

## MORPHOMETRY OF OCCIPITAL CONDYLES IN CRANIOVERTEBRAL SURGERIES

Deepa Somanath <sup>\*1</sup>, Sudha R <sup>2</sup>.

<sup>\*1</sup> Assistant Professor, Department of Anatomy, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India.

<sup>2</sup> Tutor, Department of Anatomy, Sri Manakula Vinayagar Medical College and Hospital, Puducherry, India.

### ABSTRACT

**Introduction:** The occipital condyle connects the cranium and the first cervical vertebra at the atlanto occipital joint. It overlaps the foramen magnum. The purpose of this study is to correlate the measurements of occipital condyles and its clinical implications in various surgeries involving transcondylar approach, condylar drilling, crano-vertebral surgery, accessing lesions in the posterior cranial fossa and clivus, condylectomy, occipital fixation etc.

**Materials and Methods:** The following study was performed in the Department of Anatomy of Sri Manakula Vinayagar Medical College, Pondicherry using 50 adult unsexed dry human skull bones.

**Results:** In the present study, the significant P value of the length, the middle and posterior breadth and thickness of occipital condyles as well as the angle of occipital condyle to horizontal plane were 0.001, 0.029, 0.016, 0.009, 0.009 respectively.

**Conclusion:** The morphometric values of occipital condyles is very crucial for the modified approach to the foramen magnum in crano-vertebral surgeries.

**KEY WORDS:** Occipital Condyle, Morphometry, Transcondylar Approach.

**Address for Correspondence:** Dr. Deepa Somanath, Assistant Professor, Department of Anatomy, Sri Manakula Vinayagar Medical College and Hospital, Puducherry 605 107, India.

**E-Mail:** [deepa.somanath@gmail.com](mailto:deepa.somanath@gmail.com)

### Access this Article online

#### Quick Response code



DOI: 10.16965/ijar.2017.111

**Web site:** International Journal of Anatomy and Research  
ISSN 2321-4287  
[www.ijmhr.org/ijar.htm](http://www.ijmhr.org/ijar.htm)

Received: 11 Jan 2017  
Peer Review: 11 Jan 2017  
Revised: None

Accepted: 13 Feb 2017  
Published (O): 28 Feb 2017  
Published (P): 28 Feb 2017

### INTRODUCTION

The craniovertebral junction is an important landmark for the surgeons and radiologists to expose the posterior cranial fossa. The lesions anterior to the brainstem and cervicomedullary junction have to be approached with an understanding of the anatomy of occipital condyles and structures around it. Pathological lesions affecting the spino medullary junction at the level of clivus can be accessed ventrally or dorsally. The safer approach to reach those lesions

near the foramen magnum will be the dorsal approach [1]. Different procedures are adapted by the neurosurgeons to minimise the morbidity like lateral, transcondylar approach [1,2]. During this procedure the occipital condyle is resected fully or partially. In a study conducted by Hong et al [3], the occipital condyle measurements were used in techniques such as transarticular and direct occipital screwing. Therefore a thorough knowledge of the measurements of occipital condyle is necessary for a

successful outcome of the surgery.

**MATERIALS AND METHODS**

The following study was performed on 100 occipital condyles from 50 unsexed dry human skulls in the Department of Anatomy of Sri Manakula Vinayagar Medical College, Pondicherry, India.

**Exclusion criteria:**

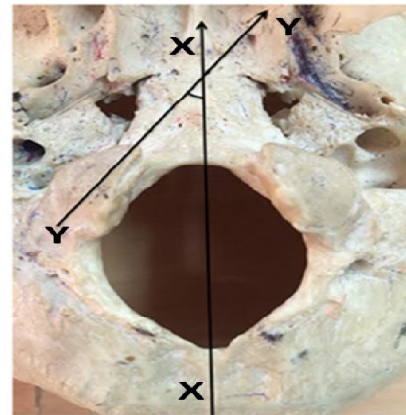
Damaged, malformed and foetal skulls were excluded in this study.

The measurements carried out were the length of the condyle, breadth in the anterior, middle and posterior parts of the condyle, thickness of the condyle, intercondylar distance in anterior, middle and posterior parts of the condyle (AID,MID,PID) using vernier calliper, the angle of the occipital condyle to the sagittal plane and the angle of the occipital condyle to the horizontal plane.

**RESULTS**

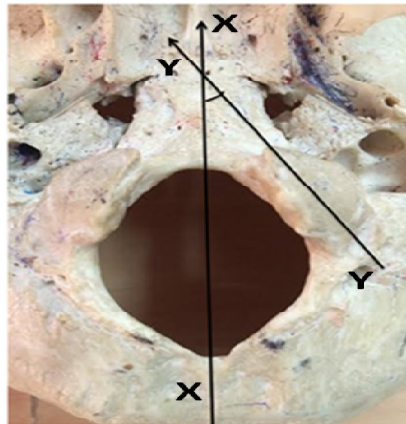
The present study was performed on 100 occipital condyles of unsexed dry human skulls. Table 1 represents the mean value of length, breadth and thickness of the occipital condyles. The mean length of the occipital condyle on the left side was 2.39 cm and on the right side 2.49 cm with standard deviation of 0.25, 0.45 respectively and the result was significant. The mean breadth of the occipital condyle at its middle part on the right side was 1.14 cm and on the left side 1.01 cm with the standard deviation of 0.30,0.29 respectively and the result was significant. The mean breadth of the occipital condyle at its posterior part on the right side was 0.84 cm and on the left side 0.68 cm with the standard deviation of 0.37, 0.23 respectively and the result was significant. The mean thickness of the right occipital condyle was 0.53 cm and on the left side 0.45 cm with the standard deviation of 0.17,0.13 respectively and the result was significant. The mean angle of occipital condyle to horizontal plane on the right side was found to be 57.64 degree and on the left side it was 55.33 degree with the standard deviation of 7.54, 10.98 respectively and the result was significant. Table 2 shows the posterior intercondylar distance (PID) which was found to be a maximum of 2.77 cm.

**Fig. 1:** Showing the angle of occipital condyle to the sagittal plane on left side.



XX- anteroposterior axis passing through the middle of foramen magnum  
YY- axis passing through midpoint of both ends of left occipital condyle.

**Fig. 2:** Showing the angle of occipital condyle to the sagittal plane on the right side.



XX- anteroposterior axis passing through the middle of foramen magnum  
YY- axis passing through midpoint of both ends of right occipital condyle.

**Table 1:** Showing the mean, standard deviation and P value.

Parameters	Mean	SD	P value
Length (cm)	R-2.49 L-2.39	R-0.45 L-0.25	0.001 <sup>*</sup>
Breadth -Anterior (cm)	R-0.46 L-0.44	R-0.29 L-0.25	0.7127
Breadth-Posterior (cm)	R-0.84 L-0.68	R-0.37 L-0.23	0.016 <sup>*</sup>
Breadth-Middle (cm)	R-1.14 L-1.01	R-0.30 L-0.29	0.0299 <sup>*</sup>
Thickness (cm)	R-0.53 L-0.45	R-0.17 L-0.13	0.0096 <sup>*</sup>
Angle of occipital condyle to sagittal plane in degrees	R-30.52 L-29.6	R-5.49 L-7.01	0.0901
Angle of occipital condyle to horizontal plane in degrees	R-57.64 L-55.33	R-7.54 L-10.98	0.0096 <sup>*</sup>

\*Marked values are significant

**Table 2:** Showing mean intercondylar distance.

Intercondylar distance in cm	
AID	1.52
MID	2.02
PID	2.77

## DISCUSSION

The success of craniovertebral surgery depend upon the knowledge of morphometry of occipital condyles in respect to length, breadth, thickness and tilt of the occipital condyles in relation with the axis of foramen magnum. Pathological lesions affecting the structures which are over the clivus and foramen magnum require a safe approach like transcondylar approach. In this study, the mean length of right and left occipital condyles were 2.49 cm and 2.39 cm respectively.

In a study by Bayat et al [1], the mean length of left occipital condyle was 19.28 mm and right occipital condyle was 19.43 mm. These findings were observed lesser than our present study findings. In the studies conducted by Mahajan et al [2], Naderi et al [4], Rathva et al [5], Swetha et al [6], Kavitha et al [7] the observations were similar to our findings. In a study conducted by Anil et al [8], he found that the length of occipital condyle on the right side in case of male was 23.88 cm and in case of female it was 22.6 cm. On the left side in case of male was 24.99 cm and in case of female it was 24.20 cm which were higher than our values. Agnihotri et al [9] observed the length of the occipital condyle ranged from 15.24 to 28.7 mm which were lesser than our findings. In our study, the the mean breadth of the occipital condyle at its middle part on the right side was 1.14 cm and on the left side 1.01 cm. This result was significant. The mean breadth of the occipital condyle at its posterior part on the right side was 0.84 cm and on the left side 0.68 cm with the standard deviation of 0.37, 0.23 respectively and the result was significant. Melissa et al [10]

identified the width of left occipital condyle as 11.42 mm and on the right side was 11.08 mm which were similar to our findings at the middle part. Naderi et al [4], Kalthur et al [11], Saralaya et al [12] and Mahamutha et al [13] measured the mean thickness as 9.2 mm, 9mm, 10.2 mm, 9.6 mm respectively which were higher than the findings of the present study which was significant.

The mean AID in the present study was measured as 1.52 cm which was similar to the finding by Bayat et al [1] which was 15.39 mm. The

mean MID in the present study was found to be 2.02 cm and PID was measured as 2.77 cm which were lesser than the findings done by Naderi et al [4], Rathva et al [5], Mahamutha et al [13]. In our study the mean angle of occipital condyle to sagittal plane on the right was 30.52 degree and on the left side 29.6 degree but it was not significant. Kizilkanat et al [14] and Hong et al [3] found the angle of occipital condyle to sagittal plane as 31.5 and 33.5 degree respectively. Our finding goes hand in hand with Kizilkanat et al [14], Naderi et al [4]. In the present study the angle of occipital condyle to the horizontal plane was measured on both sides. The mean angle of right occipital condyle to horizontal plane was 57.64 degree and on the left side 55.33 degree which was observed to be significant.

## CONCLUSION

Several surgeries involving cranio-vertebral junction is observed to be a complex procedure which demands a preoperative radiological technique to assess the occipital condyles. The resection of occipital condyle would give a better exposure to the area which will avoid damage to the surrounding vital structures. A precise morphometric parameters of occipital condyle will give an easy access for the skull base approach. In the present study, the length, the middle and posterior breadth, thickness of occipital condyles, angle of occipital condyle to horizontal plane were significant. We believe that these findings may enhance the knowledge of the neurosurgeons, radiologists to approach the area for successful outcome of surgery in the south Indian population.

## ABBREVIATIONS

**AID-** Anterior Intercondylar Distance  
**MID-** Middle Intercondylar Distance  
**PID-** Posterior Intercondylar Distance

## ACKNOWLEDGEMENTS

We thank the management of SMVMCH for permitting us to utilise the department facilities.

**Conflicts of Interests: None**

## REFERENCES

- [1]. Parvindokht Bayat, Mahdie Bagher, Ali Ghanbari, Amir Raoofi. Characterization of occipital condyle and comparison of its dimensions with head and foramen magnum circumferences in dry skulls of Iran. *Int. J. Morphol* 2014;32(2):444-448.

- [2]. Divya Mahajan, Gaurav Agnihotri, Abha Sheth, Rahat Brar. An anatomical perspective of human occipital condyles and foramen magnum with neurosurgical correlates. *International journal of experimental and clinical anatomy* 2012-2013;6-7:29-33.
- [3]. Jae Taek Hong, Tomoyuki Takigawa, Keizo sugisaki, Alejandro A. Espinoza Oráias, Nozomu Inoue, Howard S. AN. Biomechanical and Morphometric Evaluation of Occipital Condyle for Occipitocervical Segmental Fixation. *Neurol Med Chir (Tokyo)* 2011;51:701-706.
- [4]. Naderi S, Korman E, Citak G, Güvençer M, Arman C, Senođlu M, Tetik S, Arda MN. Morphometric analysis of human occipital condyle. *Clin neurol neurosurg* 2005;107(3):191-199.
- [5]. Ajay Rathva, Dharati M Kubavat, Shaileshkumar K Nagar. Morphometric analysis of occipital condyles with occipitalization of atlas vertebrae. *Medpulse-International medical journal* 2014;1(7):335-339.
- [6]. Swetha Solan. Morphometric Analysis of Foramen Magnum and Occipital Condyles in Human Skull Among Eastern Population - A Case Study. *Indian journal of applied research* 2015;(9).
- [7]. S.Kavitha, Shanta Chandrasekaran, A.Anand, K.C Shanthi. Morphometric study of occipital condyles in adult human skulls. *Int J Cur Res Rev* 2013;05(15).
- [8]. Anil Kumar, Mahindra Nagar. Human adult occipital condyles: A morphometric analysis. <https://www.omicsonline.org>.
- [9]. Gaurav Agnihotri, Divya Mahajan, Abha Sheth. An Anatomical Perspective of Human Occipital Condyles and Foramen Magnum with Neurosurgical Correlates. *Journal of Evolution of Medical and Dental Sciences* 2014-3(17):4497-4503.
- [10]. Melissa LoPresti, Leslie Auquilla, Rachel Akintayo, Nnenna Nwogu, Cigdem Erkurun Yilmazl. Morphometric analysis of the bony structures associated with the transcondylar approach. [http://www.fasebj.org/content/28/1\\_Supplement/915.15.short](http://www.fasebj.org/content/28/1_Supplement/915.15.short).
- [11]. Sneha Guruprasad Kalthur, Supriya Padmashali, Chandni Gupta, Antony S. Dsouza. Anatomic study of the occipital condyle and its surgical implications in transcondylar approach. *J Craniovertebr Junction Spine* 2014-5(2):71-77.
- [12]. Saralaya VV , Murlimanju BV, Vaderav R, Tonse M, Prameela MD, Jiji PJ. Occipital condyle morphometry and incidence of condylus tertius: phylogenetic and clinical significance. *Clin Ter* 2012-163(6):479-482.
- [13]. M.Mahamutha Affshana, Yuvraj. Analysis of the Occipital Condyl. *J. Pharm.Sci.&Res* 2015;7(7):439-440.
- [14]. Kizilkanat, Emine Dondu, Boyan, Neslihan, Soames, Roger, Oguz, Ozkan. Morphometry of the hypoglossal canal, occipital condyle, and foramen magnum. *Neurosurgery quarterly* 2006;16(3):121-125.

**How to cite this article:**

Deepa Somanath, Sudha R. MORPHOMETRY OF OCCIPITAL CONDYLES IN CRANIOVERTEBRAL SURGERIES. *Int J Anat Res* 2017;5(1):3552-3555. DOI: 10.16965/ijar.2017.111