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Sexual Dimorphism of Occipital Condyle of Adult Human Cranium

Krishna Chandra Kundu[1], Humaira Naushaba[2], Kabita Saha[3], Kohinoor Sultana[4] Sultana Parven[5]

Abstract:

Context: *Measurement of occipital condyle is frequently used to calculate various dimensions which are important in anatomy, anthropology and forensic medicine as a method for determination of sex.*

Materials and methods: *A cross-sectional analytical type of study was conducted in the Department of Anatomy, Sir Salimullah Medical College, Dhaka from January 2013 to June 2014. A total of 100 morphologically normal complete crania was examined. The minimum and maximum distance between right and left occipital condyles and maximum bicondylar breadth between occipital condyles in male and female were measured and compared.*

Results: *The mean minimum distance between right and left occipital condyles was 20.72 ± 2.14 mm in males and 18.41 ± 2.32mm in female.The mean maximum distance between right and left occipital condyles was 37.19 ± 4.24mm and 35.09 ± 4.37mm in male and female respectively. The mean maximum bicondylar breadth between occipital condyles was 48.62 ± 2.64 mm in male and 45.57 ± 2.67 mm in female.*

Conclusion: *Statistically significant difference ($p<0.001$) was found between male and female regarding minimum and maximum distance between occipital condyles and maximum bicondylar breadth.*

Keyword: *Minimum distance between right and left occipital condyle, maximum distance between right and left occipital condyle, maximum bicondylar breadth*

Introduction

Occipital condyles are located antero-laterally on each side of foramen magnum.[1] These are unique bony structures and forms craniovertebral junction and is the only articulation between occipital condyle and atlas.[2] The weight of head is transmitted through occipital condyles and passed on to the atlas.[3] Measurement of occipital condyles are important in anatomy, anthropology and forensic medicine as a method for determination of sex.[4]

Historically, human identification is one of the most challenging subjects that man has confronted. Identity is a set of physical characteristics, functional or psychic, normal or pathological, that defines an individual.[8]

Osteometric analyses of occipital condyles are important for transcondylar surgical approach indicated for tumours at craniovertebral junction.[5] Now a days advanced neuroimaging technique provide support for aggressive craniovertebral intervention. Naderi[2] and Gapert[3] found 76.6% accuracy from occipital condyles in sex determination by discriminant function analysis.

Materials and Methods

This study was carried out from January 2013 to June 2014 in the Department of Anatomy, Sir Salimullah Medical College, Dhaka, Bangladesh.

[1]Dr. Krishna Chandra Kundu, Assistant Professor, Department of Anatomy, Colonel Malek Medical College, Manikganj.

[2]Professor Dr Humaira Naushaba, Professor and Head, Department of Anatomy, Dhaka Medical College, Dhaka,

[3]Dr Kabita Saha, Medical officer, Outpatient Department, Gynaecology, Dhaka Medical College Hospital, Dhaka.

[4]Dr. Kohinur Sultana, Assistant Professor, Department of Anatomy, Dhaka Community Medical College, Dhaka.

[5]Dr. Perven Sultana, Associate Professor, Department of Anatomy, Gazi Medical College, Khulna.

Correspondence: Dr. Krishna Chandra Kundu
Email :drkundu69@gmail.com

This cross- sectional analytical type of study was performed on one hundred dry adult human crania of unknown sex. Sex were determined by discriminant function analysis.

Operational Definitions

1. Minimum distance between right and left occipital condyles (MnD): Minimum distance between medial borders of articular facets of right and left condyles.[6]
2. Maximum distance between right and left occipital condyles (MxD): Maximum distance between medial borders of articular facets of right and left condyles.[7]
3. Maximum bicondylar breadth (BCB): Maximum distance between lateral margins of right and left occipital condyles.[3]

Minimum distance between right and left occipital condyles (Figure 1), Maximum distance between right and left occipital condyles (Figure 2) and Maximum bicondylar breadth (Figure 3) were measured with the help of digital slide calipers. Significance of difference between male and female was done by unpaired student's 't' test.

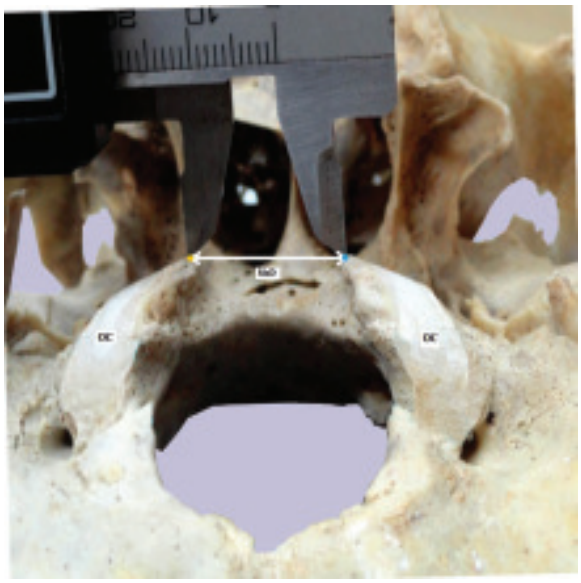

Fig-1: *Photograph showing measurement of minimum distance between right and left occipital condyle (MnD) by digital slide calipers*

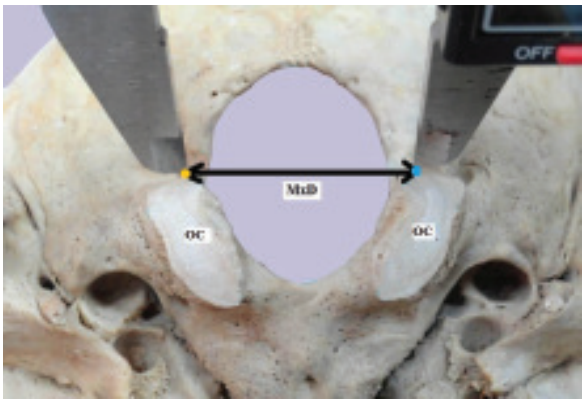

Fig-2: *Photograph showing measurement of maximum distance between right and left occipital condyle(MxD) by digital slide calipers*

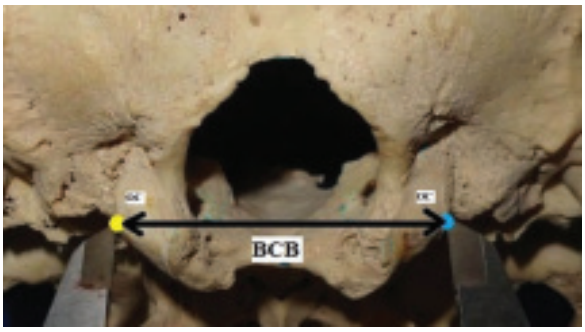

Fig-3: *Photograph showing measurement of maximum bicondylar breadth of occipital condyle (BCB) by digital slide calipers*

Ethical clearance

The study was approved by ethical review committee of Sir Salimullah Medical College, Dhaka.

Results

Minimum distance between occipital condyles (MnD):

The mean minimum distance between occipital condyles was 20.72 ± 2.14 mm in male and 18.41 ± 2.32 mm in female. The mean difference in minimum distance between occipital condyles was higher in male than that of female and the difference was statistically significant (p=0.000) (Table I).

Maximum distance between occipital condyles (MxD):

The mean (±SD) maximum distance between occipital condyles was 37.19 ± 4.24 mm and 35.09 ± 4.37mm in male and female respectively. The mean difference in maximum distance between

occipital condyles was larger in male than that of female and was statistically significant (p=0.017) (Table I).

Maximum bicondylar breadth (BCB):
The mean (± SD) maximum bicondylar breadth between occipital condyles was 48.62 ± 2.64 mm and 45.57 ± 2.67 mm in male and female respectively. The mean difference in maximum bicondylar breadth of occipital condyles was found higher in male than that of female and the difference was statistically significant (p=0.000) (Table I).

Table-I

Minimum and maximum distance between condyles and maximum bicondylar breadth in male and female

Sex	Minimum distance (mm) between occipital condyle Mean (± SD) (Range)	Maximum distance (mm) between occipital condyle Mean (±SD) (Range)	Maximum bicondylar breadth(mm) Mean (±SD) (Range)
Male	20.72 ± 2.14	37.19 ± 4.24	48.62 ± 2.64
(n=53)	(16.12-24.79)	(26.33-48.15)	(43.06-52.85)
Female	18.41 ± 2.32	35.09 ± 4.37	45.57 ± 2.67
(n=47)	(16.68-25.87)	(23.29-47.51)	(39.66-51.85)
P value	0.000***	0.017*	0.000***

Figure in parentheses indicate range.
***=significant at the level 0.001 (2 tailed).
*=significant at the level 0.05 (2 tailed).
n=sample size.

Discussion

Macaluso[6] worked on occipital condyles of sixty-eight French skulls of known sex from the Georges Olivier skeletal collection in Paris. He pointed out that sexual dimorphism was observed in occipital condyles. The findings of this study were statistically analyzed and revealed important information about morphometric variations in male and female.

Regarding minimum distance between condyles, the measured value of the present study was dissimilar (p<0.001) to the findings reported by Uysal[9], Crider[10] and Singh.[13] Their study sample was from Turkey, USA and India respectively. These dissimilarities might be due to different racial affinity and ethnicity. The measured value of the present study was similar (p>0.01) to the findings reported by Gapert[3] and Macaluso.[6] They collected the study samples from Britain and France. These similarities might be due to food habit and nutritional factor.

Regarding maximum distance between condyles, the measured value of the present study was dissimilar (p<0.001) to the findings reported by Holland[12], Wescott[13], Uysal[9] and Crider.[10] Their study sample was from Turkey, USA and India. These dissimilarities might be due to different ethnicity and racial affinity. The measured value of the present study was similar (p>0.01) to the findings reported by Gapert[3] and Macaluso.[6] They collected the study sample from Britain and France. These similarities might be due to food habit and nutritional factor.

Regarding maximum bicondylar breadth the measured value of the present study was dissimilar (p<0.01) to the findings reported by Holland[12], Wescott[13], Gapert[3], Macaluso[6], Uysal[9], and Crider.[10] Their study sample was from Britain, France, America and Turkey. These dissimilarities might be due to different ethnicity and racial affinity and nutritional factor.

Conclusion:

The present oesteometric study was an attempt to construct the data on different dimensions of occipital condyle of dry adult human skull. Minimum distance between condyles, maximum distance between condyles and maximum bicondylar breadth were compared between male and female and statistically significant difference (p<0.001) was found.

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