

Prevention of Postoperative Venous Thromboembolism in Thoracic Surgical Patients: Implementation and Evaluation of a Caprini Risk Assessment Protocol

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- BACKGROUND:** Venous thromboembolism (VTE) can be a devastating postoperative complication, with about one-third of VTEs occurring post-discharge. We previously retrospectively evaluated the Caprini VTE risk assessment model (RAM) in postoperative lung and esophageal cancer patients, demonstrating that “high risk” patients were more likely to have a postoperative VTE. In this study, we sought to implement the RAM protocol in thoracic surgical patients to evaluate adherence, safety, and VTE outcomes.
- STUDY DESIGN:** This prospective cohort study at a large safety net hospital included all surgically treated patients within the thoracic surgery division beginning in July 2014. Per RAM protocol, patients with high risk scores were prescribed a total of 30 days of postoperative daily enoxaparin prophylaxis, and moderate risk patients received a total of 10 postoperative days. Adherence and outcome audits were conducted.
- RESULTS:** A total of 126 patients were included for analysis. Provider adherence to RAM score calculation was 99.2% (125 of 126), with appropriate post-discharge prophylaxis prescribed in 96.0% of cases. Twenty-four patients scored high risk (19.2%), 60 were moderate risk (48.0%), and 41 scored low risk (32.8%). Patient adherence to post-discharge enoxaparin prophylaxis was 97.2%. The overall VTE rate was 2.3%, with no post-discharge VTEs or adverse bleeding events.
- CONCLUSIONS:** Implementation of a VTE risk assessment protocol with extended course prophylaxis in high risk patients is safe and feasible for providers and thoracic surgical patients at a large safety net institution with a diverse patient population. Follow-up studies are needed to assess efficacy of the RAM in this surgical population. (*J Am Coll Surg* 2016;222:1019–1027. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

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Postoperative venous thromboembolism (VTE), including pulmonary embolism (PE) and deep vein thrombosis (DVT), remain significant preventable causes of morbidity and mortality in surgical patients. Recent studies suggest that more than one-third of postoperative VTEs occur during the post-discharge period, with risk persisting out to 90 days after surgery.¹⁻⁵ Clinical trials evaluating extended course low molecular weight heparin with enoxaparin anticoagulation for up to 28 to 30 days in abdominal and pelvic cancer surgical patients have shown significant reductions in VTE rates by up to 60% at 30 days.^{6,7}

The Caprini VTE risk assessment model (RAM) has been evaluated in a number of surgical specialties as a decision tool for determining appropriate chemoprophylaxis

Abbreviations and Acronyms

DVT = deep vein thrombosis
PE = pulmonary embolism
RAM = risk assessment model
VTE = venous thromboembolism

in surgical patients based on individual Caprini risk score.⁸⁻¹² A patient's VTE risk factors can be used to identify a total risk factor score and Caprini risk category: low risk (0 to 4 points), moderate risk (5 to 8 points), and high risk (9 or more points).⁹ High risk patients per the RAM are candidates for up to 30 days of postoperative chemoprophylaxis. At Boston Medical Center (BMC), Cassidy and colleagues⁹ demonstrated that the RAM protocol, in conjunction with an early mobility intervention, resulted in 84% and 55% reductions in DVT and PE events, respectively, in general and vascular surgical patients.⁹

The success of a postoperative VTE prevention protocol, including risk assessment and medication administration after discharge, requires commitment from both providers and patients. In particular, patient non-adherence to injected anticoagulant medications like enoxaparin has been reported to be as high as 20% in the community setting and in postoperative orthopaedic patients.^{13,14} Adherence patterns are less clear among surgical patients treated at an urban safety net hospital such as Boston Medical Center, which serves predominantly low-income patients with complex socioeconomic and cultural challenges to health literacy and access to care.

Thoracic surgical patients, such as those with lung and esophageal cancer, are among some of the most at-risk patients for postoperative VTE and related mortality compared with other cancer surgical groups.¹⁵ We previously conducted retrospective evaluations of the Caprini RAM in postoperative lung and esophageal cancer patients, demonstrating that the majority of VTEs occur in patients stratified as high risk, with some events occurring after hospitalization.^{3,16} These studies demonstrated a 5.2% postoperative VTE rate among lung resections for cancer at our institution and a 14.3% VTE rate among esophagectomy cases.

There are currently no consensus guidelines for VTE risk assessment or extended course chemoprophylaxis in thoracic surgical patients. In this study, implementation of the Caprini RAM protocol was conducted in our thoracic surgical division, and provider and patient adherence were evaluated. Venous thromboembolism events and adverse bleeding events in patients receiving extended course prophylaxis were assessed.

METHODS

This prospective cohort study was approved by the Boston University Institutional Review Board. All postoperative patients within the thoracic surgery division at Boston Medical Center were eligible for the study, and enrollment began in July 2014. Informed consent for post-discharge direct patient assessment was conducted at the time of the first or second postoperative clinic visit when one-on-one interviews were performed and medication adherence was evaluated.

The Caprini venous thromboembolism risk assessment protocol

The Caprini risk assessment model is currently used on the general and vascular surgical services at our institution, where it has been prospectively evaluated and modified from the original scoring system published by Bahl and associates.^{8,9} The RAM is comprised of about 40 VTE-related risk factors, such as history of VTE, current cancer diagnosis, recent surgery, and central venous access, each with an assigned weighted score. Per current institutional practice, risk assessment is performed by the provider team throughout the patient hospitalization and most critically, at the time of discharge. For patients at low risk (Caprini scores 0 to 4), no post-discharge prophylaxis is prescribed. For moderate risk patients (score 5 to 8), 10 days of total prophylaxis (including inpatient and outpatient days) is currently prescribed.⁹ For high risk patients (scores ≥ 9), 30 total days of prophylaxis are recommended. If the patient length of stay exceeds the recommended duration per the RAM protocol, routine inpatient prophylaxis is provided up until discharge, with no additional anticoagulation. Currently, all patients on the thoracic surgical service receive routine inpatient prophylaxis with subcutaneous heparin every 8 hours throughout the hospitalization. Post-discharge prophylaxis is continued with daily enoxaparin for the prescribed duration based on the Caprini risk category.

Risk assessment model implementation: provider education and electronic decision support

The Caprini VTE RAM is integrated into the electronic medical record system (Epic) at our institution, and many surgical residents are familiar with the scoring system because they have rotated on other surgical services.⁹ Attending thoracic surgeons and physician assistants were instructed on RAM use and recommendations, and the protocol was reviewed with all rotating residents on the service. Before discharge, VTE risk levels were discussed with patients and caregivers, who received a

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