Prevalence and Dimensions of Complete Sella Turcica Bridges and Its Clinical Significance

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Abstract The ossification of ligamentous structures in various part of the body may result in clinical problems. The complete sella turcica bridge corresponds to the complete ossification of the interclinoid ligaments. Fifty dry adult skull bones were studied for presence of ossified interclinoid ligaments. Three skull bones show sella turcica bridge, of which one shows bilateral and two show unilateral. The ligamentous or bony interclinoid connections have important neuronal and vascular relations and are both clinically and surgically important. The knowledge of detailed anatomy of the interclinoid ligament can increase the success of diagnostic evaluation and surgical approaches to the region. The existence of a bony caroticoclinoid foramen may cause compression, tightening, or stretching of the internal carotid artery. Further, removing the anterior clinoid process is an important step in regional surgery; the presence of a bony caroticoclinoid foramen may have high risk.

Keywords Human skulls · Interclinoid ligament · Sella turcica bridge · Anterior clinoid process · Posterior clinoid process

Introduction

The wedge-shaped sphenoid bone lies between the frontal, temporal, and occipital bones in the skull base. It has a

central body, paired greater and lesser wings spreading laterally from it, and two pterygoid processes. At medial end of lesser wing, it has anterior clinoid process for attachment of free border of tentorium cerebelli. The body of sphenoid lies in middle cranial fossa. Anteriorly, this surface is smooth and is termed jugum sphenoidale; posteriorly, it presents sulcus chiasmaticus, tuberculum sellae, sella turcica, and dorsum sella. On each side of tuberculum, a small projection is present—the middle clinoid process. Dorsum sella is a square-like plate of bone, which projects upward and presents a conical projection, the posterior clinoid process. The complete sella turcica bridge corresponds to the complete ossification of the interclinoid ligaments.

Because of abnormal developments in the anterior, middle, and posterior clinoid processes, these bony structures could fuse, forming osseous bridges. Bridge formation could occur either between the anterior and the middle (caroticoclinoid bridge; caroticoclinoid foramen of Henle), the anterior and the posterior, or between the middle and posterior clinoid processes. In rare instances, the three processes could fuse with each other. Anomalies of sella region may result in confusion in the evaluations of magnetic resonance imaging (MRI) or computed tomography (CT) and also in the regional surgery planning.

The ligamentous or the bony form of interclinoid ligament is important in the aneurysm surgery of the intracavernous portion of the internal carotid artery and surgery for tuberculum sella meningiomas. Removing the anterior clinoid process is an important step in exposing the structures in the cavernous sinus and is highly complicated due to the neuronal and vascular relationships. Detailed studies in Indian skulls are lacking. The aim of present study was to know the dimensions and prevalence of complete sella turcica bridge in dry Indian human skulls.

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Fig. 1 Bilateral carotidoclinoid canal between anterior and middle clinoid process

Material and Methods

This work reports about carotidoclinoid foramen, on bilateral or unilateral sides, encountered in a dry adult human skull, belonging to the Department of Anatomy, Government Medical College, Surat, Veer Narmad South Gujarat University. The presence of complete sellar bridges was noted. The length of sellar bridges was measured from the anterior to the middle clinoid process and from the anterior clinoid process to the posterior clinoid process. The morphometry of each foramen was performed by a digital caliper. The larger transverse diameter was measured, from the edge formed by the ossified ligament until the edge formed by the anterior clinoid process. To avoid errors in measurement, it was performed three times by the same examiner being regarded as the repeated values.

Fig. 2 Unilateral carotidoclinoid canal between anterior and middle clinoid process

Fig. 3 Unilateral sella turcica bridge between anterior and middle clinoid process

Results

Of 50 skulls studied, three skulls showed presence of sellar bridges. The percentage of skull showing carotidoclinoid canal in our study is 6 %. Of 50 skulls, one skull shows the bilateral carotidoclinoid canal between anterior and middle clinoid process (Fig. 1), one skull shows the bilateral carotidoclinoid canal between anterior and middle clinoid process (Fig. 2), and one skull shows unilateral sella turcica bridge between anterior and middle clinoid process (Fig. 3). Therefore, the prevalence rate of sella turcica bridge is found to be 0.5 % in our study (Table 1). In our study, carotid canal's maximum diameter is found to be 6.08 mm (Table 2). In addition, the average length of sella turcica bridge between anterior and middle clinoid process found in our study is 5.46 mm (Table 3).

Common to all tables:

	Sella bridge between anterior to posterior clinoid process	Sella bridge between anterior to middle clinoid process present unilaterally	Sella bridge between anterior to middle clinoid process present bilaterally
Prevalence rate	0.5 %	0.5 %	0.5 %

Table 1 Diameter of carotidoclinoid canal

	Diameter (mm)
Average	5.25
Minimum	4.51
Maximum	6.08

Table 2 Length of sella turcica bridge between anterior and middle clinoid process

	Length (mm)
Average	5.46
Minimum	5.34
Maximum	5.66

Discussion

Sellar bridges may be sequelae of ossification in dura mater extending between the anterior and posterior clinoid process [1]. Ligamentous ossification occurring in the early age is possibly an extension of the normal ossifications of the anterior and posterior clinoid processes [2]. Formation of the sellar bridges may result directly from the pattern of sphenoid development or can be dictated by the physiological activities of chemical compounds that are involved in embryogenesis and buildup of the bones. Some proteins control the mechanism of hardening in ossifying structure or inhibit this process. For example, matrix Gla protein inhibits calcification in soft tissues while osteopontin slows down the ossification in hard tissues [3]. Archana et al. [4] studied 250 adult dried human skulls for the presence of interclinoid bars. They reported a total incidence of 22 % of various types of interclinoid bars. Increased prevalence has been reported in subjects with developmental craniofacial and tooth abnormalities.

Jones et al. [5] studied the incidence of sella turcica bridges in 150 patients who had undergone combined surgical orthodontic corrections. They found sellar bridges in 16.7 % cases in the group treated by combined surgical and orthodontic means, whereas it was 7.3 % in the orthodontic-only group [5].

Table 3 Length of sella turcica bridge between anterior and posterior clinoid process

	Length (mm)
Length of sella turcica bridge between anterior and posterior clinoid process	8.66

Erturk et al. [6] studied 119 adult dry skulls and 52 cadavers in which they found 8.18 % incidence of sellar bridges, higher on the right side (2.34 %) than on the left side (1.75 %) [6]. The absence of anatomic data on normal variation of the interclinoid ligament is a severe deficiency of modern anatomy textbooks. This study is very important for regional surgery; its anatomy has received less attention.

Conclusion

Cavernous sinus is bisected by the interclinoid ligament, so its ossification may influence such structures as the internal carotid artery or the oculomotor nerve. Therefore, it can be concluded that anomalies of sellar region are not very rare and may pose difficulties in interpretation of MRI or CT for the radiologist. These findings would help the radiologist and neurosurgeons to interpret and in planning neurosurgical procedures involving the sellar region.

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