

Morphometric Analysis of Intracranial Clivus in South Indian Skulls

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ABSTRACT

The clivus is a bony part of the cranium at the skull base, a shallow depression behind the dorsum sellae that slopes obliquely backward and downwards to the foramen magnum. It forms a gradual sloping process at the anterior most portion of the basilar occipital bone at its junction with the sphenoid bone. On axial planes, it sits just posterior to the sphenoid sinuses. The pons and medulla lie on the clivus. The aim of this study was to morphometrically analyse the significance of the inner surface of the clivus in the South Indian skulls, The study was done in 30 unsexed South Indian dry cranial cavities from the Department of Anatomy, Saveetha Dental College and Hospitals. The length and breadth of the internal surface of the clivus was measured using a vernier caliper and the angle was measured with the help of a goniometer. From our study the average breadth of the clivus was 24.05 ± 1.23 mm, average length was found to be 35.30 ± 3.24 mm and the average angle made by the clivus to the base of the skull was $38.15^\circ \pm 2.54^\circ$. Our morphometric analysis of length, breadth and the angle formed may provide useful anatomical, anthropometrical, and surgical data of clivus for the surgeons in planning surgeries on the skull base as many important neurovascular structures are present in this region.

Key words: Clivus, Intracranial clivus length, Intracranialclivus breadth, Basiocciput, Basisphenoid

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INTRODUCTION

The clivus is a bony component present in the cranium of the skull base, a shallow depression behind the dorsum sellae which slopes obliquely towards backward and downwards to foramen magnum [1]. It forms a gradual sloping process at the anterior most portion of the membrane bone at its junction with the sphenoid [2]. On axial planes, it sits just posterior to the sphenoid air sinuses, the pons and medulla sit on the clivus along with the basilar artery and basilar plexus of vein [3]. The clivus may be an important landmark for checking for anatomical atlanto-occipital alignment; the clivus, when viewed on a lateral Cervical spine X-ray, forms a line which, if extended, is believed to be Wackenheim'sclivus line. Just lateral to the clivus bilaterally is the foramen lacerum, the clivus forms the central

skull base. It is formed by the synostosis of the basisphenoid and basioccipital [4].

During early development, the axial sclerotomes of the first somites are integrated into the skull base to create the basioccipital part of the clivus [4]. Neurenteric cysts of the clivus are uncommon developmental lesions that occur as a result of notochordaldysgenesis during embryonic development, they typically occur within the posterior fossa, occurring typically midline anterior to the brainstem or within the cerebellopontine angle [5,6]. Clival tumors are rare tumors that arise within the clivus, several bones at the underside of the skull between the occipital and sphenoid bones [7]. This area is surrounded by essential structures and nerves of the brainstem and important arteries, just like the internal carotid arteries and basilar arteries [7,8]. For several decades neurosurgeons are challenged by lesions of skull base especially involving the clivus as various neurovascular structures are related to this complex anatomical region It is important to know

the precise morphometry of the skull base to facilitate surgical approaches and neurosurgical operations in this area.

With a rich case bank established over 3 decades we have been able to publish extensively in our domain [9-19]. Based on this inspiration we aim to morphometrically analyse the significance of the inner surface of the clivus in the South Indian skulls, we measured length and breadth in mm and also measured the angle formed by the clivus to the skull base.

MATERIALS AND METHODS

The study was done in 30 unsexed South Indian dry cranial cavities from the Department of Anatomy, Saveetha Dental College and Hospitals. The length and breadth of the internal surface of the clivus was measured using a vernier caliper and the angle of the clivus was measured with the help of a goniometer (Figure 1). Length was measured from the top of the Clivus till the anterior margin of foramen magnum and breadth was measured from one side to another side at the top of the clivus. All measurements were tabulated and statistically analysed.

RESULTS AND DISCUSSION

Range and average measurements of length, breadth, and angle of clivus are mentioned in Table 1.

Table 1: Range and average measurements of length, breadth, and angle of clivus.

	Range	Average
Breadth in mm	22-31	24.05 ± 1.23
Length in mm	29-45	35.30 ± 3.24
Angle in Degree	31°-47°	38.15° ± 2.54°



Figure 1: Measurement of angle of the clivus using goniometer.

From our study the average breadth of clivus was 24.05 ± 1.23 mm, average length was found to be 35.30 ± 3.24 mm and the average angle made by clivus to the base of skull was $38.15^\circ \pm 2.54^\circ$. In the study done by Ji et al. the average clival length, the widest and narrowest breadth of the clivus were 26, 33 and 19 mm, respectively [20]. The clivus lies at an angle of 45° from the vertical which is higher than the average angle 38.15° from our study [21]. It is clear from the study that Clivus in most of the skulls are approximately of the same range, the parameters obtained in the present study will be helpful for anyone contemplating the use of clival screws. Lot of especially important neurovascular structures and cranial nerves are related to the inner aspect of the clivus; hence surgeons need to be overly cautious not to damage any of these structures during any surgical procedures in this area.

CONCLUSION

Our morphometric analysis of length, breadth and the angle formed may provide useful anatomical, anthropometrical, and surgical data of clivus for the surgeons in planning surgeries on the skull base as many important neurovascular structures are present in this region.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest in the present study.

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