

Morphometric Study of Size and Symmetry of Foramen Ovale in Dry Skulls

Karishma Ravinthar, Thenmozhi
Saveetha Dental College and Hospitals

Abstract:

Aim : The aim of this research is to do a morphometric study of the size and symmetry of foramen ovale in dry skulls.

OBJECTIVE: In this research the dimensions of foramen ovale will be measured and its shape and symmetry is studied.

Background: The Foramen ovale is present in the posterior part of the greater wing of the sphenoid. The structures which pass through it are the mandibular nerve, the accessory meningeal artery, the lesser superficial petrosal nerve and the emissary vein .

Method And Materials : A collection of 60 human dry skulls are taken and foramen ovale will be measured and the size and symmetry will be noted.

Reason: This is the one of the important foramina which are situated at the transition zone between the intracranial and the extracranial structures. It is of immense clinical, surgical and anatomical importance. Hence I chose this topic.

Keywords: foramen ovale, sphenoid bone, morphometry, symmetry.

INTRODUCTION:

Foramen ovale is one of the several foramina present in the sphenoid bone. It is present in the infra temporal surface of the greater wing the sphenoid bone. It is found in the middle cranial fossa. The foramen ovale is situated posterolateral to the foramen rotundum and anteromedial to foramen spinosum. The foramen spinosum is present posterior to the foramen ovale. Carotid canal is present posterior and medial to the foramen spinosum and the foramen rotundum is present anterior to the foramen ovale[1]. The otic ganglion lies under the foramen ovale. The intracranial and extracranial structures pass through this foramen[2]. The structures which pass through the foramen ovale are the mandibular nerve, emissary vein, accessory middle meningeal artery and lesser petrosal nerve[3][4]. The sphenoid bone has both two types of ossification: intra membranous and endochondrial ossification. The sphenoid bone has a body(basisphenoid), a pair of lesser wings(orbitosphenoids), and a pair of greater wings (alisphenoids). The development of the greater wing of sphenoid is associated with the post sphenoid centre. The greater wing of the sphenoid are formed by endochondrial ossification in which the mandibular nerve is surrounded by cartilage to form the foramen ovale[5]. The foramen ovale is observed in the 7th fetal month as a discrete ring shaped area and is prominently visible even 3 years after birth[6]. The foramen ovale connects the Pterygoid plexus to the cavernous sinus through the emissary veins[7]. The present study focuses on the morphometric symmetry such as length and width and the symmetry of foramen ovale is also assessed.

MATERIALS AND METHODS:

This study was carried out on 60 foramen ovals using 30 adult human skulls. The skulls were obtained from the department of anatomy, Saveetha dental college and hospitals, Chennai, Tamil Nadu, India. Skulls in poor condition or with partially damaged surroundings were not considered. Measurements of the foramina ovale were done by placing a pair of dividers on the anteroposterior (length)

and transverse (width) diameters of the foramen and then carefully transferred to a meter rule for the readings to be taken. The measurements were recorded in millimeters. The symmetry of the foramen ovale was also noted. The mean and standard deviation of the length and width of the foramen ovale was calculated. The maximum and minimum values of the dimensions were noted. The percentage of symmetry and asymmetry of foramen ovale was calculated.



RESULT:

The study was conducted on a total of 60 sides in 30 dry adult skulls. The maximum and minimum length of foramen ovale on the right and left was 10.1 mm, 4.3 mm and 9.1 mm, 3.2 mm. Mean length of foramen ovale on the right was 6.773± 1.652 mm and on the left was 5.744±1.791 mm. The maximum and minimum width of

foramen ovale on the right and left was 4.8 mm, 2.3 mm and 5.7 mm, 2.9 mm. Mean width of foramen ovale on the right was 3.56±0.737mm and on the left was 4.28±0.833 mm. The foramen ovale was found to be symmetric in 13.33% of the skulls.

OBSERVATION:

Tabular column:

S.NO.	LENGTH		WIDTH		SYMMETRIC /ASYMMETRIC
	RIGHT (mm)	LEFT (mm)	RIGHT (mm)	LEFT (mm)	
1	5.7	3.2	4.1	5.0	ASYMMETRIC
2	8.0	4.5	2.7	5.7	ASYMMETRIC
3	7.1	5.1	2.5	3.2	ASYMMETRIC
4	6.2	3.9	3.2	4.3	ASYMMETRIC
5	10.1	7.2	2.9	4.5	ASYMMETRIC
6	4.3	6.4	4.8	3.6	ASYMMETRIC
7	5.1	6.9	3.3	5.3	ASYMMETRIC
8	5.9	5.9	3.7	3.7	SYMMETRIC
9	8.5	3.3	4.0	4.1	ASYMMETRIC
10	8.7	9.0	3.6	3.2	ASYMMETRIC
11	7.2	7.2	4.9	4.9	SYMMETRIC
12	5.6	9.2	4.2	4.8	ASYMMETRIC
13	9.2	9.7	4.0	5.6	ASYMMETRIC
14	8.9	4.2	4.2	4.4	ASYMMETRIC
15	7.3	3.5	3.9	4.2	ASYMMETRIC
16	4.3	5.2	3.2	2.9	ASYMMETRIC
17	9.7	4.6	4.3	5.1	ASYMMETRIC
18	7.3	5.1	3.2	4.3	ASYMMETRIC
19	6.3	5.2	3.8	4.2	ASYMMETRIC
20	8.5	3.8	2.3	5.0	ASYMMETRIC
21	4.7	4.7	3.3	3.3	SYMMETRIC
22	5.4	8.2	3.7	3.4	ASYMMETRIC
23	5.0	6.9	2.3	3.9	ASYMMETRIC
24	4.6	7.9	3.6	4.5	ASYMMETRIC
25	7.1	6.6	2.4	5.6	ASYMMETRIC
26	6.7	3.5	2.9	5.4	ASYMMETRIC
27	8.2	6.2	4.6	4.3	ASYMMETRIC
28	5.1	5.1	4.2	4.2	SYMMETRIC
29	5.4	5.0	2.6	2.8	ASYMMETRIC
30	7.1	4.9	4.3	3.1	ASYMMETRIC

	LENGTH		WIDTH	
	RIGHT (mm)	LEFT (mm)	RIGHT (mm)	LEFT (mm)
MAXIMUM	10.1	9.1	4.8	5.7
MINIMUM	4.3	3.2	2.3	2.9
MEAN	6.77 ± 1.65	5.74 ± 1.79	3.56 ± 0.73	4.28 ± 0.83

	PERCENTAGE
SYMMETRIC	13.33
ASYMMETRIC	86.67



DISCUSSION:

The foramen ovale play a very important role in various surgical as well as diagnostic procedures. It helps in the easy access of the trigeminal nerve thus helps to anesthetize the mandibular nerve[9]. Foramen ovale plays a vital role in procedures like percutaneous biopsy of tumors of cavernous sinus[10], percutaneous trigeminal rhizotomy for trigeminal neuralgia due to easy access of the gasserian ganglion[11][12] and electroencephalic analysis of the seizure for selective amygdalohippocampectomy patients[11]. The dimensions of the Foramen ovale are used to assess the skull base symmetries[13]. Mean length of foramen ovale on the right was 6.773 +- 1.652 mm and on the left was 5.744 +- 1.791 mm. The results are in agreement with a study conducted by Biswabina Ray et al on 70 sides of 35 human dry skulls in their study the mean length of foramen ovale was 7.46±1.41 mm on right side 7.01±1.41 mm on left side[14]. The mean length of foramen ovale was 6.60mm and 6.26mm on right and left side in a study conducted in Loni, Maharashtra. In a study on 82 skulls conducted in Mangalore mean length of the Foramen study the mean length of foramen ovale was 7.46±1.41 mm on right side 7.01±1.41 mm on left side[15][16]]. In this study the maximum and minimum length of foramen ovale on the right and left was 10.1 mm, 4.3 mm and 9.1 mm, 3.2 mm. This value falls in agreement with the values obtained by the research carried out by Arun (2006) in Nepal, in which the maximal length

of foramina ovale of 25 unknown adult human skulls was 9.8mm and the minimal length was 2.9mm[17]. In a developmental study conducted in Japan an average maximal length of foramen ovale was 7.48 mm and average minimal length was 4.17mm. In Lang J study the length was 7.2mm[18]. Landl MK study reported 6.9mm on right side and 6.8mm on left side.[19] Mean width of foramen ovale on the right was 3.56+- 0.737mm and on the left was 4.28+-0.833 mm. Average width on right side was 3.4mm and 3.8mm on left side was reported in a study conducted by fluoroscopically- assisted laser targeting of foramen ovale in New York[19]. The maximum and minimum width of foramen ovale on the right and left was 4.8 mm, 2.3 mm and 5.7 mm, 2.9 mm. In a study conducted by N.Gupta maximum width of foramen ovale was 5.0mm on both right and left sides while minimum width was 1.0mm on right side and 2.2mm on left side[20]. Symmetry was observed 13.33% of the skulls.

CONCLUSION:

Hence foramen ovale has differing dimensions and symmetry which has various clinical, surgical and anatomical importance. This study is of significance for the medical practitioners in cases of trigeminal neuralgia, diagnostic detection of tumors and abnormal bony outgrowths causing ischemia, necrosis etc.

REFERENCES:

- [1] Drake, Richard L; Vogl, Wayne O; Tibbitts, Adam W.M. Mitchell; illustrations by Richard; Richardson, Paul (2005). Gray's anatomy for students. Philadelphia: Elsevier/Churchill Livingstone. ISBN 978
- [2] A morphometric study of foramen ovale and foramen spinosum of the human sphenoid bone in the southern Nigerian population *Osunwoke E.A, Mbadugha C.C, Orish C.N, Oghenamavwe E.L. and Ukah C.J Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt.
- [3] Kuta AJ, Laine FJ (1993) Imaging the sphenoid bone and basiocciput: anatomic considerations. Semin Ultrasound CT MR, 14: 146-159. 10.Long J (1995) Skull base and related structures. Atlas of clinical anatomy. Shattauer, Stuttgart, New York. [4]Williams PL, Bannister LH, Berry MM, Collin P, Dyson M, Dussek JE, Ferguson MWJ. Gray's anatomy. 38th ed. Churchill Livingstone.
- [5] MORPHOMETRIC AND MORPHOLOGICAL STUDY ON FORAMEN OVALE Magi Murugan 1, Shaik Hussain Saheb *2. *1 Assistant Professor, Department of Anatomy, Pondicherry Institute of Medical Sciences, Pondicherry, India. 2Assistant Professor, Department of anatomy, JJM Medical College, Davangere, Karnataka, India.
- [6] Yanagi S. Developmental studies on the foramen rotundum, foramen ovale and foramen spinosum of the human sphenoid bone. The Hokkaido Journal of Medical Science. 1987;62(3):485-496.
- [7] Bekov DB (1965) Atlas venoznoi sistemy golovnogo mozga tscheloveka. Medicina, Moskwa.
- [8] Bochenek A, Reicher M (1993) Anatomia człowieka. Vol. 3, Ed. 6. PZWL, Warszawa.
- [9] A Morphometric study of Foramen Ovale Foramen Ovalenin Morfometrik Bir Araştırması, M.s. soMEsH1, H.B. srIDEV12, latha V. PRABHu3, M.s. Gangadhara sWAMy3, Ashwin krIsHNAMurTHy3, B.V. MurlIMANJu3, Ganesh kumar cHETTIAR3 1Srinivas Institute of Medical Sciences and Research Centre, Mukka, Mangalore, India 2Kasturba Medical College, Manipal University, Department of Pathology, Mangalore, India 3Kasturba Medical College, Manipal University, Department of Anatomy, Mangalore, India
- [10] Sindou M, Chavez JM, Saint PG. Percutaneous biopsy of cavernous sinus tumours through the foramen ovale. Neurosurgery1997;40:106-111.

- [11] Wieser HG, Siegel AM. Analysis of foramen ovale electroderecorded seizures and correlation with outcome following amygdalohippocampectomy. *Epilepsia*.1991;32: 838-850.
- [12] Gusmao S, Oliveira M, Tazinaffo U, Honey CR. Percutaneous trigeminal nerve radiofrequency rhizotomy guided by computerized tomography fluoroscopy: Technical note. *J Neurosurg*. 2003;99:785–786
- [13] Gozil R, Keskil S, Calguner E, Tunc E, Kadioglu D, Sevim A, Onal, B, Baykaner K: Neurocranial morphology as determined by asymmetries of the skull base. *J Anat* 189: 673-675, 1996
- [14] Ray B, Gupta N, Ghose S (2005) Anatomic variations of foramen ovale. *Kathmandu University Med J*, 3: 64–68. 14. Shaw JP (1993) Pterygospinous and pterygoalar foramen: a role in the etiology of Trigeminal Neuralgia? *Clin Anat*, 6: 173–178.
- [15] Daimi SR, Siddiqui AU, Gill SS. (2011) Analysis of foramen ovale with special emphasis on pterygoalar bar and pterygoalar foramen. *Folia Morphol (Warsz)*. 70(3):149-53.
- [16] Somesh MS, Sridevi HB, Prabhu LV, Swamy MS, Krishnamurthy A, Murlimanju BV, Chettiar GK. (2011) A morphometric study of foramen ovale. *Turk Neurosurg*. 21(3):378-83.
- [17] ANATOMIC VARIATIONS OF FORAMEN OVALE – CLINICAL IMPLICATIONS Ambica Wadhwa, Mamta Sharma and Paramjeet Kaur Department of Anatomy, Punjab Institute of Medical Sciences Jalandhar, India
- [18] 9. Lang J, Maier R, Schafhauser O. (1984) Postnatal enlargement of the foramina rotundum, ovale et spinosum and their topographical changes. *Anat Anz*. 156:351-87 10. Daimi SR, Siddiqui AU, Gill SS. (2011) Analysis of foramen ovale with special emphasis on pterygoalar bar and pterygoalar foramen. *Folia Morphol (Warsz)*. 70(3):149-53.
- [19] Fluoroscopically–Assisted Laser Targeting of the Foramen Ovale: Technical Note. Minrad International, Inc. 2005 14. Nemzek WR, Brodie HA, Hecht ST, Chong BW, Babcook CJ, Seibert JA (2000) MR, CT, and plain film imaging of the developing skull base in fetal specimens. *American Journal of Neuroradiology*.
- [20] Morphometry of Foramen Ovale at base of skull in Gujarat IDr. Roma Patel, 2Dr. C. D.Mehta