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Apophyseal injuries of the proximal tibial tubercle

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Abstract Avulsion fractures of the tibial apophysis are rare. Seven cases were treated between 1993 and 1998 in our department. The treatment was conservative in 1 case, in the other 6 open reduction and internal fixation was used. The results after an average of 23 months were good. There were no growth disturbances.

Résumé L'avulsion fracture de l'apophyse tibiale est rare. Sept cas ont été traités entre 1993 et 1998. Dans un cas le traitement était conservateur. Dans les autres cas, une réduction ouverte avec fixation interne a été utilisée. Les résultats après une moyenne de 23 mois étaient bons. Il n'y avait pas de trouble de la croissance.

Introduction

Avulsion of the apophysis of the tibial tuberosity frequently occurs as a result of sports activities. It is essential to distinguish between these avulsions of the upper tibial apophysis and the changes characteristic of Osgood-Schlatter's disease.

According to Watson-Jones [6] there are 3 different radiographic types. Type I: displacement of a fragment of the distal part of the tibial apophysis without displacement of the proximal part (Fig. 1a). Type II: displacement of a larger fragment of the apophysis without involvement of the articular surface (Fig. 1b), and type III: displacement of the apophysis with a fracture line passing through the apophyseal growth plate and the proximal tibial epiphysis into the knee joint (Fig. 1c).

Patients and methods

From 1993 to 1998 we treated 7 patients for avulsion of the proximal tibial apophysis. All were male between 13 and 16 years of

age. Sports injury was a causative factor in all patients (ball games in 4 cases, skiing in 2 and a fall from a bicycle in the last). Corresponding to the classification there were 1 Type I, 2 Type II and 4 Type III injuries. One patient was treated conservatively and 6 patients were treated surgically with open replacement and internal fixation (Fig. 2 and Fig. 3). All patients were immobilized in plaster cast for 4 weeks. The hardware was removed after 18.8 (13–23) weeks.

Results

Follow-up examination after 23.1 (14–36) months of all patients showed normal function and normal exercise tolerance of the affected knee joints. There was no wasting of the quadriceps muscle and no radiographic changes in the upper tibial apophysis. No growth disturbances and no recurvation of the knee were noted. All patients were capable of participating in sports.

Discussion

The ossification center of the tibial tuberosity develops between the 11th and 14th year, being formed either as an outgrowth of the proximal tibial epiphysis, or as a separate center. The ossification of the apophysis is concluded around the 16th year [3]. The osseous union of the tuberosity and the tibial diaphysis is accomplished at the same time as the ossification of the proximal tibial epiphysis (17th to 20th year).

The most frequently seen avulsion fracture of the tibial apophysis arises in puberty and predominantly among male youths. The most frequent cause is stated to be the sudden contraction of the extensor muscles of the thigh while the knee is bent [1,4]. Later in life these types of injury are mostly a consequence of direct trauma, frequently in association with multiple injuries.

Ogden in 1980 [2] described a modification of the Watson-Jones classification by means of an extension into A and B groups. Since these injuries occur so seldom,

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Fig. 1a–c Watson-Jones classification of avulsion fractures of the tibial apophysis. **a** Type I, **b** Type II, **c** Type III

Fig. 2 A 15-year-old male with type III injury of the left knee

Fig. 3 Same patient after ORIF

we are of the opinion that the original Watson-Jones classification should be retained. It is certainly less easy to compare clinical results as a result of extension, subdivision and the changes made by different authors.

With regard to the mechanism of injury the same sequence reveals itself time and again. The 7 patients treated between 1993 and 1998 injured themselves while playing sports, mostly ball games. It is striking that each patient actually described a direct trauma (e.g., a fall on to the knee joint) as the mechanism of injury. However, none of these patients had an external skin lesion. We therefore assume that the injury must have followed the usual described pattern, but the patient didn't notice until after a subsequent fall.

The clinical symptoms of this injury are vague. A high degree of suspicion is therefore indicated, especially in young males. The region of the tibial tuberosity particularly in cases of lower leg fractures in children should not be disregarded. Healing of the partially lifted apophysis by formation of a bony bridge can retard or completely stop further growth in the frontal part of the upper tibial epiphysis. As growth continues in the dorsal part this can consequently lead to a ventrally inclined tibial plateau or to a recurvation of the knee [5].

Treatment is conservative and/or surgical according to the type of injury. Type I injuries can be treated conservatively, whereas a dislocated tibial apophysis requires open replacement and internal fixation. Traction screws and tension band wiring can be used. Particular attention should be paid to the region of the tibial tuberosity especially in lower leg fractures during the growth period. The diagnosis of avulsion fractures and the differential diagnosis of Osgood-Schlatter's disease can be derived from a detailed history and a radiological examination. In our experience the early recognition and adequate treatment of these injuries leads to a satisfactory result.

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