

Bilateral Revision Quadriceps Repair in the Setting of Morbid Obesity: A Case Report

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1. Abstract

A 48-year-old female with a BMI of 72 sustained bilateral simultaneous quadriceps tendon ruptures during a trial of ambulation. Three weeks following bilateral open quadriceps tendon repair, she sustained a recurrent right quadriceps tendon rupture that necessitated revision repair with Achilles tendon allograft. Her left quadriceps tendon repair also failed with no provoking event, thus she underwent revision quadriceps tendon repair with Achilles tendon allograft supplemented with cortical button and interference screw fixation.

Bilateral quadriceps tendon ruptures are extremely uncommon but pose a challenging surgical problem. This case presentation of a treatment course following a rare diagnosis should raise awareness of possible complications and provide treatment options to diminish the morbidity associated with disrupted extensor mechanisms and maximize the success of surgical treatment.

2. Introduction

Quadriceps tendon ruptures (QTR) are reported to occur in approximately 1.37 out of 100,000 individuals [1]. Although not as common, Bilateral QTRs can be a major source of morbidity as the loss of an extensor mechanism disrupts the normal knee function to both lower extremities. Initial diagnostic studies can miss up to 50% of bilateral QTR, but it still remains a clinical diagnosis that typically presents with the inability to actively extend the leg, local swelling, and the presence of palpable suprapatellar gaps [2-6]. They frequently occur in older individuals falling down stairs but are more likely to occur spontaneously while walking in younger individuals with coexisting endocrine or renal pathology [4,7-10]. Pathologic analysis of tendons in patients with Diabetes Mellitus (DM) who sustained QTRs demonstrated fibrinous necrosis with calcifications and arteriosclerosis [8,11,12]. Obesity has also been

implicated as a risk factor for bilateral QTR. Not only does obesity place greater mechanical loads and stress on the tendon, but it creates a pro-inflammatory environment that triggers a cascade of immune responses resulting in tendinopathy [13,14]. It has also been noted that obesity is associated with a higher risk of complications following tendon repair compared to non-obese patients [15]. While there have been case reports of bilateral QTRs, there has not been a case report to our knowledge discussing revision surgery and the complex postoperative management required in these patients.

Here, we present the case of a 48-year-old female with a BMI of 72 and history of Type II DM, who required bilateral revision quadriceps tendon repair with Achilles tendon allograft following spontaneous bilateral QTR and subsequent repair.

3. Case Report

The patient is a 48 year old female with a history of type 2 diabetes mellitus and obesity with a BMI of 72 who sustained a ground level fall on 1/3/2021 and presented to the ED where she was found to have a right 4th metatarsal fracture as well as right proximal fibula fracture. While attempting to stand and work with physical therapy she felt a sudden onset of weakness in her knees and sustained another fall. A repeat CT scan demonstrated concern for a right quadriceps tendon rupture, which was then confirmed on Ultrasound as patient was unable to fit into the MRI scanner. She underwent bilateral open quadriceps repair on 1/7/2022 using a traditional 3 trans-patellar drill hole construct using two number five fiberwire sutures passed through the quad tendon. The retinaculum was reinforced with fiberwire in figure eight and another fiber wire was passed through the quadriceps and patella tendon superficially. The patient was made non weight bearing and placed into bilateral long leg casts, and later transitioned to modified knee

extension braces.

Unfortunately while working with physical therapy she felt a tearing sensation in her knee on 1/27, where CT scan confirmed a re-tear of the right quadriceps tendon. She underwent a revision right quadriceps tendon repair on 2/18/2022 with a size 7mm Achilles allograft, bone block along with a tight rope cortical button over distal patella. This was then secured with 7 x 20 mm biocomposite screw and for interference fixation. After discharge from the hospital she was found to have a left quadriceps tendon re-rupture on 6/3/2021, there was no specific incident that the patient recalled to suggest an acute traumatic tear. She was then brought back to the operating room to undergo revision left quadriceps repair.

During this procedure there was significant difficulty with achieving hemostasis as a tourniquet was unable to be placed due to the size of the patients leg. Upon further dissection the tendon was identified and noted to have significant fibrofatty tissue, which was excised to find a triangular 8 x 10 cm defect just proximal to the patella. The proximal pole the patella was then debrided and the quadriceps tendon was then mobilized (Figure 1A). A frozen Achilles allograft with bone block was prepared on the back table so that the bone block was sized to a 9mm by 20mm plug. A beath needle was passed in the central patella through the inferior pole, which was then overreamed with a 9 mm cannulated reamer. An

Arthrex bone tendon bone tight rope was then advanced through the bone block into the proximal pole the patella and docked, while the allograft and was tied over Endobutton on the inferior pole the patella. This was augmented with a bio composite 7 mm x 25 mm screw.

Once adequate patella fixation was achieved, attention was then turned to the tendinous defect. The defect was reapproximated in a V-Y plasty. Bone tunnels were made through the medial to lateral patella and fibertape was passed through these tunnels. A Kraków type suture using the fibertape was passed incorporating the Achilles allograft fascia along the lateral and medial aspect of the defect. Tension was then secured and tied over the anterior cortex of the patella. Lastly an additional bone tunnel was created with a fiber tape on the lateral aspect of the patella to advance the vastus lateralis in order to provide additional fixation. The graft was then sewed over top of itself distally and reinforced with Vicryl sutures (Figure 1b). The knee was flexed and no gapping was observed at 70 degrees of flexion. She was made non weight bearing in the left lower extremity and kept in a posterior knee splint in extension for two weeks, at which point she was transitioned to a custom fabricated T scope brace locked in extension. At her follow up appointments, graft appeared to be healing well and she was beginning to begin graduated range of motion of her knee.

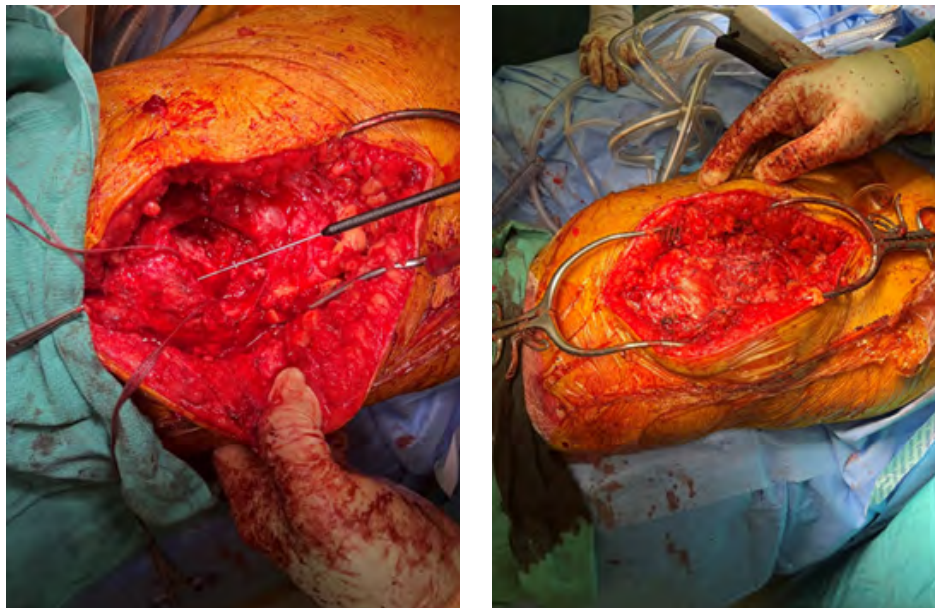


Figure 1: A) Demonstration of the superior border of the patella as well as the persistent quadriceps tendon defect after debridement and mobilization of the tendon. B) Final construct after securing the Achilles tendon allograft and V-Y plasty re-approximation.

4. Discussion

There are few studies regarding the management of quadriceps ruptures in obese patients. In regards to bilateral quadriceps tendon ruptures, only 66 cases have been reported in the English literature between 1949 and 2023. In terms of repair techniques, a cadaveric study comparing fixation strength of suture anchor vs transosseous tunnel repair demonstrated no statistically significant difference in ultimate load to failure between the two constructs,

but suture anchor repair having decreased gapping during cyclic loading [16]. This study may explain why most studies examining quadriceps repairs in obese patients utilize suture anchor construct. In a case series of three obese patients, BMI 41, 35, 35 respectively, with bilateral quadriceps tendon tears, the authors describe a novel technique involving two 2.8mm double loaded all suture anchor repair constructed placed at the superior pole of the patella with a modified Krakow suture configuration placed into the

quadriceps tendon. At final follow up, all three patients did not experience re-rupture [17]. However one case report demonstrated successful outcome in a patient with a BMI 35 with bilateral quadriceps tendon ruptures where transosseous fixation construct using an anterior cruciate ligament tibial tunnel guide was used to maneuver the drill more accurately to the desired endpoint [18].

In our case report, the primary transosseous repair technique even with reinforcement of the retinaculum had failed bilaterally. This could have been due to the larger BMI of this patient compared to any reported in the above studies, rehabilitation protocol, or delay in diagnosis and surgical repair. Individuals with obesity tend to have an increase in adipocytes, resulting in a pro-inflammatory tendon environment. The release of cytokines from this proinflammatory state triggers matrix metalloproteases, which work to further degrade tendon extracellular matrix which is often irreversible and predisposes tendons in obese patients to rupture or in this case re-rupture [13,15]. Studies have shown lower functional outcomes due to quadriceps atrophy and limited motion in patients delayed longer than one week from injury as well as decreased full functional recovery [5,19]. Additionally, no study to our knowledge describes the optimal post-operative protocol in morbidly obese.

In the revision quadriceps tendon repairs, a variety of fixation constructs involving Achilles bone block have been reported. One case report describes an 18 year old patient who sustained a quadriceps tendon retear after a traumatic injury and was found to have a 6cm gap. The authors describe a novel technique involving an Achilles bone block allograft, where the bone block was removed and the allograft was folded over the defect and secured to the superior pole of the patella with two suture anchors [20]. Another technique described utilizes the bone block of the Achilles allograft by creating a trapezoidal cut in the proximal patella where the bone plug of the graft is secured along the anterior surface of the patella with transosseous through the patella [21]. Our construct utilizes the strength of interference screw fixation to secure the bone block to the graft in addition to an endobutton to secure the fiberwire passing through the tendon.

5. Conclusion

Although bilateral quadriceps tendon ruptures are rare, they have a higher incidence in the obese patient population and pose a significant challenging surgical problem. With rising obesity rates globally, this problem may become more common and subsequently may require surgeons to be familiar with techniques in settings of re-ruptures. Here we present a case report of a patient with morbid obesity with bilateral quadriceps tendon tears that failed bilateral primary repairs. We describe a novel fixation construct utilizing strength of suture anchor and interference screw fixation with an achilles allograft with good outcomes.

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