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EFFECTS OF MORPHOLOGICAL CHANGES IN SELLA TURCICA: A REVIEW

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ABSTRACT

Sella turcica is a saddle shaped bony structure present on the sphenoid bone. The pituitary gland is seated at the inferior aspect of the sella turcica, called hypophyseal fossa. Sella turcica serves as a cephalometric landmark, that being said any morphological changes can affect the overall craniometry of the individual as well as alter the function of the structures it lodges. The following review emphasis on the possible morphological changes of sella turcica and its effects on the individual.

Keywords: Pituitary gland, morphology, bridge, foramen, bone.

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INTRODUCTION

Behind the chiasmatic groove is an elevation, the tuberculum sellae; and still more posteriorly, a deep depression, the sella turcica, the deepest part of which lodges the hypophysis cerebri and is known as the fossa hypophyseos .The anterior boundary of the sella turcica is completed by two small eminences, one on either side, called the middle clinoid processes, while the posterior boundary is formed by a square-shaped plate of bone, the dorsum sellae, ending at its superior angles in two tubercles, the posterior clinoid processes.On either side of the sella turcica is the carotid groove, which is broad, shallow, and curved somewhat like the italic letter f. It begins behind at the foramen lacerum, and ends on the medial side of the anterior clinoid process, where it is sometimes converted into a foramen (carotico-clinoid) by the union of the anterior with the middle clinoid process; posteriorly, it is bounded laterally by the lingula. This groove lodges the cavernous sinus and the internal carotid artery, the latter being surrounded by a plexus of sympathetic nerves. On either side of the sella turcica is the carotid groove, which is broad, shallow, and curved somewhat like the italic letter f. It begins behind at the foramen lacerum, and ends on the medial side of the anterior clinoid process, where it is sometimes converted into a foramen (carotico-clinoid) by the union of the anterior with the middle clinoid process; posteriorly, it is bounded laterally by the lingula. This groove lodges the cavernous sinus and the internal carotid artery, the latter being surrounded by a plexus of sympathetic nerves.Until the seventh or eighth month of fetal life the body of the sphenoid consists of two parts, viz., one in front of the tuberculum sellae, the presphenoid, with which the small wings are continuous; the other, comprising the sella turcica and dorsum sellae, the post sphenoid, with which are associated the great wings, and pterygoid processes [16].Morphology and structural orientation of sella turcica plays a major role in craniometry by serving as the center of reference used for the evaluation of craniofacial and jaw relationship. Recent findings of sellar bridging in patients with craniofacial deviations serves evident for the aforementioned statement. Changes in the bony structure can also have significant effects on the surrounding structures like the pituitary gland, internal carotid artery, oculomotor nerveand other structures passing through the cavernous sinus. The above conditions can clinically manifest with severity ranging from headache to fatal ischemic injury. The following review dwells deep into the possible morphological changes and their effects and clinical manifestations.

1. DISCUSSION

EMPTY SELLA SYNDROME

Empty sella syndrome is the condition when the pituitary gland shrinks or becomes flattened, filling the sella turcica with cerebrospinal fluid instead of the normal pituitary[1].There are two types of empty sella syndrome: primary and secondary. Primary empty sella syndrome (ESS) is an anatomo-radiological picture characterized by the presence of an arachnoid herniation filled with liquor that compresses the pituitary against the sellar wall[2]. In the case of primary empty sella (PES), several etiopathogenetic hypotheses have been proposed, including a congenital incomplete formation of the sellar diaphragm and supra sellar factors such as stable or intermittent increase in intracranial pressure as well as volumetric changes in the pituitary (as observedin pregnancy) [3]. ESS occurs particularly in obese, hypertensive, cephalgic women, it is often asymptomatic but it may be associated with ophthalmologic, neurologic and sometime non-characterizing endocrine disorders[2]. PES may be associated with variable clinical conditions ranging from the occasional discovery of a clinically

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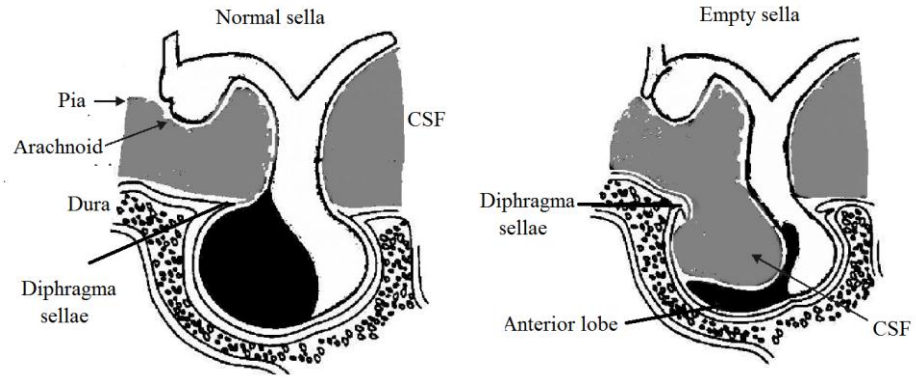
asymptomatic arachnoid pouch within the sella turcica to severe intracranial hypertension and rhinorrhea[4].On the other hand, secondary empty sella may be caused either by pituitary adenomas undergoing spontaneous necrosis (ischemia or hemorrhage) or by infective, autoimmune, and traumatic causes or by radiotherapy, drugs, and surgery [3].At the Thomas Jefferson Medical School ten cases of empty sella have been encountered during past several years. They developed after various treatments for pituitary adenomas(5 cases),sarcoidosis(2 cases),granuloma(1 case),optic glioma(1 case) and craniopharyngioma(1 case).The majority of these patients had recurrent chiasmal syndrome, associated with headaches for several months to years after initial treatment, and empty sella was found in the course of



neuroradiologic evaluation of possible recurrent lesions[5].

Figure 1: Empty Sella syndrome that occurs as a consequence of cerebrospinal herniation, resulting in flattening of the pituitary gland.

2. CAROTICO CLINOID FORAMEN

The carotico clinoid foramen, first described by Henle (1855), is an osseous bridge between the tip of the middle and anterior clinoid processes[7]. It is the result of ossification either of the carotico-clinoid ligament or of a dural fold extending between the anterior and middle clinoid processes of the sphenoid bone[8].

The presence of ossified carotico-clinoid foramen leads to compression, tightening or stretching of the clinoid part of the internal carotid artery and leading to changes in the internal carotid artery. The presence of a carotico-clinoid foramen is of great clinical and surgical importance to neurosurgeons as it intervenes in the mobilization of the cavernous part of the internal carotid artery [9].

According to a study on dry human skulls of Aurangabad district conducted at Government Medical College, Aurangabad (2012), the carotico-clinoid foramen was found in 24 skull bones (24%) out of 100 skulls observed. It was observed for various parameters like complete or incomplete, unilateral or bilateral. The data was analyzed statistically with Chi square test. Complete bilateral carotico-clinoid foramen was found in 2 skulls (2%) and complete unilateral foramen was found in 2 skulls (2%); Incomplete bilateral carotico-clinoid foramen was found in 8 skulls (8%). Incomplete unilateral foramen was found in 8 skulls (8%), on right side, 7 skulls (7%) and left side, 1 skull (1%). Bilateral carotico-clinoid foramen, complete right side and incomplete left side was observed in 2 skulls (2%). Bilateral carotico-

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clinoid foramen, complete left side and incomplete right side was observed in 2 skulls (2%) [10].

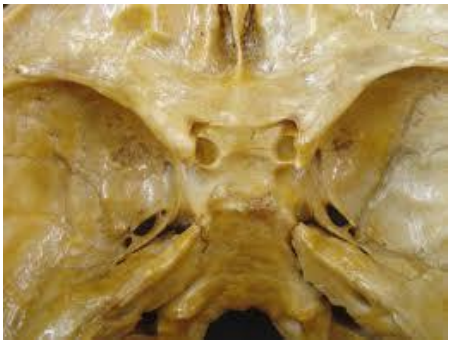

Figure 2: Caroticoclinoid foramen. Fusion of anterior and middle clinoid processes which results in the bony enclosure of the internal carotid artery.

SELLA BRIDGING

Ossification of the interclinoid ligaments of sella turcica can forma Sellabridge [11]. The bony bridge mostly connects the anterior and the posterior clinoid process[11, 12, 13]. They can be unilateral or bilateral and they vary in frequency[11, 12]. DY Patil School of Medicine, Nerul, Navi Mumbai, India reported a bilaterally fused Sella bridge in one of their dry skull specimens[12].Sella bridging ranges from 1.5% to 5.9% among all the types of interclinoidal ossifications[12]. According to the profile radiographs obtained from 177 persons at the School of Dentistry, Copenhagen University, Sella bridging was classified into two types: a) ribbon like fusion b) extension of the anterior and/or posterior clinoid process [13]. The bony bridge isobserved in vivo using a Cone Beam Computed Tomography[14]. Ossification of ligaments may result from underlying pathological conditions like pathological calcification or physiological activity of biochemical compounds that regulates osteogenesis. That includes crystallization of protein and deposition of calcium on the ligament[11].Recent investigations have demonstrated a wide prevalence of Sella bridging among patients with severe craniofacial deformities, mainly overjet and overbite[13].The cause of Sella bridging also traces back to its embryogenesis and was reported to be associated with spinal bifida[15].

Sella bridging rarely have any clinical manifestations and are mostly asymptomatic [13]. But ossification of the interclinoid ligament can interfere withcertain structures passing through the cavernous sinus like the Internal Carotid Artery and Oculomotor nerve which can occlude the artery paving way to ischemic injury and vision impairment [11].

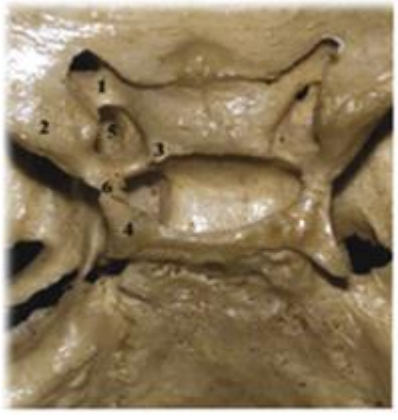

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Figure 3: Sella bridging occurs due to the ossification of anterior and posterior clinoid processes.

3. CONCLUSION

Compared with the earlier studies and the current reports have demonstrated the increased and frequent occurrence of morphological deviations in sella turcica. Knowledge on variations of sella turcica and their clinical manifestations can help orthodontists, neurosurgeons and maxillofacial surgeons to prevent fatal complications during surgery.

Ethical clearance: Not required since it's a review article.

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Conflict of interest: NIL

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