CASE REPORT

Acute unilateral rupture of the quadriceps tendon

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INTRODUCTION

Quadriceps tendon ruptures are relatively uncommon injuries.\(^1\) It has been, however, chronicled through the ages; the earliest written report is attributed to Galen.\(^2\)

While a rupture of the quadriceps tendon is a potentially severe affliction that requires accurate diagnosis and prompt management, it is an injury more frequently seen in older patients who are above 40 years of age.\(^3-6\) The injury often follows an unexpected, rapid, high energy contraction of the quadriceps muscle, and can associated with underlying pathological conditions of the quadriceps.\(^3-6\)

CASE

A 76 year old gentleman from the community of Ocean Falls, British Columbia, injured his right leg on July 1st, 2012, while jumping rope. He reported feeling and hearing a ‘popping’ in his right knee and he was no longer able to support his weight on that leg. An initial consultation at a local hospital included an ultrasound that was inconclusive and gave no clear diagnosis. The patient was given a GII knee brace to immobilize the knee for recovery. However, after several weeks there was little progress in his recovery.

He visited the Emergency Department of Vancouver General Hospital on August 8th, 2012, where the Orthopedics Trauma resident on call examined him. He was able to actively flex his right leg but could only passively extend it. He reported pain in the affected area during movement. When asked to contract the quadriceps muscle, the muscle bulk in the thigh was observed to be contracting, but no transference of force was observed through the lower leg. A suprapatellar gap was felt during examination, which is highly indicative of a complete tendon rupture. A lateral plain radiograph of the right knee was taken, which showed some avulsion fragments from the superior pole of the patella and a shadow across the soft-tissue in the region of the quadriceps tendon insertion into the patella (Figure 1).

The patient was admitted and scheduled for emergency surgical repair, which was handled by the Orthopedic Trauma team on-call on the following day. Regional anaesthesia was administered through a spinal block. A straight midline incision was made above the quadriceps tendon and knee. Surgical dissection and removal of hemarthrosis by suction revealed a complete quadriceps tendon tear at the osteotendinous junction with fibrotic tissue developing on the free edges of both quadriceps tendon and patella. Slight retraction of the muscle was noted but not measured. The fibrotic tissue was debrided and the tendon’s anatomical insertion was roughened to create a fresh cancellous bone bed to facilitate healing. Two parallel suture anchors were drilled longitudinally into the superior pole of the patella. Using a Mayo needle, one end of each suture was sewn into the free end of the tendon. The edges were reaproximated and tied down proximally while the knee was in full extension. The reaproximated edges were reinforced with 1 Vicryl sutures and the Scuderi technique of using a partial-thickness flap of proximal tendon tissue folded over the rupture and sutured in place. The knee was taken through a 0° to 90° range-of-motion test to check the strength of the repair. 1 and 2-0 Vicryl were used to close the incision and surgical staples were used to close the skin. Post-operatively, the knee was immobilized in full extension.

DISCUSSION

Anatomy and mechanisms of injury

The quadriceps tendon is formed by the distal tendinous ends of all four muscles of the quadriceps: the rectus femoris, vastus intermedius, vastus lateralis, and vastus medialis.\(^7\) These four muscles are innervated by the femoral nerve and coalesce into one band which attaches to the superior border of the patella bone.\(^7\) Occasionally an anatomical variant of the articularis genu muscle can contribute fibers to the tendon.\(^7\) The portion of the quadriceps tendon that inserts into the patella divides into three separate planes. The superficial, or anterior, plane is composed of the rectus femoris, while the second, or middle, plane contains both the vastus lateralis and medialis.\(^7\) Finally, the deep plane consists of the vastus intermedius. Deep to all these planes is the synovium.\(^7\)

The tendon is a component of the knee joint’s extension system.\(^4\) Connecting the patella to the quadriceps, it allows energy generated by those muscles during extension to be transferred through the patella and the

Figure 1: Lateral radiograph of R knee. Note avulsion fragments along the superior pole of patella, as well as a shadow in the soft-tissue region of the quadriceps tendon insertion into the patella.
The quadriceps muscles can contract concentrically (with shortening of the muscles) or eccentrically (with lengthening of the muscles). Much higher contractile forces can be generated eccentrically, and it is during this type of contraction, which occurs with a partially flexed knee and a planted foot, that tears typically happen. These mechanics are often displayed in attempts to regain balance or landing while jumping, which was how the injury manifested for our patient, as he reported to be jumping rope when he ruptured his tendon. Upon landing from a jump, the quadriceps experience a rapid and powerful eccentric contraction against the individual’s full body weight.

It is important to note that the quadriceps tendon in a normal, healthy individual is an incredibly strong structure. Past studies have found that this tendon can withstand remarkable stress loads without rupturing. Tendons that rupture under lesser trauma loads are likely to have some form of pathological architectural change. These alterations can occur due to the result of degenerative changes, vascular disturbances, chronic conditions such as renal disease, uremia, diabetes, rheumatoid arthritis, hyperparathyroidism, lupus, gout, amyloidosis, and obesity, as well as steroid overuse. Rupture due to direct trauma, laceration, or penetrating injury is rare.

**Diagnosis**

Ruptured quadriceps tendon clinically presents with a triad of knee pain, inability to actively extend the knee joint, and a suprapatellar gap. The suprapatellar gap is considered pathognomonic for a complete tear; however, it can be difficult to palpate due to edema secondary to hematoma or hemorrhage. Ultrasound has a high sensitivity and specificity for determining the location of the tear and distinguishing partial and complete ruptures. Ultrasounds are quick and non-invasive, but depend on operator skill. MRI has become the most consistent and accurate imaging modality for visualizing an injured quadriceps tendon. It can be used in cases of extensive hematoma or edema, and is able to locate and depict the extent of injury. It is useful for surgical planning; however, high costs reserve MRI use for when there is still doubt following all other diagnostic methods.

**Treatment**

Quadriceps tendon repair depends on the severity of injury. Partial tears do not require surgical treatment; the knee joint is immobilized in full extension for 6 weeks. Subsequent physiotherapy for range-of-motion and quadriceps muscle re-strengthening are recommended. Joint immobilization is gradually discontinued as the patient regains muscle control and discomfort decreases. Hematoma or hemorrhosis drainage can promote healing.

A completely ruptured quadriceps tendon requires surgical repair for optimal functional outcomes. There are many methods that can offer favorable results, with no study designed to offer a comparison on which technique is the most efficient and reliable in delivering return of function. Commonly, Krackow or Bunnell sutures are placed through the tendon using thick, non-absorbable sutures, which are subsequently passed through longitudinally drilled, parallel channels in the patella and tied distally. Suture anchors drilled into the patella and tied to the tendon, which was the method used in this case, also yield good results. Postoperative care involves keeping the knee joint immobilized in full extension with a hinged knee brace, as was done in this patient, for 4-6 weeks, followed by physiotherapy to regain range-of-motion. The brace is typically removed after 12 weeks and good functional return should be achieved 12-16 weeks after the surgery.

Delaying operation can lead to complications in the repair process as the quadriceps tendon begins to retract approximately 72 hours after injury. There is some debate on treatment timeline, with some studies showing no detriment following a delay between injury and operation, and others showing worse results for delayed repairs. In this case, there was an approximately 6 week delay between injury and repair, with noted muscle retraction during the operation. It remains to be seen how the patient’s return to function fares following the repair.

This case report shows a relatively infrequent, but potentially debilitating, injury that can result from a seemingly harmless context. It emphasizes the importance of a thorough knee examination, as critical diagnostic clues can be easily missed. Once diagnosed, prompt surgical repair is recommended and a multidisciplinary approach to management is recommended to achieve optimal functional outcomes.

**REFERENCES**

CASE REPORT


