

Clinical Outcome Differences Between Single and Multi-stage Transtibial Amputations

Alexander Shu, BS; Daniel Moon, MD; Shanthan Challa, MD; Kenneth Hunt, MD

Introduction:

Transtibial amputations are often necessary when patients experience irreversible lower extremity tissue damage. Current amputation methods incorporate either a single-stage amputation with primary wound closure or a multi-stage amputation. A multi-stage amputation consists of an initial amputation, typically performed at a more distal site, followed by a second more proximal amputation with stump formalization. The reported advantages of multi-staged amputations include decreased muscle retraction and reduced spread of infection/necrosis, which allows for reduced failure rates and lower rates of stump revision. However, multi-stage amputations are associated with increased monetary costs, time spent in the hospital, and clinical resources used over single-stage amputations. This study assesses if multi-staged amputations provide improved clinical outcomes over single stage transtibial amputations and what patient groups it may benefit.

Methods:

We conducted a retrospective study of individuals who received transtibial amputations at our institution from January 1, 2015, through December 31, 2020. Exclusion criteria included patients with less than 6 months of follow-up, history of malignancy, presence of congenital limb deformity, revision amputation without a record of primary amputation, and traumatic amputations. We reviewed the charts of patients meeting our inclusion criteria (n=118), and collected data on demographics, comorbidities, labs, indications for amputation, complications, and functional outcomes. Our sample size of 118 patients provided greater than 80% power to reject the null hypothesis using parameters from a previous study. Chi-square or student's t-tests were used to test for group differences in demographics and clinical characteristics. Multivariable Cox proportional hazards regression analyses were used to identify surgical and patient characteristics related to the hazard of a complication, revision to a higher level, and timing of prosthetic fitting within the first post-operative year.

Results:

Our query returned 118 total patients, of which 40 underwent a multi-staged amputation based on the surgeon's typical amputation preferences. Age, pre-operative WBC (white blood cell) count, history of prior amputation, presence of diabetes, insurance type, and presence of osteomyelitis were unequally distributed across groups. These variables were considered potential confounding variables in our analyses. In the multivariable model, an increase in pre-operative WBC count and a multi-staged procedure were associated with a significantly higher hazard of complications ($p=0.04$ and $p=0.004$, respectively). There were no significant associations for multi-staged amputations to increase the hazard of revision amputation or increase the likelihood of prosthetic fitting within one post-operative year.

Conclusion:

Based on these results, multi-staged transtibial amputations do not demonstrate a significant improvement in functional outcome and may suggest a higher level of complication risk compared to single-staged amputations. As these outcomes do not control for disease severity, more analyses will be required to determine the extent to which these results may be applicable for electively staged amputations compared to elective single-stage amputations.