# Using Arthroscopic Techniques for Achilles Pathology

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**KEYWORDS**

• Arthroscopic • Achilles • Chronic Achilles rupture • Tendinopathy

**KEY POINTS**

- Endoscopically assisted procedures have been established to provide the surgeon with minimally invasive techniques to address common Achilles conditions.
- Modifications to some of these techniques as well as improvements in instrumentation have allowed these procedures to provide similar clinical results to the traditional open surgeries while reducing wound complications and accelerating patient's recoveries.
- The available literature on these techniques reports consistently good outcomes with few complications, making them appealing for surgeons to adopt.

## INTRODUCTION

Endoscopic procedures around the foot and ankle provide the surgeon with the techniques to treat a variety of pathology with a minimally invasive approach. These less-invasive approaches can diminish scar tissue and result in less perioperative pain, fewer wound complications, and quicker recovery.

Special focus has been placed on the Achilles tendon complex, where these techniques have been used to address acute and chronic ruptures, equinus contractures, and both insertional and noninsertional tendinopathies. Although high-level evidence-based literature for Achilles tendoscopy is somewhat lacking, the literature available does report consistently good outcomes with few complications, making them appealing for surgeons to adopt.

## ANATOMY

Knowledge of the local anatomy is mandatory for reducing complications when surgically addressing pathology of the Achilles tendon. The Achilles tendon is the longest

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and most powerful tendon in the human body, measuring 12 cm to 15 cm in length and up to 2.5 cm in diameter.[1] It is the confluence of the soleus and gastrocnemius muscle aponeuroses, and, rarely, the plantaris.[2] These muscles are both innervated by the tibial nerve, and together form the gastrocnemius-soleus complex, or triceps surae.

The soleus lies deep to the gastrocnemius and superficial to the muscles of the deep posterior compartment. The gastrocnemius muscle originates off the distal femur and crosses the knee, ankle, and subtalar joint before inserting broadly onto the calcaneus approximately 13 mm inferior to the most proximal margin of the tuberosity.[3] Thus, when the knee is extended, the gastrocnemius limits dorsiflexion, whereas when the knee is flexed, the entire triceps surae can limit dorsiflexion. Prior investigators have divided the surgical anatomy into 5 levels. Level 5 consists of proximal insertions of the gastrocnemius. Level 4 comprises the muscle bellies of the gastrocnemius. Level 3 begins where the muscle bellies of the gastrocnemius coalesce and finishes where the aponeuroses of the soleus and gastrocnemius combine. Level 2 starts in the common aponeurotic tendon of the soleus and gastrocnemius and finishes at the distal end of the soleus muscle. Level 1 consists of the Achilles tendon.[2,4]

As the tendon courses distally, the fibers rotate, giving it greater mechanical resistance, but creating a poorly vascularized area 2 to 6 cm proximal to its insertion.[5,6] The posterior tibial artery is the major blood supply to the proximal and distal sections of the tendon, whereas the peroneal artery has fewer vessels and supplies the midsection.[7] This vascular anatomy may predispose the Achilles to degeneration in this area. In addition, the Achilles tendon does not have a true tendon sheath, but is surrounded by paratenon. This paratenon is separated into 3 layers: the inner visceral, the mesotendon, and outer parietal layers. The retrocalcaneal bursa allows for proper gliding of the Achilles tendon and lies between the tendon and the calcaneus at its insertion point. Both the paratenon and the retrocalcaneal bursa can be sites of ongoing inflammation that can cause substantial morbidity to patients.

## BIOMECHANICS

Contraction of the gastrocnemius-soleus complex produces plantarflexion of the ankle combined with adduction and internal rotation of the foot.[2] The flexion force of the gastrocnemius is greater when the knee joint is fully extended, because it crosses the knee joint. The soleus delivers more than twice the plantarflexion force of the gastrocnemius, whose medial head provides most of its power, with the lateral head only accounting for 29% of the power.[8] Overall, the Achilles tendon sustains up to 12.5 times of body weight during certain running activities.[3]

## ACUTE PATHOLOGY

### *Achilles Rupture*

Ruptures of the Achilles tendon represent one of the most common sport injuries. Although a thorough discussion of the surgical versus nonsurgical treatment is beyond the scope of this review article, investigators have cited increased wound complications,[9] significant risk of infection, and scar formation at the site of repair.[10] Because of these risks, other minimally invasive approaches have been developed. Ma and Griffith[9] first introduced this idea in 1977, which has been modified throughout the years.[11,12] Unfortunately, some of the earlier reports on these techniques had reported a higher complication rate, including increased rate of rerupture and increased sural nerve injuries.[13] These earlier percutaneous

techniques also do not allow for visual evaluation of the repair site or tendon quality, which may result in poor approximation of the tendon ends. Newer technology allows the surgeon to view the repair and place a jig within the paratenon, allowing suture passage without capturing the sural nerve.[11] To address earlier concerns with the percutaneous techniques, endoscopic-assisted methods have been introduced. These methods allow the surgeon to evaluate the tendon quality, adequate mobilize the stumps, ensure accurate needle passage, and confirm approximation of the tendon ends.

***Technique***

The patient is placed in a prone position, and a pneumatic thigh tourniquet is placed. The resting plantarflexion of contralateral extremity is examined with the knee flexed. In the author's experience, they tension their acute Achilles ruptures in maximum plantarflexion and have not experienced any instances of "overtightening." The rupture gap is outlined. Halasi and colleagues[14] described a modified Ma-Griffith technique, with 6 skin incisions, 2 scope portals, and a double suture construct (**Fig. 1**). The technique uses no. 2 Vicryl (other investigators have described variations to this repair using nonabsorbable suture, such as EthiBond). Six incisions are marked, 2 above the rupture both medial and lateral at the proximal stump, 2 at the rupture gap, and 2 below the rupture both medial and lateral at the distal stump. The 2 incisions at the tendon gap can be used for the endoscopic portals. The suture is passed using

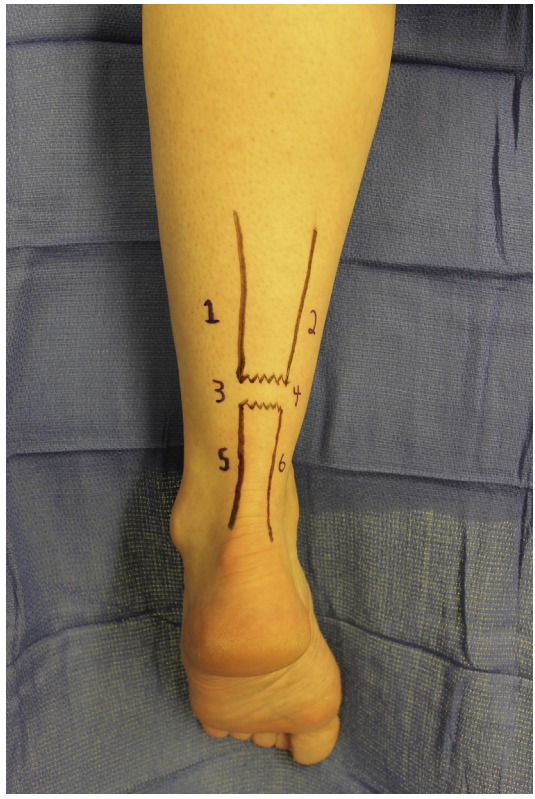


**Fig. 1.** Ma-Griffith technique with 6 incisions.

a straight needle. To protect the sural nerve, the investigators used a small drill sleeve as a soft tissue protector. The soft tissue protector is placed directly on the paratenon through the skin incisions. The same 6 incisions can be used to place both suture strands (Fig. 2). The endoscopic portals are created at the 2 central incisions directly at the rupture gap. A 4.0-mm 30° or 2.7-mm 30° scope is introduced first laterally, and the second portal incision is created at the gap. The tear is inspected; hematoma is evacuated, and if necessary, the tendon ends debrided. The surgery should be performed with low-pressure gravity inflow to prevent excessive fluid extravasation and compartment syndrome. Tendon end reapproximation can be visualized with suture tensioning. Once the double suture construct is completed, the ankle is held in plantarflexion and the sutures tied.

***Postoperative care***

Postoperative protocol included 3 weeks of non-weight-bearing in an equinus short leg cast, followed by weight-bearing in a walking brace with a lifted heel for an additional 5 weeks and functional rehabilitation initiated as well.[14]

## CLINICAL RESULTS

Turgut and colleagues[15] first reported endoscopic-assisted techniques in 2002. Since then, other studies have demonstrated satisfactory results with differing suture

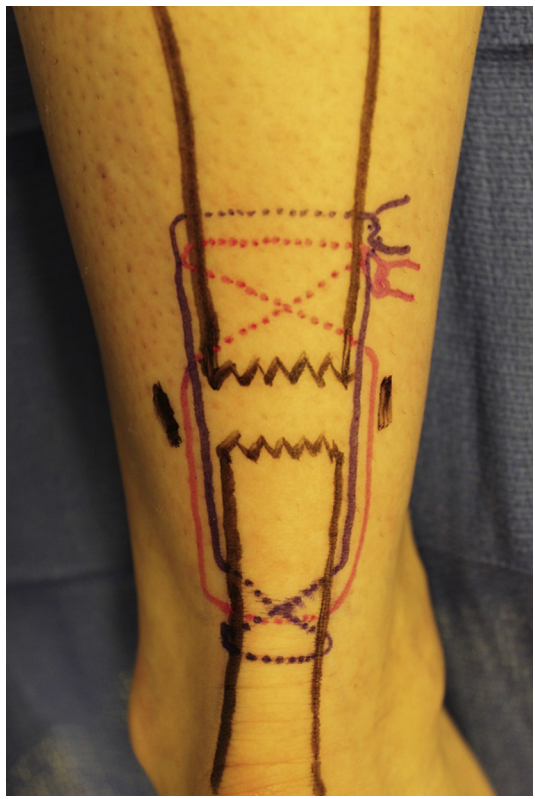

**Fig. 2.** Percutaneous Achilles rupture repair. Halasi modification with double suture construct included the *3* and *4* marked incisions as the location for the endoscopic portals.

techniques.[10,12,14–19] There has been one level II study by Halasi and colleagues[14] comparing a group of patients undergoing percutaneous Achilles repair with the use of endoscopy to a group undergoing the same procedure without endoscopy. Both groups yielded similar clinical results, including comparable strength, calf atrophy, and return to activities. The endoscopy group had lower, but nonsignificant, rate of rerupture (1.75% vs 5.7%), which the group attributed to improved visualization and control of the tendons ends (**Table 1**).

## CHRONIC PATHOLOGY

### *Equinus Contracture*

Contracture of the gastrocnemius-soleus complex has been associated with a multitude of foot and ankle pathologies, both as the root cause and in conjunction with other deformities.[20,21] An equinus contracture is a limitation in ankle dorsiflexion not caused by bony ankle pathology. It may be secondary to a global contracture of the gastrocnemius-soleus complex or isolated to the gastrocnemius muscle alone. Because the gastrocnemius crosses the knee joint, the contributions of both units can be differentiated on physical examination with the Silfverskiold test. The test is considered positive when, with the subtalar joint held in a neutral position, there is limited dorsiflexion with the knee extended that improves with the knee flexed. The most commonly used criterion to indicate an isolated gastrocnemius contracture is less than 10° of dorsiflexion with the knee extended, which improves with knee flexion.[20]

Isolated contractures of the gastrocnemius have long been treated by open techniques, whereas the tendo-Achilles lengthening is often addressed in a percutaneous manner. These techniques sometimes led to delayed wound healing, sural nerve irritation, undesirable scar formation, and tethering of the skin to the crural fascia. The described endoscopic techniques are focused on addressing the gastrocnemius contracture.

#### *Technique*

Endoscopic gastrocnemius recession was first described in a cadaveric model in 2003 by Tashjian and colleagues.[22]

The patient is placed either prone or supine on the operating room table with a thigh tourniquet. The position is most often dictated by other concomitant procedures being performed.

Endoscopy, which can be performed using 1 or 2 entry points, should ensure that the cannula is placed between the sural fascia and the aponeuroses of the insertion of the gastrocnemius to enable recession of the fascia. An alternative technique has been described in which the intramuscular portion of the aponeuroses is released instead.[23]

Medial portal placement has been anatomically detailed in many articles and is performed at the anatomic level 3, where the muscle bellies of the gastrocnemius coalesce. This placement is crucial to a successful, complication-free operation and has been described as 2 cm distal to the indent of the musculotendinous junction,[22,24] 16 to 17 cm proximal to the distal tip of the medial malleolus,[25] just distal to the junction of the middle and distal thirds of the leg,[26] and 4 fingerbreadths proximal to the flare of the medial malleolus.[27]

The medial portal is established, and a curved hemostat is used to puncture the cural fascia overlying the superficial posterior compartment. The blunt trocar with a slotted cannula is introduced and advanced laterally. The lateral portal is established in an inside-out technique. The trochar is removed, leaving the slotted

**Table 1**
**Clinical studies on endoscopic Achilles rupture repair**

| Author, Year | No. of Procedures | Clinical Outcomes | Complications | Comments |
|---|---|---|---|---|
| Turgut et al,[15] 2002 | 11 | 100% satisfactory results | No reruptures, wound issues, or nerve injury | |
| Halasi et al,[14] 2003 | 57 | 89% good-excellent | 1 partial rerupture; 4 fusiform thickening; 1 DVT | Mean plantarflexion strength 86% of contralateral side |
| Tang et al,[16] 2007 | 20 | 75% excellent, 25% good according to Arner-Lindholm scale | No reruptures, wound issues, or nerve injury | Follow-up MRI demonstrated good repair of all tendons |
| Fortis et al,[10] 2008 | 20 | 100% good-excellent; mean postoperative Merkel score 604 | 10% sural neuralgia; 1 subsided with no further treatment | |
| Doral et al,[17] 2009 | 62 | 94% excellent, 6% good; mean postoperative AOFAS score 94.6 | 3.2% sural nerve hypoesthesia, all resolved spontaneously | 95% return to prior sporting activities |
| Chiu et al,[18] 2013 | 19 | 94.8% excellent results | 1 superficial infection, 2 sural nerve hypoesthesia | 95% return to prior sporting activities |

*Abbreviation:* DVT, deep vein thrombosis.

cannula. A 4.0-mm 30° arthroscope is inserted medially and the gastrocnemius aponeurosis is inspected. The lens is rotated 180°, and the sural nerve and lesser saphenous veins are visualized. It is important to identify that the sural nerve is posterior to the cannula; otherwise, it can be inadvertently cut. The ankle is held in maximum dorsiflexion to tension the Achilles. A retrograde hook blade is introduced into the slotted cannula laterally. The gastrocnemius aponeurosis is released from medial to lateral. The ankle is passively dorsiflexed to confirm adequate release.

#### *Postoperative care*

Isolated gastrocnemius recessions can be allowed weight-bearing immediately in a walking boot, although some investigators describe a 2-week period in a non-weight-bearing splint. A 90° night splint is prescribed, and ankle dorsiflexion exercises are encouraged. Typically, patients are weaned out of the boot at 4 weeks, and physical therapy is initiated. For patients with concomitant procedures, splinting and weight-bearing restrictions were directed by those.

## CLINICAL RESULTS

Overall, good outcomes have been described using both 1- and 2-portal techniques. The first clinical series was described in 2004 by Saxena and Widtfeldt[28] and demonstrated a mean increase in dorsiflexion of 12.6°, but with 3 out of 18 patients experiencing sural dysesthesias. All except one of the patients underwent associated procedures at the time of gastrocnemius recession. Subsequent series have consistently demonstrated significant increases in dorsiflexion as well as improved outcome measures.[25–27,29–34] The largest series to date from Phisitkul and colleagues[33] demonstrated mean ankle dorsiflexion improvement from $-0.8 \pm 5.4°$ preoperatively to $11.0 \pm 6.6°$ at an average of 13 months postoperatively. Postoperative weakness in plantarflexion and sural nerve dysesthesias occurred in 3.1% and 3.4%, respectively, without any wound complications or Achilles tendon rupture (**Table 2**).

One study performed in 23 diabetic patients using a uniportal technique showed 3 conversions to open procedures, 3 delayed wound healing, and 3 undercorrections (although this was not objectively defined) without any nerve injuries.[35] The most recent study by Thevendran and colleagues[34] on 54 feet demonstrated 3 cases of unsatisfactory scar, 3 cases of sural nerve dysesthesia, and 3 cases of subjective plantar flexion weakness, while Schroeder[32] showed a 1.67% incidence of persistence sural nerve injury and no wound healing or scar problems. Phisitkul and colleagues[33] reported the largest series to date, noting a 3.1% incidence of weakness of ankle plantarflexion and 3.4% incidence of sural nerve dysesthesia without any wound complications in 320 patients.

Endoscopy provides a better cosmetic outcome, although it carries a considerable risk of sural nerve injury. The complication rate can reach 22.2%. The importance of the association between the sural nerve and the endoscopic entry point led to the study by Tashjian and colleagues,[22] who found the distance between the sural nerve and the lateral border of the gastrocnemius and soleus to be 12 mm (range, 7–17 mm). This short distance justifies the use of a medial entry point in this type of endoscopic procedure.

### *Noninsertional Achilles Tendinopathy*

Noninsertional Achilles disorders typically occur 4 cm to 6 cm proximal to its insertion and comprise midportion tendinosis as well as acute and chronic paratendinopathy. It is important to correctly diagnosis peritendinitis. On physical examination, the pain

**Table 2**
**Clinical studies on endoscopic gastrocnemius recession**

| Author, Year | No. of Procedures | Range of Motion (Degrees)/ Clinical Outcomes | Complications | Comments |
|---|---|---|---|---|
| Saxena & Widtfeldt,[28] 2004 | 18 | −8.7° → 3.6° | 3 sural dysesthesias | Only one isolated recession |
| DiDomenico et al,[29] 2005 | 31 | Mean increase 18° | | |
| Trevino et al,[26] 2005 | 28 | Modified O&M scores statistically significant improvement (8 patients able to be contacted) | 1 superficial wound infection, 1 conversion to open | 2 incorrect locations of portal placement necessitating second incision |
| Saxena et al,[30] 2007 | 54 | −8° → 7° | 1 hematoma, 1 overlengthening, 6 skin tenting, 6 lateral foot dysesthesias | Most patients with additional reconstructive procedures |
| Grady & Kelly,[31] 2010 | 40 | Mean increase 15° | No sural nerve complications | Patients 18 y old and younger |
| Roukis & Schweinberger,[35] 2010 | 23 | | 3 delayed healing, 3 undercorrections, 3 conversions to open | Focused only on complications; patient all had diabetes |
| Yeap et al,[27] 2011 | | | | |
| Angthong & Kanitnate,[25] 2012 | 4 | Mean increase 35°/significant improvements in AOFAS, VAS-FA scores | None | Severe equinus deformities in 3 patients combined with percutaneous TAL |
| Schroeder,[32] 2012 | 60 | −2.9° → 12.8° | 3 nerve complications (2 resolved), 1 weakness | |
| Phisitkul et al,[33] 2014 | 344 | −0.8° → 11.0°/significant improvements in VAS, SF-36, and FFI | 3.2% weakness of plantarflexion, 3.4% sural dysesthesias | No difference between isolated and combined procedures |
| Lui,[23] 2015 | | | | Technique paper |
| Thevendran et al,[34] 2015 | 56 | Significant improvements in SF-36, AOFAS hindfoot, modified O&M, and VAS, 91% good or very good outcomes | 3 unsatisfactory scar, 3 sural dysesthesias, 5 subjective plantar flexion weakness | |

*Abbreviations:* FFI, foot function index; O&M, Olerud and Molander; SF-36, Short Form 36; VAS, visual analogue score–foot and ankle.

remains in a specific location during ankle dorsiflexion and plantarflexion with peritendinitis, while the pain moves with the tendon in tendinosis.

Initial conservative treatment incorporating an eccentric therapy program is often successful, but can still fail to provide adequate symptom relief in almost one-third of patients.[36] A variety of surgical procedures have been described, including open debridement with or without stripping of the paratenon, percutaneous longitudinal tenotomy, plantaris release, and isolated gastrocnemius recession. These open approaches have been associated with wound complications, prolonged recovery, and scarring.[37] Thus, endoscopic techniques have been developed to achieve the goals of open surgery, excising areas of degeneration, adhesions, and thickened paratenon, and stimulating a healing response, while decreasing the morbidity.

#### *Technique*

The patient is positioned prone on the operating table with a thigh tourniquet. Their feet are positioned off the table, allowing ankle dorsiflexion and plantarflexion during the procedure.

The borders of the Achilles tendon and the superior aspect of the calcaneal tuberosity are marked out with a surgical pen. Several variations in portal placement have been described.[38,39] Typically, 2 portals are used. Maquirriain[38] described using a proximal portal 10 cm above the Achilles insertion of the calcaneus at the midline of the Achilles. The distal portal is placed again midline, at the distal location, not to disrupt the confluence of the Achilles and the skin as it nears attachment. Thermann and colleagues[39] described placing portals at the medial edge of the Achilles. Other have described a similar 2-portal technique placed lateral to the Achilles border, placed approximately 2 to 4 cm proximal and distal to the pathologic thickening on the Achilles.

A 4.0- or 2.7-mm 30° arthroscope is introduced into the proximal portal, and a dry tendon inspection is performed. Gravity inflow is then used for insufflation. The distal portal is established with the aid of direct visualization using the scope. In cases of peritendinitis, the peritendon is released, paying particular attention to releasing the anterior aspect of the tendon. In cases with tendinosis, following debridement, longitudinal incisions are made in the diseased segment of the tendon using a retrograde blade.

#### *Postoperative care*

For patients with a peritendon release and debridement only, most investigators allow immediate weight-bearing in a walker boot. Active ankle dorsiflexion and plantarflexion are encouraged. Eccentric stretching exercises are initiated after 2 weeks. For patients that underwent tenotomies, they are placed in a walker boot and kept non-weight-bearing for up to 2 weeks.

## CLINICAL RESULTS

Maquirriain[38] first described the use of endoscopic treatment of chronic Achilles tendinopathy in 1998 in a cadaveric model. Maquirriain followed his cadaveric research with a small clinic series demonstrating satisfactory results.[40] Additional investigators have published small series with satisfactory results and no reported complications.[15,39,41–44] Maquirriain[45] more recently reviewed his results on 27 patients, reporting improved outcomes and 2 complications (**Table 3**).

### *Insertional Achilles Tendinopathy*

These disorders include pathology within the first 2 cm proximal to the insertion to the calcaneus. Although these disorders include insertional Achilles tendinosis and superficial calcaneal bursitis, endoscopic treatment has focused on treating retrocalcaneal

**Table 3**
**Clinical studies on endoscopic chronic Achilles pathology**

| Author, Year | No. of Procedures | Pathology | Outcomes | Comments |
|---|---|---|---|---|
| Maquirriain et al,[40] 2002 | 7 | 2 peritendinitis, 4 midportion tendinosis, 1 chronic partial tear | Improvement in Achilles score from mean 39 to mean 89 | 1 minor hematoma with spontaneous resolution. Postoperative MRI in tendinosis patient with improvement |
| Morag et al,[41] 2003 | 4 | 2 posttraumatic adhesions, 2 midportion tendinosis | 4–6 wk return to daily activities, 4 mo return to sporting activity | No complications |
| Vega et al,[42] 2008 | 8 | Midportion tendinosis without rupture | All patients pain-free at last follow-up, 100% excellent results with Nelen scale | No complications; all patients returned to prior sporting activities |
| Thermann et al,[39] 2009 | 8 | Midportion tendinosis | Pain improved from 40 to 97.5, Achilles function from 22.5 to 90 | No complications |
| Liu,[43] 2012 | 20 | Midportion tendinosis | ATSS-17 improved from 29.4 to 89 | |
| Pearce et al,[44] 2012 | 11 | Mid-portion tendinosis | AOFAS improved from 68 to 92 postoperative, mean SF-36 scores also improved but were not statistically significant; 8/11 satisfied | No complications |
| Maquirriain,[45] 2013 | 27 | Mid-portion tendinosis | VISA-A score improved from 37.0 to 97.5; the Achilles Tendon Scoring System score improved from 32.6 to 97.2 | 1 delayed keloid lesion, 1 seroma with chronic fistula |

*Abbreviations:* ATTS-17, Achilles Tendinopathy Scoring System; VISA-A, Victorian Institute Sport Assessment-Achilles.

bursitis and associated Haglund deformity. Nonoperative treatment consists of physical therapy, shoe wear modifications, heel inserts, rest, anti-inflammatory drugs, and immobilization. However, there is a certain population of patients who fail to respond to nonsurgical measures.[46]

Open treatment traditionally includes open debridement of the tendon, retrocalcaneal bursectomy, and calcaneal exostectomy. Complications from these open procedures can include wound dehiscence, nerve irritation, and postoperative stiffness from extensive dissection. For patients with extensive insertional Achilles tendinopathy, these open approaches are preferred in order to perform an adequate debridement of the tendon, and reattachment if necessary.

Preoperative evaluation is vital to ensuring optimal, predictable results. In patients with isolated tenderness to palpation at the posterosuperior calcaneal border, and without significant intrasubstance changes on MRI evaluation, endoscopic calcaneoplasty may offer decreased wound-healing complications and the potential for quicker recovery time and decreased morbidity.

### *Technique*

The patient can be placed either prone or supine on the operating room table with a thigh tourniquet. The positioning is the physician's preference. Regardless of patient position, appropriate setup is critical. The surgeon should make sure that there is enough space between the operative and contralateral extremity to ensure full freedom of motion with the arthroscope, without abutting the contralateral extremity. For prone positioning, the feet should be allowed to hang over the end of the surgical table and be elevated to allow medial portal instrument manipulation without crowding from the contralateral limb (**Fig. 3**). In supine positioning, the operative leg rests in a well-padded leg holder with the foot free floating. A surgical pen should be used to outline the Achilles and calcaneus.

Two portals, posteromedial and posterolateral, are commonly used with investigators describing additional accessory portals to aid in the visualization. The posterolateral porter is located typically 1 cm above the Achilles insertion and 0.5 cm below the superior aspect of the Haglund tubercle, adjacent to the tendon border (**Fig. 4**). A 5-mm vertical incision is made, and a hemostat is used to perform a spread-and-nick technique into the retrocalcaneal space. Either a 4-mm or a 2.7-mm 30° arthroscope

**Fig. 3.** Patient positioned prone for endoscopic Haglund with foot placed over operative table.

**Fig. 4.** Portal position for endoscopic Haglund.

is introduced. A gravity fluid system is used to avoid excessive soft tissue distention. A needle is placed through the marked posteromedial portal, at the same level as the posterolateral portal, and is visualized with the scope. An arthroscopic shaver is introduced, and the retrocalcaneal bursa, synovitis, and hyalinized tissue over the Haglund tubercle are debrided. Both portals are used interchangeably. An arthroscopic hooded or bone rasp is used to resect the tubercle to its insertion point on the calcaneus (**Figs. 5–8**). Some techniques have described this resection with visualization using the arthroscope, whereas others have performed the resection using flouroscopic guidance (**Fig. 9**). The diseased Achilles tissue can be debrided with the shaver.

***Postoperative care***

Patients can be splinted in equinus for the first 10 to 14 days, although several investigators discuss placing their patients in a walking boot with a 1-inch heel lift

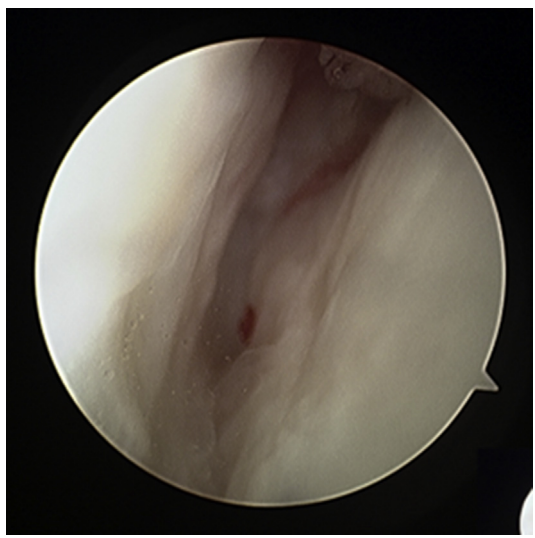

**Fig. 5.** Calcaneus covered with hyalinized tissue.

**Fig. 6.** Retrocalaneal bursitis.

immediately after surgery and permit weight-bearing as tolerated. Patients ambulate in the walking boot for 4 to 6 weeks and then transition to shoes with a heel lift.

## CLINICAL RESULTS

Endoscopic calcaneoplasty was first described in 20 patients by van Dijk and colleagues[47] in 2001. Since then, multiple studies have been published demonstrating good success with endoscopic calcaneoplasty in patients with retrocalcaneal bursitis and a painful prominence of the posterosuperior aspect of the calcaneus.[48–55] Only a single level II study, by Leitze and colleagues,[49] has

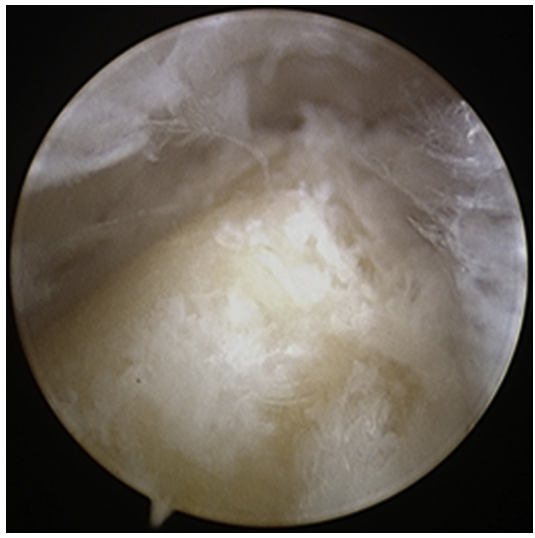

**Fig. 7.** Exposed Haglund tubercle.

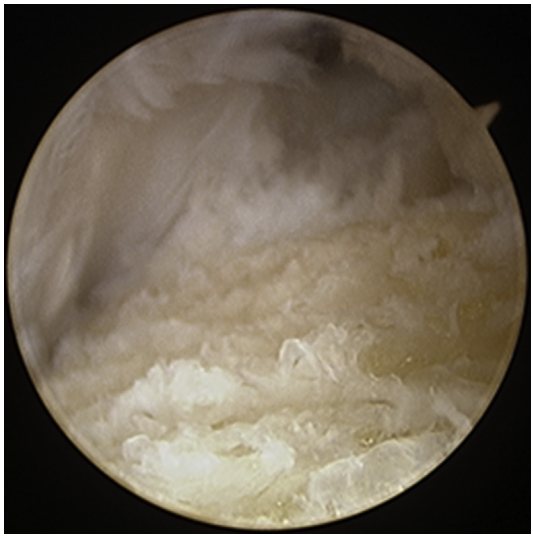

**Fig. 8.** Resected Haglund tubercle.

compared endoscopic with traditional open techniques. This study found that both compared experienced significant improvements in functional outcomes, without any significant differences between the groups in scores or time to recovery. The endoscopic procedures were associated with fewer complications than the open procedures (**Table 4**).

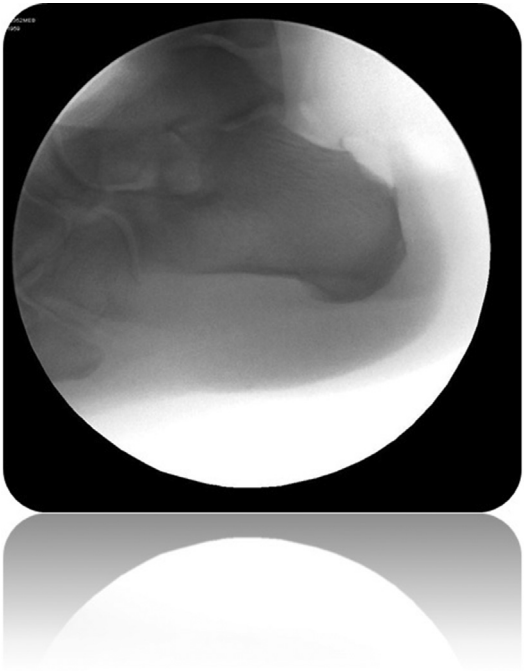

**Fig. 9.** Fluoroscopic assessment of Haglund resection.

**Table 4**
**Clinical studies on endoscopic calcaneoplasty**

| Author, Year | No. of Procedures | Clinical Outcomes | Complications | Comments |
|---|---|---|---|---|
| van Dijk et al,[47] 2001 | 21 | 15 excellent, 4 good, 1 fair result | None | 12 wk until return to sporting activities, 1 fair result in patient with cavovarus deformity |
| Jerosch & Nasef,[48] 2003 | 10 | 7 excellent, 4 good result in Ogilvie-Harris scores | None | No cavovarus deformity |
| Leitze et al,[49] 2003 | 33 | Significant improvement in AOFAS-hindfoot; no significant differences in outcomes compared with open group with similar recovery time | 3% infection (12% open), 10% altered sensation (18% open), 7% scar tenderness (18% open) | Compared with open technique |
| Jerosch et al,[50] 2007 | 81 | 41 excellent, 34 good, 3 fair results in Ogilvie-Harris scores | No neurovascular complications | No cavovarus deformity |
| Ortmann & McBryde,[51] 2007 | 32 | AOFAS 62 → 97; 26 excellent, 3 good, 1 poor result | 1 Achilles rupture 3 wk after surgery | 1 residual pain requiring secondary open procedure |
| Jerosch et al,[52] 2012 | 164 | 84 excellent, 71 good, 5 patients fair, 4 poor results in Ogilvie-Harris score | | |
| Kondreddi et al,[53] 2012 | 25 | 16 excellent, 6 good, 3 fair results; AOFAS 57 → 89 | | Patients with noninsertional tendinosis on ultrasound had worse results |
| Wu et al,[54] 2012 | 25 | AOFAS 63 → 87; 15 excellent, 7 good, 1 fair, 2 poor results in Ogilvie-Harris score | None reported | |
| Kaynak et al,[55] 2013 | 30 | AOFAS 53 → 99; all patients satisfied | None | |

### *Chronic Achilles Rupture*

Last, endoscopic techniques have been developed in order to address more complex issues with the Achilles tendon. Chronic Achilles ruptures can cause significant weakness in plantarflexion strength with resultant difficulty in walking inclines and poor balance.

Many methods to repair chronic Achilles ruptures have been described, including V-Y advancement, fascial turndown flaps, autologous tendon transfers, and allograft reconstructions. These techniques require large exposures with resultant problems with wound infection and nerve irritation,[56] especially in high-risk individuals such as diabetics, smokers, and those on disease-modifying medications for inflammatory arthropathy. In these patient populations, endoscopic techniques may have even greater benefit.

Gossage and colleagues[57] first described an endoscopic technique for a flexor hallucis longus (FHL) short harvest and transfer in the setting of 2 patients with chronic Achilles tendon ruptures, with good results and no complications. Lui and colleagues[58] published an endoscopic technique to perform a long harvest of the FHL tendon just proximal to the master knot of Henry, or down at the level of the proximal phalanx of the great toe.

Gedam and colleagues[59] used endoscopy to assist with a central turndown flap with semitendinosus augmentation in 14 patients with chronic ruptures with a mean gap of 5.1 cm. They showed American Orthopaedic Foot & Ankle Society (AOFAS) score improvement from 64.5 to 96.9 and Achilles Tendon Total Rupture Score improvement from 49.4 to 91.4, with no wound complications, nerve damage, or rerupture at a mean follow-up of 30.1 months. Piontek and colleagues[60] recently presented a technique of endoscopic Achilles reconstruction using autograft semintendinosus and gracilis tendons without any clinical results. They used a bone tunnel in the calcaneus and a tendon weave in the proximal stump in the Achilles tendon to achieve their tendon fixation.

## SUMMARY

Endoscopically assisted procedures have been established to provide the surgeon with minimally invasive techniques to address common Achilles conditions. Modifications to some of these techniques as well as improvements in instrumentation have allowed these procedures to provide similar clinical results to the traditional open surgeries while reducing wound complications and accelerating patient's recoveries.

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