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Case Report

Anterior avulsion fracture of the tibial tuberosity in adolescents – Two case reports☆

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ABSTRACT

The objective here was to report two rare cases of anterior avulsion fracture of the tibial tuberosity in adolescents. Case 1 was a 15-year-old male who became injured through landing on his left knee and presented limited extension. Case 2 was a 16-year-old basketball player who presented sudden pain in the right knee and functional incapacity, after a jump. Imaging examinations (radiographs and computed tomography) showed anterior avulsion fractures of the tibial tuberosity. Surgical fixation was performed using screws and anchors, while avoiding growth plate injury. The cases evolved without lower-limb deformities.

Fratura-avulsão tuberosidade anterior da tíbia em adolescente – Relato de dois casos

Palavras-chave:
Fraturas da tíbia/cirurgia
Fraturas da tíbia/radiografia
Tomografia computadorizada por raios X
Traumatismos do joelho

RESUMO

O objetivo é relatar dois casos raros de fratura-avulsão da tuberosidade anterior da tíbia em adolescentes. Caso 1: 15 anos, masculino, apresentou trauma em aterrissagem em joelho esquerdo, com limitação da extensão. Caso 2: 16 anos, jogador de basquete com dor súbita joelho direito e incapacidade funcional após salto. Exames de imagem (radiografias e tomografias) evidenciaram as fraturas-avulsão da tuberosidade anterior da tíbia. Feita fixação cirúrgica com parafusos e âncoras que evitou a lesão fisária. Evoluíram sem deformidades em membros inferiores.

☆ Study carried out at the Universidade Federal de Goiás, Faculdade de Medicina, Hospital das Clínicas, Departamento de Ortopedia e Traumatologia, Goiânia, GO, Brazil.

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Introduction

The anterior tibial tuberosity (ATT) develops from a secondary ossification center in the anterolateral aspect of the tibia in contrast to the ossification center of the proximal tibia. The ATT is an apophysis and develops under traction,[1] while the proximal tibial core is developed under compression. The development of ATT is divided into four stages: cartilaginous, apophyseal, epiphyseal and bony.[2]

ATT avulsion-fractures in children and adolescents are rare, with few cases described in the literature, corresponding to 1% of all growth plate injuries,[3] occurring predominantly in males (approximately 98%).[4] They are the result of two possible mechanisms: (1) abrupt knee flexion with quadriceps contraction, typical of jump landing; (2) violent quadriceps contraction with a fixed foot, as in jumping.[5–7]

The aim of this study is to report two rare cases of avulsion fracture of the anterior tibial tuberosity in adolescents treated surgically.

Case reports

Case 1

A 15-year-old male patient underwent trauma while landing on his left knee during soccer practice; he developed left leg edema and extension limitation. During examination he presented bruising, pain on palpation of the ATT, edema 2+/4+ left leg extension impairment. Radiographies (Fig. 1) and CT scan (Fig. 2) of the knee disclosured avulsion fracture of the anterior tibial tuberosity with avulsion of the bone fragment.

The patient underwent surgical treatment through fixation of the avulsed bone fragment with a malleolar screw and washer, and reinsertion of the patellar tendon with three anchors (Fig. 3). Early rehabilitation with full load and full range of motion was performed within two months. Sports practice resumed after six months postoperatively. The radiographic control showed normal growth without lower-limb discrepancy. The patient developed no recurvatum or antecurvatum.

Case 2

A 16-year-old patient, a varsity basketball player, had sudden-onset pain in the right knee and functional disability after jumping during a game. An avulsion fracture was diagnosed, with the ATT fragment extending into the joint (Fig. 4A and B). Immediate care was carried out with immobilization and surgical treatment was accomplished seven days after trauma due to significant edema. Fixation using screws and anchors was performed under fluoroscopy control to avoid growth plate lesion (Fig. 4C and D). Physical therapy rehabilitation started on the seventh postoperative day; the patient

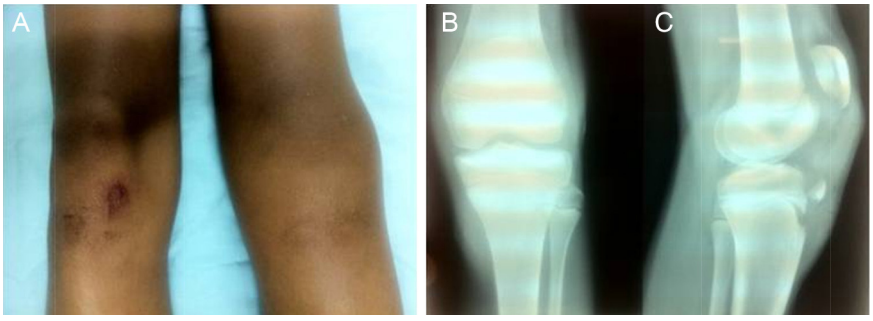

Fig. 1 – Clinical aspect of the left knee (A) compared with the contralateral one, showing severe edema in the anterior region; anteroposterior radiography of the left knee (B) demonstrating soft tissue edema; in profile (C) showing the ATT fragment avulsion.

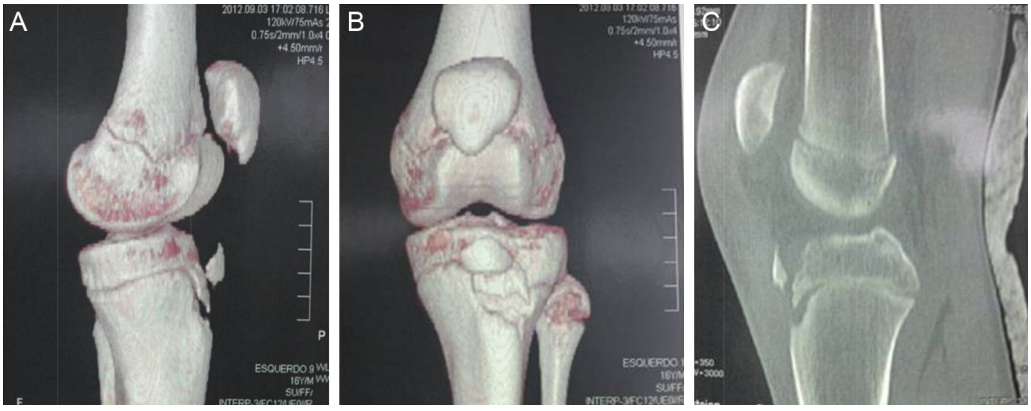

Fig. 2 – Computed tomography of the left knee, 3D reconstruction in profile (A) and anteroposterior view (B) showing avulsion of ATT and sagittal view (C) with type 1 injury according to the Watson–Jones classification.

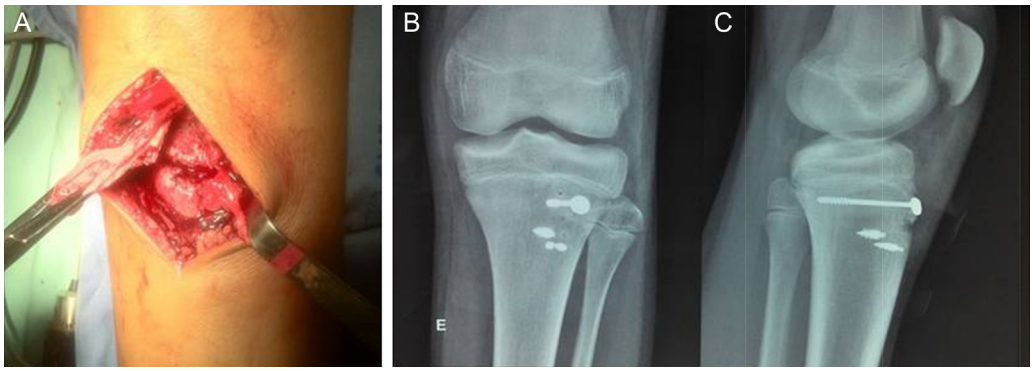

Fig. 3 – Intraoperative image (A) showing avulsed fragment of the ATT; postoperative control radiographies in anteroposterior (B) and lateral (C) view with fixation using screw and anchors.

Fig. 4 – Radiographies in AP and profile of the right knee showing ATT avulsion fracture Ogden type 3B (A and B); postoperative control radiographies (C and D) after 90 days of evolution showing consolidation of ATT.

developed no lower-limb deformities and returned to sports practice eight weeks after the trauma.

Discussion

The avulsion fractures of the anterior tibial tuberosity comprehend a higher number of injuries in men, probably due to the higher number of men practicing activities involving jumping. In our cases, they were the results of two possible mechanisms of action: (1) abrupt knee flexion with quadriceps contraction, typical of jump landing; (2) violent quadriceps contraction with a fixed foot, as in jumping.

The original classification system was created by Watson-Jones,[8] who defined three types. Type I is an avulsion of a small portion of the tibial tuberosity, distal to the physis of the proximal tibia; Type II involves the whole physis, but does not extend to the knee joint; type III corresponds to avulsion that extends proximally to the knee growth plate.

This classification was modified by Ogden and Southwick,[1] aiming at a more accurate definition of the specific fracture patterns and providing treatment for different types of fractures, including displacement and fragmentation. Ryu and Debenham[3] then suggested adding a type IV, which is a fracture of the tibial tuberosity that extends posteriorly along the proximal tibial growth plate and creates an avulsion of the entire proximal epiphysis. Subsequently, the addition of a type C was proposed by Franklin et al.,[9] for fractures with associated avulsion of the patellar ligament. Finally, a type V was suggested by McKoy and Stanitski[10] also described by Curtis,[11] which consisted of a fracture type IIIB with an associated fracture type IV, creating a Y configuration.

The treatment of these injuries using methods that do not compromise future growth of this region renders some difficulty in maintaining a satisfactory fracture reduction against the constant quadriceps pull force. However, patients with this type of injury are often very close to the end of cartilaginous growth, which allows reduction and open fixation, when indicated, to be carried out safely.

Thus, type IA Ogden fractures are usually treated conservatively with immobilization in extension, while open reduction and rigid internal fixation are recommended for the other types, with early physical therapy rehabilitation.[12] We believe that early diagnosis and early surgical treatment allowed good functional results and return to sports practice in these cases.

Among the possible complications of this injury are: limb discrepancy, genorecurvatum,[3,4] patella baja, nonunion, calcification of the patellar tendon and anterior cruciate ligament instability.[1] Complications, such as the tibial tuberosity fractures are relatively uncommon. However, compartment syndrome is a potentially severe complication that should be considered immediately after injury.[3–5]

Conflicts of interest

The authors declare no conflicts of interest.

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