Management of Periprocedural Anticoagulation (Neuraxial Access or Peripheral Nerve Procedures)

Below are guidelines to prevent spinal hematoma following Epidural/Intrathecal/Spinal procedures and perineural hematoma following peripheral nerve procedures. Procedures include epidural injections/infusions, intrathecal injections/infusions/pumps, spinal injections, peripheral nerve catheters, and plexus infusions. Decisions to deviate from guideline recommendations given the specific clinical situation are the decision of the provider. See ‘Additional Comments’ section for more details.

<table>
<thead>
<tr>
<th>Anticoagulant</th>
<th>PRIOR to Neuraxial/ Nerve Procedure</th>
<th>WHILE Neuraxial/Nerve Catheter in Place</th>
<th>AFTER Neuraxial/Nerve Procedure</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-Molecular Weight Heparin, Unfractionated Heparin, and Fondaparinux</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfractionated Heparin SQ</td>
<td>5000 units Q 12 hrs – no time restrictions</td>
<td>Yes</td>
<td>2 hrs</td>
<td>Maximum total heparin dose of 10,000 units per day (5000 SQ Q12 hrs) Heparin 5000 units SQ 8 hrs is NOT recommended with concurrent neuraxial catheter in place For IV prophylactic dosing, use ‘treatment’ IV dosing recommendations.</td>
</tr>
<tr>
<td>Unfractionated Heparin SQ/IV Treatment</td>
<td>SQ: 8-10 hrs IV: 4 hrs</td>
<td>No</td>
<td>2 hrs</td>
<td>See ‘Additional Comments’</td>
</tr>
<tr>
<td>Enoxaparin (Lovenox), Dalteparin (Fragmin) Prophylaxis Dosing</td>
<td>12 hrs</td>
<td>No (Note: May be used for Enhanced Treatment Protocol)</td>
<td>4 hrs</td>
<td>Caution in combination with other hemostasis-altering medications. See ‘Additional Comments’ for Enhanced Treatment protocol specifics</td>
</tr>
<tr>
<td>Enoxaparin (Lovenox), Dalteparin (Fragmin) Treatment Dosing</td>
<td>24 hrs</td>
<td>No</td>
<td>4 hrs</td>
<td>Recommendations for treatment remain same regardless of dosing (1mg/kg twice daily vs. 1.5mg/kg daily for enoxaparin)</td>
</tr>
<tr>
<td>Fondaparinux (Arixtra)</td>
<td>4 days</td>
<td>No</td>
<td>24 hrs</td>
<td>See ‘Additional Comments’</td>
</tr>
</tbody>
</table>

**Vitamin K Antagonist**

| Warfarin (Coumadin) | INR <1.4 See comments* | No | Yes for peripheral nerve catheters | 2 hrs | *Typically takes holding warfarin 4-5 days prior to insertion *See reference specific to warfarin |

**Factor Xa Inhibitor**

| Rivaroxaban (Xarelto) | 3 days | No | Yes for peripheral nerve catheters | 6 hrs |
| Apixaban (Eliquis) | 3 days | No | Yes for peripheral nerve catheters | 6 hrs |
| Edoxaban (Savaysa) | 3-days | No | Yes for peripheral nerve catheters | 6 hrs |
Management of Periprocedural Anticoagulation (Neuraxial Access or Peripheral Nerve Procedures, continued)

<table>
<thead>
<tr>
<th>Anticoagulant</th>
<th>PRIOR to Neuraxial/Nerve Procedure</th>
<th>WHILE Neuraxial/Nerve Catheter in Place</th>
<th>AFTER Neuraxial/Nerve Procedure</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anticoagulant</strong></td>
<td></td>
<td></td>
<td></td>
<td>What additional information do I need to consider for the care of patients?</td>
</tr>
<tr>
<td><strong>Direct Thrombin Inhibitors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dabigatran (Pradaxa)</td>
<td>How long should I hold prior to neuraxial procedure? (i.e. minimum time between the last dose of anticoagulant and spinal injection or neuraxial/nerve placement)</td>
<td>Can I give anticoagulants concurrently with neuraxial, peripheral nerve catheter, or plexus placement?</td>
<td>When can I restart anticoagulants after neuraxial procedures? (i.e. minimum time between catheter removal or spinal/nerve injection and next anticoagulation dose)</td>
<td></td>
</tr>
<tr>
<td>Argatroban (Argatra)</td>
<td>Can I give anticoagulants concurrently with neuraxial, peripheral nerve catheter, or plexus placement?</td>
<td>When can I restart anticoagulants after neuraxial procedures? (i.e. minimum time between catheter removal or spinal/nerve injection and next anticoagulation dose)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bivalirudin (Angiomax)</td>
<td>Are anticoagulants contraindicated?</td>
<td>When can I restart anticoagulants after neuraxial procedures? (i.e. minimum time between catheter removal or spinal/nerve injection and next anticoagulation dose)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **NSAIDS & Antiplatelet** | | | | \n
### Direct Thrombin Inhibitors

- **Dabigatran (Pradaxa)**
  - How long should I hold prior to neuraxial procedure? (i.e. minimum time between the last dose of anticoagulant and spinal injection or neuraxial/nerve placement)
  - Are anticoagulants contraindicated?
  - When can I restart anticoagulants after neuraxial procedures? (i.e. minimum time between catheter removal or spinal/nerve injection and next anticoagulation dose)

### NSAIDS & Antiplatelet

- **NSAIDs**
  - How long should I hold prior to neuraxial procedure? (i.e. minimum time between the last dose of anticoagulant and spinal injection or neuraxial/nerve placement)
  - Are anticoagulants contraindicated?
  - When can I restart anticoagulants after neuraxial procedures? (i.e. minimum time between catheter removal or spinal/nerve injection and next anticoagulation dose)

### Glycoprotein IIb/IIIa Inhibitors

- **Abciximab (Reopro)**
  - How long should I hold prior to neuraxial procedure? (i.e. minimum time between the last dose of anticoagulant and spinal injection or neuraxial/nerve placement)
  - Are anticoagulants contraindicated?
  - When can I restart anticoagulants after neuraxial procedures? (i.e. minimum time between catheter removal or spinal/nerve injection and next anticoagulation dose)

### References

- Management of Periprocedural Anticoagulation (Neuraxial Access or Peripheral Nerve Procedures, continued)
Management of Periprocedural Anticoagulation (Neuraxial Access or Peripheral Nerve Procedures, continued)

Additional Comments Low-Molecular Weight Heparin
- Concurrent antiplatelet medications are contraindicated. Case reports since 2003 have demonstrated an increase in spinal hematoma incidence when LMWH is administered with other antiplatelet agents. 1, 5, 6
- The guidelines have recommended against twice-daily dosing, but have accepted that once-daily dosing is safe.1
- Enhanced Treatment Protocol NOTE approved for enoxaparin 40mg SQ daily, NOT 30mg SQ every 12 hours:
  o Must wait 8 hrs after catheter PLACEMENT before giving dose
  o Must wait 12 hrs after last dose before REMOVING catheter

Fondaparinux (Arixtra)
- Studies have looked at the use of fondaparinux with indwelling catheters. The practice is currently not recommended in the United States, however, the interval as described in the EXPERT study showed no increased incidence of spinal epidural hematoma.7

Warfarin (Coumadin)
- The guidelines have consistently recommended an INR of <1.5 before removal of epidural catheter, although it has been questioned. A series of 11,235 patients received epidural analgesia for total knee replacement in which they were given 5-10 mg of warfarin the night before surgery. Epidural catheters were removed within 48 hours, and the mean INR of 1,030 patients at the time of removal was 1.5 (nearly 40% of this subset). No spinal hematomas were reported in this series.8
- Peripheral nerve catheters: in a review of 3588 patients receiving a variety of prophylactic dosed anticoagulants (LMWH, fondaparinux, warfarin, and ASA), no recorded perineural hematomas were documented after receiving single or continuous peripheral nerve blocks.10

Unfractionated Heparin
- Assessment of sensory and motor function should be monitored for at least 12 hours after catheter removal.
- is this needed? Noted above

Thrombin Inhibitors (Desirudin, Lepirudin, Bivalirudin, and Argatroban)
- Lack of information available and looking at the population these agents are often used for (HIT patients who need therapeutic anticoagulation), no recommendations can be made.1,2
- Recommendations are based on half-life elimination of the medication and waiting approximately five half-lives for the medication to clear.

NSAIDs and Antiplatelet Agents
- Nonsteroidal anti-inflammatory drugs alone do not increase the risk of bleeding, however in combination with UFH, LMWH, oral anticoagulants, and thrombolytics, there is an increased frequency of bleeding and spinal hematoma.1
- Nabumetone is part of the Enhanced Recovery order set
- Recommended discontinuation times of NSAIDs for planned procedures vary by the half-life of the drug. Discontinuation for 5 half-lives is sufficient to allow the drug’s effects on platelets to be inactive.

<table>
<thead>
<tr>
<th>Agent</th>
<th>Recommended Discontinuation Time, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diclofenac</td>
<td>1</td>
</tr>
<tr>
<td>Etodolac</td>
<td>2</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>1</td>
</tr>
<tr>
<td>Indomethacin</td>
<td>2</td>
</tr>
<tr>
<td>Ketorolac</td>
<td>1</td>
</tr>
<tr>
<td>Meloxicam</td>
<td>4</td>
</tr>
<tr>
<td>Nabumetone</td>
<td>6</td>
</tr>
<tr>
<td>Naproxen</td>
<td>4</td>
</tr>
<tr>
<td>Oxaprozin</td>
<td>10</td>
</tr>
<tr>
<td>Piroxicam</td>
<td>10</td>
</tr>
</tbody>
</table>

- For selective COX-2 inhibitors, there is no evidence of any effects on platelet aggregation or increased bleeding tendency.4

Aspirin
- 81 mg versus 325 mg: Recommendations remain the same regardless of dose
- It is known that low-dose aspirin (60-325 mg) creates the largest effect on platelet function, however a study in high-risk obstetric patients who were given aspirin 60 mg daily with epidural anesthesia produced no neurologic deficits.9

Glycoprotein IIb/IIIa Inhibitors
- Used only in acute coronary syndromes in combination with anticoagulants and aspirin, and generally cardiac procedures are usually conducted as emergencies, so neuraxial blockade is contraindicated
- Platelet counts should always be obtained due to thrombocytopenia effects if neuraxial blockade is required.2
Conclusion

An assortment of guidelines can be found on neuraxial access in the anticoagulated patients with slight variations between each. The United States (American Society of Regional Anesthesia and Pain Medicine) guidelines tend to be more conservative versus those in Europe (European Society of Anaesthesiology). Much of what is known is based on case reports and limited trial reviews. New anticoagulants (rivaroxaban and dabigatran) and antiplatelet agents (ticagrelor and prasugrel) have information regarding use perioperatively and postoperatively listed in the product insert, however this information does not specifically address neuraxial access. Close patient monitoring for sensory and motor dysfunction should be reviewed frequently postoperatively. Performing neuraxial procedures before, during, and after anticoagulation is a controversial topic, and providers should be aware of the risks of such procedures in the anticoagulated patient.


Management of Periprocedural Anticoagulation

Disclaimer
“Guidelines are not meant to replace clinical judgment or professional standards of care. Clinical judgment must take into consideration all the facts in each individual and particular case, including individual patient circumstances and patient preferences. They serve to inform clinical judgment, not act as a substitute for it. These guidelines were developed by a Review Organization under Minn. Statutes §145.64 et. seq., and are subject to the limitations described as Minn. Statutes §145.65.”

References

- 2012 ACCP Guidelines (Chest B39;141:2 Suppl e326S-e350S)
Management of Periprocedural Anticoagulation

- All recommendations are made assuming that the patient is on an appropriate dose of medication based on individual patient characteristics. The guideline does not replace good physician/provider judgment and recommendations should always be reviewed and tailored for each patient to find an appropriate balance between thrombosis risk and bleeding risk.
- Hold times for newer anticoagulants should be discussed with the patient’s surgeon to ensure that the surgeon is comfortable operating within the recommendations.
- Recommendations for LMWH are for enoxaparin. If enoxaparin is contraindicated due to renal dysfunction, unfractionated heparin is a reasonable alternative for bridging therapy. If bridging therapy other than enoxaparin is used, then the stop times prior to procedure may be different than described in the guideline.
- The INR value below which it is safe to proceed on the day of procedure is determined by surgical bleeding risk and should be decided by the surgeons. For moderate bleeding risk, an INR of ≤ 1.5 is usually safe.
- Following the procedure, anticoagulation should be resumed as soon as safe based on hemostasis and bleeding risk, 24-48 hours postoperatively.