Outcomes of Surgical Treatment for Distal Femur Nonunions

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Purpose: Nonunion is a relatively common complication following operative fixation of distal femur fractures, affecting an estimated 10% to 20% of patients. However, evidence-based guidelines for treating distal femoral nonunion are lacking, and the published literature does not include an extensive review of outcomes, complications, and predictors of treatment success. The purpose of this multicenter retrospective study is to analyze outcomes of surgical treatments for distal femoral nonunion and to identify predictors of treatment success or failure.

Methods: We identified adult patients treated for distal femoral nonunion over a 10-year period (2007-2017) at trauma centers. Patient demographics, injury characteristics, treatment methods, and outcomes were recorded. Radiographs were categorized using the AO/OTA fracture classification and nonunion type, and the modified RUST (radiographic union scale for tibial fractures) score was calculated. Univariate and multivariate regression analyses were performed to evaluate predictors of persistent nonunion.

Results: A total of 122 patients with distal femoral nonunion were identified; 44% of cases were closed fractures initially, and 56% were open fractures. Implants used at initial fixation were an intramedullary nail (11/122, 9%) or plate (111/122, 91%. 14 of 122 patients presented with an infected nonunion. Implants used at the nonunion index surgery included a blade plate (BP) (47/122, 39%), intramedullary nail (8/122, 7%), locking plate (LP) (30/122, 25%), locking plate (LP)/nail combination (10/122, 8%), bone graft only (25/122, 20%), and screws only (2/122, 2%). 84% of nonunion surgeries utilized autologous bone grafts. 7% of patients (9/122) developed an infection. 5 of 14 patients (36%) with an infection at presentation had a persistent infection, and 4 of 108 patients (3%) who presented with an aseptic nonunion developed an infection. Additionally, 87/122 patients (71%) healed after the index fixation procedure. 18 of 122 patients (15%) required a secondary procedure to achieve union, and 17 of 122 patients (14%) were diagnosed with persistent nonunion. The mean mRUST score at final radiographic evaluation was 14.8 (confidence interval [CI] 14.5-15.1) among patients who achieved union versus 10.6 (CI 8.7-12.5) for patients with persistent nonunion. Variables predictive of persistent nonunion included diabetes mellitus ($P = 0.001$) and infection ($P = 0.004$).

Conclusion: We present the largest series reporting on outcomes of distal femur nonunions in the published literature. In this study, the most common surgical technique used for nonunion was plate fixation (BP or LP). Surprisingly only 71% of patients achieved union after the index nonunion surgery. Infection and diabetes were independent predictors of persistent nonunion. These results can be used to guide patient and surgeon expectations regarding outcomes after distal femoral nonunion surgery.