

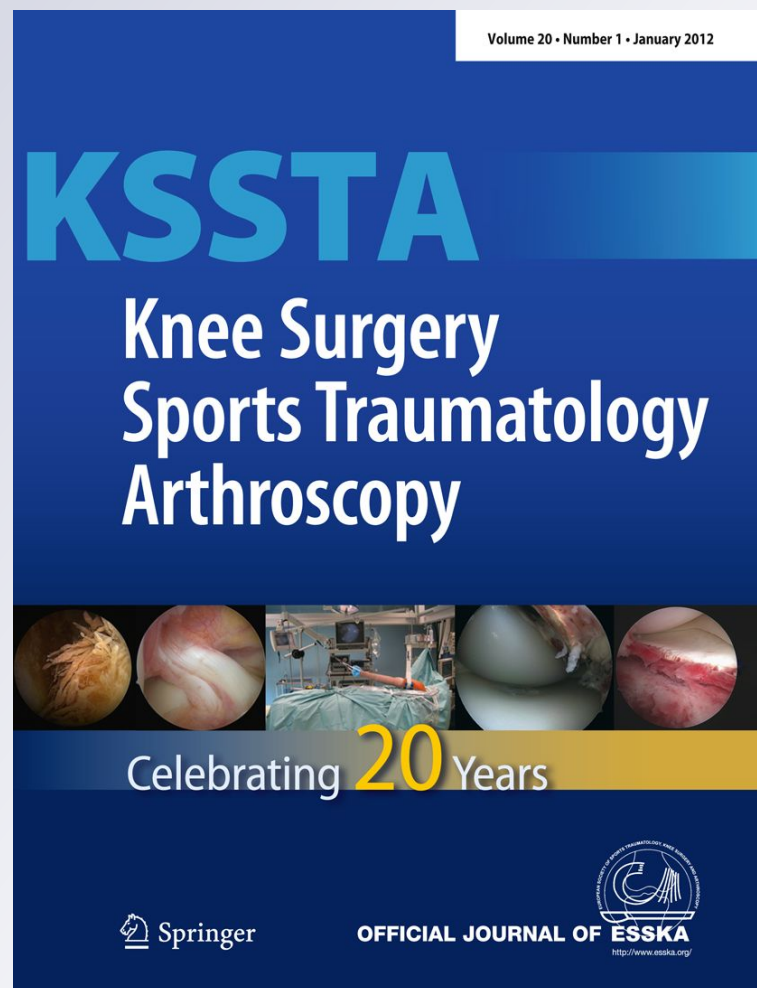
*Distal patellar tendon avulsion fracture
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**Knee Surgery, Sports Traumatology,
Arthroscopy**

ISSN 0942-2056
Volume 20
Number 2

Knee Surg Sports Traumatol Arthrosc
(2012) 20:327-330
DOI 10.1007/s00167-011-1595-9



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Distal patellar tendon avulsion fracture in a football player with osteogenesis imperfecta

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Received: 22 April 2011 / Accepted: 21 June 2011 / Published online: 30 June 2011
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Abstract Proximal patellar tendon ruptures have been described in adults with osteogenesis imperfecta, but distal avulsions from the tibial tubercle have not. This is the first case reporting a distal patellar tendon avulsion fracture in a football player with osteogenesis imperfecta and the technique of surgical repair.

Keywords Patellar · Tendon · Avulsion · Fracture · Rupture · Osteogenesis · Imperfecta

Introduction

Osteogenesis imperfecta is a genetically inherited disease that is characterized by abnormal collagen production resulting in defective bone and connective tissue. Besides blue sclera, dentinogenesis imperfecta and osteoporosis the patients often sustain many fractures [5]. Tendon ruptures are seen less frequently [10], but quadriceps and Achilles tendon ruptures [2, 4] and mid-substance patellar tendon ruptures related to osteogenesis imperfecta have been reported before [3, 6].

The authors report on a unique case of football player known with osteogenesis imperfecta who sustained a distal patellar tendon avulsion with a fracture at the tibial tubercle, and a description of the technique of surgical repair and successful post-operative rehabilitation is given.

Case report

A 29-year-old man was seen in the orthopaedic outpatient department with a painful right knee after a football injury. A couple of days before, he had developed a painful swollen knee when he tried to kick the ball but hit the ground instead. He was not able to continue playing and presented to the accident and emergency department afterwards from where he was referred to the orthopaedic department. His past medical history included osteogenesis imperfecta type 1 and in his childhood he had sustained multiple fractures of upper and lower extremities. His last tibial and femoral fractures had been more than 6 years ago though.

On physical examination, an anterior swelling was seen over the front of the knee with local bruising. Apart from local tenderness on palpation, a gap was also palpable at the distal end of the patella tendon. The patient was not able to raise his leg in full extension. No bony tenderness was found over the patella, and no gap was palpable over the quadriceps tendon proximally.

Radiographs of the right knee showed a high position of the patella, soft tissue distension and the suspicion of a small avulsed fragment of the tibial tubercle (Fig. 1). MRI examination of the knee confirmed disruption of the continuity of the patellar tendon fibres distally and also showed the bony avulsion of the tibial tubercle attached to the proximal patellar tendon (Fig. 2a, b). The menisci, cartilage, collateral and cruciate ligaments were otherwise intact.

The patient was scheduled for urgent surgical repair. Through an anterior longitudinal incision centered over the tibial tubercle, the distal patellar tendon stump was identified with a thin piece of avulsed bone still attached. The distal patellar tendon avulsion fracture was repaired with two non-absorbable Ethibond 1 sutures (Ethicon, Gargrave,

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Fig. 1 Lateral radiograph of the knee showing a high position of the patella, soft tissue distension and the suspicion of a small avulsed fragment of the tibial tubercle

UK) each whipstitched through the medial and lateral third parts of the avulsed patellar tendon proximally, and these sutures were looped through tibial tubercle drill tunnels distally. For fixation of the central part, the middle third of the patellar tendon was whipstitched with the sutures of a Mitek GII Quickanchor (DePuy, Leeds, UK), which was screwed through the attached bony avulsion into the tibial tubercle centrally (Fig. 3). A cerclage of Fibrewire 2-0 (Arthrex, Naples, USA) was looped through horizontal drill tunnels through the patella and the tibial tubercle distally for the protection of the repair and to allow early mobilization. Post-operatively the patient was mobilized full weight bearing in extension with a plaster cast for the first 2 weeks to allow wound healing. Afterwards, mobilization was started in a hinged brace with the physiotherapist, and flexion was gradually increased from 0 to 90° over the course of 6 weeks. After 2 months, quadriceps strengthening exercises with knee flexion were performed and return to sports was allowed after 6 months. Given the fact

that the patient was doing so well functionally and did not complain of any pain, the decision was made not to remove the protective cerclage of Fibrewire, which was left looped through the patella and tibial tubercle. On follow-up, a lateral knee radiograph with the knee in a 90° flexed position did not show any signs of patellar tunnel widening or patella baja (Fig. 4).

On his last follow-up, almost 1 year later, he had no complaints of pain and on examination a good range of motion with 120° of flexion and 0° of extension. He had also returned to contact sports at the same non-competitive level as before his injury. Being a recreational football player, this could be regarded as a relatively low-risk pivoting sport in this patient.

Discussion

Patellar tendon rupture or avulsion is common in patients younger than 40 years, and athletes are particularly at risk. The usual mechanism of trauma is an eccentric overload of the extensor mechanism with the foot planted and the knee partially flexed. Patellar tendon ruptures usually occur at the inferior pole of the patella [9]. Avulsions distally at the tibial tubercle are rarer in adults, but have been reported in combination with acute tibial tubercle avulsions fractures in adolescent athletes [1, 8]. Systemic diseases such as rheumatoid arthritis, gout, lupus erythematosus, diabetes, renal failure, hyperparathyroidism and obesity are associated with disruption of the extensor mechanism. Also, a relationship between tendon ruptures and steroid injections has been reported [7].

Diagnosis of patellar tendon injuries can sometimes be delayed as swelling and pain can make the examination more difficult. In every patient with a painful swollen knee after a

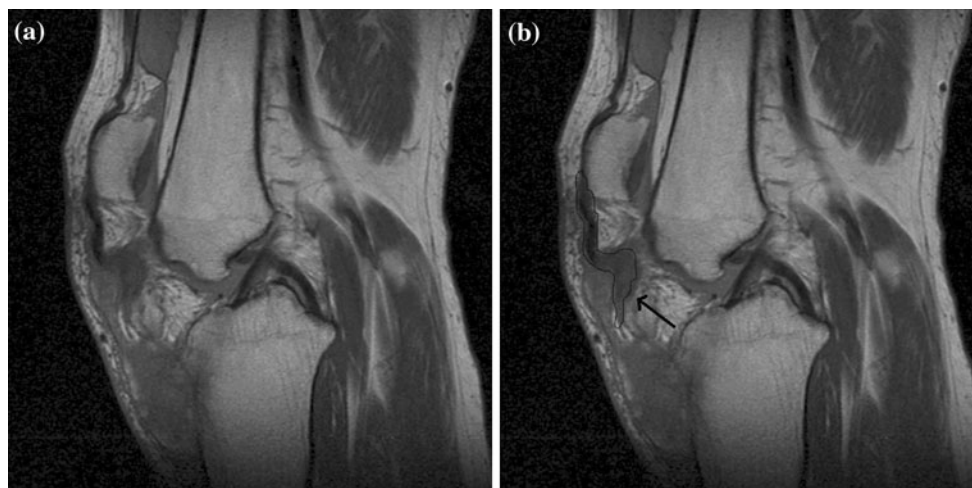


Fig. 2 a, b MRI examination confirms disruption of the continuity of the patellar tendon fibres distally and also shows the bony avulsion of the tibial tubercle attached to the proximal patellar tendon



Fig. 3 On the post-operative lateral knee radiograph, the Mitek GII Quickanchor (DePuy, Leeds, UK) is visible, which was used for fixation of the middle part of the patellar tendon. The bony midpatellar drill tunnel is also seen, through which the cerclage Fibrewire (Arthrex, Naples, USA) was tightened for protection of the repair after being led through a horizontal tunnel drilled in the tibial tubercle distally as well



Fig. 4 On the last follow-up visit, a lateral radiograph with the knee in 90° of flexion did not show any signs of patellar tunnel widening or patella baja

history of trauma, the extensor mechanism should be examined. In case of a patellar tendon rupture, a gap can usually be palpated over the tendon and the patella can be displaced superiorly by contracture of the quadriceps muscle. A significant extension lag will be seen during straight leg raising.

On a lateral radiograph, the superior displacement of the patella can be seen. An ultrasound or MRI scan can confirm the diagnosis if physical examination leaves any doubt.

Acute patellar tendon ruptures should be repaired as soon as the skin condition allows. Whilst repairing the patellar tendon, it is very important to restore the correct patellar height in the sagittal plane to prevent a patella baja or alta. When the sutures are tensioned with the knee flexed in 90°, the patella should be just sitting in front of the trochlear groove proximally. A cerclage wire, which is looped through horizontal drill tunnels in tibial tubercle and patella, can be used to protect the tendon repair and allows for early mobilization [3]. For the post-operative rehabilitation, a hinged knee brace is used to gradually increase flexion from 0 to 90° over a course of 8 weeks. Immediate full weight bearing is allowed, but straight leg raising exercises are only started after 1 month.

Patients with osteogenesis imperfecta have genetically inherited an abnormal collagen production that results in defective bone and connective tissue. Clinically, the triad of blue sclera, dentinogenesis imperfecta and generalized osteoporosis can be seen. There is no specific laboratory test to diagnose osteogenesis imperfecta. The classification of osteogenesis imperfecta is based on clinical features and ranges from mild (type 1) to severe (type 3–4) and perinatal death (type 2) [5]. In more than 90% of the cases, the genetic defect lie in mutations of type 1 collagen genes that causes the bone fragility and ligament laxity. Treatment of the genetic defects is not yet available and management is mainly concerned with the bony manifestations of the disease. Patients most often suffer from recurrent fractures, but tendon ruptures are also seen although less frequently [10]. Previous case reports in patients with osteogenesis imperfecta have described quadriceps and Achilles tendon ruptures [2, 4], and acute and chronic midsubstance ruptures of the patellar have been reported before as well [3, 6].

In this specific patient, quite brittle bone was encountered at the tibial tubercle during reattachment of the distal patellar tendon. In view of the patient's osteogenesis imperfecta, an augmentation of the primary repair was used. Augmentation of the patellar tendon repair is often performed by metal cerclage wiring. This reinforcement hardware has the possibility of breaking or migration through the bone and usually necessitates removal after 3 months as well. In this case, we have used a Fibrewire cerclage wire, which did not cause any complaints at post-operative follow-up and could, therefore, be left in situ.

Conclusion

We present a unique case of a distal patellar tendon avulsion fracture in a football player with osteogenesis

imperfecta and describe the technique of successful surgical repair and rehabilitation.

Conflict of interest No benefits in any form have been or will be received from a commercial party directly or indirectly related to the subject of this article, and the authors have declared no other personal or financial conflict of interest.

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