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High Incidence of Complete Ossification of the Superior Transverse Scapular Ligament in Brazilians and its Clinical Implications

Alta Incidencia de Osificación Completa del Ligamento Escapular Transverso Superior en Brasileños y sus Implicancias Clínicas

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SUMMARY: The aim of this study was to verify the prevalence of the ossified superior transverse scapular ligament (STSL) on dry bones of scapulae. 221 dry bones were analyzed, (111 rights and 110 lefts), proceeding from Rio de Janeiro and of Santa Catarina, Brazil. As exclusion criterion, were not analyzed bones of children or damaged. For the quantitative analysis of the data, the software Graphad Instat was used. Fisher exact test was used considering the p≤ 0,05 as significant. After analysis of the scapulae, 30,76% (68/221) presented the ossified STSL (p≤ 0,0001) of which, 52,94% (36/68) were ossified on the right side and 47,05% (32/68) on the left one. The 153 scapulae that did not present the ossified STSL, it was observed in 19,6 % (30/153) of these bones, the superior edge varying in the transverse plan, increasing superior angulation and, modified the width and depth of the scapular incisure. This anatomical curiosity should be kept in mind by clinicians that approaches painful syndrome of the shoulder, as well as, this anatomical curiosity should be kept in mind by students that may manipulate this anatomical area.

KEY WORDS: Gross Anatomy; Variation; Scapula; Superior transverse scapular ligament.

INTRODUCTION

The suprascapular notch is roofed by the superior transverse scapular ligament (STSL) converting it into foramen in some species (Khan, 2006). In humans, this conversion is a result of the ossification of the STSL (Gardner *et al*., 1988; Bergman *et al*., 1988, Williams *et al*., 1989). Variations on STSL have been reported by Testut (1904) and Poirier & Charpy (1911). Calcification, partial or complete ossification and multiple bands were also discussed by Ticker *et al*., (1998) and related by others authors (Osuagwu *et al*., 2005; Khan). Moreover, others studies have been observed the prevalence of these variations (Kajava, 1924; Vallois,1925; Vallois, 1926; Gray, 1942; Lewis, 1959).

The suprascapular artery and vein pass over the superior aspect of the STSL (Antoniadis *et al*., 1996; Weinfeld *et al*., 2002). The suprascapular notch and the overlying STSL constitute a narrow foramen, with inflexible and often sharp edges, through which the suprascapular nerve must pass (Williams *et al*.; Weinfeld *et al*.). The suprascapular nerve is fixed in the osteofibrous foramen of the notch and STSL and by its distal muscular and joint connections (Gelmers & Byus, 1977; Antoniadis *et al*.; Weinfeld *et al*.). Mechanical irritation of the suprascapular nerve can occur at this location with excursions of the scapula, particularly during cross-body abduction, during a variety of activities involving movement of the upper extremity (Clein, 1975; Gelmers & Buys; Antoniadis *et al*.; Weinfeld *et al*.).

The ossification of the STSL was considered anomalous by Lewis and Harris *et al*., (2001), suggesting

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one more factor to calcification of STSL and suprascapular nerve entrapment syndrome.

In the diagnosis of suprascapular nerve entrapment syndrome, anatomical variations of the STSL sometimes feature in the hierarchy of possible etiologic factors (Callahan *et al*., 1991). However, this syndrome has also been described in clinical scenarios without a visible ossification of the STSL (Osuagwu *et al*.). Complete ossification of the STSL or suprascapular nerve entrapment syndrome has not been previously described amongst Brazilians. Therefore, the proposal of this study was to verify the prevalence of the STSL ossified in Brazilians dry bones.

MATERIAL AND METHOD

This work was performed according to the provisions of the declaration of Helsinki in 1995 (as revised in Edinburgh, 2000). Guidelines for our internal review board were found in the observations made and the protocol was approved by local Department of Morphology.

Two hundred twenty one scapulae (dry bones) were analyzed: 111 rights and 110 lefts, proceeding of the collection of three universities from Rio de Janeiro state and one university of Santa Catarina state. As exclusion criterion, were not analyzed bones of children or damaged.

The exam was performed by presence of STSL completely ossified. It was adopted like exclusion criterion all the children scapulae and the scapulae which the superior margin of bone were bilaterally damaged. All the analyzed parameters were independent of sex or race.

For the quantitative analysis of the data, the software Graphad Instat (Graphpad) was used. The tests of Kolmogorov-Smirnov were used to analyze if the data were within the normal distribution. Fisher exact test was used to verify the relation between showed in Table I. The p≤ 0,05 was considered significant.

RESULTS

Macroscopic examination revealed that 68/221 (30,76%) of analyzed scapulae presented the ossified STSL creating a forame (Figs.1 and 2). The data obtained are considered statically significant (p≤ 0,0001) (Table I and Fig.3). In this group, it was observed that 36/68 (52,94%) were ossified on the right side and 32/68 (47,05%) on the left one. In the 153 scapulae that did not present the ossified STSL, 30/153 (19,6%) have been showed the superior edge varying at transverse plan, creating a superior angulations; which, in the specimens studied, modified the form at depth and width of the scapular notch.

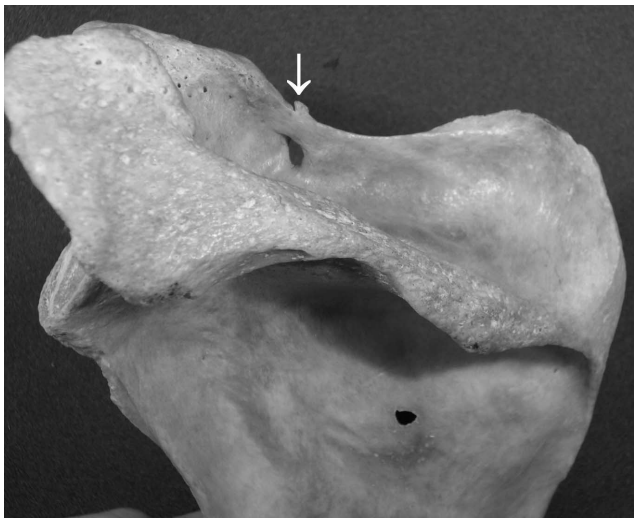

Fig. 1. Posterior-superior view of the left scapula showing ossified STSL (arrow).

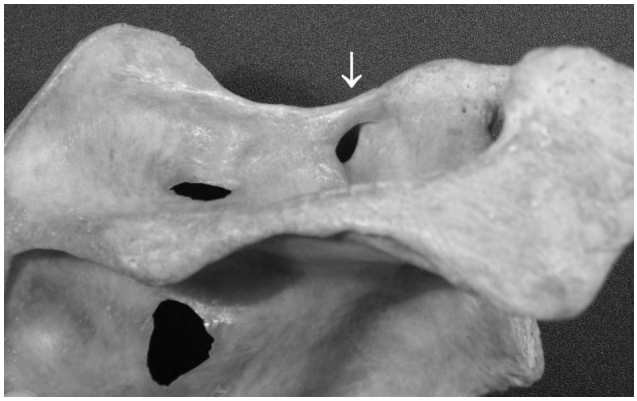

Fig. 2. Posterior-superior view of the left scapula showing ossified STSL (arrow)

Table I. Analysis between percent data waited (*) vs obtained of the 221 scapulae studied.

Anatomic elements	Waited data	Obtained data
Suprascapular notch - normal anatomy of dry bone	90%	?
Ossified STSL - abnormal anatomy of dry bone	10% *	?
Total	100%	100%

*Estimated data above of that it was found in literature (Poirier & Charpy, 1911; Kajava,1924; Vallois,1925,1926; Gray,1942).

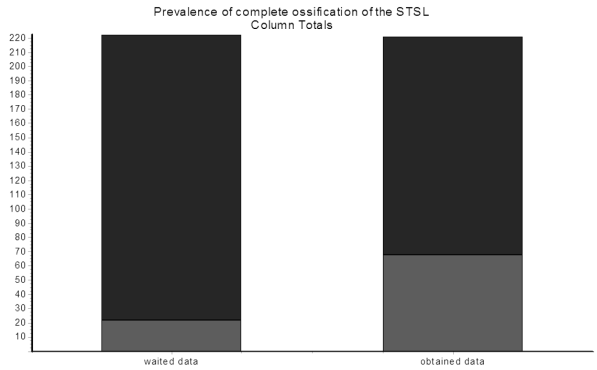

Fig. 3. Representative graphic of the results between waited data comparing with obtained data. 221 specimens analyzed: black color= suprascapular notch (normal anatomy); gray color = ossified STSL (abnormal anatomy).

DISCUSSION

The complete ossification of the STSL converting the suprascapular notch into foramen was found in three of 60 (5%) scapulae by Poirier & Charpy. In 133 finish scapulae studied by Kajava, the foramen was present only twice (1.5%). Vallois (1925) found the foramina to occur 13 times in 200 (6.5%) scapulae of French men. In a second study Vallois, (1926) reported that Italian scapulae had foramina in 6.1% and in a series of scapulae from various sources, the incidence varied from 0% to 3.3 %. Gray found foramen in 73 of 1.151 scapulae (6.34%), but no suprascapular foramina were found in 87 Indian scapulae.

To our knowledge, this work is the first to quantify the variation of STSL ossified in Brazilians. We could observed in the subjects a significant percentage of 30.76% (68/221) considered statically significant ($p \leq 0{,}0001$). Comparing with other studies, we verify a high percentage of frequency at Brazilians (Poirier & Charpy; Kajava; Vallois, 1925; Vallois, 1926; Gray). About the alteration of the superior edge scapular, we can relate this to shortening or adaptation for muscular overuse that fix at superior edge, during the life. The muscles, supraspinatus and scapula elevator transit in this region can be related to the STSL calcification, associated to the muscular groupings of this region. Certain habits of life at utilization of the upper limb can also intervene at the process.

Some studies try to elucidate the alterations provoked in the structures of the human skeleton, in special at sports (Ringel *et al*.; Tengan *et al*.; Wang & Koehler). Sandow & Ilic have been discussed about the specific volleyball movements and their implications at suprascapular nerve compression. The characteristically gestures e.g. of volleyball players as abduction associate lateral (external) rotation are factors that predispose the neuropraxis. These data justify our results and the anatomical exploration of the scapular notch region and the STSL.

The most recent papers do not elucidate reasons for the STSL ossification, they only analyze that this condition promotes the suprascapular nerve syndrome (Prescher). The ossified STSL can be a risky factor at surgical explorations during a suprascapular nerve decompression (Ticker *et al*.).

Cohen *et al*. have been described a familial case of calcification of STSL affecting a 58 year old man and his son, who had STSL calcification causing entrapment neuropathy of the suprascapular nerve, clinical symptoms of pain, weakness of the external rotation and abduction, and atrophy of the supraspinatus muscle (Weinfeld *et al*.). There are reports in the literature about bifid (Alon *et al*., 1998) and trifid (Ticker *et al*.) STSL, with the former including an account of ensuing suprascapular nerve entrapment.

Rengachary *et al*. have been observed six different types of anatomical variations in the suprascapular notch area. These variations of the suprascapular notch and the STSL constitute potential predisposing factors to suprascapular nerve entrapment. However, Harris *et al*., promoted new discusses about the suprascapular notch area. They showed that conoid ligament has accessory fascicle, the lateral border of the scapular notch at the junction of the conoid and STLS. This variation is considered anomalous by Harris *et al*., but it is mentioned by Testut and Lewis , suggesting one more factor to calcification of STSL and suprascapular nerve entrapment.

Despite this possible relationship between suprascapular nerve entrapment syndrome and the morphological differences, in the infraspinatus or supraspinatus muscle and variations in the STLS, we were unable to correlate all the aforementioned in the subject of this case report due the poor documentation (Osuagwu *et al*.; Khan). The present study demonstrates that complete ossification of STSL is common and can occur usually in Brazilians.

The anatomical knowledge of the STSL ossified are of extreme importance for the clinicians that approaches painful syndrome of the shoulder, as well as, this anatomical curiosity should be kept in mind by students and surgeons that may manipulate this anatomical area.

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RESUMEN: El objetivo de este estudio fue verificar la prevalencia del ligamento escapular transverso superior (LETS) osificado, en huesos secos. 221 escápulas secas (111 derechas y 110 izquierdas) fueron analizadas,procedentes de Río de Janeiro y de Santa Catarina, Brasil. No fueron analizados huesos de niños o dañados. El tratamiento estadístico de los datos fue realizado con el software Graphpad Instat, siendo seleccionado el test Fisher, con un $p \leq 0.05$ como significativo. El 30.76% (68/221) de las escápulas presentaron el LETS osificado ($p \leq 0{,}0001$) de ellos, el 52.94% (36/68) correspondían a escáulas derechas y 47.05% (32/68) a escápulas izquierdas. Las 153 escápulas que no presentaron el LETS osificado, se observó en el 19.6% (30/153) de estos huesos. El margen superior que variaba en el plano transversal, incrementaba la angulación superior y modificaba así el ancho y la profundidad de la incisura escapular. Esta variación anatómica la deben tener presente los clínicos debido al síndrome doloroso del hombro, como también, los estudiantes que manipulan esta área anatómica.

PALABRAS CLAVE: Anatomía; Variation; Escápula; Ligamento escapular transverso superior.

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