Building a Safe Anticoagulation Program

By knowing that Safety is not about numbers,
Safety is about an attitude…..

Speakers:
Sue Dawson, MA, RN, CCRP
Clinical Specialist-Cardiology

Cam F. Campbell, M.D.
Mercy Medical Center's Cardiovascular Medical Director

Lauren Cumings, PharmD
Interim Director of Clinical Pharmacy

Objectives

Objectives:
1. Learn critical metrics needed to measure your anticoagulation program.
2. Learn strategies to navigate between anticoagulation and the surgical patient.
3. Understand if the Electronic Health Record (Epic) keeps our patients safe.
4. Understand the importance of risk stratification in the management of anticoagulants in patients undergoing invasive procedures.
5. Understand the pharmacologic overview of old and new anticoagulants.
6. Learn current information on reversal of anticoagulants.
Summary

Summary:

- More than 6 million patients in the United States receive long-term anticoagulation therapy for the prevention of thromboembolism due to atrial fibrillation, placement of a mechanical heart-valve prosthesis, or venous thromboembolism.

- In 2009 TJC recognized that anticoagulation management was critical to the safety of patients and put in place a new National Patient Safety Goal: Reduce the likelihood of harm associated with the use of anticoagulant therapy. This came on the heels of a sentinel event alert related to anticoagulation from the Joint Commission national database.

- You will learn many strategies put in place to transform Mercy’s culture to one of safety in the management and delivery of anticoagulation.

The Joint Commission Sentinel Event Alert

(Issue 41; Sept, 2008)
National Database

- Heparin most common cause of sentinel event due to anticoagulation (2/3rd)

- Performance error in administration most common cause of adverse events relating to anticoagulant medications.

- Concurrent use of heparin and Lovenox (enoxaparin)
2009 National Patient Safety Goal:
Reduce the likelihood of harm associated with the use of anticoagulant therapy

Why Worry?

Between 2001 to 2006:
- American hospitals killed an estimated 250,000 to 500,000 patients with medical mistakes.
- During that same time frame; Passenger deaths aboard major U.S. airlines hit a total of ZERO.
- That many medical mistakes are equivalent to crashing approximately 1,400 fully loaded Boeing 747’s with no survivors.

Accountability Verses Blame

Establishing Red Rules

Red Rules: Standards of practice which allows no room for deviation

Examples when staff choose to do something unsafe:
1. Do not double check before giving high alert medications
2. No timeouts before procedures or surgeries
3. Do not check two patient identifiers

Violation of safe operating procedures decrease safety and increase the risk of patient harm.
SAFE (Safe Anticoagulation For Everyone)

NPSG: Reduce the Likelihood of Patient Harm Associated with the use of Anticoagulation

Anticoagulation Committee Meeting
October 2007 – June 2012

Inpatient INR Levels > 5.0 (Present on Admission and Not Present on Admission)

Oct. 2009:
1. Hard stop on INRs >/= 5.0
2. Pharmacist orders daily INR’s if needed.
3. Letter to all LIPs, explaining the importance of daily INR’s in the acute setting after a Vitamin K analysis.

P = 0.0001

P=0.0167

<table>
<thead>
<tr>
<th>Year</th>
<th>Total INR’s &gt; 5.0</th>
<th>INR’s &gt; 5.0 (NPOA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>359</td>
<td>165</td>
</tr>
<tr>
<td>2009</td>
<td>347</td>
<td>158</td>
</tr>
<tr>
<td>2010</td>
<td>252</td>
<td>108</td>
</tr>
<tr>
<td>2011</td>
<td>269</td>
<td>179</td>
</tr>
<tr>
<td>Jan-June 2012</td>
<td>153</td>
<td>120</td>
</tr>
</tbody>
</table>
Inpatients on Coumadin with INR Levels > 5.0
(Not Present on Admission)
May 2012 – April 2013

Incident Reports
Involving Coumadin, Heparin & Lovenox
Jan. 2009 – June 2012
Incident Reports
Involving Coumadin, Heparin & Lovenox
June 2009 – June 2012

Total Errors

June-Dec. 09 2010 2011 1st Q 12 2nd Q 12
Total errors 57 108 94 13 11
Errors that reached patient 34 69 55 7 8
Pharmacy errors 5 45 27 7 5
Nursing errors 18 64 69 7 9

Incident Reports
Involving Coumadin, Heparin & Lovenox
Total Numbers & “Good Catches”
June 2009 – June 2012

June-Dec. 09 2010 2011 1st Q 12 2nd Q 12
Total 5 7 1 0 8 9 41 31 1
Nursing errors 25 64 68 7 9
Nursing "good catches" 18 27 27 6 3
Pharmacy errors 10 46 27 7 5
Pharmacy "good catches" 5 10 12 0 1
E Code 934.2: Adverse Effects of Anticoagulants
Not Present on Admission (NPOA)
Oct. 2007- June 2012

Medical Record Audits For Anticoagulation
January-June 2012

78 charts reviewed:
None=13/78 (17%)
Therapeutic Heparin= 9/78  Prophylactic Heparin= 11/78
Therapeutic Lovenox= 2/78  Prophylactic Lovenox= 19/78
Coumadin= 30/78
Daily INR= 30/30 (100%)
INR Range provided= 19/30 (63%)
Heparin: No concerns
Lovenox: No Concerns
Coumadin: (30 patients):
  • All had baseline and daily INR's!
  • 63% of patients had INR ranges documented
ABCDE’S
*Prevention of Harm from Anticoagulation*

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>Accurate</strong> and current weight before administration of Heparin or Lovenox</td>
</tr>
<tr>
<td>B</td>
<td><strong>Baseline and every 3 Day:</strong> Hgb, Hct, &amp; Platelet Count for Heparin or Lovenox administration</td>
</tr>
<tr>
<td>C</td>
<td><strong>Creatinine</strong> level at baseline &amp; <strong>repeat every 3 days</strong> for Lovenox administration; <strong>Check</strong> INR prior to the administration of Coumadin</td>
</tr>
<tr>
<td>D</td>
<td><strong>Dosing</strong> of Lovenox based on Creatinine Clearance</td>
</tr>
<tr>
<td>E</td>
<td><strong>Epidural</strong> and anticoagulation; <strong>need to clarify with physician</strong></td>
</tr>
<tr>
<td>S</td>
<td><strong>Simultaneous</strong> ordering of Lovenox &amp; Heparin; <strong>need to clarify with physician</strong></td>
</tr>
</tbody>
</table>

---

**Atrial Fibrillation and Novel Anticoagulants**

Cam F. Campbell MD FACC
Mercy Medical Center
August 27, 2013
### CHADS<sub>2</sub> Score

<table>
<thead>
<tr>
<th>Letter</th>
<th>Condition</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Congestive heart failure</td>
<td>1</td>
</tr>
<tr>
<td>H</td>
<td>Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>Age ≥ 75 years</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>Diabetes mellitus</td>
<td>1</td>
</tr>
<tr>
<td>S</td>
<td>Stroke (or TIA)</td>
<td>2</td>
</tr>
</tbody>
</table>

### CHADS<sub>2</sub> and CHA<sub>2</sub>DS<sub>2</sub>-VASc Scores

<table>
<thead>
<tr>
<th>Letter</th>
<th>Condition</th>
<th>CHADS&lt;sub&gt;2&lt;/sub&gt; Score</th>
<th>CHA&lt;sub&gt;2&lt;/sub&gt;DS&lt;sub&gt;2&lt;/sub&gt;-VASc Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Congestive heart failure</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>H</td>
<td>Hypertension</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>Age ≥ 75 years</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>Diabetes mellitus</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>S</td>
<td>Stroke (or TIA)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>Vascular disease*</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>Age 66-74 years</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Sc</td>
<td>Sex category (female)</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

* Prior MI, peripheral artery disease, aortic plaque
Stroke Risk for Afib

<table>
<thead>
<tr>
<th>CHADS Score</th>
<th>Risk of stroke per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1.9</td>
</tr>
<tr>
<td>1</td>
<td>2.8</td>
</tr>
<tr>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>3</td>
<td>5.9</td>
</tr>
<tr>
<td>4</td>
<td>8.5</td>
</tr>
<tr>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>6</td>
<td>18.2</td>
</tr>
</tbody>
</table>

HAS-BLED Score

<table>
<thead>
<tr>
<th>Clinical Characteristic</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>H Hypertension</td>
<td>1</td>
</tr>
<tr>
<td>A Abnormal renal or liver function (1 each)</td>
<td>1 or 2</td>
</tr>
<tr>
<td>S Stroke</td>
<td>1</td>
</tr>
<tr>
<td>B Bleeding</td>
<td>1</td>
</tr>
<tr>
<td>L Labile INR</td>
<td>1</td>
</tr>
<tr>
<td>E Elderly age</td>
<td>1</td>
</tr>
<tr>
<td>D Drugs or alcohol (1 each)</td>
<td>1 or 2</td>
</tr>
</tbody>
</table>

Maximum Score 9

Hypertension, SBP > 160 mmHg; Abnormal renal function: chronic dialysis, renal transplant, serum creatinine ≥ 200 μmol/L; Abnormal liver function: chronic hepatitis, bilirubin > 2x upper limit of normal (ULN) in association with AST/ALT/ALP > 3 x ULN; Bleeding, previous history, predisposition; Labile INRs, unstable/high INRs in therapeutic range < 60%; Age > 65 years; Drugs/alcohol; concomitant use of antiplatelet agents, NSAIDs, etc.
ACTIVE A: Results

<table>
<thead>
<tr>
<th></th>
<th>Clopidogrel + Aspirin % per Year</th>
<th>Aspirin % per Year</th>
<th>HR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary end point*</td>
<td>6.8</td>
<td>7.6</td>
<td>0.89 (0.81-0.98)</td>
<td>.01</td>
</tr>
<tr>
<td>• Ischemic stroke</td>
<td>1.9</td>
<td>2.8</td>
<td>0.68 (0.57-0.80)</td>
<td>-</td>
</tr>
<tr>
<td>Death (any cause)</td>
<td>6.4</td>
<td>6.6</td>
<td>0.98 (0.89-1.08)</td>
<td>.69</td>
</tr>
<tr>
<td>Major bleeding</td>
<td>2.0</td>
<td>1.3</td>
<td>1.57 (1.29-1.92)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Composite of stroke, MI, non-CNS embolism, vascular death
ACTIVE W: Results

Trial was stopped early because of clear evidence of superiority of OAC

<table>
<thead>
<tr>
<th></th>
<th>Clopidogrel + Aspirin % per Year</th>
<th>OAC % per Year</th>
<th>HR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary end point*</td>
<td>5.6</td>
<td>3.93</td>
<td>1.44 (1.18-1.76)</td>
<td>.0003</td>
</tr>
<tr>
<td>Ischemic stroke</td>
<td>2.15</td>
<td>1.00</td>
<td>2.17 (1.51-3.13)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Total mortality</td>
<td>3.8</td>
<td>3.76</td>
<td>1.01 (0.81-1.26)</td>
<td>.91</td>
</tr>
<tr>
<td>Hemorrhage (total)</td>
<td>15.4</td>
<td>13.21</td>
<td>1.21 (1.08-1.35)</td>
<td>.001</td>
</tr>
</tbody>
</table>

*Composite of stroke, non-CNS embolus, MI, vascular death

Rates of Intracranial Bleeding

<table>
<thead>
<tr>
<th></th>
<th>Apixaban (n = 9088)</th>
<th>Warfarin (n = 9052)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>%/y</td>
<td>0.33</td>
<td>0.80</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>RE-LYb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabigatran 110 mg (n = 6015)</td>
<td>0.2</td>
<td>0.3</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Dabigatran 150 mg (n = 6076)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warfarin (n = 6022)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate/y, %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROCKET AFc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban (n = 7111)</td>
<td>0.8</td>
<td>1.2</td>
<td>.02</td>
</tr>
<tr>
<td>Warfarin (n = 7125)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Granger CB, et al. 
### Characteristics of Oral Anticoagulants

<table>
<thead>
<tr>
<th></th>
<th>Dabigatran etexilate</th>
<th>Rivaroxaban</th>
<th>Apixaban</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanism of action</strong></td>
<td>Direct thrombin inhibition</td>
<td>Direct factor Xa inhibition</td>
<td>Direct factor Xa inhibition</td>
</tr>
<tr>
<td><strong>Bioavailability</strong></td>
<td>6%</td>
<td>60-80%</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Time to peak levels (h)</strong></td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Half-life (h)</strong></td>
<td>12-17</td>
<td>5-13</td>
<td>9-14</td>
</tr>
<tr>
<td><strong>Excretion</strong></td>
<td>80% renal</td>
<td>2/3 hepatic, 1/3 renal</td>
<td>25% renal; 75% fecal</td>
</tr>
<tr>
<td><strong>Dose (AF)</strong></td>
<td>150 mg BID</td>
<td>20 mg QD</td>
<td>5 mg BID</td>
</tr>
</tbody>
</table>

Camm AJ, et al. [2]

---

### European AF Treatment Guidelines

**Class I, Level A**

Antithrombotic therapy to prevent thromboembolism for all patients with AF, except those patients (both male and female) who are at low risk (aged < 65 years and lone AF), or with contraindications.

The choice of antithrombotic therapy should be based upon the absolute risks of stroke/thromboembolism and bleeding and the net clinical benefit for a given patient.

The CHA$_2$DS$_2$-VASc score is recommended as a means of assessing stroke risk in non-valvular AF.

In patients with a CHA$_2$DS$_2$-VASc score of ≥ 2, OAC therapy with adjusted dose VKA (INR 2-3), or a direct thrombin inhibitor (dabigatran), or an oral factor Xa inhibitor (eg, rivaroxaban, apixaban) is recommended unless contraindicated.

In patients with a CHA$_2$DS$_2$-VASc score of 1, OAC with adjusted dose VKA (INR 2-3), or a direct thrombin inhibitor (dabigatran), or a oral factor Xa inhibitor (eg rivaroxaban, apixaban) should be considered based upon assessment of the risk of bleeding complications and patient preferences.

Camm AJ, et al. [III]

Thrombosis

Medscape Education

Camm AJ, et al. [2]
**ESC Guidelines: 2012 Focused Update: Recommendations for Prevention of Thromboembolism in Non-valvular AF**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Class</th>
<th>Level of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibithrombotic therapy to prevent thromboembolism is recommended for all patients with AF, except in those patients (both male and female) who are at low risk (aged &lt; 65 years and lone AF) or with contraindications.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>In patients with a CHA₂DS₂-VASc score ≥2, OAC therapy with:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- adjusted-dose VKA (INR 2-3); or</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>- a direct thrombin inhibitor (dabigatran); or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- an oral factor Xa inhibitor (eg, rivaroxaban, apixaban)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>... is recommended, unless contraindicated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In patients with a CHA₂DS₂-VASc score of 1, OAC therapy with</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- adjusted-dose VKA (INR 2-3); or</td>
<td>Ila</td>
<td>A</td>
</tr>
<tr>
<td>- a direct thrombin inhibitor (dabigatran); or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- an oral factor Xa inhibitor (eg, rivaroxaban, apixaban)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>... should be considered, based upon an assessment of the risk of bleeding complications and patient preferences.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When patients refuse the use of any OAC antplatelet therapy should be considered, using combination therapy with aspirin 75-100 mg plus clopidogrel 75 mg daily (where there is a low risk of bleeding) or, less effectively, aspirin 75-325 mg daily.

---

**ROCKET AF: Discontinuation Events**

<table>
<thead>
<tr>
<th>Stroke and SE</th>
<th>Rivaroxaban Events/100-pyrs</th>
<th>Warfarin Events/100-pyrs</th>
<th>RR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary discontinuations</td>
<td>6.2</td>
<td>5.05</td>
<td>1.28 (0.49-3.310)</td>
<td>.62</td>
</tr>
<tr>
<td>Permanent discontinuations</td>
<td>25.6</td>
<td>23.28</td>
<td>1.10 (0.71-1.72)</td>
<td>.66</td>
</tr>
</tbody>
</table>

**Stroke and SE, MI, & Death**

<table>
<thead>
<tr>
<th>Stroke and SE, MI, &amp; Death</th>
<th>Rivaroxaban Events/100-pyrs</th>
<th>Warfarin Events/100-pyrs</th>
<th>RR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temporary discontinuations</td>
<td>9.66</td>
<td>10.75</td>
<td>0.95 (0.47-1.94)</td>
<td>.89</td>
</tr>
<tr>
<td>Permanent discontinuations</td>
<td>115.8</td>
<td>137.2</td>
<td>0.91 (0.73-1.14)</td>
<td>.43</td>
</tr>
</tbody>
</table>

**After end of study (transition to/continuation on VKA)**

<table>
<thead>
<tr>
<th>After end of study (transition to/continuation on VKA)</th>
<th>Rivaroxaban Events/100-pyrs</th>
<th>Warfarin Events/100-pyrs</th>
<th>RR (95% CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.63</td>
<td>4.32</td>
<td>2.32 (1.24-4.34)</td>
<td>.0088</td>
<td></td>
</tr>
</tbody>
</table>
Pradaxa® (Dabigatran): Conversions

- Warfarin → Dabigatran
  - Start dabigatran when INR < 2
- Dabigatran → warfarin
  - Start warfarin 1-3 days before stopping dabigatran (based on renal function)
- Heparin/LMWH → Dabigatran
  - Start dabigatran at the time of heparin d/c
  - Start dabigatran 0-2 hours before next LMWH dose
- Dabigatran → Heparin/LMWH
  - Start Heparin/LMWH 12-24 hours after last dose of dabigatran (based on renal function)
Xarelto® (Rivaroxaban): Conversion

- Warfarin → Rivaroxaban
  - Stop warfarin and initiate rivaroxaban when INR < 3.0
- Heparin/LMWH → Rivaroxaban
  - Initiate rivaroxaban at the time of heparin d/c
  - Initiate rivaroxaban 0-2 hours before next LMWH dose
- Rivaroxaban → Heparin/LMWH
  - Initiate Heparin/LMWH when the next dose of rivaroxaban is due

Bridging Anticoagulants

- Bridging in, bridging out, and full bridging
- NHLBI trial expected 2015; no bridge vs. dalteparin 100IU/kg
- ADA recommends against bridging for dental cleaning or extractions
- Not required for cataracts
- Some endoscopists will snare colonic polyps on full dose warfarin
- Little evidence for bridging
- High risk patients consider bridging such as, multiple prosthetic valves, advanced MV disease, CHADS score >3
## Costs

- Heparin infusion.......................... $6.43
- Warfarin x 1 week .......................$126.00
- Lovenox Subq 80 IU/bid x 1 week......$496.30
- Lovenox, Warfarin, INR x 6 months. ...$946.30
- Xarelto x 6 months..........................$1,755
- Est. cost of bleeding complications......$72,266.81

---

**Mercy Anticoagulation Center (MAC)**

Rhonda Bridgewater ARNP
319-440-7131
Perioperative Aspirin Administration

**SOURCE:** Anesthesia Patient Safety Foundation; Spring-Summer 2012

- Recently a new NATIONAL consensus statement was released from the societies of Anesthesia, Medicine, Cardiology and Surgery in regards to perioperative Aspirin administration.
- **This recommendation is divided into two categories;**
  - **PRIMARY prophylaxis** (e.g. patients taking Aspirin in the absence of an established diagnosis of cardiovascular disease) &
  - **SECONDARY prophylaxis** (e.g. patients taking Aspirin in the presence of overt cardiovascular disease or conditions conferring particular risk).
- **Stopping Aspirin in patients taking this medication for SECONDARY prophylaxis needs an explicit discussion with the patient's primary care physician, cardiologist, neurologist, or vascular physician.**

---

**Approach to Bridging Therapy**


<table>
<thead>
<tr>
<th>Condition</th>
<th>Bridging Therapy Required:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Heart Valve</td>
<td>Mitral-value replacement, two or more mechanical valves, nonbileaflet aortic-valves, replacement, or aortic-value replacement with other risk factors.</td>
</tr>
<tr>
<td>Nonvalvular Atrial Fibrillation</td>
<td>Prior stroke or embolic event, cardiac thrombus, or CHADS score ≥ 4.</td>
</tr>
<tr>
<td>Venous Thromboembolism</td>
<td>Venous thromboembolism within previous 3 months or severe thrombophilia.</td>
</tr>
<tr>
<td>Medications</td>
<td>High risk patients with CrCL &lt; 30 mL/min Use Heparin Mechanical Heart Valve or Afib: Lovenox 1 mg/kg every 12 hours. Pls VTE: Lovenox 1.5 mg/kg daily</td>
</tr>
</tbody>
</table>
# No Bridging Therapy


<table>
<thead>
<tr>
<th>Mechanical Heart Value:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Aortic-valve replacement, bileaflet prosthesis, and no additional risk factors.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nonvalvular Atrial Fib:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ No prior stroke or embolic event, absence of thrombus, or CHADS score of &lt; 4.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VTE:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Venous thromboembolism &gt; 3 months previously or no additional risk factors (e.g. active cancer and nonsevere thrombophilia).</td>
<td></td>
</tr>
</tbody>
</table>

---

**Epic “Go Live”**  
June 1\(^{st}\), 2013
Epic Alerts Fired in One Week ??

1070
5100
50,003
76,404
108,000
130,000
Future TJC National Patient Safety Goal

• Alarm Fatigue

Getting Smarter About Prevention and Treatment of VTE:
Pharmacology Pearls

Lauren Cumings, PharmD
Mercy Medical Center
Ideal Anticoagulant

• Efficacy in treatment and prevention of VTE
• Oral, once daily dosing
• Rapid onset
• Predictable PK/PD profiles
• No renal or hepatic dose adjustments
• No routine monitoring
• Rapid reversal agent
• No significant food or drug interactions

Heparin

Advantages
• Efficacy in treatment and prevention of VTE
• Rapid onset
• No renal or hepatic dose adjustments
• No significant food or drug interactions
• Rapid reversal agent (Protamine)

Disadvantages
• Parenteral route of administration
• Multiple doses per day or continuous infusion
• Frequent monitoring and dose adjustments
• Unpredictable PK/PD profile
• Potential for HIT
Enoxaparin (Lovenox®)

**Advantages**
- Efficacy in treatment and prevention of VTE
- Potential once daily dosing
- Rapid onset
- More predictable PK profile
- No required monitoring
- No significant food or drug interactions
- Partial anticoagulant reversal with protamine

**Disadvantages**
- Parenteral administration
- Potential HIT
- Renal dose adjustment required

Warfarin (Coumadin®)

**Advantages**
- Efficacy in treatment and prevention of VTE
- Oral administration
- Reversal agent-Phytonadione
- No renal dose adjustments

**Disadvantages**
- Slow onset/offset
- Unpredictable PK/PD
- Frequent monitoring
- Significant food and drug interactions
Dabigatran (PRADAXA®)

**Advantages**
- Efficacy for prevention of VTE
- Oral dosing
- Rapid onset
- Predictable PK/PD profile
- No routine monitoring
- No significant food interactions

**Disadvantages**
- No current indication for treatment of VTE
- Twice daily dosing
- Renal and hepatic dose considerations
- No quick acting reversal agent
- Some significant drug interactions

Rivaroxaban (XARELTO®)

**Advantages**
- Efficacy in treatment and prevention of VTE
- Oral once daily dosing
- Rapid onset
- Predictable PK/PD profile
- No routine monitoring
- No significant food interactions

**Disadvantages**
- Renal and hepatic dose considerations
- No reversal agent
- Some significant drug interactions
Apixaban (ELIQUIS®)

**Advantages**
- Efficacy in VTE prevention
- Oral dosing
- Rapid Onset
- Predictable PK/PD profile
- No routine monitoring
- No significant food interactions

**Disadvantages**
- No indication for treatment of VTE
- Twice daily dosing
- Renal and Hepatic considerations
- No reversal agent
- Some significant drug interactions

What Now?
- No perfect anticoagulant
- Patient specific selection
- Reversal options needed
- Education
References