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BRIDGES OF THE SELLA TURCICA — ANATOMY AND TOPOGRAPHY

Abstract: *Bridges of the sella turcica — anatomy and topography*

This paper presents anatomy and topography of the inconstant osseous bridges that may occur in the sella turcica region. The interclinoid bridge and the caroticoclinoid bridge can be formed in consequence of abnormal ossification of the dural folds or disturbances in development of the sphenoid bone. Their presence may be of clinical importance because of potential influence on the neurovascular structures passing in the vicinity of the clinoid processes of the sphenoid bone.

Key words: sellar bridge, sella turcica, sphenoid bone

INTRODUCTION

Process of ossification of cranial structures might be a natural consequence of ageing or a result of adaptation changes of the axial skeleton, although sometimes it is difficult to guess what are the real causative factors [1–3].

The folds of the dura mater (ligaments) that are attached to the clinoid processes (the anterior, the middle and the posterior) may occasionally ossify and form bony bridges of the sphenoid bone. These inconstant osseous structures may also derive from the cartilaginous tissue [4, 5]. The formation of the osseous bridges within the sellar region may also effect of disturbances in development of the sphenoid bone [4, 6]. The ligament between anterior and posterior clinoid process is known as the interclinoid ligament, and the bony connection between these processes is known as the interclinoid bridge. In turn, the anterior and middle clinoid processes may be connected by the caroticoclinoid ligament which may ossify forming a caroticoclinoid bridge. In result, the caroticoclinoid foramen occurs between the ossified caroticoclinoid ligament and the body of sphenoid bone.

Depending on the side (unilateral or bilateral) and form (incomplete or complete) the incidence of interclinoid bridges may vary from 1% to 8% [7–10]. The frequency of the caroticoclinoid bridges seem to be higher, and may range from 6% to 36% [11–13].

The aim of the study was to present and evaluate frequency and morphological character of the complete osseous bridges that occur between the clinoid processes.

MATERIAL AND METHOD

Anatomical study was performed on 80 human skulls of adult individuals which are housed in the Department of Anatomy of the Collegium Medicum of the Jagiellonian University. Male and female skulls were analyzed together because there is not predilection between sex and occurrence of the osseous bridges connecting the clinoid processes of the sphenoid bone.

Visualization of the sellar region was performed by means of the laryngologic mirror, which was placed in the cranial cavity through the foramen magnum. The luminator armed with two flexible, slender light pipes (Highlight 3001, Olympus Optical Co.) was used as a source of light. The image in the mirror was photographed using the digital camera (Canon EOS 5D). Further the images of the osseous bridges were displayed on the computer screen and processed with the ImageJ software (<http://rsbweb.nih.gov/ij/>). This procedure allowed to evaluate location and morphological character of the sellar bridges.

The study was conducted with approval (KBET/109/B/2012) of the Bioethics Committee of the Jagiellonian University.

RESULTS

Visual inspection revealed presence of completely or incompletely ossified connections between anterior and posterior clinoid processes (interclinoid bridge) and the anterior and middle clinoid process (caroticoclinoid bridge). Complete osseous bridges were formed as flat, narrow laminas. Typical morphological appearance of the interclinoid bridge presents Figure 1, whereas the Figure 2 shows typical caroticoclinoid bridge. The complete interclinoid bridge was observed in 11 cases, and the complete caroticoclinoid bridge was observed in 13 cases. We did not observe dominance of the side in occurrence of the sellar bridges (Table 1). Eight skulls showed coexistence of the interclinoid and the caroticoclinoid bridge. There was no sex effect on morphology, frequency and location of the sellar bridges.

The interclinoid bridges occupied different position between anterior and posterior clinoid process. They were stretched between middle part of the apex of the anterior and posterior clinoid processes or between their inferior aspects. The spatial orientation of the interclinoid bridges varied from oblique to horizontal, which was more frequent.

The caroticoclinoid bridges presented less morphological variation than the interclinoid bridges. They appeared as short, flat bony laminas while the interclinoid bridges existed in the form of lamellar or trabecular connections.

Table 1

Occurrence of the complete osseous bridges

Ligament	Total number	Bilateral	Unilateral	
			Left	Right
caroticoclinoid	13	6	3	4
interclinoid	11	4	4	3

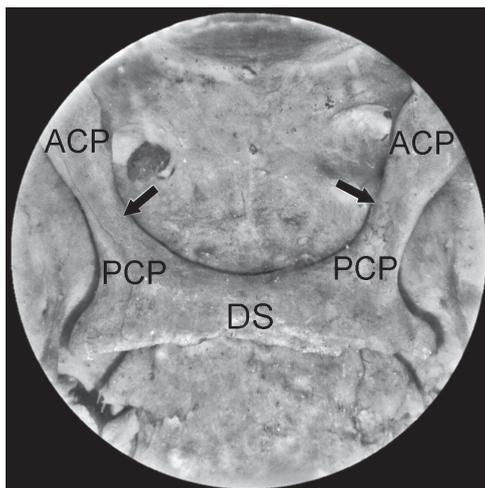


Fig. 1. Bilateral complete ossification of the interclinoid ligament (indicated by arrows); ACP — anterior clinoid process, PCP — posterior clinoid process, DS — dorsum sellae

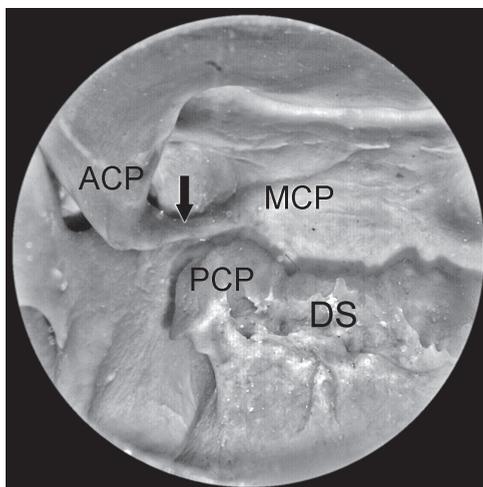


Fig. 2. Completely ossified caroticoclinoid ligament (indicated by arrow); ACP — anterior clinoid process, MCP — middle clinoid process, PCP — posterior clinoid process, DS — dorsum sellae

DISCUSSION

Up till now abnormal ossification between the clinoid processes of the sphenoid bone have been of clinicians interest because of possible compression of the neurovascular structures passing in the vicinity of the osseous bridges and potential obstacles in surgical procedures. In such cases removal of the anterior clinoid process becomes more difficult and increases the risks especially in the presence of an aneurysm. Also retraction of the cavernous segment of the internal carotid artery may tear or rupture it and cause cerebral infarction [14, 15].

Previous studies performed on the sellar bridges revealed that their presence may be a reason of clinical symptoms like compression of the oculomotor nerve or abnormal blood flow in the internal carotid artery [16–18]. Nevertheless, Müller did not find association between the sella turcica bridge and ophthalmological symptoms [19]. Platzer found an association between the occurrence of sella turcica bridges and the course of the internal carotid artery [10]. Carstens stated that there is a correlation between chronic infections, focal infections and changes in the sella turcica region (e.g. enlargement of the sella turcica) [9]. Becktor *et al.* described a correlation in the occurrence of sellar bridge and severe craniofacial deviations and Leonardi *et al.* observed a high prevalence of the bridges in subjects with anomalies in the dental eruption [20, 21]. Although the interclinoid bridges are in the proximity of the pituitary fossa their effect on the pituitary gland has not been established, and this problem is weakly discussed in literature.

Apart from clinical studies on the significance of the sella turcica bridges, other researchers investigated coexistence of the interclinoid and caroticoclinoid bridges. Kim found a correlation in occurrence of the interclinoid bridge and caroticoclinoid foramen [13]. Ray and Gupta described a case of a female skull in which both a sellar bridge and caroticoclinoid foramen were present [22]. Also Patnaik *et al.* reported similar case of bilateral caroticoclinoid bridge and the interclinoid bridge [23]. In the current study we also found out a coexistence of the interclinoid bridges with caroticoclinoid bridges. However, this was observed only in 8 cases.

CONCLUSIONS

To sum up, clinical significance of the sellar bridges depends chiefly on their size and location. The caroticoclinoid bridge can cause compression or damage of the internal carotid artery, whereas the interclinoid bridge can change proper course of the structures passing through the clinoid region or may also compress them. Hence, the sellar bridges can be an obstacle in the clinoidectomy or other surgical procedures in this cranial region.

REFERENCES

1. Skrzat J., Walocha J., Zawiliński J.: Accessory spine of the foramen ovale. *Folia Morphol.* 2012, 71: 264–267. — 2. Skrzat J., Mróz I., Walocha J., Zawiliński J., Jaworek J.K.: Bilateral ossification of the stylohyoid ligament. *Folia Morphol.* 2007, 66: 203–206. — 3. Skrzat J., Walocha J., Jaworek J.K., Mróz I.: The clinical significance of the petroclinoid ligament. *Folia Morphol.* 2007, 66: 39–43. — 4. Lang J.: Structure and postnatal organization of heretofore uninvestigated and infrequent ossifications of the sella turcica region. *Acta Anat.* 1977, 99: 121–139. — 5. Peker T., Anil A., Gulekon N., Turgut H.B., Pelin C., Karakose M.: The incidence and types of sella and sphenopetrous bridges. *Neurosurg Rev.* 2006, 29: 219–233. — 6. Suazo G.I.C., Zavando M.D.A., Smith R.L.: Ossification of the sella turcica and clinoid ligaments, a case report, morphological study and literature review. *Int J Morphol.* 2008, 26: 799–801. — 7. Bergland R.M., Ray B.S., Torack R.M.: Anatomical variations in the pituitary gland and adjacent structures in 225 human autopsy cases. *J Neurosurg.* 1968, 28: 93–99. — 8. Busch W.: Die morphologie der sella turcica und ihre beziehung zur hypophyse. *Virchow's Arch.* 1951, 320: 437–458. — 9. Carstens M.: Die sella diagnostik. *Fortschr Röntgenstr.* 1949, 7: 257–272. — 10. Platzer W.: Zur anatomie der "sellabrücke" und ihrer beziehung zur arteria carotis interna. *Fortsch Geb Röntgen Nuklearned.* 1957, 87: 613–616.
11. Akabori E.: Analytical inquires into the non-metric variation in the Japanese skull according to age and sex. *Jpn J Med Sci I Anat.* 1933, 1: 61–318. — 12. Erturk M., Kayalioglu G., Gousa F.: Anatomy of the clinoidal region with special emphasis on the caroticoclinoid foramen and interclinoid osseous bridge in a recent Turkish population. *Neurosurg Rev.* 2004, 27: 22–26. — 13. Kim J.M., Romano A., Sanan A., van Loveren H.R., Keller J.T.: Microsurgical Anatomic Features and Nomenclature of the Paraclinoid Region. *Neurosurgery.* 2000, 46: 670–682. — 14. Huynh-Le P., Natori Y., Sasaki T.: Surgical anatomy of the anterior clinoid process. *J Clin Neurosc.* 2004, 11: 283–287. — 15. Ozdogmus O., Saka E., Tulay C., Gurdal E., Uzun I., Cavdar S.: The anatomy of the carotico-clinoid foramen and its relation with the internal carotid artery. *Surg Radiol Anat.* 2003, 25: 241–246. — 16. Ozdogmus O., Saka E., Tulay C., Gurdal E., Uzun I., Cavdar S.: Ossification of interclinoid ligament and its clinical significance. *Neuroanatomy.* 2003, 2: 25–27. — 17. Peker T., Karakose M., Anil A., Turgut H.B., Gulekon N.: The incidence of basal sphenoid bony bridges in dried crania and cadavers: their anthropological and clinical relevance. *Eur J Morphol.* 2002, 40: 171–180. — 18. Skrzat J., Szewczyk R., Walocha J.: The ossified interclinoid ligament. *Folia Morphol.* 2006, 65: 242–245. — 19. Müller F.: Die bedeutung der sellabrücke für das auge. *Klin Mbl Augenheilkd.* 1952, 120: 298–302. — 20. Beक्टर J.P., Einersen S., Kjaer I.: A sella turcica bridge in subjects with severe craniofacial deviations. *Eur J Orthod.* 2000, 22: 69–74.
21. Leonardi R., Barbato E., Vichi M., Caltabiano M.: A sella turcica bridge in subjects with dental anomalies. *Eur J Orthod.* 2006, 28: 580–585. — 22. Ray B., Gupta N.: Caroticoclinoid foramen with interclinoid osseous bar. *Clin Anat.* 2006, 19: 732–733. — 23. Patnaik V.V.G., Singla R.K., Bala S.: Bilateral foramen clinoido-caroticum & interclinoid bars — a report of 2 cases. *J Anat Soc India.* 2003, 52: 60–67.

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