Time-Dependent Domains of the OTA Open Fracture Classification Predict Decision to Amputate After Severe Ankle and Hindfoot Injuries

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Purpose: The decision to reconstruct or amputate a limb after high-energy lower extremity trauma is influenced by time-dependent factors including an evolving zone of injury and complications. However, current classification systems only measure limb status at initial presentation. The purpose of this study is to assess the association of baseline covariates and evolving limb status, as measured by a novel time-varying adaptation of the OTA Open Fracture Classification (OTA-OFC), with the decision to amputate after severe ankle and hindfoot trauma.

Methods: We performed a secondary analysis of OUTLET, a multicenter study of patients 18-60 years who sustained a Gustilo-Anderson Type 3 pilon, talar, calcaneal, 3B or C ankle fracture, or an open or closed blast/crush foot injury. The primary outcome of interest was amputation within 18 months. Baseline demographics and injury characteristics were considered. The OTA-OFC was used at baseline and modified to score the condition of the injured limb throughout the treatment course. Cox proportional hazards models included time-dependent OFC, age, body mass index (BMI), major comorbidities, and ISS.

Results: 570 participants comprised the study sample of whom 118 underwent amputation. Of those amputated, 16 (14%) were performed more than 3 months after injury and 27 (23%) were performed secondary to a complication from attempted reconstruction. The rate of any amputation was 18 per 100 person-years of follow-up. There were no significant differences in age, BMI, comorbidity count or ISS between those who were amputated and those undergoing limb reconstruction. Using the least injured state (score = 1) as the referent, significantly higher adjusted hazard ratios for amputation were estimated for 1-point (2.6 to 3.1-fold) and 2-point (3.2 to 16.4-fold) changes in the skin, contamination, arterial, and muscle domains of the OTA-OFC. No association was noted between the bone domain of OTA-OFC and the decision to amputate.

Conclusion: This secondary analysis of a large prospective cohort study endeavored to describe the longitudinal clinical decision-making process regarding limb reconstruction versus amputation after severe trauma to the ankle and foot. A longitudinal modification of the OTA-OFC as a time-dependent covariate demonstrated strong adjusted associations between amputation and the skin, arterial, muscle, and contamination domains of the OTA-OFC.

Table 1. Results from Cox Proportional Hazard modeling the hazard of any amputation using time-dependent OFC scores and random effects for site

	Crude HR (95% CI)	Adjusted[1] HR (95% CI)	p-value for adjusted model
Max OFC (N=570)			
2 vs. 1	1.1 (0.1, 8.3)	0.9 (0.1, 7.3)	0.95
3 vs. 1	2.5 (0.3, 19.1)	2.3 (0.3, 17.4)	0.43
Skin OFC (N=569)			
2 vs. 1	2.8 (1.6, 4.6)	2.8 (1.6, 4.6)	<0.001
3 vs. 1	3.1 (2.0, 5.0)	3.2 (2.0, 5.1)	<0.0001
Arterial OFC (N=569)			
2 vs. 1	2.5 (1.6, 3.9)	2.6 (1.7, 4.0)	<0.0001
3 vs. 1	11.5 (7.2, 18.3)	11.5 (7.1, 18.5)	<0.0001
Muscle OFC (N=570)			
2 vs. 1	3.1 (1.4, 6.9)	3.0 (1.4, 6.8)	0.006
3 vs. 1	15.8 (7.2, 34.7)	16.4 (7.5, 35.6)	<0.0001
Contamination OFC (N=569)			
2 vs. 1	3.0 (1.9, 4.9)	3.1 (1.9, 5.0)	<0.0001
3 vs. 1	5.1 (2.9, 9.1)	5.5 (3.1, 9.8)	<0.0001
Bone OFC (N=569)			
2 vs. 1	1.4 (0.5, 4.0)	1.3 (0.4, 3.7)	0.66
3 vs. 1	0.8 (0.3, 2.5)	0.8 (0.3, 2.4)	0.70

[1]Adjusted for age, BMI, count of major comorbidities, injury severity score