Subtalar Dislocation in an 8-Year-Old Boy: A Rare Clinical Presentation

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Subtalar dislocation is a rare condition in adults, but it is rarer yet in patients less than 18 years old. In the few reports of pediatric subtalar dislocations, both adolescents and young adults have been included in the patient series.[1-5] The youngest patient with a true dislocation reported to this point has been a 13-year-old girl. All the previously reported cases were secondary to trauma, and many had associated peritalar or ankle fractures. In the majority of the cases reported, the distal tibial and fibular physes would likely have been closed. As a result, hyperinversion forces were prevented from dissipating through the physis and instead were concentrated at the subtalar joint. In younger patients, the open physes about the ankle are believed to act as the path of least resistance, fracturing prior to subtalar dislocation.[3] At the time of writing, isolated subtalar dislocation had not been described in a patient with documented open peritalar physes. This report describes a case in which an 8-year-old boy with open distal physes sustained an isolated traumatic dislocation.

Case Report

The patient is an 8-year-old boy who presented to our emergency room after sustaining a hyperinversion injury to his left foot when he tripped while running down stairs at school. He noted immediate pain, deformity, and swelling and was unable to ambulate secondary to pain. The patient had no history of neuromuscular, endocrine, or rheumatologic disorders. No previous injuries to the left foot were reported.

Examination found the foot to be held in a plantarflexed, hyperinverted posture and not passively correctable. Mild swelling was noted with tenderness to palpation about the subtalar joint. The talar head was palpable as a dorsolateral prominence. Ankle range of motion was grossly normal, as was that of the hip and knee. Neurovascular examination was normal.

Radiographs demonstrated a medial subtalar dislocation with talonavicular incongruency and widening of the subtalar joint (Figure 1). With the boy under conscious sedation in the emergency room, the subtalar joint was reduced using axial traction, eversion, and digital pressure on the talar head. The patient was then placed into a bulky Jones splint, and postreduction x-rays and a computed tomography (CT) scan were completed (Figures 2 and 3). The CT scan demonstrated concentric reduction with no evidence of associated fractures. Three days later the boy was placed into a non-weight-bearing short leg cast for 5 weeks. He was allowed to bear weight as tolerated once the cast was removed. The patient returned to all usual activities by the eighth week after injury. Twelve months out of his cast, the patient was pain free with full ankle and subtalar motion and normal ankle radiographs. He continued to have pain-free, normal motion at the 2-year follow-up. No limp is evident, and he reports no difficulty with uneven terrain.

Discussion

Percy Judcy[6] first described subtalar (otherwise known as peritalar) dislocations in 1811 as a simultaneous dislocation of the distal articulations of the talus at the talocalcaneal and the talonavicular joints. This injury accounts for less than 1% of all traumatic dislocations in the adult population.[4,7] The childhood incidence of subtalar dislocations is estimated to be even less than the adult figure, given the paucity of reported cases in the literature.[3-5]

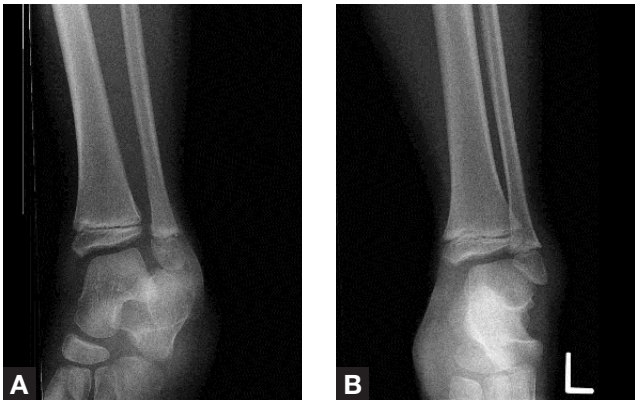

Figure 1. **(A)** Prereduction anteroposterior radiograph. Notice the talar head dislocated lateral to the navicular bone. **(B)** Prereduction lateral radiograph. Notice the dorsal prominence of the talar head and the talocalcaneal joint space widening.

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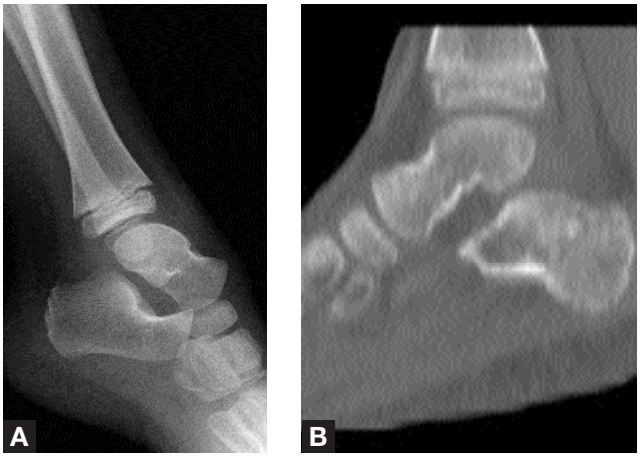

Figure 2. (A) Postreduction anteroposterior radiograph. Notice the relocation of the talonavicular joint ("ball in cup" appearance). **(B)** Postreduction lateral radiograph with congruent talocalcaneal joint.

Gross[3] published a case of a 13-year-old boy who sustained a subtalar dislocation with a concomitant distal tibia physeal injury in a motor vehicle accident. This is the only other case of a subtalar dislocation documented in a skeletally immature patient, but unlike our patient, this boy's injury was from high-energy trauma and was associated with a Salter-Harris type II fracture of the distal tibial physis. The author postulated that the low incidence of peritalar dislocations in the pediatric population was due to the fact that plantar flexion/inversion forces in children are preferentially dissipated through the open distal tibial physis rather than the more stable subtalar joint. On the contrary, older adolescents and adults with closed physes tend to concentrate the forces more distally, through the talonavicular and talocalcaneal joints, resulting in subtalar dislocation. In contrast to this report, our patient sustained an isolated subtalar joint dislocation, with no proximal injuries. Our patient's mechanism of injury may have dissipated the force preferentially through the subtalar joint, resulting in an isolated dislocation in a skeletally immature patient.

The Presentation of These Injuries

As reported by Heppenstall and Farahvar,[8] middle-aged men have the highest incidence of subtalar dislocations. The presenting symptoms commonly include:

- gross deformity
- inability to bear weight on the affected side and
- pain and diffuse swelling surrounding the talonavicular joint and posterior part of the ankle.

Medial subtalar dislocations are more common than lateral dislocations (85% vs 15%).[2,5,9,10] The majority of subtalar dislocations are due to plantar flexion with inversion (medial dislocation) or eversion (lateral dislocation).[10,11]

Impaction fractures can be associated with dislocation of the subtalar joint. These occur at the talonavicular joint on the medial aspect of the talar head and/or the lateral body of the navicular bone as the talus and navicular bone recoil toward their normal anatomic positions. **Associated injuries** include syndesmosis injuries and fractures of the talar neck or body, tibia, fibula, base of the fifth metatarsal, and cuboid bone.[7] Merchan[11] reported a 64% incidence of associated fractures in a series of 39 patients. **Neurovascular compromise** is rare but is more common in lateral dislocations. Finally, there is a tendency for **skin necrosis** secondary to tenting of the skin over the prominent head of the talus.

Mechanisms of Injury

The ankle joint has inherent bony stability in dorsiflexion. The stability stems from the mortise-and-tenon configuration of the joint. The narrower posterior margin of the body of the talus makes the ankle and subtalar joint more susceptible to injury in the plantar-flexed position.[12]

Medial dislocations are characterized as medial displacement of the foot with the head of the talus displaced dorsolaterally.[10,13] The mechanism of injury is an inversion force at the ankle with external rotation of the leg, unlocking the subtalar joint and allowing for further inversion.[3] The sustenaculum tali acts as the fulcrum to separate the talus and calcaneus.[5]

An eversion force results in **lateral dislocation** in which the head of the talus is directed medially. This presents with the talar head prominence medially and the navicular bone lateral to the talar neck.

Anterior and posterior dislocations have been reported, but they tend to be grouped with the classic medial and lateral dislocations because of their large components of medial and lateral displacement.[3,5]

In isolated subtalar dislocation the tibiotalar joint remains intact. These injuries most commonly occur following a fall from a height, motor vehicle accidents, or athletic injuries with inversion or eversion forces.

Imaging

Radiographic diagnosis can be difficult. The anteroposterior view best assesses the integrity of the talonavicular joint but also helps determine the pattern of dislocation.[5]

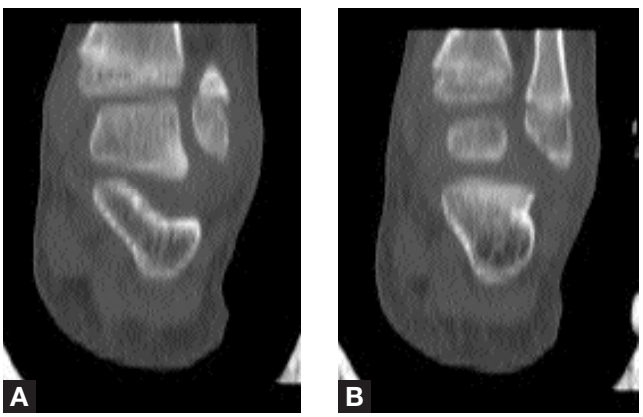

Figure 3. (A) Postreduction axial computed tomography (CT) scan through the talonavicular joint. Congruent joint reduction without impaction fractures demonstrated. **(B)** Sagittal reconstruction CT scan.

The anteroposterior view verifies the articulation of the talar head with the proximal surface of the navicular bone ("ball in cup"). On lateral injury films, the head of the talus usually lies dorsal to the navicular bone in medial dislocations and plantar in lateral dislocations. Computed tomography scans can assist with diagnosis of additional injuries. In a series of 9 patients with diagnosed subtalar dislocations, Bibbo and Lin[14] found that CT scans diagnosed all of these patients with additional associated injuries. Because of the high frequency of associated fractures and complicated radiographic anatomy of the hindfoot, CT scans are recommended in all cases of subtalar dislocation.[7,13,14]

Management

Subtalar dislocations in children can be treated the same as in adults, with the majority reduced in a closed fashion.[3,5] Under sedation, the knee is flexed in order to relax the gastrocnemius muscles, and axial traction on the foot is applied with countertraction at the thigh. A small initial accentuation of the deformity can help unlock the dislocation, followed by reversal of the deformity to reduce the joint. Direct digital pressure on the talar head aids in reduction. Postreduction radiographs should be performed for assessment of reduction and identification of additional injuries.

Once anatomic reduction is confirmed, recommendations for closed treatment in adults have varied. Immobilization with non-weight-bearing has been uniformally recommended for the first 4 to 6 weeks to allow for tissue rest and healing. Following this, authors' recommendations have varied, from advancing to unprotected, full weight bearing as tolerated to continued short leg casting with progressive weight bearing as tolerated for 3 months.[7,15] Once the patient is out of a cast, immediate range-of-motion and inversion-eversion strengthening exercises are initiated. Shorter periods of immobilization have been advocated more recently because of the inherent stability of the subtalar joint and the possible complications of prolonged immobilization, such as stiffness.[9,11,13] Six weeks of immobilization has been shown to be beneficial for younger active patients, young female patients with generalized ligamentous laxity, and patients with associated fractures.[2,5,11]

Open Injuries. Open dislocations occur 10% to 40% of the time.[5,7,16] Open injuries require débridement, open reduction, and possibly internal fixation with Kirshner wires. Lateral dislocations tend to have a higher incidence of open injuries and fractures, resulting in poorer outcomes.[9,13,16]

Outcomes

Leitner[17] concluded that closed reduction is unsuccessful 10% of the time in medial dislocations and 10% to 15% of the time in lateral dislocations. Common blocks to reduction for medial dislocations include the extensor retinaculum, extensor digitorum brevis, and talonavicular impaction fractures. Blocks to reduction for lateral dislocations are most likely an interposed posterior tibial tendon but also include flexor digitorum longus tendons and talonavicular impaction fractures.[2,5,7,17]

The prognosis with subtalar dislocations in children is very good for closed, simple dislocations. Irreducible dislocations, open dislocations, prolonged immobilization, and polytrauma may lead to a poorer outcome.[2] Associated intra-articular fractures and prolonged immobilization increase the likelihood of posttraumatic arthritis and chronic joint stiffness.[13] Lateral dislocations are normally the result of higher-energy trauma, have associated injuries, and have a worse prognosis. Goldner and colleagues[16] reported an 18-year follow-up of open subtalar dislocations, most of which were lateral. Five patients were noted to have osteonecrosis of the talus secondary to impaction fractures, and 7 developed causalgia (chronic regional pain syndrome).

Dimentberg and Rosman[2] found that an impaction fracture of the talonavicular joint was the most consistent finding adversely affecting outcome in pediatric subtalar dislocations. Delay in diagnosis and failure to reduce the dislocation promptly in 2 of the 5 patients led to chronic pain and joint stiffness in one and a triple arthrodesis in the other. In children subtalar dislocation commonly goes undiagnosed or is misdiagnosed because of the uncommon incidence of the injury. As a result, late reduction can be met with increased difficulty and poorer outcomes, which may necessitate a triple arthrodesis for relief of chronic pain.

Why Do Subtalar Dislocations Rarely Occur in Children?

Previous authors have attempted to examine the low incidence of subtalar dislocations in children.[2,3] Typically, the subtalar joint in children is subjected to lower-energy trauma. The force is further lessened because of their lesser body weight and lever arms acting at the level of the joint. The combination of the decreased energy at the subtalar joint and the dissipation of these forces proximally through open tibial growth plates may help explain the rarity of subtalar dislocations in the skeletally immature population.

Conclusions

Subtalar dislocations are rare injuries in children. Nonetheless, clinical suspicion is necessary for diagnosis. With prompt treatment, children with closed subtalar dislocations can expect a favorable long-term prognosis, with little to no residual disability.

Authors' Disclosure Statement and Acknowledgments

The authors report no actual or potential conflicts of interest in relation to this article.

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