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Case report

The hemisoleus rotational flap provides a novel superior autograft reconstructive option for the treatment of chronic extensor mechanism disruption

Jean-Charles Auregan, MD [a], James D. Lin, MD, MS [b, *], Joseph M. Lombardi, MD [b], Eugene Jang, MD [b], William Macaulay, MD [b], Melvin P. Rosenwasser, MD [b]

[a] Department of Orthopaedic Surgery, Antoine Béclère Hospital, Clamart, France
[b] Department of Orthopaedic Surgery, Columbia University Medical Center, New York, NY, USA

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ABSTRACT

Chronic disruption of the extensor mechanism is a devastating problem after total knee arthroplasty. Quadriceps tendon ruptures occur at an estimated 0.1% prevalence in the setting of total knee arthroplasty. Complete tears of the quadriceps tendon generally have poor results and high rates of rerupture. We present a case of a quadriceps tendon rupture after total knee arthroplasty which reruptured after initial direct repair. The patient presented to us with a chronically retracted rerupture and was subsequently reconstructed successfully with a novel extended medial gastrocnemius-soleus-calcaneus local rotational pedicle flap.

Introduction

Chronic disruption of the extensor mechanism is a devastating problem, in anyone, but especially after total knee arthroplasty (TKA). It can profoundly limit a patient's functional ability to perform simple activities of daily living. In addition to obligating a patient to walk short distances with an assistive device (cane or walker), extensor mechanism disruption can make it impossible for a patient to reciprocate on stairs and it can also leave certain TKA constructs anteriorly unstable. The extensor mechanism can be disrupted at the patellar tendon, within the body of a fractured patella, or at the quadriceps tendon. Quadriceps tendon ruptures occur at an estimated 0.1% prevalence in the setting of TKA.

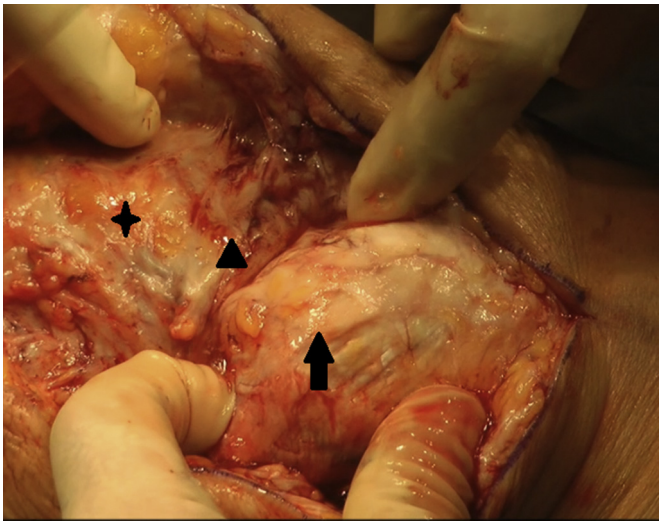

Figure 1. Intraoperative clinical photograph of the gross defect and retraction of the quadriceps tendon (plus sign). Scar tissue (arrow head) has formed in the void between the quadriceps and patella (arrow). Orientation: proximal: left; distal: right; medial: top; lateral: bottom.

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* Corresponding author. 622 West 168th Street, PH11-1164, New York, NY 10032, USA. Tel.: +1 212 305 3912.
E-mail address: jdl2161@columbia.edu

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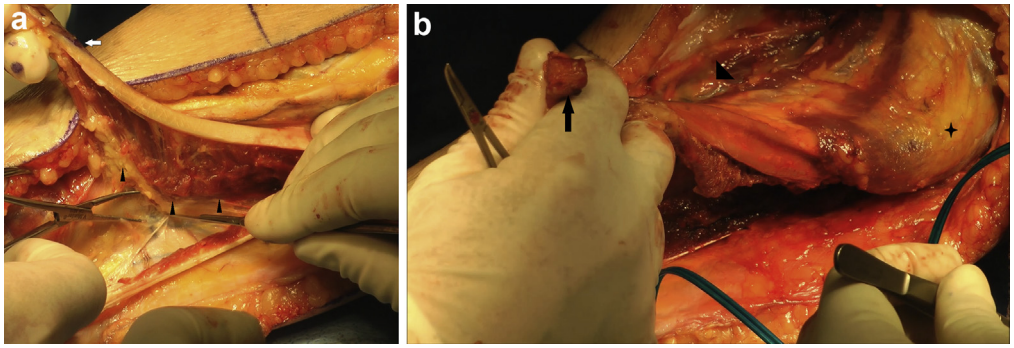

Figure 2. (a) Elevation of the hemisoleus flap (arrow heads). The Achilles tendon (arrow) remains contiguous with the calcaneal block. (b) Care was taken in identifying the perforating vessels from the posterior tibial vasculature (arrowhead). Visible here is the flap consisting of the medial belly of the gastrocnemius (star), the hemisoleus, and its continuity with the calcaneal block (arrow).

Complete tears of the quadriceps tendon generally have poor results and high rates of rerupture [1].

Current treatment options include direct suture repair, repair with mesh or autograft augmentation, and extensor allograft [1-3]. These techniques all have their limitations and have a high rate of failure in the treatment of the chronically disrupted extensor mechanism. When these options fail, the surgeon is faced with limited options.

We present a case of a quadriceps tendon rupture after TKA which reruptured after initial repair. The patient presented to us with a chronically retracted rerupture and was subsequently reconstructed successfully with a novel extended medial gastrocnemius-soleus-calcaneus local rotational pedicle flap. A video of the surgical technique involving the same patient is available through the Orthopaedic Knowledge Online Journal [4].

Case history

Our local institutional review board policy does not require approval for case reports involving a single patient. The patient is an 80-year-old active woman who presented to our clinic after undergoing a right TKA for intolerable knee pain in Mexico. The patient reported making good postoperative progress in therapy until 6 weeks after surgery when she attempted active extension of her right knee against resistance when she felt a tear and heard a popping sound just above her kneecap. An extensor lag was noted immediately. Her original surgeon performed a direct suture repair. The patient was immobilized for 5 weeks after the revision. However, she never regained extensor function in the knee signifying failure of the repair.

The patient presented to us 7 months after her initial TKA. On examination, she had a well-healed midline incision with no evidence of infection. She had a palpable defect in the suprapatellar region with retraction of the quadriceps tendon. The patient was unable to walk without the use of a brace and was very dissatisfied with her level of functioning. Radiographs obtained at this time showed patella baja, but components were otherwise well fixed. Initially, a repair with allograft was considered, but it was deemed to have a high risk of failure given the profound degree of contracture and retraction of the tendon due to nearly 7 months of inactivity. The patient was taken to the operating room for an extended medial gastrocnemius-soleus-calcaneus local rotational pedicle flap.

In the operating room, the previous anterior midline incision was extended proximally 3 cm. A 6-cm defect was visualized between the end of the retracted quadriceps tendon and the superior pole of the patella (Fig. 1). This was filled with a fibrous connective tissue, which was excised.

An incision was made from the popliteal space to the Achilles tendon insertion on the calcaneus. The Achilles tendon was split 50:50, and an osteotome was used to create a medial calcaneal bone block contiguous with the medial Achilles. Retrograde division of half of the soleus was performed and extended proximally to divide the raphe between medial and lateral bellies of the

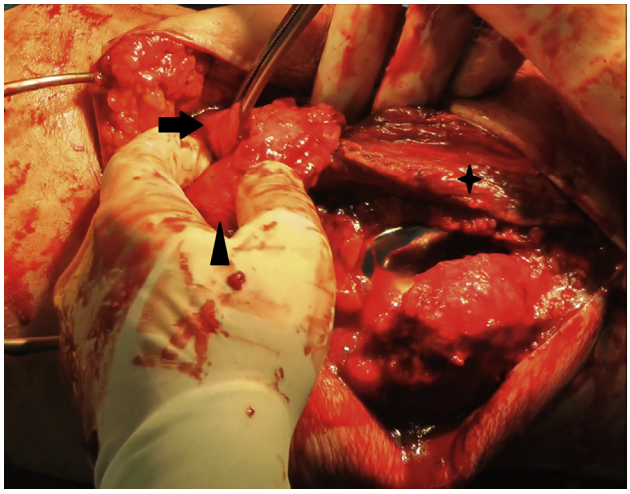

Figure 3. The flap (plus sign) is brought from the posterior compartment of the leg to the anterior compartment of the thigh. The calcaneal block (arrow) is looped through the quadriceps tendon (arrowhead) before being secured to the patella.

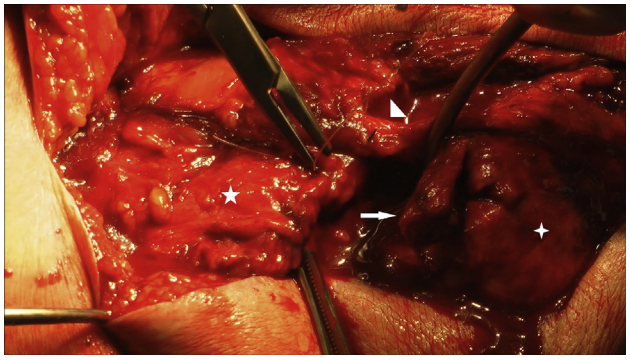

Figure 4. The hemisoleus flap (arrowhead) is secured to the quadriceps tendon (5-point star) with #1 FiberWire. The calcaneal block (arrow) will then be anchored in the patella (plus sign) allowing for bone-to-bone healing.

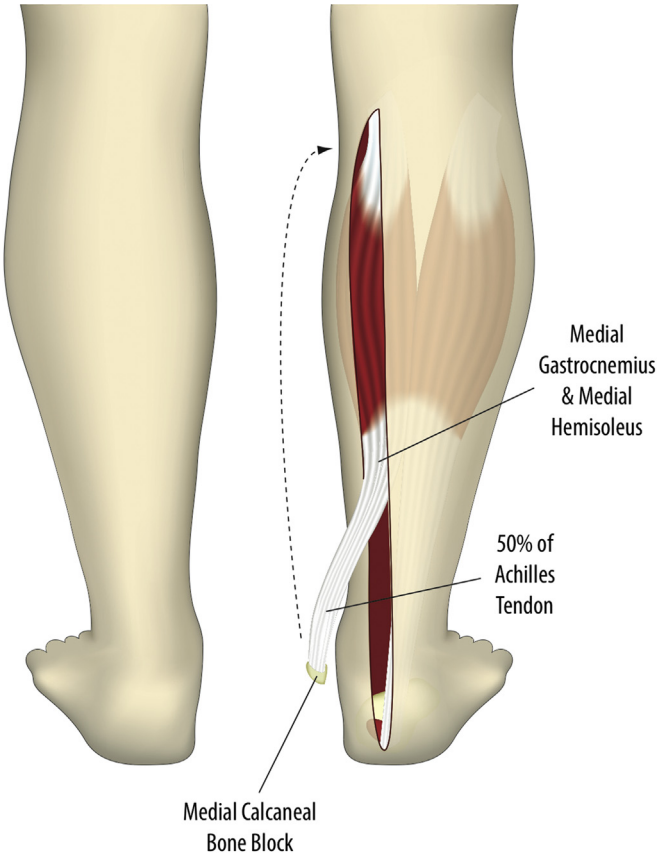

Figure 5. Posterior view of skin incision and hemisoleus flap.

gastrocnemius, resulting in a composite graft consisting of the medial gastrocnemius, medial hemisoleus, 50% of the Achilles tendon, and the calcaneal bone block (Fig. 2a and b). This bone block was approximately 2.5 × 1.5 cm in its dimensions and consisted of cortical and cancellous bones.

The graft was carefully mobilized by careful division of the multiple branches from the posterior tibial artery to the soleus, leaving the upper 3 pedicle branches to supply the soleus. The flap was then passed from the posterior compartment to the anterior compartment through a medial subcutaneous incision. A slit was made in the quad tendon proximal to the rupture, and the flap was brought through the slit in the tendon (Fig. 3). A docking "trench" in

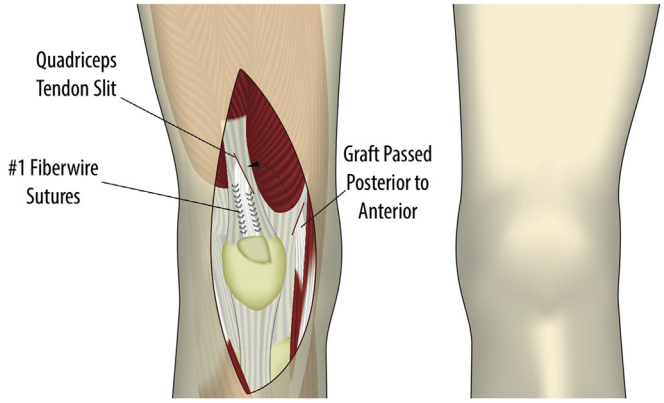

Figure 6. Anterior view of graft passed through quadriceps tendon and docked into patellar trench.

Figure 7. Patient demonstrating active extension against resistance at 3 months postoperative.

the patella was created by using a rongeur without violating the patellar implant. Two-millimeter drill holes were placed on either side of the implant in the patella, and #1 FiberWire was passed through this to secure the bone block (Fig. 4). The flap was then sutured to the native quadriceps tendon, adjacent retinacular tissues, vastus lateralis, and vastus medialis (Figs. 5 and 6). The graft was tensioned with the knee in full extension. A Jackson-Pratt drain was placed, and a bivalved long-leg cast was applied with the knee in a few degrees of flexion. The patient was immobilized in full

Figure 8. Patient walking with cane at 3 months postoperative.

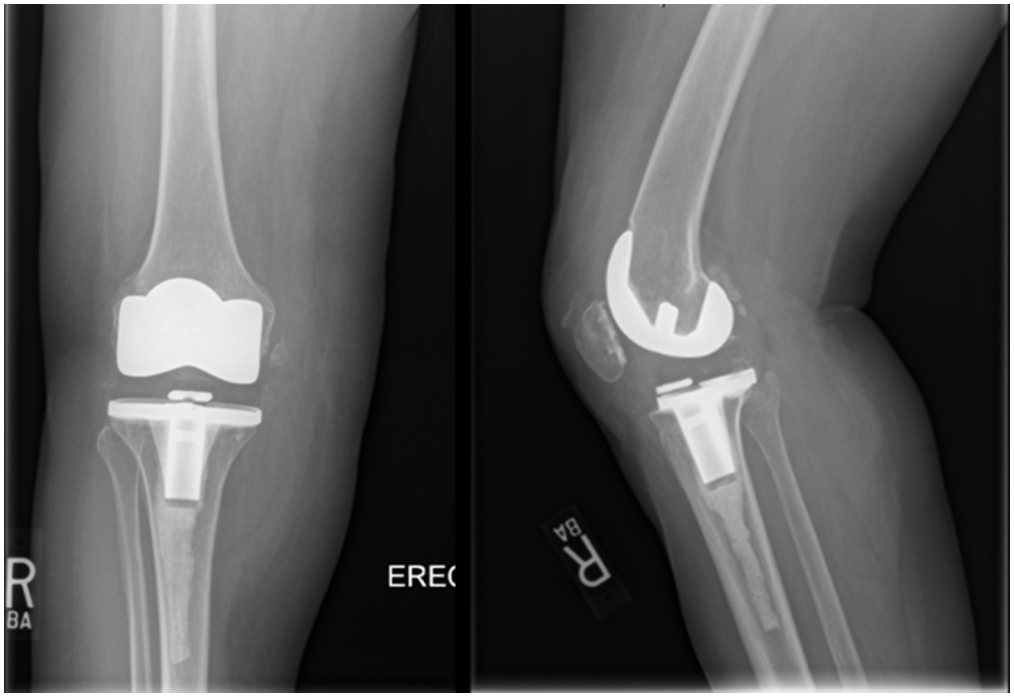

Figure 9. Radiograph at 3 months postoperative demonstrating implants in place and healing of calcaneal block to patella.

extension for 4 weeks before initiating passive range-of-motion exercises.

At 3-month follow-up, the patient demonstrated full active extension within the limitations of her knee arthroplasty which was 0° to approximately 90° (Fig. 7). She was able to walk without orthosis, using only a cane (Fig. 8). In addition, she was able to climb stairs with a reciprocal gait. The patient retained active plantar flexion with an intact gastrocsoleus complex. Radiographs demonstrated healing of the calcaneal block into the patella (Fig. 9).

Discussion

Rupture of the knee extensor mechanism is rare devastating complication of TKA. Quadriceps tendon ruptures are rare compared to patellar tendon ruptures. Risk factors for rupture are multifactorial and include lateral retinacular release, poor patellar positioning, previous extensor mechanism complications, as well as systemic factors such as steroid use, obesity, diabetes, and rheumatoid arthritis [1,5]. Complete ruptures generally have unsatisfactory results and high rates of rerupture [1].

Direct suture repair tends to be unreliable, and current treatment options include direct repair with or without mesh or autograft augmentation [1,2], suture anchor repair [6], complete extensor allograft reconstruction [3], and the medial gastrocnemius flap [7]. When these fail, the surgeon is faced with limited options.

In 1997, Jaureguito et al [7] reported on the medial gastrocnemius flap for the treatment of extensor mechanism disruptions after TKA, which were mostly patellar tendon ruptures. They also described an extended medial gastrocnemius flap consisting of the medial gastrocnemius in continuity with half of the Achilles tendon that was used in their single case of quad tendon rupture. There was no patella remaining, and the Achilles was sutured to the quad tendon.

Summary

In this case report, we present the use of a novel extended medial gastrocnemius-soleus-calcaneus local rotational pedicle flap in the setting of chronic recurrent quadriceps tendon rupture after TKA. The hemisoleus flap is a commonly used option for soft tissue coverage. The muscle has a bipenniform anatomy and independent distal vascular supply from the popliteal vessels and their posterior tibial and peroneal divisions [8].

This technique provided a secure vascularized tendon interposition, which spanned the gap of the chronic defect. The vascularized calcaneal block allowed for bony incorporation into the patella and healing. We believe this technique is potentially a valuable tool in the arsenal of the reconstructive surgeon when addressing difficult cases of extensor mechanism disruption in the setting of TKA.

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