Nomogram to Predict Unplanned Intensive Care Unit Admission Following Adult Spinal Deformity

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INTRODUCTION:

ICU admission practices following ASD varies widely among spine surgeons. We surveyed spine surgeons and examined patients who were admitted to the ICU outside of the standard protocol. This study aims to define a nomogram that predicts ICU admissions within a large study group.

METHODS:

Patients who underwent ASD surgery were included. Risk factors for ICU admission after spine surgery were identified from previous literature. These variables were added to a Lasso regression to determine the ones with the highest impact on ICU admission. After feature selection, logistic regression was optimized to predict ICU admission. The receiver operating characteristics (ROC) curve was plotted and coefficients as well as odds ratio for each of the selected variables was calculated. The nomogram was developed on 60% of the cohort and tested on 40%.

RESULTS:

557 patients were included with 8.2% (46 patients) sustaining major intraoperative or in-hospital medical adverse events requiring moderate or severe intervention, and 22% (125 patients) were admitted to the ICU. Of those, only 20/125 patients had major medical adverse events. Lasso regression identified ASA, pre-operative albumin, kidney disease at baseline, and estimated blood loss (EBL) to be the highest predictors of ICU admission. The ROC curve was plotted for ICU admission with an area under the curve of 0.8. The nomogram was developed to predict ICU admission using these 4 variables (Figure 1). After being tested on 40% of the cohort, it had an accuracy of 78%, a sensitivity of 60% and a specificity of 97%. Furthermore, the model had a threshold of 80 points for ICU admission which could be calculated using points assigned to the values of the 4 included variables. The nomogram may also be able to predict unnecessary ICU admissions, reducing costs by $1560 (median ICU admission cost).

DISCUSSION AND CONCLUSION: This novel nomogram predicts post-operative ICU admission following ASD surgery utilizing EBL, ASA score, history of kidney disease, and pre-operative Albumin with an accuracy of 78%. While this model helps predict global practice patterns associated with our pool of surgeons, ICU admissions remain an area of need for further research and standardization. Future studies can build on this nomogram to provide guidelines and predictive models for appropriate ICU admission