TABLE 1: Nonvascular Percutaneous Procedures and Risk of Bleeding

Low Risk	Moderate Risk	High Risk
Thoracentesis	Intraabdominal (excluding liver and spleen) and retroperitoneal (excluding renal) biopsy or drainage, lung, chest wall, or retroperitoneal biopsy or drainage	Renal, hepatic, or splenic parenchymal biopsy
Paracentesis	Percutaneous cholecystostomy tube (original placement and exchanges)	Biliary intervention (new tract)
Superficial aspiration or drainage (excluding intrathoracic or intraabdominal sites)	Simple RFA procedure	Complex[a] RFA procedure
Superficial biopsy (thyroid, peripheral lymph nodes, breast)	Gastrostomy tube placement (original placement and exchanges)	Nephrostomy tube placement (original placement and exchanges)
Drainage catheter exchange	Biliary tube exchange	Lumbar puncture, myelography, epidural injection

Note—RFA = radiofrequency ablation.
[a]A complex RFA procedure entails treatment of a lesion in a location near major vessels or when a large amount of hepatic or nonhepatic parenchyma must be traversed to access the lesion.

TABLE 2: Anticoagulants Dosing and Reversal Agents

Medication	Class of Agent	Laboratory Monitoring	Route of Administration	Dosing	Reversal Agent (Dose)
Warfarin	Vitamin K inhibitor	INR	PO	2–10 mg	Vitamin K (2.5–5 mg for low-risk procedure, 5–10 mg for high-risk procedure) FFP (1–2 IU) Four-factor PCC (dose relative to pretreatment INR[a])
UFH	Antithrombin III activation	APTT	IV	Cardiac therapy: initial bolus of 60 IU/kg and then 12 IU/kg/h DVT therapy: initial bolus of 80 IU/kg and then 18 IU/kg/h	Protamine (1 mg of protamine for each 100 IU of UFH [maximum dose, 50 mg])
UFH	Antithrombin III activation	APTT	SQ	DVT therapy: initial bolus of 333 IU/kg and then 50–70 IU/kg every 4–6 h	Protamine (1 mg protamine for each 100 IU of UFH [maximum dose, 50 mg])
LMWH	Antithrombin III activation	None	SQ	Enoxaparin: 1 mg/kg every 12 h Dalteparin: 150–200 IU/kg/d Tinzaparin: 175 IU/kg/d	Incomplete: protamine (1 mg/100 IU, repeat at half dose if needed)
Dabigatran	Direct thrombin inhibitor	None	PO	150 mg twice daily	None
Rivaroxaban	Direct factor Xa inhibitor	None	PO	20 mg once daily	None
Apixaban	Direct factor Xa inhibitor	None		Atrial fibrillation: 5 mg twice daily PE therapy: 5 mg twice daily DVT prophylaxis: 2.5 mg twice daily	None
Fondaparinux	Select factor Xa inhibitor	None	PO	Acute VTE: 5–10 mg (weight based) once daily DVT prophylaxis: 2.5 mg once daily	None
Argatroban	Direct thrombin inhibitor	APTT	IV	Loading dose 2 mcg/kg/min, titrate upward to keep APTT 1.5–3 times baseline (maximum dose, 10 mcg/kg/min)	None
Desirudin	Direct thrombin inhibitor	APTT	SQ	15 mg every 12 h	None
Bivalirudin	Direct thrombin inhibitor	APTT	IV	Initial bolus of 0.75 mg/kg and then continuous rate of 1.75 mg/kg/h	None

Note—INR = international normalized ratio, PO = oral, FFP = fresh frozen plasma, PCC = prothrombin complex concentrate, DVT = deep venous thrombosis, UFH = unfractionated heparin, APTT= activated partial thromboplastin time, SQ = subcutaneous, LMWH = low-molecular-weight heparin, PE = pulmonary embolism, VTE = venous thromboembolism.
[a]Dose of four-factor PCC is determined by pretreatment INR: 25 IU/kg (maximum dose, 2500 U) for pretreatment INR ranging from 2 to less than 4, 35 IU/kg (maximum dose, 3500 IU) for pretreatment INR of 4–6, and 50 IU/kg (maximum dose, 5000 IU) for pretreatment INR of greater than 6.

TABLE 3: Recommendations for Management of Anticoagulants

	Interval Between Last Dose and Procedure			Resumption After Procedure		
Medication	Low Bleeding Risk	Medium Bleeding Risk	High Bleeding Risk	Low Bleeding Risk	Medium Bleeding Risk	High Bleeding Risk
Warfarin	5 d	5 d	5 d	12 h	12 h	12–24 h
UFH (IV)	1 h	4 h	4 h	1 h	1 h	1 h
UFH (SQ)	4 h	4 h	6 h	Immediate	Immediate	1 h
LMWH (SQ)	12 h	12 h	12 h	6 h	6 h	6 h
Dabigatran	24 h	48 h	72 h	24 h	48 h	48 h
Rivaroxaban	24 h	48 h	48 h	24 h	48 h	48 h
Apixaban	24 h	48 h	72 h	24 h	48 h	48 h
Fondaparinux	24 h	36 h	48 h	6 h	6 h	6 h
Argatroban	None	4 h	4 h	1 h	1 h	1 h
Desirudin	None	4 h	4 h	1 h	1 h	1 h
Bivalirudin	None	4 h	4 h	1 h	1 h	1 h

Note—UFH = unfractionated heparin, SQ = subcutaneous, LMWH = low-molecular-weight heparin. Data from [6–9, 13, 19].

TABLE 4: Antiplatelet Dosing and Reversal Agents

Medication	Class of Agent	Laboratory Monitoring	Route of Administration	Dosing	Reversal Agent (Dose)
ASA, low dose	COX inhibitor	None	PO	81 mg once daily	DDAVP (0.3–0.4 mcg/kg)
ASA, high dose	COX inhibitor	None	PO	325 mg once daily	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
ASA and dipyridamole	Phosphodiesterase inhibitor	None	PO	ASA: 25 mg Extended release dipyridamole: 200 mg twice daily	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
NSAIDs	COX inhibitor	None	PO	Ibuprofen: 200–400 mg every 4–6 h Diclofenac: 50 mg three times daily Ketoprofen: 20–50 mg every 6–8 h Indomethacin: 20–50 mg three times daily Naproxen: 550 mg every 12 h Sulindac: 150–200 mg twice daily Diflunisal: 500 mg every 12 h Celecoxib: 200 mg twice daily Meloxicam: 7.5 mg once daily Nabumetone: 1000–2000 mg split into two doses daily Piroxicam: 10–20 mg once daily	None
Cilostazol	Phosphodiesterase inhibitor	None	PO	100 mg twice daily	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
Clopidogrel	ADP receptor antagonist	Bleeding time	PO	Recent MI, stroke, or established PAD: 75 mg once daily ACS: 300-mg loading dose and then 75 mg once daily	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
Prasugrel	ADP receptor antagonist	None	PO	ACS: 60-mg loading dose and then 10 mg once daily	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
Ticagrelor	ADP receptor antagonist	None	PO	ACS: 180-mg loading dose and then 90 mg twice daily	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
Tirofiban	GP IIb/IIIa inhibitor	None	IV	Unstable angina or NSTEMI: loading dose 25 mcg/kg and then 0.15 mcg/kg/min	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
Eptifibatide	GP IIb/IIIa inhibitor	None	IV	ACS and PCI: 180 mcg/kg bolus and then 2 mcg/kg/min	DDAVP (0.3–0.4 mcg/kg), platelet transfusion, or both
Abciximab	GP IIb/IIIa inhibitor	None	IV	PCI and unstable angina or NSTEMI: initial bolus of 0.25 mg/kg and then 0.125 mcg/kg/min	Platelet transfusion

Note—ASA = acetylsalicylic acid (aspirin), COX = cyclooxygenase, DDAVP = desmopressin acetate, NSAIDs = nonsteroidal antiinflammatory drugs, ADP = adenosine diphosphonate, GP = glycoprotein, MI = myocardial infarction, PAD = peripheral arterial disease, PO = oral, ACS = acute coronary syndrome, NSTEMI = non–ST-segment elevation myocardial infarction, PCI = percutaneous coronary intervention.

TABLE 5: Recommendations for Management of Antithrombotics

	Interval Between Last Dose and Procedure			Resumption After Procedure			
Medication	Low Bleeding Risk	Medium Bleeding Risk	High Bleeding Risk	Low Bleeding Risk	Medium Bleeding Risk	High Bleeding Risk	Comment
ASA, low dose	None	None	None	Immediate	Immediate	Immediate	
ASA, high dose	None	5 d	5 d	Immediate	Immediate	Immediate	
ASA and dipyridamole	2 d	5 d	5 d	Immediate	Immediate	Immediate	
NSAIDs	None	None	24 h–10 d	Immediate	Immediate	Immediate	Variability in duration of action, long acting NSAIDs require longer interval before procedure
Cilostazol	None	None	24 h	Immediate	Immediate	Immediate	
Clopidogrel	5 d	5 d	5 d	Immediate	Immediate	Immediate	
Prasugrel	5 d	5 d	7 d	24 h	24 h	24 h	
Ticagrelor	5 d	5 d	7 d	24 h	24 h	24 h	
Tirofiban	—	—	—	—	—	—	Recent surgery is a contraindication (within 4 wk)
Eptifibatide	—	—	—	—	—	—	Recent surgery is a contraindication (within 6 wk)
Abciximab	NR	NR	NR	—	—	—	Recent surgery is a contraindication (within 6 wk)

Note—Dash (—) indicates that there are no recommendations available. ASA = acetylsalicylic acid (aspirin), NSAIDs = nonsteroidal antiinflammatory drugs, NR = not recommended. Data from [6–9, 13, 19, 41].