Technical Note

Repair of Patellar Tendon Rupture With Suture Anchors

David Capiola, M.D., and Louis Re, M.D.

Abstract: Repair of a ruptured patellar tendon is usually performed with the use of sutures that are passed through intraosseous tunnels within the patella. However, a number of caveats pertain to this method. The Beath pin may penetrate the articular surface or may unduly injure the quadriceps through multiple passes. The already injured patellar tendon may be overly shortened after debridement and insertion into bony tunnels, and loosening through the tunnels may occur. Obliquely oriented bony tunnels may cause abnormal patellar tilt, leading to uneven force distribution. This technical note reports the details of an alternative repair with 3 suture anchors that is incorporated into a 6-stranded Krackow technique, with additional mattress sutures as needed. Because of the low-profile nature of the anchors, this technique more accurately re-creates the footprint at the inferior pole of the patella and avoids articular cartilage penetration and injury to the surrounding soft tissue. The possibility of loosening through bony tunnels or creation of abnormal stresses is eliminated. A smaller incision is used, and operative (tourniquet) time is diminished. Although pullout of the anchors may be a logical concern, previous studies have suggested that this construct is more than sufficient to withstand the forces to which it is subjected. **Key Words:** Patella—Tendon rupture—Suture anchor.

Rupture of the patellar tendon occurs most commonly in patients younger than 40 years of age and is the result of an indirect large force generated by contraction of the quadriceps, which is estimated to be at least 17.5 times body weight.[1] Although this injury is frequently seen in patients with underlying risk factors such as rheumatologic, endocrine, metabolic, and immunologic conditions, or local corticosteroid injections, it may also occur in healthy individuals. The treatment of choice for a complete patellar tendon rupture is immediate surgical repair, and numerous other methods, including intraosseous sutures through the patella, end-to-end suturing, cerclage wiring with or without Steinman pins, and Kirschner wiring and casting, have been described in the literature. More recently, Ho and Lee[2] reported the use of suture anchors for repair of a single traumatic case of bilateral patellar tendon disruption. This technical note describes in detail the technique used in 2 patients to repair patellar tendon disruption with primary suture anchor fixation.

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CASES

Two healthy patients, ages 38 and 46 years, with no predisposing risk factors were given a clinical diagnosis of traumatic patellar tendon rupture. Both patients described an eccentric loading mechanism—one that occurred during landing from a jump during a basketball game, and the other that resulted from falling off of stairs. Upon presentation, each patient was unable to perform a straight leg raise or knee extension against gravity and reported a sensation of a "pop" in the knee during a sporting event. Both exhibited patella alta on lateral radiography, as seen through the Insall-Salvati method. Conditions were diagnosed upon presentation of the patients within 24 hours of injury; patients were brought to the operating room within 48 hours.

OPERATIVE TECHNIQUE

A general or regional spinal/epidural anesthesia is used for the procedure. The patient is placed on the operating table in the supine position, and a tourniquet placed on the upper thigh is inflated to 300 mm Hg after the lower extremity has been exsanguinated with an Esmark bandage. An approximately 6-cm longitudinal incision is made at the level of the palpable defect, and sharp dissection is carried down to the level of the ruptured tendon. The hematoma is evacuated and copiously irrigated. The edges of the frayed tendon and the paratenon are freed from the surrounding soft tissue with the use of sharp dissecting scissors. The medial and lateral retinacula, which are usually involved as well, are identified for later repair.

The rupture site is usually located at the osteotendinous junction. The patella is inspected to verify that no large bony avulsions or chondral defects have to be addressed. Once the edges of the tendon have been identified and debrided, the inferior pole of the patella is curetted to stimulate cancellous bleeding to facilitate healing at the bone/tendon interface. At this point, the insertion points for the 3 suture anchors are marked with electrocautery, ensuring proper placement in the coronal plane—at the medial, middle, and lateral thirds of the patella. The anchors should be placed approximately 2 mm from the articular surface; placing them too superficially may increase the joint

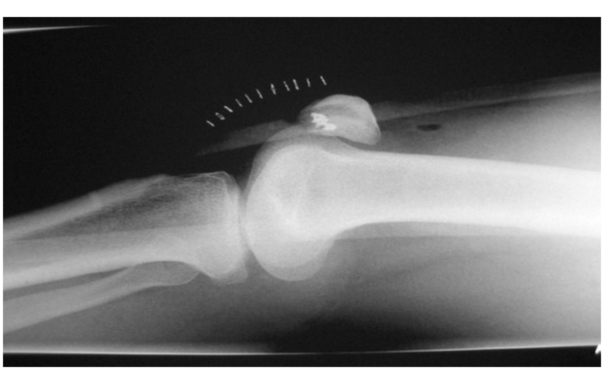

Figure 1. Postoperative lateral radiograph, again, shows the proximity of the anchors to the articular surface.

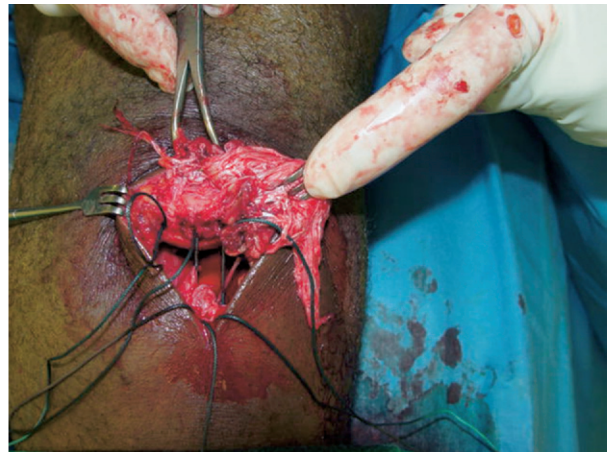

Figure 2. Intraoperative view: Suture anchors should be placed adjacent to the articular surface to avoid creation of excess patellofemoral forces, which may occur with superficial placement.[3]

reactive force and lead to abnormal patellofemoral joint mechanics (Fig 1)..[3] Pilot holes are drilled with a 3.2-mm drill bit parallel to the patella, avoiding penetration of the articular surface. Three Ultrafix RC anchors (Linvatec, Largo, FL) are each threaded with 2 No.2 Ethibond (Ethicon, Somerville, NJ) or FiberWire (Arthrex, Naples, FL) sutures and are inserted and deployed in the pilot holes in the usual manner (Fig 2). Fixation should be manually tested at this point through forceful pulling on the sutures to ensure that gross motion or pullout does not occur.

One suture in each anchor should be used to create a running, interlocked whip stitch, as described by Krackow et al.,[4] distally through the tendon, ensuring that full-thickness bites are obtained and that healthy tendon is incorporated, preferably for at least two thirds of the tendon length. Extreme care should be taken to avoid cutting the previous suture, hence a tapered needle should always be used. Of import, the second limb of each suture should be passed in an unlocked fashion through the proximal free tendon and tied within the substance of the tendon, to avoid placing the knots at the anchor/suture interface, which may create gapping and may weaken the construct. This method results in 6 running suture strands within the tendon and 6 strands that traverse the bone/tendon interface. The additional suture threaded within each anchor can be incorporated into the repair in a horizontal mattress fashion for reinforcement, if this is deemed necessary—again with care taken to avoid lacerating the previous sutures in the process (Figs 3, 4). In a small patient, if the tendon itself does not afford

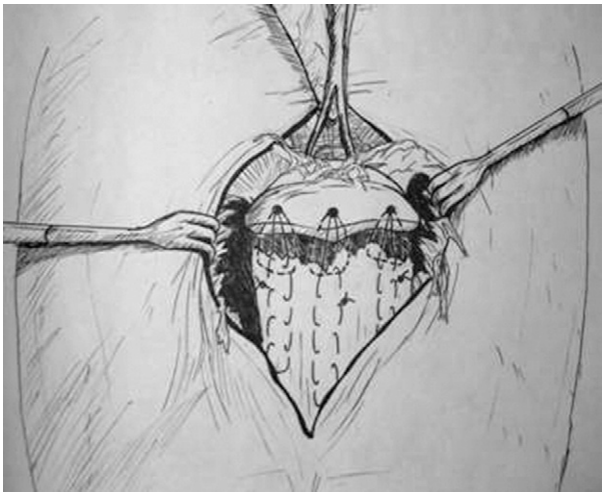

FIGURE 3. Diagram shows 3 doubly-stranded running Krackow sutures and horizontal mattresses added for further supplementation. Note that the knots are placed within the substance of the tendon—not at the islet junction—to avoid weakening of the construct.

enough room for these mattress sutures, they can be omitted.

The medial and lateral retinacula are repaired with No. 2 Ethibond in an interrupted fashion, until no palpable defects remain. At this point, the tourniquet is deflated and meticulous hemostasis is attained with electrocautery. The knee is taken through a gentle range of motion to ensure that no gapping occurs at the interface. The operative site is then irrigated, the deep soft tissue layer approximated with 0 Vicryl suture, the subcutaneous layer closed with No. 2 buried interrupted Vicryl suture, and the skin closed with staples or a running subcuticular suture. After dressing, the leg is placed in a Bledsoe brace with the knee locked in full extension.

Postoperatively, patients are allowed partial weight bearing while in the extension brace. They are given antiembolic stockings and are encouraged to perform ankle pumps from the outset. The remainder of the protocol is as follows: At 3 weeks, range of motion within a Bledsoe brace (active-assisted progressing to active) is permitted from 0° to 60°, at 6 weeks, from 0° to 90°, and at 9 weeks, from 0° to 120°. After the first 6 weeks, the patient is allowed to progress to full weight bearing. In our series, both patients achieved 0° to 120° by week 10 and recovered complete functionality by week 12. Both have returned to work and remain extremely satisfied with their progress.

DISCUSSION

Numerous surgical options have been described for surgical repair of a ruptured patellar tendon. The most commonly used technique involves the use of sutures through intraosseous patellar bone tunnels. Although this method is successful, several caveats must be noted. In an attempt to re-create the patellar tendon footprint, the articular surface may be penetrated, causing chondral damage. Numerous passes with the drill or Beath pin may injure the quadriceps unnecessarily. As mentioned by Ho and Lee,[2] intraosseous wires that pull the free tendon edges through the tunnels carry the theoretical risk of shortening the already debrided tendon, resulting in patella baja. In addition, loosening through bone tunnels, which has been shown to occur after as few as 25 cyclic loads, may lead to eventual cutout of the sutures through the tunnels.[5]

Use of the suture anchor as described here has a number of advantages. Chances of penetrating the articular surface and injuring the intact quadriceps are greatly diminished by the low-profile nature of the anchor. Additionally, although obliquely oriented bone tunnels can theoretically create abnormal patellar tilting and force distribution, suture anchors do not convey this risk. Excessive tendon shortening does not occur because the tendon edges do not penetrate into the long tunnels. Loosening or expansion of the bone tunnels is not an issue. The incision is smaller and subsequent dissection is less extensive than with the conventional method because the superior pole of the patella does not have to be exposed. Subsequently, operative (tourniquet) time is decreased. Additionally,

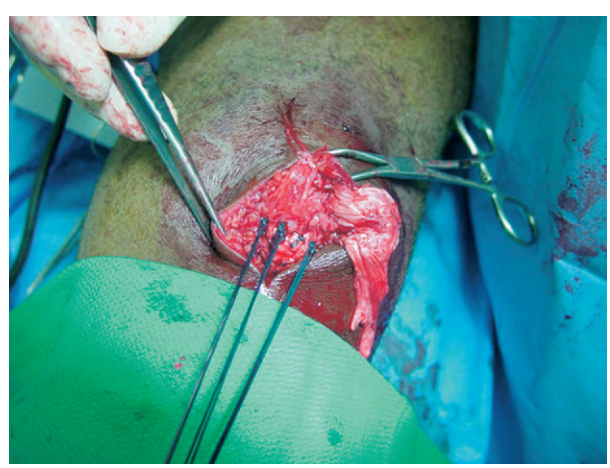

FIGURE 4. Ensure that no gapping occurs at the interface after the knots have been securely tied.

in contrast to the use of cerclage wires (another method), no reoperation for removal of broken or painful hardware is necessary.

A logical concern relates to pullout of the suture anchors themselves. However, the pullout strength of the suture anchor construct significantly exceeds the force to which it is exposed. For instance, in the example of the first patient, who weighed 71 kg, the maximum patellofemoral joint reaction force at weight bearing would be approximately 35.5 kg, or 0.5 times body weight.[6] The pullout strength of the Ultrafix RC anchors is reported to be reliably 54.4 to 56.3 kg in cancellous bone (manufacturer's information, Linvatec), which is more than sufficient. In fact, the most likely mode of biomechanical failure results from cutting of suture through the tendon; this is the rationale for the use of the strong Krackow stitch, which affords greater force dispersion and cutting restraint. In addition, reinforcement of traversing suture strands with horizontal mattress sutures leads to greater dissipation of load, further minimizing the possibility of cutout. Six traversing sutures are used because the strength of the repair is increased in proportion to the number of strands that cross the site. Finally, meticulous retinacular repair adds to the strength of the construct.

Suture anchor fixation in patellar tendon rupture is an excellent technique that enables strong fixation with minimal dissection and eliminates various complications associated with alternative techniques. This results in effective healing and a fast return to functional activities and is a viable alternative to the intraosseous suture technique.

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