Predictors of Adverse Events for Ankle Fractures: An Analysis of 6800 Patients

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Purpose: Over the last 30 years, physicians have seen a dramatic increase in the number of ankle injuries due to an active, aging population. Given that ankle fractures are one of the most common fractures seen by orthopaedic surgeons, it is essential that they understand risks associated with their treatment. With the recent expansion of the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database, we have the opportunity to investigate the rates of minor, major, and all adverse events for a large cohort of ankle fractures.

Methods: Using the ACS-NSQIP database from 2006 to 2013, we collected patient demographics, comorbidities, and 30-day complications for ankle fractures. Current Procedural Terminology (CPT) codes included 27766 (medial malleolus), 27792 (lateral malleolus), 27814 (bimalleolar), 27822 (trimalleolar), and 27823 (trimalleolar with posterior). A univariate analysis was done to compare the patient demographics, comorbidities, and complications across all CPT codes. A multivariable logistic regression model was then used to assess the odds of minor (superficial wound infection, pneumonia, and urinary tract infection) and major (deep wound infection, organ space infection, myocardial infarction, stroke, pulmonary embolism, deep venous thrombosis, sepsis, septic shock, and death) postoperative complications within 30 days following open treatment, adjusting for type of surgery by CPT code and preoperative characteristics.

Results: 6865 patients were included for analysis. As shown in Figure 1, 36.5% (n = 2507) of fractures were bimalleolar ankle fractures, which also presented with a significantly higher American Society of Anesthesiologists (ASA) score compared to the other fracture types ($P < 0.0001$). The overall rate of adverse events for ankle fractures was low. Bimalleolar ankle fractures had the highest rate of major (2.6%, n = 64), minor (3.8%, n = 94), and total complications (5.7%, n = 143). Figure 1 compares the rate of adverse events by type of ankle fracture. When controlling for individual patient characteristics, bimalleolar fractures were 4.92 times (95% confidence interval [CI] 1.80-13.5, $P = 0.002$) more likely to develop a complication as a medial malleolus fracture. Risk factors driving the higher rate of complications for bimalleolar fractures were found to be age over 65 years, male gender, diabetes, history of chronic obstructive pulmonary disease (COPD), history of congestive heart failure (CHF), ASA score greater than 2, and dependent functional status ($P < 0.0001$).

Conclusion: Our data demonstrate that even though there is an overall low rate of adverse events for ankle fractures, bimalleolar fractures are about 5 times more likely to develop any complication. As we shift into a bundled payment system, orthopaedic surgeons must be aware of the risk factors that increase the rate of ankle fracture complications in order to provide quality care and reduce costs for one of the most common types of injuries.

See pages 47 - 108 for financial disclosure information.

Figure 1. Rate of All Complications by CPT Code