Anti-thrombotics and Colonoscopy

Anna Rahmani, MD. Ph.D. FRCPC
DICLOSURES:

• consultations fees: Servier and Sanofi Pharmaceuticals

• Thrombosis Clinic Educational Fund: Servier
CONFLICT OF INTEREST: NONE
Overview and Objectives:

- Indication and modes of anti-platelet and anticoagulation therapy.
- Risk of bleeding and thrombotic events with each treatment mode after polypectomy.
- Indication for bridging anticoagulation
- Peri-procedural management of anticoagulation in era of Direct Oral Anticoagulants (DOACs).
Arterial:

★ **Antiplatelet:**
  - Coronary artery disease including prevention of stent thrombosis
  - Peripheral vascular disease
  - Cerebrovascular disease

**Anticoagulation:**
  - Atrial Fibrillation/ Flutter
  - Mechanical valves
  - Hypercoagulable state such as antiphospholipid antibody syndrome.
Venous:

- **Antiplaletet:**
  - rarely used, unless as prophylaxis for DVT/PE

**Anticoagulation:**

- Deep vein thrombosis and pulmonary embolism
- Hypercoagulable state: Antiphospholipid antibody syndrome or high risk thrombophilia such as protein C, protein S and anti-thrombin III deficiency.
# Antiplatelet Therapy

<table>
<thead>
<tr>
<th>Antiplatelet Agents</th>
<th>Mechanism</th>
<th>Indications</th>
<th>Examples</th>
<th>Recommended Time of Stopping Drug Preprocedure, if Indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin</td>
<td>Irreversibly acetylates and inactivates cyclooxygenase</td>
<td>Primary and secondary cardiovascular protection; cerebrovascular protection</td>
<td>Oral: aspirin (Bayer, Ecotrin)</td>
<td>7-10 d, not recommended to stop if high risk for cardiovascular disease</td>
</tr>
<tr>
<td>NSAIDs</td>
<td>Reversibly block cyclooxygenase; can be selective (blocking cyclooxygenase-2) or nonselective (blocking both COX-1 and COX-2)</td>
<td>Pain, osteoarthritis, rheumatoid arthritis, inflammatory arthritis, dysmenorrhea, fever, anti-inflammatory</td>
<td>Oral: ibuprofen (Advil, Motrin), naproxen (Naprosyn), celecoxib (Celebrex), diclofenac, ketoprofen, indomethacin, sulindac, meloxicam, piroxicam</td>
<td>Short-half life: ibuprofen, diclofenac, ketoprofen, indomethacin (1 d) Intermediate half life: naproxen, sulindac, celecoxib (2-3 d) Long half life: meloxicam, piroxicam (10 d)</td>
</tr>
<tr>
<td>Dipyridamole</td>
<td>Inhibits uptake of adenosine into platelets leading to inhibition of platelet aggregation</td>
<td>Thrombotic stroke prevention</td>
<td>Oral: dipyridamole (Persantine), aspirin/dipyridamole (Aggrenox)</td>
<td>2 d (7-10 d if being given as Aggrenox, the combination of aspirin and dipyridamole)</td>
</tr>
<tr>
<td>Thienopyridines</td>
<td>Irreversibly inhibits platelets by blocking their ADP receptors</td>
<td>Acute coronary syndrome, thrombotic event prevention</td>
<td>Oral: clopidogrel (Plavix), prasugrel (Effient), ticlopidine (Ticlid), ticagrelor (Brilinta)</td>
<td>5-7 d for clopidogrel, 7-9 d for prasugrel, 3-5 d for ticagrelor, 10-14 d for ticlopidine</td>
</tr>
</tbody>
</table>
Based on several retrospective studies, guidelines agree that aspirin can be safely continued during colonoscopy with polypectomy without concern for a significant increase in bleeding.


Anti-inflamatory drugs (NSAIDs) have short-acting effects on bleeding.

Guidelines agree that stopping NSAIDs prior to diagnostic or therapeutic endoscopic procedures is not mandatory.


ASGE Standards of Practice Committee; Acosta RD, Abraham NS, Chandrasekhara V, et al. The management of antithrombotic agents for patients undergoing GI endoscopy. Gastrointest Endosc. 2016;83(1): 3-16
Antiplatelet Therapy

Bleeding Risk

• In patients with coronary artery disease, especially in the setting of coronary stents, thienopyridines are frequently given in combination with aspirin (dual antiplatelet therapy).

• For patients who are continued on thienopyridines during polypectomy, retrospective studies have estimated the risk of clinically important postpolypectomy bleeding to be 0.9-2.1%.

• Required treatment in bleeding patients, in a prospective study included: pRBC transfusion and repeat colonoscopy. There were no angiography, surgery or mortality.


Thromboembolic risk of interrupting antiplatelet agents

- Aspirin
  - Cardiovascular risk associated with stopping aspirin is high in patients with prior history of CAD.
  - Most adverse events are identified within one month of stopping aspirin.
  - Cessation of antiplatelet therapy for elective procedure, in patients with previous history of ACS, was associated with higher 30-day rates of death or MI.

Thromboembolic risk of interrupting antiplatelet agents

Cardiovascular risks of interrupting thienopyridines include:

• stent thrombosis,
• myocardial infarction,
• stroke
• death

Thromboembolic risk of interrupting antiplatelet agents

Discontinuing aspirin or clopidogrel for noncardiac surgery within 2-4 weeks of stent placement is associated with a high rate (30%) of major cardiovascular events.


Thromboembolic risk of interrupting antiplatelet agents

The joint guidelines published by the American College of Gastroenterology (ACG) and the American College of Cardiology (ACC) recommend against interruption of platelet antagonists for elective procedures, particularly for patients at high risk for deadly stent thrombosis.

When should elective noncardiac surgery be done?

- Canadian Cardiovascular Society recommendations:
  - Bare Metal Stents (BMS): delay procedure or surgery for at least 6 weeks (Class I, level B).
  - Drug Eluting Stent (DES): delay surgery for at least 12 months (Class I, level B).

Which Antiplatelet Agents Should Be Stopped or Continued Around the Time of Procedure?

★ If urgent surgery needed within 6 wk of BMS or 1 yr of DES implantation, continue DAPT if possible during perioperative period (class 1, level B)

★ For elective procedures, if the risk for cardiovascular events is high, continue ASA (class IIa, level C) but discontinue clopidogrel (class IIb, level C).

Indication for Anticoagulation

**Arterial:**
- Atrial Fibrillation/ Flutter
- Mechanical valves
- Hypercoagulable state such as antiphospholipid antibody syndrome.

**Venous:**
- Deep vein thrombosis and pulmonary embolism
- Hypercoagulable state: Antiphospholipid antibody syndrome or high risk thrombophilia such as protein C, protein S and anti-thrombin III deficiency.
Rivaroxaban  
Apixaban  
Edoxaban  
Betrixaban

Extrinsic Pathway  
(Tissue factor)

warfarin

TF-Villa Complex

warfarin

warfarin

warfarin

warfarin

warfarin

Dabigatran

Activated protein C

Fibrinogen (I)

Fibrin (Ia)

Stable clot, Fibrin cross linked

Platelet activation  
vWF adheres platelets to injury  
Platelet aggregation  
Loose platelet plug
Warfarin

A retrospective cohort study focused on the use of periprocedural anticoagulation found that delayed postpolypectomy bleeding occurred in 2.6% of patients who discontinued warfarin prior to colonoscopy, compared with 0.2% of patients who are not anticoagulated.

The risk of bleeding with heparin bridging during warfarin interruption is higher (20%) than no bridging (1.4%)


Warfarin

★ Current guidelines recommend discontinuing warfarin for high risk procedures like polypectomy.

★ In high risk patients, bridging anticoagulation is recommended.
Indications for Bridging Anticoagulation

Table 1—[Introduction] Suggested Risk Stratification for Perioperative Thromboembolism

<table>
<thead>
<tr>
<th>Risk Stratum</th>
<th>Mechanical Heart Valve</th>
<th>Atrial Fibrillation</th>
<th>VTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>High*</td>
<td>Any mitral valve prosthesis</td>
<td>• CHADS$_2$ score of 5 or 6</td>
<td>• Recent (within 3 mo) VTE</td>
</tr>
<tr>
<td></td>
<td>Any caged-ball or tilting disc aortic valve prosthesis</td>
<td>• Recent (within 3 mo) stroke or transient ischemic attack</td>
<td>• Severe thrombophilia (eg, deficiency of protein C, protein S, or antithrombin; antiphospholipid antibodies; multiple abnormalities)</td>
</tr>
<tr>
<td></td>
<td>Recent (within 6 mo) stroke or transient ischemic attack</td>
<td>• Rheumatic valvular heart disease</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age $&gt;75$ y</td>
<td>• CHADS$_2$ score of 3 or 4</td>
<td>• VTE within the past 3-12 mo</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Recurrent VTE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Active cancer (treated within 6 mo or palliative)</td>
</tr>
<tr>
<td>Low</td>
<td>Bileaflet aortic valve prosthesis without atrial fibrillation and no other risk factors for stroke</td>
<td>• CHADS$_2$ score of 0 to 2 (assuming no prior stroke or transient ischemic attack)</td>
<td>• VTE $&gt;12$ mo previous and no other risk factors</td>
</tr>
</tbody>
</table>

CHADS$_2$ = congestive heart failure, hypertension, age $>75$ years, diabetes mellitus, and stroke or transient ischemic attack; VKA = vitamin K antagonist.

*High-risk patients may also include those with a prior stroke or transient ischemic attack occurring $>3$ mo before the planned surgery and a CHADS$_2$ score $<5$, those with prior thromboembolism during temporary interruption of VKAs, 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).

- individual patient factors need to be considered when using this risk stratification table.
  - ex. PE more than one year ago, associated with severe pulmonary hypertension.
- **High risk:** $>10\%$ risk of thromboembolism per year
- **Moderate risk:** $5 - 10\%$ risk of thromboembolism per year
- **Low risk:** $<5\%$ risk of thromboembolism per year
### Suggested Risk Stratification for Perioperative Thromboembolism

<table>
<thead>
<tr>
<th>Risk Stratum</th>
<th>Mechanical Heart Valve</th>
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</table>
| High\(^a\)   | - Any mitral valve prosthesis  
- Any caged-ball or tilting disc aortic valve prosthesis  
- Recent (within 6 mo) stroke or transient ischemic attack |
| Moderate     | - Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age > 75 y |
| Low          | - Bileaflet aortic valve prosthesis without atrial fibrillation and no other risk factors for stroke |
Starr-Edwards Ball-in-Cage

Single Tilting leaflet
Medtronic Hall

St. Jude Bileaflet
Perioperative Management of Antithrombotic Therapy

Moderate • Bileafl et aortic valve prosthesis and one or more of the
major vascular surgery).

Low • Bileafl et aortic valve prosthesis without atrial
fibrillation and no other risk factors for stroke

Table 1—Introduction] Suggested Risk Stratification for Perioperative Thromboembolism

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| High†       | Any mitral valve prosthesis
Any caged-ball or tilting disc aortic valve prosthesis
Recent (within 6 mo) stroke or transient ischemic attack | • CHADS₂ score of 5 or 6
• Recent (within 3 mo) stroke or transient ischemic attack
• Rheumatic valvular heart disease | • Recent (within 3 mo) VTE
• Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)
• Recurrent VTE
• Active cancer (treated within 6 mo or palliative) |
| Moderate     | Bileafl et aortic valve prosthesis and one or more of the
of following risk factors: atrial fibrillation, prior stroke
or transient ischemic attack, hypertension, diabetes,
congestive heart failure, age > 75 y | • CHADS₂ score of 3 or 4 | • VTE within the past 3-12 mo
• Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)
• Recurrent VTE
• Active cancer (treated within 6 mo or palliative) |
| Low          | Bileafl et aortic valve prosthesis without atrial
fibrillation and no other risk factors for stroke | • CHADS₂ score of 0 to 2 (assuming no prior stroke or transient ischemic attack) | • VTE > 12 mo previous and no other risk factors |

CHADS₂ = congestive heart failure, hypertension, age ≥ 75 years, diabetes mellitus, and stroke or transient ischemic attack; VKA = vitamin K antagonist.

†High-risk patients may also include those with a prior stroke or transient ischemic attack occurring > 3 mo before the planned surgery and a CHADS₂ score < 5, those with prior thromboembolism during temporary interruption of VKAs, 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).
Assessing Risk for Bleeding

Table 1—Suggested Risk Stratification for Perioperative Thromboembolism

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<td>Any native valve prostheses&lt;br&gt;Recent (within 3 mo) stroke or transient ischemic attack&lt;br&gt;CHADS&lt;sub&gt;2&lt;/sub&gt; score of 5 or 6</td>
<td>• CHADS&lt;sub&gt;2&lt;/sub&gt; score of 5 or 6&lt;br&gt;• Recent (within 3 mo) stroke or transient ischemic attack&lt;br&gt;• Rheumatic valvular heart disease</td>
<td>• Recent (within 3 mo) VTE&lt;br&gt;• Recurrent thrombophilia (e.g., deficiency of protein C, protein S, or antithrombin, antiphospholipid antibodies, multiple abnormalities)</td>
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<td>Moderate</td>
<td>Bileaflet aortic valve prostheses and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age &gt; 75 y</td>
<td>• CHADS&lt;sub&gt;2&lt;/sub&gt; score of 3 or 4&lt;br&gt;• VTE within the past 12 mo&lt;br&gt;• Severe thrombophilia (e.g., heterozygous factor V Leiden or prothrombin gene mutation)</td>
<td>• Recurrent VTE&lt;br&gt;• Active cancer (treated within 6 mo or palliative)</td>
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<tr>
<td>Low</td>
<td>Bileaflet aortic valve prostheses without atrial fibrillation and no other risk factors for stroke</td>
<td>• CHADS&lt;sub&gt;2&lt;/sub&gt; score of 0 to 2 (assuming no prior stroke or transient ischemic attack)</td>
<td>• VTE or VVBI (pulmonary and another risk factor)</td>
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CHADS<sub>2</sub> = congestive heart failure, hypertension, age ≥ 75 years, diabetes mellitus, and stroke or transient ischemic attack; VTE = vitamin K antagonist.

High-risk patients may also include those with a prior stroke or transient ischemic attack occurring > 3 mo before the planned surgery and a CHADS<sub>2</sub> score < 5, those with prior thromboembolism during temporary interruption of VKAs, or those undergoing certain types of surgery associated with an increased risk for stroke or other thromboembolism (e.g., cardiac valve replacement, carotid endarterectomy, major vascular surgery).
Perioperative Management of Antithrombotic Therapy

Table 1—[Introduction] Suggested Risk Stratification for Perioperative Thromboembolism

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| High*        | • Any mitral valve prosthesis  
               • Any caged-ball or tilting disc aortic valve prosthesis  
               • Recent (within 6 mo) stroke or transient ischemic attack | • CHADS<sub>2</sub> score of 5 or 6  
               • Recent (within 3 mo) stroke or transient ischemic attack  
               • Rheumatic valvular heart disease | • Recent (within 3 mo) VTE  
               • Severe thrombophilia (eg, deficiency of protein C, protein S, or antithrombin; antiphospholipid antibodies; multiple abnormalities) |
| Moderate     | • Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age > 75 y | • CHADS<sub>2</sub> score of 3 or 4 | • VTE within the past 3-12 mo  
               • Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)  
               • Recurrent VTE  
               • Active cancer (treated within 6 mo or palliative) |
| Low          | • Bileaflet aortic valve prosthesis without atrial fibrillation and no other risk factors for stroke | • CHADS<sub>2</sub> score of 0 to 2 (assuming no prior stroke or transient ischemic attack) | • VTE > 12 mo previous and no other risk factors |

CHADS<sub>2</sub> = congestive heart failure, hypertension, age ≥ 75 years, diabetes mellitus, and stroke or transient ischemic attack; VKA = vitamin K antagonist.

*High-risk patients may also include those with a prior stroke or transient ischemic attack occurring ≥ 3 mo before the planned surgery and a CHADS<sub>2</sub> score < 5, those with prior thromboembolism during temporary interruption of VKAs, 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 1—Introduction: Suggested Risk Stratification for Perioperative Thromboembolism

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<tr>
<td><strong>High</strong></td>
<td>Any aortic valve prosthesis</td>
<td>CHADS, score of 5 or 6</td>
<td>Recent (within 3 mo) VTE</td>
</tr>
<tr>
<td></td>
<td>Any aortic valve prosthesis</td>
<td>Recent within 3 mo stroke or transient ischemic attack</td>
<td>Recent (within 3 mo) VTE</td>
</tr>
<tr>
<td></td>
<td>Recent (within 6 mo) stroke or transient ischemic attack</td>
<td>Recent stroke or transient ischemic attack</td>
<td>Recent thrombophilia (eg, deficiency of protein C, protein S, or antithrombin; antiphospholipid antibodies; multiple abnormalities)</td>
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<td><strong>Moderate</strong></td>
<td>Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age &gt; 75 y</td>
<td>CHADS, score of 3 or 4</td>
<td>VTE within the past 3-12 mo</td>
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<td>Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)</td>
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<td>Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age &gt; 75 y</td>
<td>VTE &gt; 12 mo previous and no other risk factors</td>
<td></td>
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<tr>
<td><strong>Low</strong></td>
<td>Bileaflet aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age &gt; 75 y</td>
<td>VTE &gt; 12 mo previous and no other risk factors</td>
<td></td>
</tr>
</tbody>
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CHADS = congestive heart failure, hypertension, age > 75 years, diabetes mellitus, and stroke or transient ischemic attack; VKA = vitamin K antagonist

Moderate-risk patients may also include those with a prior stroke or transient ischemic attack occurring > 3 mo before the planned surgery and a CHADS, score > 5, those with prior thromboembolism during temporary interruption of VKAs, or those undergoing certain types of surgery associated with an increased risk for stroke or other thromboembolism (eg, cardiac valve replacement, cardiac endarterectomy, major vascular surgery).

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**Risk Stratum**

**High**

- Recent (within 3 mo) VTE
- Severe thrombophilia (eg, deficiency of protein C, protein S, or antithrombin; antiphospholipid antibodies; multiple abnormalities)

**Moderate**

- VTE within the past 3-12 mo
- Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)
- Recurrent VTE
- Active cancer (treated within 6 mo or palliative)

**Low**

- VTE > 12 mo previous and no other risk factors
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<td>Recent (within 3 mo) VTE</td>
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<td>Any caged-ball or tilting disc aortic valve prosthesis</td>
<td>Recent (within 3 mo) stroke or transient ischemic attack</td>
<td>Severe thrombophilia (eg, deficiency of protein C, protein S, or antithrombin; antiphospholipid antibodies; multiple abnormalities)</td>
</tr>
<tr>
<td></td>
<td>Recent (within 6 mo) stroke or transient ischemic attack</td>
<td>Rheumatic valvular heart disease</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>Bileafl aortic valve prosthesis and one or more of the following risk factors: atrial fibrillation, prior stroke or transient ischemic attack, hypertension, diabetes, congestive heart failure, age &gt; 75 y</td>
<td>CHADS&lt;sub&gt;2&lt;/sub&gt; score of 3 or 4</td>
<td>VTE within the past 3-12 mo</td>
</tr>
<tr>
<td></td>
<td>• CHADS&lt;sub&gt;2&lt;/sub&gt; score of 3 or 4</td>
<td>• VTE within the past 3-12 mo</td>
<td>• Nonsevere thrombophilia (eg, heterozygous factor V Leiden or prothrombin gene mutation)</td>
</tr>
<tr>
<td>Low</td>
<td>Bileafl aortic valve prosthesis without atrial fibrillation and no other risk factors for stroke</td>
<td>CHADS&lt;sub&gt;2&lt;/sub&gt; score of 0 to 2 (assuming no prior stroke or transient ischemic attack)</td>
<td>VTE &gt; 12 mo previous and no other risk factors</td>
</tr>
</tbody>
</table>

CHADS<sub>2</sub> = congestive heart failure, hypertension, age ≥ 75 years, diabetes mellitus, and stroke or transient ischemic attack; VKA = vitamin K antagonist.

*High-risk patients may also include those with a prior stroke or transient ischemic attack occurring > 3 mo before the planned surgery and a CHADS<sub>2</sub> score < 5, those with prior thromboembolism during temporary interruption of VKAs, or those undergoing certain types of surgery associated with an increased risk for stroke or other thromboembolism (eg, cardic valve replacement, carotid endarterectomy, major vascular surgery).

Two patients with A. Fib:
CHADS<sub>2</sub> score: 3 (stroke, DM)
CHADS<sub>2</sub> score: 3 (HTN, DM, age)

Patient with >1 year ago VTE associated with pulmonary hypertension
Indications for Bridging Anticoagulation

- Complex decision
- Often associated with increase morbidity (bleeding/thrombosis)
- Different comfort zones for different health care providers.
- Patient health literacy plays a significant role in reducing morbidity around bridging anticoagulation.
<table>
<thead>
<tr>
<th>Mechanism of Action</th>
<th>Rivaroxaban</th>
<th>Edoxaban</th>
<th>Apixaban</th>
<th>Dabigatran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct factor Xa inhibitor</td>
<td>Direct thrombin inhibitor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bioavailability</td>
<td>80%</td>
<td>62%</td>
<td>50%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Renal Excretion</td>
<td>30%</td>
<td>50%</td>
<td>25%</td>
<td>80%</td>
</tr>
<tr>
<td>Peak Serum concentration</td>
<td>2.5 - 4 hrs</td>
<td>1-2 hrs</td>
<td>1 -2 hrs</td>
<td>1 - 2 hrs</td>
</tr>
<tr>
<td>Half-life</td>
<td>5 - 9 hrs</td>
<td>9 - 11 hrs</td>
<td>12 hrs</td>
<td>12 -17 hrs</td>
</tr>
</tbody>
</table>
Bleeding and Thrombotic Risk associated with DOACs

- Currently no clear data available
- published data are retrospective and based on the pivotal trials which introduced these drugs
## Preoperative Interruption of DOACs

### Renal Function:
- **CrCl >50 ml/min**
- **CrCl 30-49 ml/min**
- **CrCl >50 ml/min**
- **CrCl 30-49 ml/min**

<table>
<thead>
<tr>
<th>Drug</th>
<th>Low Bleeding Risk</th>
<th>High Bleeding Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CrCl &gt;50 ml/min</td>
<td>CrCl &gt;50 ml/min</td>
</tr>
<tr>
<td></td>
<td>CrCl 30-49 ml/min</td>
<td>CrCl 30-49 ml/min</td>
</tr>
<tr>
<td>Dabigatran</td>
<td>24 hrs</td>
<td>48-72 hrs</td>
</tr>
<tr>
<td>Rivaroxaban</td>
<td>24 hrs</td>
<td>48 hrs</td>
</tr>
<tr>
<td>Apixaban</td>
<td>24 hrs</td>
<td>48 hrs</td>
</tr>
</tbody>
</table>
## Postoperative Resumption of DOACs

<table>
<thead>
<tr>
<th></th>
<th>Low Bleeding Risk</th>
<th>High Bleeding Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dabigatran</strong></td>
<td>resume 24 hr after surgery</td>
<td>Resume 48-72 hrs after surgery*</td>
</tr>
<tr>
<td><strong>Rivaroxaban</strong></td>
<td>resume 24 hr after surgery</td>
<td>Resume 48-72 hrs after surgery*</td>
</tr>
<tr>
<td><strong>Apixaban</strong></td>
<td>resume 24 hr after surgery</td>
<td>Resume 48-72 hrs after surgery*</td>
</tr>
</tbody>
</table>

* Consider DVT prophylaxis and/or alternatives such as IV heparin
Thank you.