The Perioperative Management of Anticoagulants

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Disclosures

- No financial conflicts of interest to disclose

Have you ever …

- Had a patient being prepped for surgery in the pre-op holding area say “Wait, you wanted me to stop my Coumadin five days ago?”
- On POD#1 been asked “Hey doc – do you want to start your patient on Lovenox? He has a history of atrial fibrillation”
- Had a patient who suffered a TIA when his Coumadin was held for surgery?

Overview

- Discuss how to estimate perioperative thrombotic risk
- When should you stop anticoagulants before a procedure?
- Should you use a short-term parenteral “bridging” anticoagulant (like enoxaparin)?
- Review the perioperative management of warfarin and the newer target-specific oral anticoagulants (dabigatran, rivaroxaban, apixaban)
Anticoagulant Medications

- Approximately 2 – 3 million people in the US take anticoagulants
- Invasive procedures are performed in ~250,000 people taking anticoagulants each year
- The periprocedural period is a particularly high risk time – for both thrombosis and for bleeding

Indications for Anticoagulants

- Arterial clots
  - Atrial fibrillation (stroke, peripheral emboli)
  - Mechanical heart valves (valve thrombosis)
- Venous thromboembolism
  - Deep venous thrombosis, pulmonary emboli

Management Outline

- Step 1: Estimate bleeding risk
- Step 2: Estimate clotting risk
- Step 3: Decide when to stop oral anticoagulant
- Step 4: Decide whether or not to use bridging anticoagulation
- Step 5: Figure out the post-procedure anticoagulation plan

Step #1: Estimate Bleeding Risk

- Low bleeding risk
  - Where you would accept some residual active anticoagulation during the procedure
  - Examples: dental extractions, bloodless surgeries/procedures
  - May choose to continue the patient’s anticoagulation throughout the procedure or maintain it at the lower end of the therapeutic range
- High bleeding risk
  - Goal is no residual anticoagulation: want anticoagulation completely reversed prior to surgery
  - Majority of inpatient surgical procedures
Step #2: Estimate Clotting Risk

- Arterial and venous clots have different risk factors and consequences
  - Stroke $\rightarrow$ 25% 30-day mortality
  - VTE $\rightarrow$ 5% 30-day mortality
- Also have different incidence rates of anticoagulants
  - Atrial fibrillation – 1% to 10% per year
  - Venous thromboembolism – 1% to 40% per year

Atrial Fibrillation

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>CHADS$_2$ score 0-2 and no prior stroke/TIA</td>
</tr>
<tr>
<td>Intermediate</td>
<td>CHADS$_2$ score 3-4</td>
</tr>
<tr>
<td>High</td>
<td>CHADS$_2$ score 5-6 Stroke/TIA within 3 months Rheumatic heart disease</td>
</tr>
</tbody>
</table>

CHADS$_2$ Score:
- Congestive heart failure (1 point)
- Hypertension (1 point)
- Age $\geq$ 75 years (1 point)
- Diabetes mellitus (1 point)
- Stroke/TIA (2 points)

Venous Thromboembolism

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>VTE $&gt;12$ months ago and no other risk factors</td>
</tr>
<tr>
<td>Intermediate</td>
<td>VTE within 3-12 months Recurrent VTE Active cancer History of nonsevere thrombophilia (e.g., heterozygous FVL)</td>
</tr>
<tr>
<td>High</td>
<td>VTE with 3 months Severe thrombophilia (e.g., APLA, protein C or S deficiency, multiple abnormalities)</td>
</tr>
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Mechanical Heart Valves

<table>
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<tr>
<th>Risk Level</th>
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<tbody>
<tr>
<td>Low</td>
<td>Bileaflet aortic valve without atrial fibrillation and no other stroke risk factors</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Bileaflet aortic valve with 1 risk factor: atrial fibrillation, prior stroke, CHF, HTN, diabetes, age $\geq$ 75</td>
</tr>
<tr>
<td>High</td>
<td>Any mitral valve prosthesis Any caged-ball or tilting disk valve Multiple valves CVA /TIA within 6 months Bileaflet aortic valve with $\geq$ 2 risk factors</td>
</tr>
</tbody>
</table>
**Step #3: Decide when to stop warfarin**

- For patients with INRs 2 – 3, stop warfarin for the 5 days prior to the procedure
  - Goal INR < 1.5 on day of procedure
- If INR is higher, may need to stop an additional 1-2 days

**Step #4: Decide whether or not to use bridging anticoagulation**

- Low Thrombotic Risk
  - Bridging not necessary
    - Risks of bleeding, inconvenience/cost >> Benefits
- High Thrombotic Risk
  - Strongly consider bridging
    - Benefits of thrombosis prevention >> Risk

**Intermediate Thrombotic Risk**

- More complicated decision: patient preferences and individualized risk assessment play a stronger role
- May want to seek additional input (anticoagulation clinic, anesthesiology, primary care, hematology)
- Discussion with patient should be carefully documented

**How to Bridge**

- Start when INR < 2 (~4 days prior to procedure)
- Bridging options:
  - Enoxaparin 1 mg/kg SC Q12h: last dose 24h prior to procedure
  - IV heparin continuous drip (therapeutic-dose): stop drip 4-6 hours prior to procedure
  - Low-dose enoxaparin 30 mg SQ Q12h, last dose 24h prior to procedure (reduces venous thromboembolism risk but no evidence for arterial)
    - Consider if very high bleeding risk
    - Caution with enoxaparin if renal insufficiency
Step #5: Determine the Post-Procedure Bridging Plan

- Low Thrombotic Risk
  - Standard VTE prophylaxis after surgery, resume full anticoagulation once hemostasis is achieved
- High Thrombotic Risk
  - Resume full anticoagulation once hemostasis is achieved (ideally within 24-72 hrs)
  - May elect to start with enoxaparin 30mg q12hrs initially if bleeding risk high

- Intermediate Thrombotic Risk
  - Again, individualized management plan
  - All patients should be considered for VTE prophylaxis after surgery
  - Between 24-72 hrs, can start with low dose enoxaparin (30mg q12hrs)
  - At 72 hrs, consider resumption of full-dose anticoagulation
  - Start warfarin 12-24 hrs after procedure

Newer Oral Anticoagulants (NOACs)

- Dabigatran (Pradaxa)
  - Atrial fibrillation
- Rivaroxaban (Xarelto)
  - Atrial fibrillation, venous thromboembolism, orthopedic surgery VTE prophylaxis
- Apixaban (Eliquis)
  - Atrial fibrillation

Perioperative Management of Newer Target-Specific Oral Anticoagulants
Newer Oral Anticoagulants (NOACs)

- Fixed-dose oral anticoagulants
- No need to check INR (and PT/INR and PTT do not indicate degree of anticoagulation)
- Full-anticoagulation within several hours of ingestion
- No proven means of reversal
- Not much known about perioperative outcomes with these medications

Key Differences Between Periop Management of NOACs and Warfarin

- Bridging may not be as helpful
  - NOACs wear off more quickly than warfarin
  - May consider bridging if you need to hold longer
- PT/INR testing is not useful
  - If you really need to know whether there is residual anticoagulation on day of surgery, obtain a thrombin time for dabigatran and an anti-Factor Xa level for rivaroxaban/apixaban
- Be sure to account for renal function
  - Impaired renal function may delay clearance of anticoagulation; consider holding for a longer period

Low Bleeding Risk Procedures (where some residual anticoagulation is acceptable)

<table>
<thead>
<tr>
<th>Agent</th>
<th>Recommended Interval Between Last Dose and Procedure</th>
<th>Postprocedure Initiation</th>
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<tbody>
<tr>
<td>Dabigatran</td>
<td>Hold for 24 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>t½ = 14-17 hrs (CrCl ≥50ml/min)</td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>Hold for 24 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>t½ = 8-9 hrs (CrCl&gt;60ml/min)</td>
<td></td>
</tr>
<tr>
<td>Apixaban</td>
<td>Hold for 24 hours</td>
<td>24 hours</td>
</tr>
<tr>
<td></td>
<td>t½ = 7-8 hrs (CrCl &gt;60 ml/min)</td>
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High Bleeding Risk Procedures (want complete anticoagulation reversal)

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<tr>
<td>Dabigatran</td>
<td>Hold for 2 – 4 days</td>
<td>≥ 48 hours</td>
</tr>
<tr>
<td></td>
<td>t½ = 14-17 hrs (CrCl ≥50ml/min)</td>
<td></td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>Hold for 2 days</td>
<td>≥ 48 hours</td>
</tr>
<tr>
<td></td>
<td>t½ = 8-9 hrs (CrCl&gt;60ml/min)</td>
<td></td>
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<tr>
<td>Apixaban</td>
<td>Hold for 2 – 3 days</td>
<td>≥ 48 hours</td>
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<td></td>
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### High Bleeding Risk Procedures in Patients with Renal Insufficiency

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<th>Postprocedure initiation</th>
</tr>
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<tbody>
<tr>
<td>Dabigatran</td>
<td>CrCl 30-50 ml/min: hold 3-4 days Consider checking thrombin time</td>
<td>≥ 48 hours</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>CrCl 30–59 ml/min: hold 2 days CrCl 15–29 ml/min: hold 3 days Consider checking Factor Xa level</td>
<td>≥ 48 hours</td>
</tr>
<tr>
<td>Apixaban</td>
<td>CrCl 30–49 ml/min: hold 3 days Consider checking Factor Xa level</td>
<td>≥ 48 hours</td>
</tr>
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### Summary

- Estimate thrombotic and bleeding risk
- Determine whether parenteral bridging is warranted
- Account for patient preferences and individualized patient factors
- Develop a pre- and post-operative anticoagulation management plan
- Enlist outside help in complex situations

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**Thank You!**