COMPLETE SELLA TURCICA BRIDGES PREVALENCE AND DIMENSIONS

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ABSTRACT

Interclinoid ligaments which connect the anterior and posterior clinoid processes comprise a group of intrinsic ligaments of sphenoid bone. The complete sella turcica bridge corresponds to the complete ossification of the interclinoid ligaments. 112 dry human adult skull bones were studied for presence of ossified interclinoid ligaments. Nine skulls (8.04%) showed sella turcica bridges, out of which six were unilateral and three bilateral. The average length of the bridge was 11.67mm. The average width and thickness at the anterior clinoid process was 6.33mm and 4.33mm ; at the middle of the bridge 3.08mm and 2.66mm; and at the posterior clinoid process, 4.91mm and 3.66mm, respectively. Anomalies of sellar region are not very rare and may pose difficulties in interpretation of Magnetic Resonance Imaging or Computed Tomography for the radiologist. These findings would also guide the neurosurgeons in planning neurosurgical procedures involving the sellar region.

Key words: interclinoid ligament; sella turcica bridge; human skulls; interclinoid bars; neurosurgical procedures.

INTRODUCTION

The sphenoid bone is wedged between the frontal, temporal and occipital bones in the base of the skull. It has a central body, paired greater and lesser wings spreading laterally from it and two pterygoid processes, descending from the junctions of the body and greater wings. The lesser wings end medially as anterior clinoid processes for attachment of the anterior end of the free border of tentorium cerebelli. The body of the sphenoid forms central part of middle cranial fossa. Anteriorly this surface is smooth and is termed jugum sphenoidale. Traced posteriorly, it presents, sulcus chiasmaticus, tuberculum sellae, sella turcica and dorsum sellae. Anterior boundary of sella turcica is completed laterally by 2 small eminences, the middle clinoid processes. The superolateral angles of dorsum sellae end in 2 tubercles of varying size, the posterior clinoid processes which give attachment to the fixed margin of tentorium cerebelli[1] (Fig. 1).

Until the 7th or 8th month in utero the sphenoid bone has a presphenoidal part, anterior to the tuberculum sellae, with which the lesser wings are continuous, and a postsphenoidal part, comprising the sella turcica and dorsum sellae and integral with the greater wings and pterygoid processes. Much of the bone is formed in cartilage. There are six ossification centres for the presphenoidal and eight for the postsphenoidal parts. This multiplicity accords with the sphenoids evolution from a number of elements, such as the median presphenoid and basisphenoid homologous with the human parts defined above. The lesser wings, primitively separate orbitosphenoids, show a tendency to fusion with the body in mammals[1].

The structures that seem to exhibit the greatest variations in connection with the sella turcica are the anterior and posterior clinoid processes as well as middle clinoid processes.

Along with the pterygospinous, pterygoalars and carotidoclinoid ligaments, the interclinoid ligaments which connect the anterior with posterior clinoid process comprise a group of intrinsic ligaments of sphenoid bone. The complete sella turcica bridge corresponds to the complete ossification of the interclinoid ligaments[2].

Anomalies of sellar region may create confusion in evaluations of MRI or CT and also in the regional surgery planning. 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. The presence of ossified interclinoid ligament makes the removal of anterior clinoid process more difficult and increases the risks especially in the presence of an aneurysm[3]. Detailed studies in Indian skulls are lacking. Therefore, the aim

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of the present study was to know the prevalence and dimensions of complete sella turcica bridges in dry Indian human skulls.

MATERIAL AND METHODS

112 dry human adult skulls with removed calvaria were studied for the sella turcica bridges. The clinoid processes were meticulously observed for abnormalities. The presence of complete sellar bridges noted. The width and thickness of the bridge was measured at the anterior clinoid process, at the middle of the bridge and at the posterior clinoid process. The length of the sellar bridge was measured from the anterior to the posterior clinoid process. The measurements were done using digital calipers. All measurements were done by the same researcher. The skulls with gross craniofacial malformations were excluded from the study.

RESULTS

Out of 112 skulls studied, nine skulls showed presence of sellar bridges (8.04%). The sellar bridge formation was unilateral in six skulls (Fig.2) and bilateral in three skulls (Fig.3). The bridge formation was found to be two times more common on right side (four skulls) than on left side (two skulls).

The length, width and thickness of the bridge were variable. The average length of the bridge was 11.67mm (range, 10-15 mm). The average width and thickness at the anterior clinoid process was 6.33mm (range, 5-7 mm) and 4.33mm (range, 3-6mm); at the middle of the bridge 3.08mm (range, 2-5 mm) and 2.66mm (range 1-5mm); and at the posterior clinoid process, 4.91mm (range, 4-6 mm) and 3.66mm (range 3-5mm), respectively (Table 1).

DISCUSSION

The ossified interclinoid ligament forms a bony bridge (complete sellar bridge) between the anterior and posterior clinoid processes of the sphenoid bone. This entity is rare in human population, with varying frequency of 4-17%, as found in the literature.[3,4]

Hochstetter & Kier,as quoted by Ozdogmus et al(2003)[5] postulated that osseous interclinoid ligament was a developmental anomaly and demonstrated precartilaginous connections between anterior and posterior clinoid processes. They reported that sellar bridges are laid down in cartilage at an early stage of development and ossify in early childhood. Ossification of the interclinoid ligament is not age- related and results due to complex embryology of the sphenoid bone with 14 ossification centers.

Sellar bridge may be a sequelae of ossification in duramater extending between the anterior and posterior clinoid processes[6].

Du Boulay and Tricky(1975) mentioned that this ligamentous ossification occurs in the early age and is possibly an extension of the normal ossification of the anterior and posterior clinoid processes[7].

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[8].

	Length (mm)	Width and Thickness(mm) -anterior part	Width and Thickness(mm) -middle part	Width and Thickness(mm) - posterior part
Average	11.66	6.33 and 4.33	3.08 and 2.66	4.91and 3.66
Minimum	10	5 and 3	2 and 1	3 and 3
Maximum	15	7 and 6	5 and 5	7 and 5

Table 1. Measurements of Complete Sella Turcica Bridges

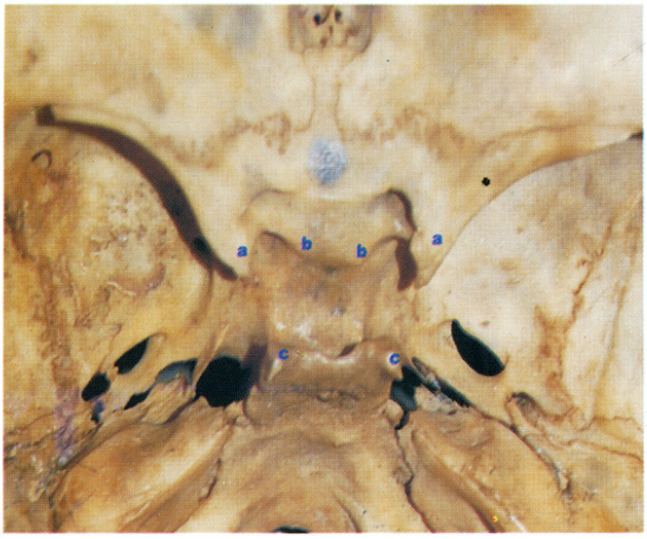

Fig.1 Normal clinoid processes

Fig.2 Unilateral complete sella turcica bridge

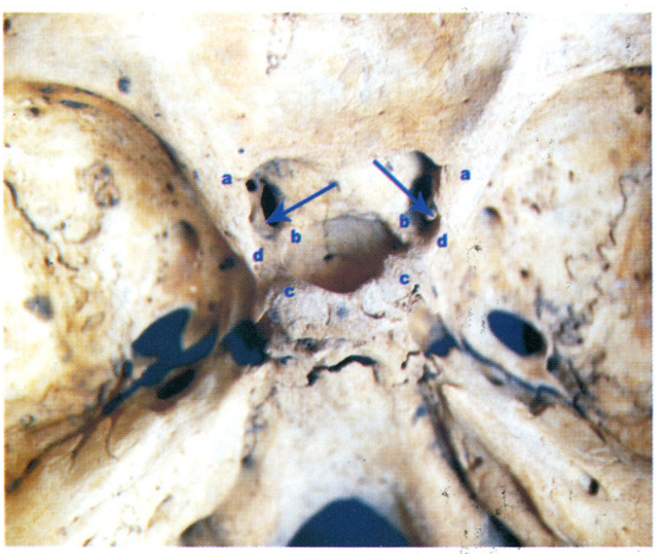

Fig.3 Bilateral complete sella turcica bridges

Archana et al (2007)[9] studied 250 adult dried human skulls for presence of interclinoid bars. It was observed that the bony bars between the three clinoid processes can be divided into four types. Due to presence of these bars three types of interclinoid foramina were formed. They reported a total incidence of 22% of various types of interclinoid bars.

In the study of Peker et al (2006)[4], 17.5% of 80 dry skulls had sellar bridges. Several endocrinological and neurological disorders associated with such sellar bridges. Sellar bridges were demonstrated radiographically to a 25% extent in idiots, to 20% in criminals, to 15% in epileptics, and to 38% in other cases with mental disorders. The incidence of sellar bridges shows great variation among different populations. The lowest incidence was found in a Japanese population (male: 3.9%, female:6%) and the highest in Ontario Iroquois population (male: 34.9%, female: 31.7%).

Increased prevalence has been reported in subjects with developmental craniofacial and tooth abnormalities. Jones et al (2005) studied the incidence of sella turcica bridges in 150 subjects who had undergone combined surgical orthodontic correction. 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 orthodontics only group[10]. In a similar study involving 177 subjects, the incidence of sellar bridges was 18.6% in combined orthodontic and surgical group[11].

Erturk et al (2004) studied 119 adult dry skulls and 52 cadavers in which he found 8.18% incidence of sellar bridges, higher on the right side (2.34%) than on the left side (1.75%)[12]. Platzer found sella turcica bridges in 5.9% of 220 hemi sectioned heads as quoted by Bector et al (2000)[11].

Busch, in a study of 343 autopsies, found 1.54% complete sella turcica bridges as quoted by Bector et al(2000)[11]. Bergland et al (1968) studied the sella turcica in connection with 225 autopsies and found bridges in 6% of them[13].

Muller studied 1040 radiographs and showed sellar bridges in 3.85% of them and Carstens reported 4.6% sella turcica bridges in 461 radiographs of healthy men as quoted by Bector et al(2000)11 and the incidence was 8% in the study of Cederberg et al (2003) involving 255 subjects' cephalometric radiographs[14].

The interclinoid ligament bisects the wall of the cavernous sinus, dividing it into two triangles; carotid trigone anteromedially and occulomotor trigone posterolaterally. Thus ossification of this ligament may influence such structures as the internal carotid artery or the occulomotor nerve.

Therefore, it can be concluded that anomalies of sellar region are not very rare and may pose difficulties in interpretation of Magnetic Resonance Imaging or Computed Tomography for the radiologist. These findings would help the radiologists to interpret well and also guide the neurosurgeons in planning neurosurgical procedures involving the sellar region.

REFERENCES

1. Williams P L.(1999). Gray's Anatomy. 38th ed. London: ELBS with Churchill Livingstone, p 585, 589.
2. Suazo G I C, Zavando M D A, Smith R L. (2008). Ossification of the sella turcica and clinoid ligaments, a case report, morphological study and literature review. Int. J. Morphol.; 26(4):99-801.
3. Inoue T,Rhoton AL,Theele D, Barry ME.(1990).Surgical approaches to cavernous sinus:a microsurgical study. Neurosurgery; 26:903-932.
4. Peker T, Anil A, Gulekon N, Turgut H B, Pelin C, Karakose M. (2006). The incidence and types of sella and sphenopetrous bridges. Neurosurg Rev; 29:219-223.
5. Ozdogmus O, Saka E, Tulay C, Gurdal E, Uzun I, Cavdar S. (2003). Osification of interclinoid ligament and its clinical significance. Neuroanatomy; 2:25-27.
6. Dabrul E L. (1996). The Skull. In: Oral Anatomy. Delhi. AITBS puslishers and distributors, p 13.
7. Du Boulay G, Tricky S. (1967). The choice of radiological investigations in the management of tumors around the sella. Clin Radiol; 18:349-365.
8. Skrzat J, Szewczyk R, Walocha J.(2006). The ossified interclinoid ligament. Folia morphol; 65(3): 242-245.
9. Archana R, Anita R, Jyoti C, Punita M, Rakesh D. (2010). Incidence of osseous interclinoid bars in Indian population. Surg Radiol Anat; 32(4):383-387.
10. Jones R M, Faqir A, Millett D T , Moos K F , McHugh S. (2005). Bridging and dimensions of sella turcica in subjects treated by surgical-orthodontic means or orthodontics only. Angle Ortho; 75(5):714-718.
11. Becktor J P, Einersen S, Kjaer I A. (2000). Sella turcica bridge in subjects with severe craniofacial deviations. Eur J orthod; 22:69-74.
12. Erturk M, Kayalioglu G, Govsa F. (2004). Anatomy of the clinoidal region with special emphasis on the caroticoclinoid foramen and interclinoid osseous bridge in a recent Turkish population.Neurosurg Rev.; 27:22-26.
13. Bergland R M, Ray B S, Torack R M. (1968).Anatomical variations in the pituitary gland and adjacent structures in 225 human autopsy cases. Journal of Neurosurgery; 28:93-99.
14. Cederberg R A, Benson B W, Nunn M, English J D. (2003). Calcification of the interclinoid and petroclinoid ligaments of sella turcica: a radiographic study of the prevalence. Orthod Craniofacial Res.; 6:227-232.