

Morphometric Study of Foramen Magnum of Human Skull in Vidarbha Region

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ABSTRACT

Foramen magnum of 80 skulls of known sex from Vidarbha region were studied for morphometric parameters, by using vernier caliper transverse and antero-posterior diameter of foramen magnum were measured. P- value for significance was calculated by all measurement followed by paired “t” test and descriptive statistics in SPSS version. The mean antero-posterior diameter in female 31.5mm is lesser than mean antero-posterior diameter in male 36.23mm. Also transverse diameter in female is lesser than male. P- value for both antero-posterior and transverse diameter is significant. Hence study help in identification of unknown sex, depending on dimensions of foramen magnum. Prospective study will help surgeon for reference value for determining feasibility of transcondylar surgical approach, which are being increasing trend in recent time for brain stem lesion.

Keyword: foramen magnum, sexual dimorphism, foramen magnum index, diameter.

INTRODUCTION

Foramen magnum is a latin word meaning largest aperture in skull. Foramen magnum is situated in an antero-medial position and is oval being wider behind with its greatest diameter being antero-posterior. [1] The foramen magnum lies one third in front and two third behind the line formed by joining tip of mastoid process. [2] Four part of occipital bones are forming its boundaries. The major structures passing through this large foramen are medulla oblongata with its meninges, vertebral artery, anterior and posterior spinal artery and accessory nerve. [1]

Various studies have reported that significant difference exist in the morphometry of foramen magnum between two sex within restricted geographical region and historical period. [3] In forensic medicine and anthropology dimension can be useful for determination of gender of

human skull. [4] The dimension of foramen magnum have clinical importance because the vital structure that pass through it may suffer compression as in case of foramen magnum achondraplasia, [5] and brain herniation. In neurosurgical practice, transcondylar approach is commonly used to access the lesions which are ventral to brainstem and cervico-medullary junction.

The aim of present study was to measure the length, width and index of foramen magnum and document their relation to gender as well as to analyse their variation of shape.

MATERIALS AND METHODS

The study was carried out in 80 known skulls (male 46, female 34) obtained from the Department of Anatomy Government medical college, Chandrapur & SVNGMC, Yavatmal. Skulls that had a history of abnormal or pathological

evidence were excluded from this study. The following parameters were studied by using vernier caliper accurate to 0.01mm on foramen magnum of dry human skulls.

Parameter measured included:

- A. Antero-posterior diameter: max straight ant-post diameter from basion (mid-point on anterior margin of foramen magnum) to opisthion (medial point posterior margin of foramen magnum).
- B. Transverse diameter: max straight transverse diameter between two points of foramen magnum on most laterally placed margin.
- C. Foramen magnum index: calculated by foramen magnum width × 100/foramen magnum length.

D. Shape of foramen magnum: different shape of foramen magnum were macroscopically noted and classified as oval, round and irregular.

Data was collected, tabulated and statistically analysed by SPSS 19.0 program. Range, mean and standard deviation was calculated for each parameter. Measurement were tabulated along with student ‘t’ test and p- value < 0.05 was consider significant.

OBSERVATION

In present study with sample size 80 skull bones known sex which included 46 male and 36 female skull bones in the age groups of 20-80 years.

Table no: 1:Genderwise distribution of shape of foramen magnum

Shape of foramen magnum	Male		Female		Total	
	No	%	No	%	No	%
Round	14	30.43	12	35.29	26	32.5
Oval	19	41.30	12	35.29	31	38.75
Irregular	13	28.26	10	29.41	23	28.75
Total	46	100	34	100	80	100

Table no 1 shows that Foramen magnum of oval shape was present in maximum 31 (38%.) skulls of which 41% in male and 35% in female. This finding correspond with the previous study.

Table no: 2: Mean differences in dimension and foramen magnum index across gender.

shape of foramen magnum	AP		TD		INDEX	
	MEAN	SD	MEAN	SD	MEAN	SD
Male	36.23mm	1.76	29.06mm	2.54	80.19mm	7.51
Female	31.5mm	1.88	27.41mm	1.42	87.01mm	3.66
P value	0.0001		0.001		0.0001	

In present study mean antero-posterior diameter i.e. 36.23mm is larger in male as compared to female i.e. 29.06mm. Also mean transverse diameter is larger in male i.e. 29.06mm as compared to female ie 27.41mm .Mean foramen magnum index in female was larger 87.0.as compared to male 80.19 . This difference was found to be highly statistically significant. (paired t test)

DISCUSSION

The morphological type of foramen magnum found in the present study were demonstrated in table no.1.round shape in male 30% and in female 33%,where oval shape is predominant with male 41% and

female 35% where irregular shape is less with male 28% and female 32%.

The present study are similar to result obtained by Radhashrishna S K, [3] also foramen magnum is usually described as oval shape. [6] Zaidi and Dyal [7] observed the oval shape foramen magnum in 64% of their specimen.

The study conducted showed that shape of foramen magnum does not show sexual dimorphism and cannot be used to ascertain the gender of skull similar to previous study. [8] In the both sex oval shape foramen magnum predomince with 38% in the present study which is similar to study by Gruber et al. [9]

It was observed that an average antero-posterior diameter in male 36.23mm, female 31.5mm where transverse diameter in male is 29.06, female 27.4. hence mean antero-posterior diameter is greater than mean transverse diameter. The average and SD deviation value are shown in table no.2. for the antero-posterior diameter analysis in both the sex revealed p- value <0.0001 and for the transverse diameter analysis revealed p value <0.001.

In the present study antero-posterior diameter is larger than transverse diameters which correspond with other study. [10] In almost all studies mean dimension of foramen magnum was more in male than female. Similar findings were observed by several authors, Oliver. [11] The mean antero-posterior in male is 36.23 whereas mean in female is 29.06 which coincide with previous studies. [9]

The mean transverse diameter in male was 28.5 and female 27.3mm and by CT imaging method in male 29.1mm and female 27.6mm, [12] transverse diameter was 30.3mm in male 29.4mm in female. [13] Hence in present study mean transverse diameter is 29.06mm and female is 27.41mm which is similar to previous studies.

P- value of transverse diameter is <0.001 which is significant hence foramen magnum size is larger in male as compared to female. Similar data was presented by Catalinsa, Herrera. [9]

In the present study mean foramen index was found to be 7.51 with minimum 3.66 with standard deviation of 0.0001 out of 80 specimen. Out of 80 skull 38% exhibited oval shape of foramen magnum. Muthukuma et al determined the shape of foramen magnum using foramen magnum index and found in 46% of specimen, index was equal or more than 1.20 and was considered as oval [14] also by Kizilant and colleagues found that foramen magnum index as 1.2. [15] In the study done by Avic et al 58% of specimen were showing oval shaped [16] foramen magnum index in male

was statistically significant, correlated with female in present study.

CONCLUSION

- 1) In the present study an effort has been made to classify the foramen magnum on its shape and to measure its antero-posterior, transverse and foramen magnum index.
- 2) These parameters should be taken into consideration during posterior and lateral approach to cranio-vertebral junction by the neurosurgeon and orthopedician. The pre-operative radiological evaluation is important for achieving surgical success along with thorough anatomical knowledge and surgical experience to prevent complications such as hemorrhage, atlanto-occipital instability and injury to major structures passing through the foramen magnum.
- 3) Foramen magnum dimensions i.e. transverse and antero-posterior are larger in male skull as compared to female skull.
- 4) The shape of foramen magnum does not show sexual dimorphism.

REFERENCES

1. Standring S, Gray's anatomy: The anatomical basis of clinical practice, 39th edition, Edinberg; Elsevier Churchill Livingstone, 2005;463-465.
2. Sinnatamby C S, Last Anatomy Regional and Applied. 10th edition, Churchill Livingstone.1999,561-571.
3. Radhakrishna S K, Shrivarana C H, Ramakrishna A, Bhagya B, "Morphometric analysis of foramen magnum for sex determination in south Indian population. NUJHS, March 2012,2(1)20-22.
4. Suazo, G.I.C, Rusco P P, Zavando, M.D.A, Smith; R.L, Sexual dimorphism in the foramen magnum dimension, Int. j. morpho, 2009: 27(1)21-23.
5. Hecht JT, Hortan WA, Reid CS, Pyeritz RE, Chakraborty R; Growth of foramen magnum in achondroplasia: Am j. med. genet 32:528-535:1987.
6. Murshed KA, Cicekcibasi AE, Tuncer I: Morphometric evaluation of foramen magnum and variation in its shape. A study on computer tomographic image

- of normal adult. *Tur.j.med sci* 33:301-306,2003.
7. Zaidi SH, Dayal SS. Variation in the shape of foramen magnum in Indian population, *Anat anz jena* 167; 338-340,1988.
 8. R.Gapert, S Black, J.Last. Sex determination from foramen magnum; discriminant function analysis in a eighteen & nineteenth century. British sample, *Int journal of legal medicine* vol 123(1) pp25-33,2009.
 9. Philip Gruber, et al,' Variability of human foramen magnum size; *Anatomical record* 292,1713-1719(2007).
 10. Venkatesh Gokuldas Kamanth, et al," Binary logistic regression analysis of foramen magnum dimension for sex determination. *Anatomy Research International*, vol 2015,article 459428.
 11. G.Oliver," Biometry of the human occipital bone, *Journal of anatomy* vol 120,no:3pp 507-518,1975.
 12. Muralidhar PS, Magi M," Morphometric analysis of foramen magnum, *Int j. Anat research* 2014,v01 2(1) 249-55.
 13. Manoel C, Prado FB, Caria PHF, Gropp FC," Morphometric analysis of foramen magnum in human skull of Brazilian individual in relation to gender, *Braz j. Morpho sci*,2001 28(2)104-08.
 14. Muthukumar N, Swaminathan R, Venkatesh G, Bhamummath SP, Morphometric analysis of foramen magnum region and its relation to transcondylar approach, *Acta Neurochir (wien)*147: 889-95,2005.
 15. Kizilkant emine, Dandu, Boynar neslihan et al.; Morphometry of hypoglossal canal, occipital condyle and foramen magnum, *Abstract; Neurosurgery quarterly* 2006,16(3);121-25.
 16. Avic E, Dagtekin A, Ozturk AH, Kara E, Ozturk NC, Uluc K, et al, Anatomical variation of foramen magnum, occipital condyle and jugular tubercle, *Turk Neurosurg* 2011;21(2) 181-90.

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