

ANATOMICAL VARIATIONS OF FORAMEN OVALE AND FORAMEN SPINOSUM IN DRY HUMAN SKULL

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ABSTRACT

Objective: The aim of the study was to find out the anatomical variation in the foreman ovale and spinosum located in the greater wing of sphenoid bone of middle cranial fossa. It has clinical significance as it provides a percutaneous approach to the base of the skull in cases like trigeminal neuralgia and other neurological abnormalities. This will provide base line study for the neurosurgeons while treating aneurysm or vascular lesions of the cranial cavity.

Materials and Methods: This study was of two-month duration and was carried out at Khyber Medical College, Peshawar. 35 dry skulls from the anatomy department of Khyber Medical College were studied and the shape features and anatomic variation of foreman ovale and spinosum was observed.

Results: Among 35 dry skulls 27(77.14%) were oval, 5(14.28%) were almond shape, 1(2.86%) was slit shape and 2(5.71%) were round in shape. Presence of bony spine, tubercle and plates around the margins of foramen ovale were also noted in 10 skulls. Duplication of foramen ovale was noticed in 2 skulls and that of foramen spinosum in 5 skulls. In one of the skull an absent foramen spinosum was also noted.

Conclusion: Anatomical variation does exist in the shape of foramen ovale and spinosum. The knowledge of this is important to the clinicians principally in treating intracranial vascular lesions and trigeminal neuralgias.

Keywords: trigeminal neuralgia, foramen ovale, foramen spinosum.

INTRODUCTION

Foramen ovale is a small opening located in the greater wing of sphenoid bone. It lies lateral to lingula and posterior to foramen rotundum. It also opens into infratemporal fossa and located somewhere in the transition zone between the intracranial and extra cranial structures.¹ The important structures

pass through them are mandibular nerve, accessory meningeal artery, emissary vein and lesser petrosal nerve.² It is separated from other foramen by a bony spur which can compress the mandibular nerve and could lead to loss of function of muscles supplying by that nerve. Sometimes for lesser petrosal nerve a separate foramen is present called as canaliculus innominatus.³

Careful evaluation of this foramen will help in the diagnosis of lesions in the nasopharynx and middle cranial fossa. Sometimes foramen ovale is enlarged due to neuroma of fifth cranial nerve.⁴ It

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is of clinical significance to medical professionals while planning transcutaneous approach to the skull base through foramen ovale in intracranial lesions.^{5,13}

Foramen spinosum is a small circular foramen located anterior to the spine of sphenoid bone in greater wing and posterolateral to the foramen ovale. It also provides access to middle cranial fossa through infratemporal fossa. It transmits middle meningeal artery, middle meningeal vein and nervus spinosus to enter middle cranial fossa.⁶ It has been observed that in 0.4% of cases it may be absent and middle meningeal artery arises directly from ophthalmic artery.^{7,9} However in some cases it can be duplicated as well. Variations in shape of both these foramen have been considered important in diagnosing lesions of middle cranial fossa.^{8,10} Less information is available on variations of foramen ovale and spinosum hence this study was carried out to highlight these variation which could be helpful to neurosurgeons in our setup.

MATERIALS AND METHODS

The study was carried out in Anatomy department Khyber Medical College Peshawar for a period of two months. During which 35 dried human skulls were chosen which were not broken or damaged without any gender preference. In each skull anatomical variations in shape of foramen ovale and spinosum was noted along with presence of bony outgrowths.

RESULTS

In our results we observed that the most common shape found in foramen ovale was oval. Out of 35 dried human skulls 27(77.14%) had oval shape, 5(14.28%) skulls were almond shape, 2(5.71%) were of round shape and 1(2.86%) was slit shape. Also among 35 skulls which means 70 foramen ovale, 3(8.57%) showed bony spines, 5(14.28%) showed bony tubercles and 2(5.75%) showed bony plates around the margins of foramen ovale on one side. In few skulls duplication of foramen ovale and spinosum was also seen i.e. 2 skulls had double foramen ovale and 3 skulls had double foramen spinosum. In 1 skull, we found out an absent foramen spinosum on the left side.

DISCUSSION

The variations in appearance of foramen ovale with bony spurs, plates, tubercles and duplication reveals bony over growths during intra natal life. The first ring formation is observed somewhere around 28 weeks of development and last one at three years after birth.^{10,16} In this study we observed that oval shape was more common followed by almond, round and slit shapes.¹⁵ Similar findings were found in the study carried by Karan Bhagwan et al (2013) in which out of 100 dried skulls 76.5% had oval shape foramen ovale also similar findings were also noted 70% of oval shaped foramen ovale.¹⁹

Bony spurs like tubercles, spines and plates observed in ten skulls were comparable in studies done by Lind Blom K et al (1936).¹⁸ Similar findings were also observed in the study carried out by Berjina et al (2019) who noted 1 bony plate around foramen ovale in 17 skulls.¹⁵ Duplicated foramen ovale and spinosum by bony plate was seen in 5 skulls on one side the same was observed by Singh et al (2001)²⁰ and Karan Bhagwan et al (2013).¹⁹ Duplication of foramen ovale is probably due to developmental reasons when pterygospinous ligament (ligament of Civinini) and pterygoalar ligament (ligament of Hyrti) undergoes ossification and causes division of foramen ovale into two compartments.^{21,7} Hence these bony spurs, plates etc. obstructs transcutaneous needle placement into foramen ovale during neurosurgical procedure.^{13,17}

The study conducted by Ray et al (2005) showed that foramen spinosum sometimes is absent, in our study only one skull had absent foramen spinosum on one side of skull.¹⁴ This happens when meningeal artery arises from ophthalmic artery directly bypassing maxillary artery or enters foramen ovale directly.¹¹ We also observed double foramen spinosum in 3 skulls, this happens when a bony bar divides the foramen in two halves due to division of middle meningeal vessels before entering into foramen spinosum.

CONCLUSION

The present study concluded that evaluation of variation in foramen ovale is necessary to both the neurosurgeons and anatomists in cases of trigeminal neuralgia and undergoing intracranial approach in cranial cavity e.g. aneurysms.¹² The presence of bony

S. No.	Shape of foramen ovale	No of skulls	Percentage
1-	Oval	27	77.14%
2-	Almond	5	14.28%
3-	Round	2	5.71%
4-	Slit shape	1	2.28%

plates, tubercles and spine over margin of foramen ovale is due to over ossification during intra natal life. The variation in shape, duplication or absence of foramen ovale interferes with the surgical procedures intervening middle cranial fossa. Foramen spinosum is a circular detectable landmark in microsurgical procedure therefore its anatomical variation should be considered while planning any neurosurgical approach to middle cranial fossa.

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