Original Article

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Morphological and Morphometricstudy of Suprascapular Notch

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Abstract

Background and Aim: The Suprascapular notch is present at the anterolateral end of the superior border of scapula medial to the root of the coracoid process. The notch is bridged by the superior transverse scapular ligament which is attached laterally to the root of the coracoid process and converts the notch into the foramen. This foramen transmits the suprascapular nerve (SSNr) to the fossa. This study was focused on different types of the suprascapular notch (SSN) and its combination of the anomalous superior transverse scapular ligament (STSL) was considered as a risk factor for Suprascapular nerve entrapment. *Materials and Methods:* This study was done in 100 human dry scapulae. The shapes of the SSN, partially or completely ossified STSL were noted and the maximum depth, superior and middle transverse diameters of suprascapular notches was measured. The data analysis of the notches was recorded and correlated with previous studies. *Results:* The shape of the SSN was observed and classified into six types. The most common type of notches ”U” shaped and less common type was small “V” shaped. The partially or completely ossified STSL was also observed in this study. *Conclusion:* The anatomical knowledge of various types of SSN and the prevalence of ossified STSL is important for clinicians for giving suprascapular nerve block. The Knowledge of anatomical variations of SSN helps the orthopedic surgeon to diagnose the cause for painful syndromes of shoulder and the early management which helpsforgood functional recovery.

Keywords: Suprascapular Notch; Ossified Superior Transverse Scapular Ligament; Suprascapular Nerve Entrapment.

Introduction

Suprascapular artery and Vein enter Suprascapular fossa by traveling over the STSL, but the Suprascapular nerve passes beneath the ligament[1]. Suprascapular nerve entrapment is the most common lesion due to a congenital abnormality of the scapula with narrow ‘v’ shaped, the absence of suprascapular notch and thick band or ossified STSL. In rotator cuff injuries, occupational injuries, tumors, ischaemic injuries to nervivasorum of the SSNr have become increasingly recognized as a cause for shoulder pain and dysfunction. The SSNr supplies motor innervation to the supraspinatus and infraspinatus muscles and sends articular branches acromioclavicular and glenohumeral joints. The anomalous STSL in combination with narrow and absence of the notch markedly reduces the space and chances to have SSN entrapment as a result of trauma, repetitive over usage in proportion to the magnitude and duration.

Rengachary et al. [2] examined 211 adult cadaveric scapulae and categorized the shape of SSN into six different types. The most common types “U” shaped” notch in 48 percent and less common type was small “V”-shaped” notch in 3 percent of cadavers. It had been hypothesized that SSNr entrapment was more likely to be associated with absence and very small “V”-shaped SSN. The mechanism by which the injury atSSN leads to kinking of the nerve against the ligament had termed as the sling effect [3]. The evaluated motion of the SSNr in relation to the inferior margin of the STSL with various moments like depression, cross adduction and hyperabduction of the shoulder was

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the cause for SSNr entrapment. The morphology of SSN and its combination of anomalous STSL were considered as a risk factor for SSNr entrapment [4-8] occupational injury.

Based on the measurementNatsis et al. [9], classified theSSN into five types as Type I- Without a discrete notch, Type II a notch with a longer transverse diameter (MTD) than a vertical diameter (VMD), Type III a notch with longer vertical than transverse diameter, Type IV a bony foramen and Type V a notch and a bony foamen.

Based on the measurement Michal polguj et al. [10] classified the SSN into five types as:

Type I- longer maximum depth than the superior transverse diameter (MVD>STD) Type II- a notch with equal MVD, STD and MTD (MVD=STD=MTD)

Type III- a notch with STD was longer than the maximal depth (STD>MVD)

Type IVa bony foramen

Type V-discrete notch.

Type I and Type III were divided into three subtypes: A- MTD was longer than STD (MTD>STD), B- (equal MTD=STD) and C- (MTD<STD)

Nafees Fatima et al. classified five types of SSN as Type I Deep "U" shaped, Type II shallow "U" shaped, Type III "J" shaped, Type IV "V" shaped and Type V as Indented.

Iqbal et al. classified the SSN into five types as Type I "J" shaped, Type II "U" shaped, Type III "V" shaped, Type IV absence of notch and Type V indentation of the notch.

Methods

This study was done in 100 adulthumanscapulae 54 right and 46 left sided with unknown sex in the department of anatomy, Meenakshi Medical College, Kancheepuram, Tamil Nadu.

Exclusion Criteria

The damaged superior border of the scapula

Inclusion Criteria

Only adult scapula

Based on the study of Rengachary et al the SSN was classified into six types: (Fig. 1a-1f)

1a-Type I-No Notch

1b II-V Shaped

1c-Type III U shaped

1d-Type IV- Small "V"

1e-Type- V Partially Ossified

1f-Type VI Fully Ossified

1g-Deep U

Fig. 1:

Type I- the absence of notch (no discrete notch)

Type II- "V" shaped

Type III- "U" shaped

Type IV- Small "V" shaped

Type V- Partially ossified Superior transverse scapular ligament

Type VI- Completely ossified Superior transverse scapular ligament

Based on the study of Michel Polguj et al the measurements of SSN were taken as:

The maximum depths, superior and middle transverse diameters of SSN were measured by using vernier caliper.

1. The diameter of the superior border of the scapula to lower margin of coracoid process was measured and marked as STD (Fig. 2a).
2. The maximum vertical depth from the center point of "STD" to the depth of SSN was measured as MVD. (Fig. 2a)
3. The middle transverse diameter was the distance in a horizontal plane between the opposite margins of the SSN was measured as MTD in half dimension of MVD (Fig. 2b).

Fig. 2a:

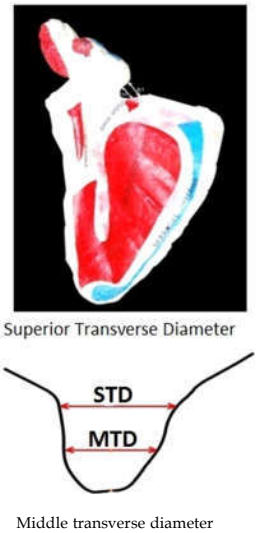

Fig. 2b:

The data analysis of type I, type II& type III was recorded as the mean, minimum, maximum and standard deviation (Table 5).

Results and Observation

Based on the study of Rengachary SS. et al. SSNwas classified into six types as-

Type I	Absent notch (no discrete notch)	Right side 10 & Left 8= 18 (18%)
Type II	" V" shaped notch	Right side 13 & Left 13= 26 (26%)
Type III	"U" shape notch	Right side 24 & Left 21 =45 (45%)
Type IV	Small "V" shaped notch	Right side 02 & Left 03=05 (5%)
Type V	Partially ossified STSL	Right side 02 & Left 0 =02 (2%)
Type VI	Completely ossified STSL	Right side 01 & Left 03=04 (4%)

The Type III was again classified into Shallow "U" and Deep "U" shaped notch. Type III was observed in 45 scapulae in which shallow "U" was observed in 36 scapulae and deep "U" in 9 scapulae. (Fig. 2g)

Based on the description by M. Polguj et.al then was classified as:

Type I - (MVD>STD) was 9%

Type II (MVD=STD=MTD), was Nil

Type III (STD>MVD), was 67%

Type IV was 4% bony foramen

Type V was 18% (no discrete notch).

In the present study, the partially ossified STSL was also observed in 2% of scapulae

Based on the measurement the TypeI and Type III were again classified into subtypes as A, B, C

Type I -IA 11.1% (MTD>STD), IB-nil (MTD=STD) and IC was 88.9% (MTD<STD).

Type III= IIIA nil, IIIB nil and IIIC was 100%.

Discussion

The absence of suprascapular notch was observed by Rubi Saikia et al. [11] in 17.79%, Raj Kishore et al. [12] in 19.64% by Ukti Desai [13] in Gujarat region was 16%. In the present study, it was observed in 18% which was close to the above studies.

In the present study - Type I- 18%was almost close to the study of usha Kannan [14] and Krishna Gopal [15]. Type II notch was observed in 26% was close to the study of Sinkeet et al. [16], Rengachary et al. The Type III U shaped notches observed in 45%which was close to Manoj Kumar et al. [17] and Rengachary et al. The Type IV in 5% of scapulae which was similar to the study of Sinkeet et al and Usha Kannan. The Type V in 2% which was close to the study of Krishna Gopal et al. and Type VI in 4% which was similar to the study of Rengachary et al Sinkeei et al. and close to Krishna Gopal et al.

In the present study, the partially ossified STSL was observed in 2% and completely ossified STSL was observed in 4% which were not reported by Iqbal

Table 1: Based on the study of Rengachary et al the shape of SSN in the present study was compared with previous studies

Studies	Type I Absent notch	Type II V-shaped	Type III U-shaped	Type IV Small"V"	Type V Partially ossified	Type VI Completely ossified
Rengachary et al	8%	31%	48%	3%	6%	4%
Sinkeet et al	22%	21%	29%	5%	18%	4%
Krishna Gopal	15.83%	41.66%	25%	12.5%	1.67%	3.33%
Manoj Kumar et.al	6.6%	41.5%	44.3%	-----	4.7%	2.8%
UshaKannan et al	20%	10%	52%	4%	4%	10%
Present study	18%	26%	45%	5%	2%	4%

Table 2: The shape of SSN was compared with studies of-of Iqbal et al and Nafees Fatima et al

Studies	Type I (MVD>STD)	Type II MVD=STD=MTD)	Type III (STD>MVD)	TypeIV bony foramen	Type V No notch
Michal Polguj et al2011	24.4%	2.3%	54.7%	7%	11.6%
Michal Polguj et al 2013	24.18%	1.95%	56.16%	4.72%	12.99%
Krishna Gopal et al	20%	3.33%	55.83%	4.16%	17.5%
Vyas KK et al 2013	20.33%	2.67%	42.7%	3.67%	30.67%
Present study	9%	Nil	67%	4%	18%

Table 3: Based on the measurement-Comparisons with previous studies

Studies	Indented notch	V-shaped	Shallow U-shaped	Deep "U" shaped	'J" shaped	Absence of notch
Iqbal et al	26.8%	20%	--	13.2%	22%	18%
NafeesFatima et al	4.87%	5.75%	31.86%	35.84%	21.68%	Nil
Present study	Nil	31%	36%	9%	Nil	18%

Table 4: Comparison of SSN with Natsis et al

Studies	Type I No notch	Type II MTD>MVD	Type III (MVD>MTD)	TypeIV bony foramen	Type V Notch and foramen
Natsis et al	8.3%	41.85%	41.85%	7.3%	0.7%
Present study	18%	13%	63%%	4%	Nil

et al. [18] and Nafees Fatima et al. [19]. In the present study the "J" shaped and indented notches were not observed. Shallow "U" was observed in 36% which was close to the study of Nafees Fatima. Deep "U" shaped notch was close to the study of Iqbal et al. Absence of notch was similar to the study of Iqbal et al. and which was not observed by Nafees Fatima.

In the present study, the partially ossified STSL was observed in 2% and Type II notch was not observed. Type IV was similar to Michal Polguj et al. [20] 2013 and Krishna Gopal et al. and Vyas KK et al. [27] Type V notch was similar to the study of Krishna Gopal et al.

In the present study, the partially ossified STSL was observed in 2% of scapulae. In the present and previous studies, the notch with foramen was not observed.

The very small "V" (type IV) shaped notch and ossified STSL lead to SSNr entrapment and neuropathy [21-24]. The origin of SSNr at a higher level to the notch and the angulation of the nerve is exaggerated during forcible depressive movements of the shoulder girdle. The mechanism by which the injury occurs at SSN has termed as the sling effect with the evaluated motion of the SSN in relation to its notch and the ligament during various movements of arm and shoulder.

The variations of the SSN is a risk factor at suprascapular nerve block, surgical explorations during su prascapular nerve decompression [25] and also during the arthroscopic decompression [26]. The knowledge of anatomical variation of SSN is mandatory for the Orthopedic surgeon to give good results to the patients. The early detection of an

Table 5: Comparative study of results of various parameters of suprascapular notch

	Maximum depth of SSN- Mean±SD(mm)		STD of SSN- Mean±SD (mm)		MTD of SSN Mean±SD (mm)	
	Gopal et al	Present study	Gopal et al	Present study	Gopal et al	Present study
Types I	12.55±4.07	9.3 ± 1.1	8.98±2.76	5.33± 0.57	9.08±2.99	3.66± 0.57
Types II	5.92±2.69	Nil	5.92±2.69	Nil	3.82±1.50	Nil
Types III	7.31±2.02	9.54 ± 2.1	8.50±1.98	11.45± 1.63	8.06±1.78	8.61± 1.81

anatomical variation of SSN will prevent atrophic changes of muscles and the patient will recover early after "The nerve decompression surgery".

Conclusion

This study is useful to predict the patients with occupational risk for SSNr entrapment. The good knowledge of morphometric parameters of SSN and its variations to the base interval (depth) will help for suprascapular nerve block and also during arthroscopic decompression of the suprascapular nerve.

This study was presented to highlight the suprascapular nerve entrapment in "Absent and Small "V" shaped SSN, partially or completely ossified superior transverse scapular ligament.

Abbreviations

SSN- Suprascapular notch

SSNr – Suprascapular Nerves

STSL- Superior transverse scapular ligament

STD- Superior Transverse Diameter

MTD- Middle Transverse Diameter

MVD- Maximum Vertical Depth

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