

# Achilles Tendon Rupture

## OVERVIEW

Achilles tendon injuries are the most common tendon injury in the lower extremity. The reported incidence ranges from 5.5-9.9 ruptures per 100,000 people in North America. A rise in the incidence of acute ruptures has been seen and is attributed to the increased participation of the aging population in physically demanding activity. The majority of acute ruptures is seen amongst the “weekend warrior” in their fourth to fifth decade of life. Treatment decisions must include the treating physician and the patient on an individual basis. Both non-operative and surgical interventions have been advocated and managing the expectations of those sustaining an Achilles tendon rupture is tantamount to achieving a successful outcome.

## ANATOMY

The Achilles tendon is derived from both the gastrocnemius muscle and the soleus muscle. 15cm proximal to the calcaneal insertion, the tendinous contributions become confluent as a single tendon. The Achilles tendon is enveloped by a paratenon that serves the function of allowing the tendon to glide freely as well as providing the majority of the blood supply to the tendon. Distally, the blood supply is mainly derived from osseous contributions. Because of the organization of the blood supply, there is a watershed area approximately 2-6cm from the insertion point on the calcaneus.

## BIOMECHANICS

The Achilles tendon provides the mechanism for plantarflexion of the ankle. Contraction of the gastrocnemius/soleus complex provides the force necessary to generate toe-off during the late stance phase of the gait cycle. It additionally functions in an eccentric manner to prevent excessive dorsiflexion and to prevent forward lurching during the gait cycle.

As is the case with all tendons, the viscoelastic properties are non-linear. This allows the Achilles tendon to become stiffer as force is applied more rapidly. The biomechanical strength of the tendon decreases with senescence which accounts for the increased incidence of Achilles tendon ruptures in the middle aged population.

## **PATHOGENESIS**

A number of risk factors have been identified in association with Achilles tendon ruptures. While certain medications (fluoroquinolones, corticosteroids), medical conditions (renal insufficiency, autoimmune diseases, arteriosclerosis, hyperuricemia, genetic disorders of collagen), and activities have all been implicated, ruptures of the Achilles tendon are most likely multi-factorial.

Two theories accounting for Achilles tendon ruptures have been described. The degenerative theory states that chronic degeneration of the Achilles tendon predisposes to a tear at loads that are physiologic. Repeated microtrauma with excessive loading, certain drugs, and alterations in the physiologic structure of the tendon can all contribute to degenerative changes of the Achilles tendon. The mechanical theory states that strong contraction of the gastrocnemius/ soleus complex may be enough to result in an acute rupture in the setting of a healthy Achilles tendon. This may be especially true in an unconditioned athlete such as one returning to activity after a prolonged period of inactivity. This may explain the high propensity for weekend warriors to sustain Achilles tendon ruptures.

## **CLINICAL PRESENTATION**

The majority of Achilles tendon ruptures occur during injuries sustained while performing athletic activity. Most of those sustaining ruptures are middle-aged episodic athletes termed weekend warriors. While the vast majority of injuries are acute, there is a small group – up to 15% - who experience prodromal symptoms of pain, swelling, and stiffness prior to rupturing their Achilles tendon.

The exact mechanism for injury usually falls into one of three patterns. The most common is that of forceful plantarflexion with the knee extended such as seen in sprinting and jumping activities. The typical presentation is that of a palpable/audible pop or the sensation of being

struck in the back of the lower leg. After this sensation patients commonly complain about weakness with push-off. Pain scales are variable amongst patients sustaining Achilles tendon ruptures and are not reliable in the history of an acute rupture. Sudden unexpected dorsiflexion of the ankle as seen in falling down stairs or slipping into a hole is also commonly reported. The least common mechanism reported is that of violent dorsiflexion of a plantarflexed ankle. This is usually related to falls from a height.

Physical examination of patients with an Achilles tendon rupture include weak plantarflexion strength as demonstrated by single heel-rise, increased ability to passively dorsiflex the ankle compared to the unaffected side, and a palpable step-off in the Achilles tendon correlating with the level of the rupture. The presence of an abnormal Thompson test may also be present although false positives have been reported. Squeezing the calf musculature should evoke plantarflexion of the foot. In the presence of an acute Achilles tendon rupture, squeezing the calf should reveal little or no plantarflexion. False positives are seen in the presence of forcefully squeezing the calf, the presence of a plantaris tendon, and a chronic rupture where scar tissue can mimic continuity of the Achilles tendon. Resting tension of the Achilles tendon can also be indicative of an acute rupture. In the prone position, the patient's knee is flexed to 90 degrees. Normal resting tension results in an approximately 15 degree plantarflexed position of the foot. Comparing the injured and unaffected side can help with the clinical diagnosis of an acute Achilles tendon rupture.

## **IMAGING STUDIES**

Diagnosis of Achilles tendon ruptures is one of clinical exam. Recent studies have demonstrated that clinical exam alone is nearly 100% sensitive in the diagnosis of Achilles tendon ruptures. While advanced imaging studies may not have clinical utility in the diagnosis of Achilles tendon rupture, MRI and ultrasound may aid in pre-operative planning when surgical intervention is indicated. One unique advantage of ultrasound over MRI is the ability to dynamically assess the tendon and the ability to re-approximate the tendon edges.

## **TREATMENT**

The optimal treatment of Achilles tendon ruptures remains controversial. While both non-operative and surgical interventions have been advocated, both treatments offer advantages and potential complications. Each case should be evaluated individually with the overall health,

activity level, and expectations of the patient carefully weighed with the potential benefits and risks of the treatment modality decided upon.

Non operative treatment remains a viable option for those choosing to avoid the risks of surgery or in those patients who are not suitable surgical candidates. Patients who undergo non-operative treatment avoid the risks associated with surgery. This includes wound problems, nerve damage, and the inherent risks of surgery in general. Numerous studies have looked at the rates of re-rupture in patients undergoing non-operative treatment. Recent studies demonstrate a re-rupture rate approximately three times that of patients treated with surgery. However, there is conflicting data on re-rupture rates when an early range of motion protocol is employed. Certain studies have shown the rate of rupture to be nearly identical when patients treated non-operatively undergo an early range of motion protocol while others have shown no benefit of early range of motion compared with cast immobilization.

Surgery for Achilles tendon ruptures can be categorized as traditional open procedures and mini-open procedures. The open traditional open repair re-approximates the ruptured tendon with direct visualization of the wound bed. The benefits of direct visualization limit the potential for iatrogenic sural nerve injury at the expense of increased wound complications. Mini-open procedures, also referred to as percutaneous repair, utilizes a small transverse incision at the level of the Achilles tendon rupture to introduce a device that allows for sutures to be passed through the ends of the tendons to re-approximate the ends of the tendons indirectly. Benefits include a smaller incision with a diminished risk of wound complications. Because there is no disruption of the paratenon, there is a theoretical benefit of less disruption to the blood supply as well as less disruption to the ability of the tendon to glide. Risks of the mini-open procedure include a higher rate of iatrogenic nerve injury, and in some studies there is a tendency towards a higher re-rupture rate compared with the traditional open repair. This is attributed to a weaker repair in the percutaneous repair compared to that of the open repair.

## **CONCLUSION**

Achilles tendon ruptures are the most commonly ruptured tendon in the lower extremity. With the propensity for the aging population to continue participating in physically demanding recreational activity, it is important to have an understanding of the pathology, treatment, and outcomes after an Achilles tendon rupture.

There is no consensus regarding the optimal treatment of acute Achilles tendon ruptures and patients need to be treated on an individual basis. The risks and benefits of operative and non-operative treatment modalities along with the expectations of the patients must be weighed before a treatment decision is made. Some patients prefer non-operative treatment with potentially higher rate of re-rupture. Other patients are willing to undergo a surgical intervention that may offer superior functional outcomes at the expense of an increased rate of wound complications.

***Written by Justin Kane, MD***  
***Reviewed by Richard Zell, MD***  
***Last reviewed July 2015***