Risk Factors for Diaphyseal Femoral Non-Unions: A Systematic Review and Meta-Analysis

Tyler Kade Williamson[1], Jonathan G Eastman, Timothy S Achor, Stephen James Warner[2]
[1]Orthopaedic Surgery, University of Texas Health San Antonio, [2]McGovern Medical School At Uthealth

INTRODUCTION: Intramedullary nailing of diaphyseal femur fractures often results in reliable union, with union rates ranging from 96-100%. However, femoral non-unions (FNU) can be a debilitating clinical condition for patients. The purpose of this review is to identify and characterize the predictors of non-union following femoral midshaft fractures.

METHODS: A systematic search was conducted using key terms 'femoral shaft non-union', 'femoral diaphyseal non-union', 'femoral shaft fracture', 'femoral diaphysis fracture', and 'femoral midshaft fracture' in databases of English language articles published before May 2024. Human studies describing risk factors associated with development of FNU in either retrospective or prospective studies were included. Articles were excluded if not able to assess risk factors for FNU. Data synthesis summarized outcome measures and study designs appropriately in the results. SPSS Meta-analysis function was used to calculate the Mean Effect Size Estimate (MESE) and 95% Confidence Intervals for each outcome.

RESULTS: This search yielded a total of 7,879 studies and, after exclusion criteria were assessed, 26 articles comprising 14,170 patients with diaphyseal femoral fractures were included in the review. These studies included 973 fractures developing non-unions after surgical intervention. Methodological quality varied from low to high. There were 25 factors assessed in the included studies. Age (MESE = 1.33, [0.92-1.74]; p<.001) and Type 2 diabetes (MESE = 1.77, [1.03-2.52]; p<.001) were significant patient-specific risk factors, along with alcoholism, RA, and hypertension. AO/OTA 32B (MESE = 0.94, [0.35-1.53]; p<.001) and Winquist-Hansen type 3 (MESE = 1.45, [0.63-2.26]; p<.001) were significant injury-specific factors, along with butterfly fragment size and displacement and open fractures. Open reduction (MESE = 0.80, [0.3-,1.30]; p<.001) and postoperative NSAID use (MESE = 1.17, [0.08-2.27]; p=.04) were significant surgical-specific and management-specific risk factors, along with external fixation and iatrogenic comminution. The majority of studies were of low-quality, with only 10.3% (3/29) of the included studies conveying Level I or II evidence.

DISCUSSION AND CONCLUSION: Age, diabetes, fracture classification grading, and postoperative NSAID use were among the factors placing patients at highest risk for femoral diaphyseal non-unions, including other patient-specific, injury-specific, surgical, and management factors. Future studies are warranted to use a prospective study design, identify diaphyseal nonunion-specific risk factors, and implement evidence-based prevention strategies.