Prediction of Pulmonary Embolism in Trauma Patients: A Risk Assessment Model Based Upon 38,000 Patients

Sheena R. Black, MD[1]*; Jeffrey T. Howard, MA*[2]*; Paul C. Chin, MD, PhD*[1]*; Adam J. Starr, MD*[1]*;*
[1]*Department of Orthopaedic Surgery, University of Texas Southwestern Medical Center, Dallas, Texas, USA;*
[2]*Department of Demography, University of Texas at San Antonio, San Antonio, Texas, USA*

Purpose: Pulmonary embolism (PE) is a rare but sometimes fatal complication of trauma. Many studies have identified risk factors and developed risk stratification models to identify patients at an increased risk of venous thromboembolism; however, they are often complex and difficult to use. The purpose of this research is to develop a risk assessment model, based upon a large sample of trauma patients, which can be easily and quickly used at the time of admission to predict PE.

Methods: Our institutional trauma registry was queried. The National Trauma Registry of the American College of Surgeons (NTRACS) registry system collects voluminous data on each patient registered. We targeted the following information: demographic and injury data, prehospital information, and data on treatments and events during hospitalization. Out of 49,604 patients admitted to our trauma center from 2000-2012, 11,007 (22%) were excluded due to incomplete data. This study used trauma registry data from the remaining 38,597 trauma patients. Of these patients, 239 (0.619%) developed a PE. A multivariate binary logistic regression model was developed to predict the likelihood of developing a PE during each patient's hospitalization. The logistic regression model was developed using a 50%, randomly selected development subsample, and then tested for accuracy of prediction using the remaining 50% validation sample. The two random subsamples did not differ with respect to any demographic, injury, prehospital, or hospital treatment variables examined.

Results: Results from this study suggest there are seven statistically significant predictors of PE, including age, obesity, injury resulting from motorcycle accident, arrival to hospital by helicopter or ambulance, pulse rate upon arrival in emergency room, admission to ICU, and location of injury (thorax, abdomen, and lower extremity). Comparison of predicted PE events to actual PE events resulted in high sensitivity (82%) and specificity (75%). The comparison of odds ratios in the model development and validation samples was nonsignificant ($P = 0.4032$), indicating that predictions from the model do not differ between the two samples.

Conclusion: Using this model, based on data available upon admission, we were able to correctly predict 88.9% of the pulmonary emboli within the top 35% of the model score distribution of our validation subsample. This knowledge will allow us to focus more stringent and earlier thromboprophylactic efforts on those patients at highest risk for PE. In the future, this model will be used to develop an application suitable for smart phone devices, to allow physicians easy and accurate identification of trauma patients at high risk for the development of PE.

- The FDA has not cleared this drug and/or medical device for the use described in this presentation (i.e., the drug or medical device is being discussed for an "off label" use). For full information, refer to page 600.