## Guidelines for Coagulation Testing and Its Use in Monitoring Anticoagulation Therapy

**North Memorial Health Care**

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| 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 | 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 |

*NOTE: aPTT is not performed for monitoring unfractionated heparin therapy.*
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| **Monitoring Enoxaparin** - low molecular weight heparin (LMW) heparin therapy | Enoxaparin Assay | 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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<tbody>
<tr>
<td>Monitoring</td>
<td>Thrombophilia Panel</td>
<td>Do not collect specimens following an acute thrombotic event or while on anticoagulant therapy</td>
<td>Current reference ranges reported in conjunction with patient test results.</td>
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<tr>
<td>Hypercoagulable states (panels available at North Memorial)</td>
<td>Lupus Anticoagulant Inhibitor Panel</td>
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<tr>
<td></td>
<td>Prolonged Clotting Panel</td>
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<td>Fetal Loss Coagulation Panel</td>
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<td></td>
<td>Anti-cardiolipin antibodies IgG and IgM</td>
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<tr>
<td></td>
<td>Factor V Leiden mutation</td>
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<td>Factor II (Prothrombin) 20210 mutation</td>
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<tr>
<td></td>
<td>Antithrombin III chromogenic levels</td>
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<td>Protein C chromogenic levels</td>
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<td>Free Protein S chromogenic levels</td>
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