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# **A morphometric Study of the Foramen Magnum in Dry Human Skulls**

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**Abstract**--Background: The foramen magnum is a large opening in the posterior aspect of the base of the skull, its appearance will be helpful. This study aimed to evaluate morphometrics of the foramen magnum in the dry human skull in central Indian populations, knowledge of these morphometric values is useful for the researcher. Material & Methods: In this study 60 dry human skulls of unknown sex were studied in the LN Medical College, Bhopal where morphometrics of foramen magnums like anteroposterior & transverse diameter and Index was observed. Results: The results obtained from the skulls along with the foramen magnum were statistically analyzed where the anteroposterior diameter is 34.41 mm, transverse diameter is 29.24mm & Index is 1.17 were noted. Conclusion: Based on the different parameters of the foramen magnum values this study will be useful for clinicians, joint biomechanics, ergonomics, physical therapy & rehabilitation.

**Keywords**---Skulls, Shapes, Foramen magnum (FM).

**Introduction**

The foramen magnum is an important structure of the skull base and is of particular interest for anthropology, anatomy, forensic medicine, and other medical fields<sup>1</sup>. There are numerous openings in the base of the skull they are called foramina. Foramen magnum is the large opening at the lower part of the occipital bone and outlet through which the medulla and spinal cord pass from the skull to the vertebral column<sup>2</sup>.

The foramen magnum is a wide communication between posterior cranial fossa and the vertebral canal. The narrow anterior part of the FM has apical ligament of dens, upper fasciculus of the cruciate ligament and membrana tectoria; both are attached to the upper surface of basioccipital bone in of the FM<sup>3</sup>. The bone around the foramen magnum constitutes the uppermost border of an extremely complex three-unit joint with intricate functional relationships between the occiput, atlas, and axis<sup>4</sup>.

The foramen magnum lies in an anteromedian position in the base of skull and locate into the posterior cranial fossa. It is oval in shape and wider behind & greatest diameter being anteroposterior<sup>5</sup>. Achondroplasia and other bone disorders distort the size of the foramen magnum<sup>6</sup>. Moreover, intradural and extradural tumors, common congenital abnormalities such as FM syndrome produced by atlanto-occipital assimilation, and cerebellar tissue herniations which invaginated into the FM may lead to neural compression and even death are commonly met pathological disorders in this region<sup>7</sup>.

The foramen magnum is a large opening in the posterior aspect of the base of the skull, its appearance will be helpful. This study aimed to evaluate of morphometric analysis of the foramen magnum in the dry human skull in central Indian populations.

### **Material & Methods**

In this study 60 dry human skulls of unknown sex, were studied in the LN Medical College, Bhopal where morphometrics of foramen magnums like anteroposterior (Image.1) & transverse diameter (Image.2) was studied, Index was calculated & data were statistically analyzed.

### **Inclusion & Exclusion criteria**

Healthy Skulls are taken for the study & broken or deformed skulls are excluded. All measurements will be recorded using a digital vernier caliper. Measurements will be based on the following bony landmarks on the skull shown in images 1 & 2.

**Basion:** Midpoint on the anterior margin of the foramen magnum.

**Opisthion:** Midpoint on the posterior margin of the foramen magnum.



Figure 1. Showing Measuring the Anteroposterior Diameter of the Foramen Magnum



Figure 2. Showing Measuring the Transverse Diameter of the Foramen Magnum

## Results

The results obtained from the skulls along the foramen magnum the mean anteroposterior & transverse diameter were statistically analyzed and recorded. The index was calculated by dividing the anteroposterior & transverse diameter as shown in the table 1.

Table 1  
Showing different parameters of the foramen magnum

Parameters	Anteroposterior Diameter (APD) (mm)	Transverse Diameter (TD) (mm)	Index (APD/TD)
Foramen magnum	34.41	29.24	1.17

## Discussion

Thus foramen magnum, as a transition zone between spine and skull, plays an important role as a landmark because of its close relationship to key structures such as the brain and the spinal cord. Because of these issues, it still remains necessary to report morphometric measurements of FM<sup>3</sup>. In the current review, anteroposterior and cross-over breadth discoveries are analyzed by the various authors.

### The observation is practically similar to our study

The mean anteroposterior & transverse diameter in the present study is 34.41mm 29.24mm which is almost similar to the Sampada P.K et al, Ravi Bhaskar et al showed in table. 2.

### The observation values are higher from our study

Sandeep Arora et al 35.38mm and 27.81mm, Faazila Fathima et al 38.22mm and 35.15, Shikha Sharma et al 38.76 and 33.76, Shweta Solanet et al 36.0mm and 32.2mm (table.2). The higher mean APD in the above studies compared to the present study may be due to racial differences as the populations studied are different<sup>8</sup>.

### The observation values are lower from our study

Muthu Kumar N et al 33.3mm & 27.9mm, P. Chethan et al 31mm & 25mm, Remya K et al 33.64mm & 27.04mm (table.2). The general objective of this study was to produce information that would be helpful to the neurosurgeon also sedative as a comprehension of the life systems of the area of skull foramina is fundamental for performing compelling nerve block furthermore keeping away from wounds to the neurovascular groups during neuro and orofacial medical procedures. The review would likewise help the radiologist and oncologist to assess the cancer inclusion of foramina on imaging.

Table 2  
Showing comparison of the present study with the different Authors

Authors	Year	Sample	APD (mm)	TD (mm)
Muthu Kumar N et al <sup>9</sup>	2005	50	33.3	27.9
P. Chethan et al <sup>10</sup>	2012	53	31	25
Shweta Solan et al <sup>11</sup>	2015	60	36	32.2
Shikha Sharma et al <sup>12</sup>	2015	50	38.76	33.44
Faazila Fathima et al <sup>6</sup>	2016	53	38.22	35.15
Sandeep Arora et al <sup>14</sup>	2017	30	35.38	27.81
Remya K et al <sup>15</sup>	2017	50	33.64	27.04
Ravi Bhaskar et al <sup>16</sup>	2017	50	34.81	28.72
Sampada P K et al <sup>17</sup>	2017	100	34.84	29.39
Present Study	2022	60	34.41	29.24

\*Anteroposterior Diameter (APD), \*Transverse Diameter (TD)

## Conclusion

Morphometric estimations of the review are valuable for neurosurgeons, transcondylar medical procedures, and orthopedics surgeries. These studies concentrate additionally on benefits for clinicians, joint biomechanics, ergonomics, non-intrusive treatment, and recovery.

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