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A Novel Neurosurgical DVT Prediction Model

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Introduction

Venous thromboembolic events (VTE), including deep venous thrombosis (DVT) and pulmonary embolism (PE), are a common source of morbidity and mortality. Developing a predictive model from a neurosurgical population to accurately stratify peri-operative DVT/PE risk would allow providers to more accurately tailor DVT prophylaxis.

Methods

2879 patients between July 2014 and June 2015 were retrospectively evaluated. DVT/PE risk factors, patient demographics, surgical procedure, VTE prophylaxis, and DVT/PE confirmation were collected. In half of the cohort, the impact of surgical categorization and risk factors on peri-operative VTE development were assessed using logistic regression analysis. Odds ratios of significant risk factors were used to generate a DVT prediction model, and area under the receiver operating curve (AUROC) was used to validate the risk assessment model in the second cohort.

Results

On initial univariate analysis, surgical procedure, history of DVT/PE, malignancy, sepsis, pneumonia, length of surgery, recent stroke, prolonged bed rest, and spinal cord injury significantly ($p<0.01$) correlated with VTE development. Based on this analysis, a neurosurgical DVT prediction model was developed. Surgical procedures were awarded the following points: functional (0), endovascular (1), shunt (2), spine (2), and cranial (3). Malignancy and length of surgery >3 hours received 1 point. History of DVT/PE, sepsis, stroke and spinal cord injury were awarded 2 points. Prolonged bed rest and pneumonia were awarded 3 points. This scoring system generated an AUROC of 0.830 (95% CI: 0.791-0.869).

Conclusions

This novel neurosurgical-tailored DVT prediction model appropriately stratifies DVT/PE risk with very good accuracy. Utilizing the ROC analysis, patients at low risk (score of <3, sensitivity 97.6%), moderate risk (4-6), high risk (7-10), and very high risk (=11, specificity 95.9%) carry a 0.5%, 2.7%, 12.8%, and 23.3% risk of VTE, respectively. This model can be used to improve decision-making regarding DVT prophylactic strategies in neurosurgical patients.

Learning Objectives

1. Describe the importance of DVT/PE prevention in neurosurgical patients.

2. Discuss the importance of risk assessment modeling in neurosurgical patients.

3. Identify effective way to implement this risk assessment model to decrease DVT/PE incidence and complications of prophylaxis.

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