

Study of Complete ossification of the superior transverse scapular ligament in Human dry Scapulae

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Abstract

Background: The complete ossification of the superior transverse scapular ligament is one of the predisposing factor for suprascapular nerve entrapment syndrome and it is a risk factor at surgical exploration during the suprascapular nerve decompression.

Aim: To study the complete ossification of superior transverse scapular ligament and its frequency of distribution in various population of different region.

Materials and Method: 65 dry scapulae were collected and studied with naked eye examination.

Results: Macroscopic observation revealed that 6 scapulae (5-left side, 1-right side) out of 65(9.2%) scapulae had a complete ossification of superior transverse scapular ligament.

Conclusion: This anatomic information is important in the management of suprascapular nerve entrapment neuropathy or interventional procedure at the supra suprascapular noth.

Key Words Scapula, suprascapular notch, superior transverse scapular ligament, ossification, Suprascapular nerve entrapment neuropathy.

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Introduction

The scapula (shoulder blade) is a triangular flat bone that lies on the posterolateral aspect of the thorax, overlying parts of second to seventh ribs. The scapula has medial, lateral and superior borders. The suprascapular notch is at the junction of medial two third and lateral one third of superior border. It is located where superior border joins the base of the coracoid process¹.

The notch is bridged by superior transverse scapular ligament [STSL] which is attached laterally to the root of coracoid process and medially to the limit of the notch. The ligament is sometimes ossified, the foramen thus completed to transmit suprascapular nerve to suprascapular fossa, suprascapular vessels pass backwards above the ligament.^{1,2}

Suprascapular nerve [SSN] is a large branch of superior trunk of brachial plexus at Erb's point. It runs laterally deep to trapezius and omhyoid, enters the supraspinous fossa through the suprascapular notch inferior to superior transverse scapular ligament.^{1,2} The SSN gives motor innervations to the supraspinatus and infraspinatus muscles and sensory innervations to the

rotator cuff muscles and to the shoulder and acromioclavicular joint.^{1,3} The documented variations of superior transverse scapular ligaments include calcification, partial or complete ossification and multiple bands.^{1,4,5,6,7} Harris et al. considered that ossification of STSL was anomalous.^{5,7,8,9}

Andre Thomas in 1936, first described the suprascapular nerve entrapment syndrome.^{3,10,11} In the diagnosis of suprascapular nerve entrapment syndrome, these variations in the anatomy of the superior transverse scapular ligament sometimes feature in the hierarchy of possible etiologic factors.^{1,6,7}

Since one of the causes of suprascapular nerve entrapment syndrome can be the complete ossification of STSL, the clinician should keep this possibility in mind while dealing with patients of suprascapular nerve entrapment.

Materials and Methods

Material for the present study consists of 65(left 36, right 29) dried human scapulae of unknown sex collected from students of first year MBBS. Shivamogga Institute of Medical Sciences, Shivamogga, Karnataka. Each scapula was carefully observed to see the presence of completely ossified STSL. Photograph of the scapula showing the complete ossified STSL were taken using the digital camera. The dimensions of STSL were recorded in millimeters with the help of vernier caliper. Following measurements of STSL were recorded.

- Superiar maximal length
- Inferior maximal length.
- Thickness at medial and lateral end

- d. Vertical diameter of the foramen
- e. Transverse diameter of the foramen
- f. Cross sectional area of the foramen was calculated using the formulae for an ellipse

$$\text{Area} = \pi \times D1/2 \times D2/2 \text{ (Mitchell, 1988a)}^{12}$$

D1-Vertical diameter of suprscapular foramen

D2-Transverse diameter of the suprscapular foramen.

Results

Macroscopic observation revealed that 6 scapulae (5-left side, 1-right side) out of 65(9.2%) scapulae had a complete ossification of superior transverse scapular ligament. The fan shaped ossification was present in 5 scapulae and only one scapula showed band typed ossification of the STSL.

Discussion

Incidence of complete ossification of STSL differs from population to population as shown in [Table 1]. In present study we observed 9.2% [complete ossification of the STSL in 6 scapulae out of 65] Our study results closely coincide with the results of the other Indian authors, Jadav et al¹³ and Perumal et al.³ and slightly higher than the Suman et al.⁵ In some population complete ossification of STSL was very rare for example in Alaskan Eskimos -0.3%, native American-2.1-2.9%.^{5,14}

The main site of entrapment of the suprscapular nerve is at suprscapular notch was described by Kopell and Thompson in the year 1959.^{9,15}

Narrowing of the suprscapular notch may occur due to calcification, partial or complete ossification of STSL, presence of bony bridge which irritate or compress the suprscapular nerve and give rise to suprscapular nerve entrapment syndrome.^{9,16}

Rengachary et al (1979)¹⁷ have reported 6 different types of anatomical variations in suprscapular notch. Type I-no discrete notch, Type II-wide V-shaped notch Type III wide Ushaped notch Type IV-narrowV shaped notch Type V-U-shaped notch with partial ossification, Type VI-bony foramen. Our study is concerned Type VI -bony foramen. Ticker⁴ classified the notch into to two types U and V shaped. They also supported that these anatomical variations of suprscapular notch and suprscapular ligament constitute potential predisposing factors to suprscapular nerve entrapment. The completely ossified STSL is one of the most important factor of suprscapular nerve entrapment neuropathy and may pose a challenge at surgical exploration during a suprscapular nerve decompression.⁴

However suprscapular nerve entrapment syndrome has also been described amongst Nigereans. They also reported that complete ossification of STSL could be possible cause of suprscapular nerve entrapment.⁶

Khan¹⁸ and Das et al¹⁹ reported a case of complete ossification of STSL and Saritha²⁰ has presented the case of coexistence of suprscapular notch and suprscapular foramen in an Indian Population. In our study also one

scapula showed double suprscapular foramen. It is a unique variation. A new hypothesis of its formation is based on recent anatomical findings (Discovered in 2002 the anterior coracoscapular ligament)²¹ and it's explained by the ossification of both the anterior coracoscapular ligament (ACSL) a structure runs in the suprscapular notch, below the superior transverse scapular ligament and ossification of superior transverse scapular ligament itself.²⁰ In such a case suprscapular nerve running through inferior suprscapular foramen and suprscapular vessels passed through superior suprscapular foramen (artery medially and vein laterally).²⁰ A bony bridge passing through the middle part of the suprscapular notch reduces the space available for the nerve passage and decreases the space by about 36.5 -38.6%.²² Some suggest that the occurrence of the bony bridge formed by ossified STSL could have a genetic basis.¹⁰ It is supported by Cohen et al. study. They have 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 suprscapular nerve, clinical symptoms of pain weakness of the external rotation and abduction and atrophy of the suprscapular muscle.²³

According to Tubbs et al. the presence of the suprscapular foramen was significantly greater on the right side and male cadavers,²⁴ But in our study out of 6 scapulae 5 scapulae showed the foramen on the left side and 1 scapula showed a foramen on right side. Bilateral complete ossification of the STSL has been reported by Gargi S et al.²⁵

Michel¹⁰ has described two types of STSL 1) band shaped type 2)fan shaped type, it was found that band shaped type was more often ossified than the fan-shaped type and also mean surface area of the foramen was greater in fan shaped type. But in our study 4 scapulae showed fan shaped type, one scapula showed band shaped type and one more scapula showed double suprscapular foramen. The surface area for fan shaped type was variable from 31.4mm to 117.75mm. However the specimen was too low to perform any statistical analysis. Thus further study with more dry bones from different regions is very essential along with clinical cases study.

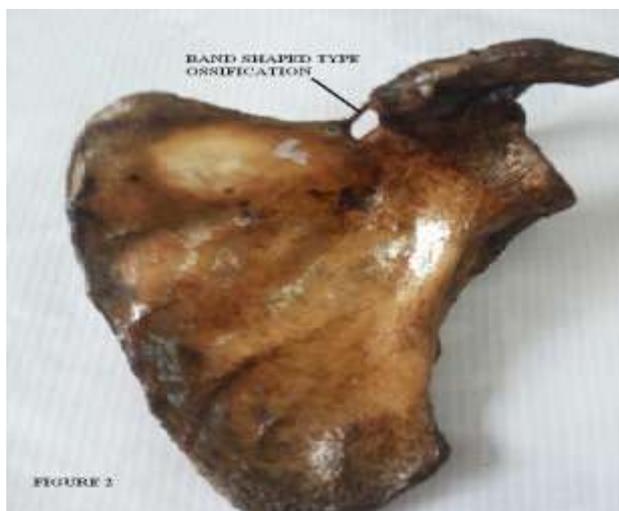
Table 1: Frequency of complete ossification of superior transverse scapular ligament in different populations

Sl. No	Authors	Incidence in%	Ossified specimen/ No. of specimen	Year	Place
1	Natsis ¹⁶	7.3	31/423	2007	Germany
2	Edelsons ²⁶	3.7	37/1000	1995	America
3	Polgovej ²⁷	6.25	6/96	2012	Poland
4	Sinkeet ²⁸	2.9	4/138	2010	Kenya
5	Silva ²⁹	30.76	68/221	2007	Brazil
6	S D Jadhav ¹³	10.57	37/350	2012	India(Maharashtra)
7	Kalpana T ³⁰	2	2/100	2012	India(Manipur)
8	Praneeta ⁵	6.1	8/131	2013	India(Andhra Pradesh)
9	A. Perumal ³	9.7	23/237	2013	India(Tamil Nadu)
10	Present Study	9.2	6/65	2016	India(Karnataka)

Table 2: Dimensions of ossified superior transverse scapular ligament

Parameters	1 left	2 left	3 left	4 left	5 left	6 right
Superior maximal length	10mm	9mm	13mm	8mm	9mm	-
Inferior maximal length	8mm	8mm	12mm	7mm	9mm	-
Width at lateral end	4mm	4.8mm	4.8mm	2mm	4.7mm	-
Width at medial end	4mm	3.7mm	4.8mm	2mm	4.7mm	-
Vertical diameter of supra scapular foramen	8mm	11.9mm	15mm	11.8mm	7.2mm	-
Transverse diameter of supra scapular foramen	5mm	8.3mm	10mm	6.5mm	6.3mm	-
Area of the supra scapular foramen	31.4mm ²	77.53mm ²	117.75mm ²	60.20mm ²	35.60mm ²	-
Type	Fan	Fan	Fan	Band	Fan	Double Foramen





Conclusion

The present study has revealed that frequency of complete ossification of STSL varied in different population. Radiologist, neurosurgeons and orthopedic surgeons should bear this anatomical variation in mind, since its existence alters the surgical technique or arthroscopic decompression of the suprascapular nerve. But further detail study should be done on large number of scapulae from different region and population along with cadaveric, radiologic and clinical cases study.

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