



## An Osseous Variation in the Foramen Ovale on the Human Sphenoid Bone

G.PRIYA

DEPARTMENT OF ANATOMY, RVS DENTAL COLLEGE & HOSPITAL,  
KUMARANKOTTAM CAMPUS, TRICHY ROAD KANNAMPALAYAM,  
COIMBATORE-641402

## ABSTRACT

Foramen ovale is an oval shaped foramen situated along the posteromedial aspect of the greater wing of the sphenoid bone. It is oriented ventro-laterally, corresponding to the direction of the mandibular division of the trigeminal nerve, its main transmitted structure. This foramen serves as an important landmark for neurosurgeons in the procedures involving the trigeminal nerve and temporal lobe of cerebrum. There are many variations reported in foramen ovale based on its shape and size. But, the division of foramen ovale into two compartments is a rare variation. In the present study a unilateral asymmetrical double foramen ovale was observed. It is divided into anterior and posterior compartments by an osseous septum. The anterior compartment is smaller which is topographically regarded as accessory part of the foramen ovale proper. The posterior compartment is larger and is regarded as foramen ovale proper. Knowledge of the exact chorography and anatomical variation of the FO is required for neurosurgeons to place the electrode in correct position to record Paroxysmal activity in medial temporal lobe epilepsy and for the fluoroscopic-guided needle insertion technique in the foramen ovale to treat trigeminal neuralgia.

## KEYWORDS

foramen ovale, osseous septum, anterior and posterior compartments.

## Introduction:

Foramen ovale is an oval shaped foramen situated along the posteromedial aspect of the greater wing of the sphenoid bone which connects the middle cranial fossa with the infratemporal fossa. This foramen is oriented slightly ventrally and laterally, corresponding to the direction of the mandibular division of the trigeminal nerve, its main transmitted structure. This nerve provides motor supply to the masticatory muscle, as well as sensory innervations of the skin of the temporal region, lower face and lips, the lower teeth and gums, the mandible, the tempromandibular joint, and a portion of duramater<sup>1</sup>. The foramen ovale also transmits emissary vein, accessory meningeal artery and lesser petrosal nerve<sup>2</sup>. The present study deals with the anatomical variation of the foramen ovale.

## Observation:

During routine osteology demonstration class for undergraduate Dental students of RVS dental college Coimbatore, a unilateral asymmetrical double foramen ovale was observed on left side of an adult dried human skull (Fig.1). An anomalous osseous septum divided the foramen into a smaller anterior compartment and a larger posterior compartment (Fig.2). The patency of the foramen was confirmed by inserting a needle through the foramen. Both the foramens opened intracranially for the transmission of neurovascular structures.

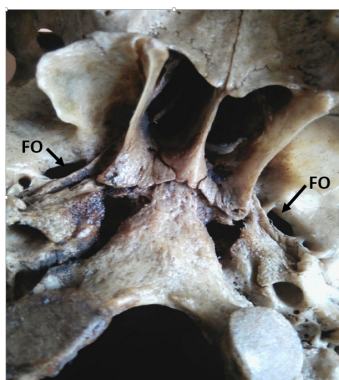


Fig 1: A unilateral asymmetrical double foramen ovale (FO) on the left side.



Fig 2: A smaller anterior (A) and larger posterior (P) compartments of foramen ovale separated by an osseous septum (OS).

## Discussion:

Foramen ovale is one of the important foramina situated at the base of skull, which is used for various invasive surgical as well as diagnostic procedures. A technique called foramen ovale electrode used to record electro clinical analysis of seizures from the mesio-basal aspect of the temporal lobe by a subdural electrode inserted through the foramen ovale (FO). This FO electrode technique provided good neurophysiological information in candidates for selective antiepileptic drug-re-

sistant seizures<sup>3</sup>. The knowledge of the exact chorography of the FO is required to place the electrode in correct position to record a more precise anatomo-electro-clinical correlation of seizures.

Knowing the anatomical variations of FO is important because surgical treatment of trigeminal neuralgia is most commonly done through FO by a procedure known as percutaneous needle insertion. This technique involves the penetration of foramen ovale using cutaneous landmarks and radiological guidance. The placement of radiopaque markers over the "zygomatic point" which lies in front of the ear and above the tragus provides landmarks that facilitate localization of the foramen ovale for intra operative radiological study. In a study conducted in India, forty patients of trigeminal neuralgia were treated with percutaneous trigeminal ganglion balloon compression. In all patients except one, the needle could not be introduced easily because the patient was with foramen ovale stenosis, in whom, the needle just fitted into the foramen. Therefore variation in foramen ovale is important for surgeons to differentiate the normal and abnormal foramen.

Krmpotic et al reported a unilateral variation in foramen ovale which was divided into two compartments by an extension of bony lamina from the pterygoid process. They have observed that the mandibular nerve was passing through both the compartments by part<sup>7</sup>. Suhani et al reported a case of bilateral atypical foramina ovalia which is divided into medial and lateral compartments by an oblique bony lamina which was referred as pterygoalar bar<sup>8</sup>. In the present study the foramen ovale was divided into two asymmetrical compartments by an anomalous osseous septum. It divided the foramen ovale into a smaller anterior compartment and larger posterior compartment. Since this variation was observed in the bony skull the structures passing through it may not be sure.

When viewed under embryological basis, the greater wing and pterygoid process of the sphenoid bone develops from the post-sphenoid centre. The foramen ovale initially appears as a distinct ring shaped opening in the area of the non-ossified cartilaginous part during the early embryonic period and the mandibular nerve is enclosed by this cartilaginous part in about the 22<sup>nd</sup> week of intrauterine life, which later about 3 years after birth becomes a prominent and definitive foramen. Through this definitive foramen the mandibular nerve and vascular structures passes in later life<sup>9</sup>. Therefore the larger posterior compartment of foramen ovale observed in the present study may be considered as foramen ovale proper which might have enclosed the mandibular nerve. The smaller anterior compartment probably considered as vascular compartment for the passage of emissary venous plexus from the middle meningeal vein to the pterygoid venous plexus. The present study corroborates with the findings of Radiojevitc and Jovanovic cited by Lang<sup>10</sup> that the venous segment of the foramen ovale may be separated from the remainder of the contents of the foramen by a bony spur resulting in a doubled foramen ovale. They found such bony spurs antero-medially in 2.8% of the subjects.

An anatomical knowledge of such abnormal osseous structure in the foramen ovale which divided it into two foramina may be useful for surgeons because during surgical procedure injury to the structures may be avoided.

#### Conclusion:

The knowledge of variations in the foramen ovale is important for surgeons because its variant form may alter the anatomical organization of the neurovascular structures which are transmitted through this foramen.

#### References:

1. Ginsberg LE, Steven W, Michael YMC, Elster AD. Skull base foramina of the middle cranial fossa: reassessment of normal variation with high-resolution CT. *AJNR AM J Neuroradiol*. 1994; 15:283-291.
2. Standring S. *Gray's anatomy*. 39th Ed. Spain (SP): Churchill Livingstone, 2005, pp- 460-6.

3. Wiser HG, Siegel AM. Analysis of foramen ovale electrode-recorded seizures and correlation with outcome following amygdalohippocampectomy. *Epilepsia*; 1991; 32:838-50.
4. Gerber AM. Improved visualization of the foramen ovale for percutaneous approaches to the gasserian ganglion. Technical note: *J Neurosurg*; 1994; 80:156-9.
5. Gusmao S, Oliveira M, Tazinaffo U, Honey CR. Percutaneous trigeminal nerve radiofrequency rhizotomy guided by computerized tomography fluoroscopy. Technical note. *J Neurosurg*; 2003; 99:785-6.
6. Natarajan M Percutaneous trigeminal ganglion balloon compression: experience in 40 patients. *Neurology India*. 2000; 48: 330-2.
7. Krmpotic-nemanic J, Vinter J, Hat J, Jalsovec D. Mandibular neuralgia due to anatomical variation. *Eur Arch Otorhinolaryngol*. 1999; 256(4):205-8.
8. Suhani S, Mamatha H, Naveen K, Jyothsna P. Bilateral atypical foramina ovalia formation due to the presence of pterygoalar bar: a rare osseous variation. *OA Case Reports*. 2013. Dec 24; 2(16):153.
9. Yanagi S. Developmental studies on the foramen rotundum, foramen ovale and foramen spinosum on the human sphenoid bone. *Hokkaido Igaku Zasshi*; 1987; 62:485-96.
10. Lang J. *Clinical anatomy of the head, Neurocranium, orbit and craniocervical region*. Springer- verlag, Berlin 1883.