Achilles tendinopathy: new insights in cause of pain, diagnosis and management

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Chapter 5

Endoscopy of tendons around the ankle

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ABSTRACT

Ankle arthroscopy is increasingly used as a technique for dealing with a wide range of ankle pathologies. In contrast, extra-articular problems of the ankle still most often demand open surgery. In the recent years, endoscopic procedures for treating various tendon pathologies have been developed. Like arthroscopic surgery, tendoscopy offers the advantages related to any minimally invasive procedure such as fewer wound infections, less blood loss, smaller wounds and less morbidity. This article defines the major indications in which tendoscopy is appropriate and presents current techniques for treatment.

INTRODUCTION

In contrast to arthroscopy, which has become the preferred technique to treat intra-articular ankle pathology, extra-articular problems of the ankle have traditionally demanded open surgery. Open ankle surgery has been associated with complications such as injury to the sural nerve or superficial peroneal nerve, infection, scarring, and stiffness of the ankle joint[1,12,29]. The percentage of complications reported with open surgery for posterior ankle impingement (removal of os trigonum, scar tissue, hypertrophic posterior talar process, or ossicles) varies between 15 and 24%[1,12,29,50]. The incidence of these complications has stimulated the development of extra- articular endoscopic techniques. Endoscopic surgery offers the advantages related to any minimally invasive procedure, such as fewer wound infections, less blood loss, smaller wounds and less morbidity. Aftertreatment is functional, and surgery is performed on an outpatient basis[46].

Tendoscopy can be performed for the treatment and diagnosis of various pathologic conditions of the peroneal tendons, the posterior tibial tendon, and the Achilles tendon. In this manuscript, we describe these procedures and their indications.

1. TENDOSCOPY OF THE PERONEAL TENDONS

Introduction

Pathology of the peroneal tendons is most often seen with, and secondary to chronic lateral ankle instability. These disorders frequently cause chronic ankle pain in runners and ballet dancers[6]. Post-traumatic lateral ankle pain is seen frequently, but peroneal tendon pathology is not always recognized as a cause of these symptoms. In a study by Dombek and co-workers, only 60% of peroneal tendon disorders were accurately diagnosed at the first clinical evaluation[11]. Because the peroneal tendons act as lateral ankle stabilizers, in chronic instability of the ankle more strain is put on these tendons, resulting in hypertrophic tendinopathy, tenosynovitis, and ultimately in tendon tears[39].

Anatomically, the peroneus brevis tendon is situated dorsomedially to the peroneus longus tendon from its proximal aspect up to the fibular tip, where it is relatively flat. Just distally to this tip, the peroneus brevis tendon becomes rounder, and crosses the round peroneus longus tendon. The distal posterolateral part of the fibula forms a sliding channel for the two peroneal tendons. This malleolar groove is formed by a periosteal cushion of fibrocartilage that covers the bony groove. The tendons are held into position by the superior peroneal retinaculum[39,47,49].

Pathology of the peroneal tendons consists of tenosynovitis, tendon dislocation or subluxation, and (subtotal) rupture or snapping of one or both of the peroneal tendons. It accounts for the majority of symptoms at the posterolateral aspect of the ankle[37, 40]. Other causes of posterolateral ankle pain are rheumatoid synovitis, bony spurs, calcifications or ossicles, pathology to the posterior talofibular ligament (PTFL), or disorders of the posterior compartment of the subtalar joint. Posterior ankle impingement can present as posterolateral ankle pain. On clinical examination, there is recognizable tenderness over the tendons on palpation. Swelling, tendon dislocation and signs of tenosynovitis can be found.

The diagnosis of peroneal tendon pathology can be difficult in a patient with lateral ankle pain. A detailed history should include the presence of associated conditions such as rheumatoid arthritis, psoriasis, hyperparathyroidism, diabetic neuropathy, calcaneal fracture, fluoroquinolone use, and local steroid injections. These can all increase the prevalence of peroneal tendon dysfunction[13]. A diagnostic differentiation must be made with fatigue fractures or fractures of the fibula, posterior impingement of the ankle, and lesions of the lateral ligament complex.

Additional investigations such as MRI and ultrasonography may be helpful in confirming the diagnosis in (partial) tears of the tendon of peroneus brevis or longus[54]. Post-traumatic or post-surgical adhesions and irregularities of the posterior aspect of the fibula (peroneal groove) can also be responsible for symptoms in this region.

The primary indication of treating pathology of the peroneal tendons is pain. Conservative management should be attempted first. This includes activity modification, footwear changes, temporary immobilization, and corticosteroid injections. Also, lateral heel wedges can take the strain off the peroneal tendons which may allow healing. Failure of these conservative measures may be an indication for surgery. We therefore developed a safe and reliable endoscopic technique which we describe in detail here[39,47].

Surgical technique

The patient is placed in the lateral decubitus position, with the operative side up. Before anaesthesia is administered, the patient is asked to actively evert the affected foot. In this way, the tendon can be palpated, and the location of the portals is drawn onto the skin. The surgery can be performed under local, regional, epidural or general anaesthesia. A support is placed under the affected leg making it possible to move the ankle freely. After exsanguination a tourniquet is inflated around the thigh of the affected leg.

A distal portal is made first, 2-2.5 cm distal to the posterior edge of the lateral malleolus. An incision is made through the skin, and the tendon sheath is penetrated with an arthroscopic shaft with a blunt trocar. After this, a 2.7 mm 30° arthroscope is introduced.

The inspection starts approximately 6 cm proximal from the posterior tip of the fibula, where a thin membrane splints the tendon compartment into two separate tendon chambers. More distally, the tendons lie in one compartment. A second portal is made 2-2.5 cm proximal to the posterior edge of the lateral malleolus under direct vision by placing a spinal needle,

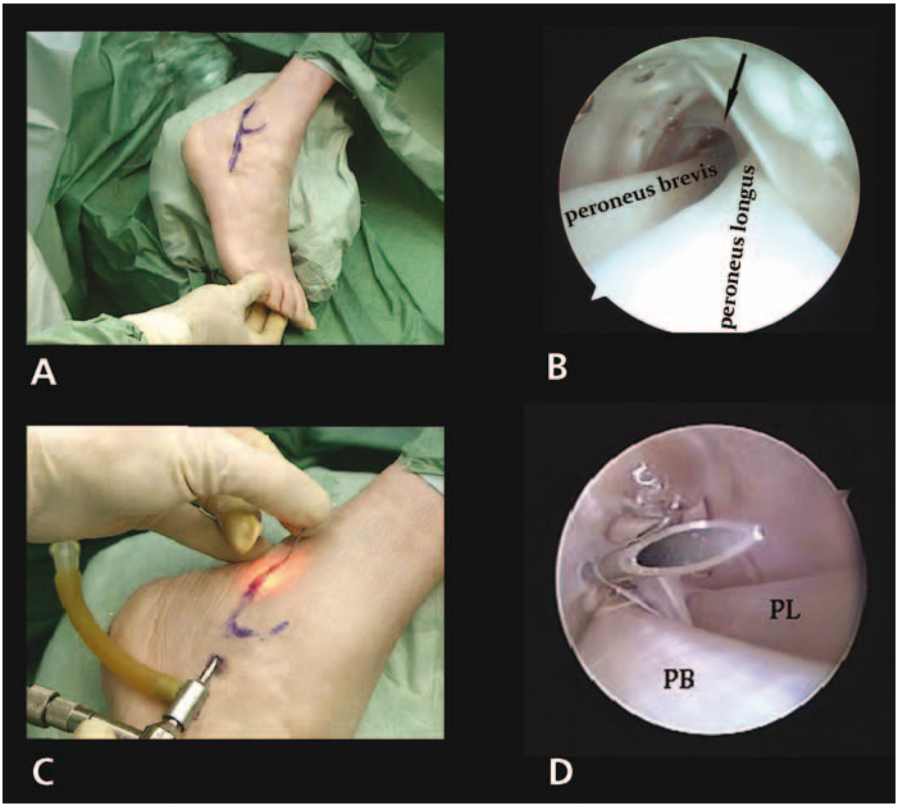

Figure 1. Peroneal tendoscopy of the right ankle: **(A)** marking the anatomy of the peroneal tendons. **(B)** Arthroscopic view at introduction of the arthroscope looking from distal to proximal. An arrow indicates a thin membrane separating the two tendons proximally. **(C)** Placement of spinal needle under direct vision for preparation of the second portal. **(D)** Endoscopic view of needle inside the tendon sheath. (PB= peroneus brevis, PL= peroneus longus)

producing a portal directly over the tendons (Figure 1). Through the distal portal, a complete overview of both tendons can be obtained.

By rotating the arthroscope over and in between both tendons, the whole compartment can be inspected. When a total synovectomy of the tendon sheath is to be performed, it is advisable to produce a third portal more distal or more proximal than the portals described previously.

When a rupture of one of the tendons is seen (Figure 2), endoscopic synovectomy is performed, and the rupture is repaired through a mini-open approach.

In patients with recurrent dislocation of the peroneal tendon, endoscopic fibular groove deepening can be performed through this approach. This is a time consuming procedure, because of the limited working area. Groove deepening is performed from within the

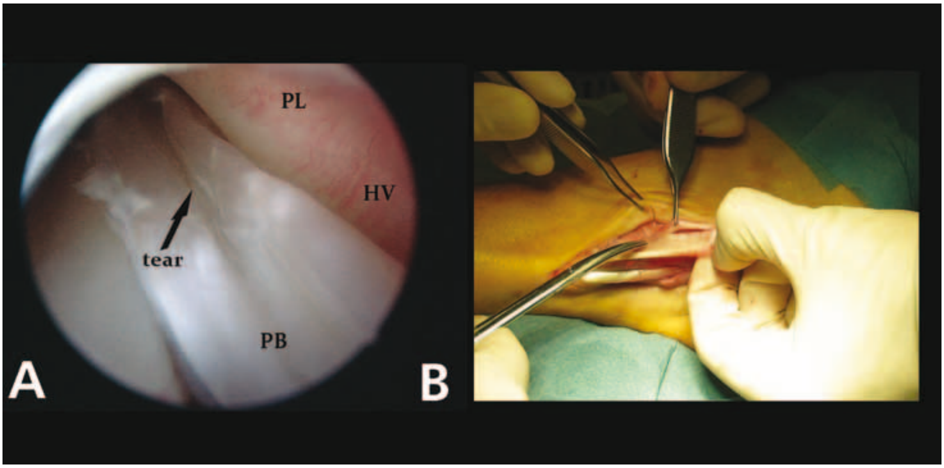

Figure 2. Peroneal tendoscopy in a 39-year-old male patient with a longitudinal tear of the right peroneus brevis tendon. The arthroscope is introduced through the distal portal looking into a proximal direction. Hypervascularisation (HV) of the peroneus brevis tendon as an expression of chronic irritation. (PB= peroneus brevis tendon, PL= peroneus longus tendon. The arrow indicates the tear.)

tendon sheath with the risk of iatrogenic damage to the tendons. We therefore prefer an approach by the 2 hindfoot portal technique[47,50].

At the end of the procedure, the portals are sutured to prevent sinus formation, and a compressive dressing is applied. Full weight bearing is allowed as tolerated and active range of motion exercises are advised starting immediately post surgery.

Results

We reported the results of peroneal tendoscopy in 23 patients operated on between 1995 and 2000, with a minimum follow up of 2 years[47]. Eleven patients were diagnosed with a longitudinal rupture of the peroneus brevis tendon; 8 of these presented with pain and swelling over the posterior aspect of the lateral malleolus and 3 presented with a snapping sensation at the level of the lateral malleolus.

Ten patients had persisting symptoms after surgery for a fracture of the fibula, lateral ankle ligament reconstruction, or after operative repair of recurrent tendon dislocation. Surgery consisted of endoscopic tenosynovectomy, adhesiolysis, removal of an exostosis, and suturing a longitudinal rupture via a mini-open procedure. The two remaining patients underwent endoscopic groove deepening of the fibular groove for complaints of recurrent tendon dislocation.

No complications occurred, and complaints disappeared after surgery. Since then, we performed another 28 procedures mainly for adhesiolysis, and diagnosis and management of longitudinal ruptures. For recurrent peroneal tendon dislocation we treated another 12 patients by means of endoscopic groove deepening with good results at one year follow-up.

The technique uses the 2 traditional hindfoot portals and one additional superoposterolateral working portal[50,10].

Lui and co-workers[21] described an endoscopic technique to reconstruct the superior peroneal retinaculum keeping the peroneal tendons in place when intact. In addition to the two portals described earlier, retinacular openings are made slightly larger than the skin openings of the portals. The lateral surface of the lateral malleolus where the retinaculum is stripped off is roughened with an arthroscopic burr or curette. Three holes are drilled through the portals with an interval of 1 cm, and three suture anchors are inserted into the fibular ridge. A needle is inserted through the portal and the retinaculum pierced in an "inside-out" manner. The sutures are pulled out and then retrieved at the surface of the retinaculum through the skin wounds. When the sutures are tightened the retinaculum can be pushed onto the fibular ridge. The authors describe 2 cases with good outcome, and a possible great advantage could be that patients with endoscopic reconstruction seem to have less subjective tightness as compared to those undergoing open procedures.

2. TENDOSCOPY OF THE POSTERIOR TIBIAL TENDON

Introduction

In the absence of intra-articular ankle pathology, posteromedial ankle pain is most often caused by disorders of the posterior tibial tendon.

Inactivity of the posterior tibial tendon gives midtarsal instability and is the commonest cause of adult onset flatfoot deformity. The relative strength of this tendon is more than twice that of its primary antagonist, the peroneus brevis tendon. Without the activity of the posterior tibial tendon, there is no stability at the midtarsal joint, and the forward propulsive force of the gastrocnemius/soleus complex acts at the midfoot instead of at the midtarsal heads. Total dysfunction eventually leads to a flatfoot deformity.

These disorders can be divided in two groups: the younger group of patients with dysfunction of the tendon, caused by some form of systemic inflammatory disease (e.g. rheumatoid arthritis); and an older group of patients whose tendon dysfunction is mostly caused by chronic overuse[32].

Following trauma, surgery, and fractures, adhesions and irregularity of the posterior aspect of the tibia can be responsible for symptoms in this region. Also, the vincula can become symptomatic in these circumstances[7,48]. The vincula connect the posterior tibial tendon to its tendon sheath[49]. Damage to the vincula can cause thickening, shortening and scarring of the distal free edge. In these patients, a painful local thickening can be palpated posterior and just proximal of the tip of the medial malleolus.

Mostly a dysfunctioning posterior tibial tendon evolves in a painful tenosynovitis. Tenosynovitis is also a common extra-articular manifestation of rheumatoid arthritis, where hindfoot problems are a significant cause of disability. Tenosynovitis in rheumatoid patients eventually leads to a ruptured tendon[30].

Although the precise aetiology is unknown, the condition is classified on the basis of clinical and radiographic findings. In the early stage of dysfunction, patients complain of persisting ankle pain medially along the course of the tendon, in addition to fatigue and aching on the plantar medial aspect of the ankle. When a tenosynovitis is present, swelling is common. On clinical examination, valgus angulation of the hindfoot is frequently seen, with accompanying abduction of the forefoot, the "too-many-toes" sign[45]. This sign is positive when inspecting the patient's foot from behind: in case of significant forefoot abduction, 3 or more toes are visible lateral to the calcaneus, where normally only 1 or 2 toes are seen.

Intra-articular lesions such as a posteromedial impingement syndrome, subtalar pathology, calcifications in the dorsal capsule of the ankle joint, loose bodies or osteochondral defects should be excluded. Entrapment of the posterior tibial nerve in the tarsal canal is commonly known as a tarsal tunnel syndrome. Clinical examination is normally sufficient to adequately differentiate these disorders from an isolated posterior tibia tendon disorder.

For additional investigation, magnetic resonance imaging (MRI) is the best method to assess a tendon rupture[18]. Also, ultrasound imaging is known as a cost-effective and accurate to evaluate disorders of the tendon[31].

Initially, conservative management is indicated, with rest, combined with nonsteroidal anti-inflammatory drugs (NSAIDS), and immobilization using a plaster cast or tape. There is no consensus whether to use corticosteroid injections; some cases of tendon rupture following corticosteroid injections have recently been described[36].

After failure of 3-6 months of conservative management, surgery can be indicated[22]. This can be performed open or endoscopically. An open synovectomy is performed by sharp dissection of the inflamed synovium, while preserving blood supply to the tendon. Post-operative management consists of plaster cast immobilization for 3 weeks with the possible disadvantage of new formation of adhesions, followed by wearing a functional brace with controlled ankle movement for another 3 weeks, and physical therapy[5].

Endoscopic synovectomy is our surgical modality of choice when access allows radical removal of inflamed synovium[35]. Several studies have been described previously in which endoscopic synovectomy was successfully performed, offering the advantages that are related to minimally invasive surgery[47,48,49].

Surgical technique

The procedure can be performed on an outpatient basis under local, regional or general anaesthesia. Patients are placed in the supine position. A tourniquet is placed around the upper leg. Before anaesthesia, the patient is asked to actively invert the foot, so that the posterior tibial tendon can be palpated and the portals can be marked. Access to the tendon can be obtained anywhere along the course of it.

We prefer to make the two main portals directly over the tendon 2-3 cm distal and 2-3 cm proximal to the posterior edge of the medial malleolus. The distal portal is made first: the incision is made through the skin, and the tendon sheath is penetrated by the arthroscopic shaft with a blunt trocar. A 2.7 mm 30° arthroscope is introduced, and the tendon sheath is filled with saline Irrigation is performed using gravity flow.

Under direct vision, the proximal portal is made by introducing a spinal needle, and subsequently an incision is made into the tendon sheath (Figure 3). Instruments as a retrograde knife, a shaver system, blunt probes, and scissors can be used. For synovectomy in patients with rheumatoid arthritis, a 3.5 mm shaver can be used. The complete tendon sheath can be inspected by rotating the arthroscope around the tendon.

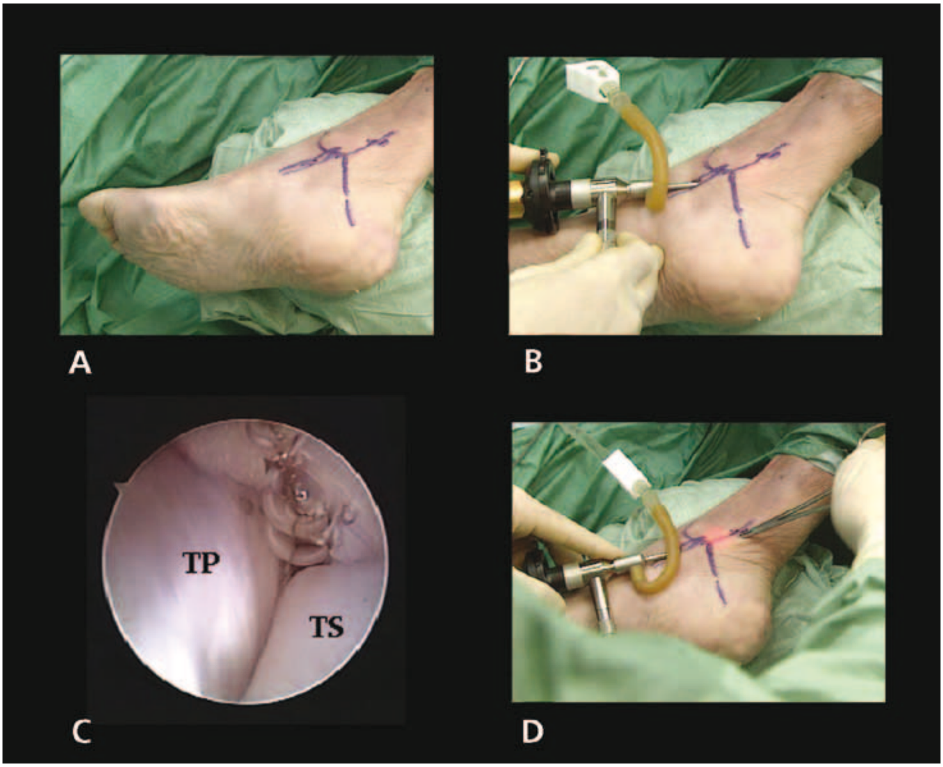

Figure 3. (A) Marked anatomy of posterior tibial tendon of the right foot. **(B)** Introduction of a 2.7mm 30° arthroscope. **(C)** Endoscopic view of the posterior tibial tendon at introduction of the arthroscope. **(D)** Blunt dissection with mosquito clamp under direct vision creating a second proximal portal

Synovectomy can be performed with a complete overview of the tendon from the distal portal, over the insertion of the navicular bone to approximately 6 cm above the tip of the medial malleolus.

Special attention should be given to inspecting the tendon sheath, the posterior aspect of the medial malleolar surface, and the posterior ankle joint capsule. The tendon sheath between the posterior tibial tendon and the flexor digitorum longus is relatively thin: inspection of the correct tendon should always be checked. This can be accomplished by passively flexing and extending the toes; if the tendon sheath of the flexor digitorum longus tendon is entered, the tendon will move up and down.

When remaining in the posterior tibial tendon sheath, the neurovascular bundle is not in danger.

When a rupture of the posterior tibial tendon is seen (Figure 4), endoscopic synovectomy is performed and the rupture is repaired through a mini-open approach. The advantage to start this procedure endoscopically over the standard open procedure is that localization of the problem is made easier by exploration of the endoscopically magnified tendon, and consequently the size of the incision for repair of the rupture can be minimized.

At the end of the procedure, the portals are sutured to prevent sinus formation.

Post-operative management consists of a pressure bandage and partial weight-bearing for 2-3 days. Active range of motion exercises are encouraged from the first day.

Results

In 1997, the senior author first described tendoscopy of the posterior tibial tendon to manage pathology of this tendon in an anatomic study[48]. From 1994 to 1997, 16 procedures were performed on 16 patients with a mean follow up of 1.1 years[7]. All had a history of

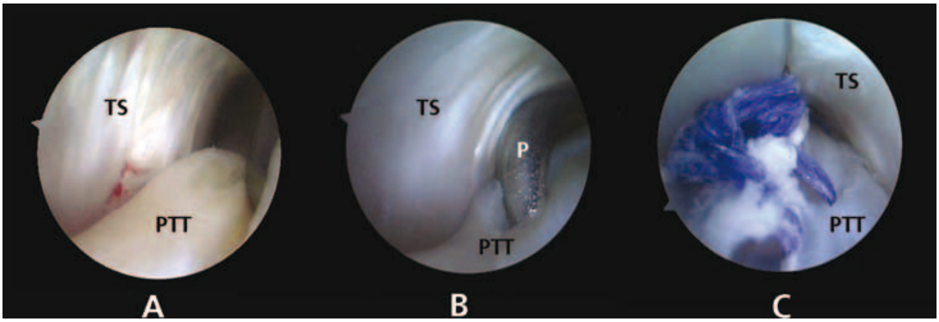

Figure 4. Posterior tibial tendoscopy of the right foot in a 46- year- old female patient with pain over the posterior tibial tendon. The arthroscope is in the anterolateral portal looking proximally. **(A)** Superficial tear of the posterior tibial tendon (asterisk). **(B)** Rupture demonstrated with the arthroscopic probe. **(C)** Repair of the rupture through a mini open repair. (P= probe; PTT= posterior tibial tendon; TS= tendon sheath)

persistent posteromedial ankle pain for at least 6 months, with pain on palpation of the posterior tibial tendon, positive resistance test results, and often local swelling. Five patients underwent a diagnostic procedure after surgery, in 5 a diagnostic procedure after a fracture was performed, a diagnostic procedure after trauma in 1, chronic tenosynovitis in 2, screw removal from the medial malleolus in 1, and posterior ankle arthrotomy in 2 patients. No complications were observed.

Between 1997 and 2004, we described 19 procedures in 17 patients[7]. Ten endoscopic synovectomies were performed in 8 patients who had chronic tenosynovitis due to rheumatoid arthritis. All had a history of persistent posteromedial ankle pain, with pain on palpation of the posterior tibial tendon, positive resistance test results, and local swelling. All patients were first managed conservatively, and experienced temporary pain relief. All 8 patients were diagnosed with synovitis without a tendon rupture by MRI or ultrasound. In 3 of these 8 patients, the endoscopy was combined with an arthroscopic synovectomy of the ankle or a hallux valgus correction. In the other nine patients, tendoscopy of the posterior tibial tendon was performed for miscellaneous reasons. Patients were allowed full weight bearing after the operation, except for the patient who had hallux valgus correction. All were able to actively move the ankle post-operatively.

Johnson and Strom classified tenosynovitis of the posterior tibial tendon into three stages[14]: stage one tenosynovitis, where the tendon length is normal; stage two, elongated tendon with mobile hindfoot deformity; and stage three, elongated tendon with fixed hindfoot deformity. Myerson modified the classification by adding stage four: a valgus angulation of the talus and early degeneration of the ankle joint[32]. Chow[8] reported a case series of 6 patients with posterior tibial tendon synovitis who underwent an endoscopic synovectomy for stage 1 posterior tibial tendon insufficiency. All patients reported good results.

Lui and co-workers[22] described an endoscopic assisted posterior tibial tendon reconstruction for stage 2 posterior tibial tendon insufficiency, when the posterior tibial tendon has become permanently elongated but the flatfoot deformity still is flexible. The endoscopic technique used is similar to the one described above. Additionally, a portal is made close to the insertion of the anterior tibial tendon, of which the medial half is cut and stripped to the insertion with a tendon stripper. The tendon is then retrieved through the distal portal, and the graft is transferred to the posterior tibial tendon. The construction is augmented by side-to-side anastomosis with the flexor digitorum longus tendon, which is supplemented by a subtalar arthroereisis with a bioabsorbable implant. Thus far only one case was described, with a good clinical outcome.

3. ACHILLES TENDOSCOPY

Introduction

Pathology of the Achilles tendon can be divided into non-insertional and insertional problems[9,38]. The first type can present as local degeneration of the tendon that can be combined with paratendinopathy. Insertional problems are related to abnormalities at the insertion of the Achilles tendon, including the posterior aspect of the calcaneus and the retrocalcaneal bursa. This chapter will describe the management of non-insertional tendinopathy. These can be divided into three entities: tendinopathy, paratendinopathy, and a combination of both. General symptoms include painful swelling typically 2-7 cm proximal to the insertion, and stiffness especially when getting up after a period of rest.

Patients with tendinopathy can present with three patterns: diffuse thickening of the tendon, local degeneration of the tendon which is mechanically intact, or insufficiency of the tendon with a partial tear. In paratendinopathy, there is local thickening of the paratenon. Clinically, a differentiation between tendinopathy and paratendinopathy can be made. Maffulli and co-workers describe the Royal London Hospital test, which is found to be positive in patients with isolated tendinopathy of the main body of the tendon: the portion of the tendon originally found to be tender on palpation shows little or no pain with the ankle in maximum dorsiflexion[24,26]. In paratendinopathy, the area of swelling does not move with dorsiflexion and plantarflexion of the ankle, where it does in tendinopathy[26,42,53]. Paratendinopathy can be acute or chronic.

Differential diagnoses include pathology of the tendons of the peroneus longus and brevis, intra-articular pathology of the ankle joint and subtalar joint, degenerative changes of the posterior tibial tendon, and tendinopathy of the flexor hallucis longus muscle must be ruled out. MRI and ultrasound can be used to differentiate between the various forms of tendinopathy[17].

We normally initiate conservative management first. Modification of the activity level of the patient is advised together with avoidance of strenuous activities in case of paratendinopathy. Shoe modifications and inlays can be given. Physical therapy includes an extensive eccentric exercise program, which can be combined with icing and NSAIDs[27,33,34,41]. Shockwave treatment, a night splint, and cast immobilization are alternative conservative methods. Sclerosing injections of neovascularisation and accompanying nerves around the Achilles tendon have initially shown promising results. This treatment is based on the theory that neovascularisation is seen in the vast majority of patients with Achilles tendinopathy but not in pain free normal tendons[2-4,20].

If these conservative measures fail, surgery must be considered. The percentage of patients requiring surgery is around 25%[19,23,26]. The technique used for operative management of tendinopathy depends on the stage of the disease. Local degeneration and thickening are usually treated by excision and curettage. An insufficient Achilles tendon due to extensive degeneration can be reconstructed. Isolated paratendinopathy can be treated by excision of the diseased paratenon.

Open surgery has a guarded prognosis, and is associated with a higher risk of complications than endoscopy [1,12,29]. Open techniques are also associated with an extensive rehabilitation period of 4-12 months. Therefore, recently minimally invasive techniques were developed. Percutaneous needling of the tendon has been described, but until now no results have been published. Testa and co-workers described a minimally invasive technique consisting of percutaneous longitudinal tenotomies[25,44], which was later optimized by adding ultrasound control. Eighty-three percent of patients reported symptomatic benefit at the time of their best outcome; however, the median time to return to sports was 6.5 months[43].

In combined tendinopathy and paratendinopathy, the question is whether both pathologies contribute to the complaints. An anatomic cadaver study described degenerative changes of the Achilles tendon in as much as 34% of subjects with no complaints[15]. Khan and co-workers only found abnormal morphology in 65% (37 of 57) of symptomatic tendons, but also in 32% (9 of 28) of asymptomatic Achilles tendons assessed by ultrasound[16]. Therefore, it is questionable whether degeneration of the tendon itself is the main cause of the pain. The authors therefore focus mainly on management of the paratendinopathy leaving the tendinopathy untouched. The current approach is an endoscopic release or resection of the plantaris tendon at the level of the nodule and removal of the local paratendinopathy tissue at the level of the painful nodule.

Surgical technique

Local, epidural, spinal and general anaesthesia can be used for this procedure, which can be performed on an outpatient basis. The patient is in prone position. A tourniquet is placed around the thigh of the affected leg, and a bolster is placed under the foot. Because the surgeon needs to be able to obtain full plantar and dorsiflexion, the foot is placed right over the end of the table (Figure 5).

The authors mostly use a 2.7 mm arthroscope for endoscopy of a combined tendinopathy and paratendinopathy. This small- diameter short arthroscope yields an excellent picture comparable to the standard 4 mm arthroscope; however, it cannot deliver the same amount of irrigation fluid per time as the 4 mm sheath. This is important in procedures in which a large diameter shaver is used (e.g. in endoscopic calcaneoplasty). When a 4 mm arthroscope is used, gravity inflow of irrigation fluid is usually sufficient. A pressurized bag or pump device sometimes is used with the 2.7 mm arthroscope.

The distal portal is located on the lateral border of the Achilles tendon, 2-3 cm distal to the pathologic nodule. The proximal portal is located medial to the border of the Achilles tendon,

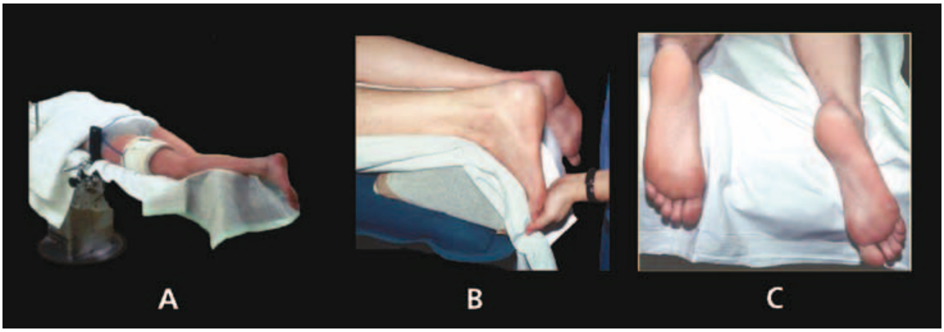

Figure 5. Positioning of a patient for endoscopy of the left Achilles tendon. **(A)** The patient is placed prone. **(B, C)** The affected leg is placed on a bolster and right over the end of the table. **(C)** The other foot is positioned so that the surgeon has sufficient working area

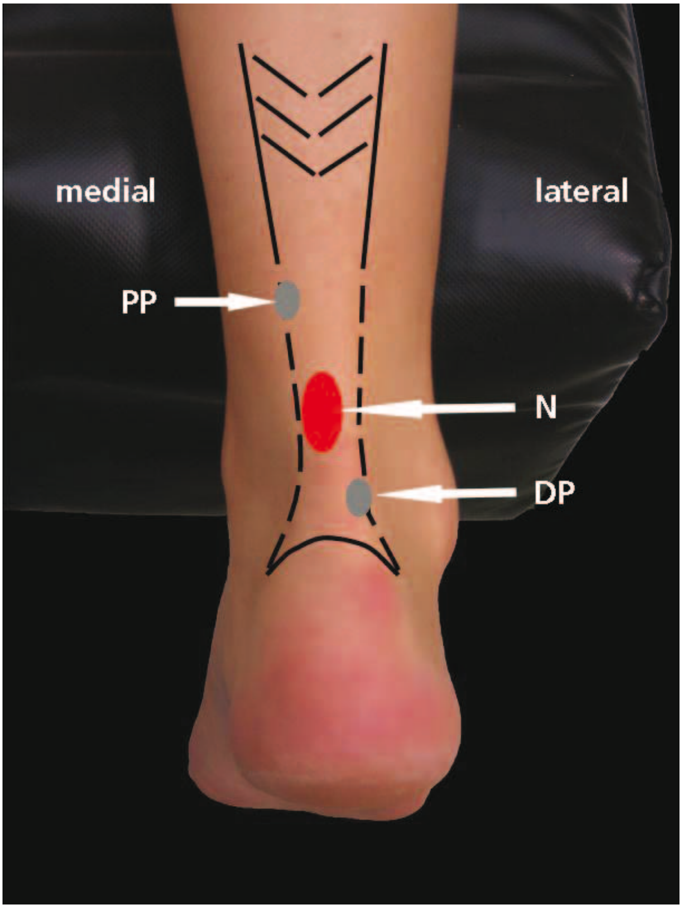

Figure 6. Posterior aspect of the right foot and ankle. Anatomy and portals for Achilles tendosopy are marked. (DP= distal portal, N= nodule, PP= proximal portal)

2-4 cm above the nodule. When the portals are placed this way, it is usually possible to visualize and work around the complete surface of the tendon, over a length of approximately 10 cm (Figure 6).

The distal portal is made first. After making the skin incision, the mosquito clamp is introduced, followed by the blunt 2.7 mm trocar in a craniomedial direction. With this blunt trocar the paratenon is approached, and is blindly released from the tendon by moving around it. Subsequently, the 2.7 mm 30° arthroscope is introduced. To minimize the risk of iatrogenic damage, the arthroscope should be kept on the tendon. At this moment, it can be confirmed whether the surgeon is in the right layer between the deepest layer of the paratenon and Achilles tendon. If not, now it can be identified and a further release can be performed (Figure 7A-C).

The proximal portal is made by introducing a spinal needle, followed by a mosquito clamp and probe. The plantaris tendon can be identified at the anteromedial border of the Achilles tendon (Figure 7D). In a typical case of local paratendinopathy, the plantaris tendon, the Achilles tendon, and the paratenon are tight together in the process. Removal of the local

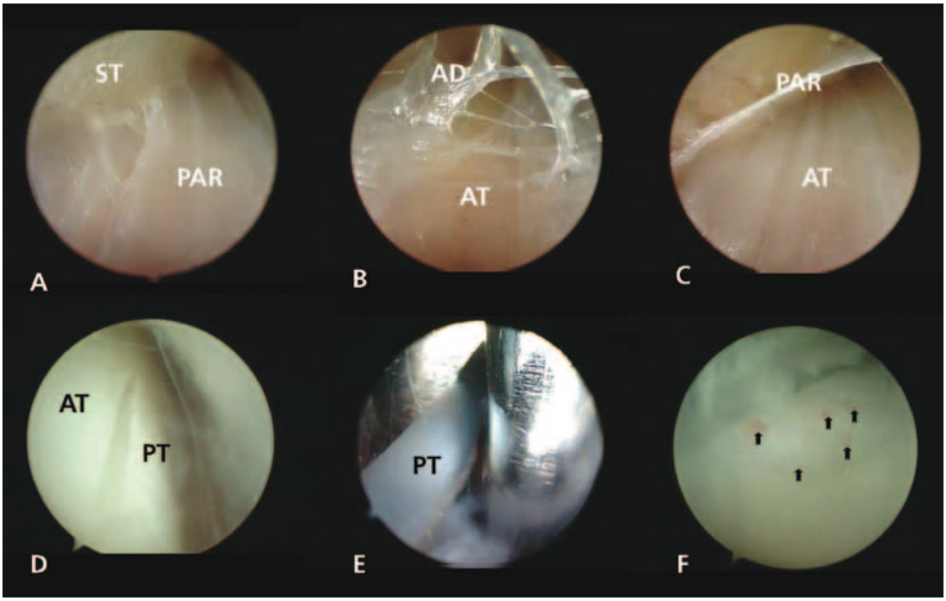

Figure 7. Tendoscopy of the left Achilles tendon in a 52- year old female patient with combined tendinopathy and paratendinopathy. The 2.7 mm arthroscope is introduced through the distal portal looking proximally. **(A)** Adhesions of the paratenon (PAR) to the subcutaneous tissue (ST) overlying the Achilles tendon. **(B)** Removal of adhesions (AD) of the paratenon to the Achilles tendon (AT), looking from distal to proximal. **(C)** Paratenon released from the Achilles tendon. **(D)** Plantaris tendon (PT) running medial to the Achilles tendon (AT). **(E)** Release of the plantaris tendon. **(F)** Neovascularisation (arrows) before removal by bonecutter shaver

thickened paratenon on the anteromedial side of the Achilles tendon at the level of the nodule, and release of the plantaris tendon which is often involved in the process (Figure 7E) are the goals of this procedure. In cases where the fibrotic paratenon is firmly attached to the lateral or posterior border of the tendon, a release in these areas is performed. Neovessels (Figure 7F) accompanied by small nerve fibres can be found in this area and are removed with a 2.7 mm full radius resector.

Changing portals can be helpful. At the end of the procedure it must be possible to move the arthroscope over the complete symptomatic area of the Achilles tendon. After the procedure, the portals are sutured.

Aftercare consists of a compressive dressing for 2-3 days. Patients are encouraged to actively perform range of motion exercises. Full weight-bearing is allowed as tolerated. Initially, the foot must be elevated when not walking.

Results

The senior author earlier described the results of 20 patients treated with an endoscopic release for non-insertional tendinopathy combined with a paratendinopathy[42]. All patients had had complaints for more than 2 years, and underwent conservative treatment for their complaints before the indication for surgery was set. The results were analyzed with a follow up of 2-7 years with a mean of 6 years. Sixteen patients were assessed at follow up, which included completing of subjective outcome scores. The Foot and Ankle Outcome Score (FAOS) and the Short Form general health survey with 36 questions (SF-36) were utilized. There were no complications. Most patients were able to resume their sporting activities after 4 to 8 weeks. All patients had significant pain relief. The results of the subjective outcome scores used were comparable to a cohort of people without Achilles tendon complaints.

Maquirriain and co-workers reported the outcome of 7 patients who underwent an endoscopic release for chronic Achilles tendinopathy, with similar results. The mean score of this group improved from 39 preoperatively to 89 post-operatively (on a scale of 0-100), and there were no complications[28]. Most recently, Vega and co-workers published a modified endoscopic technique for the treatment of Achilles tendinopathy[51]. Pathological tissue was endoscopically removed, and multiple longitudinal tenotomies were performed using a retrograde knife blade. They reported a series of 8 patients with an excellent outcome, return to their previous sports activities and no complications.

Patellar tendinopathy has a histological picture similar to that of Achilles tendinopathy. Recently, Wilberg and co-workers have developed an arthroscopic technique for patellar tendinopathy[53]. Part of their technique is comparable to Achilles tendoscopy; the main goal is to shave the area with neovessels and accompanying nerves on the posterior aspect of the patellar tendon, whereas this is one of the goals for endoscopic management of Achilles tendinopathy. A pilot study showed good clinical results in 13/15 tendons (6/8 elite athletes); all satisfied patients were back to their previous sport activity level.

CONCLUSIONS

The results of endoscopic surgery of tendons around the ankle seem promising. More experience must be acquired by different orthopaedic surgeons. Also, accurately designed studies need to be performed, to optimize techniques and ultimately be able to offer patients these minimally invasive treatments with its great advantages.

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