# 23 Quadriceps Tendon Tear: Evaluation and Management in a 54-Year-Old Man

Jason L. Koh, Roshan Wade, and Chaitanya Waghchoure

## 23.1 Case

History: A 54-year-old office worker and recreational tennis player was brought to the emergency department after a slip and fall while descending stairs. He felt immediate pain and difficulty bearing weight on his right leg. He had no previous history of knee or leg issues.

On physical examination the right thigh was tender to palpation. There was swelling of the right knee. Proximal to the patella the quadriceps tendon was soft and not readily identifiable by palpation. The patient was unable to perform a straight leg raise. There was no medial or lateral tenderness at the knee and the Lachman test was negative.

J. L. Koh (✉)
Mark R. Neaman Family Chair of Orthopaedic Surgery, NorthShore University HealthSystem, Evanston, IL, USA

Orthopaedic & Spine Institute, Skokie, IL, USA

NorthShore University HealthSystem, Evanston, IL, USA

University of Chicago Pritzker School of Medicine, Chicago, IL, USA

Northwestern University McCormick School of Engineering, Evanston, IL, USA

R. Wade
Seth G.S Medical College and KEM Hospital, Acharya Donde Marg, Mumbai, Maharashtra, India

C. Waghchoure
B J Medical College, Pune, India

Mumbai, Maharashtra, India

## 23.2 Imaging Findings

An initial set of radiographs were obtained. There was no obvious patella baja. A possible decrease in the soft tissue density proximal to the patella could be identified (Fig. 23.1).

An MRI of the knee joint was obtained, clearly demonstrating a complete tear of the quadriceps tendon (Fig. 23.2).

## 23.3 Treatment

Open repair of the quadriceps tendon was performed. A tourniquet was placed on the leg but was not elevated. A longitudinal incision was made over the proximal half of the patella and extended proximally. Extensive hematoma was evacuated from the knee and acutely bleeding blood vessels were coagulated. The bed of the ruptured quadriceps tendon was prepared down to bare bone and the torn edge of the tendon was debrided until intact tendon fibers could be identified. Three 2 mm high- strength suture tapes were placed in a Krackow locking stitch of the medial, central, and lateral edges of the quadriceps tendon, extending 3–5 cm proximal to the torn edge, 2 pairs of figure-eight high strength # 2 sutures in a locking fashion on the medial and lateral retinacular tissue was also applied.

Three pilot drill holes were made in the proximal patella and tapped. The suture tapes



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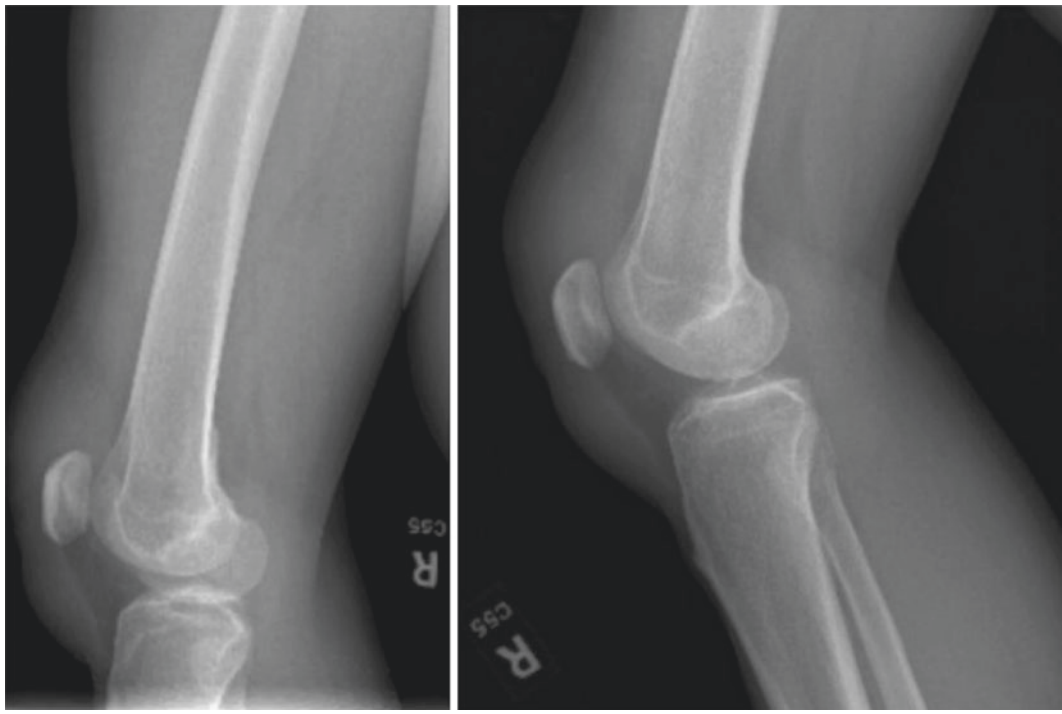

**Fig. 23.1** Initial X-ray, lateral

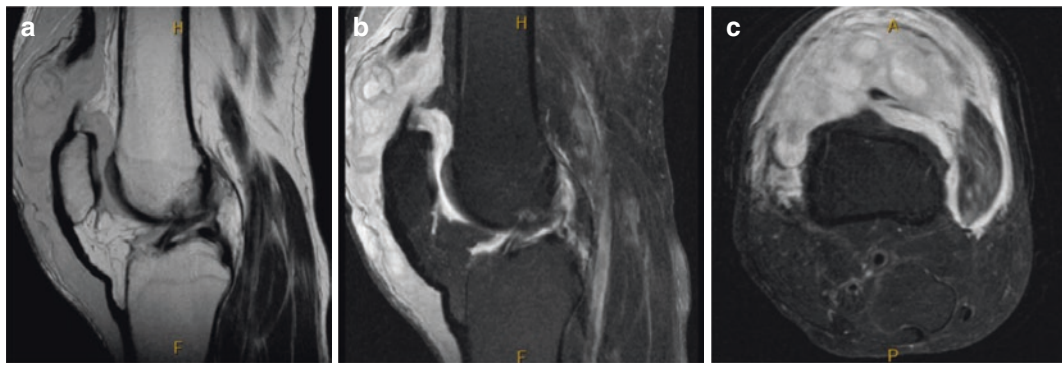


**Fig. 23.2** Pre-operative MRI. (**a** and **b**) Sagittal views demonstrating quadriceps tendon tear and gap formation. (**c**) Axial view demonstrating complete tear of quadriceps tendon

were then secured to the patella using 4.75 mm PEEK interference screw-in anchors to the bony bed. The suture tapes were then tied down over the anchor followed by use of the #2 high strength eyelet sutures in a locking fashion through the tendon, reapproximating the more superficial layer of the quadriceps mechanism.

## 23.4 Rehabilitation

Weightbearing with a knee brace locked in extension was permitted immediately. At 2 weeks range of motion to 30° was permitted, and progressed to 60° at 4 weeks and 90° at 6 weeks. The brace was discontinued after 8 weeks. Closed chain strengthening exercises eventually permit-

ted a return to normal function and no extensor lag with straight leg raising after approximately 12 months.

## 23.5 Discussion

The diagnosis of quadriceps tendon rupture can often be made clinically on examination by identification of a palpable defect proximal to the patella and inability to straight leg raise. However, particularly in the case of significant soft tissue swelling or obesity, it may be difficult to palpate the tendon, and inability to straight leg raise can be caused by multiple factors. Radiographs often do not show diagnostic findings and can be misinterpreted [1], and incorrect diagnosis of a quadriceps tendon rupture has been identified even with the use of ultrasound in up to 33% of patients [2, 3]. MRI has been shown to have excellent diagnostic sensitivity and specificity, with a positive predictive value of 1.0, and is strongly preferred when available.

The use of suture anchors to repair the quadriceps tendon rather than bone tunnels was described in 2000 in Italy [4] and in 2002 in the US [5]. The advantage in using suture anchors is decreased dissection. When compared to transosseous tunnel techniques, suture anchor repairs have been demonstrated to be essentially biomechanically equivalent in several studies [6–8], with slight differences in load to failure or gap formation. Clinical outcomes with either technique have been equivalent [9]. The use of suture tapes has been shown to be biomechanically superior to high strength suture for tendon repair [10], but both showed significant gapping (mean, 7.82 ± 3.64 mm) with an initial 150 N preload. Suture tape with knotless anchors has been shown to be biomechanically superior to either transosseous tunnels or traditional suture anchors in a cadaver model [11]; however, no clinical outcome data is available for suture tape compared to high strength suture repair.

## 23.6 Perspective: Roshan Wade, Chaitanya Waghchoure

Quadriceps tendon rupture more commonly occurs in middle age population and is seen at the osteotendinous junction. In young population, it occurs at the midtendon or the musculotendinous junction. Spontaneous tears in middle and old age correlate with the hypovascular zone which has been consistently identified between 1 and 2 cm from the superior pole of patella [12]. The quadriceps tendinopathy which is mainly seen in old age presents with persistent anterior knee pain, pain with activities or even deficit of extensor mechanism and could lead to partial or complete tears [13]. Clinically, the palpable gap of the quadriceps rupture may be obscured in the presence of significant swelling and the diagnosis can be missed. Usually radiographs are relatively normal. Occasionally, osteophytes at the superior pole of suggestive of associated tendinopathy could be seen on lateral radiographs. However, MRI scan is always confirmatory and defines the severity of the tear. Often partial tears can be treated conservatively with immobilization in full extension for 6 weeks followed by protected weight bearing, range of movement, and gradual quadriceps strengthening. Early surgical repair is indicated in complete tears.

Surgical repair techniques include end-to-end repair, transosseous suture repair, suture anchor fixation, and augmentation with autografts and allografts. Acute tears need to be repaired within 72 h to prevent tendon retraction. In case of acute midtendon tears, we prefer end-to-end suture repair using locked Krackow stitch in both proximal and distal ends. For the more common osteotendinous tears, we use both traditional transosseous suture repair or suture anchor fixation. In transosseous technique, 3 parallel vertical tunnels of 4 mm each are made in the patella to pull through the suture tapes weaved across the quadriceps tendon, which are finally secured at the inferior pole of the patella (Fig. 23.3). Advantage of transosseous suture repair is that its inexpensive as compared to the use of suture anchors and also it is easier to remove the sutures

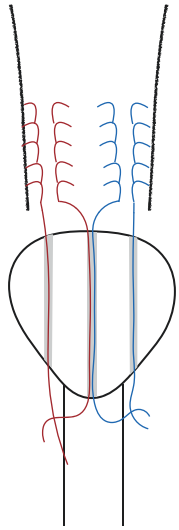

**Fig. 23.3** Transosseous repair (Courtesy by Dr. Roshan Wade)

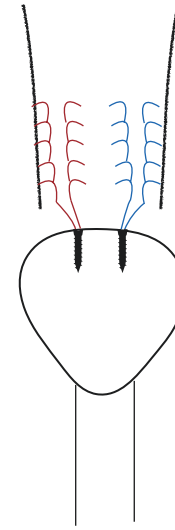

**Fig. 23.4** Suture anchor repair (Courtesy by Dr. Roshan Wade)

in the likelihood of post-operative infection. Recently, biomechanical studies have shown that suture anchor fixation is superior to transosseous repair and produce less gapping on cyclic loading [8, 14, 15]. This could be attributed to the "dead length" of suture inside the transosseous tunnels aggravating the stretching effect of the sutures [16]. However, clinical outcomes have been comparable for both transosseous and suture anchor fixations [17]. A well-designed randomized controlled trial in future could add more value to the current understanding and clinical outcomes.

Similar to the author, for both transosseous and suture anchor fixation techniques, we prefer UltraTape over high strength suture in order to securely grasp the quadriceps tendon over a length of 3–5 cm using a Krackow stitch. Use of Modified Mason-Allen pattern of stitch is an effective alternative [18]. Apart from the simplicity of the procedure, use of suture anchor offers the advantage of limited surgical exposure, avoiding the need to violate patellar tendon unlike transosseous suture fixation at lower pole of patella and less gapping on cyclic loading as mentioned earlier. The only drawback is difficulty in removal of the anchors if complicated by a post-operative infection.

In the current case scenario provided, the patient is in his mid-50s with a complete tear of quadriceps tendon at the osteotendinous junction. We would manage this patient with early surgical repair using suture anchor technique (Fig. 23.4) in similarity with the author's technique. Intra-operatively, we like to assess the "safe zone" of range which permits early movements without putting resistance at the repair site. Usually it is less than 90°. Post-operatively, toe-touch walking to full weight bearing is allowed using the long knee brace as per the pain tolerance, the range of motion is encouraged in the "safe zone" for the first 6 weeks, progressively including closed chain exercises, straight leg raising, core, and quadriceps strengthening.

Additionally, it is important to rule out pre-existing tendinopathy which could alter the management. The presence of poor quality tendon warrants debridement as well as augmentation using a semitendinosus autograft as described by Chahla et al. [19] (Fig. 23.5). In this technique, a transverse tunnel in patella is created to pass the graft and secured additionally with suture anchors to the superior pole of patella after soft tissue tunneling of the graft. The free ends of the graft are tunneled through the medial and lateral aspects of quadriceps tendon in criss-cross fashion and finally secured to the tendon with non-absorbable sutures.

In conclusion, early diagnosis and surgical repair of quadriceps tendon rupture are crucial.

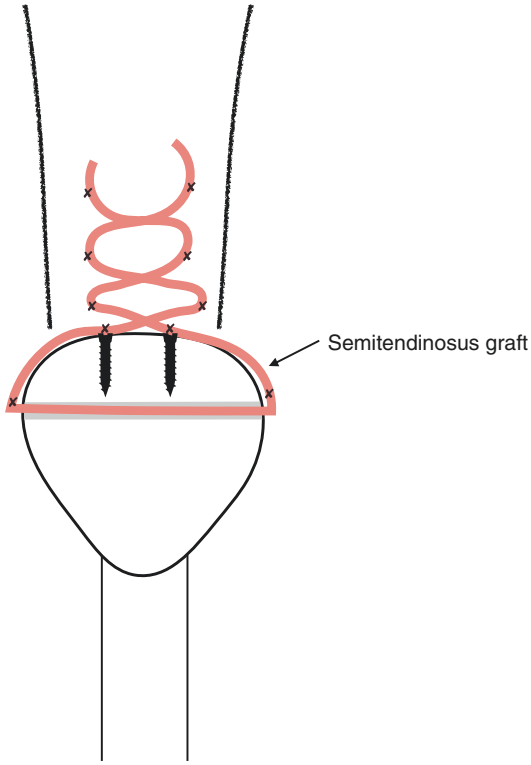


**Fig. 23.5** Semitendinosus augmentation of suture anchor repair (Courtesy by Dr. Roshan Wade)

Technique of repair depends mainly on the location of tear and the tendon quality either using transosseous or suture anchor fixation with or without graft augmentation.

**Key Points**

Diagnosis of quadriceps tendon injuries is improved by the use of MRI.

Use of suture anchors for quadriceps tendon repair demonstrates biomechanically and clinically equivalent results to transosseous tunnel repair.

Suture tape is biomechanically superior to high strength suture for tendon repair, but no comparable clinical data is currently available.

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