



Original Research Article

Morphometry of the Foramen Ovale of Sphenoid Bone in Human Dry Skulls in Kerala

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ABSTRACT

Greater wing of the sphenoid bone contains foramen ovale. Shape of the foramen ovale is oval, and it is placed obliquely at the base of the skull. It connects infratemporal fossa to the middle cranial fossa and transmits the mandibular nerve, accessory meningeal artery and lesser petrosal nerve and emissary vein which connects the cavernous venous sinus to the pterygoid venous plexus in the infratemporal fossa. This study was conducted on 120 foramen ovale of 60 adult human skulls. Maximum length and minimum length observed were 10.3 mm & 5.4 mm on right side and 9.4 mm & 4.2 mm on left side respectively. Mean length of foramen ovale was 7.80 ± 1.24 on right side, 7.26 ± 1.18 on left side. Width of foramen ovale varied from 6.2 mm to 2.8 mm on right side, 6.8 mm to 2.2 mm on left side. The shape of the foramen ovale was oval in 84 sides (40 right, 44 left), round in 16 (9 right, 7 left), slit like in 9 sides (4 right, 5 left) pear shaped in 5 (3 right, 2 left), almond shaped in 6 (4 right, 2 left). These anatomical variations can be explained in terms of embryological basis. Sphenoid bone has a body formed by pre sphenoid and post sphenoid centers along with medial crus of orbito-sphenoid. This study is of clinical and anatomical significance for treating trigeminal neuralgia and diagnosing tumors and abnormal bony growth in this region and this study is also useful in preservation of neurovascular structures in middle cranial fossa surgeries.

Key words: Emissary vein, Foramen ovale, Infratemporal fossa, Sphenoid bone and Variations.

INTRODUCTION

Sphenoid bone is one of the unpaired bones in the skull. Sphenoid bone has body, lesser wing and greater wing. Greater wing of the sphenoid bone contains foramen ovale. Shape of the foramen ovale is oval, and it is placed obliquely at the base of the skull. Position of the foramen ovale in the greater wing of sphenoid bone is close to the upper end of posterior margin of lateral pterygoid plate, lateral to the foramen

lacerum and most commonly medial to foramen spinosum.^[1] It connects infratemporal fossa to the middle cranial fossa and transmits the mandibular nerve, accessory meningeal artery and lesser petrosal nerve and emissary vein which connects the cavernous venous sinus to the pterygoid venous plexus in the infratemporal fossa.

Similar to other foramina, the foramen ovale differs in shape and size

throughout the natural life. Lang J Schafhauser O [2] (1984); in adult, the foramen ovale is about 7.2 mm in length. The average maximal length is about 7.48 mm and its average minimal length is 4.17 mm. The average width is 3.7 mm in adults.

Landl MK Walter Grand [3] (2005); fluoroscopically assisted laser targeting measurement showed length of the foramen ovale 6.9 mm on right side and 6.8 mm on left side. The average width of the foramen ovale on right side was 3.4 mm and 3.8 mm on left side.

MATERIALS AND METHODS

This study was conducted on 120 foramen ovale of 60 adult human skulls. Adult human skulls were obtained from Department of anatomy, DM- Wayanad Institute of Medical Sciences, Wayanad, Kerala. Damaged skulls in and around the foramen ovale were not considered for the study. Maximum length and width of foramen ovale was measured with the help of digital caliper. Variations in shape and dimensions were noted. Statistical analysis was done using student t test.

RESULTS

Table 1. Length and width in mm on right and left side.

Values	Length(mm)		Width(mm)	
	Right	Left	Right	Left
Maximum	10.3	9.4	6.2	6.8
Minimum	5.4	4.2	2.8	2.2
Mean	7.80±1.24	7.26±1.18	4.0±1.14	4.05±1.16
P value	0.14		0.58	

Table 2. Variations in shape of foramen ovale

Shape of the foramen Ovale	Right	Left	Total	Percentage
Oval	40	44	84	70%
Round	9	7	16	13.33%
Slit	4	5	9	7.5%
Almond	4	2	6	5%
Pear	3	2	5	4.17%

Maximum length and minimum length observed were 10.3 mm & 5.4 mm on right side and 9.4 mm & 4.2 mm on left side

respectively. Mean length of foramen ovale was 7.80±1.24 on right side, 7.26±1.18 on left side. Width of foramen ovale varied from 6.2 mm to 2.8 mm on right side, 6.8 mm to 2.2 mm on left side (Table 1).

The shape of the foramen ovale was oval in 84 sides (40 right, 44 left), round in 16 (9 right, 7 left), slit like in 9 sides (4 right, 5 left) pear shaped in 5 (3 right, 2 left), almond shaped in 6 (4 right, 2 left) (Table2).

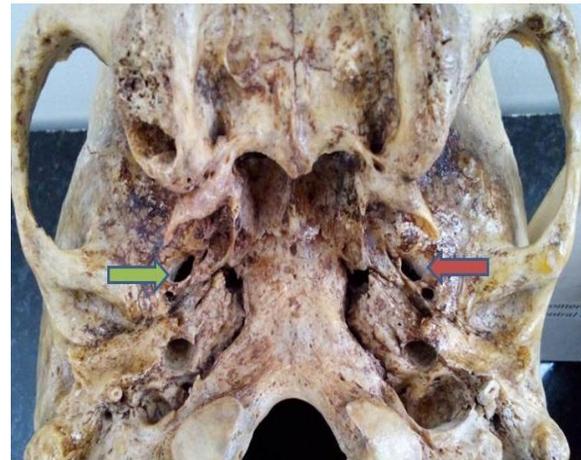


Fig 1: Green arrow showing Oval shaped and Red arrow showing slit like foramen ovale.

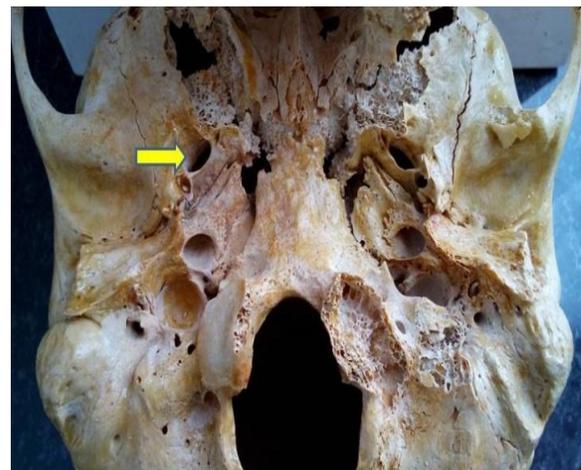


Fig 2: Yellow arrow showing the Round shaped foramen ovale.

DISCUSSION

Morphometry of foramen ovale may be helpful in open surgical, radio surgical, and radiotherapeutic treatment, especially during trigeminal neuralgia (Sindou M [4]).

Variation in shape and dimensions of foramen ovale is of great clinical significance. Most common route for the spread of nasopharyngeal carcinoma is through foramen ovale and was reported by Chong VF^[5] et al in 1996.



Fig 3: White arrow showing the pear shaped foramen ovale.

Present study showed the mean length of foramen ovale was 7.80 ± 1.24 mm on right side and 7.26 ± 1.18 mm on left side. There was no significant difference between 2 sides ($p > 0.05$). The study conducted by Yanagi S^[6] et al in Japan reported the length of foramen ovale was 3.8mm, 7.2 mm in newborn and in adults with maximum and minimum length being 7.48mm and 4.17mm in adults. Another study conducted by Nirupma Gupta^[7] et al in Uttar Pradesh showed Mean length of FO was $7.228 \text{mm} \pm 1.13$ on right side and $6.485 \text{mm} \pm 0.77$ on left side. Though Foramen ovale on right side was longer than on left side the difference was not statistically significant ($p > 0.05$).

Width measurement of foramen ovale in the present study showed 4.0 ± 1.14 mm on right side and 4.05 ± 1.16 mm on left side. Difference between the width of right and left side was not statistically significant. ($p > 0.05$). Similar findings observed by Lang J^[2] et al in Germany, in his study

measurements were with average width of 3.7mm in adult skull.

While observing the shape of foramen ovale in the present study majority were oval shaped of about 70% followed by round like about 13.33%. Slit, almond and pear shaped were 7.5%, 5%, 4.17% respectively. Similar was the findings in a study conducted by Yanagi S^[6] et al in Japan, majority of foramen was oval shaped.

These anatomical variations can be explained in terms of embryological basis. Sphenoid bone has a body formed by pre sphenoid and post sphenoid centers along with medial crus of orbito-sphenoid. The lesser and greater wings develop from orbito-sphenoids and ali-sphenoids respectively. First ossification centre appears for greater wings (ali-sphenoids). It makes appearance between foramen rotundum, ovale and spinosum. At 22 weeks, foramen ovale is seen as a discrete opening and is contained in the area of un-ossified cartilage. Ossification takes place around the mandibular nerve and other structures passing through foramen ovale in later life (BW, Babcock CJ^[8]).

CONCLUSIONS

This study is of clinical and anatomical significance for treating trigeminal neuralgia and diagnosing tumors and abnormal bony growth in this region and this study is also useful in preservation of neurovascular structures in middle cranial fossa surgeries. As the morphometric aspects of the foramen ovale vary in different countries and regions, knowledge of specific regional morphometric analysis of foramen ovale becomes necessary to aid in respective clinical and surgical procedures.

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