

Case Report

Easy and safe repair of quadriceps tendon rupture through transosseous sutures: A technical note

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ABSTRACT

Many repair techniques have been used for quadriceps tendon rupture. Transosseous sutures are the golden standard since they can offer the safest and most stable tendon reattachment. Drilling in parallel to the patella's longitudinal axis while avoiding the articular surface can be particularly challenging. In addition, drilling the patella has been shown to increase the possibility of an intraoperative fracture, especially if large diameter drills are being used. The present technical note demonstrates a simple, safe, cost-effective, and reproducible technique for quadriceps tendon repair. This technique is based on the use of a cruciate ligament reconstruction tibial tip aimer and guide wires with eyelet. After the accurate patella, entry and exit points for transosseous suturing are defined, the eyelet guide wires enable the passing of the sutures through the patella. Finally, the free ends of each suture are pulled and secured distally. This technique allows efficient and proper tendon fixation while minimizing potential complications.

Keywords: Quadriceps tendon rupture, Surgical repair, Techniques

INTRODUCTION

The quadriceps tendon rupture is an uncommon knee injury, which is usually observed in male patients of 40 years or older, while it might occur secondary to a chronic systematic disease.^[1] Its early reconstruction is required to avoid retraction and atrophy of quadriceps muscle fibers.^[2] Various techniques have been proposed, including simple suture with catgut, wire reinforced repair, pull-out suture fixation through patella, and fixation using suture anchors. Furthermore, in cases of missed or/and late diagnosis, tendon lengthening surgical repair with autograft, allograft and synthetic materials have been suggested for tendon reconstruction.^[3] Transosseous repair has become the gold standard based on its association with improved long-term outcomes.^[4,5] Most of the described techniques include passing the sutures through patellar tunnels, thus potentially increasing the risk of iatrogenic fracture of the patella and/or cartilage injury. *The use of suture anchors* is a valid alternative, however, it is associated with increased costs, while the pull-out strength of the anchors in the patella bone has been questioned.^[4]

In the present study, a reproducible, inexpensive, and safe bone-to-tendon surgical technique on the repair of quadriceps tendon rupture, using a pull-out suture fixation through patella without using bone tunnels, is described.

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CASE PRESENTATION

Surgical technique

The patient is placed in a supine position with a tourniquet around the proximal thigh. Following general anesthesia, the tourniquet is inflated to 250–300 mmHg, just before the skin incision. Through a longitudinal midline incision, approximately 10–12 cm in length overlying the patella, subcutaneous dissection is carried out to expose the proximal and the distal part of the patella and the distal part of the quadriceps tendon [Figure 1a]. At first, the Krackow stitch technique is performed on the free ruptured edge of the quadriceps, while two non-absorbable coated braided polyester sutures are applied (No. 5, Ethibond Excel, Ethicon, Somerville, NJ) to the avulsed-ruptured tendon edge [Figure 1b]. After identifying the medial and lateral borders of the patella, it is visually divided into four quadrants. Four entry points in the superior pole of the patella are marked with the electrocautery devise. Using any cruciate tip aimer

for tunnel guide positioning, the desired exit point is secured for each entry point [Figure 1c]. Subsequently, four guide wires (2.4 mm diameter) with eyelet are sequentially placed in parallel, at 8–10 mm distance alongside [Figure 1d]. The free ends of sutures are passed through the guide wire eyelet and the pins are smoothly hammered and pulled distally with a gripping tool [Figure 1e]. At least two guide wires can be used by putting one in parallel, close to the other, after pulling out the suture edge. The two edges of each suture are pulled and tied firmly in the inferior pole of the patella by positioning the knee in maximal extension [Figure 1f]. The optimal height of the patella is confirmed with the use of fluoroscopy, by comparing the pre-operative radiograph (lateral view) of the contralateral knee to the intraoperative (lateral view) radiograph of the injured knee. The evaluation of the stability of the repaired tendon is assessed intraoperatively, through gentle passive range of motion (ROM) to 90° of flexion, while ensuring the absence of overconstraint to the quadriceps tendon repair.

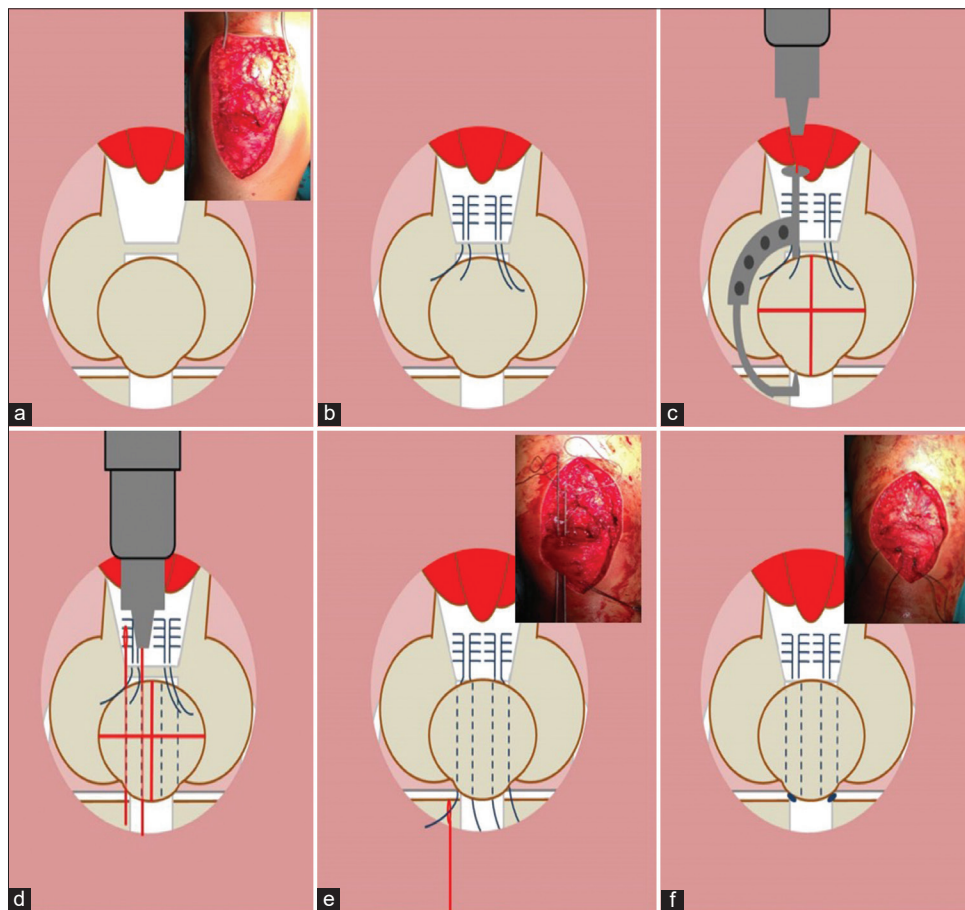


Figure 1: The drawings and intraoperative photographs demonstrate the repair of quadriceps tendon rupture: (a) ruptured quadriceps tendon, (b) two locking-type whipstitch according to Krakow technique, (c and d) parallel drilling of 2.4 mm guide wires with eyelet through the patella using the cruciate tip aimer for tunnel positioning, (e) four passages are performed to pull the four edges of the two sutures through the patella, (f) the reattached quadriceps tendon in its anatomic position.

Post-operative rehabilitation

A functional knee brace, locked in extension, is applied when walking, while partial weight-bearing with crutches is indicated for 3 weeks, followed by full weight-bearing. A gradual increase in passive ROM is also indicated from 0° to 30° during the first 3 weeks, followed by a 15° increase every week until the 8th post-operative week. Active ROM exercise is allowed after the 7th week. The knee brace is removed at the 12th post-operative week, after a normal clinical examination provided that the patient feels completely confident about his knee. The muscle strengthening exercises are based on a progression program starting with bodyweight and isometric exercises (1st week) and continuing with isotonic, isokinetic restrictive exercise for quadriceps and hamstrings (7th week) and machine resistance exercises (12th week). Closed kinetic chain exercises can be initiated at 7 weeks, while open kinetic chain exercises at 10 weeks. Recreational sports, such as swimming, cycling, and running, are allowed at 5 months postoperatively, however, contact sports should be avoided.

DISCUSSION

The present technical note demonstrates a simple, safe, cost-effective, and reproducible technique for quadriceps tendon repair. The use of a cruciate tip aimer along with guide wires with eyelet enables the drilling of a significantly smaller hole in the patella, while decreasing the risk of intra- or post-operative fractures, and offering a great transosseous fixation.

Rupture of the quadriceps tendon causes disruption of the knee extensor mechanism, thus resulting in disability and chronic dysfunction that needs to be promptly diagnosed and surgically repaired.^[2] A wide variety of surgical treatments has been described, each with specific advantages and disadvantages.^[3-5] For instance, the pull-out fixation has been performed the treatment of quadriceps tendon rupture, demonstrating satisfactory results.^[1,6] Another technique based on fixation with suture anchors, has been widely reported as an effective method to repair a quadriceps tendon rupture.^[4,7,8] Colombelli *et al.*^[8] showed acceptable results using suture anchors applied to the patellar superior pole while repairing the quadriceps tendon. The current literature has reported several improvements using suture anchors for repairing quadriceps tendon. However, only biomechanical studies, along with small case series, have been published.^[4] Traditional repair involves transosseous sutures tied over bone bridges on the patellar inferior pole. Overall, this surgical approach has shown promising results.^[2,4,8] Plessner *et al.*^[4] reported similar outcomes when using suture anchor repair or transosseous suture repair. Despite the increasing evidence for the benefit of using suture anchor, the transosseous fixation has remained the gold standard for quadriceps rupture repair.

Drilling freehand tunnels, parallel to the longitudinal axis of the patella, while avoiding the articular surface remains technically challenging. Dinneen *et al.*^[9] described a simple and reproducible method for the accurate placement of holes in the patella drill along with the passage of sutures using the Acuflex[®] Director™ Drill Guide during knee ACL reconstruction.^[9] According to their method, the desired entry and exit points for drill holes are safely selected on the patella. A 4.5 mm ENDOBUTTON[®] cannulated drill was used to overdrill close to each passing pin, to create the suture holes. The present study proposes the use of the same or any similar cruciate tip aimer used in the aforementioned technique for the positioning of the tunnel guide, to target the desired entry and exits points of the 2.4 mm guide wire with the eyelet. Since the 2.4 wire can easily pass the suture edges through patella body, overdrilling using a 4.5 mm cannulated drill is not required. The overdrilling and the use of larger bone tunnels may increase the possibility of an intraoperative fracture. In addition, a potential suture motion and wear inside the “large” tunnels may jeopardize the fixation stability. It should be noted that the overall risk of fracture during the transosseous technique varies, with increased risk of transverse fracture when the anterior cortex of the patella is violated and during certain surgical techniques (i.e. smooth K-wire vs. drill bit, small vs. large tunnels, etc.).^[10] The present technique potentially offers shorter operative procedures, decreased bone blood supply compromise, improved healing rates, and decreased risks of early or delayed patella fracture.

CONCLUSION

This simple technique can be used for quadriceps tendon repair at the osteotendinous junction or at its proximity, where the vast majority of ruptures occur. It can also be used for patellar tendon rupture. The classic footprint guide for knee cruciate ligaments reconstruction is a safe, cost-effective, and reproducible technique.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of Interest

There are no conflicts of interest.

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