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Case Report

Acute traumatic patellar tendon rupture and simultaneous fracture of the tibial tubercle avulsion in a premature soccer player

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ABSTRACT

Bone-tendon junctions are prone for acute trauma due to its structural weakness, especially in premature males. For the lower limb, the most eminent area is the tibial tubercle apophysis. Osgood Schlatter disease (OSD) due to repetitive trauma or epiphyseal fractures due to one trauma is well described in literature and known in pediatric practice. Traumatic distal patella tendon ruptures on the other hand are a typical injury of the knee extensor mechanism of mature patients in the fourth decade. Here, the very rare condition of fracture of the tibial tubercle apophysis with simultaneous rupture of the distal patellar tendon of a 15 year old soccer player with previous history of OSD is presented including a review of the recent literature.

Introduction

Epiphyseal injuries are common traumatic conditions seen in the adolescent athlete. Among these, the fracture of the boy epiphyseal aspect of the proximal tibiae, the tibial tubercle, is comparably rare with a prevalence around 2.7 % of all epiphyseal fractures [1]. More commonly, repetitive microtrauma leads in summation to the so call Osgood-Schlatter disease (OSD) [2], which is treated conservatively in most cases, as the integrity of the tendon and function is impaired and painful, but not lost [3]. Never the less, the epiphyseal structure with the columnar cells is mechanically inferior compared to mature bone in adults. Muscle shortening of the rectus femoris as well as regular participation have been identified to be risk factors for OSD [2], while OSD is a risk factor for physeal avulsion fracture of the tibial tubercle [4]. Maximum force of the extensor mechanism to the anterior part of the physis, such as sprinting or kicking (presented case), or oppositional, the forced rapid flexion against the already contracted quadriceps of the knee consecutively lead to injury in this predisposed region [5]. The force exceeds the maximum capacity of the remaining fibrocartilaginous fibers of the tibial tubercle region to withstand such traction resulting in dislocation. This predisposition origins in the maturation of the proximal tibia ossification: epiphysiodesis progresses from the posterior to the anterior aspect of the tibia with the insertions site of the patellar tendon being the last localization to consolidate. This occurs around the ages of 8 to 13 years for females and 10 to 15 years for males. Therefore, the increased prevalence in males results from powerful quadriceps strength counteracting a still weak anterior tibial epiphysis [6].

Classification of these injuries has evolved of the years and progressing knowledge of the disease. Initially, Watson published a

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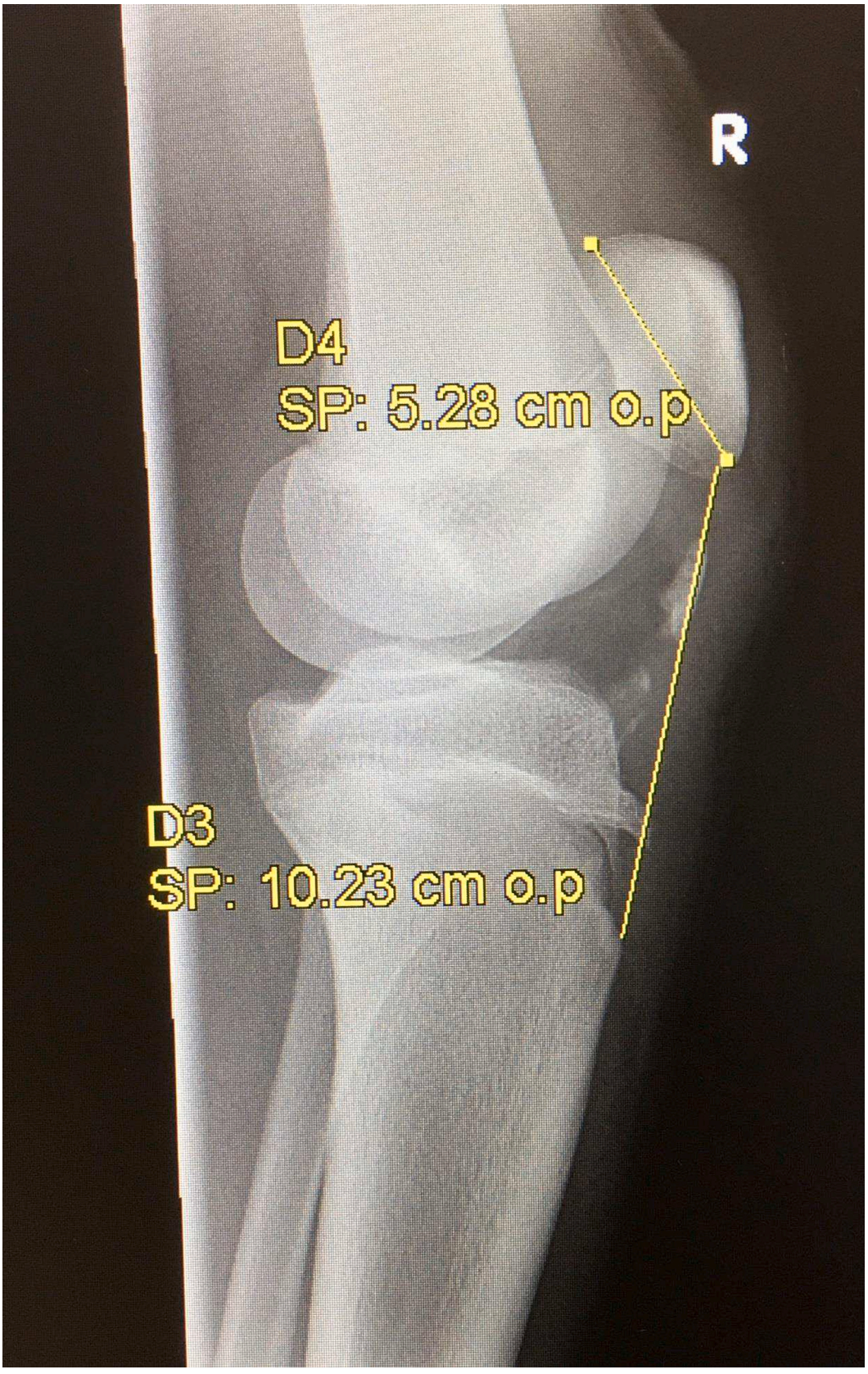

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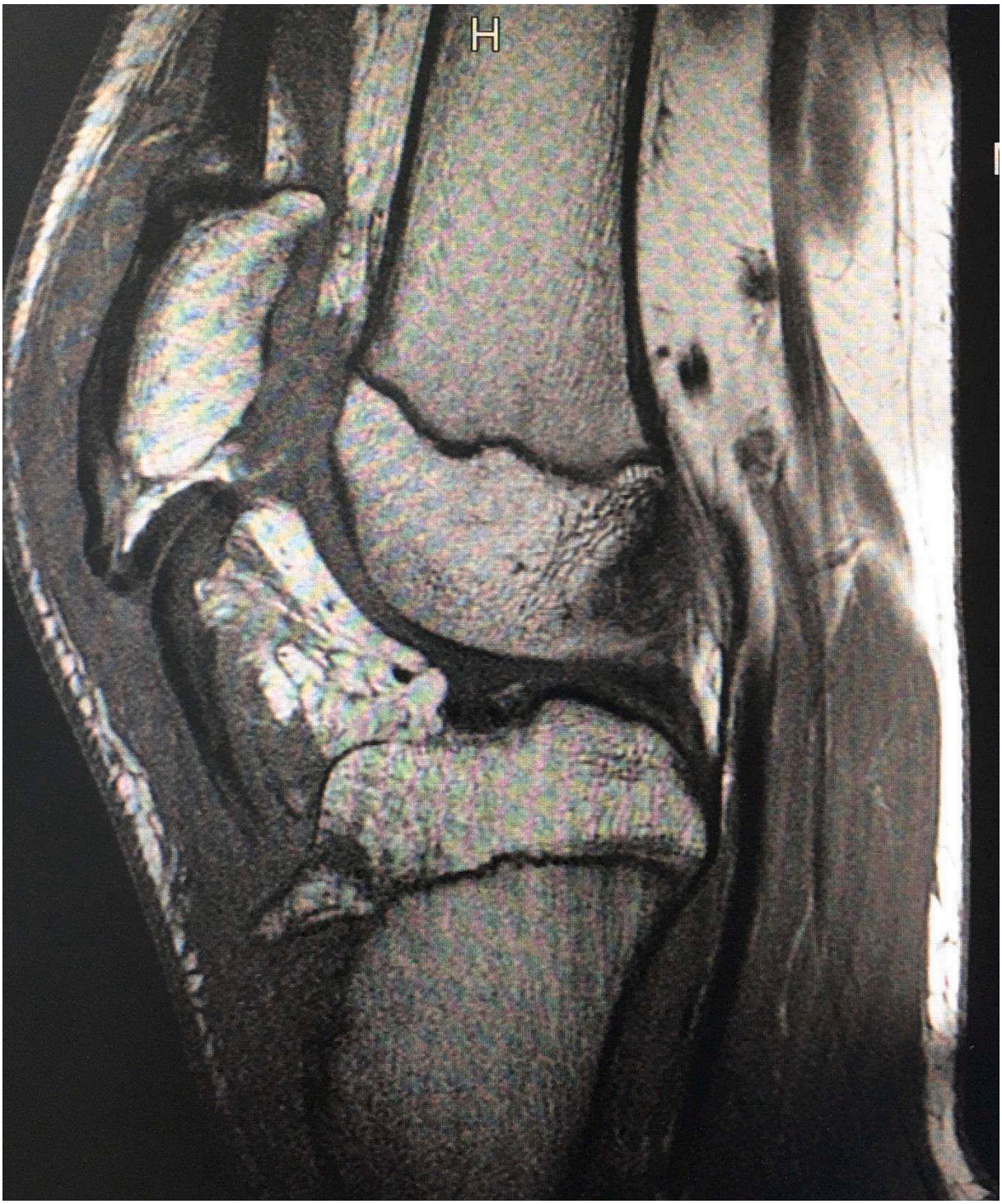
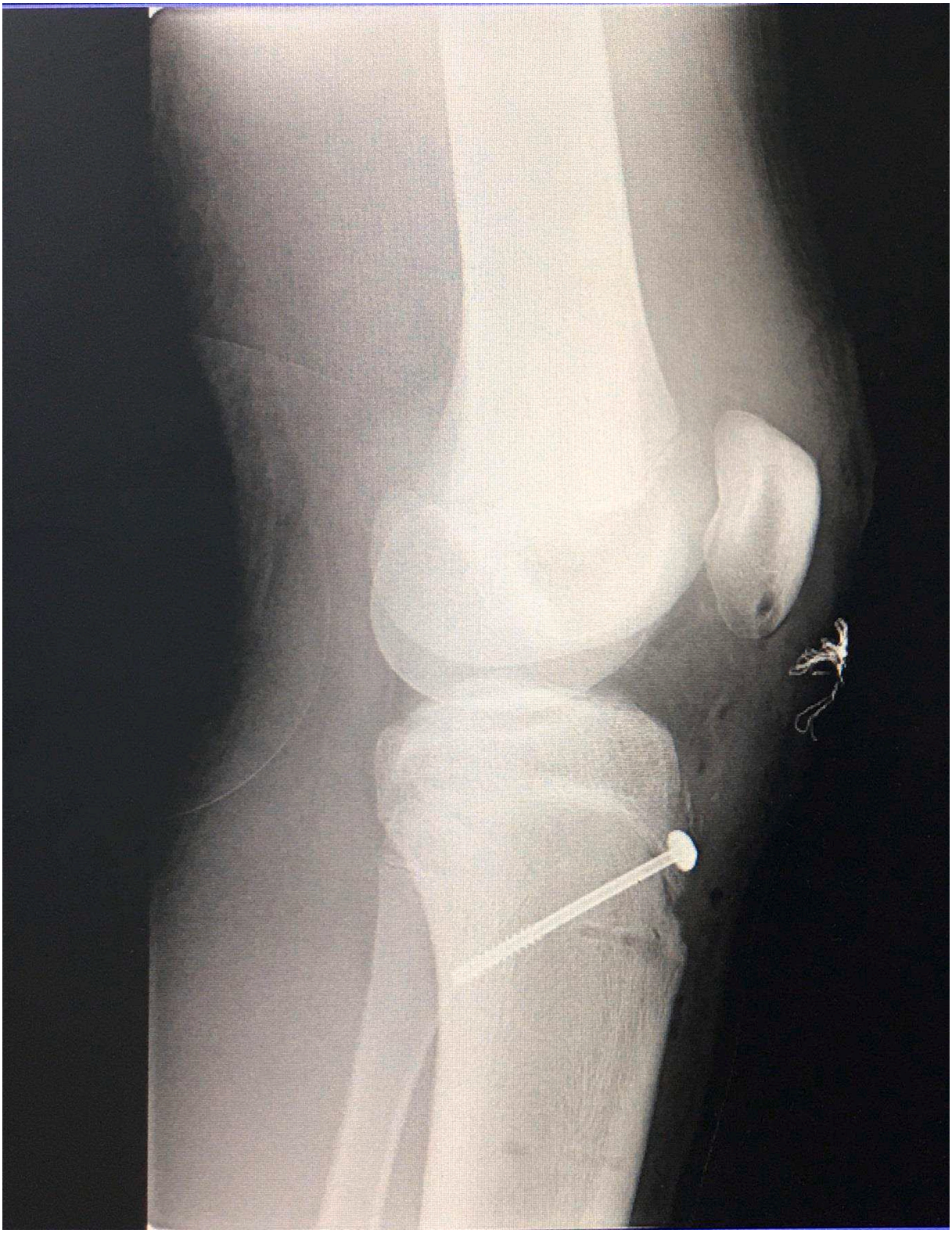
Picture 1. Preoperative lateral x-ray of the patient including measurements of Insall-Salvati Index.



Picture 2. Preoperative sagittal MRI of the knee (T1-sequence) showing the avulsion fracture, proximal wrapping of the patellar tendon and proximal tendon rupture close to the distal patellar pole.

Picture 3. Postoperative radiograph ap with 1 cancellous titanium screw in situ.



Picture 4. Postoperative radiograph lateral of the knee. Titanium screw for avulsion fracture as well as PEEK 3.5 mm Swivellock in prox tibia.

classification tool grading 3 types, according to joint involvement, which was later supplemented by Ogden to distinguish dislocation [7]. Ryu and McKoy added rare subtypes described at single cases [8].

Still, all described pathologies rely on the integrity of the patella tendon itself, sometimes associated with intraarticular osteochondral [9] or meniscal lesions [10]. Only Schiedts has published two cases of patellar ligament avulsion in 1995 so far, which were classified as Type III C according to Frankl [11].

We report the case of a 15 year-old ambitious soccer player who sustained tibial avulsion fracture in combination with distal patellar tendon rupture from the fragment with previous history of OSD. Due to the combination of premature injury aspects (Ogden Type IIB tuberosity tibia fracture) and mature injury aspects (patellar ligament rupture) we consider this unique case worth reporting.

Case presentation

A 15-year-old boy was brought to our emergency room after injuring during a soccer game (Valderrabano activity Score: 4).

The young patient reported sudden sharp pain in his right knee (supporting leg) while kicking the ball with the left foot followed by immediate falling on the grass. Afterwards he was incapable to walk or extend his right leg. The physical examination revealed atypical swelling of the tibial tuberosity and palpating pain over the right patella, which was "high-standing". Passive flexion and extension (0–0–30°) were only possible under agonising pain. Sensitivity and blood circulation were unaffected. Immediate joint sonography confirmed intra-articular hematoma and abnormal patella height with interruption of the patellar tendon and dislocation of the tibial tubercle apophysis. Native lateral Radiographs of the knee showed high-standing patella (Insall-Salvati Index 2,1) with an avulsion of the tibial tuberosity including gross dislocation, which was diagnosed as an Ogden Type IIb fracture. Same day MRI confirmed the dislocation of the tuberosity fragment, but revealed a retraction and discontinuity of the patellar tendon proximally, with the distal end ruptured with typical furling of the tendon close to the patella itself (Pictures 1 and 2). An intraarticular lesion was not found, the ACL and menisci were shown intact. Although loss of active extension clinically, the so called "substitute extensor" - the medial and lateral retinacula, seemed to be intact.

The knee was kept in straight extension in a cast and the patient was prepared for surgery on the next day. Further clinical testing revealed no sign of hyperlaxity. The history of OSD was then conducted: prior to trauma, anterior knee pain with OSD was diagnosed 12 months ago, the patient was kept at conservative treatment including eccentric training, reduction of training load and intermittent NSAR for 6 months. At the time of trauma, the patient was pain free and back to usual activity level since 20 weeks.

Under general anaesthesia and after single-shot Cefazolin dosage, the patient was placed in a supine position with a tourniquet on the thigh as high up as possible to keep the quadriceps mobile. A straight anterior infrapatellar approach was dissected to the tibial tubercle and the distal patellar tendon. After drainage of the subcutaneous hematoma, the joint capsula was found to be ruptured and an intraarticular hematoma was drained by suction. Surprisingly, the medial and lateral retinaculae were affected as well. The Hoffa adipose tissue was preserved and the patella tendon mobilized. After preparation of the osseus fragment, the growth plate remained untouched. The patellar tendon itself revealed longitudinal splitting and a transverse rupture close to the distal patellar pole. After critical appraisal due to prior diagnosis of OSD, the bony tuberosity fragment was reduced with a spear and fixed at the tibia using a cortical cancellous bone screw (5 × 55 mm) with a washer. The growth plate was hit one time only in perpendicular manner to minimalize trauma. Patellar tendon was then sutured with non-absorbable thread (PDS) including a frame suture and an additional mattress suture in modified Kirchmayr-Kessler technique for the proximal end. The loose ends of the suture frame were fixed to the tibia using a 3.5 mm Swivellock (Arthrex Inc.) knotless suture anchor distal to the growth plate. Incision was closed in intracutaneus manner, a drain was not put in (Picture 3) (Picture 4).

After dressing, the knee was initially immobilized in 0° extension for 2 weeks and the patient was instructed to walk on crutches without weight bearing for 2 weeks. Afterwards, a knee brace was prescribed with limited motion of 30° flexion (Medi m4s) for three weeks and following to 0°-0°-60° for another two weeks.

Meanwhile physical therapy including lymph drainage, manual therapy and isometric contraction in full extension as well as continuous passive motion therapy after 2 weeks was applied twice daily. Postoperative radiographs of the knee documented the restoration of a normal patellar height (Insall-Salvati 1,1) and the correct reduction of the fragment.

After discharge 2 days postoperative, the young patient recovered steadily under consequent physiotherapy twice weekly and returned to pre-trauma level of activity and soccer competition 6 months postoperative (Valderrabano activity score: 4).

Discussion

Tibial tubercle avulsion fractures in adolescent are a rare condition, accounting for approximately only 1 % of all physeal injuries and is typically seen in young athletes of about 14.6 years of age with males being 10 times more affected than females. Due to the extraordinary ossification of the tibial tubercle involving 4 stages and the closing direction of the proximal tibial physis from posteromedial to the anterolateral aspect, shortly before physiological epiphysiodesis, a predisposing mechanically weakened zone remains [12].

In this presented case, the previous history of OSD, although without symptoms in the weeks before trauma, is a well-known risk factor. As OSD is due to repetitive microtrauma from forceful contractions of the quadriceps muscle, it is quite common in adolescent male athletes as well (9.8 %). Between 25 and 75 % of OSD patient suffer tibial avulsion fractures in the later course of disease [4], as did our presented case.

Remarkably, traumatic proximal patellar tendon rupture is an injury with peak incidence at the third and fourth decade [13]. Additionally, traumatic extensor mechanism injuries are most commonly present in mature NCAA soccer players within the last decade

with an injury incidence of 34,79 per 100,000 athlete exposures, patella tendon ruptures alone with 0.87 per 100,000 athlete exposures [14]. Patellar tendinopathy, a pre-existing pathology of the patellar tendon is also very common in football players: 0.12injuries per 1000 h of professional soccer players. This pathology is associated with total exposure hours and increased body mass, but not associated to playing ground (grass vs. artificial turf) [15]. This is a condition, which is very common (13.4 %) in youth soccer players with the peak incidence around 15–17 years in Germany [16]. Moreover, most commonly, prior existing degenerative changes are associated with this injury in elderly populations [17]. Here, the preoperative x-ray of our case revealed ossification within the patellar tendon, existing prior to the traumatic rupture itself. Previous degeneration of tendons is fairly unexpected in a young athlete, while microtrauma, similar to the history of OSD, is an independent risk factor for patellar tendon rupture as well [17]. Therefore, the history of the patient was screened for changes in training load, training intensity or change of sport, which did not reveal any changes worth mentioning. Within this context, our patient presented during the spring season, which is a risk factor for Achilles tendon ruptures on the other hand [18].

Regarding the surgical repair of this case, we chose only 1 titanium screw for fixation of the tibial tubercle, as the physis was still open. One crossing to the epiphyseal is a limited trauma and not likely to alter the growth process itself, as the injured percentage of the physis will not exceed 10 %, similar to ACL reconstructions in immature athletes [19]. Never the less, literature has suggested genu recurvatum or leg length discrepancy as major complications [20]. Due to the additional patella tendon rupture, a direct open suture in modified Kirchmayr-Kessler manner of the tendon was preferred, as implant removal or additional drilling of bony tunnels wanted to be avoided (McLaughlin-sling). Therefore only one 3.5 mm hole was necessary for anchor fixation on the tibial side for the knotless reconstruction.

Summary

This case reports presents the rare situation of a combined traumatic extensor mechanism injury of an adolescent soccer player with previous history of Osgood-Schlatter disease including a physeal avulsion fracture and a proximal patellar tendon rupture. It was treated with open reduction, screw fixation and direct knotless suture of the patellar tendon with a mattress suture using an anchor in the proximal tibia. The patient had returned to pre-injury activity level one year after and no growth complication has appeared. Prevalence, risk factors, pathology and treatment options are discussed.

Declaration of competing interest

None.

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