Total Achilles Tendon Ruptures: Current Trends

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Abstract

Achilles tendon rupture occurs relatively common (De Jonge, Br J Sports Med 45:1026–1028, 2011). Although it is the thickest and strongest tendon in the human body, it remains susceptible to injury. During the last decades, the incidence of spontaneous ruptures has been rising, which may be due to the increasing keep-fit culture. Ruptures occur most frequently in patients between the age of 30 and 50 years old, with a male predominance. Approximately **75 % of Achilles tendon ruptures occur during sports activities**, especially racket games, soccer, and handball. **Diagnosis is primarily clinical**. However, there is still a lack of consensus on the best management of the Achilles tendon rupture. Generally, open surgical management is advocated, although over the past few years, percutaneous techniques are performed more commonly. Nonsurgical management appears to be a good alternative for those with comorbidity or patients who do not wish to have surgery. Recent systematic reviews have concluded that operative management has a lower re-rupture rate but must be balanced by the risks associated with surgery (Khan and Carey Smith, Cochrane Database Syst Rev CD003674, 2010).

Functional Anatomy

The Achilles tendon consists of the fibers of two muscle units in the superficial compartment of the posterior leg: the gastrocnemius muscle (medial and lateral head) and the soleus muscle. At about the level where the soleus contributes fibers to the Achilles tendon, rotation of the tendon begins and becomes more marked in the distal 5–6 cm. This rotation results in a relatively hypovascular area. The Achilles tendon inserts crescent-shaped halfway the posterior tuberosity of the calcaneus (Lohrer et al. 2008). **The blood supply to the tendon is poor** and there is a decrease in its nutrition with advancing age. Unlike other tendons in the leg, the Achilles tendon is a type I tendon that lacks a synovial sheath. Instead, it has a paratenon, which is an array of thin connective tissue containing blood vessels (Saxena and Bareither 2001). Together with the bone–tendon and the muscle–tendon junction, the paratenon forms the sole vascular supply of the Achilles tendon. A recurrent branch of the posterior peroneal artery mostly supplies the paratenon, whereas the peroneal artery makes small contributions.

The sural nerve is located at the lateral border of the Achilles tendon at its midportion, but many variations have been described (Apaydin et al. 2009). It is especially vulnerable to iatrogenic damage, most often Achilles tendon surgery, resulting in hypo- or hyperesthesia of the lateral side of the affected foot.

Tendons are designed to transfer large forces from muscle to bone and are less able to withstand shear and compression forces than tensile forces. At rest, the tendon fibers display a wavy configuration. This disappears when the tendon is stretched approximately 2 %. When the force is released, the tendon fibers resume their wavy appearance. Up to approximately 4 % elongation, the tendon will return to its original state after the tension is released. If the tendon is stressed beyond approximately 4 % of its length, partial ruptures will occur, and at approximately 8 % of elongation, a complete rupture will occur (Fig. 1). This means that irreparable changes will occur in the tendon. A stress–strain curve is often presented in the literature when describing the mechanical behavior of a tendon (Maffulli et al. 2009).

The elasticity of the Achilles tendon is important to store and release energy during the stretch–shortening cycle (SSC). A heavy load on the Achilles tendon occurs in activities during which the SSC is used. The SSC is a combination of an **eccentric muscle action** (with lengthening of the muscle and tendon) and followed immediately by a **concentric muscle action** (shortening of the muscle–tendon complex). The concentric force production is higher when it is preceded by an eccentric muscle action compared with a pure concentric muscle action. This is in part due to

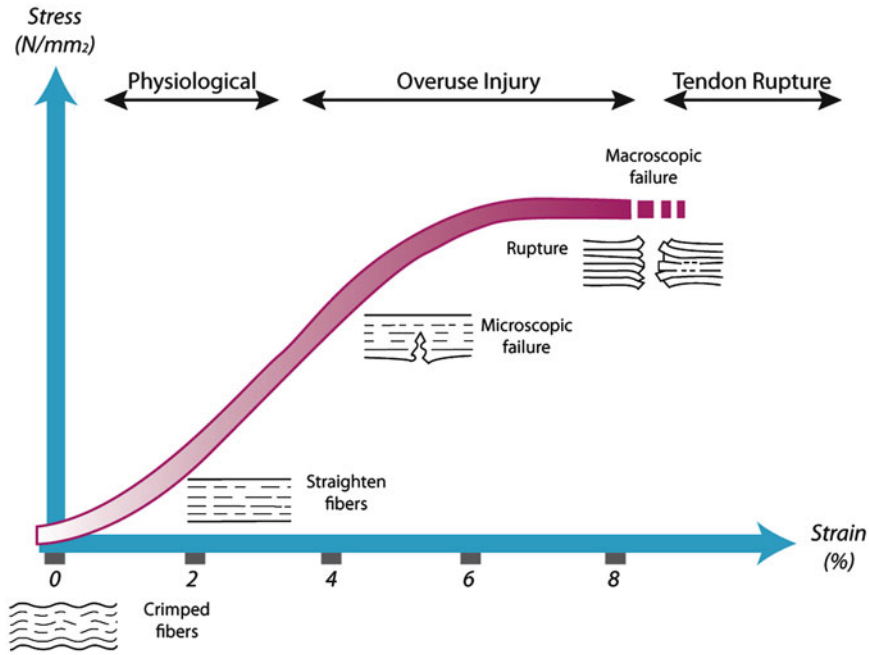

Fig. 1 Stress–strain curve of Achilles tendon rupture

the utilization of the passive elastic components such as the tendon. The larger the cross-sectional area is, the greater its capacity to withstand heavy loads before failure. Longer tendons have a greater capacity to elongate before failure compared with shorter tendons (Nilsson-Helander et al. 2009).

Tendon Healing

After a tendon injury, there are three phases of healing: inflammatory, proliferative, and remodeling (Moller et al. 2001; Nilsson-Helander et al. 2010; Willits et al. 2010).

- ***Phase 1: acute inflammatory phase***. This lasts for up to 1 week after injury. During this phase, inflammatory cells remove the injured tissue.
- ***Phase 2: proliferative phase***. During this phase, type I collagen is produced by fibroblasts to increase tendon strength. After approximately 4 weeks, more than 50 % of the tensile strength of the tissue may be restored. The proliferative phase lasts up to around 4 weeks in most individuals.
- ***Phase 3: remodeling phase***. During this phase, healing occurs for up to 1.5 years after the original injury. During this phase, the tensile strength, elasticity, and structure of the tendon improve. However, there is currently no evidence that the tendon will fully recover its properties, which indicates that there are permanent changes in the tendon.

In animal studies, the healing tendon has been reported to regain about 50 % of its tensile strength and 30 % of its energy absorption within 2 weeks after surgery. This indicates that nonsurgical treatment with early range of motion and early weight-bearing is, in most cases, a safe treatment. The optimal amount of loading that benefits the healing of the tendon but does not cause a re-rupture is, however, still unknown.

Etiology and Injury Mechanism

There is little agreement on the etiology of spontaneous Achilles tendon ruptures. Several hypotheses have been proposed, such as poor tendon vascularity, the adverse effect of the use of corticosteroids and fluoroquinolones, and exercise-induced hyperthermia in a relatively avascular tendon. Mechanical factors such as overpronation of the foot on heel strike, training errors, and malfunction or suppression of proprioception of the skeletal muscle have also been suggested. Histologically, spontaneously ruptured Achilles tendons might show degeneration of the fibers near the rupture site. There is a decrease in maximum diameter and density of collagen fibrils, and the vascularization of the tendon is known to decrease with age (Schepsis et al. 2002). However, there is little evidence of a failed healing response. Etiology is probably multifactorial. The mechanism of injury includes a sudden push-off from the weight-bearing forefoot with the knee in extension, unexpected ankle dorsiflexion, and violent dorsiflexion of a plantar-flexed foot (Arner and Lindholm 1959).

Epidemiology

Achilles tendon ruptures are relatively common, and several studies indicate that sports participation is associated with an increased rupture risk (Maffulli et al. 2003). In the last decades, the rupture incidence increased significantly especially in sports with abrupt repetitive jumping and sprinting movements (Josza et al. 1989; Houshian et al. 1998). Most Achilles tendon ruptures occur in men with a ratio from 2:1 to 18:1 (Cretnik and Frank 2004; Owens et al. 2007). Furthermore, **two peaks of rupture incidence** are seen; the first is sports activity related around the age of 40, while the second occurs at the age of 55–65 in nonathletes and women. Older athletes have more frequent ruptures than younger ones, but these younger ones are more prone to re-ruptures (Rettig et al. 2005). Not only age but also racial differences appear to exert a significant effect on Achilles tendon ruptures, with the Negroid population having a higher risk of rupture (Davis et al. 1999).

Diagnosis

Clinical Presentation and Evaluation

Achilles tendon rupture is a clinical diagnosis. Patients report sudden intense pain in the midportion of the Achilles tendon, often stating that someone might have struck their heel. Upon clinical examination, a positive calf squeeze test, the so-called Thompson's (Simmonds') test, and a gap in the Achilles tendon is consistently found. If any diagnostic doubt still exists, the next step is to perform ultrasonography of the tendon and its insertion. Additional ultrasonography or MRI can be useful for verifying the diagnosis and planning the surgical procedure. However, additional investigations should not replace a thorough clinical investigation, and it should be born in mind that the diagnosis is primarily clinical.

Ultrasonography (US)

An acute tendon rupture mostly appears as a focal lucency in the tendon, with a small amount of fluid in and surrounding the tendon. The frayed ends of the tendon can be detected, separating in dorsiflexion. In plantar flexion, full juxtaposition of the tendon stumps is used as a basis for nonoperative treatment. In delayed ruptures, complete juxtaposition is not possible, and a hematoma is seen between the tendon stumps. Ultrasonography (US) is hardly ever necessary, unless there is suspicion of a neglected rupture, there is patient delay, or if nonsurgical management is considered.

Magnetic Resonance Imaging (MRI)

Another possibility is magnetic resonance imaging (MRI), although there is little indication for it in the straightforward acute Achilles tendon

Fig. 2 Sagittal T1 MRI image of a torn Achilles tendon

Fig. 3 Sagittal T2 MRI image showing Achilles tendon rupture healing after cast immobilization (conservative treatment)

rupture, where clinical diagnosis is the key issue. It can be useful to differentiate between chronic pathologies around the Achilles tendon and its insertion. For neglected ruptures, MRI is useful to assess gap length and scar tissue or fatty degeneration in the light of preoperative planning (Fig. 2). In selected cases, it can also be used in the nonsurgical management to assess the tendon healing, since ultrasonography is difficult to perform due to the cast immobilization (Fig. 3).

Treatment

Treatment of the Acute Achilles Tendon Rupture

The treatment of acute Achilles tendon ruptures may be surgical (open/percutaneous) or nonsurgical. In the literature, the main outcome measure when comparing surgical and nonsurgical treatments is **the risk of a re-rupture** (Moller et al. 2001; Nilsson-Helander et al. 2010; Willits et al. 2010; Olsson et al. 2011).

The re-rupture rate is significantly lower with surgical treatment (approximately 3 %) than with nonsurgical treatment (approximately 10–13 %). Therefore, all trials included in a recent meta-analysis recommended surgical repair. One main problem is the variation in the methodological quality in studies on the treatment of acute Achilles tendon ruptures. There is little consensus with regard to functional recovery from recent studies due to inconsistent assessment systems. **The Achilles Tendon Rupture Score** was recently published as an instrument to report the results after treatment of Achilles tendon rupture. The score is tested for validity and reliability and has been successfully used in recent studies (Nilsson-Helander et al. 2010, Table 1).

In a recent meta-analysis, the re-rupture rates were estimated to be 4.3 % and 9.7 % in surgically and nonsurgically treated patients, respectively

Table 1 The Achilles Tendon Rupture Score, a useful questionnaire to report the results after treatment of Achilles tendon rupture

ATRS

(Achilles Tendon Total Rupture Score)

Today's Date: ____/____/_____ Date of Birth____/____/_____

Name:_____

All questions refer to your limitations/difficulties related to your injured Achilles tendon.
Answer every question by grading your limitations/symptoms from 0-10.
(0= Major limitations and 10= No limitations).

Please circle the number that matches your level of limitation

1. Are you limited due to decreased strength in the calf/Achilles tendon/foot?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
2. Are you limited due to fatigue in the calf/Achilles tendon/foot?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
3. Are you limited due to stiffness in the calf/Achilles tendon/foot?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
4. Are you limited due to pain in the calf/Achilles tendon/foot?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
5. Are you limited during activities of daily living?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
6. Are you limited when walking on uneven surfaces?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
7. Are you limited when walking quickly up the stairs or up a hill?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
8. Are you limited during activities that include running?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
9. Are you limited during activities that include jumping?
   0 1 2 3 4 5 6 7 8 9 10 (No limitations)
10. Are you limited in performing hard physical labour?
    0 1 2 3 4 5 6 7 8 9 10 (No limitations)

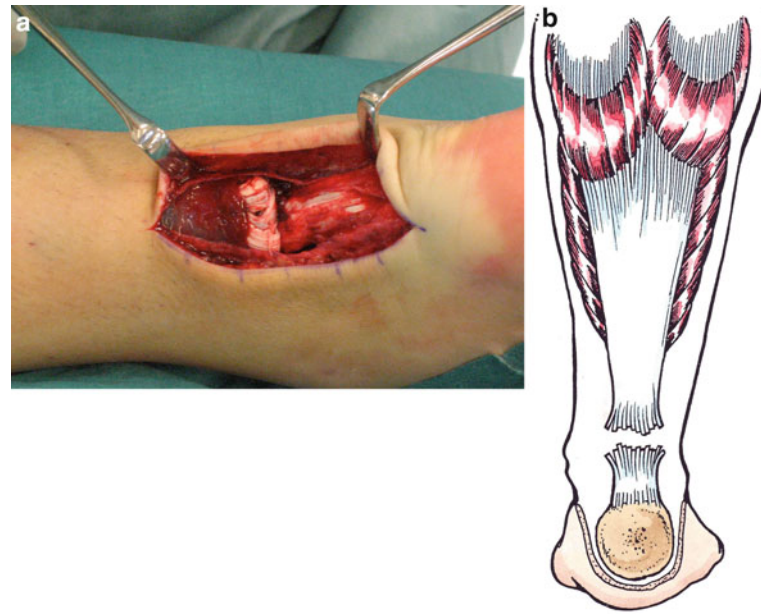

Fig. 4 (**a**) Surgical photo of an Achilles tendon rupture. (**b**) Image depicting the classic presentation of an Achilles tendon rupture

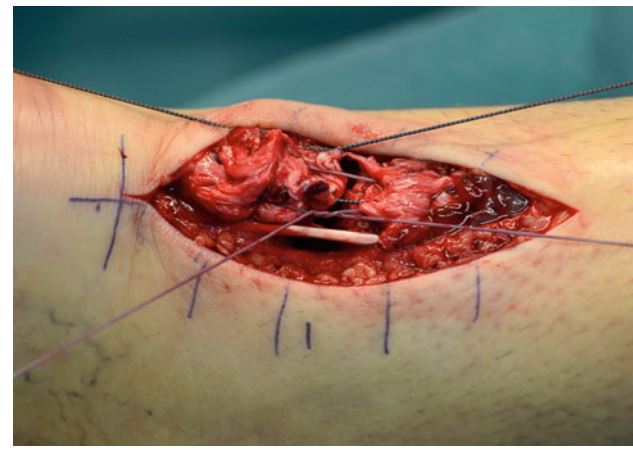

Fig. 5 Surgical photo of a "double Kessler locking loop technique" Achilles tendon repair

(Maffulli et al. 2009). Compared with nonsurgical treatment, surgical treatment can effectively reduce the risk of re-rupture (Figs. 4a, b, 5, 6, and 7). However, as noted above, surgical treatment increases the likelihood of complications, and today, there is no evidence that surgical treatment leads to improved functional recovery.

For the open surgical repair of an acute Achilles tendon rupture, limited conclusions can be drawn with regard to different suture techniques. The Kessler, Krackow, Bunnell, and triple-bundle techniques are the most commonly used surgical stitch configurations, and all have their different advantages (Olsson et al. 2011, Figs. 5, 6, and 7). Tendon augmentation has not shown any superior results over end-to-end sutures.

Surgical techniques for treating acute Achilles tendon rupture are changing, and there appears to be an increasing role for **percutaneous and mini-open techniques**. It is suggested that these techniques can give results equivalent to or better than those of an open repair. Studies of mini-invasive techniques indicate a decreased incidence of wound complications, especially infection, but this technique might increase the risk of sural nerve injury.

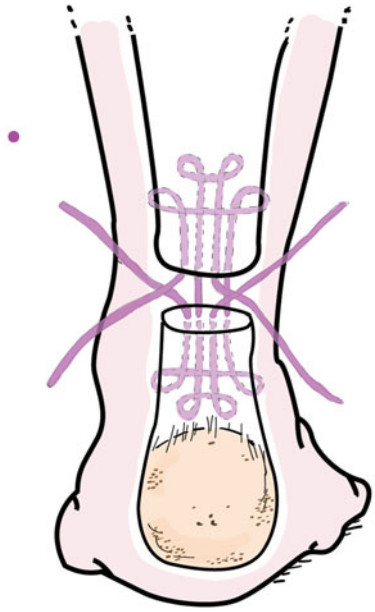

Fig. 6 Graphic example of a classic Achilles tendon rupture open repair

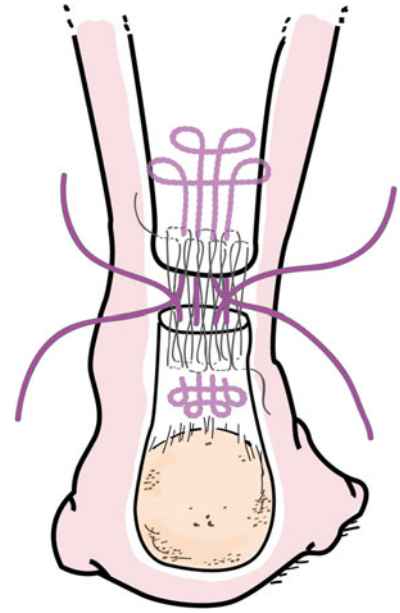

Fig. 7 Graphic example of a classic Achilles tendon rupture open repair with enhanced suturing

Evidence suggests that early functional rehabilitation can increase the strength of healed tendons and shorten rehabilitation time; early mobilization may be allowed in patients treated with these methods (Figs. 8, 9, and 10). Further studies are required but combining minimal invasive/percutaneous techniques with early functional rehabilitation is becoming the current gold standard, especially in the athlete population.

Early weight-bearing and mobilization with or without surgical treatment produced the best result, provided that the tendon ends were in contact (Maffulli et al. 2009). The limitations of surgical treatment include a significantly higher risk of infections, adhesions, and other wound-related problems compared with nonsurgical treatment. Most elite athletes prefer surgical treatment. The surgical techniques described in the literature differ considerably, although end-to-end suture – possibly with local augmentation – dominates. Tendon transfer is not recommended for the treatment of acute total Achilles tendon rupture. Compared with nonsurgical treatment, surgical treatment can effectively reduce the risk of re-rupture (it may be debated if this is the most important primary variable in studies, instead functional outcome should be increasingly considered). However, surgical treatment increases the likelihood of complications. Today, there is no evidence that surgical treatment leads to improved functional recovery (Costa et al. 2006). Studies are limited in size and the varying outcome measurements make comparisons difficult.

As has been shown, **strong scientific evidence is lacking regarding the optimal treatment for acute Achilles tendon rupture**. The outcomes between surgical and nonsurgical treatments appear to be comparable, although the re-rupture rate is somewhat higher in the nonsurgical group in most studies. A movable brace and/or weight-bearing appear to be preferable to a cast regardless of whether surgery is performed.

Treatment of the Chronic Achilles Tendon Rupture

According to the literature, a "chronic Achilles tendon rupture" is one that is diagnosed 4–6 weeks after injury. The exact timing can be debated, though. The different terms used for these injuries in the literature are "delayed," "neglected," and

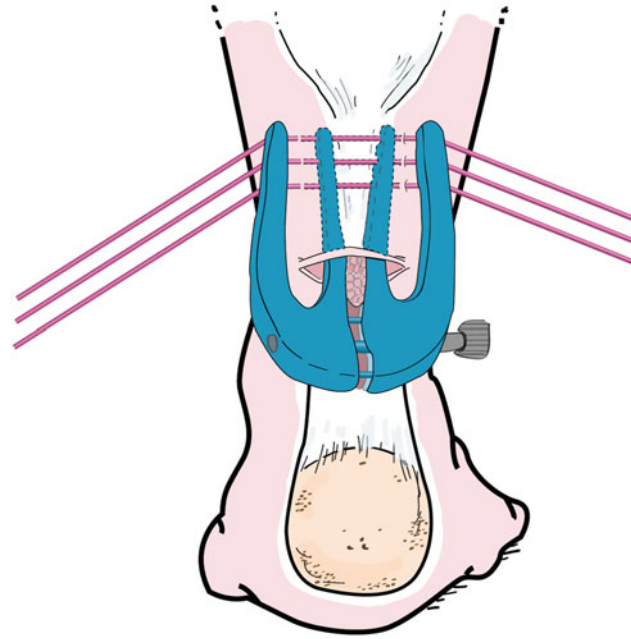

Fig. 8 Graphic example of a percutaneous Achilles tendon rupture repair (Achillion)

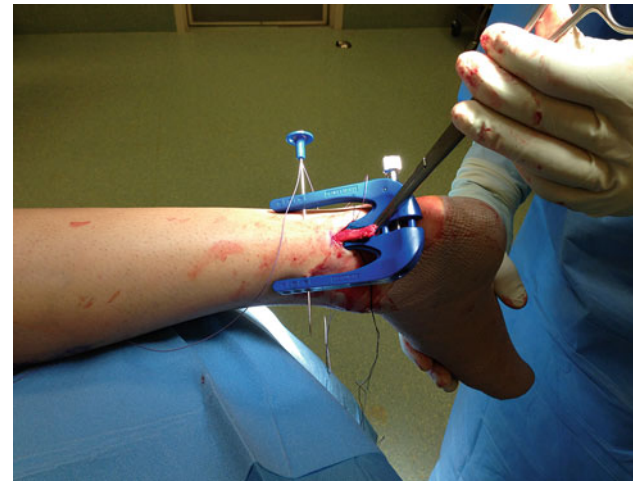

Fig. 9 Surgical photo of a percutaneous Achilles tendon repair procedure over the proximal part

"chronic ruptures." For medicolegal reasons, the term "chronic rupture" is preferable. However, there is no universally accepted time limit defining when an acute rupture turns into a chronic rupture. More than 20 % of acute Achilles tendon ruptures are described as "delayed," because the rupture is unrecognized or misdiagnosed by the examiner (doctor's delay) or the patient waits before seeking medical attention (patient's delay). When treating a chronic rupture, most surgeons agree that surgery is the treatment of choice, unless there are obvious contraindications to surgery or the patient has low functional demands (Nilsson-Helander et al. 2009).

Even though many different surgical techniques exist, only a few of them have been validated scientifically and there is an obvious lack of evidence-based guidelines for the selection of the optimal surgical technique for chronic Achilles tendon ruptures.

The repair of a chronic rupture or a re-rupture is associated with an increased risk of **complications such as infection and delayed wound healing**.

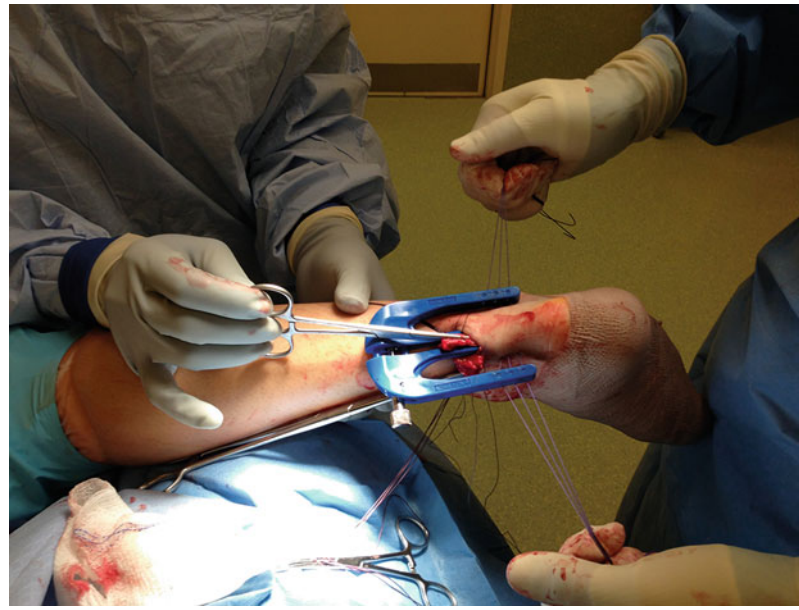

Fig. 10 Surgical photo of a percutaneous Achilles tendon repair procedure over the distal part

But, it is difficult to draw any definite conclusions in terms of the functional outcome of the different surgical techniques presented in the literature, because of the wide variation in study design, postoperative regimens, and end points. There are no comparative studies when it comes to comparing different surgical techniques for the treatment of chronic ruptures, although there is a general agreement that a chronic rupture or re-rupture needs surgery (Costa et al. 2006; Maffulli et al. 2009; Khan and Carey Smith 2010).

The surgical techniques for repair of chronic Achilles tendon ruptures can be divided into different categories:

- The V-Y technique
- Local tissue augmentation
- Turndown flaps
- Tendon transfer
- Free tissue transfer
- Use of synthetic material

Several different turndown flaps have been used to bridge the tendon gap. A recent study has shown good results after free flap transfer of the gastrocnemius aponeurosis. An open technique is usually recommended for chronic ruptures (Nilsson-Helander et al. 2008).

Thromboprophylaxis

Without thromboprophylaxis, the incidence of deep venous thrombosis (DVT) is 40–80 % and fatal pulmonary embolism 1–5 % following major orthopedic surgery. The need for thrombosis prevention has been generally agreed upon when major orthopedic surgery is undertaken, and standardized thromboprophylaxis regimens are usually implemented.

However, for patients treated for so-called "minor" lower leg injuries, such as an Achilles tendon rupture, **no consensus** exists with regard to the advantage of thromboprophylaxis. Only a few studies have reported on the risk of developing symptomatic thromboembolism after an acute Achilles tendon rupture. The results varied from a benefit from thromboprophylaxis to no benefit at all. Because the accuracy of a clinical diagnosis of thromboembolism is low, the true incidence is not well known. A recent study has shown that the risk of DVT in the calf is approximately 30 % (shown by ultrasonography screening of all patients in that study), regardless of surgical or nonsurgical treatment (Nilsson-Helander et al. 2009).

Technical advances and clinical experience have increased the advantage of color duplex sonography, which is a noninvasive, non-expensive, and

convenient method for the patient. However, the accuracy of the method has to be studied further before it can be used as the "gold standard" for diagnosing DVT. Most probably, **thrombosis prevention** should be employed in all patients who have sustained a total Achilles tendon rupture, regardless of treatment protocol.

Patient-Reported Outcome

It is important to use reliable, validated outcome measurements when evaluating treatment. Patient-reported outcomes have been more frequently used during the last decade to obtain the patients' own opinions about their results. When evaluating outcome, different functional tests together with the patient's opinion and complication registration are necessary to obtain an overall picture of the treatment results.

Evaluations of the treatment of an Achilles tendon rupture vary considerably among different studies. Clinical examination often includes calf muscle circumference, ankle range of motion, and tendon width measurements. It has, however, never been shown that any of these factors are of importance in terms of function or patient satisfaction.

Accordingly, there is an obvious need for an outcome measurement, based on patient outcome and function and tests for reliability and validity. Such a score should be useful to compare outcome studies in the future.

A validated patient-reported outcome measurement exists for the evaluation of treatment of Achilles tendinopathy: the Victorian Institute of Sports Assessment–Achilles questionnaire (**VISA-A questionnaire**). A validated patient-reported outcome measurement also is available for foot and ankle injuries, the Foot and Ankle Outcome Score (**FAOS**). Since patients with an Achilles tendon rupture have different functional complaints and symptoms than patients with Achilles tendinopathy or ankle injuries, the use of the VISA-A and FAOS as an outcome measurement for this patient group can be questioned. To our knowledge, no validated scores for evaluating treatment in patients with an acute Achilles tendon rupture have been presented in the past. Accordingly, the **Achilles Tendon Total Rupture Score** (ATRS) was constructed and has been tested for reliability and validity. It is also sensitive to changes over time. This functional outcome score is also well suited to evaluate the results after surgical or nonsurgical treatment, and it is recommended as the primary score to evaluate functional outcome after the treatment of Achilles tendon injuries (Silbernagel et al. 2010).

Recovery of Function and Future Perspectives

The strength deficit of the calf musculature on the injured side one year after an Achilles tendon rupture is reported to be approximately 10–30 % compared with the uninjured side, with large interindividual variations, and it appears that this deficit becomes permanent (Silbernagel et al. 2010; Olsson et al. 2011). More than half of the patients are unable to perform a one-legged heel raise after 3 months. Moreover, early recovery of plantar flexion torque has not only been shown to indicate the normalization of the calf musculature function, it also can be due to compensation by the flexor hallucis longus muscle. It is still not known **whether tendon lengthening**, especially after nonsurgical treatment, is of importance when it comes to strength deficit in the long run. This needs to be examined further, with more accurate research methods than previously existed, for instance, ultrasonography.

To evaluate muscle endurance, the most commonly used test is counting the number of consecutive heel rises the subject is able to perform until fatigue sets in on one leg and then compare this with the other leg.

The **height of the heel rise** may be important, since there is a disproportionate weakness in end-range plantar flexion. One explanation for this is tendon lengthening that may occur during the healing of the tendon. The theory that tendon lengthening is important in terms of functional recovery needs further studies. It is well known that extreme tendon lengthening has negative consequences, but the impact of minor/moderate

tendon lengthening is not currently known (Silbernagel et al. 2010).

Studies have demonstrated that there is a separation of tendon ends after Achilles tendon repair. Interestingly, early motion can result in a smaller degree of tendon separation compared to immobilization following Achilles tendon ruptures treated with surgery. The smaller degree of tendon separation also correlates with better clinical outcomes. These findings are in accordance with the hypothesis that tendon lengthening may be of greater importance than previously realized.

Changes in plantar flexion muscle forces and deficits in heel-rise heights have functional implications when it comes to the patients' ability to walk, run, and jump. For the patients, the important outcomes of an Achilles tendon rupture are recovery of full function and the ability to return to previous activities, including sports, without an increased risk of re-rupture and of developing other overuse injuries.

Interestingly, recent studies have shown that the number of patients that returns to the previous activity level is rather low, approximately 50 % in some studies. Some recent studies (Olsson et al. 2011) have shown a somewhat higher number, around 70 %, but still, there is more research needed regarding why active persons are unable to return to sports activity. There are several reasons for this, and one of them could be kinesiophobia, i.e., fear of moving and fear of re-rupture.

Rehabilitation

In recent studies, patients who had surgical treatment were randomized postoperatively to a rigid cast alone or to a functional brace after a short period in a rigid cast. An overall lower re-rupture rate in favor of a **functional brace** was reported. However, there were no significant differences between the treatment groups in any of the studies in terms of complications other than re-rupture rate. Therefore, functional braces appear to be beneficial at least when compared to casting (Moller et al. 2001; Nilsson-Helander et al. 2009; Nilsson-Helander et al. 2010; Silbernagel et al. 2010; Olsson et al. 2011).

A recent **meta-analysis** including six randomized studies compared traditional (immobilization) and early functional postoperative protocols (Maffulli et al. 2009). In the group using a functional postoperative protocol with early weight-bearing, patients judged their quality of life to be higher than those in the traditional non-weight-bearing group. Patients in the traditional group complained more about scar adhesion and transient sural nerve dysfunction.

The treatment regimens in the studies mentioned above were not identical, but all of them still concluded that **early mobilization appears to reduce rehabilitation time and result in a lower re-rupture rate in patients treated surgically**. It may also result in faster return to sport, with impact on health economy that should be taken into consideration. It may therefore be argued that early mobilization and early weight-bearing are probably of major importance in the treatment of an acute Achilles tendon rupture. In summary, an additional functional brace rather than a cast has been shown to be beneficial in terms of the risk of re-rupture and functional recovery. Limited information is, however, available on the effects of a functional brace, especially in combination with nonsurgical treatment (Bostick et al. 2010).

The **optimal rehabilitation is not known, and most patients treated for Achilles tendon ruptures still have functional deficits 1 year after the injury, regardless of whether the treatment is surgical or nonsurgical**. However, improved acute-phase treatment, e.g., improved rehabilitation protocol during the first 3 months after injury, is probably of importance (Maffulli et al. 2009; Hess 2010; Karkhanis et al. 2010).

Key Take-Home Messages and Current Knowledge on Achilles Tendon Ruptures

- Achilles tendon rupture is common and recent studies have reported an increasing incidence.

- This increase is thought to be related to a greater interest in recreational sports activities.
- The risk of an Achilles tendon rupture is approximately ten times higher in males than in females.
- Acute Achilles tendon ruptures are frequently sustained in activities that involve running and racket sports.
- Sports-related Achilles tendon ruptures are most common in persons aged 30–49 years (mean 40 years), but there is a second peak in older athletes 55–65 years of age.
- The most common injury mechanism is a sudden, forced ankle dorsiflexion, often in racket sports.
- The diagnosis of an acute total Achilles tendon rupture is always clinical in the first place, and additional examinations, e.g., US and MRI, are only needed occasionally. Additional examinations should not replace a thorough clinical examination.
- Partial rupture is very uncommon and the diagnosis is probably incorrect in most cases; the tendon is almost always completely torn.
- Surgical treatment is superior to nonsurgical treatment in terms of lower risk of re-rupture and shorter sick leave.
- Surgical treatment is inferior to nonsurgical treatment in terms of complication risks, especially scar adhesion, superficial infection, and disturbed skin sensibility. However, there are no differences in terms of symptomatic DVT and extreme Achilles tendon lengthening (limited data on minor/moderate tendon lengthening, though).
- There is no difference between surgical treatment and nonsurgical treatments in terms of return to sports, provided no major complication (i.e., re-rupture) occurs.
- The assessment systems should be more consistent. The Achilles Tendon Rupture Score (ATRS) has been well tested for reliability and validity and can be used as the standard assessment system of all outcome studies in the future.
- Most patients have not had any symptoms in the Achilles tendon before the rupture (e.g., tenderness, stiffness, pain). Typically, patients without previous symptoms report hearing a sudden audible "snap" in the calf. The patient often feels they have been hit from behind.
- There are several areas that need further research such as surgical versus nonsurgical treatment in a large-scale study (cohort size 500 patients or more in each group), effect of tendon lengthening, and standardization of functional outcome testing and functional scores.

Conclusion

There remains a lack of consensus on how to best manage the acute Achilles tendon rupture. Several randomized controlled trials have been published, but no definitive treatment recommendations can be made based upon the available literature, although there is a consensus that functional outcome scores are recommended to be used as a primary outcome measure. **Generally, surgical treatment is indicated in the high-demand patient population**. When choosing the surgical option, open surgical management is used, although over the past few years, percutaneous techniques are performed more commonly. The nonsurgical cast immobilization treatment is generally chosen for the more sedentary patient. It is suggested to **tailor the management to the specific patient's lifestyle**. Nonsurgical management leads to a higher re-rupture rate, while surgical management is related to a higher complication rate (but reduces the re-rupture rate). In this regard, it is also shown that fast postoperative functional bracing is preferred over long-term cast immobilization because it shortens the rehabilitation period.

Cross-References

- ▶ Achilles Tendon Surgery: Perspective from an Orthopedic Surgeon
- ▶ Advantages of Endoscopy-Assisted Repair for Achilles Tendon Ruptures
- ▶ Endoscopy and Percutaneous Suturing in the Achilles Tendon Ruptures and Proprioceptive Physiotherapy

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