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MORPHOMETRIC STUDY OF FORAMEN SPINOSUM IN HUMAN SKULLS

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ABSTRACT

Foramen Spinosum is a foramen in the greater wing of Sphenoid bone transmitting Middle meningeal vessels and Nervous spinosus. In the present study, Foramen Spinosum was studied in Fifty dried human skulls of which 25 were male & 25 female. In each skull, the location and shape of foramen spinosum, its relation to spine of sphenoid and foramen ovale were noted. Dimensions of the foramen were taken and data was analysed. Absence of foramen was noticed in 1%, confluence of foramen ovale and spinosum in 2%, asymmetry in shape and size were noted and in two skulls, foramen was present lateral to the spine of sphenoid. This knowledge will be useful to Neurosurgeons to identify and preserve the neurovascular structures while approaching middle cranial fossa.

Keywords: Foramen Spinosum, Variations, Skull

INTRODUCTION

Foramen Spinosum is a small circular foramen located in the greater wing of sphenoid near or at the root of spine of sphenoid, posterolateral to foramen ovale [Fig-1]. It transmits middle meningeal artery, Nervous spinosus to the middle cranial fossa and middle meningeal vein¹. Posterolateral to the FS, is the Spine of Sphenoid which is laterally related to auriculotemporal nerve². The FS may be absent, in which case the middle meningeal artery enters the cranial cavity through the foramen ovale. The FS may be duplicated or continuous with foramen ovale or more or less incomplete³. The foramen spinosum is an important landmark in skull base injury especially in middle cranial fossa and infratemporal fossa. The knowledge of foramen spinosum is helpful for Neurosurgeons.

MATERIAL AND METHODS

Fifty dried Human skulls of which 25 male and 25 female available in the department of Anatomy, Kempegowda Institute of Medical

Sciences, Bangalore were taken for the study. For each Skull, features and variations of foramen spinosum were noted. Measurements were taken by placing the dividers anteroposteriorly for the length and transverse diameter for the width and then carefully transferred to a meter rule for the readings⁴. Results were compared and Data analyzed statistically.

RESULTS

Out of 50 skulls foramen spinosum was present in 48 skulls on both sides. In one of the male skull it was present on left side and absent on Right side and in one female skull, it was a common opening for foramen ovale and spinosum [Table-1] [Fig -2, 3]. Three different shapes of FS like round, oval and irregular were observed of which round shape was more commonly seen and percentage has been shown in [Table-2] [Fig-4]. In one male and one female skull, on one side the FS was lying lateral to spine of sphenoid [Fig- 4]. In one Male Skull on the left side FS was lying posterior to foramen

ovale [Fig-5]. The Mean length in Males was 2.58 mm [Rt side], 2.35 mm [Lt side] and width 2.18 and 2.02mm [Table-4]. In females the mean length was 2.68mm [Rt side], 2.52 mm [Lt Side] and width 2.37 and 2.24mm respectively [Table - 5].

DISCUSSION

The Foramen Spinosum is one of the foramen that lies in the greater wing of Sphenoid, provides communication between middle cranial fossa and infratemporal fossa. It lies posterolateral to foramen ovale. It transmits middle meningeal artery, Nervus Spinosus and middle meningeal vein.

Various studies have reported variations of FS. Khan *et al*³ reported absence of FS on the left side of one skull among 25 skulls taken for the study. Karan *et al*⁵ observed absence of FS on the Right side in one skull out of 100 skulls. In the present study, out of 50 skulls absence of FS was noticed on the Right side of one skull [2%]. The absence of FS may be when Middle Meningeal Artery arises from ophthalmic artery instead of Maxillary artery. Khan *et al*³ have reported confluence of foramen ovale and FS in one skull on the right side out of 25 skulls. Karan *et al*⁶ found confluence of foramen ovale and FS in three skulls out of 100 skulls. In the present study confluence of foramina was seen on both sides in one of the skull [4%].

According to Desai *et al*⁷, 52% of FS were round in shape, 42% Oval and 6% irregular in shape, Osunwoke *et al*⁴ in their study have reported, either circular or oval FS with only one triangular shape out of 87 human skulls. In the present study, 55% were round, 40% oval and 2% irregular.

According to Osunwoke *et al*⁴, the maximal length of foramen spinosum was 4.0mm and minimal length was 1.0mm. Majority of the length of the FS fall within 2 to 2.5 mm. The maximal width of the FS was 2 mm and minimal width 1mm. A

study carried out by Lang *et al*⁸ the width of FS ranged from 1.5mm to 2.1mm in adults.

According to Karan *et al*⁵, mean diameter of FS was 2.3mm in male on the right, 2.4mm on the left side. In female it was 2.5mm on the Right side and 2.3mm on the left side. The maximum diameter in both male and female on both sides was 4.0mm and minimum 1.0mm. In the present study the Mean length in male was 2.58 mm [Rt side], 2.35 mm [Lt side] and width 2.18 and 2.02mm. In female the mean length was 2.68mm [Rt side], 2.52 mm [Lt Side] and width 2.37 and 2.24mm. The length was ranging from 1.5- 4 mm and width 1-3.5mm in male whereas in female the length ranged from 2- 4 and width 1.5- 4mm. The dimensions of FS were larger in female when compared to male. The asymmetrical size and shape, variations in the dimensions could be due to developmental reasons which may hamper clinical and diagnostic procedures.

In the present study, it was noted that FS was anteromedial to spine of sphenoid in most of the skulls. In two skull, on one side the FS was present lateral to the spine of Sphenoid. FS is an important landmark in microsurgeries of middle cranial fossa. The knowledge about the variations of normal, and abnormal position of FS is helpful in computerized tomography and magnetic resonance imaging examinations. Spine of Sphenoid is related to chordatympani nerve medially and auriculotemporal laterally. In supratentorial hematomas, surgical treatment includes a bone flap made over the greater diameter of the clot, with the exposure of FS⁹. Hence the relation of spine of sphenoid to FS is clinically important.

CONCLUSION

This study provides essential information for the detailed knowledge of anatomical variations of FS. The variations are of clinical significance in fractures of base of skull and in diagnosing any aneurysms or vascular lesions in cranial cavity. This knowledge will be useful to Neurosurgeons

to identify and preserve the neurovascular structures while approaching middle cranial fossa.

Abbreviations used

FS - Foramen Spinosum, FO - Foramen Ovale, SS - Spine of Sphenoid

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Table-1 Variations of Foramen Spinosum

Foramen spinosum	Percentage (%)
Present	97
Absent	1
Common	2

Table - 2 Shape

Shapes	Total %	Male%	Female%
Round	55	50	60
Oval	40	44	36
Irregular	2	4	0

Table - 3 Relation with spine of sphenoid

Relation to Spine of sphenoid	Male%	Female%
Anterior	96	94
Lateral	2	2

Table- 4 Showing Dimensions of Foramen Spinosum in Male

Male	Length (Rt)	Width(Rt)	Length(Lt)	Width(Lt)
Min	1.5	1	1.5	1.5
Max	3.5	3.5	4	2.5
Mean with Std dev	2.5833±0.5647	2.1875±0.5480	2.3542±0.6507	2.02083±0.3451

Table- 5 Showing dimensions of Foramen Spinosum in Female

Female	Length (Rt)	Width (Rt)	Length(Lt)	Width(Lt)
Min	2	1.5	2	2
Max	4	3.5	4	4
Mean with Std dev	2.6875±0.604557	2.375±0.536697	2.52±0.620484	2.24±0.481318



Figure-1 showing the location of Foramen Spinosum (FS), Foramen Ovale (FO), Spine of sphenoid (SS)

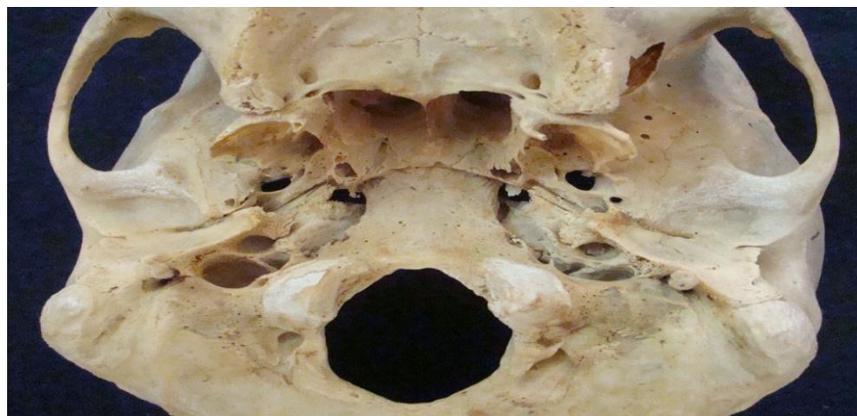


Figure-2: Showing the absence of Foramen spinosum on the Rt side

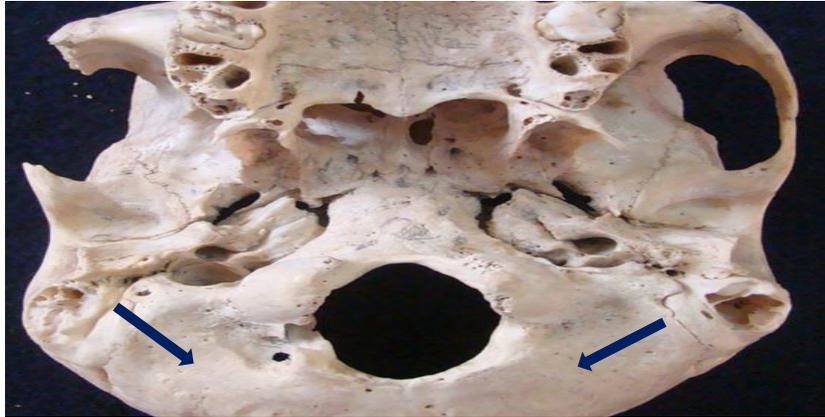


Figure -3: Showing the confluence of Foramen spinosum & Foramen Ovale



Figure 4: Showing the irregular Foramen spinosum (FS) on the Rt side & on the Lt side Foramen spinosum (FS) is present lateral to spine of sphenoid (SS)

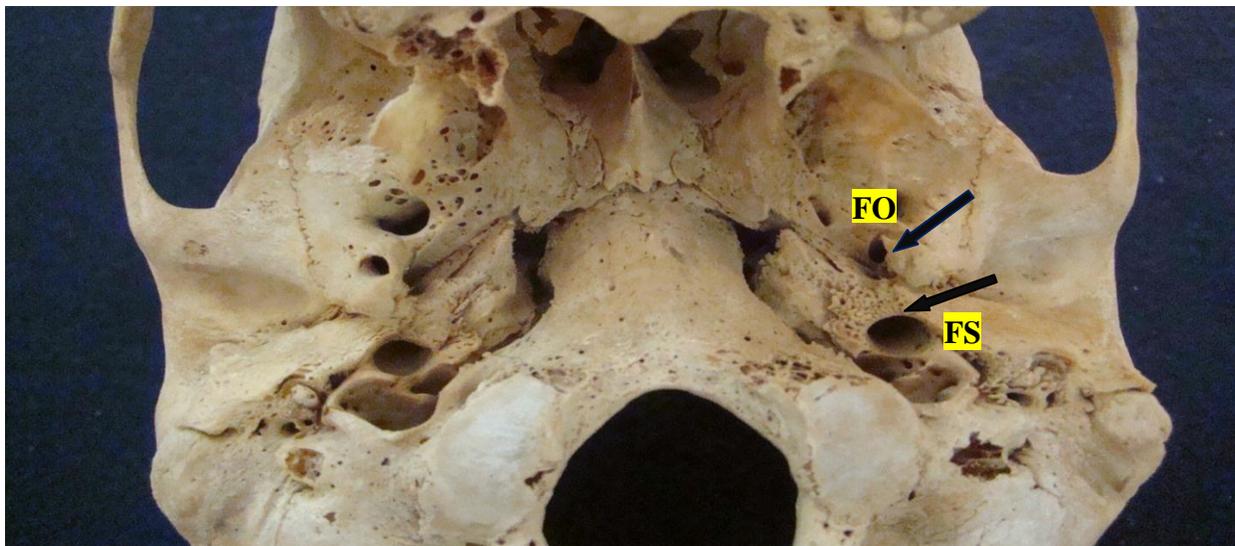


Figure 5: Showing Foramen spinosum (FS) posterior to Foramen ovale (FO)