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MORPHOLOGICAL AND MORPHOMETRY STUDY OF THE FORAMEN OVALE. A RETROSPECTIVE RADIOLOGICAL STUDY

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Abstract

Background:- The Foramen Ovale, also known as the Oval Window,is a relatively large opening located in the posterior part of the Sphenoid bone, posterolateral to the foramen rotundum. It serves as a passage for the important structures such as Mandibular nerve, a branch of the trigeminal nerve. Accessory Meningeal artery andLesser Petrosal nerve.

Materials and Method: A retrospective cross-sectional study took place between November 2023 and March 2024 in the Department of Anatomy in collaboration with the Department of Radiology, at Amar Shaheed Jodha Singh Attaiya Thakur Dariyao Singh Autonomous State Medical College, Fatehpur. Radiological data were randomly obtained from the picture archiving and communication system (PACS), specifically CT scan images of patients were taken of foramen ovale for medical or surgical reasons

Result: The most common shape observed was oval whs(54 %).We observed that the length on the right side was 6.55 mm& on the left side was 6.22 mm. width on the right side 5.79 mm and on left side 5.73 mm

Conclusion: An in-depth knowledge of morphology and morphometry has been studied including the different metric and nonmetric parameters. This knowledge would be helpful to neurosurgeons and anaesthetist when planning their clinical procedures involving the base of the skull.

Keyboard:- Foramen ovale, morphological variations, morphometric dimensions, skull

Introduction

The foramen ovale also known as the oval window is a relatively large opening located in the posterior part of the sphenoid bone, posterolateral to the foramen rotundum.[1] It serves as a passage for the important structures of the foramen ovale such as the mandibular nerve, a branch of the trigeminal nerve. lesser petrosal nerve, and occasionally a meningeal branch of the mandibular nerve.[3]

Situated in the greater wing of the sphenoid bone, it is positioned adjacent to the foramen rotundum and anterior to the foramen spinosum.[2] This opening allows foramen ovale the transmission of several structures including the mandibular nerve, accessory meningeal artery,

In the field of medicine, the foramen ovale is utilized as an entry point for Percutaneous Rhizotomy, to treat trigeminal neuralgia, as well as for observing neural activity in patients with suspected epilepsy. During Percutaneous Rhizotomy, the foramen ovale ovale is used as the entry point for inserting the electrode to partially or fully ablate one or more divisions of the trigeminal nerve, typically the Mandibular division, in order to relieve pain. Additionally, this opening is used to surgically place electrodes on the surface of the temporal lobe for observing neural activity in patients with suspected epilepsy.[4]

Materials and Method

Study type and participants

A retrospective cross-sectional study took place between November 2023 and March 2024 at the Department of Anatomy in collaboration with the Department of Radiology at Amar Shaheed Jodha Singh Attaiya Thakur Dariyao Singh Medical College, Fatehpur. Radiological data were randomly obtained from the picture archiving and communication system (PACS), specifically CT images of patients from Fatepur that were taken foramen ovale medical or surgical reasons. Patients with foramen ovale pathologies and any motion artifacts were excluded from the study."

Subjects

We conducted an analysis of the shapes and measurements of the foramen ovale utilizing CT mastoid images from archival records. The study encompassed 200 patients (100 males and 100 females) sourced from the radiological data system. Both left and right foramen ovale were assessed, resulting in a total of 200 foramen ovale analyzed. The patients were selected through a simple random sampling method from those who had undergone mastoid CT scans. The study included patients aged between 25-45 years, excluding individuals under 25 or over 45 years of age, those with neurological pathologies, and those who had undergone major neurosurgery.

Variables

The study comprehensively analyzed various variables to assess their influence on the foramen ovale in the human skull. The independent variable under scrutiny was the factor of sex, encompassing both female and male participants. The dependent variables encompassed multiple aspects related to the foramen ovale, such as its shape, length, width, distance from the midline, and the presence or absence of a spur. The various shapes considered of foramen ovale, were almond, oval, and round. Additionally, measurements were taken for length and width of both sides.

Data collection

Data collection took place from November 2023 to March 2024 using a multi-detector row computed tomography scan. CT imaging parameters included a 0.6mm section thickness, 120 KVp and 150-180 mA. Measurement analysis was performed ovalermed using GE picture archiving and communication system (PACS) software.

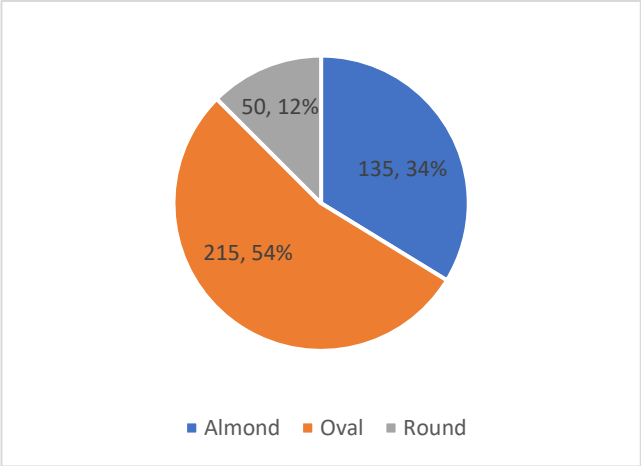
In our analysis, we used the RadiAnt DICOM Viewer 2024.1 BETA fimage analysis and measurements, as well as IBM SPSS statistical analysis.

Result

In present study, we observed that the most common shape of foramen ovale is oval followed by almond and then round given in table number 1.

A. **SHAPE**

S. No	Shape of Foramen Ovale	Number of Foramen Ovale	Percentage
1	Oval	215	54%
2	Almond	135	34%
3	Round	50	12%



Pie Chart 1 showing shape of Foramen Ovale

B. VARIATIONS

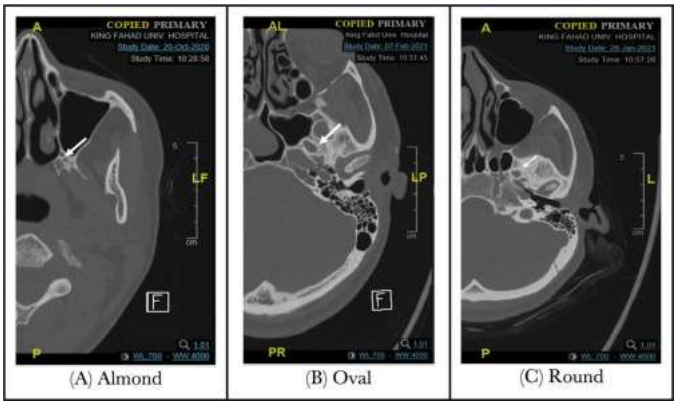


Fig No 1 showing the CT image of foramen ovale with different shapes

B. MEASUREMENTS

In our study, we observed that the length of right side was 6.55mm & on left side 6.22 mm, Width on right side was 5.79mm and left side was 5.73 mm as given in table number 2

Table number 2 Measurements of foramen ovale on the right and left side.

	Mean	Std. Deviation	Std. Error Mean	P Value.
Length Rt	6.55	1.10	0.11	0.9
Length Lt	6.22	1.91	0.19	
Width Rt	5.79	1.31	0.13	0.8
Width Lt	5.73	1.08	0.15	

Discussion

In present study, we observed that the most common shape of foramen ovale was oval, in 215 skulls which is 54 %; we observed that the mean length of the right side was 6.55 mm & on the left side 6.22 mm. The mean width on the right side 5.79 mm and left side 5.73 mm .

Kuppasad Gurushanthappa Prakash[5,] observed the mean length and width, on right side was 7.64 ± 1.194 mm, 5.128 ± 0.827 mm, and on the left side the values were 7.561 ± 1.123 mm, 5.244 ± 0.950 mm. The shape of the foramen ovale was typically oval in most of the skulls (56.70%), with some bony variations such as the spine, tubercles, bony bridge/bar, and confluence. which is comparable to our study Another study of S R Daimi[6] the ranges of anteroposterior diameter of the right and left foramen ovale were 8.5-4.5 mm and 10-3 mm, respectively. The mean length of the right foramen

ovale was 6.60 mm, while that of the left foramen ovale was 6.26 mm. The ranges of transverse diameter (width) of both right and left foramen ovale were 2.5-6 mm and 2-5 mm, respectively. The mean transverse diameter of the right foramen ovale was 3.70 mm, and that of the left was 3.34 mm. Bony spur in foramen ovale was seen in 6.66% of cases, which was similar to our findings. In another study of M S somesh[7] the values foramen ovale the right side were 7.64 ± 1.194 mm, 5.128 ± 0.827 mm, and 30.808 ± 7.545 mm^2 and on the left side the values was 7.561 ± 1.123 mm, 5.244 ± 0.950 mm and 31.310 ± 8.262 mm2 respectively for the mean length, width, and area of the foramen ovale. The shape of foramen ovale was typically oval in most of the skulls (56.70%), in agreement to our finding. In another study of Bhattarai[8]. foramen ovale mean length, width, and area were 7.79±1.10 mm, 3.68±0.64 mm, and 22.80±6.18 mm^2, respectively. mean length, width, and area were 2.38±0.36 mm, 1.94±0.30 mm, and 3.69±0.95. Ray 9, 74,3% of foramen ovale had oval shapes, while 25.7% varied because of developmental reasons, including a spine on the foramen ovale margin of 4.2%, tubercle protruding from a margin of 4.2%, a bridge-like spur of 2.8% or a slit-like narrow shape 1.4%.

Mohammed Alaftan[10], found the values of foramen ovale ; mean length, width, and distance from the midline on the right side were 6.462 mm ± 1.681 mm, 4.897 ± 1.0631 mm, and 2.4565 ± 0.51275 mm, and 6.451 ± 1.6691 mm, 4.812 ± 1.0848 mm and 2.4290 ± 0.60039 mm foramen ovale the left side, respectively. The foramen ovale shape was oval in the majority (47%), foramen ovale followed by a round shape (31%) with no bony outgrowths such as spur in the studied foramen ovale.

Conclusion

The present study would add useful information to the already existing pool of literature related to morphology and morphometry of foramen ovale. It would assist the neurosurgeons and anaesthetists to plan their procedures with better precision, thus minimizing adverse outcomes.

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