Talar body fracture in a 10-year-old boy. Case presentation

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ABSTRACT
Talar body fractures are an extremely rare presentation in children that are associated with high-energy trauma. They constitute devastating injuries and a management challenge for orthopedic surgeons, which could be further complicated by avascular necrosis, post-traumatic arthritis, and non-union. We report a case of a fracture-dislocation of the talar body in a 10-year-old boy, including emergency management, definitive treatment, and 1-year follow-up clinical and radiologic findings.
Key words: Fracture-dislocation; talus, necrosis.
Level of Evidence: IV

Fractura del cuerpo del astrágalo en un niño: a propósito de un caso

RESUMEN
La fractura del cuerpo del astrágalo es un cuadro extremadamente raro en la población infantil, y se asocia con mecanismos de alta energía. Se trata de una lesión muy grave y tiene un manejo complejo para el cirujano ortopedista, no exento de complicaciones, como la necrosis avascular, la artrosis postraumática o la seudoartrosis. Presentamos a un niño de 10 años con una fractura-luxación del cuerpo del astrágalo, su manejo de urgencia, el tratamiento definitivo y la evaluación clínico-radiológica al año de la lesión.
Palabras clave: Fractura-luxación; astrágalo; necrosis.
Nivel de Evidencia: IV

INTRODUCTION

Talar fractures in children are extremely rare, owing to their immature skeleton and greater foot laxity.[1]

The current increase of children engaging in impact activities results in this fracture prevalence rate increase. In some cases, such as with sport-climbing, the ankle is locked in neutral position while the impact of the calcaneus prevents ankle hyperdorsiflexion. Consequently, continuous impact forces injure the talar body and may produce associated nearby-joint dislocation.[2]

The most widely used classification is the Marti system, which evaluates the degree of displacement and initial dislocation as well as the number of damaged joints. Concomitant joint dislocations considerably increase the rates of avascular necrosis and post-traumatic arthritis in adults (Table).[3]

Table. Marti classification for talar fractures

Type I	Talar neck or head fractures
Type II	Non-displaced talar head or body fractures
Type III	Displaced talar neck or body fractures
Type IV	Talar neck or body fractures with complete dislocation of the talar body or comminuted fracture

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We report a clinical case of a talar fracture-dislocation in a boy, which was caused by a high-energy mechanism associated with preoperative neurovascular compression. Emergency surgery allows for compression relief and prevents joint complications.[4]

CLINICAL CASE REPORT

A 10-year-old boy with no relevant clinical history, who sustained an unspecified injury of his left ankle while sport-climbing. He was brought into the Emergency Department with a supinated foot and his ankle in neutral flexion. Physical examination revealed an increasing sensory deficit of the tibial nerve, with pulses, and no associated soft-tissue lesions.

The initial imaging studies revealed a fracture-dislocation of the talar body. After the computed tomography study, the fracture is classified as Type III according to the Marti classification (Figure 1).

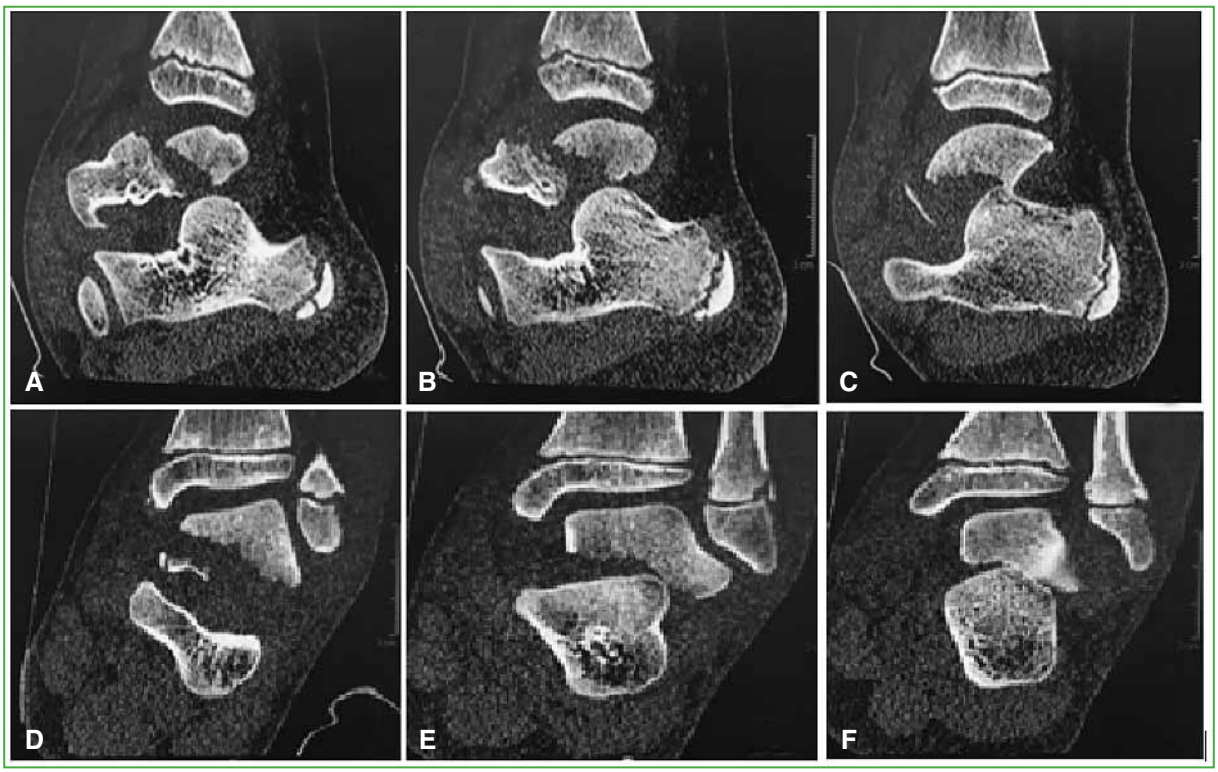

Figure 1. Preoperative computed tomography. **A-C.** Sagittal section. **D-F.** Coronal section.

Considering the progressive sensory deterioration and the type of injury, an emergency surgery is performed. Surgery involved open reduction of the subtalar dislocation and exploration of the neurovascular bundle using a medial approach, conducted under general anesthesia and with prophylactic antibiotics. Exploration revealed an unharmed neurovascular bundle as well as an important hematoma in the tarsal tunnel, which was removed to prevent further compression. After subtalar joint reduction through a medial approach, the fracture open reduction using a double approach (medial and lateral) was performed, using two Kirchner pins for its temporary fixation. After reduction corroboration with radiographic imaging, definitive fixation was performed using two 4.0-mm partial thread cannulated compression screws (posterolateral and anteromedial) (Figure 2).

Figure 2. A and B. Preoperative radiographs of the Marti type III talar body fracture. **C and D.** Postoperative radiographic control.

Follow-up and outcomes

At postoperative hour 48, plantar sensory examination revealed complete sensory recovery. Short-leg additional immobilization was applied for three weeks, after which the patient was allowed to begin active motion. At post-operative week 6, consolidation of the fracture being achieved, the patient was allowed to bear weight.

After rehabilitation, the patient had achieved normal ankle range of motion and returned to his daily routine activities three months after surgery, with no detectable neurological sequelae.

At postoperative month 10, internal fixation was removed. At a year and a half follow-up, the weight-bearing radiographic study was repeated, and a clinical evaluation performed using the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot scale.

The radiographic study confirmed complete fracture consolidation as well as foot and ankle normal alignment. No osteoarthritic change or avascular necrosis was observed (Figure 3). The patient was asymptomatic and engaged in impact sports activities with no complications. His AOFAS score was 95 at 18-month follow-up (excellent 90-100; good 80–89; poor <60).

Figure 3. Final follow-up radiographic control, following hardware removal.

DISCUSSION

Talar fractures are extremely serious injuries because this bone is the link between the ankle joint, the tarsus and the subtalar joint. Differentiation between neck and body fractures is based on the location of the fracture line. When the fracture line extends into the subtalar joint, it is classified as a talar body fracture.[5]

Talar fractures in children are extremely rare, owing to their tissue elasticity, immature skeleton, and lower incidence of high-energy injury incidence compared with adults. However, high-energy sports activities, such as sport-climbing, and motor-vehicle accidents result in this injury not exclusive to the adult population.[1]

The suspected mechanism of talar body fracture is an impact of the calcaneus over a talus locked in neutral position following a high fall, such as may occur in sport-climbing. Continuous impact forces may result in fracture of the talar body and dislocation of surrounding joints, predominantly the subtalar joint.[1,6-8] This circumstance may have been our patient's mechanism of injury, as the patient reported a fall where he tried to slide his foot into a climbing wall crack and had his foot locked in supinated position and his ankle in neutral position, unable to make any kind of movement after impact.

Although neurovascular injuries are rare, patients who had sustained excessive displacement may present injuries due to neurovascular bundle entrapment.[4,9] In our case, although displacement was not particularly striking, the decreased plantar sensation warranted surgical exploration. The procedure revealed a large hematoma compressing the nerve, which may have been the cause of hypesthesia.

In injuries with neurovascular alterations, significant displacements or tendon entrapment, untimely actions are unadvised whereas performing an emergency exploratory surgery of the injury with definitive fixation subject to soft-tissue condition is advised.[4,9]

Given the high-energy required to produce this kind of fractures, surrounding soft-tissue and bone lesions are to be expected. These patients' fixation should be performed using external fixation techniques until the soft tissue condition allows for definitive fixation. The available literature shows no outcome difference in terms of fixation time, provided an early reduction of the fracture is performed to prevent avascular necrosis.[1,4,10,11] Our patient, although presented with progressive sensory deterioration and a high-energy injury mechanism, had his soft tissue unharmed, which facilitated the definitive treatment.

Kamphuis *et al*. reported associated physeal lesions at the medial malleolus level.[1,7] In such cases, the lesion calls for the surgical management of the talus, as they allow visualization and direct reduction from said fracture site as if operating on an osteotomy.[1,7]

This type of fractures requires perfect anatomical reduction. Whenever the talar head is not clearly visualized through a lateral approach, an additional anteromedial approach should be used with caution not to damage the vascular supply to the talus medial aspect.[5,7] Although a medial malleolus osteotomy provides exceptional visualization in these procedures, we decided against it in order to prevent distal tibia physis complications, given that the patient was a child.

In our case, we used an initial anteromedial approach to reduce the subtalar joint and subsequently release the neurovascular bundle. We then performed an additional lateral approach to achieve an anatomic reduction of the fracture.

The most used method in children is Kirschner pinning, but we decided in favor of partial thread cannulated screws to achieve fracture compression. Ten months after the injury, we scheduled hardware removal to avoid complications.[1,12]

Displaced fractures of the talar body are characterized by a high risk of avascular necrosis in adults. This complication is less common in children, owing to their lower rate of subtalar dislocation.

Eberl *et al*. compared the types of talar fractures in groups of patients younger and older than 12 years of age and found that high-energy mechanism of injury resulted in less severe injuries in the younger patients (Marti type I and II) than in the older patients.[15]Smith *et al*. reported the incidence of this type of injuries was greater in adolescents than in children. Their reported complications were avascular necrosis (7%), arthritis (17%), and delayed union (3%).[14] As indicated by the aforementioned studies, the absence of subtalar dislocation and the presence of increased bone metabolism (characteristic in children) were conducive to preventing any of the described complications.[13-15]

Our 10-year-old patient sustained a talar body fracture (Marti type III). Despite his age, the energy of the impact mechanism was more than enough to result in an injury more serious than those commonly seen in his age group. The greater tissue elasticity and increased bone metabolism characteristic of his age were determining factors in preventing complications.

CONCLUSIONS

Although talar body fractures are rare in children, their incidence is increasing as children increasingly engage in impact sports activities. They constitute devastating injuries and a management challenge.

Our patient had a Marti type III, talar body fracture. This type of fractures has a high risk of complications and sequelae in adults. The case satisfactory outcome was associated with the emergent management and the patient's age.

Conflict of interests: The author claim they do not have any conflict of interests.

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