

# Morphometric analysis of Foramen Spinosum in south Indian skulls

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## Abstract

The foramen spinosum is located in the base of skull on the sphenoid bone, structure passing through it are middle meningeal artery and vein, the nervus spinosum. Total 125 skull were used for this study. The results were foramen spinosum found as round shape in 52%, oval shape in 42% and irregular in 6%. The maximum diameter of foramen spinosum was  $2.92 \pm 0.65$  mm and  $2.12 \pm 0.45$  mm was minimum in males, in females maximum was  $2.67 \pm 0.62$  mm and  $1.79 \pm 0.41$  mm as minimum. The knowledge of foramen spinosum is great helpful for neurosurgeons.

**Key words** – Foramen spinosum, Sphenoid bone, Middle meningeal artery, Middle meningeal vein.

## INTRODUCTION

The foramen spinosum is one of important foramina located in the base of the skull on the greater wing of sphenoid bone situated posteriorlaterally to the foramen ovale, therefore it could be identified both from the exterior and interior of the skull base, externally the foramen spinosum pierces the spinous process of the sphenoid bone at its apex or medial aspect. Foramen spinosum transmits the passage of the middle meningeal artery, parietal trunk of the middle meningeal artery and posterior trunk of the middle meningeal vein to the middle cranial fossa. The foramen may be absent in which case the middle meningeal artery enters the cranial cavity through the foramen ovale, the foramen spinosum and ovale may be continuous and the foramen spinosum may be duplicated, the foramen spinosum may be more or less incomplete. The foramen spinosum was small or altogether absent, this is in case of when the middle meningeal artery arises from the ophthalmic artery, in some cases early division of the middle meningeal artery into a posterior and anterior division may result in a duplication of the foramen spinosum [1]. In the newborn, the foramen spinosum is about 2.25 mm

and in the adults about 2.56 mm in length. The width of the foramen extends from 1.05 mm to about 2.1 mm in the adults[2]. The average diameter of the foramen spinosum is 2.63 mm in the adult, the foramen spinosum is an important landmark in skull base injury especially in the middle cranial fossa and infratemporal fossa[3]. The knowledge of foramen spinosum helpful for neurosurgeons.

## MATERIALS AND METHODS

125 dry adult human skulls constituted the material for the present study. The skulls belong to the Department of Anatomy, JJM Medical College, Davangere, Karnataka, India. Each was studied for the morphometric analysis of foramen spinosum and recorded.

## RESULTS

Total 125 skull were used for this study. The results were foramen spinosum found as round shape in 52%, oval shape in 42% and irregular in 6%. The maximum diameter of foramen spinosum was  $2.92 \pm 0.65$  mm and  $2.12 \pm 0.45$  mm was

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**Table 1. Shapes of Foramen Spinosum**

Shape of foramen spinosum	Incidence
Round shape	52%
Oval shape	42%
Irregular shape	6%

**Table 2. Sizes of Foramen Spinosum**

Sex	Maximum diameter	Minimum diameter
Females	$2.92 \pm 0.65$ mm	$2.12 \pm 0.45$ mm
Males	$2.67 \pm 0.62$ mm	$1.79 \pm 0.41$ mm

### DISCUSSION

The Foramen Spinosum is one of important foramina that lies in the greater wing of the sphenoid bone and provides communication between the infratemporal fossa and middle cranial fossa. The Foramen Spinosum also Transmits middle meningeal artery, it contains a venous component, the middle meningeal vein which connects the cavernous sinus with the pterygoid plexus, this is an important factor for clinical evaluation of radiological images of the diseased region. Different authors have been reported in their studies that the Foramen Spinosum was present in the human skulls at the percentage of 99.6%[4], 99.2%[5], and 98.5%[2]. Lindblom found that absence of foramen spinosum in 0.4% cases the reason would be the middle meningeal artery arose from the ophthalmic artery, in rare cases early division of the middle meningeal artery into an anterior and posterior division may result in the duplication of the foramen spinosum. [4].

According to Lanaprai et al study the middle meningeal artery arose from the maxillary artery in 100%, the foramen spinosum is much smaller than the foramen ovale with a diameter range of 1 - 4.3 mm with average 2mm and it is mostly round or oval in shape[6]. According to Lang et al[2] and Osunwoke et al[7] most of the foramen spinosum showed asymmetrical size. According to Lang et al. (1984) the foramen spinosum was about 2.25mm in the new born and 2.56mm length in

adults , the width of the foramen spinosum range from 1.05 to about 2.1mm in adults[2].

According to Reymond et al study of 100 skulls the mean area of the foramina measured, excluding the foramen ovale, was not considerable, which may suggest that they play minor role in the dynamics of blood circulation in the venous system of the head[8]. In Wood-Jones study found the foramen spinosum to be more or less incomplete in approximately 44% and in 16%, the foramen in the right side was unclosed 84% were open[9]. The findings of Osunwoke EA et al study were the maximal length of foramen spinosum was 4.0mm and minimal length was 1.0mm, in majority cases the lengths of the foramen spinosum ranges between 2.0 to 2.5mm. The maximal width of foramen spinosum was 2.0mm and the minimal width was 1.0mm, some of the foramen spinosum were partially divided into two components by bony spurs. The same author studied about the shape of foramen spinosum, the results were oval, circular and triangular[7].

Yanagi observed that the earliest perfect ring-shaped formation of the foramen spinosum was observed in the 8th month after birth and the latest in 7 years after birth in a developmental study on the foramen rotundum, foramen ovale and foramen spinosum, the majority of the foramen in the skulls studies was round in shape[3]. Ginsberg et al observed in study of 123 CT findings did not find an inverse relationship between the size of the foramen spinosum and that of the foramen ovale[10].

### REFERENCE

- [1]. Opus V . Skeletal Systems: Cranium - Sphenoid Bone. Illustrated Encyclopedia of Human Anatomic Variation. Retrieved 2006-04-10.
- [2]. Lang J, Maier R, Schafhauser O. Postnatal enlargement of the foramina rotundum, ovale et spinosum and their topographical changes. Anatomischer Anzeiger 1984; 156 (5):51–87.
- [3]. 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): 485–96.

- [4]. Lindblom K. A roentgenographic study of the vascular channels of the skull, with special reference to intracranial tumors and arteriovenous aneurysms. *Acta Radiol Suppl.* 1936; 30:1-146.
- [5]. Berlís A, Putz R, Schumacher M. Direct and CT measurements of canals and foramina of the skull base. *Br J Radiol.* 1992 Aug;65(776):653-61.
- [6]. Lanaprai Kwathai, Krisana Namonta, Thanaporn Rungruang, Vipavadee Chaisuksunt, Wandee Apinhasmit, Supin Chompoopong. Anatomic and Morphometric Consideration for External Landmarks of Foramen Spinosum in Thai Dry Skulls. *Siriraj Med Journal* .2012; 64;26-29.
- [7]. Osunwoke EA, Mbadugha CC, Orish CN, Oghenemavwe EL, Ukah CJ. A morphometric study of foramen ovale and foramen spinosum of the human sphenoid bone in the southern Nigerian population. *J Appl Biosci.* 2010 Feb;26:1631-5.
- [8]. Reymond J, Charuta A, Wysocki J. The morphology and morphometry of the foramina of the greater wing of the human sphenoid bone. *Folia Morphol (Warsz).* 2005 Aug;64(3):188-93.
- [9]. Wood-Jones F, 1931. The non-metrical morphological characters of the skull as criteria for racial diagnosis. par 1: General discussion of the morphological characters employed in racial diagnosis. *J. Anat.* 65: 179-495.
- [10]. Ginsberg LE, Pruett SW, Chen MY, Elster AD. Skull-base foramina of the middle cranial fossa: reassessment of normal variation with high-resolution CT. *Americal Journal of Neuroradiology.* 1994;15(2): 283–91.