The Relevance of the Number of Distal Locking Plates and Nail to Canal Ratio in Bone Healing After Intramedullary Nailing in Tibial Shaft Fractures

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Purpose: The objective of this retrospective study was to assess the effect of the ratio of intramedullary nail diameter to tibial canal diameter (nail to canal ratio [NCR]) and the number and configuration of distal locking screws in bone healing in tibial shaft fractures.

Methods: We analyzed 223 consecutive tibial shaft fractures treated with reamed intramedullary nailing between January 2014 and December 2020. We recorded and evaluated the NCR and the number and configuration of distal locking screws. Median NCR was 0.87 (interquartile range [IQR] 0.82-0.94). 10 fractures (4.48%) were treated with 1 distal locking screw, 173 (77.57%) with 2, and 40 (17.93%) with 3. Surgeons used interlocking screws in uniplanar fashion in 63 (28.25%) cases, biplanar fashion in 150 (67.26%) cases, and triplanar fashion in 10 cases (4.48%). Uni-, bi-, and multivariate analyses were performed to compare patients who achieved bone union with those who did not. The sensitivity and specificity of NCR was assessed with receiver operating characteristic curves.

Results: Bone union was achieved in 195 patients (87.44%). Uni/bivariate analyses showed that bone union increased significantly with larger NCRs ($P = 0.0001$) and a greater number of locking planes ($P = 0.001$) and distal screws ($P = 0.046$). The ROC curve analysis for union showed that an NCR >0.78 had a sensitivity and specificity of 93.9% and 77.8%, respectively (area under the ROC curve [AUC] 0.88; $P<0.00001$). NCR >0.78 (odds ratio [OR] 48.77, 95% confidence interval [CI] 15.39-154.56; $P<0.0001$) and distal locking screw configuration (OR 2.91, 95% CI 1.12-9.91; $P = 0.046$) were identified as independent variables for union.

Conclusions: Our findings suggest that in tibial shaft fractures treated with intramedullary nailing, NCR should be ≥0.79. Additionally, distal locking screws should be used with a biplanar or triplanar configuration.

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