

To Establish The Gender Wise Reference Values for Occipital Condyles Using 3D Computer Tomography Images in Young Adults



Healthcare

KEYWORDS : Computer Tomography, Occipital Condyles, Forensic Anthropology, Sexual Dimorphism, Forensic Medicine.

Nilon lobo	MSc Medical Imaging Technology, School of Allied Health Sciences, Manipal University, Manipal.
Sushil Yadav	Senior Scale Assistant Professor, Department of Medical Imaging Technology School of Allied Health Sciences, Manipal University, Manipal.
*Rahul P. Kotian	Senior Scale Assistant Professor, Department of Medical Imaging Technology School of Allied Health Sciences, Manipal University, Manipal. *Correspondance Author

ABSTRACT

Background: occipital condyles are used of gender discrimination in forensic anthropology and forensic medicine cases because it is one of the most preserved part in a skeletal system after death. Aim: To establish the gender wise reference values for occipital condyles using 3D computer tomography images in young adults. Materials and Methods: Sampling was done by convenience sampling method considering inclusion and exclusion criteria and a sample of 204 was taken with 102 males & 102 Female and length and width of occipital condyles were measured and statically analyzed. Result: the male condylar dimensions were grater and length of right occipital condyles were statically significant. Conclusion: occipital condyles showed the average performance in discriminating gender. Condyles can be used for gender discrimination in case of no other morphological indicator available.

Introduction

CT is a significant advancement in radiology. The basic principles of CT is that the internal structure of the object can be reconstructed from multiple projections of the object(1). CT scanning is useful in forensic medicine and forensic anthropological studies, usually in determination of sex, age, stature from the skeleton remains. The occipital condyle are oval or kidney shaped structures which is important part of the craniovertebral junction, which connects the cranium and the vertebral column and allows the head to move from up and down, side to side, as well as to rotate(2). The computer tomography with three-dimensional reconstructions, has allowed a more exact assessment of occipital condyle. Gender discrimination from the human skulls has been used from long time which uses quantitative morphological methods, in which the linear dimensions are taken into account. In most of the forensic anthropology cases the skull is the only available part because of it hard bony tissue.

Objectives

The purpose of the study is to establish the gender wise reference values for occipital condyles in young adults and Morphometric evaluation to determine gender using the condylar dimension.

Materials and Methods

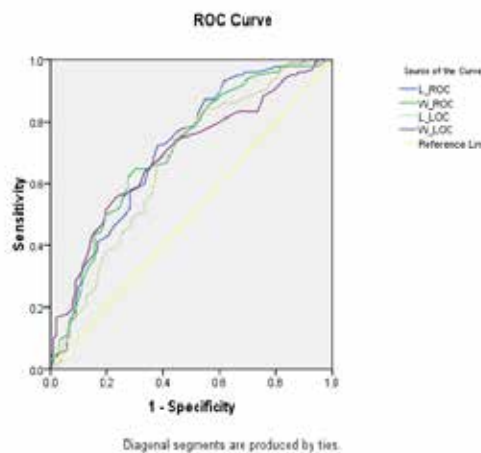
A cross-sectional study was conducted with 204 samples which included 102 males and 102 females conceding all the inclusion criteria. The patient who has referred for brain scan falling in age group of 18-35 were included in the study. The scan was performed and obtained images were reconstructed from 5mm to 0.9mm. The reconstructed images were post-processes using volume rendering software to get 3D images. Then the length and width of both occipital condyles were measured and noted and statistically analysed.

Results:

The mean and the standard deviation for each dimension of occipital condyles were calculated in order to find the reference value. The male condylar dimensions were, the right condylar length 20.05mm and standard deviation of 1.4 and width 10.6mm with standard deviation of 1.1. The left condylar length 19.50mm with standard deviation of 1.465 and width 10.5mm with standard deviation of 1.1.

The female condylar dimensions were, the right condylar length 18.8mm with standard deviation of 1.76 and width 9.8mm with standard deviation of 1.1. The left condylar length 18.6mm with standard deviation of 1.79 and width 9.7mm with standard deviation of 0.949. According to the obtained values the male condylar dimensions were greater than the female condyles.

The data is plotted using ROC curve and area under the curve is found given in the following graph.



Area Under the Curve

Test Result Variable(s)	Area
L_ROC	.711
W_ROC	.707
L_LOC	.665
W_LOC	.692

According to ROC curve the area under the curve were greater for length of right occipital condyle (.711) and width of right occipital condyle (.7) compared with length of left occipital condyle (.66) and width of left occipital condyle (.69).

According to the values obtained from the curve the length of right occipital condyle is greater predictor of gender which is statistical significant with 73% specificity and 62% sensitivity compared to width of right occipital condyle with 67% specificity and 59% sensitivity, length of left occipital condyle with 69%

specificity and 60% sensitivity and width of left occipital condyle with 68% and 62%.

Discussion

There are many studies done on the occipital condyles for discrimination of gender using dry bone. However there is limited studies reported using computer tomography 3D reconstructed images for this purpose.

Sait Naderia et al performed a prospective study in Turkish population to evaluate the morphology of occipital condyle(3). 27 parameters of occipital condyles were measured using Vernier calliper on 202 dry skulls and the measurement were statistically analysed using Mann Whitney U-test. Authors concluded that the occipital condyles are present in various shape, width, length and orientation.

Suazo G.I et al performed a prospective study to evaluate the efficiency of Baudoin condylar index for sex determination(4). Length and width of condyles were measured on 215 dry skulls using digital caliper and Baudoin condylar index was calculated for each condyles. Using descriptive statistics and t-test the result was analysed. It was found that all the measurements were greater in male condyles than female condyles but only the maximum length was statistically significant for discrimination of sex. The author concluded that the Baudoin condylar index has a low yield for determining the sex.

Ivan Suazo Galdames & Zavando et al performed a cross sectional study to evaluate the effect of age in sex determination in 16 morphological indicators(5), which includes occipital condyles. They studied 275 skull bones in which 250 with mandibles and the measurements were taken accordingly. And the author reported that 31-40 and 61-70 years age range group showed the best performance and lowest precision were found in the age group of 21-30 years.

Ivan Claudio Suazo Galdames et al examined the accuracy of the 16 traditional indicators of morphological sexual dimorphism in Brazilian population using 284 skulls in which 187 were males and 97 were females. Visual examination was done with each indicator to determine the level of accuracy. In which occipital condyles had accuracy of 79.30% and sensitivity of 80% for male and 77.7% for female. They found that all the 16 indicators studied had high levels of accuracy. And the author concluded that the morphological indicators showed an adequate performance as diagnostic tests.

We found in the present study that the dimensions of male occipital condyle are greater than female which is similar in most of other reported studies. In the present occipital condyle show the average performance in discriminating gender whereas Suazo G.I et al. reported that occipital condyles show low yield for determining the sex. These may be due to the different measurement technique used and the level of statistical significance considered in these studies.

Conclusion

The dimensions of male occipital condyles were greater than female occipital condyles. The length of right occipital condyle has greater specificity and sensitivity to discriminate gender compared to other dimensions of condyles. Hence occipital condyles can be used for discrimination of gender in case no other alternative morphological indicators are available.

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