
Patterns of Failure of a Standardized Perioperative Venous Thromboembolism Prophylaxis Protocol



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- BACKGROUND:** Venous thromboembolism (VTE) is a leading contributor to morbidity after operations. We previously implemented a standardized VTE risk assessment, based on the Caprini score, along with risk-stratified prophylaxis. This system reduced the odds ratio of a VTE event from 3.02 to 0.75. We investigated patterns of failure to determine characteristics of patients in whom VTE develops despite the protocol.
- METHODS:** We reviewed all nontrauma general surgery patients with evidence of VTE after the inception of a VTE risk assessment and prophylaxis program. Characteristics were recorded, including demographics, diagnoses, operations, risk profile, prophylaxis prescribed, and regimen compliance.
- RESULTS:** Twenty-seven patients failed the protocol and manifested VTE, representing an overall VTE rate of 0.3%. Of these patients, 63% had emergency operations and 52% underwent multiple operations, compared with 13% and 2.0% of the nontrauma general surgery population in whom VTE did not develop, respectively ($p < 0.001$). Of patients with VTE, 52% had pre-existing or postoperative infections, 22% had malignancies, but only 15% had missed 1 or more doses of pharmacologic prophylaxis during hospitalization. Five VTEs manifested after discharge; one of those patients was prescribed extended prophylaxis beyond hospitalization, and an extended course was not provided to 3 who were eligible. One patient had underestimation of the Caprini score due to lack of awareness of a family history of VTE.
- CONCLUSIONS:** Emergency and multiple operations seem to confer dramatic hazards for VTE, despite standard prophylaxis. These factors are not currently captured in the Caprini model, but might be significant modifiers of risk that should prompt reassessment, perhaps with a weighted numeric value along with enhanced prophylaxis. It is encouraging that most patients received appropriate prophylaxis in compliance with the protocol. (J Am Coll Surg 2016;222:1074–1080. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)
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Venous thromboembolism (VTE) is considered a preventable cause of morbidity and mortality after operations.^{1,2} This complication includes deep venous thromboses (DVTs) and pulmonary emboli (PEs) and can impart both immediate harm, such as sudden death, and long-term sequelae.³ Patients are at particular risk for VTE events after operations, related to the associated inflammatory state, endothelial vascular insult, and venous stasis. A variety of predisposing factors have been identified, each posing differing degrees of hazard that permit the calculation of a numeric VTE risk score.³⁻⁷

Prophylaxis for VTE events has been well studied, and current guidelines suggest consideration of both

Abbreviations and Acronyms

DVT	= deep venous thrombosis
EMR	= electronic medical record
LMWH	= low molecular weight heparin
PE	= pulmonary emboli
VTE	= venous thromboembolism

mechanical and pharmacologic prophylaxes based on risk profiles. In 2008, comprehensive recommendations were proposed by the American College of Chest Physicians.⁶ However, these recommendations were based mainly on operation type, with limited strategies for individual risk assessment. Adherence to these guidelines could potentially result in prophylaxis measures being inappropriately applied, with some high-risk patients receiving inadequate or no prophylaxis and low-risk patients possibly being overtreated.⁸⁻¹⁰ The solution to this problem might be explicit risk stratification and risk-based prophylaxis for every patient.¹¹

National Surgical Quality Improvement Program data revealed our general surgery service to be a high outlier for VTE events in 2009, with a risk-adjusted odds ratio of 3.02. We responded by implementing a mandatory VTE

risk calculation for every patient on the service, integrating the Caprini grading system into the Sunrise Acute Care (Allscripts) electronic medical record (EMR). The derived scores dictate the nature and duration of VTE prophylaxis that can continue on an outpatient basis when indicated by high scores. Electronic reminders about appropriate VTE prophylaxis are automatically generated before and after operations and at discharge. Both mechanical (pneumatic compression boots) and pharmacologic (unfractionated or low molecular weight heparin [LMWH]) prophylaxis are used, as indicated by risk level. The program has successfully reduced the odds ratio of a VTE event to a sustained level in the first NSQIP decile, most recently 0.75 in 2014 (Fig. 1).

Despite the success of our program, VTE events still occur, even when appropriate prophylaxis is administered. The goal of this investigation is to analyze patients who failed the mandatory, standardized prophylaxis system, in hopes of identifying hazards that might not be captured in the current Caprini score.

METHODS

We reviewed NSQIP and University HealthSystem Consortium databases to identify episodes of postoperative

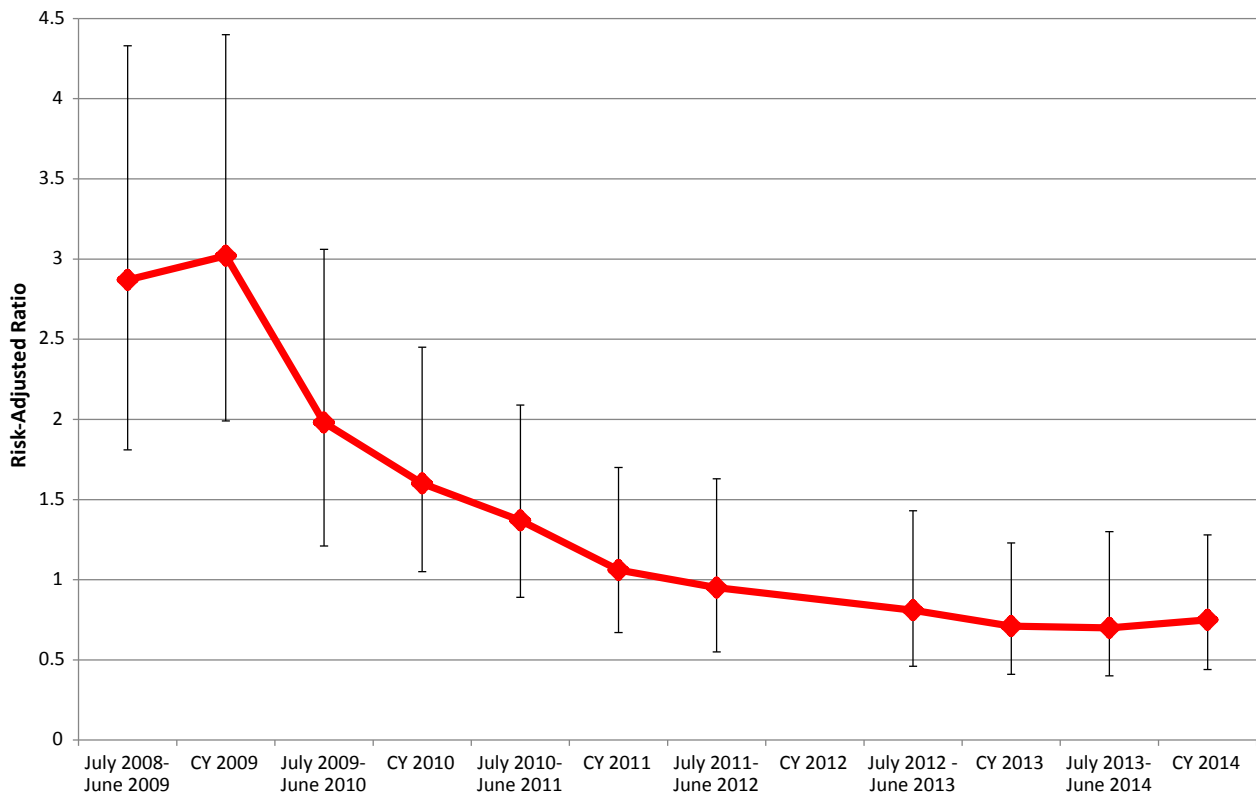


Figure 1. Risk-adjusted ratio for total venous thromboembolism at Boston Medical Center, during consecutive NSQIP reporting periods. For reporting periods before calendar year (CY) 2010, NSQIP reports risk-adjusted data as observed/expected. For CY2010 and later, NSQIP reports risk-adjusted data as odds ratios. Vertical lines indicate 95% CIs.

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