

Case Report

Anatomical retinaculum repair and pseudo-pouch closure: surgical technique for management of posterior tibial tendon dislocations

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ABSTRACT

This study aims to present a surgical technique for managing Type-II posterior tibial tendon (PTT) dislocations, characterized by a detachment of both the flexor retinaculum and periosteum from the tibia, and to review existing literature on treatment approaches for this rare condition. We describe a surgical procedure that involves an approach to the PTT, assessment, and potential deepening of the retro malleolar groove, and repair of the detached flexor retinaculum using a double suture technique. The technique addresses the challenges posed by the pseudo pouch formed due to the detachment and aims to stabilize the PTT within the groove. The surgical outcomes of two cases involving young, active patients are discussed, including pre- and post-operative assessments. In case 1, a 19-year-old male athlete demonstrated improvement in pain and function, with no recurrence of dislocation at six months follow-up. Case 2, a 40-year-old male athlete, experienced slight discomfort but returned to practice with improved strength and function. Both cases showed effective tendon stabilization within the retro malleolar groove and favorable outcomes without significant complications. The described surgical technique for Type-II PTT dislocations, involving reattachment and repair of the retinaculum, successfully addresses the challenges of the pseudo pouch and provides effective stabilization of the tendon. This approach results in satisfactory clinical and radiological outcomes, with most patients achieving a return to pre-injury function. The study highlights the need for further research to compare biomechanical effectiveness and long-term tissue healing outcomes of this technique.

Keywords: Ankle, Posterior tibial tendon, Dislocation, Tendon, Surgical technique, Tendon surgery

INTRODUCTION

Traumatic dislocation of the posterior tibial tendon (PTT) is an exceedingly rare occurrence, with few cases documented in the current literature.^{1,2} The PTT, situated as the most superficial structure within the tarsal tunnel, relies primarily on the flexor retinaculum for containment inside retro malleolar groove, as well as groove depth

itself.³ Rupture of the retinaculum permits anterior dislocation of the PTT, particularly facilitated by pre-existing dysplasia of the retro malleolar groove.

Typically, other contents within the tarsal tunnel remain unaffected by the dislocation, residing deeper within the tunnel. In the acute phase, early diagnosis is often overlooked due to edema hindering palpation of the PTT

in the medial gutter, leading to delays in diagnosis compounded by the rarity of the condition.^{4,5} Consequently, many cases are initially misdiagnosed as simple ankle sprains. Accurate diagnosis usually is prompted by persistent pain over the medial malleolus and thorough physical examination.^{6,7}

The most common mechanisms of injury involve pronation-external rotation or inversion of either a dorsiflexed or plantarflexed ankle.^{5,8,9} Two types of PTT dislocation have been identified: type I involves rupture of the flexor retinaculum, allowing the PTT to move freely over the medial malleolus within the subcutaneous tissue, while type II entails detachment of both the flexor retinaculum and periosteum from the tibia, resulting in the formation of a pseudo pouch where the PTT can reside (Figure 1).^{6,10} Non-operative treatment is generally not favored due to low success rates and high recurrence rates, hence surgical management is preferred. However, no universally accepted gold standard technique exists.

Addressing retinaculum repair in type II dislocations poses challenges, as the retinaculum cannot be simply repaired due to its anterior detachment from the tibia, leading to false enlargement of the retinaculum with subsequent laxity facilitating further tendon dislocation. Strategies to correct the pseudo pouch typically involve reinsertion with anchors.^{1,2} We present a surgical technique for managing type II dislocations with pseudo pouch correction and anatomical retinaculum repair, while also providing insights into two cases of PTT dislocations in young, active patients.

Surgical technique

The surgical procedure begins with the patient lying supine and the application of a proximal thigh tourniquet. A curved incision is made along the course of the PTT, extending downward toward the inner ankle bone. Intraoperatively, it is noted that the flexor retinaculum is detached from the front of the tibia, creating a false pocket over the periosteum (Figure 1).

Upon dividing the retinaculum along the same line as the skin incision, the previously dislocated posterior tibial tendon is exposed (Figure 2). Attention is then directed toward assessing the structure (with management of ruptures if appropriate) and appearance of the retro malleolar groove for potential deepening.

Typically, subcortical drilling with a 3mm drill bit is performed, followed by gentle posterior tapping along the groove using a curved rectangular impactor (Figure 3). After relocating the dislocated tendon into the groove, the detached retinaculum pouch is reattached to the tibia, just anterior to the retro malleolar groove via trans osseous suture (Figure 4).

The retinaculum is firmly pulled and tensioned posteriorly to minimize the space anteriorly, thereby eliminating the

false pocket (Figure 5). Before the final closure of the retinaculum, the stability of the reduced tendon is assessed through ankle range of motion, confirming smooth gliding within the groove.

Once this is achieved, a clear flap of retinaculum is available to suture repair, using a vest-over-pants technique if necessary for secure closure, enclosing the tendon inside the retro malleolar groove (Figure 6). Nevertheless, avoiding overtightening is key for smooth tendon gliding, therefore we recommend introducing a dissector parallel to the PTT.

CASE REPORT

Case 1

A 19-year-old recreational male athlete presented two weeks after sustaining a twisting injury to his right ankle while walking. The patient was able to ambulate with mild pain on the medial aspect of the ankle. Upon initial examination, a stable ankle was noted, with comparable laxity to the contralateral side, and no limitation of range-of-motion or strength.

Tenderness was observed with palpation of the medial malleolus, particularly in the anterior aspect where a palpable cord-like structure was present. Although radiographs were unremarkable, MRI findings indicated posterior tibial tendon dislocation, with the tendon located inside an anterior pouch originating from the detached retinaculum (type II dislocation), alongside increased intrasubstance signal and edema in the tarsal tunnel (Figure 8).

Subsequent surgical exploration involved partial excision of the torn portion of the posterior tibial tendon, groove deepening along its course, and repair of the flexor retinaculum using a double suture technique.

Postoperatively, the patient was instructed to remain non-weightbearing for two weeks in a posterior cast, followed by partial weightbearing using a walker boot and initiation of range-of-motion exercises. Six weeks post-surgery, he progressed to full weight-bearing with a removable ankle brace and started physical therapy.

At sixteen months following surgery, the patient reported experiencing slight discomfort during sports activities (VAS 1), particularly when running on uneven ground or externally rotating the ankle.

However, on physical examination, full range-of-motion and normal strength were noted, with stability of the posterior tibial tendon throughout the entire range-of-motion and during forced contraction. Notably, there was no recurrence of tendon dislocation or subluxation, and a final computed tomography scan showed the tendon inside the deepened groove (Figure 8).

Case 2

A healthy 40-year-old male recreational athlete (triathlon) presented after one month after a sudden pain and a pop feeling over the medial aspect of his ankle during training (running). Initially, he remained at rest for one week, and tried to resume training; however, the pain worsened when he went back to training, and was largely impaired and had to stop due to severe pain with activity.

On physical examination he had pain (VAS 6) on eversion and inversion manoeuvres, with a clinically palpable subluxable PTT. An MRI obtained at two months following the initial injury confirmed the dislocation of the PTT. Groove deepening and repair of the flexor retinaculum were performed. Intraoperatively, the tendon remained inside the posterior malleolar groove with simulation of ankle motion.

Post-operatively, the patient adhered to a partial weight bearing protocol and using a posterior cast for two weeks, and then progressed to partial weight bearing as tolerated and range-of motion exercises with a controlled ankle motion boot, undergoing physical therapy at this time. Impact exercises were initiated at 8 weeks.

At 3-month follow-up a limitation in ankle dorsiflexion was present but the patient had no complains to this matter having regained full strength and returned to practice. Nevertheless, he still exhibited slight pain while full weight bearing, mainly while running on uneven ground and on external rotation (VAS 4).

Physical therapy was therefore adjusted to mainly focus on posterior lengthening exercises. Dorsiflexion limitation remained (decrease in 5°), and at a 12-month follow-up the patient repeated an MRI, showing a central anterior ankle exostosis, with no obvious signs of anterior conflict of the ankle, (Figure 9).

Nevertheless, the PTT was normal and well located inside the deepened groove, and the patient had returned to practice with a slight discomfort while training (VAS 2).

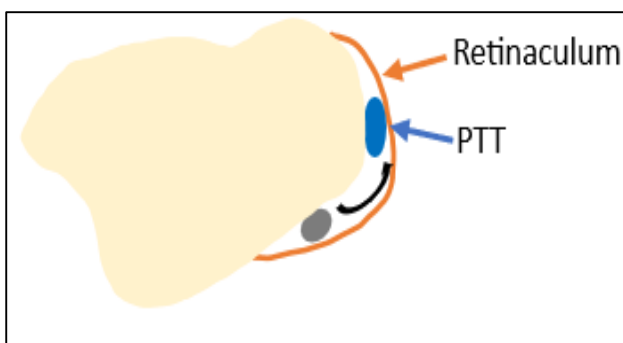


Figure 1: Schematic drawing in the axial plane highlighting posterior tibial tendon (PTT) dislocation, retinaculum detachment, and the formation of a pseudo pouch.

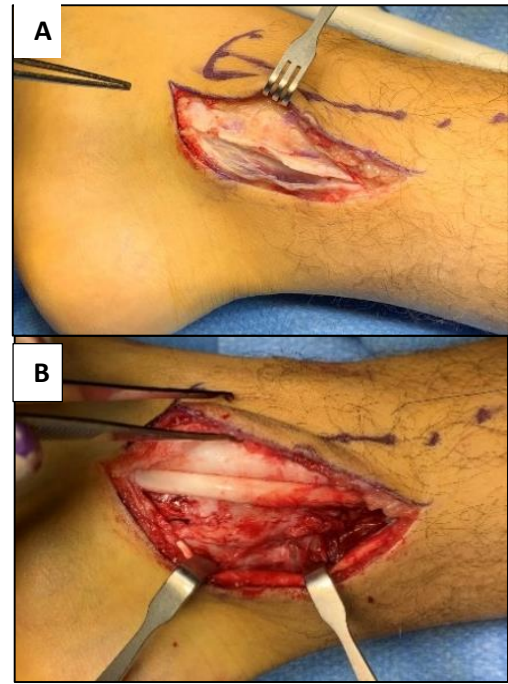


Figure 2: A curved incision is planned along the PTT. (A) Exposure of the posterior tibial tendon after retinaculum incision and (B) note the observable dislocated tendon, care must be taken when planning the incision over the retinaculum not to damage the anteriorly dislocated tendon.

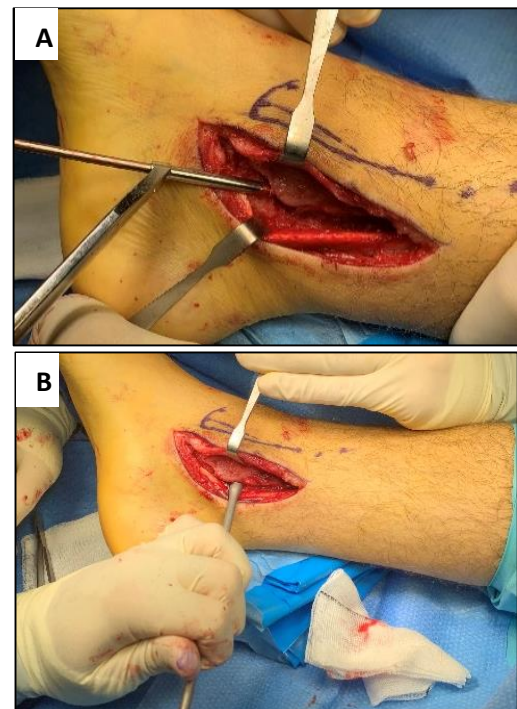


Figure 3: (A) Subcortical groove via drilling and posterior tapping. Drilling is performed parallel to the retro malleolar groove and (B) removing subcortical bone allowing for impaction with the curved impactor shapes the groove to accommodate the tendon.

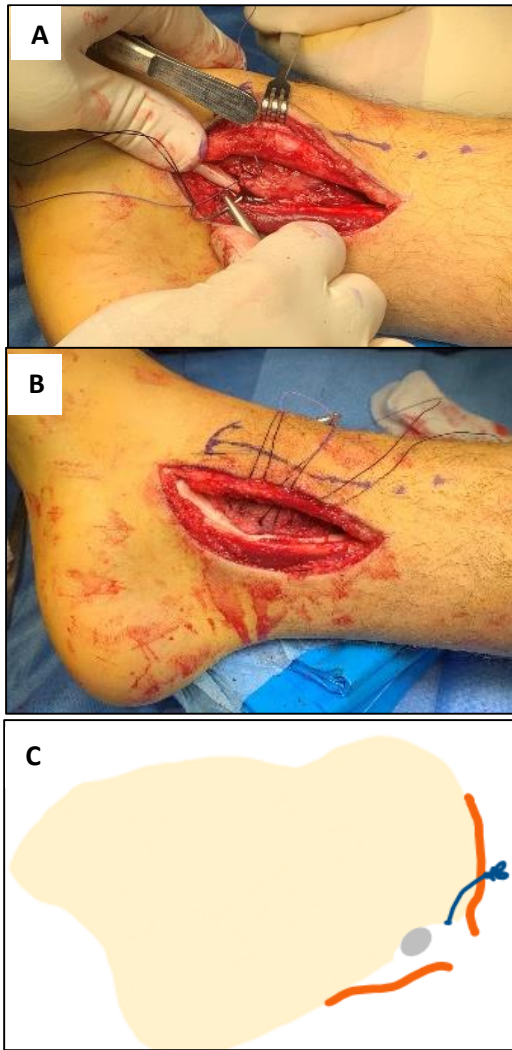


Figure 4: (A & B) Reinsertion of the retinaculum to the tibia using a trans osseous suture; the repair is positioned just anterior to the deepened retro malleolar groove to secure tendon stability and (C) schematic drawing showing the retinaculum reattachment technique.



Figure 5: Tensioning of the reattached retinaculum to close off any false pocketing and ensure a snug fit around the tendon; when performing the reattachment to the tibia the retinaculum is pulled taut to minimize anterior slack.

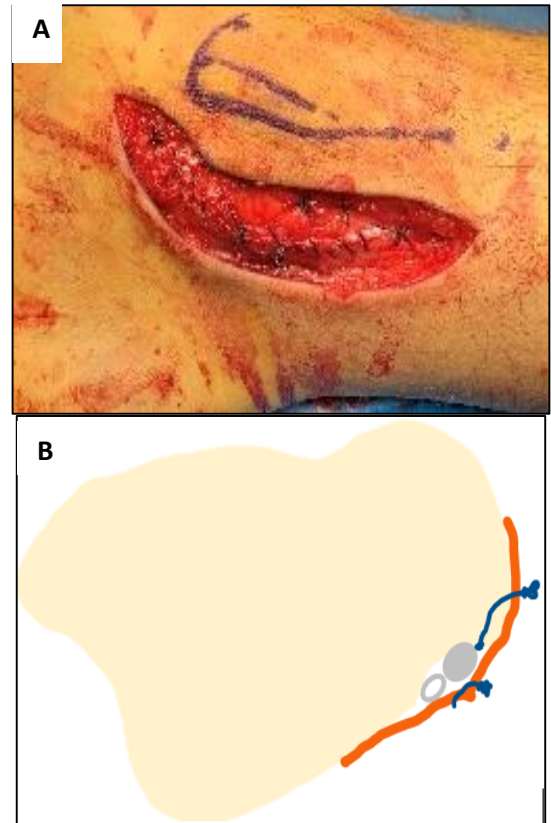


Figure 6: (A) Final retinaculum closure. The tendon is securely enclosed within the deepened retro malleolar groove, ensuring smooth gliding during range of motion tests and (B) schematic drawing (axial tibia cut) showing final suture with the retinaculum reattached.

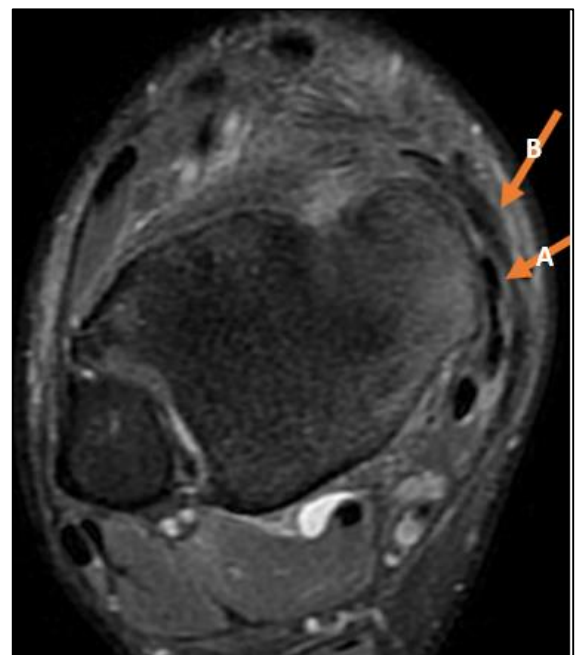


Figure 7: MRI scan showing the PTT dislocation (arrow a) and retinaculum detachment with pseudo pouch formation (arrow b) –Case 1.

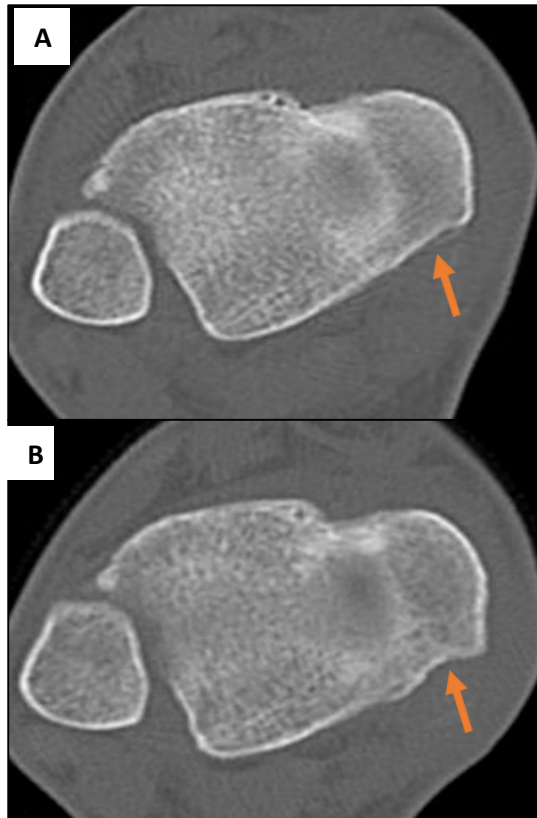


Figure 8: CT scans demonstrating the preoperative (A) and postoperative (B) appearances following groove deepening-Case 1.

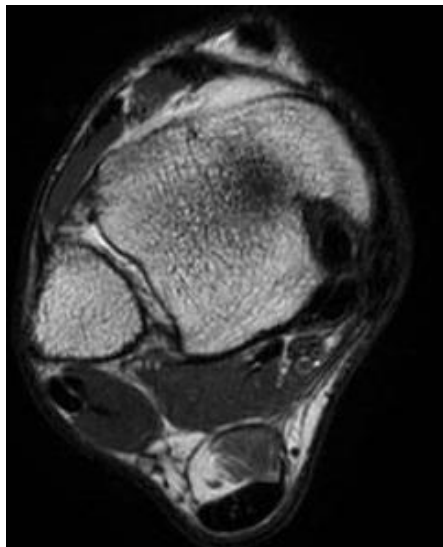


Figure 9: MRI scan showing the PTT located inside the deepened retromalleolar groove-Case 2.

DISCUSSION

Posterior tibial tendon dislocation was initially described by Martius in 1874 and, since then, few articles have reported this pathology, most with small patient cohorts.^{7,11} Ouzanian and Myerson reported a series of

seven cases involving posterior tibial tendon dislocation, with an average delay in diagnosis of nine months. Despite attempted conservative treatments, all patients required surgical intervention. Surgical exploration revealed various findings, including inflamed posterior tibial tendons and shallow retro malleolar grooves. Treatment consisted of retinaculum repair or reconstruction, with some patients also undergoing groove-deepening procedures. At final follow-up, most patients showed improvement or were asymptomatic, highlighting the effectiveness of surgical intervention.¹²

From the literature, tear or avulsion of the flexor retinaculum or its laxity without tear, along with elevation of a periosteal sleeve, are commonly observed in cases of posterior tibial tendon dislocation.^{3,8,13–18} A shallow retro malleolar groove may also be present.^{6,19}

There is no strong agreement in the literature on what is the best method of treatment. Treatment methods vary, with options including simple flexor retinacular repair, reconstruction with a periosteal sleeve or Achilles tendon flap, or suture anchor repair.⁵ Groove deepening procedures are sometimes performed, although conflicting reports exist regarding the necessity based on groove depth.^{5,13,19} More specifically, in some reported cases of hypoplastic retro malleolar groove, some authors opt for reconstruction with a periosteal sleeve without groove deepening.³ Despite these differences, good or excellent results with a return to pre-injury activity levels are consistently reported across the literature.

To the best of our knowledge, no previous reports detailing the treatment of posterior tibial tendon dislocation using groove deepening and retinaculum reattachment and repair technique have been published to date. In cases where a lax retinaculum is present, reconstruction procedures involving periosteal flaps are commonly described in the literature. However, concerns regarding increased procedural difficulty and associated morbidity may arise.

Despite the potential strength of the groove as a barrier, simple end-to-end suturing of the detached retinaculum may not ensure stable tendon relocation due to the latent anterior pouch. In such cases, as well as in instances of chronic subluxation with retinacular laxity, certain authors advocate for the implementation of reconstructive procedures. These may involve reinsertion of anchors into the retinacular flap or the placement of a cortical bone slot graft anteriorly to serve as a medial block.^{2,16,19–21}

However, concerns with donor site morbidity, bone healing and mechanical irritation by the impingement between the knot of the suture anchor or the scar tissue formed next to the grafting material itself and the tendons may arise.^{5,6,20,21} In our suggested approach, the first step consists in inspection and treatment of PTT damage, either by partial tenotomy or by suture of longitudinal tears, as dictated by surgical findings and tendon quality. This leaves the final condition of the tendon available for

stability tests. Next, we believe that for optimal results, the stability of the tendon should be conferred primarily by bone anatomy, as the quality of the retinaculum might be compromised.

So, instead of having measurements thresholds for groove deepening, we suggest deepening the groove until the tendon is stable within the groove with circular ankle range of motion. As this step might interfere with the retinaculum repair (anchors or sutures), we do this before addressing the retinaculum. The detached retinaculum is then reinserted and tensioned into the medial tibia, just anterior to the retro malleolar groove, with either sutures or anchors. Subsequently, end-to-end suturing of the retinaculum is performed. It is important to note that careful manipulation is necessary to avoid compromising the neurovascular structures within the tarsal tunnel. To this date, we did not encounter mechanical irritation due to impingement between the suture and tendon.

While this approach utilizes an intact structure for reconstruction, it is essential to acknowledge some potential limitations associated with this report. Specifically, further biomechanical comparative studies are warranted to investigate the effectiveness of fixation points of the retinaculum on the bone, as well as tissue healing outcomes.

CONCLUSION

Posterior tibial tendon dislocation, a rare injury, often leads to delayed diagnosis and ineffective conservative treatments. Surgical stabilization, involving tendon relocation and retinaculum repair or reconstruction, typically yields high success rates, with most patients regaining pre-injury function. In type-II dislocations, satisfactory clinical and radiological outcomes were achieved in a delayed diagnosis scenario by deepening the groove and reinserting the retinaculum into the medial tibia near the groove and subsequently suturing the remaining retinaculum rupture.

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Ethical approval: Not required

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