



Variation in Morphology of Suprascapular Notch and Its Clinical Significance

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ABSTRACT

Background: The suprascapular notch (SSN) shows considerable morphological and morphometric variations that can influence the course and compression of the suprascapular nerve, leading to suprascapular nerve entrapment syndrome. Knowledge of these variations is essential for accurate diagnosis and effective surgical intervention.

Aim & Objectives: To study the morphological patterns and morphometric dimensions of the suprascapular notch and to evaluate their clinical significance in relation to suprascapular nerve entrapment.

Methodology: A descriptive observational study was conducted on 80 dry human scapulae of unknown age and sex. The suprascapular notch was examined macroscopically and classified according to Rengachary's classification. Morphometric parameters including maximal depth, superior transverse diameter, and middle transverse diameter were measured using a digital Vernier caliper.

Results: Type III suprascapular notch was the most common (43.75%), followed by Type II (25%) and Type V (15%). Rare types included Type IV and Type VI (2.5% each). Morphometric analysis revealed significant dimensional differences among various types, with narrower and deeper notches potentially predisposing to nerve compression. No significant side predominance was observed.

Conclusion: The suprascapular notch exhibits marked anatomical variability. Detailed morphological and morphometric knowledge of the SSN is valuable for anatomists and clinicians in diagnosing and managing suprascapular nerve entrapment.

Keywords: Suprascapular notch; Scapula; Morphometry; Suprascapular nerve; Nerve entrapment syndrome

INTRODUCTION

Scapula, also known as shoulder blade is a flat triangular bone resting on the posterolateral part of the thorax, extending from second to seventh ribs [1]. It has two surfaces, costal and dorsal. The spine of the scapula irregularly separates the convex dorsal surface into a significantly bigger infraspinous fossa and a smaller supraspinous fossa. The concave costal surface features a sizeable subscapular fossa [2]. The suprascapular notch (SSN) is a variable depression on the superior border of the scapula, serves as a crucial conduit for the suprascapular nerve.

Entrapment of suprascapular nerve is seen whenever there is formation of complete suprascapular foramen. Suprascapular nerve entrapment is characterised by chronic, poorly localised pain in the posterior or/and lateral region of the shoulder, which may radiate down the arm or up into the neck, mimicking angina; along with weakness of abduction and increased external rotation of the arm, with atrophy of the supra- and infraspinatus muscles[3].

The morphometry and morphological variations in the suprascapular region have a significant role in the development of suprascapular nerve entrapment syndrome. Also, the side symmetry and sex distribution of suprascapular notch are considered as predisposing factors in suprascapular nerve entrapment syndrome. So, plentiful and clear anatomical knowledge of morphology and morphometry of the suprascapular region provides clear explanation of the most etiopathological factors of suprascapular nerve entrapment syndrome. These data are essential in the clinical practice to facilitate the diagnosis and improve outcome of the different surgical or arthroscopic procedures associated with the decompression of suprascapular nerve [4].

The incidence of suprascapular neuropathy ranges from 7% to 10%. The prevalence was found to be between 12% to 33% among the athletic population, with volleyball players being the most prevalent group. To better comprehend the location and to identify the source of entrapment syndrome, it is crucial to have a detailed awareness of the anatomical changes along the suprascapular nerve [5].

The gold standard for identifying suprascapular nerve entrapment is electromyography and nerve conduction velocity investigations, however these procedures are costly. Relying less on numerous diagnostic modalities and offering a more economical diagnostic method for risk assessment might be achieved by establishing a correlation between the types of SSN based on its shape and size [6].

A good knowledge of the morphometric variation of the scapulae is important in clinical investigation as it helps to understand shoulder and back pains as well as the arrangement of the neurovascular structures [7].

Aim& Objective

To perform a morphological and morphometrical study of suprascapular notch.

Material and Methods

Study Design

The present study was a descriptive observational study conducted to analyze the variation in morphology of the suprascapular notch and its clinical significance.

Study Place

The study was carried out in the Department of Anatomy, Rama Medical College Hospital & Research Centre, Kanpur.

Study Duration

The duration of the study was 12 months, from January 2025 to December 2025.

Study Material

The study material consisted of 80 dry human scapulae of unknown age and sex, obtained from the bone collection available in the Department of Anatomy.

Inclusion Criteria

- All intact dry human scapulae available in the department during the study period.
- Scapulae with clearly identifiable superior borders and suprascapular notches.

Exclusion Criteria

- Scapulae with deformed, damaged, or fractured superior borders.
- Scapulae with erosion or pathological changes affecting the suprascapular notch.

Procedure

All selected scapulae were cleaned and carefully examined. Each scapula was assigned a serial number for identification. Side determination (right or left) was performed based on standard anatomical landmarks such as the glenoid cavity, spine, and acromion process.

The suprascapular notch was studied by gross anatomical examination. Morphological characteristics including shape, depth, and width of the notch were observed. Measurements were taken using a Vernier Calliper to assess the dimensions of the suprascapular notch wherever applicable.

Based on gross appearance and morphometric parameters, the suprascapular notches were classified into different types according to standard anatomical classification systems such as Rengachary's classification [8].

There are six basic types of scapular notch:

Type I: Notch is absent. The superior border forms a wide depression from the medial angle to the coracoid process.

Type II: Notch is a blunted V-shape occupying the middle third of the superior border.

Type III: Notch is U-shaped with nearly parallel margins.

Type IV: Notch is V-shaped and very small. A shallow groove is frequently formed for the suprascapular nerve adjacent to the notch.

Type V: Notch is minimal and U-shaped with a partially ossified ligament.

Type VI: Notch is a foramen as the ligament is completely ossified

The following morphometric dimensions were measured on dry human scapulae in **mm** using digital **Vernier Calliper**

1. **The maximal depth (MD)**—the maximum value of the longitudinal measurements taken in the vertical plane from an imaginary line between the superior corners of the notch to the deepest point of the suprascapular notch.
2. **The superior transverse diameter (STD)**—the maximum value of the horizontal measurements taken in the horizontal plane between the corners of the SSN on the superior border of the scapula.
3. **The middle transverse diameter (MTD)**—the value of the horizontal measurements taken in the horizontal plane between the opposite walls of the SSN at a midpoint of the MD and perpendicular to it.

Classification of scapulae according to morphometric parameters of suprascapular notch. Which was introduced by Natsis et al. 2007 and modified by Polguy et al. 2011[9]. In type I, MD was greater than STD. Type II presented equal MD, STD and MTD. Type III presented longer STD than MD. In type IV, a bony bridge joins the corners of the SSN. Type V presents a discrete notch.

Data Analysis

The collected data were tabulated and analyzed. The frequency and percentage of each type of suprascapular notch were calculated. Comparative analysis between right and left scapulae was also performed. Results were interpreted in relation to their clinical significance, particularly concerning suprascapular nerve entrapment.

Ethical Considerations

As the study was conducted on dry human bones with no identification details, ethical clearance was obtained as per institutional guidelines, and no ethical issues were involved.

Results:

Table 1: Classification of Scapula according to shape of suprascapular notch

	No. of Scapulae (%) (n=80)	Right Sided	Left Sided
Type I	9 (11.25%)	6	3
Type II	20 (25%)	12	8
Type III	35 (43.75%)	19	16
Type IV	2 (2.5%)	2	0
Type V	12 (15%)	7	5
Type VI	2 (2.5%)	0	2

Table 1 shows the distribution of suprascapular notch (SSN) types among the 80 scapulae examined revealed considerable morphological variation. Type III suprascapular notch emerged as the predominant variant, observed in 43.75% (n = 35) of specimens. This type showed a nearly symmetrical distribution between the right (n = 19) and left (n = 16) sides, indicating the absence of significant laterality. The predominance of Type III suggests that a notch with a greater transverse diameter than depth is the most common morphological pattern in the studied population. The second most frequently encountered variant was Type II, accounting for 25% (n = 20) of scapulae, followed by Type V, which constituted 15% (n = 12) of the total sample. Both types demonstrated a slight predominance on the right side. Type I suprascapular notch, characterized by a minimal indentation, was identified in 11.25% (n = 9) of scapulae, again showing right-side dominance. Rare morphological variants included Type IV and Type VI, each comprising 2.5% (n = 2) of cases. Type IV was exclusively observed on the right side, whereas Type VI was confined to the left side. Overall, the findings indicate marked morphological diversity of the suprascapular notch with a clear predominance of Type III, while no consistent or clinically significant side predilection was evident across the different types.



Figure 1: Morphological types of suprascapular notch

Table 2: Dimensions in different type of SupraScapular Notches

Types of Scapula	Maximal depth (MD) in mm	Superior Transverse Diameter (STD) in mm	Middle transverse diameter (MTD) in mm
Type I (with indentation)	3.65 ± 0.88	10.36 ± 1.98	9.23 ± 1.56
Type II (MD > STD)	10.33 ± 2.74	7.01 ± 3.19	7.68 ± 2.34
Type III (STD > MD)	7.02 ± 2.71	12.46 ± 3.66	9.17 ± 2.63
Type IV (MD > STD) with shallow groove adjacent to it	6.24 ± 2.29	4.02 ± 2.28	4.35 ± 2.29

The morphometric analysis of suprascapular notch types demonstrated distinct variations in maximal depth (MD), superior transverse diameter (STD), and middle transverse diameter (MTD) across the different morphological categories. Type I scapulae exhibited the least maximal depth (3.65 ± 0.88 mm), along with relatively greater transverse diameters, indicating a shallow and broad notch configuration.

Type II suprascapular notches, defined by a greater maximal depth compared to superior transverse diameter, showed the highest mean maximal depth (10.33 ± 2.74 mm) with comparatively reduced transverse dimensions. This narrow and deep notch morphology may have potential clinical significance due to the reduced space available for the suprascapular nerve.

In contrast, Type III notches, which were the most prevalent, demonstrated a significantly greater superior transverse diameter (12.46 ± 3.66 mm) relative to depth (7.02 ± 2.71 mm), reflecting a wide notch morphology. The relatively larger middle transverse diameter further supports the presence of an expanded notch at different levels, suggesting a lower likelihood of neurovascular compression.

Type IV suprascapular notches displayed moderate maximal depth but the smallest superior and middle transverse diameters, indicating a narrow passage despite the presence of a shallow groove adjacent to the notch. Such a configuration may predispose to compression of the suprascapular nerve.

Overall, the morphometric differences observed among the various suprascapular notch types highlight the anatomical heterogeneity of this region and emphasize the importance of notch morphology in determining the potential risk of suprascapular nerve entrapment.

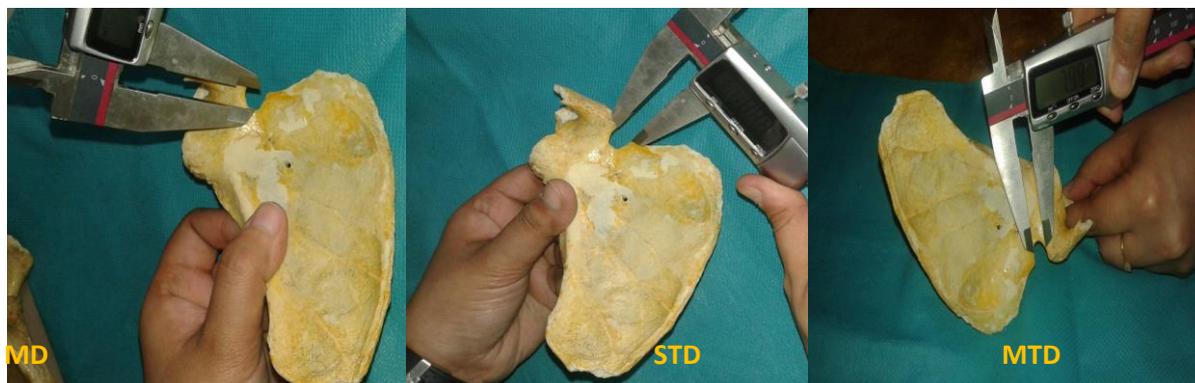


Figure 2: Morphometric parameters of suprascapular notch

Discussion

The suprascapular notch (SSN) exhibits considerable morphological and morphometric variability, which has significant anatomical and clinical implications, particularly in relation to suprascapular nerve entrapment. In the present study, Type III (U-shaped notch) was the most common configuration (43.75%), followed by Type II (V-shaped notch) (25%) and Type V (absence of notch) (15%). These findings are broadly consistent with earlier studies that reported U-shaped notches as the predominant morphology in different populations [1,2,5,9]. Rengachary et al. classified the suprascapular notch into six types and emphasized that variations in notch shape may influence susceptibility to nerve compression [8].

The relatively high incidence of Type III notches in this study aligns with observations by Sutaria et al. and Gopal et al., who also noted a predominance of U-shaped notches in Indian populations [1,2]. The presence of Type V scapulae, where the suprascapular notch is absent, is clinically relevant as it may be associated with ossification of the superior transverse scapular ligament, leading to the formation of a suprascapular foramen [10,11]. In the present study, Type VI scapulae with a complete bony foramen constituted 2.5%, which is comparable to the lower frequencies reported in previous anatomical studies [3,12].

Side-wise distribution showed a slightly higher occurrence of SSN variations on the right side, which corroborates findings reported by Patil et al., who suggested that asymmetry may be related to differential mechanical stress or developmental factors [3]. Although the difference may not be clinically significant, awareness of such asymmetry is important during surgical approaches and radiological interpretation.

Morphometric analysis revealed distinct dimensional patterns among different SSN types. Type II notches showed greater maximal depth (10.33 ± 2.74 mm) compared to superior transverse diameter, whereas Type III notches demonstrated significantly larger transverse dimensions (STD 12.46 ± 3.66 mm). These findings are in agreement with Polgaj et al., who emphasized that narrower and deeper notches may increase the risk of suprascapular nerve entrapment [9]. Similarly, Nasr reported that reduced transverse diameter combined with increased depth can predispose individuals to compression neuropathy [4].

Type IV notches, though less common, demonstrated markedly smaller dimensions in all parameters, suggesting a potentially higher risk of nerve compression due to restricted space. Duparc et al. highlighted that anatomical constraints at the suprascapular notch, especially in narrow configurations, play a crucial role in nerve entrapment syndromes [11]. The absence of the notch or the presence of a bony foramen further alters the biomechanics of the nerve, as noted by Bayramoğlu et al. and Ticker et al., who linked such variations to clinical symptoms including shoulder pain and muscle atrophy [12,13].

Overall, the findings of the present study reinforce the importance of detailed morphological and morphometric evaluation of the suprascapular notch. Such data are valuable for anatomists, radiologists, and orthopedic surgeons, particularly during diagnostic imaging and surgical decompression procedures. The observed variations underscore the necessity of population-specific anatomical data to improve clinical outcomes and minimize iatrogenic injury.

Conclusion

The study of variations of suprascapular notch and ossification of suprascapular ligament is important for understanding of location and source of the entrapment syndrome.

This study is useful for anatomists, as well as clinicians for a better diagnosis and management of the suprascapular nerve entrapment syndrome.

REFERENCES

1. Gopal K, Choudhary AK, Agarwal J, Kumar V. Variations in suprascapular notch morphology and its clinical importance. *Int J Res Med Sci.* 2015 Jan;3(1):301-6.
2. Sutaria LK, Nayak TV, Patel SV, Jadav HR, Pensi CA. Morphology and morphometric analysis of suprascapular notch. *International Journal of Biomedical and Advance Research.* 2013; 04 (01): 35-39.
3. Patil VG, Kumar S, Apoorva D, Thejeswari, Sushanth NK. Study of Morphological Variations of Suprascapular Notch in Human Dry Scapulae of South Indians. *International Journal of Scientific and Research Publications.* 2014; 4 (9): 1-4
4. Nasr AY. Morphological types and morphometrical measurements of the suprascapular notch in both dry bones and human cadavers: anatomical study to improve the outcomes of the diagnostic and interventional procedures in the shoulder region. *Anatomy and Cell Biology,* 2023 Dec 31;56(4):482-493. doi: 10.5115/acb.23.167.
5. Vahini P, Senthamizhselvi R, Raj S, Anbumalar B. Morphometric study of suprascapular notch in south indian population. *Int J Acad Med Pharm.* 2024; 6 (1): 1727-1731.
6. Raman RK, Pandey AK, Pandey V, Shastry P, Alok Y. Morphometric evaluation of suprascapular Notch and superior angle of the scapula using three-dimensional computed tomography in the Indian population. *Translational Research in Anatomy.* 2024; 37: 100359. 10.1016/j.tria.2024.100359.
7. Paul AD, Nidhi S, Avadhani R. A Study of Morphometric Measurements of Scapula and Suprascapular Notch. *Int J Anat Var.* 2022;15(9):219-222.
8. 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 Oct;5(4):447-51. doi: 10.1227/00006123-197910000-00007. PMID: 534048.
9. Polgaj M, Jędrzejewski K, Majos A, Topol M. Coexistence of the suprascapular notch with the suprascapular foramen—rare anatomical variation and a new hypotheses of its formation based on anatomical and radiological studies. *Anat Sci Int.* 2013;88(3):156–162. doi: 10.1007/s12565-012-0165-7.
10. Dunkelgrun M, Lesaka K, Park SS, Kummer FJ, Zuckerman JD. Interobserver reliability and intraobserver reproducibility in suprascapular notch typing. *Bull Hosp Joint Dis.* 2003; 61: 118-22.
11. Duparc F, Coquerel D, Ozeel J, Noyon M, Gerometta A, Michot Ch. Anatomical basis of the suprascapular nerve entrapment and clinical relevance of the supraspinatus fascia. *Surg Rad Anat* 2010; 32: 277–284.
12. Bayramolu, A., Demiryerek, D., Tüccar, E., Erbil, M., Aldur, MM., Tetik, O. and Doral, MN. Variations in anatomy at the suprascapular notch possibly causing suprascapular nerve entrapment: An anatomical study. *Knee Surg Sports Traumatol Arthroscopy,* 2003, vol. 11, p. 393-8.
13. Ticker J B, Djurasovic N, Strauch RJ, April EW, Pollock RG, Flatow EL, Bigliani LU, 1998. The incidence of ganglion cysts and other variations in anatomy along the course of the suprascapular nerve. *J Should Elb Surg* 7: 472-478.
14. Muralidhar Reddy Sangam, Sattiraju Sri Sarada Devi, KarumanchiKrupadanam, KollaAnasuya. A Study on the Morphology of the Suprascapular Notch and Its Distance from the Glenoid Cavity; *Journal of Clinical and Diagnostic Research* 2013; February, Vol-7(2): 189-192.