



# RUPTURED ACHILLES TENDON, A COMMON INJURY IN ATHLETES

Bryam Esteban Coello García<sup>1</sup>, Cristhian Eduardo Guartazaca Rocano<sup>2</sup>,  
José Raúl Ugalde Ortega<sup>3</sup>, Ana Belén Valero Martillo<sup>4</sup>, Analy Alejandra Salinas Salinas<sup>5</sup>,  
Jonathan Paul Monge Patiño<sup>6</sup>, Santiago Andrés Vintimilla Pesantez<sup>7</sup>

<sup>1</sup>General Practitioner in Independent Practice, Faculty of Medical Sciences, Universidad de Cuenca.  
Azua- Ecuador. ORCID <https://orcid.org/0000-0003-2497-0274>

<sup>2</sup>General Practitioner in Independent Practice, Faculty of Medical Sciences, Universidad de Cuenca. Azua- Ecuador.  
ORCID <https://orcid.org/0000-0002-8283-3430>

<sup>3</sup>General Practitioner in "Servicios Médicos Horizonte S.A Diaverum-Melipilla, Chile. RUT 48.220.348-5  
ORCID: 0000-0002-1774-7608

<sup>4</sup>General Practitioner in "Corporación Municipal de Melipilla, Servicios De Atención Primaria De Urgencias Dr.  
Edelberto Elgueta, Chile. RUT 48.220.347-7 ORCID: 0000-0002-7123-1805

<sup>5</sup>General Practitioner in "Clínica San Pablo". Universidad de Guayaquil. Guayas. Ecuador  
ORCID: 0000-0001-8852-0518

<sup>6</sup>General Practitioner in Independent Practice, Faculty of Medical Sciences, Universidad de Cuenca.  
Azua- Ecuador. ORCID <https://orcid.org/0000-0001-6299-9583>

<sup>7</sup>General Practitioner in Independent Practice, Faculty of Medical Sciences, Universidad de Cuenca. Azua- Ecuador.  
ORCID <https://orcid.org/0000-0003-1450-6128>

Corresponding Author: Bryam Esteban Coello García

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## SUMMARY

**Introduction:** The Achilles tendon also named calcaneal tendon, can be subjected to tensile loads up to 10 times the body weight. It is located on the posterior aspect of the lower leg and is the thickest tendon. This tendon accounts for 20% of all large tendon injuries. There is discussion on which is the best treatment, among which the percutaneous repair of the Achilles tendon has risk of injuring the sural nerve. When a sharp, explosive and sudden force is exerted on the Achilles tendon, rupture or tears can occur. Most of these ruptures occur during sports; however, sometimes it happens in non-athletes or sedentary people.

**Objective:** To detail the current information related to Achilles tendon rupture and its treatment, as well as the different approach techniques.

**Methodology:** A total of 29 articles were analyzed in this review, including review and original articles, as well as clinical cases, of which 19 bibliographies were used because the other 10 articles were not relevant for this study. The sources of information were PubMed, Google Scholar and Cochrane; the terms used to search for information in Spanish and English were: achilles tendon, Achilles tendon rupture, Achilles tendon treatment.

**Results:** Achilles tendon rupture is more frequent in adults between the third and fifth decade of life. When it happens acutely they usually present sudden pain in the back of the leg accompanied by a "snapping". This pathology can be falsely diagnosed as an ankle sprain in 20% to 25%. All patients require physical and orthopedic therapy and initial treatment consists of rest, elevation, pain control and functional orthopedic appliances. The advantages of non-surgical treatment are the avoidance of hospital admissions, wound complications and the risk of anesthesia. However, its main disadvantage lies in the increased risk of re-rupture, ranging up to 40%. Return to sporting life can be initiated 9 months after surgery as long



as the patient is able to dorsiflex. Surgical treatment has a new rupture rate of 0.5% while non-surgical treatment has a rupture rate of approximately 40%.

**Conclusions:** The Achilles tendon is formed by the fusion of the gastrocnemius and soleus muscles in its distal part. The contraction of these two muscles generates a force that causes plantar flexion of the foot. The Achilles tendon is innervated essentially by the sural nerve. Signs of the affected person may include swelling, bruising and/or a noticeable alteration in the tendon. Thompson's test can be used to better assess the picture. In athletics, basketball, diving, tennis, cycling, volleyball, gymnastics and others it is common to see tendon ruptures. If the patient presents with trauma to the lower leg, it is advisable to take X-rays in order to rule out fractures. The diagnosis can be confirmed with MRI or ultrasound. Surgical approach techniques for Achilles tendon repair include open, semi-open or limited open and percutaneous repair, although regardless of the technique of choice, restoration of tendon length must be ensured. Patients with significant medical comorbidities or those with relatively sedentary lifestyles are usually recommended to opt for non-surgical therapy. Surgical treatment mitigates the risk of re-rupture compared to conservative treatment; however, complication rates are much higher, and almost all athletes can return to physical activity without any limitations.

**KEYWORDS:** Rupture, Achilles, tendon, Achilles injury, rupture.

## INTRODUCTION

Achilles tendon, initially named after the mythological and literary character Achilles, is also named calcaneal tendon. It can be subjected to tensile loads of up to 10 times the body weight. It is located on the posterior aspect of the lower leg, being the thickest tendon in humans and very resistant to tensile forces. It also converges with the gastrocnemius and soleus muscles to the calcaneus (1-3).

The Achilles tendon consists mostly of fast twitch type II fibers with great elasticity, type I collagen which gives great strength to the tendon and elastin. The Achilles tendon is surrounded by a paratenon made up of a connective tissue sheath that can stretch 2 to 3 cm with movement (1).

This tendon accounts for 20% of all large tendon injuries. There is discussion about the best treatment, among which percutaneous repair of the Achilles tendon has a risk of injuring the sural nerve (4).

When a sharp, explosive and sudden force is exerted on the Achilles tendon, partial or complete rupture or tears can occur. Most of these ruptures occur during sports; however, it sometimes happens in non-athletes or sedentary people(1).

## METHODOLOGY

A total of 29 articles were analyzed in this review, including review and original articles, as well as clinical cases, of which 19 bibliographies were used because the other 10 articles were not relevant to this study. The sources of information were PubMed, Google Scholar and Cochrane; the terms used to search for information in Spanish and English were: Achilles tendon, Achilles tendon rupture, Achilles tendon treatment.

The choice of the bibliography exposes elements related to Achilles tendon rupture in the last 5 years; in addition to this factor, these studies have several important factors related to their different treatments.

## DEVELOPMENT

The Achilles tendon is formed by the fusion of the gastrocnemius and soleus muscles in its distal part. The gastrocnemius muscle is born in the posterior part of the femur exactly in the medial and lateral condyles, presenting the medial

and lateral heads and is innervated by the tibial nerve (S1, S2). The soleus muscle arises from the posterior surface of the fibula and the medial border of the tibia and is innervated by the tibial nerve (L4, L5, S1, S2). The superficial posterior compartment of the leg is made up of these two muscles. Contraction of these two muscles generates a force that causes plantar flexion of the foot, which aids in propulsion and locomotion. Cutaneous innervation also comes from the tibial nerve. The Achilles tendon is innervated essentially by the sural nerve and to a lesser extent by branches of the tibial nerve(1).

The Achilles tendon is irrigated by the longitudinal arteries that accompany it in its extension, in addition the proximal and distal section is irrigated by the posterior tibial artery and the medial part by the peroneal artery (5). It must be remembered that the proximal part receives blood from the muscles connected to the tendon and the distal part has the tendon-bone interface(6).

The tendon becomes stiffer as people get older. Achilles tendon rupture is most common in adults between the third and fifth decades of life. When it occurs acutely, they usually present with sudden pain in the back of the leg accompanied by a "snapping" sound at the affected site. Those affected may report a kicking sensation in the lower leg. The injury causes significant pain and disability (6,7).

Signs of involvement may include swelling, bruising and/or a noticeable alteration in the tendon. Occasionally, there may be pain with intact plantar flexion in partial ruptures. The Thompson test can be used to better assess the picture, which consists of squeezing the calf which in a healthy subject produces plantar flexion, this movement may be more tenuous or be eliminated in case of rupture of the Aquilian tendon. In addition, these Achilles tendon injured individuals cannot stand on tiptoe or have very weak plantar flexion of the ankle(1,6).

Achilles tendon injuries occur more in males, in those who are not adequately warmed up and in those who are only intermittently active. This pathology can be falsely diagnosed as an ankle sprain in 20% to 25%. The condition usually occurs between the third and fifth decade, among these 10% show a history of symptoms, in addition to presenting associated risk factors such as previous intratendinous degeneration, steroid



injections, use of fluoroquinolones and inflammatory arthritis(6,8,9).

Other risk factors for tendon rupture are inadequate footwear, training, conditioning and techniques, subtalar hyperpronation, excessive forefoot or rearfoot valgus or varus, lower extremity length discrepancy, inflexibility of the triceps suralis at the muscle-tendon junction, muscle imbalance and fatigue, overweight, obesity, age, prolonged use of corticosteroids and overexertion. In athletics, basketball, diving, tennis, cycling, volleyball, gymnastics and others it is common to observe tendon ruptures. Reasons for Achilles tendon rupture include direct trauma, sudden forced plantar flexion of the foot and long-term tendinopathy or intratendinous degenerative conditions. Achilles tendon rupture is frequently located two to four centimeters above the insertion of the tendon on the calcaneal bone. In left-handed people, it is more likely to rupture the right Achilles tendon and vice versa(6,10,11).

Some systemic diseases are associated with Achilles tendon damage among which we have: infections, diabetes mellitus, chronic renal failure, gout, collagen deficiency, thyroid and parathyroid disorders, lupus and rheumatoid arthritis(6).

Studies have shown that rupture of the Achilles tendon is more common in those with blood group O. Apparently type III collagen is the main collagen manufactured after rupture. Those with a family history of this injury are also at higher risk(6).

If the patient presents with trauma to the lower leg, it is advisable to perform radiographs in order to rule out fractures. The diagnosis can be confirmed with MRI or ultrasound, in cases where there is clinical suspicion and a congruent physical examination (12).

Differential diagnosis: Achilles bursitis, ankle impingement syndrome, ankle fracture, ankle sprain, ankle osteoarthritis, peroneal calcaneal ligament injury, calf injuries, psoriatic arthritis, calcaneal fractures, exertional compartment syndrome, deep vein thrombosis, muscle sprain or tear, fascial tears, plantar tendon tear, retrocalcaneal bursitis, talofibular ligament injury, Haglund's deformity, ruptured Baker's cyst, syndesmosis and Reiter's syndrome (6).

The debate regarding the effectiveness of the treatment of choice for Achilles tendon rupture is constant, especially when we question whether healing in non-surgical management is feasible, if we consider that there is no direct contact between the injured structures, or that late or incomplete healing may lead to calf weakness or risk of a new rupture. Studies have shown good functional results and patient satisfaction with both surgical and non-surgical modalities(6,13).

Healing rates with serial casting and functional bracing are similar compared to surgical tendon anastomosis, however return to work varies and may be later in those treated medically. All those affected require physical and orthopedic therapy to strengthen the muscles and extend the range of motion of the ankle(14,15).

Initial treatment consists of rest, elevation, pain control and functional orthotics. Immobilization in this treatment lasts 6

to 8 weeks in a cast, with the ankle in plantar flexion for 4 weeks and then in neutral position for the remaining 2 to 4 weeks. The rate of recurrence of the rupture is around 12.6% compared to 3.5% for surgical treatment, which can be reduced if the time of immobilization in plaster is reduced and the implementation of early functional rehabilitation is implemented, which according to new studies represents an important axis in the treatment(6,13).

The advantages of non-surgical treatment are to avoid: hospital admission costs, wound complications and the risk of anesthesia. However, its main disadvantage lies in the increased risk of a new rupture, ranging up to 40%.

Surgical approach techniques for Achilles tendon repair include open, semi-open or limited open and percutaneous repair, although regardless of the technique of choice, restoration of tendon length must be ensured to avoid excessive elongation. This is achieved by comparing the healthy plantar tendon during surgery, in case of its absence, the dorsiflexion range of the contralateral foot should be measured. Subsequently, the paratenon that surrounds the Achilles tendon is repaired to avoid infection. The risk of superficial and deep wound complications must be considered despite the good clinical results of the open technique. Patients with significant medical comorbidities or those with relatively sedentary lifestyles are usually recommended to opt for non-surgical therapy(6,13).

One study demonstrated that surgery restores calf muscle strength with a strength difference of 10% to 18% in benefit of surgery at 18 months compared to non-surgical treatment(16).

The large number of complications following Achilles tendon repair led to the creation of new techniques, thus the limited open technique and the percutaneous technique were born; however the risk of injuring the sural nerve remains latent even with the advances in technique in recent years. Some clinical studies prove that the use of the percutaneous technique shows similar results compared to the open technique with no increase in new ruptures or wound complications(17). However, other bibliographies show a higher rate of injury associated with the percutaneous procedure compared to the open technique(6).

Percutaneous repair is performed through several incisions through which the proximal and distal ends of the tendon are knotted together resulting in the tendon being left in position during plantar flexion of the ankle. Given the limited visibility, this technique may cause injury to the sural nerve(13).

This technique can be supplemented by the use of endoscopy to allow visualization of both tendon apposition and to preserve the integrity of the sural nerve. This innovation is supported by a study in which 10% of patients with sural nerve numbness resolved in 1 month and showed that by moving the incisions directly on the lateral border of the Achilles tendon this complication disappears(17).

In order to reduce complications, the mini-open repair technique was also created, in which a smaller incision is made over the rupture site and the subcutaneous tissue is separated,



and then sutures are made to bring the proximal and distal ends of the tendon closer together by suturing with the ankle in dorsiflexion. There are several techniques for the repair of the Achilles tendon, most of them approximate the torn ends, sometimes the repair is reinforced by the plantar tendon or the gastroc soleus aponeurosis(6,13).

Limited open repair results from a combination of techniques, allowing greater visualization of the lesion and ensuring that approximation of the tendon edges is maximized

by percutaneous suturing within the paratendon. A prospective multicenter study of 187 patients treated by this technique showed results without wound complications or sural nerve compromise. Likewise, a prospective randomized study performed in 40 patients compared the open and limited open technique showing similar results in the AOFAS score also called Kitaoka scale and showed decreased skin adhesions, local sensitivity, less scar or tendon thickness in the group with limited open repair(17).

**Tabla 1.Kitaoka (AOFAS)**

<b>Kitaoka score (AOFAS)</b>	<b>Score</b>
<b>A) Pain</b>	40 points
None	40
Occasional	30
Moderate, daily	20
Severe, almost always present	0
<b>B) Function</b>	
	45 points
1. Activities	
No limitations and no external support	10
No limitations in daily life, but limitations in sport, and no external support	7
Limitations in daily recreational life (crutch needed)	4
Severe limitations even with crutch	0
2. Footwear requirements	
Any type of footwear	5
Only comfortable footwear or insole use	3
Special footwear or orthosis	0
3. Walking (maximum distance)	
More than 2 km	10
Between 1.5-2 km	7
Between 0.5-1 km	4
Less than 350m	0
4. Type of walking surface	
No difficulties on any walking surface	10
Some difficulties on uneven surfaces and stairs	5
Difficulties en on uneven surfaces and stairs	0
5. Limp	
None	10
Mild	5
Obvious	0



<b>C) Foot alignment</b>	15 points
Good: well aligned plantigrade foot	15
Average: plantigrade foot with some degree of misalignment, but asymptomatic	8
Poor: non-plantigrade foot and symptomatic	0
Total	Maximum 100

Source: Úbeda Pérez de Heredia I, Martínez de Renobales JI, García Díaz J, Otaño Aranguren FJ, Sánchez Zapirain I. Measurement of the results of functional treatment of metatarsal fractures using the AOFAS scale and the duration of work incapacity. *Rev Esp Cir Ortopédica Traumatol Engl Ed.* marzo de 2012;56(2):132-9.(18)

Postoperatively, previously, after Achilles tendon repair surgery, immobilization for 6 weeks without weight bearing was the norm until a prospective randomized study showed that the use of early weight bearing by means of plaster orthoses reduced the time to return to walking and stair climbing. A new study in 110 patients also showed that weight bearing in an ankle and foot orthosis at 2 weeks and implementation of early movement exercises mitigates the risk of new ruptures as well as improved quality of life and reduced activity limitations at 6 weeks post-surgery, although no significant statistical differences were reported at 6 months with the control group. Identical results were shown in those patients operated with percutaneous technique and who had early movement exercises after 2 weeks of surgery. The return to sporting life can begin 9 months after the intervention as long as the patient can dorsiflex the ankles with the previously injured limb(17).

Multiple randomized controlled studies show that surgical treatment mitigates the risk of re-rupture versus conservative treatment; however, complication rates are much higher. Although there is an increase in the incidence of Achilles tendon rupture, paradoxically there is a reduction in the number of surgical interventions and this is largely due to the use of functional rehabilitation, despite this, surgical treatment is preferred for athletes and also for those patients who prefer to remain active(19).

The prognosis is usually good in patients with Achilles tendon rupture, however, especially in non-athletes, they may present some residual deficits such as decreased range of motion. Almost all athletes can resume physical activity without any limitations. However, surgical treatment has a new rupture rate of 0.5% while non-surgical treatment has a rupture rate of approximately 40% (6).

## CONCLUSIONS

The Achilles tendon is formed by the fusion of the gastrocnemius and soleus muscles in its distal part. The contraction of these two muscles generates a force that causes plantar flexion of the foot. The Achilles tendon is innervated essentially by the sural nerve. Achilles tendon rupture is more frequent in adults between the third and fifth decade of life. When it happens acutely they usually present sudden pain in the back of the leg accompanied by a "snapping". Signs of the affected person may include swelling, bruising and/or a

noticeable alteration in the tendon. Thompson's test can be used to better assess the picture. This pathology can be falsely diagnosed as an ankle sprain in 20% to 25%. In athletics, basketball, diving, tennis, cycling, volleyball, gymnastics and others it is common to see tendon ruptures. If the patient presents with trauma to the lower leg, it is advisable to take X-rays in order to rule out fractures. The diagnosis can be confirmed with MRI or ultrasound. All patients require physical and orthopedic therapy and initial treatment consists of rest, elevation, pain control and functional orthopedic appliances. The advantages of non-surgical treatment are the avoidance of hospital admissions, wound complications and the risk of anesthesia. However, its main disadvantage lies in the increased risk of re-rupture, ranging up to 40%. Surgical approach techniques for Achilles tendon repair include open, semi-open or limited open and percutaneous repair, although regardless of the technique of choice, restoration of tendon length must be ensured. Patients with significant medical comorbidities or those with relatively sedentary lifestyles are usually recommended to opt for non-surgical therapy. Return to sporting life can be initiated 9 months after surgery as long as the patient is able to dorsiflex. Surgical treatment mitigates the risk of re-rupture compared to conservative treatment; however, complication rates are much higher, and almost all athletes can return to physical activity without any limitations. Surgical treatment has a new rupture rate of 0.5% while non-surgical treatment has a rupture rate of approximately 40%.

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