External Validation of the Radiographic Investigation of the Distal Extension of Fractures into the Articular Surface of the Tibia (RIDEFAST Study)

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Purpose: Distal tibial shaft fractures are often associated with distal intra-articular tibia fractures (DIAs). The RIDEFAST study previously showed utility of radiographs to rule out DIA using the fracture to plafond (FTP) ratio (length of the fracture/distance to plafond). This study tested the external validity of the FTP ratio to rule out DIA at an independent tertiary trauma center.

Methods: All patients presenting Level-I trauma: 2010-2015) with a distal tibial shaft fracture (OTA/AO 42-A1- 3, 42-B1-3, 42-C1-3, and 43-A1-3) formed our model cohort. A similar cohort at an equivalent second center (2013-2017) formed our validation cohort. Presentation radiographs and CT scans were used to confirm DIA. On both the AP and lateral radiographs fracture length, and the distance from the inferior extent of the fracture to the tibial plafond, were measured. The FTP ratio is dimensionless, negating the effects of magnification and patient size. Our prior receiver operating characteristic (ROC) curve for the FTP ratio and absence of DIA was tested against the validation cohort using simple logistic regression.

Results: 217 patients were identified to develop the model. 56 patients (25.8%) had DIAs. The validation cohort included 146 patients; 41 (28.1%) had DIAs. Logistic regression revealed the FTP ratio on AP films performed better in the validation data set than the initial model yet similar on lateral radiographs. The AP FTP ratio ROC area under the curve (AUC) for DIA was 0.83 (95% confidence interval [CI] 0.78 to 0.88) in the model data set versus 0.86 (95% CI 0.80 to 0.91). The previously established AP FTP cut-off of <0.61 had a 93.8% negative predictive value (NPV) in our model cohort and a 100% NPV in the validation cohort.

Conclusion: Our results suggest that the established AP FTP ratio <0.61, which traded a 50% reduction in CT scans required for a few missed cases of DIA, is actually conservative and unlikely to miss DIAs. The FTP ratio is an effective and externally validated screening tool to rule out DIA in distal tibia shaft fractures.

Evaluation of AP and Lateral FTP ratio as a diagnostic test to rule out DIA

	Cutoff	NPV (%)	DIA Missed (%)	CT saved (%)
AP FTP ratio				
Model AUC 0.83	<0.22	100.0	0.0	12.0
	<0.61*	93.8	3.2	52.1
Validation AUC 0.86	<0.22	100.0	0.0	11.0
	<0.62‡	100.0	0.0	31.5
Lateral FTP ratio				
Model AUC 0.82	<0.26	100.0	0.0	17.1
	<0.56*	93.9	3.7	53.5
Validation AUC 0.82	<0.26	100.0	0.0	13.0
	<0.65‡	100.0	0.0	32.9

*Model cohort optimal threshold based on maximal Youden index.

‡Validation cohort cut-off that maintains 100% NPV.

AUC, Receiver operating characterstic area under curve; FTP, fracture to plafond; NPV, negative predictive value; DIA, distal intra-articular fracture; CT computed tomography

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