Periprocedural Management of Coagulation Status and Hemostasis Risk in Percutaneous Imaging Guided Interventions: Body Imaging Division

Category 0: Procedures with easily detected and controllable bleeding:

Procedures:
- Superficial fluid aspiration
- Thyroid FNA and core biopsy
- Superficial lymph node or mass FNA and core biopsy

Pre-procedure Lab Testing
- None

Management
- Ice pack x 5 min

Category I: Procedures with low risk of bleeding:

Procedures
- Thoracentesis
- Paracentesis

Pre-procedure Lab Testing
- INR: if on Warfarin or with liver disease
- Platelet count: if with liver disease

Management
- INR > 2.0: Without liver disease: Stop Warfarin and wait 1-2 days or treat with vitamin K until at or below 2.0. Resume Warfarin in the evening.
- INR > 2.0: With liver disease, MELD score > 30: Hepatology consult
- Platelets: Transfuse if < 20,000
- IV heparin stop x 3 hours. Resume 2-4 hours post procedure.
- Lovenox: Therapeutic dose: withhold one dose. Resume in the evening. Prophylactic dose: no need to withhold
- All other anticoagulants: Do not withhold

Category II: Procedures with moderate risk of bleeding

Procedures
- Intraabdominal, intrathoracic, or retroperitoneal biopsy or abscess aspiration.
- Percutaneous liver biopsy

Pre-procedure Lab Testing
- INR: Recommended
- Platelet count: Recommended
Management

- INR: Correct if above 1.5.
- Platelets: Transfuse if < 50,000
- Warfarin: Withhold for 2 days before procedure then check INR. Resume in the evening.
- IV heparin: Stop x 3 hrs. Resume in the evening.
- Lovenox (prophylactic and therapeutic): Withhold one dose before procedure. Resume in the evening.
- Plavix: Withhold for 5 days before procedure; bridge as needed. Resume the next day.
- Aspirin and non-steroidal anti-inflammatory drugs: Do not withhold
- Newer anticoagulants: Withhold or bridge with Lovenox as needed. Resume next day.

Category III: Procedures with significant bleeding risk, difficult to detect or control

Procedures
- Renal biopsy
- Spleen biopsy

Pre-procedure Lab Testing
- INR: Routinely recommended
- Platelet count: Routinely recommended
- Activated PTT: if on IV heparin

Management
- INR: Correct if above 1.5
- Activated PTT: Correct if > 1.5 times control
- Platelets: Transfuse if < 50,000
- Warfarin: Withhold x 2 days; check INR; bridge with Lovenox as needed. Resume in the evening.
- Lovenox (therapeutic): Withhold x 24 h or two doses. Resume in the evening.
- IV heparin: Stop x 3 hrs. Resume in the evening.
- Plavix and aspirin: Withhold x 5 days; bridge as needed. Resume next day.
- Other anticoagulants: Withhold or bridge as needed. Resume next day.

Notes:
-Guidelines may be exceeded at the discretion of radiologist after consulting with the clinician
-Always use color Doppler to avoid intervening vessels
-Resume IV heparin, Warfarin, and Lovenox the evening of and all other anticoagulants the day after the procedure if no signs of bleeding.
**Appendix 1:**

**Aspirin: ASA**
- Anti-platelet agent
- Blocks formation of thromboxane A2, inhibiting platelet aggregation
- Irreversible, platelets regenerate at 10% per day

**Coumadin: Warfarin**
- Anticoagulant
- Inhibits vitamin K recycling, depleting active vitamin K
  - Vitamin K activates factors II (PT), VII, IX, X, and proteins C, S, and Z
- Half-life 40 hours, liver metabolism, renal excretion

**Heparin: unfractionated heparin**
- Anticoagulant
- Binds antithrombin III, inactivating thrombin and factor Xa
- Half-life 1.5 hours, metabolized by endothelial cells and macrophages

**Lovenox: Enoxaparin sodium, low molecular weight heparin**
- Anticoagulant
- Binds to antithrombin to irreversibly inactivate factor Xa
- Less activity against IIa (thrombin) than Heparin
- Elimination half-life 4.5 hours, renal excretion
- Similar drugs:
  - Innohep: tinzaparin sodium
  - Fragmin: dalteparin sodium, metabolized by liver

**Plavix: Clopidogrel**
- Anti-platelet agent
- Irreversibly inhibits an ADP receptor (P2Y\textsubscript{12}) on platelet membranes
- Half-life 7-8 hours, metabolized by the liver, hepatic and renal elimination

**MELD score:**
- Model for End-Stage Liver Disease
- Utilizes serum bilirubin, serum creatinine, and INR to predict survival
Appendix 2: Management of Antiplatelet Therapy

The probability of a thromboembolic complication following reversal or discontinuation of anticoagulation or antiplatelet agents depends upon the preexisting condition for which the medication was prescribed

Up-To-Date 2016-Management of antiplatelet agents in patients undergoing endoscopic procedures

Condition-related risk of thromboembolic complications

<table>
<thead>
<tr>
<th>High-risk conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrial fibrillation associated with valvular heart disease (including the presence of a mechanical valve)</td>
</tr>
<tr>
<td>Atrial fibrillation associated with congestive heart failure or a left ventricular ejection fraction of &lt;35 percent</td>
</tr>
<tr>
<td>Atrial fibrillation associated with a history of a thromboembolic event</td>
</tr>
<tr>
<td>Atrial fibrillation associated with hypertension, diabetes, or age &gt;75 years</td>
</tr>
<tr>
<td>Mechanical valves in the mitral position</td>
</tr>
<tr>
<td>Mechanical valves in patients who have had a prior thromboembolic event</td>
</tr>
<tr>
<td>Coronary stents placed within one year</td>
</tr>
<tr>
<td>Acute coronary syndrome</td>
</tr>
<tr>
<td>Nonstented percutaneous coronary intervention after myocardial infarction</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low-risk conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deep vein thrombosis</td>
</tr>
<tr>
<td>Chronic or paroxysmal atrial fibrillation that is not associated with valvular disease</td>
</tr>
<tr>
<td>Bioprosthetic valves</td>
</tr>
<tr>
<td>Mechanical valves in the aortic position</td>
</tr>
</tbody>
</table>
## Appendix 3:
Management of Anticoagulant Therapy

Perioperative thrombotic risk for Anticoagulants- UpToDate 2016

<table>
<thead>
<tr>
<th>Risk stratum</th>
<th>Indication for anticoagulant therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Atrial fibrillation</strong></td>
<td></td>
</tr>
<tr>
<td>Very high thrombotic risk*</td>
<td>$\text{CHA}<em>{2}\text{DS}</em>{2}\text{-VASc}$ score of $\geq 6$</td>
</tr>
<tr>
<td></td>
<td>(or $\text{CHADS}_{2}$ score of $5-6$)</td>
</tr>
<tr>
<td></td>
<td>Recent (within three months) stroke or transient ischemic attack</td>
</tr>
<tr>
<td></td>
<td>Rheumatic valvular heart disease</td>
</tr>
<tr>
<td>High thrombotic risk</td>
<td>$\text{CHA}<em>{2}\text{DS}</em>{2}\text{-VASc}$ score of $4-5$ or $\text{CHADS}_{2}$ score of $3-4$</td>
</tr>
<tr>
<td>Moderate thrombotic risk</td>
<td>$\text{CHA}<em>{2}\text{DS}</em>{2}\text{-VASc}$ score of $2-3$ or $\text{CHADS}_{2}$ score of $0-2$ (assuming no prior stroke or transient ischemic attack)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk stratum</th>
<th>Mechanical heart valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high thrombotic risk*</td>
<td>Any mitral valve prosthesis</td>
</tr>
<tr>
<td></td>
<td>Any caged-ball or tilting disc aortic valve prosthesis</td>
</tr>
<tr>
<td></td>
<td>Recent (within six months) stroke or transient ischemic attack</td>
</tr>
<tr>
<td>High thrombotic risk</td>
<td>Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation,</td>
</tr>
<tr>
<td></td>
<td>prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age $&gt;75$</td>
</tr>
<tr>
<td>Moderate thrombotic risk</td>
<td>Bileaflet aortic valve prosthesis without atrial fibrillation and no other risk factors for stroke</td>
</tr>
</tbody>
</table>
VTE: venous thromboembolism
CHADS2: congestive heart failure, hypertension, age ≥75 years, diabetes mellitus, and stroke or transient ischemic attack
CHA2DS2-VASc: congestive heart failure, hypertension, age ≥75 years (2 points), diabetes mellitus, prior stroke or transient ischemic attack or thromboembolism (2 points), vascular disease (peripheral artery disease, myocardial infarction, or aortic plaque), age 65-74 years, sex category female.

* Very high risk patients may also include those with a prior stroke or transient ischemic attack occurring >3 months before the planned surgery and a CHA2DS2-VASc score <6 (or CHADS2 score <5), those with prior thromboembolism during temporary interruption of anticoagulation, or those undergoing certain types of surgery associated with an increased risk for stroke or other thromboembolism (eg: cardiac valve replacement, carotid endarterectomy, major vascular surgery).

<table>
<thead>
<tr>
<th>Risk stratum</th>
<th>VTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high thrombotic risk*</td>
<td>Recent (within three months) VTE</td>
</tr>
<tr>
<td></td>
<td>Severe thrombophilia (eg, deficiency of protein C, protein S, or antithrombin; antiphospholipid antibodies; multiple abnormalities)</td>
</tr>
<tr>
<td>High thrombotic risk</td>
<td>VTE within the past 3 to 12 months</td>
</tr>
<tr>
<td></td>
<td>Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)</td>
</tr>
<tr>
<td></td>
<td>Recurrent VTE</td>
</tr>
<tr>
<td></td>
<td>Active cancer (treated within six months or palliative)</td>
</tr>
<tr>
<td>Moderate thrombotic risk</td>
<td>VTE &gt;12 months previous and no other risk factors</td>
</tr>
</tbody>
</table>

Body Imaging Section 5/1/2016
References: