

ORIGINAL RESEARCH

Utilization of Parenteral Anticoagulants and Warfarin: Impact on the Risk of Venous Thromboembolism Recurrence in the Outpatient Setting

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BACKGROUND: Clinical guidelines recommend parenteral anticoagulation therapy with an early initiation of warfarin therapy for the treatment of patients with acute venous thromboembolism (VTE) and the prevention of recurrence.

OBJECTIVES: To evaluate the outpatient utilization of parenteral anticoagulant therapy and warfarin among patients with VTE, and to examine the effects of parenteral anticoagulant use and the time to warfarin initiation from VTE diagnosis on the risk for VTE recurrence.

METHODS: The Truven Health MarketScan Commercial Claims Database was used to identify patients aged 18 to 64 years who had an outpatient claim for deep-vein thrombosis or pulmonary embolism between January 2010 and December 2011 (ie, index date) and had no VTE diagnosis or treatment during the 12 months before the index date, had no hospital or emergency department VTE claim within 7 days after the index outpatient VTE claim, and had received warfarin <30 days after the index date. A recurrent VTE event was defined as a VTE-related emergency department visit or hospitalization within 8 to 365 days after the index date. A Cox proportional hazards model was used to estimate the adjusted hazard ratio (HR) associated with VTE recurrence risk related to parenteral anticoagulant use and warfarin initiation timing.

RESULTS: A total of 5820 patients were included in the study (mean age, 50.5 years); of these, 45% were female. A total of 75.7% (4403) of the patients receiving warfarin also received a parenteral anticoagulant, and the median time from VTE diagnosis to warfarin initiation was 5 days for parenteral anticoagulant users compared with 11 days for nonusers. Parenteral anticoagulant use was associated with a 49% recurrent VTE risk reduction (HR, 0.51; 95% confidence interval [CI], 0.43-0.60; $P < .001$). Each day of delayed warfarin initiation from the diagnosis of acute VTE was associated with a 1% increase in the risk for VTE recurrence (HR, 1.01; 95% CI, 1.01-1.02; $P = .003$).

CONCLUSIONS: Overall, 1 in 4 patients with VTE who had received warfarin in the outpatient setting did not receive parenteral anticoagulation therapy. Among those who received warfarin, its initiation was not always timely, despite its positive effects on reducing VTE recurrence. These findings highlight the potential quality-of-care concerns associated with the failure to use or the delayed implementation of guideline-recommended VTE treatment, and the need to improve compliance with clinical guidelines in the treatment of patients with VTE.

Am Health Drug Benefits.
2014;7(8):444-451
www.AHDBonline.com

Received September 15, 2014
Accepted in final form October 7, 2014

Disclosures are at end of text

Venous thromboembolism (VTE) encompasses deep-vein thrombosis (DVT) and pulmonary embolism (PE). VTE is a chronic disease that is associated with a high risk for recurrence, especially

during the initial months of therapy.¹⁻⁷ The risk for VTE recurrence is higher for patients with “unprovoked” VTE (ie, VTE occurring in the absence of malignancy or any of the factors of “provoked” VTE) than for patients with provoked VTE (ie, VTE occurring within 3 months of hospitalization, major surgery, pregnancy, trauma, or fracture).⁸ The rates of VTE recurrence in patients with unprovoked VTE have been estimated at 10% after 1 year and 30% after 5 years of the first VTE event compared with patients with VTE provoked by surgery, in whom the recurrence rates are estimated to be 1% after 1 year and 3% after 5 years.⁸

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VTE recurrence is recognized as an important risk factor for mortality and long-term complications, such as postthrombotic syndrome after DVT and pulmonary hypertension after PE. Recurrent VTE events also pose a significant economic burden to the healthcare system. In a recent retrospective analysis of claims data, patients with VTE recurrence were found to have 2.2-fold to 3-fold higher healthcare costs in the 1 year after their first VTE event, which was primarily driven by an increase in inpatient services utilization.⁷

The American College of Chest Physicians (ACCP) recommends initial parenteral anticoagulant therapy as an option for the initial treatment of acute DVT or PE.⁸ The ACCP guidelines recommend the early initiation of warfarin therapy rather than delayed initiation (eg, on the same day as parenteral therapy is started), and the continuation of parenteral anticoagulation therapy for a minimum of 5 days until the international normalized ratio (INR) is ≥ 2.0 for at least 24 hours. The ACCP also recommends continuation of anticoagulation therapy for 3 months in patients with acute DVT and PE to allow for the complete treatment of the acute episode of VTE and to prevent recurrent episodes of VTE.⁸

The outpatient treatment of uncomplicated VTE has become more common since the availability of subcutaneous low-molecular-weight heparin (LMWH) therapy as an alternative to intravenous unfractionated heparin for the treatment of VTE.⁸⁻¹⁰ Although the administration of heparin therapy and INR monitoring are much easier in the inpatient setting, there are challenges associated with the outpatient treatment of VTE. The outpatient use of LMWH requires the coordination of care, laboratory monitoring, and patient education and participation in treatment.¹¹

It remains unclear how well parenteral anticoagulation therapy utilization in the outpatient clinical practice is consistent with the treatment guidelines for VTE. In addition, although previous randomized clinical trials suggest that the early initiation of warfarin therapy with a shorter course of heparin therapy for approximately 5 days is as effective as the delayed initiation of warfarin with a 10-day course of heparin, and that this approach has the benefit of reducing the risk for heparin-induced thrombocytopenia,⁸ it remains unclear how well this recommendation has been adopted in real-world clinical settings.

The objectives of this study were to assess the utilization of parenteral anticoagulation therapy and the timing of the initiation of warfarin for the treatment of VTE in the outpatient setting, and to examine the effects of parenteral anticoagulation therapy and the timing of warfarin initiation relative to a diagnosis of VTE on the risk of VTE recurrence.

KEY POINTS

- Recurrent venous thromboembolism (VTE) is a risk factor for mortality and long-term, serious complications; the risk for recurrence is especially high in the early months of an acute VTE event.
- Recurrent VTE poses a significant economic burden to the healthcare system.
- Current clinical guidelines recommend the early addition of warfarin to parenteral anticoagulation to reduce the risk for VTE recurrence.
- In this study of 4403 patients with acute VTE who received parenteral anticoagulants in the outpatient setting, only 25% of patients received warfarin on the same day of initiating parenteral anticoagulant therapy; 52% received warfarin 3 days after initiating parenteral anticoagulant therapy.
- Overall, parenteral anticoagulation plus warfarin reduced the risk for recurrent VTE by 49% over 1 year.
- In this study, each day that the initiation of warfarin was delayed from the VTE diagnosis translated to a 1% increase in VTE recurrence risk.

Methods

Patient Population

A retrospective cohort study was conducted utilizing the Truven Health MarketScan Commercial Administrative Claims Database, which contains the integrated enrollment history and medical and pharmacy claims data for more than 137 million patients with commercial health insurance that is provided through their employers in the United States. The study sample consisted of patients aged 18 to 64 years who had an outpatient claim associated with a diagnosis of VTE between January 1, 2010, and December 31, 2011, as identified by *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnosis codes 451.x, 452, and 453.x (excluding 451.82 and 453.8) for either DVT, or diagnosis code 415.1x (excluding 415.12) for PE. The date corresponding to the first outpatient claim with a qualifying ICD-9 diagnosis code for acute VTE was defined as that patient's index date. Patients with a diagnosis of atrial fibrillation, atrial flutter, coagulation disorder, VTE, or a warfarin prescription within 12 months before the index date (baseline period) were excluded. Patients aged ≥ 65 years were excluded from this analysis, because the claims data may not be complete in the database for Medicare-eligible patients.

To ensure that the index acute VTE events were treated solely in an outpatient setting, the patients who

had a claim for a VTE-related emergency department visit or hospitalization within 7 days from the index outpatient claim were excluded from this analysis. Eligible patients were required to have a pharmacy claim for warfarin within 30 days after the index date for VTE outpatient diagnosis, and to be continuously eligible for health plan benefit coverage for at least 12 months before (baseline) and 12 months after (follow-up) the index date. Warfarin was the only oral anticoagulant indicated by the US Food and Drug Administration for the treatment of VTE during the study time frame. All study patients were followed for 12 months after the index outpatient claim for VTE.

Patients were classified as having an index DVT event or a PE with or without DVT event. To capture all the parenteral anticoagulant use subsequent to the index VTE event, the pharmacy claims and the outpatient administration claims (with J codes J1645, J1650,

J1652, J1655, or J1644) for unfractionated heparin, LMWH (ie, dalteparin, enoxaparin, tinzaparin), and fondaparinux (ie, factor Xa inhibitor) within 7 days of the index date were taken into account. The time to the initiation of warfarin was calculated from the index outpatient claim date to the first warfarin pharmacy claim date for each patient.

Recurrent VTE was defined as a VTE-related emergency department visit or hospitalization claim occurring between 8 and 365 days subsequent to the date of the index outpatient claim for VTE. Outpatient claims for VTE that occurred between 8 and 365 days of the index VTE diagnosis and emergency department and hospitalization VTE claims that occurred within <8 days of the index VTE diagnosis were not considered a recurrent VTE event, because they could be caused by the continuous care of the index VTE. Using emergency department visit and hospitalization claims that are associated with a VTE diagnosis to identify VTE recurrence is consistent with the method used in another published claims analysis.⁷

The patient demographics and clinical information, including patient age, sex, type of health insurance, and baseline comorbidity information, was extracted. A summary score derived from the Elixhauser Comorbidity Index (ECI) was used to assess the patient overall baseline comorbidity burden.¹² This baseline comorbidity score was calculated using ICD-9 codes that are associated with specific comorbid conditions during the 12-month baseline period.^{12,13}

Statistical Analysis

The parenteral anticoagulation agents that were used in the outpatient setting and the time to warfarin initiation from initiation of parenteral therapy were summarized. Characteristics, such as age, sex, type of index VTE, time to warfarin initiation, baseline ECI score, and cancer diagnosis in patients who were parenteral anticoagulant therapy users or nonusers were analyzed.

Descriptive statistics were used to calculate all study variables. The mean, median, and standard deviation were calculated for each continuous variable, and statistical comparisons between parenteral anticoagulant users and nonusers were performed using *t*-tests. Frequency statistics were calculated for categorical variables, and comparisons were made using chi-square tests.

A Cox proportional hazards model was used to assess the association of parenteral anticoagulant use and the time from VTE diagnosis to warfarin initiation with the risk for VTE recurrence, while adjusting for age, sex, health insurance type, index VTE type, and baseline comorbidity index (ie, ECI) score. The cumulative probability of a patient being free of VTE recurrence over

Table 1 Demographics and Clinical Characteristics of Patients Treated with Warfarin for VTE among Parenteral Anticoagulant Users and Nonusers

Characteristics	Parenteral anticoagulant users	Parenteral anticoagulant nonusers
Total patients in the cohort, N (%)	4403 (75.7)	1417 (24.3)
Mean age, yrs (SD)	50 (10) ^a	52.2 (9.7) ^a
Female, N (%)	1951 (44.3)	665 (46.9)
PE as index VTE event, N (%)	420 (9.5) ^a	247 (17.4) ^a
Time to warfarin initiation from index VTE claim		
Mean (SD), days	9.8 (9) ^a	13.1 (8.5) ^a
Median, days	5	11
Time to warfarin initiation relative to parenteral anticoagulation therapy initiation		
Before starting parenteral agent, N (%)	61 (1.39)	—
Same day as initiating parenteral agent, N (%)	1094 (24.85)	—
Within 3 days of starting parenteral agent, N (%)	960 (21.8)	—
>3 days after starting parenteral agent, N (%)	2288 (51.96)	—
Baseline Elixhauser Comorbidity Index score, mean (SD)	1.4 (1.6) ^a	2.1 (2.1) ^a
Patients with cancer, N (%)	379 (8.6)	134 (9.5)

^aSignificant difference, *P* <.01.

PE indicates pulmonary embolism; SD, standard deviation; VTE, venous thromboembolism.

time with the use of parenteral anticoagulant use (illustrated as users and nonusers) was plotted using the Kaplan-Meier method.

Results

The study cohort consisted of a total of 5820 patients who received treatment for their index acute VTE events in the outpatient setting and who received a prescription for warfarin within 30 days of their index outpatient VTE-related claim. Overall, the mean patients' age was 50.5 years, and 45% of the patients were female. Most patients (88.5%) had an index acute DVT event.

Of the total study cohort, 4403 (75.7%) patients received a parenteral anticoagulant within 7 days of the qualifying index VTE-related outpatient claim. The demographics and clinical characteristics of parenteral anticoagulant users and nonusers in the study are presented in **Table 1**. Enoxaparin was the most frequently used parenteral anticoagulant, followed by fondaparinux, dalteparin, and unfractionated heparin (**Figure 1**).

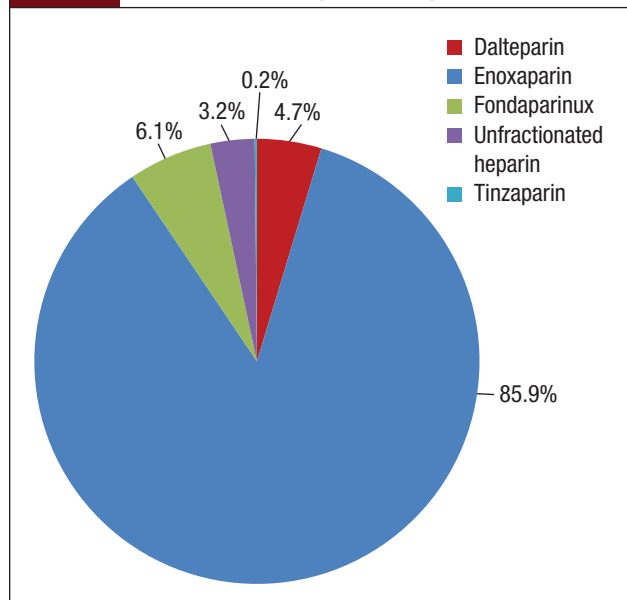
Only 25% of patients received warfarin on the same day as their parenteral anticoagulant therapy was initiated, and 52% received warfarin more than 3 days after the initiation of parenteral anticoagulant therapy. Among patients who received warfarin after the initiation of parenteral anticoagulation, the median time to the initiation of warfarin from the initiation of parenteral anticoagulation was 9 days. Parenteral anticoagulant users were younger than nonusers (mean age, 50 vs 52.2 years, respectively; $P < .001$). The median time to parenteral anticoagulant initiation from the index VTE outpatient claim was 1 day for an index DVT claim and 2 days for an index PE claim.

The time from an index VTE outpatient claim to the initiation of warfarin was longer among parenteral anticoagulant nonusers than users (median, 11 vs 5 days, respectively; $P < .01$). The median times to the initiation of warfarin therapy from the index VTE outpatient claim were 8 days and 6 days from the index diagnoses of DVT and PE, respectively. Parenteral anticoagulant users had a lower ECI score than nonusers (mean score, 1.4 vs 2.1, respectively; $P < .001$).

In our study cohort, 626 (10.8%) patients had recurrent VTE events within 1 year after the index acute VTE event. The 1-year VTE recurrence rate for parenteral anticoagulant users was lower than that for nonusers (8.7% vs 17.3%, respectively; $P < .001$). Kaplan-Meier curves of time to VTE recurrence among parenteral anticoagulant users and nonusers are included in **Figure 2**. Cox proportional hazards model results are reported in **Table 2**.

Parenteral anticoagulant therapy was associated with a 49% risk reduction of VTE recurrence (adjusted hazard ratio [HR], 0.51; 95% confidence interval [CI], 0.43-

Figure 1 Distribution of Parenteral Anticoagulant Therapies Used by the Study Cohort



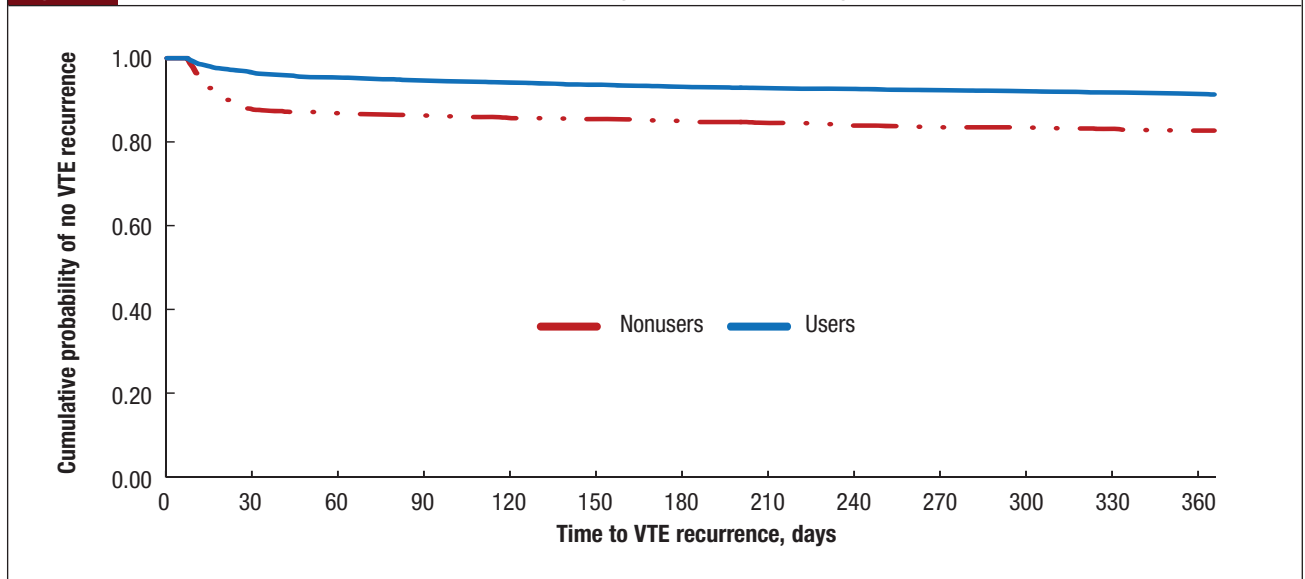
0.60; $P < .001$). Each additional 1-day delay of warfarin use was associated with a 1% increase of VTE recurrence risk (HR, 1.01; 95% CI, 1.01-1.02; $P = .003$). Increasing patient age was associated with a lower risk for VTE recurrence (HR, 0.989; 95% CI, 0.981-0.997; $P = .007$). Higher baseline comorbidity burden as assessed by the ECI score was significantly associated with an increased risk for VTE recurrence (HR, 1.12; 95% CI, 1.07-1.17; $P < .001$).

Discussion

Our results show that parenteral anticoagulant therapy in conjunction with warfarin therapy is effective in reducing the risk for VTE recurrence, conferring a 49% reduction over 1 year compared with patients who received warfarin but not a parenteral anticoagulant. This finding is consistent with results from a previous clinical trial that showed an unacceptably high incidence of symptomatic extension or VTE recurrence among patients taking a vitamin K antagonist but not receiving heparin compared with patients receiving heparin plus a vitamin K antagonist (20% vs 6.7%, respectively).¹⁴

However, contrary to current treatment guidelines that recommend the use of parenteral anticoagulant therapy in conjunction with vitamin K antagonist therapy for the treatment of VTE,⁸ based on real-world administrative claims, we found that only 76% of patients with VTE who were managed in the outpatient setting and received warfarin also received parenteral anticoagulant therapy. We also found that

Figure 2 Kaplan-Meier Curve of VTE Recurrence among Parenteral Anticoagulant Users and Nonusers



VTE indicates venous thromboembolism.

Table 2 Adjusted Risk for VTE Recurrence Based on Cox Proportional Hazards Regression Model^a

Risk factor	Adjusted hazard ratio	P value
Parenteral anticoagulant use	0.51 (95% CI, 0.43-0.60)	<.01
Days from VTE diagnosis to warfarin initiation	1.01 (95% CI, 1.01-1.02)	<.01
Outpatient PE index event (ref, DVT)	0.95 (95% CI, 0.74-1.21)	.66
Elixhauser Comorbidity Index	1.12 (95% CI, 1.07-1.17)	<.01
Male sex (ref, female)	0.98 (95% CI, 0.84-1.15)	.83
Age	0.989 (95% CI, 0.981-0.997)	.01

^aThe health insurance types were adjusted in the regression analysis; the results are not shown. CI indicates confidence interval; DVT, deep-vein thrombosis; PE, pulmonary embolism; VTE, venous thromboembolism.

more than 50% of patients with VTE did not receive warfarin until more than 3 days after the initiation of parenteral therapy, despite the treatment guidelines that recommend the initiation of vitamin K antagonist therapy as early as the same day as the initiation of parenteral anticoagulation.⁸ Our results also show that the delayed initiation of warfarin relative to the

time of a VTE diagnosis significantly increases the risk for VTE recurrence.

The 1-year VTE recurrence rate of 10.8% observed in the present study is generally consistent with published estimates of up to a 15% rate.¹⁻⁷ Heit and colleagues estimated the 1-year DVT recurrence rate to be 5.6% to 12.9% among a cohort of 1719 patients in Minnesota with an index VTE event between 1966 and 1990.⁵ Cushman and colleagues estimated an annual VTE recurrence rate of 7.7% (95% CI, 4.5%-10.9%) among 21,680 patients aged ≥45 years from 2 combined study cohorts (the Atherosclerosis Risk in Communities Study and the Cardiovascular Health Study) across 6 communities during the 2 years subsequent to an index VTE event.² Hansson and colleagues found a cumulative incidence of 7% of recurrent VTE at 1 year among patients in Sweden.⁴

Our study population is unique in that it was geographically diverse across the United States compared with other studies of VTE recurrence that were geographically limited.^{2,5} Underlying differences in patient risk factors, the age limitation of the study sample, and different methods used for identifying recurrent VTE cases may have contributed to differences in recurrence rates across the studies.

The current study is among only a few studies that assess the relationship of anticoagulation treatment with VTE recurrence using real-world clinical practice data. In an analysis of abstracted medical records of 1166 patients with VTE in Minnesota during 14 years to assess the predictors of VTE recurrence, Heit and

colleagues found that time from symptom onset to heparin use was not significantly associated with the risk for recurrence.¹⁵ Although increasing the proportion of time of using warfarin therapy with an INR ≥ 2.0 significantly reduced the risk for recurrence, the durations of parenteral anticoagulant therapy and warfarin overlap were not associated with recurrence.¹⁵

Our study extended beyond these findings to evaluate the impact of the early initiation of warfarin on treatment outcomes. Our results demonstrate that parenteral anticoagulant therapy and the early initiation of warfarin play independent roles in the reduction of VTE recurrence risk. These results corroborate the results from other clinical studies¹⁶ and support the benefit of early warfarin initiation. Because of limited availability of laboratory data, we were unable to assess INR control in our study.

Finally, we found that the risk for VTE recurrence decreased with increasing patient age; the adjusted risk of recurrence decreased by 1.1% for every additional year of a patient's age. Although increasing patient age has been identified in a few studies as a risk factor for VTE recurrence,^{1,5} some studies have found conflicting results or no effect between age and recurrent VTE.^{4,17,18}

Limitations

Several limitations should be noted when interpreting our study's findings. First, our study was limited to patients whose index VTE events were in an outpatient setting, and may not be generalizable to patients with acute VTE who were hospitalized. Our patient population, therefore, presumably represents less severe patients for whom outpatient VTE treatment was deemed appropriate by their physicians. By not including VTE-related outpatient visits when neither emergency department visits nor hospitalizations were claimed, the recurrent VTE event rate could have been underestimated.

Second, because our study utilized administrative medical and pharmacy claims, some important clinical information (eg, INR) was not captured in the database. Using ICD-9 codes to identify the patients with VTE may be subject to some misclassifications in our study. Other research found that relying solely on claims data could likely underestimate the actual clinical care provided¹⁹; this may also apply to our study. Because not all patients are suitable for home-based treatment with LMWH, parenteral anticoagulant therapy might have been administered in a healthcare provider's office and might not have been recorded in outpatient prescription claims. We attempted to overcome this potential bias by using J codes in addition to prescription claims to identify

the use of parenteral anticoagulants. However, our identification method was not conducive to identifying any prescribed parenteral anticoagulation therapies that were not filled by the patients at a pharmacy, nor was it conducive to assessing patient adherence to parenteral anticoagulation therapy.

Finally, the current US guidelines recommend initial parenteral anticoagulant therapy with warfarin or anticoagulation with rivaroxaban as treatment for acute DVT or PE that is not associated with active cancer. The recent introduction of novel oral anticoagulants without the requirement for INR monitoring will allow more flexibility in the treatment of acute VTE and the prevention of recurrent VTE. However, data on rivaroxaban were not available in the database when we conducted this study.

Our results demonstrate that parenteral anticoagulant therapy and the early initiation of warfarin play independent roles in the reduction of VTE recurrence risk.

Future studies to assess the utilization of novel oral anticoagulation therapy for the treatment of VTE are warranted.

Conclusions

This study showed that 1 in 4 patients with VTE receiving warfarin in an outpatient setting did not have evidence of parenteral anticoagulant use. Among patients who received parenteral anticoagulation therapy, the initiation of warfarin was not always timely. Our study further demonstrated that parenteral anticoagulation therapy coadministered with warfarin was associated with a 49% reduction of VTE recurrence risk versus warfarin alone, and delayed warfarin initiation was also associated with an increase for VTE recurrence risk. These data suggest that there are potential discrepancies between the evidence-based US guideline recommendations and clinical practice patterns and warrant further investigation. Future research using alternative data sources to assess the potential barriers to the adoption of clinical guidelines will be important to improve the quality of VTE treatment and clinical outcomes in the outpatient setting. ■

Acknowledgment

The authors wish to acknowledge the editorial assistance provided by Jenifer Wogen (of MedMentis Consulting, LLC) for this manuscript.

Continued

Funding Source

This research was funded by Daiichi Sankyo, Parsippany, NJ.

Author Disclosure Statement

Ms Cai, Dr Preblick, Dr Zhang, and Dr Kwong are employees of Daiichi Sankyo Inc.

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STAKEHOLDER PERSPECTIVE

Better Compliance with Clinical Guidelines for Venous Thromboembolism Can Improve Patient Outcomes, Reduce Costs

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PAYERS: Health plans manage large numbers of patients with complex diseases and strive to achieve the best clinical outcomes while balancing the need to control costs. Guidelines provide an excellent way to reduce practice variation and help to deliver more predictable outcomes for patients. Because of the number and extent of the guidelines and the organizations that develop and promulgate them, many health plans allow physicians to identify and follow guidelines based on their experience, expertise, and general preferences.

The article by Cai and colleagues highlights the need for better compliance with clinical guidelines and the potential to improve outcomes and to reduce costs with their appropriate application by physicians for the treatment of patients who are at risk for venous thromboembolism (VTE).¹ The guidelines from the American College of Chest Physicians (ACCP) recommend the use of warfarin and parenteral anticoag-

ulants for the treatment and prevention of VTE and identify, using outcomes-based published data, the risk for VTE recurrence in provoked and unprovoked patient groups.² These ACCP evidence-based guidelines support the general philosophy of health plans of focusing on patient outcomes for the delivery of consistent value to patients and to purchasers of health-care services.

The cost of oral warfarin and of the parenteral agents that are currently available as generic options is relatively low for standard courses of therapy. The true financial risk that concerns health plans is the cost of treatment for subsequent episodes of VTE that could have been prevented with effective anticoagulation through improved physician compliance with guidelines and greater adherence to therapy by patients.

As Cai and colleagues discuss in their article,¹ one study identified a 2- to 3-fold increase in healthcare costs

STAKEHOLDER PERSPECTIVE *Continued*

during the first year after an acute VTE event.³ This opportunity to prevent subsequent VTE-related clinical events that utilize high-cost resources is an area of routine focus by a health plan's medical management.

PROVIDERS: One opportunity to encourage physicians to consider and comply with the ACCP-recommended anticoagulation guidelines is the implementation of bundled payment contracts for surgical procedures, including for hip and knee replacement surgeries. The bundle would comprise all aspects of care before and after surgery, including physician-administered medications that are needed for the complete treatment of the individual patient. A key aspect of the bundled payment process is to work with providers to help them reduce the risk for complications resulting from surgery and to improve the management of patients and to decrease the cost of potential complications or to eliminate them entirely.

Data mining can be used to evaluate patients throughout their surgical and recovery periods by identifying the patterns of care that lead to positive and negative outcomes. Information gleaned from the analysis provided by Cai and colleagues can help to highlight potential areas of risk for VTE and opportunities for improvements in current clinical practice that will help to reduce that risk, will save money for the provid-

er group, and ultimately for the health plan or the self-insured employer.¹

HEALTHCARE SYSTEM: The data presented by Cai and colleagues effectively highlight the value of appropriate use of anticoagulant therapy using current national guidelines and the need for improvement in the care delivery and management of patients receiving anticoagulant agents. We often hear drug manufacturers promoting earlier treatment or earlier intervention in patients to achieve positive clinical outcomes and to avoid long-term complications. This analysis highlights the validity of early intervention.

It is clear that earlier initiation of treatment with warfarin and parenteral anticoagulants has the potential to save the healthcare system significant dollars while improving outcomes for individual patients.⁴ ■

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