The Combined Geriatric Nutritional Risk Index–ASA–RAI–Preoperative Acute Severe Condition (CGARP) Score: A Novel Composite Index Predicting Mortality and Non-Home Discharge After Transmetatarsal Amputation

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INTRODUCTION:
Transmetatarsal amputation (TMA) is a common limb-salvage procedure in high-risk vascular and diabetic patients. However, postoperative mortality and non-home discharge remain significant concerns. Existing frailty indices, such as the Risk Analysis Index (RAI), Geriatric Nutritional Risk Index (GNRI), and American Society of Anesthesiologists (ASA) classification, have each demonstrated value in surgical risk stratification. These indices are typically applied in isolation. Currently, no integrated model combines frailty, nutrition, and acute physiologic severity into a single predictive framework for patients undergoing TMA. This study aimed to develop and internally validate the Combined Geriatric Nutritional Risk Index, ASA, RAI, and Preoperative Acute Severe Condition (CGARP) score to improve prediction of adverse 30-day outcomes.
METHODS:
We conducted a retrospective cohort study using ACS-NSQIP data (2015–2021) to identify adult patients (age ≥18) who underwent transmetatarsal amputation. Patients were excluded for age ≥90, emergent procedures, concurrent operations, or missing frailty data. The CGARP score was derived by integrating four preoperative risk metrics: RAI, GNRI (as inverse-GNRI), ASA class, and a newly defined Preoperative Acute Condition Score (PACS). Primary outcomes included 30-day mortality and non-home discharge. Secondary outcomes were complications, extended length of stay (eLOS ≥4 days), readmission, and reoperation. Predictive performance was assessed via AUROC analysis and compared to individual indices using DeLong's test, with bootstrap validation using 100 replications.
RESULTS:
Among 2,897 patients (mean age 61.1±12.7; 71.3% male), 30-day mortality occurred in 2.7% and non-home discharge in 37.5%. CGARP outperformed all individual frailty metrics in predicting mortality (AUROC 0.785, 95% CI 0.706–0.848), compared to RAI (0.718), ASA (0.684), PACS (0.657), GNRI (0.611), and mFI-5 (0.668) (all $p<0.01$). For non-home discharge, CGARP and RAI tied with AUROC 0.704, both significantly outperforming other indices (all $p<0.01$). In multivariable models adjusted for demographics and comorbidities, CGARP remained independently predictive of mortality (OR 2.72 per point, 95% CI 2.14–3.44, $p<0.001$) and non-home discharge (OR 2.96 per point, 95% CI 2.50–3.51, $p<0.001$), while other indices lost significance. Bootstrap-corrected AUROCs remained high (0.777 for mortality; 0.698 for discharge).
DISCUSSION AND CONCLUSION:
The CGARP score is a novel composite index that combines frailty, nutritional status, and acute physiologic stress. It demonstrated superior predictive accuracy for 30-day mortality and non-home discharge following transmetatarsal amputation. Because the score relies on routinely collected preoperative data, it offers real-time clinical utility and is suitable for integration into perioperative workflows. These findings support the role of composite modeling in surgical risk stratification and suggest CGARP may enhance precision care and discharge planning for high-risk surgical patients. Future research should focus on external validation and clinical implementation.