

Characterization and Dimensions of Human Occipital Condyle

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Abstract

Objective: 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. The present work is aimed to study the morphology of the occipital condyles and their facets is important clinically. **Materials and Methods:** The study was performed on 200 occipital condyles of 100 adult human dry skulls of unknown age and sex. The measurements like Distance between basion and anterior and posterior tip of occipital condyle, Distance between opisthion and anterior and posterior tip of occipital condyle were measured. **Results:** Distance between anterior and posterior tip of occipital condyle and basion were found to be 10.51 and 26.91 mm on the right and 11.43 and 27.85 mm on the left respectively. Distance between anterior and posterior tip of occipital condyle and opisthion were found to be 38.97 and 27.81 mm on the right and 39.05, and 26.98 mm on the left respectively. **Conclusion:** The above said parameters of the occipital condyles and its variations should be taken into consideration during posterior and lateral approaches to the craniovertebral junction by neurosurgeons and orthopaedicians. The larger the distance, the free the space for the postero-lateral approach.

Keywords: Occipital Condyle; Foramen Magnum; Surgical Anatomy.

Introduction

The occipital condyles (OC) of the skull are located with the superior articular facets of the atlas vertebra and form an important junction between the cranium and the vertebral column. Its integrity is thus of vital importance for the stability of craniovertebral junction [1].

Craniovertebral bony abnormalities have been recorded since many years in morphological and

clinicoradiological studies [2]. Anomalies of craniovertebral junction are of interest not only to an anatomist but also to the clinicians because many of these deformities produce clinical symptoms, the occipital bone being the main site for these variations. Abnormalities of this area can be classified as congenital, developmental, acquired and traumatic, either alone or in combination [3].

During the last two decades, craniovertebral junction has been a focus for variety of anatomical and biomechanical studies. Most of these studies throw light upon the morphometric analysis of occipital condyles, while some provide information regarding the different surgical procedures [4]. The occipital condyles represent the cranial portion of the craniocervical junction. Space-occupying lesions ventral to the spinal canal at the level of the foramen magnum can be reached using a ventral or a dorsal approach. The difficulties and a high rate of morbidity associated with ventral approaches necessitate a dorsal approach in such conditions. Partial resection of the occipital condyle during transcondylar surgical procedure is an important step for access to the ventral and ventrolateral foramen magnum [5], A three

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dimensional understanding of the anatomy is crucially important for any kind of surgery in craniovertebral region. Various authors have reported incidence of vertebral artery injury during trans articular screw (occipital screw) placement and during lateral approaches to the foramen magnum. The injury to the artery during surgery can lead to catastrophic intra-operative bleeding and compromise to the blood flow. This can lead to unpredictable neurological deficits which will depend on the adequacy of blood flow from contralateral vertebral artery [6,7].

Hence, the present study of morphometric analysis of occipital condyle has been undertaken. It is hopeful

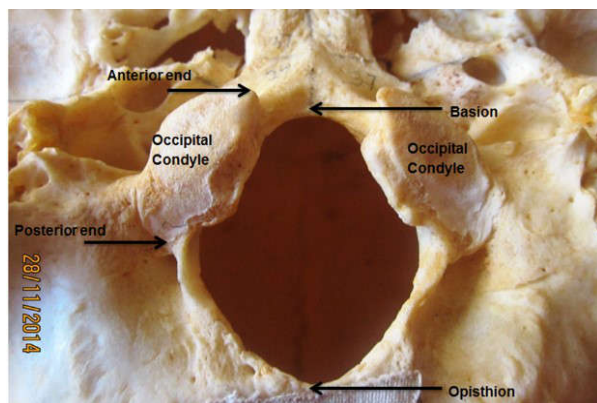


Fig. 1: base of the skull

that the data will be valuable particularly for the neurosurgeon, radiologist and orthopaedician particularly in preoperative decision-making process.

Materials and Methods

The present study was performed on 100 adult human skull of unknown age and sex. All of them were dry and free from deformity and fully ossified.

All the skulls were obtained from Department of Anatomy, Government Medical College. The equipment's used for the purpose of study were

- Vernier calipers,
- Measuring scale - Digital photography equipment

The following parameters were measured on both right and left sides

1. *Distance between basion and anterior tip of occipital condyle:* With the help of vernier calliper maximum distance was noted by anterior margin of midpoint of foramen magnum (Basion) to anterior tip of right occipital condyle and left occipital condyle (Figure 2).

2. *Distance between basion and posterior tip of occipital condyle:* With the help of vernier calliper maximum distance was noted by anterior margin of midpoint of foramen magnum (Basion) to posterior tip of right occipital condyle and left occipital condyle (Figure 3).
3. *Distance between opisthion and anterior tip of occipital condyle:* With the help of vernier calliper maximum distance was noted by posterior margin of midpoint of foramen magnum (Opisthion) to anterior tip of right occipital condyle and left occipital condyle (Figure 4).

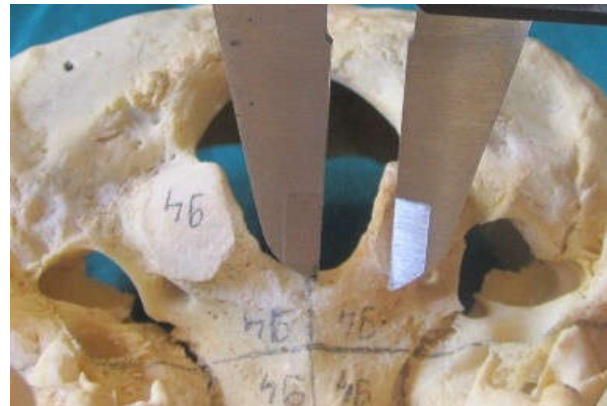


Fig. 2: Showing anterior tip

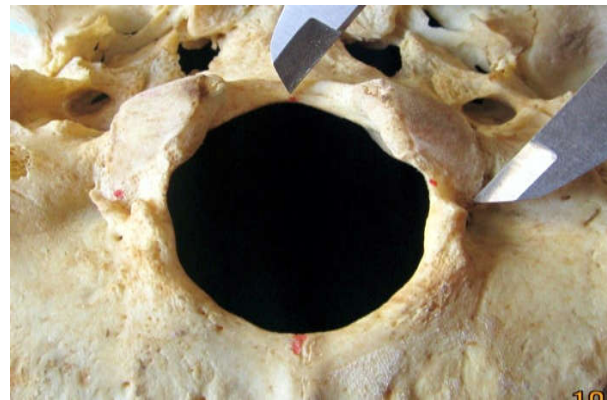


Fig. 3: Showing posterior tip of occipital condyle and Basion

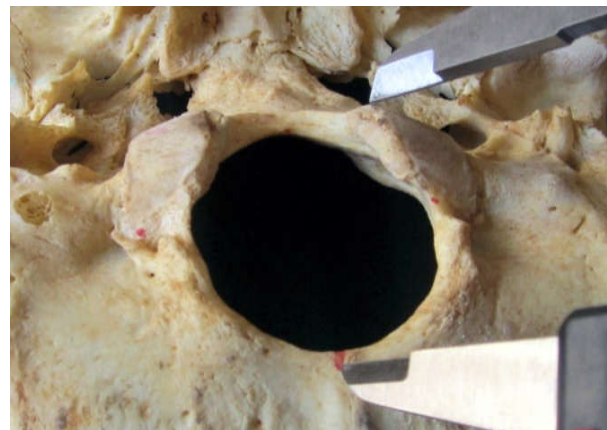


Fig. 4: Showing anterior tip



Fig. 5: Showing posterior tip of occipital condyle and Opisthion

4. Distance between opisthion and posterior tip of occipital condyle: With the help of vernier calliper maximum distance was noted by posterior margin of midpoint of foramen magnum (Opisthion) to posterior tip of right occipital condyle and left occipital condyle (Figure 5).

Results

The results obtained from the present study are shown in Table 1. The mean distance between occipital condyle and basion measured were found to be 10.51mm (right) and 11.43 mm (left) for the anterior tip, 26.91mm (right) and 27.85 mm (left) for

Table 1: Comparison of Right and Left side of occipital condylar Parameters

S. No.	Parameters	Right		Left		P value	Significance (unpaired 't' test)
		Mean	SD	Mean	SD		
1.	Distance between anterior tip of occipital condyle and basion	10.51	2.0	11.43	1.74	0.0001	Significant
2.	Distance between posterior tip of occipital condyle and basion	26.91	3.17	27.85	4.0	0.0011	Not Significant
3.	Distance between anterior tip of occipital condyle and opisthion	38.97	3.44	39.05	3.0	0.7358	Not Significant
4.	Distance between posterior tip of occipital condyle and opisthion	27.81	2.44	26.98	2.48	0.0009	Significant

O.C = occipital condyle, Rt = right, Lt = left, ATOC-B=Anterior tip of occipital condyle and Basion, PTOC-B=Posterior tip of occipital condyle and Basion, ATOC-O=Anterior tip of occipital condyle and Opisthion, PTOC-B=Posterior tip of occipital condyle and Opisthion, S.D = standard deviation.

Table 2: Comparison between others studies

Sr. No	Parameter		Mustafa Bozbuga et al (1999)	Naderi et al. (2004)	Fathy Ahmed (2006)	Avci (2011)	Ozer MA et al (2011)	Ajay Rathva (2014)	Present study
1.	Distance between anterior tip of O.C and basion (ATOC-B)	R	14.4	10.5	11.1	9.9	12.6	10.1	10.51
		L	13.7	11.1	11.3	10.0	10.0	11.0	11.43
2.	Distance between posterior tip of O.Cand basion (PTOC-B)	R	-	27.5	27.38	-	29.4	28.5	26.91
		L	-	28.1	27.97	-	29.5	27.1	27.85
3.	Distance between anterior tip of O.Cand opisthion (ATOC-O)	R	-	38.9	39.9	-	41.4	35.9	38.97
		L	-	39.1	40.1	-	39.7	34.1	39.05
4.	Distance between posterior tip of O.Cand opisthion (PTOC-O)	R	24.3	26.7	27.87	26.6	29.0	26.5	27.81
		L	24.7	26.2	27.94	27.1	30.0	26.1	26.98

O.C = occipital condyle, R = right, L = left ATOC-B=Anterior tip of occipital condyle and Basion, PTOC-B=Posterior tip of occipital condyle and Basion, ATOC-O=Anterior tip of occipital condyle and Opisthion, PTOC-O =Posterior tip of occipital condyle and Opisthion.

the posterior tip and The mean distance between occipital condyle and opisthion measured were found to be 38.97 mm (right) and 39.05mm (left) for the anterior tip, 27.81 mm (right) and 26.98mm (left) for the posterior tip.

There were no significant differences for the measured parameters between the right and left sides.

Discussion

The occipital condyles of the skull articulate with the superior articular facets of the atlas vertebra and form an important junction between the cranium and the vertebral column thus forming the atlanto-occipital joint [8].

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 clinically [4].

The surgical treatment for any space-occupying lesion is usually performed at the level of the foramen magnum, through a ventral or dorsal approach [4]. Most of the surgical approaches, such as the lateral transjugular approach, transtuberular approach and transcondylar approach, require resection of the condyles [1,5]. Understandably, surgical resection of the occipital condyles requires thorough anatomical knowledge for preoperative planning.

In the present study the mean Distance between anterior tip of O.C and basion were found to be mean of 10.51±2.0mm on right and 11.43 ±1.74mm on left sides respectively. This measured Distance between ATOC-B comparable to what was found by S. Naderiet al [4]. Who reported the Distance ATOC-B to be 10.5mm on right and 11.1mm on left respectively. Similarly the study carried out by Fathy Ahmed [9] who reported the Distance ATOC-B to be 11.1mm on right and 11.3mm on left respectively.

The mean Distance between posterior tip of O. C and basion was found to be 26.91±3.17mm on right and 27.85±4.0mm on left sides respectively. This measured Distance between PTOC-B comparable with the results obtained by Fathy Ahmed [9] who reported the OCPT-B as 27.38mm on right and 27.98mm on left. But differ from the results obtained by Naderiet al [4] also reported the PTOC-B as 27.5mm on right and 28.1mm respectively on left side.

The Distance between anterior tip of O.C and

opisthion was found to mean of 38.97±3.44mm on right and 39.05±3.0mm on left sides respectively. This measured distance between ATOC-O is approximate to the result obtained by Naderiet al [4]. Who reported the ATOC-O as 38.9mm on right and 39.1 mm on left sides respectively.

The Distance between Posterior tip of O.C and opisthion were found to be 27.81± 2.44mm on right and 26.98±2.48mm on left sides respectively. These measured distances are comparable to the results obtained by Naderiet al [4]. Who reported these distances as 26.7mm on right and 26.2mm on left sides respectively and away from the results obtained by Mustafa Bozbuga et al [6] who reported them as 24.3mm on right and 24.7mm on left sides respectively. The above said parameters will be helpful in interpreting the neurological investigative procedures and also in planning surgical interventions involving the skull base.

Conclusion

In the present study an effort was made to measure various parameters related to occipital condyle. These parameters should be taken into consideration during posterior and lateral approaches to the craniovertebral junction by neurosurgeons and orthopaedicians. Understandably, surgical resection of the occipital condyles requires thorough anatomical knowledge for preoperative planning.

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