

Chronic Achilles Tendon Rupture Repaired with Tendon Graft

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Abstract:

Background: The Achilles tendon, the largest and strongest tendon in the human body, is nevertheless one of the tendons which most commonly undergoes a complete subcutaneous tear. Achilles tendon ruptures are especially common in middle aged men who occasionally participate in sport. Even though Achilles tendon ruptures are frequent, up to 25% of acute injuries are misdiagnosed, and present as chronic injuries.

Methods: This is an original research article about surgical management of chronic Achilles tendon ruptures by minimally invasive Achilles tendon reconstruction with tendon graft.

Results: The optimal surgical procedure is still debated, however, less invasive peroneus brevis reconstruction technique and free hamstring autograft provide good functional results.

Conclusion: The management of chronic ruptures is more demanding than acute tears, because of the retraction of the tendon ends, and the gap makes primary repair impossible. Wound complications and infections are frequent after open procedures. Minimally invasive treatments provide good functional results and lower complications rate. In chronic tears of the Achilles tendon, with a gap of at least 6 cm, free tendon grafts allow predictable return to sport and acceptable recovery function.

Keywords: Achilles Tendon, Chronic Ruptures, Tendon Graft, Minimally-Invasive Surgery, Neglected Injury,

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Introduction

The Achilles tendon is the strongest and largest tendon in the human body, with a tensile strength in the order of 50–100 N/mm [1]. Despite its strength, it is one of the tendons most commonly affected by spontaneous rupture. Most ruptures (75%) occur during recreational activities in men between 30 and 40 years old, in particular in soccer, basketball, tennis, and squash. However, 25% of ruptures may occur in sedentary patients [2]. Even though Achilles tendon ruptures are frequent and are usually not difficult to diagnose for experienced physicians, more than 20% of acute injuries are misdiagnosed, leading to a chronic rupture [3].

A chronic rupture can be defined as a rupture with a delay in diagnosis or treatment for more than 6 weeks [3]. The management of chronic Achilles tendon tears is technically more demanding than the primary repair of acute ruptures, because the tendon ends normally are retracted and the status of the surrounding soft tissues makes primary repair increasingly more difficult [4]. Primary repair is not generally possible, because of the increased gap between the two tendon ends. Different surgical

techniques have been described to address this problem. Traditional open surgical options include flap tissue turn down using one [5] and two flaps [6], local tendon transfer [7,8] and autologous hamstring tendon harvesting [8,9]. The main concerns of these techniques include complications, especially wound breakdown and infections [10]. These complications are probably related to the scanty soft tissue vascularity, and may require plastic surgical procedures to cover significant soft tissue defects.

However, given the lack of prospective randomized trials and the small size of the studies, a standard procedure is lacking. Less invasive peroneus brevis [11] and flexor hallucis longus (FHL) transfer [12] have been described for the treatment of chronic Achilles rupture. These techniques allow reconstruction of the Achilles tendon preserving skin integrity over the site most prone to wound breakdown. Although not the authors' preference, good results have been reported with the transfer of the FHL. The FHL is a strong, long tendon and allows bridging of large gaps. The muscle itself is able to produce force that supplements the strength

exerted by the gastrocnemius-soleus complex. We prefer not to use this tendon in running and sprinting athletes, who necessitate being able to “grip” the ground in a powerful fashion, and therefore, the loss of flexion of the interphalangeal joint of the hallux would be detrimental to performance. However, in patients when this feature is not of paramount importance, FHL transfer can be used with excellent results [13,14]. When the tendon gap produced is greater than 6 cm despite maximal plantar flexion of the ankle and traction on the Achilles tendon stumps, the tendon of peroneus brevis is not sufficient to fill the gap, and an ipsilateral hamstring tendon graft is recommended [15].

Clinical presentation and Imaging: A chronic Achilles tendon injury may present with an obvious sign of rupture with a palpable or visible defect in the continuity of the Achilles tendon. Clinical tests for testing the integrity of the Achilles tendon include the Simmond's or Thompson's calf squeeze test [31], Matle's test, O'Brien's needle test, and the Copeland's sphygmomanometer Test. Step like deformity visible on the lateral view. If a scar bridges the defect, such a dip may not be visualized. The calf squeeze test described by Simmond [16,31] about 5 years before Thompson [17] involves squeezing of the calf muscles in a patient lying prone with his feet overhanging the edge of the examination couch. The examiner squeezes calf causing the feet to plantarflex indicating the integrity of the tendon. In the Matle's test, [18, 32] the patient lies prone with his knees flexed to 90 degrees and ankles let loose. In a patient with a ruptured Achilles tendon, the involved ankle falls into dorsiflexed or neutral position, while the normal ankle stays in plantarflexion due to the tone of the triceps surae .

Matle's test: The involved ankle in the foreground is more dorsiflexed compared with the uninvolved foot in the back ground which remains plantarflexed due to the tone of the triceps surae. In the O'Brien's needle test, [19] a needle is inserted into the substance of the Achilles tendon ~10 cm proximal to the insertion and just medial to the midline and the patient is asked to dorsiflex and plantarflex his ankle. The tip of the needle tilts distally and hub proximally with dorsiflexion if the substance of the tendon distal to the needle is intact. In the Copeland's sphygmomanometer test, [20] a cuff is tied around the patient's midleg flexed at the knee in a prone position with the foot plantarflexed and is inflated to 100 mm Hg. The patient's foot is then passively dorsiflexed and the quantum of the rise in the sphygmomanometer is noted. In individuals with an intact Achilles tendon, the pressure will rise to ~140 mm Hg. [17](#) A point to remember, however, is that the test was originally described using a mercury manometer which is a rarity nowadays.

During clinical testing, it must be kept in mind that a false positive result may occur due to the formation of a bridging scar in between the cut ends of the Achilles tendon. Patients are also able to perform an active ankle flexion the presence of a ruptured Achilles tendon due to the action of the intact secondary flexors of the ankle joint such as the flexor hallucis longus (FHL), flexor digitorum longus, peroneus longus, and tibialis posterior muscles. This can be unmasked by the relative weakness of the affected side when compared with the normal side.

Imaging: A plain X-ray taken in an individual shows the soft tissue outline of the Achilles tendon inserting into the calcaneum. The maximum anteroposterior width of the Achilles tendon in the lateral view radiograph has been found to be 8 mm and anything more than that signifies a pathology of the Achilles tendon. [21] A translucent area just beneath the Achilles tendon represents the fat pad and it dips ~2 mm below the superior most border of the calcaneus. In inflammatory conditions of the Achilles tendon, this inverted triangle bordered by the calcaneum anteriorly, the enthesis posteriorly and continuous with the Kager's fat pad superiorly, gets obliterated.

The X-ray shows the soft tissue outline of the normal Achilles tendon with a lucent area deep to it representing the Kager fat pad and fatty tissue deep to the Achilles tendon.

High-frequency ultrasonogram can also be used to identify the continuity of the Achilles tendon, its dimensions, and its vascularity. [22] The gold standard imaging test is a magnetic resonance imaging (MRI) scan of the involved area. T1-weighted images show a good anatomical delineation of the tendon, whereas T2-weighted images demonstrate fluid accumulation, a sign of tendon pathology, well. [23] The normal average thickness of the Achilles tendon on an MR is ~6 mm. [24] The normal retrocalcaneal bursa measures ~ 6 mm superoinferiorly, 3 mm mediolaterally, and 2 mm anteroposteriorly. [25]

Pedobarogram: A pedobarogram is a dynamic recording of the pressures that act on the sole of the foot during the stance phase of the gait cycle. Information like peak pressures, force, area in contact with the ground, and the duration of the stance phase can be gathered from a pedobarogram. Force plate testing has not been described as a diagnostic modality of Achilles tendon injuries; however, it has been an established method to diagnose gait disturbances in patients with neuropathic ulcers and orthopaedic problems. [26, 27, 28, 29]

We have noticed in our series of patients that the pedobarogram is effective at indirectly diagnosing

an inefficiency of the muscle-Achilles tendon-calcaneum, midfoot, and forefoot axis integrity by documenting the increase in calcaneal loading and the associated calcaneal gait that occurs with Achilles tendon insufficiency [30] even when clinical testing is inconclusive because of fibrous bridging of the gap. Serial pedobarograms at regular intervals after surgical repair of a ruptured Achilles

tendon documented the return of function evidenced by the progressive increase in forefoot loading.

Surgical Management of Chronic Achilles Tendon Rupture

Two classifications of chronic ruptures of the AT are reported, the Myerson classification [33] (Table 1) and the Kuwada classification [34] (Table 2). Neither is evidence based.

Table 1: Meyerson classification

Defect size	Treatment
Type I (rupture < 2 cm)	End-to-end anastomosis and posterior compartment fasciotomy
Type II (2–5 cm)	V–Y lengthening, augmented with tendon transfer if needed
Type III (rupture > 5 cm)	Tendon transfer alone or in combination with V–Y advancement or turnaround

Table 2: Kuwada classification

Defect size	Treatment
Type I (partial ruptures < 50%)	Conservative management
Type II (rupture < 3 cm)	End to end anastomosis
Type III (tendinous gap 3 to 6 cm)	Often requires tendon/synthetic graft
Type IV (defect > 6 cm)	Tendon/synthetic graft and gastrocnemius recession

In chronic ruptures of the Achilles tendon with a large gap [34], a local tendon transfer or a free tendon graft can be considered to restore tendon continuity [35]. In the former, the tendon of a working muscle unit around the ankle (classically, peroneus brevis, peroneus longus, flexor hallucis longus or flexor digitorum longus) is transferred to supplement the function of the gastroc-soleus complex. When using a free tendon graft, the tendon is detached from its native muscle, and used to bridge the gap between the proximal and distal stumps of the Achilles tendon [36].

Various free grafts (autograft, allografts, xenografts, synthetic grafts) have been used for this purpose [37,38,39], but the actual choice of one over another graft rests with the surgeon.

The present study investigates in a systematic fashion the outcome of free tendon grafts used in the management of chronic ruptures of the Achilles tendon, evaluating clinical outcomes, complications, return to activities and return to sport.

Material and Methods

With the approval of the responsible ethical committee, a retrospective comparative observational study and outcome analysis was conducted at our institution, in order to analyze patients treated surgically for a chronic neglected Achilles tendon rupture with tendon graft.

This retrospective study was conducted in the period between July 2024 and august 2026.

The PICOT algorithm was preliminarily pointed out:

- P (Problem) = Chronic rupture of the mid-portion Achilles tendon;

- I (Intervention) = Graft;
- C (Comparison) = peroneus brevis, Semitendinosus, Gracilis, Achilles,
- O (Outcomes) = Clinical outcomes, complications, and return to sport;
- T (Timing) = ≥ 6 months of follow-up.

Two authors independently performed data extraction. The following data were extracted: surgical technique, baseline data, aetiology of rupture, activities limitations. The primary outcome of interest was clinical outcomes. The secondary outcome of interest was return to daily activities including sports.

Surgical Technique

{I} Ipsilateral Free Semitendinosus Tendon Graft: If the gap between the proximal and distal stumps is greater than 6 cm despite maximal plantar flexion of the ankle and traction on the tendon stumps, an ipsilateral semitendinosus tendon graft is indicated. The first two longitudinal incisions are the same performed for the peroneus brevis tendon transfer. One incision is medial to the proximal Achilles tendon end, and the second is just lateral to the distal stump, taking care to prevent damage to the sural nerve. Through the proximal incision, the peritendinous adhesions are gently dissected and a partial resection of the proximal tendon stump is performed to expose the healthy portion of the tendon. The free tendon edge is sutured with a #1 Vicryl locking suture to prevent separation of the bundles. The soft tissues anterior to the soleus and gastrocnemius are released to better mobilize the proximal stump of the tendon and minimize the gap. The distal stump is mobilized too. A loop of polyglyconate is used in a Krackow configuration to

impose adequate traction to the proximal stump of the tendon. Moderate traction to the proximal stump is applied taking care to maintain the ankle in maximal plantar flexion.

The ipsilateral semitendinosus tendon is harvested through a 2 cm longitudinal incision over the anteromedial aspect of the tibia over the pes anserinus [40]. In the original technique, the semitendinosus was harvested with the patient supine, but it was technically demanding, as the patient was upside down, and the anatomy is obviously 'the other way round' [41]. Currently, the authors harvest the tendon of semitendinosus with the patient prone, using a 2 cm transverse incision over the palpable tendon of the semitendinosus in the popliteal fossa.

Once the two ends of the semitendinosus graft have been tubularized using a 1-0 Vicryl whipstitch, the graft is passed into the substance of the proximal

stump of the Achilles tendon about 2 cm above the tendon end through a small incision, and secured to the Achilles tendon at both the entry and exit points with a 3-0 Vicryl suture. Then, the graft is delivered to the distal incision beneath the intact skin bridge and passed through a transverse tenotomy into the distal stump from the medial to the lateral side. With the ankle in maximal plantar flexion, the semitendinosus tendon is sutured to the entry and exit points of the distal stump using a 3-0 Vicryl suture, and the reconstruction is tensioned with the ankle in maximum equinus. One extremity of the semitendinosus tendon graft is moved again to the proximal incision, beneath the intact skin bridge and passed into the proximal stump through a transverse tenotomy from medial to lateral. Similarly, the other extremity of the semitendinosus tendon is passed again into the distal stump from medial to lateral.

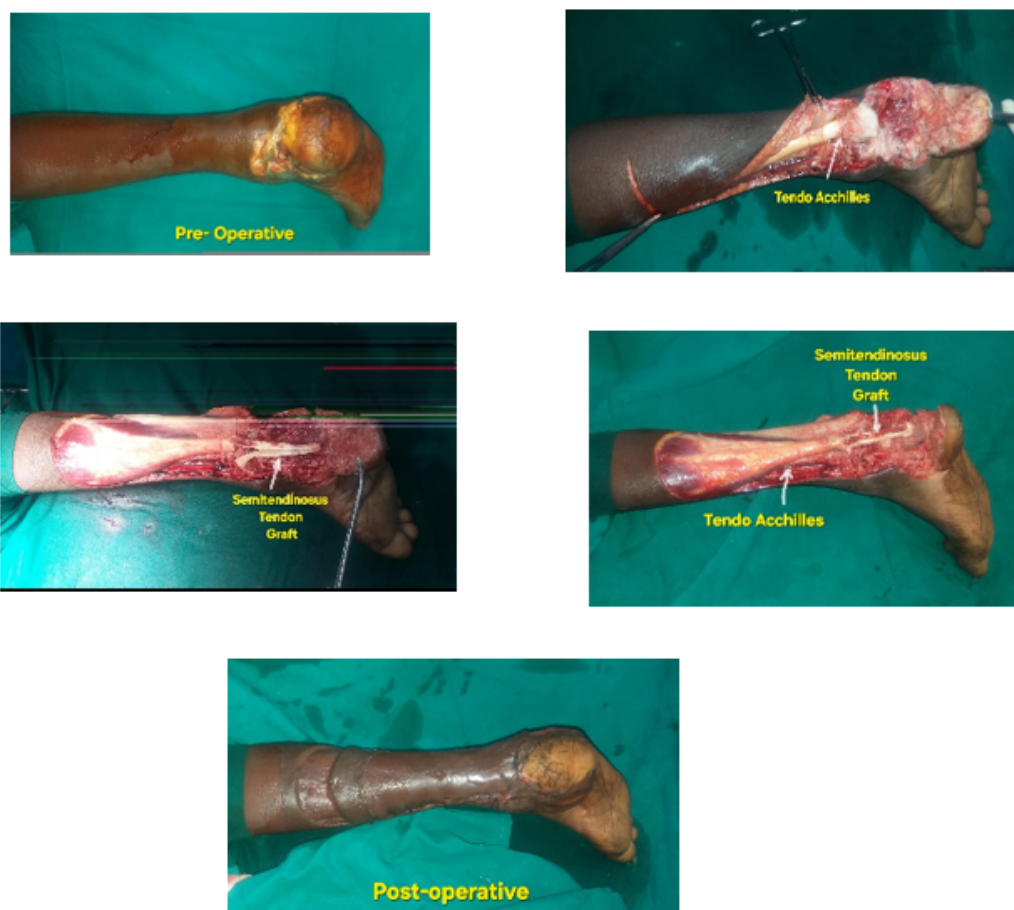


Figure 1: Semitendinosus Tendon Graft

{II} Peroneus Brevis Tendon graft: The peroneus brevis tendon transfer is an effective technique to repair a chronic Achilles tendon rupture when the gap between the two tendon stumps is smaller than 6 cm. The patient is placed prone under general anaesthesia, with the ankles clear of the operating table. A tourniquet is applied to the limb to be

operated. The limb is exsanguinated, and the tourniquet is inflated to 250 mm Hg. Three longitudinal surgical approaches are made. The first incision is made medially the proximal tendon stump. It is about 5 cm long and it begins 2 cm proximal to the palpable end of the residual tendon. The second incision is lateral to the distal end of the

tendon rupture, and it is about 3 cm long. Care is taken to prevent damage to the sural nerve by making the incision as close as possible to the

anterior aspect of the lateral border of the Achilles tendon. The third incision is a 2 cm longitudinal incision at the base of the fifth metatarsal.

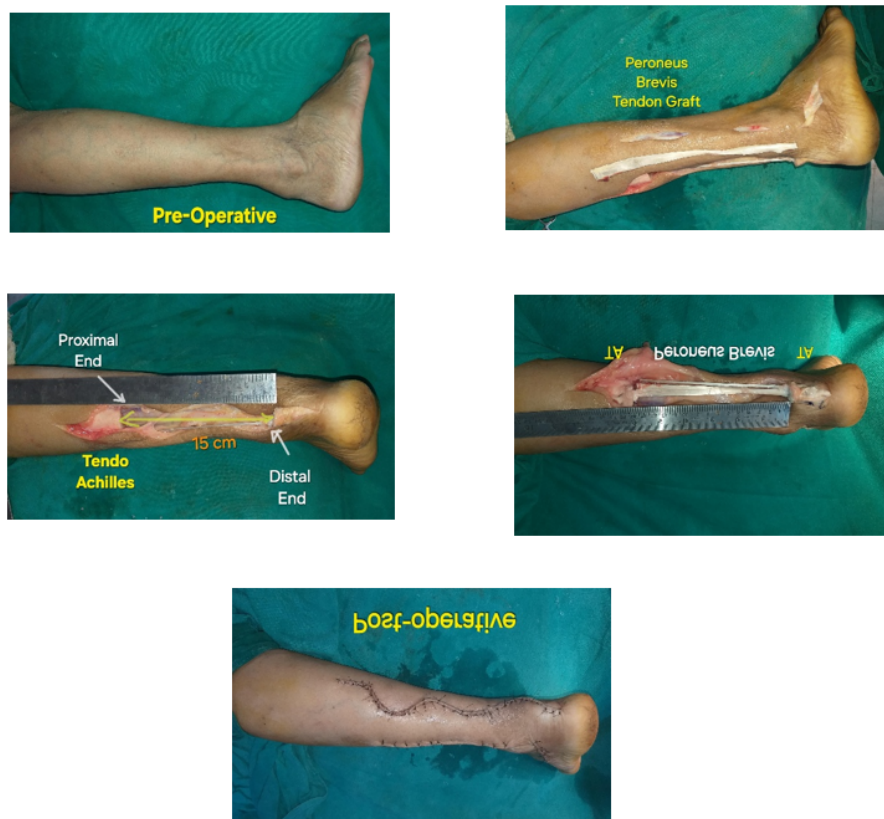


Figure 2: Peroneus Brevis Tendon Graft

(III) Achilles graft and wrap-around fascial flap:

The surgical approach was made through a mid-axial incision from the midpoint of the crural length to the calcaneal prominence. This revealed that the distal stump of the tendon was fragile and ragged, while the gap observed on the MRI was confirmed to be about 5 cm. As there was barely any healthy Achilles tissue available at the distal stump, the author decided to take a 7-cm half-width of Achilles tendon, to be used as a reconstructive graft. The graft was then inserted into the calcaneal prominence and secured using a 0.3-mm steel wire in a double-strand Bunnell fashion. Meanwhile, a double-core Bunnell/modified Kessler suturing technique was performed to suture the graft to the proximal Achilles stump using polypropylene 1-0. A slight

bunching of the repair site was intended to ensure strong tissue contact. Subsequently, a polypropylene 4-0 running suture was used to encircle the repair site. An ipsilateral gastrocnemius fascial flap 7-cm long and 3-cm wide with a distally-based pedicle was then harvested to wrap the tendon graft. The fascial flap was wrapped in a spiraling fashion and secured with 3-0 polyglactin 910 sutures. All of the reconstructive procedures were reassessed with a tension balance check by measuring the tension of the repaired tendon by lightly pressing the foot into dorsiflexion with the knee in 90° flexion. Finally, the skin was closed with a continuous intradermal suture, and the ankle was immobilized in a below-knee circular cast for 6 weeks.



Figure 3: Achilles Graft

(IV) Gracilis tendon graft: The management of neglected tears of the Achilles tendon by free gracilis tendon grafting is safe but technically demanding. It affords good recovery, even in patients with a neglected rupture of a duration of 9 months. These patients should be warned that they are at risk for postoperative complications, and that their ankle plantar flexion strength can remain reduced. The long-term results of treatment of chronic tears of the Achilles tendon with free gracilis tendon grafting showed that patients retained good functional results despite permanently impaired ankle plantar flexion strength and decreased calf circumference

Results

A total of 28 patients with a mean age of 47 years were included in the present study. A chronic tear of the Achilles tendon was diagnosed on clinical grounds in all studies and confirmed by US (ultrasound) and MRI (magnetic resonance imaging) in 14 of them. An open reconstruction was performed in all of the patient with use of peroneus brevis tendon graft in 12 patients, semitendinosus graft in 10 patients, Achilles tendon graft in 4 patients, and Tensor Fascia Lata tendon graft in 2 patients in our study. The average time from acute rupture to the index surgery was reported in these studies with a mean time of 25.1 weeks. The distance between the Achilles tendon stumps was documented, with a mean of 6.2 cm.

Chronic midportion AT ruptures are accidents that mostly affect relatively young males, with a mean age of 44 years.

In this study, 24 patients reported no postoperative complications [13-15,17,18,47,49,51]

The most common complication was superficial post-operative infection in 3 patients and wound dehiscence in only patients.

No patients experienced any problems in the wound used to harvest the tendon of gracilis. Five patients were managed conservatively following a superficial infection of the Achilles tendon surgical wound. No patients developed a deep vein thrombosis or sustained a rerupture. All patients were able to walk on tiptoes, and no patient used a heel lift or walked with a visible limp. The maximum calf circumference remained significantly decreased in the operated leg at final review. The operated limb was significantly less strong than the nonoperated one.

An overview of the complications associated with the procedures is shown in Table 3.

As previously mentioned, being mostly young people or athletes, return to activity (RTA) and return to sport (RTS) are two of the major characteristics investigated, but only 24 of 28 studies addressed return to activity.

Of the 24 patients in whom return to activity was documented, 21 reported had not daily activity

limitations, and 3 reported limitations in activities of daily living .

Table 3: complications associated with the procedures

Complications	Semitendinosus Tendon Graft	Peroneus Brevis Tendon graft	Achilles graft	Gracilis tendon graft
Wound infection	1	1	1	0
Delayed wound healing	0	0	0	0
Wound dehiscence	0	0	1	0
Deep infection	0	0	0	0
Hypertrophic scar	0	0	0	0
Weakness from the donor site	0	0	0	0

Discussion

The most important finding of the present study based on 28 patients is that the most suitable free tendon graft to manage surgically chronic tears of the main body of Achilles tendon is probably an ipsilateral semitendinosus tendon autograft. Several free tendon grafts have been used in the management of large gaps in patients with chronic Achilles tendon ruptures, and the most commonly used tendon is an ipsilateral semitendinosus autograft.

The scales most commonly used to evaluate the clinical outcomes were the AOFAS and ATRS. Developed in 1994, the clinician-based AOFAS (American Orthopaedic Foot and Ankle Surgery) is one of the most widely used PRO (Patient-Reported Outcomes) measures for foot and ankle conditions [42]. Each measure is comprised of nine questions and covers three categories: pain (40 points), function (50 points), and alignment (10 points); 0 stands for severe pain, impairment; 100 for no pain. However, the AOFAS score has not been validated to assess the outcome of management of Achilles tendon rupture.

Nilsson-Helander et al. [43] developed the Achilles tendon Total Rupture Score (ATRS) to measure the outcome related to symptoms and physical activity after treatment in patients with total AT rupture. The scale ranged from 0 = major limitations/symptoms to 10 = no limitations/symptoms and has now been cross culturally validated and reliability tested in several languages [44, 45, 46].

Many different techniques can be used to reconstruct a chronic AT rupture, and, in general, they tend to yield similar functional outcomes. The most effective treatment for chronic Achilles rupture remains undecided, with no concrete guideline for treatment of the ATR with a defect larger than 6 cm.

Transfer of FHL or PB (peroneus brevis) are considered suitable options in chronic rupture of Achilles tendon, with good clinical outcomes and a reliable return to daily activities and sports [47].

Free tendon autograft, allograft or xenograft are described for the management of chronic rupture of the AT.

Autografts are the most commonly reported, carrying, at least theoretically, a series of advantages over other grafts:

- Healthy and strong tissue
- No disease transmission
- Fast recovery and easy harvest procedure

Hamstring tendons are commonly used as a free graft for anterior cruciate ligament (ACL) [48, 49].

These tendons are long, allowing to reconstruct the continuity of the Achilles tendon even in chronic ruptures with a wide gap between the stumps.

Wilson et al. [50] compared the load to failure, graft composite stiffness, and the elastic modulus of matched bone-patellar tendon-bone and double-looped semitendinosus-gracilis tendon grafts from young donors. The average load to failure for the patellar tendon grafts was 1784 N ($\pm$ 580), significantly lower than 2 = 422 N ($\pm$ 538) for the hamstring tendon grafts.

Some researchers have investigated open techniques for reconstruction of the Achilles tendon. In long-term studies, Maffulli et al. [38, 51, 52] showed that both free gracilis tendon graft and peroneus brevis tendon transfer techniques can be performed to manage, respectively, gaps up to and greater than 6 cm.

Sarzaeem et al. [53] evaluated an open technique using a free semitendinosus tendon graft to reconstruct Achilles tendon ruptures with gaps larger than 6 cm, with good functional results, providing a statistically significant improvement in terms of ATRS. Moreover, peroneus brevis tendon transfer and free gracilis tendon graft techniques [38, 45, 52] lead to significant improvement in the ankle plantarflexion strength and calf circumference in the affected leg. Maffulli et al. [45, 52] showed that patients treated using a free gracilis tendon graft retained good functional results despite permanently decreased ankle plantar flexion strength and decreased calf circumference.

Allografts, on the other hand, are advantageous for their lack of donor site morbidity but they are expensive, may have limited availability, sterilization process makes tissue weaker, and a re-

rupture on the same site can be a real and worrisome complication [54].

Song et al. [55] reported promising patient-reported results with low risk of re-rupture and complications utilizing semitendinosus tendon allograft for chronic ruptures of the Achilles tendon. This study reported no complications, with an ATRS of 99.0 points, with only 4 patients reporting mild pain.

Xenografts are available in great supply and wide range of sizes; however, consideration must be given to the risk of cross contamination with bovine spongiform encephalopathy or porcine endogenous retroviruses. Xenografts cannot be adequately screened for these viruses [56].

Magnussen et al. [57] reported that augmentation of Achilles tendon repair with extracellular matrix xenograft decreases gapping and increases load to failure immediately after surgery in a cadaveric model.

Lee et al. [37] showed no loss of function in augmentation of Achilles tendon using an acellular human dermal tissue matrix named GraftJacket Matrix (Wright Medical Technology Inc., Arlington, TN, USA), and favorable return to activity times without risk of re-rupture, but reported three cases of dehiscence of wound and one case of deep vein thrombosis in a small cohort of patients (N = 9).

Barrera Oro et al. [58] compared the total mean cost per case for allograft and autograft in ACL reconstruction. It was \$4,147 ± \$943 in the allograft group compared with \$3,154 ± \$704 in the autograft group (P < 0.001). Supply costs comprised a mean of 58.7% of total expenses in the autograft group and 72.2% in the allograft group. It is unclear whether similar consideration can be applied to the field at hand, thought costs are likely to be higher for allografts.

Papalia et al. [59] systematically reviewed the literature on regeneration of hamstrings after their harvest as grafts for reconstruction of the ACL. Hamstrings regeneration occurs in over 85% of operated patients as seen on histologic and imaging evaluation, but a concomitant deficit in muscular strength at deep knee flexion is most often present and remains the most concerning functional undesired effect after this procedure. Similar studies should be performed in chronic Achilles tear patients.

Although allografts are widely used in North America, in Europe there is relatively lower availability of such grafts. Also, healthcare costs limit the use of allografts in routine clinical work.

It is important that surgeons are fully conversant with several techniques depending on the patient, the local conditions, the physical requirements of the

patient, and the technical abilities of the surgeons themselves.

As these procedures are not common, there could be a case for regional tertiary referral centers to offer the best available care to patients with a chronic tear of the Achilles tendon and wide retraction of the stumps which classically require these complex procedures.

Considering the average age of the patients, functional recovery is essential to return to normal daily and sports activities. The small number of patients studied does not allow to show a clear advantage of one technique over another. RTS rates are dependent on the quality of the method used to measure the RTS. To better understand RTS after chronic Achilles tendon rupture, a standardised, reliable, and valid method is required [60].

This study has several limitations. First, the retrospective design of most studies and the absence of blinding. Moreover, the inhomogeneity of the evaluation scales prevents an adequate comparison between the studies. Chronic AT ruptures especially occur in athletes, and therefore impact negatively on QoL (Quality of Life) especially in terms of return to daily activity and to sport. The present study is the first to systematically review the type of graft used in mid-portion chronic Achilles tendon rupture. However, the number of studies involved was small, and only 22 were eligible for this review. Given the lack of quantitative data available for inclusion, it was not possible to analyse the results of each graft separately.

Conclusion

Chronic Achilles tendon ruptures have been reported up to 25% of patient with a tear of the Achilles tendon. The diagnosis is more difficult, and management is technically more demanding than primary repair of acute rupture. Complications, such as wound breakdown and infection, are also frequent following open procedures. Minimally invasive reconstruction of chronic Achilles tendon ruptures provides good clinical results, with the advantages of decreased perioperative morbidity and complications rate. Reconstruction with the tendon of peroneus brevis using two para-midline incisions is safe, less invasive, and reliable, and good results have been reported in recent literature. However, there are concerns with using a PB tendon transfer, such as a loss of eversion strength and the pull of the transferred PB tendon not matching the Achilles medial moment arm. In our opinion, the PB tendon transfer should not be the first choice. If the tendon gap is higher than 6 cm, a free hamstring autograft (semitendinosus), is recommended. Mini-invasive reconstruction of the Achilles tendon, with a gap lesion larger than 6 cm, using the ipsilateral free semitendinosus tendon graft provides a significant

improvement of symptoms and function, although calf circumference and ankle plantarflexion strength do not recover fully. However, achilles tendon graft and gracilis tendon graft required further study to advocate. The long-term results of treatment of chronic tears of the Achilles tendon with free gracilis tendon grafting showed that patients retained good functional results despite permanently impaired ankle plantar flexion strength and decreased calf circumference.

Ethical Approval: The study was performed in accordance with the principles of the Declaration of Helsinki. Written informed consents were obtained.

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