Letters

RESEARCH LETTER

Preventability of Hospital-Acquired Venous Thromboembolism

Venous thromboembolism (VTE) is a common, largely preventable condition. The Agency for Healthcare Research and Quality reports that VTE prophylaxis is among the top-10 strongly suggested practices for improving patient safety.[1] Although optimal VTE prevention requires both prescription and administration of prophylactic medications, to date, most attempts to improve care have focused predominantly on medication prescription.[2]

National bodies (eg, the Centers for Medicare and Medicaid Services) and regional entities (eg, the Maryland Health Services Cost Review Commission) impose financial penalties for hospitalized patients developing VTE despite evidence that not all events are preventable, even with prophylaxis.[3] Publicly reported measures from both The Joint Commission's Core Measures and the Centers for Medicare and Medicaid Services' Hospital Compare report whether a patient received at least 1 dose of VTE prophylaxis within the first day of hospitalization, rather than considering all prescribed and administered doses for the entire hospitalization.[4]

Current measures for the quality of VTE care provide limited insights into the extent to which VTE is preventable. The specific aim of our study was to characterize the true preventability of VTE by identifying the proportion of patients with VTE who had received "defect-free care."

Methods | We conducted a retrospective review of patients with hospital-acquired VTE identified by the Maryland Hospital Acquired Conditions pay-for-performance initiative at the Johns Hopkins Hospital for 1 year (July 2010–June 2011). Our study was approved by the institutional review board of the Johns Hopkins University School of Medicine under a waiver of consent. Data on patient risk assessment for VTE (using our mandatory computerized clinical decision support tool), prescription of risk-appropriate prophylaxis,[5] and pharmacological

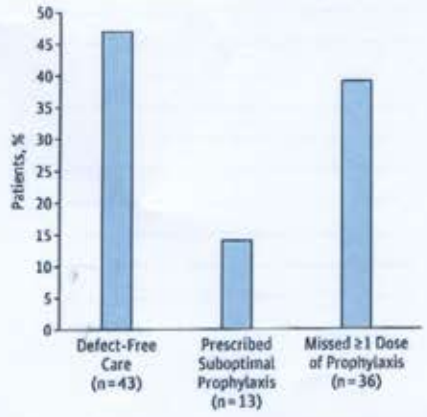
Table. Demographic and Clinical Characteristics of Patients Developing Preventable VTE[a]

Characteristic	Patients, No. (%)			P Value
	VTE (n = 92)	Prophylaxis Failure (n = 49)	Defect-Free Care (n = 43)	
Age, mean (SD), y	60.6 (18.1)	59.0 (19.6)	62.4 (16.3)	.37
Female sex	43 (47)	26 (53)	17 (40)	.08
Race				.69
White	47 (51)	24 (49)	23 (53)	
Black	36 (39)	21 (43)	15 (35)	
Other	9 (10)	4 (8)	5 (12)	
Admitting service				.96
Surgery	50 (54)	26 (53)	24 (56)	
Medicine	33 (36)	18 (37)	15 (35)	
Neurology	9 (10)	5 (10)	4 (9)	
Payor				.15
Private	44 (48)	19 (39)	25 (58)	
Medicare	34 (37)	21 (43)	13 (30)	
Medicaid	5 (5)	2 (4)	3 (7)	
No insurance	9 (10)	7 (14)	2 (5)	
VTE risk stratum				.21
Very high	12 (13)	9 (18)	3 (7)	
High	45 (49)	21 (43)	24 (56)	
Moderate	35 (38)	19 (39)	16 (37)	
Duration of hospitalization, median (IQR), d	14.5 (7-25)	16 (7-30)	13 (5-21)	.21
Time to diagnosis, median (IQR), d	5 (3-11)	6 (3-10)	5 (3-11)	.52
Alive at discharge	84 (91)	46 (94)	38 (88)	.47
Event type				.41
DVT	45 (49)	23 (47)	22 (51)	
PE	43 (47)	25 (51)	18 (42)	
DVT and PE	4 (4)	1 (2)	3 (7)	

Abbreviations: DVT, deep vein thrombosis; IQR, interquartile range; PE, pulmonary embolism; VTE, venous thromboembolism.

[a] Defined by the Maryland Hospital Acquired Conditions pay-for-performance initiative.

Figure. Categorization of Patients With Hospital-Acquired VTE By Process of Care Appropriateness



Of the 92 patients with a venous thromboembolism (VTE), 43 (47%) received defect-free care, while 49 (53%) had truly potentially preventable VTE and were in the prophylaxis-failure group (ie, 13 of 92 patients were prescribed suboptimal prophylaxis [14%], and 36 of 92 patients missed ≥1 dose of prescribed prophylaxis [39%]).

prophylaxis administration were abstracted from the electronic health record.

Because catheter-associated deep vein thrombosis (DVT) is not preventable with prophylaxis,[6] we excluded patients with upper extremity, catheter-associated DVT. The remaining patients were dichotomized by whether or not they received defect-free care, which is defined as receiving all doses of risk-appropriate VTE prophylaxis as recommended by our validated, mandatory computerized clinical decision support tool[5] prior to VTE diagnosis. Suboptimal care was further classified as *prescription failures* or *dose-administration failures*. We counted patients with a documented contraindication to pharmacologic prophylaxis (n = 6) who were prescribed sequential compression devices as defect-free care. We compared characteristics between groups using a 2-sided χ^2 test, an unpaired *t* test, or the Wilcoxon rank sum test using Stata version 12.0 (StataCorp).

Results | A total of 128 patients had hospital-acquired VTE. Of these 128 patients, 36 (28%) had nonpreventable, catheter-related DVT, leaving 92 patients (72%) who experienced VTE events (45 had DVT only, 43 had a pulmonary embolism only, and 4 had both DVT and a pulmonary embolism) that were potentially preventable with prophylaxis (Table). Of the 92 patients who experienced VTE events, 79 (86%) were prescribed optimal prophylaxis, yet only 43 (47%) received defect-free care. Of the 49 patients (53%) who received suboptimal care, 13 (27%) were not prescribed risk-appropriate VTE prophylaxis, and 36 (73%) missed at least 1 dose of appropriately prescribed prophylaxis (Figure). There was no difference in suboptimal care patterns between surgical and medical patients.

Discussion | Our study identifies a need to dramatically reevaluate the VTE outcome and process measures. Half of VTE events identified in a state-run pay-for-performance program were not truly preventable because patients received best-practice prevention, and there was no real opportunity for improvement. Venous thromboembolism outcome measures should not include these patients as having "potentially preventable events."

The overwhelming cause (73%) of inadequate VTE prophylaxis was patients missing at least 1 medication dose, which is associated with VTE events.[7] Until recently, the importance of missed VTE prophylaxis doses has been underappreciated. Perhaps targeting missed doses will have a significant effect on VTE events.

The current The Joint Commission/Centers for Medicare and Medicaid Services sampling method was likely adopted to reduce the burden of data collection. Our study questions the validity of this approach, which misclassifies suboptimal care as high-quality care, misinforms the public, and may limit efforts by health care professionals to improve VTE prevention when they already score well on these misleading measures. To reduce preventable harm, policy makers need to improve the measures, and clinicians need to ensure that patients receive all prescribed preventative therapies.[8] As electronic health records are adopted nationally, information technology will allow us to use more advanced clinical analytics to base VTE process measures on every dose of VTE prophylaxis for every hospitalized patient.

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