



## MORPHOMETRIC ANALYSIS OF LOCATION AND POSITION OF FORAMENS PRESENT IN THE MIDDLE BASE OF THE SKULL

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Foramen ovale, jugular foramen  
and carotid canal.

### ABSTRACT

**Aim:** To evaluate and analyse the location and position of foramen ovale, jugular foramen and carotid canal morphometrically.

**Background:** Since the articles about foramina mainly concentrate only on single foramen but this research is different in a way like analysing the three foramens present in the middle part of base of the skull with reference to their location and position in the skull.

**Reason:** Evaluation of the location and position of foramen ovale, jugular foramen and carotid canal, morphometrically may predict the anatomical variation of the relative location.

**Materials and Methods:** 60 dry unsexed skulls from the department of anatomy, Saveetha dental college, Chennai was used in the study. The distance of foramen Ovale, Jugular Foramen and Carotid canal from the mastoid process on the left side was measured using manual vernier caliper, the readings were tabulated.

**Result:** The mean value for the distance between mastoid process and Foramen ovale is about 7.01 cms. The mean for the distance between mastoid process and jugular Foramen is quite less about 3.45 cm. The mean for the distance between mastoid process and carotid canal is about 4.76cm.

**Conclusion:** Working knowledge of the normal and variant anatomy of the skull base is essential for effective surgical treatment of disease in this area.

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## INTRODUCTION

At the base of the skull the foramen ovale is one of the larger of the several opening that transmit nerves through the skull. The foramen ovale is situated in the posterior part of the sphenoid bone, posterolateral to the foramen rotundum. The foramen ovale is a foramen in the greater wing of the sphenoid bone. The foramen ovale is one of two cranial foramina in the greater wing, the other being the foramen spinosum [1]. The foramen ovale is posterolateral to the foramen rotundum and anteromedial to the foramen spinosum. Posterior and medial to the foramen is the opening for the carotid canal [2]. The foramen ovale is used as the entry point into the skull when conducting a Percutaneous Stereotactic Rhizotomy, a type of radiofrequency ablation performed to treat trigeminal neuralgia. Jugular foramen of human skull is one of the most interesting foramina [3]. It is a complex bony canal, numerous vital structures, including nerves and vessels are transmitted through it. Most of the intracranial and extra cranial lesions of posterior cranial fossa might affect the structures in jugular foramen in addition to intrinsic abnormalities [4].

Hence, the present study was done to examine the anatomy of jugular foramen, including its morphological features and dimensions [6]. The jugular foramen is a large foramen (aperture) in the base of the skull [6]. It is located behind the carotid canal and is formed in front by the petrous portion of the temporal bone, and behind by the occipital bone; it is generally larger on the right than on the left side. Cranial nerves IX, X, and XI and the internal jugular vein pass through the jugular foramen [7]. The carotid canal is the passageway in the temporal bone through which the internal carotid artery enters the middle cranial fossa from the neck. The canal starts on the inferior surface of the temporal bone at the external opening of the carotid canal. The canal ascends at first superiorly, and then, making a bend, runs anteromedially. The canal's internal opening is near the foramen lacerum above which the internal carotid artery passes on its way anteriorly to the cavernous sinus. It transmits into the cranium, the internal carotid artery, and the carotid plexus of nerves. Sympathetics to the head from the superior cervical ganglion also pass through the carotid canal [9]. Working knowledge of the normal and variant anatomy of the skull base is essential for effective surgical treatment of disease in this area.

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## MATERIALS AND METHOD

The study was conducted in the Department of Anatomy, Saveetha Dental College and Hospitals, Chennai. 60 dry unsexed skulls from the department of anatomy, Saveetha dental college, Chennai was used in the study. The distance of foramen Ovale, Jugular Foramen and Carotid canal from the mastoid process on the left side was measured using manual vernier caliper, the readings were tabulated. The skulls were observed with naked eye. In each skull the presence, the shape and laterality i.e., present unilaterally or bilaterally and the side of unilateral presence of foramen Ovale jugular Foramen and carotid canal from the point of mastoid process was measured, noted and photographed.

## RESULT

	Range	Mean
Distance between mastoid process and Foramen ovale	5.9-8.2 cm	7.01cm
Distance between mastoid process and jugular foramen	5.9-8.2 cm	3.45cm
Distance between mastoid process and carotid canal	3.8-5.3 cm	4.76cm

The data is tabulated as shown in the above table. Here the range of distance between mastoid process and Foramen ovale is about 5.9-8.2 cm and the mean value for the distance between mastoid process and Foramen ovale is about 7.01 cms. The distance between mastoid process and jugular Foramen and the range for this is about 2.8-3.9 cm and the mean for the distance between mastoid process and jugular Foramen is quite less about 3.45 cm and the distance between mastoid process and carotid canal it's range is about 3.8-5.3cm and the mean for the distance between mastoid process and carotid canal is about 4.76cm.

## DISCUSSION

The size and shape of the jugular foramen is obviously related to the size of the internal jugular vein and the presence or absence of a prominent superior bulb. There is a very wide variation in the anatomy of the intra cranial venous sinuses which accounts for variation in size and shape of jugular foramen [8]. Foramen ovale is situated at the transition zone between intracranial and extracranial structures, it is used for various invasive surgical as well as diagnostic procedures, because of this important reason the knowledge of diameters and shapes of foramen ovale is essential for surgeons. Our results are in agreement study of Biswabina Ray *et al* conducted on a total of 70 sides in 35 dry adult skull in their study the mean length of foramen ovale was  $7.01 \pm 1.41$  mm and mean length was  $7.16 \pm 1.39$  [11]. The similar results were observed in development studies conducted by Yanagi [9]. Namita sharma studied maximum transverse and antero-postero diameters of foramen lacerum and carotid canal in 50 dry skulls of Indian population by using vernier calipers [10]. The mean transverse diameter and antero-postero diameter of carotid canal was 7.01 and 5.42 respectively. In the present study the diameter of the canal studied at the bend is important to note any kinking of the artery which in turn can lead to vascular complications and there was a bilateral significant difference in measurements of diameter between direct bone method and cast method.

## CONCLUSION

The need for familiarity with the detailed anatomy of these foramina (Foramen ovale jugular Foramen and carotid canal) under study and their variations are very much essential in

microsurgical techniques as many extracranial and intracranial lesions including intrinsic anomalies may affect the foramina. Pathological processes affecting the foramina include paragangliomas, schwannomas, metastatic lesions, and infiltrative inflammatory processes from surrounding structures such as the middle ear. Surgical resection is the treatment of choice in the majority of these cases. Advances in microsurgical techniques have made possible the removal of advanced lesions of the foramina, which were once assumed inoperable. A neurosurgeon becomes bolder in approaching the region with the anatomical and variational knowledge of these foramina.

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