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RESEARCH ARTICLE

MORPHOMETRY OF FORAMEN OVALE AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT

Objective:- Foramen ovale is located in the greater wing of sphenoid bone. It has great clinical significance in percutaneous trigeminal rhizotomy for neuralgia. This study presents variations in dimensions and shape of foramen ovale.
Methods:- 30 dry human skulls were studied in the department of anatomy, Yenepoya medical college, mangalore. Length and width of foramen ovale was measured.
Results:- out of 60 sides, mean length and width of foramen ovale was 7.85±1.32 and 3.95±1.27 on right side and 7.3±1.27 and 4.1±1.28 on left side. Majority of foramen studied were oval in shape.5 of 30 skulls showed the presence of foramen of Vesalius. One of the foramen showed the presence of bony bridging across the foramen.
Conclusion:- This study is of great surgical significance in case of trigeminal neuralgia, fine needle aspiration technique in perineural spread of tumour and also in neurovascular compression.

INTRODUCTION

Greater wing of sphenoid bone presents an oval shaped foramen called foramen ovale. It is located in the posterior part and transmits mandibular nerve, accessory meningeal artery, lesser petrosal nerve and emissary vein[1].In majority of cases it is oval in shape but the shape is quite variable. It has great clinical significance in functional neuroanatomy as it provides transcutaneous approach to skull base in trigeminal neuralgia[2]. Sphenoid bone has both intramembranous and endochondral ossification centres .sphenoid bone has body and a pair of greater and lesser wings. At 22 weeks, the foramen ovale can be seen as discrete ring shaped opening. Mean length of foramen ovale is 7.2mm and width is 3.7 mm in adults[3]. The present study was conducted to provide data on anatomical variations of foramen ovale and review literature regarding the same.

MATERIALS AND METHODS

This study was conducted on 60 foramen ovale of 30 adult human skulls .Human skulls were obtained from preserved sets of bones received at Department of anatomy, Yenepoya medical college, Mangalore. Skulls in poor condition and with damaged surroundings were not considered. Patency of foramen was confirmed by inserting a probe through each. Maximum length and width of foramen ovale was measured with the help of divider and the values were transferred to metre scale. Variations in shape of foramen were noted. Margins of foramen was carefully observed for any bony projection. Statistical analysis was done using student t test.

RESULTS

This study was conducted on total of 60 sides in 30 dry adult skulls. Out of 30 skulls 21 were from males and 9 were of females. Maximum length and minimum length observed were 10mm & 5.5 mm on right side and 9mm & 4mm on left side respectively. Mean length of foramen ovale was 7.85±1.32 on right side, 7.3±1.27 on left side (Graph 1). Maximum width of foramen ovale on right side was 6mm and 7mm on left side. Minimum width on right side was 3mm and 2mm on left side (Table .1). The shape of the foramen was oval in 41 sides (19 right, 22 left), round in 3 (2 right, 1 left), slit like in 9 sides (5 right,4 left)pear shaped in 4(2 right,2 left),almond shaped in 3 (2 right,1 left) (Table 2). Among 30 skulls, 05 skulls were showing foramen of Vesalius. 01 skull showed the presence of bony bar bridging the foramen ovale. In one skull a large irregular foramen was observed on the left side and it measured 12mm in length and 5 mm in width. Right side showed both foramen ovale and spinosum but left side showed only one large irregular foramen. Out of 30 skulls, 3 (01 left and 02 right) had spine projecting from the margins of the foramen.

Table 1. Length and width in mm on two sides (Right & left)

Values	Length(mm)		Width(mm)	
	Right	Left	Right	Left
Maximum	10	09	06	07
Minimum	5.5	04	03	02
Mean&Std of Right & Left Foramen ovale	7.9±1.3	7.3±1.3	3.9±1.2	4.1±1.3
P-value	0.11		0.64	

Table 2. Variations in shape of foramen ovale

Shape of foramen ovale	RIGHT	LEFT	TOTAL
OVAL	19	22	41
ROUND	02	01	03
ALMOND	02	01	03
SLIT	05	04	09
PEAR	02	02	04

DISCUSSION

Foramen ovale is an important landmark for middle cranial fossa surgeries as well as for diagnostic procedures. Accuracy of percutaneous biopsy of cavernous sinus tumours through foramen

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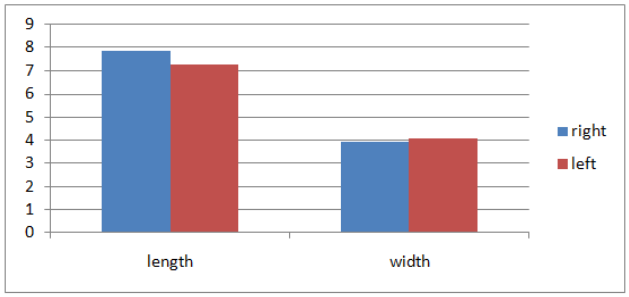

Graph 1. Showing mean length & width of foramen ovale

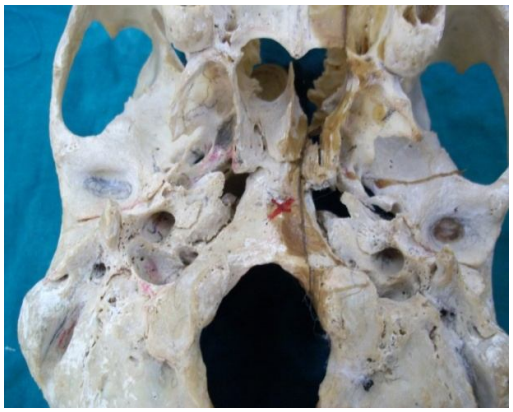

Fig. 1. Arrow showing bony bar bridging the right foramen ovale

Fig. 2. Arrow showing pear shaped foramen ovale

ovale is required to indicate the need for open surgical, radio surgical, and radiotherepeutic treatment[4]. Knowing the anatomical variations of foramen ovale is important for surgical treatment of trigeminal neuralgia. So any variation in shape, formation or location is of great clinical significance. Present study showed maximum number of foramen to be oval shaped about 68% followed by slit like about15%.Round, almond and pear shaped were 5%, 5%, 7% respectively. Similar was the findings in a study conducted in Japan, majority of foramen was oval shaped and they were irregular compared to other foramen of human sphenoid bone [5]. Present study showed the mean length of foramen ovale was 7.85±1.32 mm on right side and 7.3±1.27mm on left side. There was no significant difference between 2 sides (p>0.05). One of the study conducted in Japan reported the length of foramen ovale was 3.8mm,7.2mm in newborn and in adults with maximum and minimum length being 7.48mm and 4.17mmin adults [5].

Another study conducted in Uttar Pradesh showed Mean length of FO was 7.228mm+/-1.13 on right side and 6.485mm+/ -0.77 on left side. Though FO on right side was longer than on left side the difference was not statistically significant (p>0.05)[6]. In the present study mean width of foramen ovale was 3.95±1.22 on right side and 4.1±1.28 on left side. Difference between the width of right and left side was not stastically significant. (p>0.05).Similar findings were observed by a German study where average width was 3.7mm in adult skull[7]. These anatomical variations can be explained in terms of embryological basis. Sphenoid bone has a body formed by presphenoid and post sphenoid centres along with medial crus of orbitosphenoid. The lesser and greater wings develop from orbitosphenoids, alisphenoids. First ossification centre appears for greater wings (alisphenoids). It makes appearance between foramen rotundum, ovale and spinosum. At 22 weeks, foramen ovale is seen as a discrete opening and is contained in the area of unossified cartilage. Ossification takes place around the mandibular nerve and other structures passing through foramen ovale in later life[8]. Most common route for the spread of nasopharyngeal carcinoma is through foramen ovale and was reported in 1996[9]. Ray *et al*. in their study of foramen ovale also reported a spine on the margin of the oval foramen in 3 cases, (2 left, 1 right) and 2 sides (1 left, 1 right) sides they found a bridge like bony spur dividing the foramen ovale into two compartments[10]. We also noticed short bony spicule from the medial margin of foramen ovale in 3 cases.

Conclusion

Study is of clinical significance to medical practitioners in case of trigeminal neuralgia or in case of bony outgrowth leading to ischemia. This study will be useful in preservation of neurovascular structures in middle cranial fossa surgeries.

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