

Morphometric Study Of Anterior Clinoid Process And Its Clinical Importance In Skulls Of South Indian Population

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Abstract

The medial end of the lesser wing of sphenoid forms the anterior clinoid process which gives attachment to tentorium cerebelli, it is sometimes joined with the middle clinoid process with a spicule of bone and forms carotidoclinoid foramen. This study is done to obtain the knowledge of morphometry of the anterior clinoid process which is important for neurosurgeons in approaching the lesions of this area.

The length of ACP, the width of ACP, and the distance of ACP from its tip to OS were measured from the right and left sides of 31 skulls (out of which 25 were males and 6 were females) using digital calipers.

In the case of the male's length in left side is more than the right side with $p < 0.001$, Where as width does not differ between the left and right sides with $p > 0.05$, Distance between ACP & OS was more significant than the right side with p -value $p < 0.001$. presence of carotid clinoid foramen was observed out of 11 carotidoclinoid foramen (N=9) were of incomplete form (most common), (N=1) contact form and (N=1) was of complete form.

The knowledge of the morphology of ACP & CCF allows better surgical results and minimizes surgical morbidity.

Keywords: Anterior clinoid process(ACP), cavernous sinus, Optic strut(OS).

INTRODUCTION:

The anterior clinoid process(ACP) forms the projecting tubercle from the medial end of the lesser wing of sphenoid and is connected to the body of sphenoid bone (basisphenoid bone) by superior and inferior roots. The superior root is flat and forms the roof of optic canal and continues as the planum sphenoidale. The inferior root (optic strut) forms the lateral and ventral walls of the optic canal and connects the lesser sphenoid wing with the basisphenoid bone(1).

The anterior clinoid process(ACP) provides attachment to the free margin of tentorium cerebelli and is grooved medially by the internal carotid artery.

Sella turcica consists of tuberculum sellae, hypophyseal fossa, and dorsum sellae, On each side, the tuberculum sellae presents a small projection, middle clinoid process(MCP). In the middle cranial fossa, Fibrous ligament connects the clinoid process of the sphenoid bone. Ossification spreads along these ligaments to form bony bars thus fibrous ligament connecting anterior and middle clinoid processes carotidoclinoid ligament ossifies to form carotidoclinoid foramen(2).

Removal of ACP facilitates radical removal of tumors or radical neck clipping of aneurysms in the supra and parasellar regions by providing a wide operative exposure of internal carotid artery, and optic nerve and reduces the need for brain retraction(3).

Neurosurgeons verify the dimensions and variations of anterior clinoid process and optic strut as they are often removed during the surgery of anterior part of cavernous sinus(4).

AIM:

The present study was done to obtain the knowledge about morphometry of anterior clinoid process which is pertinent in anterior clinoidectomy to prevent injury to adjacent neurovascular structures.

MATERIALS AND METHODS:

The study was done in the Department of Anatomy, K S Hegde Medical Academy Mangalore Karnataka. A total of 31 skulls were included in the study, out of 31 skulls 25 were of males and 6 were females skull. The skulls with damaged ACP were excluded from the study. Sexual dimorphism of the skulls was done based on criteria given by Walrath et al(5). The parameters were measured using digital calipers. Statistical analysis was done by using SPSS software version 17.

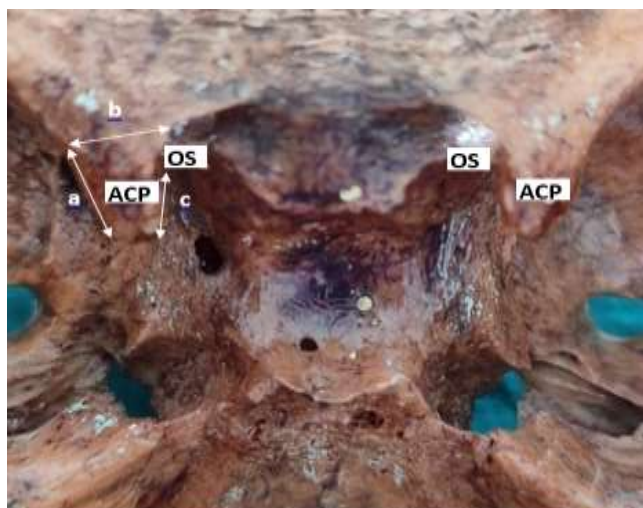


Fig 1: ACP=Anterior clinoid process, OS=optic strut.
a=length of ACP, b=breadth of ACP, c= distance from tip of ACP to OS

The anterior clinoid process was observed in the middle cranial fossa, The length of ACP was measured from its base to the tip and the width at its base was noted. The distance between the tip of ACP to optic strut (OS) was also measured and is shown in Table no 2 & 3.

Out of 31 skulls, ossification between clinoid process was observed, if carotid clinoid foramen is present it was classified according to criteria given by Keyes(6). As incomplete, contact form and complete form of carotid clinoid foramen. Table no 1.

RESULTS:

Out of 31 skulls 25 were of males and 6 females skull, the average length of ACP in males on right side was 12.14 mm and on the left side was measured about 13.29mm. The width of ACP in males was 10.81mm on right side and 11.01mm on the left side. The distance between ACP & OS was found to be 9.94mm on right side and 11.74mm on the left. The left and right side comparison was done using Paired t-test. [Table no 2].

In case of male's length in left side is more than the right side with $p < 0.001$, Where as width does not differ between left and right side with $p > 0.05$, Distance between ACP & OS was more significant than the right side with p value $p < 0.001$.

Male		Mean	Std. Deviation	P value
Length	Right	12.1360	1.68328	$P < 0.001$
	Left	13.2920	1.17253	
Width	Right	10.8056	1.31212	$p > 0.05$
	Left	11.0084	1.21032	
Distance	Right	9.9368	1.53711	$P < 0.001$
	Left	11.7412	1.67309	

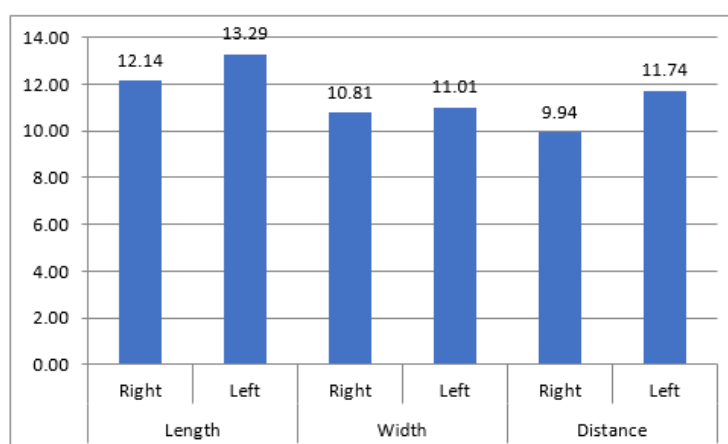


FIG 1: Shows the comparison between right and left side in case of males.

In case of females the average length of ACP on the right side was observed to be 11.72 and on left side it was found to be 11.57mm. The width of ACP on right side was observed to be 11.53mm on right side and 10.48mm on the left side. The average distance between ACP and OS was found to be 9.60mm on right side and 9.38 on left side [Table no 3].

Female		Mean	Std. Deviation	P value
Length	Right	11.7167	2.26560	p>0.05
	Left	11.5700	.91730	
Width	Right	11.5267	.82713	P<0.05
	Left	10.4817	1.24824	
Distance	Right	9.5967	.93275	p>0.05
	Left	9.3817	1.14087	

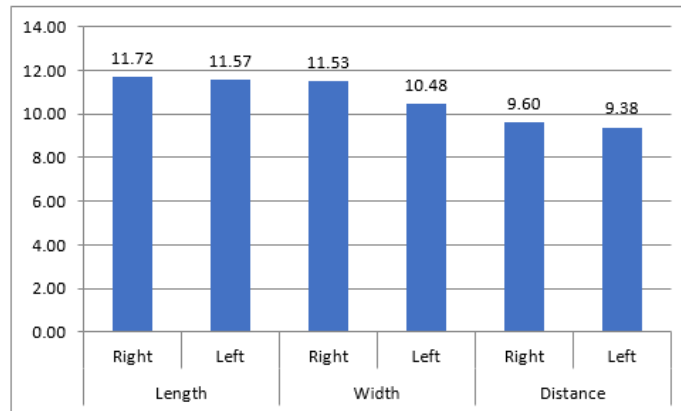


FIG 2: Shows the comparison between right and left side in case of Females

In females the length and distance between ACP & OS did not differ significantly on right and left side with p value $p>0.05$, where as width on right side was observed to be significantly more than left side with p value $p<0.05$.

Comparison between the male and female ACP parameters were done using an unpaired T test as shown in [Table no 4]/Fig 3.

	Gender		Mean	Std. Deviation	P value
Length	Right	Male	12.1360	1.68328	p>0.05
		Female	11.7167	2.26560	
	Left	Male	13.2920	1.17253	P<0.05
		Female	11.5700	.91730	
Breadth	Right	Male	10.8056	1.31212	p>0.05
		Female	11.5267	.82713	
	Left	Male	11.0084	1.21032	p>0.05
		Female	10.4817	1.24824	
Distance	Right	Male	9.9368	1.53711	p>0.05
		Female	9.5967	.93275	
	Left	Male	11.7412	1.67309	P<0.05
		Female	9.3817	1.14087	

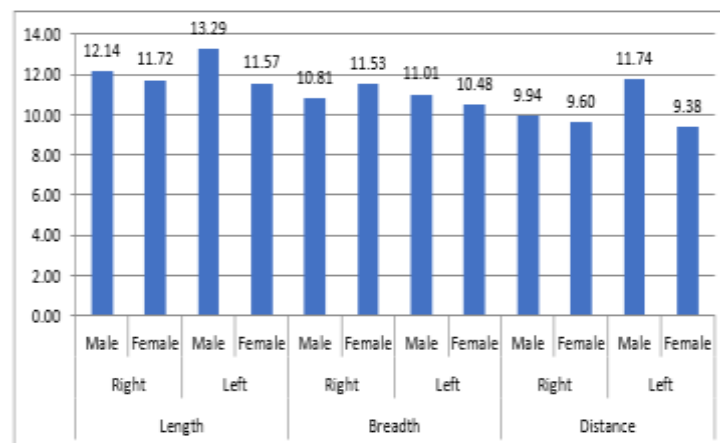


Fig 3: Shows the comparison between male and female skull

The length of ACP on right side did not show any significant difference in males and females, whereas length of ACP on left side was more in case of males than in females. Breadth of ACP did not show any significant difference in right and

left side in case of both males and females. The distance between ACP and OS was observed significantly more in case of males than females on left side, on right side the distance between the two did not show much difference in case of males and females.

Type of carotico-clinoid foramen	Male (n=25)		Female (n=6)	
	Left	Right	Left	Right
Incomplete	5	2	2	0
Contact	0	1	0	0
Complete	1	0	0	0

Table: 5 Shows the presence of carotid clinoid foramen, it was classified as incomplete, contact & complete form according to the criteria by keyes 1935(7).

DISCUSSION:

The sella turcica of the sphenoid bone is an important area due to its anatomical relation with the cavernous sinus and its contents (8). The superior approach of the cavernous sinus in radical removal of tumors and paraclinoid aneurysm, complete removal of ACP is an important step removing the ACP in the presence of any abnormality in the anatomical structure of ACP combined with a completely ossified may have high risk. The major risk is an injury to the ICA (9). Hence the study of the anterior clinoid process will be useful for surgeons in surgeries of the cavernous sinus and anterior clitoridectomy.

Gupta et al in his study observed that the length of ACP on right and left side was 11.1 ± 1.49 mm and 11.61 ± 2.07 mm (10). A study by Kapur et al stated that In case of males the average width of ACP was 9.4mm on the right side and 9.1 mm on the left side and the length was 9.9 and 9.3 mm in females the average width of ACP was 8.7mm on right and 8.3 mm left while the length was 9.3mm on right and 8.9mm on the left side(11).

A study done by Cheng et al on the Chinese population found the length of ACP to be 10.76 ± 1.87 mm, the thickness of ACP was found to be 3.14 ± 0.88 mm on the right side, and 3.02 ± 0.80 mm on the left side(12).

In a study done by ozdogmus et al in 100 carotidoclinoid foramina, the carotidoclinoid ligament was completely ossified on 18 sides and incomplete carotid clinoid foramen was seen on 55 sides, in this study the co relation of the dimensions of the carotid clinoid foramen and internal carotid artery showed no statistical significance. However, the bilateral carotid clinoid foramen was observed in 5 skulls(13).

Study by Priya et al on 100 dry skull bones observed bilateral complete foramina in 2%, incomplete foramina was seen bilaterally in 3% of cases and unilaterally in 4% of skulls(14).

A study done by Boyan et al on Turkish population found that the basal width of ACP at the medial margin of optic canal 12.4 ± 2.1 mm, from the tip of ACP(ACT) to the base of ACP 11.5 ± 1.9 mm, from ACT to posterior margin of OS(optic strut) 6.9 ± 1.6 mm, thickness of ACP 4.3 ± 1.2 mm. Out of 34 skulls examined 5.9% showed IOB(Interclinoid osseous bridge) either unilaterally or bilaterally(15).

In the present study morphometry of ACP was done comparing both sides which did not show any significant differences and the gender differences did not vary significantly, the knowledge of these measurements will help to reduce the mortality and morbidity during the surgical intervention of suprasellar region.

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