CLINICAL RESEARCH STUDY

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Assessing the Caprini Score for Risk Assessment of Venous Thromboembolism in Hospitalized Medical Patients

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ABSTRACT

BACKGROUND: The optimal approach to assess risk of venous thromboembolism in hospitalized medical patients is unknown. We examined how well the Caprini risk assessment model predicts venous thromboembolism in hospitalized medical patients.

METHODS: Between January 2011 and March 2014, venous thromboembolism events and risk factors were collected from non-intensive care unit medical patients hospitalized in facilities across Michigan. After calculation of the Caprini score for each patient, mixed logistic spline regression was used to determine the predicted probabilities of 90-day venous thromboembolism by receipt of pharmacologic prophylaxis across the Caprini risk continuum.

RESULTS: A total of 670 (1.05%) of 63,548 eligible patients experienced a venous thromboembolism event within 90 days of hospital admission. The mean Caprini risk score was 4.94 (range, 0-28). Predictive modeling revealed a consistent linear increase in venous thromboembolism for Caprini scores between 1 and 10; estimates beyond a score of 10 were unstable. Receipt of pharmacologic prophylaxis resulted in a modest decrease in venous thromboembolism risk (odds ratio, 0.85; 95% confidence interval, 0.72-0.99; $P = .04$). However, the low overall incidence of venous thromboembolism led to large estimates of numbers needed to treat to prevent a single venous thromboembolism event. A Caprini cut-point demonstrating clear benefit of prophylaxis was not detected.

CONCLUSIONS: Although a linear association between the Caprini risk assessment model and the risk of venous thromboembolism was noted, an extremely low incidence of venous thromboembolism events in non-intensive care unit medical patients was observed. The Caprini risk assessment model was unable to identify a subset of medical patients who benefit from pharmacologic prophylaxis.

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KEYWORDS: Caprini risk assessment model; Deep venous thrombosis; Pharmacologic prophylaxis; Pulmonary embolism; Venous thromboembolism

Venous thromboembolism, including deep vein thrombosis and pulmonary embolism, is a common cause of morbidity and mortality in hospitalized patients. Although national guidelines endorse assessing venous thromboembolism risk in hospitalized medical patients through the use of various risk assessment models,[1-6] no accepted standard by which to perform this evaluation is currently available.[7] Despite this fact, the Joint Commission and the Centers for Medicare and Medicaid Services have introduced a performance measure for venous thromboembolism prophylaxis in hospitalized medical patients. This measure requires clinicians to provide

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venous thromboembolism prophylaxis or document reasons for its omission.[8]

Originally developed for surgical patients, the Caprini risk assessment model facilitates the derivation of venous thromboembolism risk by summing individual risk factors to place patients into 4 categories: "low risk" (0-1 points), "moderate risk" (2 points), "high risk" (3-4 points), and "highest risk" (≥5 points).[1] Although the Caprini risk assessment model has been widely adopted and is increasingly applied to hospitalized medical patients,[9-11] it is not known whether this tool adequately predicts venous thromboembolism or identifies a risk threshold for which anticoagulation prophylaxis is beneficial.

A statewide quality collaborative aimed at preventing adverse events in hospitalized medical patients, the Michigan Hospital Medicine Safety Consortium (HMS) collects detailed data on venous thromboembolism risk factors and outcomes across diverse Michigan hospitals.[12] By using data from this collaborative, we conducted a retrospective study to assess the utility of the Caprini risk assessment model in predicting risk of venous thromboembolism in hospitalized medical patients.

CLINICAL SIGNIFICANCE

- The Caprini risk assessment model demonstrated a linear relationship between the Caprini score and the risk of venous thromboembolism in hospitalized medical patients.
- The Caprini model was unable to identify a subset of patients who benefit from pharmacologic prophylaxis.
- Given the very low incidence of venous thromboembolism in this patient population, a strategy of universal pharmacologic prophylaxis cannot be recommended.

MATERIAL AND METHODS

Study Setting and Participants

The HMS is a collaborative of 48 hospitals in Michigan dedicated to preventing adverse events in hospitalized medical patients through creation of a data registry and sharing of best practices. The setting and design of HMS have been described.[12,13] Although voluntary, each hospital receives payments from Blue Cross Blue Shield of Michigan and Blue Care Network for participating in the consortium and for data collection.

Eligible cases included patients admitted to a medicine service for 2 or more days. Patients were excluded if they met any of the following criteria: (1) aged <18 years; (2) pregnant; (3) any surgical procedure during the admission; (4) direct admission to an intensive care unit; (5) direct admission for end-of-life or comfort care; (6) diagnosis of venous thromboembolism in the 6 months before admission; (7) admitted for presumed venous thromboembolism; (8) admitted under observation status; (9) readmitted within 90 days of discharge from an admission included in the registry; or (10) receiving systemic anticoagulation.

Clinical data were collected through a standardized process at each hospital by trained medical record abstractors. Patients discharged from each participating hospital were sampled on an 8-day rolling cycle to avert bias in selecting cases for review.[14] Follow-up data were collected through both medical record review and direct telephone follow-up 90 days after hospital discharge. In the event a patient was transferred to an intensive care unit or palliative care, data collection was terminated; however, venous thromboembolism events that may have contributed to such events were captured. Each hospital was audited on an annual basis by quality coordinators to ensure completeness and accuracy of data abstraction.

Ascertainment of Outcomes

The primary outcome was clinically suspected, image-confirmed, hospital-associated venous thromboembolism including proximal upper- or proximal lower-extremity deep vein thrombosis and pulmonary embolism. To be attributable to a hospital, we required that venous thromboembolism events occurred on or beyond the third day of the index hospitalization. Diagnosis of deep vein thrombosis required confirmation via Doppler ultrasound or venography, whereas pulmonary embolism was confirmed by computed tomography scan, ventilation perfusion scan, or pulmonary angiography. Venous thromboembolism outcomes were assessed 90 days after hospital discharge from the index hospitalization. Medical record review at 90 days (including those discharged to home or postacute settings) was completed for 100% of eligible patients in every hospital; telephone follow-up at 90 days was successfully completed for 58% of all patients.

Covariates of Interest

Detailed patient demographic, medical history, physical examination findings, and laboratory and medication data were collected for all patients. Risk factors used to calculate the Caprini risk score were captured. Appropriate venous thromboembolism prophylaxis was defined as receipt of any of the following treatments on day 1 or 2 of the index hospitalization: heparin 5000 units 2 times per day; heparin 5000 units 3 times per day; heparin 7500 units 3 times per day (for morbid obesity); enoxaparin 40 mg/d; enoxaparin 30 mg/d (for creatinine clearance <30 mL/min); enoxaparin 30 mg 2 times per day; dalteparin 5000 U/d; or fondaparinux 2.5 mg/d.[12,13]

Statistical Analysis

Descriptive statistics were used to illustrate the percentage of patients with each Caprini risk factor. Bivariable logistic