

# BONY SUPRASCAPULAR FORAMEN, A POTENTIAL SITE FOR SUPRASCAPULAR NERVE ENTRAPMENT: A MORPHOLOGICAL STUDY ON DRIED HUMAN SCAPULAE

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## ABSTRACT

**Introduction:** The superior transverse scapular ligament (STSL) is present above the suprascapular notch . It joins the two superior corners of this notch and converts it into suprascapular foramen through which passes the suprascapular nerve , while the suprascapular artery and vein usually pass above the ligament . The anterior coracoscapular ligament (ACSL) runs in the suprascapular notch, below the superior transverse scapular ligament. Narrowed bony foramen by ossification of STSL and ACSL is one of the predisposing factor of suprascapular nerve entrapment as well as with an injury to the suprascapular nerve in arthroscopic procedures.

**Aim:** The aim of present study was to know the prevalence of suprascapular foramen in Indian dry scapulae and provide a knowledge on the variations along the course of suprascapular nerve which is essential to understanding the source of entrapment syndrome.

**Methods and Results:** The present study was carried out on 73 dried human scapulae irrespective of age and sex. Visual observation revealed that 3 scapulae (4.1%) had completely ossified superior transverse scapular ligament and 2 scapulae (2.7 %) had partially ossified STSL. The incidence of ossified anterior coracoscapular ligament is 1.3 % ( 1 scapula ) in our study.

**Conclusion:** The knowledge of variations in the suprascapular region and ossification of STSL & ACSL is important for anatomists, orthopaedicians, radiologists and neurosurgeons to obtain a safe zone which would be useful to avoid iatrogenic nerve lesion and for better diagnosis and management of the nerve entrapment syndrome.

**KEY WORDS:** Superior transverse scapular ligament, Suprascapular notch, Anterior coracoscapular ligament, Bony foramen, Ossification, Suprascapular nerve, Entrapment syndrome.

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## INTRODUCTION

Scapula also known as the shoulder blade is triangular in shape and is the fulcrum and basis

of all the motions of the humerus. Its peculiar shape has always been a point of attraction to many Anatomists. The superior margin of the

scapula is thin and sharp and is the shortest of the three. It is interrupted by the scapular notch, which lies very close to the medial side of the coracoid process. The superior transverse scapular ligament (STSL) is present above the suprascapular notch (SSN). It joins the two superior corners of this notch and converts it into suprascapular foramen through which passes the suprascapular nerve (SN), while the suprascapular artery and vein usually pass above the ligament [1]. The anterior coracoscapular ligament (ACSL) runs in the suprascapular notch, below the superior transverse scapular ligament. The superior transverse scapular ligament [2] and anterior coracoscapular ligament [3] sometimes ossified. Many researchers have reported variations of STSL. This ligament may be calcified, partially or completely ossified, trifurcation and anomalous bands of it [4]. According to Harris et al. the ossification of the STSL was considered anomalous [5]. Ossification may be influenced by age, mechanical load on ligament, sex and genetic factors [6]. Narrowed bony foramen by ossification of STSL and ACSL has gained increased attention over the past few year, because of it being one of the predisposing factor of suprascapular nerve entrapment as well as with an injury to the suprascapular nerve in arthroscopic procedures [7,8,9]. The anatomical knowledge of variation of suprascapular foramen is of extreme importance for clinicians because an ossified ligaments may also pose a challenge during decompression of suprascapular nerve if the condition is not fully appreciated [4]. Many researchers reported variable incidence of ossification of STSL and ACSL which varies in different population throughout the world . Considering the paucity of data on incidence of ossification of STSL and ACSL, present study was carried out to observe the prevalence of suprascapular foramen in Indian dry scapulae. The aim of our study was to provide a knowledge on the variations along the course of suprascapular nerve which is essential to understanding the source of entrapment syndrome.

## MATERIALS AND METHODS

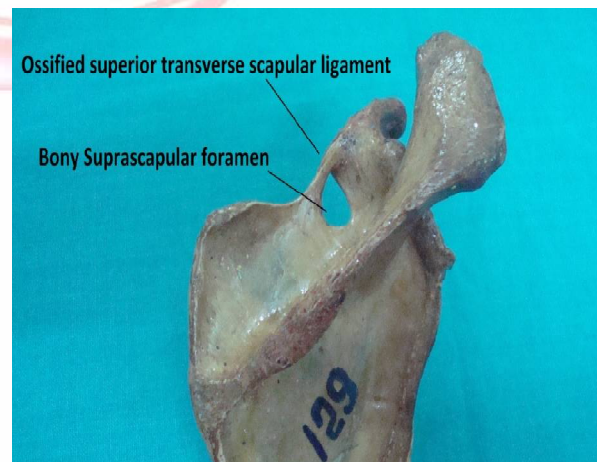
The present study was carried out on 73 dried human scapulae, which were obtained from the

Dept. of Anatomy, CIMS ( C.G.), India. The scapulae included in this study were 41 of right side and 32 of left side irrespective of age and sex. The broken scapulae were excluded from the study. Each scapula was closely observed and analysed to see the presence of completely or partially ossified superior transverse scapular ligament and anterior coracoscapular ligament. The bone showing ossified scapular ligaments were photographed

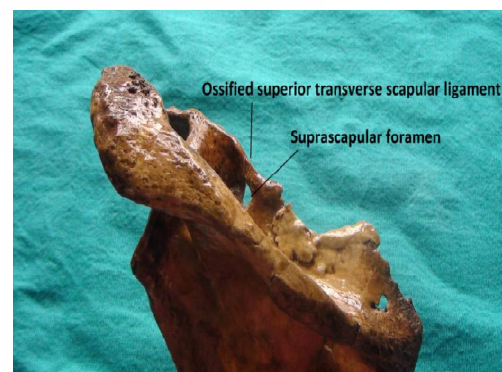
## RESULTS

It was found that 06 out of 73 scapulae showed presence of ossified ligaments. Visual observation of 06 scapulae revealed that 3 scapulae (4.1%) had completely ossified superior transverse scapular ligament. Out of 3 scapulae, 2 were right sided and 1 was left sided (fig 1 & 2). We observed partially ossified STSL in 2 scapulae (2.7 %), 1 was right sided and 1 was left sided (fig 3 & 4). 1 scapulae (1.3%) shows ossification of anterior coracoscapular ligament (fig 5). The incidence of ossified superior transverse scapular ligament is 6.8 % and incidence of ossified anterior coracoscapular ligament is 1.3 % in our study (Table 1).

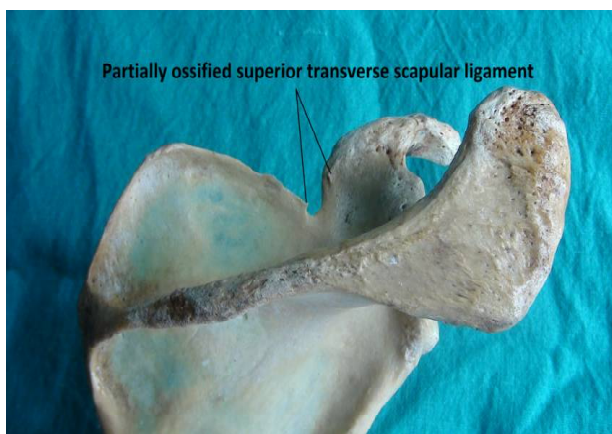
**Fig. 1:** Right sided scapula with completely ossified STSL.



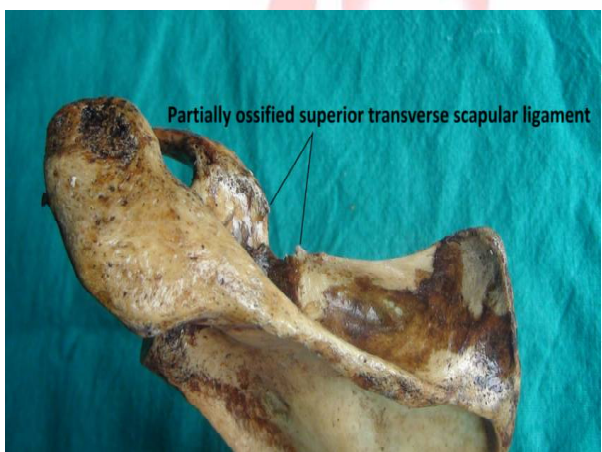
**Fig. 2:** Left sided scapula with completely ossified STSL.



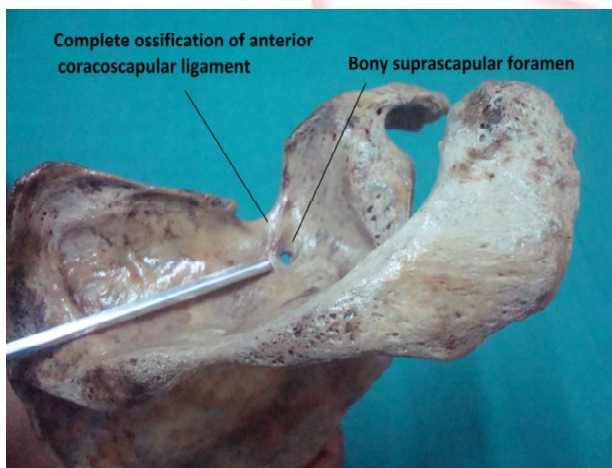
**Fig. 3:** Right sided scapula with partially ossified STSL.



**Fig. 4:** Left sided scapula with partially ossified STSL.



**Fig. 5:** Right sided scapula with completely ossified ACSL.



**Table 1:** Total number of scapulae showing ossification of Superior transverse scapular ligament (STSL) and Anterior coracoscapular ligament (ACSL).

S. No.	Ossification of STSL and ACSL	Total no. of scapulae (%)
1	Completely ossified STSL	3 (4.1%)
2	Partially ossified STSL	2(2.7%)
3	Complete ossification of ACSL	1 (1.3%)

**Table 2:** Frequency of ossification of the superior transverse scapular ligament in different populations.

S no.	Researchers	Country	No. of studied specimens	Incidence of ossification in %	
				Complete	Partial
1	Natsis et al. 2007 [19]	Germany	423	7.3	----
2	Dunkengrun et al. 2003 [11]	America	623	5	12
3	Polguy et al 2011 [8]	Poland	86	7	23.3
4	Sinkeet et al 2010 [9]	Kenya	138	2.9	----
5	Ticker et al [4]	America	79	5	18
6	Silva et al 2007 [13]	Brazil	221	30.76	----
7	S D Jadhav et al 2012 [14]	India	350	10.57	----
8	Zahid A et al 2014 [12]	Pakistan	204	1.96	----
9	Present study	India	73	4.1	2.7

## DISCUSSION

Suprascapular notch is located in the superior border of the scapula near to the root of coracoid process. Suprascapular ligament is a strong fibrous band that bridges the suprascapular notch creating a foramen to serves as a passage for suprascapular nerve, which supplies motor branches to supraspinatus, infraspinatus and sensory branches to the rotator cuff muscles and ligamentous structures of the shoulder and acromio-clavicular joint. The suprascapular notch is frequently bridged by bone rather than a ligament, converting it into foramen in some animals but incidence is much less in humans [10]. Multiple studies have been carried out with particular reference to suprascapular notch, partial or complete ossification of superior transverse scapular ligament to avoid the risk during operative procedures and to study the pathology of suprascapular nerve compression. It differs from population to population (Table.2).

Our study reported 4.1% incidence of completely ossified STSL which is close to the report of Dunkengrun et al.2003 (5%) [11] and Ticker et al 1998 (5%) [4] but slightly higher than Sinkeet et al 2010 (2.9%) [9] and Zahid A et al 2014 (1.96%) [12]. Incidence of ossified STSL reported by Silva et al 2007 (30.76%) [13] and Jadhav et al 2012 (10.57%) [14] was quite high as compared to our study. Complete ossification of STSL was very rare in some population such as in American Native 2.1- 2.9%, Eskimos-0.3% [15]. We also observed the scapulae with partial ossification of STSL and the incidence is 2.7% which is much less than report of Dunkengrun

et al.2003 ( 12 % ) [11], Polguy et al 2011 (23.3%) [8] and Ticker et al 1998 (18 %) [4]. In our study we also reported the 1.3 % incidence of complete ossification of ACSL with coexistence of suprascapular notch and foramen which is close to the report of Natsis et al 2007 ( 1% ) [16]. Notch with foramen was described by Natsis et al as bony bridge, which limit the area of suprascapular notch and divide it into a bony foramen inferiorly and a notch superiorly and it occurs in about 1% of the population. This bony bridge passing through the middle part of the suprascapular notch reduces the space available for nerve passage (bony bridge decreases the space by about 36.5–38.6 %) [17]. A bony bridge lay between them, is created by an ossified anterior coracoscapular ligament discovered by Avery et al. [3]. Variation of these ligaments may irritate the suprascapular nerve and gives rise to pain which is deep and poorly localized and because of this the cause of the pain and tenderness is difficult to discover in any individual and the muscle atrophy starts [18]. Narrowing of the suprascapular notch may occur due to calcification, partial or complete ossification of STSL, presence of bony bridge which irritate or compress the suprascapular nerve and give rise to suprascapular nerve entrapment syndrome [19]. Also, the shape of the suprascapular notch and excessive movement of the shoulder exerts traction on the suprascapular nerve which leads to its compression against the superior transverse scapular ligament [20]. A case report of complete ossification of STSL was reported by Khan and Das et al. in Indian population [10,21]. A familial case of calcification of STSL was described by Cohen et al. in father and son and both were suffering from entrapment neuropathy of suprascapular nerve [7]. Suprascapular nerve entrapment is an acquired neuropathy which is secondary to the compression of the nerve, in the bony suprascapular notch [22].

Coexistence of suprascapular notch and suprascapular foramen a rare anatomical variation was found during radiological and anatomical investigations by Micha<sup>3</sup> Polguy et al. [8]. Presence of inferior bony bridge caused by the ossification of anterior coracoscapular ligament decreases the total area of space for

the suprascapular nerve in the notch and it may result in suprascapular nerve entrapment. A thorough anatomical knowledge of the course of the nerve and its possible sites of entrapment is essential for an early and correct diagnosis and management of the nerve entrapment syndrome.

## CONCLUSION

The ossification of STSL and ACSL can be one of the risk factors for suprascapular entrapment neuropathy. The knowledge of variations in the suprascapular region and ossification of STSL & ACSL is important for anatomists, orthopaedicians, radiologists and neurosurgeons to obtain a safe zone which would be useful to avoid iatrogenic nerve lesion and for better diagnosis and management of the nerve entrapment syndrome.

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## Conflicts of Interests: None

## REFERENCES

- [1]. Tubbs RS, Shoja MM, Shokouhi G, Loukas M, Oakes WJ. 2007. Retrosplenic course of the transverse cervical artery with the suprascapular artery travelling through the suprascapular notch. *Folia Morphol.* 2007;66:80-82.
- [2]. Standring S, ed. *Gray's Anatomy*. 40th Ed., New York, Churchill Livingstone. 2008; p.794-821.
- [3]. Avery BW, Pilon FM, Barclay JK. Anterior coracoscapular ligament and suprascapular nerve entrapment. *Clin Anat.* 2002;15(6):383–386. Doi: 10.1002/ca.10058
- [4]. Ticker, J. B.; Djurasovic, M.; Strauch, R. J.; April, E.W.; Pollock, R. G.; Flatow, E. L. & Bigliani, L.U. The incidence of ganglion cysts and variations in anatomy along the course of the suprascapular nerve. *J. Shoulder Elbow Surg.* 1998;7(5):472-8.
- [5]. Harris RI, Vu DH, Sonnabend DH, Goldberg JA, Walsh WR. 2001. Anatomic variance of the coracoclavicular ligaments. *J. Shoulder Elbow Surg.* 2001;10:585-8.
- [6]. Mahato R K , P Suman . Ossification of superior transverse scapular ligament: incidence , etiological factors and clinical relevance . *International J of health science and research.* 2013;3(9):14–21.
- [7]. Cohen SB, Dnes DM, Moorman CT. Familial calcification of the superior transverse scapula ligament causing neuropathy. *Clin Orthop Rel Res.* 1997;334:131–5.

- [8]. Polguy M, Jedrzejewski K, Podgorski M, Topol M. Morphometric study of the suprascapular notch: proposal of classification. *Surg Radiol Anat.* 2011;33(9):781-787.
- [9]. Sinkeet SR, Awori KO, Odula PO, Ogeng'o JA, Mwachaka PM. The suprascapular notch: its morphology and distance from the glenoidal cavity in a Kenyan population. *Folia Morph (Warsz)* 2010; 69:241–245
- [10]. Khan, M. A. Complete ossification of the superior transverse scapular ligament in an Indian male adult. *Int. J. Morphol.* 2006;24(2):195-6.
- [11]. Dunkelgrun M, Iesaka K, Park SS, Kummer FJ, and Zuckerman JD. Interobserver reliability and intraobserver reproducibility in suprascapular notch typing. *Bull Hosp Joint Dis.* 2003;61:118-22.
- [12]. Zahid A, Khan M W, Khan B. Ossified superior transverse scapular ligament : a morphological study on dried Pakistani scapulae . *Biomedica* 2014;30;3:1- 4.
- [13]. Silva, J. G.; Abidu-Figueiredo, M.; Fernandes, R. M. P.; Aureliano-Rafael, F.; Sgrott, E. A.; Silva, S. F. & Babinski, M. A. High Incidence of Complete Ossification of the Superior Transverse Scapular Ligament in Brazilians and its Clinical Implications *Int. J. Morphol.* 2007;25(4):855-859.
- [14]. S D Jadhav, R J Patil, P P Roy, M P Ambali, M A Doshi, Rajeev R Desai. Supra-scapular foramen in Indian dry scapulae. *National Journal of Clinical Anatomy.* 2012;1(3):133-135.
- [15]. Osuagwu FC, Inocemi IO, Shokunbi MT. Complete ossification of the superior transverse scapular ligament in a Nigerian male adult. *Int. J. Morphol.* 2005;23(2):121-2.
- [16]. Natsis K, Trifon T, Ioannis G, Konstantinos V, Efthymia P, Prokopios T. A bony bridge within the suprascapular notch. *Anatomic study and clinical relevance. Aristotle University Medical Journal.* 2008;35(1):204-211.
- [17]. Saritha S. Coexistence of suprascapular notch and suprascapular foramen, a rare anatomical variation and its clinical correlation. *International J of Med. Science and clinical invention.* 2014;1(02):65-68.
- [18]. Thompson WAL, Kopell HP. Peripheral entrapment neuropathies of the upper extremities. *N Engl J Med.* 1959;260:1261-1265.
- [19]. Natsis K, Totlis T, Tsikaras P, Appell HJ, Skandalis's P, and Koebke J. Proposal for classification of the suprascapular notch: a study on 423 dried scapulae. *Clin Anat* 2007;20:135–139.
- [20]. Soni, G, Malik, VS, Shulka L, et al. Morphometric analysis of the suprascapular notch. *The Internet Journal of Biological Anthropology.* 2012;5(1):20-7.
- [21]. Das S, Suri R, Kapur V. Ossification of Superior Transverse Scapular Ligament and its Clinical Implications. *Sultan Qaboos University Medical Journal.* 2007;7(2):157-160.
- [22]. Rengachary SS, Burr D, Lucas S, Hassanein KM, Mohn MP, Matzke H, Suprascapular entrapment neuropathy: a clinical, anatomical and comparative study. Part 2 *Neurosurgery* 1979; 5:447-51.

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