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The Knee



Case report

Distal patellar tendon avulsion in association with high-energy knee trauma: A case series and review of the literature☆

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ABSTRACT

Background: Patellar tendon rupture is rare in the general population. Typically, failure occurs proximally or at the mid-substance. Distal avulsion from the tibial tubercle in adults is rare and not well described in the orthopedic literature.

Methods: We present the largest series of patients with distal patellar tendon injury with associated multi-ligamentous disruption of the knee. A series of six patients with distal patellar tendon avulsion were identified at a single institution. The cases were reviewed and are presented.

Results: Each case of distal patellar tendon rupture was associated with high-energy trauma to the knee. There was multi-ligamentous disruption in all cases, associated tibial plateau fracture in one case, and a compartment syndrome diagnosed in another. We propose that distal patellar tendon avulsion is a distinct pathology of the extensor mechanism in healthy adults. When present, it should prompt clinicians to assess patients for occult knee dislocation, monitor their neurovascular status, and obtain an MRI to evaluate for associated multi-ligamentous injury.

Conclusion: We propose a modification to the Schenk classification to include extensor mechanism injury to help guide steps of operative intervention.

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1. Introduction

Patellar tendon rupture is considered a rare injury in the general population with an annual incidence of 0.5% [1]. It typically occurs in patients less than 40 years of age and is less common than rupture of the quadriceps tendon [1,2]. Risk factors include history of corticosteroid use, anabolic steroids, chronic tendinosis (jumper's knee), systemic lupus erythematosus (SLE), rheumatoid arthritis (RA), diabetes mellitus, age, and male sex [1,3,4]. Rupture of the patellar tendon has been described in athletes and in patients with chronic medical conditions. Thus, the mechanism of injury can range from relatively low to high-energy traumatic failure.

Multi-ligamentous knee injuries typically require high-energy trauma and are often sustained during motor vehicles accidents or high-energy athletic injuries. However, these injuries can also be sustained from low-energy falls, particularly in the morbidly

Abbreviations: SLE, systemic lupus erythematosus; RA, rheumatoid arthritis; CT, computed tomography; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament; MCL, medial collateral ligament; ABI, ankle brachial index.

☆ *What is known about this subject:* Patellar tendon injury typically occurs from the proximal insertion or the mid-substance. Injury is typically failure from eccentric loading of the extensor mechanism. Distal patellar tendon avulsion in healthy adults is a very rare occurrence not well described in the literature.

What this study adds to existing knowledge: This series identifies several cases of distal patellar tendon avulsion in skeletally mature individuals, a unique pathologic entity which has been rarely defined in the literature. We highlight this injury in association with high-energy trauma to the knee. In each case there was associated multi-ligamentous injury. We advocate a heightened sense of awareness for associated ligamentous or neurovascular injury when this injury is identified on initial emergency room radiographs. In addition, we propose a mechanism of injury and suggest a modification to the Schenk knee dislocation (KD) classification to help guide surgical management.

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obese. In either case, it is important to evaluate for potential occult knee dislocation, even if the patient presents with a reduced knee. Schenck et al. described the spectrum of ligamentous injury in patients with knee dislocations beginning with anterior or posterior cruciate injury and progressing to include both corners and peri-articular fracture [5]. Further initial displacement may lead to progressive ligamentous disruption and potential for neurovascular injury.

Rupture of the patellar tendon from the distal insertion is a rare entity not well described in the orthopedic literature [6,7]. The authors aim to present a series of distal patellar tendon avulsion injuries at one institution. In each case, there was associated multi-ligamentous disruption of the ipsilateral knee. In one case, a compartment syndrome and vascular compromise was diagnosed requiring emergent vascular consultation and fasciotomy. We propose that distal patellar tendon avulsion in a non-chronically ill patient represents a distinct pathology indicating a high-energy trauma to the knee. If identified, it should be the key for the investigator to evaluate for additional intra- and extra-articular knee pathology.

2. Materials and methods

Six cases of distal patellar tendon avulsion were identified between 2013 and 2015 at a single institution and are presented for review. Institutional review board (IRB) exemption was obtained.

3. Case examples

3.1. Case 1

Forty-year-old male bicyclist presented to the emergency room with acute left knee pain after he was struck by a motor vehicle, resulting in pain, swelling and inability to extend the knee against gravity. Radiographs and computed tomography (CT) scan confirmed distal patellar tendon avulsion and identified a non-displaced fracture of the lateral tibial plateau (Figure 1A). The patient also underwent magnetic resonance imaging (MRI) of the knee, which confirmed a complete tear of the anterior cruciate ligament (ACL), complex tear of the medial meniscus, partial medial collateral ligament (MCL) tear, and partial tear of the biceps femoris (Figure 1B).

The patient was brought to the operating room on hospital day one for repair of his patellar tendon rupture. Although the patient had palpable pulses during routine pre-operative checks, intra-operative examination demonstrated absent dorsalis pedis and posterior tibialis pulses, firm compartments, and an ankle brachial index (ABI) of 0.65 (Normal (NI) 0.9 to 1.2). A vascular surgery consult was emergently obtained and an angiogram was performed, which demonstrated no vascular injury but sluggish arterial flow in the left lower extremity likely related to elevated leg compartment pressures. The planned tendon repair was aborted and a four-compartment fasciotomy was performed with immediate restoration of palpable pulses. Three days later, the patient was brought back to the operating room for closure of fasciotomy wounds and repair of the patellar tendon avulsion injury using suture anchor fixation. He was discharged without further events with a plan for delayed reconstruction of his ACL. Two months after repair of the patellar tendon the patient was doing well with a normal neurovascular exam and progressing range of motion up to 75° (Figure 1C). The patient was subsequently lost to follow-up. We theorize that this patient actually sustained an unrecognized knee dislocation as evidenced by disruption of the anterior knee stabilizers and significant soft tissue injury.

3.2. Case 2

A 57 year-old schizophrenic male presented to the emergency department two weeks after being struck by a car. He subsequently presented to our institution with knee pain, swelling, and instability. On exam, he was unable to straight leg raise and had significant laxity to valgus, anterior and posterior stress testing with intact pulses distally. Radiographs confirmed patella alta with a small avulsion fragment from the tibial tubercle, posterior subluxation on the lateral view, and a bony Segond fracture on the antero-posterior (AP) view. An MRI demonstrated a complete tear of the anterior and posterior cruciate ligaments and complete tear of the medial collateral ligament from the tibial insertion. The distal MCL fragment was flipped underneath the medial meniscus and entrapped in the knee joint.

He subsequently underwent repair of the patellar tendon, MCL, open medial meniscus repair, and external fixation to protect the ligament repairs given his underlying psychiatric disorder and uncertainty as to whether or not he would be able to comply with post-operative instructions. The patellar tendon and MCL were repaired with suture anchor fixation. At six weeks post-operatively, the external fixator was removed. Exam under anesthesia at that time demonstrated range of motion from five to 80° of knee flexion and 1+ stability to valgus stress at 0 and 30° with firm end points. At three months from fixator removal, the knee remained stable to valgus stress and had knee range of motion from 0 to 100°. Given his medical history, we elected not to perform bicruciate reconstruction as we were uncertain if he would follow up and comply with a complex rehabilitation protocol. He was subsequently lost to follow-up.

3.3. Case 3

A 36 year-old male presented to the emergency department after reportedly being struck by a motor vehicle. The patient had a large knee effusion, inability to extend against gravity, and was neurovascularly intact. Radiographs and CT scan demonstrated avulsion of the patellar tendon and posterolateral tibial plateau fracture (Figure 2A) and physical examination confirmed presence

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