

Open Traumatic Achilles tendon Rupture in a Pediatric Patient Managed by Modified Kessler Technique: A Case Report

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Learning Point of the Article:

Primary repair using non-absorbable sutures with a Modified Kessler configuration is a safe and effective approach for open traumatic Achilles tendon rupture in pediatric patients.

Abstract

Introduction: Open traumatic Achilles tendon rupture is uncommon, particularly in the pediatric population. Unlike closed spontaneous ruptures – which predominantly affect middle-aged adults – sharp lacerating injuries in children pose challenges due to contamination risk and the close relation of neurovascular structures in the posterior ankle.

We report a case of complete open Achilles tendon rupture in a 9-year-old boy following a sharp metallic object injury, treated with primary tendon repair using the Modified Kessler technique. This case adds to the limited pediatric literature and may guide clinicians in management of this injury.

Case Report: A 9-year-old male child presented with a 3 × 1 × 1 cm contaminated laceration wound over the right posterior ankle following injury by a sharp metallic object. Clinical examination revealed a positive Thompson test and a palpable gap at the Achilles tendon. Primary surgical repair was performed using the modified Kessler technique with epitendinous augmentation under general anesthesia.

Conclusion: This case highlights that open Achilles tendon injury can occur in children and prompt surgical repair using the modified Kessler technique yields excellent functional outcomes with an AOFAS ankle-hindfoot score of 95. Pediatric surgeons and orthopedic residents should be aware of this rare but serious injury pattern.

Keywords: Pediatric Achilles tendon rupture, open tendon injury, modified Kessler technique, pediatric tendon repair.

Introduction

Achilles tendon rupture is among the most common tendon injuries encountered in orthopedic practice. However, the vast majority of reported cases involve closed spontaneous or degenerative ruptures in middle-aged recreational athletes, typically males in the fourth to fifth decade of life [1]. Open traumatic Achilles tendon ruptures secondary to sharp penetrating objects are much less commonly reported, carrying the added risks of wound contamination, tendon exposure, and

concurrent injury to adjacent neurovascular structures.

In the pediatric population, Achilles tendon ruptures of any etiology are relatively uncommon. The pediatric Achilles tendon is characteristically more elastic and resilient than its adult counterpart, with the calcaneal apophysis – rather than the tendon itself – being the weakest link in the musculotendinous unit during childhood [2]. Consequently, avulsion injuries at the calcaneal apophysis are more frequently reported in children [3]. Open traumatic ruptures in children have very limited published

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Figure 1: Pre-operative posterior ankle laceration showing exposed Achilles tendon ends.

literature [4].

To identify relevant literature, we searched PubMed/MEDLINE and Google Scholar using combinations of terms including “Achilles tendon rupture,” “pediatric,” “adolescent,” “tendon repair,” and “imaging.” Relevant case reports, reviews, epidemiological studies, and biomechanical studies were reviewed, and reference lists of relevant articles were also screened for additional studies.

The Achilles tendon is anatomically flanked by neurovascular bundles medially, which are vulnerable in sharp lacerating injuries of the posterior ankle region. Failure to recognize and manage concurrent neurovascular injury in conjunction with tendon repair may result in chronic sensory deficits, ischemic complications, and suboptimal functional recovery.

A focused review of the published literature shows that very few cases of open Achilles tendon rupture in the pediatric age group have been reported. Reporting the management and outcomes of such cases may help clinicians managing similar injuries [5, 6, 7].

The modified Kessler technique, originally developed for flexor tendon repair in the hand, has been widely adopted for Achilles tendon reconstruction because it provides good repair strength with less gap formation compared to simpler suture configurations [8]. We present this case to describe our experience with primary modified Kessler repair in an open pediatric Achilles tendon rupture (Table 1).

Case Report

Patient presentation

A 9-year-old male child was brought to the Emergency Department by his parents with acute pain, swelling, and inability to walk following an accidental laceration to the right posterior ankle by a sharp metallic object approximately 2 h before presentation. There was no history of prior tendon pathology, systemic illness, metabolic disorder, or medication use (including fluoroquinolones or corticosteroids). The child's vitals were stable.

Local examination

Examination of the right ankle and posterior leg revealed a $3 \times 1 \times 1$ cm contaminated laceration wound over the posterior aspect of the ankle, located approximately 2–3 cm proximal to the calcaneal insertion of the Achilles tendon. Wound margins were sharply incised. Visible tendon ends were identifiable through the wound with active capillary ooze (Fig. 1).

A palpable gap was appreciated at the site of Achilles tendon transection on gentle palpation adjacent to the wound. Thompson's test was positive. The child was weakly able to plantar-flex the right ankle actively.



Figure 2: Intraoperative image demonstrating modified Kessler suture placement.

Table 1: Published cases of open Achilles tendon rupture in the pediatric age group

Author (year)	Age/sex	Mechanism	NV deficit	Outcome	Repair technique
Supanich MA (2023)	10/M	Traumatic laceration	Not reported	Good	Krackow
Kouassi-Driai (2026)	14/M	Bilateral spontaneous	None	Excellent	Not mentioned
Vasileff WK (2014)	10/M	Sports injury (partial)	None	Good	Not mentioned
Present case (2026)	9/M	Sharp metal object	None (vessel intact)	Excellent —AOFAS 95	Modified Kessler

M: Male, NV: Neurovascular

Pre-operative planning and consent

Pre-operative ultrasonography demonstrated complete discontinuity of the Achilles tendon approximately 4.5 cm proximal to its calcaneal insertion, confirming the diagnosis.

Parental informed written consent was obtained, including consent for clinical photography and video documentation for academic publication. Surgical risks, anesthesia risk, and post-surgical complication were discussed. The child was kept nil by mouth as per pediatric anesthesia guidelines. Intravenous cefazolin 25 mg/kg (age-adjusted) was administered as antibiotic prophylaxis 30 min pre-incision. Tetanus prophylaxis was administered at presentation.



Figure 3: Intraoperative image demonstrating complete repair with epitenoid augmentation suture.

Operative procedure

The child was taken to the operating room and positioned prone on the operating table under general anesthesia (endotracheal intubation). The right lower limb was scrubbed, painted, and draped in standard sterile fashion.

The traumatic wound was extended using a posteromedial approach to provide adequate exposure with care taken to avoid injury to nearby neurovascular structures. The wound was copiously irrigated with normal saline and betadine solution under pressure. Minimal debridement of non-viable tissue was

performed.

Intraoperative findings: Complete transverse laceration of the Achilles tendon approximately 4.5 cm from its calcaneal insertion. Both tendon ends were retrievable. No active arterial injury was identified (Figs. 2 and 3).

Achilles tendon repair: Primary end-to-end repair was performed using the modified Kessler technique. A No. 2-0 FiberWire® suture was used to place a locking Kessler core suture through each tendon stump. Because of the smaller tendon size, smaller suture bites were taken and proportionally placed to maximize purchase without splitting the tendon. The



Figure 4: Clinical photograph at 2-week follow-up showing healed wound and active plantar flexion.

Table 2: A standardized post-operative protocol was followed

Phase/timeframe	Management
Day 1–5 (in-patient)	IV Cefazolin 25 mg/kg TDS; IV paracetamol for analgesia; limb elevation; NV observations 4-hourly; wound inspection day 3.
Day 5–14	Discharge on oral cephalexin 25 mg/kg/day BD; analgesia as needed; slab maintained in 20° PF; suture removal day 14; wound check.
Week 3	Slab at 10° plantar flexion; no weight-bearing; physiotherapy: Isometric quadriceps and hip exercises.
Week 4–6	Slab at neutral (0°); toe-touch weight-bearing with crutches commenced.
Week 6–10	Slab removed; transition to removable boot; physiotherapy: Passive and active ROM, plantar flexion strengthening, hydrotherapy.
Month 4–6	Full unrestricted physical activity at 6 months
PF: Plantar flexion, ROM: Range of motion, NV: Neurovascular, IV: Intravenous	

repair was tensioned with the ankle in approximately 15–20° of plantar flexion. A continuous epitendinous circumferential suture using 1-0 Vicryl was placed to reinforce the repair and smooth the coaptation site. The repair was stable without visible gapping.

Hemostasis was confirmed. Wound closure was performed in layers: Subcutaneous tissue with 2-0 Vicryl, and skin with interrupted 3-0 Ethilon mattress sutures. A well-padded below-knee plaster slab was applied with the ankle maintained in 20° plantar flexion.

Post-operative management

Postoperatively, the child was monitored in the pediatric ward. A standardized post-operative protocol was followed (Table 2 and Fig. 4).

Discussion

This case is unusual because of the patient's age, open injury pattern. First, it represents a rare occurrence of complete open Achilles tendon rupture in a 9-year-old child. Second, it demonstrates that with prompt surgical management, excellent functional outcomes (AOFAS score 95) including full return to childhood physical activity are achievable.

Achilles tendon rupture is less common in children. Unlike adults, where degeneration and eccentric loading predispose the tendon to failure, the pediatric Achilles tendon retains high elasticity and intrinsic tensile strength. The weakest point in the pediatric posterior chain is the calcaneal apophysis – leading to Sever's disease or apophyseal avulsions rather than midsubstance tendon failure [2]. In open injuries, however,

sharp lacerating injuries can still result in complete tendon transection.

The diagnosis of complete Achilles tendon rupture was established clinically by a positive Thompson test and confirmed by preoperative ultrasonography. Ultrasonography is the first-line imaging modality of choice for Achilles tendon injuries – it is rapid, cost-effective, dynamic, and avoids ionizing radiation, which is particularly pertinent in the pediatric population [9]. Magnetic resonance imaging, though more detailed, was not required in this acute setting given the clear clinical and sonographic diagnosis. Plain radiography was performed to exclude bony injury and avulsion fractures at the calcaneal apophysis, which are more common in children [3] (Figs. 5 and 6).

The neurovascular bundle lies in close proximity to the Achilles tendon and is particularly vulnerable in posterior ankle lacerations.

The posterior tibial vessels, which course medially to the Achilles tendon, showed adventitial contusion without frank arterial injury in our case. Vascular integrity was confirmed intraoperatively. Had there been a complete vascular transection, immediate vascular surgical intervention would have been required to prevent limb ischemia. In surgeons managing such injuries, vascular assessment should be performed when vascular injury is suspected.

Regarding tendon repair, the modified Kessler technique has



Figure 5: Plain radiograph demonstrating no bony deformities.



Figure 6: Ultrasonography demonstrated complete discontinuity of Achilles tendon fibers approximately 4.5 cm proximal to calcaneal insertion.

been studied in biomechanical models. Hockenbury and Johns (1990) demonstrated superior tensile load-to-failure and minimal gap formation with Kessler-based repairs compared to Bunnell or simple suture configurations in cadaveric Achilles tendons [8]. Compared with the Krackow technique, the modified Kessler repair provides adequate tensile strength with smaller suture bulk, making it particularly suitable for the pediatric population [10]. In our case, suture caliber and bite size were adjusted proportionally to account for the smaller tendon diameter, to avoid damage to the smaller tendon.

The post-operative rehabilitation protocol used in this case followed a progressive plantar-flexion reduction and early functional mobilization model. Careful wound management was important in this case because of contamination risk. Pediatric skin is more pliable and vascular than adult skin, facilitating wound healing; however, contaminated wounds still carry infection risk. Our protocol of copious irrigation, conservative debridement, layered primary closure, and targeted antibiotic prophylaxis resulted in uneventful wound

healing with no infective complications. Post-operative recovery was uneventful, with normal walking and return to activities by 6 months after surgery with an AOFAS ankle-hindfoot score of 95, indicating excellent functional recovery. A limitation of this report is the relatively short follow-up duration; however, early functional recovery was excellent.

In summary, this case demonstrates that early repair of open Achilles tendon injury in children can result in good functional recovery.

Conclusion

Open traumatic Achilles tendon rupture, though uncommon in children, demands prompt recognition and surgical management. Primary Achilles tendon repair using the modified Kessler technique, combined with intra-operative neurovascular assessment, wound irrigation, and structured progressive rehabilitation, results in excellent functional outcomes. Compared with the Krackow technique, the modified Kessler repair provides adequate tensile strength with smaller suture bulk, making it particularly suitable for the pediatric population.

In this 9-year-old patient, full plantar flexion strength, complete return to physical activity were achieved by 6 month follow-up. This case adds to the limited pediatric literature on open Achilles tendon injuries and highlights the importance of clinician awareness of this rare but serious injury pattern.

Clinical Message

Early primary repair with the modified Kessler technique gives a strong, low-bulk construct well suited to the small pediatric tendon, and with structured rehabilitation a full return to activity is a realistic goal.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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