

# Gut Dysbiosis Increases the Risk of Infection and Complications after Acute Fixation of Closed Pilon Fractures as compared to Staged Fixation: A Stratified Propensity Score Matched Cohort Analysis

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**INTRODUCTION:** Gut dysbiosis (GD), an imbalance in gut microbiota, is linked to immune dysregulation and increased infection susceptibility. The association between GD and infection rates following fracture fixation remains unclear. There also remains debate on the most optimal treatment strategy in choosing acute vs. staged fixation of pilon fractures. This study aims to investigate if gut dysbiosis increases the risk of infection and complications following acute fixation of pilon fractures and if a staged fixation protocol would reduce these risks in those patients with gut dysbiosis.

**METHODS:** A large, federated database was utilized for a matched cohort study in patients with acute closed pilon fractures who underwent fixation. International Classification of Diseases, Tenth Revision (ICD-10) codes were used to identify eligible patients. Propensity score matching, multivariate regression analyses, and subgroup analyses were performed to control for selection bias. A total of 7,182 patients who underwent open reduction and internal fixation of closed pilon fractures were included, among whom 562 (7.82%) had GD. Propensity score matching was conducted to match 506 GD patients to 506 patients with no GD based on age, sex, body mass index, fracture characteristics, and Charlson Comorbidity Index. Additionally, 182 GD patients who underwent acute fixation were matched to GD patients who underwent staged fixation. The primary endpoints included post-fixation systemic and surgical site infections, complications, and healthcare resource utilization, such as emergency department presentations and readmissions.

**RESULTS:** Upon propensity-adjusted multivariate analyses, GD was associated with increased risks for overall post-fixation infection (Risk Difference, RD=-0.02 (95%CI: -0.032, -0.008), p= 0.001), organ/space surgical site infection (RD=-0.018 (95%CI: -0.032, -0.008), p= 0.001), overall rate of systemic and intestinal infectious diseases (RD=-0.057 (95%CI: -0.103, -0.011), p=0.01), overall postoperative complications (RD=-0.02 (95%CI: -0.032, -0.008), p= 0.001), delayed healing (RD=-0.019 (95%CI: -0.032, -0.008), p= 0.001), nonunion (RD=-0.0198 (95%CI: -0.032, -0.008), p= 0.001), emergency department visits (RD=-0.02 (95%CI: -0.032, -0.008), p= 0.002), and readmission (RD=-0.019 (95%CI: -0.032, -0.008), p= 0.001), following acute fixation of closed pilon fracture. Subgroup analyses of GD patients by fixation timing protocol (acute versus staged) showed staged protocol decreased the risk of surgical complications (RD=0.056 (95%; 0.022, 0.090), p=0.001), wound dehiscence (RD=0.054 (95%CI: 0.0218, 0.08805), p=0.0014), delayed union RD= 0.056 (95%: 0.022, 0.089) p=0.001, ED visits (RD= 0.055 (95%CI: 0.022, 0.088), p=0.001), and enterocolitis due to c. difficile (RD=0.056 (95%CI: 0.022, 0.091), p=0.001), as compared to acute fixation. However, staged fixation was associated with increased the risk of superficial surgical site infection (RD= -0.056(95%CI: -0.089, -0.022), p=0.001) in GD patients.

**DISCUSSION AND CONCLUSION:** Gut dysbiosis increases the risk of infection and complications following acute fixation of pilon fractures. However, implementing a staged fixation protocol in patients with gut dysbiosis can mitigate these risks. These findings highlight the potential importance of identifying and addressing gut dysbiosis as part of the perioperative care strategy in patients undergoing fixation of pilon fractures.

