Managing Anticoagulants, Antiplatelets, and NSAIDS in the Interventional Radiology Setting

Amy Huggins, BSN, RN
Objectives

1. Recognize bleeding risk based on classes of IR procedures
2. Differentiate between anticoagulants, antiplatelet agents and NSAIDS and how they work
3. Discuss monitoring parameters to evaluate the effects of “blood thinners”
4. Determine how long to hold medications prior to procedure
5. Understand reversal agents and when each would be most appropriate
STANDARDS OF PRACTICE

Consensus Guidelines for Periprocedural Management of Coagulation Status and Hemostasis Risk in Percutaneous Image-guided Interventions

Indravadan J. Patel, MD, Jon C. Davidson, MD, Boris Nikolic, MD, MBA, Gloria M. Salazar, MD, Marc S. Schwartzberg, MD, T. Gregory Walker, MD, and Wael A. Saad, MD, for the Standards of Practice Committee, with Cardiovascular and Intervventional Radiological Society of Europe (CIRSE) Endorsement

ABBREVIATIONS

aPTT = activated partial thromboplastin time, DIC = disseminated intravascular coagulation, DTI = direct thrombin inhibitor, FFP = fresh frozen plasma, INR = international normalized ratio, LMWH = low molecular weight heparin, LP = lumbar puncture, NSAID = nonsteroidal antiinflammatory drug, PT = prothrombin time

PREAMBLE

The membership of the Society of Interventional Radiology (SIR) Standards of Practice Committee represents experts in a broad spectrum of interventional procedures from both the private and academic sectors of medicine. Generally, Standards of Practice Committee members dedicate the vast majority of their professional time to performing interventional procedures; as such, they represent a valid expert constituency of the subject matter under consideration for standards production.

Technical documents specifying the exact consensus and literature review methodologies, as well as the institutional affiliations and professional credentials of the authors of this document, are available upon request from SIR, 3975 Fair Ridge Dr., Suite 400 N., Fairfax, VA 22033.

METHODOLOGY

SIR produces its Standards of Practice documents by using the following

An in-depth literature search is performed by using electronic medical literature databases. Then, a critical review of peer-reviewed articles is performed with regard to the study methodology, results, and conclusions. The qualitative weight of these articles is assembled into an evidence table, which is used to write the document such that it contains evidence-based data with respect to content, complication rates, outcomes, and thresholds for prompting quality assurance reviews.

When the evidence of literature is weak, conflicting, or contradictory, consensus for the parameter is reached by a minimum of 12 Standards of Practice Committee members by using a modified Delphi consensus method (Appendix) (1). For the purposes of these documents, consensus is defined as 80% Delphi participant agreement on a value or parameter.

The draft document is critically reviewed by the Standards of Practice Committee members either by telephone conference calling or face-to-face meeting. The finalized draft from the Committee is sent to the SIR membership for further input/criticism during a 30-d comment period.
Procedure Categories

I
Low Bleeding Risk/Easily Detectable or Controlled

II
Moderate Bleeding Risk

III
Significant Bleeding Risk/Bleeding Difficult to Detect or Control
Procedure Examples

I
- Nontunneled Venous Catheter Placement/Removal
- Dialysis Access Interventions
- IVC Filters
- Catheter Exchanges
- Paras & Thoras

II
- Angiograms (with access up to 7 FR)
- Venous Interventions
- Tunneled Catheters
- Spinal Procedures

III
- TIPS
- Renal Biopsy
- Nephrostomy Tube Placements
- Biliary Interventions

“Blood Thinners”

- Antiplatelets
- Anticoagulants
- NSAIDS
Antiplatelet Agents
Endothelial cells near the site of damage respond by synthesising von Willebrand factor which is secreted in the form of large multimeric chains. Platelets express cell surface receptors, such as GP1b, that allow them to adhere to von Willebrand factor bound to subendothelial collagen fibrils.
Antiplatelets

- Aspirin
- P2Y12 Inhibitors
  - Ticlodipine (Ticlid)
  - Clopidogrel (Plavix)
  - Prasugrel (Effient)
  - Ticagrelor (Brilinta)
- GP IIb/IIIa Inhibitors
  - Eptifibatide (Integrilin)
  - Abciximab (Reopro)
  - Tirofiban (Aggrastat)
Aspirin

- Acetylates cyclooxygenase-1 and -2 (COX) enzymes
  - Irreversibly binds, inhibits platelet aggregation

<table>
<thead>
<tr>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-6 Hours</td>
<td>Do not withhold</td>
<td>Do not withhold</td>
<td>5 days</td>
</tr>
</tbody>
</table>
P2Y12 Inhibitors

- Ticlopidine (Ticlid)
- Clopidogrel (Plavix)
- Prasugrel (Effient)
- Ticagrelor (Brilinta)
# P2Y12 Inhibitors*

<table>
<thead>
<tr>
<th>Medication</th>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clopidogrel (Plavix)</td>
<td>6 hours</td>
<td>0-5 days</td>
<td>5 days</td>
<td>5 days</td>
</tr>
<tr>
<td>Ticlopidine (Ticlid)</td>
<td>12.5 hours</td>
<td>0-5 days</td>
<td>7 days</td>
<td>7 days</td>
</tr>
<tr>
<td>Prasugrel (Effient)</td>
<td>2-15 hours, avg appx 7</td>
<td>0-5 days</td>
<td>5 days</td>
<td>5 days</td>
</tr>
<tr>
<td>Ticagrelor (Brilinta)</td>
<td>7 hours</td>
<td>0-5 days</td>
<td>5 days</td>
<td>5 days</td>
</tr>
</tbody>
</table>

GP IIb/IIIa Inhibitors

- Eptifibatide (Integritin)
- Abciximab (Reopro)
- Tirofiban (Aggrastat)
GP IIb/IIIa Inhibition

Activated platelet

Clopidogrel
Ticlopidine

GP IIb/IIIa receptor

ADP

TXA2

To neighboring platelet

Aspirin

Fibrinogen

Adhesive proteins
- Thrombospondin
- Fibrinogen
- P-selectin
- vWF

Prothrombotic factors
- Factor V
- Factor XI
- PAI-1

Proinflammatory factors
- CD 154 (CD40L)
- PDGF

Platelet agonists
- ADP
- ATP
- Serotonin
- Calcium
- Magnesium

Thrombin
Serotonin
Epinephrine
Collagen

COX1

Degranulation

Platelet

http://www.nature.com/ki/journal/v82/n2/images/ki2012130f1.jpg
## GP IIb/IIIa Inhibitors

<table>
<thead>
<tr>
<th>Medication</th>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abciximab (Reopro)</td>
<td>30 minutes</td>
<td>12-24 hours aPTT ≤ 50 s ACT ≤ 150 s 24 hours aPTT ≤ 50 s ACT ≤ 150 s 24 hours aPTT ≤ 50 s ACT ≤ 150 s</td>
<td>24 hours aPTT ≤ 50 s ACT ≤ 150 s 24 hours aPTT ≤ 50 s ACT ≤ 150 s</td>
<td>24 hours aPTT ≤ 50 s ACT ≤ 150 s 24 hours aPTT ≤ 50 s ACT ≤ 150 s</td>
</tr>
<tr>
<td>Eptifibatide (Integrilin)</td>
<td>2.5 hours</td>
<td>Immediately prior to procedure 4 hours 4 hours</td>
<td>4 hours 4 hours</td>
<td>4 hours 4 hours</td>
</tr>
<tr>
<td>Tirofiban (Aggrastat)</td>
<td>2 hours</td>
<td>Immediately Prior to Procedure 4 hours 4 hours</td>
<td>4 hours 4 hours</td>
<td>4 hours 4 hours</td>
</tr>
</tbody>
</table>

Cilostazol (Pletal)

- *Inhibits thrombosis and platelet aggregation*
- Less potent platelet inhibitor than Plavix
- Half Life: 11-13 hours
- Not listed in SIR CPG
Reinitiation of Antiplatelets

• When postoperative bleeding risk has subsided
• Aspirin takes effect almost immediately after it is taken
• P2Y12 Inhibitors can have a delayed impact
  • Could consider a loading dose
    • Plavix 300-600 mg
    • Prasugrel 60 mg
Anticoagulant Agents
Warfarin

• Vitamin K Antagonist
  • Inhibits Vitamin K Clotting Factors
    • II, IX, X, and VII

• Delayed onset based on half life of the affected factors

• Drug Interactions affect INR

<table>
<thead>
<tr>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-60 hours</td>
<td>3-5 days INR ≤ 2.0</td>
<td>5 days INR ≤ 1.5</td>
<td>5 days INR ≤ 1.5</td>
</tr>
</tbody>
</table>

Factor Xa Inhibitors

- Fonadparinux (Arixtra)
- Apixaban (Eliquis)
- Rivaroxaban (Xaraltoo)
## Factor Xa Inhibitors

<table>
<thead>
<tr>
<th>Medication</th>
<th>Half-Life</th>
<th>Renal Elimination</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fonadparinux (Arixtra)</td>
<td>17-21 hours</td>
<td>77%</td>
<td>Do not withhold</td>
<td>2-3 days (CrCl &gt;50 mL) 3-5 days (CrCl &lt;50 mL)</td>
<td>2-3 days (CrCl &gt;50 mL) 3-5 days (CrCl &lt;50 mL)</td>
</tr>
<tr>
<td>Apixaban (Eliquis)</td>
<td>8-15 hours</td>
<td>27%</td>
<td>1-2 days</td>
<td>2-4 days</td>
<td>2-4 days</td>
</tr>
<tr>
<td>Rivaroxaban (Xaralto)</td>
<td>5-9 hours, 11-13 hours in the elderly</td>
<td>66%</td>
<td>1-2 days</td>
<td>2-4 days</td>
<td>2-4 days</td>
</tr>
</tbody>
</table>

Am J Health-Syst Pharm. 2013 May;70:S3-11
Rivaroxaban and Apixaban

Hold times mildly dependent on renal function

<table>
<thead>
<tr>
<th>Creatinine Clearance</th>
<th>Last Dose before Minor Procedure</th>
<th>Last Dose before Major Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 50 mL/min</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>31-50 mL/min</td>
<td>1-2</td>
<td>3-4</td>
</tr>
<tr>
<td>≤ 30 mL/min</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
Direct Thrombin Inhibitors

Dabigatran
(Pradaxa)

Bivalirudin
(Angiomax)

Argatroban
## Direct Thrombin Inhibitors

<table>
<thead>
<tr>
<th>Medication</th>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argatroban</td>
<td>40-60 minutes</td>
<td>Do not withhold</td>
<td>Hold 4 hours, defer procedure if possible</td>
<td>Hold 4 hours, defer procedure if possible</td>
</tr>
<tr>
<td>Bivalirudin (Angiomax)</td>
<td>25-60 minutes</td>
<td>Do not withhold</td>
<td>2-3 hours (CrCl &gt;50 mL/min)</td>
<td>2-3 hours (CrCl &gt;50 mL/min)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3-5 hours (CrCl &lt;50 mL/min)</td>
<td>3-5 hours (CrCl &lt;50 mL/min)</td>
</tr>
<tr>
<td>Dabigatran (Pradaxa)</td>
<td>12-17 hours</td>
<td>Do not withhold</td>
<td>2-3 days (CrCl &gt;50 mL/min)</td>
<td>2-3 days (CrCl &gt;50 mL/min)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3-5 days (CrCl &lt;50 mL/min)</td>
<td>3-5 days (CrCl &lt;50 mL/min)</td>
</tr>
</tbody>
</table>
Unfractionated Heparin

• Combines with antithrombin III (Heparin cofactor)
  • Prevents the conversion of prothrombin to thrombin
  • Inactivates the activated Factor X

<table>
<thead>
<tr>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-60 minutes</td>
<td>No consensus, check aPTT</td>
<td>No consensus, check aPTT</td>
<td>Withhold 2-4 hours before procedure, aPTT ≤ 1.5 x control</td>
</tr>
</tbody>
</table>
Low Molecular Weight Heparins

- Enoxaparin (Lovenox)
- Dalteparin (Fragmin)
Low Molecular Weight Heparins

<table>
<thead>
<tr>
<th>Medication</th>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enoxaparin (Lovenox)</td>
<td>4.5-7 hours</td>
<td>1 dose or 12 hours</td>
<td>1 dose or 12 hours</td>
<td>2 doses or 24 hours</td>
</tr>
<tr>
<td>Dalteparin (Fragmin)</td>
<td>2-7 hours</td>
<td>1 dose or 12 hours</td>
<td>1 dose or 12 hours</td>
<td>2 doses or 24 hours</td>
</tr>
</tbody>
</table>
Could use as “Bridge” Therapy

- For patients with high risk when off anticoagulation
- Stop Coumadin 3-5 days prior and use Lovenox up until 12-24 hours before procedure
- Restart the Coumadin post and continue Lovenox until goal INR is reached
Restarting Anticoags

- When post procedure risk has subsided
NSAIDS
**NSAIDS**

- Like ASA, NSAIDs block the COX Receptors
- Unlike ASA, NSAIDS diminish over time as they circulate

<table>
<thead>
<tr>
<th>Medication</th>
<th>Half-Life</th>
<th>Hold for Class I</th>
<th>Hold for Class II</th>
<th>Hold for Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short Acting</td>
<td>2-6 hours</td>
<td>Do not withhold</td>
<td>Do not withhold</td>
<td>24 hours</td>
</tr>
<tr>
<td>Intermediate</td>
<td>7-15 hours</td>
<td>Do not withhold</td>
<td>Do not withhold</td>
<td>2-3 days</td>
</tr>
<tr>
<td>Acting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Acting</td>
<td>&gt; 20 hours</td>
<td>Do not withhold</td>
<td>Do not withhold</td>
<td>10 days</td>
</tr>
</tbody>
</table>

Monitoring for Efficacy
<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>Time in seconds for plasma to coagulate after addition of thromboplastin</td>
</tr>
<tr>
<td>INR</td>
<td>Calculation of PT that accounts for manufacturer’s sensitivity index</td>
</tr>
<tr>
<td>Dilute PT (dPT)</td>
<td>Similar to PT, dilution increases the sensitivity</td>
</tr>
<tr>
<td>aPTT</td>
<td>Reflects activity of Factors II, V, VIII-XII</td>
</tr>
<tr>
<td>Thrombin Time (TT)</td>
<td>Activity of thrombin in plasma</td>
</tr>
<tr>
<td>Ecarin Clotting Time (ECT)</td>
<td>Measures thrombin generation</td>
</tr>
<tr>
<td>Chromogenic Assays</td>
<td>Color changes of substrate specific for a certain factor</td>
</tr>
<tr>
<td>Heptest</td>
<td>Measures the inhibition of exogenous Factor Xa</td>
</tr>
<tr>
<td>Prothrombinase--induced clotting time (PiCT)</td>
<td>Involves phospholipids, Fxa, &amp; enzymes to activate factor V to measures time &amp; effect of anticoagulant</td>
</tr>
<tr>
<td>Lab Value</td>
<td>Utility</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>PT</td>
<td>✔️</td>
</tr>
<tr>
<td>Dilute PT (dPT)</td>
<td>-----</td>
</tr>
<tr>
<td>aPTT</td>
<td>-----</td>
</tr>
<tr>
<td>Thrombin Time (TT)</td>
<td>-----</td>
</tr>
<tr>
<td>Ecarin Clotting Time (ECT)</td>
<td>-----</td>
</tr>
<tr>
<td>Chromogenic Anti Factor IIa Assays</td>
<td>✔️</td>
</tr>
<tr>
<td>Heptest</td>
<td>✔️</td>
</tr>
<tr>
<td>Prothrombinase--induced clotting time (PiCT)</td>
<td>✔️</td>
</tr>
</tbody>
</table>
# Lab Values—Apixaban (Eliquis)

<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Utility</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>✔️</td>
<td>Widely available, more sensitive at higher concentrations</td>
</tr>
<tr>
<td>Dilute PT (dPT)</td>
<td>✔️</td>
<td>More sensitive than PT, not widely available or FDA approved</td>
</tr>
<tr>
<td>aPTT</td>
<td>-----</td>
<td>Less sensitive than PT, not ideal</td>
</tr>
<tr>
<td>Thrombin Time (TT)</td>
<td>-----</td>
<td>No effect</td>
</tr>
<tr>
<td>Ecarin Clotting Time (ECT)</td>
<td>-----</td>
<td>Unlikely to have an effect</td>
</tr>
<tr>
<td>Chromogenic Anti Factor IIa Assays</td>
<td>✔️</td>
<td>Accurate &amp; Precise, most promising</td>
</tr>
<tr>
<td>Heptest</td>
<td>✔️</td>
<td>Sensitive at low and high concentrations. Not widely available</td>
</tr>
<tr>
<td>Prothrombinase--induced Clotting time (PiCT)</td>
<td>✔️</td>
<td>Not widely available, not FDA approved</td>
</tr>
</tbody>
</table>
## Lab Values—Dabigatran (Pradaxa)

<table>
<thead>
<tr>
<th>Lab Value</th>
<th>Utility</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>-----</td>
<td>Not ideal, but widely available</td>
</tr>
<tr>
<td>Dilute PT (dPT)</td>
<td>-----</td>
<td>More sensitive than PT, not widely available</td>
</tr>
<tr>
<td>aPTT</td>
<td>✔️</td>
<td>Availability &amp; sensitivity support use</td>
</tr>
<tr>
<td>Thrombin Time (TT)</td>
<td>✔️</td>
<td>Limited utility in quantifying extent of anticoagulation</td>
</tr>
<tr>
<td>Ecarin Clotting Time (ECT)</td>
<td>✔️</td>
<td>Sensitive at all concentrations, limited availability</td>
</tr>
<tr>
<td>Chromogenic Anti Factor IIa Assays</td>
<td>-----</td>
<td>Minimal data, not available</td>
</tr>
<tr>
<td>Heptest</td>
<td>-----</td>
<td>Poor correlation, not useful</td>
</tr>
<tr>
<td>PiCT</td>
<td>-----</td>
<td>Not studied, not likely to be useful</td>
</tr>
</tbody>
</table>

Am J Health-Syst Pharm. 2012 Sept; 69:1473-84
Am J Health-Syst Pharm. 2013 May; 70:S21-31
Blood. 2013 Dec 6; 120(24):4699-705
Strategies for Reversals
## Blood Products

<table>
<thead>
<tr>
<th>Packed Red Blood Cells</th>
<th>Fresh Frozen Plasma</th>
<th>Platelets</th>
</tr>
</thead>
</table>
| • Maintain oxygenation and hemoglobin  
• Will increase Hgb by appx 1 | • Contains clotting factors contained in human plasma  
• 20-30% increase in plasma clotting factors | • Human platelet concentrates  
• May give in combo with DDAVP |
Prothrombin Complex Concentrate (PCC)

Profilnine
- 3 factors
  - II, IX, X
- May use multiple doses
- No max dose

Kcentra
- 4 factors
  - II, VII, IX, X
- Repeat dosing not recommended
- Max dosing weight = 100kg

Dosing is the same for both:
- INR <4: 25 units/kg
- INR 4-6: 35 units/kg
- INR > 6: 50 units/kg
# FFP vs. PCC

<table>
<thead>
<tr>
<th></th>
<th>FFP</th>
<th>PCC</th>
</tr>
</thead>
</table>
| **Dose**       | • Commonly appx 2 units  
• 10-30 mL/kg  
(appx 200-250 mL/unit) | • Expressed as Factor IX  
• 25-50 units/kg |
| **Adverse Reactions** | • Hemolytic Reaction  
• Acute Lung Injury  
• Hypersensitivity | • Hypersensitivity  
• Thrombosis (1-2%) |
| **Price**      | $40/pack                                                            | $1.27 per unit                                                       |
| **Advantages** | Contains all factors found in human plasma                          | • Fast administration  
• No type and cross needed |
| **Disadvantages** | • Large Volume  
• Need to be thawed  
• Risk for transmission of disease | • Expensive  
• Risk of infectious disease transmission |
Factor VIIa – NovoSeven RT

• Recombinant Activated Factor VII
• Dose 10-20 mcg/kg, max 100 mcg/kg
  • Higher risk for thrombosis with higher dosing
  • Dosing regimen evidence isn’t clear
• Activated products carry a higher risk of arterial thrombosis
Vitamin K

- Can be used to reverse Warfarin
- Can be used if patient cannot wait for Warfarin to wear off or if they are actively bleeding

<table>
<thead>
<tr>
<th>Route</th>
<th>Reversal Time</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>12-16 hours</td>
<td>5-10 mg</td>
</tr>
<tr>
<td>PO</td>
<td>24 hours</td>
<td>2-5 mg</td>
</tr>
</tbody>
</table>
Protamine Sulfate

- Used to reverse heparin (unfractionated and low molecular weight)
- Max dose of 50 mg
- As time passes from heparin administration, dose needed drops

<table>
<thead>
<tr>
<th></th>
<th>Unfractionated Heparin</th>
<th>Low Molecular Weight Heparin</th>
<th>Dalteparin (Fragmin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 mg Protamine Neutralizes</td>
<td>100 units</td>
<td>1 mg</td>
<td>100 anti-Xa units</td>
</tr>
</tbody>
</table>
Desmopressin (DDAVP)

- *De-amino d-arginin vasopressin*
- Often given in addition to platelets
- Increases Von Willebrand Factor and Factor XIII
- Dosing
  - 0.3 mcg/kg in 100 mL of saline administered over 30 minutes
  - Effect is immediate

J Thromb Haemost 2011;9:1705-12
J Thromb Haemost 2003;1:682-9
# Reversal of Selected Agents

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Antidote</th>
<th>Dialysis</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| Antiplatelets               | Desmopressin (DDAVP)      | Acute ASA toxicity only | • Platelets  
  - ASA only – 1 pack  
  - Combo Therapy – 2 packs  
  • Factor VIIa  
  • pRBC |
| Vitamin K Antagonists       | Vitamin K                 | No            | • Vitamin K +/- PCC  
  • FFP  
  • pRBCs |
| Warfarin (Coumadin)         |                           |               |                            |
| Dabigatran (Pradaxa)        | In Development            | Yes           | • PCC 50 units/kg IV  
  • Factor VIIa 90 mcg/kg IV  
  • FFP  
  • pRBC |
## Reversal of Selected Agents

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>Antidote</th>
<th>Dialysis</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor Xa Inhibitors</td>
<td>In Development</td>
<td>No</td>
<td>• PCC 50 units/kg IV</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Factor VIIa 30 mcg/kg IV</td>
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<tr>
<td></td>
<td></td>
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<td>• FFP</td>
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<td>• pRBC</td>
</tr>
<tr>
<td>Heparin &amp; Low Molecular Weight Heparins</td>
<td>Protamine Sulfate</td>
<td>No</td>
<td>• FFP</td>
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<td></td>
<td></td>
<td></td>
<td>• pRBC</td>
</tr>
</tbody>
</table>
Possible New Agents on the Horizon

• Potential Future Reversals
  • Dabigatran monoclonal antibody fragment
  • Rivaroxaban, apixaban, LMWH antidote
    • Factor X Fragment

• New Agents being Studied
  • Cangrelor—P2Y12 Inhibitor, IV Route with Rapid Onset
  • Endoxaban—Factor Xa Inhibitor, PO Route
Questions

• How urgent is the procedure? Can it wait for the agent to wear off on its own?

• What reversal strategy is most appropriate for the agent in use?

• Will the patient need to restart the medication? If so, what would be the safest way to do so?
Thank you to…

- Carlion Clinic Pharmacy
  Joleen Bierlein, Pharm.D.
References

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6) Dager WE. Developing a management plan for oral anticoagulant reversal. Am J Health-Syst Pharm. 2013 May; 70:(S21-S31)