Impact of Elevated BMIs On Risk of Infection Outcomes Following Type I and II Open Tibial shaft Fractures Treated with Plate and Screw or Intramedullary Nailing: A Retrospective Cohort Study

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INTRODUCTION: Post operative fracture-related infections represent an ongoing problem both for patients and healthcare systems, representing both increased risk of non-union, need for revision operations, increased hospital stays, and financial burden. The tibia is at particular risk due to poor soft tissue envelope, especially along its anteromedial surface, making it more vulnerable to devitalization and impaired healing. There are many factors that have been studied as risk factors for infection after tibial shaft fracture fixation including obesity, however, obesity is a risk factor that is often heavily confounded by other comorbidities. The goal of this study was to isolate obesity as a primary risk factor for infections related to tibial shaft fracture repairs using open reduction and internal fixation. The study postulates that increasing BMI will be associated with increased risk of post-surgical infection complications.

METHODS: A retrospective multicohort study was conducted using the TriNetX database. Patients having undergone open reduction and internal fixation procedures of intramedullary nailing and plate and screw fixation were queried using CPT codes. Data is collected using the international classification of diseases (ICD) and current procedural terminology (CPT) codes. The deidentified nature of the information by this database exempted it from institutional review board review. Over 82 HCOs were surveyed in July 2025. Three cohorts were created, one for only plate and screw fixation, one for only intramedullary nailing procedures and one for both procedures. Factors from the Charleston Comorbidity Index were matched among the cohorts to look at obesity as the driving factor of infection. ICD-10 codes were used to explore complications including infection due to implant/device, osteomyelitis, and surgical site infection. The cohorts were further divided into BMI above 30, BMI below 30, and BMI below 25 for matched comparison.

RESULTS: This study identified relative risk across 4 cohorts. Within the combined procedure cohorts, the combined outcomes of infection due to implant, osteomyelitis, and surgical site infections groups matched 10,334 patients for the BMI>30 group and 10,511 for the BMI<30 group, after excluding patients with the diagnosis prior to 90 days before the procedure, the relative risk was 1.25 (P-<.001). The combined procedure cohort matched 8,602 patients for the BMI>30 group compared to 8,751 patients in the BMI<25 group and had a relative risk of 1.23 (P-.002). The intramedullary nailing group matched 8,353 patients in the BMI>30 group and 8,471 in the BMI<30 group with a relative risk of 1.15 (P-.034). The intramedullary nailing cohort also matched 7,246 patients in the BMI>30 group compared to 7,381 patients in the BMI<25group and had a relative risk of 1.16 (P-.044). The plate and screw procedure cohort matched 3,797 patients for the BMI>30 group and 3899 for BMI<30 group with a relative risk of 1.14 (P-.189). The plate and screw cohort also matched 2,763 patients in the BMI>30 group compared to 2,796 patients in the BMI<25 group and had a relative risk of 1.21 (P-.062). When comparing the plate and screw procedures to intramedullary nailing in patients with BMIs>30 3,719 patients were matched in the plate and screw cohort and 3,745 were in the intramedullary nailing cohort with a risk ratio of 1.31 (P-.002) for the plate and screw cohort.

CONCLUSION: The data supports the conclusion that increased BMI is a risk factor for post operative infection in tibial shaft fracture open reduction and internal fixation repair, even after propensity score matching of 12 different comorbidities. This is consistent with previous research suggesting an immune function disruption component, as well as the increased complexity and surgical times required. This is clinically relevant so that proper precautions may be taken to ensure adequate infection coverage for obese patients who are at increased risk of infection such as increased prophylactic medication, coated implants and more extensive debridement. Since only patients' ICD10 codes were used to determine outcomes and inputs in the cohorts, this study heavily relies on hospital coding and reporting. Furthermore, assumptions were made that since the ICD 10 codes were listed between 1 and 90 days after the procedural codes they were related to the procedure. This assumption may not have been the case in every patient in our dataset. BMI is a limitation as it may not be the best indicator of obesity and morbidity in weight. Patients also may be malnourished at elevated BMIs after losing too much weight or malnourished at lower BMIs. This could lead to a confounding factor in the cohorts. In addition, many healthy individuals can have higher BMIs such as weightlifters, athletes, and those of shorter stature. Weightlifters and athletes are also at risk for orthopaedic trauma which can be a confounding variable as well.

SIGNIFICANCE/CLINICAL RELEVANCE: This project serves to improve patient outcomes through identifying risk factors in common tibial shaft fractures that could improve from antibiotic practices.