

DESCRIPTIVE CROSS-SECTIONAL STUDY OF SPHENOID SINUS PNEUMATIZATION VARIANTS, ONODI CELLS AND THEIR CLINICAL IMPLICATIONS

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Abstract

Background: Variations in sphenoid sinus pneumatization are significant, particularly in diseases and transsphenoidal surgeries where the degree of pneumatization plays a crucial role. Analyzing anatomical variants in the general population was the focus of our descriptive cross-sectional study, conducted among patients undergoing CT head scans for various complaints such as trauma, headaches, seizures, etc. Our findings revealed that the most prevalent variant in sphenoid pneumatization in the population is the partial sellar type. Additionally, we observed the presence of Onodi cells and dehiscence of the pterygoid canal, optic canal, and maxillary nerve, ICA wall.

INTRODUCTION

Sphenoid sinus pneumatization exhibits significant anatomical variation, which may have clinical implications in the diagnosis and management of sinonasal disorders. The degree of sphenoid variations determines the possibility of transsphenoidal surgery. This descriptive cross-sectional study aims to characterize sphenoid sinus pneumatization variants and explore their potential association with sinus-related pathologies.

Sphenoid Sinus Pneumatization

Sphenoid sinus pneumatization,^[1] can be divided into conchal, presellar, incomplete and complete sellar types.^[1]

Conchal type: pneumatization >10 mm anterior to the anterior wall of sella. Presellar type:

the posterior margin of pneumatization anterior to the anterior wall.

Incomplete sellar: the posterior margin of pneumatization beneath the sella, but anterior to the posterior wall of sella.

Complete sellar: the posterior margin of pneumatization, posterior to the posterior wall of sella.

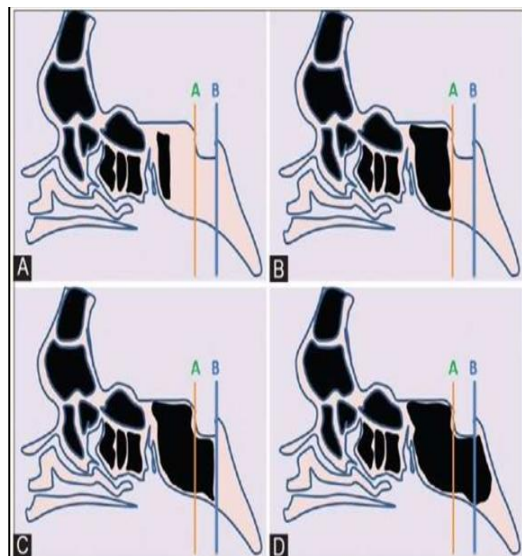


Figure 1: Showing the different type of sphenoid sinus pneumatization A) Conchal B) Presellar C) Incomplete sellar D) Complete sellar

The conchal nonpneumatized sphenoid sinus was always considered to be a contraindication to the trans-sphenoidal approach to the sella.

Hypoplasia /Agenesis of the sphenoid sinus may be seen. There may be dehiscence of bony canal wall if foramen rotundum /vidian canal/optic nerve canal or internal carotid artery.

Variations of the Optic Nerve

The Delano classification delineates the optic nerve's pathway into four distinct types:

Type I: This is the most prevalent, found in 76% of cases. Here, the optic nerve runs closely alongside the sphenoid sinus without indenting the sinus wall or coming into contact with the posterior ethmoid air cell.

Type II: In this type, the optic nerve courses adjacent to the sphenoid sinus, causing indentation of the sinus wall, but without direct contact with the posterior ethmoid air cell.

Type III: In this scenario, the optic nerve traverses through the sphenoid sinus, with a minimum of 50% of its length surrounded by sinus tissue.

Type IV: In this classification, the optic nerve lies immediately adjacent to both the sphenoid and posterior ethmoid sinuses.

Type III and type IV optic nerve morphology are prone for FESS related optic nerve injury.

MATERIALS AND METHODS

A descriptive cross sectional study was conducted in the Department of Radiodiagnosis, Government Medical College, Kottayam for a period of 12 months. The study population included 210 patients undergoing CT brain evaluation for various reasons from different departments who are interviewed using a semi structured questionnaire. Non contrast CT brain was performed for these patients and was evaluated for anatomical variations of nose and paranasal sinuses.

RESULTS

Sphenoid Sinus Pneumatization

The most common type of sphenoid pneumatization is partial sellar (76.19 percent) followed by complete sellar (19.5 percent), pre sellar (3.33 percent) and conchal type (0.95 percent).

Out of 48 cases with onodi cells 2 cases (4.1 percent) showed the presence of corresponding sphenoid sinus mucosal changes. No significant association seen between sinusitis and sphenoid pneumatization changes.

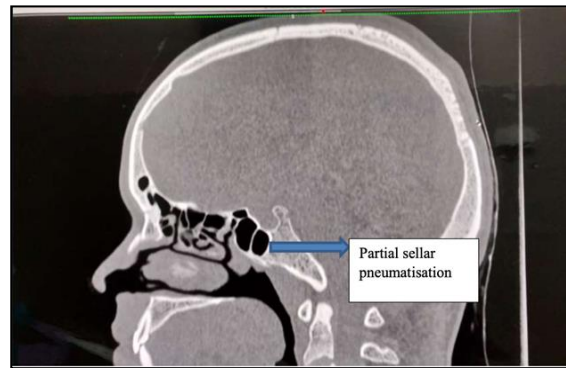


Figure 2: Sagittal section of the brain and sinuses showing partial stellar pneumatization of sphenoid sinus

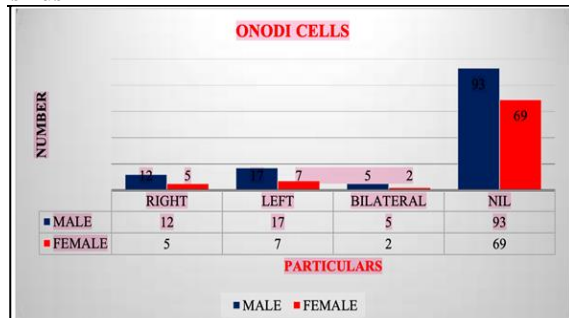


Figure 3: Chart showing the percentage of patients with onodi cells in our study population

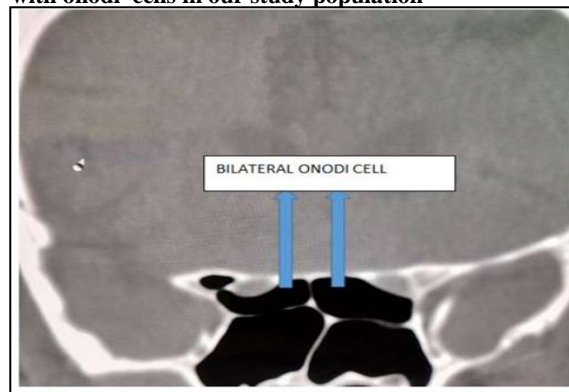


Figure 4: Coronal CT images showing Bilateral onodi cells

Dehiscence of Optic Nerve Canal

Dehiscence of optic nerve canal was detected in 20 cases out of 210 (9.5 percent). Out of 20 cases right sided presentation was seen in 55 percent, left sided in 25 percent, bilateral in 20 percent. M C Delano et al3 had reported a prevalence of 24 percent and Fuji et al4 had reported a lower prevalence of 4 percent.

Dehiscence of Pterygoid Canal

Dehiscence of pterygoid canal was seen in 136 cases out of 210(64.7 percent). Right sided presentation was seen in 75 cases (55 percent), left sided in 44 cases (32.3 percent) and bilateral in 17 cases(12.5 percent).

Dehiscence of Foramen Rotundum

Dehiscence of foramen rotundum was seen in 39 cases out of 210 (33 percent).

Table 1: Showing the proportion of sphenoid sinus pneumatization in our study population

Sphenoid Sinus Pneumatization	Number of Cases
Conchal	2
Presellar	7
Partial Sellar	160
Complete Sellar	41
Total	210

DISCUSSION

The presence of an Onodi cell poses a challenge for transsphenoidal surgical approaches aimed at sellar lesions. Sinusitis affecting the sphenoid region can manifest with visual symptoms due to its close proximity to the optic nerve. During surgery, mistaking the Onodi cell for the sphenoid sinus can lead to incomplete procedures. Studies, such as the one by Ji-hyeon Shin (564), highlight the heightened risk of injury to both the optic nerve and internal carotid artery, when there is onodi cell variation. In our current study, bilateral Onodi cells were observed in only 2 cases out of 210 (4.1 percent), both of which presented with bilateral sphenoid sinus mucosal changes.

Regarding sphenoid pneumatization, the most frequently encountered type. was found to be partial sellar in the present study (76.19 percent) complete sellar type was observed in 19.5 percent patients, presellar type in 3.33 percent, conchal type in 0.95 percent.

Dehiscence of optic nerve canal was detected in 20 cases out of 210 (9.5 percent). Out of 20 cases right sided presentation was seen in 55 percent, left sided in 25 percent, bilateral in 20 percent. M C Delano et al³ had reported a prevalence of 24 percent and Fuji et al,^[4] 67 had reported a lower prevalence of 4 percent.

Dehiscence of pterygoid canal was seen in 136 cases out of 210 (64.7 percent). Right sided presentation was seen in 75 cases (55 percent), left sided in 44 cases (32.3 percent) and bilateral in 17 cases (12.5 percent). Davoodi et al,^[7] reported in their study that the rate of dehiscence in the Vidian canal bony roof was 34.4% in males and 37.5% in females. Hewaidi et al,^[8] reported a dehiscence rate of 37%. Yazar et al^{5,70} reported a dehiscence frequency of 32%. In a study by Yakup,^[6] et al dehiscence of the bony roof of the vidian canal was found on the right side in 22.2% of the patients and on the left side in 26.6%.

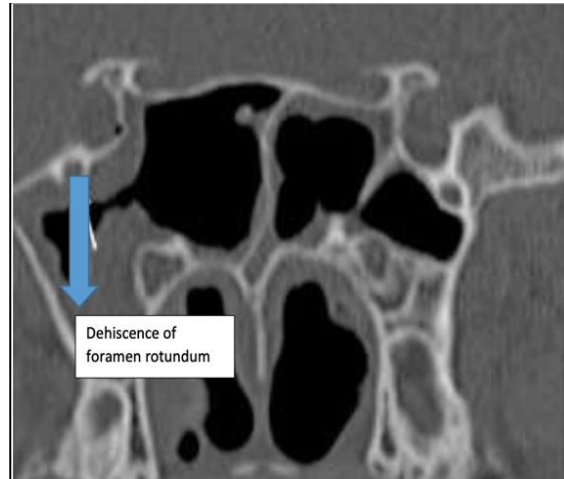


Figure 5: Coronal CT image of the paranasal sinuses showing dehiscence of wall of right foramen rotundum with sphenoid sinusitis

Dehiscence of foramen rotundum was seen in 39 cases out of 210 (33 percent). Right sided presentation was seen in 18 cases out of 39(46 percent), left sided in 15 cases (38.4 percent) and bilateral in 6 cases (15.3 percent).



Figure 6: Dehiscence of right ICA wall

CONCLUSION

Variation in the structure and pneumatization of the sphenoid sinus is individualized. Computed

tomography evaluation of the paranasal sinuses is crucial for identifying these variations, particularly with regard to the optic nerve, vidian nerve, and maxillary nerve, and for assessing bony canal wall dehiscence. Recognizing dehiscence in the bony canal of the optic nerve, internal carotid artery (ICA), vidian nerve, and maxillary nerve is vital, as it can facilitate the spread of infection or malignancy.

Given the descriptive nature of our study, the association between sinus anatomical variants and sinusitis was not assessed so to investigate this relationship, a case-control study would be necessary.

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Conflicts of interest: nil.

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