Ultrasound-guided regional anesthesia for ambulatory surgery

Meg A. Rosenblatt, MD*

*Professor of Anesthesiology and Orthopaedics Mount Sinai School of Medicine.

**LEARNING OBJECTIVES**

At the conclusion of this activity participants should be able to:

- Explain why ultrasound-guided nerve blocks are excellent for ambulatory surgical procedures
- Evaluate which specific blocks would be useful in their practice, and recite how to perform those blocks
- Analyze the utility of continuous peripheral nerve blocks for their practice

**ADVANTAGES IN AMBULATORY PRACTICE**

- Postoperative analgesia
- Increased cardiovascular stability
- Avoid airway manipulations
- Fast operating room turnover
- PACU bypass
- Lower incidence
  - PONV
  - Drowsiness
- Decreased time to discharge
- Greater patient satisfaction

**WHY ULTRASOUND?**

- Real-time visualization of nerves
  - Direct visualization of anatomic structures
  - Blocks for pts that would not be candidates

Este artículo puede ser consultado en versión completa en http://www.medigraphic.com/rma
Real-time control of needle advancement
- ↓Number of needle passes
- ↓Performance times
- ↓Risk for complications?
Visualization of LA spread
- Faster block onset
- Less local anesthetic volume
- Ability to rescue

WHAT YOU NEED TO START...

(Technical and organizational prerequisites)

Transducer
- Linear array with small footprint (25-38 mm)
- Uniform scan line density
- High frequency, low penetration (5-12 MHz)
- Sterile cover and gel
- Thin clear dressing
- Acoustic coupling

LEARNING AUXILLARY BLOCKS

- 20 residents with no previous block experience:
  - US-guided ax block
    - 259 cas
    - 89% success
    - 10-15 attempts
  - PNS ax block
    - 343 cases
    - 80% success
    - 20-30 attempts
- US skills learned
  - Faster
  - Higher success rate


WHAT YOU NEED TO START...

(The «PART» of scanning)

- Pressure
- Alignment
- Rotation
- Tilting
  - Ergonomics are important!
  - Ergonomics are important!
- Probe in non-dominant hand
- Direct visualization of screen
- Comfortable bed height
Needle choices

- Short bevel (>35°)
- Ultrasound:
  - Most easy to visualize at 0°
  - Most blocks require 30-60° from transducer
  - At 45° angle, significant impact on image quality
- Newer reflecting needles
- The most echogenic needle won’t be seen if it is not parallel to the beam!


Out-of-plane (OOP)

In-plane (IP)
What to put in the blocks

- **Do:**
  - Mix agents to decrease toxicity, not decrease onset
  - Alkalinize mepivacaine, ± lidocaine
  - Epinephrine with caution in pts with pre-existing deficits
    - Consider 1:400,000
  - Know procedures and surgeon preferences
    - Not everyone needs long-acting blocks
    - Lose protective reflexes/propiroception
- **Don’t:**
  - Bother with clonidine
  - Prolongs analgesia by 2 hours
  - Associated with hypotension, fainting and sedation

Dexamethasone - magic bullet?

- Dex 8 mg or saline 2 + 30 mL
- Bupivacaine 0.5%
- Ropivacaine 0.5%
- Block duration ropivacaine
  - 11.8 (9.7, 13.8) *versus* 22.2 (18.0, 28.6) h
- Block duration bupivacaine
  - 14.8 (11.8, 18.1) *versus* 22.4 (20.5, 29.3) h
- p < 0.001
- Ropiv > bupiv, p = 0.029

Cummings. BJA 2011;107:446.


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5 TECHNIQUES YOU NEED (AND THEN SOME)

- Supraclavicular block
  - With ultrasound able to visualize
    - First rib
    - Pleura
    - Vessels
  - Excellent for all hand/arm surgeries

Supraclavicular block

- The «spinal of the upper extremity»
- Block at the level of the divisions
  - Packed closely
  - Prior to branching
- Historically unpopular
- Fear of injury
  - Lung
  - Subclavian artery

Ultrasound-guided supraclavicular block

*Outcome of 510 consecutive cases*

Anahi Perlas, MD, FRCPC*† Giovanni Lobo, MD,† Nick Lo, MD,* Richard Brull, MD FRCPC,* Vincent WS, Chan, MD, FRCPC,‡ and Reena Karkhanis, MBBS†

- 460 ambulatory
- 24 months
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- 94.6% successful
- 6 pts with dyspnea
  - No pneumothorax
  - 5 ipsilateral hemidiaphragmatic paresis
  - 1 angina (pt with h/o angina)
- 5 Horner syndrome
- 0.4% transient neurological deficits

Perlas. RAPM 2009;34:171.

**Supraclavicular block**

**THE SWEEP!**

*How do you get there?*

**Interscalene block**

- Cervical nerve roots
- C3 $\rightarrow$ C7 blocked
- C8, T1 40% of time
- Why learn it?
- All shoulder, upper humerus procedures
- Makes sitting position easy!
- Protects the repair with GA
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Orebauch. RAPM 2010;35:450.

**THE REVERSE SWEEP!**

How do you make sure you are there?

- Lumbar plexus gives rise to:
  - Femoral n
  - Lateral femoral cutaneous n
  - Obturator n
- Sensory/motor to upper thigh
- Femoral n. becomes saphenous n. below knee
- Why learn it?
  - Postoperative pain tx for ACL
  - Patellar procedures
  - Muscle biopsies
  - Vein ligations
  - Knee arthroscopy
Popliteal block

- Block of sciatic nerve
- Prior to division
  - Tibial n
  - Common peroneal n
- Sensory below knee
- Except saphenous distribution
- Avoidance of spinal anesthesia
- Avoidance of general anesthesia
- Watch for tourniquet use!
- Prone or lateral approaches

*Ultrasound guidance improves the success of sciatic nerve block at the popliteal fossa*

- 74 patients
- 15 mL 2% lido/epi + 0.5% bupiv
- US or NS 10 cm proximal to crease
- Blinded observer assess block
- Similar procedure time
- Significantly higher block success
  - 89.2% versus 60.6%

Perlas. RAPM 2008;33:259

*Popliteal Block*

Start at the level of the popliteal crease!!!
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Saphenous block - near adductor canal


**SFAST block**

- Ultrasound over medial aspect upper thigh
- Identify
  - Sartorius muscle
  - Superficial femoral a
- Saphenous nerve
  - Hyperechoic
  - Anterolateral to SFA
- 10-15 mL local seen adj and anterior to SFA
- May block femoral branches to *Vastus medialis*

Kirpatrick. RAPM 2010;35:222.
**Transversus abdominus plane (TAP) block**

- Effective postoperative analgesia for:
  - Midline incisions
  - Paramidline incisions
  - Laparoscopic surgery
- Innervation of anterior abdominal wall
  - Intercostal nerves
  - Subcostal nerves
  - First lumbar nerves
- *Transversus abdominus* plane
  - Internal oblique muscle
  - *Transversus abdominus* muscle
  - 20 mL local anesthetic per side

**TAP for outpatient laparoscopy**

- 70 women for gyn laparoscopy
- Preop bilateral TAP blocks with 15 cm³:
  - Saline
  - .25% ropivacaine
  - .5% ropivacaine
- Postop
  - Ibuprofen 400 mg q 6°
  - Hydromorphone/acetaminophen pain > 4
- Blinded observer for 24°
  - Quality of recovery score
  - Analgesic use

<table>
<thead>
<tr>
<th>Physical comfort</th>
<th>Physical independence</th>
<th>Pain</th>
<th>Emotional status</th>
<th>Psychological support</th>
<th>Overall</th>
</tr>
</thead>
</table>


- TAP block is an effective adjunct
  - Reduced pain
  - Decreased opioid consumption
  - Provided earlier discharge readiness
  - Associated with better quality of recovery
Table I.

<table>
<thead>
<tr>
<th></th>
<th>Saline (n = 23)</th>
<th>Ropivacaine 0.25% (n = 23)</th>
<th>Ropivacaine 0.5% (n = 24)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area under the numeric rating scale for pain versus time curve in the postanesthesia care unit (score x min)</td>
<td>405 (360-502)</td>
<td>210 (135-365)*</td>
<td>210 (90-345)*</td>
<td>0.0003</td>
</tr>
<tr>
<td>Cumulative opioid consumption first 24 h after discharge (oral morphine equivalents)</td>
<td>78 (61-90)</td>
<td>39 (25-58)*</td>
<td>40 (13-72)*</td>
<td>0.0005</td>
</tr>
<tr>
<td>Time to meet discharge criteria from hospital (min)^2</td>
<td>120 (105-150)</td>
<td>90 (75-135)</td>
<td>90 (75-120)</td>
<td>0.03</td>
</tr>
<tr>
<td>Numerical rating scale for pain at 24 h</td>
<td>2 (3-5)</td>
<td>2 (2-3)</td>
<td>2 (0-3)*</td>
<td>0.003</td>
</tr>
</tbody>
</table>


BONUS BLOCKS
Infraclavicular block

A comparison of a single or triple injection technique for ultrasound-guided infraclavicular block: a prospective randomized controlled study

- 30 mL 1.5% mepivacaine
- 10 mL posterior, medial and lateral
- Total dose posteriorly
- 100 patients
- Endpoint complete sensory block at 15 min
- No difference in outcome

Table III.

<table>
<thead>
<tr>
<th>Total femoral nerve catheters</th>
<th>206</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interventions</strong></td>
<td></td>
</tr>
<tr>
<td>Patient education issues</td>
<td>5</td>
</tr>
<tr>
<td>Equipment malfunction</td>
<td>1</td>
</tr>
<tr>
<td>Inadequate pain control</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total interventions</strong></td>
<td>8</td>
</tr>
<tr>
<td><strong>Complications</strong></td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>0</td>
</tr>
<tr>
<td>Toxicity (seizures, perioral numbness)</td>
<td>0</td>
</tr>
<tr>
<td>Permanent nerve damage</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total complications</strong></td>
<td>0</td>
</tr>
</tbody>
</table>

Outpatient management of continuous peripheral nerve catheters placed using ultrasound guidance: an experience in 620 patients

- 20-gauge polyamide epid caths /18-gauge needles
- Ultrasound ONLY—no stimulation
- Documentation prior to d/c of:
  - Motor weakness
  - Loss of temperature and light touch
  - Test dose - 3 mL 0.25% bupi with epi 5 ug/mL
  - Infuse 0.25% bupivacaine @ 5 mL/hour
  - Oral breakthrough analgesics prescribed


Table IV.

<table>
<thead>
<tr>
<th>Total sciatic nerve catheters</th>
<th>224</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interventions</strong></td>
<td></td>
</tr>
<tr>
<td>Patient education issues</td>
<td>1</td>
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<tr>
<td>Equipment malfunction</td>
<td>1</td>
</tr>
<tr>
<td>Inadequate pain control</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total interventions</strong></td>
<td>5</td>
</tr>
<tr>
<td><strong>Complications</strong></td>
<td></td>
</tr>
<tr>
<td>Infection</td>
<td>0</td>
</tr>
<tr>
<td>Toxicity (seizures, perioral numbness)</td>
<td>0</td>
</tr>
<tr>
<td>Nerve injury</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total complications</strong></td>
<td>2</td>
</tr>
</tbody>
</table>

Swenson. A&A 2006;103:1436

Ilfield. RAPM 2010;35:123.

- Catheter consent
- Verbal instructions
- Written instructions
- Written contact info
- 24° follow-up
- Oral analgesics
- 48° catheter removal
- 2 wk follow up for sensory/motor testing
- Compression injury at fibular head
- CRPS tx with sympathetic blocks
- Both resolved w/in 6 wks
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A prospective randomized comparison of ultrasound and neurostimulation as needle end points for interscalene catheter placement

<table>
<thead>
<tr>
<th></th>
<th>Ultrasound (n = 41)</th>
<th>Neurostimulation (n = 40)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needle time under skin (s)</td>
<td>78 (65-101)</td>
<td>108 (94-129)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Insertion NRPS</td>
<td>2 (0-4)</td>
<td>3 (1-5)</td>
<td>&lt; 0.048</td>
</tr>
<tr>
<td>Minimum twitch amplitude (mA)</td>
<td>0.31 (0.21-0.38)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle stimulated &lt; 0.5 mA (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biceps</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Triceps</td>
<td>24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deltoid</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pectoralis</td>
<td>2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


40 infraclavicular catheters
Successful (protocol) placement 100 versus 70%
9 (6-13.2) versus 15 (4.9-30) min to insert
100 versus 90% block
0 versus 30% vascular puncture


**Time for Catheter Placement**

![Graph showing time for catheter placement with ultrasound and nerve stimulation](www.medigraphic.org.mx)
Catheter fixation

- Sterile liquid adhesive
- Sterile tape
- Occlusive dressings
- Subcutaneous tunneling

Catheter over needle

- 19 gauge catheter
- 25 gauge needle
  - Improved pt comfort?
  - Less leakage
  - Fewer steps
    - Decreased insertion time?
  - Frees a hand for continuous ultrasound visualization
  - Coming 2013

Pump choice

- Non-Electronic
  - Elastometric or spring loaded
  - Fixed rate with/without PCA
  - Programmable rate with PCA
  - Disposable
- Electronic
  - Return at visit
  - Self-addressed return envelope
  - Disposable
Discharge/follow-up

- Instructions
- Written and verbal
  - Signs and symptoms of LA toxicity
- 24° Contact phone number
- Document all patient contacts
- Daily phone calls vs. nursing visits
- Plan for catheter removal
- Return to hospital
- Caretaker/patient at home
- 98% felt comfortable removing catheter at home

Complications

- Block failure
- Inadvertent catheter removal
- Kinking, knotting and looping
- Infection
- Vascular puncture/hematoma
- Delayed local anesthetic toxicity

Conclusions

- US has had a dramatic and positive impact
- Decreases in time to place blocks/catheters and improve block quality and success suited to busy ambulatory practices
- Limitations
  - Learning curve
  - Expense
- By mastering 5 blocks, you will have the tools needed to care for the vast majority of ambulatory patients
- Consider catheters for ambulatory patients


Thank you!

meg.rosenblatt@mountsinai.org