Risk Prediction Model for Manipulation Under Anesthesia after Total Knee Arthroplasty

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INTRODUCTION: Manipulation under anesthesia (MUA) is commonly performed after total knee arthroplasty (TKA) for patients with arthrofibrosis to improve range of motion. The purpose of this retrospective cohort study was to develop a risk prediction model for requiring MUA after primary TKA using patient comorbidities and demographic risk factors.

METHODS:
We identified all patients who underwent primary TKA at a single institution between January 2020 and January 2022. We compared demographic data including age, sex, race, marital status, smoking status, BMI, and comorbidities of patients who required MUA to patients who did not require MUA. Predicted probabilities were estimated using logistic regression models for potential predictors, and AIC was used to determine best model fit. Harrell's C-statistic was used to validate the model performance using the remaining 30%. Risk scores were calculated using the final predictive model.

RESULTS: Of the 1,374 patients who underwent primary TKA, 112 required MUA (8.15%). Younger age ($p<0.0001$), smoking status ($p=0.05$), and female sex ($p=0.01$) were significant risk factors for requiring MUA. African American race ($p=0.10$), marital status ($p=0.18$), and obesity ($p=0.67$) increased risk for requiring MUA but results did not reach significance. Comorbidities including diabetes ($p=0.80$), rheumatoid arthritis ($p=0.76$), anxiety ($p=0.95$), and depression ($p=0.97$) were not significant. The final model included age, sex, race, smoking status, and BMI as predictors and had validation C-statistic of 0.722. With this model, a 50-year-old female, African American, smoker with BMI >30 has a 32.6% chance of needing MUA, whereas an 85-year-old male, Caucasian, non-smoker with BMI <30 has a 1.7% chance of needing MUA.

DISCUSSION AND CONCLUSION: We developed the first risk prediction model for MUA after primary TKA using patient comorbidities and demographic risk factors. Future prospective research will use the model to identify patients with elevated individual risk and determine if early intervention reduces risk of MUA.

Age	BMI	Smoking Status	Sex	Race	Probability of MUA
85	Not Obese	Never Smoker	Male	White	1.68%
93	Obese	Smoker	Female	White	2.81%
75	Obese	Smoker	Male	Other	3.74%
66	Obese	Never Smoker	Male	White	4.04%
76	Obese	Smoker	Male	Black	7.65%
64	Obese	Never Smoker	Female	Other	7.74%
57	Not obese	Smoker	Female	White	12.68%
44	Obese	Smoker	Male	Other	14.44%
52	Not Obese	Smoker	Female	White	15.07%
65	Obese	Smoker	Female	Black	19.72%