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Original Article

Pneumatization of the sphenoid sinus on a panoramic radiograph

Pipop Sutthiprapaporn, D.D.S., Ph.D., F.R.C.D.S.(Thailand)[1]
Pornpop Rattana-arpha, D.D.S., F.R.C.D.S.(Thailand)[2]

[1]Department of Oral Diagnosis, Faculty of Dentistry, Khon Kaen University, Khon Kaen, Thailand
[2]Dental Division, Medical Correctional Hospital, Bangkok, Thailand

Abstract

The paranasal sinuses are composed of a set of structures of the maxillofacial region and its proximity to the oral cavity. The sphenoid sinus is located within the body of the sphenoid bone. However, an excessive pneumatization of this structure may cause difficulties in radiographic diagnosis, particularly with panoramic radiographs. This article describes a case of pneumatization of the sphenoid sinus in the pterygoid process and greater wing of the sphenoid bone, presented on a panoramic radiograph. Cone beam computed tomography in axial and coronal sections was performed to confirm the pneumatization of these structures.

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Key words: *cone beam computed tomography; panoramic radiography; pneumatization; sphenoid sinus*

Correspondence: Pipop Sutthiprapaporn, spipop@kku.ac.th

Introduction

The paranasal sinuses are air-filled cavities which function to reduce weight of the skull. The paired paranasal sinuses are frontal, ethmoid, maxillary and sphenoid sinus. These sinuses are composed of a set of structures of the maxillofacial region and its proximity to the oral cavity. The sphenoid sinus is deeply located in the body of the sphenoid bone, which is originally called the sphecoid bone (wasp bone) before a transcription error turned it into the sphenoid (wedge-shaped) bone; at which two sphenoid sinuses are separated by an internal septum and the drainage pass through to the sphenoethmoid recess (Baker EW, 2010). Pneumatization of the maxillary and frontal sinuses develop gradually during cranial growth, but the ethmoid air cells are already pneumatized at birth until late puberty or until the sinus wall reach compact bone. However, the sphenoid bone is not shown as such. Pneumatization of the sphenoid sinus begins after 2 years of age and develops in the inferior and posterolateral direction and attain its the mature size by 14 years of age and may continue until after puberty (Morton, 1983; Scuderi et al., 1993). In the dental field, the clinician can incidentally find the sphenoid sinus by panoramic radiograph, if it is sometimes extensive. Because of its deep location and close to the intracranial structures, the pneumatization of the sphenoid sinuses may be difficult to diagnose because of the superimposition of the anatomical landmarks on the panoramic radiograph. Few studies have shown the pneumatization of sphenoid sinus on panoramic radiograph (Liang et al., 2001, Terra et al., 2006; de Oliveira et al., 2013). The purpose of this report is, therefore, to present a rare radiographic feature of pneumatization of the sphenoid sinus on panoramic radiograph and to clarify this anatomy by cone beam computed tomography.

A case report

A 20-year-old female was referred to the Radiology Clinic at Faculty of Dentistry, Khon Kaen University for a routine panoramic radiograph to screen for the impacted third molar. She was asymptomatic and had no history of trauma. The panoramic radiograph (Fig. 1) showed the multilocular radiolucency, well defined and corticated border at the left side in the region of pterygoid process close to the posterior wall of maxillary sinus. This region superimposed with the zygomatic process of maxilla. Therefore, the diagnosis was not definitive.

Fig. 1 A Panoramic radiograph showing the multilocular radiolucency at the left side in the region of pterygoid process close to the posterior wall of maxillary sinus (arrow).

The differential diagnosis should be multilocular lesion or anatomical variations. After discussion about this with the patient, it was agreed that she must undergo an investigation on anatomical structures for definitive diagnosis by cone beam CT, field of view 200 mm x 170 mm, x-ray tube current 9 mA, tube voltage 15 kVp and load time 9 seconds (Whitefox, distributed by Satelec-Acteon Group,Italy). The axial CT scan (Fig. 2, 3) showed the extension on the left side of the sphenoid sinus to the middle of greater wing of sphenoid bone. In the coronal view (Fig. 4) presented the extension of left sphenoid sinus to lateral direction and extension to the pterygoid process of the sphenoid bone in this region.

Discussion

The sphenoid bone composes of the body, the lesser and greater wings and the pterygoid plates. The sphenoid sinus is formed in the body of the sphenoid bone and between the anterior and middle cranial fossa.

Fig. 2 Axial view showing the extension of the sphenoid sinus to the middle of greater wing of sphenoid bone on the left side (arrow).

Fig. 3 Axial view showing the extension of the sphenoid sinus to the superior part of the pterygoid process on the left side (arrow).

Fig. 4 Coronal view showing the extension of left sphenoid sinus (arrow).

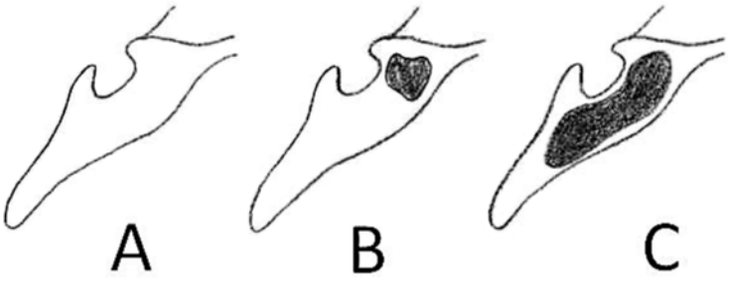

Fig. 5 Types of pneumatization of the sphenoid sinus in sagittal view: A; conchal type, B; presellar type, C; sellar type (Figure is modified from Cho et al., 2010).

Three main types of sphenoid sinus pneumatization in sagittal view are classified: 1. conchal type; a small sinus separated from the sella turcica or no air cavity in sphenoid sinus(1% of cases), 2. presellar type or juvenile type; pneumatization of the sphenoid to the level of the sella turcica or air cavity does not expand beyond vertical plane passing through anterior clinoid process (9% of cases), 3. sellar type or adult type; pneumatization of the sphenoid below the sella or further posteriorly (90% of cases) (Fig. 5) (Vidic, 1968; Cho et al., 2010). In 2015, Vaezi et al classified sphenoid sinus pneumatization in coronal view: Type I; both the vidian canal and the foramen rotundum are covered by 3 mm of bone (24.5% of cases), Type II; pneumatization reaches the medial edge of the foramen rotundum (39% of cases), Type III; pneumatization extends beyond the medial foramen rotundum (36.5% of cases) (Fig. 6) (Vaezi et al., 2015). In our case the sphenoid sinus is of sellar type and Type III including downward movement and close to the maxillary sinus.

Bulging of the internal carotid artery into the sphenoid sinus also appears in 34-93% of cases (Sareen et al., 2005; Budu et al., 2013). Computed tomography can guide the surgical plan and the limits of dissection in the sphenoid sinus. Previous studies reported the

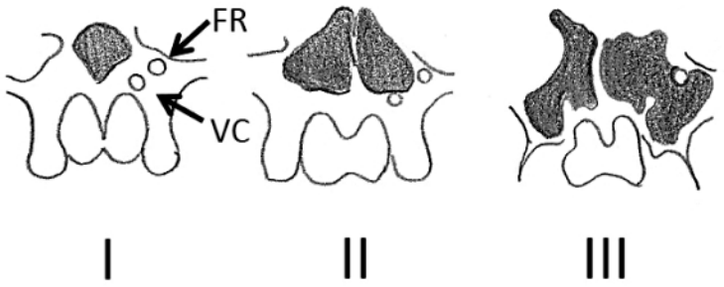

Fig. 6 Types of pneumatization of the sphenoid sinus in coronal view: Type I, II and III (FR= foramen rotundum, VC= vidian canal) (Figure is modified from Vaezi et al., 2015).

variations of the sphenoid sinus and surrounding vital neurovascular structures and found a highly variable structure with varying degrees of pneumatization. They suggested to conduct CT scan before sphenoid sinus surgeries to interpret anatomic variations and pathological conditions (Sirikci et al., 2000; Kazkayasi et al., 2005). Terra et al also reported a better diagnosis for a patient who had the pneumatization of the sphenoid sinus by using a computerized tomography (Terra et al., 2006). Excessive pneumatization of the sphenoid sinus was also reported with a facial swelling. In this case the preparation of the postero-anterior and submentovertical radiograph that showed radiolucency over the left temporal region and CT scan was then carried out. No panoramic radiograph was taken (Morton, 1983). Our patient did not have any swelling, but the location close to the posterior wall of maxillary sinus. We therefore suggested the patient to observe this region. Chordoma is also a rare tumor arising from the notochord remnant which often occurs in the clivus. It sometimes involves the sella and sphenoid sinus and increases density on CT (Sakai and Nadgir, 2011). This is, therefore, the reason for investigating this area by cone beam CT in our patient for the definitive diagnosis. Furthermore, two previous studies have shown the extensions of the sphenoid sinus and presented as a unilocular with a sclerotic margin on panoramic radiograph (Terra et al., 2006; de Oliveira et al., 2013). Our case report is the first presentation of the multilocular radiolucency of pneumatization of the sphenoid sinus at the posterior to the maxillary sinus detected on the routine panoramic radiograph. Some reasons include many internal septum bones inside the sphenoid sinus and superimposition of the anatomical structures. Even though the treatment is not necessary, it could be explained to the patient if it is suspected. However, the clinician should interpret both panoramic radiograph and cone beam CT carefully. In conclusion, anatomical variation of the sphenoid sinus may be encountered in panoramic radiographs and cone beam CT is helpful for diagnosis.

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