MRI Evaluation of Achilles Tendon Injuries

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Abstract

Introduction: Although it is the strongest tendon in the human body, the Achilles tendon is the most commonly injured ankle tendon. Clinical evaluation alone is often suggestive of the diagnosis of acute rupture of the Achilles tendon, which could be partial or complete. However, the clinical examination alone is not sufficient in all cases, and imaging can play a crucial role.

Aim of the Work: The purpose of this study was to evaluate the role of MRI in differentiating full-thickness tears from partial-thickness tears or tendinosis of the Achilles tendon.

Material and Methods: 14 patients with clinically suspected tear of the Achilles tendon underwent MRI evaluation after proper clinical evaluation.

Results: MRI findings were suggestive of full thickness tear in 8 patients, who were operated, and of partial thickness tear in 6 patients who were treated conservatively by cast. Two of these 6 patients were operated later after failure of the conservative treatment while the other 4 patients improved upon conservative treatment.

Conclusion: MRI is a sensitive and accurate tool for evaluation of the spectrum of abnormalities encountered with Achilles tendon injury, with good ability to discriminated partial from full thickness tears.

Key Words: Achilles tendon – Tear – MRI.

Introduction

ACHILLES tendon rupture is the most common tendon rupture of the lower extremity. Although it is the strongest tendon in the human body, the Achilles tendon is the most commonly injured ankle tendon [1,2].

It occurs suddenly during movements that stress the Achilles tendon, such as running. The Achilles tendon is especially vulnerable to quick movements that place extreme stress on it. Achilles tendon rupture can occur at any age, but most commonly in the third to fifth decade. There is a significant male preponderance [3].

Achilles tendon rupture usually presents as abrupt onset of pain with loss of strength and range of motion following sudden, forceful contraction of the calf muscle. Partial rupture may not have a well-defined onset and may involve gradual worsening of symptoms [1].

The pathologic findings can be acute or chronic and range from mild peritenonitis to full-thickness tendon rupture. Chronic corticosteroid use is one of the predisposing factors particularly in elderly patients [4].

With partial ruptures, the clinical picture may not be as clear, and imaging can play a crucial role. Findings noted at clinical evaluation alone are often suggestive of the diagnosis of acute rupture of the Achilles tendon. However, because the flexor, peroneal, and plantaris tendons also contribute to plantar flexion and can compensate, to some degree, for an injured Achilles tendon, the clinical examination can be confounded. Similarly, edema caused by an acute tear can obliterate a tendon defect, which renders palpation ineffective [1,4,5].

A complete tear shows discontinuity of fibers while a partial tear shows tendon thickening and increased signal on T2-weighted images. The pathophysiologic characteristics of tendon tears likely represent a spectrum of disease, with tendinosis predisposing to partial tearing and, barring effective treatment, ultimately to complete tendon rupture [4-8].

It has been reported by some authors [9] that there is an avascular zone about 2-6cm from the base of the calcaneus and that this area of avas-
cularity is the most common site for rupture of the achilles tendon. Still other authors [10] found the midsection of the tendon to be hypovascular, especially in patients with compromised blood supply.

Neither ultrasonography nor magnetic resonance imaging (MRI) has demonstrated a high degree of differentiation in helping to distinguish partial-thickness tears from tendinosis [7,11,12].

However, this distinction may not be of great clinical importance since a partial-thickness tear or tendinosis, in the absence of a full-thickness tear, is usually initially treated with nonsurgical means [4,13,14].

It has been reported that more than 20% of full-thickness tears can be missed clinically at initial presentation. Thus, there is a need for a rapid and reliable means of diagnosing full-thickness tears and of differentiating them from less severe pathologic conditions that are usually treated successfully with conservative means [2,4,15].

Aim of the work:

The purpose of this study was to evaluate the role of MRI in differentiating full-thickness tears from partial-thickness tears or tendinosis of the Achilles tendon.

Patients and Methods

From July 2010 through December 2011, 14 consecutive patients (11 male and three female patients) underwent MRI for clinically suspected Achilles tendon injury.

MRI Protocol:

The patients were examined on a 1.5-T MRI system (Gyroscan NT, Philips Medical Systems) using a quadrature neck coil. The patients were examined in the supine feet first position. The protocol entailed as a standard a multiplanar localizer gradient echo sequence upon which all other sequences were planned. This was followed by sagittal fast spin-echo T2W & STIR sequences, coronal fast spin-echo T2W & STIR, and axial fat-suppressed spin-echo T1W sequence. A 15x15cm field of view was adopted, with 256x192 acquisition matrix. Sagittal and coronal images were obtained with a 3mm slice thickness/1mm gap, and axial images were obtained with a 4-mm slice thickness/1mm gap. Gadolinium wasn’t given in any case in the study.

Image assessment:

Images were evaluated by three radiologists blinded to the clinical data. The assessment was based upon consensus between the three radiologists.

The MR images were evaluated for the following characteristics:

a- Antero-posterior diameter of the tendon in the zone of abnormality.
b- Signal intensity of the tendon at the abnormal area.
c- Presence or absence of tendon gap (and/or retraction), and its length in cm (in sagittal images),
d- Pre-Achilles tendon (Kager) fat herniation into an area of tendon abnormality, and (e) Presence of subcutaneous edema.

The MRI findings were used to assign cases into one of two categories: (a) full-thickness tendon ruptures and (b) partial-thickness tears or tendinosis.

Full-thickness tears were diagnosed when complete rupture of the Achilles tendon was noted with complete disruption of the tendon continuity. A partial-thickness tear or tendinosis was diagnosed when increased antero-posterior diameter of the tendon was noticed, with or without defects in the tendon and when there was evidence of at least some intact tendon fibers.

Results

The mean age of patients in the study at the time of MRI was 36.14 years, with a SD of ± 11.94 (age range 17-61 years) Table (1). Clinically, 8 patients were presented with acute posterior ankle/heel pain, and in the other 6 patients, there was inability to flex or extend the ankle. Five patients reported a direct injury. Among the 14 patients included in the study, the right Achilles tendon was involved in 9 patients, and the left Achilles tendon was involved in 5 patients Table (2).

According to MRI findings, 8 patients were diagnosed to have full-thickness tear, and 6 patients were diagnosed to have partial thickness tear. In surgery, among the 8 patients who were diagnosed by MRI to have full thickness tear, only 7 were found to have full thickness tears, and the eighth patient was found to have major partial thickness tear. Only 10 out of the 14 patients were operated (8 operated upon MRI diagnosis of full-thickness tear, and 2 were operated after failure of conservative treatment). At operation, there were 7 surgically proved full-thickness tears and 3 surgically proven partial-thickness tears or tendinosis Table (3).
Conservative treatment using plaster cast and restriction of movement was done for the other non-operated 6 patients. Four of these patients showed clinical improvement after removal of the cast, and the other 2 patients who showed no improvement after cast removal needed surgery to repair the partial thickness tear.

MRI could properly diagnose full thickness tear in 7 out of 8 patients, and could correctly detect partial thickness tear in 6 patients, while in the seventh patient the case diagnosed by MRI to have full thickness tear was found during operation to be a major partial thickness tear. The overall sensitivity and specificity of MRI were 100% and 85.4% respectively.

Table (1): Distribution of the studied patients according to age.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>No. (n= 14)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>4</td>
<td>28.6</td>
</tr>
<tr>
<td>30 - &lt;40</td>
<td>6</td>
<td>42.9</td>
</tr>
<tr>
<td>≥40</td>
<td>4</td>
<td>28.6</td>
</tr>
<tr>
<td>Mean ± SD (Range)</td>
<td>36.14±11.94 (17 – 61)</td>
<td></td>
</tr>
</tbody>
</table>

Table (2): Distribution of the studied patients according to the affected side.

<table>
<thead>
<tr>
<th>Side</th>
<th>No. (n= 14)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>9</td>
<td>64.3</td>
</tr>
<tr>
<td>Left</td>
<td>5</td>
<td>35.7</td>
</tr>
</tbody>
</table>

Table (3): Assessment of the studied cases by MRI and by operation.

<table>
<thead>
<tr>
<th></th>
<th>MRI (n= 14)</th>
<th>Operation (n= 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Complete</td>
<td>8</td>
<td>57.1</td>
</tr>
<tr>
<td>Partial</td>
<td>6</td>
<td>42.9</td>
</tr>
</tbody>
</table>
Case (3): Sagittal STIR; partial-thickness tear of the left Achilles tendon in a 49 year old man. There’s marked attenuation of the antero-posterior diameter of the tendon, with edema within its substance, and within the surrounding tissues.

Case (4): Sagittal T2W; full-thickness tear of the right Achilles tendon in a 31 year old man. There’s complete disruption of continuity of the tendon, with retraction of its ends and an abnormal gap about 5 cm. The gap is filled with hematoma. There’s also noted edema and fluid collection within the surrounding tissues. The tear is close to the tendon insertion.
Discussion

The Achilles tendon is among the most frequently injured tendons of the body with a variety of types of traumatic and overuse conditions affecting its integrity. A significant relationship exists between leisure athletic activities and tendon injuries. 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" Achilles tendon rupture. Achilles tendon tears can also occur abruptly without a definite history of overuse.

Although most Achilles tears occurs 2-6cm from its insertion, Achilles tears can be seen in two other locations: Distally and proximally. More common than an insertional tear, a proximal Achilles tear is, in reality, a musculo-tendinous junction injury [16].

In this study, 8 patients were diagnosed according to MRI findings to have full-thickness tear, and 6 patients were diagnosed to have partial thickness tear. Full thickness tears were found and repaired during surgery and a major partial thickness tear was detected and repaired in the eighth patient. MRI also could successfully diagnose partial thickness tear in 6 patients; four of them showed improvement upon conservative treatment and surgery were needed for repair of the partial thickness tear in the other two patients.

The results of MRI imaging was helpful in choice of treatment of patients in this study. According to some authors [17], MRI is the method of choice when evaluating Achilles tendon lesions, facilitating the choice of treatment and follow-up during the healing period. MRI allows discrimination of normal from pathological structures, and observation of the internal substance of the tendon. It is superior to other imaging techniques in the detection and evaluation of intra-tendinous changes.

All patients in the study experienced a variable degree of trauma. Rupture of the Achilles tendon usually occurs in middle-aged and older patients due to eccentric loading on a dorsi-flexed foot. There is often prodromal pain for several days. Predisposing factors include pre-existing tendinosis, steroid injections, anabolic steroid abuse, gout, hyperparathyroidism and fluoroquinolone use. Patients present with pain, swelling and weakness. There may be a palpable defect in the tendon but this is often obscured by hematoma. With partial tears, MRI shows focal discontinuity, swelling and alterations in tendon texture and the surrounding soft tissues. At MR imaging, partial Achilles tendon tears demonstrate heterogeneous signal intensity and thickening of the tendon without complete disruption. Acute partial tears are often associated with subcutaneous edema, hemorrhage within the Kager fat pad and intra-tendinous hemorrhage [18].

In all patients with complete tendon rupture, there was noted major disruption of the thickness of the Achilles tendon. Complete Achilles tendon rupture manifests as discontinuity with fraying and retraction of the torn edges of the tendon. The gap between the tendon edges seen with full-thickness tears is usually filled by liquid blood or organizing hematoma depending on the age of the tear. In acute rupture, the tendon gap demonstrates intermediate signal intensity on T1-weighted images and high signal intensity on T2-weighted images [16-18].

Conclusion:

MRI is a sensitive and accurate tool for evaluation of the spectrum of abnormalities encountered with Achilles tendon injury, with good ability to discriminated partial from full thickness tears.

References


