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Case Report Open Access

Simultaneous, Bilateral Triplane and Juvenile Tillaux Fractures in a 13-year-old Boy: A Case Report and Discussion

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Abstract

Pediatric Triplane and Tillaux fractures represent a continuum of Salter-Harris injuries of the distal tibia. Over an 18-month period in children 12 to 15 years of age, the distal tibial physis closes first centrally, than medially and finally laterally. It is this unique and asymmetric pattern that makes them vulnerable to these injuries, with the Tillaux fracture historically occurring in slightly older children than the triplane fracture. However, we present a case and discussion of a 13-year-old male who incurred simultaneous Tillaux and Triplane fractures.

Keywords: Pediatric triplane; Tibial physis; Tillaux and triplane fractures

Introduction

Triplane and Tillaux ankle fractures are considered transitional injuries that cannot be easily classified within the Salter-Harris system. Plain radiographs depicting a Salter-Harris 3 injury on the anteroposterior view and a Salter-Harris 2 injury on the lateral are consistent with a triplane fracture. Conversely, a Tillaux fracture will present as a Salter-Harris 3 injury on both views. Tillaux and triplane fractures are external rotation injuries that occur after medial physical closure but before lateral physical fusion. However, the Tillaux is seen in older children as it always involves the anterolateral distal tibia, which is the last portion of the lateral physis to close. In this article, we report the case of a 13-year-old boy who sustained simultaneous, bilateral triplane and Tillaux fractures after falling off a swing set.

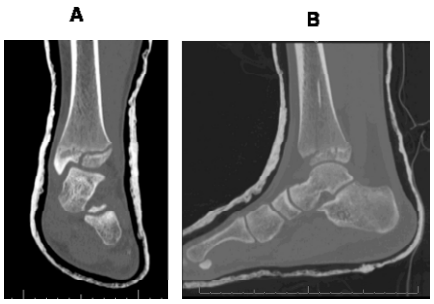

Figure 1: Coronal (A) and Sagittal (B) computed tomographic images of the right ankle, consistent with a triplane fracture. The coronal cut demonstrates a Salter-Harris 3 injury, while the sagittal view depicts a Salter-Harris II injury.

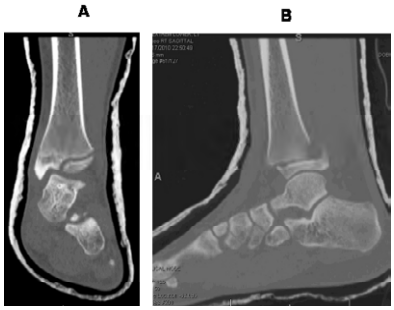

Figure 2: Coronal (A) and Sagittal (B) computed tomographic images of the left ankle, consistent with a Tillaux fracture. Both the coronal and sagittal cuts demonstrate Salter-Harris 3 injuries. Of note, the fracture line evident on the coronal image extends from the epiphysis through the lateral tibial physis. This occurs in the setting of Tillaux fractures as the lateral physis is not yet fused.

Case Report

An otherwise healthy 13-year-old boy twisted both of his ankles after a five-foot fall from of a swing set. The patient immediately felt pain and was unable to bear weight on either leg. He was brought the emergency department shortly after the accident, accompanied by his parents. On physical examination, the patient had a normal neurovascular examination but diffuse swelling and tenderness at both ankles. Plain radiographs were obtained of the ankles, identifying bilateral distal tibial epiphyseal injuries. To better delineate the fracture patterns, computed tomography (CT) images of the patient's ankles were obtained, demonstrating a right-sided triplane fracture (Figure 1A and B) and a left-sided Tillaux fracture (Figure 2A and B). Gentle closed reduction under procedural sedation was attempted, but was unsuccessful. As such, the patient was placed in well-padded splints and prepared for operative intervention. Open reduction and internal fixation of the left ankle (Tillaux fracture) was performed through an anterolateral approach. After achieving anatomic reduction and provisional Kirschner wire stabilization, definitive fixation was obtained with a 4-0, 50 mm partially threaded cancellous screw in the distal tibial epiphysis (Figure 3A and B). The right ankle (Triplane fracture) was approached through an anteromedial incision. After provisional stabilization, definitive fixation was performed with two 40 mm 4-0 partially threaded screws in the distal tibial metaphysis (Figure 4A and B). The patient was placed in bilateral short leg fibre glass casts post-operatively and made non-weight bearing.

At the patient's six week follow-up visit, excellent healing was noted bilaterally and he was transitioned from non-weight bearing to protected weight bearing in Equalizer® Walker boots (Ossur, Foothill Ranch, CA). At ten weeks, the patient was transitioned from the boots to his regular

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Figure 3: AP (A) and Lateral (B) radiographs obtained 12 months following open reduction and internal fixation of the left-sided Tillaux fracture.

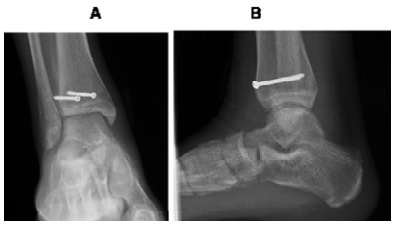

Figure 4: AP (A) and Lateral (B) radiographs obtained 12 months following open reduction and internal fixation of the right-sided triplane fracture.

shoes and made full weight bearing. At one-year follow-up, the patient was noted to be doing well, with no activity limitations, residual pain or evidence of growth arrest (Figures 3A, B, 4A and B).

Discussion

There is an 18-month period in which the distal tibial epiphysis undergoes closure. Closure begins centrally and then proceeds in an anteromedial direction, then posteromedial, and last, to the lateral aspect of the epiphysis [1]. Of note, the distal tibial physis contributes 50% of tibial growth and approximately 0.25 inches (4-6 mm) of longitudinal growth per year [2,3]. Triplane fractures occur in children aged 12 to 15 years old, as they progress towards skeletal maturity. It is important to note that these transitional fractures rarely occur in patients younger than 10 years or older than 16.7 years of age. However, any time the distal tibial physis is open, the patient is susceptible to a triplane fracture [4].

The triplane fracture is usually attributed to an external rotation force of the foot on the leg, and behaves like a Salter-Harris IV injury. It consists of sagittal, transverse and coronal components that traverse the physis, entering the ankle joint [5,6]. Juvenile Tillaux fractures occur in adolescents within a year of complete distal tibial physeal closure. At this time, only the anterolateral aspect of the physis is open and vulnerable to injury. Like triplane fractures, Tillaux injuries are most often attributed to an external rotation force on the foot. However, the fracture pattern created in this setting most closely resembles a Salter-Harris III fracture. Most patients who sustain these injuries are adolescent males with right ankle involvement [7]. This is attributed to the later closure of the lateral distal tibial physis in boys as compared to girls, making them more vulnerable to this injury for a greater amount of time. Diagnostic imaging is crucial in the work-up of pediatric ankle fractures. Plain radiographs should be obtained first and should include an anteroposterior (AP), lateral and mortise view of the ankle. A CT scan must also be obtained (Figures 1A, B, 2A and B), as the practitioner may fail to appreciate the true extent of the fracture on standard radiographs. It is also useful for operative planning (e.g., screw trajectory). Although attempts at closed reduction may be tried first, fracture displacement of >3 mm or >2 mm of articular step-off necessitate open reduction and internal fixation.

In these instances, poor outcomes have been consistently observed with closed treatment and are attributed to the energy of the injury and soft-tissue interposition at the fracture [8,9]. The surgical management of transitional injuries involving the distal tibial physis requires meticulous pre-operative planning. As previously mentioned, CT scanning will help in identifying all of the fracture planes, while helping the surgeon effectively plan for lag screw placement. In general, transphyseal fixation should be positioned parallel to the physis. Additionally, fracture anatomy dictates the placement of incisions. As such, triplane fractures are usually approached through an anterior or anteromedial incision, while Tillaux fractures are often approached through an anterolateral incision. The anteromedial approach is based on an intermuscular plane between the tibialis anterior and the extensor hallucis longus. Care must be taken not to damage the long saphenous vein and saphenous nerve. The intermuscular plane of the anterolateral approach is between the peroneus brevis and extensor digitorum longus. When this approach is utilized, the short saphenous vein and superficial peroneal nerve must be protected. The development of degenerative arthritis is the predominant concern with inadequately reduced distal tibial physeal fractures. Although physeal arrest is often considered the most severe sequelae of a trans-physeal injury, triplane and Tillaux fractures are less likely to result in premature physeal closure as compared to other pediatric ankle fractures, as the patients who sustain these injuries are close to skeletal maturity [10]. Tillaux fractures have the lowest rates of growth arrest, as they occur in an older age group than any of the traditional Salter-Harris type fractures and the triplane fracture. Rates of premature growth arrest following triplane fracture have ranged from 0 to 21% [11].

We have presented the unique case of simultaneous, bilateral distal tibial physeal injuries that are representative of two distinct stages of skeletal maturity. Although trauma can cause asymmetric physeal closure, it has never been identified as the manifestation of it. To our knowledge, this is the first case elucidating this. It cannot be refuted that the diagnosis and management of triplane and Tillaux fractures is well described. However, this case reinforces the notion that physeal closure does not always progress at a symmetric rate. It is pivotal for orthopaedic surgeons to understand this, as this concept has both diagnostic and prognostic implications, particularly in the pediatric patient presenting with bilateral ankle injuries.

References

1. Mac Nealy GA, Rogers LF, Hernandez R, Poznanski AK (1982) Injuries of the distal tibial epiphysis: Systematic radiographic evaluation. Am J Rad Roentgenol 138: 683-689.
2. Crawford A'H (1995) Ankle fractures in children. Instr course lect 44: 317-324.
3. Kärrholm J, Hansson LI, Svensson K (1983) Prediction of growth pattern after ankle fractures in children. J Pediatr Orthop 3: 319-325.
4. Kärrholm J (1997) The triplane fracture: four years of follow-up of 21 cases and review of the literature. J Pediatr Orthop B 6: 91-102.
5. Kling TF Jr (1990) Operative treatment of ankle fractures in children. Orthop Clin North Am 21: 381-392.
6. Peiró A, Aracil J, Martos F, Mut T (1981) Triplane distal tibial epiphyseal fracture. Clin Orthop Relat Res 160: 196-200.
7. Landin LA, Danielsson LG (1983) Children's ankle fractures. Classification and epidemiology. Acta Orthop Scand 54: 634-640.
8. Kay RM, Matthys GA (2001) Pediatric ankle fractures: evaluation and treatment. J Am Acad Orthop Surg 9: 268-278.
9. Ertl JP, Barrack RL, Alexander AH, VanBuecken K (1988) Triplane fracture of the distal tibial epiphysis. Long-term follow-up. J Bone Joint Surg Am 70: 967-976.

10. Barmada A, Gaynor T, Mubarak SJ (2003) Premature physeal closure following distal tibia physeal fractures: a new radiographic predictor. J Pediatr Orthop 23: 733-739.

11. Cass JR, Peterson HA (1983) Salter-Harris Type-IV injuries of the distal tibial epiphyseal growth plate, with emphasis on those involving the medial malleolus. J Bone Joint Surg Am 65: 1059-1070.