

STUDY OF ANATOMIC VARIANT OF FORAMEN OVALE AND SPINOSUM IN DRIED HUMAN SKULLS

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ABSTRACT

Introduction: Foramen ovale and Foramen spinosum are important foramina found on the greater wing of the sphenoid. An anatomical study was done to note the size and shape of the Foramen ovale and Foramen spinosum and presence of any bony deformity related to both these foramina.

Materials and Methods: We studied 45 human dried skulls of unknown age and sex and found different shapes of Foramen ovale with variation in size.

Result: We found divided Foramen ovale by a bony bar, confluent foramen spinosum and absent Foramen spinosum. We also noticed a small bony spicule projecting in Foramen ovale and Foramen spinosum. The maximum A-P diameter of F.O on the right side was 5mm to 9mm and 5mm to 8mm on the left side while the transverse diameter of F.S on both the side was 2mm to 4 mm.

Conclusion: These variations may be of clinical and anatomical significance to neurosurgeons and physician particularly in cases of trigeminal neuralgia and diagnostic detection of vascular tumors and aneurysm.

KEY WORDS: Foramen ovale, Foramen spinosum, Sphenoid, Trigeminal neuralgia, Skull.

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INTRODUCTION

Foramen ovale and Foramen spinosum are important foramina of the middle cranial fossa. Foramen ovale is present on the greater wing of sphenoid behind the Foramen rotundum and lateral to the lingula and posterior end of the carotid groove [1], while the Foramen spinosum is located posterolateral to the Foramen ovale. Foramen ovale gives passage to the

mandibular nerve, accessory meningeal artery, lesser petrosal nerve and emissary vein [2]. Foramen ovale opens into the infratemporal fossa, through its other opening on the lateral surface of the greater wing [3]. Foramen spinosum also leads to the infratemporal fossa [4] it transmits the Middle meningeal artery to the middle cranial fossa [4-6]. Mandibular nerve is a branch of trigeminal nerve thus study of

Foramen ovale is of great surgical and diagnostic importance in percutaneous trigeminal rhizotomy in cases of trigeminal neuralgia and in transfacial fine needle aspiration technique. Enlarged Foramen ovale may be suggestive of neuroma of the vth cranial nerve [7]. Foramen spinosum transmits middle meningeal artery to the middle cranial fossa [4-6]. Although Foramen spinosum is found as a permanent opening in majority of the cases but it may be absent when middle meningeal artery arises from the ophthalmic artery.

MATERIALS AND METHODS

Study was done on 45 dried human skulls of unknown age and sex collected from the CMCH BHOPAL and FHMC TUNDLA (Firozabaad). Posterior part of the greater wing of sphenoid was carefully examined for the existence of foramen ovale and foramen spinosum. The shape, size and any bony growth were inspected macroscopically and the anteroposterior diameter and the transverse diameter of the foramen ovale were noted. We also noted anteroposterior diameters of foramen spinosum by using a divider and scale on both the sides.

RESULTS

In maximum number of skulls the shape of the Foramen ovale was oval. In two cases it was almond shaped and semilunar shaped, in two skulls we found duplicate Foramen ovale while in two cases a confluent Foramen ovale was found (Table 1). In two skulls we also found absent Foramen spinosum. In one skull a bony spur was seen in to the Foramen spinosum and in two skulls in Foramen ovale, while in three skulls there was a bony spicule in between the Foramen spinosum and Foramen ovale. The anteroposterior diameter of the foramen ovale on the right side varies from 5mm to 9mm, on the left side it varies from 5mm to 8mm (Table 2). The transverse diameters on the right and left side ranges from 2mm to 4mm. (Table 3) The anteroposterior diameters of foramen spinosum lie in the range of 1mm to 3mm on the right and left side (Table 4) The mean value for anteroposterior diameter of Foramen ovale was 4.9mm and 3mm for the transverse diameter. The presence of various bony growth of the

foramen ovale like spines, bony plates etc indicate bony overgrowths during its developmental process, between its first appearance and the perfect ring formation. Variations in the shape of the foramen ovale showed the maximum number of FOs as oval shaped followed by almond shape and semilunar shape. We found absent F.S in two cases and a very tiny FS in one case [8]. The venous segment of the FO may be separated from its other contents. This results in a doubled FO [9]. Tubbs et al [10] in their study on the ossification of the ligaments near the FO, revealed that the ossified pterygospinous (ligament of Civinini) and pterygoalar (ligament of Hyrtl) ligaments divides the FO in to two compartments. Such bony obstructions could interfere with the transcutaneous needle placement into the FO. In case of FO, the puncture advancement of a catheter, more than 10mm from the foramen ovale, is likely to damage the internal carotid artery [11]. In the treatment of trigeminal neuralgia injection is given into thr Gasserian ganglion situated just below the FO [12].

Table 1: Showing % of different shapes of Foramen ovale, Foramen spinosum and bony out growth.

Shape	Right	Left
Oval	30(66.6%)	35(77.7%)
Almond	2(4.44%)	2(4.44%)
Divided	2(4.44%)	2(4.44%)
Spur over F.O	1(2.22%)	-
Absent F.S	2(4.44%)	2(4.44%)
Confluent F.S	2(4.44%)	1(2.22%)
Bony Spicule between F.O. & F.S	3(6.66%)	3(6.66%)
Bony spicule in F.O.	2(4.44%)	-
Bony spicule in F.S.	1(2.22%)	-

F.O=Foramen ovale, F.S=Foramen spinosum

Table 2: Anteroposterior Diameter of the Foramen Ovale in mm on both sides.

Anteroposterior diameter in (mm)	Frequency in right side	Frequency in left side
9mm	1	-
8mm	7	7
7mm	10	13
6mm	16	18
5mm	11	7

Table 3: Transverse Diameter of Foramen Ovale On both sides.

Transverse diameter in (mm)	Frequency in right side	Frequency in left side
2mm	4	4
3mm	35	37
4mm	6	4

Fig. 1: Showing bilateral absence of foramen spinosum and almond shaped foramen ovale on the right side.



Fig. 2: Showing foramen spinosum with a bony spur.



Fig. 3: Showing divided foramen ovale on the left side.



Fig 4: Showing confluent foramen spinosum and double foramen ovale on the left side.



Fig. 5 & 6: Showing oval shaped foramen spinosum on the right side and a bony spur in to the foramen spinosum on the left side.



Fig 7: Showing confluent foramen spinosum on the right side.



Fig. 8: Showing double foramen spinosum and divided foramen ovale on the left side.



Fig. 9: Showing a bony spine in to the F.O on the right side.

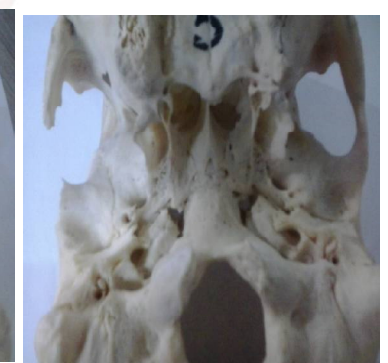


Fig. 10: Showing confluent F.S on the left side.



Fig 11: Showing a large F.O on the right side and almond shape F.O on the left side.



Fig 12: Showing oval shaped F.S on the left side.



Fig 13: Showing a bony spicule projecting in to the F.S and divided F.O on the left side.



Fig. 14: Showing bilateral large foramen ovale.



Table 4: Anteroposterior Diameter of Foramen Spinosum.

Max A.P diameter in mm	Frequency in right side	Frequency in left side
3mm	10	11
2mm	18	14
1mm	15	18
Absent	2	2

DISCUSSION

The presence of bony spur, confluent Foramen spinosum, divided Foramen ovale indicate anomalies during its developmental process. The earliest ring shaped formation of Foramen ovale was observed in the 7th month of intrauterine life and the latest at 3 years after birth [13]. The presence of various bony overgrowth of the foramen ovale like spines, bony plates etc indicate bony overgrowths during its developmental process between its first appearance and the perfect ring formation. Variations in the shape of the foramen ovale showed the maximum number of FOs as oval shaped followed by almond shape and semilunar shape. We found absent FS in two cases and a very tiny FS in one case [8]. In such cases the middle

meningeal artery enters the cranial cavity through the foramen ovale or may arise from the ophthalmic artery. The venous segment of the FO may be separated from its other contents. This results in a doubled FO [9]. Tubbs et al [10] in their study on the ossification of the ligaments near the FO, revealed that the ossified pterygospinous (ligament of Civinini) and pterygoalar (ligament of Hyrtl) ligaments divides the FO in to two compartments. Such bony obstructions could interfere with the transcutaneous needle placement into the FO. In case of FO, the puncture advancement of a catheter, more than 10mm from the foramen ovale, is likely to damage the internal carotid artery [11]. In the treatment of trigeminal neuralgia injection is given into the Gasserian ganglion situated just below the FO [12].

CONCLUSION

This study helps in understanding the features of Foramen ovale and Foramen spinosum. Small sized Foramen ovale indicates an over ossification during the developmental process. The mandibular nerve passes through the Foramen ovale which is the target in trigeminal rhizotomy. The data in the present study helps in the management and treatment in cases of trigeminal neuralgia. Thus knowledge of the different variations of foramina took into account by neurosurgeons, while planning neurosurgical procedures in the middle cranial fossa. This study is also of clinical and anatomical significance to the medical practitioners in cases of trigeminal neuralgia and in diagnosing any aneurysm and vascular lesion of the cranial cavity.

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Conflicts of Interests: None

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