Predictors of Failure in Induced Membrane Technique for Acute Traumatic Bone Loss

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INTRODUCTION:

Acute traumatic bone loss presents a challenge for orthopaedic trauma surgeons. Masquelet's induced membrane technique (IMT) is a treatment option that has been successful for managing acute bone loss. However, protocols vary among surgeons. The purpose of this study was to identify predictive factors that reduce infection and reoperation rates of acute bone defects treated with IMT.

METHODS:

Patients who underwent IMT for acute lower extremity fracture with bone loss within four weeks of injury at four Level 1 trauma centers between 2010-2020 were retrospectively reviewed. Patients less than 16 years of age, pathologic fractures, or patients who did not undergo the second stage procedure were excluded. Demographics and fracture characteristics were collected as well as outcomes including infection, secondary grafting surgery, amputation, and fracture union. Patients were followed to union or a minimum of 12 months. Chi square and Wilcoxon rank sum tests were performed on categorical and continuous variables, respectively. Regression analysis was performed to evaluate effect size of significant variables.

RESULTS:

One hundred twenty patients underwent IMT, where 25% developed an infection during treatment period. Five of the seven total amputations were performed for infection. Reoperation for secondary grafting procedure after stage 2 occurred in 21.7% patients (26/120). Patient gender, tobacco-use, diabetes, open fracture, and follow-up were not significantly different between groups.

Fasciotomy, Gustilo-Anderson Classification, definitive stabilization with intramedullary nail, spacer antibiotic selection, or autograft source was not predictive of infection or secondary grafting procedures. Patients who underwent secondary grafting had longer initial bone defects (8.1cm vs 5.6cm, $p<0.004$; OR 1.25). Infection significantly increased secondary grafting procedures (OR 3.62, $p=0.007$). Antibiotic dose was available in 71 fractures. Total antibiotic dose of 4 grams or greater decreased incidence of secondary grafting (5/36 vs 12/35) (OR 0.309, $p = 0.05$). Need for flap coverage following injury and decreased time between stage 1 and 2 were also significantly associated with infection (15/30, $p=.001$ and 80 vs 99.5 days, $p=.033$ respectively).

DISCUSSION AND CONCLUSION:

In acute lower extremity fractures treated with IMT, smaller defect size, absence of infection, and at least 4 grams of antibiotics in the cement spacer was associated with fewer reoperations for secondary grafting. Infection after IMT procedures occurs in 25% of patients. Flap coverage and less time between stage 1 and stage 2 were associated with infection.