Metaphyseal Fracture Displacement Is Predictive of Intra-Articular Diastasis in Adolescent Triplane Ankle Fractures

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**Purpose:** The accurate determination of intra-articular displacement in adolescent triplane fractures using plain radiography is difficult and correlates poorly with advanced imaging modalities. The purpose of this study is to determine the utility of a novel and simple plain radiographic measurement as a predictor of intra-articular displacement.

**Methods:** An IRB-approved, retrospective review of all adolescents who sustained a triplane ankle fracture was performed at a single Level I pediatric trauma center from 2003-2013. Plain radiographs (XR) and computed tomography (CT) scans obtained at initial presentation were independently reviewed by 3 orthopaedic surgeons. Maximum articular diastasis and step-off were measured using digital calipers on AP, mortise, and lateral XR as well as on axial, coronal, and sagittal CT scans. In addition, maximal metaphyseal fracture displacement was recorded on lateral XR. Articular displacement and step-off were compared between the 2 imaging modalities using Student’s t-test. Pearson and Spearman coefficients were used to identify correlations between XR and CT measurements.

**Results:** 87 triplane ankle fractures were identified with both XR and CT scans prior to treatment. XR underestimated fracture diastasis by 233% in the sagittal plane (1 mm and 3.3 mm on sagittal CT; P <0.05). XR underestimated diastasis by 24% in the coronal plane (2.3 mm on AP XR vs 2.9 mm on coronal CT; P <0.05). XR underestimated articular step-off by 184% in the coronal plane and 177% in the sagittal plane (P <0.05). Axial CT demonstrated a significantly greater amount of articular diastasis (4.2 mm; range, 0-19 mm) when compared to coronal (2.9 mm; range, 0-18.7 mm) and sagittal (3.3 mm; range, 0-11 mm) cuts (P <0.05). 65 patients had metaphyseal fracture displacement ≥1 mm on lateral XR, of whom 61 had an articular gap of >2.5 mm on CT (positive predictive value of 94%).

**Conclusion:** Surgeons underestimate articular displacement of triplane fractures on XR with the greatest discrepancy in the interpretation of sagittal plane displacement. Metaphyseal displacement is easily measured on XR and correlates with articular displacement. Metaphyseal displacement ≥1 mm is strongly predictive of articular diastasis above what is commonly considered the threshold for operative intervention. This finding should therefore raise suspicion for significant articular displacement that may not be appreciated on XR and, when identified, should prompt consideration of CT before proceeding with nonoperative management.

See the meeting app for complete listing of authors’ disclosure information.