Transitional Fracture Patterns in Pediatric Patients: Ligaments Are as Important as the Growth Plate

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Purpose: Transitional fractures are complex injuries mostly occurring in children between 12 and 15 years old. It is generally assumed that the growth plate plays the primary role in the injury pattern. In this study we used fracture maps to qualitatively analyze whether these injuries correlate to the asymmetric closure of the growth plate and age.

Methods: A total of 131 pediatric patients with a transitional fracture and preoperative CT scan were included in this study. To ensure correct classification, together with a fellowship-trained pediatric orthopaedic trauma surgeon, the patients were screened and classified as 2, 3, or 4-part triplane or as a Tillaux fracture. Using standardized axial views, fracture lines were recorded manually and superimposed on a template.

Results: A characteristic Y-pattern can be observed in all fracture maps, regardless of grouping by age, gender, fracture type or fracture classification. There was no significant difference ($P = 0.955$) in mean age at trauma between triplane (13 ± 1.5 years) and Tillaux fractures (13 ± 1.7 years). Minor fracture lines occur in the middle between the anterior and posterior tibiofibular ligaments, and the fused medial part of the distal tibia.

Conclusion: Transitional fractures in pediatric patients are more strongly influenced by the forces of the tibiofibular ligaments on the distal tibia during these external rotation injuries than previously assumed. Age and gender do not have an effect on the type of transitional fracture, and in addition there is a great interpersonal variation in bone age.