

Figure 1. Perioperative Timing of Bridging Anticoagulation

Medication and Risk Factors		Preoperative Day					Day of Surgery	Postoperative Day				
Medication	Procedural Bleeding Risk	-5	-4	-3	-2	-1	0	1	2	3	4	...
Warfarin	High	Last Dose	⊘	⊘	⊘	⊘	Resume	→	→	→	→	→
	Low or Minimal	Last Dose	⊘	⊘	⊘	⊘	Resume	→	→	→	→	→
LMWH	High			Start ^a	→	Last Dose ^b	⊘	⊘	Resume ^c or Resume	→	→	Last Dose ^c
	Low or Minimal			Start ^a	→	Last Dose ^b	⊘	Resume ^c	→	→	→	Last Dose ^c

LMWH, Low Molecular Weight Heparin

^aGive first dose in the morning; ^bGive last dose in the morning, at least 24 hours prior to surgery; ^cAt least 24 hours after surgery; ^dStop LMWH when INR therapeutic for at least 24 hours
Data from Doherty et al. J Am Coll Cardiol. 2017,²² Douketis et al. Chest. 2012,²³ and Spyropoulos et al. J Thromb Haemost. 2016²⁴ For educational purposes only.

Figure 2. Perioperative Timing of Dabigatran

Medication and Risk Factors			Preoperative Day					Day of Surgery	Postoperative Day				
Medication	Renal Function	Procedural Bleeding Risk	-5	-4	-3	-2	-1	0	1	2	3	4	5
Dabigatran	CrCl ≥ 50	High	→	→	Last Dose ^b	⊘	⊘	⊘	⊘	Resume ^c or Resume	→	→	→
		Low or Minimal	→	→	→	Last Dose ^b	⊘	⊘	Resume ^c	→	→	→	→
	CrCl 30-50 ^a	High	Last Dose ^b	⊘	⊘	⊘	⊘	⊘	⊘	Resume ^c or Resume	→	→	→
		Low or Minimal	→	→	Last Dose ^b	⊘	⊘	⊘	Resume ^c	→	→	→	→

CrCl, creatinine clearance

^aAn even longer period of preoperative interruption is appropriate for CrCl < 30; ^bGive last dose in the morning; ^cAt least 24 hours after surgery
Data from Pradaxa prescribing information,²² Doherty et al. J Am Coll Cardiol. 2017,²³ Horlocker et al. Reg Anesth Pain Med. 2018,²⁴ Bell et al. Hematol Oncol Clin N Am. 2016²⁵, and Spyropoulos et al. J Thromb Haemost. 2016²⁶ For educational purposes only.

Figure 3. Perioperative Timing of Factor Xa Inhibitors

Medication and Risk Factors		Preoperative Day					Day of Surgery	Postoperative Day				
Medication	Procedural Bleeding Risk	-5	-4	-3	-2	-1	0	1	2	3	4	5
Rivaroxaban, Apixaban, Edoxaban	High	→	→	★ Last Dose ^a	⊘	⊘	⊘	⊘	→ Resume ^b or → Resume ^b	→	→	→
	Low or Minimal	→	→	→	★ Last Dose ^a	⊘	⊘	→ Resume ^b	→	→	→	→
Fondaparinux	High	→	★ Last Dose ^a	⊘	⊘	⊘	⊘	⊘	→ Resume ^b or → Resume ^b	→	→	→
	Low or Minimal	→	→	→	★ Last Dose ^a	⊘	⊘	→ Resume ^b	→	→	→	→

Renal impairment may require longer periods of preoperative interruption

^aGive last dose in the morning; ^bAt least 24 hours after surgery

Data from Doherty et al. J Am Coll Cardiol. 2017;² Horlocker et al. Reg Anesth Pain Med. 2018;¹¹ Bell et al. Hematol Oncol Clin N Am. 2016;¹⁰ Spyropoulos et al. J Thromb Haemost. 2016²⁶, and Arixtra prescribing information¹⁹ For educational purposes only.

Table 1. Patient-Related Bleeding Risk Factors

- A bleeding event within 3 months prior to the planned procedure
- Any bleeding event associated with a similar procedure
- Any bleeding event during previous bridging anticoagulation
- Disorders of platelet number or function

Data from Doherty et al; J Am Coll Cardiol. 2017² For educational purposes only.

Table 2. Procedure-Related Bleeding Risk

Minimal Risk	High Risk
Dental procedures <ul style="list-style-type: none"> • Tooth extraction • Root canal 	Central and peripheral nervous system <ul style="list-style-type: none"> • Intracranial surgery • Spine surgery • Neuraxial anesthesia • Peripheral nerve block at a non-compressible site
Cardiology procedures <ul style="list-style-type: none"> • Pacemaker implantation • Defibrillator implantation 	Urologic surgeries <ul style="list-style-type: none"> • Transurethral prostate resection • Bladder resection
Cutaneous procedures <ul style="list-style-type: none"> • Skin biopsy • Excision of skin cancers other than melanoma 	Gastrointestinal surgeries <ul style="list-style-type: none"> • Bowel resection • Large polyp resection
Cataract surgery	Vaginal or cesarean delivery
	Surgery on or biopsy of highly vascular organs <ul style="list-style-type: none"> • Kidney • Liver • Spleen
	Surgery with extensive tissue injury <ul style="list-style-type: none"> • Cancer surgery • Joint arthroplasty • Reconstructive plastic surgery
	Cardiac surgery

Data from from Doherty et al; J Am Coll Cardiol. 2017³, Douketis et al. Chest. 2012⁷, and Nishimura et al. Circulation. 2017⁸ For educational purposes only.

Table 3. Nomenclature of Perioperative Days

Preoperative Day					Day of Surgery	Postoperative Day				
-5	-4	-3	-2	-1	0	1	2	3	4	5

Table 4. Pharmacokinetic Properties of Direct Thrombin and Factor Xa Inhibitors

	Dabigatran	Rivaroxaban	Apixaban	Edoxaban	Fondaparinux
T _{1/2} (hours)*	13**	7	12	12	19
T _{max} (hours)*	2	3	3	2	2
Route of elimination*	80% Renal	35% Renal	25% Renal	50% Renal	75% Renal

T_{1/2}, half-life; T_{max}, time to maximal concentration

*Values are approximate

**T_{1/2} up to 27 hours in patients with reduced creatinine clearance

Data from prescribing information,^{23-26,27} Sie et al. Arch Cardiovasc Dis. 2011,²² and Bell et al. Hematol Oncol Clin N Am. 2016²¹ For educational purposes only.

Table 5. Removal of Epidural Catheters

Agent	Catheter Removal*	Resumption of Anticoagulant**
IV UFH	4 to 6 hours after discontinuation	1 hour
Subcutaneous UFH	4 to 6 hours after last dose	1 hour
Wafarin	INR < 1.5	No delay indicated
Daily Prophylactic† LMWH	12 hours after last dose	4 hours
Therapeutic LMWH	N/A‡	4 hours
BID Prophylactic† LMWH	N/A‡	4 hours
DOAC	N/A‡	6 hours
Fondaparinux	N/A‡	6 hours

IV, intravenous; UFH, unfractionated heparin; INR, international normalized ratio; LMWH, low molecular weight heparin; DOAC, direct oral anticoagulant (dabigatran, rivaroxaban, apixaban, and edoxaban)

*Minimum time from last anticoagulant dose to catheter removal; **Minimum time from catheter removal to next anticoagulant dose; †Doses indicated for venous thromboembolism prophylaxis; ‡These agents/regimens should not be started until after epidural catheter removal

Data from Horlocker et al. Reg Anesth Pain Med. 2018²². For educational purposes only.

Table 6. CHA₂DS₂-VASc Scores and the Risk of ATE

CHA₂DS₂-VASc Scoring System	
Risk Factors	Points
Congestive Heart Failure	1
Hypertension	1
Age 65-74 years	1
Diabetes Mellitus	1
Stroke or transient ischemic attack	2
Vascular disease	1
Age ≥ 75 years	2
Sex (female)	1

ATE Risk	
CHA₂DS₂-VASc Score	Stroke Rate/ 100 patient years*
0	0.3
1	1.0
2	3.3
3	5.3
4	7.8
5	11.7
6	15.9
7	18.4
8	17.9
9	20.3

ATE, Arterial Thromboembolism (stroke, transient ischemic attack, systemic embolization)
**Data from Friberg et al. JAMA. 2001²⁵. For educational purposes only.*

Table 7. Risk Stratification for Perioperative ATE in Patients with Atrial Fibrillation

Thromboembolic Risk Category	Risk Factors
High	<ul style="list-style-type: none"> • CHA₂DS₂-VASc ≥ 7 • Recent stroke or TIA (within 3 months)
Moderate	<ul style="list-style-type: none"> • CHA₂DS₂-VASc = 5 or 6 • Prior stroke or TIA (greater than 3 months prior)
Low	<ul style="list-style-type: none"> • CHA₂DS₂-VASc ≤ 4

TIA, transient ischemic attack
Data from Doherty et al. J Am Coll Cardiol. 2017². For educational purposes only.

Table 8. Risk Stratification for Perioperative ATE in Patients with Mechanical Heart Valves

Thromboembolic Risk Category	Risk Factors
High	Any mitral valve Older aortic valve (caged ball or tilting disc) Bileaflet aortic valve plus one or more risk factor <ul style="list-style-type: none"> • Atrial fibrillation • Previous ATE • Hypercoagulable condition • Congestive heart failure Recent stroke or TIA (within 6 months)
Moderate/Low	Bileaflet aortic valve <ul style="list-style-type: none"> • No atrial fibrillation • No other risk factors

Data from Nishimura et al. Circulation. 2017⁶. For educational purposes only.

Table 9. Risk Stratification for Perioperative Venous Thromboembolism

Thromboembolic Risk Category	Risk Factors
High	Recent VTE (within 3 months) Severe thrombophilia <ul style="list-style-type: none"> • Protein C deficiency • Protein S deficiency • Antithrombin III deficiency • Antiphospholipid antibodies • More than one nonsevere thrombophilia mutation
Moderate	VTE within 3-12 months Recurrent VTE Active cancer <ul style="list-style-type: none"> • treated within 6 months or palliative Nonsevere thrombophilia <ul style="list-style-type: none"> • Heterozygous factor V Leiden mutation • Prothrombin gene mutation
Low	Single VTE <ul style="list-style-type: none"> • > 12 months ago • No other risk factors

Data from Douketis et al. Chest. 2012⁷. For educational purposes only.

Table 10. Bridging Indications by Condition

Condition	Bridging Criteria
Atrial Fibrillation ¹	CHA ₂ DS ₂ -VASc ≥ 7 Recent stroke or TIA (within 3 months) CHA ₂ DS ₂ -VASc = 5 or 6 if both of the following <ul style="list-style-type: none">• History of ATE• No bleeding risk factors
Mechanical Heart Valve ⁸	Any mitral valve Older aortic valve (caged ball or tilting disc) Recent stroke or TIA (within 6 months) Bileaflet aortic valve with risk factor <ul style="list-style-type: none">• Atrial fibrillation• Previous arterial thromboembolic event• Thrombophilia• Left ventricular systolic dysfunction
Venous Thromboembolism ⁷	Recent VTE (within 3 months) Severe thrombophilia <ul style="list-style-type: none">• Protein C deficiency• Protein S deficiency• Antithrombin III deficiency• Antiphospholipid antibodies• More than one non-severe thrombophilia mutation