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An Observational Study of Anatomical Variants in Patients Presenting with Sinonasal Headache as Seen on Computed Tomography

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Abstract:

- ***Background:***

Headaches are a very common condition worldwide. The sinonasal region demonstrates considerable anatomical variability which can potentially predispose patients to obstruction of the osteomeatal complex, impaired sinus drainage, recurrent rhinosinusitis, and technical challenges during functional endoscopic sinus surgery (FESS). CT scan provides a high-resolution imaging of nose and paranasal sinus anatomy. This study was undertaken to evaluate the anatomical variations as seen on CT scan in such patients.

- ***Method:***

An observational hospital-based study was conducted over 18 months at a tertiary care centre involving 52 patients.

- ***Result:***

Deviated nasal septum (especially s-shaped), septal spurs and concha bullosa were found to be the most prevalent anatomical variants in sinonasal anatomy in patients with headache.

- ***Conclusion:***

Computed tomography of the paranasal sinuses proved essential for identifying structural issues like a deviated nasal septum or concha bullosa that caused narrowing of the osteomeatal complex and secondary headaches. Functional endoscopic sinus surgery (FESS) corrected these obstructions, restoring proper ventilation and relieving symptoms.

Keywords: *Sinonasal Headache, CT Scan, DNS, Concha Bullosa.*

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I. INTRODUCTION

Headaches are a very common condition worldwide and are classified as either primary or secondary [1]. Headaches located in the frontal, supraorbital, or occipital regions are frequently of sinonasal origin [1, 2].

The sinonasal region demonstrates considerable anatomical variability, reflecting the complex embryological development of the nasal cavity and paranasal sinuses [3]. These variations are commonly encountered in routine clinical practice and are of particular importance to otorhinolaryngologists and radiologists because of their potential influence on mucociliary clearance, ventilation of the paranasal sinuses, and surgical anatomy [3, 4]. Although many anatomical variants are incidental findings without clinical consequences, certain variations may predispose individuals to obstruction of the osteomeatal complex, impaired sinus drainage, recurrent rhinosinusitis, and technical challenges during functional endoscopic sinus surgery (FESS) [4, 5].

Computed tomography (CT) has become the gold standard imaging modality for evaluating the anatomy of the nose and paranasal sinuses [5, 6]. High-resolution coronal, axial, and sagittal CT images provide excellent visualization of bony landmarks and anatomical relationships that are often difficult to appreciate on clinical examination alone [6]. Preoperative CT assessment is therefore indispensable for identifying normal anatomical landmarks, detecting disease extent, and recognizing variants that may increase the risk of surgical complications involving the orbit, optic nerve, internal carotid artery, olfactory nerve, or skull base [5, 7].

Among the commonly described sinonasal anatomical variants are deviated nasal septum, septal spur, concha bullosa, paradoxical middle turbinate, agger nasi cells, Haller cells, Onodi cells, enlarged ethmoid bulla, accessory maxillary ostium, and variations of the uncinate process [4, 8]. The prevalence of these variants differs widely across populations owing to ethnicity, genetics, developmental and methodological differences among studies [8]. Several investigators have attempted to correlate these anatomical variations with chronic rhinosinusitis and headache; however, available evidence remains inconsistent [2, 8].

The present observational study was undertaken to evaluate the prevalence and pattern of sinonasal anatomical variants detected on computed tomography in patients presenting to a tertiary care centre [9]. The study also aimed to describe the distribution of these variations and emphasize their clinical relevance in the assessment and surgical management of sinonasal disorders [9].

II. MATERIALS AND METHODOLOGY

This was an observational hospital based study conducted in the department of otorhinolaryngology, in IMCHRC, Indore for the duration of 18 months.

➢ *Inclusion Criteria-*

- Patient presenting with sinonasal headache

➢ *Exclusion Criteria-*

- Patient with other co-existing pathologies
- Age less than 8 years or more than 60 years
- Refractive errors

➢ *Sample Size- 52 Patients with Sinonasal Headache*

- *Method-*

After thorough Ent examination, patients were sent for CT scan. 30 minutes prior to the scan, 0.1% Xylometazoline drops were instilled in both nasal cavities. 1 mm thickness slices were taken, from nasion to posterior extent of sphenoid, perpendicular to hard palate.

III. RESULT

Most common sinonasal variant noted was deviated nasal septum (80.76%), followed by maxillary sinus thickening (76.9%), concha bullosa (51.9%), inferior turbinate hypertrophy (28.8%) and anterior ethmoidal haziness (26.9%).

Table 1 Result

Findings	Computed tomography
Uncinate process (pneumatization)	3
(Paradoxical)	1
(polypoidal)	0
Haller cells	4
Accessory maxillary ostium presence	1
Middle turbinate (paradoxical)	3
(concha bullosa)	27
(hypertrophy)	4
Inferior turbinate (hypertrophy)	15
(polypoidal)	0
(atrophy)	2
Deviated nasal septum	42
Frontal sinus opacity	9
Maxillary sinus mucosal thickening	40

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Sphenoidal sinus mucosal thickening	14
Anterior ethmoidal cell haziness	14
Posterior ethmoidal mucosal thickening	6
Middle meatus secretions	4

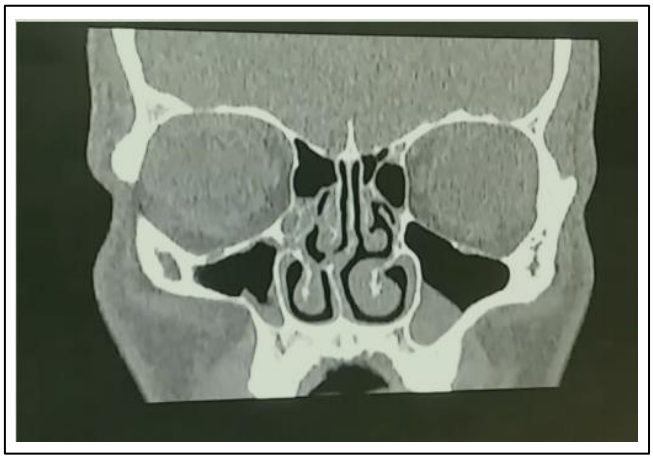

Fig 1 Showing Deviated Nasal Septum with Spur

Fig 2 Showing Left Side Concha Bullosa

IV. CONCLUSION

Computed tomography (CT) of the paranasal sinuses proved crucial for evaluating sinonasal headache, offering superior visualization of the micro-anatomy and narrow recesses of the sinonasal cavity that remained obscured during anterior rhinoscopy or nasal endoscopy. Radiographic evidence demonstrated that a deviated nasal septum (DNS)-particularly S-shaped deformities—comprised the most prevalent structural anomaly. These septal deviations, alongside septal spurs and concha bullosa, frequently narrowed or occluded the osteomeatal complex. This mechanical obstruction impaired mucociliary clearance, precipitated sinus ventilation failure, and induced the subsequent development of sinusitis and associated secondary headaches.

Following appropriate diagnostic workup, functional endoscopic sinus surgery (FESS) was performed to restore sinus ventilation, which successfully alleviated the patient's sinonasal headache.

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