MORPHOMETRIC ANALYSIS OF FORAMEN MAGNUM

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Abstract
Background: The foramen magnum is the large opening in the base of the skull through which the spinal cord exits the cranial vault.The foramen magnum is situated in the occipital bone, and forms around the base of the brainstem (the medulla oblongata).The foramen magnum in humans is formed by the fusion of the four individual parts of the occipital bone.

Aim: Understanding the anatomy and morphometry of the foramen magnum in different skulls of South Indian population.

Objective: To determine the exact range of measurement, the variations, area and inequality of size are seen in foramen magnum

Materials and methods: 50 dry skulls will be examined for the foramen magnum in the occipital bone of the cranium and large opening at the base of the skull base. The type of foramen magnum will be classified according to its shape. Length and width will be noted.

Reason for this project::The morphometric evaluation of foramen magnum is clinically interesting because of its relation with its contents. These vital structures that pass through it may suffer compression in cases of achondroplasia, foramen magnum brain herniation and atlanto-occipital fusion. Therefore the topic will be studied.

Keywords: Foramen magnum, Base of the skull,Occipital bone,,vertebral arteries.

Introduction:

The morphological and morphometric study of position and orientation of foramen magnum have been of interest to anatomists, anthropologists, forensic experts and clinicians. The parameters include frequency of occurrence, dimensions, bilateral symmetry and variations seen.

Foramen magnum is a Latin word meaning largest aperture in skull. Foramen magnum is situated in an anteromedian position, and is oval, being wider behind with its greatest diameter being anteroposterior. The foramen magnum lies one third in front and two third behind the line formed by joining tips of mastoid processes.Foramen magnum is the most conspicuous feature of the cranial base. The major structures passing through this large foramen are medulla oblongata with the meninges, vertebral arteries, anterior and posterior spinal arteries and accessory nerves.The foramen magnum is surrounded by different parts of the occipital bone, squamous part lies behind and above, basilar part in front and a condylar part on either sides.On each side its antero-lateral margin is encroached by occipital condyles, hence the foramen magnum is narrow anteriorly. The anterior edge of the foramen magnum is slightly thickened and lies between the anterior ends of the condyles. The posterior half of the foramen magnum is thin and semicircular. Upper ends of anterior and posterior atlanto-occipital membranes are attached to the anterior and posterior margins of the foramen magnum respectively, and their lower ends are attached to the superior surface of anterior and posterior arches of the atlas respectively. The foramen magnum is a wide communication between posterior cranial fossa and the vertebral canal. The narrow anterior part of the foramen magnum has apical ligament of dens, upper fasciculus of the cruciate ligament and membrana tectoria, both are attached to the upper surface of basioccipital bone infront of the foramen magnum. Its wide posterior part contains the medulla oblongata and its meninges. In subarachnoid space spinal rami of the accessory nerve and vertebral arteries, with their sympathetic plexus, ascend into the cranium; the posterior spinal arteries descend posterolateral to the brain stem, where as anterior spinal artery descends anteromedian to the brain stem. The cerebellar tonsils may project into the foramen magnum ..he diameters and area of the foramen magnum are greater in males than in females, hence its dimensions can be used to determine sex of the individuals

The present study aims at determining the exact range of measurements, the variations, area and inequality of size seen in the foramen magnum in the South Indian skulls in the Anatomy Lab of Saveetha Dental College. Measurements are taken with Vernier Callipers and a metal scale with the least count being 0.01mm

Methods and materials:
50 dry skulls will be examined for the foramen magnum in the base of the skull. The type of foramen magnum will be classified according to its shape. The diameter will also be measured along with the total area. The measurement will be taken with the help

of vernier Callipers and a metal scale.
Result:
The present study was conducted on 50 skulls. The mean length of foramen magnum was 4.71 ±0.34cm and the mean width was 4.36±0.25cm. The mean area was 15.98±1.82cm2. The maximum length on the right side was 5.35cm, maximum width was 4.22cm and the maximum area was 16.55cm2

The incidence of the number of skulls and their measurements has been shown in Table 1,Table 2,and Table 3.

Table1:	Length
Class Interval	
2.01 - 2.50	4
2.51-3.00	14
3.00-4.00	16
4.00-5.00	10
>5.00	4

Table2:	Width
Class Interval	
2.01 - 2.50	3
2.51-3.00	12
3.00-4.00	18
4.00-5.00	15
>5.00	2

Table3:	Area
Class Interval	
12.01 – 13.50	4
13.50-14.50	16
14.50-15.50	13
15.50-16.50	10
>16.50	7

In 64%of the skulls, the foramen was oval. In 20% of the skulls, the foramen was round and in 16% of the skulls, the foramen was irregular. In 100% of the skulls, the foramen was singly placed.

Discussions:
In the present study, considerable variations in the morphometry of the foramen magnum can be seen. The characteristics of the foramen were observed from the base of the skull. The difference between the mean lengths and widths of the foramen magnum of male and female skulls is not statistically very significant.
In a study conducted by Muralidhar on 100dry adult skulls, the foramen magnum was a permanent feature of 60% oval shape 30% of round shape and 10%of irregular shape.The maximum length of the foramen magnum was 4.5cm and the minimum was3.5cm.The maximum width of the foramen magnum was 5.2cm and the minimum was 4.5cm.The maximum area of the foramen magnum was 17.52cm2 and the minimum area was 14.68cm2. According to a study conducted on 211 ,the mean anteroposterior diameter of the foramen magnum for males was 4.5±3.6cm and transverse diameter was 3.6±2.5cm. Mean antero-posterior diameter of the foramen magnum for female was 4.6±2.5cm and transverse diameter was 3 .5±2cm.In the present study on CT scan images male subjects showed a significantly higher longitudinal diameter and area of the foramen magnum. The mean longitudinal diameter of the foramen magnum in present study on CT scan images, males was 3.85cm and in females it was 3.52cm.

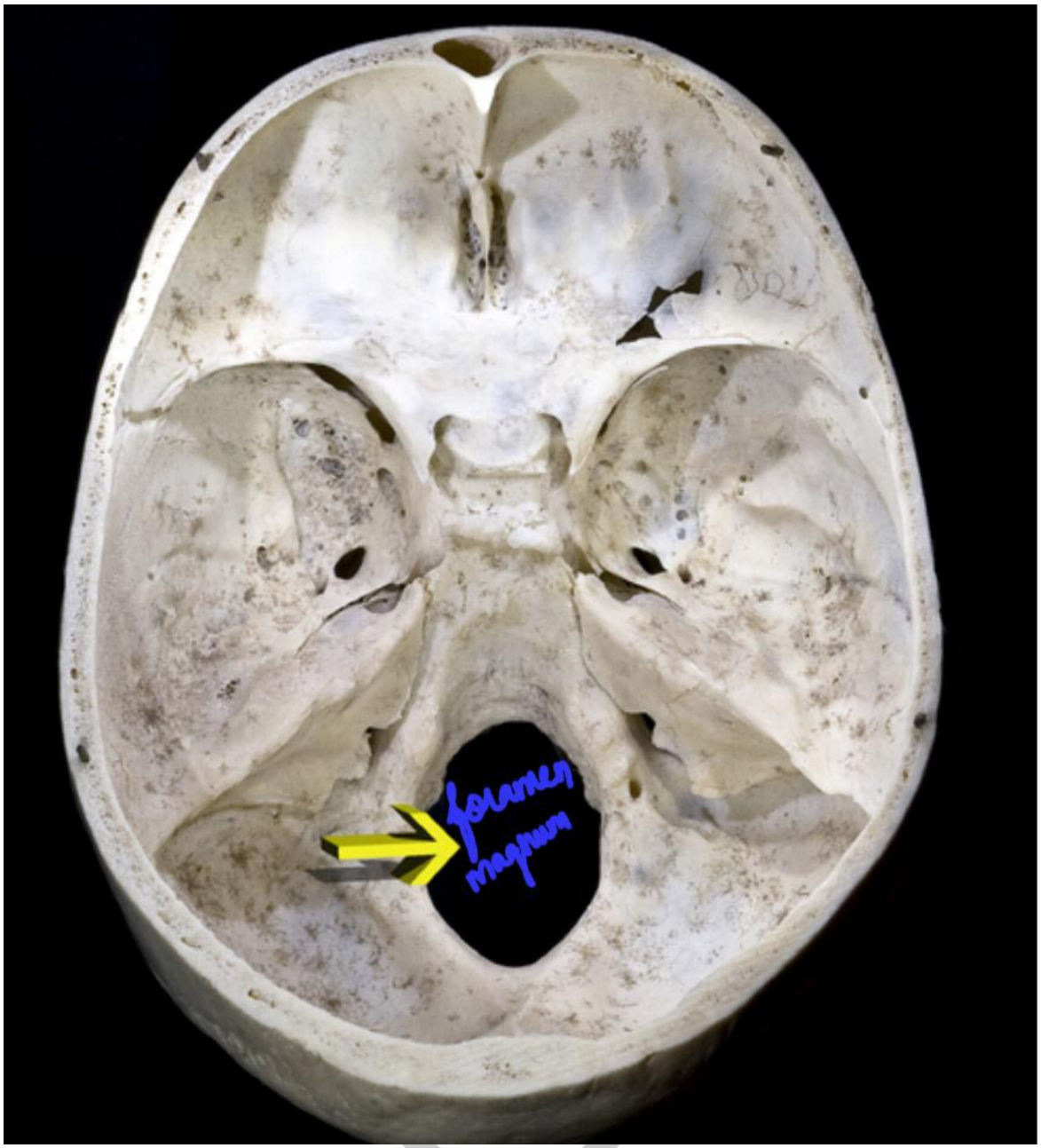

Figure1:Foramen Magnum

Conclusion

Variations in the size and shape and irregularity affecting the margins of the foramen magnum as observed in the study can be attributed to the abnormality during ossification of the occipital from initial to final stage of ring formation. Persistence of such morphology can be due to variation in the course of structures passing through this foramen. The dimension of the foramen magnum are clinically important because vital structures passing through it. The knowledge of diameters of the foramen magnum are needed to determine radiological malformations (Arnold Chiari's syndrome) and prior to cutting off of foramen magnum or posterior cranial fossa lesions, or sex determination of skulls.

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