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Caroticoclinoid Foramen – Incidence, Morphometry and Its Clinical Importance

Anatomy

KEYWORDS: caroticoclinoid foramen, interclinoid ligament, internal carotid artery

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ABSTRACT

Background-The caroticoclinoid foramen (CCF) is located in the middle cranial fossa between anterior clinoid process and middle clinoid process. It is formed by the ossification of fibrous interclinoid ligament or dural fold between the anterior and middle clinoid process. They can be present unilaterally or bilaterally and vary in frequency.

Purpose of the study- This study was conducted on 112 dry adult human skulls. The caroticoclinoid foramen was examined for various parameters like complete or incomplete caroticoclinoid foramen, and whether they were present unilaterally or bilaterally. The maximum diameter of the complete foramen was measured by using a digital vernier callipers. The obtained data was analysed statistically.

Results- Out of 112 skulls, the complete bilateral foramen was found in 2 skulls with incidence of 1.78%. Their maximum diameters were 5.04 mm on the left side, 5.79 mm on the right side in 1 skull. In the another skull, it was 5.15 mm on the left side and 5.26 mm on the right side. Incomplete bilateral foramen, was found in 1 skull. Its incidence was 0.89%. Incomplete unilateral foramen was found in 2 skulls, on the left side with incidence rate of 1.78% and in one skull, it was on the right side with incidence of 0.89%.

Conclusions- The caroticoclinoid foramen if present may cause compression or stretching of internal carotid artery, cranial nerves and hypophysis cerebri or neurological problems . Hence the knowledge of incidence of this foramen and its implications are very important from clinical point of view.

INTRODUCTION

The Carotico-clinoid foramen is the result of ossification of carotico-clinoid ligament between anterior and middle clinoid process Certain parts of sphenoid bone are connected by ligaments, which occasionally ossify such as, pterygospinous, the sella turcica bridge and the carotico-clinoid ligament. The caroticoclinoid foramen (CCF) was first described by Henle in 1855. It can develop unilaterally or bilaterally and can vary in frequency.The interclinoid segment of internal carotid artery (ICA) passes through the caroticoclinoid foramen (CCF) and it turns upwards to supply the brain. The presence of bony obstruction in CCF may cause compression, or stretching of the ICA leading to transient ischaemic attacks and headache. It may also possess challenge to neurosurgeons for exposure of ICA during surgery[1,2].

The anatomical variation of a bone can be influenced by race, geographical distribution and environmental factors. Although most fibrous ossifications of ligaments are considered a normal aging process, formation of CCF of sphenoid bone occurs during embryological development was initially described by Henle[3].

Due to greater calibre of internal carotid artery compared to the diameter of caroticoclinoid foramen, the possibility of compression by the foramen is high. Also the presence of CCF can produce nerve entrapment syndrome and can interfere with surgical or anaesthetic procedures. Variations in the anterior clinoid process (ACP) may increase a risk during surgical procedures[4].

The knowledge of the incidence and anatomical variants of CCF is very important for surgeons, anaesthetists, radiologists and neurologists.

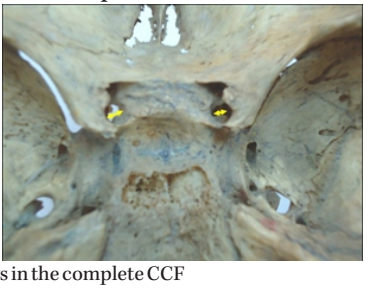
MATERIALS AND METHODS

This study was conducted on 112 dry adult human skulls obtained from the department of Anatomy, Maulana Azad Medical College, and New Delhi. The caroticoclinoid foramen was examined for various parameters like complete or incomplete caroticoclinoid foramen, and whether they were present unilaterally or bilaterally. The maximum diameter of the complete foramen was measured by using a digital vernier callipers. Consecutive three readings were taken by the same observer and mean of them was taken as the final reading.The obtained data was analysed statiscally by using Chi square tests.

OBSERVATIONS AND RESULTS

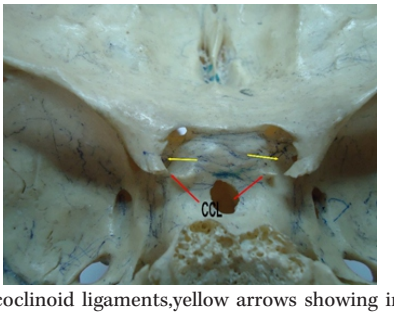
Out of 112 skulls, the complete bilateral foramen was found in 2 skulls with incidence of 1.78%. Their maximum diameters were 5.04 mm on the left side, 5.79 mm on the right side in 1 skull. In the another skull, it was 5.15 mm on the left side and 5.26 mm on the right side. Incomplete bilateral foramen, was found in 1 skull. Its incidence was 0.89%. Incomplete unilateral foramen was found in 2 skulls, on the left side with incidence rate of 1.78% and in one skull, it was on the right side with incidence of 0.89%.

Figure 1. Bilateral complete caroticoclinoid foramen



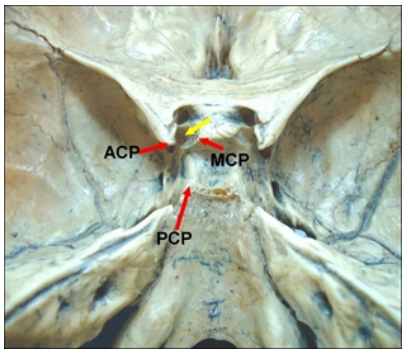
Yellow arrows in the complete CCF

Figure 2- Showing bilateral incomplete caroticoclinoid foramen



CCL-caroticoclinoid ligaments,yellow arrows showing incomplete CCF on both sides

Figure. 3- Unilateral incomplete caroticoclinoid foramen



ACP- Anterior clinoid process, MCP - Middle clinoid process, PCP - Posterior clinoid process, caroticoclinoid foramen (yellow arrow)

Table 1 -Showing the incidence of CCF
Incidence of CCF

	Type	No. of specimen	incidence	P value
Bilateral	complete	2	1.78%	0.56
	incomplete	1	0.89%	
Unilateral	complete	0	0 %	0.34
	incomplete	2	1.78%	

Table 2 -Showing the diameter of CCF
Diameter (in mm) of bilateral CCF.

No. Of specimen	Right side	Left side	P value
1	5.79	5.04	0.126
2	5.24	5.15	
Mean ±SD	5.51±0.39	5.09±0.08	

DISCUSSION-

The sella turcica is extremely important region, due to its proximity with the cavernous sinus and its contents, and pituitary gland. Surgery of the cavernous sinus, tumours, management of arterial aneurysms by superior approach in this region requires complete or partial removal of the anterior clinoid process (ACP) . Presence of any variation in the structure of ACP combined with a completely ossified caroticoclinoid foramen (CCF), may be risky while surgery in this area. have high risk.The important injury concern in this area is to carotid siphon of internal carotid artery (ICA). Therefore, understanding the complex anatomy of ACP and knowledge of the type of ossifications of the carotico-clinoid ligament is important to plan surgery in and around sella turcica [5,6,7].

The incidence of incomplete unilateral foramen varies from 8-35% while a bilateral and complete foramina are very rare found in 0.2-4% of population. Differences in races are being reported highest incidence has been noted in Turkish (35-67%), Caucasian Americans (34.84%), Alaskan Eskimos (17%), Sardinians (23.4%),Koreans (15.7%), Portuguese, Nepalese, whereas lowest incidence has been reported in Japanese (9.9%), Brazilians (2.5%) .Table 3 shows the comparison of incidence of CCF in different studies. The side and sexual variations have been reported by different authors but are not uniform. Some authors have found it to be more common in females, while others found it more common in males [1,8,9].

Table 3-Comparison of present study results with Other Studies [10-17]

Author	Year	Population	No.Of Specimens	Unilateral	Bilateral	Total
Azeredo et al	1988	Portugal	270	2.22%	4.05%	6.27%
Deda et al	1992	Turkish	88	6.82%	7.95%	14.77%
Gurunet et al	1994	Turkish	198	8.08%	5.55%	13.63%
Erturk et al	2002	Turkish	171	23.98%	11.69%	35.67%
Desai et al	2010	South indian	223	23.74%	13.45%	37.19%
Shaikh et al	2011	Central India	100	10%	14%	24%
Freire et al	2011	Brazilian	80	6.25%	2.5%	8.5%
Present study	2015	North indian	112	2.67%	2.67%	5.35%

CONCLUSION

Compression, tightening, stretching of internal carotid artery in CCF can results in transient ischaemic attacks and headache.It can cause difficulty during anterior clinoidectomy, which is done in paraopthalmic aneurysm,complex basilar aneurysm & paraclinoid aneurysm of internal carotid artery and tumour surgeries. Hence knowledge of incidence and types of CCF is important for neurosurgeons so that mortality and morbidity can be reduce in surgical approaches.

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