

Pharmacist-led program to improve venous thromboembolism prophylaxis in a community hospital

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Venous thromboembolism (VTE), consisting of deep venous thrombosis (DVT) and pulmonary embolism (PE), is associated with increased morbidity, mortality, length of hospital stay, and health care expenses. More than 2 million Americans are affected by DVT annually, with 600,000 developing PE, leading to 60,000 deaths.¹ VTE is recognized as the most preventable cause of inpatient mortality.²

The DVT free registry of 5451 hospitalized patients with documented DVT indicated that 71% of all patients with DVT risk factors received no prophylaxis in the 30 days before diagnosis of DVT; 59% of these patients were nonsurgical.³ These findings illustrate the need for routine VTE risk assessment and prophylaxis among all patients in the acute care setting.

Beginning in 2005, the Joint Commission and National Quality Forum began cooperative development of the National Consensus Standards (NCS) for the Prevention and Care of Deep Vein Thrombosis.⁴ Currently, their focus on VTE risk reduction lies

Purpose. The implementation of a pharmacist-led program to improve venous thromboembolism (VTE) prophylaxis is examined.

Summary. Nursing and pharmacy leaders at a 278-bed hospital reviewed VTE prophylaxis. The review revealed that among the total patient days for a month (excluding maternity, nursery, pediatric, and psychiatry patient days), prophylaxis was administered on only 19.5% of those days. Pharmacy leadership viewed this as an opportunity to make hospitalwide improvements and offered to develop a pharmacist-led program to assess all new admissions for risk of VTE and to recommend appropriate pharmacologic prophylaxis. Under the new program, a pharmacist receives a daily report of all new admissions, which are cross-referenced with a report including patients currently prescribed heparin or low-molecular-weight heparin. Maternity, nursery, pediatric, and psychiatry patients are identified and excluded. The pharmacist assesses the remaining patients for VTE

risk using a tracking sheet. The pharmacist then places all recommendations in the progress notes of the chart in the form of a bold sticker alerting the physician of known risk factors, VTE risk, and treatment recommendations. The program was developed to be performed seven days a week and maintained by one pharmacist per day for an average of four hours a day. Evaluation of the program three and six months after its implementation revealed marked increases in the use of prophylaxis and associated reductions in the occurrence of deep venous thrombosis (DVT) confirmed by Doppler ultrasonography.

Conclusion. A pharmacist-led program for VTE prevention was associated with a significant increase in the prescribing of VTE prophylaxis and a significant reduction in ultrasonographically confirmed DVT.

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with surgical patients through their Surgical Care Improvement Program efforts. In order to satisfy future standards, health care institutions must demonstrate that routine measures

are in place, not only to identify patients at risk for VTE but also to improve outcomes.

In an attempt to improve service to its patients, Saint Elizabeth's Hospital

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began using a VTE risk assessment and prophylaxis order form for all patient admissions. The institution also emphasized the education of hospital staff, physicians, and patients to increase awareness of VTE. After several months of using the order form, performance reviews revealed that it was underused and, thus, ineffective. These findings prompted the development of a pharmacist-led VTE prophylaxis program. The purpose of the program is to improve patient care and to increase adherence to current evidence-based medicine practices regarding VTE prophylaxis. This article describes how the current program developed.

Background

Saint Elizabeth's Hospital is a 278-bed, not-for-profit facility representing over 40 medical specialties. The hospital serves the metropolitan St. Louis and Southern Illinois areas and sees an average of more than 13,000 admissions annually. In 2005, nursing and pharmacy leaders discussed the possible relationship between inpatient cardiac arrests and seemingly underused VTE prophylaxis. In response to this concern, pharmacy reviewed VTE prophylaxis use for the month of August 2005. The review revealed that out of 4,151 total patient days for the month

(excluding all maternity, nursery, pediatric, and psychiatry patient days), pharmacologic prophylaxis was administered on only 808 (19.5%) of those days. (It was understood that not all patients' days are associated with risk for VTE.) Additionally, data from the institution's vascular laboratory revealed that DVT confirmed by Doppler ultrasonography occurred in 1 hospitalized patient per 88 patient discharges.

Order form and educational efforts

Pharmacy leadership attempted to improve prophylaxis rates by developing a VTE risk assessment and prophylaxis order form to potentially be used on all admissions. This form was reviewed by nursing leaders who agreed that it should be presented with the institution's VTE data to the pharmacy and therapeutics (P&T) committee.

To justify addressing improvements in VTE prophylaxis, the pharmacy's presentation to the P&T committee included descriptions of the NCS⁴ as well as a summary of the seventh American College of Chest Physicians recommendations for VTE prophylaxis.⁵ The P&T committee was eager to address the lack of attention paid to VTE prophylaxis within the hospital and make it one

of the institution's top performance-improvement initiatives.

Before implementing the VTE assessment and prophylaxis form, hospital staff and physicians received intensive education about the initiative. A "Dear Doctor" letter was mailed to all physicians on staff detailing the program information. Posters created through the marketing department were placed in patient care areas and physician lounges to increase VTE awareness and encourage prophylaxis. Presentations outlining the program were delivered to medical, nursing, and administrative staff. Further information was distributed via pharmacy and medical staff newsletters. A patient education flier was also created to increase patient awareness of the risks and complications of VTE.

Three months after implementation of the VTE form, the P&T committee reviewed performance measures, including inpatient DVT rates and patient days with prophylaxis, and compared the outcomes with baseline measures (Table 1). The results showed minimal improvement and prompted the group to discuss further options.

Pharmacist-led program

Pharmacy leadership identified an opportunity to make hospitalwide

Table 1.
Effect of Interventions on Outcomes Related to VTE^a

| Variable ^b | Time of 1-Month Evaluation | | | |
|---|---------------------------------------|--|---|--|
| | Before Any Intervention (August 2005) | 3 Months after Order Form Introduced (June 2006) | 3 Months after Start of Pharmacist-Led Program (March 2007) | 6 Months after Start of Pharmacist-Led Program (June 2007) |
| No. patient days | 4151 | 3990 | 4430 | 3876 |
| No. (%) patient days with VTE prophylaxis | 808 (19.5) | 912 (22.9) | 1750 (39.5) | 2333 (60.2) |
| % discharges in which DVT occurred ^c | 1.1 | 1.1 | 0.2 ^d | 0.1 ^e |

^aVTE = venous thromboembolism, DVT = deep venous thrombosis.

^bExcludes maternity, nursery, pediatric, and psychiatric patients.

^cAs verified by Doppler ultrasonography.

^d*p* < 0.007 for comparison with August 2005 (Fisher's z-test).

^e*p* < 0.002 for comparison with August 2005 (Fisher's z-test).

improvements and offered to develop a pharmacist-led program to assess all newly admitted patients for risk of VTE and to recommend appropriate pharmacologic prophylaxis. The P&T committee was unanimous in support of this approach.

Under the pharmacist-led program, a pharmacist receives a daily report of all new admissions, which are cross-referenced with a report that includes patients currently prescribed heparin or low-molecular-weight heparin. Maternity, nursery, pediatric, and psychiatry patients are excluded from assessment. The pharmacist assesses patients for VTE risk using a tracking sheet developed from the original VTE form (Figure 1).

The pharmacist places all recommendations in the progress notes of the medical record in the form of a bold 3-in × 5-in sticker (Figure 2). The sticker alerts the physician of known risk factors, VTE risk, and treatment recommendations, which are based on protocols and regimens approved by the P&T committee. Only high-

to highest-risk patients are given recommendations for prophylaxis. Pharmacy leadership chose to focus on high- to highest-risk patients to facilitate physician acceptance. Once all patients are assessed and recommendations are placed in the respective chart, the pharmacist reviews the tracking sheets from the previous four days for accepted recommendations.

The program was developed to be performed seven days a week. Following education and training of the clinical pharmacists on staff, the program is maintained by one pharmacist per day and requires an average of four hours each day for completing the review of reports, VTE risk assessment of patients, and placement of VTE prophylaxis recommendations in the designated patient charts.

Pharmacy reviews the program quarterly to determine whether the pharmacist-led program is meeting the institution's goals of improving prophylaxis rates and reducing development of VTE. Measures reviewed include patient days during which

VTE prophylaxis is used and VTE rates in inpatients via daily reports from the vascular laboratory. Following the program's first three months, a poster was created highlighting evidence for VTE prophylaxis and explaining details of the pharmacist-led program to further enhance the education process with physician staff. Findings from the first performance review were also shared at multiple meetings of medical executive committees. Following discussion with medical staff supporters, the pharmacy added mechanical prophylaxis to the list of recommendations in high- and highest-risk patients who have contraindications to pharmacologic therapy. To streamline the patient assessment process, a new daily report was created listing all patients receiving sequential compression devices (SCDs) for mechanical prophylaxis.

Initial barriers to the pharmacist-led VTE program included consistency of interpretation and identification of VTE risk factors among the clinical pharmacists conducting the program and a concern that physi-

Figure 1. Venous thromboembolism (VTE) tracking form. MD = physician, Pt(s) = point(s), HF = heart failure, MI = myocardial infarction, tx = therapy, IBD = inflammatory bowel disease, DVT = deep venous thrombosis, PE = pulmonary embolism, CVA = cerebrovascular accident, SCDs = sequential compression devices.

| | | | |
|--|-------------|---|------------|
| Patient: | Age: | Location: | MD: |
| Risk: <input type="checkbox"/> < 10% (0 – 1 pts), <input type="checkbox"/> 10-20% (2 pts), <input type="checkbox"/> 20-40% (3 – 4 pts), <input type="checkbox"/> 40-80% (≥ 5 pts) | | | |
| Risk Factors: 1 Pt: <input type="checkbox"/> Age 40-60; <input type="checkbox"/> Systolic HF/MI; <input type="checkbox"/> Estrogen tx; <input type="checkbox"/> Obesity; <input type="checkbox"/> IBD; <input type="checkbox"/> Surgery< 1hr 2 Pt: <input type="checkbox"/> Age > 60; <input type="checkbox"/> Immobility/bed rest >24 hr; <input type="checkbox"/> Major surgery > 1hr; <input type="checkbox"/> Pulmonary disease 3 Pt: <input type="checkbox"/> Cancer; <input type="checkbox"/> Mechanical ventilation; <input type="checkbox"/> History of DVT/PE or hypercoagulable state 5 Pt: <input type="checkbox"/> CVA/Paralysis; <input type="checkbox"/> Spinal injury; <input type="checkbox"/> Knee/hip replacement; <input type="checkbox"/> Pelvic/hip/leg fracture/trauma | | | |
| Contraindications to Anticoagulation: <input type="checkbox"/> YES: _____ <input type="checkbox"/> NO | | | |
| Recommendation: <input type="checkbox"/> Heparin 5000 units q8h, <input type="checkbox"/> Enoxaparin 30 or 40 mg q24h (circle dose), <input type="checkbox"/> SCDs | | | |
| Recommendation Accepted: <input type="checkbox"/> YES <input type="checkbox"/> NO Date: _____ Rx initiated (if different): | | | |
| <hr/> 30-Day Follow-Up: | | | |
| VTE: <input type="checkbox"/> YES <input type="checkbox"/> NO Date: _____ | | Mortality: <input type="checkbox"/> YES <input type="checkbox"/> NO Date: _____ | |
| Readmission: <input type="checkbox"/> YES <input type="checkbox"/> NO Date: _____ | | Bleeding: <input type="checkbox"/> YES <input type="checkbox"/> NO Event: _____ | |

Figure 2. Sticker placed by pharmacists in progress notes of the medical record. Regimens approved by the pharmacy and therapeutics committee called for pharmacists to adjust dosages of subcutaneous enoxaparin sodium for VTE (venous thromboembolism) prophylaxis to 40 mg daily, or 30 mg daily if the CrCl (creatinine clearance) was less than 30 mL/min. Pharmacists also changed the frequency of 5000-unit subcutaneous heparin sodium injections, when used for VTE prophylaxis, from every 12 hours to every 8 hours.⁶ HF = heart failure, MI = myocardial infarction, IBW = ideal body weight, DVT = deep venous thrombosis, PE = pulmonary embolism, CVA = cerebrovascular accident, Est. = estimated.

ATTENTION PHYSICIAN

This patient is at **HIGH (20-40%)** **HIGHEST (40-80%)** risk for VTE

Identifiable risk factors include:

| | |
|--|---|
| <input type="checkbox"/> Age > 40 | <input type="checkbox"/> Surgery |
| <input type="checkbox"/> Systolic HF, MI | <input type="checkbox"/> Pulmonary disease |
| <input type="checkbox"/> Obesity (≥ 30% IBW) | <input type="checkbox"/> Cancer |
| <input type="checkbox"/> Immobility > 24 hours | <input type="checkbox"/> Mechanical ventilation |
| <input type="checkbox"/> History of DVT/PE | <input type="checkbox"/> Knee or hip replacement |
| <input type="checkbox"/> CVA or Paralysis | <input type="checkbox"/> Pelvic, leg, or hip fracture or major trauma |

Other: _____

If patient does not have contraindications to anticoagulation, please consider prophylaxis with:

- Heparin 5000 units q 8 hrs
- Enoxaparin 40 mg q 24hr
- Enoxaparin 30 mg q 24hr (Est. CrCl < 30 ml/min)
- Patient is at risk but has contraindications for anticoagulation. Recommend mechanical prophylaxis.

cians' medicolegal liability would increase because of recommendations being placed in a patient's medical record. Additional training of clinical pharmacists, including periodic reviews of randomly selected patient cases, developed consistency within the program among all participating pharmacists. Pharmacy management addressed the medicolegal liability concern with initially resistant physician groups. Resistance has waned following increasing support from the medical staff and hospital administration and increased education. To date, there has been a positive response to this pharmacist-led VTE prophylaxis program throughout the institution.

Experience with the program

Following the first month of the program, a review was conducted

to evaluate the safety of this program. The review revealed that three patients developed DVT (two subsequently developed PE); a recommendation for prophylaxis was made for all three patients but not accepted by the prescriber. No bleeding complications or instances of heparin-induced thrombocytopenia were found to have resulted from accepted VTE prophylaxis recommendations.

Two quarterly performance reviews have been conducted since the implementation of the pharmacist-led VTE program. The first review (at three months into the program) revealed a doubling in patient days with pharmacologic VTE prophylaxis and a 79% reduction in inpatient-diagnosed VTE rates (Table 1). Following the first quarter of this program, nonpharmacologic recommendations, such as SCDs for

patients with contraindications to anticoagulants, were added. In the second review (at six months into the program), patient days with VTE prophylaxis had tripled over baseline, and inpatient diagnosed DVT rates had fallen to 7.5% of the baseline rate. Cumulative tracking of recommendations made since the start of the program revealed an average of 58 recommendations accepted per 187 recommendations made each month (approximate acceptance rate, 31%).

If an average cost saving of \$10,000 is assigned to each VTE episode prevented⁷ and 10 patients must be treated to prevent one case of VTE,⁸ each accepted recommendation provides a cost saving of \$1,000. Therefore, it would take 10 accepted recommendations (or patients treated) to account for the \$10,000 saved per VTE episode. Because

pharmacists' recommendations were made only for high- to highest-risk patients, the assumed number needed to treat (10) probably results in an underestimation of cost-saving. While taking into account increased hospital cost from increased use of anticoagulants for VTE prophylaxis, the pharmacist-led VTE prophylaxis program has provided the institution a net estimated cost-saving benefit of approximately \$450,000 during its first seven months.

Discussion

A pharmacist-led VTE risk assessment and prophylaxis recommendation program is a novel approach to addressing institutional needs for improving VTE awareness and outcomes. The increased use of VTE prophylaxis coinciding with pharmacist recommendations and the decrease of diagnosed DVT during the inpatient stay appear to demonstrate this program's success.

This initiative has provided benefit for the institution by improving patient outcomes and decreasing resource use through reduction of VTE. The success of this program has not only enhanced the value of pharmacy services but also increased demand for pharmacy leadership involvement throughout the institution.

Conclusion

A pharmacist-led program for VTE prevention was associated with a significant increase in the prescribing of VTE prophylaxis and a significant reduction in ultrasonographically confirmed DVT.

References

1. Hirsh J, Hoak J. Management of deep vein thrombosis and pulmonary embolism. A statement for healthcare professionals. Council on Thrombosis (in consultation with the Council on Cardiovascular Radiology), American Heart Association. *Circulation*. 1996; 93:2212-45.
2. Sandler DA, Martin JF. Autopsy proven pulmonary embolism in hospital patients: are we detecting enough deep vein thrombosis? *J R Soc Med*. 1989; 82:203-5.
3. Goldhaber SZ, Tapson VE. A prospective registry of 5,451 patients with ultrasound-confirmed deep vein thrombosis. *Am J Cardiol*. 2004; 93:259-62.
4. National Quality Forum. National consensus standards for the prevention and care of venous thromboembolism (including deep vein thrombosis and pulmonary embolism). www.qualityforum.org/projects/ongoing/vte/index.asp (accessed 2007 Aug 8).
5. Geerts WH, Pineo FP, Heit JA et al. Prevention of venous thromboembolism: the seventh ACCP conference on antithrombotic and thrombolytic therapy. *Chest*. 2004; 126:S338-400.
6. Gärdlund B. Randomised, controlled trial of low-dose heparin for prevention of fatal pulmonary embolism in patients with infectious diseases. *Lancet*. 1996; 347:1357-61.
7. MacDougall DA, Feliu AL, Bocuzzi SJ et al. Economic burden of deep-vein thrombosis, pulmonary embolism, and post-thrombotic syndrome. *Am J Health-Syst Pharm*. 2006; 63(suppl 6):S5-15.
8. Samama MM, Cohen AT, Darmon JY et al. A comparison of enoxaparin with placebo for the prevention of venous thromboembolism in acutely ill medical patients. *N Engl J Med*. 1999; 341:793-800.