

ORIGINAL RESEARCH

Assessment of different shapes of foramen magnum

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ABSTRACT

Background: Foramen magnum (FM) is the largest foramen in the skull. It lies in an antero-median position and leads into the posterior cranial fossa. The present study was conducted to assess different shapes of foramen magnum.

Materials & Methods: 56 dry adult human skulls of either gender obtained in Anatomy department will be selected and the shape of foramen magnum will be determined.

Results: Out of 56 dry skull, 26 were of males and 30 were of females. Shape found was round in 26, oval in 14, irregular in 5, hexagonal in 3, pentagonal in 4, pentagonal in 4, tetragonal in 2 and egg shaped in 2 cases. The difference was significant ($P < 0.05$).

Conclusion: The analysis of various shapes of foramen magnum is utmost important. This study provides guidance to the surgeons, radiologists, orthopedics, anthropologists as well as forensic experts.

Key words: foramen magnum, Skull, posterior cranial fossa

INTRODUCTION

Foramen magnum (FM) is the largest foramen in the skull. It lies in an anteromedian position and leads into the posterior cranial fossa.¹ It is oval, wider behind, with its greatest diameter being anteroposterior. It contains the lower end of the medulla oblongata, meninges, vertebral arteries, and the spinal accessory nerve.²

Vital structures passing through the foramen magnum are affected by the variations in shape of foramen magnum. Irregular shape of foramen magnum is featured by the formative cranial anomalies. Occipital bone anterior to the foramen magnum develops from the basioccipital portion, posterior to the foramen magnum develops from supraoccipital portion and lateral to the foramen magnum develops from exoccipital portion of the chondrocranium.⁴ Development of a particular shape of the foramen magnum is explained on the basis of the embryologic data. It may be caused by ossification of primordial cranial residues, which join the endochondral ossification points in different locations, resulting in various shapes.⁵

Measurements of various bones are often used during forensic and anthropological investigations of unknown individuals for estimation of age, gender, stature, and ethnicity. Base of the skull is covered by large mass of soft tissue which helps to protect the foramen magnum.⁶ The present study was conducted to assess different shapes of foramen magnum.

MATERIALS & METHODS

The present study comprised of 56 dry adult human skulls of either gender obtained in Anatomy department. The study was approved from ethical committee of institute.

All the dry adult human skulls were observed from outer side at their base by naked eyes to determine the shape of foramen magnum. The shapes of foramen magnum were classified into one of the following: Oval, round, tetragonal, egg shaped, hexagonal, pentagonal and irregular. Results of the study was compiled and assessed statistically. P value less than 0.05 was considered significant ($P < 0.05$).

RESULTS

Table I Distribution of specimens

Total- 56		
Gender	Male	Female
Number	26	30

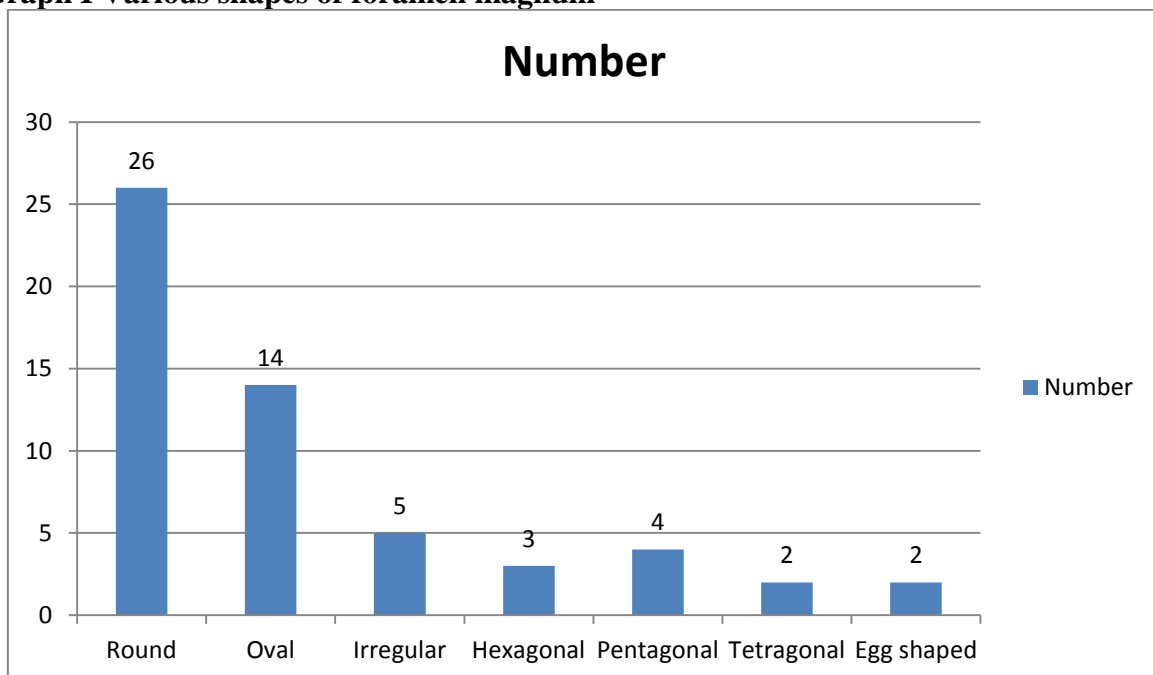
Table I shows that out of 56 dry skull, 26 were of males and 30 were of females.

Table II Various shapes of foramen magnum

Shapes	Number	P value
Round	26	0.01
Oval	14	
Irregular	5	
Hexagonal	3	
Pentagonal	4	
Tetragonal	2	
Egg shaped	2	

Table II, graph I shows that shape found was round in 26, oval in 14, irregular in 5, hexagonal in 3, pentagonal in 4, pentagonal in 4, tetragonal in 2 and egg shaped in 2 cases. The difference was significant ($P < 0.05$).

Graph I Various shapes of foramen magnum



DISCUSSION

Development of a particular shape of the foramen magnum is explained on the basis of the embryologic data.⁷ It may be caused by ossification of primordial cranial residues, which join the endochondral ossification points in different locations, resulting in various shapes.⁸ Irregular shape of foramen magnum is accentuated by the developmental anomalies of the bone and soft tissues at the craniovertebral junction.⁹ Due to high chances of morbidity and mortality during various surgical procedures at the skull base, this area is having higher clinical importance.¹⁰ The present study was conducted to assess different shapes of foramen magnum.

We found that out of 56 dry skull, 26 were of males and 30 were of females. Kumar et al¹¹ evaluated the various shapes of foramen magnum in dry adult human skulls of Indian population and to find out their clinical correlation. The shape of the foramen magnum in dry skulls were oval in 44.95%, round in 30.84%, hexagonal in 9.23%, irregular in 6.63%, pentagonal in 5.19%, tetragonal in 1.73 %, and egg shaped in 1.44%.

We found that shape found was round in 26, oval in 14, irregular in 5, hexagonal in 3, pentagonal in 4, tetragonal in 2 and egg shaped in 2 cases. Vinutha et al¹² found out shape and dimensions of foramen magnum in cranial CT scans. The study sample comprised 200 CT scans (110 males and 90 females) of south Indian origin. The shapes of the foramen magnum were classified into 8 types: oval, egg, round, tetragonal, pentagonal, hexagonal, irregular (A), and irregular (B). The foramen magnum was classified into 8 types based on shape. Commonest was oval and pentagonal was the least common type. The antero-posterior diameter, transverse diameter, circumference, and area were significantly greater in males than in females.

Radhakrishna et al¹³ analyzed 100 (55 males and 45 females) skulls. The cranial base was visually assessed for foramen magnum shape. Morphometry (antero-posterior diameter (APD) & Transverse diameter (TD)) was determined and their differences by gender. Ganapathy et al¹⁴ in their study a total of 100 adult human skulls and 100 CT Brain images were taken. Maximum transverse, anteroposterior, right and left oblique diameters of foramen magnum were calculated using sliding vernier calipers to an accuracy of 0.1mm and visually assessed for foramen magnum shape classification into- oval, round, tetragonal, hexagonal and irregular. The same parameters were also evaluated in adult CT Brain images after 3D reconstruction. The mean anteroposterior, transverse, right oblique and left oblique diameters in dry skulls and CT images were 3.39cm, 2.87cm, 2.90cm, 2.92cm and 3.49cm, 2.98cm, 3.04cm, 3.04 cm respectively. The dimensions in CT images were significantly higher than dry skull and significantly higher in CT images of males compared to females. Commonest shape noted was oval followed by irregular and the least was round in both dry skull and CT images.

Radhika et al¹⁵ evaluated the various shapes of foramen magnum in dry adult human skulls of Indian population and to find out their clinical correlation. 347 dried adult human skull base obtained from the Department of Anatomy. The shape of the foramen magnum in dry skulls were oval in 44.95%, round in 30.84%, hexagonal in 9.23%, irregular in 6.63%, pentagonal in 5.19%, tetragonal in 1.73 %, and egg shaped in 1.44%.

The limitation of the study is small sample size.

CONCLUSION

Authors found that the analysis of various shapes of foramen magnum is utmost important. This study provides guidance to the surgeons, radiologists, orthopedics, anthropologists as well as forensic experts.

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