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ORIGINAL ARTICLE

Diagnostic Accuracy of Ultrasonography for Detection of Achilles Tendinopathy by Taking Surgical Findings as Gold Standard

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ABSTRACT

Objective: To assess the diagnostic accuracy of ultrasonography for detection of Achilles tendinopathy by taking surgical findings as gold standard.

Design of the Study: It was a descriptive cross-sectional study.

Study Settings: This study was carried out at Department Of Diagnostic Radiology And Diagnostic Imaging Combined Military Hospital, Lahore from 23rd December 2017 to 22nd June 2018.

Material and Methods: A total of 70 patients of age 20-70 years, of either gender presenting with severe pain and swelling in area of Achilles tendon were included. Patients with heel pain having concurrent heel ulcer, eczematous changes or calcaneal fractures, muscular dystrophy and previous surgery were excluded. All the patients were then underwent ultrasonography and findings were noted for presence or absence of Achilles tendinopathy. Each Ultrasonographic finding were compared with surgical findings.

Results of the Study: Mean age was 41.24 ± 10.34 years. Out of these 70 patients, 46 (65.71%) were male and 24 (34.29%) were females with male to female ratio of 1.9:1. In USG positive patients, 40 (True Positive) had Achilles tendinopathy and 04 (False Positive) had no Achilles tendinopathy on surgical findings. Among, 26 USG negative patients, 03 (False Negative) had Achilles tendinopathy on surgical findings whereas 23 (True Negative) had no Achilles tendinopathy on surgical findings. Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of ultrasonography for detection of Achilles tendinopathy by taking surgical findings as gold standard was 93.02%, 85.19%, 90.91%, 88.46% and 90.0% respectively.

Conclusion: This study concluded that diagnostic accuracy of ultrasonography for detection of Achilles tendinopathy is quite high.

Keywords: Achilles tendinopathy, ultrasonography, sensitivity.

INTRODUCTION

An overuse painful injury of Achilles tendon is Achilles tendinitis or Achilles tendinopathy. This injury is commonly observed in athletes particularly that are involved in jumping and running games. Earlier or current symptoms of Achilles tendinopathy have been presorted in 43% of field and elite track athletes and its frequency is highest (83%) in runners [1, 2]. Among overall injuries ratio of tendinopathy is about 30-50% in which prevalence of Achilles tendinopathy is high [3]. Despite of advancements in understanding this injury, it is still albeit slowly progressing and distressing injury. Such athletes continue participation in sports though their performance is greatly affected and upon continuous ignoring, the injury may get worsen. Its fully recovery may take 12 months or so with vivid chances of re-injury upon returning to sports vigorously [4, 5].

In US, common musculoskeletal injuries are abnormalities of tendon that comes to 7% of physician visits besides being 50% of injuries associated with sports. In running athletes, a common problem is Achilles tendinopathy. Till yet, its etiology has not been recognized fully and likewise no criteria exist for predicting development of Midportion tendinopathy (MPT) [6]. In comparison with young people, prevalence of chronic Achilles tendinopathy is very high in old age people. Among 470 patients of Achilles tendinopathy in Kvist's study, its prevlance was 10% in population with age less than 14 years and only 25% were young athletes while others were in old age group. However, prevalence of insertional tendinopathy is high in active persons while non-insertional tendon injury is more common in less active, old age and obese patients [7].

Now, widely used assessment tools for ligament and tendon abnormalities are ultrasound and MRI. In healthy ligaments and tendons, collagen level is high and has structured orientation. Owing to injury and diseases, changes in tendons and ligament can be seen by using any of the techniques i.e MRI or ultrasound [8]. However, among both the modalities, ultrasound is not only quick rather inexpensive and widely available technique for detection of this disease. However, some of the associated common limitations are pathologic conditions in the US and unfamiliarity with the modality. [9].

It is described that for detection of Achilles tendinopathy, USG has sensitivity: 43-70%, specificity: 59-85%, PPV: 66-79% and NPV: 54-63% [10]. One study showed that sensitivity and specificity of USG for detection of Achilles tendinopathy was 100% and 83%, respectively which showed that it is a reliable tool for detection of Achilles tendinopathy [11].

Rationale of this study was to assess the diagnostic accuracy of USG for detection of Achilles tendinopathy taking surgical findings as gold standard. Literature has showed controversial results regarding the diagnostic accuracy of USG for detection of Achilles tendinopathy. Moreover, no local evidence is present in this regard which can help in deciding whether to rely on USG for Achilles tendinopathy. However, it has also been stated in literature that it is reliable enough to replace surgical findings. This study will help evaluation of diagnostic accuracy of USG in local setting to avoid the need of invasive methods in patients with heel pain. Moreover, we will get local magnitude which will help us in future.

MATERIAL AND METHODS

The study was conducted after approval from hospital's ethical and research committee. Informed consent in written form was taken from enrolled patients after telling them the protocols of the study. It was a descriptive cross-sectional was conducted from 23rd December 2017 to 22nd June 2018. Sample size of 70 cases was calculated with 95% confidence level, and taking expected percentage of Achilles tendinopathy i.e. 50%[11] and sensitivity 70%[12] with 13% margin of error and specificity 85%[12] with 10% margin of error taking surgical findings as gold standard. 70 patients referred to Radiology Department, CMH Lahore fulfilling selection criteria were enrolled in the study. Written informed consent was taken. Demographic detail (name, age, gender, BMI, duration of symptoms, anatomical side) was noted. Patients with age between 20-70 years from both the genders presenting with severe pain and swelling in area of Achilles tendon (as per medical

record) referred from Orthopedic Department and already planned to undergo surgery. Patients with heel pain having concurrent heel ulcer, eczematous changes or calcaneal fractures, patients with muscular dystrophy (on clinical examination), patients with previous surgery of same side (on history) were exclude from study. Then all patients were undergone USG by using GE Healthcare Medical Systems, with 11MHz linear-array transducers by a senior radiologist having at least 4 years' experience with assistance of researcher. During tendon examination, patients were lying in prone position on the bed and feet were hanging with the edges of the bed. Then patients were labeled as positive or negative (as per operational definition). Then patients were undergone surgery by a single surgical team under spinal anesthesia. Patients were confirmed as positive or negative (as per operational definition). All this information was recorded through proforma (attached).

The collected data was entered and analyzed in computer software SPSS21. Age, BMI and duration of symptoms were presented as mean±SD. Gender, anatomical side and Achilles tendinopathy (in USG and surgical findings) were presented as frequency and percentage. 2x2 table was generated to calculate the sensitivity, specificity, PPV, NPV and accuracy of USG keeping surgical findings as gold standard. Post-stratification, 2x2 tables was generated to calculate the sensitivity, specificity, PPV, NPV and accuracy of USG keeping surgical findings as gold standard.

STUDY RESULTS

Patients had mean age of 41.24 ± 10.34 years between 20-45 years as shown in Table I. Out of these 70 patients, 46 (65.71%) were male and 24 (34.29%) were females with male to female ratio of 1.9:1. Mean duration of symptoms was 4.84 ± 1.54 months. Distribution of patients according to anatomical side is shown in Table III. Mean BMI was 28.07 ± 2.41 kg/m^2. All the patients were subjected to ultrasonography and USG supported the diagnosis of Achilles tendinopathy in 44 (62.86%) patients. Surgical findings confirmed Achilles tendinopathy in 43 (61.43%) cases where as 27 (38.57%) patients revealed no Achilles tendinopathy. In USG positive patients, 40 (True Positive) had Achilles tendinopathy and 04 (False Positive) had no Achilles tendinopathy on surgical findings. Among, 26 USG negative patients, 03 (False Negative) had Achilles tendinopathy on surgical findings whereas 23 (True Negative) had no Achilles tendinopathy on surgical findings as shown in Table V. Overall sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of ultrasonography for detection of Achilles tendinopathy by taking surgical findings as gold standard was 93.02%, 85.19%, 90.91%, 88.46% and 90.0% respectively.

Characteristic	Patients screened	Frequency
Gender	Male	46(65.71)
	Female	24(34.29)
Age group	20-45	45(64.29)
	46-70	25(35.71)
	>60	26(14.6)
Duration of symptoms	≤5 months	26(37.14)
	>5 months	62(0.79)
Anatomical side	Right	40(57.14)
	Left	33(47.14)
BMI (kg/m^2)	≤27	37(52.86)
	>27	32(17.9)

Table 2: Diagnostic accuracy of ultrasonography for detection of Achilles tendinopathy by taking surgical findings as gold standard

	Positive result on surgical findings	Negative result on surgical findings	P-value
Positive on USG	40 (TP)*	04 (FP)***	0.0001
Negative on USG	03 (FN)**	23 (TN)****	

*-TP=True positive **-FP=False positive ***-FN=False negative ****-TN=True negative

Table 3: Performance of the ultrasonograhy in detection of Achilles tendinopathy

Index	Ultrasonography
Sensitivity	83.02%
Specificity	85.19%
Positive Predictive Value (PPV)	90.91%
Negative Predictive Value (NPV)	88.46%
Diagnostic Accuracy	90.0%

DISCUSSION

Being real time is one of the greatest privileges associated with ultrasound which helps the radiologist in identifying exact location of pain and its comparison with opposite side. Furthermore, muscles and tendons can be assessed dynamically. Tendon length can be seen along with its functioning and probable subluxation. Tendon tearing and tendinopathy can be differentiated with the help of compression [13]. This study was conducted for determining diagnostic accuracy of ultrasonography for detecting Achilles tendinopathy by taking surgical findings as gold standard.

Age range in my study was from 20-45 years with mean age of 41.24 ± 10.34 years. Out of these 70 patients, 46 (65.71%) were male and 24 (34.29%) were females with male to female ratio of 1.9:1. It is described that for detection of Achilles tendinopathy, USG has sensitivity: 43-70%, specificity: 59-85%, PPV: 66-79% and NPV: 54-63%.12 One study showed that sensitivity and specificity of USG for detection of Achilles tendinopathy was 100% and 83%, respectively which showed that it is a reliable tool for detection of Achilles tendinopathy [10].

In a study by Khasru et al. (2017) on 61 patients showed similar results with our study where majorty of the patients belong to male group and 38.0% were from 36-45 years age group. As regards, Achilles tendinopathy, sensitivity, specificity and accuracy of USG was 95.0%, 50.0% and 92.0% respectively while X-rays had sensitivity, specificity, and accuracy of 39.0%, 75.0%, and 42.0% correspondingly [14].

Sonogram diagnosed one case as calcific tendinits out of 26 Achilles tendinopathy cases in Fornage series. Moreover, Kayser et al[15] series reported sensitivity and specificity of USG to be 50% and 81% respectively in diagnosis of partial rupture while ultrasound examination had an overall agreement of 61.5%. For assessing injury in Achilles tendon, diagnostic accuracy of sonography was determined by Kainberger et al.[16] and held specificity and sensitivity of USG as 83.0% and 72.0% respectively. As per existing literature, USG has accuracy between medium-high ranges for characterizing Achilles tendinopathy in comparison with that of MRI. That is why, use of USG in clinical setting is encouraged very much but if findings of the USG are negative then MRI should be arranged complementary particular in cases with suspicion of partial tear [17].

For musculoskeletal examination, USG is in clinical use since long but with no focus on tendinopathy. USG was complementary to MRI in the past for imaging tendons. Recently available USG is highly competitive keeps standard of choice for imaging injuries of tendon and has proved cost effective, accurate and valid modality [18]. For infestation of structures which are located superficially i.e tendons it is highly recommended [19]. In comparison with MRI, USG has biggest advantage of offering dynamic examination. Many studies have compered USG with MRI to clinically confirm diagnosis of patellar tendinopathy. Accuracy of US/CD and grey scale ultrasound is more than MRI. GS/US produces thick tendon, irregularly organized collagen fiber and hypoechoic area.

In midportion tendinotic Achilles tendinopathy, hypoechoic areas are seen on ventral side of tendon where the tendinotic tendon is very thick. In the tendinotic patellar tendinopathy these areas are seen in the dorsal side of the tendon near the apex patella. Yet another edge of USG is color. Visible blood flow can be seen in the CD and it helps in studying flow of blood within the tendon [20].

CONCLUSION

This study concluded that diagnostic accuracy of ultrasonography for detection of Achilles tendinopathy is quite high, and has not only dramatically improved our ability of Achilles tendinopathy but also be a simple, economical and readily available alternative to MRI. So, we recommend that this simple, easily available, non-ionizing and cost effective technique should be used as a primary imaging modality for detection of Achilles tendinopathy.

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