

MORPHOMETRY OF ANTERIOR CLINOID PROCESS: A CADAVERIC STUDY

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ABSTRACT

Introduction: Surgeries in the paraclinoid region for the clinoid segment of internal carotid artery, periclinoid tumours, lesions of anterior part of cavernous sinus and traumatic optic neuropathy require the removal of anterior clinoid process to increase the accessibility to the important structures in the region. Anterior clinoidectomy is a critical and important procedure and requires utmost knowledge of the morphometry of anterior clinoid process. So, this study was undertaken to record the morphometry of anterior clinoid process (ACP).

Materials and Methods: Fifty formalin-fixed cadavers were utilized from a medical college in Mumbai, Maharashtra. The measurements were done bilaterally after removal of the brain and meticulous dissection of cranial fossae was done to reflect the duramater, nerves, vessels and other structures from the field of measurement.

Results: The mean distance between the tip of ACP and medial margin of the optic canal on the right side was 11.5 mm and on the left side was 11.6 mm; the mean distance between the tip of ACP and lateral margin of the optic canal on the right side was 5.4 mm and on the left side was 5.4 mm; the mean distance between medial margin of the optic canal and the lateral edge of ACP on the right side was 14.3 mm and on the left side was 14.2 mm; the mean distance between the lateral margin of the optic canal and the lateral edge of ACP on the right side was 3.3 mm and on the left side was 3.4 mm; the mean distance between the tip of ACP and the tip of posterior clinoid process (PCP) on the right side was 4.2 mm and on the left side was 4.3 mm; the mean distance between the tips of ACP was 22.8 mm; the mean distance between the ACPs at the level of lateral margin of the optic canal was 23.9 mm; the mean distance between the ACPs at the level of medial margin of the optic canal was 12.3 mm and mean vertical dimension of the ACP at the level of lateral margin of optic canal was 2.4 mm. **Conclusion:** The findings of the present study will help the surgeons in surgeries of the cavernous sinus and paraclinoid region requiring anterior clinoidectomy.

KEY WORDS: Anterior Clinoid Process, Anterior Clinoidectomy, Cavernous Sinus, Internal Carotid Artery.

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INTRODUCTION

The central region of the middle cranial fossa and cavernous sinus are difficult to access even though there have been surgical and radiological advancements. The structures in this region are surrounded by bony projections called the anterior, middle and posterior clinoid processes. The projecting part of the medial end of lesser wing is the anterior clinoid process. It is continuous with the sphenoid bone at three points, the base, the anterior root and the posterior root (optic strut). The anterior root and the posterior root form the roof and floor of the optic canal whereas the base binds the canal laterally. The anterior clinoid process is related to the anterior part of cavernous sinus covering it superiorly. The internal carotid artery segment between the upper and lower dural rings, which is visible on removal of anterior clinoid process (ACP) is called the clinoid segment of internal carotid artery (ICA) [1,2].

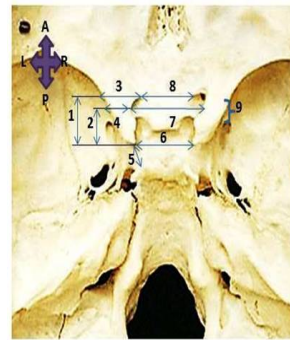
The removal of anterior clinoid process is required for better exposure of the paraclinoid region in surgeries of aneurysm of ICA (clinoid segment), lesions of cavernous sinus in its anterior part, tumours of paraclinoid region and optico-carotid triangle, lesions of orbital apex and optic nerve [3-5].

Therefore, the present study focuses on the measurements in relation to ACP to provide metric data which will be helpful for surgical procedures in the region.

MATERIALS AND METHODS

Fifty skulls were harvested from formalin-fixed cadavers from a medical college in Western Maharashtra. The skull caps were removed followed by the removal of the brain. The duramater was meticulously dissected along with the structures passing through the fissures, foramina and canals. The anterior clinoid process was exposed completely. The measurements were done with the help of a divider and a measuring scale. The parameters (Fig. 1) measured were the distance (i) between the tip of anterior clinoid process and medial margin of the optic canal, (ii) between the tip of anterior clinoid process and lateral margin of the optic canal, (iii) between the medial margin of the optic canal and lateral

Fig. 1: photograph representing the parameters measured.



1.	Tip of the ACP and medial margin of the OC
2.	Tip of the ACP and lateral margin of the OC
3.	Medial margin of the OC and lateral edge of the ACP
4.	Lateral margin of the OC and lateral edge of the ACP
5.	Tip of the ACP and tip of the PCP
6.	Tips of ACPs
7.	ACP at the level of lateral margin of the OC
8.	ACP at the level of medial margin of the OC
9.	Vertical dimension of the ACP at the level of lateral margin of OC

ACP: Anterior clinoid process, PCP: posterior clinoid process, OC: Optic canal

Fig. 2: Showing the measurement of distance between the lateral margin of the optic canal and lateral edge of the anterior clinoid processes.

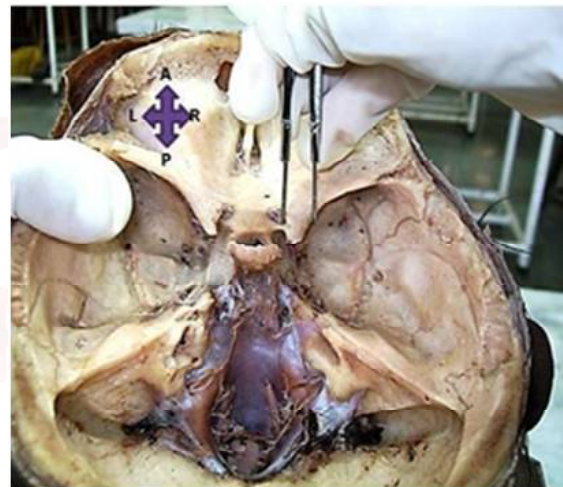
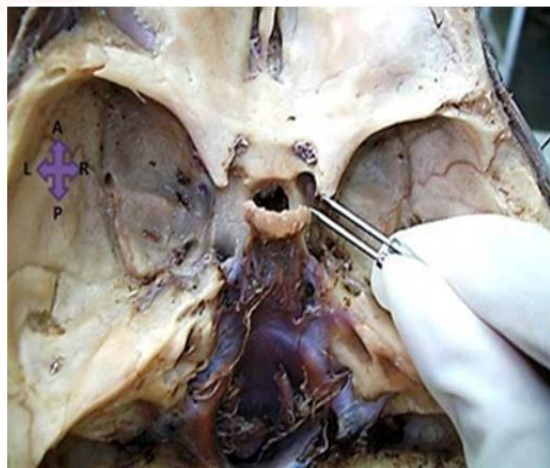


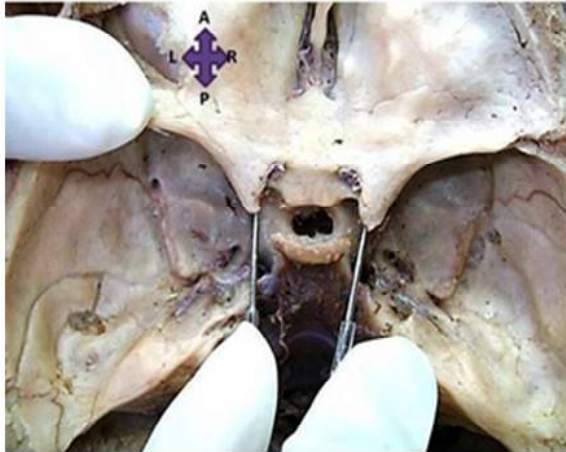
Fig. 3: Showing the measurement of distance between the tips of the anterior clinoid processes and the tip of the posterior clinoid process.



edge of anterior clinoid process, (iv) between the lateral margin of the optic canal and lateral edge of the anterior clinoid process (fig. 2), (v) between the tip of the anterior clinoid process and the tip of the posterior clinoid process (fig. 3), (vi) between the tips of the anterior clinoid processes (Fig. 4), (vii) between the anterior clinoid processes at the level of lateral

margin of the optic canal, (viii) between the anterior clinoid processes at the level of medial margin of the optic canal, and (ix) the vertical dimension of the anterior clinoid processes at the level of the lateral margin of the optic canal. The data were statistically analysed by calculating the mean, range and standard deviation.

Fig. 4: Showing the measurement of distance between the tips of the anterior clinoid processes.



RESULTS

There were no significant differences found in the right and left side measurements. The results are tabulated in table 1 & 2.

Table 1: Measurements of the anterior clinoid process.

Sr. no.	Parameters	Range (mm)		Mean (mm) ± S.D.	
		Right	left	Right	left
1.	Tip of the ACP and medial margin of the OC	06-16	06-15	11.5±2.2	11.6±2.1
2	Tip of the ACP and lateral margin of the OC	01-13	02-13	5.4±2.2	5.4±2.1
3	Medial margin of the OC and lateral edge of the ACP	12-18	11-18	14.3±1.5	14.2±1.5
4	Lateral margin of the OC and lateral edge of the ACP	02-07	02-07	3.3±1.3	3.4±1.3
5	Vertical dimension of the ACP at the level of lateral margin of OC	01-05	01-05	2.4±1	2.4±1

ACP- Anterior clinoid process, OC- Optic canal

Table 2: Measurements of the distances between anterior clinoid processes and anterior clinoid processes & posterior clinoid process.

Sr. no.	Parameters	Range (mm)		Mean(mm) ± S.D.	
		Right	left	Right	left
1	Tip of the ACP and tip of the PCP	01-09	01-09	4.2±2	4.3±2.1
2	Tips of ACPs	20-27		22.9±1.3	
3	ACP at the level of lateral margin of the OC	19-29		23.9±1.5	
4	ACP at the level of medial margin of the OC	07-16		12.3±1.5	

PCP- Posterior clinoid process, OC- Optic canal

DISCUSSION

The anterior clinoid process covers the anterior part of cavernous sinus. The exposure of the antero-superior aspect the cavernous sinus and the visualization of clinoid segment of ICA and optic nerve and access to optico carotid triangle improves significantly after anterior clinoidectomy [3-6].

So the morphometry of anterior clinoid process is very important to get adequate exposure for the surgical intervention in this area and to prevent intraoperative and postoperative complications.

Inoue et al. in their study measured the antero-posterior length of the anterior clinoid process at various levels in fifty dry human skulls and found the distance between the tip of anterior clinoid process and the medial margin of the optic canal was in the range of 6.5-16.0 mm with an average of 10.9 mm, the distance between the tip of anterior clinoid process and the lateral margin of the optic canal was in the range of 1.1-10.2 mm with an average of 5.4 mm. They had also found the distance between the medial margin of the optic canal and the lateral edge of anterior clinoid process was in the range of 12.0-19.5 mm with an average of 15.2 mm, and the distance between the lateral margin of the optic canal and the lateral edge of anterior clinoid process was in the range of 2.2-8.0 mm with an average of 5.1 mm. The vertical dimension of the anterior clinoid process at the level of the lateral margin of the optic canal was in the range of 1.0-6.1 mm with an average of 3.9 mm [7].

In the present study, it was found that the distance between the tip of anterior clinoid process and the medial margin of the optic canal was in the range of 6-16 mm with an average of 11.5 mm and the distance between the tip of the anterior clinoid process and the lateral margin of the optic canal was in the range of 1-13 mm with an average of 5.4 mm. It was also found that the distance between the medial margin of the optic canal and the lateral edge of the anterior clinoid process was in the range of 11-18 mm with an average of 14.2 mm and the distance between the lateral margin of the optic canal and the lateral edge of the ante-

rior clinoid process was in the range of 2-7 mm with an average of 3.4 mm.

Inoue et al. also measured the distances between the clinoid processes and found that the distance between the tip of anterior clinoid process and the tip of posterior clinoid process was in the range of 0.0-10.5 mm with an average of 5.3 mm, the distance between the tip of anterior clinoid processes was in the range of 18.0-28.0 mm with an average of 22.3 mm, the distance between the anterior clinoid processes at the level of the lateral margin of the optic canal was in the range of 18.2-30.4 mm with an average of 24.3 mm, the distance between the anterior clinoid processes at the level of the medial margin of the optic canal was in the range of 5.0-17.0 mm with an average of 11.0mm [7].

Dalgic et al. studied fifty cavernous sinuses in twenty-five formalin-fixed tissue blocks and found the distance between the tip of anterior clinoid process and the tip of posterior clinoid process in the range of 4.83-8.77 mm with an average of 6.80 mm and the distance between the tip of anterior clinoid processes in the range of 19.67-24.41 mm with an average of 22.04 mm [8].

In the present study, the distances between the clinoid processes were measured and found that the distance between the tip of anterior clinoid process and the tip of posterior clinoid process was in the range of 1-9 mm with an average of 4.3mm, the distance between the tip of anterior clinoid processes was in the range of 20-27 mm with an average of 22.8 mm, the distance between the anterior clinoid processes at the level of the lateral margin of the optic canal was in the range of 19-29 mm with an average of 23.9 mm, the distance between the anterior clinoid processes at the level of medial margin of the optic canal was in the range of 7-16 mm with an average of 12.3 mm. Vertical dimension of the anterior clinoid process at the level of the lateral margin of the optic canal was in the range of 1-5 mm with an average of 2.4 mm. Also, the anterior clinoid process shows many variations like ossification of ligaments, pneumatisation and canalization by venous channels. So it is advisable to do preoperative radiological evaluation [2,4,9].

In the present study, the measurements were done in embalmed cadavers, whereas the referred studies were conducted on dry bones. Hence it is expected that some difference in the measurements will be there because of the drying of bones.

CONCLUSION

Anterior clinoidectomy is a critical procedure in approaching the paraclinoid region for surgical interventions and requires a thorough knowledge of the region specifically the morphometry of anterior clinoid process. Thus, the findings of the present study shall help the surgeons in operations of the region requiring anterior clinoidectomy.

Abbreviations:

ACP- Anterior Clinoid Process

ICA- Internal Carotid Artery

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Conflicts of Interests: None

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