

# ASSESSMENT OF VARIATIONS IN SPHENOID SINUS PNEUMATIZATION IN PAKISTANI POPULATION AT TERTIARY CARE HOSPITAL. A RETROSPECTIVE MULTIDETECTOR COMPUTED TOMOGRAPHY STUDY

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## ABSTRACT

**Objectives:** To evaluate the role of computed tomography in identifying the various patterns of pneumatization in the sphenoid sinuses. Knowledge of the pattern of pneumatization is essential for various trans-sphenoidal surgical procedures.

**Methods:** This is a retrospective study conducted at tertiary care hospital Lahore General Hospital Department of Diagnostic Radiology from the period of June 2020 to December 2020. The study consisted of a total of 80 patients from age group of 20 years to 70 years who were referred to the Department of Diagnostic Radiology for CT scan (PNS). Patients of age less than 20 years, previous facial surgeries, trauma of skull base and having tumor of sphenoid sinuses were excluded. Sphenoid sinuses images were evaluated for pneumatization by posterior and anterior extensions.

**Results:** The patients included were in the age range of 20-70 year with an average age of 43.5 year in which 44 (55%) were male and 36 (45) were female. The pneumatization pattern observed in the sphenoid sinuses in descending order was as follows, post sellar prevalence was 75%, prevalence of sellar was 10% and 2.5% was presellar. Conchal prevalence was observed to be 0%.

**Conclusion:** Sphenoid sinus anatomy review before trans-sphenoidal surgery is vital for safer endoscopic instrumentation of the patients.

**Keyword:** Sphenoid sinus, pneumatization, cerebral fluid leak, endoscopy.

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## INTRODUCTION

The sphenoid sinus is located in the sphenoid bone in the skull. Development of sphenoid sinus starts in the fourth month of the fetus and is present in a non-pneumatized state at time of birth. Process of pneumatization starts when the infant is 9-month-old and

at fourteen year of age adult configuration occurs<sup>1</sup>. Pneumatization absence is considered a rare phenomenon and is associated with syndromes like Down's syndrome, osteodysplasia and craniosynostosis. Progression of pneumatization takes place in an inferior-posterior-lateral direction. Many vital structures lie close to sphenoid sinus like maxillary nerve, optic nerve, vidian nerve, abducent nerve, oculomotor nerve, internal carotid arteries, trochlear nerve, cavernous sinus, frontal lobe, pituitary gland and ventral surface of brainstem. The superior, posterior and lateral walls are located near cerebrospinal fluid<sup>2</sup>.

For skull base surgeries access through the transsphenoidal approach has become a popular approach for pituitary adenomas, skull base lesions and lesions in the sella. The appearance of sphenoid sinus is not consistent and hence the pneumatization degree of variation is from extensive to low in different patients<sup>3</sup>. Pneumatization pattern variations are vital for skull base lesions. So, planning for surgeries of the sellars and skull base lesion<sup>4</sup>. The extension of pneumatization is from pterygoid process, greater wing of sphenoid, anterior clinoid process and clivus<sup>5</sup>. CT evaluation helps the surgeons to analyze the anatomic appearance and condition of pathology before starting and planning a surgery. From the Hamberger classification sphenoid sinus can be classified into sellar type, presellar and conchal type depending upon their posterior extent and anterior sellar wall<sup>6</sup>. Complete sellar and incomplete sellar are the subdivision of sellar type. Sellar extension study is important based on the sellar region for transsphenoidal surgeries. In order to avoid the endoscopic complications assessment of the sellar region is required. Therefore, the pattern of pneumatization of sphenoid sinus is important for skull base surgical intervention<sup>7</sup>. Therefore, each patient is extensively evaluated for anatomic pattern of sphenoid sinus involving pituitary gland, cranial nerves, brain, internal carotid artery cavernous sinus and optic nerve<sup>8</sup>. If pneumatization patterns are not evaluated properly these vital structures during surgical intervention may be at risk. Therefore, CT scan helps in the pneumatization evaluation of sphenoid sinus from the skull surrounding bones<sup>9-10</sup>.

## METHODS

The retrospective study was conducted at the Department of Diagnostic Radiology Lahore General Hospital from the period of June 2020 to December 2020. CT images of patients for paranasal sinus were taken of 80 patients who showed different pathologies. The patients from both genders were included who have an age group above 20 years till 70 years. Age below 20 years and patients with concurrent pathologies, patients with paranasal sinus surgery, sphenoid sinus disease or facial trauma were excluded.

## SPHENOID SINUS CLASSIFICATION

For CT multiplanar axial, sagittal and coronal images reconstructions were used. The slice thickness used was 1.5 mm, 1.3 mm recon increment and 223mm× 223 mm field of view.

For Sphenoid sinus pneumatization classification vertical lines are marked with the anterior and posterior wall of sella. Absence of pneumatization is considered as conchal type. Posterior margin of pneumatization is

anterior to the anterior wall in presellar type. Posterior margin of pneumatization extension is beneath the sella in sellar type. The posterior margin of pneumatization extended posteriorly to the posterior wall of sella in complete sellar or postsellar type. Classification of sphenoid sinus is based upon its contact with posterior and anterior walls of sella turcica and can be Sellar (complete, incomplete) presellar and conchal from the sagittal planes.

## RESULTS

Total of 80 scans were selected in the study and CT scan (PNS) was performed for all of them. Age group was from 20 years to 70 years and the mean age group of the participants was  $40.12 \pm 14.30$ . Female participants were 36(45%) and male participants were 44(55%). Pneumatization pattern was similar in both male and female. Conchal type was not observed among our selected group of the patient while presellar was present among 2.5% of the sample, incomplete sellar/sellar was observed among 10% of the cases and complete sellar / post sellar was observed among 75% of the cases.

Table 1 Sphenoid sinus pneumatization prevalence.

Sellar type	Present	Percentage
Conchal	0	0%
Presellar	2	2.5%
Complete Sellar	60	75% %
Incomplete Sellar	8	10%

## DISCUSSION

The present study analyzed the presence of various pattern of sphenoid sinus pneumatization in connecting bones. Sphenoid sinus pneumatization is independent of gender. Pneumatization of sphenoid sinus extent knowledge is important for sellar and skull base lesions for surgical and clinical implications<sup>11</sup>. Prevalence of conchal in East Asian and Caucasian population was from 1-2% but in our study the conchal was not found<sup>12</sup>. Hiremath et al. (2018) study findings consist of 76.6% of complete sellar / post sellar among the patients of sphenoid sinus which is close to our study 75%.

Hammer and Radberg classified the sphenoid sinus into presellar, sellar (complete and incomplete) and conchal<sup>14</sup>. Their classification was commonly used for surgical interventions. Complete and incomplete sellar type was subdivided by Gulderner et al based on the extension of pneumatization from the posterior wall of sella<sup>15</sup>.

From the study of Wang et al the classification of sphenoid sinus based upon the anatomy and images of anterior and lateral extension helps to identify the sites in trans sphenoid sinus surgeries<sup>10</sup>. It is important to assess

the variation in pattern of sphenoid sinus to avoid intervention complications like visual disturbance, hormonal dysfunction, cerebral spinal fluid leak, transient or permanent neurological deficit. Therefore, a tailored approach based upon the anatomy of sphenoid sinus is important for endoscopy intervention. Due to its close proximity with neurovascular structure and brain the intervention remains a risk<sup>14</sup>.

Sirikci et al. (2000) has concluded the significant relationship of anterior clinoid process pneumatization with the access of the sphenoid sinus into the optic nerve. Pre-surgical evaluation is therefore important in order to avoid CSF leak.

According to a study by B. Anusha<sup>1,2</sup> • A. Baharudin<sup>1</sup> • R. Philip, the pattern of pneumatization is important because it determines not only the extent of surgery but also the type of approach to the sphenoid sinus, whether transseptal, transantral, transtethmoidal, transpalatal, or endonasal endoscopic. The sphenoid sinus can then be exploited to gain access to the parasellar and sellar region, clivus, cavernous sinus, anterior skull base and region of petroclival<sup>13</sup>.

## CONCLUSION

The study has helped to analyze the various patterns of sphenoid sinus pneumatization specially to determine range of sphenoid sinus wall for trans-sphenoidal approaches which in turn reduces complication. The pneumatization pattern of sphenoid sinus should be written in regular templates. More studies are required to find prevalence and lateral extension of sphenoid sinus pneumatization to prevent complications during endoscopic surgeries.

## ETHICAL APPROVAL

The study was approved by the Ethical Review Committee of Postgraduate Medical Institute / Ameer-ud-Din Medical College/Lahore General hospital, Lahore via Research No. 00-88-21 Dated: March 27, 2021.

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## AUTHOR'S CONTRIBUTIONS

**MA:** Manuscript Writing, Data Collection

**NR:** Data analysis

**SB:** Data collection, Supervision, Proofreading

**NH:** Supervision, Proofreading