

Malreduction is the Most Important Technical Factor Contributing to Nonunion in Supracondylar Distal Femur Fractures Treated with Lateral Locked Plating

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INTRODUCTION: Nonunion and implant failure continue to be significant issues in the operative treatment of supracondylar distal femur fractures fixed with lateral locked plates. The biomechanical evolution of implant design, application, and augmentation has outpaced our basic understanding of how to optimally use bridge fixation with a lateral locked plate for these fractures. This study aimed to identify modifiable technical factors associated with nonunion after operative treatment with lateral locked plating.

METHODS: We retrospectively reviewed the records from 10 Level One trauma centers. Adult patients with AO/ OTA Type 33 A and C fracture patterns treated with lateral locking plate were eligible. Patients with infection, pathologic fracture, partial articular fractures, and fixation augmented with intramedullary nail or medial plate were excluded. Previously identified non-modifiable patient and injury factors were used to stratify nonunion risk into low-, medium-, and high-risk categories. We examined a number of potentially modifiable technical factors including the amount of medial translation of the articular block, anatomic lateral distal femoral angle (aLDFA), lateral plate length, proximal screw density, and type of metal used in the plate. The primary analysis employed multivariable logistic regression to determine the association of these technical variables on the risk of nonunion.

RESULTS:

The study group (N=615) were 39% male with an average age of 61 years. Fifty-two percent were intra-articular, 23% were open, and 28% were periprosthetic fractures. Stratification on known risk factors demonstrated nonunion rates of 1.6% in the low-risk group (N=129), 4.2% in the medium-risk (N=333), and 14% in the high-risk group (N=153).

The most important technical factor associated with nonunion was varus malreduction with an aLDFA greater than 84°, associated with double the odds of nonunion in the medium and high-risk groups (OR 2.1, 95%CI 1.1-4.2, P=0.03). Malreduction by medial translation of the articular block also increased the odds of nonunion across all strata, with 30% increased odds per 4mm of medial translation (95% CI 1.0-1.6, P=0.03). Working length increased the odds of nonunion primarily in the medium risk group, with an 18% increase in nonunion per 10mm increase in working length (95%CI 1.0-1.4, P=0.01). Proximal screw density, defined as the number of occupied screw holes proximal to the fracture divided by the total proximal holes available, was protective against nonunion across all strata (OR 0.71, 95%CI 0.53-0.92, P=0.02). Lateral plate length and type of plate material were not associated with nonunion.

DISCUSSION AND CONCLUSION: Surgeons should be aware that malreduction with medial translation of the articular block or varus malalignment are both associated with increased odds of nonunion after lateral plate fixation of supracondylar distal femur fractures. Longer working lengths were also associated with nonunion, suggesting the possibility that simple bridge plating may be less likely to succeed for longer fractures.