Time-Dependent Limb Assessment of High-Energy Lower Extremity Trauma Improves Prediction of Amputation A Secondary Analysis of the OUTLET Study

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INTRODUCTION: The decision to reconstruct or amputate a limb after high-energy lower extremity trauma is influenced by time-dependent factors including evolution of the extent of injury and complications. The purpose of this study was to introduce a time-dependent classification of limb condition and assess its association with amputation.

METHODS: This was a secondary analysis of OUTLET, a multicenter study of participants aged 18-60 with a Gustilo-Anderson Type III pilon, talar, calcaneal, IIIB or C ankle fracture, or an open or closed blast/crush foot injury. The primary outcome was amputation within 18 months. The Orthopaedic Trauma Association Open Fracture Classification (OTA-OFC) was modified to score the evolving condition of the injured limb throughout the treatment course to create a novel time-dependent OFC (tOFC). Cox proportional hazards models were fit to estimate the hazard of amputation associated with tOFC domains over time and compared to models using the baseline OTA-OFC.

RESULTS: 568 participants comprised the study sample, of which 99 underwent amputation. The average age was 38, 33% female, and 68% White. Using the least injured state (score=1) as the referent, the highest adjusted hazard ratios for amputation were estimated for 2-point changes in the skin (6.1-fold; 95% CI: 3.1-12.0), muscle (28-fold; 95% CI: 6.8-117), arterial (12.9-fold; 95% CI: 7.1-23.2), and contamination (7.2-fold; 95% CI: 2.9-18.0) domains of the tOFC. When the relationship of the tOFC with amputation was allowed to change after two weeks from injury, further improvements in model fit were found for skin (p=0.03) and muscle domains (p=0.005). The time-dependent models outperformed baseline models, with the largest effect sizes observed within 14 days after injury.

DISCUSSION AND CONCLUSION: A longitudinal modification of the OTA-OFC improves prediction of amputation, especially among skin and muscle domains. Dynamic, quantitative limb viability assessment more accurately reflects clinical practice and patient management but requires prospective validation.