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Original Research Article

MORPHOMETRIC STUDY OF SUPRASCAPULAR NOTCH AS A FACTOR OF SUPRASCAPULAR NERVE ENTRAPMENT AND DIMENSIONS OF SAFE ZONE TO PREVENT SUPRASCAPULAR NERVE INJURY

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ABSTRACT

Background: The scapula is a large, flat, triangular bone which lies on the postero-lateral aspect of the chest wall Suprascapular nerve entrapment depends on the size and shape of suprascapular notch.

Purpose of the study: Aim of the present study is to classify SSN based on morphometry according to Michal Polguj and to obtain a safe zone which would be useful to avoid iatrogenic nerve lesion and to verify the reliability of the existing data for the management of entrapment neuropathy.

Materials and Methods: Study included 60 dried human scapulae obtained from the Department of Anatomy, Pondicherry institute of medical sciences. Three measurements were defined and collected for each SSN, Maximum depth (MD), Superior transverse diameter (STD) and Middle transverse diameters (MTD) based on which suprascapular notch was classified.

Results: In the present study type IIIC was the most common type with 83.3%. The mean of maximum depth was 6.87mm in type I whereas in type III it was 5.3mm. The mean of STD was 1.98mm in type I whereas in type III it was 10.03mm. The mean of MTD was 2mm in type I whereas in type III it was 6. 56mm.The distance between the SSN and the supraglenoid tubercle (AB) and the distance between posterior rim of glenoid cavity and the base of scapular spine (CD) were larger in Type V followed by type IV, III and Type I. The mean distance of AB for all the types were 24.79mm and for CD mean was 13.07mm.

Conclusion: Our study with morphometric variations of SSN may be helpful for the surgeons performing SN decompression especially by means of endoscopic techniques and measurements of safe zone may be helpful in the preoperative evaluations of patients with suprascapular neuropathies.

KEY WORDS: Suprascapular nerve, Suprascapular notch, Suprascapular foramen, Safezone.

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INTRODUCTION

The scapula is a large, flat, triangular bone which lies on the postero-lateral aspect of the chest wall. The suprascapular notch is situated on the superior border of the scapula, just medial to the base of the coracoid process. It is converted into a suprascapular foramen by the suprascapular ligament [1]. The SSN notch is frequently bridged by bone in some animals [2].

The suprascapular ligament may get ossified and convert the notch into complete foramen which is responsible for the entrapment of the SN [3]. Kopell and Thompson were the first to describe the supra scapular nerve entrapment syndrome [4].

The suprascapular foramen transmits the suprascapular nerve to the supraspinatus fossa, while suprascapular vessels pass above the ligament. [1]. The SSN is the most important point along the course of the suprascapular nerve (SN), because this region is the main site of injury and compression of the SN [5]. The variations in the suprascapular notch are accompanied by variations of the suprascapular ligament and constitute one of the potential risk factors to suprascapular nerve entrapment syndromes [6].

The suprascapular nerve entrapment is more frequently seen in males than females less than 35 years and it is commonly seen in athletes like volleyball players and baseball pitchers [7]. Aim of the present study is to classify SSN based on morphometry according to Michal Polguj obtain a safe zone which would be useful to avoid iatrogenic nerve lesion and to verify the reliability of the existing data for the management of entrapment neuropathy.

MATERIALS AND METHODS

Present study included 60 dried human scapulae obtained from the Department of Anatomy, Pondicherry institute of medical sciences Puducherry. Examination was focused on the suprascapular region. Three measurements were defined and collected for each SSN,

1. Maximum depth (MD) - Maximum vertical distance between deepest points at the base of suprascapular notch to an imaginary line between superior edges of notch.

2. Superior transverse diameter (STD) - Maximum distance between superior most edges of suprascapular notch (SSN).

3. Middle transverse diameters (MTD) - Maximum distance taken in horizontal plane between opposite walls of SSN at midpoint of MD and perpendicular to it.

The type of SSN was determined by using the classification system used by Michal Polguj et al. (2011) (8) and given in Table 1.

Table 1: Classification of SSN by Polguj [14].

Types of SSN	Description
Type I	MD > STD
IA	MTD>STD
IB	STD=MTD
IC	MTD<STD
Type II	MD=STD=MTD
Type III	STD<MD
IIIA	MTD>STD
IIIB	STD=MTD
IIIC	STD>MTD
Type IV	Bony bridge joins the corners of SSN
Type V	Presence of discrete notch

The safe zone from the supraglenoid tubercle to the base of SSN (AB) and distance between the posterior glenoid rim and base of scapular spine (CD) was also measured. The results of the present study were compared with the results of previous authors in different populations. The scapulae with broken superior border were excluded from this study. Measurements of suprascapular notch were made using digital Vernier caliper with resolution of 0.01mm. The data was analyzed statistically.

Fig. 1: Showing the measurements of Suprascapular notch. 1. MD 2. STD 3. MTD.

RESULTS

Table 2: Distribution of the suprascapular notch.

TYPE	RIGHT (%)	LEFT (%)	TOTAL (%)
Type I A	2(3.3)	2(3.3)	4(6.6)
Type I B	none	None	None
Type I C	1(1.6)	1(1.6)	2(3.3)
Type II	none	None	None
Type III A	none	None	None
Type III B	none	None	None
Type III C	22(36.6)	28(46.6)	50(83.3)
Type IV	1(1.6)	1(1.6)	2(3.3)
Type V	1(1.6)	1(1.6)	2(3.3)
TOTAL	27(45)	33(55)	60(100)

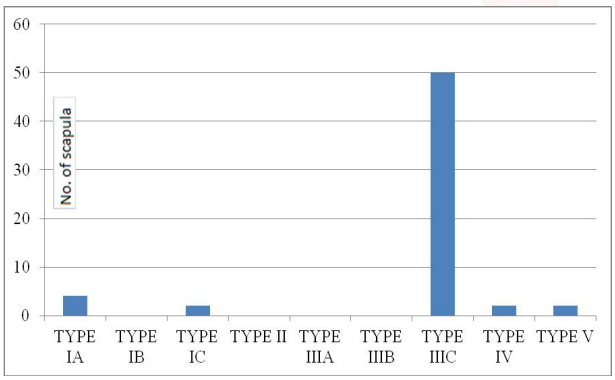
Table 3: Measurements of suprascapular notch.

Diameter of SSN	Type I			Type II			Type III		
	Mean (mm)	Max (mm) Min (mm)	SD	Mean (mm)	Max (mm) Min (mm)	SD	Mean (mm)	Max (mm) Min (mm)	SD
MD	6.87	11.37 3.26	4.12	0	0	0	5.3	13.57 0.04	3.38
STD	1.98	3.55 0.76	1.42	0	0	0	10.03	28.3 3.01	3.43
MTD	2.97	8.49 0.13	4.77	0	0	0	6.56	17.32 1.34	2.24

Table 4: Measurement of distance from suprascapular notch.

Type	Distance between SSN & Supraglenoid tubercle (AB)		Distance between posterior rim of Glenoid cavity and base of scapular spine (CD)	
	Mean (mm)	Standard deviation	Mean (mm)	Standard deviation
Type I	27.57	3.28	13.36	2.46
Type II	0	0	0	0
Type III	28.71	4.03	14.75	2.59
Type IV	33.35	1.2	16.74	0.48
Type V	34.35	1.62	20.54	2.14

Graph 1: Distribution of suprascapular notch types:



60 (26 right 34 left) scapula were analyzed without sex difference. The distribution of different types of SSN is given in Table 2. In the present study type IIIC was the most common type with 83.3% whereas type II, IIIA and IIIB were 0%. Measurements of SSN are given in Table 3. The mean of maximum depth was 6.87mm with standard deviation of 4.12 in type I whereas in type III it was 5.3mm and 3.38. The mean of STD was 1.98mm with standard deviation of 1.42 in type I whereas in type III it was 10.03mm and 3.43. The mean of MTD was 2.97mm with standard deviation of 4.77 in type I whereas in type III it was 6.56mm and 2.24. The measurements of distance from SSN are given in Table 5. The distance between the SSN and the supraglenoid tubercle (AB) and the distance between posterior rim of glenoid cavity and the base of scapular spine (CD) were varied among the different types. AB and CD were larger in Type V followed by type IV, III and Type I. The mean distance of AB for all the types were 24.79mm and for CD mean was 13.07mm.

DISCUSSION

Several classifications of SSN have been proposed in scientific literature [9-11]. All these studies were based on the morphology of SSN and very few literatures are available on the morphometry of SSN. Our study is to classify SSN on the basis of morphometry of SSN according to Polguj. In the study done by Hrdicka et al in 1942 classified SSN into five types based on visual observations: in type I SSN was absent, type II SSN was shallow, type III SSN was medium, type IV SSN was deep and complete foramen in type V.

Rengachary et al in 1979 classified SSN into 6 types in 211 cadaveric scapulae based on shape of SSN and ossification of STSL. Type I without discrete notch, Type II with wide V shaped notch, Type III with symmetrical U shaped notch, Type IV with very small V shaped notch, Type V with U shaped notch and partial ossification of STSL and Type VI with bony foramen and completely ossified STSL [10].

Natsis et al. in 2007 classified SSN into 5 types: Type I without discrete notch (8.3%), Type II with notch longest in transverse diameter (41.85%), Type III presents notch longest in vertical diameter (41.85%), Type IV with calcified STSL to form a bony foramen (7.3%), in Type V scapula shows a notch and a bony foramen (0.7%) [9].

Duparc et al. in 2010 reported V and U shaped SSN in 36.7% and 66.3% of shoulders respectively [12].

Iqbal et al. in 2010 classified SSN into 3 types based on shape: U (13.2%), V (20%) and J (22%) shaped [13]. In 2011 Hua-Jun Wang et al. classified SSN into 5 typed based on Natsis where type II was 58.11% and Type III 28.23% [14].

In the present study we have classified SSN based on Michael Polguj who has described SSN into 5 types based on specific geometrical parameters where type III (50%) is the most common type. In our study subtype IB, type II, Subtype IIIA, IIIB were zero percent whereas in Polguj it was 3.08%, 1.95%, 2.92% and 0.97% respectively. In our study subtype IA was 4%, IC was 2%, type IV was 2% and type V was 2%. Table 5 shows the comparison of distribution of SSN with other studies.

Table 5: Comparison of distribution of ssn with other studies.

TYPE	Michael Polguj et al. (%)(2011) [14]	Vyas Kintu K et al. (%) (2013)	Present study (%) 2016
Type I A	15.1	6	4
Type I B	3.5	5	0
Type I C	5.8	9.33	2
Type II	2.3	2.67	0
Type III A	8.2	2.33	0
Type III B	2.3	2.67	0
Type III C	44.2	37.67	50
Type IV	7	3.67	2
Type V	11.6	30.67	2

In the present study, distance between SSN & Supraglenoid tubercle (AB) and distance between posterior rim of Glenoid cavity and base of scapular spine (CD) has also been measured. The mean distance of AB was 30.99mm with the range of 27.57 – 34.35mm. These morphometric data give the measurements of the safe zone to be operated without injuring the suprascapular nerve. These findings correlate with the findings of the previous authors like Mustafa Urguden et al (2003), Sinkeet et al (2010) and Stefano Gumina et al (2011) [2,12,10]. The mean distance of CD was found to be 16.34mm with a range of 13.36 – 20.54mm which was similar to the study by Bigliani et al [15]. Our study gives a quantitative classification of SSN which is simple reproducible and based on geometrical parameters that distinguishes each type. The measurements of safe zone are important to the clinicians in the treatment of suprascapular neuropathies.

CONCLUSION

Our study with morphometric variations of SSN may be helpful for the surgeons performing SN decompression especially by means of endoscopic techniques and measurements of safe zone may be helpful in the preoperative evaluations of patients with suprascapular neuropathies.

Conflicts of Interests: **None**

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