Discussion - Anticoagulation in Head Injury

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Anticoagulation

- Reversal
- Prophylaxis
- Resume

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EXPERT CONSENSUS DECISION PATHWAY

2017 ACC Expert Consensus Decision Pathway on Management of Bleeding in Patients on Oral Anticoagulants

A Report of the American College of Cardiology Task Force on Expert Consensus Decision Pathways

Life-threatening

- Stop oral anti-coagulant
- Vitamine antagonist
  - 5-10mg IV Vitamin K
  - Reversal agent
- Direct acting oral anticoagulant
  - Direct thrombin inhibitor (dabigatran)
  - Factor Xa inhibitor (apixaban, rivaroxaban)
  - Half-lives
  - Potential reversal

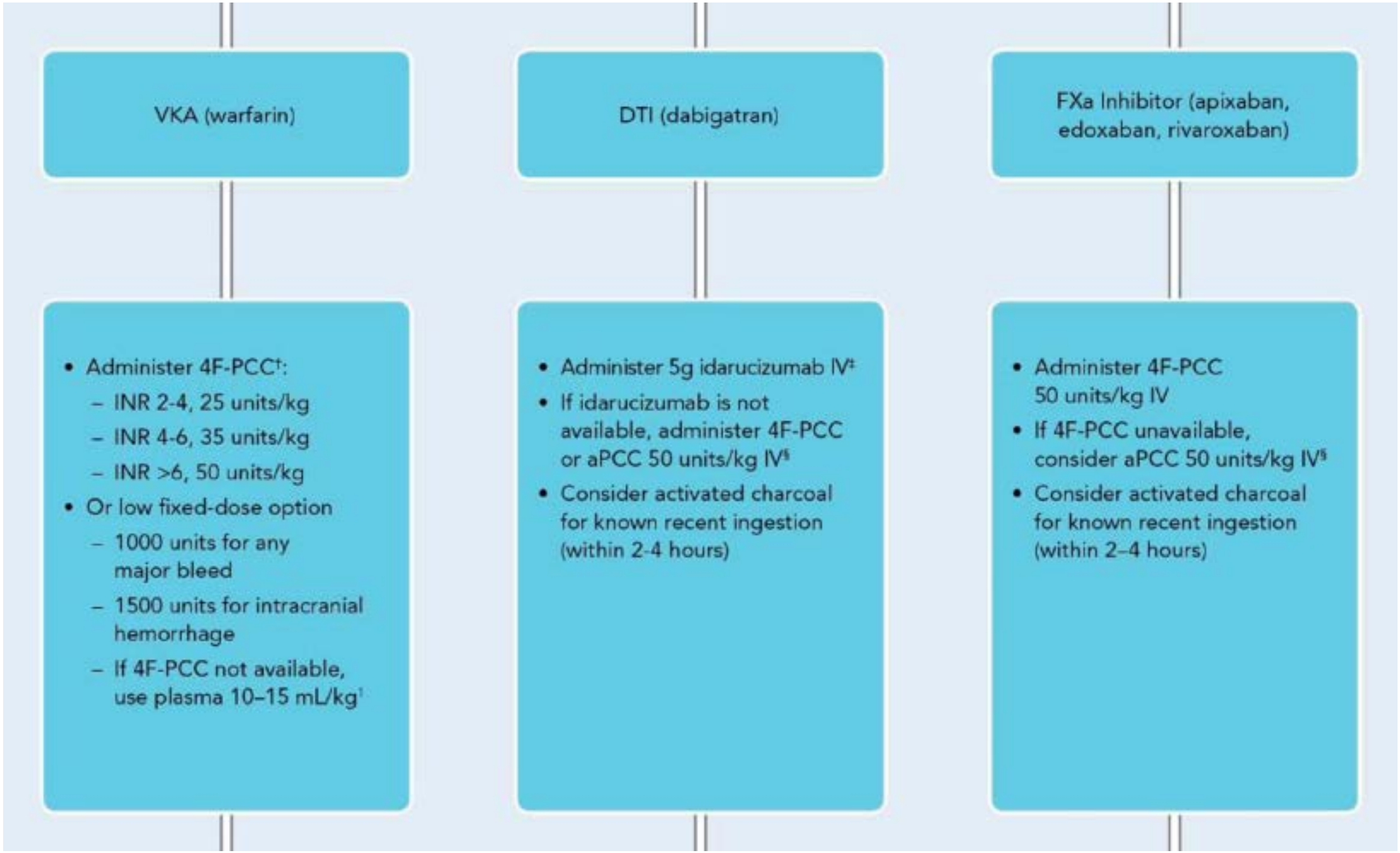

VKA (warfarin)
DTI (dabigatran)
FXa Inhibitor (apixaban, edoxaban, rivaroxaban)
• Administer 4F-PCC†:
– INR 2-4, 25 units/kg
– INR 4-6, 35 units/kg
– INR >6, 50 units/kg
• Or low fixed-dose option
– 1000 units for any major bleed
– 1500 units for intracranial hemorrhage
– If 4F-PCC not available, use plasma 10–15 mL/kg‡
• Administer 5g idarucizumab IV‡
• If idarucizumab is not available, administer 4F-PCC or aPCC 50 units/kg IV§
• Consider activated charcoal for known recent ingestion (within 2-4 hours)
• Administer 4F-PCC 50 units/kg IV
• If 4F-PCC unavailable, consider aPCC 50 units/kg IV§
• Consider activated charcoal for known recent ingestion (within 2–4 hours)

TABLE 4 Recommended Durations for Withholding DOACs Based on Procedural Bleed Risk and Estimated CrCl When There Are No Increased Patient Bleed Risk Factors

	Dabigatran					Apixaban, Edoxaban, or Rivaroxaban		
CrCl, mL/min	≥80	50–79	30–49	15–29	<15	≥30	15–29	<15
Estimated drug half-life, h	13	15	18	27	30 (off dialysis)	6–15	Apixaban: 17 Edoxaban: 17 Rivaroxaban: 9	Apixaban: 17 (off dialysis) Edoxaban: 10-17 (off dialysis) Rivaroxaban: 13 (off dialysis)
Procedural bleed risk								
Low	≥24 h	≥36 h	≥48 h	≥72 h	No data. Consider measuring dTT and/or withholding ≥96 h	≥24 h	≥36 h	No data. Consider measuring agent-specific anti Xa level and/or withholding ≥48 h
Uncertain, intermediate, or high	≥48 h	≥72 h	≥96 h	≥120 h	No data. Consider measuring dTT	≥48 h	No data. Consider measuring agent-specific anti Xa level and/or withholding ≥72 h	

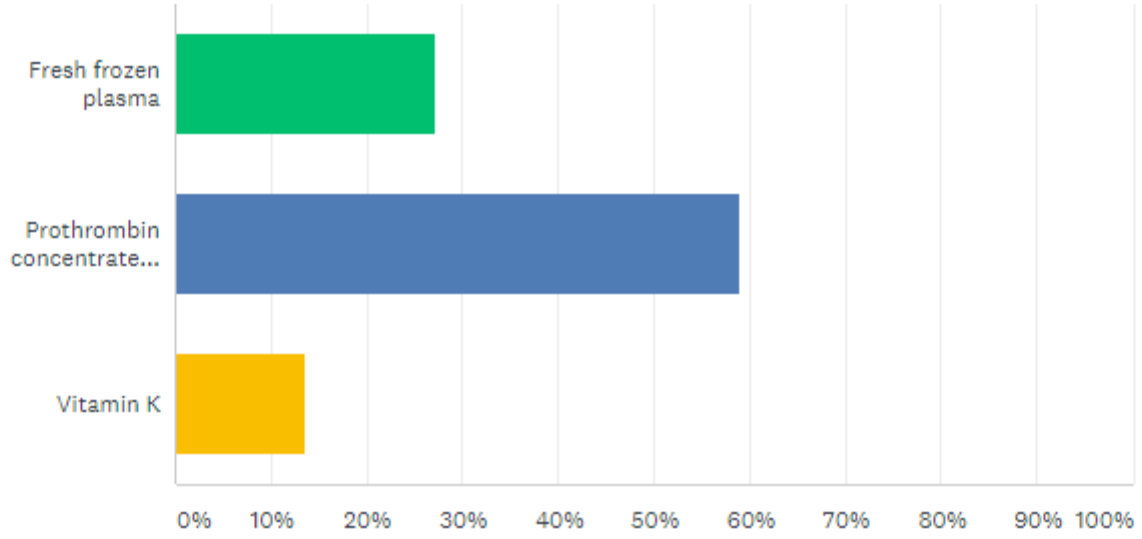
NOTE: The duration for withholding is based upon the estimated DOAC half-life withholding times of 2 to 3 half-lives for low procedural bleeding risk and 4 to 5 drug half-lives for uncertain, intermediate, or high procedural bleeding risk (47-55).

CrCl = creatinine clearance; DOAC = direct-acting oral anticoagulant; dTT = dilute thrombin time.

Question 14

What is your first line anticoagulation reversal agent for a patient on Coumadin with an intracranial injury?

Answered: 44 Skipped: 2

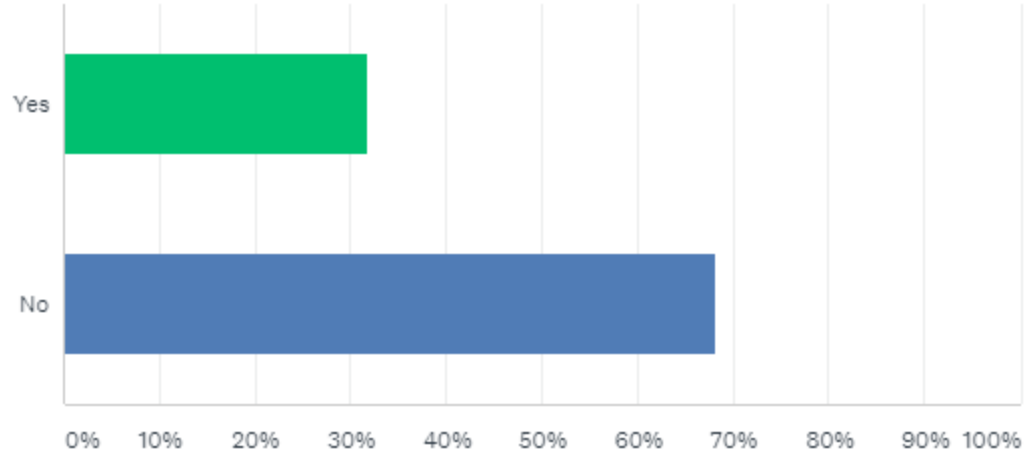


ANSWER CHOICES	RESPONSES	
Fresh frozen plasma	27.27%	12
Prothrombin concentrate complex	59.09%	26
Vitamin K	13.64%	6
TOTAL		44

Question 15

In your practice, do you administer anticoagulation reversal agents for a patient on Coumadin with a potential intracranial injury prior to obtaining a head CT scan?

Answered: 44 Skipped: 2

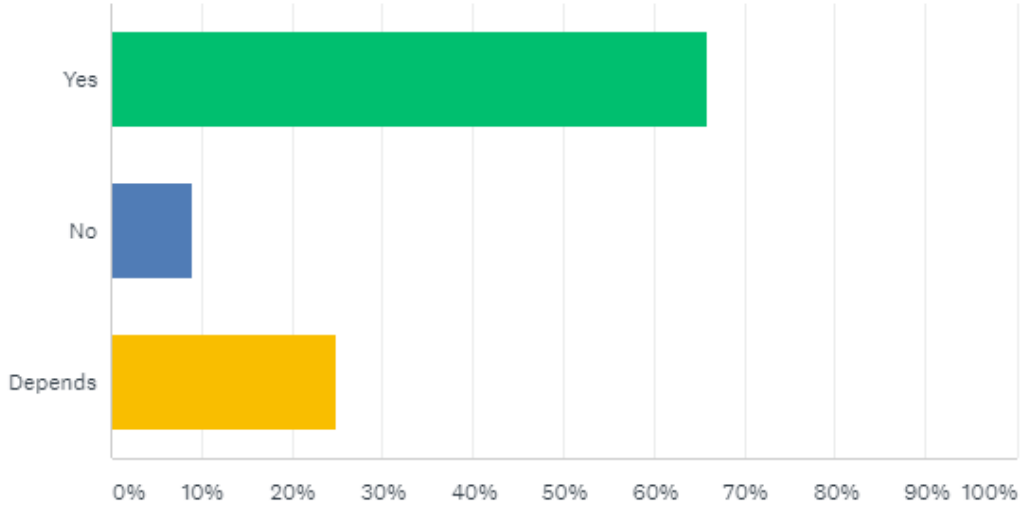


ANSWER CHOICES	RESPONSES	
Yes	31.82%	14
No	68.18%	30
TOTAL		44

Question 6

For a non-intubated, mild to moderate TBI patient, with a structural injury, with a clinical exam that can be followed, do you routinely obtain a repeat head CT scan in a patient with a stable/non-changed clinical exam.

Answered: 44 Skipped: 2

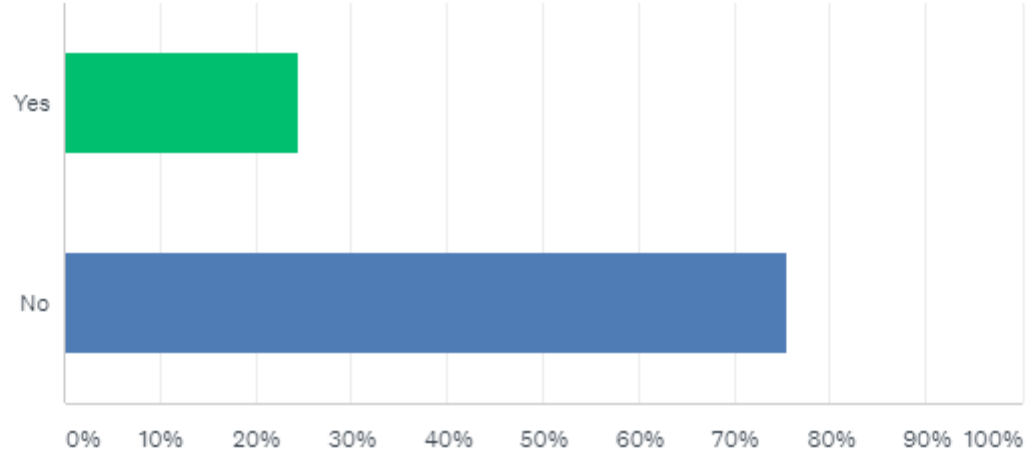


ANSWER CHOICES	RESPONSES	
Yes	65.91%	29
No	9.09%	4
Depends	25.00%	11
TOTAL		44

Question 7

For a non-intubated, mild to moderate TBI patient, with a minor structural injury, with a stable/non-changed clinical exam that can be followed, are you comfortable allowing initiation of VTE pharmacoprophylaxis 24-48 hours after admission without obtaining a repeat head CT scan?

Answered: 45 Skipped: 1

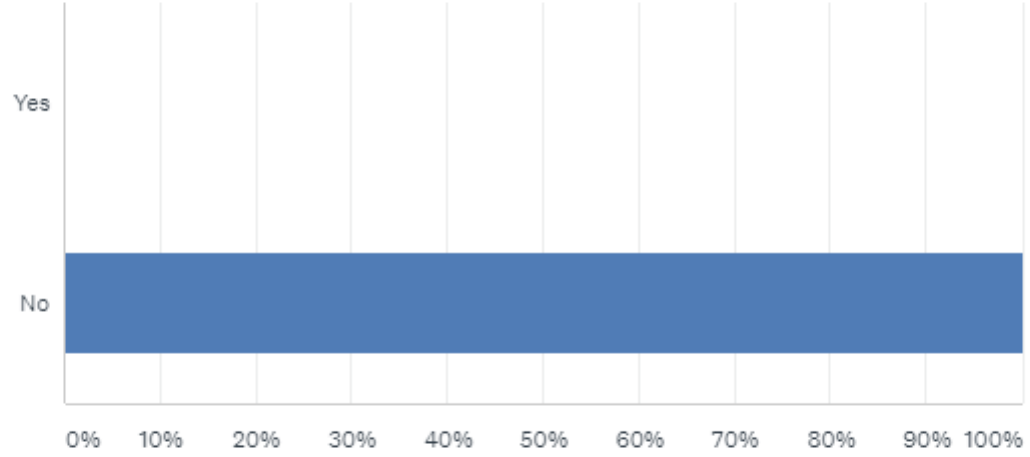


ANSWER CHOICES	RESPONSES	
Yes	24.44%	11
No	75.56%	34
TOTAL		45

Question 7 (Neurosurgeons)

For a non-intubated, mild to moderate TBI patient, with a minor structural injury, with a stable/non-changed clinical exam that can be followed, are you comfortable allowing initiation of VTE pharmacoprophylaxis 24-48 hours after admission without obtaining a repeat head CT scan?

Answered: 11 Skipped: 0

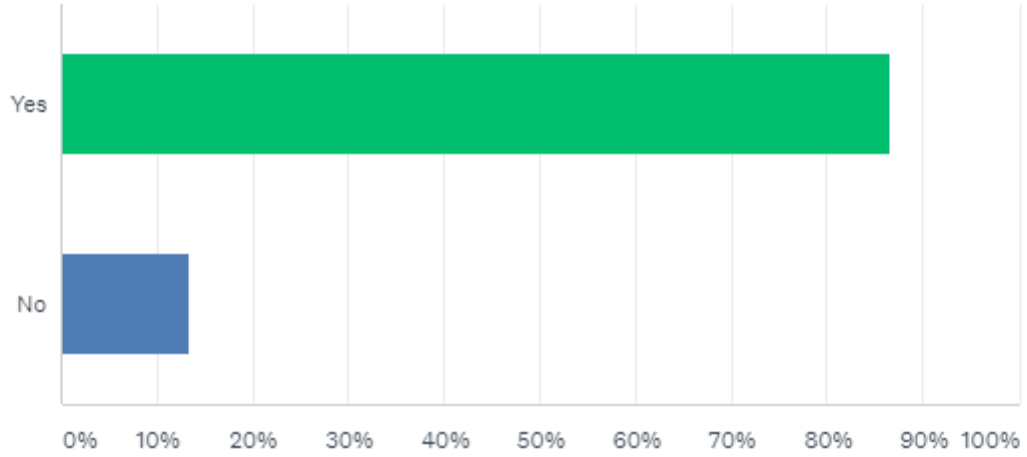


ANSWER CHOICES	RESPONSES	
Yes	0.00%	0
No	100.00%	11
TOTAL		11

Question 8

For a non-intubated, mild to moderate TBI patient, with a minor structural injury, with a stable/non-changed clinical exam that can be followed, and a stable non-changed repeat head CT scan are you comfortable allowing initiation of VTE pharmacoprophylaxis 24-48 hours after admission?

Answered: 45 Skipped: 1

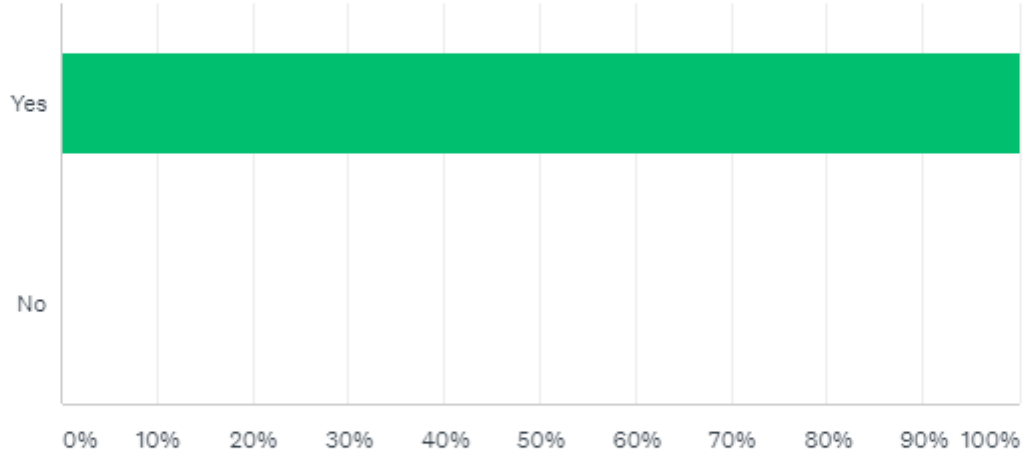


ANSWER CHOICES	RESPONSES	
Yes	86.67%	39
No	13.33%	6
TOTAL		45

Question 8 (Neurosurgeons)

For a non-intubated, mild to moderate TBI patient, with a minor structural injury, with a stable/non-changed clinical exam that can be followed, and a stable non-changed repeat head CT scan are you comfortable allowing initiation of VTE pharmacoprophylaxis 24-48 hours after admission?

Answered: 11 Skipped: 0

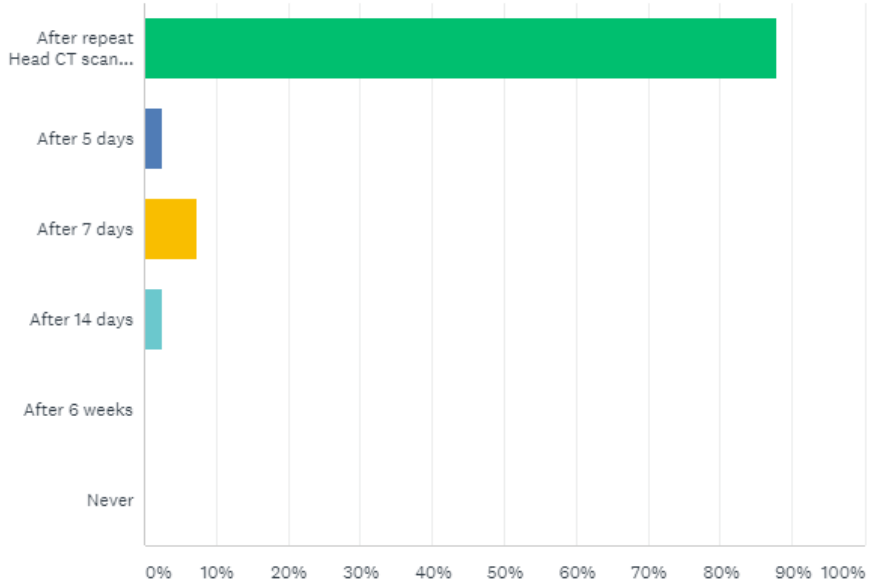


ANSWER CHOICES	RESPONSES	
Yes	100.00%	11
No	0.00%	0
TOTAL		11

Question 11 (New)

When do you allow initiation of VTE prophylaxis in a TBI patient with evidence of intracranial hemorrhage and no evidence of ongoing bleeding?

Answered: 41 Skipped: 5

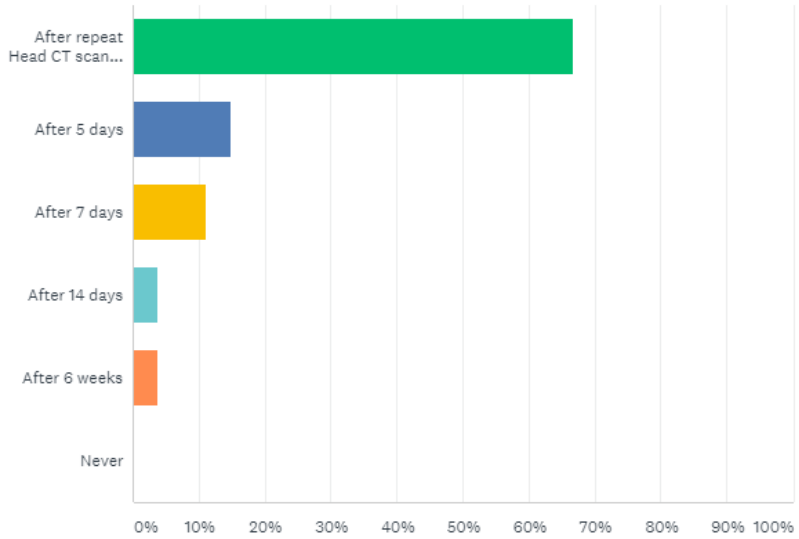


ANSWER CHOICES	RESPONSES	
After repeat Head CT scan with stabilization of brain injury findings in 24-48 hrs.	87.80%	36
After 5 days	2.44%	1
After 7 days	7.32%	3
After 14 days	2.44%	1
After 6 weeks	0.00%	0
Never	0.00%	0
TOTAL		41

Question 11 (Compare)

When do you allow initiation of VTE prophylaxis in a TBI patient with evidence of intracranial hemorrhage and no evidence of ongoing bleeding?

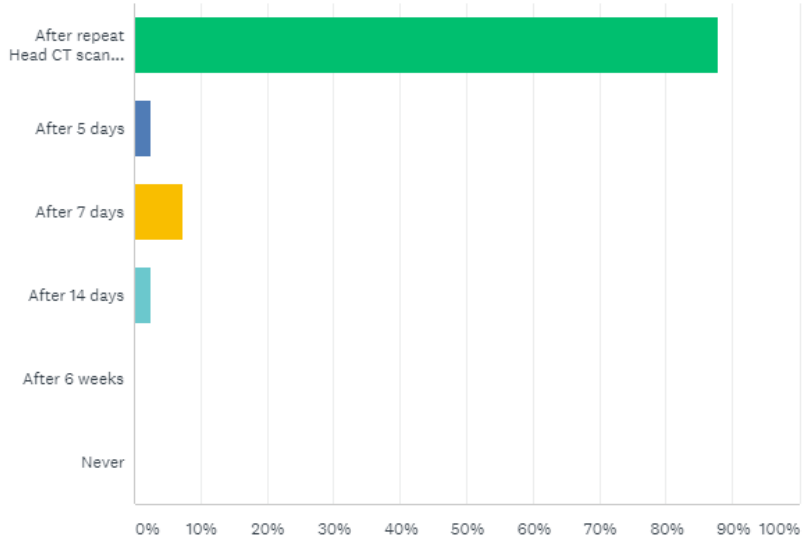
Answered: 27 Skipped: 0



ANSWER CHOICES	RESPONSES	
After repeat Head CT scan with stabilization of brain injury findings in 24-48 hrs.	66.67%	18
After 5 days	14.81%	4
After 7 days	11.11%	3
After 14 days	3.70%	1
After 6 weeks	3.70%	1
Never	0.00%	0
TOTAL		27

When do you allow initiation of VTE prophylaxis in a TBI patient with evidence of intracranial hemorrhage and no evidence of ongoing bleeding?

Answered: 41 Skipped: 5

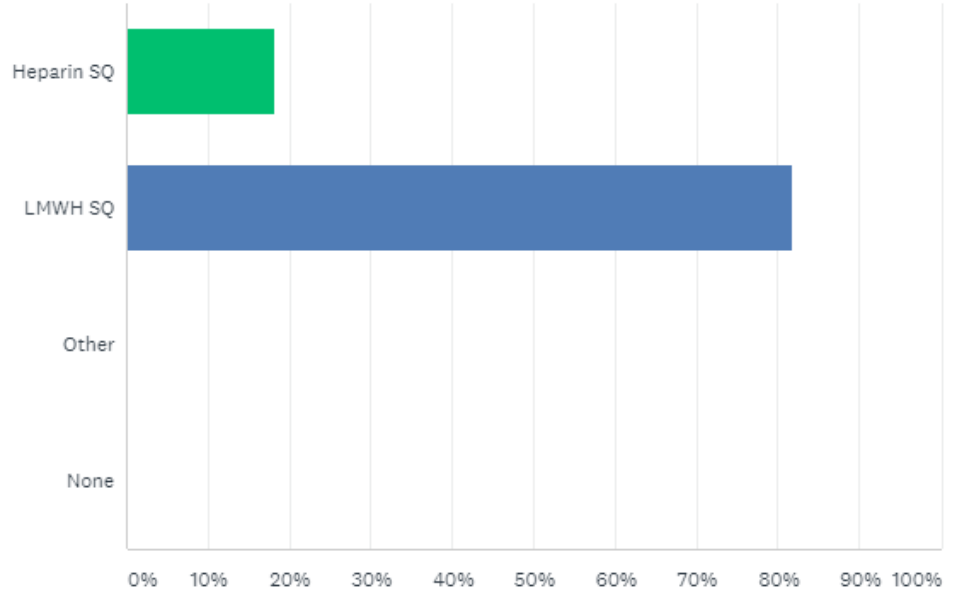


ANSWER CHOICES	RESPONSES	
After repeat Head CT scan with stabilization of brain injury findings in 24-48 hrs.	87.80%	36
After 5 days	2.44%	1
After 7 days	7.32%	3
After 14 days	2.44%	1
After 6 weeks	0.00%	0
Never	0.00%	0
TOTAL		41

Question 12 (New)

What agent do you prefer for venous thromboembolism (VTE) prophylaxis in a TBI patient?

Answered: 44 Skipped: 3

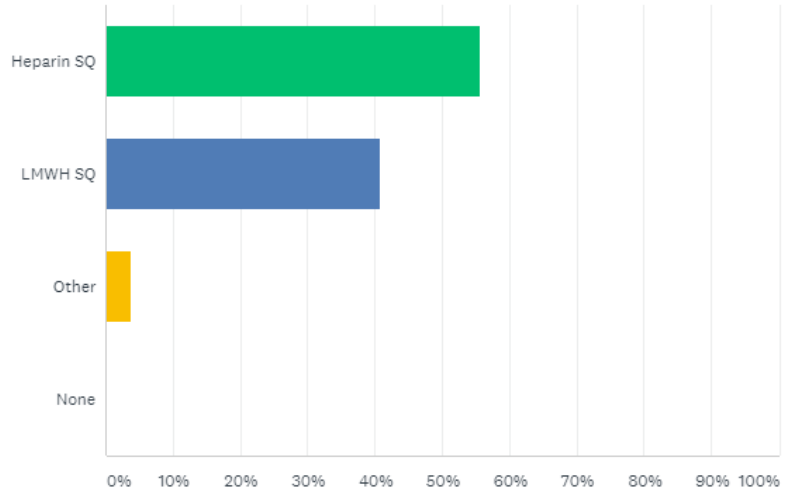


ANSWER CHOICES	RESPONSES	
Heparin SQ	18.18%	8
LMWH SQ	81.82%	36
Other	0.00%	0
None	0.00%	0
TOTAL		44

Question 13 (Compare)

What agent do you prefer for venous thromboembolism (VTE) prophylaxis in a TBI patient?

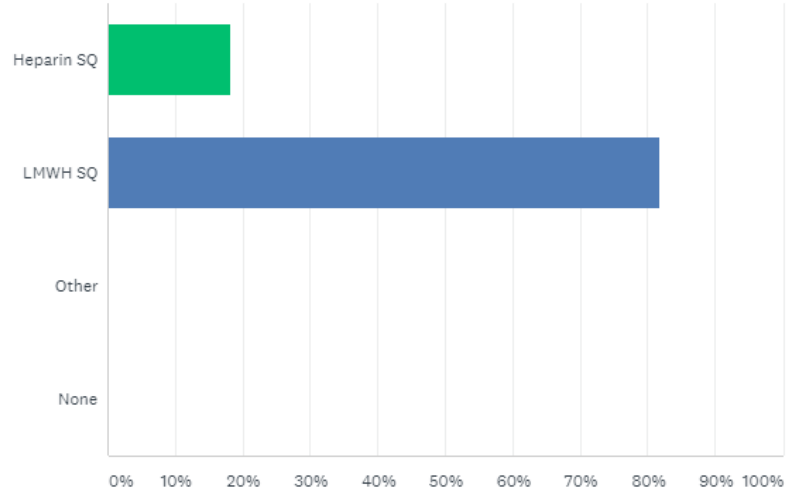
Answered: 27 Skipped: 0



ANSWER CHOICES	RESPONSES	
Heparin SQ	55.56%	15
LMWH SQ	40.74%	11
Other	3.70%	1
None	0.00%	0
TOTAL		27

What agent do you prefer for venous thromboembolism (VTE) prophylaxis in a TBI patient?

Answered: 44 Skipped: 3



ANSWER CHOICES	RESPONSES	
Heparin SQ	18.18%	8
LMWH SQ	81.82%	36
Other	0.00%	0
None	0.00%	0
TOTAL		44

Unfractionated heparin versus low-molecular-weight heparin for venous thromboembolism prophylaxis in trauma

Benjamin N. Jacobs, MD, Anne H. Cain-Nielsen, MS, Jill L. Jakubus, MHSA, MS, PA-C, Judy N. Mikhail, PhD, RN, John J. Fath, MD, Scott E. Regenbogen, MD, *and* **Mark R. Hemmila, MD**, *Ann Arbor, Michigan*

BACKGROUND: Venous thromboembolism (VTE) is a common complication in trauma patients. Pharmacologic prophylaxis is utilized in trauma patients to reduce their risk of a VTE event. The Eastern Association for the Surgery of Trauma guidelines recommend use of low-molecular-weight heparin (LMWH) as the preferred agent in these patients. However, there is literature suggesting that unfractionated heparin (UFH) is an acceptable, and less costly, alternative VTE prophylaxis agent with equivalent efficacy in trauma patients. We examined data from the Michigan Trauma Quality Improvement Program to perform a comparative effectiveness study of UFH versus LMWH on outcomes for trauma patients.

METHODS: We conducted an analysis of the Michigan Trauma Quality Improvement Program data from January 2012 to December 2014. The data set contains information on date, time, and drug type of the first dose of VTE prophylaxis. Thirty-seven thousand eight hundred sixty-eight patients from 23 hospitals were present with an Injury Severity Score of 5 or greater and hospitalization for more than 24 hours. Patients were excluded if they died within 24 hours or received no pharmacologic VTE prophylaxis or agents other than UFH or LMWH while admitted to the hospital. We compared patients receiving LMWH to those receiving UFH. Outcomes assessed were VTE event, pulmonary embolism, deep vein thrombosis, and mortality during hospitalization. We used a generalized estimating equation approach to fit population-averaged logistic regression models with the type of first dose of VTE prophylaxis as the independent variable. Unfractionated heparin was considered the reference value. Timing of the first dose of VTE prophylaxis was entered into the model in addition to standard covariates. Odds ratios were generated for each of the dependent variables of interest.

RESULTS: The analysis cohort consisted of 18,010 patients. Patients administered LMWH had a decreased risk of mortality (odds ratio, 0.64; confidence interval, 0.49–0.83), VTE (odds ratio, 0.67; confidence interval, 0.53–0.84), pulmonary embolism (odds ratio, 0.53; confidence interval, 0.35–0.79), and deep vein thrombosis (odds ratio, 0.73; confidence interval, 0.57–0.95) when compared with UFH following risk adjustment and accounting for hospital effect. The reduced risk of a VTE event for patients receiving LMWH was most pronounced for patients in the lower injury-severity categories.

CONCLUSIONS: In our examination of VTE prophylaxis drug effectiveness, LMWH was found to be superior to UFH in reducing the incidence of mortality and VTE events among trauma patients. Therefore, LMWH should be the preferred VTE prophylaxis agent for use in hospitalized trauma patients. (*J Trauma Acute Care Surg.* 2017;83: 151–158. Copyright © 2017 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Therapeutic, level III.

KEY WORDS: Collaborative quality improvement; complications; quality improvement; trauma outcomes; venous thromboembolism; venous thromboembolism prophylaxis.

VTE Prophylaxis Study

- Date range: 1/1/2012 to 12/31/2014
- Inclusion:
  - MTQIP patient
  - VTE prophylaxis with heparin or LMWH
- Exclusion:
  - Direct admit
  - Transfer out
  - Dead and hospital days <=1
  - Trauma centers who joined after 1/1/2012

Unadjusted Outcomes

Outcome	Heparin	LMWH	p-value
Patients, N	7,786	10,224	--
Mortality, % (N)	2.1 (166)	1.4 (139)	<0.001
DVT, % (N)	2.1 (161)	1.5 (153)	<0.001
Pulmonary Embolism, % (N)	0.8 (66)	0.5 (52)	0.01
VTE, % (N)	2.7 (207)	1.9 (190)	<0.001

Risk Adjustment

- Patient Characteristics
- Insurance status
- Physiology
- Injuries
- Comorbidities
- Intubation status
- Transfer status
- Timing of initiation of VTE prophylaxis

Adjusted Outcomes

	Outcome	N	OR	95% CI
★	VTE Event, with Hospital Effect	18,010	0.67	0.53-0.84
	VTE Event by ISS categories			
★	5-15	13,328	0.70	0.49-0.99
★	16-24	3,035	0.46	0.31-0.70
	≥ 25	1,647	1.05	0.72-1.53

Adjusted Outcomes

	Outcome	N	OR	95% CI
★	PE, with Hospital Effect	18,010	0.53	0.35-0.79
	PE by ISS categories			
★	5-15	13,328	0.41	0.23-0.73
★	16-24	3,035	0.41	0.19-0.87
	≥ 25	1,647	1.2	0.60-2.38

Adjusted Outcomes

	Outcome	N	OR	95% CI
★	DVT, with Hospital Effect	18.010	0.73	0.57-0.95
	DVT by ISS categories			
	5-15	13,328	0.82	0.54-1.25
★	16-24	2,919	0.50	0.32-0.80
	≥ 25	1,505	1.18	0.79-1.77

Adjusted Outcomes

	Outcome	N	OR	95% CI
★	Mortality, with Hospital Effect	18,010	0.64	0.49-0.83
	Mortality by ISS categories			
	5-15	13,328	0.81	0.56-1.18
	16-24	3,035	0.75	0.43-1.30
★	≥ 25	1,647	0.55	0.36-0.84

Effectiveness of low-molecular-weight heparin versus unfractionated heparin to prevent pulmonary embolism following major trauma: A propensity-matched analysis

James P. Byrne, MD, William Geerts, MD, Stephanie A. Mason, MD, David Gomez, MD, PhD, Christopher Hoeft, MA, Ryan Murphy, MPH, Melanie Neal, MS, *and* **Avery B. Nathens, MD, PhD**, *Toronto, Ontario, Canada*

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Issn Print: 0003-4932
Publication Date: 2017/09/01

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Pharmacological Thromboembolic Prophylaxis in Traumatic Brain Injuries: Low Molecular Weight Heparin Is Superior to Unfractionated Heparin

Elizabeth Benjamin; Gustavo Recinos; Alberto Aiolfi; Kenji Inaba; Demetrios Demetriades

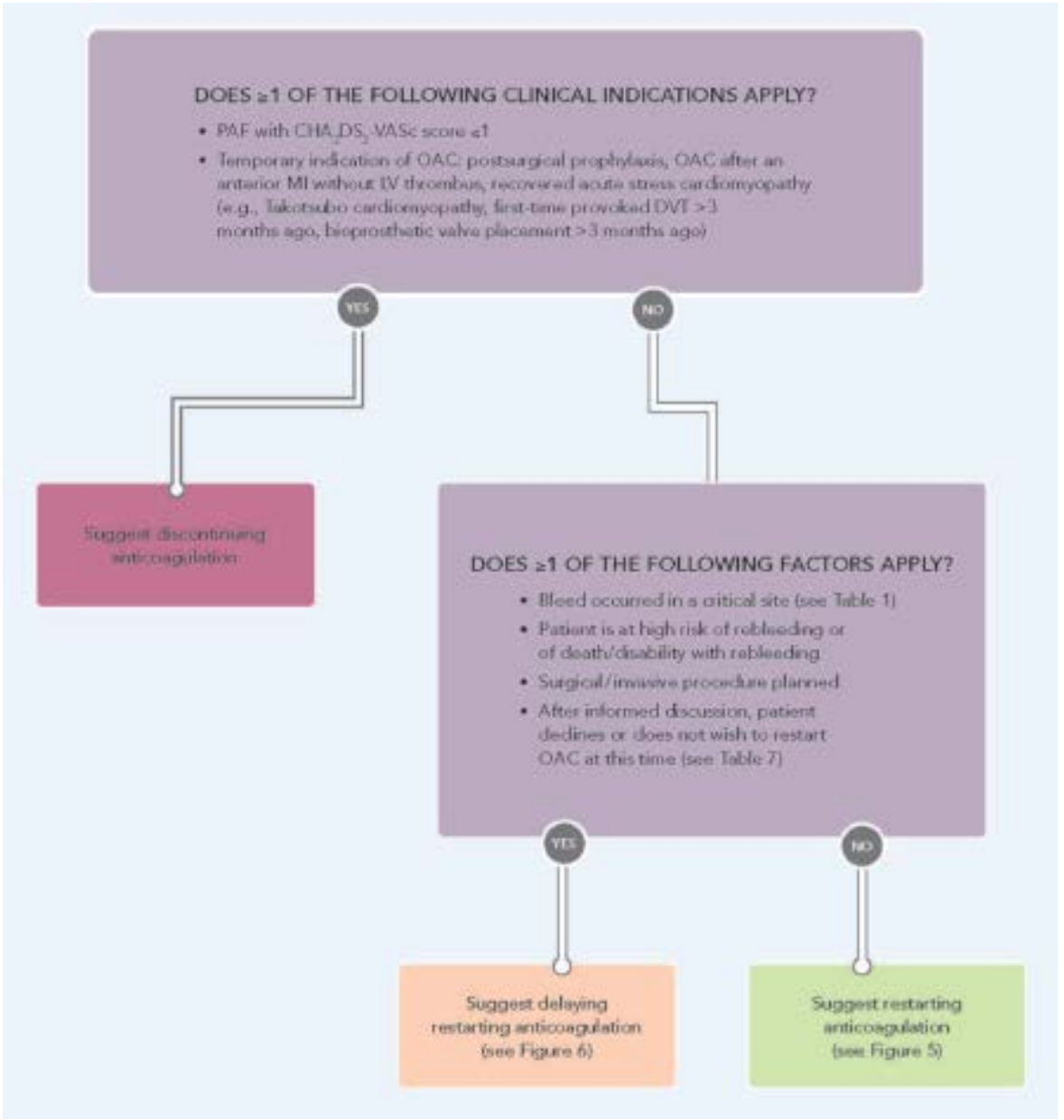
DOES ≥1 OF THE FOLLOWING CLINICAL INDICATIONS APPLY?
• PAF with CHA2DS2-VASc score ≤1
• Temporary indication of OAC: postsurgical prophylaxis, OAC after an anterior MI without LV thrombus, recovered acute stress cardiomyopathy (e.g., Takotsubo cardiomyopathy), first-time provoked DVT >3 months ago, bioprosthetic valve placement >3 months ago)
YES
NO
Suggest discontinuing anticoagulation
DOES ≥1 OF THE FOLLOWING FACTORS APPLY?
• Bleed occurred in a critical site (see Table 1)
• Patient is at high risk of rebleeding or of death/disability with rebleeding
• Surgical/invasive procedure planned
• After informed discussion, patient declines or does not wish to restart OAC at this time (see Table 7)
YES
NO
Suggest delaying restarting anticoagulation (see Figure 6)
Suggest restarting anticoagulation (see Figure 5)

TABLE 6 Indications for Anticoagulation With High Thrombotic Risk

Indication	Patient Characteristics
Mechanical valve prosthesis	■ Mechanical valve + additional thrombotic considerations: AF, CHF, prior stroke/TIA ■ Caged-ball or tilting disc aortic valve prosthesis ■ Stroke/TIA within 6 months
AF	■ AF with $CHADS_2$ score ≥4 (or CHA_2DS_2-VASc score ≥6) (84) ■ Stroke/TIA within 3 months ■ Stroke risk ≥10% per year ■ Rheumatic valve disease or mitral stenosis
VTE	■ VTE within 3 months ■ History of unprovoked or recurrent VTE ■ Active cancer and history of cancer-associated VTE
Prior thromboembolism with interruption of anticoagulation	
Left ventricular or left atrial thrombus	
Left ventricular assist device (LVAD)	