

GENDER RELATED PATTERNS IN THE SHAPE AND DIMENSIONS OF THE FORAMEN MAGNUM IN AN ADULT KENYAN POPULATION

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ABSTRACT

Foramen magnum is a useful landmark in the base of the skull. Its shape and dimensions show ethnic and gender differences. This data is useful in forensic medicine and anthropology but are unknown among Kenyans. Two hundred and two dry adult skulls from the Osteology Department at the National Museums of Kenya, were studied. The shape of the foramen magnum was oval, circular and polygonal in 13%, 24% and 63% of the cases respectively. The foramen magnum does not show sexual dimorphism in shape among Africans. The shape of foramen magnum cannot be used in solitude to ascertain the gender of skulls.

Key words: Foramen magnum, variations

INTRODUCTION

The foramen magnum is an important structure of the skull base and is of particular interest for anthropology, anatomy, forensic medicine, and other medical fields (Grubber et al., 2009). Foramen magnum shows ethnic and gender dimorphism in its dimensions and shapes (Catalina-Herrera, 1987; Murshed et al., 2003). Achondroplasia and other bone disorders distort the size of the foramen magnum (Hecht et al., 1985). Shapes of the foramen magnum have been described to

be oval, round, tetragonal, pentagonal, hexagonal and irregular (Murshed et al., 2003). The shape of the foramen magnum is of radiological, forensic and clinical value (Harvati and Weaver, 2006). The size and shape of the foramen magnum in the Kenyan population is largely unknown. The aim of the present study is to document the gender dimorphism in the morphometry and shape of the foramen magnum in the Kenyan population.

MATERIALS AND METHODS

Two hundred and two skulls were acquired from the Osteology Department of the National Museums of Kenya. This is a labeled collection, obtained in Kenya between 1956 and 1971. The anteroposterior (AP) and transverse diameters of the foramen magnum were determined using a sliding caliper [Figure 1] (Precision 0.001) and taken as a mean measurement of two different observers. The AP dimensions were between the AP

diameter was between the basion and opisthion. Transverse diameters were measured from the margins of the foramen at its junction with the posterior ends of the occipital condyles. The shape of the foramen was observed, compared to pretested shape models and recorded as circular, oval or polygonal. Data obtained were analyzed using Statistical Package for Social Sciences (SPSS) for windows version 17.00 Chicago Illinois 2010.

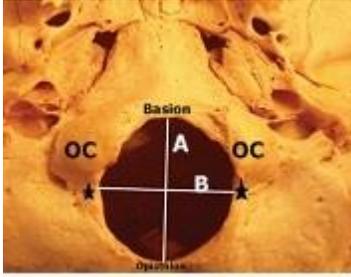


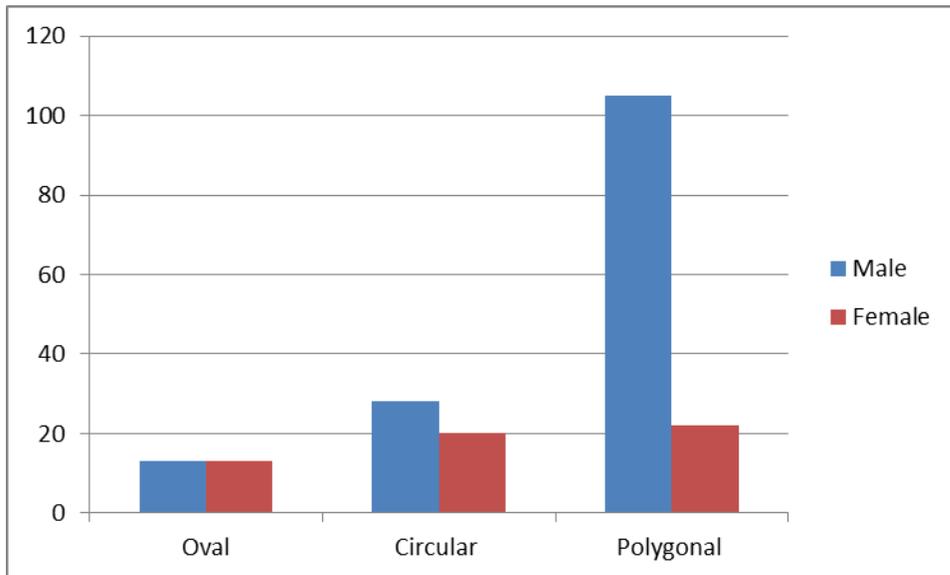
Figure 1: An Image showing the measurements made on the foramen magnum

RESULTS

One hundred and thirty eight (68%) male and 64 (32%) female foramen magnum were assessed. The shape of the foramen magnum was oval, circular and polygonal in 13%, 24% and 63% of the cases respectively. There were no significant gender differences in the shapes of the

foramen magnum. The mean AP and transverse diameters were 3.85 ± 0.65 cm (4.00 cm for males and 3.4 cm for females, $p=0.191$) and 3.50 ± 0.7 cm (3.8 cm for males and 2.80 cm for females, $p= 0.220$) respectively ($p=0.267$).

Figure 2: The shape of the foramen magnum



DISCUSSION

The foramen magnum is wider in the AP dimensions than lateral dimensions. In addition, it is wider in males than females, similar to observations made in previous reports (Catalina-Herrera, 1987; Günay and

Altinkök, 2000). Similar to observations made in other studies, the gender difference in AP and lateral dimensions were however not significant (Grubber et al., 2009).

Table 1: Ethnic variations in the dimensions of the foramen magnum

Study (Year)	Populations	Sample size	AP (mm)		Transverse (mm)	
			Male	Female	Male	Female
Sendemir et al., 1994	Turkish	27	35.1 +/- 2.8		28.7 +/- 2.2	
Present study	Kenyan	138	40	3.4	3.8	2.8

Since this gender difference in AP and lateral dimensions were not statistically significant it implies that more reliable markers that display distinct sexual differences should instead be utilized in forensic identification of skulls (Claudio et al., 2009; Raghavendra Babu et al., 2012). The dimensions of the foramen magnum show ethnic variations. It is wider in Africans compared to Caucasians (Table 1).

The shape of the foramen magnum was often polygonal, without significant gender disparities different from observations made in previous studies (Table 2). The shape of the foramen magnum is determined by the spinal cord and the hind brain (Rosing et al., 2007). This shape can guide surgeons in instrumentation and manipulation around this region.

Table 2: Comparison of the shapes of foramen magnum in different populations

Study	Population	Sample size	Oval (%)	Round (%)	Polygonal (%)	Other (%)
Zaidi and Dayal, 1988	Indian	200	64	0.5	32	35
Present study	Kenyan	138	13	24	63	-

REFERENCES

1. Catalina-Herrera CJ. 1987. Study of the anatomic metric values of the foramen magnum and its relation to sex. *Acta Anatomica*. 130: 344-347.
2. Claudio I, Galdames S, Russo PP, Matamala DAZ, Smith RL. 2009. Sexual Dimorphism in the Foramen Magnum Dimensions. *International Journal Of Morphology*. 27: 21-23.
3. Grubber P, Henneberg M, Boni T, Ruhli FJ. 2009. Variability of Human Foramen Magnum Size. *The Anatomical Record*. 292: 1713–1719.
4. Günay Y, Altinkök M. 2000. The value of the size of foramen magnum in sex determination. *J. Clin. Forensic. Med.*, 7(3):147-9.
5. Harvati K, Weaver TD. 2006. Human cranial anatomy and the differential preservation of population history and climate signatures. *Anat Rec A Discov Mol Cell Evol Biol*. 288 :1225-33.
6. Hecht JT, Nelson FW, Butler LJ, Horton WA, Scott CI, Wassman ER, Mehringer MC, Rimoin DL, Pauli RM, Opitz JM, Reynolds JF. 1985. Computerized tomography of the foramen magnum: Achondroplastic values compared to normal standards. *American Journal of Medical Genetics*. 20: 355–360.
7. Murshed KA, Cicekcibasi AE, Tunce I. 2003. Morphometric evaluation of the foramen magnum and variations in its shape: a study on computerized tomographic images of normal adults. *Turkish Journal of Medical Sciences*. 33: 301-306.
8. Raghavendra Babu YP, Kanchan T, Attiku Y, Dixit PN, Kotian MS. 2012. Sex estimation from foramen magnum dimensions in an Indian population. *J Forensic Leg Med*. 19:162-7.

9. Sendemir E, Savci G, Cimen A. 1994. Evaluation of the foramen magnum dimensions. *Kaibogaku Zasshi*. 69(1):50-2.
10. Zaidi SH, Dayal SS. 1988. Variations in the shape of foramen magnum in Indian skulls. *Anat Anz*.167:338-40.