The Egyptian Journal of Hospital Medicine (July 2018) Vol. 72 (4), Page 4339-4342

MRI In Achilles Tendon Injuries

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ABSTRACT

Background: The prevalence of Achilles tendon injuries is a common musculoskeletal disorder affecting the foot in athletic and non-athletic population. The Achilles tendon is the thickest and strongest tendon in the human body. It is the major plantar flexor of the foot and contributes to the maintenance of the upright position. MRI is an excellent imaging modality for suspected Achilles tendon lesions due to its accuracy, efficiency, multiplanar imaging capabilities and excellent soft tissue characterization.

Objective: The aim of this study is to evaluate the role of MR imaging in clinically diagnosed Achilles tendon rupture and how MRI influences the management.

Patients and Methods: This study was conducted at the radiology department, Faculty of medicine, Ain shams University. 20 patients with clinically diagnosed partial and full thickness tear of the Achilles tendon underwent MRI evaluation after four clinical tests.

Results: The results of our study revealed many limitations in clinical tests that revealed defective details which were essentially significant for the way of management being operative or conservative.

Conclusion: MRI is the method of choice and superior to clinical tests when evaluating Achilles tendon lesions, facilitating the choice of treatment being operative or non-operative, evaluating intra-tendinous changes in all types of AT tear and follow up during the healing period.

Keywords: Achilles tendon lesions, MRI, clinical Tests.

INTRODUCTION

The Achilles tendon is the thickest and strongest tendon in the human body. It is the thickest and strongest tendon in the human body. It is the major plantar flexor of the foot and contributes to the maintenance of the upright position. It originates from the aponeuroses of the medial, lateral gastrocnemius and soleus muscles (triceps surae) and is inserted into the posterior calcaneal tuberosity [(1)].

The Achilles tendon is the most frequently injured ankle tendon. It lacks a tendon sheath; however it has a peritenon whose vascular system extends both within and outside the tendon. Achilles tendon injuries frequently occur in athletes, as well in the general population [(2)]. Its injuries may be classified as non-insertional or insertional. The former group includes partial or complete thickness tear. Achilles tendon tear is usually 2–6 cm above the insertion of the tendon on the calcaneus [(3)].

MRI has been widely used in confirming the diagnosis of Achilles tendon injuries. It is an excellent technique for those cases where the diagnosis is uncertain; it is the most suitable investigation for assessment of soft tissue for persistent foot and ankle pain following injury, Owing to its multiplanar imaging capabilities and excellent soft tissue contrast characteristics [(3)].

However; in this study, clinical diagnosis of Achilles tendon Tear could be primary based on specific clinical tests followed by MRI examinations as a reference that allow a global evaluation of the bones, tendons, ligaments, and other structures with a single examination that exceeds the capabilities of all other available clinical tests [(4)].

AIM OF THE WORK

The aim of this study is to compare the value of MR imaging in clinically diagnosed Achilles tendon rupture and to investigate reliability of these clinical examination tests.

PATIENTS AND METHODS

This study was conducted at the radiology department, Faculty of medicine; Ain shams University between October 2016 and June 2018 following the approval by the scientific and ethics committee

Patients: This study performed on 20 patients with clinical diagnosis of partial or complete Achilles tendon tear and at least 2 positive clinical tests are needed (score 2/4) (Tiptoes test, Matles test, Palpable gap test, Thompson test), then all patients had been submitted for ankle MRI at the radiology department, Ain Shams University.

Clinical Tests: The Achilles tendon is the most frequent site of injury in the foot. Its superficial location leads to excellent evaluation by clinical examination especially in a complete tear injury type [(1, 5)].

The diagnosis of acute Achilles tendon ruptures is usually diagnosed with appropriate patient history taking and clinical examination. Most of the patients present with pain and swelling in the posterior ankle and describe a traumatic event or a feeling of being kicked at the back of the heel.

On examination: There is loss of Achilles tendon congruity or palpable gap, weakness of ankle joint plantar flexion, and inability to do heel raises [(6)].

Received:18/5/2018
Accepted:27/5/2018

Thompson (calf squeeze) test: The most commonly used clinical test was originally described by Simmonds and popularized by Thompson and Doherty.

Patients are made to lie in a prone position with their feet hanging over the edge of the table, and the examiner squeezes the largest muscle portion of the calf complex to simulate a contraction/shortening of the Achilles tendon complex, which should normally produce a plantar flexion of the foot. An "abnormal" or positive Thompson test result is observed when there is a lack of plantar flexion response [(7)].

Matles Test: The patient lies in prone, active or passively flexing the knee to 90° with both feet and ankles in a neutral position according to the patient.

Tiptoes test: The patient lies in standing position, stands with full weight bearing maximally planter flexed ankle of the ipsilateral injured lower limb, if the patient unable to do voluntary plantar flexion, the test is positive.

Inclusion criteria: Patients complaining of posterior heel pain post history of trauma, limitation of plantar flexion movement, swollen and ecchymotic ankle related to trauma and two positive clinical tests (score 2/4) as a minimum (Tiptoes test, Matles test, Palpable gap test, Thompson test).

Exclusion criteria: Any associated injury located in the same lower limb e.g. knee, leg and foot because it may causes referred pain to the Achilles tendon region, limits their normal range of motion and provide insufficient details to diagnostic tests accuracy.

Patients are contraindicated to MRI: Patients have metallic vascular clips, metallic foreign bodies (especially intraocular), coronary stents (1st to 6th weeks), cardiac pacemakers, insulin pumps (old non-compatible types to MRI), cochlear implants, first trimester of pregnancy and patients are overweight >120kG.

Statistical analysis: Data were statistically described in terms of mean ± standard deviation (± SD), and range, or frequencies (number of cases) and percentages when appropriate. A comparison between selected 4 clinical tests and MRI was done using statistic. P values less than 0.05 was considered statistically significant, rather than the four clinical tests were devoid of the most important AT pathological details that determine the exact management.

RESULTS

Table (1): The Results of a Comparison between clinical tests and MRI findings.

N	Age	sex	Clinical criteria (Four clinical tests)		MRI Findings						MRI Diagnosis
			Score	Partial/ Complete Tear	1-Full thickness disruption of the tendon fibers and tendon gap	2- Tendon end Fraying	3- Focal discontinuity of the fibers of the tendon.	4-Heterogenous signal intensity in the substance of the tendon.	5- pre-Achilles fat pad low signal intensity in T1, high signal intensity in T2 and STIR.	6- Loss of the Tendon concavity (axial) plane.	Tendinopathy/ Partial/ Complete Tear,
1	52	M	4/4	Complete Tear	Positive(<3cm)						Complete Tear
2	45	M	3/4	Complete Tear	Positive(3-6 cm)						Complete Tear
3	46	M	4/4	Complete Tear	Positive(3-6 cm)						Complete Tear
4	25	M	4/4	Complete Tear	Positive(<3cm)						Complete Tear
5	53	M	3/4	Complete Tear	Positive(<3cm)						Complete Tear
6	60	F	3/4	Complete Tear	Positive(<3cm)						Complete Tear
7	35	M	4/4	Complete Tear	Positive(3-6 cm)	positive					Complete Tear
8	57	M	4/4	Complete Tear	Positive(<3cm)						Complete Tear
9	43	F	4/4	Complete Tear	Positive(<3cm)						Complete Tear
10	41	M	4/4	Complete Tear	Positive(<3cm)						Complete Tear
11	38	M	2/4	Partial tear			Positive			positive	Isolated Partial tear
12	56	F	4/4	Complete Tear	Positive(3-6 cm)	Positive					Complete Tear
13	33	M	4/4	Complete Tear	Positive(<3cm)	Positive					Complete Tear
14	50	M	2/4	Partial tear			Positive	Positive	Positive	Positive	Partial tear with tendinosis and peritendinitis
15	49	M	2/4	Partial tear			Positive	Positive	Positive		Partial tear with peritendinitis
16	22	M	4/4	Complete Tear	Positive(<3cm)						Complete Tear
17	53	M	4/4	Complete Tear	Positive(<3cm)						Complete Tear
18	47	F	4/4	Complete Tear	Positive(<3cm)	Positive					Complete Tear
19	39	M	2/4	Partial tear			Positive	Positive	Positive	positive	Partial tear with tendinosis and peritendinitis
20	32	M	4/4	Complete Tear	Positive(<3cm)						Complete Tear

DISCUSSION

The Achilles tendon is one of the most important and multifunctional tendons in the body. A conjoining of the gastrocnemius and soleus muscles, the tendon spans three different joints and is integral in knee flexion, foot plantar flexion, and hindfoot inversion. Given the broad array of critical functions that it helps to provide, injury to the Achilles tendon can be devastating [1,2].

The true etiology of Achilles tendon injuries is still unknown, but the degenerative theory postulates that chronic degeneration of the tendon leads to a rupture without the need for excessive loads to be applied. This theory was first postulated after found degenerative changes in all 74 of their patients with acute Achilles ruptures. These degenerative changes have been seen in multiple other studies. The sedentary lifestyle results in decreased blood flow and nutrition to the Achilles tendon. This situation is compounded by the effects of aging on the vascular supply. Recreational physical activities that intermittently stress the ischemic Achilles tendon, without giving it time to adapt, may lead to "spontaneous" partial thickness AT tear and it can also occur abruptly without a definite history of overuse [10].

This agrees with our study where all the four patients with spontaneous partial thickness AT tear, had degenerative changes in the form of peritendonitis, tendinosis or both in their MR images.

In our study all the patients had the four clinical tests (Tiptoes test, Matles test, Palpable gap test, Thompson test) followed by MRI examinations as a reference imaging modality. MRI examinations were done for all patients using the same system, (1.5 Tesla, MR imaging unit), with the standard circular extremity coil. The clinical tests in our study were similar to many literatures recommendations [8].

The clinical diagnosis of Achilles tendon tear being partial or complete depends upon the four clinical tests score; **two** positive clinical tests needed for diagnosis of partial AT tear and **three or four** positive clinical tests needed for diagnosis of complete AT tear, as previously mentioned [9].

Diagnosis of Achilles tendon lesions resulted by the clinical tests score were compared to the MRI findings and revealed that; four patients were partial thickness tear with tendinopathy; partial thicknesses tear with tendinosis and peritendinitis in two patients, partial thicknesses tear with peritendinitis in one patient and partial thicknesses tear with tendinitis in the other one. Sixteen patients were full thickness tear; full thickness tear with gap distance less than 3cm without fraying in ten patients whom were treated conservatively, full thickness tear with gap distance less than 3cm with fraying tendon ends in two patients whom were treated surgical end-end anastomosis, full thicknesses tear with gap distance (3-6 cm) without fraying in two patients whom were treated FHL tendon graft and full thickness tear with gap distance (3-6 cm) with fraying tendon ends in two patients whom were treated FHL tendon graft and gastrocnemius recession [10].

The Kuwada [11] classification of Achilles tendon tear was proposed in 1990 and at the time of writing remains the most widely used system for describing Achilles tendon rupture.

Type I: partial ruptures ≤50% which typically treated with conservative management.

Type II: complete rupture with tendinous gap ≤3;

A: With fraying tendon ends → end-end anastomosis.

B: Without fraying tendon ends → conservative treatment.

Type III: complete rupture with tendinous gap 3 to 6 cm;

A: Without fraying tendon ends → FHL tendon graft.

B: With fraying tendon ends → FHL tendon graft and gastrocnemius recession.

Type IV: complete rupture with defect of >6 cm (neglected ruptures) which often requires tendon/ synthetic graft and gastrocnemius recession [11].

Many Literature recommendations are against the routine use of magnetic resonance imaging (MRI) to confirm the diagnosis of acute Achilles tendon rupture [10].

MRI findings in our study had a fundamental role in decision making and management. For example; in full thickness AT tear with fraying tendon ends and gap <3cm, the management was changed from conservative treatment to surgical repair (e.g. cases no 13, 18).

The all cases with partial thickness AT tear associated with different types of tendinopathy, were treated with conservative treatment duration up to 12 weeks instead of 8 weeks duration (in partial thickness tear without tendinopathy). MRI findings have fundamental role in duration of the treatment.

Thus, according to our study, the values of MRI examinations had great impact on type and duration of the treatment as briefly described above, so we strongly disagree with this recommendation.

CONCLUSION

MRI is the modality of choice when evaluating Achilles tendon lesions, facilitating the choice of treatment and follow up duration. MRI allows discrimination of normal from pathological structures and observation of the internal substance of the tendon. The four clinical tests were devoid of the most important AT pathological details that determine the exact management, so MRI is superior to clinical tests in the detection, evaluation of intra-tendinous changes in all types of AT tear and had great impact on type and duration of the treatment.

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