

Original Research Article

A Study on Suprascapular Foramen and Its Clinical Importance: A Cadaveric Study in Western Part of Tamilnadu, India

Vijaianand M ^{*1}, Sakthivel M ².

^{*1} Associate Professor, Department of Anatomy, KMCH Institute of Health Sciences & Research, Coimbatore, Tamilnadu, India.

² Tutor, Department of Anatomy, KMCH Institute of Health Sciences & Research, Coimbatore, Tamilnadu, India.

ABSTRACT

Background: Suprascapular notch is present along the superior border of the scapula close to the lateral angle, which is converted into a Suprascapular foramen by the transverse Suprascapular ligament. Normally the Suprascapular nerve and vein pass through the foramen below the ligament, while the Suprascapular artery runs above the ligament. Suprascapular nerve entrapment is an interesting clinical condition which is widely involved in this area.

Aim of the study: To find out the presence of Suprascapular artery passing along with the Suprascapular nerve and vein within the foramen and any pathology associated with it.

Materials and Methods: The proposed study is carried out in the Department of Anatomy, Karpagam Faculty of Medical Sciences and Research, Coimbatore, where 51 well embalmed cadavers of both the sexes and various age groups was utilised.

Results: Out of 51 cadavers dissected, we found Suprascapular artery was found passing along with the Suprascapular nerve and vein in 2 of the cadavers, of which one each is found in a male and a female cadaver with an incidence of 3.92%.

Conclusion: Studies done earlier pointed out the importance of Suprascapular nerve entrapment, the various causes and predisposing factors responsible for it, and a knowledge of safe zone around the shoulder region should be known well to the operating surgeon and the available imaging techniques should be utilised by the radiologists in order to avoid the complications while dealing with the Suprascapular nerve entrapment.

KEY WORDS: Cadaver, Suprascapular foramen, Suprascapular artery, Nerve entrapment, Transverse Suprascapular ligament.

Corresponding Author: Dr. Vijaianand M, Department of Anatomy, KMCH Institute of Health Sciences & Research, Coimbatore, Tamilnadu, India. **E-Mail:** dr.vijaitarun7474@gmail.com

Access this Article online	Journal Information	
Quick Response code  DOI: 10.16965/ijar.2021.151	International Journal of Anatomy and Research ISSN (E) 2321-4287 ISSN (P) 2321-8967 https://www.ijmhr.org/ijar.htm DOI-Prefix: https://dx.doi.org/10.16965/ijar	
	Article Information Received: 19 Jun 2021 Peer Review: 19 Jun 2021 Revised: 26 Jul 2021	
	Accepted: 14 Aug 2021 Published (O): 05 Sep 2021 Published (P): 05 Sep 2021	

INTRODUCTION

A notch present close to the root of the Coracoid process, in the lateral aspect of the superior margin of the scapula is called 'Suprascapular notch'. Across this notch transverse scapular ligament bridges and converts this notch into a foramen called

'Suprascapular foramen' [1]. Below this ligament and through the Suprascapular foramen, Suprascapular nerve and vein passes [2] however Suprascapular artery passes above the transverse scapular ligament and the foramen. Several types of Suprascapular foramen has been reported previously on dry

foramen has been reported previously on dry human scapula based on the numerous types of Suprascapular notch and by which the possible foramen morphology complications has been reported [3].

Suprascapular nerve is an important branch that arises from the upper trunk of the brachial plexus. It conveys fibers from C5 and C6 roots and provides innervation to Supraspinatus, Infraspinatus and also gives an articular twig to the capsule of the glenohumeral joint. This nerve is more prone for entrapment within the foramen, and variations in Suprascapular notch acts as one of the predisposing factors for the nerve entrapment [4,5]. Suprascapular neuropathy was first described by Andre Thomas in the year 1936 and it accounts for 1-2 % of pain and dysfunction of the shoulder girdle [6,7]. Many causes for Suprascapular nerve damage has been described that include fracture involving scapula, clavicle, proximal part of humerus, dislocation of shoulder and acromioclavicular joint. Others such as during surgical procedures, physical labourers, osteosarcoma and certain systemic diseases like systemic lupus erythematosus and Rheumatoid arthritis also lead to Suprascapular nerve damage. Apart from the above-mentioned causes various anatomical factors such as shape of Suprascapular notch, course of the Suprascapular nerve and vessels also predispose to the nerve damage [8,9,10].

Studies made earlier pointed out that sex of an individual also plays a role in the nerve damage and males are 3 - 4 times involved than females due to deep and narrow Suprascapular notch.

Occasionally Suprascapular artery running along with the nerve within the foramen also cause compression of the nerve when the arterial pressure increases [11]. Microinjuries involving small vessels also produces ischemia of Suprascapular nerve which when supplying it [12]. The present study has been carried out as an eye opener for the Orthopaedicians, Neurosurgeons and Radiologists that apart from the regular Suprascapular nerve entrapment within the Suprascapular foramen there may be some rare occasions where such

entrapment may not occur as the nerve will be passing above the foramen, hence the present study has been carried out as an attempt in the cadavers to find any such variations occurring in the Suprascapular foramen including the Neurovascular structures.

MATERIALS AND METHODS

Present study was carried out in the Department of Anatomy, Karpagam Faculty of Medical Sciences and Research, Coimbatore, Tamilnadu, South India, over a period of 4 to 5 years during routine dissection classes for Phase I MBBS Students. Following the Standard dissection techniques of Cunningham manual [13], 51 well embalmed cadavers belonging to both the sexes and various age groups which was preserved and stored in the formalin tanks were taken into consideration. The Suprascapular region dissected in layers viz - the skin, fascia and the Supraspinatus muscle which were cut and exposed to approach the Suprascapular foramen and to visualise the structures passing through and above the foramen. Adequate photographs were taken.

RESULTS

Out of 51 cadavers (32 males and 19 females) all belonging to Indian origin, during dissection over the Suprascapular region we identified Suprascapular artery traversing through the foramen along with the Suprascapular nerve and vein [Normally Suprascapular artery does not pass through the foramen, it runs above the transverse suprascapular ligament]

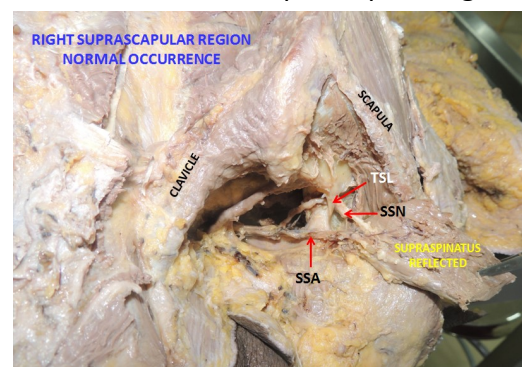


Figure 1: Shows Suprascapular notch converted into a foramen by transverse Suprascapular ligament in which Suprascapular nerve & vein passes through the foramen & Suprascapular artery passes above the foramen which is considered **Normal**.

in two of the cadavers with an incidence of 3.92%, of which one is a male cadaver and the variation is present on the left side and another a female cadaver with the variation present on the right side, and the cadavers are aged around 70 and 65 years respectively.

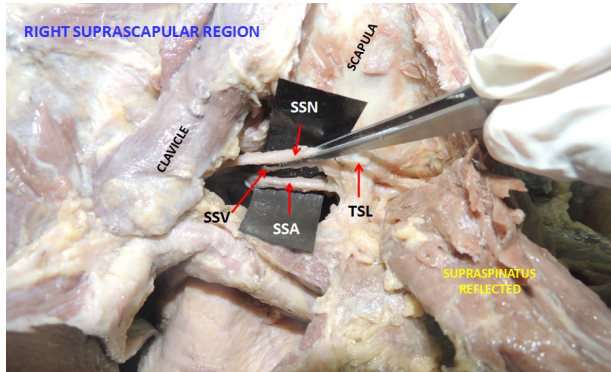


Figure 2: Shows Suprascapular notch converted into a foramen by transverse Suprascapular ligament in which Suprascapular artery passes along with Suprascapular nerve & vein through the foramen on **Right** Suprascapular region.

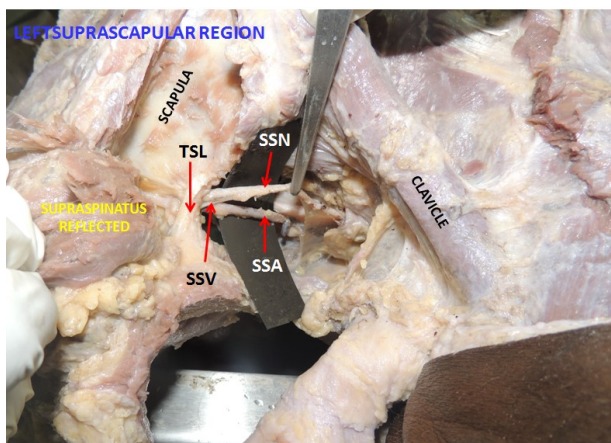


Figure 3: Shows Suprascapular notch converted into a foramen by transverse Suprascapular ligament in which Suprascapular artery passes along with Suprascapular nerve & vein through the foramen on **Left** Suprascapular region

DISCUSSION

Most of the studies carried out earlier in Suprascapular notch and foramen was performed in dry human bones [Scapula] and a very few countable studies were carried out in human cadavers during routine dissection. To our knowledge one such rare study was made by us over a period of 4 to 5 years through which we come across that Suprascapular artery was found passing through the Suprascapular foramen along with

the Suprascapular nerve and vein in two of the cadavers. Normally, the artery passes above the foramen [over the transverse suprascapular ligament - which converts the Suprascapular notch into a foramen]. Our findings were limited to this extent, and we further not traced from where the Suprascapular artery get originated and travelling through the foramen. Usually, Suprascapular artery arises from the thyrocervical trunk of the 1st part of the subclavian artery [14]. Panagiotis from his study pointed out that Suprascapular artery passing through the Suprascapular foramen originated from 3rd part of Subclavian artery on the right side and is considered to be one of the rare origins [15]. Other anomalous origin of Suprascapular artery arising from 1st part of axillary artery and entering the Suprascapular foramen was reported by Mishra and Ajmani [16] and also by Adibatti and Prasanna [17] and both seen on the left side. Suprascapular artery arising from 3rd part of axillary artery on both sides was reported by Mahato [18]. Developmentally, primary plexus of smaller vessels give rise to main vessels, as a result some vessels undergo enlargement while some of them get regressed.

Tubbs et al concurred from his study that an incidence of 2.5% of Suprascapular artery is associated with the Suprascapular nerve passing under superficial transverse suprascapular ligament (STSL) in 3/120 cadavers he dissected [11]. Reineck and Krishnan concluded from their side that while performing endoscopic Suprascapular nerve release in live individuals they found three cases of Suprascapular artery runs through the Suprascapular notch, but what was the total number of live individuals they have come across has not been a mention [19].

The arrangement of Suprascapular vessels in relation to the superficial transverse suprascapular ligament is classified into three types according to Yang et al. In 59.4% the Suprascapular vessels is seen over the STSL and they constitute Type I. In 29.7% the Suprascapular vessels is found passing above and below the STSL and it is Type II, whereas in Type III the Suprascapular vessels pass below the STSL and

accounts for 10.9%. A colour Doppler study carried out in Turkish population found that in 43 from 50 individuals the Suprascapular artery-vein complex runs under STSL [20]. Clein IJ from his studies made out that unusual presence of Suprascapular artery leads to entrapment of Suprascapular nerve [21].

Suprascapular nerve entrapment is due to ossification of STSL, but however complete ossification of STSL incidence ranges from 3.7% to 13.6% [1]. The calcified STSL is believed to be the sign of entrapment. Authors from their earlier studies made out that supraspinatus fascia, hypertrophied subscapularis muscle, double suprascapular foramen and presence of anterior coracoscapular ligament act as some of the predisposing factors for Suprascapular nerve entrapment [22, 23]. Playing some sports such as volleyball, basketball and baseball, is associated with repeated overhead movements and as a result of 'sling effect', the Suprascapular nerve gets compressed against the sharp suprascapular notch border causing irritation and subsequently neuropathy [24,25]. Absence of suprascapular notch also lead to Suprascapular nerve entrapment [26] and the shape of the notch whether 'U' or 'V' shaped does not predispose to nerve entrapment. There are three common sites where Suprascapular nerve can get compressed such as suprascapular notch, spinoglenoid notch and the course of the nerve between bone and deep to fascia. Among the three Suprascapular nerve entrapment is common and it occur in the suprascapular notch. Suprascapular nerve is also damaged during regional anaesthetic blocks and other procedures carried out on the shoulder.

CONCLUSION

In order to avoid damage to the Suprascapular nerve during surgical interventions involved in treating posterior instability of shoulder, tears in the rotator cuff and Suprascapular nerve entrapment decompression, the operating surgeon should have a wide depth in knowledge about the 'safe zone' which is found to lie within 2.3 cm from glenoid rim at the level of superior rim of the glenoid and within 1.4 cm from posterior rim of the glenoid at the level of Base of spine of scapula.

Further the surgeons can seek the help of radiologists by using various imaging modalities such as MRI, CT, Ultrasonography and C-arm who can mark the safe zone so that injury to the Suprascapular nerve can be avoided. Thus, in our study Suprascapular artery is found to travel along with the Suprascapular nerve and vein through the suprascapular foramen, where due to limited space within the foramen and rise of pressure within the Suprascapular artery may lead to compression of the Suprascapular nerve. Therefore this type of variations alarms surgeons, orthopedicians and radiologists to be more familiar with it, as the chances of Suprascapular nerve entrapment is more common so that the underlying pathology can be identified and corrected.

Conflicts of Interests: None

REFERENCES

- [1]. Polguy M, Jedrzejewski K, Podgorski M, Topol M (2011) Morphometric study of Suprascapular notch : proposal of classification. *Surg Radiol Anat*, 2011;33:781-787.
- [2]. Moore KL, Dalley AF, Agur AM. Clinical oriented anatomy 6th Ed. Lippincott Williams and Wilkins, Philadelphia, 2010; pp 1 - 1168.
- [3]. Rengacharry S, Burr D., Lucas S., Hassanein K.M., Mohn M.P., Matzke H. Suprascapular entrapment neuropathy : a clinical, anatomical, and Comparative study. *Neurosurgery* 1979;5:447-451.
- [4]. Osuagwu F, Imosemi I, Shokunbi M. Complete ossification of the superior transverse scapular ligament in a Nigerian male adult. *Int J Morphol*, 2000;23:121-122.
- [5]. Silva J, Aureliano - Rafael F, Sgrott E, Silva S, Babinski M, Fernandes R. High incidence of complete ossification of the superior transverse scapular ligament in Brazilians and its clinical implications. *Int J Morphol*, 2007;25:855-859.
- [6]. H. Zehetgruber, H. Noske, T. Lang, and C. Wurnig. Suprascapular nerve entrapment. A meta-analysis," *International Orthopaedics*, 2002;2(6):339- 343.
- [7]. R. S.Snell, *Clinical Anatomy for Medical Students*, Williams & Wilkins, Baltimore, Md, USA, 1995.
- [8]. L. F. Solheim and A. Roass. Compression of the suprascapular nerve after fracture of the scapular notch. *Acta Orthopaedica* 1978;49(4):338-340.
- [9]. J.D. Zoltan, "Injury to the suprascapular nerve associated with anterior dislocation of the shoulder,". *The journal of Trauma: Injury, Infection, and Critical care*, 1979;19(3):203-206.
- [10]. T. Fabre, C.Piton, G.Leclouerrec, F. Gervais-Delion, and A.Durandau. Entrapment of the suprascapular nerve," *Journal of Bone and Joint Surgery - Series B*, 1999;81(3):414-419.

- [11]. R.S. Tubbs, M.D.Smyth, G.Salter, and W.J.Oakes. Anomalous traversment of the suprascapular artery through the suprascapular notch: a possible mechanism for undiagnosed shoulder pain ? Medical Science Monitor. 2003;9(3):BR11-BR119.
- [12]. S.P. Ringel, M. Treihaft, M. Carr, R. Fisher, and P.Jacobs. Suprascapular neuropathy in pitchers. The American Journal of Sports Medicine, 1990;18(1):80-86.
- [13]. Cunningham's Manual of Practical Anatomy. Upper and Lower Limbs. 16th Edition. Oxford.
- [14]. Vishram singh Text book of Anatomy. Volume I. Third Edition. Elsevier. Page 13.
- [15]. Panagiotis Pyrgakis, Eleni Panagouli, Dionysios Venieratos. Anomalous origin and course of the suprascapular artery combined with absence of the suprascapular vein. Case study and clinical implications. North Am J Med Sci 2013;5:129-33.
- [16]. Mishra S, Ajmani ML. Anomalous origin of the suprascapular artery: A case report. J Anat Soc India 2003;52:180-2.
- [17]. Adibatti M, Prasanna LC. Variation in the origin of suprascapular artery. IJAV 2010;3:178-9.
- [18]. Mahato NK. Bilateral anomalous suprascapular arteries. Eur J Anat 2010; 14:31-4.
- [19]. Reineck JR, Krishnan SG. Subligamentous suprascapular artery encountered during arthroscopic suprascapular nerve release: A report of three cases. J Shoulder Elbow Surg 2009;18:e1-3.
- [20]. Yucesoy C, Akkaya T, Ozel O, Comert A, Tuccar E, Bedirli N, Unlu E, Hekimoflu B, Gumus H. Ultrasonographic evaluation and morphometric measurements of the suprascapular notch. Surg Rad Anat, 2009;31:409-414.
- [21]. Clein IJ (1975) Suprascapular entrapment neuropathy. J Neurosurg, 1975;43:337-342.
- [22]. Duparc F, Coquerel D, Ozeel J, Noyon M, Gerometta A, Michot C. Anatomical basis of the suprascapular nerve entrapment, and clinical relevance of the supraspinatus fascia. Surg. Radiol. Anat. 2010;32:277-284.
- [23]. Joy P, Sinha MB, Satapathy BC. The ossified bifid superior transverse scapular ligament causing a double suprascapular foramen: A case report. J. Clin. Diagn. Res. 2015;9:AD03-AD04.
- [24]. Witvrouw E, Cools A, Lysens R, Cambier D, Vanderstraeten G, Victor J, Sneyers C, Walravens M. Suprascapular neuropathy in volleyball players. Br. J. Sports Med. 2000;34:174-180.
- [25]. Seroyer ST, Nho SJ, Bch BR, Jr, Buch-Joseph CA, Nicholson GP, Romeo AA. Shoulder pain in the overhead throwing athlete. Sports Health 2009;1:108-120.
- [26]. Ofusori DA, Ude RA, Okwuonu CU, Adesanya OA. Complete absence of the suprascapular notch in a Nigerian scapula: A possible cause of suprascapular nerve entrapment. International journal of shoulder surgery. 2008 Oct;2(4):85-6.

How to cite this article:

Vijaianand M, Sakthivel M. A Study on Suprascapular Foramen and Its Clinical Importance: A Cadaveric Study in Western Part of Tamilnadu, India. Int J Anat Res 2021;9(3.3):8086-8090. DOI: 10.16965/ijar.2021.151