Original Article
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Morphometric Study of Occipital Condyles in Fully Ossified Dry Human Occipital Bone in a Bangladeshi Population

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Abstract

Background*: The occipital condyle is a bony structure lying anterolateral to the foramen magnum that connects the cranium to the vertebral column.*

Objective*: To determine the morphometric dimensions (length, width and height) of the occipital condyles in fully ossified dry human occipital bones in a Bangladeshi population.*

Methods*: A cross-sectional descriptive study was conducted on 100 fully ossified dry human occipital bones in the Department of Anatomy, Mymensingh Medical College, Mymensingh, between July 2021 and June 2022. A non-random purposive sampling technique was adopted. The length, width and height of the occipital condyles were measured using a sliding caliper (in mm).*

Results*: The mean±SD length of the occipital condyle was 22.29±2.83 mm on the right side and 22.21±2.87 mm on the left side. The mean width of the occipital condyle was 12.23±1.67 mm on the left side and 11.85±1.42 mm on the right side. The mean height was 8.92±1.3 mm for the left occipital condyle and 8.97±1.3 mm for the right occipital condyle.*

Conclusion*: As condylar drilling is an important step in the transcondylar approach, knowledge of the morphometry of the occipital condyle is of great surgical importance.*

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Keywords: *occipital condyle, condylectomy, morphometry, dry, fully ossified, Bangladeshi people.*

Introduction

The human occipital bone is a single bone occupying the back of the skull. It has four parts — the squamous part, the right and left condylar parts, and the basilar part.[1,2] The condylar part is situated on each side of the foramen magnum.[3]

The occipital condyles are important elements in maintaining the head vertically, as they articulate with the superior articular facets on the lateral mass of the atlas, forming the atlanto-occipital joint. The stability of this joint is important, and it is maintained by congruency of the articular surfaces together with capsulo-ligamentous factors. Deep to each condyle traverses the hypoglossal canal, which transmits the hypoglossal nerve and a meningeal branch of the ascending pharyngeal artery.[1] Morphometry of the occipital condyle is important in craniovertebral surgeries, particularly in accessing lesions ventral to the brainstem.[4,5] The transcondylar approach, which involves partial condylectomy by drilling the posterior aspect of the occipital condyle, is increasingly being used to access such lesions because it increases the surgical field of view and minimizes nerve tissue retraction.[6,7] Knowledge of the morphometry of the occipital condyle, as well as the position of the hypoglossal canal, may therefore be useful in

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decisions regarding the extent and direction of condylar drilling, to avoid occipito-cervical destabilization and injury to the hypoglossal nerve.[8]

Materials and Methods

This was a descriptive cross-sectional study. One hundred occipital bones were collected from the Department of Anatomy of Mymensingh Medical College, Bangladesh; Community Based Medical College, Bangladesh; and Netrokona Medical College, Bangladesh. Only fully ossified, intact bones were included; unossified, broken and abnormal bones were excluded. The length, width and height of the occipital condyles were measured using a digital Vernier sliding caliper. Two hundred condyles from the 100 occipital bones were measured on the left and right sides, and all data were compiled, sorted and analyzed statistically using Statistical Package for Social Science (SPSS) version 25. Regression analysis was also performed to test the association between findings. A P value of less than 0.05 was considered significant. This study was approved by the Ethical Review Committee of Mymensingh Medical College Hospital, Mymensingh, Bangladesh IRB No: **MMC/IRB2022/475.**

Figure 1: Procedure of measurement of length of occipital condyle

Figure 2: Procedure of measurement of width of occipital condyle

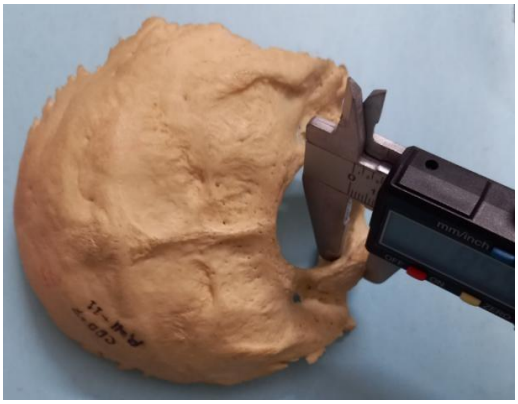

Figure 3: Procedure of measurement of height of occipital condyle

Results

The present study was performed on 100 occipital bones at the Department of Anatomy of Mymensingh Medical College, Mymensingh.

The length of the left occipital condyle ranged from 11.8 mm to 29 mm; more than 85% of samples were measured within the range of 20 mm to 30 mm. The length of the right occipital condyle ranged from 9.9 mm to 29.5 mm; more than 90% of samples were measured within the range of 20 mm to 30 mm.

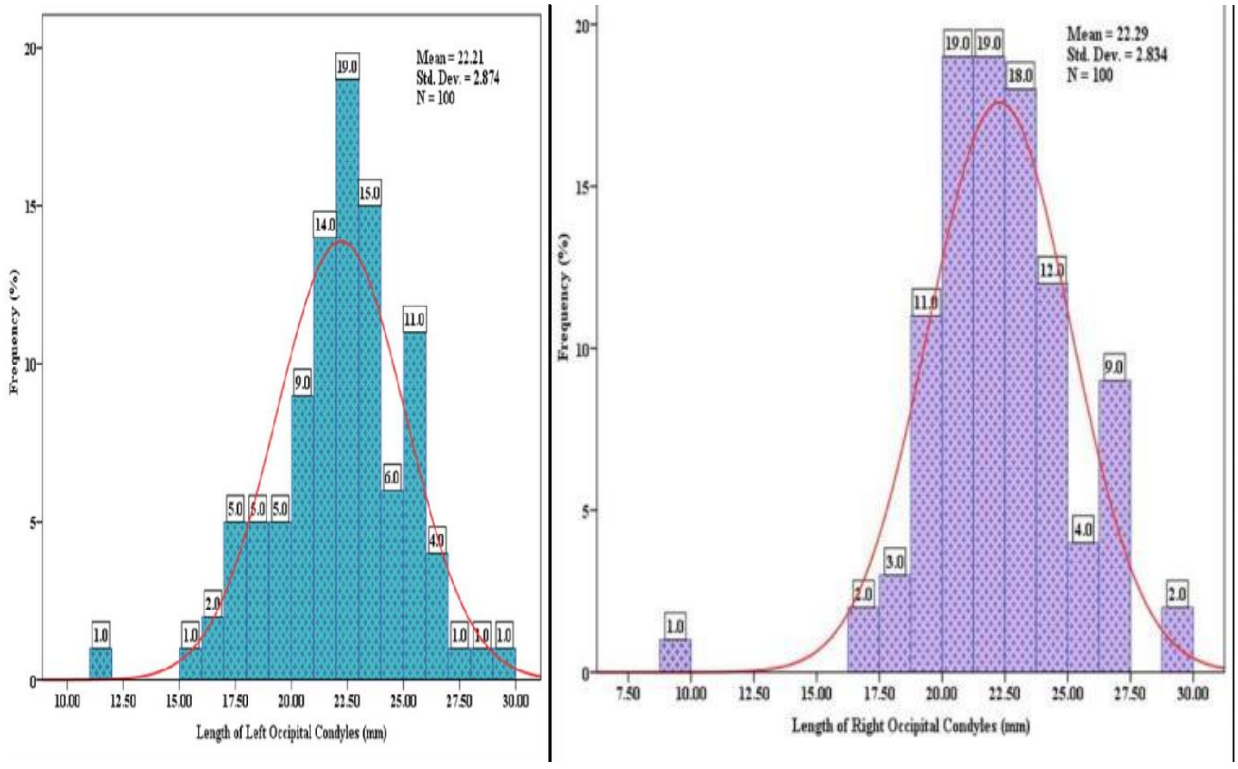

Figure 4: Frequency distribution of length of occipital condyles of both sides

The width of the left occipital condyle ranged from 8.8 mm to 19.4 mm; more than 85% of samples were measured within the range of 10 mm to 16 mm. The width of the right occipital condyle ranged from 8.8 mm to 16.5 mm; more than 80% of samples were measured within the range of 10 mm to 15 mm.

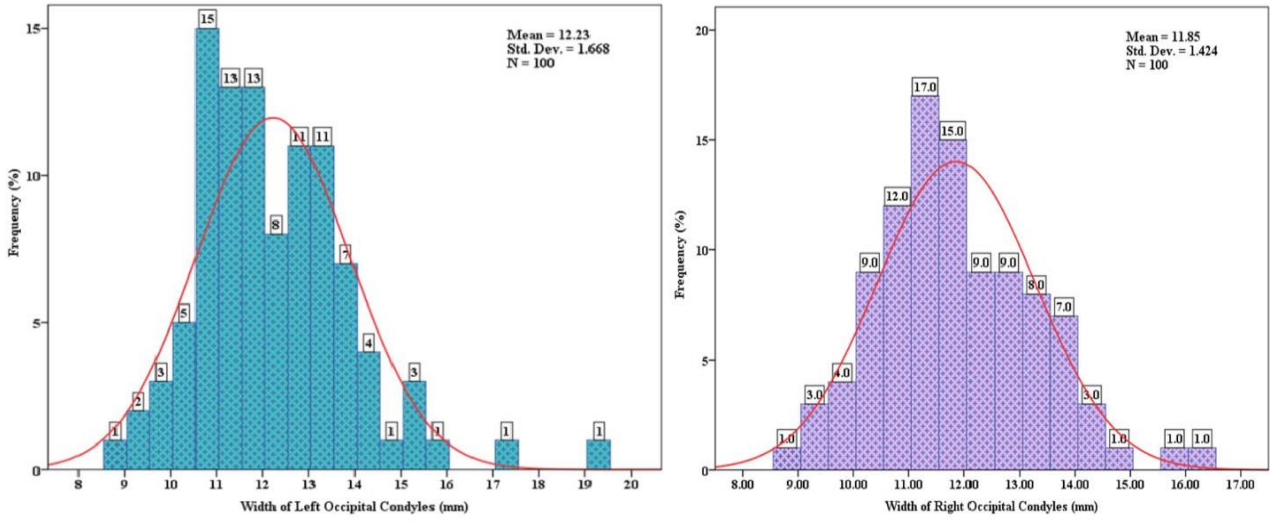

Figure 5: Frequency distribution of width of occipital condyles of both sides

The height of the left occipital condyle ranged from 6.7 mm to 15 mm; more than 90% of samples were measured within the range of 7 mm to 12 mm on the left side. The height of the right occipital condyle ranged from 6.8 mm to 15 mm; more than 90% of samples were measured within the range of 7 mm to 11 mm.

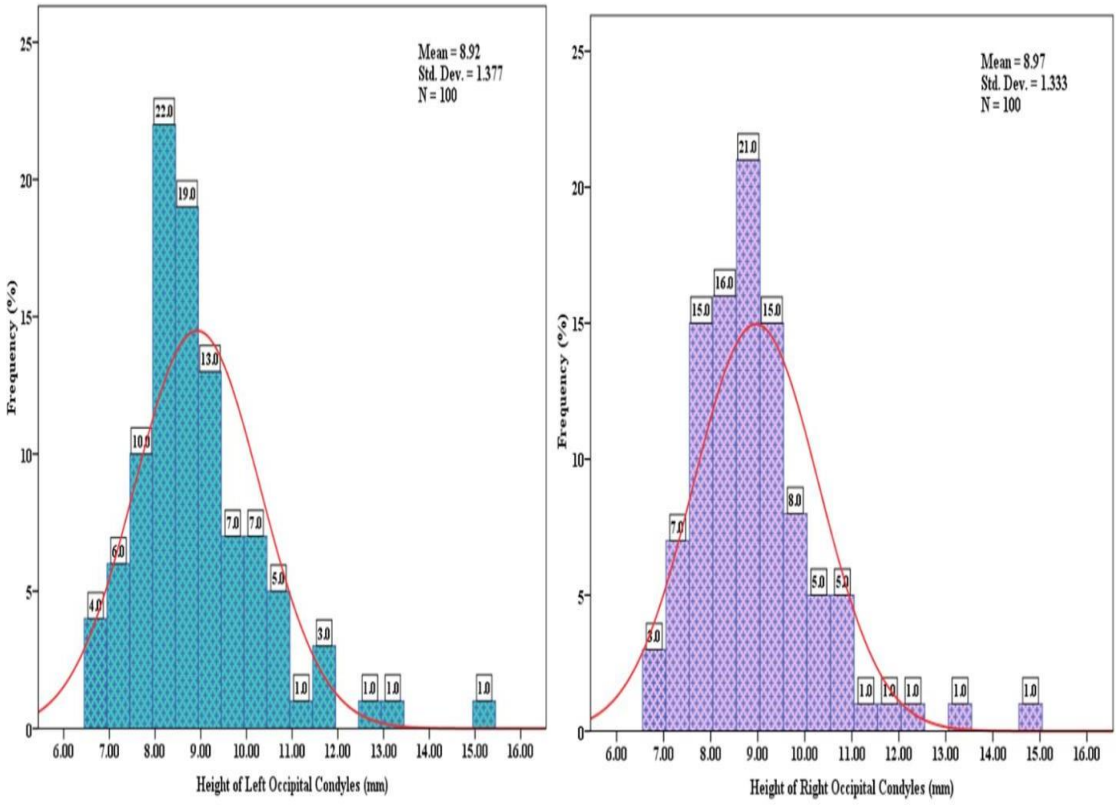

Figure 6: Frequency distribution of height of occipital condyles of both sides

Discussion

In the present study, the mean length of the occipital condyle was 22.21 ± 2.87 mm on the left side and 22.29 ± 2.83 mm on the right side. Similar findings were reported by Avci E et al.13, who observed the mean length of the occipital condyle to be 22.61 ± 2.3 mm on the right side and 22.36 ± 2.3 mm on the left side. S. Kavita, Shanta, Anand, and Shanthi9 reported a mean occipital condyle length of 22.34 ± 2.5 mm on the left side and 21.97 ± 2.5 mm on the right side, which is comparable to the findings of the present study. The findings of the present study are also consistent with those reported by Ajay, Dharati, and Shailesh.10

The mean width of the left occipital condyle was 12.23 ± 1.67 mm, whereas that of the right occipital condyle was 11.85 ± 1.42 mm. These measurements are comparable to the findings of Avci E et al.13, who reported mean widths of 12.3 ± 1.2 mm on the right side and 12.4 ± 1.5 mm on the left side. The findings of the present study are also in agreement with those reported by Anwesha et al.15 and Muthukumar et al.11.

The mean height of the occipital condyle was 8.92 ± 1.3 mm on the left side and 8.98 ± 1.3 mm on the right side. These measurements are comparable to those reported by Naderi S et al.12 and Fathi Z et al.14, who reported mean occipital condyle heights of 9.2 ± 1.4 mm on the right side and 9.2 ± 1.3 mm on the left side, respectively.

Conclusion

The occipital condyles are an integral part of the neck and the base of the skull. In the present study, an effort was made to measure various parameters related to the occipital condyle. These parameters should be taken into consideration during surgery of the craniovertebral junction by neurosurgeons and orthopaedic surgeons, to minimize mortality and morbidity. Preoperative radiological evaluation through plain radiography, CT and MRI is important for achieving surgical success, and this evaluation is required before surgery to prevent complications such as haemorrhage, atlanto-occipital instability, and injury to major structures passing through the foramen magnum. The findings are also useful for clinical anatomists and anthropologists for the purposes of teaching and further research.

Ethical Clearance

This study was approved by the Ethical Review Committee of Mymensingh Medical College Hospital, Mymensingh, Bangladesh. *[IRB reference number and date of approval to be provided]*

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article.

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Author Contribution

Mili DA[1] conceived and designed the study, contributed to data collection and analysis, and drafted the manuscript. **Ara A**[2] contributed to the study design, data collection, interpretation of findings, and critical revision of the manuscript. **Begum T**[3] supervised the study and contributed to the interpretation of findings and critical review of the manuscript. **Islam ASMS**[4] contributed to the clinical interpretation of the findings and critical revision of the manuscript. **Jannat RA**[5] contributed to data collection, data organization, and manuscript preparation. **Shom T**[6] contributed to data collection, literature review, and manuscript revision. **Shanta MA**[7] contributed to data collection, data organization, and review of the manuscript. **Sharna T**[8] contributed to the literature review, interpretation of findings, and critical revision of the manuscript. All authors reviewed and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration on Use of Generative AI

No artificial intelligence (AI) tools were used in the preparation of this manuscript.

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