

Morphological and Morphometric Study of Foramen Ovale and Foramen Spinosum in Human Skull

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ABSTRACT

Introduction: Foramen ovale and spinosum are the important foramina located in the base of skull on the greater wing of sphenoid. Foramen ovale transmits the mandibular nerve, accessory meningeal artery, lesser petrosal nerve, emissary vein and occasionally the anterior trunk of the middle meningeal vein. Foramen spinosum gives passage to middle meningeal vessels and nervous spinosus. Study of anatomical variations of these foramina provides important information useful in skull base injury and helpful for procedures like transfacial fine needle aspiration technique, percutaneous trigeminal rhizotomy for trigeminal neuralgia, etc.

Materials and Methods: 60 dry human skulls were obtained from the department of anatomy, SMS Medical College, Jaipur. The anteroposterior (APD), transverse diameter (TD) of foramen ovale and spinosum were measured by vernier calipers and shapes were observed. Mean and range were calculated and tabulated.

Observations and Results: The mean length of foramen ovale was 7.98 mm and 4.24 mm on right side and 7.14 mm and 3.78 mm on left side. Most common shape observed was oval (74%). The mean length and width of foramen spinosum was 3.14 mm and 2.68 mm on the right side and 3.05 mm and

2.58 mm on left side. The most common shape observed was rounded (58.5%).

Conclusion: No significant difference was found between the foramen spinosum of both sides whereas significant difference was observed in the size of foramen ovale. The knowledge of foramina is helpful for the neurosurgeons and radiologists.

Keywords: Sphenoid Bone, Ovale, Spinosum.

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INTRODUCTION

The sphenoid bone is a bat shaped bone found on the base of the skull and consists of a body, greater wing and a lesser wing. The foramen ovale and foramen spinosum are found on the infratemporal surface of the greater wing of the sphenoid bone. The foramen ovale transmits the mandibular nerve, accessory meningeal artery, emissary vein and the lesser petrosal nerve. Occasionally the anterior trunk of the middle meningeal vein also passes. It can be occasionally covered by ossified ligament stretching between the lateral pterygoid process and the sphenoid spine.¹ The venous segment of the foramen ovale may be separated from the other contents of the foramen by a bony spur; thus resulting in a so called doubled foramen ovale. Such spurs are located anteriorly and medially.

Foramen ovale is used for various invasive neurosurgical procedures like the microvascular decompression by trigeminal

rhizotomy for the management of trigeminal neuralgia and the percutaneous biopsy of cavernous sinus tumours.² Intracranial approach through foramen ovale is also used as diagnostic procedures such as electroencephalographic analysis of the seizure for patients undergoing selective amygdalohippocampectomy.³ Cannulation of the foramen ovale is done to access intracranial structures. The technique of CT-guided transfacial fine needle aspiration technique through the foramen ovale is used to diagnose squamous cell carcinoma⁴, meningioma etc., and allows biopsy of deep lesions that would otherwise require craniotomy or open surgical biopsy. Foramen spinosum is an important landmark in skull base injury especially in the middle cranial fossa and infratemporal fossa. Foramen spinosum transmits the passage of the nervous spinosum (meningeal branch of mandibular nerve), the middle

meningeal artery and the middle meningeal vein. Variations in foramen spinosum are documented so many times. The foramen spinosum may be absent in case where the middle meningeal artery enters the cranial cavity through the foramen ovale.⁵ The foramen spinosum and ovale may be continuous.⁶ The foramen spinosum may be duplicated or may be more or less incomplete.⁷ The knowledge of foramen spinosum and ovale is helpful for neurosurgeons.

MATERIALS AND METHODS

60 dry human skulls were taken from the department of Anatomy, SMS medical college, Jaipur.

The anteroposterior, transverse diameter of foramen ovale and foramen spinosum were measured from the base of skull. Measurements of the foramen were taken with the help of divider and digital Vernier calipers. Shapes of the foramina were observed by naked eye examination. Variations were noted. The findings were tabulated and appropriate

statistical analysis was done using SPSS (version 12.0) software under supervision of statistician.

OBSERVATIONS AND RESULTS

The mean antero-posterior diameters (APD) of the right and left foramen ovale were 7.98 mm and 7.14mm. The mean transverse diameters (TD) of the right and left foramen ovale were 4.24mm and 3.78mm respectively (table-1).

The mean anteroposterior diameters (APD) of the right and left foramen spinosum were 3.14 mm and 3.05mm. The mean transverse diameters (TD) of both the right and left foramen spinosum were 2.68mm and 2.58mm respectively (table-2). Various shapes of foramen ovale and spinosum were observed (fig 1, 2). These observations are given in table no. 3 and 4. Two rare variations were also observed. A skull with elongated upper end of lateral pterygoid plate overlapping foramen ovale was found converting it into doubled foramina. Another skull was having bony spur over Foramen spinosum.



Fig-1: Different shapes of Foramen ovale

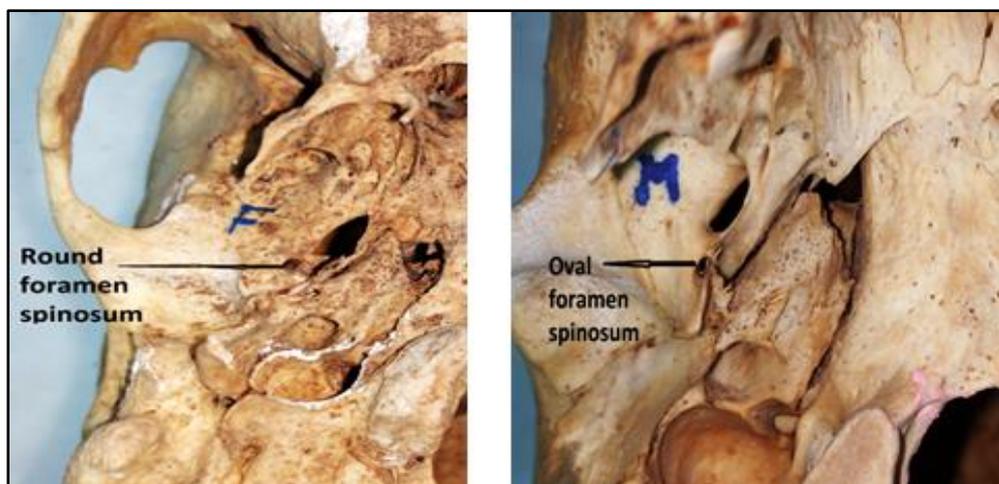


Fig-2: Different shapes of Foramen spinosum

Table 1: Transverse and Anteroposterior diameter of Foramen ovale (n=60)

Foramen Ovale	Transverse diameter (right)	Transverse diameter (left)	Anteroposterior diameter (right)	Anteroposterior diameter (left)
Mean and SD (mm)	4.24±1.15	3.78±0.61	7.98±0.99	7.14±1.24
Maximum diameter(mm)	7.19	5.5	9.9	9.9
Minimum diameter(mm)	2	2.64	5.6	4.8

Table 2: Transverse and Anteroposterior diameter of Foramen spinosum (n=60)

Foramen Spinosum	Transverse diameter (right)	Transverse diameter (left)	Anteroposterior diameter (right)	Anteroposterior diameter (left)
Mean and SD (mm)	2.68±0.71	2.58±0.65	3.14±0.53	3.05±0.67
Maximum diameter(mm)	3.9	4	4	4.48
Minimum diameter(mm)	1.13	1.22	1.5	1.4

Table 3: Shapes of Foramen ovale (n=60)

Shape	Right	Left	Total
Oval	45(75%)	43(71.6%)	88(74%)
Rounded	8(13.3%)	8(13.3%)	16(13%)
Semilunar	7(11.7%)	9(15.1%)	16(13%)

Table 4: Different shapes of Foramen Spinosum(n=60)

Shape of the Foramen spinosum	Right Side	Left Side	Total
Oval	26(43.3%)	24(40%)	50(41.5%)
Round	34(56.7%)	36(60%)	70(58.5%)

DISCUSSION

The mean antero-posterior diameters of the right and left foramen ovale (7.98 mm and 7.14 mm) in this study were in accordance with the study conducted by Ray B in 2005 (7.46 mm and 7.01 mm) and less than the study of S Magi Murugan conducted in 2014 (8.9 mm and 8.5 mm).

The mean transverse diameter of the right foramen ovale (4.24mm) was larger than the left foramen ovale (3.78mm) in this study and is in accordance with the study of Ray B; 2005 (3.21 mm and 3.19mm).

This finding was opposite to the study of Magi Murugan; 2014 (3.7mm and 3.9mm) where mean transverse diameter of left side was found to be larger than on right side. There were very few exceptions where 14 (23%) of the skulls had foramen ovale with large left width (TD) and small right width (TD), another 10 skulls (16%) had foramen ovale with large left length (APD) and small right length (APD).

The mean anteroposterior diameter of the right and left foramen spinosum (3.14 mm and 3.05mm) in this study was in accordance with the study of Somesh M.S.;2015 (3.4 mm and 3.3mm) and Anju et al, 2012 (3.31mm and 3.73mm).

The mean transverse diameter of both the right (2.68mm) and left (2.58mm) foramen spinosum in this study were found to in this study was in this study was in accordance with Somesh M.S.2015 (2.68 mm and 2.67mm) S.D Desai 2012 (2.68mm).

The exceptions were very few where 6 (10%) of the skulls had foramen spinosum with large left width/TD and small right width/TD, another 8 skulls (13%) had foramen spinosum with large left length/APD and small right length/APD.

CONCLUSION

In the present study it was observed that foramen ovale is generally larger on the right side and has statistical significance. A large foramen ovale is normally associated with a large foramen spinosum. The shape of the foramen ovale was often oval and spinosum was rounded. Thus, this study adds the important information about the morphology and morphometry of foramen ovale and foramen spinosum which can be applied by neurosurgeons and radiologists for diagnostic and therapeutic purposes.

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