

Development and Validation of a Postoperative Nonunion Risk Score for Subtrochanteric Femur Fractures

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Purpose: The purpose of this study was to develop and validate a postoperative scoring system predicting progression of subtrochanteric fractures to nonunion.

Methods: Following IRB approval, 316 consecutive patients presenting to our institution (85 nonunions; 26.9%) with a fracture involving the subtrochanteric region and fulfilling the inclusion criteria were retrospectively identified. To identify potential unadjusted associations with progression to nonunion, simple logistic regression models were used. A revised adjusted model of multiple logistic regression to predict progression to nonunion was then used, removing covariates in a stepwise fashion according to their likelihood-ratio χ^2 *P* value. For the development of the nonunion scoring system, all factors identified by the logistic regression model were considered, with a highest score of 100.

Results: Having established the risk factors for nonunion, the coefficients were used to produce a risk score for predicting nonunion. In an attempt to identify the high-risk patients in the immediate postoperative period, self-dynamization was excluded. The revised scoring system was the sum of the following: diabetes (6), deep wound infection (35), simple or severe comminution (13), presence of an atypical fracture (14), lateral cortex gap size ≥ 5 mm (11), varus malreduction 5 to 10° (9), and varus malreduction $>10^\circ$ (20). On the ROC (receiver operating characteristic) curve, the area under the curve (0.790) demonstrated very good discriminatory capability of the scoring system, with good calibration (Hosmer-Lemeshow test; *P* = 0.291). Moreover, 5-fold cross-validation confirmed good fit of the model and internal validity (accuracy 0.806; κ 0.416). The cut-point determined by Youden's formula was calculated as 18.

Conclusion: This study demonstrates that the risk of nonunion can be reliably estimated in patients presenting with a subtrochanteric fracture, from the immediate postoperative period. The resulting nonunion risk score can be used not only to identify the high-risk patients early, offering them appropriate consultation and in some cases surgical intervention, but also inform surgeons of the modifiable surgery-related factors that contribute to this risk.