

## Risk Factors for Wound Failure After Primary Closure of Type IIIA Open Tibia Fractures

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**Purpose:** Previous studies have reported high complication rates with treatment of Gustilo-Anderson type IIIA open tibia fractures; however, little data exist to assist clinicians in predicting the likelihood of complications for these severe injuries after attempted primary skin closure. Our hypothesis is that risk factors can be identified that increase the likelihood of subsequent wound failure requiring flap coverage following primary closure of type IIIA open tibia fractures.

**Methods:** A retrospective review of all acute open fractures of the tibia (plateau, shaft, or pilon) classified as type IIIA that underwent primary closure at a single Level I trauma center from 2005 to 2013 yielded 278 patients. Patient, injury, and treatment characteristics were abstracted from the medical record. The primary outcome measure was any complication requiring unplanned surgical treatment of the study injury resulting in flap coverage. Bivariate and multiple variable regression techniques were used to identify independent predictors of complications while adjusting for multiple confounders.

**Results:** 55 patients (20%) ultimately underwent flap coverage to obtain wound closure for complication after an attempt at primary closure. Patient who required a flap experienced a 42% complication rate (23/55) after delayed flap coverage. The limb salvage rate was 95% for the study population. Three statistically significant predictors of complications after primary closure were identified: >3 debridements prior to closure (odds ratio [OR] 29.8, P <0.001, confidence interval [CI] 5.9-150.1), wound closure >2 days after injury (OR 9.8, P = 0.01, CI 1.6-60.2), and use of external fixator for more than 14 days (OR 7.3, P = 0.01, CI 1.6-34.6). Patients who had >3 debridements prior to closure had a 70.7% chance of having a complication resulting in a flap (29/41) compared with only 6.8% of those who had 2 or less debridements (14/205, P <0.001). A number of variables were tested and found not to be risk factors for complications including age, sex, body mass index, American Society of Anesthesiologists score, use of negative-pressure wound therapy, fracture location, fracture severity, and timing of initial debridement.

**Conclusion:** Analysis of this large cohort of type IIIA open tibia fractures identified three strong risk factors for complication after primary closure including number of debridements, wound closure after 2 days, and greater than 14 days of external fixation. It can be argued that all of these risk factors are markers for increased severity of the soft-tissue injury and therefore beyond the surgeon's control. However, noting that wounds requiring >3 debridements failed 70.7% of the time after closure, surgeons should be cautious in closing the wound primarily in this situation. Alternative approaches, such as flap coverage, should be considered in these more severe cases.

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.