Basics of Regional Anesthesia and Pharmacological considerations

Daniel Nash CRNA DNAP ARNP
Objectives

After this presentation the learner will

• Recognize reasons for using nerve blocks
• Understand the differences, advantages and disadvantages of the 2 main nerve block techniques
• Have an understanding of local anesthetic pharmacology
• Have knowledge of the protocol for treating Local Anesthetic Systemic Toxicity (LAST)
• Be able to choose patient and goal specific block/drug combinations
• Compare the Femoral and Adductor Canal blocks for advantages and disadvantages
Why?
Why regional?

- ↓ PONV
- ↓ Urinary retention
- ↓ Narcotics
- Superior Pain Control
- Earlier Discharge
- Surgeon Satisfaction
- Increased revenue
Technique

TECHNIQUE

Practical & Safe

Clinically Effective

Easy to Learn

Cost Effective
Nerve Stimulation
mA Intensity to proximity

**B**
- Completely insulated needle
- High stimulus current
- Needle tip closer to nerve

**C**
- Completely insulated needle
- Low stimulus current
- Needle tip closer to nerve
Nerve Stimulation

Advantages

- Readily Available
- Inexpensive
- Time
- Consistent Landmarks
Nerve Stimulation

Disadvantages

- Patient Variability
- Needle-to-Nerve Relationship
- Variant Anatomy
- 1 injection
Ultrasound
Ultrasound - Advantages

Advantages

- Anatomy Visualization
- Repositioning
- Anesthetic Spread
- Visualization
- Lower Volumes
Ultrasound-Disadvantages

- Availability
- Cost
- New Skill Development
- Time
Combined Techniques

Nerve Stimulation + Ultrasound = Dual Advantage
Local Anesthetics
Patient and Goal specific
Classes of Local Anesthetics

Esters & Amides:

- Differences?
  - **Metabolism**
    - Amides: Hepatic
    - Esters: Plasma Cholinesterases

- **Potential for Allergic Reactions:**
  - Esters > Amides
    - Very Rare: Almost always due to the Preservative (Para-Aminobenzoic Acid)
Local anesthetics Block sodium gated channels

Onset- pKa (ionized vs non-ionized) Closer to physio pH, more non-ionized, faster onset. Exceptions Chlorprocaine & Benzocaine??? Possible intrinsic chemical properties

Potency- lipid solubility

Duration- protein binding and lipid solubility
Adjuvants like epi, decadron, bicarb, clonidine

- acidosis can decreases protein binding by a factor of 6 and can lead to toxicity. (Nysora 10/14/2013 16:40:00 )
<table>
<thead>
<tr>
<th>Local Anesthetic</th>
<th>Potency and Lipid Solubility/Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMIDES</strong></td>
<td></td>
</tr>
<tr>
<td>Bupivacaine and levo-</td>
<td>4/4</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td></td>
</tr>
<tr>
<td>Etidocaine</td>
<td>4/4</td>
</tr>
<tr>
<td>Lidocaine</td>
<td>2/2</td>
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<tr>
<td>Mepivacaine</td>
<td>2/2</td>
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<tr>
<td>Prilocaine</td>
<td>2/2</td>
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<tr>
<td>Ropivacaine</td>
<td>4/4</td>
</tr>
<tr>
<td><strong>ESTERS</strong></td>
<td></td>
</tr>
<tr>
<td>Chloroprocaine</td>
<td>1/1</td>
</tr>
<tr>
<td>Cocaine</td>
<td>2/2</td>
</tr>
<tr>
<td>Procaine</td>
<td>1/1</td>
</tr>
<tr>
<td>Tetracaine</td>
<td>4/3</td>
</tr>
</tbody>
</table>

1 = least; 4 = greatest
Local Anesthetic Systemic Toxicity

LAST

Cardiovascular Toxicity
Dependent on rate & extent of absorption

- Injection site
- Total Dose
- Chemical Properties
- Addition of Epinephrine
<table>
<thead>
<tr>
<th>Esters</th>
<th>Max Dose (mg/kg)</th>
<th>Duration (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloroprocaine</td>
<td>12</td>
<td>0.5 – 1</td>
</tr>
<tr>
<td>Procaine</td>
<td>12</td>
<td>0.5 – 1</td>
</tr>
<tr>
<td>Cocaine</td>
<td>3</td>
<td>0.5 – 1</td>
</tr>
<tr>
<td>Tetracaine</td>
<td>3</td>
<td>1.5 – 6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amides</th>
<th>Max Dose (mg/kg)</th>
<th>Duration (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>4.5/(7 with epi)</td>
<td>0.75 – 1.5</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>4.5/(7 with epi)</td>
<td>1 – 2</td>
</tr>
<tr>
<td>Prilocaine</td>
<td>8</td>
<td>0.5 – 1</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>3</td>
<td>1.5 – 8</td>
</tr>
<tr>
<td>Ropivacaine</td>
<td>3</td>
<td>1.5 – 8</td>
</tr>
</tbody>
</table>
Absorption Rate of LA’s

- Highest
  - Intercostals
  - Caudal
  - Epidural
  - Brachial Plexus
  - Sciatic

- Lowest
  - Lumbar Plexus
  - Femoral
Signs of CNS Toxicity

Excitatory!!!
Circumoral numbness
Visual disturbance
“train in my head”
Signs of Cardiovascular Toxicity

- Initially ↑ HR and BP

- With higher levels of LA’s
  - Hypotension
  - Arrhythmias
  - Cardiac Arrest
LipidRescue™ TREATMENT FOR LOCAL ANESTHETIC-INDUCED CARDIAC ARREST PLEASE KEEP THIS PROTOCOL ATTACHED TO THE INTRALIPID BAG

In the event of local anesthetic-induced cardiac arrest that is unresponsive to standard therapy, in addition to standard cardio-pulmonary resuscitation, Intralipid 20% should be given i.v. in the following dose regime: – Intralipid 20% 1.5 mL/kg over 1 minute – Follow immediately with an infusion at a rate of 0.25 mL/kg/min,

– Continue chest compressions (lipid must circulate) – Repeat bolus every 3-5 minutes up to 3 mL/kg total dose until circulation is restored – Continue infusion until hemodynamic stability is restored. Increase the rate to 0.5 mL/kg/min if BP declines
– A maximum total dose of 8 mL/kg is recommended

In practice, in resuscitating an adult weighing 70kg:
– Take a 500ml bag of Intralipid 20% and a 50ml syringe. – Draw up 50ml and give stat i.v., X2 – Then attach the Intralipid bag to an iv administration set (macrodrip) and run it i.v over the next 15 minutes – Repeat the initial bolus up to twice more – if spontaneous circulation has not returned.

If you use Intralipid to treat a case of local anaesthetic toxicity, please report it at www.lipidrescue.org. Remember to restock the lipid.

Ver 7/06
Patient and Goal specific dosing

• What is procedure?
  • Single shot or catheter
• Age considerations
• Disease processes
• Post op rehab: ambulation
• Surgeon preferences
Common blocks

- Brachial Plexus- ISB, SCB, Axillary
- Femoral
- FICB
- Adductor Canal
- Sciatic
- IPACK
- TAP (transversis abdominus plane)
Femoral vs Adductor Canal
Femoral Nerve Block

2 branches
- Anterior
- Posterior
  - saphenous
Historical Standard Block

- ACL reconstruction
- Total Knee Arthroplasty
- ORIF Ankle with Sciatic
- Patellar femoral reconstruction
- Does not reliably cover Tibial Plateau fxs alone- need sciatic block also
Landmarks for PNS
Ultrasound View

LEFT FEMORAL NERVE TARGET AREA

Artery

Nerve

Triangle

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JACK VANDER BEEK
Advantages

• Very dense block- great pain relief
• Easy to perform with either technique
• High % of success
• Covers tourniquet pain
• Can use PNS technique- if US not available
Disadvantages

• Quadriceps weakness
  • Slower time to ambulate
  • Longer length of stay in hosp.
  • Danger of falling
  • Patients feel unsafe walking
Local Anesthetic Choice

• Typically 30ml of 0.5% Bupivacaine or Ropivacaine for single shot blocks

• Can use continuous infusion via a catheter at 4-8ml/hr
Adductor Canal Block

• Relatively new block- first described in 1993 by van der Mal\textsuperscript{1}

• In 2009, Horn and colleagues described using US to approach blocking the saphenous nerve using its close anatomical association to the descending genicular artery\textsuperscript{2}

• 2011, Lund et al describe block for analgesia for major knee surgery\textsuperscript{3}
Adductor Canal block

• Developed to help preserve quadriceps strength and provide adequate analgesic following major knee surgery
• TKR or any arthroscopic knee procedure (ACL)
• 2013 double blind RCT by Jaeger et al\textsuperscript{4}, and 2014 RCT by Kim et al\textsuperscript{5}, showed preservation of quad strength and comparable pain relief compared to femoral nerve block.
Local Anesthetic Choice

• Typically 30ml of 0.5% Bupivacaine or Ropivacaine for single shot blocks

• Can use continuous infusion via a catheter at 4-8ml/hr

• Catheter may need to be placed post-operatively to avoid the sterile field
Conclusion

• Choose proper technique
  – Dual usage offers advantages

• Dose drug specifically for patient & goal

• Femoral is standard bearer, long, safe history

• Adductor Canal maintains Quad strength

• www.maverickanesthesia.com Learn from some of the best in the business.
Remember!!

WWW.LIPIDRESCUE.ORG
References


References


5. Kim et al, Adductor Canal Block *versus* Femoral Nerve Block for Total Knee Arthroplasty. *Anesthesiology* 2014;120:520-50