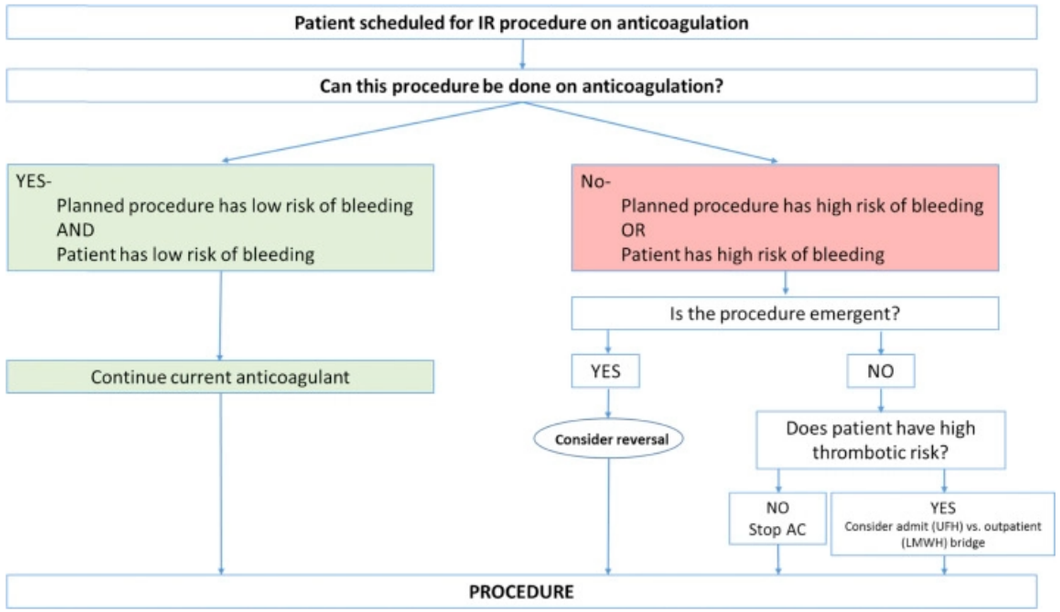
Periprocedural Anticoagulation Recommendations – 2019 SIR Guideline Update (Endorsed by CAIR and CIRSE)

Every patient situation is different regarding anticoagulation therapy. In general, a broad approach to deciding on how to best manage a patient's periprocedural anticoagulation medication can be approached in the following manner (adapted from Patel et al, 2019):



Below are summary recommendations from the guidelines. Full guideline details can be reviewed from reference 1.

***Chronic Liver Disease Patients**

In patients with **chronic liver disease**, threshold values for low and high-risk procedures are different. Although these patients have decreased liver function in the formation of coagulation factors, the liver also is responsible for the formation of many anticoagulation factors. Thus, chronic liver disease patients are prone to thrombus formation despite the increased INR and low platelet levels (Tripodi et al, 2016).

Low Risk	High Risk
INR: Not applicable Platelets: transfuse if < $20 \times 10^{9}/L$ Fibrinogen > 100 mg/dL	INR: correct to within range of < 2.5 Platelets: transfuse if < $30 \times 10^{9}/L$ Fibrinogen > 100 mg/dL

LOW RISK PROCEDURES

PT/INR: not routinely recommended

Platelet count/ hemoglobin: not routinely recommended

VASCULAR

- Diagnostic arteriography and arterial interventions: peripheral, sheath < 6 F, including embolotherapy
- Diagnostic venography and select venous interventions: pelvis and extremities
- Dialysis access interventions
- IVC filter placement and removal
- Nontunneled venous access and removal (including PICC placement)
- Transjugular liver biopsy
- Tunneled venous catheter placement/removal (including ports)

NON-VASCULAR

- Catheter exchanges (gastrostomy, abscess, biliary, nephrostomy, gastrostomy tube conversions)
- Facet joint injections and medial branch nerve blocks (thoracic and lumbar spine)
- Lumbar puncture

MEDICATION	DISCONTINUE Y/N	STOP RECOMMENDATION	RESUME ANTICOAGULATION
Anticoagulant Agents			
Heparin (Unfractionated)	No		
Fragmin=Dalteparin Lovenox=Enoxaparin	No		
Fondaparinux (Arixtra)	No		
Argatroban (Acova)	No		
Bivalirudin (Angiomax)	No		
Warfarin (Coumadin)	Yes	Target INR ≤ 3.0; consider bridging for high thrombosis risk cases	Same day for bridged patients
Apixaban (Eliquis)	No		
Betrixaban (Bevyxxa)	No		
Dabigatran (Pradaxa)	No		
Edoxaban (Savaysa)	No		
Rivaroxaban (Xarelto)	No		
Antiplatelet Agents			
Argatroban	No		
Clopidogrel (Plavix)	No		
Ticagrelor (Brilinta)	No		
Prasugrel (Effient)	No		
Cangrelor (Kengreal)	Yes	Defer procedure until off medication; if procedure is emergent, withhold 1h before procedure; multidisciplinary	Patients receiving Cangrelor are undergoing PCI or are within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making

▪ Nontunneled chest tube placement for pleural effusion ▪ Paracentesis ▪ Peripheral nerve blocks, joint, and musculoskeletal injections ▪ Sacroiliac joint injection and sacral lateral branch blocks ▪ Superficial abscess drainage or biopsy (palpable lesion, lymph node, soft tissue, breast, thyroid, superficial bone, eg, extremities and bone marrow aspiration) ▪ Thoracentesis ▪ Trigger point injections including piriformis ▪ Tunneled drainage catheter placement **THRESHOLDS FOR TREATMENT** INR: correct to within range of ≤ 2.0-3.0 Platelets: transfuse if < 20 × 109/L	Cangrelor (Kengreal) continued		discussion with cardiology suggested	recommended
	Aspirin	No		
	Aspirin/Dipyridamole (Aggrenox)	No		
	NSAIDS (Ibuprofen, Ketorolac, etc)	No		
	Abciximab (ReoPro)	Yes	24h before procedure	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended
	Eptifibatide (Integrilin)	Yes	4-8h before procedure	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended
	Tirofiban (Aggrastat)	Yes	4-8h before procedure	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended
	Cilostazol (Pletal)	No		

HIGH RISK PROCEDURES

PT/INR: routinely recommended

Platelet count/ hemoglobin: routinely recommended

VASCULAR

- Arterial interventions: > 7F sheath, aortic, pelvic, mesenteric, CNS
- Catheter directed thrombolysis (DVT, PE, portal vein)
- IVC filter removal complex
- Portal vein interventions
- Transjugular intrahepatic portosystemic shunt
- Venous interventions: intrathoracic and CNS interventions

MEDICATION	DISCONTINUE Y/N	STOP RECOMMENDATION	RESUME ANTICOAGULATION
Anticoagulant Agents			
Heparin (Unfractionated)	Yes	IV heparin for 4–6h before procedure; check aPTT or anti-Xa level; for BID or TID dosing of SC heparin, procedure may be performed 6h after last dose	6-8h post procedure
Lovenox=Enoxaparin	Yes	1 dose if prophylactic dose is used; withhold 2 doses or 24h before procedure if therapeutic dose is used; check anti-Xa level if renal function impaired	12h post procedure
Fragmin=Dalteparin	Yes	1 dose before procedure	12h post procedure
Fondaparinux (Arixtra)	Yes	2-3 days (CrCl ≥ 50 mL/min) or 3–5 days (CrCl ≤ 50 mL/min)	24h post procedure
Argatroban (Acova)	Yes	2–4h before procedure; check aPTT	4-6h post procedure
Bivalirudin (Angiomax)	Yes	2–4h before procedure; check aPTT	4-6h post procedure
Warfarin (Coumadin) Warfarin (Coumadin) continued	Yes	5 days until target INR ≤ 1.8; consider bridging for high thrombosis risk cases; if STAT or emergent, use reversal agent	Resume day after procedure; high thrombosis risk cases may benefit from bridging with LMWH and multidisciplinary management especially if reversal agent used along with vitamin K
Apixaban (Eliquis)	Yes	4 doses (CrCl ≥ 50 mL/min) or 6 doses (CrCl < 30–50 mL/min); if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-	24h post procedure

NON-VASCULAR ▪ Ablations: solid organs, bone, soft tissue, lung ▪ Biliary interventions (including cholecystostomy tube placement) ▪ Deep abscess drainage (eg, lung parenchyma, abdominal, pelvic, retroperitoneal) ▪ Deep nonorgan biopsies (eg, spine, soft tissue in intraabdominal, retroperitoneal, pelvic compartments) ▪ Gastrostomy/gastrojejunostomy placement ▪ Solid organ biopsies ▪ Spine procedures with risk of spinal or epidural hematoma (eg, kyphoplasty, vertebroplasty, epidural injections, facet blocks cervical spine) ▪ Urinary tract interventions (including nephrostomy tube placement, ureteral dilation, stone removal)	Apixaban (Eliquis) cont'd		Xa activity or apixaban level especially with impaired renal function	
	Betrixaban (Bevyxxa)	Yes	3 doses; if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-Xa activity especially with impaired renal function	24h post procedure
	Dabigatran (Pradaxa)	Yes	4 doses (CrCl ≥ 50 mL/min) or 6–8 doses (CrCl < 30–50 mL/min); if procedure is STAT or emergent, use reversal agent (idarucizumab); consider checking thrombin time or dabigatran level with impaired renal function	24h post procedure
	Edoxaban (Savaysa)	Yes	2 doses; if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-Xa activity especially with impaired renal function	24h post procedure
	Rivaroxaban (Xarelto)	Yes	2 doses (CrCl ≥ 30 mL/min), or 3 doses (CrCl < 15–30 mL/min); if procedure is STAT or emergent, use reversal agent (andexanet alfa); consider checking anti-Xa activity or rivaroxaban level especially with impaired renal function	24h post procedure
	Antiplatelet Agents			
	Argatroban	Yes	2-4 hrs before procedure. Check aPTT.	4-6h after procedure
	Clopidogrel (Plavix)	Yes	5 days before procedure	6 h after procedure if using 75-mg dose, but should occur 24 h after procedure if using a loading dose (300–600 mg)
	Ticagrelor (Brilinta)	Yes	5 days before procedure	Day after procedure

THRESHOLDS FOR TREATMENT INR: correct to within range of ≤ 1.5–1.8 Platelets: transfuse if < 50 × 10^{9}/L	Prasugrel (Effient)	Yes	7 days before procedure	Day after procedure
	Cangrelor (Kengreal)	Yes	Defer procedure until off medication; if procedure is emergent, withhold 1 h before procedure; multidisciplinary discussion with cardiology suggested	Patients receiving Cangrelor are undergoing PCI or are within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended
	Aspirin	Yes	3-5 days before procedure	Day after procedure
	Aspirin/Dipyridamole (Aggrenox)	Yes	3-5 days before procedure	Day after procedure
	NSAIDS (Ibuprofen, Ketorolac, etc)	No Recommend.		
	Abciximab (ReoPro)	Yes	24h before procedure	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended
	Eptifibatide (Integrilin)	Yes	4-8h before procedure	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended
	Tirofiban (Aggrastat)	Yes	4-8h before procedure	Patients receiving glycoprotein IIb/IIIa inhibitor are undergoing PCI or within immediate periprocedural period from cardiac intervention; multidisciplinary, shared decision making recommended
	Cilostazol (Pletal)	No		

Patel IJ, Rahim S, Davidson JC, Hanks SE, Tam AL, Walker TG, Wilkins LR, Sarode R, Weinberg I. Society of Interventional Radiology Consensus Guidelines for the Periprocedural Management of Thrombotic and Bleeding Risk in Patients Undergoing Percutaneous Image-Guided Interventions-Part II: Recommendations: Endorsed by the Canadian Association for Interventional Radiology and the Cardiovascular and Interventional Radiological Society of Europe. J Vasc Interv Radiol. 2019 Aug;30(8):1168-1184.e1. doi: 10.1016/j.jvir.2019.04.017. Epub 2019 Jun 20.

Tripodi A, Primignani M, Mannucci PM, Caldwell SH. Changing Concepts of Cirrhotic Coagulopathy. Am J Gastroenterol. 2017 Feb;112(2):274-281. doi: 10.1038/ajg.2016.498. Epub 2016 Nov 1.