Anatomical Variations of the Suprascapular Notch in Dry Scapula with its Clinical Importance in Suprascapular Entrapment

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Abstract

The suprascapular notch (SSN) plays a crucial role in transmitting the suprascapular nerve, which is susceptible to compression along its course, particularly at the SSN and spinoglenoid notch. Understanding anatomical variations in the SSN is essential, as these variations may predispose individuals to suprascapular nerve entrapment, resulting in pain, muscle weakness, and functional disability. This study examined 90 dry human scapulae to evaluate morphological differences in the SSN and their potential role in nerve compression syndromes. Variations were documented through direct observation and photographic analysis, and categorized based on established morphological classifications. The majority of scapulae demonstrated a U-shaped notch, while other shapes, including V-shaped, J-shaped, and complete ossification of the superior transverse scapular ligament forming a foramen, were noted. Anatomical variations of the SSN are clinically significant, influencing diagnosis, imaging interpretation, and surgical planning. Awareness of these variations helps clinicians, radiologists, and orthopedic surgeons prevent iatrogenic injury and improve treatment outcomes in cases involving shoulder pain or nerve compression. Our findings highlight the necessity of recognizing diverse SSN configurations for accurate assessment of suprascapular neuropathies and for guiding safe surgical interventions. (3, 2020)(7, 2019)(12, 2018)

Introduction

The suprascapular notch (SSN) is a key anatomical landmark located on the superior border of the scapula near the root of the coracoid process. It serves as a passage for the suprascapular nerve, which innervates the supraspinatus and infraspinatus muscles. Compression of this nerve can lead to significant morbidity, including shoulder weakness, chronic pain, and functional impairment. Suprascapular nerve entrapment syndrome is considered a cause of posterolateral shoulder pain and is seen across various populations, particularly in athletes performing repetitive overhead activities. Accurate knowledge of SSN anatomy is therefore essential. (5, 2021) Several morphological classifications of the SSN have been proposed, as variations in shape and depth influence nerve vulnerability. The SSN typically forms a semicircular depression bridged by the superior transverse scapular ligament (STSL). In some scapulae, the STSL undergoes complete ossification, converting the notch into a bony foramen, which may predispose individuals to nerve entrapment. Anatomical variations in SSN morphology have been documented extensively, with studies reporting diverse shapes such as U-shaped, V-shaped, J-shaped, and slit-like forms. These variations show population-specific patterns, highlighting the importance of regional anatomical studies. (9, 2017)(2, 2022) The clinical relevance of SSN variations extends beyond orthopedics. Radiologists rely on precise anatomical interpretation to avoid diagnostic pitfalls during CT and MRI evaluations of

shoulder pathologies. Similarly, neurosurgeons and orthopedic surgeons must be aware of these variations during decompression surgeries to prevent iatrogenic injury. Misidentifying the SSN shape or extent of ligamentous ossification may result in incomplete decompression or unnecessary surgical exploration. (10, 2016) Despite numerous studies on SSN variations, there remains a need for further documentation in different populations to enhance the understanding of regional morphological diversity. Therefore, the present study aims to analyze and classify variations of the SSN in dry scapulae from the North Indian population, evaluate their prevalence, and discuss their clinical significance in suprascapular nerve entrapment.

Materials and Methods

This cadaveric observational study was conducted on 90 dry human scapulae obtained from the Department of Anatomy, Pt. B. D. Sharma PGIMS, Rohtak, Haryana, India. Ethical clearance was exempted as specimens were part of the departmental collection. All scapulae included were adult bones with fully fused features. Damaged or deformed scapulae were excluded. (1, 2015) Each scapula was examined macroscopically to identify the SSN. The scapulae were numbered sequentially, and morphological assessment was performed by three independent observers to reduce subjective bias. Photographs were taken using a high-resolution digital camera, and measurements were recorded using a 0.02 mm precision digital Vernier caliper. Observations included the shape, depth, width, and presence or absence of ossification of STSL. Variations were compared against established classification systems. (8, 2019) The SSN was categorized into U-shaped, V-shaped, J-shaped, slit-like, and foramen types where the STSL was completely ossified. Measurements included the maximum width, maximum depth, and transverse diameter. Data were entered into Microsoft Excel and analyzed descriptively using percentage distribution. Inter-observer agreement was evaluated using kappa statistics. Cases of disagreement were reassessed jointly until consensus was reached. (4, 2020)(6, 2018) Photographs were arranged systematically and reviewed to ensure accurate representation of variations. Anatomic landmarks surrounding the SSN were documented to rule out misinterpretation caused by erosion or degenerative changes. Special emphasis was placed on identifying bony spicules or bridging patterns indicating partial ossification of the STSL. The clinical relevance of observed variations was interpreted based on literature reports correlating SSN morphology with suprascapular nerve entrapment. Particular attention was paid to the stenosis-prone notch types, especially those with ossified ligaments. (13, 2021)(15, 2019)

Results

Out of 90 scapulae examined, the majority displayed a U-shaped SSN, constituting 55 scapulae (61.11%). This was followed by the J-shaped notch observed in 25 scapulae (27.77%). The V-shaped notch was seen in 7 scapulae (7.77%), while complete ossification of the STSL resulting in a bony foramen was identified in 3 scapulae (3.33%). No slit-like variant was recorded in the present sample. (11, 2018) Measurements of the SSN revealed that U-shaped notches had the largest width and depth, suggesting a lower predisposition for suprascapular nerve compression. Conversely, the V-shaped and ossified types exhibited narrower transverse diameters, indicating higher risk for nerve entrapment. Inter-observer agreement was statistically strong ($\kappa = 0.89$). The occurrence of complete ossification was rare but clinically important. All three ossified specimens presented significantly narrow foramina that could predispose to nerve compression. Morphological patterns observed were consistent with global studies but showed slight population-specific differences.

Discussion

The present study highlights significant morphological diversity in SSN anatomy, with U-shaped notches being the most prevalent, similar to previous regional studies. Variants such as V-shaped, J-shaped, and ossified types, although less common, carry higher clinical significance due to their association with suprascapular nerve entrapment. Understanding these variations is essential for orthopedic surgeons, radiologists, and clinicians to ensure accurate diagnosis and avoid nerve injury during procedures. (14, 2020)

Summary

This study demonstrated that SSN variations are common, with U-shaped notches being predominant. Clinically significant variants, especially ossified STSL, may predispose individuals to nerve entrapment. Recognizing these anatomical differences is essential for safer surgical planning, improved diagnostic accuracy, and better patient outcomes.

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