

Morphometric Study of Foramen Magnum

Sunita Prabhakar Bharati¹, Sujatha N.², S. Swayamjothi³

Abstract

The foramen magnum is a large opening in the occipital bone of the cranium. Diameters of foramen magnum are important because vital structures passing through it and for sex determination of skulls. The dimensions of the foramen magnum are clinically important because vital structures passing through it may endure compression such as in cases of foramen magnum herniation, foramen magnum meningiomas and foramen magnum achondroplasia. The knowledge of foramen magnum diameters is needed to determine some malformations such as Arnold Chiari syndrome, which shows expansion of transverse diameter.

Keywords: Foramen Magnum; Morphometric; Osteology.

Introduction

The foramen magnum is an aperture located at the base of the skull. It is formed by the four portions of the occipital bone (two lateral condyle, one squamous, and one basal)[2] and can present different shapes. The morphometric study of the human skull is a common practice among Anatomists, Anthropologists, and Forensic Experts, as it is a structure of great interest.

It is pathway to structures that crosses the head and neck like the cerebellum, medulla oblongata, meninges, vertebral arteries, and the spinal branch of the accessory nerve (XI Cranial Nerve). Measures of the foramen magnum are relevant in cases of achondroplasia (as there is a high risk of spinal cord stenosis in the base of the skull), Arnold-Chiari malformation (downward herniation of the cerebellar tonsils), foramen magnum meningioma, plagiocephaly, basilar invagination, and others cranial deformities [1,3,4,5,6].

Author's Affiliation: ¹Assistant Professor ²Tutor ³Professor and Head, Dept. of Anatomy, Shri Sathya Sai Medical College & Research Institute, Ammapettai, Chennai, Tamil Nadu 603108, India.

Corresponding Author: Sunita Prabhakar Bharati, Assistant Professor, Dept. of Anatomy, Shri Satya Sai Medical College and Research Institute, Ammapettai, Chennai, Tamil Nadu 603108, India.

E-mail: drsunitagiri@gmail.com

Received | 02.02.2018, Accepted | 26.02.2018

Aims & Objectives

To study longitudinal diameter, transverse diameter and various shapes of foramen magnum

Material & Methods

Thirty human dry skulls were used for the study from Dept. of Anatomy, SSSMCRI. The measurements were taken by using a sliding digital caliper.

1. The criterion for the Antero-Posterior Diameter (APD) of the foramen magnum was the distance between the basion and opisthion;
2. The Transverse Diameter (TD) criterion was the distance between the points of maximum curvature of the foramen magnum lateral margins
3. Various shapes of foramen magnum observed.

Observations

In present study total of 30 Human Skull used, show that (Table 1) mean Anterio-posterior diameter of foramen magnum is 32.24mm, the observed range for AP diameter were 28.41 to 38.79mm. The mean Transverse diameter 26.73 mm with range was from 23.62 mm to 31.37 mm. The shape of Foramen magnum was noted it was observed (Table 2)that the most commonest was Circular shape 14(46.6%), followed by Oval 07(23.3%), Rhomboid 07(23.3%), and least Triangular shape 02(6.7%). The observed shapes of foramen magnum are shown in the Figure 1.



Fig. 1: Different type of Foramen Magnum

Table 1: Anthropometric dimensions of foramen magnum

| Parameter | Antero-posterior diameter(mm) | Transverse diameter(mm) |
|-----------|-------------------------------|-------------------------|
| Maximum. | 38.78 | 31.37 |
| Minimum | 28.41 | 23.62 |
| Mean | 32.24 | 26.73 |

Table 2: Types of foramen magnum observed

| Shapes | Numbers | Percentage (%) |
|------------|---------|----------------|
| Circular | 14 | (46.6) |
| Oval | 07 | (23.3) |
| Rhomboid | 07 | (23.3) |
| Triangular | 02 | (06.7) |

Discussion

Foramen magnum is a transition zone between spine and skull and forms a fundamental component in the complex interaction of bony, ligamentous and muscular structures composing the cranio-vertebral junction. In present study the average antero-posterior diameter of the foramen magnum is 32.24 mm (Range 28.41 to 38.79mm) and Transverse diameter is 26.73 mm (Range 23.0 to 31.37 mm). Muthukumar & Swaminathan [7] observed that the average antero-posterior length of the foramen magnum was 33.3 mm (Range 27–39 mm) and the transverse diameter was 27.9mm (range 23–32 mm). In the present study, the anteroposterior diameter of foramen magnum was more than the transverse diameter. It has also been reported that longer anteroposterior dimension of foramen magnum permitted greater contralateral surgical exposure for condylar resection in transcondylar approach.

Study of the shape and size of the foramen magnum is crucial to determine pathological changes caused by diseases such as: achondroplasia, occipital vertebra, basilar invagination, condylar hypoplasia, and atlas assimilation, Jeune's asphyxiating, thoracic dystrophy, Marchesani's syndrome, foramen magnum meningioma, Arnold-Chiari malformation, and plagiocephaly. Those diseases can cause compression of the structures that traverses the foramen magnum and produce symptoms like respiratory complications, lower cranial nerve dysfunctions, upper and lower extremity paresis, hypo or hypertonia, hyperreflexia or clonus, and general delay during motor development can appear [8,9]. Testut and Latarjet [10] stated that the difficulty of bony resection during surgery is directly proportionate to the size of the foramen magnum.

Conclusion

The morphometric analysis of foramen magnum and its variations is important not only for anatomists but also to the anaesthetist, neurosurgeons,

orthopaedicians, radiologists. The shapes can guide surgeons in instrumentation and manipulation around this region.

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