The Relative Contribution of Medical Comorbidities in the OARA Score: A Machine Learning Analysis

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Background/Objective: The Outpatient Arthroplasty Risk Assessment (OARA) score has been used successfully to identify patients who can safely undergo outpatient primary total joint arthroplasty (TJA) based on medical risk stratification. The targeted score (0 to 79) was conservatively established to ensure patient safety. However, the number of points associated with each of the 52 comorbidities in the OARA score were assigned based on physician experience with early discharge. This study applied machine learning (ML) to empirically identify the relative contribution/importance of each medical comorbidity to safe same-day discharge (SDD).

Methods: 3,047 patients who underwent primary unilateral TJA by a single surgeon at a single institution were included in the analysis; 573 were SDDs. Before ML analysis, associations among binary (yes/no) comorbidities were examined using Cramér's V. A CART decision tree model using Gini method was used to develop a model for SDD (yes/no) based on the presence or absence of the comorbidities.

Results: To produce interpretable results with acceptable face validity the 52 comorbidities were grouped in 19 common medical categories (heart disease, liver disease, etc.). Although the resulting model was less than perfectly predictive (AROC = 0.652, 95% CI 0.629–0.675), it resulted in an interpretable classification tree identifying heart disease, kidney disease, immunosuppression, chronic sedative use, pulmonary disease, thrombophilia, anemia, and history of stroke, in order, as the most important predictors of SDD.

Conclusion: Model limitations expressed as AROC were not unexpected because the relative contribution (expressed as points) of comorbidities to the OARA score are based on physician decision-making, not empirical identification of the importance of each medical condition to safe SDD. Study results moved the goal of empirical classification forward but the low prevalence of many of the comorbidities limited variability and hence model performance and accuracy. Future work with a larger sample is being planned.