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A machine learning model utilizing only six variables can accurately predict outcomes following posterior cervical fusion

Spencer Smith BS, Jung Yoo MD

Keywords:

Humans, Body Mass Index, Spinal Fusion, Spinal Diseases, Machine Learning, Ankylosis, Albumins

Abstract:

Introduction

The practical application of machine learning models in clinical medicine is limited by the substantial amount of time required to input the many variables that the models depend on. This study aimed to develop a good-performing prediction tool for outcomes after posterior cervical fusion procedures using a limited number of pre-operative variables.

Methods

A retrospective analysis of the NSQIP database from 2010 to 2020 evaluated the prediction ability of six pre-operative variables, including WBC count, HCT, albumin, ASA score, BMI, and age, on complications, readmission, home discharge, 30-day mortality, and length of stay. A random forest classification model and 10-fold cross validation assessed the prediction ability, with AUC, sensitivity, and specificity used to evaluate model effectiveness.

Results

Between 2010 and 2020, a total of 10,357 patients who underwent posterior cervical fusion were identified in the NSQIP database.

The models for complications, home discharge, and 30-day mortality demonstrated good predictive accuracy, with respective AUC values of 0.72, 0.76, and 0.82. Sensitivity and specificity measures were also reported, with complications demonstrating a sensitivity of 60% and specificity of 78%, home discharge exhibiting a sensitivity of 73% and specificity of 69%, and the 30-day mortality model achieving a sensitivity of 79% and specificity of 86%.

Conversely, the model for 30-day readmission exhibited a very weak predictive AUC value of 0.55, with a sensitivity and specificity of 57% and 55%, respectively.

Conclusion

Age, BMI, albumin, WBC, ASA, and HCT were the only pre-operative variables needed to create a good prediction tool for major outcomes after posterior cervical fusion. Using only six variables would allow clinicians, patients, and hospitals to quickly assess the chance of different outcomes and plan for them.