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Original Research Article

MORPHOMETRIC ANALYSIS OF THE ANTERIOR CLINOID PROCESS OF SPHENOID WITH ITS CLINICAL IMPLICATIONS IN NEUROSURGERIES

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ABSTRACT

Introduction: Anterior clinoidectomy is a surgical removal of the anterior clinoid process which is widely used to increase the clinoid space for the treatment of internal carotid artery or ophthalmic artery aneurysms, tumors of this region, and cavernous sinus pathology. Morphometric analysis of the anterior clinoid process would help the neurosurgeons while performing extradural or intradural anterior clinoidectomy.

Materials and Methods: The present study was consisting of 100 anterior clinoid processes in 50 adult human skulls of South Indian origin. The skull caps were removed and the skulls with damage or pathology near the sella turcica and anterior clinoid process were excluded from the study. All the parameters were measured by using digital vernier calipers and the measurements were recorded.

Results and Discussion: The mean distance between the tips of the right and the left anterior clinoid processes, the medial margins of the right and the left optic canals, the lateral margins of the right and the left optic canals were 23.93 ± 1.69mm, 13.58 ± 2.15mm, and 19.75 ± 2.77mm respectively. There was no significant difference between the right and the left sides with respect to the distance from the tip of the anterior clinoid process to the medial margin of the optic canal, the distance from the tip of anterior clinoid process to the lateral margin of the optic canals, the distance from the medial margin of the optic canal to the lateral edge of the anterior clinoid process, the distance from the lateral margin of the optic canal to the lateral edge of the anterior clinoid process and the vertical dimension of the anterior clinoid process.

Conclusion: The knowledge on the morphometry of the anterior clinoid process gives guidance to the neurosurgeons while performing intra or extradural anterior clinoidectomy for various clinical conditions such as internal carotid artery or ophthalmic artery aneurysms, neoplasms of this region and also useful to the approach the optic nerve, cavernous sinus, clinoidal space and apex of orbit

KEY WORDS: Anterior clinoid process, Internal carotid artery, Aneurysms, Sphenoid, Anterior clinoidectomy.

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INTRODUCTION

The anterior clinoid process (ACP) is an extension of the medial end of the lesser wing of sphenoid. The lesser wing of sphenoid bone is joined to the body of the sphenoid by two roots which are separated by the optic canal. Carotico clinoid ligament extends from the ACP to the middle clinoid process of sphenoid [1]. Clinically the ACP is a bony landmark to distinguish between para clinoid aneurysms and cavernous sinus aneurysms [2,3].

The Anterior clinoidectomy is a surgical removal of the ACP which is a difficult surgical procedure for a variety of conditions such as para sellar, proximal carotid, and central skull base pathologies. The anterior clinoidectomy can be classified into intradural or extradural techniques. Recently a hybrid method is introduced [4]. Intradural anterior clinoidectomy was introduced six decades ago, Later on, the extradural anterior cliniodectomy was introduced [5-7]. The intradural clinoidectomy is advantageous in clipping of ophthalmic aneurysms where the bone removal can be tailored based on the pathology and also the anterior clinoidectomy can be done under careful monitoring of an aneurysm to prevent manipulations that would place an aneurysm at risk of intraoperative rupture. Extradural clinoidectomy is preferred in the removal of the medial end of the lesser wing of sphenoid meningiomas where the bony removal would be aggressive and which facilitates devascularization of the tumor and finally enhance gross tumor removal. The hybrid method can be used under both circumstances mentioned above [4].

The ACP extends backward and covers the anterior part of the cavernous sinus. Anterior clinoidectomy allows exposing the antero superior aspect of the cavernous sinus by which the clinoid segment of ICA and optic nerve could be visualized [2,8,9]. The knowledge on the morphometry of ACP is very much essential as the anterior clinoidectomy is performed in the radical removal of the suprasellar, para sellar tumors and treatment of internal carotid, ophthalmic, upper basilar arteries aneurysms and cavernous sinus pathologies [10,11]. Thus the morphometry of anterior clinoid process is very important to get adequate exposure of the clinoid and cavernous regions to perform surgical procedures with minimal complications.

MATERIALS AND METHODS

Fig. 1: Showing the distance between the tips of two ACPs (i), the distance between the two LMOCs (ii) and the distance between the two MMOCs (iii).

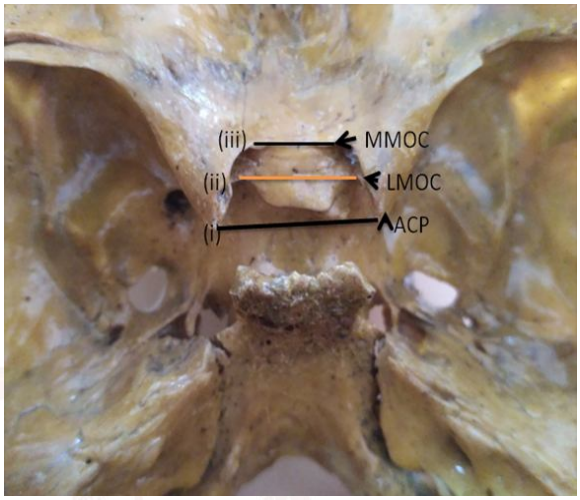


Fig. 2: Showing the distance from the tip ACP to the MMOC (iv) and the distance from the tip of ACP to the LMOC (v).

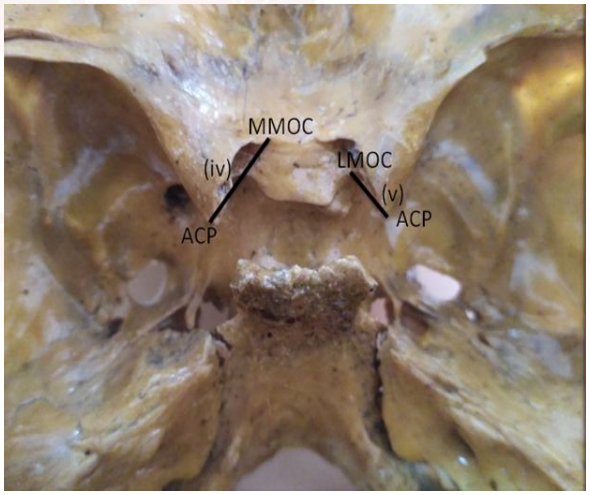
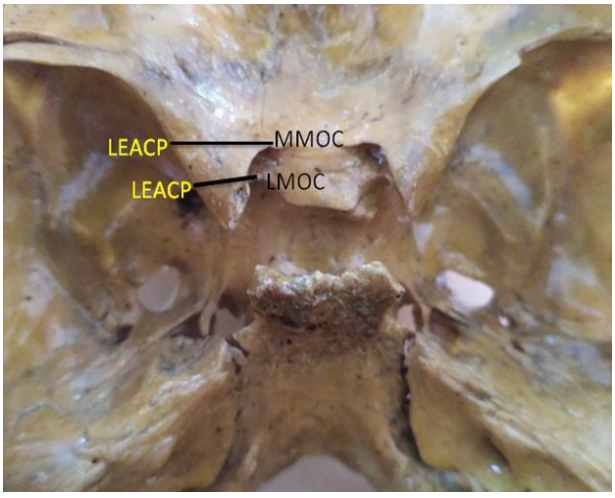


Fig. 3: Showing the distance from MMOC to LEACP and the distance from the LMOC to LEACP.

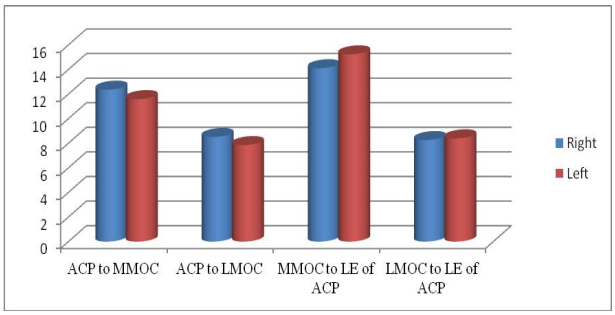


It was a cross-sectional morphometric study consisting of 100 anterior clinoid processes in 50 adult human skulls of South Indian origin. The skull caps were removed and the skulls with damage or pathology near the sella turcica and ACP were excluded from the study. The following parameters were measured by using digital vernier calipers: (i) The distance between the tips of right and left anterior clinoid processes (ACPs) (ii) The distance between the lateral margins of right and left optic canals (LMOCs), (iii) The distance between the medial margins of right and left optic canals (MMOCs), (vi) The distance from the tip ACP to medial margin of optic canal (MMOC) on right and left sides separately, (v) The distance from the tip of ACP to lateral margin of optic canals (LMOC) on right and left sides separately, (vi) The distance from MMOC to lateral edge of ACP (LEACP), (vii) The distance from the LMOC to lateral edge of ACP and (viii) the vertical dimension of ACP at the level of LMOC (Figure 1,2 & 3).

RESULTS

The mean distance between the tips of right and left anterior clinoid processes was 23.93 ± 1.69mm. The mean distance between the medial margins of right and left optic canals was 13.58 ± 2.15mm. The mean distance between the lateral margins of right and left optic canals was 19.75 ± 2.77mm. The mean distance from the tip ACP to the medial margin of the optic canal (MMOC) on the right side was 12.36 ± 1.60mm and on the left side was 11.59 ± 1.44mm. The mean distance from the tip of ACP to the lateral margin of optic canals (LMOP) on the right and left sides were 8.51 ±.68mm and 7.85 ± 1.51mm respectively. The mean distance from medial margin of the optic canal to the lateral edge (LE) of ACP on the right and the left sides was 14.10 ± 1.55mm and 15.23 ± 1.86mm respectively. The mean distance from the lateral margin of the optic canal to the lateral edge (LE) of ACP on right and left sides was 8.26 ± 1.36mm and 8.40 ± 1.19mm respectively. The mean vertical dimension of ACP at the level of lateral margin of the optic canal on the right and the left sides was 6.64 ± 1.20mm and 6.65 ± 1.17mm respectively. The level of significance was determined by using student "t" test and found that there was no significant difference between the right and left sides as the p value was more than 0.05 (Figure 4).

Fig. 4: Bar diagram showing the differences between right and left sides in all parameters.



DISCUSSION

Anterior clinoidectomy allows exposure of structures in and around the optic nerve, internal carotid artery, cavernous sinus, optic canal, clinoidal space and orbital apex. It also makes the intracranial part of the internal carotid artery and optic nerve mobilization possible with minimal brain retraction [7,12-14]. Several studies on the morphometry of the ACP were concentrated on the length and width of the ACP. Lee et al. had found the mean ACP length and width as 9.18±1.55 and 9.63±1.49 mm, respectively the Korean skulls [15]. In the present study instead of the length and width of the ACP other parameters were considered which would be very much helpful while performing anterior clinoidectomy.

In the present study, the distance between the tips of the ACPs and the distance between the medial margins of optic canals and the distance between the tips of lateral margins of the optic canals were measured and compared with other studies. The distance between the tips of ACPs and the distance between the medial margins of optic canals were little longer than the other studies but the distance between the lateral margins of the optic canals was shorter than the other studies. The mean distance between the tips anterior clinoid processes was 23.93 ± 1.69mm which was similar but little longer than the other studies by Mangesh Lone et al., Inoue et al., and Dalgic et al., where they reported it as 22.8mm, 22.3mm, and 22.4mm respectively [16-18]. The mean distance between the medial margins of right and left optic canals in the present study was reported as 13.58 ± 2.15mm which was little longer than the studies by

Mangesh Lone et al and Inoue et al., where they have reported it as 12.3 and 11.0mm respectively. The mean distance between the lateral margins of right and left optic canals was 19.75 ± 2.77mm which was shorter that the studies of Mangesh Lone et al., and Inoue et al., where it was 23.9 and 24.3mm respectively p16,17].

In the present study the distance from the tip ACP to medial margin of optic canal, the distance from the tip of ACP to lateral margin of optic canals, the distance from medial margin of optic canal to lateral edge of ACP, the distance from the lateral margin of optic canal to lateral edge of ACP and the vertical dimension of ACP at the level of lateral margin of optic canal were also measured and compared with other studies. The mean distance from the tip ACP to the medial margin of the optic canal (MMOC) on the right and the left sides were observed as 12.36 ± 1.60mm and 11.59 ± 1.44mm respectively, which was coinciding with Mangesh Lone et al., where he reported it as 11.5mm on right side and 11.6mm on left side. Inoue et al., reported it as 10.9mm which was smaller than the above two studies [16,17]. The mean distance from the tip of ACP to the lateral margin of optic canals (LMOP) on the right and left sides were observed as 8.51 ±.68mm and 7.85 ± 1.51mm respectively, which is much larger than the study by Mangesh Lone et al., where it was 54mm in both sides. The mean distance from medial margin of the optic canal to the lateral edge (LE) of ACP on the right and the left sides was 14.10 ± 1.55mm and 15.23 ± 1.86mm respectively. This was similar to the study by Mangesh Lone et al., and Inoue et al where it was 14.3mm and 15.2mm respectively. The mean distance from the lateral margin of the optic canal to the lateral edge (LE) of ACP on right and left sides was 8.26 ± 1.36mm and 8.40 ± 1.19mm respectively, which is larger than the Mangesh Lone and Inoue et al., where it was 3.34 and 5.1mm respectively. The mean vertical dimension of ACP at the level of lateral margin of the optic canal on the right and the left sides was 6.64 ± 1.20mm and 6.65 ± 1.17mm respectively which is thicker than the Mangesh Lone et al., and Inoue et al., where it was 2.4 and 3.9mm respectively [16,17].

The present study was carried out on the dry skulls whereas the Mangesh Lone et al was conducted study on the cadavers, this may be the reason for the differences in the measurements.

CONCLUSION

The data provided in the present study would be of a guidance to the neurosurgeons while performing intra or extradural anterior clinoidectomy for various clinical conditions such as internal carotid artery or ophthalmic artery aneurysms, neoplasms of this region and also useful to the approach of the optic nerve, cavernous sinus, clinoidal space and apex of orbit. The CT scan measurements of the anterior clinoid process would be suggested preoperatively to minimize the complications.

Conflicts of Interests: **None**

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