Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 665-670 | ISSN:2251-6727

Morphological Variations of the Suprascapular Notch and Its Clinical Correlation with Suprascapular Nerve Entrapment Syndrome

[1]Chinmaya Das, [2]Swagatika Pradhan, [3]B Shanta Kumari, [4]Dhiren K Panda

[1,2]Assistant Professor, [3]Associate Professor, [4]Tutor, IMS and SUM Hospital, Siksha O Anusandhan (Deemed to be University), Bhubaneswar, India

Corresponding Author: Swagatika Pradhan**,** Assistant Professor, IMS and SUM Hospital, Siksha O Anusandhan (Deemed to be University), Bhubaneswar, India

(Received: 27 October 2023 Revised: 22 November Accepted: 26 December)

KEYWORDS

Nerve compression, Nerve entrapment syndrome, Suprascapular notch, Suprascapular nerve entrapment, Suprascapular nerve blockade

ABSTRACT:

Introduction- The suprascapular nerve, which supplies the rotator cuff muscles and ligaments in the acromioclavicular and shoulder joints, passes via the suprascapular notch, which is located medial to the coracoid process. The compression of the suprascapular nerve, which often occurs in the suprascapular notch, can cause excruciating shoulder discomfort, arm weakness, limited range of motion, and ultimately atrophy of the muscles that the nerve supplies. Suprascapular nerve entrapment syndrome is a noteworthy differential diagnosis for shoulder pain. Sadly, it is frequently overlooked while determining the cause of shoulder pain or discomfort. The major goal of our research is to determine the frequency of various morphological abnormalities in the suprascapular notch and whether or not these differences may contribute to suprascapular nerve entrapment syndrome.

Material and methods-In order to determine the type, quantity, and presence of suprascapular notch, we thoroughly inspected 75 scapula. We took pictures to record the suprascapular notch's observed alterations, then arranged the data in a table.

Results –4% of the 75 scapulae in our study had no suprascapular notch (Type 1), 17.3% had a blunted V-shape (Type 2), 32% had a U-shape (Type 3), 13.3% had a minimally V-shaped (Type 4), 24% had a V-shape with partial ossification (Type 5), and 9.3% had a foramen at the site of the suprascapular notch (type 6). Type 3 was the most prevalent morphological variant of the suprascapular notch.

Conclusion-Understanding the morphological changes in the suprascapular notch is essential for correctly identifying suprascapular nerve entrapment syndrome using non-invasive diagnostic imaging and for organising the best surgical procedures.

INTRODUCTION

The superior edge of the scapula contains the suprascapular notch, which is located medial to the base of the coracoid process. The superior transverse scapular ligament, which provides the suprascapular nerve (SSN) with a conduit, converts the notch into a foramen. The rotator cuff muscles, as well as the ligaments in the acromioclavicular and shoulder joints, receive sensory and motor nerve impulses from the SSN.[1]

The rotator cuff muscles and ligaments of the acromioclavicular and shoulder joints receive sensory innervation from the suprascapular nerve, whereas the supraspinous and infraspinous muscles receive motor innervation. The most frequent location where the suprascapular nerve is squeezed, leading to nerve damage and entrapment, is the suprascapular notch [2]. Koppel and Thompson [3] initially reported the condition of suprascapular nerve entrapment in 1959. Compression of the nerve at the notch may result from trauma injuries such as scapular, clavicular, and proximal humeral fractures as well as dislocation of the acromioclavicular or shoulder joint [4,5]. An entrapment syndrome, also known as an acquired

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 665-670 | ISSN:2251-6727

neuropathy, is frequently seen in the spinoglenoid notch, where compression of the suprascapular nerve occurs. The symptoms of this illness include atrophy of the supraspinatus and infraspinatus muscles and vague discomfort on the posterolateral side of the shoulder joint [6].

Athletes, especially volleyball players, who frequently strain their shoulders with repeated overhead movements, are more likely to have the syndrome.One important component that should be considered when assessing shoulder pain is the syndrome of SSN entrapment. Unfortunately, while making a differential diagnosis for shoulder pain or discomfort, it is frequently overlooked. [7]The aim of present research is to study the morphological variations of the suprascapular notch and its clinical correlation with suprascapular nerve entrapment syndrome.

MATERIAL AND METHODS

The present study was conducted at department of anatomy for the duration of one year. Total 75 dried adult scapulae of unknown sex were taken from the department for this study. Scapulae which were intact and unbroken were included in the study. Excluded from the study were the scapulae with physical abnormalities and those of undetermined age or race.

A physical examination was performed to determine whether the suprascapular notch was present in each scapula. The Vernier calliper was used to measure the circumference, maximum depth (MD), middle transverse diameter (MTD), and superior transverse diameter (STD) of the notch. The final data were tallied and documented. Capsulae with different notch forms were recorded and photographed.

The horizontal distance between the superior corners of the suprascapular notch at the superior border of the scapula is known as the superior transverse diameter.The mid transverse diameter, which is perpendicular to the maximum depth at the notch's halfway, is the horizontal distance between the opposing walls of the suprascapular notch.The maximum depth is the separation between the suprascapular notch's deepest point and superior corner.A scale is used to measure the length, medial end, deepest point, and lateral end of the thread.

75 dry scapulae were classified in the current study using the Rengachary classification, and all scapulae lengths were measured using digital Vernier callipers. Rengachary and colleagues in 1979 identified six categories of scapular notch. [8-10]

Type 1: Absent notch. Superior border of the notch forms a wide depression between the medial angle and coracoid process.

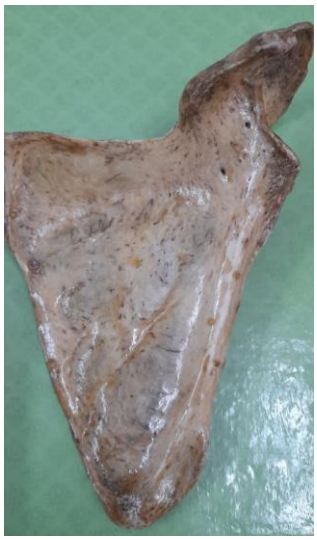

Figure 1: Type 1

Type 2: Blunt V shaped notch

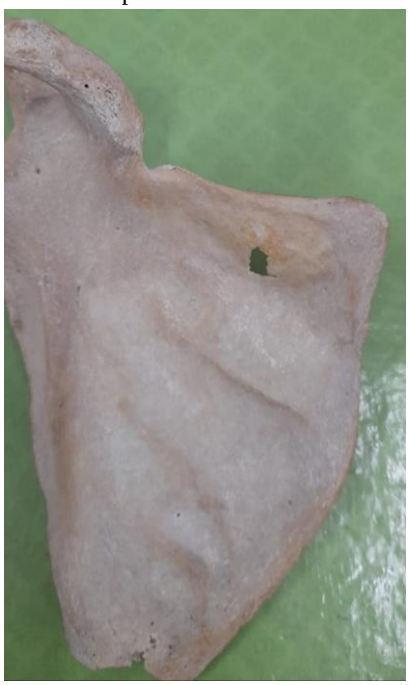

Figure 2: Type 2

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 665-670 | ISSN:2251-6727

Type 3: U-shaped notch with its margins nearly parallel

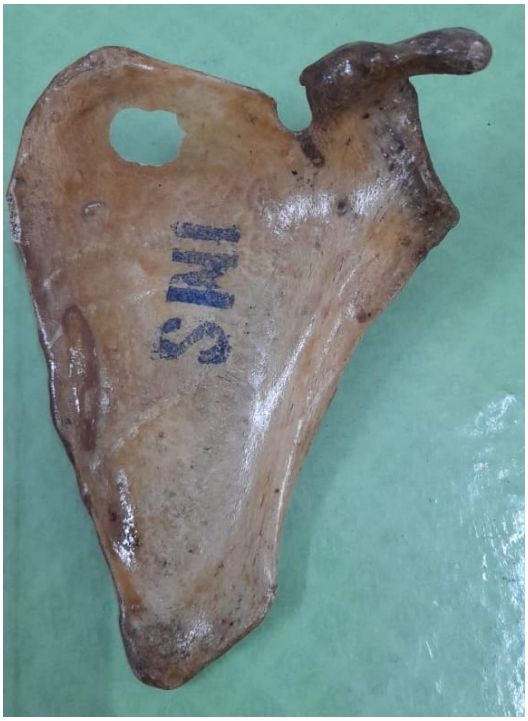

Figure 3: Type 3

Type 4: Very small V shaped notch. Frequently there is a shallow groove that is formed for the suprascapular nerve adjacent to the notch.

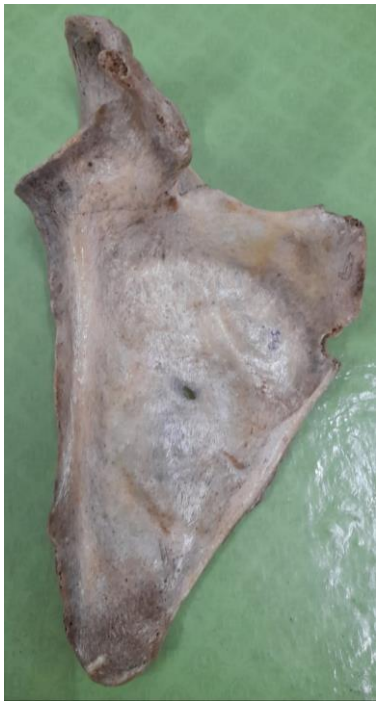

Figure 4: Type 4

Type 5: V shaped minimal notch and has a partially ossified ligament.

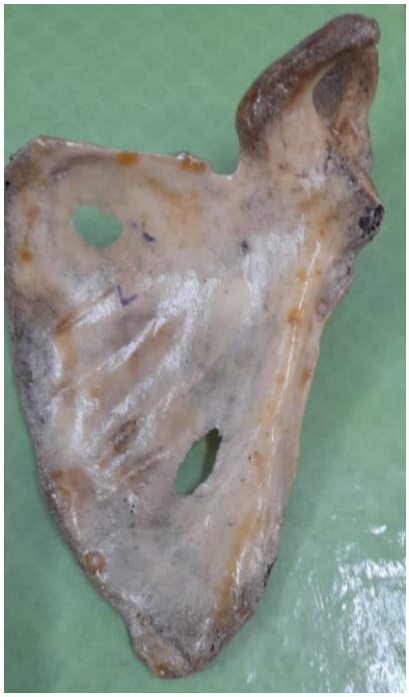

Figure 5: Type 5

Type 6: The completely ossified ligament converts the notch into a foramen.

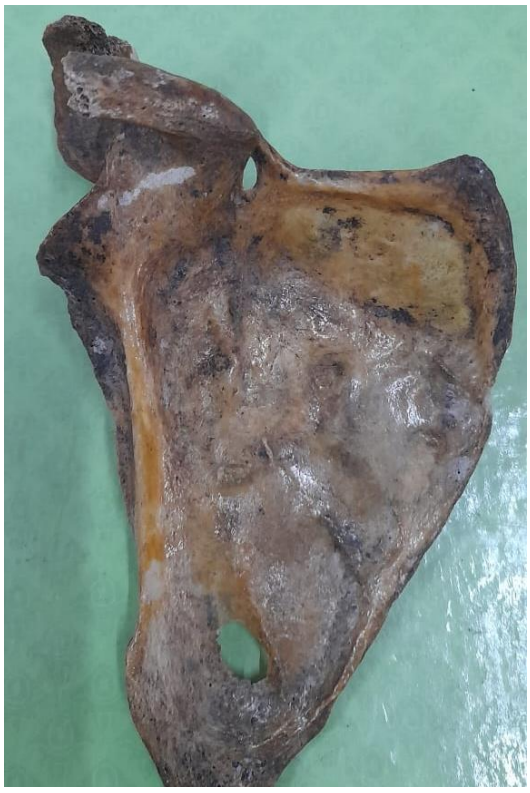

Figure 6: Type 6

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 665-670 | ISSN:2251-6727

Calculation was performed using a statistical analysis program, IBM® SPSS® Statistics version 25.0.

RESULTS

Six different varieties of suprascapular notches were examined. Three (4%) of the 75 scapulae in our study had no suprascapular notch (Type 1), thirteen (17.3%) had a blunted V-shape (Type 2), twenty-four (32%) had a U-shape (Type 3), ten (13.3%) had a minimally V-shaped (Type 4), eighteen (24%) had a V-shape with partial ossification (Type 5), and seven (9.3%) had a foramen at the site of the suprascapular notch (type 6). According to our findings, Type 3 was the most prevalent morphological variant of the suprascapular notch, followed by Types 5, 2, 4, 6, and 1, in that order. Table 1 displays our findings about the suprascapular notch's morphological variability.

Table 1 Morphological variations of the suprascapular notch using Rengachary classification

Type of Notch	Frequency (%)
Type 1	3 (4)
Type 2	13 (17.3)
Type 3	24 (32)
Type 4	10 (13.3)
Type 5	18 (24)
Type 6	7 (9.3)
Total	75

Measurements of different parameters like STD, MTD, MD and TCD among types of suprascapular notch like u shaped, V shaped, J shaped, incomplete notch and complete notch at the superior border of the scapula were noted as shown in table 2

Table 2 Measurements of different types of suprascapular notch at the superior border of the scapula

Measurements	U shaped notch	V shaped notch	J shaped notch	Incomplete notch	Complete notch
STD	13.05±0.8	13.23±1.2	10.23±1.5	10.17±1.5	7.84±0.6
MTD	7.86±0.7	6.89±0.7	8.24±0.4	5.13±0.9	8.63±1.0
MD	7.31±1.2	12.65±0.8	8.09±1.5	6.87±0.4	10.84±0.8
TCD	21.63±1.5	18.23±0.7	11.23±1.7	19.25±1.5	19.43±0.7

DISCUSSION

The scapula is a small, triangular bone that acts as the humerus's pivot point and base of motion. It crosses over the second through seventh ribs and is situated in the posterior-lateral region of the chest wall. Located directly medial to the base of the coracoid process, the suprascapular notch is a depression in the superior edge of the scapula. This notch is transformed into a foramen by the superior transverse scapular ligament. This ligament may ossify in certain cases, creating a bony foramen. [11]

The suprascapular notch serves as a passageway for the nerve and suprascapular veins. Six A branch of the upper trunk (C5,6) of the brachial plexus, the suprascapular nerve is a mixed peripheral nerve with both motor and sensory components. It descends deeply to the omohyoid and trapezius muscles after entering the suprascapular notch inferior to the superior transverse scapular ligament. [12]The SSN supplies sensory innervation to the glenohumeral joint and the acromioclavicular joint as well as motor innervation to the supraspinatus and infraspinatus muscles. [13]

The type of suprascapular notch has a considerable impact on the SSN entrapment syndrome. [14] Various factors, including its transverse dimension, shape, and vertical length, have been taken into consideration by different authors in order to classify the anatomical forms of this notch. We employed the Regachary classification in our study.

Our analysis revealed that type 1 was the least prevalent, in contrast to the Rengachary investigation, which concluded that type 4 was the least common. Our results, however, which showed a greater prevalence of type 3 suprascapular notch, were consistent with Rengachary's research. Additional research by Paolo Albino et al [15] and Iqbal et al (2010) [16] revealed that type 3 and type 5 suprascapular notches, respectively, were the most frequently seen.

Small notches are known to increase the risk of nerve impingement. V-shaped notches were frequently linked

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(1), 665-670 | ISSN:2251-6727

to suprascapular nerve entrapment because they are smaller in area than U-shaped notches [17].The transverse scapular ligament completely osseointegrates, transforming the notch into a foramen. Of the 75 scapulae in the current study, a few of them were like this. Prior research indicated that different populations have varying incidences of foramen.[18,14]

Understanding the suprascapular notch entrapment syndrome requires an understanding of anatomical diversity in the suprascapular notch and its shape. The c5 and c6 roots of the brachial plexus at Erb's point give rise to the suprascapular nerve, a mixed nerve. The suprascapular nerve splits into motor and sensory branches after passing deeply into the suprascapular foramen and spinoglenoid notch. The subacromial bursa, acromioclavicular, and glenohumeral joints are supplied by the motor branch, whereas the supra and infraspinatus muscles are supplied by the sensory branch [18].

An acquired neuropathy brought on by nerve compression in the suprascapular notch is known as suprascapular nerve entrapment.Suprascapular nerve entrapment is a major cause of shoulder discomfort and impairment, while being relatively uncommon.A narrow or deep suprascapular notch, a V-shaped notch, a band-shaped, bifurcated, or fully ossified superior transverse scapular ligament, and unusual configurations of the suprascapular vessels and nerves at the suprascapular notch are morphological factors that may contribute to this condition. According to international research, 1-2% of people with shoulder pain may have suprascapular nerve entrapment, which could lead to a false positive. [19]

Suprascapular nerve entrapment is more common in athletes who engage in overhead motions and endure repetitive strain. When performing radiological imaging procedures in clinical practice, such as computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound, it is critical to understand the morphological differences of the suprascapular notch.Furthermore, understanding the anatomical differences is essential for treatments like suprascapular nerve blockades and arthroscopic shoulder operations. [20]

The limitation of the study was small sample size, more number of scapulae can be used for the study.

CONCLUSION

Understanding the suprascapular nerve entrapment condition requires anatomical understanding of the suprascapular notch and the ossification of the suprascapular ligament. Nerve entrapment has been linked to a narrow notch form and a thick, ossified suprascapular ligament at the superior edge of the scapula. For doctors, radiologists, neurosurgeons, and orthopaedic surgeons to make an accurate diagnosis and plan shoulder-related surgical operations, an ossified suprascapular ligament and a change in the notch's shape are extremely important.

REFERENCES

1. Standring S. Pectoral girdle and upper limb. In: Johnson D, Collins P, editors. Gray’s Anatomy: The Anatomical Basis of Clinical Practice. New York, USA: Churchill Livingtone. 2008;793–821.
2. Zehetgruber H, Noske H, Lang T, Wurnig C. Suprascapular nerve entrapment. A meta-analysis. Int Orthop 2002;26:339-343.
3. Kopell HP, Thompson WAL. Pain and the frozen shoulder. Surg Gynecol Obstet. 1959;109:92-96.
4. Bhatia DN, de Beer JF, van Rooeyn KS, du Toit DF. Arthroscopic suprascapular nerve decompression at the suprascapular notch. Arthroscopy. 2006;22:1009-1013.
5. Shishido H, Kikuchi S. Injury of the suprascapular nerve in shoulder surgery: An anatomic study. J Shoulder Elbow Surg. 2001;10:372-376.
6. Piatt BE, Hawkins RJ, Fritz RC, et al. Clinical evaluation and treatment of spinoglenoid notch ganglion cysts. J Shoulder Elbow Surg. 2002;11:600-604.
7. Callahan JD, Scully TB, Shapiro SA, Worth RM. Suprascapular nerve entrapment. A series of 27 cases: A series of 27 cases. J Neurosurg. 1991;74(6):893–6.
8. Rengachary SS, Neff JP, Singer PA, Brackett CE. Suprascapular entrapment neuropathy: a clinical, anatomical, and comparative study. I: clinical study. Neurosurgery. 1979;5(4):441–6.
9. Rengachary SS, Burr D, Lucas S, Hassanein KM, Mohn MP, Matzke H. Suprascapular entrapment neuropathy: a clinical, anatomical, and comparative study. Part 2: Anatomical study. Neurosurgery. 1979;5:447–51.
10. Rengachary SS, Burr D, Lucas S, Brackett CE. Suprascapular entrapment neuropathy: a clinical,

anatomical, and comparative study. Part 3: comparative study. Neurosurgery. 1979;5(5):452–5.

11. Akhtar J, Madhukar PK, Fatima N, Kumar A, Kumar B, Sinha RR, et al. Ossification of transverse scapular ligament in North Indian population. J Evol Med Dent Sci. 2014;3(63):13884–92.
12. Schroeder HP, Kuiper SD, Botte MJ. Osseous anatomy of the scapula. Clin Orthop Relat Res. 2001;383(383):1319–9.
13. Cummins CA, Anderson K, Bowen M, Nuber G, Roth SI. Anatomy and histological characteristics of the spinoglenoid ligament. J Bone Joint Surg Am. 1998;80(11):1622–5.
14. Yang HJ, Gil YC, Jin JD, Ahn SV, Lee HY. Topographical anatomy of the suprascapular nerve and vessels at the suprascapular notch. Clin Anat. 2012;25(3):359–65.
15. Iqbal K, Iqbal R, Khan SG. Anatomical variations in the shape of suprascapular notch of scapula. J Morphol Sci. 2010;27(1):1–2.
16. Albino P, Carbone S, Candela V, Arceri V, Vestri AR, Gumina S. Morphometry of the suprascapular notch: correlation with scapular dimensions and clinical relevance. BMC Musculoskelet Disord. 2013;14(1):172.
17. Dunkelgrun M, Lesaka K, Park SS, Kummer FJ, Zuckkerman JD. Interobserver reliability and intraobserver reproducibility in suprascapular notch typing. Bull Hosp Joint Dis. 2003;61(3-4):118-22.
18. Bagoji IB, Hadimani GA, Bulgoud RS, Desai V, Prakash KG, Bharatha A. Anatomical variations of the suprascapular notch and its importance in suprascapular entrapment neuropathy. Maedica (Bucur). 2020;15(3):298–304.
19. Łab˛etowicz P, Synder M, Wojciechowski M, Orczyk K, Jezierski H, Topol M. Protective and predisposing morphological factors in suprascapular nerve entrapment syndrome: A fundamental review based on recent observations. Biomed Res Int. 2017;2017:4659761.
20. Surya P, Pankhania R, Islam SU. Suprascapular neuropathy in overhead athletes: A systematic review of aetiology and treatment options. Open Orthop J. 2019;13(1):177–82.
21.