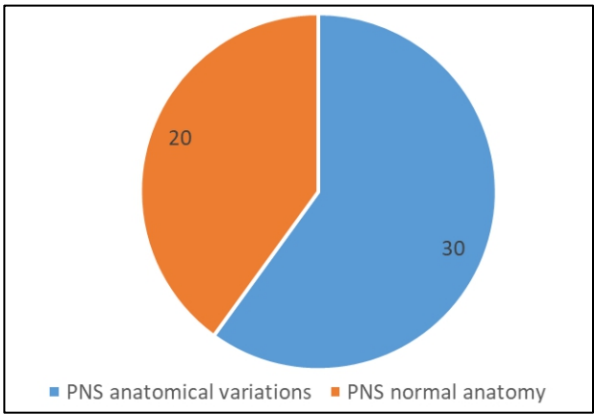


**Figure 1: Distribution of Normal & Variations in PNS Anatomy**

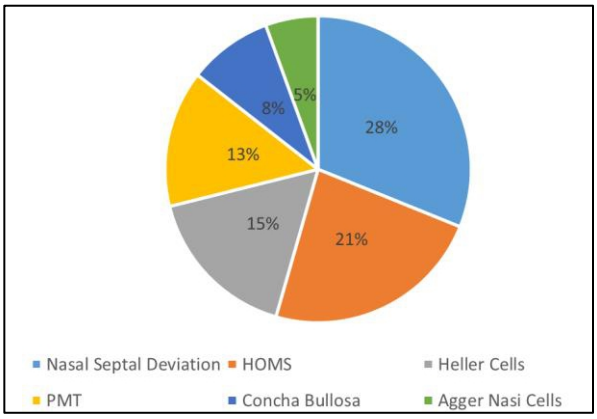


**Figure 2: Distribution of PNS Anatomical Variants**

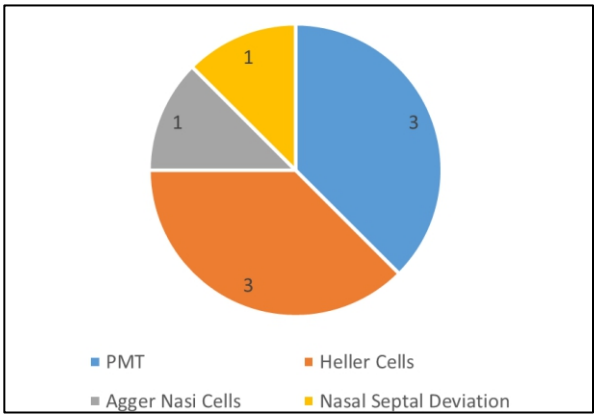


**Figure 3: Distribution of Variants in Severe Sinusitis Cases**

## DISCUSSION

Surgical treatment of Sino nasal disease has emerged over the years. Increasing external and long-term surgical procedures have replaced a less invasive procedure called endoscopic sinus surgery (ESS).[6] Skull base, in case of complications in surgery, can lead to dangerous and harmful conditions.[14] CT is an excellent method that can give images to the different axes, especially the coronal view. It is essential to seek surgeons opinions before the endoscopic procedure.[14] Because the coronal CT view shows the endoscope's precision and any inhibition of anatomical diversity is indicated by this concept, which makes pre-surgery planning easier.[13] A study by Koo SK et al. 2017 showed that the most common anatomical variation was Nasal Septal Deviation with a frequency of 79%.[15] The results correlate well with the given study; the most common anatomical variation was Nasal Septal Deviation with a frequency of 28%. A study conducted by El-Taher M. et al. in 2019 shows that the least common anatomical variation found was Concha Bullosa, with a frequency of 37%.[16] The results analogize with the current study. The least common anatomical variation found was Concha Bullosa, with a frequency of 8%. A study conducted by Madani GA et al. in 2021 showed that the frequency of Paradoxical Middle Turbinate was 4.9% (3 cases only).[17] However, the frequency of Paradoxical Middle Turbinate in the current study is 13%. A study conducted by Rahmawati R. in 2021 concluded in her study that the frequency of Heller Cells was 11% (4 cases).[18] The results coordinate with the given study. The frequency of Heller Cells was 15%. A study by Reddy A. et al. 2018 showed that the frequency of Agger Nasi Cells was 33%.[19] However, the frequency of Agger Nasi Cells in the given study is 5%. Not all cell degeneration is clinically significant. Many can cause sinus disease and cause complications during chronic surgery. A dissertation by Praveena E in 2019 showed that deviation from the water can push the middle turbinate to one side, obstructing the ipsilateral maxillary and reducing access to the medial meatus during endoscopic sinus surgery.[20] Many authors believe that the anatomical variability of paranasal structures may plan for patients with recurrent sinusitis. However, a systematic review by Papadopoulou AM et al. in 2022 showed that there is no association between all of the anatomical differences and rhino sinusitis and emphasized the environmental, systemic, or mucosal disease within the pathogenesis of rhino sinusitis.[21]

## LIMITATIONS

There are fewer patients in the research than in other studies. The p (probability) value for each PNS variant is not given in the study.

## CONCLUSIONS

Different types of configuration can be found more often in Paranasal Sinuses. Since all variations have anatomic and surgical significance, a CT scan should thoroughly evaluate each case before surgery to maximize patient benefit and avoid significant complications. Axial and Coronal fragments with a thickness of 1-3mm of a piece of PNS CT scan provide more essential details than large images of lump size and nasal septum deviation. Patients with various physiological features included in the study, when encountered, were counselled about changing their lifestyle, recognizing nasal infections, and not allowing long-term exacerbations that could lead to weight loss.

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