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## RESEARCH ARTICLE

## A STUDY ON ANATOMICAL VARIATIONS OF ANTERIOR CLINOID PROCESS AND CAROTICOCLINOID FORAMEN.

Harini. K<sup>1</sup>, Dr. Thenmozhi<sup>2</sup>.

1. First year BDS, Saveetha dental college and hospitals, Chennai, India.
2. HOD of Department of anatomy, Saveetha dental college and hospitals, Chennai, India.

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#### \*Corresponding Author

Harini. K.

### Abstract

**Topic:-** A study on anatomical variations of anterior clinoid process and caroticoclinoid foramen.

**Aim & objective:-** To conduct a study on anatomical variations of anterior clinoid process and caroticoclinoid foramen.

**Background:-** Anterior clinoid process is the posteriorly directed projection that is medial to the lesser wing of sphenoid. It provides attachment for the free edge of the tentorium cerebelli. The caroticoclinoid foramen is an inconstant structure which connects the anterior and middle clinoid process composed by the ossification of the fibrous ligament that begins on the anterior clinoid process and binds to the middle clinoid process.

**Reason:-** There are many reports regarding safe surgical procedures of anterior clinoidectomy but few about their anatomical variations. Hence the present investigations were planned to study any variations in the anterior clinoid process, incidence of caroticoclinoid foramen that will provide a guide for neurosurgeons in surgical approach of the sellar region.

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### Introduction:-

The Sphenoid bone, an unpaired pneumatic bone form parts of anterior and middle cranial fossae of skull. It consists of a central body, greater and lesser wings and two pterygoid processes. The lesser wings end medially in the triangular process termed as anterior clinoid processes (ACP) which gives attachment to the free margin of tentorium cerebelli (1). Anterior Clinoid Process (ACP) is located on the medial end of the lesser wing of the sphenoid bone. (2) The caroticoclinoid foramen (CCF) is an inconstant structure which is located in the middle cranial fossa, composed by the ossification of a fibrous ligament that begins on the anterior clinoid process and joins to the middle clinoid process (3). CCF allows the passage of one of six segments of the internal carotid artery (ICA), the clinoidal segment (4). The superficial and the thin deep layer of the dura cover the upper and lower sides of the anterior clinoid process. Removal of the anterior clinoid process (anterior clinoidectomy) allows a full approach to the anterior portion of the cavernous sinus and to the vertical segment of the internal carotid artery. (5) The pneumatized anterior clinoid process contains air cells that communicate with paranasal sinuses, there is a risk of rhinorrhea followed by an anterior clinoidectomy. (6) Owing to the deep location of the ACP and the complexity of the anatomical structure around it, anterior clinoidectomy requires precise knowledge of the anterior and middle cranial fossa. (7)

There are many reports regarding safe surgical approaches of anterior clinoidectomy but few about their anatomical variations. Hence the present investigation was planned to study any variations in the Anterior clinoid process,

incidence of Caroticoclinoid foramen that will provide a guide for neurosurgeons in the surgical approach of sellar region.

### Materials and methods:-

The present morphometric study was carried out on thirty dry adult skulls of either sex obtained from the preserved set of bones received at Department of Anatomy , Saveetha dental college, Chennai, India. Damaged and diseased skulls were not included in the study. The following morphometric parameters were studied on either side of skull.

- ❖ Basal width of ACP – measured from lateral margin of optic foramen to lateral margins of ACP, on both right and left side.
- ❖ Length of ACP – perpendicular length taken between apex and base
- ❖ Caroticoclinoid foramen was studied on both sides and are classified as follows :
- ❖ Absent
- ❖ Incomplete: ACP and MCP are approaching each other with a gap
- ❖ Complete: Caroticoclinoid ligament is ossified and converted into a bone leading to the formation of CCF. ACP and MCP Are fused.

In addition to the above parameters the ACP were observed for the anatomical variations with respect to the direction of the tip.

### Results:-

Thirty adult dry skulls were considered for the present study. Mean length of ACP was 10.73mm and 11.26mm on left and right sides respectively. The mean basal width of ACP on left side was 11.10mm & right side was 11.52mm. (Table-1)

In most of the cases the anterior clinoid process appear as inwardly curved (53% in left side & 37% in right side).

Caroticoclinoid foramen is absent in most of the cases in both sides. (74% in left side and 58% in right side). 26% of caroticoclinoid foramen is incomplete in left side and 37% in right side. There is no complete caroticoclinoid foramen in left side. Only 1(5%) of caroticoclinoid foramen is complete in right side. (Table -2)

**Table 1:** Different dimensions of anterior clinoid process

#### Left side:

Parameters (mm)	Mean	Range
Length	10.73	7-14
Width	11.10	7-16

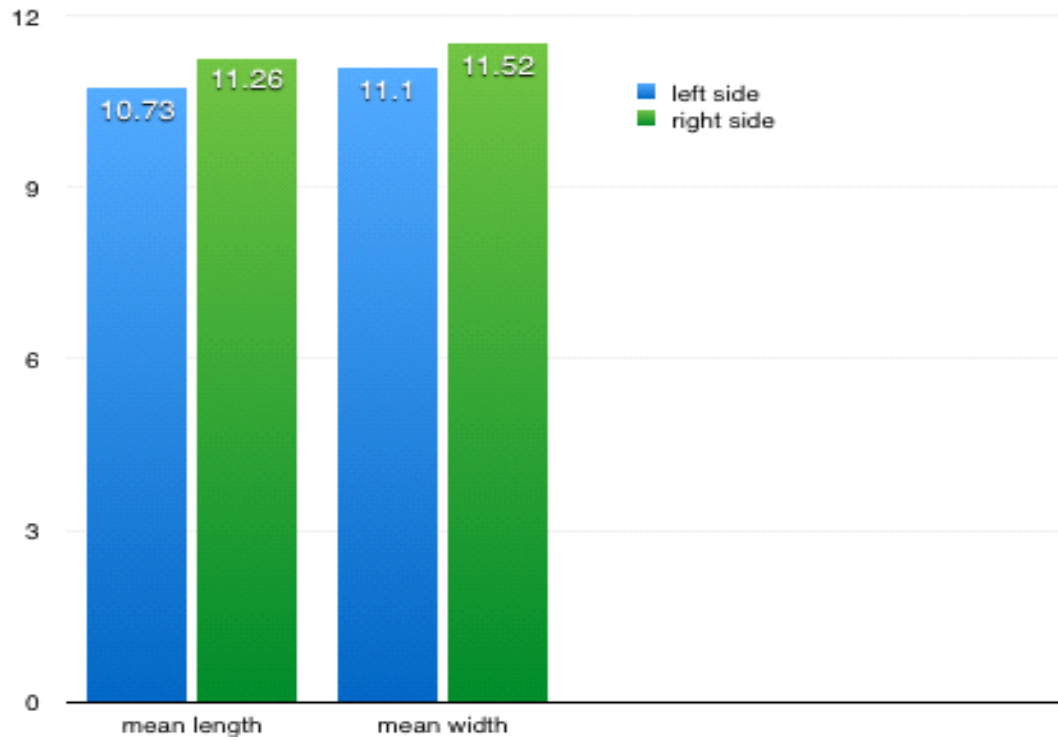
#### Right side:

Parameters (mm)	Mean	Range
Length	11.26	7-15
Width	11.52	7-18

**Figure1:-** Picture showing the length and width of ACP.



Chart showing mean length and mean width in left side & right side.



**Table 2:-** Incidence of caroticoclinoid foramen.

CCF	RIGHT SIDE	LEFT SIDE
ABSENT	14(74%)	11(58%)
INCOMPLETE	5(26%)	7(37%)
COMPLETE	0	1(5%)

**Fig2:-** Incidence of complete caroticoclinoid foramen.



**Fig3:-** Incidence of incomplete caroticoclinoid foramen.

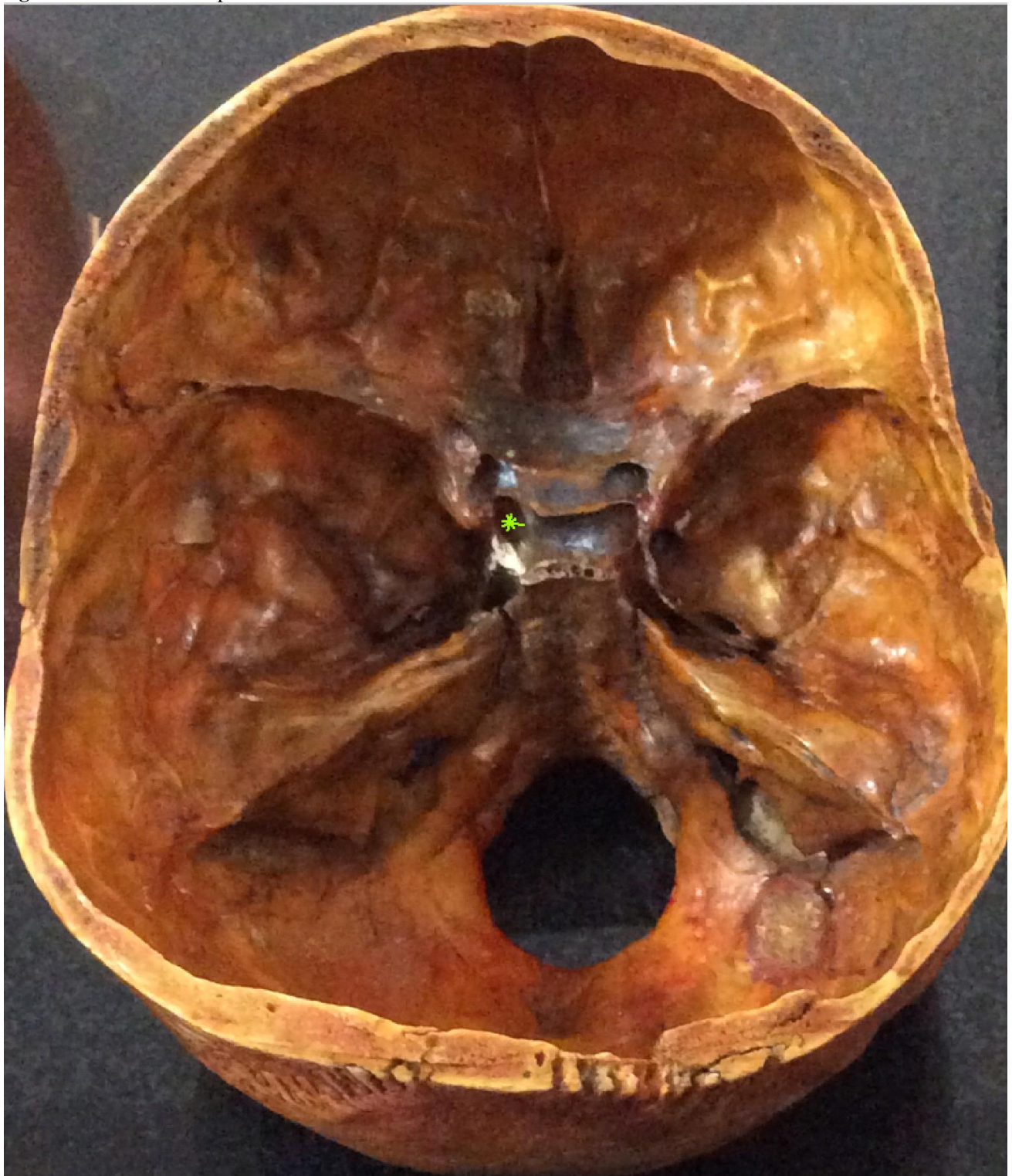
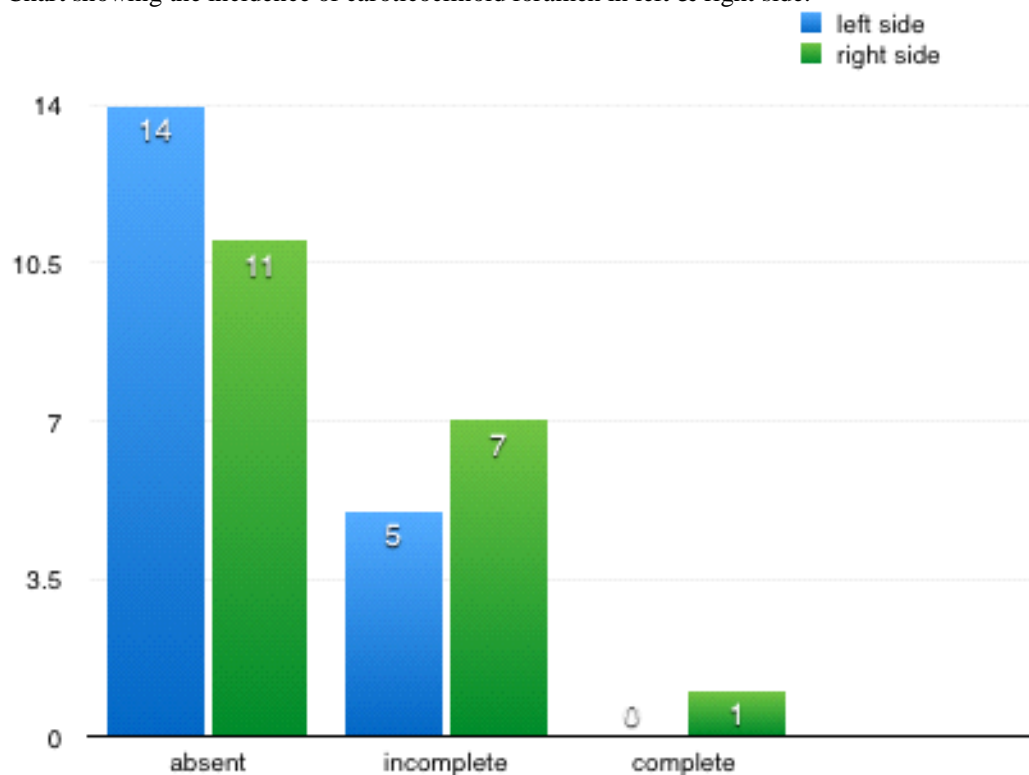


Chart showing the incidence of caroticoclinoid foramen in left & right side.



### Discussion:

Anatomical structures surrounding the anterior clinoid process are important in relation to the surgical approaches to the cavernous sinus. The ICA lies close to the optic nerve, being posterior and superior to the OS and the posterior medial projection of the ACP(9). In any surgical operation involving exposure of the clinoid segment of the internal carotid artery, excision of the anterior clinoid process is mandatory. Even to expose the cavernous sinus superiorly and to manage paraclinoid aneurysm, the ACP has to be removed(10). This treatment is more difficult when the CC foramen is present, causing higher possibility of serious bleeding in this region.(11)

In the present study, the mean length of ACP was 10.73mm on left side & 11.26mm on right side. Hyeyeon lee in his study reported average length as 9.09±1.67mm on left side and 9.26± 1.43 mm on right side (7) and DAGTEKIN in his study reported average length as 9.6mm and 9.7 mm on left and right side respectively(8). EldanKapur in his study reported the average length in males as 9.3± 1.4 mm (left side) and 9.9± 1.6(right side) and in females as 8.9±2.0 mm (left side) and 9.3±1.6mm(right side).(6). These studies have low values than the present study.

In the present study, the mean basal width of ACP was 11.10 mm and 11.52 mm on left side and right side respectively. Hyeyeon lee reported average width as 9.29± 1.39mm on left side and 9.97±1.58 on right side (7) and DAGTEKIN reported as 7.2 mm and 7.3mm on left side and right side respectively(8). EldanKapur reported the average width in males as 9.1±1.7 mm(left side) and 9.4±1.4(right side) and in females as 8.3± 2.1 (left side) and 8.7 ±1.5(right side)(6). These studies have low values than the present study.

In the present study, 1(5%) complete caroticoclinoid foramen and 7(37%) incomplete foramen was observed on the left side. In the right side, no complete caroticoclinoid foramen and 5(26%) incomplete caroticoclinoid foramen was observed. Caroticoclinoid foramen was absent in 14(74%) of skulls in right side and 11( 58%) in left side. Gupta in his study observed complete foramen in 6% of skulls, incomplete foramen in 16% of skulls and absent in 78% of skulls. In one skull he observed the bilateral complete CCF(1). Anne in his study observed complete foramen in 3 skulls, incomplete in 7 skulls and contact form in 2 skulls. He also observed 5 skulls with bilateral caroticoclinoid foramen.(2). Kapur observed the complete form of caroticoclinoid foramen in 17 cases(4.25%) ,incomplete form in

39 cases(9.75%) and contact form in 11 cases (2.75%).In his study he found that the complete, contact and incomplete forms of caroticoclinoid foramen were more often found in men, and were more often found on right side of the skulls regardless of gender.(6)

### Conclusion:-

Although the anatomical variations in various parameters of the bone can be influenced by reasons like race,geographical distribution and environmental factors, knowledge about anatomical variations of anterior clinoid process and caroticoclinoid foramen is very essential during neurosurgeries. Presence of any variations may result in unnecessary injury to the neurovascular structures. Anatomical variations provided in this study help the neurosurgeons to avoid the serious complications.

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