



## A3 Sex Determination Through the Evaluation of Foramen Magnum Measurements on an Italian Population

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**Learning Overview:** After attending this presentation, attendees will understand a new system for sex determination using head Computed Tomography (CT) scan measurements of the foramen magnum.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by providing a new metric sex determination for Caucasians from ages 18 to 90 years.

This method is applicable for complete remains (cases in which it is comparable to other parameters) and incomplete ones due to dismemberment, trauma (with no affection of the cranial base), and advanced states of decomposition.

Sex determination is an important initial step in forensic identification of unknown skeletal remains and it could be reached in different ways. One of these, less described, is the morphometric evaluation of the foramen magnum. A few studies have been published, both on dry skull and on CT scan evaluations. In the literature, CT scan measurements of the foramen magnum have been obtained on Turkish, Swiss, South Indian, and Iraqi populations, but no study has been conducted on an Italian population. Furthermore, measurements taken into consideration in the present study were used in only one study on a Saudi Arabian population.<sup>1</sup>

The CT images included in the present study were obtained from Caucasian patients undergoing head CT for medical or surgical reasons. The sample was composed of 50 adults, 25 males and 25 females. Subjects with congenital or acquired cranial deformities were excluded. Measurements were made using Horos™ Software Version 3.0. The following measurements of the foramen magnum were taken: Length of the Right Occipital Condyle (LROC), Length of the Left Occipital Condyle (LLOC), Width of the Left Occipital Condyle (WLOC), Width of the Right Occipital Condyle (WROC), Maximum Bicondylar Distance (MBD), Length of the Foramen Magnum (LFM), Width of the Foramen Magnum (WFM), Area of the Foramen Magnum (AFM), and Minimum Bicondylar Distance (MiBD).

The parameters 1 to 8 were evaluated from the Saudi Arabian study; the MiBD was a new parameter chosen for a more complete evaluation of bicondylar distances.<sup>1</sup>

The primary purpose of this study was to validate the use of Saudi Arabian measurements even on an Italian Caucasian sample. Another goal was determining whether the new measurement (MiBD) could also be used in sex determination. In the Saudi Arabian study, concordance was assessed for sex with LROC, LLOC, LFM, WFM, and AFM. In this study, results from preliminary statistical analysis suggest a statistical association of sex with LROC, LLOC, LFM, WFM, and AFM. Furthermore, no statistically significant concordance was found between sex and this new parameter (MiBD).

In conclusion, results were encouraging; therefore this study's goal is to broaden the sample in order to obtain more statistically significant results. Furthermore, this method could be reliable and repeatable and may provide forensic anthropologists with an additional tool for sex determination, especially in situations where remains do not include other bones, especially the long ones.

### Reference(s):

1. Mohammed Madadin, Ritesh G. Menezes, Hind S. Al Saif, Hossain Abu Alola, Afnan Al Muhanna, Abid H. Gullenpet, K.R. Nagesh, Magdy A. Kharoshah, Bander Al Dhafery. Morphometric evaluation of the foramen magnum for sex determination: A study from Saudi Arabia. *Journal of Forensic and Legal Medicine* 46 (February 2017): 66-71, <https://doi.org/10.1016/j.jflm.2017.01.001>.

### Anthropology, Sex Determination, Foramen Magnum