Explosive athletic motions such as leaping and sprinting are dependent on an intact gastrosoleus-tendon complex. The optimal treatment to restore these athletic abilities following an Achilles tendon rupture remains controversial. Operative management appears to be the preferred treatment, especially in young, high-performance athletes.

In the past, treatment was primarily limited to open surgical repair or plaster immobilization. More contemporary means include limited exposure repairs and functional bracing. Both are designed to minimize the shortcomings of traditional management—wound breakdown, rerupture, and loss of plantar flexor power. Furthermore, rehabilitation protocols have advanced the benefits of early motion and weight bearing to minimize muscle atrophy and tendocutaneous scarring.

Regardless of treatment form, goals include the restoration of normal function of the muscle-tendon complex. This requires recovery of preinjury muscle strength, power, and endurance, as well as a painless, healed tendon with adequate excursion. Restoration of the musculotendinous unit can be achieved by indirect healing via tendon immobilization or by more direct means with varying forms of surgical repair.

Prolonged immobilization of any torn tendon results in predictable sequelae—muscle atrophy, joint stiffness, adhesion formation, and generalized deconditioning. These are detrimental to performance in any competitive athlete. Surgical repair has been touted as providing a precise, secure, end-to-end repair with a low rerupture rate. However, wound breakdown and infection are common complications that portend an unsatisfactory outcome. Although a minimal exposure or percutaneous technique may produce fewer wound problems, a weaker and less accurate repair with an increased risk of rerupture or iatrogenic nerve injury may result.

LITERATURE REVIEW

The comparison of clinical series detailing operative and nonoperative management is difficult when confounding variables such as surgical technique, patient selection, rehabilitation protocols, and outcome scoring are present.

Wong et al retrospectively analyzed the results of >125 well-documented reports comprising the treatment of >5000 patients. They confirmed a strong bias toward surgical treatment for these injuries. The reported incidence of complications appeared to be trending downward—with a 13% overall complication rate. Nonoperative treatment was associated with a five-fold increase in rerupture rates, whereas operative intervention was associated with a 30-fold increase of wound complications. The complication rate was highest in a subset of patients undergoing percutaneous repair with early mobilization. This group had a complication rate >30%.

Functional Bracing

The use of custom or over-the-counter functional walking braces has recently gained popularity (Figure 1). In general, such management must be instituted within several days of the injury. Again, differences in treatment protocols, such as time to initiation of weight bearing, position of ankle...
immobilization, and length of immobilization, make direct comparisons difficult. The use of a functional brace was first popularized by Carter et al\(^2\) in 1992. McComis et al\(^3\) reported the results of 15 athletes treated with a protocol of immobilization in a customized polypropylene orthosis with early motion but limited weight bearing for 8 weeks. Good to excellent results were reported in 80% of the series. Although an increase of an average 2.6° of dorsiflexion was noted, no significant differences were reported in functional testing compared to age- and gender-matched controls. The authors estimated the cost of nonoperative treatment to be approximately 25% of the operative cost. Interestingly, professional and collegiate scholarship athletes were excluded from this study.

The effect of immediate weight bearing has also been studied. Josey et al\(^4\) reported excellent outcomes in 39 patients with 40 Achilles tendon ruptures treated with immediate full weight-bearing casts. Follow-up averaged 55 months. Treatment consisted of casting in maximum equinus with a heel lift for 4 weeks with the use of crutches with weight bearing as tolerated. Subsequently, gravity equinus casting was undertaken for an additional 4 weeks; this was followed by use of a shoe with a 1.5-inch heel for an additional 4 weeks. Running and jumping were prohibited for 6 months. The rerupture rate was 6%. The results of isokinetic testing were comparable to open repairs. Ninety-five percent of patients were completely satisfied with their treatment; average American Orthopaedic Foot and Ankle Society score was 95. Although numerous recreational athletes were included in this series, no elite athletes were treated.

Limited Exposure/ Percutaneous Repairs

Over the past decade, minimal incision and percutaneous techniques to repair the Achilles tendon have been devised to decrease skin healing problems. The first description was reported by Ma and Griffith.\(^5\) This limited but multiple incision technique produces a repair with adequate strength (to permit early mobilization), restores normal length-tension relations, and decreases incidence of wound breakdown and infection. With limited surgical exposure, iatrogenic injury to the sural nerve may occur due to its intimate association with the Achilles tendon (Figure 2).

Several studies have documented the outcomes following percutaneous tendon repair. In a prospective, randomized study comparing percutaneous and open repair techniques, Lim et al\(^6\) reported outcomes in 66 patients. In their postoperative regime, all patients were immobilized in plaster for a mean of 12.4 weeks. In the 33 patients undergoing percutaneous procedures, an equal or superior outcome was documented. Specifically, 12 complications occurred in the open group and 5 in the percutaneous group. Twenty individuals who described themselves as either athletes or sportsmen were...
included in this series; however, none were considered high-performance athletes. Lim et al.6 also highlighted an 11% incidence of preoperative sural nerve hypersensitivity, implying a concomitant neuropraxic injury may accompany Achilles tendon ruptures. They concluded that the percutaneous repair was a simple procedure performed under local anesthesia with a low complication rate, equivalent functional outcome, and superior cosmesis.

Hockenbury and Johns7 compared the strength of a percutaneous tendon repair using no. 1 nonabsorbable suture to an open repair using a Bunnell-type suture in 10 cadaveric specimens. Each repair was stressed to failure—the open repair construct was twice as strong as the percutaneous. Furthermore, sural nerve entrapment occurred in 3 of 5 specimens undergoing a percutaneous repair. A 1-cm diastases of the tendon edges resulted following “repair” in 1 specimen with this surgical approach.

A comparative study of open versus percutaneous repairs involving 27 athletes was reported by Bradley and Tibone.8 Unfortunately, the study was longitudinal and comparative. The open procedures were performed with a direct repair using Bunnell sutures reinforced with a gastrocnemius fascial graft. Both groups were managed with 4 weeks of nonweight-bearing casts, followed by use of a walking cast for an additional 4 weeks. All patients were satisfied with their outcomes. Objective isokinetic testing of each group’s plantar flexion strength, power, and endurance revealed no statistically significant differences. Cosmesis of the percutaneous repair was noted to be significantly better than in open repairs. Two reruptures were reported; both were percutaneous repairs. The authors recommend treating recreational athletes with the percutaneous technique, but prefer an open repair in professional athletes.

Rehabilitation Protocols

In a prospective, randomized study, Mortensen et al.9 compared early motion versus static casting following traditional open repairs in 71 patients. Weight bearing was permitted at 4 and 6 weeks for the functionally braced and casted patients, respectively. They concluded that early mobilization was safe, resulted in a more normal range of motion, with fewer surgical adhesions and acceleration to return to work and sports. However, at 16 months, no significant difference in calf circumference or strength was detected.

Recently, Maffulli et al.10 reported a comparative, longitudinal study that compared two forms of rehabilitation following the open repair of 53 Achilles tendon ruptures. The results of immediate weight bearing were compared to the outcome of patients in whom weight bearing was delayed until 4 weeks postoperatively. All patients were immobilized in equinus with an anterior slab of plaster for the first 4 weeks post-injury. The early mobilization group demonstrated a shorter rehabilitation period, shorter use of crutches, and were more satisfied.10 Neither rehabilitation form resulted in less atrophy or a stronger calf. In general, aggressive mobilization of the muscle and tendon appeared to be appropriate and beneficial with little risk of anastomosis failure.

DISCUSSION

Currently, multiple viable management options are available for the treatment of an Achilles tendon disruption. Conservative treatment appears to be gaining in popularity. All treatment is designed to provide a milieu for tendon healing with full restoration of plantar flexion power and endurance. Literature review does not support an overwhelming superior treatment modality; therefore, the management of an acute Achilles rupture should be individually tailored. Although operative and nonoperative means appear to produce comparable outcomes, each has distinct advantages and disadvantages. In the elite athlete, an open procedure with aggressive mobilization may be the most appropriate means to optimize return to preinjury activity. Parameters such as time at presentation, age, medical fitness, and occupational demands can help direct treatment decisions. □

REFERENCES