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Case report

Rare sleeve fracture of the superior patella pole in an adult due to forceful passive physiotherapy following cast immobilization

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ABSTRACT

Sleeve fractures are generally restricted to children or adolescents, and usually occur at the lower patella pole. Here we report on a superior pole sleeve fracture in an adult that occurred following forceful passive physiotherapy after cast immobilization. To our knowledge, this is the first report of a superior pole sleeve fracture in an otherwise healthy adult. The case highlighted that a diagnosis of a superior patella pole sleeve fracture in an adult can easily be missed because it is a rare injury, and hence is unlikely to be suspected by physicians.

1. Introduction

Sleeve fractures are a common type of patellar fracture in children or skeletally-immature adolescents [1]. Sleeve fractures can occur following traumatic avulsion of the lower or upper patella pole, resulting in a small bony fragment being pulled off along with a sleeve of periosteum and patella cartilage. Most sleeve fractures occur at the inferior pole of the patella [2], whereas sleeve fractures of the superior patella pole, resulting from forced flexion of a knee with existing restriction of flexion [3], are rare, with only a few adolescent cases being reported [3–8]. Superior patella pole sleeve fractures in adults are extremely rare because the enthesis of a fully ossified adult patella is more resistant to tensile force injury than the immature osteochondral junction in children [9]. Furthermore, a diagnosis of such a sleeve fracture in an adult can be missed or delayed due to physician unfamiliarity and vague radiographic findings.

The present report describes a superior patella pole sleeve fracture in an adult in the absence of any bony metabolic disorder. To our knowledge this is the first such case report of its kind. The case highlighted that a high index of suspicion is required for an early diagnosis of a superior pole sleeve fracture in adults.

2. Case report

A 24-year-old male was referred by a local clinic due to posterior instability in the left knee following a motorcycle traffic accident. The instability was present despite 3 months of conservative treatment including 6 weeks of cylinder cast application. An initial clinical examination of the left knee revealed a full range of motion with no effusion. However, there was no step off on the medial aspect of the tibiofemoral joint, and the posterior drawer test was grade 3 positive. A dial test was positive not only at 90° but also at 30°, and a posterolateral draw test was also positive compared to the contralateral side. Neither abnormal findings nor tenderness were observed during patellar compression or patellar tilting tests, or around the patellofemoral compartment. A posterior stress radiograph revealed a side-to-side difference >10 mm. Magnetic resonance imaging (MRI) scans showed a complete tear of the posterior cruciate ligament (PCL), but there was no abnormal signal in the patella. All physical and imaging study findings were consistent with a PCL tear associated with a posterolateral corner structure injury. Therefore, we performed a PCL reconstruction as well as a posterolateral corner reconstruction using allogenic Achilles tendons. The PCL reconstruction was performed using the transtibial technique under arthroscopic guidance via a trans-septal portal. Posterolateral corner reconstruction was performed as a fibular sling which mimicked the lateral collateral ligament and popliteofibular ligament. After surgery, the knee was immobilized for 3 weeks using a knee brace, and weight-bearing was permitted with a crutch.

At postoperative 3 weeks, passive range of motion exercises were commenced. The plan for range of motion gain was 90° of flexion at postoperative 4 weeks and 120° of flexion at postoperative 6 weeks. The patient performed the heel slide exercise using a towel for one week, following which he performed passive range of motion exercises until his pain reached a level of 7 or 8 on a visual analogue scale. During the initial passive range of motion exercise, however, the patient described a “popping” sensation and experienced immediate pain and swelling in the knee. He was unable to bear weight on his left lower extremity due to the severe pain, and the leg was weak. Physical

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Fig. 1. Plain knee lateral radiograph showing a thin cortical shell (arrow) avulsed from the superior patella pole, with no anterior patella tilt.

examination identified moderate joint effusion. The patient had tenderness to palpation at the superior pole of the patella. He was unable to actively extend his knee or perform a straight-leg raise. Pain markedly limited the left knee range of motion to an extension of 5° and flexion of 20°.

The initial examination of plain radiographs of the left knee revealed no unusual features. However, further more thorough examination revealed a suspicious avulsed fragment at the superior pole of the patella (Fig. 1). A computed tomography scan clearly revealed that a very thin semi-lunar-shaped fragment of cortical bone had been avulsed from the superior pole of the patella (Fig. 2a). MRI scans confirmed an avulsion fracture of the superior aspect of the patella, as well as intact quadriceps and patellar tendons (Fig. 2b).

Two weeks after the superior pole injury, we decided that surgery was necessary to restore the extensor mechanism via accurate reduction and stable fixation of the markedly displaced superior pole fragment. If the fragment was too small to repair or there was no purchase available for fixation, we intended to perform an indirect reduction by attaching the quadriceps tendon to the patellar fracture site using threads of suture anchors. We planned an open reduction and internal fixation of the fracture through an anterior midline skin incision. The patient was placed under spinal anesthesia, the superior patella pole was palpated, and a 5 cm transverse incision was made to expose the fracture site. The small cortical fragment avulsed from the superior pole was palpated, and was attached to the quadriceps tendon, and we could identify the fracture site showing underlying trabecular bone of the patellar body (Fig. 3). We cautiously removed the blood clot at the fracture surface, being careful not to extensively dissect the soft tissue around the small bony fragments to preserve their vascularity, and then inserted two threaded suture anchors (with two threads at each anchor) into the fracture surface of the distal patellar body. Then we passed 4 inferior threads of suture anchors to the inferior patellar body through 4 drilled holes using a suture passer, and passed the other 4 threads superiorly through the quadriceps tendon using a French needle to secure the small bony fragment to the superior patella pole. Two of each thread, which superiorly purchased the superior pole fragment and inferiorly passed through the distal patellar body, were tied securely with the knee in extension. Another two holes were drilled in the distal patellar body to perform two additional transosseous suture procedures using Ethibond sutures (Fig. 4) in order to augment fragment fixation.

Following surgery, the knee was immobilized in extension for 3 weeks using a knee brace. Active straight leg raising exercise was recommended during that time. Physical therapy with passive range of motion exercises was commenced gradually at 4 weeks postoperatively. At postoperative 12 weeks, the patient was able to raise his leg voluntarily, and plain radiographs indicated healing of the superior pole fracture (Fig. 5). At 6 months postoperatively, the patient

Fig. 2. (a) Computed tomography showing a displaced small fragment (black arrows), indicating a superior patella pole avulsion fracture. (b) Magnetic resonance imaging showing a small cortical shell (white arrows), and also showing intact quadriceps and patella tendons.