## Surgical and Microbiological Characteristics Associated with Non-Union in Fracture-Related Infections

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INTRODUCTION: Nonunion is a challenging complication following fracture fixation and fracture-related infections (FRI) can increase rates of non-union. Non-union rates in FRIs range from 18-37%. While FRIs have been associated with a higher rate of nonunion, data on how surgical factors and independent microbes in FRIs impact nonunion have been poorly described. The purpose of this study was to compare the surgical and microbiological characteristics of FRI patients that had union and those that had non-union.

## METHODS:

This was a retrospective study in Single Level I Trauma Center between 2013-2021. Adults with FRIs were identified via review of an institutional database on musculoskeletal infections maintained jointly by the infectious disease division and the orthopaedic surgery department. Inclusion criteria were patients over 18 years of age that had operatively managed fractures with an FRI. Exclusion criterion included patients without evidence of bone union that had less than 6-months follow-up from the presentation of the FRI and patients with osteomyelitis without surgical fixation.

The primary outcome assessed was non-union in patients with FRI assessed radiographically or clinically. Radiographic non-union was characterized by failure of bone healing progression at a minimum of three months following the initial injury. Clinical non-union was characterized by the presence of infected osteolysis or synovial pseudarthrosis by the treating surgeon intra-operatively. Demographic, injury, preoperative, operative, and post operative information was collected through review of the electronic medical record (EMR). Descriptive statistics were generated to characterize the study population. Chi-square test, Fisher's exact test or independent t test were used for data analysis. A 5% significance level was used for all analyses.

## RESULTS:

A total of 247 patients were included in the study, of which 55 (22.2%) were diagnosed with non-union. Patients with bone graft at fracture surgery prior to FRI had higher rates of non-union (25%, p=0.035). Similarly, patients that received topical antibiotics at closure (30.8%) during initial fixation had higher rates of non-union (p=0.028). Infection with *Pseudomonas aeruginosa* was associated with a decreased rate of non-union (0%, p=0.027). However, rates of non-union in patients infected with MRSA were similar to those infected with MSSA (19.6% vs 20.9%, p=0.874) and other pathogens (19.6% vs 23%; p=0.591). No other pathogens were found to be significantly associated with non-union.

DISCUSSION AND CONCLUSION: Use of bone graft at fixation surgery prior to FRI and topical antibiotics during initial fixation of fracture increases risk for non-union, while infection with *P. aeruginosa* decreases risk for non-union in FRI. Infection with MRSA did not increase risk of non-union. Further prospective studies should examine the impact of bone grafting and topical antibiotics during fracture fixation on development of FRI, as they are associated with increased rates of non-union when they develop FRI. This will help delineate best practices in utilization of these surgical adjuncts.