

Fracture Characteristics Predicting Displacement in 438 Stress-Examined Lateral Compression Type-1 Pelvic Fractures

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Purpose: Stress examination of lateral compression pelvic ring fractures can contribute to treatment decision- making. However, resource constraints may preclude immediate testing. This study investigated which fracture characteristics and scoring systems best predict stress positivity in lateral compression type-1 (LC1) pelvic ring fractures.

Methods: A multicenter retrospective cohort study included adult LC1 pelvic fractures treated at eight Level I centers over 10 years. Nine fracture characteristics were assessed, with Beckmann and Bruce scores calculated. The primary outcome was a positive stress examination, defined as a 1-cm change in linear measurement between the medial femoral heads. To account for nonlinear relationships and interactions, each fracture characteristic's predictive importance was analyzed with Random Forest machine learning. Beckmann and Bruce scores were compared using receiver operating characteristic (ROC) analysis.

Results: A stress examination was performed on 438 LC1 pelvic fractures; 193 (44%) were positive. Superior and inferior ramus displacement as well as the sacral zone (with zone 2 predicting stress positive) were the characteristics that most predicted stress positivity (see figure). The Beckmann score is significantly more predictive of stress positivity than the Bruce score (area under the curve [AUC] 0.70 vs AUC 0.63, $p = 0.02$).

Conclusion: Ramus displacement was the most important factor in predicting stress positivity of LC1 pelvic fractures. Many important fracture characteristics that influence pelvic ring stability were not captured in the traditional Bruce scoring system.

