



Achilles Tendinopathy: Causes, Diagnosis, Treatment, and Prevention

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Introduction

Achilles tendinopathy is a common overuse injury characterized by pain, swelling, and impaired function of the Achilles tendon. It frequently affects athletes, particularly runners and individuals engaged in repetitive physical activities. This article provides an in-depth review of Achilles tendinopathy, covering its pathophysiology, risk factors, diagnostic methods, and current evidence-based treatments [1]. It also discusses preventive strategies and emerging interventions. The Achilles tendon is the largest and strongest tendon in the human body, connecting the gastrocnemius and soleus muscles to the calcaneus. It plays a crucial role in walking, running, and jumping. Despite its strength, the tendon is prone to overuse injuries, particularly in active individuals [2].

Achilles tendinopathy is a chronic condition resulting from repeated microtrauma, leading to collagen degeneration, thickening, and reduced elasticity. Unlike acute tendonitis, which involves inflammation, tendinopathy is primarily a degenerative condition [3]. The Achilles tendon, the largest and strongest tendon in the human body, plays a vital role in mobility by connecting the calf muscles (gastrocnemius and soleus) to the heel bone (calcaneus). It is essential for everyday activities such as walking, running, and jumping, as well as athletic performance. However, due to its high functional demand and relatively poor blood supply, the Achilles tendon is particularly susceptible to overuse injuries, one of the most common being Achilles tendinopathy [4]. Achilles tendinopathy is a degenerative condition characterized by pain, swelling, and impaired performance of the tendon. It typically results from repetitive stress, microtrauma, or chronic overload rather than an acute rupture or tear. This condition is frequently observed in athletes, particularly runners, but can also affect sedentary individuals, especially those with sudden increases in physical activity [5]. Additionally, biomechanical factors, footwear, and systemic conditions such as diabetes or inflammatory diseases can contribute to its onset. Diagnosing Achilles tendinopathy requires a thorough clinical evaluation, including a patient's medical history, physical examination, and, when necessary, imaging techniques such as ultrasound or magnetic resonance imaging (MRI) [6]. Accurate diagnosis is critical to differentiate it from other conditions, such as Achilles bursitis or partial tendon tears, which can present with similar symptoms. Treatment of Achilles tendinopathy ranges from conservative measures, such as physical therapy and eccentric loading exercises, to more advanced interventions, including shockwave therapy, platelet-rich plasma (PRP) injections, and, in severe or chronic cases, surgical procedures. Prevention strategies are equally important, with proper warm-up routines, gradual progression of training intensity, and appropriate footwear playing a key role in reducing the risk of recurrence [7].

Understanding the underlying causes, recognizing the symptoms early, and applying evidence-based treatments are essential for optimal recovery and long-term management [8]. This comprehensive guide will explore the causes, diagnostic methods, treatment options, and prevention strategies for Achilles tendinopathy, providing valuable insights for both healthcare professionals and individuals affected by

this condition.

Epidemiology

Achilles tendinopathy affects both recreational and elite athletes, with a prevalence rate of 6%–18% in runners. It is also common in middle-aged individuals who engage in occasional physical activity. Men are more frequently affected than women, with a male-to-female ratio of approximately 2-1.

Risk factors include-

Age- Higher incidence in individuals over 35 years.

Gender- Males are more commonly affected.

Physical activity- Runners, dancers, and athletes in high-impact sports are at greater risk.

Foot mechanics- Flat feet, overpronation, and poor biomechanics can increase strain on the tendon.

Footwear- Worn-out or improper shoes contribute to overuse injuries.

Systemic conditions- Diabetes, obesity, and inflammatory arthritis are associated with tendinopathy.

Achilles tendinopathy results from a failed healing response due to repetitive stress. The pathology involves-

Collagen disorganization- The normal parallel collagen fibers become disorganized and irregular.

Neovascularization- Increased blood vessel formation in the tendon, contributing to pain and swelling.

Matrix degradation- Excessive matrix metalloproteinase (MMP) activity leads to extracellular matrix breakdown.

Chronic inflammation- Although tendinopathy is primarily degenerative, low-grade chronic inflammation may be present.

Patients with Achilles tendinopathy often present with the following symptoms-

Pain- Gradual onset of pain along the posterior ankle, worsened

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Received: 01-Feb-2025, Manuscript No. crfa-25-163465; Editor assigned: 03-Feb-2025, Pre-QC No. crfa-25-163465 (PQ); Reviewed: 17-Feb-2025, QC No. crfa-25-163465; Revised: 21-Feb-2025, Manuscript No. crfa-25-163465 (R); Published: 26-Feb-2025, DOI: 10.4172/2329-910X.1000621

Citation: Maya P (2025) Achilles Tendinopathy: Causes, Diagnosis, Treatment, and Prevention. Clin Res Foot Ankle, 13: 621.

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by activity.

Stiffness- Morning stiffness and pain that improves with movement.

Swelling and thickening- Palpable thickening and tenderness over the Achilles tendon.

Crepitus- In some cases, a creaking sensation during movement.

Diagnosis

Accurate diagnosis involves a thorough clinical evaluation and imaging studies.

Palpation- Tenderness 2-6 cm above the calcaneus (common site of mid-portion tendinopathy).

Thompson test- Used to rule out Achilles tendon rupture.

Functional tests- Heel-raise test to assess strength and endurance.

Ultrasound (US) - Detects tendon thickening, disorganized fibers, and neovascularization.

Magnetic Resonance Imaging (MRI) - Identifies degenerative changes and distinguishes tendinopathy from tears or ruptures.

X-rays- Rarely used but can reveal calcifications or bony abnormalities.

Treatment

The management of Achilles tendinopathy involves a combination of conservative, pharmacological, and surgical approaches.

Eccentric exercises- Key component of treatment, improving tendon strength and elasticity.

Stretching and flexibility- Gastrocnemius and soleus stretch to reduce tendon strain.

Orthotics and footwear- Shoe modifications or orthotic inserts to correct foot mechanics.

Activity modification- Temporary reduction of high-impact activities.

Ice and rest- To reduce pain and inflammation in acute cases.

Non-steroidal anti-inflammatory drugs (NSAIDs)- Provide symptomatic relief but do not alter the disease process.

Corticosteroid injections- Effective for short-term relief but may weaken the tendon and increase rupture risk.

Platelet-rich plasma (PRP)- Emerging therapy aimed at promoting healing through growth factors.

Shockwave therapy- High-energy sound waves stimulate healing and reduce pain.

Ultrasound therapy- Improves circulation and tissue repair.

Laser therapy- Low-level laser reduces pain and promotes tendon healing.

Surgery is reserved for cases resistant to conservative management.

Debridement- Removal of degenerated tissue.

Tendon repair- For partial tears or severe degeneration.

Gastrocnemius recession- Lengthening the muscle-tendon unit to reduce strain.

Prevention strategies

To prevent Achilles tendinopathy, individuals should follow these recommendations-

Proper warm-up- Perform dynamic stretches before activity.

Gradual training progression- Avoid sudden increases in intensity or volume.

Footwear- Use appropriate shoes for the activity, ensuring good arch support.

Cross-training- Incorporate low-impact exercises like swimming or cycling.

Strength and flexibility- Regular strengthening and stretching exercises.

Gene therapy- Experimental studies are exploring the use of gene therapy to promote tendon regeneration.

Stem cell therapy- Early trials show potential for tendon repair through mesenchymal stem cells (MSCs).

Biologic scaffolds- Use of engineered scaffolds to promote tissue regeneration.

Conclusion

Achilles tendinopathy is a common and often chronic condition that can significantly impact physical activity and quality of life. Early diagnosis and evidence-based interventions, including eccentric loading, physical therapy, and novel biologic treatments, are key to successful management. Preventive strategies, such as proper footwear, gradual training progression, and regular stretching, are essential for reducing the risk of recurrence. Achilles tendinopathy is a complex and multifactorial condition that demands a multifaceted approach to diagnosis, treatment, and prevention. As a degenerative condition rather than a purely inflammatory one, its management requires more than just symptomatic relief—it necessitates addressing the underlying biomechanical and pathological factors.

Effective treatment strategies typically involve a combination of conservative therapies, such as eccentric exercises, manual therapy, and activity modification, which have demonstrated high success rates. More advanced interventions, such as extracorporeal shockwave therapy (ESWT) or PRP injections, may be considered for chronic or refractory cases. In rare, severe cases, surgical intervention may be necessary to remove degenerated tissue and restore tendon integrity.

Ultimately, successful management of Achilles tendinopathy requires a combination of patient education, evidence-based clinical interventions, and ongoing preventive measures. By fostering awareness of early warning signs, promoting proper conditioning techniques, and encouraging appropriate rehabilitation, individuals can reduce their risk of injury, enhance their performance, and maintain long-term tendon health.

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