Journal of Cranio-Maxillo-Facial Surgery 42 (2014) e266–e270

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

The ossified pterygoalar ligament: An anatomical study with pathological and surgical implications

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ARTICLE INFO

Article history:
Paper received 1 May 2013
Accepted 8 October 2013

Keywords:
Pterygoalar ligament
Pterygoalar bar
Pterygoalar foramen
Mandibular nerve compression
Trigeminal neuralgia

ABSTRACT

Mandibular nerve entrapment has great significance, as it may be responsible for the appearance of several neurological pathologies, such as chewing disorders, taste loss, facial or tongue paraesthesia and neuralgia. The ossified pterygoalar (Pta) bar is the result of calcification and/or ossification of the ligament extending from the pterygospinous process of the lateral pterygoid lamina to the infratemporal surface of the sphenoid bone. The ossified bar may act as the cause for this entrapment.

One hundred and forty-five Greek adult dry skulls were examined for the existence of a complete or incomplete Pta bar and a relative foramen. The Pta bar appeared in 31.7% of the skulls, in total, in 4.1% completely and in 27.6% incompletely ossified. The mean sagittal and transverse diameters of Pta foramen were 3.21 ± 1.70 and 4.79 ± 1.39 mm, respectively. There was no statistical significant difference between the presence of Pta bar and the side or gender. Apart from the neurological interest, this study highlights the importance of the existence of Pta bar in neurosurgery, anaesthesiology, oral and maxillofacial surgery. The passage of the needle through the foramen ovale for the injection of anaesthetics, as a treatment for trigeminal neuralgia may not be achieved due to this anatomical obstacle. In this case, intra- or postoperative radiologic investigation may be helpful.

1. Introduction

The Pterygoalar (Pta), or Hyrtl–Calori's ligament, is a thin bundle of dense connective tissue extending from the root of the lateral pterygoid lamina to the undersurface of the greater wing of the sphenoid bone (Chouke and Hodes, 1951). The Pta ligament has been observed as a distinct fibrous structure in an embryo of only 120 mm rostral–caudal length (James et al., 1980).

Osseous bridging, in various parts of the body, is a frequent age-dependent process, poorly understood and represents the outcome of secondary ossification of fibrous structures (Natsis et al., 2007). Ossification of Pta ligament results in the appearance of a bony bridge, called the Pta bar, which occasionally forms a Pta foramen or porus crotaphitico-buccinatorius (Chouke and Hodes, 1951). The Pta foramen should be discriminated from the pterygospinous (Pts), or foramen of Civinini, which derives from the ossification of Pts ligament. The Pts bar originates from the Pts process of the lateral pterygoid lamina, similarly to the origin of Pta bar, resulting to the sphenoidal spine. Thus, Pts bar is either below or medial to the foramen ovale (FO), in contrast to Pta bar, which lies laterally to the foramen or runs beneath it, dividing FO in two parts (Chouke, 1946; Chakravarthi and Babu, 2012).

The existence of Pta bar has great clinical importance, as it can be responsible for the compression of the branches of the mandibular division of the trigeminal nerve (TN) (Antonopoulou et al., 2008). This phenomenon may cause several neurological symptoms, such as chewing disorders, pain and numbness of the buccal region and tongue and salivatory changes of the parotid gland (Peker et al., 2002). In addition, an ossified Pta ligament may hinder the transoval approaches (horizontal transzygomatic and Hartel's or other transmalar ascending approaches), that neurosurgeons and maxillofacial surgeons perform in order to inject anaesthetics into the FO region for the treatment of trigeminal neuralgia (Lepp and Sandner, 1968). Hence, the detailed anatomical study of this abnormality can contribute to both the investigation of neurological pathologies and the effectiveness of surgical procedures.

This study investigates the incidence of Pta bar in a Greek population and its relation to side, gender and age, compares the

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http://dx.doi.org/10.1016/j.jcms.2013.10.003

results with the findings of other studies on different populations and highlights the clinical implications of this anatomical entity.

2. Materials and methods

One hundred and forty-five Greek adult dry human skulls (80 males and 65 females) were obtained from the Departments of Anatomy of Aristotle University of Thessaloniki and National and Kapodistrian University of Athens. No skulls showed evidence of obvious trauma or pathological condition. Their age range was 18–91 years. Two hundred and ninety sides were observed for the existence of Pta bar and Pta foramen. Considering that Pta ossification is believed to be an age-dependent process the age of the skulls presenting a complete or an incomplete ossification of Pta ligament unilaterally or bilaterally was assessed (Figs. 1 and 2). The Pta bar was classified as incomplete when there was an elongation of the tubercles or spines on one or both bones of the ligamentous attachment and complete when there was a fusion between the elongated tubercles or spines, thus forming a foramen. When Pta foramen was present its dimensions were measured using a digital sliding calliper (Mitutoyo ABSOLUTE 500-196-20) accurate to 0.01 mm. In cases of incomplete ossification of the Pta ligament, the distance between two tips of the Pta bar was measured.

2.1. Statistical analysis

Sexual dimorphism and side asymmetry were also investigated using the chi-square test. The statistical analysis was performed using SPSS Software for Windows version 15.0 and a value of $P < 0.05$ was considered statistically significant.

3. Results

The Pta bar was observed in 46 skulls (31.7%). The ossification was complete in 6 skulls (4.1%), in 4 (2.7%) unilaterally and in 2 (1.4%) bilaterally. In 40 skulls (27.6%) Pta bar was incomplete, in 28 (19.3%) unilaterally and in 12 skulls (8.3%) bilaterally. There was no statistical significant difference between the existence of Pta bar and the side of the skull ($P = 0.857$). The incidence of Pta bar in male skulls was 33.8% (27/80skulls). Among them, the ossification was complete in 4 (5%) and incomplete in 23 male skulls (28.8%). In female skulls, the incidence of Pta bar was 29.2% (19/65 skulls), a lower percentage compared to that of males. The ossification was complete in 2 (3%) and incomplete in 17 female skulls (26.2%). Despite the lower incidence of Pta bar in females, no statistical significant difference was accomplished ($P = 0.238$). The data are summarized in Table 1. The mean sagittal and transverse diameters of Pta foramen, in cases of complete ossification were 3.21 ± 1.70

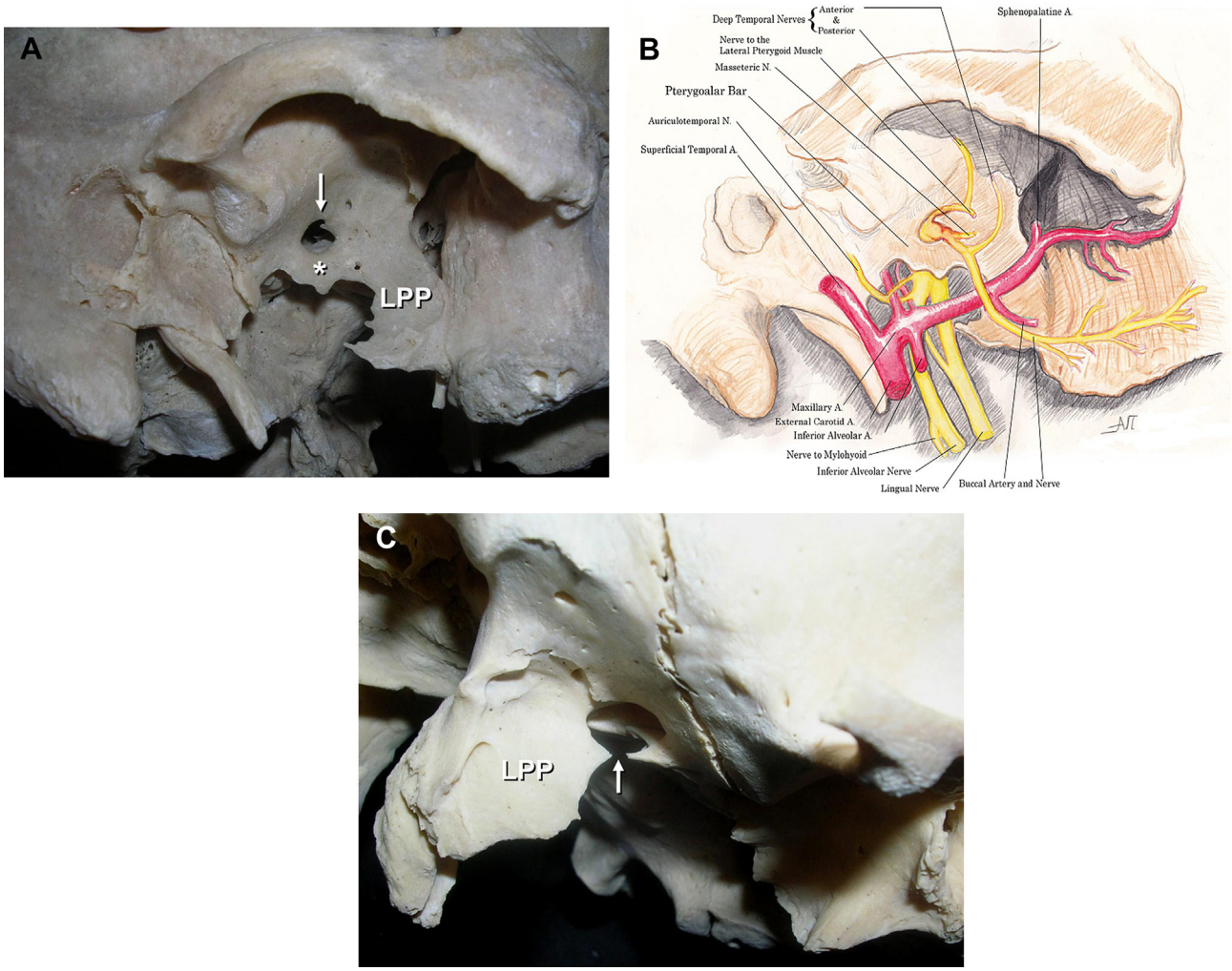

Fig. 1. A Lateral right view of the complete pterygoalar (Pta) bar (*) and Pta foramen indicated by an arrow, B schematic drawing indicating the existence of the complete Pta bar in the same skull and related neurovascular structures, C lateral left view of the incomplete Pta bar indicated by an arrow. LPP: lateral pterygoid plate.