

Triplane Fracture: An Intricate Pediatric Injury

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Triplane fractures are complex transitional pediatric ankle injuries affecting mainly adolescents who are approaching skeletal maturity. Although several previous medical reports had described the special characteristics of these rare adolescent lesions [1-3], this term was coined by Lynn in 1972 [4].

They account for 5-15% of all pediatric ankle fractures [5] and are typically more prevalent in young girls and boys, aged 14 and 16 years old respectively, videlicet at the end of the growth period [6] They are strongly associated with the circumstance of the closure of the tibial epiphyseal plate which occurs asymmetrically from a medial to a lateral direction during an 18 month to 2 year period. Moreover, they are usually the result of an external-rotation mechanism of the ankle joint [1].

The specific fracture pattern of these unusual intra-articular lesions of the distal tibia, which are combinations of Salter- Harris types II, III, and IV, is characterized by fracture lines which extend into three anatomic planes. More specifically the sagittal fracture extends through the epiphysis, whilst the coronal component occurs through the posterior tibial metaphysis, and the transverse fracture imperils the growth plate [2,7].

Given their complexity, the exact fracture pattern of these multiplanar injuries cannot always be easily identified based on standard anteroposterior, medial-lateral and mortise plain radiographs [8] so often added investigation with two or three-dimensional imaging is mandatory [2]. Advanced radiography imaging and more specifically Computerized Tomography (CT) is a useful tool which depicts the fracture configuration in multiple planes. The disclosure of articular damage in a detailed analysis, as well as the depiction of the number and special anatomical characteristics of the displaced fragments, highlights the valuable contribution of this imaging modality for the diagnosis and treatment of triplane fractures [9-11].

Conservative treatment is the treatment of choice on the assumption of a nondisplaced fracture occurrence. It includes the application of a short or long leg plaster cast or 4 to 8 weeks followed by gradual weight-bearing [1,8,12]. When closed reduction is needed this is achieved under general anesthesia, using intensified imaging, with adduction for medial triplane fractures and internal rotation for lateral triplane fractures respectively [13].

On the presence of fracture displacement > 2 mm after a failed reduction attempt, the surgical approach is warranted. The satisfactory reduction is of uppermost importance as triplane fractures are intra-articular fractures which demand anatomic reduction and articular congruity restoration to avoid later devastating complications such as premature closure of the growth plate and subsequent tibial shortening and deformation of the tibia as well as posttraumatic degenerative arthritis [7,11].

Surgical interventions for the precise and safe reduction of displaced fractures include percutaneous Kirschner wire fixation or open reduction and internal fixation with cannulated cancellous transepiphyseal screws with special precautions to eschew the penetration of both the articular surface and physis [7,13,14]. For medial triplane fractures, open reduction using an anteromedial approach has been proposed, whereas for the lateral triplane fractures an anterolateral approach is employed [13].

Arthroscopically carried out reduction and percutaneous fixation

is a minimally invasive technique which provides rigid fixation and less soft tissue disruption in comparison with open portals [3,7,8,15,16].

As a conclusion, a high degree of suspicion for the presence of triplane fractures should be aroused when facing serious ankle injuries in the special population of children near the skeletal maturity. Especially when they sustain an injury which is the result of a force applied to the joint from a fall during athletic activities such as skiing and skateboarding or they are injured during a motor vehicle accident [8].

Early detection of these complex injuries guarantees the most favorable treatment which debars devastating future consequences for the injured young patient.

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