

MSK Ultrasound Bites: Tips and Tricks

Utilizing Diagnostic Musculoskeletal Ultrasound for Assessment of the Infraspinatus Muscle and Tendon: Implications for Rehabilitation Professionals

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The rotator cuff, comprising the subscapularis, supraspinatus, infraspinatus, and teres minor muscles, plays a crucial role in stabilizing the glenohumeral joint by securing the head of the humerus within the glenoid cavity of the scapula. The tendinous insertions of these muscles generate tension within the capsule, enhancing joint stability during muscular activity. The rotator cuff is susceptible to damage from disease, injury, or trauma, which can result in tears or ruptures of one or more tendons. The evaluation of the infraspinatus muscle and tendon is vital for diagnosing and managing various shoulder pathologies. Accurate imaging to determine the specific muscle involvement and injury severity significantly impacts treatment decisions. Diagnostic musculoskeletal ultrasound (MSK-US) has emerged as a valuable tool for assessing the infraspinatus muscle and tendon, offering real-time, dynamic assessment capabilities essential for precise diagnosis and effective rehabilitation planning. This article reviews the utility and advantages of MSK-US in evaluating the infraspinatus muscle and tendon, emphasizing technique specifics, diagnostic accuracy, and comparative efficacy against other imaging modalities. It details a systematic approach to the ultrasound examination technique for the infraspinatus, including patient positioning and identification of common pathologies such as tears, tendinopathy, and calcifications. With recent advancements in transducer strength, image resolution, and operator training, ultrasound serves as an excellent alternative imaging modality for diagnosing rotator cuff tears. This article aims to equip rehabilitation professionals with a comprehensive understanding of MSK-US as a diagnostic tool for the infraspinatus, promoting more precise diagnosis, treatment planning and improved patient outcomes.

INTRODUCTION

Rotator cuff tears are a prevalent source of debilitating shoulder pain and reduced mobility, often leading to irreversible damage of the glenohumeral joint.¹ They constitute a significant portion of shoulder-related disabilities in the United States, accounting for 30% to 70% of shoulder pain cases and representing a primary reason for over 4.5 million annual medical consultations.²⁻⁴ The progression of these tears typically initiates with partial-thickness damage and can advance to complete tendon rupture due to various pathological or traumatic factors. Symptoms commonly include nocturnal pain, shoulder weakness, and difficulty performing overhead activities.

The infraspinatus muscle, integral to the rotator cuff, frequently sustains injury in both athletic and general populations. The infraspinatus plays a primary role in facilitating external rotation motion. Equally important, the infraspinatus serves as a stabilizer of the glenohumeral joint. Together with other rotator cuff muscles, the infraspinatus

reinforces the inherently fragile glenohumeral capsule, ensuring the humeral head remains securely positioned within the scapular glenoid cavity.

Disorders affecting the infraspinatus can significantly impair shoulder function and are commonly encountered in clinical practice. Accurate assessment of rotator cuff pathology is essential for effective management. Historically, contrast arthrography was pivotal in diagnosing full-thickness tears, yet its utility in assessing tear size and detecting partial-thickness tears is limited.^{5,6} Magnetic resonance imaging (MRI), though widely accepted, faces challenges in reliably distinguishing between tear types and cuff degeneration.⁶ Recently, musculoskeletal ultrasound (MSK-US) has gained prominence for its real-time imaging capabilities, safety profile, and cost-effectiveness in diagnosing infraspinatus tendon and muscle conditions.⁷ This article examines the role of MSK-US in the comprehensive evaluation of these structures, particularly relevant to rehabilitation professionals.

ANATOMY OF THE INFRASPINATUS

A comprehensive understanding of anatomy is essential for precise MSK-US evaluation, facilitating the identification of pathological alterations and the formulation of effective rehabilitation protocols. Situated beneath the scapular spine within the infraspinatus fossa, the infraspinatus muscle originates from this fossa and inserts into the greater tubercle of the humerus. Its fibers extend towards the glenohumeral joint, attaching just inferior to the supraspinatus insertion. Primarily responsible for external rotation, horizontal abduction, and abduction of the humerus, the infraspinatus muscle collaborates with other rotator cuff muscles to stabilize the humeral head within the glenoid cavity. Innervated by the suprascapular nerve and predominantly vascularized by branches from the posterior humeral circumflex and suprascapular arteries, it exhibits comparatively robust vascular support, potentially reducing the incidence of pathology and degenerative changes. Patients experiencing an infraspinatus tear often report pain during resisted external rotation and active elevation movements.

BENEFITS OF MSK-US

MSK-US offers several advantages over other imaging modalities in the assessment of the infraspinatus muscle and tendon. These include:

- **Real-time Imaging:** Allows for dynamic assessment during motion and muscle activation. This ability is crucial for identifying subtle dysfunctions that occur during movement, which are often missed by static imaging techniques.
- **Cost-Effectiveness:** MSK-US is generally more affordable than MRI or CT scans, making it accessible for routine clinical use.
- **Non-Invasive:** The procedure is non-invasive and well-tolerated by patients, reducing the need for anesthesia or contrast agents.
- **High Resolution:** Detailed visualization of soft tissue structures is possible at a higher resolution than MRI in some cases.
- **Immediate Results:** MSK-US provides immediate feedback, allowing for quicker clinical decision-making. The immediate feedback and interactive nature of the ultrasound examination also facilitate enhanced patient-clinician communication.
- **Accessibility and Safety:** MSK-US is a patient-friendly option, avoiding the discomfort and contraindications associated with ionizing radiation and magnetic fields.

LIMITATIONS AND CONSIDERATIONS

Despite its benefits, MSK-US also presents several limitations:

- **Operator Dependency:** The accuracy of MSK-US is highly dependent on the skill and experience of the operator.
- **Limited Field of View:** While excellent for soft tissues, MSK-US may not be as effective for evaluating bony structures.
- **Artifact Presence:** Artifacts can sometimes obscure the view and complicate the interpretation of images.

MSK-US TECHNIQUE FOR EVALUATING THE INFRASPINATUS

The examination of the infraspinatus muscle and tendon via MSK-US requires precise technique. Proper patient positioning and transducer placement are crucial to obtain accurate and reproducible images. The patient is typically positioned in a sitting posture with the back exposed and the arm in internal rotation to maximize infraspinatus visibility. The transducer is placed in a longitudinal and transverse orientation along the course of the muscle and tendon to assess for any structural abnormalities, such as tears, tendinopathy, or atrophy. Special attention is paid to the echogenicity and texture of the tendon, signs of inflammation, and the presence of bursal fluid.

EQUIPMENT AND SETUP

- **Transducer:** A high-frequency linear transducer (7–15 MHz) is typically used for evaluating the infraspinatus.
- **Patient Positioning:** The patient is usually seated position with the shoulder in slight abduction and internal rotation to optimize visualization of the infraspinatus.
- **Scanning Technique:**
 1. **Transverse Scans:** Begin with transverse scans to identify the spine of the scapula and follow the muscle belly towards its insertion on the humerus. The transducer is transversely placed inferiorly and slightly laterally from the scapular spine. Passive internal and external rotation of the patient's arm may be helpful in visualization of the tendon. The infraspinatus tendon appears as a beak-shaped soft-tissue structure that progressively thins as it approaches its attachment to the posterior aspect of the greater tuberosity.⁶ Additional structures seen at this level are the posterior glenoid labrum, imaged as a hyperechoic triangular structure and the hypoechoic articular cartilage of the humerus.
 2. **Longitudinal Scans:** Longitudinal scans help in assessing the tendon and its attachment to the greater tubercle of the humerus.

KEY FINDINGS

Ultrasound imaging of the infraspinatus must be carefully interpreted. Normal anatomy appears as a fibrillar pattern

with uniform echotexture. Pathological findings may include:

- **Muscle Atrophy:** Reduced muscle bulk can indicate chronic rotator cuff pathology.
- **Tendinopathy:** Characterized by hypoechoic (darker) areas and tendon thickening which may signify tendinopathy or degeneration.
- **Tears:** Full-thickness or partial-thickness tears are displayed as hypoechoic or anechoic (absence of echoes) defects within the tendon. Additionally, they may be identified by discontinuities in the tendon fibers.
- **Calcific tendinitis:** Identified by hyperechoic (brighter) foci with or without acoustic shadowing.

CONCLUSION

Musculoskeletal ultrasound has emerged as a pivotal tool for assessing and managing disorders of the infraspinatus muscle and tendon. Its capability to deliver real-time, high-resolution imaging renders it invaluable for dynamic evaluations and guiding rehabilitation protocols. Despite inherent limitations, the benefits of MSK-US position it as a cornerstone of contemporary clinical practice. To effectively integrate MSK-US into rehabilitation settings, practitioners must acquire specialized training encompassing both ultrasound techniques and detailed knowledge of infraspinatus musculoskeletal anatomy. By leveraging this technology in clinical practice, rehabilitation providers can elevate diagnostic accuracy, optimize therapeutic interventions, and ultimately enhance outcomes for patients grappling with shoulder pathologies.

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Infrapinatus Tendon

Figure 1A: Patient Position

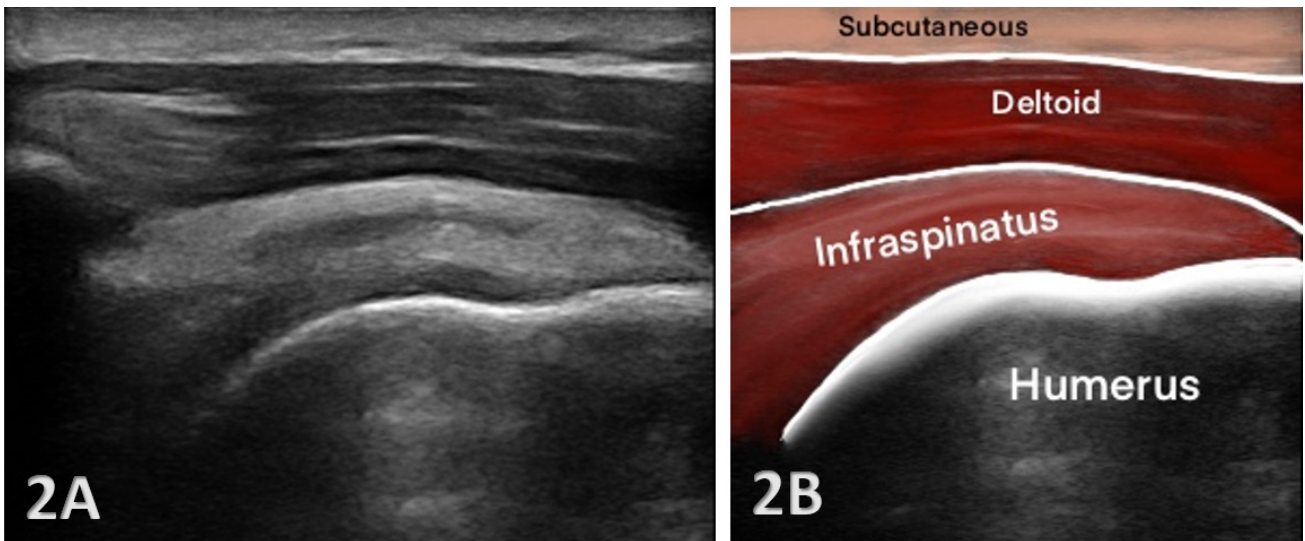
The patient is seated with the ipsilateral hand resting on the contralateral shoulder. This places the arm in a slight internal rotation and adduction pulling the infrapinatus in an anterior-lateral tensioned position. This provides the ability to see abnormalities in the tendon.

Figure 1B: Short Axis Transducer Placement

Short Axis (SAX) view places the transducer perpendicular to the floor, parallel to the axial spine and is perpendicular to the tendon fibers as they insert onto the humeral head. This view provides the ability to image the tendon footprint at its distal insertion.

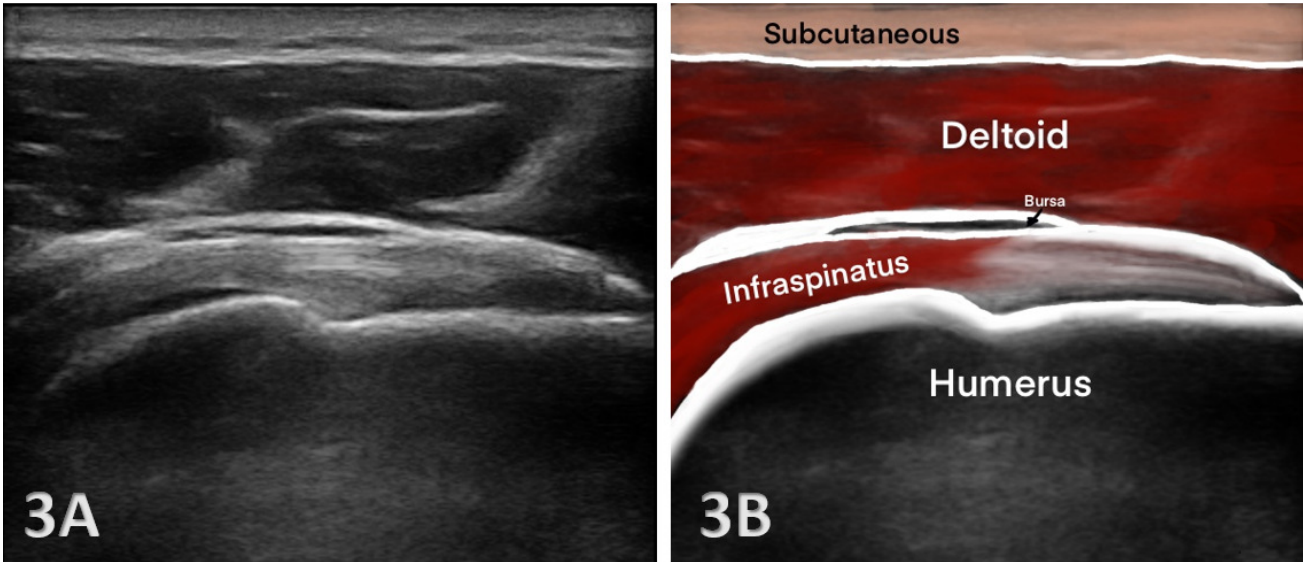
Figure 1C: Long Axis Transducer Placement

Long Axis (LAX) view places the transducer parallel to the floor and perpendicular to the axial spine. This view places the transducer parallel with the fibers of the infrapinatus tendon. Start with the transducer placed in the middle of the deltoid and capturing the edge of the acromion. The acromion will be a bony landmark for orientation along with the humeral head.



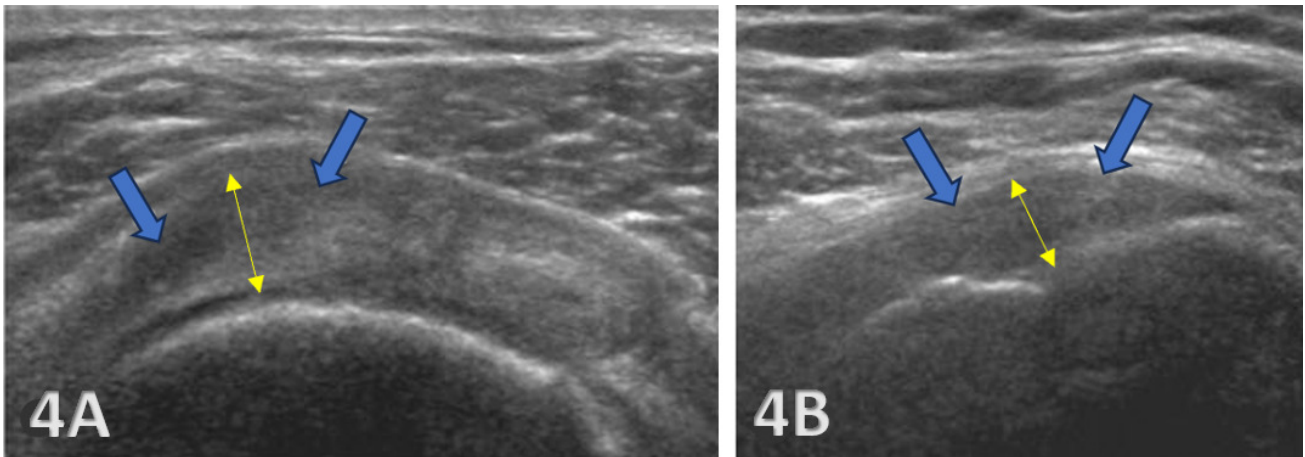
NORMAL VIEW IN SHORT AXIS (SAX)

Figures 2A and 2B Short Axis View: Look for the bony cortex of the humeral head initially and the parallel fibers of the infrapinatus tendon as it inserts on the lateral facet of the greater tuberosity. The mild indentation noted in the middle of the bony cortex represents the anatomical neck. The infrapinatus tendon lies on the humeral head and maintains a uniform appearance. Note that the tendon will exhibit a hyperechoic brightness. Identify the humeral head, the hyaline cartilage (seen as an anechoic interface above the cortex), the hyperechoic infrapinatus tendon, and its anechoic insertion onto the lateral facet of the greater tuberosity. This insertion typically has a larger anechoic footprint at its distal insertion, which should not be mistaken for pathology. Superior to the tendon is the anechoic space for the bursa, typically visible in non-pathological infrapinatus tendons. Above the tendon and bursa, you will see the deltoid muscle and the subcutaneous fat tissue at the top of the image.



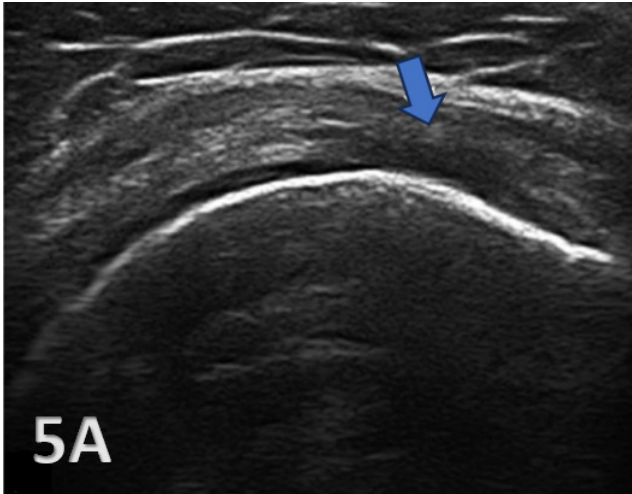
NORMAL VIEW IN LONG AXIS (LAX)

Figures 3A and 3B Long Axis View: The Long Axis View technique will be parallel to the spine of the scapula placing the transducer parallel with the tendon fibers. This position should capture the edge of the acromion as shown in image 2A above. The acromion is the anechoic structure on the left and will be a bony landmark for orientation. Superior to the tendon would be the bursa and deltoid muscle followed by the subcutaneous fat tissue. The infraspinatus tendon should have a consistent hyperechoic nature but slightly less hyperechoic compared to the supraspinatus tendon.



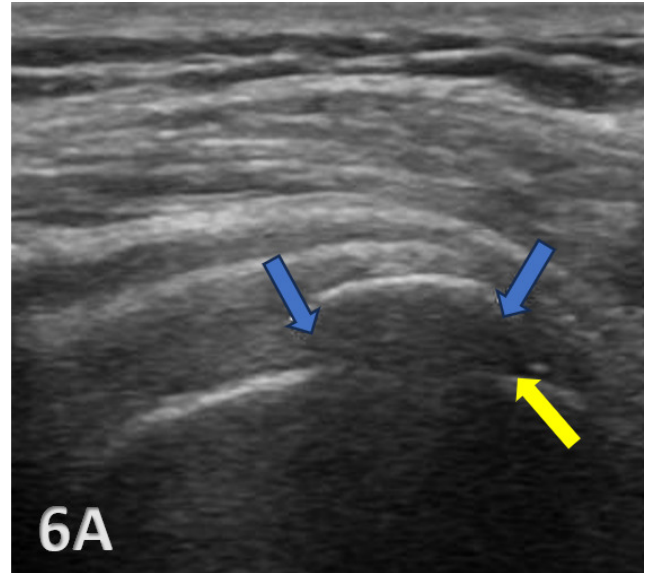
TENDINOSIS IN SHORT AXIS (SAX) AND LONG AXIS (LAX) VIEW:

Figures 4A and 4B: Infraspinatus tendon in Short Axis view and Long Axis view shows increased thickness. This thickness is greater than 4.2 mm (outlined in yellow) and is known to indicate increased cellularity and is one of the criteria that is used to diagnosis tendinosis. Normal tendon thickness can vary slightly with age and with dominant verses non-dominant shoulders. For an individual 30-39 years old, normal thickness is 4.2 ± 0.7 mm. Both images show abnormal hypoechoic (blue arrows) along with increased tendon thickness (yellow arrows).



TENDINOUS FAILURE IN SHORT AXIS (SAX)VIEW

Figure 5A: Disruption of the infraspinatus tendon which is shown above. Blue Arrow pointing to the hypoechoic changes within the tendon.



TENDON CALCIFICATION IN SHORT AXIS (SAX)

Figure 6A: Tendon Calcification and degenerative tendon. Ultrasound image shows a well-defined linear calcific deposit (blue arrows) along the infraspinatus tendon fibers with partial shadowing (yellow arrow).



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