



## To correlate the shape of foramen ovale in Adulthuman skull through Measurement of bony structure in North Indian Population

Ved Prakash Yadav<sup>1</sup>, Vimal Modi<sup>2</sup>, S V Sharma<sup>3\*</sup>

1. Research scholar, Department of Anatomy, Index medical college, hospital & Research Centre Malwanchal University Indore
2. Professor & Head, Department of Anatomy, Index medical college, hospital & Research Centre Malwanchal University Indore
3. \* Research scholar, Department of Anatomy, Index medical college, hospital & Research Centre Malwanchal University Indore

### \*Corresponding Author:

#### Dr. Shyam Vinay Sharma

Research Scholar, Department of Anatomy, Index medical college, hospital & Research Centre Malwanchal University Indore

**Key words:** Measurement of foramen ovale, shape of foramen, segment of bony structure  
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### Abstract:

**Introduction:** The human skull protects the brain and permits it to communicate with other structures. Even though skulls appear similar within a species, they are not identical. Many variations can be observed in the skulls belonging to different populations, age groups and sexes.

**Method:** This study has been conducted on the total 158 dried adult human skulls North Indian population. The skull was carefully observed for size and shape of the foramen ovale and presence of any accessory osseous bony structure in relation to the foramen ovale.

**Discussion:** In the present study the foramen ovale were present in all 158 skulls on both sides (Right and left). Out of 158 skulls studied the shape of foramen ovale was found to be in so many varied shapes. The variation in these shape plays an important role in surgical point of view.

**Result:** In the right side of the skull around 146 skulls were oval, 6 were round and 2 of each were triangular, longitudinal slit and almond. In right side of the foramen ovale no pear-shaped foramen ovale were found in the skull studied. Oval shaped foramen ovale was highest in percentage 92.04% and round was 3.80%. Further triangular, longitudinal slit and almond were 1.20% respectively.

**Conclusion:** In our study there was no statistical significance difference in morphometric parameters such as dimension of the foramen ovale which includes (length and width).

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**Introduction:**

The base of the cranium is subdivided into anterior, middle and posterior cranial fossae. The anterior area is formed by roof of the orbit. The middle fossa is mainly occupied by the sphenoid bone, the apical area of petrous part of the temporal bone and basilar part of the occipital bone. The posterior part is formed by the occipital bone. The inferior of the skull base comprises of many foramina through which the neurovascular structures exit and enters the cranial cavity [1].

Along with anterior and posterior cranial fossae, the middle one is connected to the orbit by the optic canal and superior orbital fissure, to pterygopalatine fossa through the foramen rotundum and to the base of the skull by the foramen ovale, foramen spinosum, carotid canal, internal auditory meatus and hypoglossal canal [2]. The medial part of the greater wing of the sphenoid bone presents foramen ovale and spinosum, located on the basal aspect. The foramen ovale located medial to the foramen spinosum and anterolateral to the foramen lacerum in the infratemporal surface of greater wing of sphenoid bone. Carotid canal is located behind and posterolateral aspect of the foramen lacerum in the petrous part of the temporal bone [1]. The internal carotid artery enters the skull through the same foramen, ascends in the carotid canal, and then turns anteromedially to reach the posterior aspect of the foramen lacerum. The foramina of the skull, their size, shape, symmetry, variations and location have long attracted the attention of anatomists, anthropologists, forensic experts and clinicians because of their clinical, radiographic and evolutionary significance [3]. The human skull protects the brain and permits it to communicate with other structures. Even though skulls appear similar within a species, they are not identical. Many variations can be observed in the skulls belonging to different populations, age groups and sexes [4]. This intrigues and inspires scientists till date to revisit the skull for further investigation [5].

Cerebral surface of each greater wing of sphenoid bone forms part of the middle cranial cavity of the skull containing numerous foramina and fissures, which accommodate many nerves and vessels [6]. The body of sphenoid develops mainly from two centers – Presphenoid and post-sphenoid. The greater wing of sphenoid develops from the post-sphenoid center by endochondral ossification that lodges foramen ovale. Foramen ovale is an important foramen present in the middle cranial cavity, at the posterior aspect of each greater wing of sphenoid bone. Foramen ovale is large and oval in shape and it is placed obliquely at the base of skull. Several other studies have claim that the most frequent shape of foramen ovale is oval in shape and its show much variation with different ethnicity [7]. It is located posterolateral to foramen rotundum, anteromedial to foramen lacerum. Foramen ovale connects to the extracranial and intracranial structures. The longitudinal axis of foramen is oriented slightly ventrally and laterally corresponding to the direction of the mandibular nerve [8].

**Methods:**

This study has been conducted on the total **158** dried adult human skulls North Indian Population. After obtaining ethical clearance from research cell committee, Index medical college, hospital & Research Centre Malwanchal University Indore. To prevent discrimination, skulls have recruited for our study fulfilling inclusion criteria. The skull was carefully observed for size and shape of the foramen ovale and presence of any accessory osseous bony structure in relation to the foramen ovale.

**For the morphometry of the adult human skulls, following measurements have been taken in to consideration:**

**Materials:**

- Dry adult human skull
- Digital caliper

**Inclusion criteria:**

- Well preserved dried adult human skulls

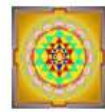
**Exclusion criteria:**

- Damaged skull

**Measurements:**

Length and breadth of foramen ovale was measured with digital vernier caliper of 0.01mm sensitivity. Distance of the foramen ovale from adjacent bony landmarks such as root of zygoma and articular tubercle was measured.

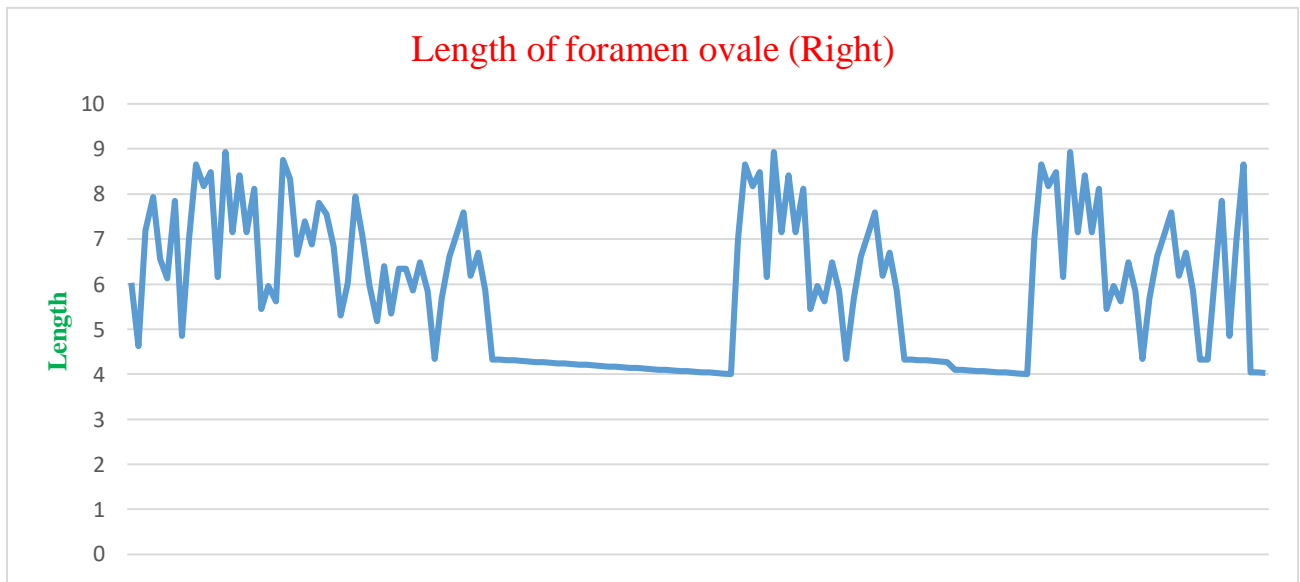




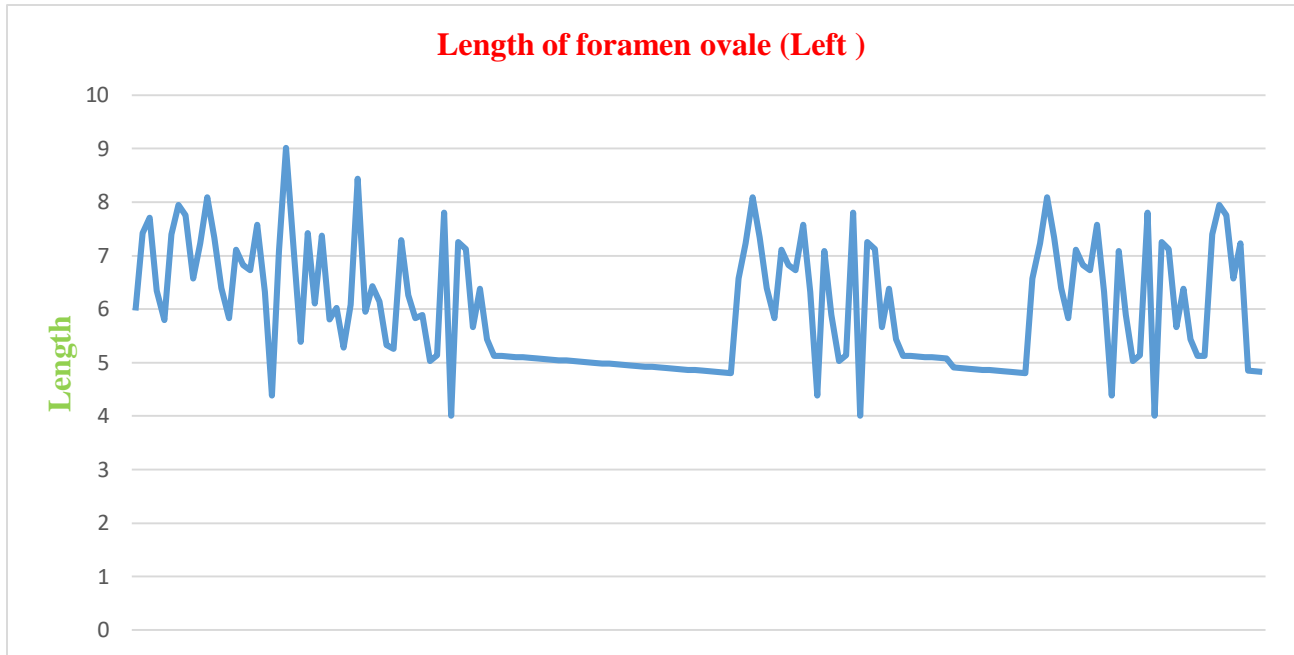
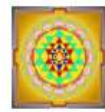
**Result:**

Dimension of foramen ovale		
Length (Mean± SD)		
Right	Left	p- value
5.85±1.57	5.95±1.12	0.50 (not significant)

**Table No- 1 Represents the dimension of foramen ovale**



**Figure No- 2 Represents the length of foramen ovale (Right side)**



**Figure No- 4 Represents the length of foramen ovale (Left side)**

**Discussion:**

In humans, the foramen ovale develops from primitive foramen lacerum medius and the space persists as the foramen lacerum after formation of the carotid canal medially and the sphenopetrosal fissure posterolaterally. Foramen ovale is seen as a discrete foramen at 22 weeks. [70]

This oval shape foramen ovale does not only act as opening but it also communicates between the middle cranial fossa and the infratemporal fossa.

Its position helps in approaching the intracranial structures percutaneously through the transjugular-transovale route of Hartel [71].

**In the present study** the foramen ovale were present in all 158 skulls on both sides (Right and left). Out of 158 skulls studied the shape of foramen ovale was found to be in so many varied shapes. The variation in these shaped plays an important role in surgical point of view

In the right side of the skull around 146 skulls were oval, 6 were round and 2 of each were triangular, longitudinal slit and almond. In right side of the foramen ovale no pear-shaped foramen ovale were found in the skull studied. Oval shaped foramen ovale was highest in percentage 92.04% and round was 3.80%. Further triangular, longitudinal slit and almond were 1.20% respectively. In left side of the skull studied 147 skull foramen ovale were oval, 5 were triangular and 2 of each were longitudinal slit, round and pear.

**Conclusion:**

In our study there was no statistical significance difference in morphometric parameters such as dimension of the foramen ovale which includes (length and width). For the study of topographic location of foramen ovale, its distance from two bony landmarks on zygomatic arch was measured that is the anterior root of the zygomatic process and the articular tubercle on it. The variation in the morphometric aspects such as shape and size of the foramen ovale leads us in giving the information regarding the variation in ethnicity of different countries and regions, which further helps clinicians to necessary aid in respective clinical and surgical procedures.

**Statistical analysis:**

The data obtained was tabulated and analyses statistically. Student's t test was applied to find out the p value. p value less than 0.05 was considered to be significant.

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