Prevention and Treatment of DVT and PE

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Summary

Pulmonary embolism and deep vein thrombosis are collectively referred to as venous thromboembolism (VTE). Pulmonary embolism is the most common preventable cause of hospital death. Pharmacologic methods to prevent VTE are safe, effective, cost-effective, and advocated by evidence-based guidelines. Hospitalized medical and surgical patients routinely have multiple risk factors for VTE, but prophylaxis is significantly underused. Multiple national quality initiatives are underway to decrease the rate of VTE during hospitalization and after discharge.

Key Points

- Venous thromboembolism events are common and often fatal.
- Hospitalization is the most important risk factor for developing a VTE.
- Pulmonary embolism is the most preventable cause of hospital death and the number one strategy to improve patient safety in hospitals.
- Pharmacologic methods to prevent venous thromboembolism are safe, effective, cost-effective, and advocated by authoritative guidelines, yet are significantly underused.
- Reducing thromboembolism events is a current focus of many quality initiatives.
- Current guidelines should be followed for identifying and managing those patients who should receive prophylaxis during and after a hospital stay.
- Treatment of DVT and PE should follow published, evidence-based guidelines.

VENOUS THROMBOEMBOLISM IS A DISEASE that often presents as a fatal event and the diagnosis is commonly made on autopsy (see Case Study). Approximately 900,000 pulmonary embolisms (PE) and deep vein thrombosis (DVT) cases occurred in the United States in 2002. An estimated 300,000 deaths secondary to PE occur each year. Seven percent of cases where PE is the cause of death are diagnosed as PE but are treated unsuccessfully, 34 percent occur suddenly, and 59 percent are undetected prior to death.[1] Hospitalization is the most important risk factor for developing a venous thromboembolism event (VTE). The annual number of people at risk for VTE includes 7.7 million medical service inpatients and 4.3 million surgical service inpatients.[2] Two thirds of VTE cases and deaths are hospital-acquired.[1] Despite prevention efforts, the incidence of these events has been increasing (Exhibit 1).[3]

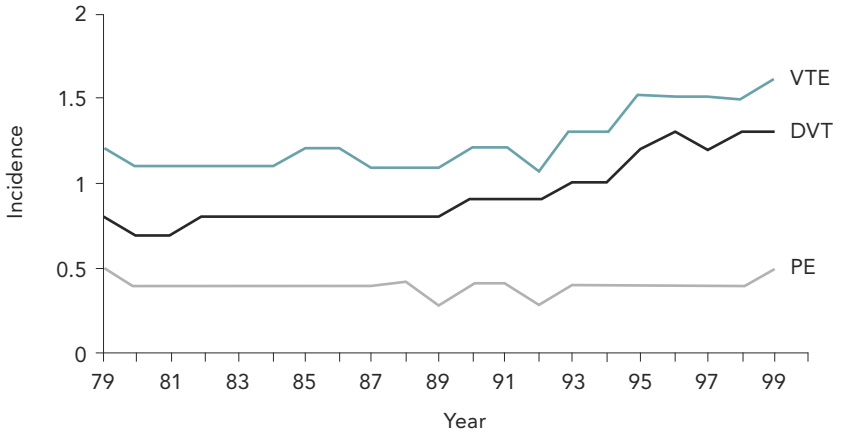
VTE is common after major orthopedic surgery. DVT occurs in 60 percent of patients in the absence of prophylaxis. Despite prophylaxis with low molecular weight heparin (LMWH) or warfarin, 15 to 30 percent still develop DVT.

VTE in hospitalized patients is not just a surgical problem. Fifty to 70 percent of symptomatic VTEs occur in non-surgical patients, and 70 to 80 percent of fatal PEs occur in non-surgical patients.[4] DVT was detected by ultrasound in 33 percent of medical patients in the ICU during an eight-month screening study.[5] Pulmonary embolism is the most preventable cause of hospital death and the number one strategy to improve patient safety in hospitals.

The consequences of VTE include post-thrombotic syndrome and pulmonary hypertension. The overall frequency of post-thrombotic syndrome after symptomatic DVT ranges from 20 to 50 percent.[6] Severe post-thrombotic syndrome occurs in 5 to 10 percent of patients with DVT. The cumulative incidence of symptomatic pulmonary hypertension in patients with acute PE is 3.8 percent at two years.[7]

DVT and PE have a substantial economic impact per patient. The estimated average cost of manage-

Exhibit 1: Rising VTE Incidence in Hospitalized Patients



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ment of DVT is $10,072 and the estimated average cost of management of DVT with PE is $14,649. Hospital readmission may occur in 5 to 14 percent of patients. The mean cost for a readmission for recurrent DVT is $11,862, and $14,722 for PE readmission. More than half of readmissions are within 90 days of initial hospitalization.[8]

VTE prophylaxis has become a significant measure of quality in the hospital setting. As part of the Agency for Healthcare Research and Quality top ten safety practices for hospitals, appropriate VTE prophylaxis in patients at risk is the number one evidence based way to save lives.[9] A national VTE prophylaxis quality initiative began in 2003 with the National Quality Forum (NQF) Safe Practice Standards.[10] The NQF Statement of Policy released in 2006 states "every health care facility shall have a written policy … and continuous quality improvement related to VTE risk assessment, prophylaxis, diagnosis, and treatment".[11] Some VTE quality measures, specifically for surgical patients, have been put into place. The first was the Surgical Care Improvement Project (SCIP) started in 2005. This is a partnership between multiple organizations with the goal of reducing significant perioperative complications by 25 percent in five years. Thromboembolic complications are second in cost behind respiratory complications among the four major perioperative complications.[12]

SCIP has two process measures: 1) recommended venous thromboembolism prophylaxis is ordered during admission and 2) appropriate venous thromboembolism prophylaxis is received within 24 hours before surgical incision time and 24 hours after surgery end time.[13] SCIP defines what procedures are high-risk and require prophylaxis.

Medicare pay-for-reporting legislation has been enacted to help improve the quality of hospital health care.[14] These rules are based on Medicare experience showing that targeted financial incentives can successfully increase hospitals' reporting on quality measures.[15] As a result, hospitals must submit quality data as required, including the two SCIP-VTE measures, or lose their 2-percent annual Medicare payment update. In a 500-bed hospital with 80 percent occupancy and 50 percent Medicare patients, the potential loss of income from Medicare would be $2,600,000 if reporting was not done. In 2007, the first year of the program, 93 percent of hospitals met the Medicare quality reporting goals.[16]

Case presentation: A 32-year-old man was recently hospitalized for a severe fungal infection. Approximately three weeks after discharge, the patient presented to the emergency room with fever, tachycardia, and tachypnea. The patient was admitted to the intensive care unit and was seen by the Infectious Disease consult service. Significant concern was raised for dissemination of the fungal disease versus a hospital-acquired pneumonia. Antifungal therapy was converted to parenteral therapy and aggressive antibacterial therapy was initiated. The tachycardia and increased respiratory rate persisted over the next four days and the patient acutely decompensated and died. A large PE was discovered on autopsy.

Exhibit 2: Levels of Thromboembolism Risk and ACCP Recommendations for Prophylaxis in Hospital Patients[a]

Levels of Risk	Approximate DVT Risk Without Thromboprophylaxis %[b]	Suggested Thromboprophylaxis Options
Low risk		
Minor surgery in mobile patients	< 10	No specific thromboprophylaxis
Medical patients who are fully mobile		Early, "aggressive" ambulation
Moderate risk		
Most general, open gynecologic, or urology surgery patients	10-40	LMWH (at recommended doses), LDUH bid or tid, fondaparinux
Medical patients, bed rest or sick		
Moderate VTE risk plus high bleeding risk		Mechanical thromboprophylaxis
High risk		
Hip or knee arthroplasty, HFS	40-80	LMWH (at recommended doses), fondaparinux, oral vitamin K antagonist (INR 2-3)
Major trauma, SCI		
High VTE risk plus high bleeding risk		Mechanical thromboprophylaxis[c]

[a]Descriptive terms purposely left undefined to allow individual clinician interpretation. [b]Rates based on objective diagnostic screening for asymptomatic DVT in patients not receiving thromboprophylaxis. [c]Mechanical thromboprophylaxis includes IPC or VFP and/or GCS; consider switch to anticoagulant thromboprophylaxis when high bleeding risk decreases.

HFS = hip fracture surgery; IPC = intermittent pneumatic compression; GCS = graduated compression stockings; LDUH = low dose unfractionated heparin; LMWH = low-molecular–weight heparin; SCI = spinal cord injury; VFP = venous foot pump.

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Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS®) is a national patient satisfaction survey that measures communication with nurses and doctors, responsiveness of hospital staff, cleanliness and quietness of hospital environment, pain management, communication about medicines, and discharge information.[17] For patients receiving prophylaxis or treatment for DVT, information about medication as well as appropriate discharge instructions is a key communication point.

Other national initiatives related to VTE include programs targeted at hospital-acquired conditions and readmission measures. Beginning Oct. 1, 2008, Medicare is not paying for 11 selected secondary diagnoses (conditions that developed in the hospital).[18] A DVT or PE after hip replacement or knee replacement is one of the included diagnoses. This reflects progress in translating measures to outcomes. Any VTE occurring during hospitalization is being considered as an unpaid diagnosis for FY 2009. Readmission measures also are under consideration. Readmission within 30 days of discharge for VTE is one measure under NQF scrutiny for use in 2010.[19]

Joint Commission standards for hospitals include six VTE measures for 2009. These measures were adopted from NQF recommendations. These not only span prophylaxis but also safe use of anticoagulants. These measures target VTE prophylaxis, VTE prophylaxis specifically in the ICU, anticoagulation overlap therapy in VTE patients, heparin dosing and monitoring, VTE discharge instructions, and incidence of potentially preventable VTE. Measures will be available for data collection and reporting for discharges beginning autumn 2009. The complete measure specifications will be available in the spring of 2009.[20]

The purpose of the Joint Commission's National Patient Safety Goals (NPSG) is to promote specific improvements in patient safety. The requirements highlight problematic areas in health care, and describe evidence and expert-based solutions to these problems. The requirements focus on system-wide solutions wherever possible. Each year, the Sentinel Event Advisory Group works with TJC to undertake a systematic review of the literature and available databases to identify potential new goals and requirements.

In the September 2008 Sentinel Event Report highlighted information related to anticoagulants. In the sentinel event database from January 1997 to December 2007, 9.3 percent of the events were medication related. Of the medication related events, 7.2 percent (n=32) were related to anticoagulants. These sentinel events resulted in 28 deaths and six loss of functions. Twenty-nine events occurred in

Exhibit 3: Acquired Risk Factors for VTE

ACCP[1]
- Increasing age
- Immobility, paresis
- Previous VTE
- Cancer and/or its treatment
- Surgery
- Trauma (major or lower limbs)
- Obesity
- Central venous catheters
- Inflammatory bowel disease
- Nephrotic syndrome
- Pregnancy and postpartum
- Estrogen therapy or estrogen containing oral contraceptives
- Acute medical illness

THRIFT[2]
- Increasing age
- Immobility (>4d), limb paralysis
- Previous VTE
- Malignancy
- Surgery
- Trauma (pelvis, hips, legs)
- Obesity
- Varicose veins
- Heart failure
- Recent myocardial infarction
- Inflammatory bowel disease
- Nephrotic syndrome
- Pregnancy
- High-dose estrogen therapy
- Infection

1. Geerts WH, et al. *Chest.* 2008;133:381S-453S.
2. THRIFT Consensus Group. *BMJ.* 1992;305:567-574.

the hospital setting.

NPSG 8 is "accurately and completely reconcile medications across the continuum of care" and took effect Jan. 1, 2009. NPSG 3E seeks to reduce the likelihood of patient harm associated with the use of anticoagulation therapy by having organizations evaluate anticoagulation safety practices. There are a few caveats for 3E. It applies to anticoagulation therapy and/or long-term anticoagulation prophylaxis and only where the clinical expectation is that the patient's lab values will remain outside normal values. VTE prophylaxis is "implied" but not explicitly stated. The only anticoagulants covered are warfarin, low molecular weight heparin, and unfractionated heparin. Institutions may develop their own policies and procedures. For example, under E3, warfarin dosage has to be dosed by a standard protocol that must be followed and enforced.

All position statements on prophylaxis state that anticoagulation therapy should be appropriate. It means using the right agent, dose, and duration, and in the right patient. This decision on appropriate therapy must be made while considering the balance of risk and benefit to the individual patient. Exhibit 2 lists the recommendations for prophylaxis in hospital patients with low, moderate, and high-risk for VTE.[4]

Hypercoagulability, direct vessel injury, and blood stasis are clinical conditions that facilitate VTE. The acquired risk factors for VTE has shown in Exhibit 3 but these type lists do not stratify the various risk factors based on importance.[4,21] Not all risk factors are the same. As an example, COPD patients with DVT are older, more likely to be inpatients, more likely to be in the ICU and mechanically ventilated, and more often have concomitant PE.22 Up to 25 percent of hospitalized patients with respiratory conditions are estimated to have DVT.23 The high prevalence of VTE in chronic obstructive pulmonary disease (COPD) patients with exacerbation warrants routine screening for VTE. In patients with heart failure, those with left ventricular ejection fractions less than 20 percent, are at highest risk for a VTE.[24]

VTE is one of the leading causes of death in cancer patients, occurring in 4 to 20 percent of patients. Hospitalized patients with cancer and cancer patients receiving active therapy are at greatest risk for VTE. Major risk factors in cancer patients include older age, comorbid conditions, recent surgery or hospitalization, and active chemotherapy or hormonal therapy. Thus, all hospitalized cancer patients should be considered for prophylaxis. Patients with cancer undergoing surgery should be considered for prophylaxis with LMWH the preferred drug.[25]

The incidence of VTE does increase with increasing numbers of risk factors in an individual patient.[26] It is difficult to develop specific strategies or tools to identify which patients have a low, moderate, or high-risk. Risk assessment tools for identifying patients who need VTE prophylaxis have not been validated and do not necessarily work well.

In a study of patients presenting with a first VTE, hospitalization or nursing home admission within 30 days was the best predictor (Exhibit 4).[27] Thus being acutely ill and requiring hospital or nursing home care is the best predictor of developing a VTE.

VTEs also occur in the outpatient setting. In one

Exhibit 4: Independent Risk Factors for First Lifetime Definite VTE Within Olmsted County

RISK FACTOR[a]	AR[b]	95% CI
Hospitalization or nursing home	58.8	53.4-64.2
Hospitalization with surgery	23.8	20.3-27.3
Hospitalization without surgery	21.5	17.3-25.6
Nursing home	13.3	9.9-16.8
Active malignant neoplasm	18.0	13.4-22.6
Trauma	12.0	9.0-14.9
Congestive heart failure	9.5	3.3-15.8
Prior central venous catheter or pacemaker	9.1	5.7-12.6
Neurological disease with extremity paresis	6.9	3.5-10.2
Prior superficial vein thrombosis	5.4	3.0-7.7

[a]All 8 risk factors together accounted for 74% of all observed VTE cases.
[b]All values are given as percentages. AR = attributable risk. Adjusted for age, sex, year, and terms in final model.

Adapted with permission from Heit JA, et al. Arch Intern Med. 2002;162:1245-1248.

study, 74 percent of VTE presented in outpatients.[28] Twenty three percent of these outpatient VTE patients had recent surgery and 37 percent were recently hospitalized. Only 43 percent had received VTE prophylaxis. A recent hospitalization or surgery is another major risk factor for VTE.

The American College of Cardiology has published guidelines addressing prophylaxis that vary according to patient level of risk. Acutely ill medical patients who have been admitted to the hospital with heart failure, severe respiratory disease, or who are confined to bed and have ≥1 additional risk factors, including active cancer, previous VTE, sepsis, acute neurologic disease, or inflammatory bowel disease should receive pharmacologic prophylaxis.[4,29] For most patients, pharmacologic management is recommended over mechanical. Risk can be reduced by about 50 percent with prophylaxis with LMWH but it cannot be reduced to zero.[30-31] Based on the guidelines, mechanical prophylaxis is only recommended in patients at high-risk for bleeding.[4] There are no data on the use of pneumatic compression devices in general medical patients. There also are no data that mechanical methods reduce the risk of PE or death. The exceptions for mechanical devices are high-risk for bleeding, gynecological surgery, urological surgery, laparoscopic surgery with VTE risks, and neurosurgery. In cases where mechanical methods of prophylaxis are used, the patient's high-risk for bleeding should be documented.

Because many patients develop VTE after leaving the hospital, extended prophylaxis may be necessary. A recent study examined extended prophylaxis with a LMWH in high-risk patients for 28 days.[32] It found a 50 percent reduction in events with pharmacologic prophylaxis. Interestingly, in this study ambulation did not protect against VTE. Specific groups have proven benefits from extended prophylaxis – trauma and high-risk orthopedic patients, postcancer surgery, and at-risk medical patients with continued decreased mobility. Duration of prophylaxis for other patients is an undecided issue. New standards are making hospitals responsible for events that happen after hospitalizations so that this issue is important to hospitals and managed care.

As for treatment of DVT and PE, the majority of patients who present with a DVT can be treated as outpatients with adequate follow-up. Institutions should have a system of practice for managing DVT and PE. Evidence based guidelines are available for managing VTE and should be followed.[4]

Conclusion

VTE is a significant preventable cause of hospitalization and death. Pharmacologic methods to prevent venous thromboembolism are safe, effective, cost-effective, and advocated by authoritative guidelines, yet these preventive methods are significantly underused. Given the national initiatives for reducing the incidence of VTE events, there is a huge motivation for health care systems and managed care to take action in reducing the risk of VTE in hospitalized and post hospitalized patients. **JMCM**

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