*Quest Journals*
*Journal of Medical and Dental Science Research*
*Volume 8~ Issue 4 (2021) pp: 39-42*
*ISSN(Online) : 2394-076X ISSN (Print):2394-0751*
www.questjournals.org

**Research Paper**

# Sphenoidal Air Sinuses Septum Anatomical Variations among Sudanese - A Radiological Study

Yasser Seddeg Abdulghani [1] , Khalid Ali Salih[1]
[1] *Anatomy department – faculty of medicine – The National Ribat University-Sudan*
*Corresponding author: Yasser Seddeg Abdulghani*

***Abstract***

- ***Background:*** *the sphenoid sinus variations are common among populations. These variations may associate with inflammatory diseases like sinusitis or other diseases (allergic rhino-sinusitis and bronchial asthma).*
- ***Aim:*** *to investigate sphenoid sinus septum variations by using CT in adult Sudanese population.*
- ***Methods:*** *50 (Males=25, Females=25) subjects of different age groups were subjected to CT scan skull to evaluate the sphenoid sinus septum anatomy.*
- ***Results:*** *more than one septum was observed in 15 participants (n=15/50, 30%), 2 septa in 10 participants (n=10/50, 20%) and 3 septa in 5 participants (n=5/50, 10%).There was no significant difference between gender and different age groups.*
- ***Conclusion****: awareness of anatomical variations of sphenoid sinus septum is important for the neurosurgeon, otolaryngologists, radiologist and anatomist for proper diagnosis and to minimize surgical complications.*
- ***Key words:***

*Sinus, Sphenoid, Anatomical variations, Sudanese*

*Received 29 Mar, 2021; Revised: 10 Apr, 2021; Accepted 12 Apr, 2021 © The author(s) 2021.*
*Published with open access at* www.questjournals.org

## I. INTRODUCTION

Paranasal sinuses anatomy is a fundamental in diagnosis, treatment and follow up of sinuses diseases. Paranasal sinuses show a lot of anatomical variations from the studies done worldwide.[(1)]

The sphenoid sinuses are a pair which lies within the body of the sphenoid bone. The structures lying in a close relationship to the sinus are the blood vessels and nerves which travel alongside the sinus on their way to or from the cranial fossa [(2)]. The right and left sinuses are separated by a septum which is commonly skewed to one side and not necessarily located in the midline. Deviation of the septum towards one side would lead to the inequality of the sizes of the sinus and the larger one usually being referred to as the 'dominant' sinus. The average volume of the sinus ranges between 3.0 and 10.0 ml [(3)]. An average well formed adult sphenoid sinus measures 20 mm in height, 23 mm in depth and 17 mm in width [(2)].

A small sinus lies in front of the pituitary fossa ([(4)], and when large, it may extend into the greater wing of the sphenoid and the pterygoid process [(5)].

Superiorly, the sphenoid sinus is related to the pituitary fossa and the middle cranial fossa, laterally to the cavernous sinus and its contents, posteriorly to the posterior cranial fossa, clivus, brain stem and basilar part of occipital bone, and inferiorly the roof of the nasopharynx .[(6,7)] The sinuses are in approximation to the optic nerve supero-laterally, ICA postero-laterally [(5)] and maxillary and vidian nerve inferiorly. The carotico-optic recess is a small depression that separates the carotid artery and the optic nerve.

Complications of trans-sphenoidal surgery may lead to mortality with an incidence rate of less than 1 % [(8,9)]. These complications can be reduced by better understanding of the anatomy involved, as well as proper preoperative planning which is where imaging comes into the picture.

The anatomical relations of the sphenoid sinus are important for neurosurgeons, especially as the sinus forms the most accessible approach to the pituitary gland.

Clear understanding of sphenoid sinus anatomy and anatomical variants provides a better surgical approach in functionally endoscopic sinus surgery and also in endoscopic endonasal transsphenoidal approach

for treatment of lesions involving the region of tuberculum sellae, planum sphenoidale, supradiaphragmatic intradural space, and medial cavernous sinus.

The relevant structures may be visualized on CT scan which is ordered prior to endoscopic sinus surgery, especially when addressing the sphenoid sinus. All the paranasal sinuses from the frontal sinus anteriorly to the sphenoid sinus posteriorly are visualized on the CT images.
[10,11,12]
.

The degree of pneumatization of the sphenoid sinus varies considerably, and 3 main types are recognized, first described by Hamberger et al.[15] In the sellar type, a sellar floor bulges into a well-developed sinus, pneumatization extending beyond the tuberculum sellae. Pneumatization extends only as far posteriorly as the tuberculum sellae in the pre-sellar type, where the sphenoid sinus is usually small and sometimes rudimentary. In the conchal type, the sphenoid sinus is characterized by a very small sinus, separated from the sella turcica by a wall approximately 10 mm thick.

Another pattern of pneumatization is the post-sellar (occipito-sphenoid) type, where the sinus is over pneumatized and the posterior border extending beyond dorsum sellae, even across the occipital synchondrosis.[16]

The sphenoid sinus ostia is located on the anterior wall of the sinus and opens into the spheno-ethmoidal recess. It may be round or oval in shape. Madiha et al. [17] reported 58 % of the 50 ostias in their 25 cadaveric dissections to be oval in shape, and the remainder round. 68 % of the ostia was more than 4 mm in size, whereas the balance were less than 4 mm in size. The sphenoid sinus ostium can be located and visualized on the medial aspect of the superior turbinate, and this has been considered to be one of the most constant and reliable landmark for endoscopic sinus surgery. In a study published by Hidir et al. [18], the vertical height of the sphenoid ostium from the roof of the choanae ranged between 5.7 and 21.5 mm with an average of 10.9 mm [18], and Abuzayed et al. [19] reported the vertical height from the posterior choanae to the ostia to be 15 mm in their study on Turkish patients. The ostia was found to be located at an average of 2.2 cm from the anterior end of the superior turbinate [20].

Most studies report the sphenoid ostia to be located on the middle portion of the anterior wall of the sinus [18,21]. The anterior nasal spine and the limen nasi have been used as landmarks to measure the distance of the ostia. The anterior nasal spine has been mentioned as a reference point by Davis et al. and Turgut et al. [22]

The intersphenoid septae may occur as a single septum or be present in multiples, for Elwany et al. [23] found 73 % of their sinuses had multiple septae. 80 % of the intersphenoid septae in Sareen et al.'s work [20] was also multiple in nature. This implies that the septum may not exactly be a reliable guide for approaching the midline in endoscopic sinus surgery.

The dehiscence and protrusion of the neurovascular structures are closely associated with the extent of sphenoid sinus pneumatization [24].

In most of the studies, optic nerve dehiscence was defined as absence of the bony wall overlying the optic nerve [25], although some studies mention in terms of thickness of the separating bony wall.

Delano et al. [26] outlined a classification used to describe the association and relationship between the sphenoid sinus, posterior ethmoid sinus and the optic nerve. The optic nerve was categorized as Type 1 when it was found to be lying adjacent to the superior and lateral walls of the sphenoid sinus. They were considered to be Type 2 when the optic nerve was found to make an indentation on the sphenoid sinus. Type 3 classification was given to optic nerves that traversed the sphenoid sinus and in Type 4, the optic nerves were adjacent to the sphenoid and posterior ethmoid sinus and covered by aerated cells.

Protrusion of the optic nerve in most studies was defined as a bulging of the optic canal into the sphenoid sinus cavity so as to cause exposure of more than half of the circumference of the nerve, with or without defects in the bony margins.

Dehiscence of the ICA is defined as the absence of the bony wall separating the ICA from the sphenoid sinus as described by Siricki et al.[27], Sapci et al. [28] and Davoodi et al. [29]. The two main studies that quote a high rate of ICA dehiscence are by Heiwaidi et al. [30] and Siricki et al. [27], which are 30 and 22 %, respectively. Otherwise, generally the rate of carotid artery dehiscence is low at about 5 % [4,31], and reported to be lower at 1.5 % by Kazkayasi et al. [32].

Internal carotid artery protrusion is defined as presence of more than half of the diameter of the vessel into the sphenoid structure [31]. Two studies on carotid artery protrusion based on CT scans by Meloni [4] on Caucasian patients and Heiwaidi [30] on Libyan patients had reported of 67 and 41 %, respectively, which are indeed high. Researches about the sphenoid sinus variations were done worldwide, but there is no study done here in Sudan.

So this study aimed to find out the anatomical variations of the sphenoid sinus among Sudanese people. Also to find out the relation between the anatomical variations of the sphenoid sinus and the gender, age, residency, occupation.

## II. METHODS:

This prospective study comprised 66 (Males=33, Females=33) paranasal computerized tomography scans of Sudanese patients attending Antalya Medical Center, Khartoum, Sudan, between December 2014 and March 2015. All the patients underwent a complete medical history and head and neck physical examination. We excluded patients with prior sinus surgery or head or neck injury. Patients younger than 8 years were also excluded.

There were equal numbers of male and female patients, and age ranged between 13-69 years. Data was collected from registered CT scan by self-administered questionnaire then analysis was done using SPSS (social package for statically science).

## III. RESULTS:

Sixty six axial CT radiographs were studied to evaluate the sphenoid air sinuses .Out of 66 participants, 33 were females and 33 were males, of different age groups.

Antral septa was observed in 63 persons (95.5%), 3 persons (4.5%) showed absence of septum, 57 persons showed one septa (86.4%) and 9 showed two septa.

Five out of 66 (7.6%) participants were observed to show absence of recesses while 61 persons (92.4%) have sinus recesses.

Sixteen of persons (24.2%) showed symmetrical sphenoid sinus of both sides. No hypoplastic changes were observed in this study.

## IV. DISCUSSION

Anatomical variations of sphenoid air sinuses, in association with their inherent conditions, were found to be risk factors for many respiratory tract pathological conditions. Therefore, identifying these variations has recently been critical for clinical practice. [33]

Paranasal sinus anatomy and variations have gained interest with the introduction of functional endoscopic sinus surgery (FESS) and the knowledge of anatomical variations is most important in the surgical management and specifically in the prevention of complications. The acquisition of an excellent definition of the sinus anatomy for a preoperative endoscopic evaluation can be done by means of computed tomography that is the gold standard in the study of such structures, for providing accurate information on soft tissues, bone structures and air, thus characterizing a highly sensitive imaging.

Discussion regarding the prevalence and clinical significance of sphenoid sinus bony anatomical variations is included as a guide to assist the otolaryngologist, radiologist and maxillofacial surgeons in the evaluation of coronal sinus CT scans method.

In this study, the antral septa were found to be the most common anatomical variation of sphenoid sinus (95.5%).

Variations were diagnosed in 66 of samples. There was no significant difference between genders and age groups. Antral septa were the most prevalent abnormality (95.5%), followed by presence of recesses (92.4%), sinus asymmetry (75.8%). No hypoplastic variation was observed in this study.

This result agrees with study done in Iran by Seddighi et al [33] who found antral septa the most prevalent abnormality and found single septa in (28.1%) of cases more than one in (71.9%) which also agree with study result.

There are multiple approaches to the sphenoid sinus. Be it the transseptal, transantral, transpterygoid, transethmoidal, transpalatal or the endonasal endoscopic approach, the choice of approach is determined by the skills of the surgeon and the extent of the disease. Knowledge on the anatomical variations in the respective population, together with the aid of imaging, could result in successful surgeries with lesser complications. [34]

Although the medical field has come a long way in terms of imaging and surgical practices, we have yet to see what more the future holds. However for the present, it would perhaps be wise to bear in mind the possible variations of the anatomical structures of the sphenoid sinus by ethnicity, prior to embarking on surgery.[34]

## V. CONCLUSION

In conclusion, common anatomic variations of sphenoid sinuses in this study are antral septa, presence of recesses and asymmetry sinuses. The most common variation observed in this study is the antral septa. From the results there is no significant between male and female, also there is no difference between age groups. No hypoplastic variation was found. Results of this study agreed with results of previous studies done worldwide.

## REFERENCES

[1]. **Jones NS**. CT of the paranasal sinuses: a review of the correlation with clinical, surgical and histopathological findings. *Clin Otolaryngol Allied Sci* **2002; 27: 11-7.**

[2]. **Van Alyea OE.** Sphenoid sinus. Anatomic study, with consideration of the clinical significance of the structural characteristics of sphenoid sinus. *Arch Otolaryngol* 34. **1941, p 225–253.**

[3]. **Sareen D, Agarwal AK, Kaul JM et al**. Study of sphenoid sinus anatomy in relation to endoscopic surgery. *Int J Morphol* 23(3) **2005, p. 261–266.**

[4]. **Meloni F, Mini R, Rovasio S et al.** Anatomic variations of surgical importance in ethmoid labyrinth and sphenoid sinus. A study of radiological anatomy. *Surg Radiol Anat* 14(1) **1992, p. 65–70.**

[5]. 12. **Sinnathamby CS.** Last's anatomy, regional and applied, 11th edn. *Churchill Livingstone Elsevier, UK.* **2006, p. 215**.

[6]. 13. **Kayalioglu G, Govsa F, Erturk M et al.** The cavernous sinus: topographic morphometry of its contents. *Surg Radiol Anat* 21(4). **1999, p. 255–260.**

[7]. 14. **Lang J.** Clinical anatomy of the nose, nasal cavity and paranasal sinuses. *Thieme Medical Publishers, New York***. 1989, p. 191-195.**

[8]. **Ciric I, Ragin A, Baumgartner C et al.** Complications of transsphenoidal surgery: results of a national survey, review of the literature, and personal experience. *Neurosurgery* 40. **1997, p.225–236.**

[9]. **Lanza DC, Kennedy DW.** Ballery Byron J (ed) Endoscopic sinus surgery in head and neck surgery-otolaryngology. *J.B. Lippincott, Philadelphia*, **1993, p. 389–398.**

[10]. **Dessi P, Moulin G, Castro F et al.** Protrusion of the optic nerve into the ethmoid and sphenoid sinus: prospective study of 150 CT studies. *Neuroradiology* 36(7). **1994, p.515–516.**

[11]. **Abdullah BJ, Arasaratnam S, Kumar G et al.** The sphenoid sinuses: computed tomographic assessment of septation, relationship to the internal carotid arteries, and sidewall thickness in the Malaysian population. *J HK Coll Radiol* 4. **2001, p.185–188.**

[12]. **Hernandez GM, Lorduy TC, Garcia MJV et al.** Revision of surgical treatment of rhinosinusitis. *Acta Otorrinolar* 62(1). **2011, p.56–64 49.**

[13]. **Lanzieri CF, Shah M, Krauss D et al.** Use of gadoliniumenhanced MR imaging for differentiating mucocoeles from neoplasms in the paranasal sinuses. *Radiology* 178. **1991, p.425–428.**

[14]. **Lehmann P, Bouaziz R, Page C et al.** Sinonasal cavities: CT imaging features of anatomical variants and surgical risk. *J Radiol 90*(1 Pt 1). **2009, p.21–29.**

[15]. **Hamberger CA, Hammer G, Norlen G, Sjogren B**.Transantrosphenoidal hypophysectomy. *Arch Otolaryngol* 74. **1961, p. 2-8.**

[16]. **Banna M, Olutola PS**. Patterns of pneumatization and septation of the sphenoid sinus. *J Can Assoc Radiol34.* **1983, p. 291-293.**

[17]. **Madiha AES, Raouf AA.** Endoscopic anatomy of the sphenoidal air sinus. *Bull Alex Fac Med* 43. **2007, p.1021–1026.**

[18]. **Hidir Y, Battal B, Durmaz A et al.** Optimum height from the roof of the choana for seeking the sphenoid ostium. *J Craniofac Surg* 22(3). **2011, p. 1077–1079.**

[19]. **Abuzayed B, Tanriover N, Ozlen F et al.** Endoscopic endonasal transsphenoidal approach to the sellar region: results of endoscopic dissection on 30 cadavers. *Turk Neurosurg* 19(3). **2009, p. 237–244.**

[20]. **Sareen D, Agarwal AK, Kaul JM et al.** Study of sphenoid sinus anatomy in relation to endoscopic surgery. *Int J Morphol* 23(3). **2005, p. 261–266.**

[21]. **Kim HU, Kim SS, Kang SS.** Surgical anatomy of the natural ostium of the sphenoid sinus. *Laryngoscope* 111. **2001, p.1599–1602.**

[22]. **Turgut S, Gumusalan Y, Arifoglu Y et al.** Endoscopic anatomic distances on the lateral nasal wall. *J Otolaryngol* 25. **1996, p.371–374.**

[23]. **Elwany S, Yacout YM, Talaat M et al.** Surgical anatomy of the sphenoid sinus. *J Laryngol Otol* 97. **1983, p.227–241.**

[24]. Cho **JH, Kim JK, Lee JG et al.** Sphenoid sinus pneumatisation and its relation to bulging of surrounding neurovascular structures. *Ann Otol Rhinol Laryngol* 119(9). **2010, p.646–650.**

[25]. **Dessi P, Moulin G, Castro F et al.** Protrusion of the optic nerve into the ethmoid and sphenoid sinus: prospective study of 150 CT studies. *Neuroradiology* 36(7). **1994, p.515–516.**

[26]. **DeLano MC, Fun FY, Zinreich SJ.** Relationship of the optic nerve to the posterior paranasal sinuses: a CT anatomic study. *Am J Neuroradiol* 17(4). **1996, p.669–675**

[27]. **Bouthillier A, van Loveren HR, Keller J.** Segments of the internal carotid artery: a new classification. *Neurosurgery* 38(3). **1996, p.4254–4332.**

[28]. **Sapci T, Derin E, Almac S et al.** The relationship between the sphenoid and the posterior ethmoid sinuses and the optic nerves in Turkish patients. *Rhinology* 42(1). **2004, p.30–34.**

[29]. **Davoodi M, Saki N, Saki G et al.** Anatomical variations of neurovascular structures adjacent sphenoid sinus by using CT scan. *Pak J Biol Sci* 12. **2009, p.522–525.**

[30]. **Hewaidi G, Omami G.** Anatomic variation of sphenoid sinus and related structures in Libyan population: CT scan study. *Libyan J Med* 3(3). **2008, p.128–133.**

[31]. **Unal B, Bademci G, Bilgili YK et al.** Risky anatomic variations of sphenoid sinus for surgery. *Surg Radiol Anat* 28(2). **2006, p.195–201.**

[32]. **Kazkayasi M, Karadeniz Y, Osman KA.** Anatomic variations of the sphenoid sinus on computed tomography. *Rhinology* 43. **2005, p.109–114.**

[33]. **Seddighi et al,**Sphenoid Sinus: Anatomic Variations and Their Importance in Trans-sphenoid Surgery. *ICNSJ.* **2014; 1 (1):31-34.**

[34]. **Anusha B, Baharudin A, Philip A et al.** Anatomical variations of the sphenoid sinus and its adjacent structures: a review of existing literature. *Surgical and Radiologic Anatomy 36*. **2013, p. 419-427.**