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Morphometric of the Foramen Magnum in Indian and Sudanese Populations

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Abstract

Background: The foramen magnum is lying on the posterior part of the base of the skull, and its transmitting lower part of the brain, vertebral arteries, and accessory nerves. The morphometric of the foramen magnum is very important for anatomist, radiologist, surgeons, forensic doctors, and the anthropologist. **Objectives:** This study aimed to estimate and compare the metrics of the foramen magnum for adult Indian and Sudanese populations. **Material and methods:** 141 adult dry skulls; includes 74 from India and 67 from Sudan. The length and transverse diameter measurements (in millimeters) of the foramen magnum were applied for each skull by using a Vernier caliper. The statistical analysis (mean and standard deviation) was applied. **Results:** The Indian populations showed a significant value ($p \leq 0.0001$) in the mean of length and width of the foramen magnum in compared with that of Sudanese, and the foramen magnum is slightly wide in Sudanese (mean length=33.89±4.73, mean width=30.66±4.00) is compared with the same parameter for the Indian (mean length=29.32±3.33, mean width=22.47± 3.45). **Conclusion:** foramen magnum measurements and comparisons were established for adult Sudanese and Indian populations and this knowledge can be used by specialists during their interventions in the foramen magnum regions.

Key words: morphometric, foramen magnum, Indian, Sudanese, populations

Introduction:

The foramen magnum occupies the central area of the floor of the posterior cranial fossa of the skull and transmits the medulla oblongata and its surrounding meninges, the ascending spinal parts of the accessory nerves, and the two vertebral arteries [1]. Craniofacial anatomy among racial groups has been documented in a variety of structures but the skull regions are a particularly defining region of variability between different racial/ethnic groups, also the craniofacial features can be used during the forensic and anthropological investigation of unknown individuals [2]. Cranial morphology is widely used to reconstruct evolutionary relationships and variation of skull features are common among different races and this may be due to the climate that as we see different races in the different geographical area [3]. The measurements of the foramen magnum can be used in studying sexual dimorphism in forensic medicine such as unidentifiable human remains [4]. The metrics of the foramen magnum are clinically interested because of its relations with its structures that pass through it may compression in foramen magnum brain herniation and atlanto-occipital fusion associated with

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the reduction in dimensions of foramen magnum [5]. This study focuses on the measurement diameter of the foramen magnum of Indian and Sudanese adult populations, this observation is important for surgeons during operations, and for radiologists, forensic medicine and anthropologist, they seeing if the foramen magnum diameters are different in these different geographical and climate areas.

Materials and Method:

Unknown sex adult's age between 45-65 years of samples of dry skulls were measured and examined in this study. Samples were taken randomly [6]. Samples were taken from Indian medical college, (Nims medical college, Mahatma Gandhi medical college, and Unani medical colleges and the national institute of Ayurveda Jaipur, (Rajasthan) (total number =74), and from Kassala medical college, Dongle medical college and Read sea medical colleges in Sudan (total number =67). Samples were teaching collections of a similar population. Each skull was marked to avoid repetition. The length and width of foramen magnum were taken from each skull by used Caliper Varnier. The length of the foramen magnum is the distance in a straight line from the end of the anterior border (basion) through the center of the foramen magnum until the end of the posterior border (opistio), toward the median sagittal plane. The widths of the foramen magnum are the distance in a straight line from the end of the right border through the center of the foramen magnum until the end of the lateral border of the concavity more pronounced, with transverse direction [4].

Results:

The morphometric in millimeters were at the following settings; the mean length of the foramen magnum in Sudanese samples was 33.89±4.73 while the mean width was 30.66±4.00. The same parameter in Indian was 29.32±3.33 in mean length, and 22.47± 3.45 was in mean width (Table 1) and (Figures 1, 2). In comparison between the measurement of the foramen magnum between Sudanese and Indian we found that the length and width of the foramen magnum in the Indian population was lower than that demonstrated in Sudanese populations, with a significant value set at $\{p \leq 0.0001\}$.

Table1: shows the statistical analysis (in millimeters) of the length and width of the foramen magnum in Sudanese.

Parameter for Sudanese	Length of the foramen magnum	Width of the foramen magnum
Mean	33.39	30.66
Standard deviation	4.73	4.00

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Table2: shows the statistical analysis (in millimeters) of the length and width of the foramen magnum in Sudanese.

Parameter for Indian	Length of the foramen magnum	Width of the foramen magnum
Mean	29.32	22.47
Standard deviation	3.33	3.45

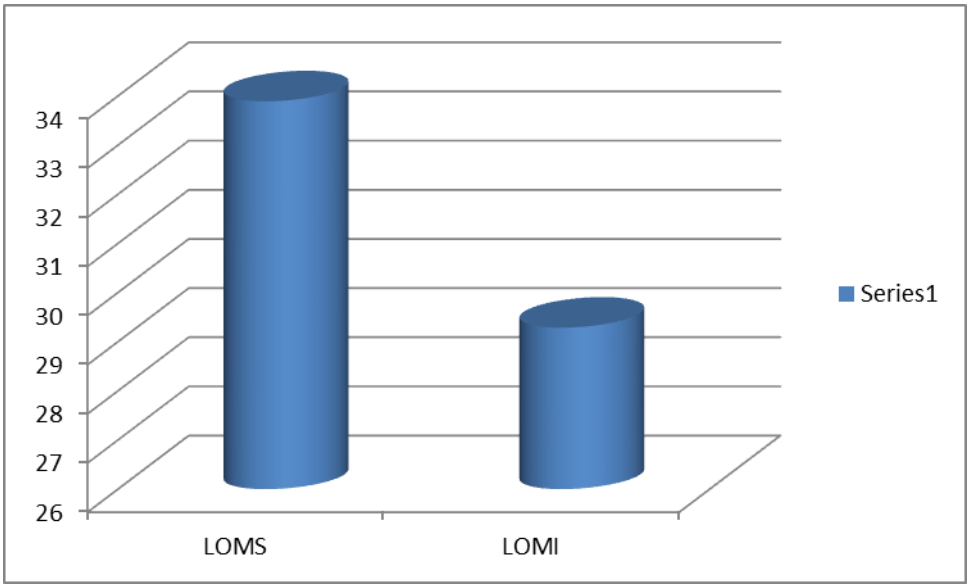

Figure 1: Metrical observation (Length foramen magnum) Comparison between Sudanese &Indian LOMS= Length foramen magnum in Sudanese, LOMI= Length foramen magnum in Indian

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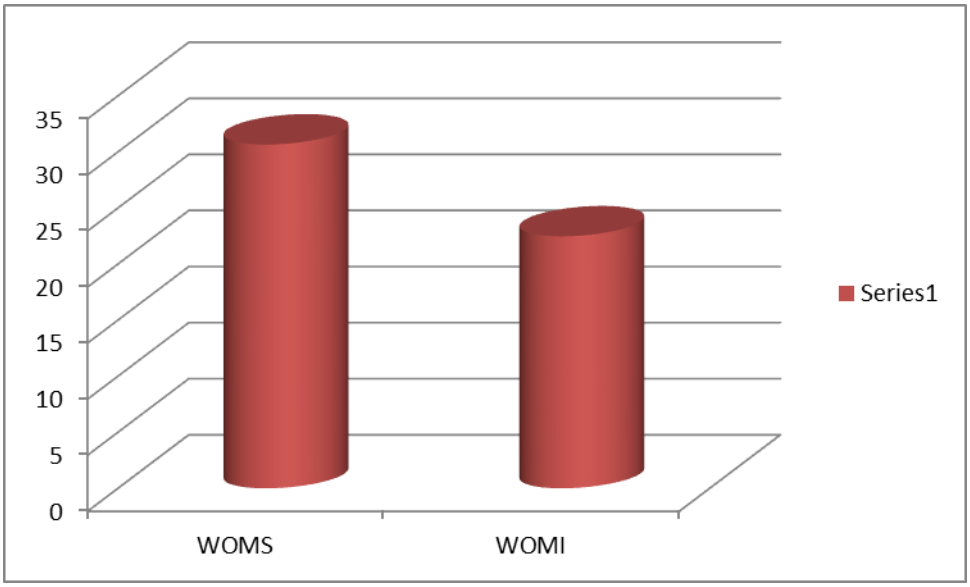

Figure 2: Metrical observation (width foramen magnum) Comparison between Sudanese &Indian. W0MS=width of the foramen magnum in Sudanese, W0MI= width foramen magnum in Indian

Discussion:

Comparing with the above results in our study, the variations of the measurement of the foramen magnum were observed between adult Sudanese and Indian populations, so it can be a useful indicator for race identification. The information provided in this study will assist surgeons during the intervention to treat structures affected by distress or the widening of the foramen magnum. Many researchers showed variations in foramen magnum metric in different populations: The mean length and width diameter of the foramen magnum in adult Brazilian peoples was determined as 35.70 ± 0.37 mm and 30.20 ± 0.24 mm respectively [7]. In adult Egyptians, a dry skull showed the mean length and width of the foramen magnum was 36.80 ±3.30mm and 31.50±2.60mm respectively [8]. The measurement of the foramen magnum for the South African black populations recorded the mean length and width diameters in the South African black population as 35.15±2.74 mm and 28.86±2.35mm, respectively [9]. In Nepalese populations, the foramen magnum measurement observed that the mean length was 32.80mm, the transverse diameter was 28.60mm [10]. For the European population's foramen magnum metric showed that the mean length was 36.28 ± 2.80mm, while the width was 31.10±2.70mm [11]. When comparing the current study findings with the same results in previous studies on different populations and presented that the length of the foramen magnum in Sudanese and Indian populations were slightly short (-2 to 3mm) than that of Brazilian, Egyptians, South African, Nepalese and European populations. The foramen magnum width in Sudanese and Indian in this study is proportional to that of the Brazilian and slightly wide in comparison with that of the Egyptians.

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Conclusion:

The present study has provided important measurements data about the foramen magnum for Indian and Sudanese populations. These data have a useful for surgeons to operate on the structures related to the foramen magnum. Moreover, these findings are important in in the field which related to forensic medicine, anthropology, and radiology.

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