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Minimally Invasive Mid-Substance Achilles Tendon Repair Using the Percutaneous Achilles Repair System (PARS)

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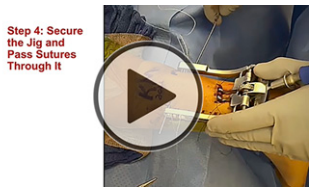
Published outcomes of this procedure can be found at: *Foot Ankle Int*. 2015 Nov;36(11): 1279-86, and *Clin Res Foot Ankle*. 2018;6(1):263.



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Abstract

Background: Achilles tendon ruptures commonly occur in physically active individuals and drastically alter the ability to perform recreational activities[1,2]. Many patients want to continue participating in recreational activities, which can be facilitated by operatively treating the injury in a timely fashion, maximizing their functional recovery. The Percutaneous Achilles Repair System (PARS) Jig (Arthrex) can be utilized in patients with acute mid-substance Achilles tendon ruptures[3,4].

Description: Begin by positioning the patient prone with a thigh tourniquet on the operative side. Mark a 3-cm transverse incision 1 cm distal to the proximal Achilles stump and make the incision, taking care to protect the sural nerve laterally. Next, create a transverse paratenon incision and bluntly dissect it from the Achilles circumferentially. After gaining access to the proximal Achilles stump, clamp it with an Allis clamp and insert the PARS Jig between the Achilles tendon and paratenon, sliding it proximally to the myotendinous junction. To secure the jig to the proximal Achilles tendon, insert a guide pin into the jig position-1 hole. To pass sutures through the Achilles tendon, insert pins with their respective sutures into positions 2 through 5 and insert the FiberTape suture (Arthrex) in position 1. Remove the jig from the transverse incision, pulling the suture ends out of the incision. Once they are out, reorient the sutures on the medial and lateral sides to match their positions when initially placed. On both sides, wrap the blue suture around the 2 striped green-and-white sutures twice, and pull the blue suture through the looped green-and-white suture on the ipsilateral side. After doing that, fold the blue suture on itself to create a shuttling suture with the green-and-white suture. Next, pull on the medial non-looped green-and-white suture until it has been pulled out medially, and repeat that with the lateral non-looped green-and-white suture until it has been pulled out laterally, to create a locking stitch. Group the medial sutures together and the lateral sutures together, and utilize a free needle to further incorporate both bundles of sutures into the Achilles tendon. Next, create bilateral mini-incisions 1.5 cm proximal to the calcaneal tuberosity. Insert a rigid cannulated suture-passing device into each mini-incision, pass it through the distal Achilles tendon, load the ipsilateral suture bundle into the

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Nitinol wire, and pull the suture-passing device out the distal mini-incision to approximate the Achilles. To prepare the calcaneus, drill calcaneal tunnels toward the midline bilaterally, taking care to avoid convergence of the tunnels. Place a suture-passing needle in the tunnels to assist with placing the anchors. Next, tension the sutures, cycling them 5 to 10 times to remove any slack in the system. With the ankle in 15° of plantar flexion, anchor the sutures with cortical bioabsorbable interference screws, following the angle that the suture-passing needles are in. After confirming function of the Achilles tendon, close the peritenon, deep tissues, and superficial tissues, and place the ankle in a splint in 15° of plantar flexion.

Alternatives: Acute Achilles ruptures can be treated operatively or nonoperatively[1,2]. Operative techniques include open, percutaneous, or minimally invasive Achilles tendon repair. Open Achilles tendon repair involves making a 10-cm posteromedial incision to perform a primary repair[5], while percutaneous Achilles tendon repair involves the use of medial and lateral mini-incisions to pass needles and sutures into the Achilles tendon to repair it[6]. Minimally invasive Achilles tendon repair involves the use of a small 3 to 4-cm incision to introduce instrumentation such as modified ring forceps or an Achillon device (Integra)[7,8], along with a percutaneous technique, to repair the Achilles tendon. Nonoperative treatment can be utilized in patients with <5 mm of gapping between the ruptured tendon edges on dynamic ultrasound in 30° of plantar flexion[9], in patients with limited activity, or in patients whose comorbidities make them high-risk surgical candidates. Nonoperative treatment includes a below-the-knee rigid cast in 30° of plantar flexion or the use of a functional splint in 30° of plantar flexion with gradual progression to a neutral position, along with early rehabilitation according to the postoperative protocol described in the present article.

Rationale: This technique allows patients to begin early postoperative rehabilitation, limits wound and soft-tissue complications such as superficial and deep infections, and protects neurovascular structures such as the sural nerve that may be injured if utilizing other techniques. These benefits are achieved through the use of a minimally invasive knotless approach that places nearly all of the suture material into the Achilles tendon, reducing friction within the paratenon and potentially facilitating improved gliding. Additionally, securing the sutures into the calcaneus minimizes post-operative Achilles tendon elongation and facilitates early postoperative rehabilitation.

Expected Outcomes: Patients undergoing this procedure can expect to return to their baseline physical activities by 5 months[3], with the best functional results observed at ≥12 months postoperatively[4]. One retrospective cohort study compared the results of 101 patients who underwent Achilles repair with use of the PARS Jig and 169 patients who underwent open Achilles repair, and found that 98% of PARS patients returned to baseline activities in 5 months compared with 82% of patients undergoing open Achilles repair ($p = 0.0001$)[3]. Another retrospective chart review assessed the results of 19 patients who underwent Achilles repair with the PARS Jig[4] and found that patients began to return to sport as early as 3 months postoperatively and that functional scores in patients increased as time progressed, with significant increases observed at 12 months and longer postoperatively.

Important Tips:

- Locate the Achilles tendon rupture site prior to marking the transverse incision.
- Bluntly dissecting the paratenon during closure stimulates healing and reduces scarring, thereby maintaining the integrity of the tissue[10].
- When advancing the PARS Jig, ensure that the proximal Achilles tendon remains inside the device.
- Maintaining meticulous suture management and organization prevents tangles and improves suture shuttling.
- Ensure that the Achilles tendon is tensioned with the ankle in 15° of plantar flexion prior to distal anchor fixation.

Acronyms and Abbreviations:

- MRI = magnetic resonance imaging
- US = ultrasound
- BID = twice daily

- PRN = as needed
- DVT = deep vein thrombosis

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