

OSSIFIED LIGAMENTS OF THE SKULL

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ABSTRACT

The ligamentous connections between the different parts of the skull occasionally ossify. In the present study, 134 sides of adult dried skulls of unknown origin and sex from the department of anatomy of Medical College were studied for the presence of ossified ligaments.

In 51 sides the ossified ligaments were present while in 83 sides of skulls, the ligaments had not ossified. The ligaments are related to many clinically important anatomical structures and their ossification can lead to compression of these structures. The ossified ligamentous connections are also significant to the surgeons.

KEYWORDS: caroticoclinoid, interclinoid, petrosphenoid, pterygospinous, ossified ligament.

INTRODUCTION

Williams et al¹ (2000) reported that certain sphenoidal parts are connected by ligaments which occasionally ossify. Srisopark² (1974) and Skrzat et al³ (2006) stated that the ossification of some normally occurring ligaments of the human skull produce new structures like the bony bridges that connect the clinoid processes with other surrounding structures. Ozdogmus et al⁴ (2003) found that these sellar bridges are unilateral or bilateral. In a few text-books, the ossified ligaments have been mentioned and Galdames et al⁵ (2008) reported these ligaments as caroticoclinoid, interclinoid, petrosphenoid and pterygospinous. There is dearth of literature in the text-books regarding these ligaments in description of the skull.

The ligaments are related to many anatomical structures and when ossified, may cause compression of these structures. According to Basmajian⁶ (1989) and Breathnach⁷ (1965), the caroticoclinoid and interclinoid ligaments are related to the internal carotid artery and the oculomotor nerve. The petrosphenoid ligament is related to the abducent nerve while pterygospinous ligament is related to the branches of the mandibular and the chorda tympani nerves.

The presence of these ossified ligamentous connections are of significance to the surgeons while

doing regional surgeries. Thus, the present study was done to see the occurrence of these ossified ligaments in the adult skulls.

MATERIAL & METHODS

Sixty seven (134 sides) of adult dried skulls of unknown origin and sex were studied for the occurrence of ossified ligaments. The study was conducted in the Department of Anatomy, Gian Sagar Medical & Dental College, Banur, Patiala. The number of ossified ligamentous connection and their side were observed. It was also noted that the ossified ligament was unilateral or bilateral and complete or incomplete.

RESULTS

67 adult dried skulls (134 sides) were studied for the occurrence of ossified ligaments. In 51 sides of skulls the ligaments had ossified while in 83 sides of skulls, the ligaments had not ossified. The ossified ligaments were caroticoclinoid, interclinoid, petrosphenoid and the pterygospinous ligament. The ossified ligaments were present almost equally in both sides and the side difference was insignificant. The distribution of the ossified ligaments in 134 sides of skulls is shown in table I.

The caroticoclinoid ligament was present in 22 sides, extending from the anterior clinoid process to the middle clinoid process. It was bilateral in 3 sides and unilateral in 16 sides. It was complete in 4 and incomplete in 18 sides (Fig 1).

The interclinoid ligament extending from the anterior clinoid process to the posterior clinoid process was found unilaterally in 9 sides. In 7 sides, it was

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incomplete and in 2 sides, it was complete (Fig 2). The ossified petrosphenoid ligament extending from the apex of petrous bone to the posterior clinoid process was present unilaterally in 7 sides. It was incomplete in 4 sides and complete in 3 sides (Fig 3).

The ossified pterygospinous ligament was present in 13 sides and extended from the pterygospinous process of the lateral pterygoid plate to the spine of the sphenoid bone. It was incomplete in 9 sides and complete in 4 sides (Fig 4).

Table I - Distribution of ossified ligaments of skull (n= 134)

LIGAMENT	COMPLETE	INCOMPLETE	TOTAL	UNILATERAL	BILATERAL
Caroticoclinoid	4	18	22	16	3
Interclinoid	2	7	9	9	-
Petrosphenoid	3	4	7	7	-
Pterygospinous	4	9	13	9	2

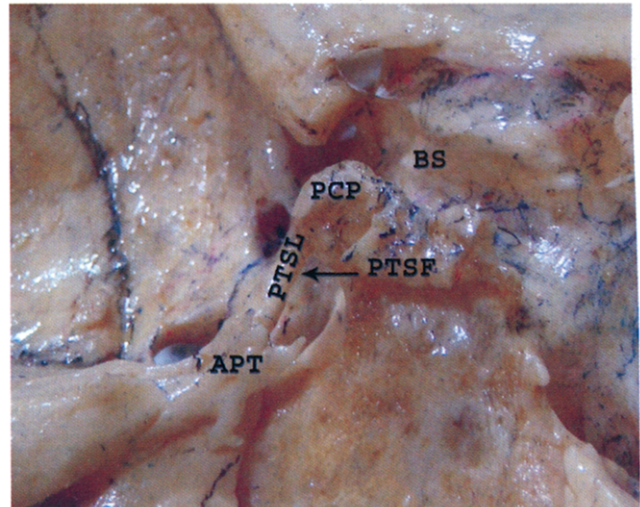


Fig3. Shows ossified petrosphenoid ligament (PTSL) on the left side of middle cranial fossa, petrosphenoid foramen (PTSF), posterior clinoid process (PCP), apex of petrous temporal (APT) and the body of sphenoid (BS).

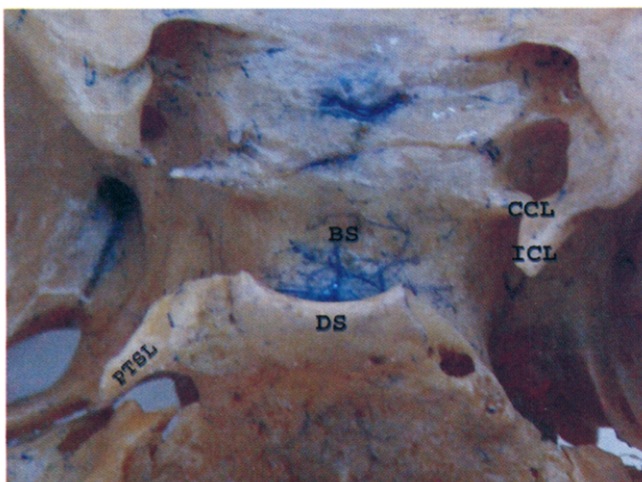


Fig1. Shows ossified caroticoclinoid ligament (CCL), incomplete interclinoid ligament (ICL) on the right side & petrosphenoid ligament (PTSL) on the left side of middle cranial fossa, body of sphenoid (BS) and dorsum sellae (DS).

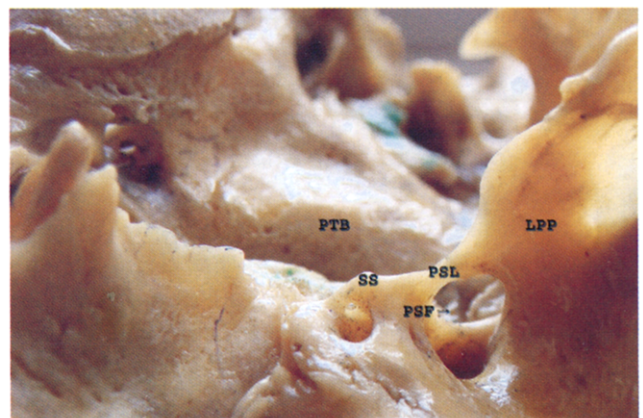


Fig4. Shows ossified pterygospinous ligament (PSL) in the lateral view of the right side of skull, pterygospinous foramen (PSF), spine of sphenoid (SS), lateral pterygoid plate (LPP) and the petrous temporal bone (PTB).

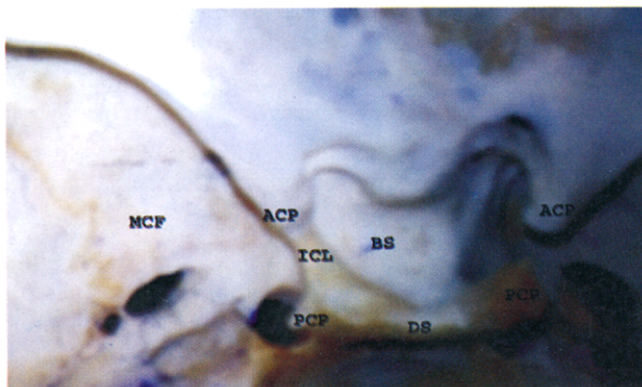


Fig2. Shows ossified interclinoid ligament (ICL) on the left side of middle cranial fossa, anterior clinoid process (ACP), posterior clinoid process (PCP), body of sphenoid (BS), dorsum sellae (DS) and middle cranial fossa (MCF).

DISCUSSION

The different parts of bone and the different bones in the skull are connected by ligaments. Erdogmus et al⁸ (2009)⁸ stated that some of these ligaments may ossify resulting in alteration of the interrelations of the anatomic configuration.

In the present study the caroticoclinoid, interclinoid, petrosphenoid and pterygospinous ligaments were observed to be ossified in 51 sides of skulls out of 134 sides.

In the present study, the interclinoid ligament was observed unilaterally in 9 sides of skulls. Ossified interclinoid ligaments as case reports have been reported in populations of Poland by Skrzat et al³

(2006) and Brazil by Galdames et al⁵ (2008). Azeredo et al⁹ (1988) reported that the incidence of bilateral ligament in the Portugal population was 6 out of the 270 skulls. Ananthi et al¹⁰ (2010) reported a case of bilateral interclinoid ligament in South Indian dry skull. In the present study, no side of skull had bilateral interclinoid ligament. The interclinoid ligament has also been reported on autopsy findings in the Turkish population by Ozdogmus et al⁴ (2003). The incidence of completely ossified ligament was more in the Turkish population as compared to the present study. The caroticoclinoid ligament was observed in 22 sides in the present study which is less as compared to previous workers. The ossified caroticoclinoid ligament has been reported earlier in Turkish population in 35.67% of skulls by Erturk et al¹¹ (2004) and Raveedranath et al¹² (2010) found complete caroticoclinoid foramen in 9.92% of skulls in South-Indian populations. Patnaik et al¹³ (2003) reported a case of bilateral ossified caroticoclinoid ligament and stated that the ossified ligament could be a sequel of ossification of dura mater extending between the two clinoid processes.

The bony bridge formed by ossified ligaments might compress the internal carotid artery and influence its blood flow. Skrzat et al³ (2006) found that the ossified ligament can also cause dysfunction of the muscles of the eye owing to possible compression of the oculomotor nerve. Galdames et al⁹ (2008) and Das et al¹⁴ (2007) found that the surgical removal of the anterior clinoid process of sphenoid bone, to expose the structures within the cavernous sinus becomes more difficult when the interclinoid ligament and caroticoclinoid ligaments are ossified.

A single case of an incompletely ossified pterygospinous ligament was observed by Das and Paul¹⁵ (2007) in a study on 50 dried skulls. In this study, 4 complete and 9 incomplete ossified pterygospinous ligament were observed. Antonopoulou et al¹⁶ (2008) studied the ossified pterygospinous ligament in the Greek population. The ossified pterygospinous ligament forms the pterygospinous Bridge and the pterygospinous foramen. Tubbs et al¹⁷ (2009) called the ossified ligament as the ligament of Cinivini and the foramen, the Cinivini's foramen. He also suggested that the ossified pterygospinous ligament may compress upon the structures passing through the pterygospinous foramen like the branches of the mandibular nerve and chorda tympani nerves. The entrapment of the lingual nerve may lead to lingual numbness and pain associated with speech

impairment. Peuker et al¹⁸ (2001) found that the ossified pterygospinous ligament may cause mandibular neuralgia.

Das et al¹⁴ (2007) opined that the awareness of such anomalies of ossified ligaments is beneficial for maxillofacial and dental surgeons and anesthetists. Tubbs et al¹⁷ (2009) earlier reported that anomalous bony obstructions could interfere with transcutaneous needle placement into the foramen ovale or distort anatomic relationships during approaches to the cranial base for mandibular nerve block.

In the present study; the ossified petrosphenoid ligament was observed in 7 sides that were complete in 3 sides and incomplete in 4 sides. In an earlier study by Skrzat et al¹⁹ (2007) in Poland, one case of partially ossified ligament was observed in the form of a bony spike. Tekdemir et al²⁰ (1996) called the ossified petro-sphenoid ligament, the Gruber's ligament, that forms the Dorello's canal. Liu et al²¹ (2009) and Ozveren et al²² (2003) reported that the abducent nerve passes through the Dorello's canal and as the canal has an osteofibrous structure, the nerve can get compressed while passing through it.

CONCLUSION

The ossified ligaments of skull may cause compression of the anatomic structures that are related to them producing symptoms. The presence of ossified ligaments may make the surgeries of this region difficult and special care has to be taken to avoid injuries to structures which pass under these ossified ligaments.

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