Neuroanatomy, 2003, Volume 2, Pages 25-27.

Original Article

Published online 26 June, 2003 © neuroanatomy.org

Ossification of interclinoid ligament and its clinical significance

Omer Ozdogmus (1)
Erdinc Saka (1)
Cumhur Tulay (1)
Esra Gurdal (1)
Ibrahim Uzun (2)
Safiye Cavdar (1)

(1) Department of Anatomy, Marmara University School of Medicine, Istanbul, Turkey
(2) Council of Forensic Medicine, Istanbul, Turkey

Correspondence Address

Dr. Omer Ozdogmus
Marmara University School of Medicine,
Department of Anatomy,
Haydarpasa 81326
Istanbul, Turkey
E-mail: omerozdogmus@hotmail.com

Received 9 June 2003; accepted 23 June 2003

ABSTRACT

The ossification of ligamentous structures in various part of the body may result in clinical problems. The osseous interclinoid ligament is an underestimated structure in the middle cranial fossa. Early studies on the interclinoid ligament has been conducted on either dry skull, fixed adult / fetus cadavers. The present study states data on fresh autopsy cases. The frequency of ossification of the interclinoid ligament were investigated on 50 autopsy cases bilaterally. Bilaterally complete ossification of interclinoid ligament was found in only three male autopsy cases (6%). The length of the interclinoid ligament was measured 8.95 mm ± 0.92 on the left side and 9.20 mm ± 0.87 on the right side. Statistical analysis showed no correlation between age, side and frequency of ossification of the interclinoid ligament. 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.

Key words: interclinoid ligament, sella bridge, interclinoid taeina, anterior clinoid process, posterior clinoid process

Introduction

Certain parts of the sphenoid bone are connected to each other by ligaments, which occasionally ossify, such as the pterygospinous (the ossification between the spine of the sphenoid and the upper part of the lateral pterygoid plate), the interclinoid (the ossification between the anterior and posterior clinoid processes); and the carotico-clinoid (the ossification between the anterior and middle clinoid processes) [1]. Anomalies of sellar region may result in confusion in the evaluations of MRI or CT and also in the regional surgery planning.

The nomenclature on the complete ossification of interclinoid ligament is vague. In the literature this bony formation is referred to as interclinoid taeina [2-5], sella bridge [6], or interclinoid osseus bridge [7].

The ligamentous or the bony form of interclinoid ligament is important in the aneurysms surgery of the intracavernous portion of the internal carotid artery [7-10] and surgery for tuberculum sella meningiomas [11]. 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 the anterior clinoid process more difficult and increases the risks especially in the presence of an aneurysm [7]. Therefore, to obtain a satisfactory result from these surgeries, detailed anatomical knowledge of the region and the type of ossification between the anterior and posterior clinoid process is necessary.

The aim of the present study, is to investigate the frequency of ossification of interclinoid ligament in autopsy cases and its relations with sex and age. Further, the clinical importance of osseus interclinoid ligament is discussed.

Material and Methods

Fifty autopsy specimens (12 female, 38 male), a hundred interclinoid ligament, aged between 18 and 80 years (mean age 42 years) were evaluated. The autopsies with head injuries were excluded from the study.

The calvaria and the brains were removed via routine autopsy dissections, and neural and vascular structures related to the interclinoid ligament were exposed (Figs. 1A, B). Further, dissections by clearing the dura of the region, exposed the ligament or completly ossified form of the interclinoid ligament (Fig. 2). The length of the interclinoid ligament were measured using a digital compass. All measurements were done by the same researcher. The presence of ossification of the interclinoid ligament was stated. The data obtained was statistically analysed.

Results

In 50 autopsies (100 sides) there was 94 non-ossified and 6 completely ossified interclinoid ligaments (Fig. 2). The average length of 94 interclinoid ligaments was 9,20 mm ± 0,87 on the right and 8,95 mm ± 0,92 on the left side (Fig. 1B). Completely ossified interclinoid ligaments were found bilaterally in three male autopsy cases (7.89 % of male autopsies). The ages of these autopsy cases were 27, 53 and 57. Statistical evaluations

 ISSN 1303-1775 (electronic) 1303-1783 (printed)

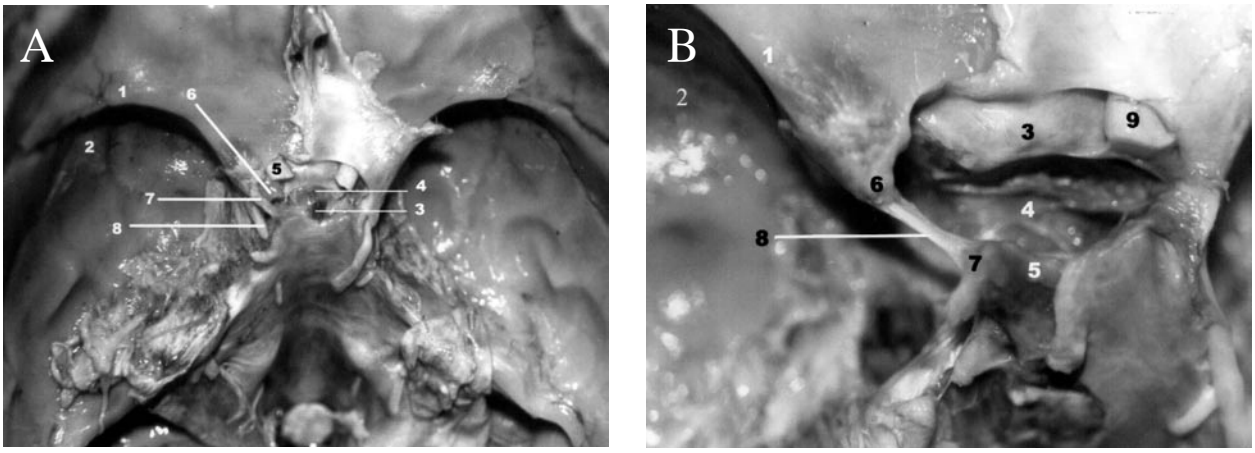

Figure 1 | (A) The interclinoid ligament and surrounding structures have been exposed with the dura intact. 1. lesser wing of sphenoid bone; 2. greater wing of sphenoid bone; 3. stalk (infundibulum) of hypophysis; 4. hypophysis cerebri; 5. optic nerve; 6. internal carotid artery; 7. interclinoid ligament; 8. oculomotor nerve. (B) The interclinoid ligament has been exposed after removing the dura, neural and vascular structures. 1. lesser wing of sphenoid bone; 2. greater wing of sphenoid bone; 3. tuberculum sellae; 4. hypophyseal fossa; 5. dorsum sellae; 6. anterior clinoid process; 7. posterior clinoid process; 8. interclinoid ligament; 9. optic nerve.

showed no significant correlations between ossified interclinoid ligament, age and side. There were no ossified interclinoid ligament in the 12 female autopsy cases examined. In three cases, complete ossification of the interclinoid ligament were accompanied with complete ossification of the carotico-clinoid ligament. The interclinoid ligaments were localized between the internal carotid artery and the oculomotor nerve in all the cases examined (Fig. 1A).

Discussion

The ossification of ligamentous structures in various part of the body is frequently observed. This may result in a clinical problem such as compression to neighbouring structures or complications in the regional surgery. The absence of anatomic data on normal variation of the interclinoid ligament is a severe deficiency of modern anatomy textbooks. Although interclinoid ligament is very important for regional surgery, its anatomy has received less attention. The studies on the interclinoid ligament have been conducted on either dry skull, fixed adult / fetus cadavers. The present study states data on fresh autopsy cases.

The presence of osseous interclinoid ligament on dry skull was stated as 4% by Inoue [7], 8.68% by Keyes [12], 5% by Lang [6] and 7% by Müller [13]. In the present study osseous interclinoid ligament was found in 6% of autopsy cases. Further, Camp [14], reported as 5% in his X-ray series. Platzer [5] studied 220 dry skulls and observed sella bridges in 5.9% of his cases. He also reported that internal carotid artery was stretched by the sella bridge in his 25% of cases while it pass through the cavernous sinus.

Ossification is regarded as a normal age dependent physiological condition. Hochstetter [4] and Kier [15] postulated that osseous interclinoid ligament was a developmental anomaly and showed the existence of the foramen that is formed by this ligament on fetus and infant skull. An embryological study by Hochstetter [4], showed precartilage connections between the anterior and posterior clinoid processes. He concluded that cartilaginous interclinoid taeina were extremely rare hence could not be regarded as routine occurrences. It is reported that sellar bridges are laid down in cartilage at an early stage of development and ossify in early childhood [2]. In accordance with the findings above, the result of the present study showed that ossification of the interclinoid ligament is not age related. These ossifications that observed in early life can be due to the complex embryology of the sphenoid bone in which there are 18-19 ossification centers.

The present data was obtained from the fresh autopsy cases, which is closest to the living. Further, the interclinoid ligament, internal carotid artery, oculomotor nerve and the bony structure can be visualized all together, whereas on dry skulls only bony structures can be evaluated. In the case of cadaver studies due to fixation solution used, the measurements obtained are far from actual data. The presence of the bony connection between the anterior and posterior clinoid processes makes the removal of the anterior clinoid process more difficult and increases the risks especially in the presence of an aneurysm [7]. The osseous interclinoid ligament is an underestimated structure which is clinically and surgically important. The knowledge of detailed anatomy of the interclinoid ligament could increase the success of diagnostic evaluation and surgical approaches to the region.

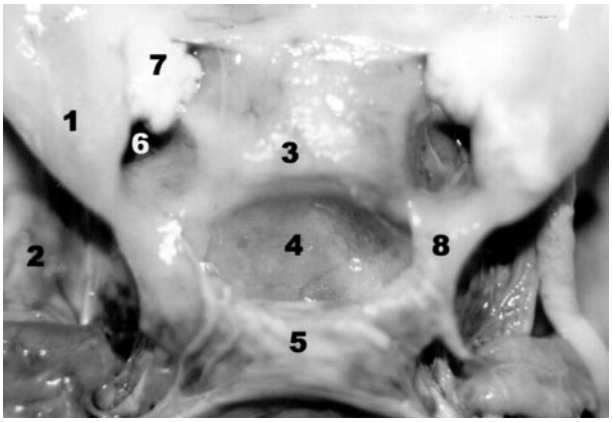

Figure 2 | A case of bilateral complete ossification of interclinoid ligament. 1. lesser wing of sphenoid bone; 2. greater wing of sphenoid bone; 3. tuberculum sellae; 4. hypophyseal fossa; 5. dorsum sellae; 6. carotico-clinoid foramen; 7. optic nerve; 8. complete ossification of interclinoid ligament.

References

[1] Williams PL, Warwick R, Dyson M, Bannister LH. Gray's Anatomy 37th ed, Churchill Livingstone, Edinburgh, 1989; 373-377.

[2] Lang J. Skull base and related structures: Atlas of clinical anatomy. Stuttgart: Schattauer, 1995; 175.

[3] Gaupp E. Über die Ala temporalis des Säugerschädels und die Regio orbitalis einiger anderer Wirbeltierschädel. Anat. H., 1. Abt., vol. 19, Heft 61, 1902; 155-230.

[4] Hochstetter F. Über die Taenia interclinoidea, die Commissura alicochlearis und die Cartilago supracochlearis des menschlichen Primordialkraniums. Gegenbaurs Morph. Jb. 1940 (84) 220-243.

[5] Platzer W. Zur Anatomie der 'sellabrücke' und ihrer Beziehung zur a. carotis interna. Fortschr. Röntgenstr. 1957 (87) 613-616.

[6] Lang J. Structure and postnatal organization of heretofore uninvestigated and infrequent ossifications of the sella turcica region. Acta Anat. 1977 (99) 121-139.

[7] Inoue T, Rhoton AL Jr, Theele D, Barry ME. Surgical approaches to the cavernous sinus: a microsurgical study. Neurosurgery. 1990 (26) 903-932.

[8] Linskey ME, Sekhar LN, HirschWL Jr, Yonas H, Horton JA. Aneurysms of the intracavernous carotid artery: History and indications for treatment. Neurosurgery. 1990 (26) 933-938.

[9] Al-Rodhan NYF, Piepgras DG, Sundt TM. Transitional cavernous aneurysms of the internal carotid artery. Neurosurgery. 1993 (33) 993-998.

[10] Sekhar LN, Burgess J, Akin O. Anatomical study of the cavernous sinus emphasizing operative approaches and related vascular and neural reconstruction. Neurosurgery. 1987 (21) 806-816.

[11] Arai H, Sato K, Okuda O, Miyajima M, Hishii M, Nakanishi H, Ishii H. Transcranial transsphenoidal approach for tuberculum sellae meningiomas. Acta Neurochir. (Wien) 2000 (142) 751-757.

[12] Keyes JEL. Observations on four thousand optic foramina in human skulls of known origin. Arch. Ophthalmol. 1935 (13) 538-568.

[13] Müller F. Die Bedeutung der Sellabrücke für das Auge. Klin. Mbl. Augenheilk. 1952 (120) 298-302.

[14] Camp JD. Roentgenological observations concerning erosions of the sella turcica. Radiology. 1949 (53) 666-673.

[15] Kier EL. Embryology of the normal optic canal and its anomalies. An anatomic and roentgenographic study. Invest. Radiol. 1966 (1) 346-362.