



## RESEARCH ARTICLE

### MORPHOLOGY AND MORPHOMETRY OF FORAMEN MAGNUM

<sup>\*</sup>1Dr. Shifan Khanday and <sup>2</sup>Dr. Pranu Chakaravarthy

<sup>1</sup>Department of Anatomy, DMCG, UAE

<sup>2</sup>Department of Anatomy, Sri Ramchandra Medical College, Chennai, Tamilnadu, India

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#### ABSTRACT

**Context:** Foramen Magnum also known as Foramen Primum is the largest foramen of the skull. Its position and structures passing through it makes it an important landmark. After Pelvis the skull is an important bony structure which exhibits gender differences. Particularly Foramen magnum shows gender difference owing to which it becomes an area of interest for Anthropometry, Forensic sciences, Anatomy and Neurosurgery.

**Objective:** To Study the morphology and do a morphometric analysis of Foramen magnum and correlate with the gender of the skull.

**Method:** A total of 60 dry skulls were observed and measurements were taken by means of vernier calipers. Diameter, Area and shapes were recorded. Measurements were taken. Later on a correlation was done

**Result.** The mean for Anteroposterior diameter was 3.68 cm and mean for Transverse diameter was 3.09 cm. Height was observed to have a mean of 0.9 cm and area was 5.76. On an average the male skull foramen magnum was larger as compared to females. It was proved to be statistically significant

**Conclusion:** A detailed examination of foramen magnum was performed. The main forms of foramen were established. Several were measured. Some new data could provide important information about the anatomy of the Foramen Magnum for reliable surgical interventions in this area.

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## INTRODUCTION

Foramen Magnum also known as Foramen Primum is the largest foramen of the skull. Its position and structures passing through it makes it an important landmark. After Pelvis the skull is an important bony structure which exhibits gender differences. Particularly Foramen magnum shows gender difference owing to which it becomes an area of interest for Anthropometry, Forensic sciences, Anatomy and Neurosurgery. Owing to its position the foramen magnum is a site for approach for posterior cranial fossa surgeries. Numerous clinical conditions like herniation of cerebellar tonsils and Foramen magnum syndrome makes it an important neurosurgical landmark.

### Objective

To Study the morphology and do a morphometric analysis of Foramen magnum and correlate with the gender of the skull.

*\*Corresponding author: Dr. Shifan Khanday*  
Department of Anatomy, DMCG, UAE

**Materials and Methods:** The study was conducted in the Department of Anatomy Sri Ramchandra Medical College and Dubai Medical College. Foramen Magnum in male and female were studied. All skulls were adult type and without any signs of erosion.

### Following parameters were studied:

**Inclusion criteria:** Healthy Skulls

**Exclusion criteria:** The Skulls that have been eroded and deformed.

**Osteometric parameters:** Below given parameters were measured using Vernier caliper and scale.

**Anteroposterior:** The Anteroposterior diameter of the foramen was measured from basion to opisthion.

**Transverse diameter or Width:** Maximum length in front of one occipital condyl to the other.

**Height:** The height of the foramen magnum i.e its thickness.

**Area:** The total Area was also calculated.

**RESULTS**

The mean for Anteroposterior diameter was 3.68 cm and mean for Transverse diameter was 3.09 cm .Height was observed to have a mean of 0.9 cm and area was 5.76. On an average the male skull foramen magnum was larger as compared to females. It was proved to be statistically significant.

**Shape:** Majority of foramen magnum were observed to be oval and near circular.



Fig. 1. Blue arrow showing the transverse diameter or the width and Red arrow showing the Anteroposterior length

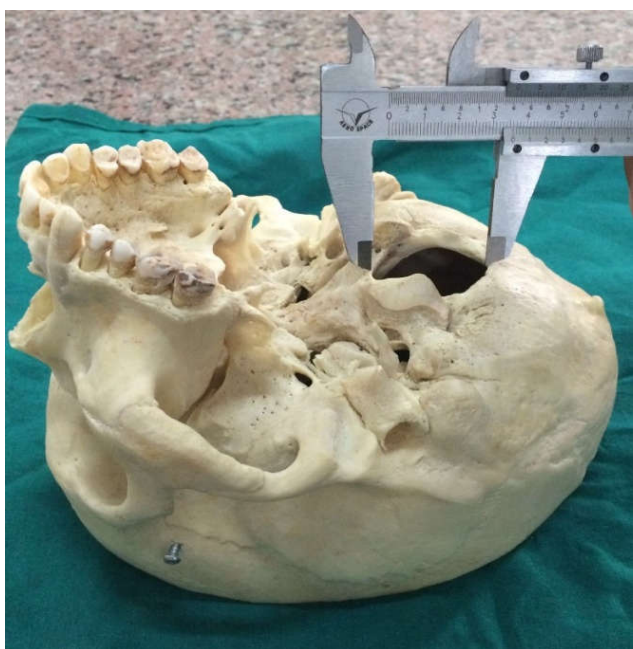


Fig. 2. Measuring the Anteroposterior diameter by using sliding caliper



Fig. 3. Measuring the Width or Transverse diameter by using sliding caliper

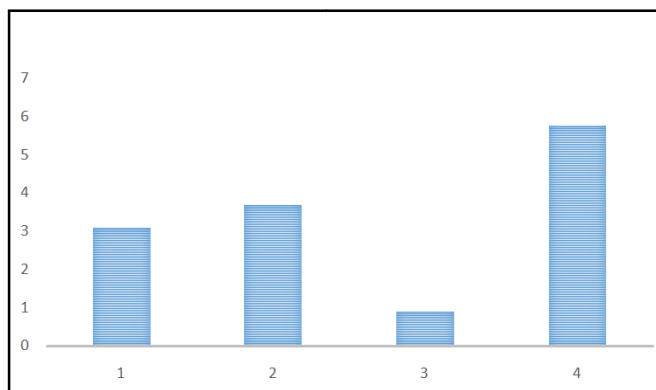


Fig 4. 1= Transverse diameter, 2= Anteroposterior diameter, 3=Height 4=Area

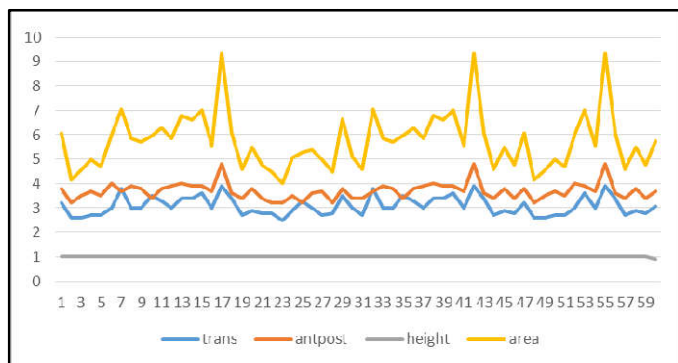


Fig 5.

**DISCUSSION**

In this study the fact is revealed that foramen magnum dimensions vary significantly between males and females so it can be a useful indicators for gender identification. Supporting all major researches which have found the same variation. The accuracy of determinations depends mainly on the kind of bones available and their condition. The foramen magnum was used since it is a regular structure and less likely to major morphological changes (Williams *et al.*, 1989; Radhakrishna

*et al.*, 2012). Wescott and Morre Jansen, 2000 found length of foramen magnum as one of the most reliable measurement for sex determination in African-American population (Scheuer and Black, 2004). Expression of sexual dimorphism within the foramen magnum area in relatively modern populations is limited to a level of approximately 70% (Teixeira, 1982). The morphometry of the skull and jaw are methods for the assessment of sexual dimorphism that can assist in the determination of gender (Uysal *et al.*, 2005; Gapert *et al.*, 2009). Raghavendra Babu *et al.* and Radhakrishna *et al.* stated significant differences between males and females for length and breadth of foramen magnum which demonstrated statistically (RaghavendraBabu *et al.*, 2012). Catalina-Hercera indicated that sagittal and transverse dimensions of the foramen magnum were significantly higher in men's skull (Catalina-Hercera, 1987). Krogman reported close to 100% accuracy of sex determination in 750 intact skeletons. The maximum sex determination accuracy of the whole skull alone was found to be 90% (Krogman and İşcan, 1986) accuracy of 81% (Uysal *et al.*, 2005) which was at higher sensitivity than that of Gapert *et al.* of 2009, who used British skulls of 18<sup>th</sup> and 19<sup>th</sup> centuries (Gapert *et al.*, 2009). Holland suggests that the measurements of the region of occipital condyles and the foramen magnum are useful for determining the sex, with an accuracy of 70–90% (Holland, 1986).

### Conclusion

In conclusion variations in the size, shapes and gender of foramen magnum might be a part of the ongoing evolutionary process. During the past few decades, biological consideration of discrete cranial traits such as their ontogeny, asymmetry, sex differences and intertrait association have been addressed to assess a possible genetic background. Knowledge of morphology, variation and arrangement of structures within the foramen helps in deducing position of various structures from the available data. The knowledge may also be utilized by the clinicians to understand clinical presentations and progression of the lesions of the foramen and planning for the possible approaches for the operations. Foramen magnum may provide a statistically useful indication as to sex of the unknown skull.

### REFERENCES

- Catalina-Hercera CJ. 1987. Study of the Anatomical matrix values of the foramen magnum and its relationship with sex. *Acta Anat (Basel)*, 130(4):344-7. 12.
- Gapert R, Black S, Last J. 2009. Sex determination from the foramen magnum: discriminant function analysis in an eighteenth and nineteenth century British sample. *Int J Legal Med.*, 123(1):25-33.
- Holland TD. 1986. Sex determination of fragmentary crania by analysis of the cranial base. *Am J PhysAnthropol.*, 70(2):203-8.
- Krogman WM, İşcan MY. 1986. 'The Human Skeleton in Forensic Medicine, 2nd ed. Charles C Thomas, Springfield, IL, 189 – 200.
- Radhakrishna SK., Shivarama CH., Ramakrishna A, Bhagya B. 2012. Morphometric analysis of foramen magnum for sex determination in south Indian population. *Nitte University Journal of Health Science*, 2(1):20-2.7.
- RaghavendraBabu YP, Kanchan T, Attiku Y, Dixit PN, Kotian MS. 2012. Sex estimation from foramen magnum dimensions in an Indian population. *J Forensic Leg Med.*, 19(3): 162-7.
- Scheuer L. and Black S. 2004. The juvenile skeleton. Elsevier, London, 1-19.
- Teixeira WR. 1982. Sex identification utilizing the size of Foramen magnum. *Am J Forensic Med Pathol.*, 3(3):203-6.
- Uysal S, Gokharman D, Kacar M, Tuncbilek I, Kosa U. 2005. Estimation of sex by 3D CT measurements of the foramen magnum. *J Forensic Sci.*, 50(6):1310-4.
- Williams PL, Warwick R, Dyson M, Bannister LH. 1989. Gray's anatomy. 37th ed. New York: Churchill Livingstone, 307.

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