Avulsion of anterior tibial tuberosity in a young athlete: Case report and literature review

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Corresponding Author:
Dr. Rida Allah Bassir,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco

Submitting Author:
Dr. Bassir Rida Allah,
Chirurgie Orthopédique et Traumatologique, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco

Other Authors:
Dr. Aniss Chagou,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Farid Ismael,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Mohamed Kharmaz,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Abdou Lahlou,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Moulay Omar Lamrani,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Mohamed Elouadghiri,
Faculty of Medicine, Mohamed V Souissi RABAT - Morocco
Dr. Ahmed Elbardouni,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Mustapha MAHFOUD,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Mohamed Saleh BERRADA,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
Dr. Moradh ELYAACOUBI,
Orthopaedic Surgery and Traumatology, Faculty of Medicine - Mohamed V Souissi University - RABAT - Morocco
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**Abstract**

Avulsion of the anterior tibial tuberosity is a rare injury. When they do occur, it is usually in an adolescent athletic male. The age range of the injury corresponds to the time of growth plate closure and maturation of the fibro-cartilagenous attachment of the tuberosity. We report a case of 17-year-old sports amateur, who presents an avulsion of the anterior tibial tuberosity, treated by surgery. Epidemiologic, etiopathogenic, therapeutic and pronostic aspects are analysed.

**Introduction**

Avulsion fracture of the tibial tubercle is not a common injury. The incidence ranges from 0.4% to 2.7% of all epiphyseal injuries (1,2). It occurs in a vulnerable period when the physis is undergoing physiologic changes that weaken its ability to resist tensing loading. The age range corresponds to the time of growth plate closure and maturation of the fibro-cartilagenous attachment of the tuberosity. Its mechanism of onset is a brutal contraction of the quadriceps and relationship with the Osgood-Schlatter disease is much more frequent. Watson-Jones (3) classified these fractures into three types which was further modified by Ogden et al.(4) who subdivided the three types into A and B according to comminution and by Ryu and Debenham(5) who proposed the addition of a type IV (propagation of the fracture line into the posterior cortex). We are reporting an anterior tibial tubercle avulsion fracture in a 17-year-old boy while playing Basketball.

**Case report**

A 17-year-old young athlete, without previous medical history, was victim of an accident during a Basketball game: brutal contraction of the quadriceps during an extension against resistance of the right knee, foot blocked in the ground, which caused pain and functional impairment (He was unable to weight bear and extend his knees). On examination there was swelling and bruising around proximal tibia with palpable deformity of the anterior tibial tuberosity. He denied any knee pain or discomfort prior to his injury. Radiographs of the left knee showed avulsion fractures of the tibial tuberosity; Ogden type IIIa (Figure 1). The treatment consisted on surgical reduction with fixation by 4mm cortical screw (Figure 2), the patellar tenon was intact. He was placed in cylinder casts for 4 weeks after which he commenced a course of intensive physiotherapy. He regained normal function activity by 8 weeks and returned to sports by 9 months. There was no disruption of the proximal tibial epiphyses at 18th month follow-up.

**Discussion**

The avulsion of the anterior tibial tuberosity is a rare injury, few cases are reported in the literature (4,6). Description of fractures of the tibial tuberosity is dependent on bone displacement. Watson-Jones (3) classified these fractures into three types which was further modified by Ogden et al.(4) who subdivided the three types into A and B according to comminution and by Ryu and Debenham(5) who proposed the addition of a type IV (propagation of the fracture line into the posterior cortex). Essentially, there are four main mechanisms responsible for these fractures: (I) jumping up from a stationary position, i.e. take-off, (II) landing on feet after a jump, (III) block to extension, (IV) rapid forced knee flexion. The extent and severity of this type of fracture is related to the degree of knee flexion at the time of fracture and also can correlate with Watson-Jones classification. The tensile force exerted by the quadriceps is transmitted to the tibial tubercle via the patellar tendon. An imbalance in this tensile force is responsible for the avulsion fracture. When the injury occurs with the knee either in near-full extension or in flexion up to 30°, avulsion of the tibial tuberosity without fracture of the proximal tibial epiphysis is the usual result. With the knee in a position of flexion greater than 30° at the time of injury, it result is an avulsion of both the tibial tubercle and the proximal tibial epiphysis (7).

The sport is the main circumstances arising (8), especially when playing basketball or combat sports. Spontaneous fractures are rare and happen in a predisposed context: Osgood-Schlatter disease or...
metaphyseal dysplasia (4). The association avulsion of the TTA-Osgood-Schlatter disease is still frequent (nine cases out of 15 in Ogden and Murphy (4), five out of five for Peyroux and Mathevon (9). However, there are two completely different pathologies (4). In the Osgood-Schlatter disease, the primary lesion appears to be an avulsion of the anterior portion of the epiphysis, while the pullouts of tuberosity achieve a separating of the whole tuberosity including epiphysis and underlying metaphysis.

Associated collateral ligament injuries, anterior cruciate ligament tears and meniscal tears have been reported with avulsion fractures of the tibial tuberosity (1,10); however, no such injuries were seen in our patient. Reported complications from avulsion fractures of the tibial tuberosity are rare. Genu recurvatum has been postulated but never described. Loss of flexion, mal-union, non-union, patella infera and compartment syndrome have all been seen (4,11).

The final choice of internal fixation devices should be made according to fracture pattern to achieve a well-stabilized fracture reduction and prevent re-displacement. If growth potential in the proximal tibial remains, the position and the size of implants are crucial. Surgery around the tibial tubercle in young patients with open physis can be dangerous and catastrophic complications such as angular deformity, leg length discrepancy, genu recurvatum or premature epiphysiodesis have been previously reported in the literature. (4,12,13) In the published series to date, the overall outcome of unilateral avulsion fractures treated by open reduction and internal fixation is excellent. Conservative management with closed reduction and above-knee extension cast (for approximately 4 weeks) is feasible in non-displaced or minimally-displaced fractures.
Illustrations

Illustration 1

- Figure 1: Lateral Radiograph of the left knee showing an avulsion fractures of the tibial tuberosity; Ogden type Illa.

Illustration 2

- Figure 2: Surgical reduction and fixation by 4mm cortical screw.