Radiology Corner

Bilateral patellar tendon rupture (#37)

Guarantor: 2dLt Ramon A. Riojas, USAF, MSC[1]
Contributors: 2dLt Ramon A. Riojas, USAF, MSC[1]; Col Les Folio, USAF, MC, SFS[2]

Note: This is the full text version of the radiology corner question published in the June 2009 issue, with the abbreviated answer in the July 2009 issue.

The authors present a case of bilateral patellar tendon rupture in an active duty male exiting his truck while deployed in Iraq. The patellar tendon is one of the strongest tendons in the body, second only to the Achilles tendon. Bilateral patellar tendon rupture is a rare occurrence usually associated with chronic degeneration of tendon fibers, use of steroids, or systemic illness. Our patient had no systemic risk factors. However, he was wearing heavy body armor and weapons while exiting the truck from an unusually high truck cabin, landed on his left leg and heard a pop in his knee. When he tried ambulating on the opposite leg to seek medical attention, he heard another similar pop in his right knee.

History

A 42-year-old active duty male jumped to exit his truck wearing full body armor and weapons and felt a pop in his left knee. He then tried to hop on the other leg to the aid station and felt a similar pop in the opposite leg. The soldier was unable to walk, however, he tried crawling to obtain medical attention. Eventually friendly forces saw him in distress and took him to medical care out of harm's way. At the medical facility plain radiographs were taken of both knees. On exam, there was swelling of the patellar tendons and a high riding patella bilaterally. The patient was evacuated to a higher echelon of care outside of Iraq for MRI and definitive treatment.

Summary of Findings: Plain AP and lateral radiographs were taken of both knees. Lateral radiographs showed patella alta, a high riding patella, bilaterally. A joint effusion was also noted. On MRI, disrupted patellar tendons were noted bilaterally (Figs. 2, 4).

Diagnosis

Bilateral patellar tendon rupture

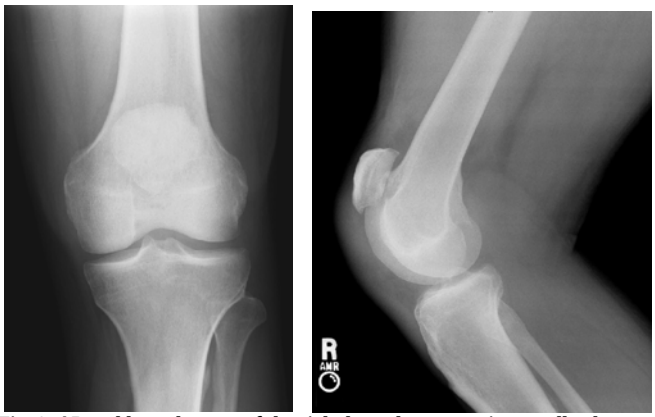

Fig. 1: AP and lateral x-rays of the right knee demonstrating patella alta.

Patient discussion: Bilateral patellar tendon rupture injuries occur in those with chronic tendon degeneration, steroid use, and systemic conditions predisposing them to this unusual injury pattern. Our case on the other hand is a healthy active duty military male with no known conditions to increase his risk. Likely predisposing factors in this case were the fog of war, adrenaline (truck driving in areas away from base protection is one of the most dangerous jobs in combat), and the wearing of heavy body armor and weapons (about 50 pounds).

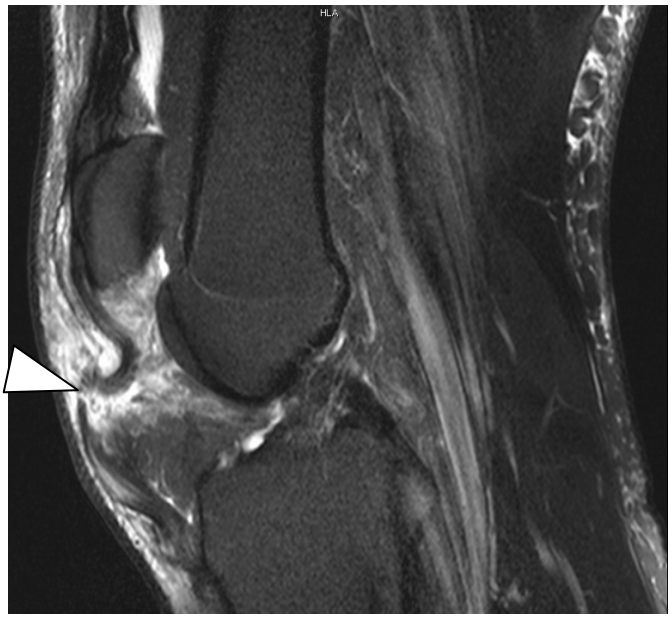

Fig. 2: T2-weighted sagittal MRI of the right knee with arrowhead pointing to the retracted patella tendon with associated increased signal representing inflammation around the tendon disruption with surrounding fluid.

[1] School of Medicine, Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799
[2] Department of Radiology and Radiological Sciences; Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799

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Discussion

In a one-year retrospective study of U.S. soldiers at Fort Bragg, 52 tendon ruptures occurred and 12 were patellar tendon ruptures. Further it was found that the rate of major tendon rupture was 13.3 times greater for black men when the data was adjusted for gender and age (1). This case and a review of the literature also suggest that active men in their 30's-40's may be at increased risk for tendon rupture.

Epidemiology: The patellar tendon is one of the strongest tendons in the body, second only to the Achilles tendon. It is postulated that the patellar tendon can normally withstand 17.5 times an individual's body weight (2). Rupture of the patellar tendon is very rare; in fact it is more common to find a patella fracture (3) with this type of injury mechanism. Bilateral patellar tendon rupture is even less common, but has been noted in the literature (4). Bilateral patellar tendon rupture is commonly associated with chronic degeneration within the tendon or systemic disorders such as lupus erythematosus, diabetes mellitus, chronic kidney disease, rheumatologic disease, and local or systemic steroid use (3, 4). However, in our case there were no signs or history of systemic illness. Also, the FDA recently emphasized the increased risk of tendon rupture after fluoroquinolone therapy, and requested that pharmaceutical manufacturers include boxed warnings. In healthy adults, tendon ruptures often affect men in their third or fourth decade who are involved in athletic activities, especially athletic activities such as basketball, volleyball, and soccer (5, 6).

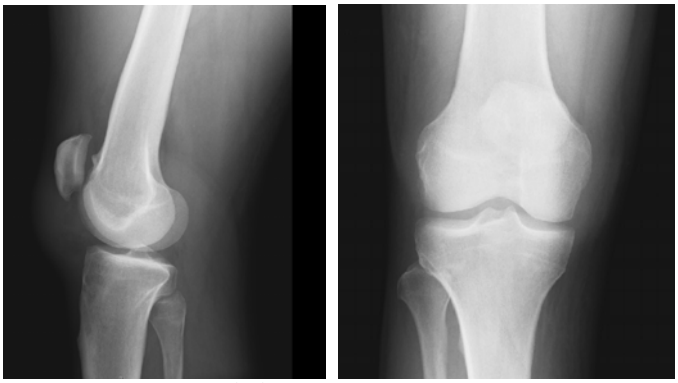

Fig. 3: Plain radiographs of left knee also showing patella alta.

Risk Factors: Relative risk factors for patellar tendon rupture include obesity, male gender, age 30-40, activities that increase patellar stress, systemic lupus erythematosus, diabetes mellitus, use of systemic corticosteroids, direct injection of steroids, use of fluoroquinolones, prior history of knee surgery, rheumatoid arthritis and gout (7). Based on histological evidence, one theory suggests that chronic degeneration of the patellar tendons precedes rupture from indirect trauma as in this case. In these cases, granulation tissue and neo-vascularization from micro-trauma may be evident (3). Typically patellar tendon ruptures due to micro-trauma occur near the tibial tubercle but may also be found in the mid-substance of the tendon (3).

Signs and Symptoms: As in this case, patellar tendon rupture is usually associated with a popping or tearing sensation and severe pain. Hemarthrosis may develop, and unassisted weight bearing is difficult or not possible. One important sign is the inability to hold or actively extend the knee and maintain it extended against gravity (3, 8). A palpable gap may be elicited at the site of the tendon rupture, and the patella may be found displaced cranially, also known as patella alta (3, 8). This type of knee injury may be found in conjunction with other knee and ligamentous injuries. The differential diagnosis includes fracture of the tibial plateau, fracture of the patella, intra-articular ligament or meniscus injury, and patellar dislocation (9).

Imaging: Initial imaging includes standard radiography. Advanced imaging modalities may include ultrasound or Magnetic Resonance Imaging (MRI). MRI can also be used to look for avulsion of any tendons or bony fragments (9, 10). A longitudinal field of view sonogram may show changes within the patellar tendon fibers such as an incomplete rupture or partially torn fibers. MRI is useful for highlighting the patellar tendon, the infrapatellar fat pad, and other infrapatellar structures (10). On T2-weighted images, a ruptured tendon will appear with an associated focal increase in signal intensity (9). In the absence of patella alta, disruption of the infrapatellar fat pad can be used to diagnose patellar tendon rupture (11). Although patella alta can be appreciated by physical exam, a lateral radiograph can demonstrate the extent of the patella alta compared to the normal knee. The position of the patella may be evaluated on the basis of the ratio of the greatest diagonal length of the patella to the length of the patellar tendon on lateral radiographs (the Insall-Salvati ratio) (12). This measurement is relatively independent of knee flexion, and a ratio of less than 0.80 indicates patella alta (Fig. 5).

Fig. 4: MRI of left knee with arrowheads pointing to ruptured patellar tendon.

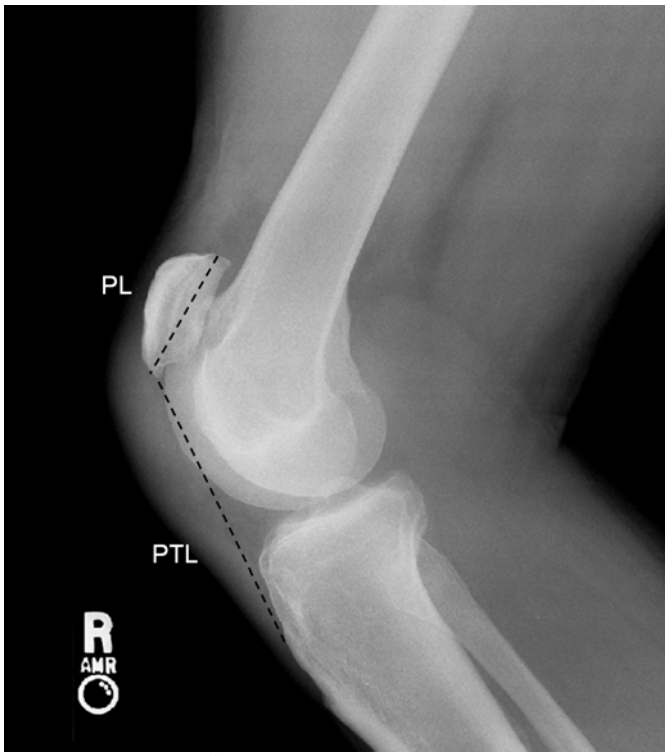

Fig. 5: Patella alta confirmed by the Insall-Salvati ratio on lateral x-ray. Patellar length (PL) should be about the same distance as the Patellar Tendon Length (PTL), or a ratio of about 1. Less than 0.8 (this one is about 0.5) indicates patella alta in this case.

Management: Prompt diagnosis is important because neglected injuries lead to proximal retraction of the patella with scarring, complicated repair, and diminished long-term function (3). Long-term immobilization of the extensor mechanism is not recommended because extensor lag develops and mechanics of the knee fail to return to normal (13). Delayed repair often requires extensive release of scar tissue and use of a tendon allograft or harvesting of other tissues for use as an autograft, including the Achilles, semitendinosus, or gracilis tendons (3, 6). Acute ruptures may be repaired by tunneling heavy absorbable sutures through the patella and through the tendon. Wire or suture cerclages may be placed for additional reinforcement (7, 13). In a distal avulsion from the tibial tubercle, a transverse tunnel is made posterior to the tibial tubercle. Sutures are then passed through this tibial tunnel and passed proximally through the quadriceps tendon in a figure-of-eight fashion. It is recommended that the patellar height is assessed intra-operatively before the sutures are tied down (6, 7). Post-operatively, it is recommended that aggressive rehabilitation and range-of-motion exercises are initiated as early as possible to regain function of the extensor mechanism (7, 13).

Summary: Patellar tendon rupture is a rare occurrence usually associated with chronic degeneration of tendon, steroid use, fluoroquinolone use, and systemic illness. However, in healthy adults, overweight men in their 3rd or 4th decade of life may be at increased risk when partaking in athletic activities, especially those that require jumping. Body armor and additional weight of weapons and perhaps prior repetitive microtrauma are precipitating factors in this case. Trends of this unusual presentation in the future should be kept in mind. Patella alta is a key finding on physical exam and radiography as was evident in our case. Further imaging may include ultrasound or MRI. MRI is especially accurate in identifying concurrent injuries. Prompt surgical management and early rehabilitation are paramount to regaining normal function of the extensor mechanism. Preventive medicine education may be important for those at increased risk of injury.

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