CLINICAL REPORT

Long-term result of a pure tibiotalar dislocation in a child

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KEYWORDS
Pure ankle dislocation; Lateral collateral ligament

Summary
Pure ankle dislocation without fracture is a very rare injury in children. We report the case of a 9-year-old patient who sustained open medial dislocation of the tibiotalar joint without fracture. The management, contributive factors, and long-term results are reported with a review of the literature.
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Introduction

Even though ankle injuries in children are frequent accidents, pure dislocations of the tibiotalar joint without fracture remain exceptional. Very few cases have been reported in children. The observation presented herein is remarkable for the severity of the associated soft tissue lesions and for the follow-up during the patient’s entire growth period to adulthood. An analysis of the long-term results compared to the data found in the literature is presented.

Observation

A 9-year-old child was seen in the emergency department following a traffic accident, with his foot crushed by a car. Upon arrival, he presented a medial open tibiotalar dislocation of the right ankle. Examination of the foot showed a large anterolateral wound through which the tibial pilon and the lateral malleolus projected. The dislocated foot showed signs of distal ischemia and the distal pulses were absent. In this context, the neurological exam of the foot could not be performed in its totality. Standard radiographs confirmed the presence of medial dislocation of the tibiotalar joint with no fracture (Fig. 1).

The child received emergency surgery. After abundant joint lavage, reduction of the dislocation was obtained without incident. Exploration of the lesion showed a ruptured dorsal artery of the foot. The extensor hallucis longus and the extensor digitorum longus tendons were found to be relaxed at the ankle, demonstrating a high muscular rupture. The anterolateral joint capsule was widely open.

Avulsion of the lateral collateral ligament was found, taking away a bony fragment with a patch of periostium of the lateral malleolus. The inferior extensor retinaculum as well as the medial collateral ligament were also ruptured. The anterior and posterior tibiofibular ligaments were intact.

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The superficial fibular nerve and its branches as well as the cartilage of the ankle presented no particular lesion.

The repair procedure consisted in transosseous reinsertion of the lateral collateral ligament, suturing the joint capsule and the dorsal artery of the foot. Muscle repair required a counterincision at the middle third of the lower leg to re-establish continuity and tension of the affected muscles. After releasing the tourniquet, the foot regained color and the distal pulses were noted.

The wound was closed with suction drainage and the foot was immobilized using an adjustable cast. The secondary appearance of superficial cutaneous necrotic zones required local care until healing. The cast was removed at the sixth week and neurological examination of the foot showed no deficit. The patient was allowed to resume walking. Complete recuperation of extensor hallucis longus and extensor digitorum longus muscle strength was obtained five months after the accident.

The child was regularly followed up in consultation; a follow-up X-ray taken one year after showed a line of arrested growth (Fig. 2a, b).

Follow-up has continued for 10 years to date. The clinical examination of the foot has shown no neurological problems. The anterolateral scar remains flexible although unsightly. Only the tendon of the tibialis anterior muscle remained subcutaneously prominent (consequence of the rupture of the inferior extensor retinaculum). The ankle’s range of motion is comparable to the opposite side. The objective assessment of the functional result using the Kitaoka score [1] is excellent (100/100).

Radiologic follow-up at the last consultation showed an irregularity in the tibiotalar joint space as well as calcification within the lateral collateral ligament (Fig. 3a, b).

The radiographic measurements of the two legs and talocalcaneal segments showed no inequality in length. The application of radiographic measurements according to Eisé et al. [2] showed bilateral shortness of the tibial malleolus (Fig. 4), whereas the coverage angle of the talus was normal.
Figure 4  Radiographic measurements using the Elisé index showing short tibial malleolus and a normal talus coverage angle.

Table 1  Clinical and radiological evaluation at adulthood.

<table>
<thead>
<tr>
<th>Kitaoka score AOFAS = 100</th>
<th>Medial/lateral malleolus index: 0.58–0.62</th>
<th>Talus coverage index: 0.58–0.60</th>
<th>Tibia measurement (cm)</th>
<th>Talocalcaneal measurement (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left side (healthy)</td>
<td>100</td>
<td>0.47</td>
<td>0.6</td>
<td>42</td>
</tr>
<tr>
<td>Right side (dislocated)</td>
<td>100</td>
<td>0.5</td>
<td>0.6</td>
<td>42</td>
</tr>
</tbody>
</table>

Table 1 summarizes the clinical and radiological evaluation at the last follow-up visit.

Discussion

Pure tibiotalar dislocations are relatively rare. The first case documented by X-rays was reported by Péraire in 1913 [3]. A first review of the literature done by Wilson et al. [4] in 1939 collected 16 cases (including two personal observations). Since then, several observations have been reported in isolated reports or within small series [2, 5, 7–9].

All these observations involved young adults. We found only four cases reported under this term in children (Table 2). Two of these cases were rotatory displacements under the tibial mortise [10, 11], which we consider to be incomplete dislocations, and two cases were displacements outside of the tibial mortise [12, 13], which were true dislocations similar to our observation. The scarcity of this phenomenon in children is attributed to the relatively lower resistance of the growth cartilage, which makes epiphyseal separation fractures more frequent at this age. The low number of cases in children and the follow-up of our patient into adulthood brought us to engage this discussion based on the data in the literature in both children and adults.

In the literature, tibiotalar dislocations are classified according to the anterior, posterior, medial, lateral, and vertical direction of the displacement as well as the combined forms. All the authors underscored the importance of the traumatizing force causing the dislocation.

Medial and posteromedial dislocations are the most frequently found variants. Predisposition factors have been raised. Ligament laxity seems to play a predisposing role. For some authors, shortness of the tibial malleolus may facilitate their onset [14]. Application of the radiographic measurements recommended by Elisé et al. [2] is not sufficiently reliable in children because of the substantial epiphyseal cartilage. In our observation, long-term follow-up has allowed us to take these measurements in adulthood on the injured side and the controlateral side. A short tibial malleolus was found on both sides. This predisposing factor was found in two cases out of 16 in the Elisé series [2] as well as in two other recent observations reported by Rivera et al. [15] and Mujeeb et al. [16].

Tibiotalar dislocations can be associated with cutaneous, ligament, blood vessel, nerve, muscle, and tendon lesions. In the young adult, approximately 50% of dislocations are open [2, 5]. The site of the opening depends on the direction of the displacement that has taken. Onset of secondary cutaneous necrosis is not rare and surgery to place a flap cover is occasionally required. Exposure of the joint can result in a risk for infectious osteoarthritis [6].

In children (Table 2), only the case we report herein was an open dislocation and the secondary cutaneous necrosis remained superficial, requiring local care for several weeks. Ligament involvement was present in all cases, essentially the lateral collateral or medial ligament or both concurrently [14]. These lesions were observed by Elisé [2] and Garbuio et al. [6] in their series, as in our observation. We treated the medial collateral ligament...
lesion orthopaedically, as recommended by several authors [2, 5–7].

In the majority of medial and posteromedial dislocations, the inferior tibiofibular ligaments are spared [5, 7]. We were able to verify that they were intact in our patient. In other types of dislocation, they are frequently injured and can go unobserved [17]. Radioscopy-guided testing provides a better analysis of their involvement. In addition, the observation reported by Segal and Wasilewski [18] is a reminder that one must verify the stability of the adjacent joints (subtalar and mediotarsal) in the search for combined lesions.

Particular attention must be paid to vascular and neurological lesions in the dislocated foot. Vascular involvement can seriously compromise the foot’s vitality. The literature reports three cases of amputation caused by vascular lesions [7, 17, 19]. In our case, the child’s foot initially presented signs of ischemia; the immediate management of this problem allowed us to re-establish vascularization.

The associated neurological lesions vary from simple elongation to rupture. Garbuio et al. [6] reported five cases with nerve involvement. Other publications discuss them in little detail, making evaluation of their frequency less precise. However, for Wroble et al. [9] the frequency of vascular and neurological lesions is estimated at 10%. According to De Mourgues et al. [14], the relatively low number of these lesions is attributable to the rupture of the anatomical supports that normally restrain these structures, thus providing them with greater mobility during movement.

The violence of the initial injury can lead to muscular and tendinous lesions. Only Wehner and Lorenz’s observation [20] describes involvement of the flexor hallucis longus. All the other cases found showed involvement of the muscles of the anterolateral and lateral compartments of the leg. The majority of these lesions are noted in open dislocations (as in our observation). Muscle and tendon involvement is probably underestimated in closed dislocations and MRI, in our opinion, plays an important role in screening for these lesions.

Treatment of dislocation is reduction under anesthesia. It is relatively easy and should be done as quickly as possible. The associated lesions must be searched for and treated on a case-by-case basis. Immobilization is generally required for 6–8 weeks.

Over the long term, the result remains satisfactory in the majority of cases, particularly in closed dislocations [2, 8]. Factors with a poor prognosis have been advanced by certain authors [6, 8, 14]: age, inferior tibiofibular ligament involvement, presence of a vascular lesion, late reduction, open dislocation, cutaneous necrosis, and infection.

Long-term complications occur with some frequency. Limited ankle range of motion is relatively frequent, found in 50% of Wroble’s series [9] and in one of five children (Table 2).

With a mean follow-up of 11 years, Elisé [2] reported residual paresthesia in 25% of cases. In this same study, 25% of the patients presented osteoarthritis, notably after open dislocations. For a similar follow-up period, calcifications and osteophytes were found in all the patients in Wroble’s series [9]; they are associated with narrowed joint space in one case. In Garbuio’s study [6], with a mean 12 years of follow-up, narrowed joint space was found in five out of nine cases.
Residual ligament laxity remains rare: a single case was reported by Colville et al. [5]. Tibiotalar dislocations spare the vascularization of the talus, undertaken by the arch of the sinus tarsi, making necrosis an exception. Only one case of avascular necrosis was noted by Toohey and Worsening [8], who attributed it to the delay in reduction and the postoperative infection occurring in the same patient.

In children, the repercussions of dislocation on segment growth were not studied in the other observations reported. In our case, we observed a radiologic sign of growth arrest one year after injury, but the radiologic measurements did not reveal unequal leg length (Table 1). With 10 years of follow-up, we found calcification in the lateral collateral ligament and irregularity of the tibiotalar joint surface and a slight flattening of the talus dome. These aspects will be monitored clinically and radiologically over the longer term.

**Conclusion**

Pure tibiotalar dislocations remain rare, with exceptional occurrence in children. Emergency reduction should be done as quickly as possible. The associated lesions should be looked for and treated on a case-by-case basis. The possibility of repercussions on the child’s growth requires long-term follow-up.

**References**