

SEXUAL DIMORPHISM OF THE FORAMEN MAGNUM BY MDCT IN WESTERN UP ADULT POPULATION

Radiology

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ABSTRACT

This study investigated gender-based disparities in foramen magnum dimensions and their clinical implications. Computed tomography (CT) scans were utilized to measure the foramen magnum dimensions in 63 males and 37 females. The study aimed to provide insights into potential anatomical variations that could impact surgical interventions, diagnostic procedures, and treatment planning related to the foramen magnum. The results indicated significant differences in foramen magnum dimensions between males and females. Males exhibited larger mean Anteroposterior (30.2 ± 6.25 mm vs. 30.1 ± 4.96 mm), Transverse (27.89 ± 2.67 mm vs. 25.77 ± 3.21 mm), compared to females, with p-values for Anterior Posterior 0.915398, Transverse 0.006626 and all dimensions. These findings underscore the importance of recognizing gender-specific anatomical variations when interpreting imaging studies and planning involving the foramen magnum. Moreover, this research contributes to the broader understanding of foramen magnum anatomy and its clinical relevance. By elucidating gender-based differences in foramen magnum dimensions, this study fills a gap in existing literature and provides valuable insights for clinicians and researchers alike. However, further investigation is warranted to explore additional factors contributing to anatomical variations in the foramen magnum, such as age, ethnicity, and environmental factors. In conclusion, this study highlights the significance of considering gender-specific differences in foramen magnum dimensions for clinical practice. By recognizing and incorporating these variations into patient care protocols, healthcare professionals can enhance the accuracy of diagnoses, optimize treatment strategies, and improve overall patient outcomes in the management of foramen magnum.

KEYWORDS

CT- Computed Tomography, Foramen Magnum, 3D- Three Dimensional

INTRODUCTION

Computer Tomography (CT) Also known as Computer axial Tomography (CAT) scan, is a medical imaging technique that creates accurate cross-sectional imaging of the body reusing X- Ray technology and computer processing. This imaging modality uses X-ray technology to provide detailed and comprehensive images, giving medical practitioners the capacity to precisely see and examine different anatomical locations. In contrast to traditional X – ray imaging, it provides a complete and more accurate Picture of inside structure.

Foramen Magnum

The morphology of the foramen magnum varies from skull to skull and is said to have a variety of morphologies, from round to polygonal or even irregular (Vaseemraja G. Shaikh 2014). The occipital condyles extend downward to articulate with the superior articular facets on the lateral masses of the atlas, slightly overlapping the edge of the foramen magnum anteriorly. Additionally, there is a correlation between the FM and intracranial volume, cranial size, and brain size (Raghanti MA *et al.*, 2016), (Ashton EH, Spence TF 1958) (Radinsky L 1967) (Acer N *et al.*, 2006). The neuroanatomical connection of the meningeal tentorium and foramen magnum to the cerebral hemisphere (supratentorial) and brain stem (infratentorial) determines the two crucial points at which the brainstem is susceptible to compression (Bozbuga M *et al.*, 1999). factors that can change the size and shape of bone structures, including gender, age, and geographical variances. These factors have a major role in identifying the anthropometric variations between genders and populations (Humphrey *et al.*, 1999) (Prado *et al.*, 2007).

Functions

For a number of vital bodily structures, the foramen magnum is an essential passageway. The spinal cord is a lengthy, fragile structure that runs from the brain into the spinal column through the foramen magnum. It transmits movement and sensory information and acts as the primary conduit for communication between the brain and the rest of the body. The brain and spinal cord receive their blood supply via the vertebral arteries, which are two blood vessels. They enter the skull through the foramen magnum and proceed to their destination via the foramen magnum margin (Snell, R. S 2019).

The 12 nerves that make up the cranial nerves are derived from the brain and provide the head and neck with a variety of activities. On their path to the rest of the body, some of these nerves, including the glossopharyngeal and vagus nerves, cross the foramen magnum (Bergman *et al.*, 1988).

Material and Methods

The study was conducted in the Department of Radio-Diagnosis& Imaging at Chhatrapati Shivaji Subharti Hospital in Meerut, Uttar Pradesh. The study was conducted to Determination of gender variation in measurement of ForamenMagnum in western U.P. adult population by MDCT. In this study 100 subjects were selected. All the subjects are distributed in two groups according gender (male and female). Patient was scanned and data was collected from 160 slice MDCT scanner machine in radiology department, and dimensions On CT console by the help CT software and measurements tools we can measure the foramen magnum (FM) anteroposterior diameter, and transverse diameter. The study was conducted on 100 patient's that was undergone CT Head Scan at Chhatrapati Shivaji Subharti Hospital. The study was conducted after getting approval by the Institutional Ethical Committee. The Inclusion criteria was patients referred to the Department of Radio-Diagnosis and imaging for NCCT and CECT scan of the head from the OPD/IPD/ of Chhatrapati Shivaji Subharti Hospital, Subharti Medical College, Meerut, U.P. were the source of data for this study. The patient ages ranges from 18 to 80 years and including male and female. And exclusion criteria was skulls that are damaged or deformed, Pregnancy and Patients who don't give consent. the aim of the study was Measurement of Foramen Magnum to Determine Gender Variation Western U.P. Adult Population by MDCT.

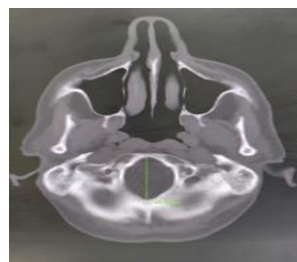


Fig (a)

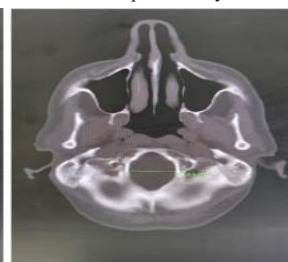


Fig (b)

Fig (a) Measurement of Foramen magnum diameter in Anterior Posterior and Fig (b) Measurement of Foramen magnum diameter in Transverse.

RESULT

Distribution of patients on the basis of gender:

A total of 100 patients were included in this study in which 63 patients were male and 37 patients were female. The distribution on the basis of gender is as follows:

Table-1 Distribution of patients on the basis of gender

Gender	No. of patients	Percent%
Male	63	63%
Female	37	37%
Total	100	100

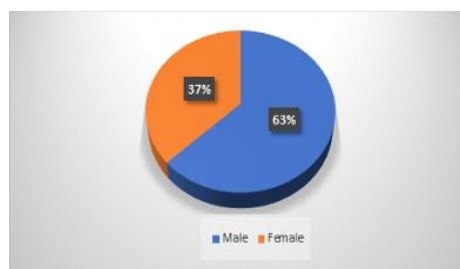


Figure-1 Distribution of patients on the basis of gender

Table-2, Transverse Diameter (mm) of FM on the basis of gender

Gender	Total number of Patients	(Mean±SD) of Transverse	P – value
Male	63	27.89±2.67	0.006626
Female	37	25.77±3.21	

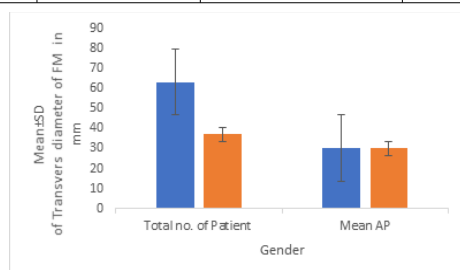


Figure-2- Transverse Diameter (mm) on the basis of gender

The table- 2 and figure 2 display the comparison of transvers diameter of FM of patients on based on gender. A total of 100 patients were included in this study in which 63 patients were male and 37patients were female.(Mean±SD) of Transverse diameter (mm) of FM of males was 27.89±2.67 while females it was 25.77±3.21 and the P – value was 0.006626.

Table -3, Anteroposterior Diameter of Foramen Magnum According to Age Group

Age Groups (Years)	Number of Patients	Mean±SD	SD Error
18-28	23	29.3±7.6	1.5
29-39	12	29.8±6.0	1.7
40-50	13	32.2±5.7	1.5
51-61	20	30.5±5.1	1.1
62-72	26	29.7±5.7	1.1
73-80	6	30.7±2.9	1.1
Total	100	30.2±5.9	0.5

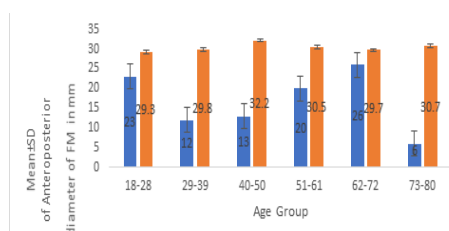


Figure-3 Mean±SD of Anteroposterior foramen magnum according to Age group

The table 3 and fig 3 showed the mean anteroposterior diameter of the foramen magnum was analyzed across different age groups. In the 18–28 years group (n=23), the mean value was **29.3 ± 7.6 mm**, with a standard error of 1.5 mm. For individuals aged 29–39 years (n=12), the mean was **29.8 ± 6.0 mm** (SE = 1.7 mm), while in the 40–50 years group (n=13), it was **32.2 ± 5.7 mm** (SE = 1.5 mm). Participants aged 51–61 years (n=20) showed a mean of **30.5 ± 5.1 mm** (SE = 1.1 mm), and those in the 62–72 years group (n=26) had a mean of **29.7 ± 5.7 mm** (SE = 1.1 mm). The highest age group, 73–80 years (n=6), exhibited a mean of **30.7 ± 2.9 mm** (SE = 1.1 mm). Overall, for all age groups combined (n=100), the mean anteroposterior diameter was **30.2 ± 5.9 mm**, with a standard error of 0.5 mm.

Table-4, Transverse Diameter of Foramen Magnum According to Age Group

Age Groups (Years)	Number of Patients	Mean±SD	SD Error
18-28	23	27.2±2.3	0.4
29-39	12	27.5±2.9	0.8
40-50	13	27.0±3.5	0.9
51-61	20	27.0±3.0	0.6
62-72	26	26.1±3.7	0.7
73-80	6	26.4±2.9	1.1
Total	100	26.8±3.1	0.3

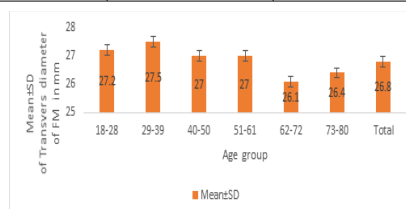


Fig- 4 Transverse Diameter of Foramen Magnum According to Age Group

The table-4 and fig-4 showed the transverse diameter of the foramen magnum was measured across various age groups. In the 18–28 years age group (n=23), the mean transverse diameter was **27.2 ± 2.3 mm**, with a standard error (SE) of 0.4 mm. For the 29–39 years group (n=12), the mean was **27.5 ± 2.9 mm** (SE = 0.8 mm), and for the 40–50 years group (n=13), it was **27.0 ± 3.5 mm** (SE = 0.9 mm). Participants aged 51–61 years (n=20) had a mean of **27.0 ± 3.0 mm** (SE = 0.6 mm), while those in the 62–72 years group (n=26) had a slightly lower mean of **26.1 ± 3.7 mm** (SE = 0.7 mm). In the oldest group, 73–80 years (n=6), the mean transverse diameter was **26.4 ± 2.9 mm**, with a standard error of 1.1 mm. The overall mean transverse diameter for all subjects (n=100) was **26.8 ± 3.1 mm**, with a standard error of 0.3 mm.

DISCUSSION

In this study, gender variation of Foramen magnum dimensions was carried out by applying unpaired t-test in the measured dimensions of foramen magnum. This study investigated gender-based disparities in Foramen magnum dimensions and their clinical implications. Computed tomography scans were utilized to measure the Foramen Magnum dimensions in 63 male and 37 females. The study aimed to provide insights into potential anatomical variations that could impact surgical interventions, diagnostic procedures, and treatment planning related to the foramen magnum. The results indicated significant differences in foramen magnum dimensions between males and females. Males exhibited larger mean Anterior Posterior (30.2±6.25 mm vs. 30.1±4.96 mm), Transverse (27.89±2.67mm vs. 25.77±3.21 mm), and compared to females, with p-values for Anterior Posterior 0.915398, Transverse 0.006626 and all dimensions. (Samara et al., 2017)In comparison to females (34.4 ± 3.1 and 42.4 mm, respectively), males had larger mean and maximum anteroposterior diameters (35.8 ± 3.0 and 43.7 mm, respectively). For both sexes, the minimum anteroposterior diameter was 27.0 mm. (Zdilla et al., 2017)According to reports, the mean transverse diameter of adult males ranges from 26.92 to 38.0 mm, while that of adult females ranges from 25.45 to 31.34 mm.

CONCLUSION

Our study provides valuable insights into the gender-based differences in foramen magnum dimensions and their implications for clinical practice. Anteroposterior and transverse diameter of foramen Magnum was larger in males compare to females.