

Floating Patella: Combined Quadriceps Tendon, Retinacula, and Patellar Tendon Ruptures in a High-Performance Elite Athlete

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Abstract

Simultaneous quadriceps and patellar tendon rupture is rare. To our knowledge, we present the first known case of simultaneous quadriceps tendon, patella tendon, and retinacula rupture in the ipsilateral knee of a high-performance elite athlete. This disabling injury in the active person results in an inability to actively obtain and maintain full knee extension. When the tendons do not heal properly, at the correct length and tension, knee range of motion and strength can become significantly altered, leading to early fatigue, patellofemoral pain, and possible instability, preventing return to preinjury status. Immediate surgical repair is recommended for optimal return of knee function and power.

Ruptures of the patellar or quadriceps tendon are rare injuries that require immediate repair to re-establish knee extensor continuity and to allow early motion. A strong

association exists with numerous systemic diseases and prior degenerative changes in the knee extensor mechanism. Various conditions, such as hyperparathyroidism, chronic renal failure,¹ diabetes mellitus, systemic lupus erythematosus (SLE), and steroid abuse,² can damage the tendon vascular supply or disrupt the tendon structure.

occurs during falls. The estimated force required to disrupt the extensor mechanism has been reported to be as high as 17.5 times body weight. With the knee flexed, the patellar tendon undergoes more stress than the quadriceps tendon does, and the tensile load is much higher at the insertion sites than in the midsubstance of the ten-

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Ruptures most often occur unilaterally. Bilateral ruptures are highly correlated with systemic disease but have been reported in healthy patients who do not have predisposing factors.³⁻⁸

Ruptures of the quadriceps tendon occur relatively infrequently and usually in patients older than 40 years.⁹ Patellar tendon ruptures are less common than quadriceps ruptures and tend to occur in patients younger than 40 years.⁹ In rare cases, partial ruptures of the quadriceps tendon occur in young athletes with end-stage jumper's knee.¹⁰⁻¹³ Jumper's knee usually involves the patellar tendon; in 25% of cases, the quadriceps is involved.

Quadriceps and patellar tendon ruptures usually occur during a rapid, violent, eccentric contraction of the quadriceps muscle with the foot planted and the knee partially flexed. This injury commonly

don. Therefore, the patellar tendon most commonly ruptures near its proximal end, off the inferior pole of the patella. In patients with systemic disease, however, the patellar tendon tends to tear in the midsubstance rather than at the osseotendinous junction. Quadriceps tendon ruptures, on the other hand, usually occur distally 0 to 2 cm from the superior pole of the patella, through pathologic tissue.

Simultaneous quadriceps and patellar tendon rupture is rare. Mechanical factors and coexisting systemic and local factors are taken into consideration in the pathogenesis of these ruptures. In patients with some chronic systemic diseases, simultaneous rupture can occur spontaneously or with minor traumas.¹⁴ Several cases of simultaneous rupture in patients with chronic renal failure on hemodialysis¹⁵⁻¹⁷

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Figure 1. Lateral (A) and anteroposterior (B) radiographs of injured extremity.

or with SLE¹⁸ have been documented. In addition, the first case of simultaneous quadriceps tendon and contralateral patellar tendon rupture was reported in a healthy athlete.¹⁵ To our knowledge, in this article, we present the first known case of simultaneous quadriceps tendon, patellar tendon, and retinacula rupture in the ipsilateral knee of a high-performance elite athlete. The patient provided written informed consent for print and electronic publication of this case report.

CASE REPORT

The patient, a 37-year-old professional basketball player, presented with acute right knee pain on December 19, 2007. He had sustained a noncontact traumatic injury to the knee when it buckled during play in a professional regular season basketball game.

Examination at that time was consistent with a high-riding patella tendon, a small avulsion fracture of the patella, inability to extend against gravity, a significant 2+ effusion, and no instability of the knee—consistent with a patellar tendon rupture. Preoperative radiographs showed a patella alta (Figures 1A, 1B).

Relevant prior surgical history of the right knee included repair of a partial tear of the patellar tendon (October 1998), and relevant nonsurgical history of the knee included extracorporeal shockwave treatments for patellar tendinosis (June 2005 and May 2007). The patient had been asymptomatic at his preseason physical examination (September 2007), though routine preseason magnetic resonance imaging (MRI) had revealed postsurgical changes in the proximal patellar tendon and diffuse thick-

ening of the tendon, which can reflect tendonitis.

Additional prior surgical history included a living related donor kidney transplantation (December 2003) for focal segmental glomerular sclerosis (diagnosed in October 2000). Pertinent pharmacologic interventions include brief (weeks) steroid treatment immediately after transplantation (2000) and again 6 months after transplantation during a mild rejection episode. Because the patient was an active, high-performance elite athlete, the treating nephrologists used almost no steroids in his regimen over approximately 4 years. Before the traumatic episode that led to the patient's latest presentation, he was taking tacrolimus 3 mg orally twice daily and sirolimus 2 mg orally once daily. These medications kept his serum levels between 5 and 10 ng/mL, which is therapeutic for a transplantation patient. He had been at these dosages for several years, and his kidney function was stable throughout the changes in his immunosuppressive medications. He was not taking quinolone antibiotics. The only other medication therapy was thyroid hormone replacement.

After a thorough discussion of the risks and benefits of surgical and nonsurgical treatment, the patient was brought to surgery on December 20, 2007. After initial exposure with a standard midline approach to the knee, marked scarring was noted over the patellar tendon and prepatellar bursa, which was totally scarred to the tendon. This was dissected free,



Figure 2. (A) Patellar tendon rupture. (B) Patellar tendon with Fiberwire No. 2 sutures interwoven before transpatellar placement. (C) Transpatellar repair of patellar tendon rupture.



Figure 3. On subsequent inspection, completely torn medial and lateral retinacula are seen extending back at least 6 cm medially and 4 cm laterally. Primary repair with Fiberwire No. 2 suture.

and the patellar tendon rupture was obvious (Figures 2A–2C). The pathologic report of this tissue was tendon with areas of degenerative change, fibrosis, and mild chronic inflammation, consistent with rupture bursa showing chronic mild bursitis. Next, the edge of the patellar was débrided to create a bleeding surface for reattachment of the patellar tendon. Subsequent inspection found the medial and lateral retinacula completely torn, extending back at least 6 cm medially and 4 cm laterally (Figure 3). At this point, a Fiberwire No. 2 suture was woven into the tendon, first laterally, then centrally. Subsequently, another Fiberwire No. 2 suture was placed medially and then centrally. The patellar tendon was noted to be free of scar and well mobilized. Then the quadriceps tendon was examined; it had significant tearing, with a longitudinal rent and a transverse deep tear (Figures 4A, 4B). The edges of these tears were débrided and primarily repaired with Ethibond No. 2 suture, first to the quadriceps tendon and then to the patella. Three longitudinal holes were then drilled parallel to one another in the patella. The free ends of the Fiberwire No. 2 sutures interwoven in the patella tendon were brought through the tunnels in the patella and tied superiorly over the bony bridge. In addition, a 2.7-mm bone anchor was placed to further reinforce the repair, creating a tension-free construct. At this



Figure 4. (A) Quadriceps tendon with significant tearing (longitudinal rent, transverse deep tear). (B) Primary repair with Ethibond No. 2.



point, medial and lateral retinacula were closed, after copious irrigation, with a Vicryl 0 suture, first medially and then laterally. The patella tracked well through a range of motion (ROM) of 0° to 100°. No tension was noted on the patellar tendon or quadriceps tendon repairs with appropriate balancing and anatomical placement of the patella (Figure 5). After copious irrigation, the surgical wound was closed in standard fashion, and the operative extremity was placed in a well-molded long leg cast.

After surgery, the patient was kept in the long leg cast for 2 weeks, at which point the cast was converted to a locked hinged knee brace. Four weeks after surgery, the knee brace was unlocked to allow ROM of 0° to 20° and some isometric strengthening. Every 3 days, ROM was increased another 10°. A formal physical therapy program was instituted 6 weeks after surgery. Three months after surgery, the patient was pain-free and had ROM of 0° to 130° and appropriate strength of the extensor mechanism.

The pharmacologic regimen was carefully adjusted by the patient's nephrologists. Although sirolimus has not been shown to cause tendon weakness, it has been shown to impair wound healing, so after surgery it was switched to mycophenolate mofetil. Six weeks after surgery, and with careful discussion between the patient and his treating nephrologist, mycophenolate mofetil was discontinued and sirolimus reinitiated. The tacroli-

mus dosing regimen remained constant after surgery. Throughout the change in medications, the patient's kidney function was stable.

By 12 months after surgery, the patient had returned to his preinjury level of function. Final examination of the affected extremity revealed it to be symmetric to the contralateral side in terms of ROM, strength, and gait pattern. From an orthopedic standpoint, the patient was cleared to return to professional basketball. However, he retired secondary to his pre-existing renal condition.

DISCUSSION

In cases of complete extensor mechanism ruptures, early diagnosis and repair are essential for best outcomes.¹⁹ When intervention is delayed, repair is more difficult, and results may be compromised. Early surgical repair yields the best results for complete quadriceps and patellar tendon ruptures.²⁰ This disabling injury in the active person



Figure 5. Patella tracks well (range of motion, 0° to 100°). No tension noted on patellar tendon or quadriceps tendon repairs with appropriate balancing and anatomical placement of patella.

results in an inability to actively obtain and maintain full knee extension. When the tendons do not heal properly, at the correct length and tension, knee ROM and strength can become significantly altered, leading to early fatigue, patellofemoral pain, and possible instability, preventing return to preinjury status. Immediate surgical repair is recommended for optimal return of knee function and power. The ultimate outcome depends not only on the anatomical

at least 85% to 90% of the other knee, and completion of a sport-specific agility program.

It is important to draw attention to the unique nature of the patient described in this report. He was a professional basketball player who had been repeatedly cleared to play at an elite level of athletics. Unlike in other cases of simultaneous quadriceps and patellar tendon ruptures in patients with systemic diseases (SLE,¹⁸ chronic renal

“The ultimate outcome depends not only on the anatomical repair of the extensor mechanism but also on the patient’s rehabilitative efforts.”

repair of the extensor mechanism but also on the patient’s rehabilitative efforts. It is important to emphasize in the preoperative period the importance of participating in the postoperative rehabilitative protocol so that maximal ROM and strength can be achieved.

Unique to the present case is the simultaneous nature of the complete disruption of the entire extensor mechanism complex of the ipsilateral knee—that is, the simultaneous ipsilateral quadriceps tendon, patellar tendon, and retinacula rupture. It is commonly believed that, after immediate repair of an isolated patellar tendon or quadriceps tendon rupture, most patients experience nearly full return of knee ROM, quadriceps strength, and preinjury activity levels. Persistent quadriceps atrophy commonly occurs but is not considered a complication, as the atrophy does not prevent return of strength. Typically, athletes treated for partial or complete ruptures may return to play when several conditions are met, including nearly full, painless ROM, knee strength

failure on hemodialysis,¹⁵⁻¹⁷) in this case, the patient’s kidney function had been stable for several years, since his 2003 kidney transplantation. It is important to recognize this injury in this athlete, as similar injuries may occur more often as more athletes with single organs are cleared to play as a result of the Americans With Disabilities Act (Public Law 101-336), enacted in 1990 to end discrimination against persons with disabilities.

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The authors report no actual or potential conflict of interest in relation to this article.

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