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Analysis of Occipital Condyles on Dry Human Skulls

Hemant Ashish Harode

Research Scholar, L.N. Medical College & J.K. Hospital, Department of Anatomy, LNCT University Bhopal, Madhya Pradesh, India

S.D. Gupta

Professor & Head of Department, Department of Anatomy, L.N. Medical College, Bhopal, India

Abstract--The human occipital condyle (OC) is the bony structure connecting the base of the cranium to the atlas vertebra to form the atlantooccipital joint. The occipital condyles are bilateral inferior extensions of the occipital bones it's present on the lateral aspect of the foramen magnum. This study aims to document the various dimensions of occipital condyles which is important to joint biomechanics rehabilitations, neurologists & orthopaedic surgeons. The study was done on 60 skulls of unknown sex where different parameters of the occipital condyles were observed like length, breadth, anterior & posterior intercondylar distance were measured. Measurements of right-side occipital condyles length and breadth were found 22.62 mm and 13.06 mm respectively, whereas left side length and breadth were found 22.72mm & 13.46mm respectively. The documented morphometric values of the occipital condyles are useful for a better understanding of joint biomechanics & occipital surgeries.

Keywords---Condyles, skulls, Occipital bone.

Introduction

The human occipital condyle is the bony structure connecting the base of the cranium to the atlas vertebra to form the atlantooccipital joint. The occipital condyles are bilateral inferior extensions of the occipital bones it's present on the lateral aspect of the foramen magnum. This study aims to document the various dimensions of occipital condyles which is important to joint biomechanics rehabilitations, neurologists & orthopedic surgeons. Several types of anomalies and traumas are associated with the occipital condyles. The condyles articulate

with the lateral masses of the atlas vertebral body. This unique anatomical feature results in a unique biomechanical characteristic. Its integrity is of vital importance for the stability of the craniovertebral junction¹. Occipital condyles are the two bony projections that are present in the inferior surface of occipital bone in the skull. The occipital condyle occupies the anterior half of the outer margin of foramen magnum². Symmetry of the occipital condyles does not pose any difficulty in flexion, extension and lateral bending but asymmetrical facets will give rise to altered kinematics in the atlanto occipital joint³.

The occipital condyles represent the cranial portion of the cranio-cervical junction. The space-occupying lesion ventral to the spinal canal at the level of the foramen magnum can be reached using a ventral or dorsal approach. Owing to the difficulties and high rate of morbidity associated with ventral approaches, the dorsal approach is preferred to reach the space occupying lesion ventral to the spinal cord at the cranio-vertebral junction. Partial resection of the occipital condyle as made during trans-condylar surgical approaches is an important step for access to the ventral and ventro lateral foramen magnum^{4,5}.

Understanding the anatomical basis of craniovertebral anomalies is important when carrying out surgery in the region. A lateral approach during craniovertebral surgery requires resection of the occipital condyles. Hence, the morphology of the occipital condyles and their facets is important clinically⁶.

Material & Methods

The study was conducted on 120 occipital condyles including right & left of unknown sex in the Department of Anatomy, LN Medical College Bhopal, the length, breadth, and anterior & posterior intercondylar distance were measured by digital vernier caliper & data statistically analyzed.

Inclusion & Exclusion criteria

Healthy skulls are taken for the study & broken or deformed skulls are excluded.

- Anteroposterior diameter (Right and Left): From its anterior tip to posterior tip of OC (Image.1)
- Transverse diameter (Right and Left): Maximum transverse diameter in between its anterior and posterior tip of OC (Image. 2).
- Anterior Intercondylar Distance: In between anterior tip of right & left OC (Image. 3)
- Posterior Intercondylar Distance: In between Posterior tip of right & left OC (Image. 4).



Figure 1. Showing measurements of the anteroposterior diameter of the occipital condyle



Figure 2. Showing measurements of the transverse diameter of the occipital condyle



Figure 3. Showing measurements of the anterior intercondylar distance of the occipital condyle



Figure 4. Showing measurements of the posterior intercondylar distance of the occipital condyle

Results

In the present study measurements of right-side occipital condyles length and breadth were found 22.62 mm and 13.06 mm, whereas left side length and breadth were found 22.72mm & 13.46mm respectively shown in the table. 1 and anterior & posterior intercondylar distance was 21.75mm & 41.15mm.

Table 1
Showing right & left side of different parameters of Occipital Condyle

Parameters of Occipital Condyle	Anteroposterior Diameter (mm)	Transverse Diameter (mm)
Right Side	22.62	13.06
Left Side	22.72	13.46
p-value	0.76	0.09

Discussion

The anatomy of occipital condyles plays an important role in decision-making regarding the degree and direction of condylar drilling with minimal injury. Condylar drilling is an important step in the transcondylar extension of the far lateral approach⁷.

Length

In the present study right & left side occipital condyles lengths were recorded 22.62mm & 22.72mm respectively, the parameters compared with the others authors M.Mahamutha et al 2015 in their study they got anteroposterior diameter of the occipital condyle right & left side was 23.5mm & 23.72mm, In 2016 Sandeep et al in their study right & left side length was 22.90mm & 22.60mm respectively, which is very close to our study whereas in 2018 Isaac Cheruiyot et al observed right & left side length was 20.51mm & 20.59mm, Priya A et al 2019 recorded 14mm & 17mm which is slightly lower to my study (table 2). Muthukumar et. al has measured 100 occipital condyles in 50 dry skulls and the average anteroposterior length of the occipital condyle was 23.6 mm. Xiang Jain et. al have measured 30 dry skulls and the average length of the occipital condyle is 24.47mm+3.32mm (left) and 25.16mm+ 2.39 mm (right)

Breadth

In the present study right & left side occipital condyles breadth were found 13.06mm & 13.46mm respectively whereas other authors M.Mahamutha et al 2015, breadth were found 13.58mm & 13.62mm, Sandeep S et al 2016, 12.98mm & 12.97mm, Isaac Cheruiyot et al 2018, 12.27mm & 12.20mm which is close to our study. Priya A et al (2019) observe 08mm & 09mm which is slightly lower than my study (table 3). The surgical treatment for any space-occupying lesion is usually performed at the level of the foramen magnum, through a ventral or dorsal approach¹⁷.

Intercondylar distance

In the present study anterior & posterior intercondylar distance is 21.75mm & 41.15mm which is close to the Naderi & Ajay Rathwa et al anteriorly they got 21.60mm & 22mm & posteriorly is 41.60mm & 41.05mm. whereas Anil Kumar & M.Mahamutha et al got the values anteriorly 17.63mm & 20.64mm lesser than

our study & Anil Kumar et al 2014 reported maximum posterior intercondylar distance which is 42.02mm.

The transcondylar approach provides access to the lower clivus and premedullary area. The partial transcondylar approach is performed to treat lesions located predominantly anterior to the spinomedullary junction and the complete transcondylar approach is performed to treat extradural lesions⁸.

Table 2
Showing comparison of different parameters of Occipital Condyle with other authors

Authors and year of study	Anteroposterior diameter of Occipital condyle (mm)		Transverse diameter of Occipital condyle (mm)	
	Right	Left	Right	Left
Priya A et al (2019) ⁹	14	17	08	09
Isaac Cheruiyot et al (2018) ¹⁰	20.51	20.59	12.27	12.20
Sandeep S et al (2016) ¹¹	22.90	22.60	12.98	12.97
Roopashree R et.al (2019) ¹²	15.1	14.6	6.58	6.96
M.Mahamutha et al (2015) ¹³	23.5	23.75	13.58	13.62
Present study	23.07	22.67	13.24	13.36

Table 3
Showing comparison of different parameters of Occipital Condyle with other authors

Authors & Years of the study	Anterior Intercondylar distance (mm)	Posterior Intercondylar distance (mm)
Naderi et al (2005) ⁶	21.60	41.60
Anil Kumar et al (2014) ¹⁵	17.63	42.02
Ajay Rathwa et al (2014) ¹	22.0	41.5
M.Mahamutha et al (2015) ¹³	20.64	41.4
Present Study (2022)	21.75	41.15

Conclusion

The documented morphometric values of the occipital condyles are useful for occipital surgeries for Neurosurgeons, Orthopaedician & Forensic medicine, analysis of OC enhances the knowledge of this region to deal with Joint Biomechanics & Physiotherapy Rehabilitation.

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