CHAPTER **34**

Achilles Tendon Rupture: Operative Versus Nonoperative Treatment

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INTRODUCTION

Achilles tendon ruptures (ATR) occur frequently in both recreational and elite athlete populations. In recreational athletes, ruptures occur more commonly in men who are in the third and fourth decades of life, and who participate infrequently in sporting events. These patients are sometimes given the designation "weekend warriors" (1). Recent studies demonstrate an increase in the incidence of ATR since the 1950s, with an increase in individuals participating in sporting activities (2). The proper management of ATR is heavily debated. There is a trend for nonoperative management due to studies demonstrating no differences in strength outcomes between operative and nonoperative treatment (3). Operative management can result in secondary complications including infection, dehiscence and wound healing issues. Nonoperative management, however, is associated with higher re-rupture rates in some studies (4). Recently, operative management has been favorable toward percutaneous repair to prevent the complications that exist with open repair. Beyond operative and nonoperative management, the literature has been focusing on formulating an aggressive rehabilitation program and earlier weightbearing. Studies are demonstrating that regardless of operative or nonoperative management, the postoperative protocol significantly affects the outcome.

ANATOMY

The Achilles tendon (AT) consists of the conjoined tendon from the gastrocnemius and soleus muscles. It is the strongest and largest tendon in the body. The gastrocnemius and soleus vary in their contribution, orientation, and the extent of fusion in the tendon (5). The tendon is enclosed by a paratenon. Blood supply to the tendon is through 3 areas; the musculotendinous junction, the length of the tendon and the tendon to bone junction (6). The watershed area is located 2-6 cm from the insertion of the tendon. This is the most common area for ATRs to occur. With age, there is decreased cross-linking of collagen and decreased tensile strength (7). The AT is supplied by superficial sensory nerves and branches of the tibial nerve. The sural nerve is vulnerable during repair of the AT due to location. The nerve consists of 4 named parts: the medial sural cutaneous nerve, the lateral sural cutaneous nerve, the peroneal communicating branch, and the sural nerve. The sural nerve crosses the tendon approximately 8-10 cm from its insertion (8). Multiple cadaveric studies have demonstrated common variations of the nerve. An ultrasound study found that the sural nerve tracked closer to the AT in older and shorter patients (9). The goal with AT repair includes improved alignment of collagen fibers, strength, vascularity, and prevention of re-rupture. Early motion of the tendon has shown to aid in alignment of the collagen fibers, and movement increases collagen synthesis (10). Controlled mobilization of the AT accelerates tendon repair, and decreases scar tissue and adhesion formation (11). Studies have investigated the histology of ATR, and have found that ruptured tendons show degenerative changes present before the rupture. One study demonstrated tenocytes in both ruptured and tendinopathic tendons, which increased production of type III collagen. This type of collagen makes the tissue less resistant to tensile forces (12, 13).

NONOPERATIVE TREATMENT

The Achilles tendon can achieve apposition treated by immobilization with the foot in a plantar flexed position. Nonoperative management avoids surgical complications associated with both open and percutaneous treatment. One study noted a decrease in surgical management from 2009-2013 with the increased availability of randomized control trials (14). Traditional conservative management consists of casting in equinus and keeping patients non-weightbearing for many weeks. Previous studies evaluated placement of the cast above or below the knee to immobilize the gastrocnemius muscle, however cadaveric studies demonstrated no difference in outcomes (15).

Nonoperative management is commonly associated with an increased re-rupture rate (cited as 10-12%) (16) Increasing the non-weightbearing duration from 8 to 12 weeks can decrease the re-rupture rate as the rupture usually occurs within the first few weeks a patient is taken out of the cast (17, 18). Nonoperative management with cast immobilization can result in lengthening of the tendon, muscle weakness, gait abnormalities, and the need for surgical shortening (19, 20). However, with changes in functional bracing and early range of motion protocols,

the difference in re-rupture rates between operative and nonoperative treatment of ATR has narrowed. Barfod et al demonstrated dynamic rehabilitation did not increase the re-rupture rate in conservatively-treated patients with ATR (21). This was again demonstrated in a study comparing weightbearing the first day of treatment as opposed to 4 weeks of immobilization (22). Currently, patients are treated in functional braces with inserts that are changed in a weekly fashion and are allowed to weight bear fully within the first few weeks of treatment (23). Nonoperative treatment used to be reserved for older patients that are not ideal surgical candidates. With new protocols, more physicians are treating all patients nonoperatively to avoid surgical complications.

OPERATIVE TREATMENT

Operative management has demonstrated lower re-rupture rates than traditional conservative treatment of ATR. A literature review in 2002 found a re-rupture rate of 1.4% in open repair and 10.7% in nonoperative treatment with immobilization (24). A meta-analysis in 2005 cited a re-rupture rate of 3.5% in operative treatment and 12.6% in nonoperative treatment (4). Operative management includes open, minimally invasive, and percutaneous surgery. Major complications have been cited to occur in up to 10% of patients and minor complications in up to 15% of cases treated surgically. The most frequent complications include wound healing issues, deep and superficial infections, and nerve injury.

Open Versus Percutaneous Repair

Recently, percutaneous repair has gained favor over open repair to avoid the common complications associated with open treatment. Both open and percutaneous repair have shown success in treating ATR (25). A meta-analysis by McMahon et al compared open and minimally invasive techniques. The study found that patients overall were more satisfied with minimally invasive surgical repair over open repair, but with similar functional outcomes (26). Percutaneous repair was originally described by Ma and Griffith in 1977, it included sutures crossing the Achilles tendon through 6 medial and lateral short skin incisions (27) The authors reported no complications, however this approach did not allow for visualization of the repair and it placed the sural nerve at risk for injury. Kakiuchi in 1995 described the original mini-open method with percutaneous technique (5). There have been significant modifications to minimally invasive and percutaneous repair of ATR.

Beyond technique, there has been improvement in the devices that aid in these repairs. Clanton et al compared 3 types of percutaneous repair to open repair. The study found percutaneous repair techniques allowed for elongation of the tendon earlier than open repair when the tendon was stressed. Overall, the ultimate strength of the repair was similar among all techniques (28).

Complications

The most common complications of open operative treatment include infection, wound healing, peritendinous adhesions, sural nerve injury, sensory disturbances, muscle atrophy, and strength differences. Percutaneous repair decreases most of the complications with the exception of nerve injury. Mertz et al found a 36% overall complication rate with minimally invasive ATR treatment, with sural nerve injury accounting for 19% and re-rupture for 8% (29). Overall, sural nerve injury has been cited to occur in 9 to 18% of percutaneous surgery (30, 31). A study using ultrasound cited sural nerve injuries up to 60%. Ultrasound is an inexpensive and quick modality that can be implemented preoperatively to decrease injury to the sural nerve.

COMPARISON OF OPERATIVE VERSUS NONOPERATIVE TREATMENT

Early Weightbearing

Van der Eng et al found no differences in re-rupture rates, or minor or major complications in patients treated operatively and nonoperatively with early weight-bearing protocols (32). Early weightbearing should prevent muscle atrophy, stiffness, adhesions, deep venous thrombosis, and improve vascularization, and healing. Early mobilization is patient preferred, and is becoming the standard of care for both operative and nonoperative patients with ATRs.

Re-rupture Rate

Re-rupture rates are highest in nonoperatively treated ATR with traditional immobilization protocols. When functional rehabilitation occurs, the re-rupture rate is similar between the groups. Overall the lowest re-ruptures rates are found in patients treated operatively and then immobilized in a cast. A meta-analysis in 2012 found re-ruptures in surgically treated patient to be 3.6%, and 8.8% in nonoperative patients (33). Many studies have demonstrated this re-rupture difference to be true however, only a few studies have demonstrated it with statistical significance (34).

Return to Work

Many studies have demonstrated earlier return to work with surgical over conservative management of ATRs (34, 35). Henriquez et al demonstrated an earlier return to work with percutaneous repair over open repair (36). Earlier return to work is also associated with earlier weight-bearing postoperative protocols for both conservative and surgical patients.

Wound Healing and Adhesions

A meta-analysis found the overall deep infection rate was 2.36% in surgical patients. Pajala et al found 56% patients with deep infection had 3 or more risk factors. Known risk factors include age >60 years, diabetes mellitus, corticosteroid therapy, smoking, delay in treatment, and pain in the tendon before injury (37). Non-cosmetic scar and skin adhesions were found to occur in 13.1% of surgical patients and 0.62% in nonoperative patients.

Strength

Muscle atrophy is directly related to immobilization time. A study found 10% muscle atrophy after 6 weeks of immobilization (33). Early postoperative mobilization decreases atrophy. Soroceanu et al found no differences in strength or calf circumference in operative versus nonoperative patients (38). Calf circumference is not always an indicator of strength. Most patients have a difference naturally before rupture. Multiple studies have demonstrated no significant differences in functional outcomes between operative and nonoperative treatment.

In conclusion, there are still no definitive guidelines present for treatment for ATRs. There are more well-designed studies demonstrating the benefits and risks of both surgical and conservative management, allowing physicians to make better decisions. With earlier weightbearing postoperatively and with functional bracing, conservative management of ATRs is a viable option for all patients instead of only in individuals that are not ideal surgical candidates. With improvements in percutaneous repair techniques and instrumentation, similar functional outcomes to open repair with decreased complications are seen. There continues to be a need for further studies to make definitive guidelines for ATR treatment.

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