NEURAXIAL BLOCKADE AND ANTICOAGULANTS
Disclaimer

- Every effort was made to ensure that material and information contained in this presentation are correct and up-to-date. The author cannot accept liability/responsibility for errors that may occur from the use of this information. It is up to each clinician to ensure that they provide safe anesthetic care to their patients.
INTRODUCTION
Benefits of Neuraxial Blockade

- Decreased nausea and vomiting
- Decreased blood loss
- Decreased incidence of graft occlusion
- Improved mobility after major knee surgery
- Superior postoperative pain control
- Less alteration to the cardiopulmonary status of the patient
The need for formalized guidance for anticoagulated patient:

- Advances in pharmacology
- Desire to prevent thromboembolism
- Formulation of thromboembolism prophylaxis
- Use of regional anesthesia
ASRA Guidelines

- 1998 the first Consensus Conference on Neuraxial Anesthesia and Analgesia was held.
- 2002 the second Consensus Conference was held.
- The result: formalized guidelines to assist the anesthesia provider in decision making.
THROMBO PROPHYLAXIS
Medications for total joint thromboprophylaxis

- Unfractionated heparin
- Low molecular weight heparin (ardeparin sodium or Normoflo®, dalteparin sodium or Fragmin®, danaparoid sodium or Orgaran®, enoxaprin sodium or Lovenox® and tinzaprin or Innohep®).
- Warfarin sodium
Medications for general surgery thromboprophylaxis

- Unfractionated heparin
- Low molecular weight heparin (dalteparin sodium, enoxaparin sodium)
Acute Coronary Syndrome and venous thromboembolism therapy

- Enoxaparin sodium (Lovenox®)
- Dalteparin sodium (Fragmin®)
- Tinzaparin (Innohep®)
The major complication related to anticoagulation is bleeding.
Major Bleeding Sites

- Intraspinal
- Intracranial
- Intraocular
- Retroperitoneal
- Mediastinal
Factors that increase the risk of a major bleed

- Intensity of anticoagulant effect
- Increased age
- Female gender
- Use of aspirin
- History of Gastrointestinal bleed
- Duration of treatment
Epidural Hematoma Formation

- Due to spontaneous bleed
- Due to trauma induced by a needle
Epidural Space vs Intrathecal Space

- Epidural space is richly supplied with a venous plexus.
- Area around the spinal cord is fixed. Bleeding results in compression, ischemia, nerve trauma, and paralysis.
- Bleeding into the intrathecal space is diluted by the Cerebral Spinal Fluid (usually less devastating).
Incidence of Epidural Hematoma Formation

- Epidural anesthesia: 1:150,000 to 1:190,000
- Spinal anesthesia: 1:220,000
- Epidural anesthesia and anticoagulants administered during surgery: 33:100,000
- Spinal anesthesia and anticoagulants administered during surgery: 1:100,000
Risk Factors for the Development of Epidural Hematoma

- Anatomic abnormalities of the spinal cord or vertebral column
- Vascular abnormalities
- Pathologic/medication induced alterations in homeostasis
- Alcohol abuse
- Chronic renal insufficiency
- Difficult and traumatic needle placement
- Epidural catheter removal
Signs and Symptoms of an Epidural Hematoma

- Low back pain (sharp and irradiating)
- Sensory and motor loss (numbness and tingling/motor weakness long after block should have abated)
- Bowel and/or bladder dysfunction
- Paraplegia
Diagnostic Testing

- MRI (preferred)
- CT scan (may miss small hematomas)
- Myelogram
Treatment and Outcome

- Must be treated within 8-12 hours of onset of symptoms
- Emergency decompressive laminectomy with hematoma evacuation
- Outcome is generally poor
Factors Affecting Recovery

- Size and location of the hematoma
- Speed of hematoma development
- Severity and nature of pre-existing neurological problems
General ASRA recommendations related to perioperative use of anticoagulants

- Concurrent use of coagulation altering medications may increase risk of bleeding without altering coagulation studies.

- When providing postoperative analgesia with an epidural use opioids or dilute local anesthetic to allow for neurological evaluation.

- Remove catheters at the nadir of anticoagulant activity and do not give additional anticoagulants immediately after removal.
General ASRA recommendations related to perioperative use of anticoagulants

- Frequent evaluation of neurological status of the patient should be pursued for early detection of an epidural hematoma.
- In high risk cases continue monitoring neurological status for 24 hours post catheter removal.
Common anticoagulants encountered in the surgical setting.

- Antiplatelet medications
- Oral anticoagulants
- Standard Heparin
- Herbal preparations
- New anticoagulants
Specific anticoagulant and ASRA recommendations
Antiplatelet Medications
Types of Antiplatelet Medications

- Aspirin
- NSAIDs
- Thienopyridine Derivatives
- Platelet GP IIb/IIIa inhibitors
Aspirin

- **MECHANISM OF ACTION:**
  
  Blocks cyclooxygenase. Cyclooxygenase is responsible for the production of thromboxane A2 which inhibits platelet aggregation and causes vasoconstriction.

- **DURATION OF ACTION:**
  
  Irreversible effect on platelets. Effect of aspirin lasts for the life of the platelet which is 7-10 days. Long term use of aspirin may lead to a decrease in prothrombin production and result in a lengthening of the PT.
NSAIDS

- MECHANISM OF ACTION:
  Inhibits cyclooxygenase by decreasing tissue prostaglandin synthesis.

- DURATION OF ACTION:
  Reversible. Duration of action depends on the half life of the medication used and can range from 1 hour to 3 days.
ASRA RECOMMENDATIONS

Aspirin
NSAIDS
Aspirin and NSAIDS

- Either medication alone does not increase risk.
- Need to scrutinize dosages, duration of therapy and concomitant medications that may affect coagulation.
- No wholly accepted laboratory tests. A normal bleeding time does not indicate normal homeostasis. An abnormal bleeding time does not necessarily indicate abnormal homeostasis.
In addition to assessment of concomitant medications look for the following:

- History of bruising easily
- History of excessive bleeding
- Female gender
- Increased age
Thienopyridine Derivatives

- MECHANISM OF ACTION:
  Interfere with platelet membrane function by inhibition of adenosine diphosphate (ADP) induced platelet-fibrinogen binding.

- DURATION OF ACTION:
  Thienopyridine derivatives exert an irreversible effect on platelet function for the life of the platelet.
ASRA RECOMMENDATIONS
THIENO PYRIDINE DERIVATIVES
- DC ticlopidine for 14 days prior to a neuraxial block.
- DC clopidogrel for 7 days prior to a neuraxial block.
- There is no accepted laboratory tests for these medications.
Platelet GP IIb/ IIIa inhibitors

- Abciximab (Reopro®)
- Eptifibatide (Integrilin®)
- Tirofiban (Aggrostat®)
Platelet GP IIb/ IIIa inhibitors

- **MECHANISM OF ACTION:**
  Reversibly inhibits platelet aggregation by preventing the adhesion of ligands to glycoprotein IIb/ IIIa, including plasminogen and von Willebrand factor.

- **DURATION OF ACTION:**
  For abciximab it takes 24-48 hours until there is normal platelet function. For eptifibatide (Integrillin) and tirofiban it takes 4-8 hours until there is normal platelet function.
ASRA RECOMMENDATIONS

GP IIb/IIIa INHIBITORS
Platelet GP IIb/ IIIa inhibitors

- No neuraxial blockade should be undertaken until platelet function is normal.
- GP IIb/ IIIa inhibitors are contraindicated within 4 weeks of surgery.
- If one is received postoperatively, after a neuraxial block, there should be careful monitoring of the neurological status.
Warfarin (Coumadin)

- **MECHANISM OF ACTION:**
  Inhibits vitamin K formation. Depletion of the vitamin K dependent proteins (prothrombin and factors VII, IX and X) occurs.

- **DURATION OF ACTION:**
  Onset is 8-12 hours with a peak at 36-72 hours.
ASRA RECOMMENDATIONS

WARFARIN
Warfarin

- Evaluate patient for use of concomitant use of medications that may alter coagulation.
- Warfarin should be stopped for 4-5 days and a PT/INR should be checked prior to neuraxial blockade.
- Preoperative warfarin: if warfarin has been administered >24 hours prior or the patient has been given more than 1 dose then check a PT/INR.
Warfarin

- Patients receiving postoperative epidural analgesia and warfarin should have the PT/INR monitored daily.
- If the INR is > 3.0 the dose of warfarin should be withheld.
- Epidural catheters should be DC’d only when the INR is <1.5.
- If removed with INR > 1.5 the patient should be monitored for neurological deficits for 24 hours.
Standard Heparin

- MECHANISM OF ACTION:
  Binds with antithrombin III, neutralizing the activated factors of X, XII, XI and IX.

- DURATION OF ACTION:
  The elimination half life for IV heparin is 56 minutes.
ASRA RECOMMENDATIONS
STANDARD HEPARIN
Standard Heparin

- Mini-dose subq heparin does not contraindicate a neuraxial block. The administration of subq heparin should be held until after the block.
- Patients should be screened for concurrent medications that may impact clotting.
- Patients on heparin for more than 4 days should have a platelet count assessed prior to neuraxial blockade due to the risk of heparin induced thrombocytopenia.
Standard Heparin

- Heparin administration should be delayed for 1 hour after neuraxial blockade.
- Indwelling catheters should be removed 2-4 hours after the last dose and evaluation of PTT. Heparin should not be reinitiated until 1 hour has passed.
- If a “bloody tap” has occurred it should be communicated to the surgeon. No data suggests the mandatory cancellation of the surgical case.
LMWH

- Ardeparin (Normiflo®)
- Dalteparin (Fragmin®)
- Enoxaparin (Lovenox®)
- Tinzapraiain (Innohep®)
- Danaparoid (Organran®)
LMWH

In 1997 the FDA issued a black box warning for LMWH and neuraxial blockade. There were more than 80 voluntary reports of epidural or spinal hematoma formation associated with the use of enoxaparin.
LMWH- factors associated with hematoma formation with enoxaparin

- Female gender
- Elderly
- Traumatic needle/catheter placement
- Indwelling catheter present during LMWH administration
LMWH administration and risk of hematoma formation

- Continuous epidural administration and LMWH increases the risk of hematoma formation to 1:3,000.
- 1:40,000 for patients receiving spinal anesthesia.
LMWH

- MECHANISM OF ACTION:
  Effects factor X. LMWH does not alter the patient’s PTT and there are no laboratory tests to measure its actions.
ASRA RECOMMENDATIONS
LMWH
General ASRA recommendations

- Assess the patient for concomitant medications that may alter coagulation.
- “Bloody tap” does not necessitate the cancellation of the surgery. Communicate with the surgeon. LMWH administration should occur 24 hours after the “bloody tap.”
LMWH administration

- LMWH should be held for 10-12 hours prior to neuraxial blockade for normal dosing.
- LMWH should be held for 24 hours in the following dosing regimes: enoxaparin 1 mg/ kg every 12 hours or 1.5 mg/ kg every 24 hours; dalteparin 120 U/ kg every 12 hours or 200 U/ kg every 24 hours; tinzaparin 175 U/ kg every 24 hours.
Twice daily dosing: the first dose should not be administered until 24 hours after the block.

Indwelling catheters should be removed prior to the initiation of LMWH.

If a continuous technique is used then the catheter should be removed the next day with the first dose of LMWH occurring at a minimum of 2 hours after catheter removal.
LMWH administration

- Single daily dosing: first dose of LMWH may be given 6-8 hours postoperatively with the second dose occurring at least 24 hours after the first.
- Indwelling catheters should be removed 10-12 hours after the last dose of LMWH.
- Additional doses of LMWH should not occur for at least 2 hours after catheter removal.
Thrombolytic and Fibrinolytic Medications
Thrombolytic and Fibrinolytic Medications

- Original recommendation was to withhold neuraxial blockade for 10 days.
- No data concerning the length of time that neuraxial blockade should be withheld.
- If a patient has received a neuraxial block and unexpectantly receives thrombolytic/fibrinolytic therapy then monitor patient for neurological complications.
- No recommendations related to the removal of epidural catheters in the patient who unrepentantly receives thrombolytic/fibrinolytic therapy.
Herbal Preparations
Herbal preparations mechanism of action

- Garlic, ginger, feverfew - inhibit platelet aggregation.
- Ginseng - antiplatelet components
- Alfalfa, chamomile, horse chestnut, ginseng - contain a coumadin component
- Vitamin E - reduces platelet thromboxane production
- Ginkgo - inhibits platelet activating factor
ASRA RECOMMENDATIONS FOR HERBAL PREPARATIONS
Herbal Preparations

- Unknown risk
- Most patients advised to stop for 5-7 days prior to surgery
- Screen for concomitant use of medications that alter coagulation
- Assess the patient for bleeding tendencies
New anticoagulants
Fondaparinux (Arixta®)

- Antithrombotic medication for DVT prophylaxis
- Binds with antithrombin III which neutralizes factor Xa.
- Peak effect in 3 hours with half life of 17-21 hours
- Irreversible effect
- Need further clinical experience to formulate guidelines
- Black box warning similar to the LMWH
New anticoagulants

- Bivalirudin - thrombin inhibitor used in interventional cardiology.
- Lepirudin used to treat heparin-induced thrombocytopenia.
- Caution advised. No recommendations related to limited clinical experience.
Anticoagulation and peripheral nerve blockade

- Case reports of major bleeding occurring with psoas compartment and lumbar sympathetic blocks.

- Patients with neurological deficits had complete recovery in 6-12 months. The key to this reversal was the fact that bleeding occurred in expandable tissue as opposed to the non-expandable compartments associated with neuraxial blockade.
<table>
<thead>
<tr>
<th>Classification</th>
<th>Medications</th>
<th>Recommendations</th>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antiplatelet's</td>
<td>Aspirin/NSAIDS</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Ticlopidine</td>
<td>DC 14 days before</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Clopidogrel</td>
<td>DC 7 days before</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Abciximab</td>
<td>Avoid</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Eptifibatide</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tirofiban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticoagulants</td>
<td>Warfarin</td>
<td>DC 4-5 days before; Monitor patient for 24 hours post spinal, epidural or removal of catheter</td>
<td>PT/INR prior to needle placement or catheter removal; INR &lt;1.5</td>
</tr>
<tr>
<td>Heparin</td>
<td>Subq heparin</td>
<td>Delay until block</td>
<td>&gt;4 days check plt count</td>
</tr>
<tr>
<td></td>
<td>IV heparin</td>
<td>Delay until 1 hour after block; remove catheter 2-4 hours after last dose.</td>
<td>Measure PTT</td>
</tr>
<tr>
<td>LMWH</td>
<td>Ardeparin</td>
<td>Preop: block 10-12 hrs after last dose; high dose delay 24 hrs.</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Dalteparin</td>
<td>Postop: Twice daily dose delay 1st dose for 24 hrs; 2 hr delay after catheter removal. Once daily dose 1st dose 6-8 hrs post op; remove catheter 10-12 hr after last dose and wait 2 hrs till next dose.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enoxaparin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tinzaparin</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Danaparoid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Herbal Preparations</td>
<td>Garlic</td>
<td>DC 5-7 days before surgery</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Ginkgo</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ginseng</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ginger</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Feverfew</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Vitamin E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Anticoagulants</td>
<td>Bivalirudin</td>
<td>Unknown; assess risk</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Lepirudin</td>
<td>Extreme caution; atraumatic needle placement; no catheters</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td>Fondaparinux</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

