

Diagnostic Accuracy of Musculoskeletal Ultrasound on Long Head Biceps Tendon Pathologies

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Clinical Scenario: Pathologies of the long head of the biceps brachii (LHB) tendon are a source of shoulder pain in many people. It is important to have a reliable assessment of the LHB tendon to make an accurate diagnosis and provide the correct treatment or referral if necessary. Shoulder ultrasound is very accurate in the diagnosis of rotator cuff tears. However, its ability to detect pathologies of the LHB tendon is still unclear. **Clinical Question:** In patients with shoulder pain, can musculoskeletal ultrasound accurately diagnose LHB tendon pathologies? **Summary of Key Findings:** Four high-quality cohort studies met inclusion criteria and were included in the critical appraisal. The STrengthening the Reporting of OBServational studies in Epidemiology checklist was used to score the articles on methodology and consistency. Three studies evaluated accuracy in diagnosis of full-thickness tears and found high sensitivity (SN) and specificity (SP). Three studies evaluated accuracy in diagnosis of partial-thickness tears and found low SN and negative predictive value, but high SP and positive predictive value. Two studies evaluated tendon subluxation/dislocation and found high SN and SP. Two studies evaluated tendinitis and found moderate SN and high SP. **Clinical Bottom Line:** There is moderate to strong evidence to support the use of musculoskeletal ultrasound in diagnosis of LHB tendon pathology. **Strength of Recommendation:** There is grade B evidence that musculoskeletal ultrasound can accurately diagnose full-thickness tears and tendon subluxation/dislocation; can rule in partial-thickness tears (based on SP and positive predictive value), but not rule out partial-thickness tears; and can rule in tendinitis (based on SP and positive predictive value), but not rule out tendinitis.

Keywords: diagnostic ultrasound, clinical imaging, shoulder pathology

Clinical Scenario

Disorders of the long head of the biceps brachii (LHB) tendon are a common source of shoulder pain.¹⁻⁵ An effective treatment plan first requires an accurate understanding of the impairment. Although a careful history and physical examination are important, clinically differentiating full-thickness tears (FTT) from partial-thickness tears (PTT) or tendinitis can be difficult,⁶ as clinical special tests for the proximal biceps do not differentiate type of biceps pathology and demonstrate low or moderate sensitivity and specificity (SP) when used individually or in combination.⁷ Advances in arthroscopic techniques and the clinical success of procedures, such as biceps tenotomy (tendon transection) and tenodesis (anchoring of tendon to the proximal humerus) emphasize the significance of LHB tendon abnormalities and the importance of an accurate preoperative diagnosis.³ Musculoskeletal ultrasound (MSK US) is attractive as an imaging test because it is fast, safe, inexpensive, widely available, and noninvasive.^{6,8-10} For suspected rotator cuff pathology, MSK US has been shown to have high accuracy as compared to magnetic resonance imaging (MRI)¹¹⁻¹³; however, its ability to detect pathologies of the LHB tendon is still unclear.

Focused Clinical Question

In patients with shoulder pain, can MSK US accurately diagnose LHB tendon pathologies?

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Summarized Key Findings

- The literature was searched for cohort and cross-sectional studies that investigated the diagnostic accuracy of ultrasound for LHB tendon pathologies.
- The literature search returned 10 possible studies related to the clinical question; 4 studies met the inclusion criteria.
- Two prospective cohort studies and 2 retrospective cohort studies were included.
- All included studies scored at least a 15 on the STrengthening the Reporting of OBServational studies in Epidemiology checklist.
- All included studies demonstrated that ultrasound was accurate in diagnosing biceps tendon dislocation, subluxation, and FTT, but less accurate in diagnosing PTT and tendonitis.

Clinical Bottom Line

There is moderate to strong evidence to support the use of MSK US in diagnosis of LHB tendon pathology.

Strength of Recommendation

There is grade B evidence that MSK US can accurately diagnose FTT and tendon subluxation/dislocation; can rule in PTT (based on SP and PPV), but not rule out PTT; and can rule in tendinitis (based on SP and PPV), but not rule out tendinitis.

Search Strategy

Terms Used to Guide Search Strategy

- **P**atient/Client group: Individuals with shoulder pain
- **I**ntervention (or Assessment): Musculoskeletal ultrasound
- **C**omparison: None
- **O**utcome(s): Diagnosis of LHB tendon pathology (sensitivity, specificity, predictive value)

Sources of Evidence Searched (Databases)

- CINAHL
- PubMed
- SPORTDiscus
- Google Scholar
- Additional resources obtained via review of references lists

Inclusion and Exclusion Criteria

Inclusion Criteria

- Studies that investigated individuals with shoulder pain
- Studies that used MSK US to make a diagnosis

- Studies that diagnosed individuals with pathology of the LHB tendon
- Studies that provided diagnostic accuracy statistics, including sensitivity, SP, and predictive values
- Limited to the English language
- Level 2 evidence or higher

Exclusion Criteria

- Studies that did not report diagnostic accuracy statistics such as sensitivity, SP, and predictive values
- Studies that did not use MSK US as the diagnostic instrument
- Participants who were not diagnosed with LHB tendon pathology

Results of Search

Four relevant studies were located and categorized as shown in Table 1.

Summary of Best Evidence

Characteristics of studies identified as the best evidence are shown in Table 2.

Table 1 Summary of Study Designs of Articles Retrieved

Level of evidence	Study design/methodology of articles retrieved	Number located	Author
2b	Prospective cohort study	2	Armstrong et al ¹⁴ Huang and Wang ¹¹
2b	Retrospective cohort study	2	Read and Perko ⁶ Skendzel et al ³

Table 2 Characteristics of Studies Identified as the Best Evidence

	Armstrong et al ¹⁴	Huang and Wang ¹¹	Read and Perko ⁶	Skendzel et al ³
Study design	Prospective cohort	Prospective cohort	Retrospective cohort	Retrospective cohort
Participants	71 patients with acute or chronic shoulder pain (41 males and 30 females, age range 34–80 y [mean 59])	336 patients with shoulder pain and an initial diagnosis of biceps tendinitis (136 males and 200 females, age 52.8 [13.4] y)	42 patients with acute or chronic shoulder who underwent arthroscopic surgery who had preoperative MSK US examination findings (age range 19–70 y [mean 44])	66 patients who underwent arthroscopic surgery who had preoperative MSK US examination findings (41 males and 25 females, age range 21–79 y [mean 55])
Intervention investigated	MSK US (longitudinal and transverse views)	MSK US (longitudinal and transverse views)	MSK US (longitudinal and transverse views)	MSK US (longitudinal and transverse views)
Outcome measure(s)	SP, SN, PPV, and NPV were calculated for FTT and PTT, and subluxation	SP and SN were calculated for biceps tendinitis. PPV and NPV were calculated from raw data provided in the article	SP, SN, PPV, and NPV were calculated for FTT and PTT, dislocation, and tendinitis	SN, SP, PPV, and NPV were calculated for FTT and PTT
Main findings	FTT: SN: 91% SP: 100% PPV: 64% NPV: 100% PTT: SP: 100% SN: 50% PPV: 100% NPV: 71%	Tendinitis (longitudinal): SN: 81% SP: 73% PPV: 67% NPV: 85% Tendinitis (transverse): SN: 68% SP: 90% PPV: 82% NPV: 81%	FTT: SN: 100% SP: 97% PPV: 91% NPV: 100% PTT: SN: 46% SP: 97% PPV: 86% NPV: 80%	FTT: SN: 88% SP: 98% PPV: 87% NPV: 98% PTT: SN: 27% SP: 100% PPV: 100% NPV: 88%

(continued)

Table 2 (continued)

	Armstrong et al ¹⁴	Huang and Wang ¹¹	Read and Perko ⁶	Skendzel et al ³
	Subluxation: SN: 100% SP: 96% PPV: 67% NPV: 100%		Tendinitis: SN: 80% SP: 100% PPV: 100% NPV: 94% Dislocation: SN: 100% SP: 100% PPV: 100% NPV: 100%	
Level of evidence	2b	2b	2b	2b
Validity score (STROBE)	16/22	19/22	15/22	17/22
Conclusion	MSK US is accurate at ruling in and ruling out FTT. It is accurate at ruling in PTT, but not ruling out PTT. It is accurate at ruling in and ruling out subluxation	MSK US is moderately accurate at ruling in and ruling out tendinitis. Transverse view is more accurate at ruling out tendinitis. Longitudinal view is more accurate at ruling in tendinitis	MSK US is accurate at ruling in and ruling out FTT. It is accurate at ruling in PTT, but not ruling out PTT. It is accurate at ruling in and ruling out dislocation	MSK US is accurate at ruling in and ruling out FTT. It is accurate at ruling in PTT, but not ruling out PTT

Abbreviations: FTT, full-thickness tears; MSK US, musculoskeletal ultrasound; NPV, negative predictive value; PPV, positive predictive value; PTT, partial-thickness tears; SN, sensitivity; SP, specificity; STROBE, STrengthening the Reporting of OBServational studies in Epidemiology.

Implications for Practice, Education, and Future Research

Currently, the gold standard for confirming a diagnosis of LHB tendon pathologies is arthroscopic examination. The MRI is commonly ordered for diagnosis; however, MRI has only moderate sensitivity and SP.^{4,5} The results of this review indicates that MSK US is a fast, safe, inexpensive, and noninvasive alternative to MRI imaging or arthroscopy in the diagnosis of LHB tendon pathology. When used in combination with clinical special tests, MSK US drastically increases the diagnostic accuracy of the clinical examination.⁷

Ultrasonography is, however, a difficult skill to master, but a quantitative ultrasound diagnostic method is more accurate than physical examination in both sensitivity and SP.² When used correctly by an experienced sonographer, MSK US is an excellent tool that can help improve patient outcomes.^{9,10} Therefore, it is essential to educate health care providers on how to appropriately use MSK US as a diagnostic aid. In sports medicine and other prehospital settings, MSK US can be used to make diagnoses of complete LHB tendon ruptures, subluxations, or dislocations. However, it should be used with caution when evaluating for PTT and tendinopathies. Future research should focus on evaluating the diagnostic criteria and different techniques of identifying PTT and FTT. Having definitive criteria for the diagnosis of both PTT and FTT will help improve the sensitivity and SP of MSK US, as well as reproducibility of the results.^{2,3} Research should also look for ways of distinguishing between lesions, tendonitis, and other degenerative issues of the biceps tendon.

In conclusion, MSK US is a versatile diagnostic tool that can be used to accurately diagnose a variety of LHB tendon pathologies, and therefore is an asset that should be used in the sports medicine setting to facilitate diagnosis and treatment of patients with shoulder pain due to suspected biceps tendon pathologies.

Increased education and training on how to use MSK US will further improve its sensitivity, SP, and overall accuracy as a diagnostic tool.

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