Middle cranial fossa variations including bilateral foramina entering the sphenoid air sinuses: a case report

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Abstract

Reports on anatomical variations and anomalies are very important in keeping track of changes that occur in the human body during development. Not only does it help to explain some of the disease conditions affecting people, but it can aid in describing the aetiology of some of these conditions. The current observation indicated the presence of unusual bilateral foramina in the middle cranial fossa communicating with the sphenoid air sinuses. They were located anterolateral to the sella turcica and medial to the superior orbital fissure behind the optic canal. The complexity of sphenoid bone development and non fusion of some of its parts may lead to abnormal foramina like the ones seen in this case. Since observations were made on a prepared dried skull, the contents of the foramina were not verified. Another observation in the same skull was the bilateral abnormally joined anterior and posterior clinoid processes. The two were joined by a thick bar of bone (Interclinoid bar). Any outgrowth from the posterior clinoid process may compress the surrounding neuro-vascular structures especially the internal carotid artery. In the present case, the clinical history of the patient was not available to corroborate this observation. Knowledge on the described abnormalities of this skull may be useful for radiologists, neurosurgeons, endocrinologists as well as anthropologists.

Key words: Middle cranial fossa, bilateral foramina, Sphenoid sinuses

Introduction

The middle cranial fossa is butterfly shaped and is bounded in front by the posterior borders of the lesser wings, anterior clinoid processes and sulcus chiasmaticus (that connects the two optic canals). Behind the sulcus chiasmaticus is the sella turcica, whose anterior slope bears a median tuberculum sellae, behind which is the hypophyseal fossa. The fossa's floor is part of the roof of the sphenoidal sinuses.(1) Lateral to the sella turcica the sphenoid has a shallow groove for the internal carotid artery. Behind, the middle cranial fossa is bounded by the superior borders of the petrous temporal bones and sphenoid's dorsum sellae (whose its superolateral angles are expanded as posterior clinoid process), laterally by the temporal squamae, parietal bones and greater wings of the sphenoid. Centrally the floor of the middle cranial fossa is narrow and formed by the sphenoid body. Normal foramina found within the middle cranial fossa include the foramen rotundum which transmits the maxillary division of the trigeminal nerve; the foramen ovale that transmits the mandibular division of the trigeminal nerve and foramen spinosum which transmits the middle meningeal vessels among other structures.(2) An abnormal foramen connecting the middle cranial fossa with the sphenoidal air sinus has been documented.(30 In this report the foramen was unilateral and it was suggested that it could have occurred due to developmental defects in the sphenoid. The posterior clinoid process anomalies have been reported and it was suggested that it may be responsible for the altered arrangement of the tentorium cerebelli which is attached to it and may compress the internal carotid artery.(4) Patnaik reported on a skull with anterior and posterior clinoid processes joined bilaterally to each other by a thick bone and suggested that these could be sequalae of ossification in dura matter extending between these two processes.(5)

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Observations

The current observations were made on the skull of a male adult cadaver that was used for dissection. Variations noted involved the anterior and posterior clinoid processes and the unusual foramina connecting the middle cranial fossa and the sphenoid air sinuses (Figure 1 and 2).

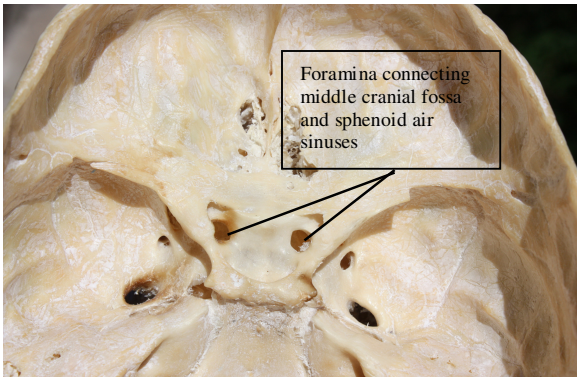

Figure 1: Human skull showing two foramina connecting the middle cranial fossa and sphenoid air sinuses

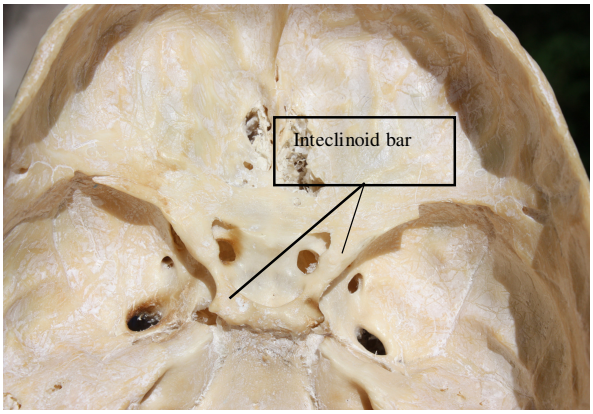

Figure 2: Human skull showing abnormally joined anterior and posterior clinoid processes

The current observation indicated the presence of unusual bilateral foramina in the middle cranial fossa. They were located anterolateral to the sella turcica and medial to the superior orbital fissure behind the optic canal. The openings of the foramina to the middle cranial fossa were circular measuring 0.8 cm wide and presented with smooth margins. Since observations were made on

the prepared dried skull, the contents of the foramina were not verified.

The foramina were 1.7cm long and close examination revealed that each foramen communicated with the sphenoid air sinuses. Each foramen showed constant diameter throughout its course to the sphenoid air sinus and had a straight course.

Observation of the middle cranial fossa revealed the presence of the normally occurring foramina. These included foramen rotundum, ovale, spinosum and lacerum. The opening of the foramen Ovale measured 0.9cm wide, Spinosum 0.2cm wide and Rotundum 0.3cm wide. Arterial and nervous supply to the sphenoid air sinus is through posterior ethmoidal arteries and nerves branches of ophthalmic artery and nasociliary nerve respectively.

It was also observed in the same skull that the anterior clinoid process was abnormally joined bilaterally to the posterior clinoid processes by a thick bar of bone. From the middle of this bony bar on both sides, a bony spicule was projecting medially and inferiorly towards a similar one arising from middle clinoid process. Both of these fused with each other on either side to form a foramen clenoideo-carotium on both sides.

Discussion

The foramina reported in this case are unique and have been previously reported only unilaterally.[3] The normal foramina of middle cranial fossa which were also found in this skull included foramen ovale, foramen rotundum and foramen spinosum. The sphenoid bone is formed by the fusion of different primordia whose embryonic origins are different. It is thought that the complexity of its development and non fusion of some of its parts may lead to abnormal foramina[7] The fact that these foramina were not in the midline and only extended into the sphenoid sinus and not into nasopharynx, implies that they cannot be remnants of the craniopharyngeal canal. The foramina probably occurred due to some developmental defects in the sphenoid bone.

Other foramina which are rarely found in relation to the sphenoid bone in the middle cranial fossa are pterygospinous foramen and pterygoalar foramen and emissary sphenoidal foramen[3] An emissary sphenoidal foramen exists in 13-17% of cases.[7] A case of atypical foramen ovale has also been reported[8] A hypophysial or craniopharyngeal canal may be found connecting the nasopharynx with the pituitary fossa.[9] The presence of such craniopharyngeal canal may lead to sphenoidal meningocele. None of these rarely occurring foramina were found in this skull.

The knowledge of this foramen may be useful for radiologists, endocrinologists and anthropologists.

Any outgrowth from the posterior clinoid process may compress the surrounding neuro-vascular structures especially the internal carotid artery. In the present case, the clinical history of the patient was not available to corroborate this observation. Thus, anatomical and radiological knowledge of the anterior and posterior clinoid processes and the clinoid space is important when operating on the internal carotid artery. Excision of the anterior clinoid process may be required for many skull-base surgical procedures, and the presence of any anomalies such as interclinoid bar may pose a problem for neurosurgeons.

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References

1. William PL, Banister LH, Berry MM., Collins P, Oyson M. Gray's anatomy. 38th ed. Harcourt Brace and Company Limited; London, 1999: 570-2
2. Moore K. Clinically Oriented Anatomy. 5th ed. Lippincott Williams & Wilkins; Philadelphia, 2006: 899-901
3. Satheesha Nayak: An abnormal foramen connecting the middle cranial fossa with sphenoidal air sinus: A Case Report. The Internet Journal of Biological Anthropology 2008; 2(1):
4. Paul S, Das S. Anomalous posterior clinoid process and its clinical importance. Colombia Medica 2007; 38(3):301-304.
5. Patnaik VVG; Singla RK, Bala S. Bilateral Foramen Clinoideo-Caroticum & Interclinoid Bars-A Report of 2 Cases. Journal of the Anatomical Society of India 2003; 52(1): 69-70.
6. Hughes ML, Carty AT, White FE. Persistent hypophyseal (craniopharyngeal) canal. Br J Radiol. 1999;72(854):204-6
7. Dubrul, E. L. Oral Anatomy In: The skull. AITBS Publishers & Distributors, Delhi, 1996: 13.
8. Bergman RA, Afifi AK, Miyauchi R. Compendium of human anatomical variations. Baltimore: Urban and Schwarzenberg. 1988: 200.
9. Skrzat J, Walocha J, Srodek R, Nizankowska A. An atypical position of the foramen ovale. Folia Morphol (Warsz). 2006; 65(4):396-9.
10. Catala M. Embryology of the sphenoid bone. J Neuroradiol. 2003;30(4):196-200