IJAE
Vol. 121, n. 2: 205-210, 2016
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

Research article - Human anatomy case report

Formation of suprascapular foramen as a result of ossification of superior transverse scapular ligament: a case report and short review of the literature

Stylianos Kapetanakis*, Nikolaos Gkantsinikoudis, Aliki Fiska

Department of Anatomy, Medical School of Alexandroupolis, Democritus University of Thrace, Greece

Abstract

Ossification of superior transverse scapular ligament resulting in a bony suprascapular foramen is of fundamental anatomical and clinical importance. In this case report, we describe a special case of a suprascapular foramen. Its specificity lies in foraminal dimensions, resulting in a unique morphometrical pattern in comparison with reported similar cases. This pattern is of great anatomical and clinical importance, because ossification of suprascapular foramen leads to limitation of suprascapular notch, over which suprascapular nerve passes. Ossification can consequently constitute a major predisposing factor for suprascapular nerve entrapment and subsequent neuropathy. Therefore, this anatomic variation should be considered from surgeons and other healthcare professionals.

Key words

Suprascapular foramen, superior transverse scapular ligament, ossification, variations, case report, review

Introduction

The suprascapular foramen is formed normally by the suprascapular notch, which is converted in a foramen by the superior trasverse scapular ligament in the scapular region (Moore et al., 2014). A recently reported ligament is present in the anterior aspect, which leads to a significant decrease in the foraminal vertical diameter and has been named anterior coracoscapular ligament (Avery et al., 2002).

However, the stability of this anatomic standard is disputed, as featured by the report of many anatomical variations in current population. In 1979, six different types of suprascapular notch were reported, which lead automatically to different types of suprascapular foramen and complicate the possible foramen morphology (Rengachary et al., 1979). In recent years, two cases involving double suprascapular foramen were described and primarily attributed to ossification of superior transverse scapular ligament and anterior coracoscapular ligament, and to ossification of bifid superior transverse scapular ligament (Polguj et al., 2012; Joy et al., 2015). Ossification of a single-bundle anterior coracoscapular ligament constitutes the cause of another additional reported anatomical variation, the coexistence of suprascapular notch and suprascapular foramen (Polguj et al., 2013).

* Corresponding author. E-mail: stkapetanakis@yahoo.gr

http://www.fupress.com/ijae
DOI: 10.13128/IJAE-18496

In this case report, we describe a single bony suprascapular foramen in a right dry scapula, caused by ossification of superior transverse scapular ligament. To our knowledge, this anatomic variation has been reported only three times (Das et al., 2007; Tubbs et al., 2013; Polguj et al., 2014) and was additionally analyzed as a special case in two other wide morphological studies (Albino et al., 2013; Kannan et al., 2014). Nevertheless, it is interesting that in morphological analysis none of those authors described a suprascapular foramen with so small diameters. Morphologically, the originality lies in foraminal dimensions, which would not be expected according to the recent classification settled in 2014 (Polguj et al., 2014). As a result, this morphology creates new perspectives in the clinical standards for suprascapular nerve entrapment.

Case report

This anatomic variation was found during laboratory anatomical research. A total of 20 scapulae were stored in the laboratory, 10 right and 10 left scapulae. Dry scapulae were derived from six men and four women of Greek ancestry. Mean age was 64,5 years with range from 63 to 66 years. Only one right dry scapula presented this anatomically important feature. Based on the above, the percentage is 0,05% but the sample was not wide enough for statistics. Measurements were performed to better define the finding.

The morphology of the ossified superior transverse scapular ligament put it in the category of fan-shaped ossified superior transverse scapular ligament according to the classification first established in 2014 (Polguj et al., 2014). The length was 11.7 mm (black line in Fig. 1), and the ossified superior transverse scapular ligament (lateral part) formed the superior border of the foramen at the medial and posterior end of coracoid process. The width was 9.5 mm in the middle (red line in Fig. 1), just over the foraminal apex. The medial part of superior transverse scapular ligament adhered to the superior border of scapula along an oblique line (yellow line in Fig. 1) 17 mm long.

The foramen has an ellipsoid shape with the superior apex laterally and the inferior medially. The maximum transverse diameter was only 3.88 mm, while the average vertical diameter was 6.46 mm with a maximum of 8.00 mm. The anteroposterior thickness was 3.04 mm. The distance from the superior angle of the scapula was 58.04 mm (Fig. 2), while the distance from the glenoid notch was 28.95 mm (Fig. 3). The foramen surface area was 24.36 mm^2. Osteological deformities were not noticed in general during anatomical examination, except for two imperceptible breaks in the lower part of subscapularis fossa, which could be also observed in the posterior aspect, in the infraspinatus fossa. Osteophytes were also present on the lateral side of acromion.

Discussion

The scapula constitutes embryologically a bone of the upper limb. During the fifth week, mesenchyme migrates along central axis of the limb bud, originating from lateral plate mesoderm, and its condensation results in the formation of mesenchymal bone

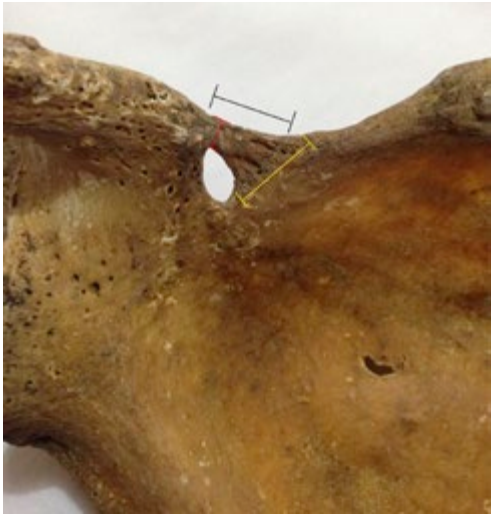

Figure 1 – Morphology of ossified superior transverse scapular ligament. Black line: ligament length; red line: ligament width; yellow line: line of fusion between the ligament and the scapula on the medial site.

Figure 2 – Overview of the scapula with suprascapular foramen. Green line: distance between foramen and superior angle of the scapula.

Figure 3 – Detail of suprascapular foramen with distance from glenoid notch (blue line).

models. Chondrification occurs in the sixth week. Ossification of hyaline cartilage models leads to bone formation by endochondral ossification (Singh, 2012).

The suprascapular foramen is formed normally by the suprascapular notch, which is converted into a foramen by the superior transverse scapular ligament which bridges the borders of the notch. The suprascapular nerve, an important branch of the brachial plexus, and the transverse scapular vein pass through the foramen. The suprascapular artery passes in general over the superior transverse scapular ligament (Moore et al., 2014).

The different types of suprascapular notch were first described in 1979. The notch can even be absent (Rengachary et al., 1979). In type VI, found in 4% of subjects, the notch is converted into a bony foramen as the superior transverse scapular ligament is completely ossified.

Our anatomical case is peculiar because the foraminal diameters were very small in comparison with previously reported cases (Das et al., 2007; Polguj et al., 2014;

Table 1 – Previous reports on suprascapular bony foramen.

Authors	Vertical diameter (mm)	Transverse diameter (mm)	Surface area (mm^2)
Tubbs et al. (2013)	No specific measurement information have been reported		
Das et al. (2007)	12.00 (maximum)	8.00 (maximum)	Not reported
Polguj et al. (2014) (fan-shaped superior transverse scapular ligament)	7.15 (mean)	8.75 (mean)	50.75
Polguj et.al. (2014) (band-shaped superior transverse scapular ligament)	7.03 (mean)	5.35 (mean)	30.43
Present case	· 8.00 (maximum) · 6.46 (mean)	3.88	24.36

Table 1). Even if our case belongs to fan-shaped type of superior transverse scapular ligament, the resulting foramen was even narrower than in cases of band-shaped superior transverse scapular ligament (Polguj et al., 2014). A fan-shaped superior transverse scapular ligament, as in this case, may therefore be a predisposing factor for suprascapular nerve entrapment (a condition first described by Thomas, 1936) because of the extremely narrow foramen from which the suprascapular nerve passes.

Ossification of superior transverse scapular ligament constitutes a cause of suprascapular nerve entrapment (Ticker et al., 1998, Osuagwu et al., 2000; Silva et al., 2007) and the superior transverse scapular ligament peculiar shape or ossification should be considered as predisposing factor for such entrapment (Bruce and Dorizas, 2013).

Other predisposing factors for suprascapular nerve entrapment are supraspinatus fascia and hypertrophied subscapularis muscle (Duparc et al., 2010), double suprascapular foramen (Joy et al., 2015), anomalous position of suprascapular artery (Tubbs et al., 2003) and presence of anterior coracoscapular ligament. The incidence of this last condition was 60% in patients who suffered from suprascapular nerve entrapment in U.S.A. (Avery et al., 2002), 18,8% in Turkey (Bayramoğlu et al., 2003**)** and 28% in Thai population (Piyawinijwong and Tantipoon, 2012).

Repeated overhead movements (Tubbs et al., 2003), such as volleyball (Witvrouw et al., 2000) and overhead throwing sports (Seroyer et al., 2009) may lead to suprascapular nerve entrapment through the "sling effect": during such movements the suprascapular nerve can be pressed on the sharp suprascapular notch border, causing, on repetition, nerve irritation and eventually neuropathy (Rengachary et al., 1979).

The typical symptoms of suprascapular nerve entrapment include pain or weakness in the posterior and lateral part of shoulder and atrophy of supra- and infraspinatus muscles. However, the similarity of symptoms with other shoulder pathologies, such as rotator cuff tears, make differential diagnosis difficult (Zehetgruber et al., 2002). The treatment is in the beginning conservative, with physiotherapy directed at strengthening rotator's cuff musculature. In case of failure, surgical decompression is recommended (Tubbs et al., 2003). In the case of a bony suprascapular foramen, special arthroscopic decompression can be proposed (Agrawal, 2009).

References

Agrawal V. (2009) Arthroscopic decompression of a bony suprascapular foramen. J. Arthrosc. Rel. Surg. 25: 325-328.

Albino P., Carbone S., Candela V., Arceri V., Vestri A.R., Gumina S. (2013) Morphometry of the suprascapular notch: correlation with scapular dimensions and clinical relevance. BMC Musculoskelet. Disord. 14: 172.

Avery B.W., Pilon F.M., Barclay J.K. (2002) Anterior coracoscapular ligament and suprascapular nerve entrapment. Clin. Anat. 15: 383-386.

Bayramoğlu A., Demiryürek D., Tüccar E., Erbil M., Aldur M.M., Tetik O., Doral M.N. (2003) Variations in anatomy at the suprascapular notch possibly causing suprascapular nerve entrapment: an anatomical study. Knee Surg. Sports Traumatol. Arthrosc. 11: 393-398.

Bruce J., Dorizas J. (2013) Suprascapular nerve entrapment due to a stenotic foramen. Sports Health 5: 363-366.

Das S., Suri R., Kapur V. (2007) Ossification of superior transverse scapular ligament and its clinical implications. Sultan Qaboos Univ. Med. J. 7: 157-160.

Duparc F., Coquerel D., Ozeel J., Noyon M., Gerometta A., Michot C. (2010) Anatomical basis of the suprascapular nerve entrapment, and clinical relevance of the supraspinatus fascia. Surg. Radiol. Anat. 32: 277-284.

Joy P., Sinha M.B., Satapathy B.C. (2015) The ossified bifid superior transverse scapular ligament causing a double suprascapular foramen: A case report. J. Clin. Diagn. Res. 9: AD03-AD04.

Kannan U., Kannan N.S., Anbalagan J., Rao S. (2014) Morphometric study of suprascapular notch in Indian dry scapulae with specific reference to the incidence of completely ossified superior transverse scapular ligament. J. Clin. Diagn. Res. 8: 7-10.

Moore K.L., Dalley A.F., Agur A.M.R. (2014) Clinically Oriented Anatomy, 7th Edition. Wolters Kluwer Health, Lippincott Williams and Wilkins, Philadelphia.

Osuagwu F., Imosemi I., Shokunbi M. (2000) Complete ossification of the superior traverse scapular ligament in a Nigerian male adult. Int. J. Morph. 23: 121-122.

Piyawinijwong S., Tantipoon P. (2012) The anterior coracoscapular ligament in Thais: possible etiological factor of suprascapular nerve entrapment. Siriraj Med. J. 64: S12-S14.

Polguj M., Podgórski M., Jędrzejewski K., Topol M. (2012) The double suprascapular foramen: unique anatomical variation and the new hypothesis of its formation. Skeletal. Radiol. 41: 1631-1636.

Polguj M., Jędrzejewski K., Majos A., Topol M. (2013) Coexistence of the suprascapular notch and the suprascapular foramen - a rare anatomical variation and a new hypothesis on its formation based on anatomical and radiological studies. Anat. Sci. Int. 88: 156-162.

Polguj M., Sibiński M., Grzegorzewski A., Waszczykowski M., Majos A., Topol M. (2014) Morphological and radiological study of ossified superior transverse scapular ligament as potential risk factor of suprascapular nerve entrapment. Biomed. Res. Int. 2014: 613601.

Rengachary S., Burr D., Lucas S., Hassanein K. M., Mohn M. P., Matzke H. (1979). Suprascapular entrapment neuropathy: a clinical, anatomical, and comparative study. Neurosurgery 5: 447-451.

Seroyer S.T., Nho S.J., Bach B.R. Jr., Bush-Joseph C.A., Nicholson G.P., Romeo A.A. (2009) Shoulder pain in the overhead throwing athlete. Sports Health 1: 108-120.

Silva J.F., Aureliano-Rafael F., Sgrott E.A., Silva S.F., Babinski M.A., Fernandes R.M.P. (2007) High incidence of complete ossification of the superior transverse scapular ligament in Brazilians and its clinical implications. Inter. J. Morph. 25: 855-859.

Singh V. (2012) Textbook of Clinical Embryology. Elsevier Health Sciences India, Gurgaon.

Thomas A. (1936) La paralyse du muscle sous-épineux. Presse Med. 64: 1283-1284.

Ticker J.B., Djurasovic M., Strauch R.J., April E.W., Pollock R.G., Flatow E.L., Bigliani L.U. (1998) The incidence of ganglion cysts and other variations in anatomy along the course of the suprascapular nerve. J. Shoulder Elbow Surg. 7: 472-478.

Tubbs R.S., Nechtman C., D'Antoni A.V., Shoja M.M., Mortazavi M.M., Loukas M., Rozzelle C.J., Spinner R.J. (2013) Ossification of the suprascapular ligament: A risk factor for suprascapular nerve compression? Int. J. Shoulder Surg. 7: 19-22.

Tubbs R.S., Smyth M.D., Salter G., Oakes W.J. (2003) Anomalous traversement of the suprascapular artery through the suprascapular notch: a possible mechanism for undiagnosed shoulder pain? Med. Sci. Monitor 9: BR116-BR119.

Witvrouw E., Cools A., Lysens R., Cambier D., Vanderstraeten G., Victor J., Sneyers C., Walravens M. (2000) Suprascapular neuropathy in volleyball players. Br. J. Sports Med. 34: 174-180.

Zehetgruber H., Noske H., Lang T., Wurnig C. (2002) Suprascapular nerve entrapment. A meta-analysis. Int. Orthop. 26: 339-343.