

Achilles tendinopathy

Overview

- Noninsertional Achilles tendinosis typically occurs in the watershed area of the Achilles tendon, 2 to 6 cm proximal to its insertion into the calcaneus [1].
- Noninsertional Achilles disorders are classified into three main types: peritendinitis without tendinosis, peritendinitis with tendinosis, and tendinosis [1].
- Peritendinitis without tendinosis involves inflammation primarily of the paratenon and peritendinous structures [1].
- Peritendinitis with tendinosis involves inflammation of the paratenon and degenerative changes within the Achilles tendon [1].
- Tendinosis involves thickening and degenerative changes within the Achilles tendon without inflammation of the paratenon [1].
- Acute peritendinitis causes pain and swelling [1].
- Chronic tendinosis can be a relatively asymptomatic condition characterized by a bulbous nodularity that moves with passive flexion and extension of the ankle [1].
- Calcification within the tendon may ensue from chronic, degenerative tendinosis as seen on radiographs [1].
- MRI is helpful in evaluating the extent of degenerative changes, especially in preoperative planning and counseling [1].
- Surgical management is indicated for patients in whom conservative treatment of at least 6 months has failed [1].
- Surgical treatments for noninsertional Achilles tendinopathy include ventral paratenon stripping, open tendon debridement, and tendon reconstruction procedures with tendon transfers [1].
- In extensive disease, reconstruction procedures have excellent results and remain the gold standard but are accompanied by significant recovery times and potential complications [1].
- Gastrocnemius recession is becoming more popular as an alternative surgical treatment with less morbidity and good results [1].

- Endoscopic debridement of ventral paratenon adhesions has been reported to yield good results and shortened recovery [1].
- Surgically treated patients with extensive disease involving >50% of the tendon volume may be candidates for tendon transfer augmentation [1].
- Most literature supports the use of flexor hallucis longus tendon transfers for Achilles tendon reconstruction [1].
- Similar outcomes have been reported with flexor digitorum longus transfers for Achilles tendon reconstruction [1].
- Martin et al. reported decreased pain in 42 of 44 patients treated with complete excision of the diseased Achilles tendon and transfer of the flexor hallucis longus tendon [1].
- Richardson et al. demonstrated decreased hallux pressure and flexor hallucis longus weakness after a single incision flexor hallucis longus transfer [1].
- Richardson et al. noted minimal patient morbidity following single incision flexor hallucis longus transfer [1].
- No differences were noted in the 1st and 2nd metatarsal head pressures when compared with the unaffected foot in the study by Richardson et al. [1].
- Schon et al. prospectively reported results of surgical treatment in 46 patients with insertional or midsustance tendinosis [1].
- In the study by Schon et al., patients were treated with Achilles debridement and flexor hallucis longus transfer after failed conservative treatment [1].
- At 24 months after surgery in the study by Schon et al., significant improvement was recorded in visual analogue scale scores [1].
- At 24 months after surgery in the study by Schon et al., significant improvement was recorded in Short Form Health Survey physical scores [1].
- At 24 months after surgery in the study by Schon et al., significant improvement was recorded in the Ankle Osteoarthritis Scale [1].
- At 24 months after surgery in the study by Schon et al., significant improvement was recorded in the performance of a single-leg heel rise [1].

Anatomy & Pathophysiology

ANATOMY

- The Achilles tendon is the largest and most powerful tendon in the ankle [8].
- The Achilles tendon is formed from the confluence of the gastrocnemius and soleus muscles [4, 8].
- The gastrocnemius muscle attaches above the knee to the posterior aspect of the medial and lateral femoral condyles [8].

- The soleus muscle originates from the upper part of the posterior tibia, fibula, and interosseous membrane [8].
- The Achilles tendon is innervated by the tibial nerve [4].
- The Achilles tendon is the only musculotendinous unit that crosses two major joints (knee and ankle) in the body [4].
- The Achilles tendon undergoes a 90° internal rotation such that fibers from the medial gastrocnemius muscle lie posteriorly at its insertion on the calcaneus [4].
- The Achilles tendon acts as an inverter of the heel because it runs just medial to the hindfoot axis of rotation [4].
- The Achilles tendon is the major plantar flexor of the ankle joint [4].
- The Achilles tendon acts as a weak knee flexor due to the contribution of the gastrocnemius muscle insertion on the posterior femoral condyles [4].
- The Achilles tendon is surrounded by a paratenon instead of a true tendon sheath [4, 20].
- Lubrication of the Achilles tendon is aided by two bursae: one anterior (retrocalcaneal) and one posterior (superficial) to the tendon [4].
- The retrocalcaneal bursa lies between the calcaneal tuberosity and the Achilles tendon just anterior and proximal to the Achilles' insertional footprint [6].
- The superficial (pretendinous) bursa separates the Achilles tendon from the overlying skin [6].
- The sural nerve runs in the midline of the gastrocnemius-soleus muscle to the musculotendinous junction, where it crosses over to the lateral side of the tendon [4].
- The plantaris tendon courses from superolateral to inferomedial along the ventral surface of the Achilles tendon [20].
- The plantaris tendon inserts onto either the distal Achilles tendon or the calcaneal tuberosity [20].
- The normal Achilles tendon measures 4 to 7 mm in anteroposterior dimension on MRI [20].
- The average height of the Achilles tendon insertion is 19.8 mm [6].
- The average width of the Achilles tendon insertion at the proximal aspect is 23.8 mm [6].
- The average width of the Achilles tendon insertion at the distal aspect is 32.1 mm [6].

VASCULARITY & CRITICAL ZONE

- There is a zone of relative avascularity in the Achilles tendon 2 to 6 cm proximal to its insertion into the calcaneus [4, 8, 18].
- Vascularity is supplied to the tendon through the paratenon on the deep surface, muscular arterial branches within the gastrosoleus complex proximally, and small interosseous vessels at the insertion distally [8].
- The major blood supply of the tendon is through its mesotendon, with the richest supply through the anterior mesentery [18].
- With increasing age, the anterior mesenteric blood supply to the Achilles tendon becomes reduced [18].

- Abnormal vascularization of the ventral mesotenal vessels 2 to 6 cm proximal to the insertion limits blood flow to diseased tissue and decreases capacity for healing [9, 10].
- The lack of a true synovial sheath and local anatomy result in a vascular watershed region in the tendon 2 to 6 cm above the insertion on the calcaneus [4].

PATHOPHYSIOLOGY & ETIOLOGY

- Achilles tendinopathy is a degenerative condition thought to be related to overuse [5].
- Histopathology of Achilles tendinopathy typically does not show markers of inflammation within the tendon, making the term “tendinitis” a misnomer [5].
- Tendinopathy is diagnosed in 55% to 65% of Achilles tendon-related disorders [2].
- Tendon injury is thought to be caused by a failed healing process resulting in altered tendon structure, neovascularization, and nerve ingrowth [2].
- The risk for developing Achilles tendinopathy is multifactorial, related to an interaction of intrinsic and extrinsic factors that lead to tendon overloading [2].
- Lower extremity impairments that lead to abnormal kinetics and/or kinematics producing eccentric overload can result in Achilles tendon injury [2].
- Genes associated with the collagen-production pathway may functionally affect tendon strength and stiffness, leading to an abnormal tendon response during loading [2].
- Individuals with a family history of tendinopathy have five times the risk of developing Achilles tendinopathy [2].
- Noninsertional Achilles tendinopathy accounts for nearly half of all Achilles tendinopathy cases [9, 10].
- Noninsertional tendinopathy is thought to involve the response to microscopic tearing of the tendon [9, 10].
- Multifactorial etiology of noninsertional Achilles tendinopathy includes overuse, mechanical imbalance, poor tissue vascularity, genetic predisposition, and use of fluoroquinolone antibiotics [9, 10].
- Age-dependent changes in collagen crosslinking result in increased stiffness and loss of viscoelasticity, predisposing to Achilles tendon injury [18].
- Repetitive microtrauma to the hypovascular area may make it impossible for the reparative process to keep pace, leading to degenerative attrition responsible for many Achilles tendon ruptures [18].
- A theory concerning the cause of Achilles tendon rupture is the failure of inhibiting mechanisms at the musculotendinous unit as a result of fatigue, with resultant eccentric overload [18].
- The cause of Achilles tendon rupture is likely a combination of a relatively hypovascular area and repetitive microtrauma that causes an inflammatory reparative process unable to keep up with stresses due to decreased vascularity, completed by mechanical overload [18].
- Tendinosis of the Achilles tendon is most commonly due to hypoxia, which has a predisposition for the critical zone because of its relative hypovascularity [20].
- Myxoid degeneration is the second most frequent etiology of Achilles tendinosis, referring to the accumulation of mucoid vacuoles among tendon fibers which may coalesce to form interstitial tears [20].

- Less common causes of Achilles tendinosis include lipoid and ossific degeneration, describing the accumulation of fat and ossification within the tendon [20].
- Degenerative ossification of the Achilles tendon occurs proximal to its insertion, in contrast with enthesopathy which occurs at the insertion [20].
- Insertional tendinopathy may be characterized by retrocalcaneal bursitis, pretendinous bursitis, or insertional Achilles tendinopathy with or without calcification [6].
- Increased or repetitive abrasion of the tendon against a Haglund deformity creates inflammation of the retrocalcaneal bursa [6].
- With prolonged inflammation and worsening symptoms, degenerative changes occur and osteophytes form within the tendon [6].
- A superficial (pretendinous) bursitis may cause symptoms due to chronic irritation from a shoe heel counter [6].

CLASSIFICATION & CLINICAL PRESENTATION

- Achilles tendon disorders are classified by nodularity, location of pain, and the presence or absence of redness and warmth [4].
- Acute paratenonitis/tendinitis presents with no nodularity, pain over the entire tendon unaffected by ROM, and redness/warmth [4].
- Paratenonitis/tendinitis with tendinosis presents with nodularity, pain over the entire tendon unaffected by ROM, and redness/warmth [4].
- Tendinosis presents with nodularity, pain that moves with ROM, and no redness/warmth [4].
- Noninsertional tendinosis typically occurs in the watershed area of the Achilles tendon, 2 to 6 cm proximal to its insertion into the calcaneus [1].
- Noninsertional disorders occur as three main types: peritendinitis without tendinosis, peritendinitis with tendinosis, and tendinosis [1].
- Calcification within the tendon may ensue from chronic, degenerative tendinosis [1].
- Patients with noninsertional Achilles tendinopathy typically have fusiform thickening or nodularity of the tendon 4 to 6 cm proximal to the insertion and associated tenderness to palpation [5].
- A contracture of the gastrocnemius-soleus complex is often observed in patients with noninsertional Achilles tendinopathy [5].
- Patients with noninsertional Achilles tendinopathy often present with pain, swelling, and impaired performance, especially with running [9, 10].
- Insertional Achilles tendinopathy appears as pain at the bone-tendon junction [12].
- Insertional Achilles tendinopathy is common in men aged 35 to 45 years who are recreational runners, as well as elderly women and those who are overweight, sedentary, or have multiple medical comorbidities [12].
- The patient rarely gives a history of acute injury in insertional tendinopathy; rather it is a slow, insidious process of gradual enlargement and pain at the insertion [6].

- Progressive difficulty with wearing closed-back shoes and pain after a period of rest, such as when first arising in the morning, are noted in insertional tendinopathy [6].
- Pain only when wearing shoes may indicate a pretendinous bursitis [6].
- Pain when first arising in the morning is more consistent with retrocalcaneal bursitis or Achilles tendinitis [6].
- Examination often reveals a significant contracture of the gastrocnemius complex, especially with the knee in extension, in insertional tendinopathy [6].

IMAGING

- MRI is helpful in evaluating the extent of degenerative changes in Achilles tendinopathy, especially in preoperative planning and counseling [1].
- Weight-bearing ankle radiographs may demonstrate intratendinous calcification at the affected level in noninsertional Achilles tendinopathy [5].
- In insertional tendinopathy, radiographs may demonstrate an insertional osteophyte and/or Haglund deformity [5].
- MRI or ultrasonography evaluation are useful for presurgical planning and can detect the degree of tendon degeneration [5].
- MRI is valuable for evaluating the extent of diseased tendon in insertional Achilles tendinopathy and allows the success of nonsurgical treatment to be predicted [12].
- On MRI, the healthy Achilles tendon should be homogeneously hypointense in signal on all sequences [20].
- On MRI, tendinosis of the Achilles tendon manifests as abnormal thickening and altered signal within the tendon [20].
- Tendinosis is characterized by increased signal on short and long TE sequences, with the increased signal on long TE sequences being intermediate in nature and not brightening to the level of simple fluid [20].
- MRI demonstrates thickening of the tendon with intrasubstance intermediate signal intensity consistent with disorganized tissue in noninsertional Achilles tendinopathy [9, 10].
- In the setting of a chronic rupture, MRI shows a large gap between the hypoechoic tendon ends [9, 10].
- Peritendinous soft-tissue edema is best seen on axial fluid-sensitive sequences and can be seen in paratenonitis (limited to the posterior margin) and peritendinitis (surrounding the entire tendon) [20].
- Edema may extend into Kager fat pad, a finding often seen in isolation in asymptomatic individuals [20].
- In cases of retrocalcaneal bursitis, sagittal fluid-sensitive sequences best demonstrate distension of the retrocalcaneal bursa, often associated with bone marrow edema within the superior aspect of the calcaneal tuberosity [20].
- Entesophytes can be identified on MRI because of the presence of intrinsic fatty marrow which is bright on T1-weighted images [20].
- Calcifications are often difficult to detect within tendon on MRI, and correlation with radiographs should render the diagnosis of enthesopathy and calcium pyrophosphate deposition apparent [20].

Classification

- Acute paratenonitis/tendinitis is characterized by the absence of nodularity [4].
- In acute paratenonitis/tendinitis, pain is located in the entire tendon and range of motion has no effect on pain [4].
- Acute paratenonitis/tendinitis presents with redness and warmth [4].
- Paratenonitis/tendinitis with tendinosis is characterized by the presence of nodularity [4].
- In paratenonitis/tendinitis with tendinosis, pain is located in the entire tendon and range of motion has no effect on pain [4].
- Paratenonitis/tendinitis with tendinosis presents with redness and warmth [4].
- Tendinosis is characterized by the presence of nodularity [4].
- In tendinosis, pain moves with range of motion [4].
- Tendinosis presents without redness or warmth [4].
- The most clinically useful classification of Achilles tendinopathy distinguishes between insertional and noninsertional types [5].
- Insertional Achilles tendinopathy is located at the calcaneal tuberosity [5].
- Noninsertional Achilles tendinopathy is located 2 to 6 cm proximal to the insertion [5].
- Patients with noninsertional Achilles tendinopathy typically have fusiform thickening or nodularity of the tendon 4 to 6 cm proximal to the insertion [5].
- Patients with noninsertional Achilles tendinopathy have associated tenderness to palpation [5].
- A contracture of the gastrocnemius-soleus complex is often observed in Achilles tendinopathy [5].
- Weight-bearing ankle radiographs may demonstrate intratendinous calcification at the affected level in Achilles tendinopathy [5].
- In insertional tendinopathy, radiographs may demonstrate an insertional osteophyte [5].
- In insertional tendinopathy, radiographs may demonstrate a Haglund deformity [5].
- A Haglund deformity represents a prominence at the superior, posterolateral aspect of the calcaneal tuberosity [5].
- MRI or ultrasonography evaluation can detect the degree of tendon degeneration in Achilles tendinopathy [5].

Clinical Presentation

GENERAL CHARACTERISTICS

- Achilles tendinopathy is characterized by pain and dysfunction of the Achilles tendon [5].
- Histopathology of Achilles tendinopathy typically does not show markers of inflammation within the tendon [5].

- The term “tendinitis” is considered a misnomer for Achilles tendinopathy because it is a degenerative condition [5].
- Achilles tendinopathy is thought to be related to overuse [5].
- Patients present with pain at the Achilles tendon that correlates with increased activity [5].
- Examination reveals tenderness and swelling at the level of the tendinosis [5].
- Achilles tendinopathy is a common pathology in active individuals resulting from repetitive loading during recreational activities and occupational tasks [2].
- Repetitive loading in Achilles tendinopathy results in functional impairments, stiffness, and pain [2].
- Tendon injury in Achilles tendinopathy is thought to be caused by a failed healing process resulting in altered tendon structure, neovascularization, and nerve ingrowth [2].
- The risk for developing Achilles tendinopathy is likely multifactorial and related to an interaction of intrinsic and extrinsic factors that lead to tendon overloading [2].
- Lower extremity impairments that lead to abnormal kinetics and/or kinematics producing an eccentric overload can result in Achilles tendon injury [2].

NONINSERTIONAL ACHILLES TENDINOPATHY

- MRI is helpful in evaluating the extent of degenerative changes in noninsertional tendinopathy, especially in preoperative planning and counseling [1].
- Noninsertional Achilles tendinopathy may consist of inflammation of the paratenon alone, peritendinitis with a component of tendon thickening, or tendinosis alone [9].
- Noninsertional Achilles tendinopathy is thought to involve the response to microscopic tearing of the tendon [9].
- Abnormal vascularization of the ventral mesotenal vessels 2 to 6 cm proximal to the insertion limits blood flow to diseased tissue and decreases capacity for healing in noninsertional Achilles tendinopathy [9].
- Diagnosis of noninsertional Achilles tendinopathy includes a tender area of fusiform thickening localized approximately 2 to 6 cm proximal to the insertion of the tendon [9].
- In the setting of a chronic rupture associated with noninsertional tendinopathy, MRI shows a large gap between the hypoechoic tendon ends [9].

INSERTIONAL ACHILLES TENDINOPATHY

- Insertional tendinopathy may be characterized by one or a combination of conditions, including retrocalcaneal bursitis, pretendinous bursitis, or insertional Achilles tendinopathy with or without calcification [6].
- A true Haglund deformity refers to a large exostosis off the posterosuperior aspect of the calcaneal tuberosity located anterior to the Achilles tendon [6].
- Increased or repetitive abrasion of the tendon against the tuberosity creates inflammation of the retrocalcaneal bursa [6].

- With prolonged inflammation and worsening symptoms, degenerative changes occur and osteophytes form within the tendon in insertional tendinopathy [6].
- A superficial bursitis (pretendinous) separates the Achilles tendon from the overlying skin [6].
- The pretendinous bursa becomes inflamed by chronic irritation from a shoe heel counter in the presence of insertional thickening from tendinosis and calcification [6].
- The patient rarely gives a history of acute injury in insertional tendinopathy; rather it is a slow, insidious process of gradual enlargement and pain at the insertion of the Achilles tendon [6].
- Progressive difficulty with wearing closed-back shoes is noted in insertional tendinopathy [6].
- Pain after a period of rest, such as when first arising in the morning, is noted in insertional tendinopathy [6].
- Direct palpation over the retrocalcaneal bursa just anterior to the Achilles tendon, centralized over the Achilles insertion, or more superficially over the pretendinous bursa can aid in making an accurate diagnosis of insertional tendinopathy [6].
- In prolonged or severe cases of insertional tendinopathy, all aspects of insertional tendinopathy (retrocalcaneal bursitis, Achilles tendinopathy, and pretendinous bursitis) can exist concomitantly [6].
- Examination for insertional tendinopathy often reveals a significant contracture of the gastrocnemius complex, especially with the knee in extension [6].
- Radiographic evaluation for insertional tendinopathy should include a standing lateral view of the heel to evaluate for the presence of calcific spurs and the presence of a large posterosuperior process of the calcaneal tuberosity [6].
- The size of the Haglund deformity in symptomatic patients has not been statistically different from control groups [6].
- Weight-bearing ankle radiographs may demonstrate an insertional osteophyte and/or Haglund deformity in insertional tendinopathy [5].
- MRI or ultrasonography evaluation are useful for presurgical planning and can detect the degree of tendon degeneration in insertional tendinopathy [5].

CLASSIFICATION AND DIFFERENTIAL DIAGNOSIS

- Acute paratenonitis/tendinitis presents with no nodularity, pain throughout the entire tendon where range of motion has no effect, and redness and warmth [4].
- Paratenonitis/tendinitis with tendinosis presents with nodularity, pain throughout the entire tendon where range of motion has no effect, and redness and warmth [4].
- Tendinosis presents with nodularity, pain that moves with range of motion, and no redness or warmth [4].
- It is helpful to distinguish “tendinitis” from “tendinosis” in the classification of Achilles tendon disorders [8].
- Tendinitis typically refers to an acute, reversible inflammatory process with healing potential [8].
- Tendinosis refers to a chronic, irreversible process characterized by fibrous degeneration without reparative, inflammatory cells [8].

- Tendinopathy is a broad term used to describe both tendinitis and tendinosis [8].
- It is helpful to divide Achilles tendon disorders into locality (insertional and noninsertional) and acuity [8].

Investigations

- MRI is helpful in evaluating the extent of degenerative changes in noninsertional Achilles tendinopathy, especially for preoperative planning and counseling [1].
- Radiographs may demonstrate calcification within the tendon resulting from chronic, degenerative tendinosis [1].
- In cases of insertional Achilles tendinopathy, radiographs may demonstrate an insertional osteophyte and/or Haglund deformity [5].
- MRI or ultrasonography evaluation are useful for presurgical planning and can detect the degree of tendon degeneration in Achilles tendinopathy [5].
- Radiographs may show calcification at the Achilles tendon insertion or a posterosuperior calcaneal prominence in insertional Achilles tendinopathy [12].
- MRI and ultrasonography can be used to confirm an Achilles tendon rupture in cases of ambiguous physical examination findings but are not routinely necessary [11].
- MRI and ultrasonography may help localize the level of an acute Achilles rupture, identify underlying tendinosis at the site of rupture, and quantify gapping of tendon ends [11].
- The American Academy of Orthopaedic Surgeons clinical practice guideline rates the routine use of magnetic resonance imaging, ultrasound, and radiography to confirm the diagnosis of acute Achilles tendon rupture as having inconclusive evidence [19].
- The physical examination for acute Achilles tendon rupture should include two or more of the following tests: Clinical Thompson test (Simmonds squeeze test), decreased ankle plantar flexion strength, presence of a palpable gap, or increased passive ankle dorsiflexion with gentle manipulation [19].
- Thompson testing is highly sensitive (96%) and specific (93%) for a complete acute Achilles rupture [11].
- Physical examination for suspected Achilles rupture reveals decreased resting tension compared with the contralateral side, plantar flexion weakness with recruitment of toe flexors, and a palpable gap at the site of the rupture [11].
- Chronic tendinosis of the Achilles tendon is characterized by a bulbous nodularity that moves with passive flexion and extension of the ankle [1].
- Acute peritendinitis causes pain and swelling, whereas chronic tendinosis can be a relatively asymptomatic condition [1].
- Patients with noninsertional Achilles tendinopathy typically present with fusiform thickening or nodularity of the tendon 4 to 6 cm proximal to the insertion and associated tenderness to palpation [5].
- A contracture of the gastrocnemius-soleus complex is often observed in patients with Achilles tendinopathy [5].

- In acute paratenonitis/tendinitis, there is no nodularity, pain is located in the entire tendon with no effect from range of motion, and redness and warmth are present [4].
- In paratenonitis/tendinitis with tendinosis, nodularity is present, pain is located in the entire tendon with no effect from range of motion, and redness and warmth are present [4].
- In tendinosis, nodularity is present, pain moves with range of motion, and redness and warmth are absent [4].
- Axial T1-weighted MRI can show substantial degenerative changes in the anterior aspect of the Achilles tendon in chronic tendinosis [4].
- Sagittal T1-weighted MRI can demonstrate greater than 50% involvement of the tendon in chronic tendinosis [4].
- Sagittal T2 magnetic resonance imaging of insertional Achilles tendinopathy can demonstrate insertional bone marrow edema, tendon thickening, and intrasubstance hyperintense signal [5].
- Sagittal T2 magnetic resonance imaging of noninsertional Achilles tendinosis can demonstrate severe tendon thickening and intrasubstance hyperintense signal indicating partial thickness interstitial tearing [5].
- T2 sagittal magnetic resonance imaging of an Achilles rupture in the setting of noninsertional tendinosis can show rounded tendon ends indicating chronicity and severe tendon thickening at the site of rupture [11].

Treatment

NON-OPERATIVE MANAGEMENT

- Initial nonsurgical treatment for Achilles tendinopathy consists of a period of rest, activity modification, and use of heel lifts with or without immobilization in a walking boot [5].
- Physical therapy with a focus on eccentric strengthening has shown efficacy for the nonsurgical treatment of insertional and noninsertional Achilles tendinopathy [5].
- Heavy-load eccentric strengthening has demonstrated the highest success rate for nonoperative treatment of noninsertional Achilles tendinopathy [9, 10].
- Nonoperative treatment for noninsertional Achilles tendinopathy is effective in approximately 50% to 70% of cases [9, 10].
- A 2015 randomized controlled trial demonstrated that both eccentric training and heavy slow resistance training protocols result in similar improvements in pain and function [17].
- Heavy slow resistance training resulted in greater patient satisfaction at 12 weeks compared to eccentric training [17].
- The AOPT clinical practice guidelines recommend implementing mechanical loading, either as eccentric exercise or a heavy-load, slow-speed (concentric/eccentric) exercise program, to decrease pain and improve function in individuals with Achilles tendinopathy [17].

- Extracorporeal shock wave therapy can be considered for nonsurgical treatment, and some studies show benefit over eccentric physical therapy [5].
- For insertional Achilles tendinopathy, extracorporeal shockwave therapy is more beneficial than other nonsurgical treatments and can be considered before surgical treatment [12].
- Long-term use of an ankle-foot orthosis to neutralize the Achilles tendon can be considered as an alternative to surgery if other nonsurgical treatments have been ineffective [5].
- Rehabilitation programs should focus on improving lower extremity impairments that lead to abnormal kinetics and/or kinematics, including exercises to improve ankle dorsiflexion range of motion and strengthening of lower extremity and proximal stabilizers [2].
- Low-level laser therapy (LLLT) may be used as an adjunct to manual therapy and exercise to reduce inflammation and pain and improve tendon regeneration [17].
- A randomized controlled trial reported accelerated recovery compared with a placebo group when LLLT was used as an adjunct to an eccentric program for Achilles tendinopathy [17].
- Surgical management is indicated for patients with noninsertional Achilles tendinopathy in whom conservative treatment of at least 6 months has failed [1].
- Surgery for paratenonitis is considered after 3 to 6 months of unsuccessful nonsurgical treatment [24].

OPERATIVE MANAGEMENT: NONINSERTIONAL TENDINOPATHY

- In extensive disease involving more than 50% of the tendon volume, reconstruction procedures have excellent results and remain the gold standard but are accompanied by significant recovery times and potential complications [1].
- Gastrocnemius recession is becoming more popular as an alternative surgical treatment for noninsertional tendinopathy due to less morbidity and good results [1].
- For noninsertional disease with a gastrocnemius contracture, isolated gastrocnemius recession has shown good results prior to consideration of a tendon débridement [9, 10].
- Less invasive operative options for noninsertional tendinopathy include percutaneous longitudinal tenotomies in the area of degeneration and stripping of the anterior aspect of the tendon with a large suture to free adhesions [9, 10].
- For moderate to severe noninsertional disease, open excision of the degenerated tendon tissue with tubularization has had good results [9, 10].
- For more than 50% degenerative involvement of the Achilles tendon, débridement with a flexor hallucis longus (FHL) tendon transfer is recommended [9, 10].
- MRI evidence of significant involvement, defined as diffuse thickening of the tendon without a focal area of disease, indicates the need for FHL transfer [9, 10].
- Martin et al. reported decreased pain in 42 of 44 patients treated with complete excision of the diseased Achilles tendon and transfer of the FHL tendon [1].
- Richardson et al. demonstrated decreased hallux pressure and FHL weakness after a single incision FHL transfer, with minimal patient morbidity noted [1].

- No differences were noted in the 1st and 2nd metatarsal head pressures when comparing the operated foot with the unaffected foot after FHL transfer [1].
- Schon et al. reported significant improvement in visual analogue scale (VAS) scores, Short Form Health Survey (SF-36) physical scores, Ankle Osteoarthritis Scale, and single-leg heel rise performance at 24 months after Achilles debridement and FHL transfer [1].
- Postoperative care for FHL tendon transfer involves protecting the reconstruction with a boot with heel wedges that are slowly removed, allowing shoe wear around 8 weeks and gradual return to activities 3 to 4 months from surgery [23].

OPERATIVE MANAGEMENT: INSERTIONAL TENDINOPATHY

- Surgical procedures for insertional Achilles tendinopathy are indicated only after failure of conservative treatment [6].
- In early disease, treatment for retrocalcaneal bursitis by removing the Haglund deformity does not necessarily accompany tendon debridement [6].
- Recalcitrant retrocalcaneal bursitis without tendinosis can be treated with open or endoscopic calcaneal exostectomy [6].
- A dorsal closing wedge calcaneal osteotomy technique has been described to decompress tuberosity impingement in insertional tendinopathy [6].
- In later stages of insertional disease, treatment often requires tendon debridement, calcaneal exostectomy, with or without augmentation with tendon transfers [6].
- Open techniques for insertional tendinopathy require large incisions with significant wound complications and prolonged recovery [6].
- In a small series of runners treated with open procedures, 67% were able to return to the same level of sport at 8 months after an exostectomy [6].
- In a small series of runners treated with open procedures, 78% were able to return to the same level of sport at an average of 10 months after reconstruction procedures [6].
- Isolated gastrocnemius lengthening has been reported to have success in insertional and noninsertional tendinopathy, but patients exhibit continued plantarflexion weakness 18 months after this procedure when compared with controls [6].
- The central tendon-splitting approach has gained popularity for insertional Achilles tendinopathy because of its direct approach to the area of pathology [12].
- Surgical treatment for insertional Achilles tendinopathy is usually successful, although no single method or approach appears to be more beneficial than others [12].
- In a level I study of 39 patients randomized to débridement and decompression alone or with FHL transfer, no difference was found between groups at 1 year in terms of visual analog scale pain scores, American Orthopaedic Foot & Ankle Society ankle/hindfoot score, and FHL plantar flexion strength [24].
- Authors of a level I study concluded that FHL transfer may be best reserved for revision cases given the lack of difference in outcomes compared to débridement alone [24].

- In a retrospective review, FHL transfer led to significant improvement in Achilles tendon function, physical function, and pain in patients who were older than 44 years and relatively inactive at 2-year follow-up [24].
- For insertional Achilles tendinosis, the FHL tendon is woven (Pulvertaft) through the Achilles tendon and passed through a bone tunnel in the calcaneus [23].
- If complete debridement of the Achilles tendon is performed, the FHL graft should be tensioned with the ankle in moderate equinus, provided that the ankle can be brought to neutral after final suturing [23].

Complications

- Reconstruction procedures for extensive noninsertional Achilles tendinopathy are accompanied by significant recovery times and potential complications [1].
- Open surgical techniques for insertional Achilles tendinopathy require large incisions with significant wound complications and prolonged recovery [6].
- Patients treated with isolated gastrocnemius lengthening for insertional or noninsertional tendinopathy exhibit continued plantarflexion weakness 18 months after the procedure [6].
- Richardson et al. demonstrated decreased hallux pressure and FHL weakness after a single incision FHL transfer for Achilles tendinopathy [1].
- Repair of chronic Achilles ruptures has a high incidence of venous thromboembolism [7].

References

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