Regional Anesthesia

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Regional Anesthesia

- No conflicts
- Nothing to disclose
Regional Anesthesia

- Definition
- Indications and Contraindications
- Types of blocks
  - Upper extremity
  - Lower extremity
  - Truncal blocks
  - Neuraxial
- Risks and Benefits
- Considerations
Regional Anesthesia

- Advent of ultrasound guidance
  - P. LaGrange, described 1st ultrasound-guided SC block in 1978

- Utilization of regional anesthesia is increasing
  - Increased focus on patient satisfaction
  - Minimalization of PACU/inpatient stay
  - Improved outcomes
Loss of sensation in a region of the body produced by application of an anesthetic agent to the nerves supplying that region.

- Peripheral Nerve Block
  - Single shot
  - Continuous catheter

- Neuraxial
  - Epidural
  - Spinal
Regional Anesthesia

Types of surgery
- Orthopedic
- Vascular
- Thoracic
- General (ie. hernia repair)
- Urologic
- Surgical oncology
- Pediatric
Indications

- Intolerance to GA
- Expectation of significant post-op pain
- Chronic pain, Opioid dependence
- Surgeon preference
- Patient request

Contraindications

- Patient refusal
- Site Infection
- Sepsis
- Anticoagulation (relative)
- Pre-existing parasthesia or nerve dysfunction (relative)
- Surgeon Resistance
How It’s Done

- Blind/Palpation and anatomic landmarks
  - Neuraxial, some peripheral
- Direct Nerve Stimulation
  - Uncomfortable
  - Moderate success rate
- Ultrasound Guided – GOLD STANDARD
  - Limited by operator experience
  - Direct visualization of needle placement
  - Highest success rate, lowest risk
Local Anesthetics

- From shortest to longest-acting
  - Chlorprocaine
  - Lidocaine
  - Mepivacaine
  - Bupivacaine
  - Tetracaine

- Additives
  - Epinephrine, opioids, clonidine, decadron

- Duration depends on type of drug, concentration, volume, patient physiology
When To Administer

- Pre-Operatively
- Intra-Operatively (rarely)
- Post-Operatively “rescue block”
- Trauma/Acute Pain
Types of Peripheral Nerve Blocks

- Upper Extremity Blocks
  - Brachial Plexus

- Lower Extremity Blocks
  - Lumbar Plexus
  - Sacral Plexus

- Truncal Blocks
  - Transversus Abdominis Plane (TAP)
  - Ilioinguinal/Iliohypogastric
  - Paravertebral
  - PECS
Innervation of the Upper Extremity
Upper Extremity Blocks

- **Interscalene** → shoulder/arm/hand
- **Supraclavicular** → upper arm & lower arm
- **Infraclavicular** → elbow & lower arm
- **Axillary** → lower arm and hand
Trunk Blocks

- **TAP**
  - Abdominal incision below umbilicus

- **Paravertebral**
  - Thoracic, breast, rib fractures

- **PECS**
  - Breast, rib fractures

- **Rectus sheath**
  - Midline incisions
TAP (transversus abdominis plane) Block
Paravertebral Blocks

- Endothoracic fascia
- Innermost intercostal muscle
- External intercostal muscle
- Internal intercostal membrane (continuous with superior costotransverse ligament medially)
- Dorsal ramus
- Ventral ramus (continuous with intercostal nerve laterally)
- Sympathetic chain
- Transverse process
- Visceral pleura
Paravertebral Blocks
Lower Extremity Blocks

- Lumbar Plexus
  - Femoral Nerve (saphenous nerve)
  - Obturator Nerve
  - Lateral Femoral Cutaneous Nerve

- Sacral Plexus
  - Sciatic Nerve
    - Popliteal Fossa (tibial, peroneal)
  - Ankle block
Femoral Block
Sciatic nerve, Popliteal Fossa Block

Popliteal Block: Distribution of Anesthesia

7 Popliteal block (posterior approach).
Neuraxial Anesthesia

Spinal and Epidural
Neuraxial Anesthesia

- **Spinal**
  - Spinal fluid (CSF)
  - Single shot vs. catheter
  - Dense central block
  - Titratable duration
  - Examples
    - C-section
    - Cerclage
    - Cystoscopy/TURP
    - Hip, knee replacements

- **Epidural**
  - Epidural space
  - Catheter
  - Titratable block
  - Titratable duration
  - Examples
    - Labor epidural
    - Thoracic
    - Intra-abdominal procedures
    - Knee replacements
Neuraxial Anesthesia

- Excellent analgesic option for large abdominal incisions, thoracic, ortho surgery
- Faster return of bowel function
  - Decreased opioid requirement
  - Sympathectomy
- Usually placed in pre-op holding area (epidural) or intra-op prior to surgery (spinal)
- Combined spinal-epidural (CSE) good option for longer surgeries (ie. TKR, repeat C/S)
Regional Anesthesia

Challenges, Risks, and Benefits
Challenges:
- Scoliosis/Kyphosis
- Prior spine surgery
- Obesity
- Anticoagulation
- Cardiopulmonary disease
- Anatomical variation
- Limited mobility
- Age
- Altered mental status
Benefits

- Superior post-operative pain management
- Reduces side effects of general anesthesia
- Decreased opiate use
- Improved outcomes
  - Decreased hemodynamic events
  - Prevention of chronic pain syndromes
  - Possible decrease in risk of recurrence, metastasis of certain cancers
  - Faster return of bowel function (epidurals)
- High degree of patient satisfaction*

*when expectations are clear!
Complications

- Hematoma
- Infection
- Pneumothorax
- Nerve Damage
- Local anesthetic toxicity
- Intrathecal injection (complete spinal)
- Epidural abscess, hematoma
- Falls

Nerve Damage

- Increased utilization = increased # complications
  - ASA Closed Claims data from 1980-1990 estimates peripheral nerve block risk of long-term injury ~0.02-0.4%
  - Risks of epidural-related permanent nerve injury is also infrequent, approximately 0.005-0.006%, although overall serious complications is somewhat higher, up to 0.04%
  - Estimates vary widely depending on population and definition of nerve injury, but overall incidence is relatively rare
"Double–Crush" Phenomenon

- Originally noted that a proximal nerve injury made a nerve more sensitive to distal compression injury

- Initial nerve insults as markers for increased risk secondary to peripheral nerve block
  - Diabetes
  - Smoking
  - Neurological disease
  - Demyelination

- Must be considered in risk/benefit evaluations
Nerve Damage

- Identification of injury is often delayed, and other causes of nerve injury (surgical complication, metabolic derangement, etc.) should be promptly ruled out.
- Initial management should involve referral to neurology or neurosurgery as an outpatient, although more emergent consultation should be considered for severe or actively evolving deficit.
- An estimated 95% will resolve spontaneously in 4–6 weeks, with 99% resolving by approximately 1 year.
Signs/Symptoms of Local Anesthetic Toxicity

- Peri-Oral Numbness
- Tinnitus
- Metallic Taste
- Lightheadedness
- Hypertension
- Seizure
- Loss of consciousness
- Tremor
- Cardiovascular Collapse
- Intralipid
Pre–Op/Post–Op Considerations

- IV Access
  - Safety
- Sedation
  - The interactive patient
- Anticoagulation
# Anticoagulation

## Anticoagulation & Neuraxial Procedures

<table>
<thead>
<tr>
<th>Anticoagulants</th>
<th>Dose → Placement</th>
<th>Dose → Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>UF Heparin 5000 units SQ</strong></td>
<td>Minimum time between last dose of anticoagulant and catheter Placement</td>
<td>Minimum time between last dose of anticoagulant and catheter Removal</td>
</tr>
<tr>
<td><strong>UF Heparin 5000 units SQ TID</strong></td>
<td>no contraindication</td>
<td>no contraindication</td>
</tr>
<tr>
<td><strong>UF Heparin Full dose IV</strong></td>
<td>when aPTT &lt; 40</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td><strong>Enoxaparin 30mg SQ BID</strong></td>
<td>12 hours</td>
<td>12 hours</td>
</tr>
<tr>
<td><strong>Enoxaparin 40mg SQ daily</strong></td>
<td>12 hours</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td><strong>Enoxaparin Full dose SQ</strong></td>
<td>24 hours</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td><strong>Warfarin (Coumadin)</strong></td>
<td>when INR &lt; 1.3</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td><strong>Fondaparinux (Arixtra)</strong></td>
<td>4-6 days *</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td><strong>Tinzaparin (Innohep)</strong></td>
<td>24 hours</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td><strong>Dalteparin (Fragmin)</strong></td>
<td>24 hours</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
</tbody>
</table>

## Direct Thrombin Inhibitors

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<tr>
<th>Direct Thrombin Inhibitors</th>
<th>Dose → Placement</th>
<th>Dose → Removal</th>
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<tbody>
<tr>
<td>Argatroban</td>
<td><strong>CONTRAINDICATED</strong></td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td>Lepirudin (Refludan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bivalirudin (Angiomax)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desirudin (Revasc)</td>
<td></td>
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</tbody>
</table>

## Oral Direct Thrombin Inhibitors

<table>
<thead>
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<th>Dose → Placement</th>
<th>Dose → Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pradaxa (Dabigatran)</td>
<td>after 1 dose = 2 days*</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td></td>
<td>after mult dose = 4-5 days*</td>
<td></td>
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<td></td>
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</tbody>
</table>

## Activated Factor Xa Inhibitors

<table>
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<th>Dose → Placement</th>
<th>Dose → Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xarelto (Rivaroxaban)</td>
<td>2-4 days*</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td></td>
<td>Black Boxed Warning for spinal/epidural anesthesia</td>
<td></td>
</tr>
<tr>
<td>Eliquis (Apixaban)</td>
<td>5-7 days*</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td></td>
<td>Not approved in US</td>
<td></td>
</tr>
</tbody>
</table>

## Thrombolytic Agents

<table>
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<th>Dose → Placement</th>
<th>Dose → Removal</th>
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<tbody>
<tr>
<td>Alteplase (TPA)</td>
<td>10 days</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
<tr>
<td>Full dose for stroke, MI etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alteplase (Cathflo)</td>
<td>no contraindication</td>
<td>no contraindication</td>
</tr>
<tr>
<td>2mg dose for catheter clearance</td>
<td>Maximum daily dose = 4mg total</td>
<td>Maximum daily dose = 4mg total</td>
</tr>
</tbody>
</table>

## Special Anticoagulants

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<th>Special Anticoagulants</th>
<th>Dose → Placement</th>
<th>Dose → Removal</th>
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<tr>
<td>Drotrecogin alfa (XIGRIS)</td>
<td>24 hours</td>
<td><strong>AVOID</strong> while catheter in place</td>
</tr>
</tbody>
</table>

* Inadequate data – actual risk of spinal hematoma unknown
** ASRA suggest similar application of neuraxial recommendations if performing deep plexus or peripheral block
*** Increased risk of spinal hematoma with traumatic technique. Risk further increased in setting of anticoagulant
Pre-Op/Post-Op Considerations

- IV Access
  - Safety
- Sedation
  - The interactive patient
- Anticoagulation
- Fall Risk
  - Spinal, epidural, nerve block
- ADLs
  - Going home
- Education and Expectations
Regional anesthesia is an excellent option for many types of surgery.

Duration and density of block can vary with type of block and local anesthetics.

Multiple factors may determine ability to perform regional anesthesia.

Patient expectations, risks and benefits are important considerations when discussing options.