



Why do VTE risk scores fail to prevent VTE?

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DISCLOSURES: None

Overview

- VTE risk assessment
- Is VTE prophylaxis effective?
- Mechanisms of failure of VTE prophylaxis
- Potential strategies

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VTE Risk Score

Caprini risk score

Score 0 (Low Risk)

- Major surgery (lower)
- History of prior major surgery (<1 month)
- Active cancer
- History of inflammatory bowel disease
- Weight loss (recent)
- Weight (BMI) (<1 kg/m²)
- Acute renal insufficiency
- Comorbid heart failure (<1 month)
- Age (>65 years)
- Recent long distance traveling (previous (<1 month)
- Medical admission currently in hospital
- Other risk factors

Score 1 (Low Risk)

- Major surgery (higher)
- Major surgery (<10 weeks)
- Active cancer (>10 weeks)
- History of inflammatory bowel disease (>10 weeks)
- Weight loss (recent) (>10 weeks)
- Weight (BMI) (<1 kg/m²)
- Acute renal insufficiency
- Comorbid heart failure (<1 month)
- Age (>65 years)
- Recent long distance traveling (previous (<1 month)
- Medical admission currently in hospital
- Other risk factors

Score 2 (Low Risk)

- Major surgery (highest)
- Major surgery (>10 weeks)
- Active cancer (>10 weeks)
- History of inflammatory bowel disease (>10 weeks)
- Weight loss (recent) (>10 weeks)
- Weight (BMI) (<1 kg/m²)
- Acute renal insufficiency
- Comorbid heart failure (<1 month)
- Age (>65 years)
- Recent long distance traveling (previous (<1 month)
- Medical admission currently in hospital
- Other risk factors

Score 3 (Moderate Risk)

- Major surgery (highest)
- Major surgery (>10 weeks)
- Active cancer (>10 weeks)
- History of inflammatory bowel disease (>10 weeks)
- Weight loss (recent) (>10 weeks)
- Weight (BMI) (<1 kg/m²)
- Acute renal insufficiency
- Comorbid heart failure (<1 month)
- Age (>65 years)
- Recent long distance traveling (previous (<1 month)
- Medical admission currently in hospital
- Other risk factors

Score 4 (Moderate Risk)

- Major surgery (highest)
- Major surgery (>10 weeks)
- Active cancer (>10 weeks)
- History of inflammatory bowel disease (>10 weeks)
- Weight loss (recent) (>10 weeks)
- Weight (BMI) (<1 kg/m²)
- Acute renal insufficiency
- Comorbid heart failure (<1 month)
- Age (>65 years)
- Recent long distance traveling (previous (<1 month)
- Medical admission currently in hospital
- Other risk factors

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VTE Risk Score

IMPROVE Score

VTE Risk Factors	Bleeding Risk Factors
<input type="checkbox"/> Previous VTE	<input type="checkbox"/> Gastrointestinal ulcer
<input type="checkbox"/> Thrombophilia	<input type="checkbox"/> Bleeding prior 3 months
<input type="checkbox"/> Lower limb paralysis	<input type="checkbox"/> Admission platelets <50x10 ⁹
<input type="checkbox"/> Current cancer	<input type="checkbox"/> Hepatic failure
<input type="checkbox"/> Immobilization ≥7 days	<input type="checkbox"/> ICU/CCU stay
<input type="checkbox"/> ICU/CCU stay	<input type="checkbox"/> Cardiovascular catheter
<input type="checkbox"/> Age >60 years	<input type="checkbox"/> Rheumatic diseases
	<input type="checkbox"/> Current cancer
The incidence of asymptomatic VTE is ≈10 times greater than the incidence of symptomatic disease.	
	Sex: Female
	Age: <40
	GFR: ≥60 mL·min ⁻¹ ·m ⁻²

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Low to Moderate Risk Non-orthopedic Surgical Patients Do Not Benefit From VTE Chemoprophylaxis

- Large CQI registry General, Vascular, Gyn pts
- 2013 - 2017
- N = 32,856
- 80% of practitioner's reported they did formal risk assessment
- VTE rate = 1.46%

Hospital Specific Risk Reliability Adjusted VTE Rate and Associated Appropriate VTE Chemoprophylaxis Rate

Ann Surg 2022;276:e691-e697

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Low to Moderate Risk Non-orthopedic Surgical Patients Do Not Benefit From VTE Chemoprophylaxis

Ann Surg 2022;276:e691-e697

Weighted VTE Risk Score	None (N = 8586) No (%) VTE Rate (%)	UFHLMWH (N = 8586) No (%) VTE Rate (%)	P-value
Low			
0	300 (3.49%)	374 (4.36%)	0.4695
1-3	40 (0.47%)	47 (0.55%)	
Moderate			
3-6	7450 (86.77%)	7362 (85.74%)	0.8115
High			
6-8	630 (7.34%)	667 (7.77%)	0.6861
> 8	166 (1.93%)	136 (1.58%) P = .09	0.09
	4.22%	3.68%	

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Low to Moderate Risk Non-orthopedic Surgical Patients Do Not Benefit From VTE Chemoprophylaxis

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Factors associated with VTE in those chemo-prophylaxed

Predictors of Postoperative VTE	OR (95% CI)	P value
Days in hospital	1.09 (1.08-1.11)	<0.001
Personal history of DVT	2.37 (1.82-3.09)	<0.001
Age	1.02 (1.01-1.03)	<0.001
Intraoperative transfusion	1.55 (1.11-2.15)	0.010
Postoperative transfusions	1.47 (1.08-2.01)	0.014
Peripheral vascular disease	0.64 (0.45-0.90)	0.009
Dialysis	0.38 (0.15-0.96)	0.042

ASA indicates American Society of Anesthesiologists; DVT, deep venous thrombosis; VTE, venous thromboembolism.

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Call to Action to Prevent Venous Thromboembolism in Hospitalized Patients

A Policy Statement From the American Heart Association

Circulation. 2020;141:e914-e931

Table 3. Areas of Further Research to Inform Policy Development and Clinical Guidance

- Determine what should constitute preventable VTE across medical and surgical patients.
- Compare chart-abstracted VTE rates with ICD-10 code-rates in all US hospitals to assess precision and completeness.
- Evaluate EMRs as a system to automatically provide risk assessment and suggest an appropriate level of VTE prophylaxis.
- Define the effect of surveillance bias on VTE rates, consider a study of indications and triggers for VTE diagnostic studies and potential standardization of these across disease and hospitalizations.
- Evaluate the best methods to disseminate VTE risk assessment and prophylaxis education to practitioners and VTE risks to patients and families.
- Compare the VTE risk scoring prospectively against specific pharmacological and mechanical prophylaxis.
- Evaluate and test best methods to prevent missed prophylaxis dosing and to improve compliance.

EMR indicates electronic medical record; ICD-10, International Classification of Diseases, 10th Revision; and VTE, venous thromboembolism.

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The Thresholds of Caprini Score Associated With Increased Risk of Venous Thromboembolism Across Different Specialties

A Systematic Review

An issue of over prescription of VTE prophylaxis

In most patient groups, should have Caprini score > 8

May lead to not focusing prophylaxis efforts on those most likely to benefit

Ann Surg 2023;277:929-937

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Mixed population*	0.2%	0.4%	0.7%	1.0%	1.4%	2.1%	3.0%	4.3%	6.0%	8.4%	11.7%	16.1%	22.0%	30.0%	40.8%	54.8%	72.8%	96.4%	126.8%	167.2%	221.6%	292.8%
Medical patients*	0.7%	0%	0%	0.2%	0.4%	0.6%	0.9%	1.3%	1.8%	2.5%	3.4%	4.6%	6.1%	8.0%	10.5%	13.8%	18.1%	23.6%	30.6%	39.4%	51.2%	66.4%
COVID-19 patients*	0%	4.3%	7.4%	11.4%	17.4%	24.4%	32.4%	42.4%	55.4%	72.4%	93.4%	118.4%	150.4%	190.4%	240.4%	300.4%	380.4%	480.4%	600.4%	750.4%	930.4%	1150.4%
Cancer	0%	0%	0%	0.2%	0.4%	0.6%	0.9%	1.3%	1.8%	2.5%	3.4%	4.6%	6.1%	8.0%	10.5%	13.8%	18.1%	23.6%	30.6%	39.4%	51.2%	66.4%
Bone*	0.2%	0.4%	0.7%	1.0%	1.4%	2.1%	3.0%	4.3%	6.0%	8.4%	11.7%	16.1%	22.0%	30.0%	40.8%	54.8%	72.8%	96.4%	126.8%	167.2%	221.6%	292.8%
Trauma and orthopedics*	1.7%	3.1%	5.2%	7.3%	10.4%	14.5%	19.6%	26.7%	35.8%	47.9%	62.0%	79.1%	100.2%	126.3%	157.4%	193.5%	244.6%	300.7%	371.8%	457.9%	569.0%	705.1%
Urology and gynecology*	0.1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Vascular surgery*	1	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
General surgery and mixed surgery	0%	0.7%	1.4%	2.1%	3.0%	4.3%	6.0%	8.4%	11.7%	16.1%	22.0%	30.0%	40.8%	54.8%	72.8%	96.4%	126.8%	167.2%	221.6%	292.8%	374.0%	475.2%
Head and neck surgery	0%	0.1%	0.2%	0.3%	0.4%	0.6%	0.9%	1.3%	1.8%	2.5%	3.4%	4.6%	6.1%	8.0%	10.5%	13.8%	18.1%	23.6%	30.6%	39.4%	51.2%	66.4%
Thoracic surgery	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Plastic surgery	0.4%	0.7%	1.0%	1.4%	2.1%	3.0%	4.3%	6.0%	8.4%	11.7%	16.1%	22.0%	30.0%	40.8%	54.8%	72.8%	96.4%	126.8%	167.2%	221.6%	292.8%	374.0%
Critically ill patients	1.9%	3.8%	7.6%	15.2%	30.4%	60.8%	121.6%	243.2%	486.4%	972.8%	1945.6%	3891.2%	7782.4%	15564.8%	31129.6%	62259.2%	124518.4%	249036.8%	498073.6%	996147.2%	1992294.4%	3984588.8%

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Systematic review of venous thromboembolism risk categories derived from Caprini score

48 cohort studies; 7 case series; 2 cross sectional PO and medical pts

VTE rate and Caprini Score by VTE Category

Source: *J Vasc Surg Venous Lymphat Disord* 2023;35:1401-6

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Multi-institution Evaluation of Adherence to Comprehensive Postoperative VTE Chemoprophylaxis

Annals of Surgery • Volume 271, Number 6, June 2020

- 36 hospital QI collaborative with review of novel chemoprophylaxis process measure in colectomy patients
- Defect free chemoRx failed in 18%
- Less failure at non-safety net hospitals and Magnet designated hospitals

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Just What the Doctor Ordered

Missed Ordering of Venous Thromboembolism Chemoprophylaxis Is Associated With Increased VTE Events in High-risk General Surgery Patients

- NSQIP data with 19,578 pts, of which 4252 high risk
- Modified Caprini score > 5
- 'perfect' vs non 'perfect' VTE prophylaxis ordered
- Associated with OR = .50 (.3 - .8, P < .05) reduction in VTE at 30d

FIGURE 1. Association of days-covered-by-orders with outcomes, after adjustment for confounding factors.

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Is it simply underdosing of chemo-Rx?

Systematic Review
Published 02/16/2023
DOI: 10.3389/med.2023.1084511

Strategies involving low-molecular-weight heparin for the treatment and prevention of venous thromboembolism in patients with obesity: A systematic review and meta-analysis

Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI	Odds Ratio	M-H, Fixed, 95% CI
Chen 2012	2	101	1	101	0.26	0.20 (0.01, 3.48)		
Hernandez 2005	1	118	1	117	0.76	0.31 (0.04, 2.13)		
Schwarzer 2002	2	389	5	32	10.75	0.68 (0.24, 1.87)		
Yamada 2009	2	657	1	51	0.40	0.20 (0.01, 3.72)		
Wang 2012	12	1375	31	2309	68.83	0.52 (0.27, 1.00)		
Total (95% CI)		2864		2559	100.00	0.47 (0.27, 0.82)		
Total events	19		47					
Heterogeneity: Chi ² = 6.46, df = 4, P = 0.17, I ² = 38%								
Test for overall effect: Z = 2.68, P = 0.007								

Study or Subgroup	Events	Total	Events	Total	Weight	M-H, Fixed, 95% CI	Odds Ratio	M-H, Fixed, 95% CI
Chen 2012	1	72	1	71	0.26	0.20 (0.01, 3.48)		
Hernandez 2005	1	100	1	99	0.76	0.31 (0.04, 2.13)		
Schwarzer 2002	0	119	0	118	0.40	0.20 (0.01, 3.48)		
Wang 2012	2	38	10	38	1.00	0.31 (0.04, 2.13)		
Yamada 2009	0	16	1	16	0.76	0.20 (0.01, 3.48)		
Schwarzer 2002	1	300	1	32	1.00	0.20 (0.01, 3.48)		
Wang 2012	12	1375	210	2100	68.83	0.52 (0.27, 1.00)		
Total (95% CI)		2446		2030	100.00	0.68 (0.48, 1.00)		
Total events	19		217					
Heterogeneity: Chi ² = 4.31, df = 4, P = 0.33, I ² = 0%								
Test for overall effect: Z = 1.28, P = 0.20								

- Higher LMWH dose with less VTE and no increase in bleeding OR = 0.47; 95% CI = 0.27 - 0.82; p = .007

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Best practices to reduce VTE breakthrough in post-op patients

- Risk assessment of all patients, to allow risk v harms assessment for chemo-Rx and mechanical Rx
- Each hospital should have system for tracking defect free VTE prophylaxis
- Define and reduce patient refusal, nursing lapses, MD lapses for orders
- Re-assess VTE risk of patient if complicated course
- ? Standard indicators for Duplex scanning?

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Thank you!

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