NORTH MEMORIAL HEALTH

Guidelines for Coagulation Testing and Its Use in Monitoring Anticoagulation Therapy
North Memorial Health Care

Category	Test/assay	Clinical setting	Target values
Monitoring **Vitamin K antagonists (i.e. Warfarin)**	• International normalized ratio (Protime/INR)	• Not recommended for patients with lupus anticoagulants • NOACs (new oral anticoagulants) can elevate INR to differing degrees depending on the concentration present at the time of INR.	• Most settings: INR target: 2-3 • Patients with recurrent thromboembolic events: INR target: 2.5-3.5
	• Chromogenic Factor X	• Patients with lupus anticoagulants • Patients with direct thrombin inhibitors (i.e. Argatroban and dabigatran)	• 20-40% correlates with INR value of 2-3
	• Factor II activity	• Alternate test for patients with lupus anticoagulants • Not recommended in the setting of direct thrombin inhibitors (i.e. argatroban and dabigatran)	• Most settings: 15-25%
Monitoring **Unfractionated (UF) heparin**	• UF heparin assay	Patients on unfractionated heparin therapy *NOTE: aPTT is not performed for monitoring unfractionated heparin therapy.*	• Standard dose protocol (i.e. acute myocardial infarction, post-thrombolytic therapy, unstable angina, or prosthetic valve): 0.25–0.6 IU/mL • High dose protocol (i.e. deep venous thrombosis or pulmonary thromboembolism): 0.3-0.7 IU/mL • Low dose protocol (for Impella patients only): 0.2-0.3 IU/mL

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Monitoring **Enoxaparin** - low molecular weight heparin (LMW) heparin therapy	• Enoxaparin Assay In most settings, monitoring is not necessary *Assay should be measured four hours after subcutaneous injection.*	Monitor with LMW heparin assay only in one of the following settings: • Patients with renal insufficiency • During pregnancy • Children and newborns • Prolonged treatment course • Markedly high (> 150 kg) or low body weight	• For twice daily administration: enoxaparin level of 0.6-1.0 IU/mL • For daily administration: enoxaparin level of 1.0-2.0 IU/mL • For prophylactic dosing: enoxaparin level of 0.2-0.4 IU/mL
Monitoring **Direct Thrombin Inhibitors** (i.e. Argatroban, Bivalirudin, Dabigatran)	• Activated partial thromboplastin time (aPTT) • Thrombin time (TT) • Argatroban and dabigatran levels: available as send out test(s)	• aPTT is used to monitor Argatroban and Bivalirudin • TT elevation may indicate a direct thrombin inhibitor (but *cannot* be used for monitoring) • Argatroban levels: for patients with lupus anticoagulants	• For Argatroban: aPTT 150-250% of baseline aPTT (current goal 60-85 sec) • Argatroban levels: Therapeutic Range: 0.40-0.60 mcg/ml • For Bivalirudin: aPTT 150-250% of baseline aPTT (current goal 43-71 seconds)
Monitoring **Factor Xa inhibitors** (i.e. Fondaparinux, Rivaroxaban, and Apixaban)	• Anti-Xa (for Fondaparinux) *Monitoring is not required for Rivaroxaban or Apixaban*	Patients on factor Xa inhibitors	For Fondaparinux (collected 3-4 hours after dose): • Prophylactic peak anti-Xa level of 0.3-0.5 mg/L • Therapeutic peak 0.8-1.2 mg/L
Tests for **Excluding Deep Vein thrombosis**	• D-dimer	A marker of breakdown of cross-linked fibrin; elevated in many conditions (surgery, trauma, pregnancy, disseminated intravascular coagulation, venous thromboembolism, deep vein thrombosis)	< 230 ng/mL (D-DU)

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Screening tests for **Evaluating prolonged PT/INR and/or aPTT**	First consider Mixing Studies • If mixing studies do not correct: consider *Lupus Anticoagulant panel* • If aPTT remains prolonged, may additionally consider factor levels: *Factor VIII, Factor IX, Factor XI, Factor XII* • If PT/INR remains prolonged, may additionally consider factor levels: *Factor VII* • If aPTT *and* PT/INR remain prolonged, may additionally consider factor levels: Factor II, Factor V, Factor X, Fibrinogen	Causes of prolonged aPTT and PT/INR • Factor deficiency • Inhibitors • Lupus anticoagulant • Vitamin K deficiency • Liver disease • Disseminated intravascular coagulation (DIC) • Anticoagulant therapy (i.e. Warfarin, heparin, direct thrombin inhibitors) • Poor specimen quality • von Willebrand disease (aPTT only)	Refer to the performing laboratory's normal ranges
Platelet function tests *Only available as send out tests*	• Platelet function closure time • Thromboelastography (TEG) • VerifyNow P2Y12 and aspirin tests • Platelet aggregation tests, and electron microscopy	Suspected qualitative platelet dysfunction	Refer to the performing laboratory's normal ranges

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Monitoring **Hypercoagulable states** (panels available at North Memorial)	• Thrombophilia Panel • Lupus Anticoagulant Inhibitor Panel • Prolonged Clotting Panel • Fetal Loss Coagulation Panel • Anti-cardiolipin antibodies IgG and IgM • Factor V Leiden mutation • Factor II (Prothrombin) 20210 mutation • Antithrombin III chromogenic levels • Protein C chromogenic levels • Free Protein S chromogenic levels	• Do not collect specimens following an acute thrombotic event or while on anticoagulant therapy • Allow 30 days off warfarin before collecting specimen	Current reference ranges reported in conjunction with patient test results.