CHAPTER 38

PERCUTANEOUS ACHILLES TENDON RUPTURE REPAIR: A Technique Guide

Dorian L. Jimenez, DPM
Thomas Branch, MD
Robert Karsch, MD

INTRODUCTION

A topic of great debate, treatment of acute Achilles tendon ruptures pits conservative versus surgical options with staunch support for each. The strength of surgical repair and clear visualization afforded by open techniques lead most to brave the reported associated wound complications. On the other hand, proponents of nonsurgical modalities cite competitive patient results with decreased cost and significantly lower risks. Whichever one chooses, literature abounds with positive and negative points to sway the opinion of the reader. In 1977, Ma and Griffith[1] added yet another point of consideration to the mix with a report of percutaneous achilles tendon repair. Currently, percutaneous repair has proven to bridge the gap between conservative and surgical treatment of the acute Achilles tendon rupture.

When considering treatment options for the acute Achilles tendon rupture, the advantages and disadvantages for each must be weighed. The main issues of concern include strength and endurance of repair, rerupture possibility, wound healing complications and restoration of normal tendon function. While specifics abound throughout the literature, a few general statements are safely made. First, open repair provides increased strength, power and endurance to the Achilles tendon. In addition, a low rate of rerupture is present with open techniques. Closed conservative treatments ranging from functional bracing to strict cast immobilization eliminate the inherent anesthesia risks, decrease cost and avoid the potential wound complications at the expense of higher rerupture rates. Percutaneous techniques offer surgical repair with a simple, shortened procedure time but risk sural nerve compromise.

The authors present a technique of percutaneous Achilles tendon rupture repair utilized for acute injuries. Although conservative and open surgical techniques are also employed, the percutaneous repair is the preferred method of choice.

TECHNIQUE

1. Palpate the tendon defect and determine the margins of the proximal and distal stumps.
2. Stab incisions are created on each side of the rupture site (Figure 1).
3. Beginning approximately one centimeter above the proximal margin, a series of three stab incisions are created along the medial and lateral borders of the tendon at one centimeter increments.
4. Three number 1 PDS suture strands threaded on a suture passer are tunneled through the most proximal incision (Figure 2).
5. Utilizing a modified Bunnell suturing technique, the three strands of PDS are weaved through the proximal tendon stump converging at the rupture site with the aid of the suture passer ensuring healthy tissue purchase (Figures 3,4).
6. Palpation reveals the superior margin of the posterior calcaneus.
7. Stab incisions are created just inferior to this point both medially and laterally.
8. Two more stab incisions are spaced equally between the superior posterior calcaneus and the margin of the distal tendon stump on each side.
9. Each incision is deepened with blunt instrumentation down to the level of the deep fascia to minimize neurovascular compromise[1] (Figure 5).
10. A 2.0mm drill bit is used to create a tunnel in the posterior calcaneus through the most distal stab incisions (Figure 6). This drill hole is important as biomechanical studies have

proven that failure of percutaneous repairs occur via suture pullout from the distal tendon stump.[2]

11. Three number 1 PDS strands threaded on a suture passer are tunneled through the most distal incision/calcaneal drill hole (Figures 7, 8).
12. Utilizing a modified Bunnell suturing technique, the three strands of PDS are weaved through the distal tendon stump converging at the rupture site with the aid of the suture passer ensuring healthy tissue purchase (Figure 9).
13. The strands are secured with a surgeon's knot at the medial and lateral borders of the rupture site with the ankle in resting plantarflexion equal to the opposite lower extremity (Figure 10).
14. Final assessment should reveal absence of an over lengthened gastrosoleal complex which can lead to lack of plantar and dorsiflexory strength as well as a limitation in ankle joint motion.[3]
15. Palpation and visual inspection displays complete tendon continuity throughout the site of repair (Figure 11).
16. Closure is carried out with non-absorbable simple interrupted sutures following confirmation of desired repair and steri-strips are applied (Figure 12).

DISCUSSION

The authors present a technique for percutaneous Achilles tendon repair that is utilized with success in acute injuries. Contraindications to a percutaneous repair include chronic tears, non-complicance and rerupture.[4] Another relative contraindication is repair in the high level athlete. However, a comparison of strength, endurance and power following percutaneous and open repair found no long-term statistically significant differences between the involved and uninvolved extremities.[3] A report by Martinelli of percutaneous repair in 30 patients showed excellent results with athletes returning to preoperative level of sports activity in 120-150 days.[5] Therefore, percutaneous repair has proven to be a useful tool in treatment of the acute achilles tendon injury depending on surgeon preference.

An alternate approach to treatment along with non-operative and open surgical repair, percutaneous methods provide many advantages. In 1959, Lagergren and Lindholm defined an area of decreased blood supply present ~4-5 cm proximal to the posterior calcaneus.[6] Percutaneous repair affords minimized trauma to this area of tenous vascularity as compared with open repair.[1] Minimal disruption in turn decreases the incidence of wound complications involving the superficial and deep structures of the posterior leg. A higher wound complication rate is one of the disadvantages of open techniques. However, Wong et al in a comprehensive literature review spanning from 1966-2000 report wound complication rates of 0.4%-4.9% in both open and percutaneous surgical repairs.[7]

Another advantage of percutaneous repair is a decreased surface area available for tendon tissue adhesion formation.[1] Open repair often involves complete disruption of the deep fascia and paratenon layers of the achilles tendon. Failure to adequately identify and repair these layers may lead to scarring of the tendon to overlying soft-tissue structures. Free gliding movement of the Achilles tendon is therefore limited in these instances. Percutaneous repair maintains the areas of intact deep fascia and paratenon reducing potential scar formation.

Other advantages to percutaneous methods include decreased possibility for contamination and a relatively simple and shorter operation thus avoiding anesthesia risks.[2] Also reported are shorter recovery times with earlier return to activities of daily living, work and preoperative physical activity. In a review of 30 patients treated percutaneously, Martinelli reported an average of 30 days return to normal activities and 60 days return to work.[5]

Sural nerve complications and rerupture rates are the main cited complications with percutaneous techniques. Webb et al describe the course of the sural nerve in relation to the achilles tendon as crossing the lateral border ~9.8 cm proximal to the posterior calcaneus.[8] Therefore, placing percutaneous sutures in this area of the leg risks sural nerve entrapment. A 5-17% incidence of sural nerve injury is reported throughout the literature.[3,9,10] It is imperative to bluntly separate the subcutaneous tissues from the deep fascia when threading the suture proximal to the level of the ruptured Achilles tendon. Multiple different methods of percutaneous repair have been proposed to combat and lessen the incidence of sural nerve complications since the original report by Ma and Griffith.

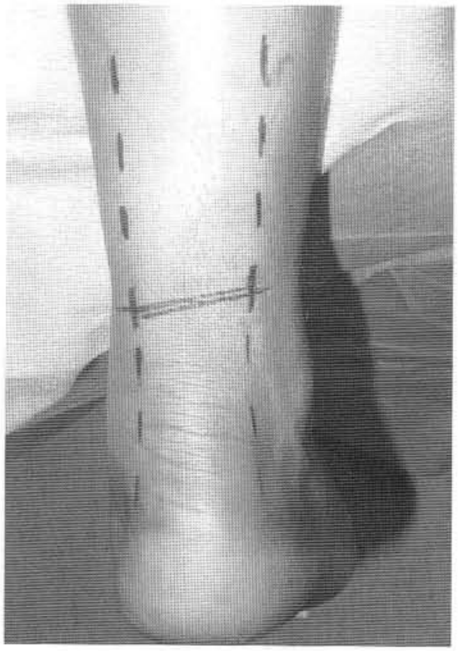

Figure 1.

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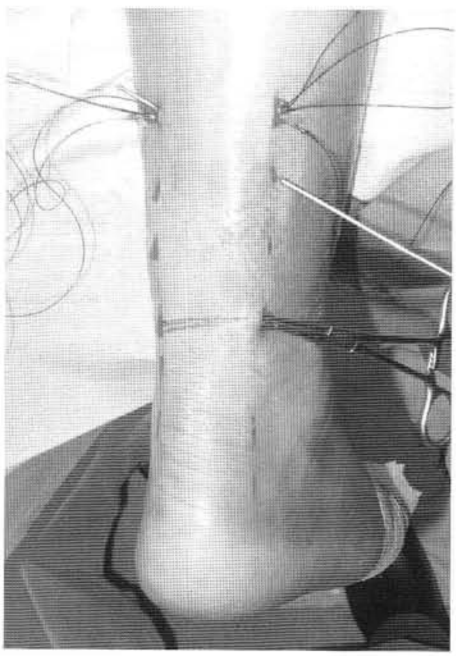

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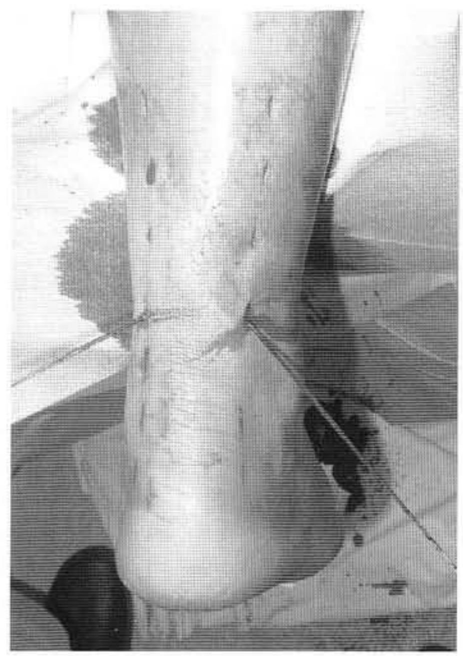

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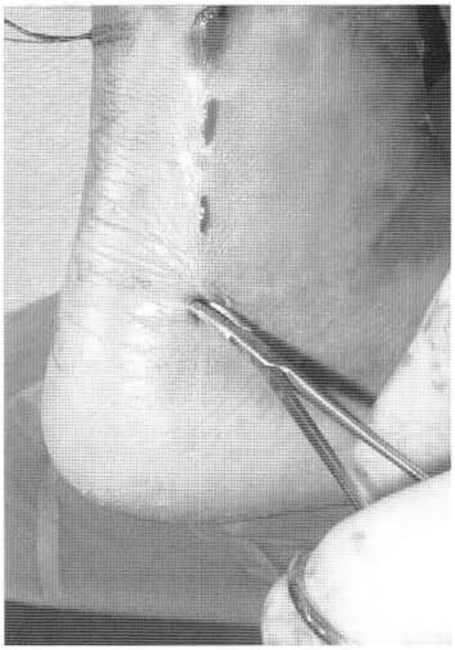

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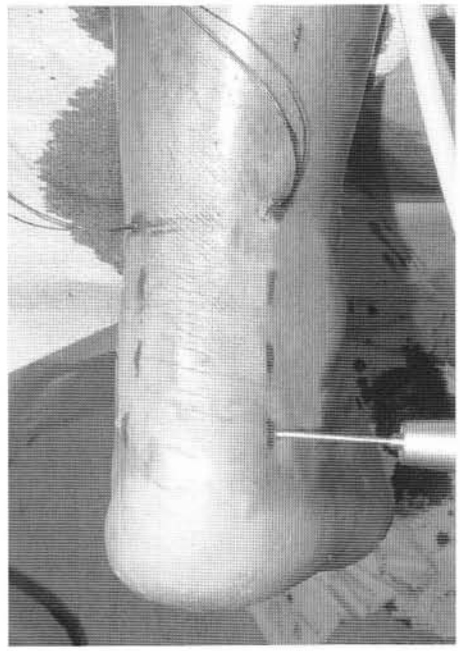

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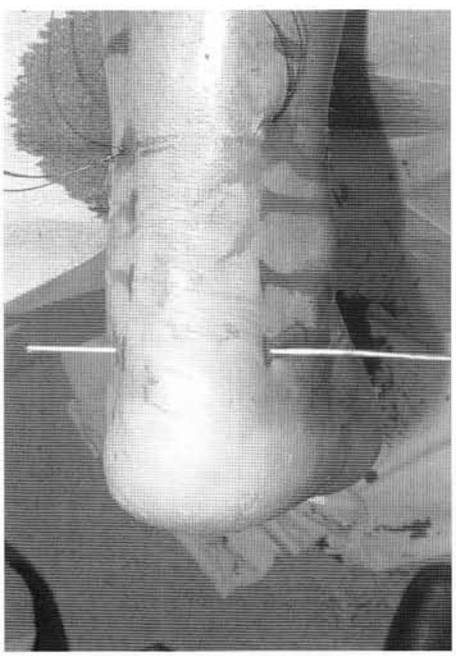

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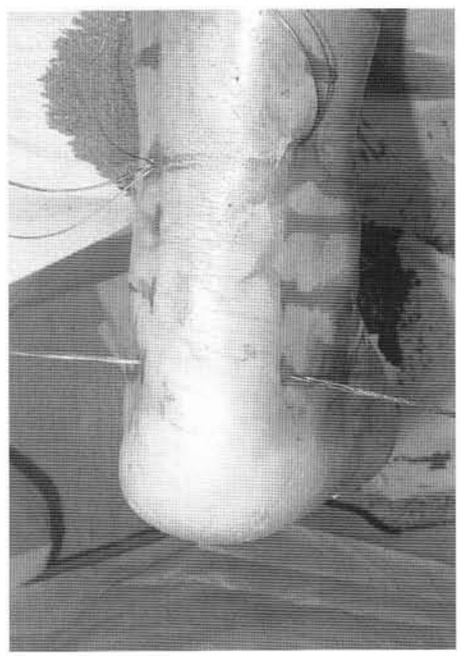

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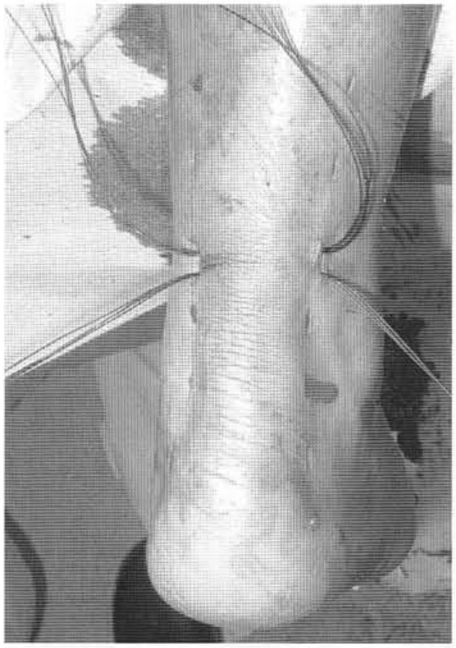

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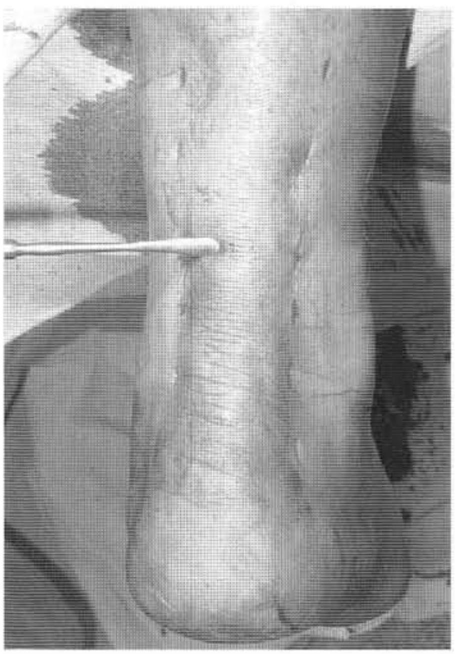
Figure 10.



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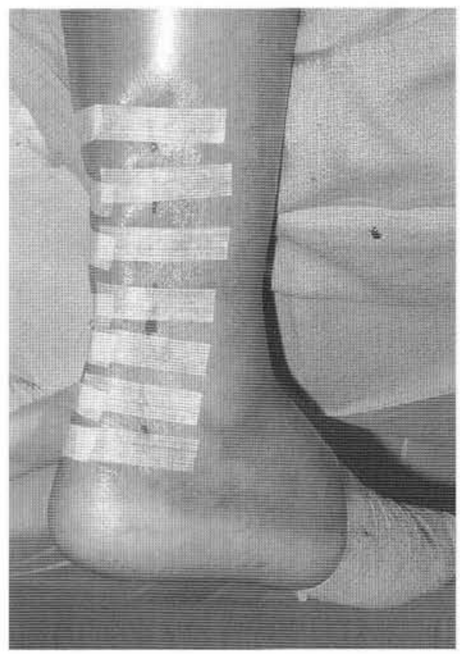

Figure 12.

Rerupture of the Achilles tendon after surgical repair is an unfortunate complication. Rerupture occurs in all forms of treatment from closed to open techniques. In the literature review by Wong et al, an average 10% rerupture rate is present when conservative treatment is administered. That average drops to ~5% with percutaneous methods and down to ~2% with open surgical repairs.[7] The fibrous repair characterizing closed treatment provides insufficient mechanical properties and therefore a higher rerupture rate.[5] The ability to attain exact end to end approximation with open repair obviously contributes to the low rates of rerupture seen with these techniques. However, the numbers compare favorably for percutaneous repair in the face of the added complications associated with both open and closed treatments.

CONCLUSION

The goals of treatment of the acute Achilles tendon rupture are similar whether using open or percutaneous techniques. These include recovery of full normal function to the gastrosoleal complex, good end to end apposition of the tendon rupture site thus avoiding tendon lengthening, restoration of normal tension and a decrease in the likelihood of rerupture.[4] Each may be attained with a percutaneous technique and a successful gradual rehabilitation program. The authors present a technique used as a modification of the original method described by Ma and Griffith in the acute setting. Though open repair continues to be the gold standard for Achilles tendon repair, surgeon preference maintains percutaneous repair as a viable option.

REFERENCES

1. Ma GW, Griffith TG. Percutaneous repair of acute closed ruptured achilles tendon: a new technique. *Clin Orthop* 1977;128:247-55.
2. Cretnik A, Zlajpah L, Smrkolj V, Kosanovic M. The strength of percutaneous methods of repair of the achilles tendon:a biomechanical study. *Med Sci Sports Exerc* 2000;32:16-20.
3. Fitzgibbons RE, Hefferon J, Hill J. Percutaneous achilles tendon repair. *Am J Sports Med* 1993;21:24-7.
4. Tomak S Fleming L. Achilles tendon rupture: an alternative treatment. *Am J Orthop* 2004;12:9-12.
5. Martinelli B. Percutaneous repair of the achilles tendon in athletes. *Bull Hosp Joint Dis* 2000;59:149-52.
6. Lagergren C, Lindholm A. Vascular distribution in the achilles tendon. *Acta Chir Scand* 1959;116:491-5.
7. Wong J, Barrass V, Maffulli N. Quantitative review of operative and nonoperative management of achilles tendon ruptures. *Am J Sports Med* 2002;30:565-75.
8. Webb J, Moorjani MB, Radford M. Anatomy of the sural nerve and its relation to the achilles tendon. *FAI* 2000;21:475-7.
9. Klein W, Lang DM, Saleh M. The use of the Ma-Griffith technique for percutaneous repair of fresh ruptured tendo achilles. *Chir Organi Mov* 1991;76:223-8.
10. Bradley JP, Tibone JE. Percutaneous and open surgical repairs of achilles tendon ruptures. *Am J Sports Med* 1990;18:188-95.