BILATERAL PATELLAR TENDON RUPTURE AT DIFFERENT SITES WITHOUT PREDISPOSING SYSTEMIC DISEASE OR STEROID USE

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ABSTRACT

Simultaneous bilateral patellar tendon ruptures are extremely rare, and even more rare in patients without systemic disease. We describe bilateral simultaneous patellar tendon disruptions in the absence of systemic disease or steroid usage, with one tendon disruption at the inferior pole and the other an intrasubstance tear. The different locations of the ruptures are also exceedingly rare, as only two cases of non-identical ruptures have ever been reported. We also review all bilateral patellar tendon rupture case reports from English and German literature.

INTRODUCTION

Bilateral patellar tendon rupture is an extremely rare occurrence, with approximately 50 reported cases in the English and German literature. It is thought to be associated with systemic disease such as rheumatoid arthritis, lupus erythematosus, and hyperparathyroidism. In addition, long-term microtrauma and corticosteroid use may also contribute to bilateral rupture.[1,2] Bilateral rupture in the absence of systemic disease or corticosteroid use is exceedingly, accounting for only a small percentage of the reports in the literature.

MATERIALS AND METHODS

In August 2006, a 36-year-old man playing soccer jumped, brought both feet off of the ground and, upon landing, had immediate pain and a subjective popping sensation in both knees simultaneously. He was unable to ambulate at the scene. He denied any prior trauma, any pre-existing symptoms of either knee or extensor mechanism, any past medical history, and any history of corticosteroid or anabolic steroid usage. At presentation to the emergency department, plain radiographs of his bilateral knees revealed effusions and slight patella alta; however, the films were taken with the knees in near-full extension (Fig. 1).

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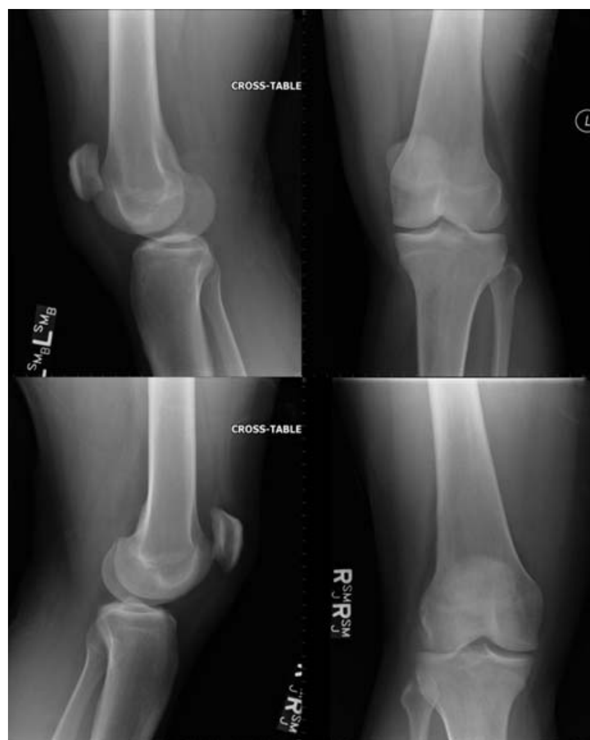

Figure 1. Injury radiographs showing bilateral patella alta.

Physical examination showed a healthy appearing man who was approximately 190 cm tall and 104 kg in weight. Both knees had large effusions without skin lacerations, abrasions, or other skin defects. A noticeable step-off of the normal patellar tendon was palpated on his right knee, but a step-off in his contralateral knee was only palpated after some difficulty. Quadriceps contractions did cause translation of his patella in a cranial direction, but he was unable to extend either knee or hold either knee in extension when passively positioned.

Operative repair of his bilateral patellar tendon ruptures was performed the following day. Intraoperatively the right patellar tendon had an intrasubstance rupture with mop-like ends and complete disruption of the retinaculum. The left patellar tendon was avulsed from its origin at the inferior patellar pole with similar complete disruption of the retinaculum. There were no other intra-articular injuries. The ruptures were each repaired with FiberWire suture (Arthrex, Inc., Naples, FL) in Krackow

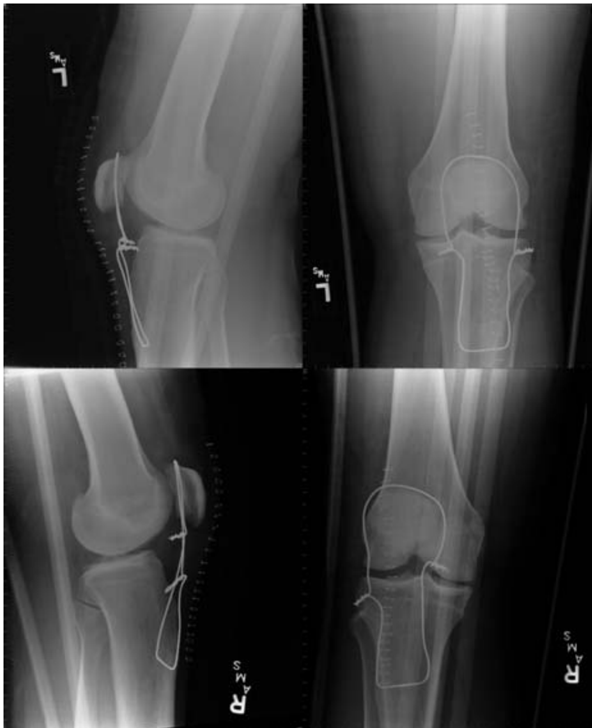

Figure 2. Postoperative radiographs showing restoration of the patella level.

fashion and supplemented with 18-gauge wire cerclage; the retinaculum was also repaired using absorbable suture. Excellent range of motion was achieved without any gapping of the tendon repair. Knee immobilizers were applied at the end of the case. Postoperative x-rays are shown in Figure 2.

Postoperatively, he began ambulation on the day of surgery with both legs locked in extension braces. He was allowed to bear weight as tolerated with crutches. His recovery course was complicated by a pulmonary embolism diagnosed on postoperative day 19, which was treated successfully with heparin and warfarin. His bilateral patellar tendon ruptures healed uneventfully. At four months postoperatively, the patient had 120° flexion of both knees; at one year postoperatively, he had returned to light athletic activities and had full range of motion of both knees.

DISCUSSION

Bilateral patellar tendon rupture is an extremely rare occurrence, with approximately 50 reported cases in the English and German literature. It is thought to be associated with systemic disease such as rheumatoid arthritis, lupus erythematosus, and hyperparathyroidism, as well as long-term microtrauma and corticosteroid use.[1,2] Bilateral patellar tendon rupture in patients without

TABLE 1
Cause of Rupture

Cause of Rupture	Systemic Disease[2-20]	No Systemic Disease[1,21-50]
Traumatic	9	28
Atraumtic	10	5

Note: Systemic disease includes: rheumatoid arthritis, systemic lupus erythematosus, ulcerative colitis, osteogenesis imperfecta, renal failure, and primary hyperparathyroidism.

TABLE 2
Site of Tear

Cause of Rupture	Systemic Disease[2-20]	No Systemic Disease[1,21-50]
Inferior pole	25	41
Midsubstance	6	17
Insertion at tibial Tubercle	5	4
Not noted in study	4	2

Note: Table contains number of tendons total that were disrupted at each site. Since each patient had bilateral rupture, the number of tendons is equal to double the number of patients.

systemic disease or corticosteroid use is exceedingly rare and comprises only a small percentage of the case reports in the literature. Tables 1 and 2 summarize the reported bilateral patellar tendon ruptures with respect to the presence/absence of systemic disease, traumatic versus atraumatic injury, and site of tear.[1-50]

In order to discuss bilateral patellar tendon rupture, one must first address the extensor mechanism of the knee. The extensor mechanism consists of the quadriceps tendon, the patella, the patellar tendon, and the insertion of the patella on the tibial tubercle. Patellar tendon rupture is the third most common cause of extensor dysfunction, after patellar fracture and quadriceps tendon rupture.[3] The muscle moment arm of the extensor mechanism is increased by the patella. Patellar rupture is thought to result from contraction of the quadriceps in a flexed knee. The juxtaposition of these opposite contractile forces creates a superior moment arm across the quadriceps and an inferior moment arm pointing towards the tibial tubercle. If the opposing forces are strong enough, the patellar tendon will rupture. Zernicke, et al.[51] reported that a force of 17.5 times the body weight is required to rupture this tendon. To put this into perspective, climbing stairs is reported to create a force of 3.3 times body weight.[52] Athletic movements such as acceleration, deceleration, and jumping are reported to create forces of seven-to-eight times the body weight.

Men have an increased propensity for bilateral patellar tendon rupture as compared to women: the calculated ratio based on the case reports in the literature is 5:1 (12/62 cases). Although bilateral rupture is often dis-

cussed in the realm of systemic disease, it has been reported that approximately 60% have no evidence of systemic or autoimmune disease.[49]

Bilateral patellar tendon rupture has been shown to be difficult to diagnose and has often been overlooked in clinical assessments. Siwek and Rao[53] found that 28% of the reported bilateral tendon ruptures were misdiagnosed on initial examination. These patients often present with a sudden onset of bilateral knee pain, bilateral knee effusions, and extensor dysfunction. On inspection, there are bilateral effusions and high-riding patellae. It is often difficult to appreciate the high-riding patella on inspection because of a lack of a contralateral normal knee for comparison. A palpable infrapatellar defect may be present, but again this may be difficult to discern due to a substantial effusion or lack of a normal knee for comparison. Patients also have difficulty with extension of the knee. This usually manifests as a complete inability to extend the knee, but some patients may still have some extension function if extensile forces are able to be conducted through intact medial and lateral retinacula.

Bilateral rupture may be diagnosed radiographically via the presence of bilateral patella alta. The best way to make this diagnosis is through a lateral view of the knee in slight flexion to tension the patellar tendon. On this view, an Insall-Salvati ratio can be calculated.[54] This ratio is the longest diagonal length of the patella over the length of the patellar tendon, measured from the inferior pole to the tibial tubercle. A patellar length:tendon length < 0.8 is indicative of patella alta and this finding bilaterally may be indicative of bilateral patellar tendon rupture. Another radiographic test for patella alta involves the use of Blumensaat's Line. In a lateral x-ray view, with the knee in 30° of flexion, a line is drawn through the roof of the intercondylar notch in the distal femur. A patella that is > 2 cm above Blumensaat's line is considered to exhibit patella alta.[54] A final radiographic evaluation can be performed using the Blackburne and Peel method, which also uses the lateral x-ray view of the knee in approximately 30° of flexion. The ratio between the perpendicular distance from the lower articular margin of the patella to the tibial plateau articular surface and the length of the articular surface of the patella should be 0.80. Ninety-five percent of the population will be in the range of 0.54 and 1.06. Any increase in this ratio indicates patella alta.[4]

The underlying pathophysiology of bilateral patellar tendon rupture has been reported in the literature as falling under three categories. The first group consists of patients with underlying systemic or autoimmune disease who are thought to have a higher risk for bilateral patellar tendon rupture. This includes patients with lupus erythematosus, rheumatoid disease, diabetes mellitus, chronic renal disease, and hyperparathyroidism. These conditions are thought to cause inflammatory changes that alter the structure of the tendon. Histologic examination of these patients' tendons has shown chronic inflammation and amyloid deposition.[55] The second group involves oral or injectable corticosteroids, which are thought to have an association with bilateral patellar tendon rupture. It is believed that the steroids affect collagen synthesis and compromise blood supply, thereby weakening the tendon.[1,3,21] Patients in group three exhibit inflammatory and degenerative changes on histologic studies attributed to chronic microtrauma.[22] This theory of repetitive microtrauma leading to rupture has been referred to as the Davidson Theory in the literature.[23]

These tendon tears are classified according to a three-part system:[24,25] Type 1—at the origin of the tendon at the inferior pole of the patella, Type 2—a midsubstance tear through the tendon, or Type 3—at the insertion of the patellar tendon to the tibial tubercle. Types 1 and 3 are referred to as tears of the osteotendinous junction. It was once thought that patients with tears related to steroid use had a greater propensity for the midsubstance of the tendon, but a Fisher exact test showed no relationship between midsubstance or osteotendinous tears and steroid use.[3] Of note, the patient in this report had a midsubstance tear on the left side and a rupture at the inferior pole on the right; this variance in tear pattern from one knee to another has only been reported in two other cases in the literature.[5,26]

Treatment for bilateral patellar tendon rupture is early primary operative repair. The necessity for early repair cannot be overemphasized, as retraction of the tendon and scarring occur fairly shortly after injury and can greatly complicate repair.[53] If repair is delayed, it may be necessary to release scar tissue, use patellar traction, and adjunct allograft or gracilis/semitendinosis autograft to facilitate repair. Delayed fixation also leads to increased rehabilitation time due to atrophy of the tendon. In fact, delay in repair (more than 2 weeks post-injury) has been reported as the strongest determinant of final outcome.[53] Rehabilitation protocols are not well described, as only one brief report makes recommendations regarding guidelines for postoperative physiotherapy.[27]

CONCLUSION

In summary, a 36-year-old athletic man experienced bilateral patellar tendon ruptures while playing soccer. Bilateral rupture was accurately diagnosed in the emergency department and early primary repair was performed. Of note, the patient had a midsubstance tear on the left and a rupture at the inferior pole on the right. To our knowledge, there have only been two other

published reports in which the rupture occurred at a different portion of the tendon in either knee. Despite the rarity of similar cases, surgeons must be able to recognize and appropriately treat these patients in an early manner for optimal outcomes.

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