The CGARP Score: A Novel Composite Risk Model Outperforms Conventional Indices in Predicting Adverse Outcomes After Lumbar Discectomy

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INTRODUCTION:
Frailty is a well-established predictor of postoperative outcomes in spine surgery. However, existing tools such as the Risk Analysis Index (RAI), Geriatric Nutritional Risk Index (GNRI), modified Frailty Index-5 (mFI-5), American Society of Anesthesiologists (ASA) classification, and acute physiologic severity scores are typically applied independently. No validated composite model currently exists for surgical risk stratification in lumbar discectomy patients, despite the rising prevalence of frailty and malnutrition in this population. This study aimed to develop and internally validate a novel composite frailty-nutritional risk score, the CGARP score (Combined GNRI, ASA, RAI, and Preoperative Acute Condition), to improve prediction of adverse 30-day outcomes following endoscopic and open lumbar discectomy.
METHODS:
We conducted a retrospective cohort study using the ACS-NSQIP database (2015–2021), identifying adult patients (age ≥18) who underwent lumbar discectomy using CPT codes 62380 (endoscopic) and 63030 (open). Patients were excluded for age ≥90, emergency surgery, or missing frailty data. We evaluated five preoperative indices: RAI, GNRI, ASA, mFI-5, and Preoperative Acute Condition Score (PACS). The CGARP score was developed from multivariable logistic regression coefficients for mortality. Primary outcomes included 30-day mortality, complications, extended length of stay (eLOS ≥1 day), readmission, reoperation, and non-home discharge. Predictive performance was assessed using AUROC analysis and internally validated with 100 bootstrap replications.
RESULTS:
Among 50,476 patients (mean age 51.8±15.8; 56.1% male), mortality occurred in 0.2%, major complications in 1.3%, unplanned readmissions in 3.7%, and eLOS in 24.2%. All individual indices were significantly associated with mortality and complications in univariate analysis. The CGARP score demonstrated superior AUROC for predicting mortality (0.758), major complications (0.735), minor complications (0.716), eLOS (0.653), and non-home discharge (0.794), significantly outperforming individual indices ($p<0.001$). In multivariable analysis, CGARP remained independently associated with mortality ($p<0.001$), whereas RAI ($p=0.17$), ASA ($p=0.05$), and PACS ($p=0.042$) lost standalone significance. Bootstrap validation yielded bias-corrected AUROCs of 0.751 (mortality), 0.727 (major complications), and 0.646 (eLOS), confirming model stability.
DISCUSSION AND CONCLUSION:
This study introduces the CGARP score, a novel multidimensional risk stratification model that combines frailty, nutritional status, anesthetic risk, and acute physiological burden to predict 30-day outcomes after lumbar discectomy. CGARP significantly outperformed traditional indices across all major postoperative outcomes and demonstrated strong internal validity. Its reliance on routinely available preoperative data improves feasibility for clinical use, supporting more accurate surgical risk prediction, perioperative planning, and discharge preparation. External validation and integration into clinical decision-support systems are needed to support the adoption of CGARP in spine surgery care pathways.