Why?
Why regional?

- Patient satisfaction
  - ↓ PONV
  - ↓ urinary retention
  - ↓ narcotics
  - Superior pain control
- Earlier discharge
- Improved rehabilitation scores
- ↑ Surgeon satisfaction
- Increased revenue
Technique??

- Clinically Effective; Successful
- Practical; Safe
- Cost Effective
- Easy to Learn
Knowledge

Discipline

Patience
Before the Block:

1. History/physical
2. Indications/contraindications
3. Determine block, approach and technique
4. Informed consent
5. Educate the patient
6. Equipment
Pre-Block Considerations

- **Any Contraindications???
  - Relative:
    - Surgeons preference
    - Coagulopathy or Anticoagulation at time of block (Deep or Uncompressible??)
    - Bacteremia
  - Absolute:
    - Infection at block site
    - Pre-op Nerve involvement/ intra-op nerve repair
    - Uncooperative or unwilling patient
Risks & Benefits

- **Risks:**
  - Toxicity: CNS, Cardiovascular or Neural
  - Permanent or transient nerve damage
  - Incomplete block or block failure

- **Benefits:**
  - Superior Analgesia
  - Avoid General Anesthesia
  - Reduced Post-op Nausea/Vomiting
  - Early discharge/ decreased hospital stay
Equipment Needed:

- ✔ Syringes (10ml)
- ✔ Surface Electrode (EKG pad)
- ✔ Betadine/Chloroprep
- ✔ Appropriate needle
- ✔ Nerve stimulator
- ✔ Doppler
- ✔ Sterile gloves

- ✔ EKG, pulse Ox, O2
- ✔ Marking pen (not Sharpie)
- ✔ Steri-strips, Tegaderm, Dermabond
- ✔ Sterile towels
- ✔ Second set of hands
Local Anesthetics
Patient and Goal specific

✓ 30-40 ml of local anesthetic injected in fractional doses after negative aspiration for single shots

✓ .25% - .5% Marcaine with or without epinephrine

✓ .2% - .5% Ropivacaine

✓ May add 3% Nesacaine to any of the above local anesthetics to hasten onset

✓ Bicarbonate shown to shorten onset and prolong duration of blocks (Yung, et.al, 2009)
How do they work:

- Blocking voltage-gated sodium channels and thus inhibiting axon conduction.
- Potency determined by its lipid solubility.
  - **Potential for toxicity also depends on lipid solubility!**
- Onset is determined by the LA molecule’s pKa
  - The higher the pKa, the slower the onset.
  - Small fibers > sensitive than large fibers
  - Myelinated fibers blocked before non-myelinated of the same diameter.
- Duration is affected by protein binding
  - As does Age of patient (Old > Young).
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)
Classes of Local Anesthetics

- **Amides**
  - Lidocaine (Xylocaine)
  - Bupivacaine (Marcaine)
  - Ropivacaine (Naropin)
  - Prilocaine (Citinest)

- **Esters**
  - Chloroprocaine (Nesacaine)
  - Tetracaine
  - Procaine (Novacaine)
Local Anesthetic Toxicity

- Systemic absorption can produce CNS and Cardiovascular toxicity
  - Rate and extent of absorption depends on:
    - the site of injection
    - total dose of LA
    - the chemical properties of LA
    - and the addition of Epinephrine.
Rate of Absorption of LA’s

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

- Lowest
Signs of CNS Toxicity

- Usually Excitatory
  - Numbness of tongue
  - Lightheadedness
  - Dizziness
  - Visual Disturbances
  - Tinnitus
  - Disorientation
  - Progress to Tonic-Clonic seizures, Resp. depression and eventually Resp. arrest.
Signs of Cardiovascular Toxicity

- Initially ↑ HR and BP
- With higher levels of LA’s
  - Hypotension
  - Arrhythmias
  - Cardiac Arrest
One plausible dosing application to consider after “all standard resuscitation methods fail to re-establish sufficient circulatory stability” would be as follows:

20% Intralipid: Administer 1.5 mL/kg as an initial bolus; the bolus can be repeated 1-2 times for persistent asystole. Start an infusion at 0.25 mL/kg/min for 30-60 minutes; increase infusion rate up to 0.50 mL/kg/min for refractory hypotension.
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
Remember!!

WWW.LIPIDRESCUE.ORG
Selection of Local Anesthetics

- Should be tailored to your **GOALS!**
  - Analgesic block can be achieved with as little as 3ml of 0.25% Marcaine or 0.5% Ropivacaine.
  - Increasing the Concentration does NOT alter the blocks characteristics.

**Use a Volume & Concentration that achieves adequate Blockade.** Increasing mass will NOT improve your block...only increase your risk of systemic and neurotoxicity!! *****
Local Anesthetic Adjuvants

- Epinephrine
- Clonidine
- Opioids
- Alkalization
Epinephrine

- Main Effect:
  - Prolongs duration and intensity of most LA’s

- Mechanism of Action:
  - Vasoconstriction of vasculature at site

- Dose:
  - 5 mcg/ml (1:200,000)

- Vasoconstriction may also decrease risk of systemic toxicity. But, also may increase risk of cardiac ischemia in patients with diminished blood flow (DM, PVD) and may increase risk of neurotoxicity.

- NO data to date shows that EPI containing LA’s are linked to digital ischemia.
Clonidine

- **Main Effect:**
  - Prolonged duration
  - 150 mcg for BP block delayed pain onset 2X.

- **Mechanism of Action:**
  - ? Synergistic? Local Pharmacokinetic action??

- **Dose:**
  - Recommended: 1 mcg/kg
  - 0.1 mcg/kg showed to prolong analgesia by 50%

- *No beneficial effects seen with CPNB’s.*
Opioids

- **Main Effect:**
  - Increased analgesia

- **Mechanism of Action:**
  - Hypothetical effect on axonal opioid receptors
  - Most peripheral n. block studies fail to show reason to add opioids; no differences in onset, duration, block quality or pain scores (ASRA).

- **Dose:**
  - 3-5 mg Morphine with LA solution
  - Proven to enhance Intra-Articular block. (ASRA)
**Main Effect:**
- Shortens Onset 30-50%; 14 min decrease w/Marcaine (Chelly)

**Mechanism of Action:**
- LA’s penetrate the nerve cell membranes in their Nonionized form, but act intracellularly in their ionized form. Adding NaHCO₃ increases the pH to physiologic range. This results in both increased penetration of the nerve membrane and a greater total mass of LA in the nerve. (Chelly)

**Dose:**
- Unknown; Enough to adjust the pH of LA to the physiologic range of patient.
## Reference Guide to LA’s:

<table>
<thead>
<tr>
<th>Nerve Block</th>
<th>Expected Onset of Surgical Anesthesia</th>
<th>Expected Duration of Surgical Anesthesia</th>
<th>Local Anesthetic/Additive to Use&lt;sup&gt;a,b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical plexus block</td>
<td>15–20 min</td>
<td>1.0–1.5 h</td>
<td>Mepivacaine or lidocaine 1.5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.5–2.0 h</td>
<td>Mepivacaine or lidocaine 1.5% + epi</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.0–4.0 h</td>
<td>Ropivacaine, bupivacaine, or levobupivacaine 0.5%</td>
</tr>
<tr>
<td>Upper extremity blocks:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brachial plexus:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interscalene</td>
<td>10–15 min</td>
<td>≦1.0 h</td>
<td>Chloroprocaine 3%</td>
</tr>
<tr>
<td>Intraclavicular</td>
<td>10–15 min</td>
<td>≦2.0 h</td>
<td>Chloroprocaine 3% + epi</td>
</tr>
<tr>
<td>Axillary</td>
<td>10–20 min</td>
<td>1.5–3.0 h</td>
<td>Mepivacaine or lidocaine 1.5%</td>
</tr>
<tr>
<td>Elbow and wrist&lt;sup&gt;c&lt;/sup&gt;</td>
<td>10–20 min</td>
<td>2.0–4.0 h</td>
<td>Ropivacaine, levobupivacaine, or bupivacaine 0.5%</td>
</tr>
<tr>
<td></td>
<td>10–20 min</td>
<td>3.0–5.0 h</td>
<td>Ropivacaine, levobupivacaine, or bupivacaine 0.5% + epi</td>
</tr>
<tr>
<td></td>
<td>10–20 min</td>
<td>3.0–4.0 h</td>
<td>Mixture of mepivacaine or lidocaine 1.5% and ropivacaine 0.75%</td>
</tr>
<tr>
<td>Lower extremity blocks:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lumbar plexus</td>
<td>10–15 min</td>
<td>≦1.0 h</td>
<td>Chloroprocaine 3%</td>
</tr>
<tr>
<td>Femoral</td>
<td>10–20 min</td>
<td>2.0–3.0 h</td>
<td>Mepivacaine or lidocaine 1.5%</td>
</tr>
<tr>
<td>Sciatic block</td>
<td>10–15 min</td>
<td>1.5–2.0 h</td>
<td>Ropivacaine, levobupivacaine, or bupivacaine 0.5%</td>
</tr>
<tr>
<td></td>
<td>10–20 min</td>
<td>2.0–4.0 h</td>
<td>Mixture of mepivacaine or lidocaine 1.5% and ropivacaine 0.75%</td>
</tr>
<tr>
<td>Popliteal block</td>
<td>10–20 min</td>
<td>≦1.0 h</td>
<td>Chloroprocaine 3%</td>
</tr>
<tr>
<td>Ankle block</td>
<td>15–30 min</td>
<td>3.0–4.0 h</td>
<td>Mepivacaine or lidocaine 1.5%</td>
</tr>
<tr>
<td>Thoracic and lumbar</td>
<td>10–20 min</td>
<td>3.0–4.0 h</td>
<td>Ropivacaine, levobupivacaine, or bupivacaine 0.5%</td>
</tr>
<tr>
<td>paravertebral block</td>
<td>10–15 min</td>
<td>3.0–4.0 h</td>
<td>Ropivacaine, levobupivacaine, or bupivacaine 0.5%</td>
</tr>
<tr>
<td>Intravenous block</td>
<td>10–15 min</td>
<td>2.0–3.0 h</td>
<td>Lidocaine 0.5%</td>
</tr>
<tr>
<td>Eye block</td>
<td>10–15 min</td>
<td>1.5–2.0 h</td>
<td>Ropivacaine 0.2%, levobupivacaine 0.15%</td>
</tr>
</tbody>
</table>

<sup>a</sup> Chloroprocaine, mepivacaine, and lidocaine are routinely used with bicarbonate.

<sup>b</sup> Duration of anesthesia more predictable than duration of analgesia.

<sup>c</sup>Local anesthetics for distal blocks should not contain epinephrine.

*Source: Adapted with permission from the New York School of Regional Anesthesia. Available at: www.NYSORA.com. Accessed April 30, 2003.*
Is there still a place for the use of Nerve Stimulation?
“Is there still a place for the use of nerve stimulation”; Dillane & Tsui; Pediatric Anes. Vol 22, 2012.

“Ultrasound-Guided Regional Anesthesia and Patient safety; An Evidence Based Analysis”; Neal; Regional Anes. & Pain Medicine: vol. 35, 2010.

“Neurological complications of 1000 UGRA block for elective orthopedic surgery: a prospective study”; Fredrickson & Kilfoyle; Anesthesia; vol. 64 issue 8. 2009.

“UGRA vs PNS; A systematic review and meta-analysis of randomized controlled trials”; Abrahams et al; Oxford Journal of Medicine; vol 102 issue 3; 2009.
Yes!! There is a place for both.

No safety advantage using USGRA vs PNS.

USGRA: Possibly faster (1 min), shorter onset and longer duration.

Both US and PNS have advantages and limitations. Knowledge of these is essential to selecting the appropriate technique.

Combined use of both may optimize advantages of both.