

# Why are Reported Nonunion Rates After Locked Plate Fixation of Distal Femur Fractures so Variable? A Multicenter Retrospective Study of 284 Fractures

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**Background/Purpose:** Reported initial success rates after lateral locked plating (LLP) of distal femur fractures have given way to more concerning outcomes with reported nonunion rates now ranging from 0% to 21%. Reported factors associated with nonunion include comorbidities such as obesity, age, and diabetes, as well as technical factors such as plate length and screw density of constructs. Our goal was to examine variation in institutional nonunion rates at three Level I trauma centers treating a similar patient population in order to define a set of patient characteristics that identify nonunion risk and to determine if nonunion rates are related to the management approach. We hypothesized that institutions with a more aggressive approach to nonunion management based on radiographic findings and patient symptoms would have higher nonunion rates and shorter times to intervention than those where nonunion is primarily managed only after hardware failure.

**Methods:** A retrospective review was conducted of all distal femoral fractures treated with LLP at the three institutions (A, B, C) comprising our Combined Trauma Service (August 2004–December 2010). Nonunion was defined as the need for a secondary procedure to manage poor healing based on individual surgeon criteria (hardware failure, radiographic findings, and/or patient symptoms). 284 fractures met inclusion criteria and each patient's chart and radiographs was reviewed to extract age, gender, medical comorbidities (obesity, diabetes, tobacco use, steroid usage, dialysis), and injury characteristics (AO fracture type, open vs closed, mechanism of injury, periprosthetic). Multivariate analysis was performed using the Cox regression model.

**Results:** 29 of the 284 fractures analyzed went on to nonunion (10.2%). Only obesity, diabetes, and an open fracture were significant independent risk factors. 38% of patients with nonunion had diabetes compared with 23% of patients in the healed group. 57% of patients with nonunion were obese compared with 37% of patients in the healed group. 23% of patients with open fractures went on to nonunion. Institution A had 14.1% of all nonunions, B had 8.8%, and C had 8.1%. While  $\chi^2$  testing suggested no differences in nonunion rates between the institutions, the time to intervention for nonunions varied inversely with nonunion rates. Institution A intervened on average at  $9 \pm 4$  months, institution B at  $11 \pm 7$  months, and C at  $20 \pm 10$  months. Institution C had a significantly longer time to intervention for nonunion than A ( $P = 0.02$ ) and B ( $P = 0.04$ ).

**Conclusion:** Obesity, diabetes, and an open fracture are all predictors of nonunion in distal femoral fractures treated with LLP despite differences in how surgeons define and manage nonunion. The institutional difference in nonunion rates, and perhaps in the literature, may be explained in part by individual surgeon approaches to the management of the nonunion patient. Without a consistent definition of nonunion, comparisons between institutions and surgeons are difficult.

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