ISSN 2515-8260 Volume 10, Issue 1, 2023

EVALUATION OF ULTRA SONOGRAPHY (USG) IN DISTAL BICEPS TENDON INJURY AND ITS CORRELATION WITH SURGICAL FINDINGS

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Abstract

Objective: The aim of this research was to evaluate the accuracy of ultrasonogrphy (USG) for differentiating the level of biceps tendon injury and correlate with surgical findings. USG of normal bicep tendon was used as the reference standard. Clinical follow-up was conducted to assess the condition of the biceps.

Materials and Methods: The study population included 100 consecutive elbow USG cases with surgical confirmation and 10 cases of a clinically normal biceps tendon in volunteers. The cases were reviewed by two trained radiologists. Bicep tendons were classified as complete tear, partial tear and normal biceps tendon. The posterior acoustic shadowing at the distal biceps tendon was assessed as present or absent. The USG findings were correlated with the surgical findings and clinical follow-up.

Result: Ultrasound showed 95% sensitivity, 71% specificity, PPV, NPV and 91% accuracy for the diagnosis of distal biceps tendon tears and level of tearing. Posterior acoustic shadowing on the distal biceps had sensitivity of 97% and accuracy of 91% for indicating complete tear versus partial tear and sensitivity of 97%, specificity of 100%, and accuracy of 98% for indicating complete tear versus normal tendon.

Conclusion: Ultrasonography can play an effective role in the diagnosis of elbow injuries when a distal biceps tendon tear is suspected and helps in surgical decision.

Keywords: Distal Biceps tendon, Ultrasonography, sensitivity, specificity

Introduction

Distal biceps tendon injuries are common in males between 40 to 60 year of age.[1] Distal biceps tendon's injuries are less common than the proximal biceps tendon.[2] Partial tear usually do not require any surgery but complete tears required because it losses strength and function both in case of non-surgical management.[3]

The clinical diagnosis of injured distal biceps tendon is usually made by complete patient history and physical examination. Patients feel a painful "pop" while the elbow is forcibly extended. They will describe pain in the antecubital fossa and weakness in the elbow. On examination, the clinical test described by O'Driscoll et al. [1] known as the "hook test" can diagnose complete ruptures, especially when the findings are compared with the uninjured contra lateral side.[4] Devereaux et al. [2] combined three clinical tests to identify a complete rupture. By using the hook test, passive forearm pronation, and the biceps crease interval in sequence, they found those tests resulted in 100% sensitivity and specificity when the outcomes of all three were in agreement.[5]

ISSN 2515-8260 Volume 10, Issue 1, 2023

In situations where there is muscular retraction, the clinical observation and diagnosis of a complete tear of the distal biceps brachii tendon may be simple, although it is more challenging.[6,7] Clinical diagnosis may be challenging for less severe distal biceps brachii abnormalities, such as partial rips, tendinosis, and bicipitoradial bursa inflammation. Because the best surgical outcomes are obtained within the first one to two months following a tear, it is crucial to accurately and quickly diagnose complete ruptures of the distal biceps brachii tendon.[8-11]

It has been demonstrated that MRI and ultrasound are both useful for assessing the distal biceps brachii tendon. [12,13] MRI has revealed findings for both partial and full rips of the distal biceps brachii that substantially correlate with surgical results. [14] However, MRI is more expensive than ultrasound, may be more difficult to access, and is dangerous for some patients, such as those who have aneurysm clips. The cost of ultrasound is lower, and the technology is readily accessible. Additionally, dynamic evaluation and comparison with the contralateral extremity are made possible by ultrasound. Although USG has been found to be helpful in the identification of distal biceps brachii tendon injury in a small number of patients, to our knowledge no published reports of a sizable patient population with surgical linkage have been made the decision

MRI has shown findings that strongly correlate with surgical findings for both partial and complete tears of the distal biceps brachii [10,11] However, MRI is more expensive than ultrasound, may be less accessible, and is contraindicated in some cases, including those with aneurysm clips. Ultrasound is less expensive, and the equipment is easily available. Moreover, Ultrasonography enables dynamic examination as well as comparison with the contralateral extremity. In a small series of patients, ultrasound has been shown to be useful in the diagnosis of distal biceps brachii tendon tears, but, to our knowledge, there have been no published reports of a large patient population with surgical correlation [9,12]. To determine the role of ultrasound, our study retrospectively compared ultrasound findings with surgical results for acute biceps tears and compared ultrasound findings with clinical follow up for normal tendons.

Aim and Objectives

The aim of this research was to evaluate the accuracy of Ultrasonography (USG) for differentiating level of biceps tendon injury and correlate with surgical findings.

Materials and Methods

This study was conducted at Rama Medical College, Hospital & research Centre, Kanpur, U.P., India. The ethical approval has been obtained from institutional Ethical Committee. The patient consent was taken before any procedure. A prospective analytical research of the radiology and surgical findings from January 2021 to December 2022 was conducted to identify patients who had ultrasound evaluation of the distal biceps brachii tendon. The cases with surgical follow up and no prior history of surgery of the distal biceps brachii were included as the final surgical subject group. Additionally ten patients who underwent elbow USG for non biceps abnormalities were also identified for inclusion as control of normal biceps cases. All these cases were screened for clinical concern for the following abnormalities: flexor tendon attachment injury and triceps, ulnar collateral ligament injury, lateral epicondylitis, and concern for inflammatory arthritis. In general, the biceps brachii muscle and tendon were evaluated from the musculotendinous junction to the insertion at the radial tuberosity. Transverse and Longitudinal images were taken with the elbow in flexion or mild extension. We determined that ultrasound imaging during muscle contraction and compare it with the other side where necessary. Similar to this, we performed dynamic

scanning of the distal biceps while the elbow was flexed from a medial or lateral approach [15,16].

All USG images were observed by two radiologists having four years of musculoskeletal USG experience. Ten elbow USG examinations with a physiologically normal distal biceps tendon were included as control in the consensus review. All distal biceps tendon USG cases were observer in randomized order and concluded as normal, complete tear or partial tear. A full-width, full-thickness tear of the distal biceps tendon was considered to be a complete tear. A partial width tear and, or partial thickness tear was considered as partial tear. Posterior acoustic shadowing of the distal biceps was also recorded as present or absent in each case. Surgical observations were recorded so that each surgical patient was compared with USG findings. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated for distinguishing complete ruptures from partial tears. Time intervals from imaging to surgery with complete and partial tears were evaluated using the Mann Whitney U Test [2]. Time of clinical follow-up USG was also determined for the clinically normal distal biceps tendon control group with test group.

Results

The test group included 100 patients who underwent USG of the distal biceps brachii and a subsequent surgical treatment, as well as 10 patients who had a normal biceps tendon but underwent clinical rather than surgical follow up. Out of the 100, there were 77 cases with complete distal biceps brachii tears, 23 with partial thickness tears, and no one with a normal finding in surgery. Out of the 100 cases 96 were male and 4 female in both the surgical and clinical follow up groups. Average age of male was 43 years (age range 22 to 66 years, SD±6 years). The mechanism of trauma in the majority of surgical cases was elbow flexion against a weight (eccentric contraction). The median time from USG to surgery was 9 days for complete tears (average, 13 days; range, 12–80 days) and 16 days for partial tears (average, 38 days; range, 23–121 days). The median time was significantly different and p less than 0.001in Mann Whitney U Test. The mean clinical follow up time after USG for those with a normal biceps tendon at USG was 192 days.

Of the 82 cases confirmed by surgical finding as complete tears, USG findings correctly recorded a complete tear preoperatively in 77 (93.9%) cases. In 12 cases, a complete tear at surgery was interpreted as a partial tear which was recorded as complete tear in USG. Out of the 18 partial tears confirmed at surgery, USG correctly identified 6 (33.3%) cases. In 12 cases, where USG reported a complete tear, but during surgery partial tear was recorded. These results are summarized in Table No 1

Table No. 1: Comparison of Ultrasound Findings with Surgical Findings in Complete and Partial Tears.

Ultra sound findings	Surgical Findings		Total
	Complete	Partial	
Complete	77	12	89
Partial	5	6	11
Total	82	18	100

Ultrasound reported two cases of a tear where as no tear (partial or complete) was recorded at the time of surgery. No case was recorded by other radiologists as a normal tendon in case of torn whether partial or complete tear.

The sensitivity of USG in compare with surgical finding was 93.9% with 83.0% accuracy. Specificity of USG was calculated as 33.3%. Positive Predictive Value (PPV) and Negative

Predictive Value (NPV) of USG were calculated as 77.8% and 54.5% respectively. All the above findings were calculated at 95 % of confidence interval (CI=95%).

Table No. 2: Comparison of shadowing at Ultrasound in Complete, Partial and no Tears.

Ultrasound findings	Surgical Findings			Total
	Complete	Partial	Normal	
Shadowing	79	14	0	93
No shadowing	3	4	10	17
Total	82	18	10	110

The presence of USG shadowing in all type of tendons i.e partial tears, complete tears, and normal tendons is mention in Table No 2. The sensitivity and specificity of USG for shadowing to indicate comparison with complete and partial tear was 96.3% and 22.2% respectively with an accuracy of 89.4%. The sensitivity of USG for shadowing to indicate complete tear and normal tendon was 96.3% with specificity of 100% and an accuracy of 96.7%. The sensitivity of USG for shadowing to indicate partial versus normal tendon was 77.8% with specificity 100% and accuracy 85.7%. All the above findings were calculated at 95 % of confidence interval (CI=95%).

Discussion

Middle aged group men are more prone to distal bicep tendon injury in present study. The most common cause of distal bicep tendon tear is accident. The mechanism of distal bicep tendon injury often involves force against resistance from a flexed elbow, such as in gymnastics or weightlifting [6–8, 11].

In present study most of the cases were male and the average age of males belongs to middle age group. Similar findings were reported by most of the studies [12-16]. The reason of distal bicep tendon injury in middle age group male could be more involvement of physical work in Indian scenario.

In present study, the median time from USG to surgery was 9 days for complete tears (average, 13 days; range, 12–80 days) and 16 days for partial tears (average, 38 days; range, 23–121 days). The median time was significantly different and p less than 0.001in Mann Whitney U Test. The mean clinical follow up time after USG for those with a normal biceps tendon at USG was 192 days. Similar findings were reported by Lucas Da Gama Lobo et al [2].

Diagnostic accuracy is important for prompt surgical decision of complete tears. The results present study indicated that USG can differentiate partial tear verses complete with 96.3% sensitivity and 22.2% specificity with an accuracy of 89.4%. The sensitivity of USG for shadowing to indicate complete tear and normal tendon was 96.3% with specificity of 100% and an accuracy of 96.7%. The sensitivity of USG for shadowing to indicate partial versus normal tendon was 77.8% with specificity 100% and accuracy 85.7%. These findings have a high correlation with the study conducted by Hartgerink P et al [15]. Our findings suggest a lack of shadowing on USG should not exclude a partial tear. More study is required with a larger sample of partial tears.

Another study conducted by Seiler et al. [16] find that the main sites of biceps brachii tears on the basis of CT scan finding and anatomic studies to identify causes of bicep tendon tears. They analyzed that a combination of mechanical impingement and supply of artery were the primary cause of bicep tendon tears. In several other studies, MRI has shown a big correlation with surgical findings for both partial and complete tears of the distal biceps brachii tendon [13, 14].

USG has shown a similar great correlation with surgical findings in some studies of distal biceps tendon tears. Belli P et al. [12] analyzed 25 cases with clinically indicated distal biceps brachii ruptures. USG recorded 17 of 18 full thickness tears, with 14 of the 18 having surgical diagnostic confirmation [12]. Using USG, Miller and Adler [12] analyzed 7 cases for distal biceps abnormalities. USG correctly diagnosed 4 of the 5 surgically confirmed cases of complete tears. Two partial tears were accurately diagnosed using USG, one of which was confirmed by surgical procedure [13]. In present study larger number of patients (n=77) shows sensitivity of 93.9% for the USG detection of complete tears and accuracy of 83% for diagnosing tears as complete versus partial tear. There was only one case of partial tear which was interpreted as complete tear by USG. Scar tissue was described at the site of the tendon tear in the operative report of one of these cases and may have been mistaken at ultrasound for intact tendon fibers. Specificity of USG was 33.3% in present study. Positive Predictive Value (PPV) and Negative Predictive Value (NPV) of USG were as 77.8% and 54.5% respectively at 95% confidence interval.

The recommended management for complete tears of the distal biceps tendon is surgical repair because it is well understood that patients treated with conservative treatment lose flexion as well as supination strength of the tendon [11.12]. These findings correspond with our findings because the median time from USG to surgery was 9 days for complete tears (average, 13 days; range, 12–80 days) and 16 days for partial tears (average, 38 days; range, 23–121 days). The mean clinical follow up time after USG for those with a normal biceps tendon at USG was 192 days. [14-16].

Limitations of the present study include MRI diagnosis and follow-up. Surgical diagnosis was included as the gold standard of reference for the all of the cases and introduces bias; however, the direct observation of the bicep tendon at surgery is a gold standard than clinical follow-up. More number of cases was required; in present study small number of cases limits statistical evaluation.

Conclusion

In conclusion, USG has shown significant sensitivity and accuracy in the diagnosis of complete tears of the distal biceps tendon versus partial tears but the specificity was comparatively less. Ultrasound diagnosis is fast, less expensive and non invasive diagnostic procedure. I can play a vital role in the diagnosis of commonly observed bicep tendon injuries, where distal biceps brachii tendon tear is more suspected.

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ISSN 2515-8260 Volume 10, Issue 1, 2023

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