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Ultrasound-guided regional anesthesia for ambulatory surgery

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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?

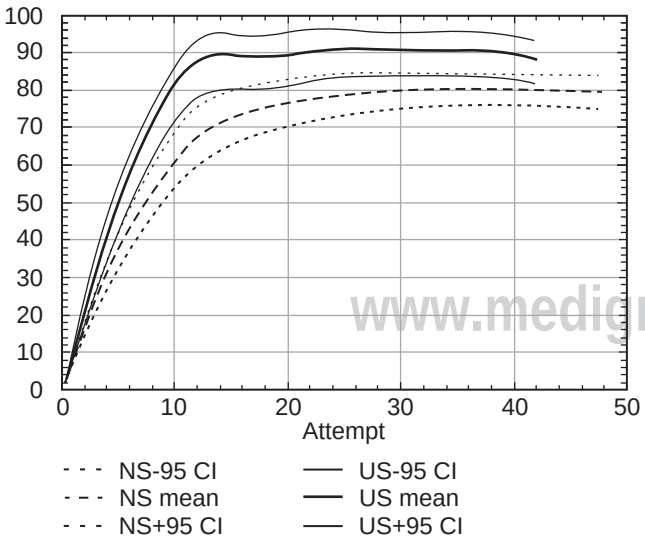
- Real-time visualization of nerves
  - Direct visualization of anatomic structures
    - Blocks for pts that would not be candidates

- 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

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 attemps
- US skills learned
  - Faster
  - Higher success rate

Luyet. Anesth Res and Pract 2010; ID 309462.



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

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 hight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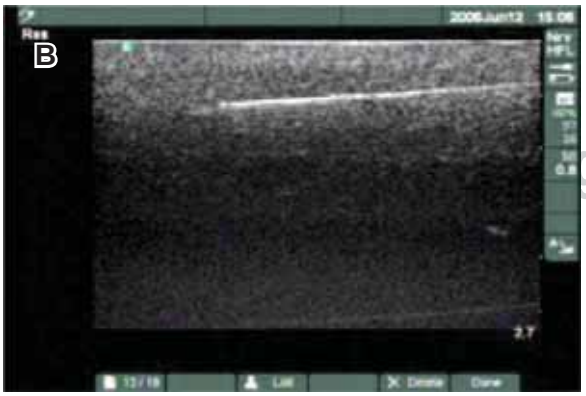
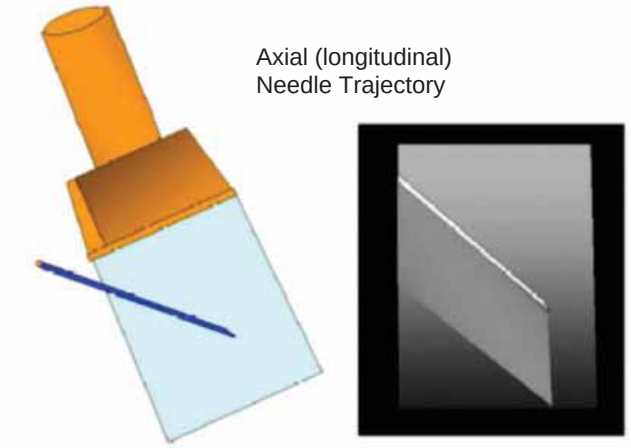
Needle choices

- 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!

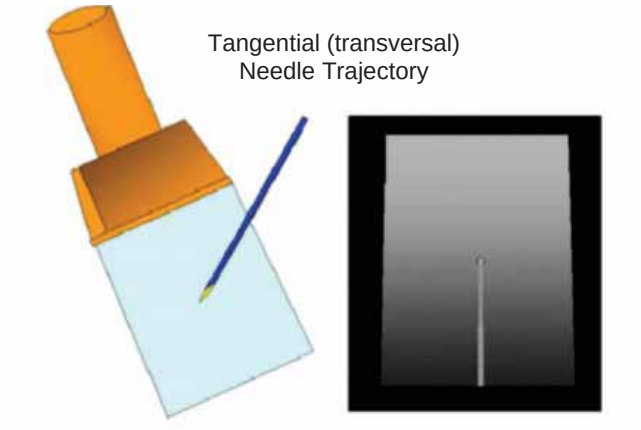
In-plane (IP)





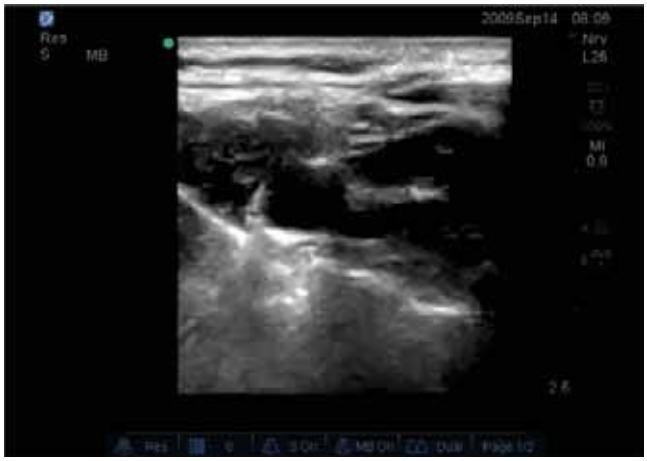
Grau. Best Pract &Res 2005;19:175.

Out-of-plane (OOP)



Grau. Best Pract &Res 2005;19:175.

Hydrodissection

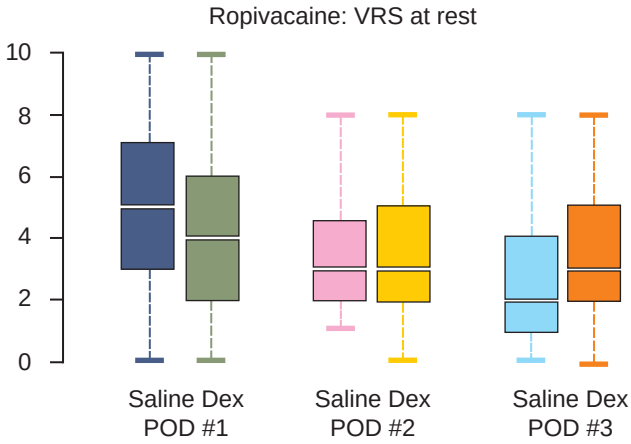


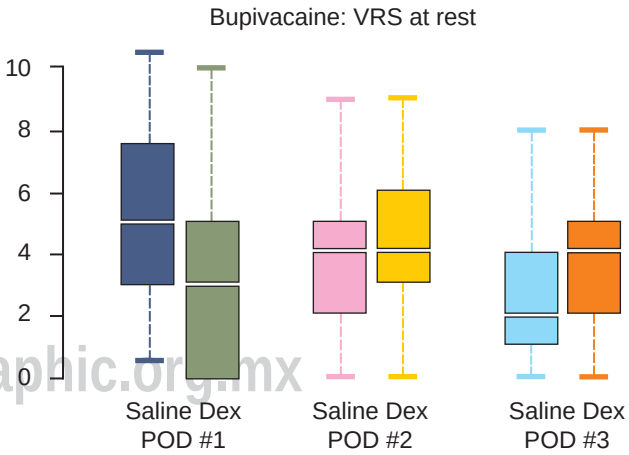
What to put in the blocks

- 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/proprioception
- Don't:
  - Bother with clonidine
    - Prolongs analgesia by 2 hours
    - Associated with hypotension, fainting and sedation

Dexamethasone - magic bullet?

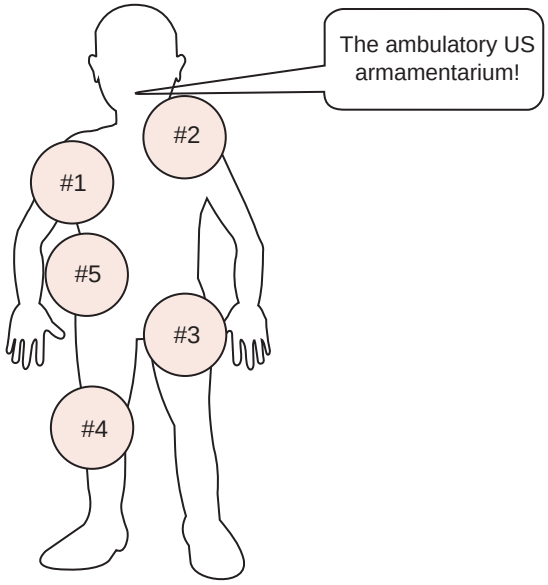
- Dex 8 mg or saline 2 + 30 mL
  - Bupivacaine 0.5%
  - Ropivacaine 0.5%
- Block duration ropivacaine
  - 11.8 (9.7, 13.8) *versus* 22.2 (18.0, 28.6) h
- Block duration bupivacaine
  - 14.8 (11.8, 18.1) *versus* 22.4 (20.5, 29.3) h
- $p < 0.001$
- Ropiv > bupiv, $p = 0.029$

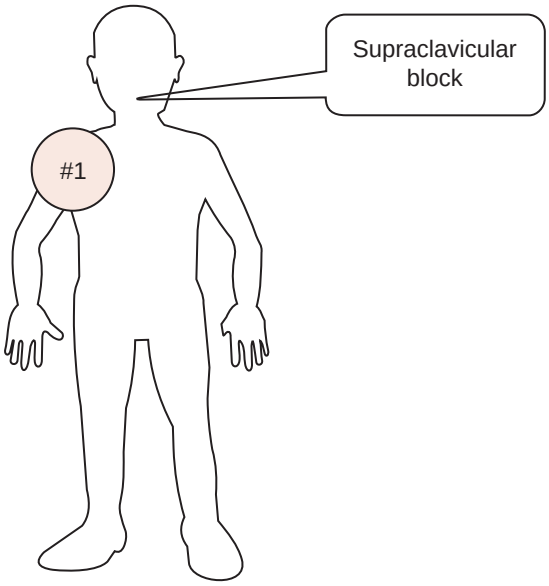




Cummings. BJA 2011;107:446.

5 TECHNIQUES YOU NEED (AND THEN SOME)

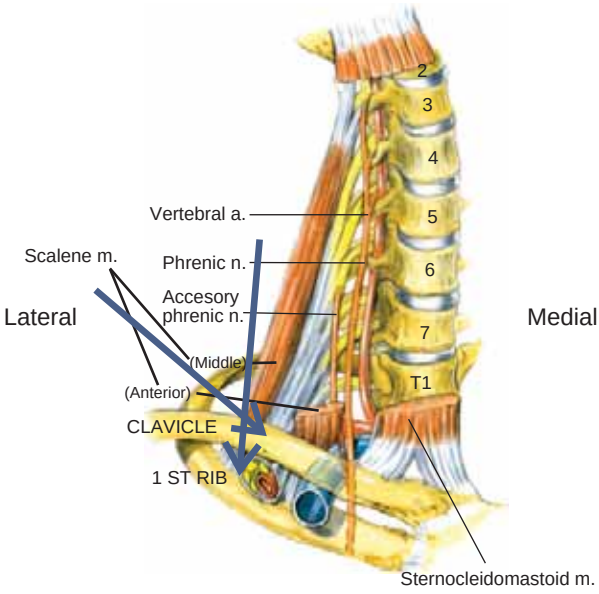




Supraclavicular block

- 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

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

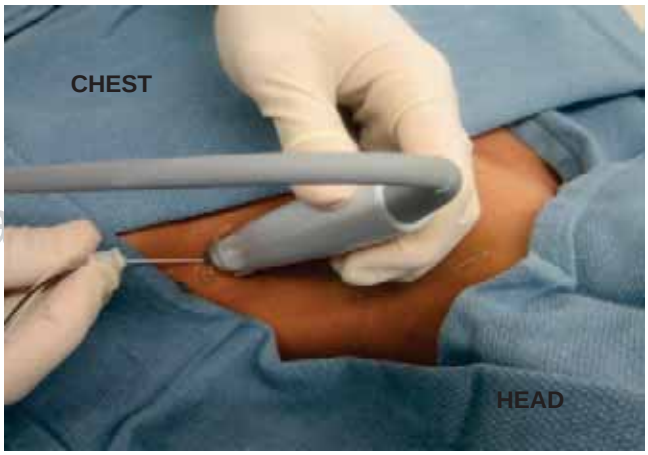


Ultrasound-guided supraclavicular block

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†

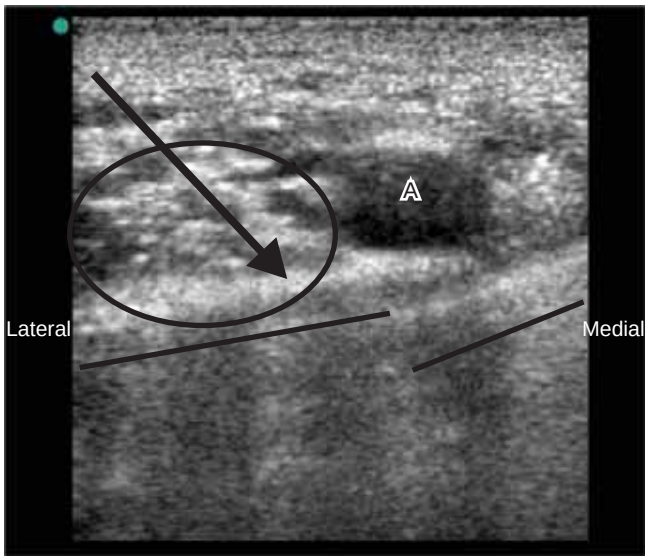
- 460 ambulatory
- 24 months



- 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

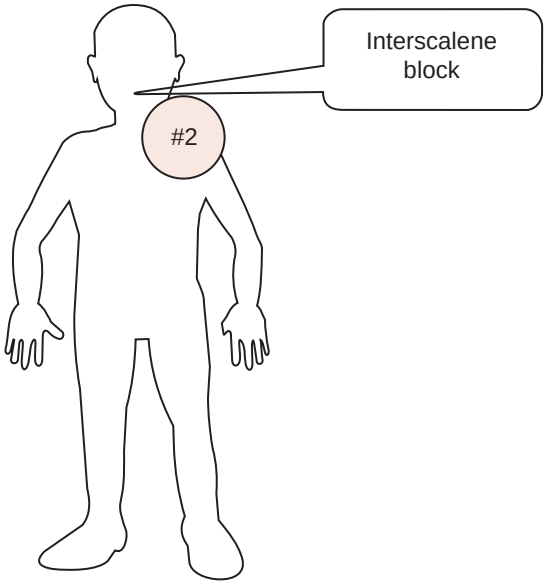
Perlas. RAPM 2009;34:171.

Supraclavicular block



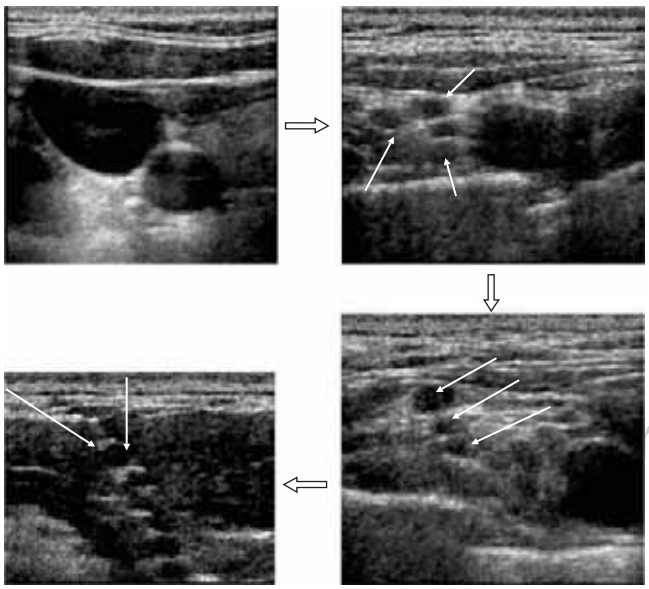
THE SWEEP!

How do you get there?

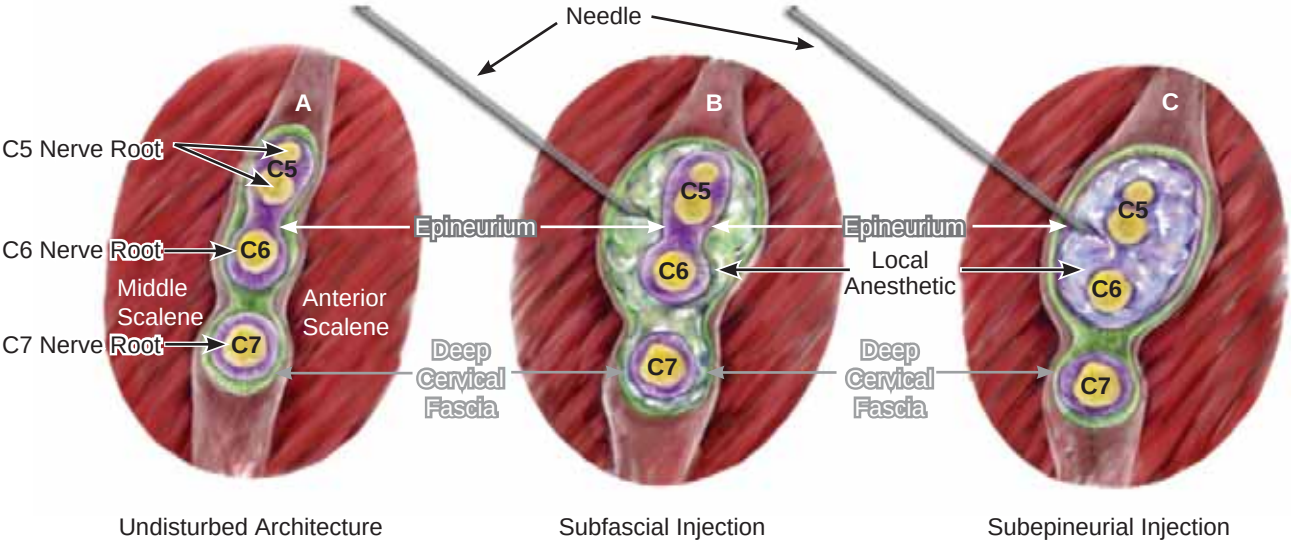


Interscalene block

- Cervical nerve roots
  - C3 → C7 blocked
  - C8,T1 40% of time
- Why learn it?
  - All shoulder, upper humerus procedures
  - Makes sitting position easy!
  - Protects the repair with GA



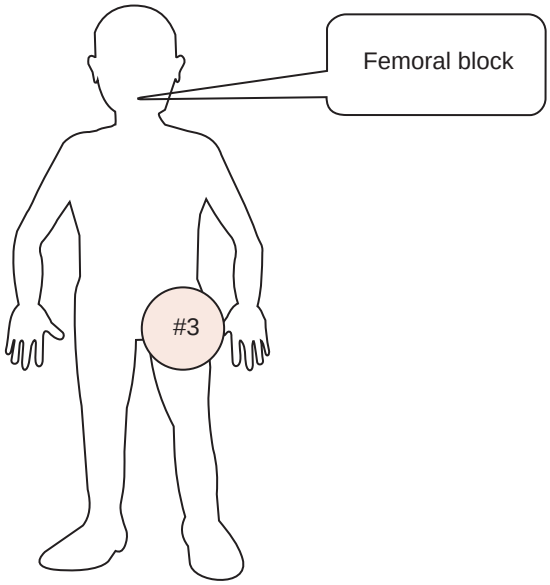
Soffer. JCA 2007;19:241.



Orebauch. RAPM 2010;35:450.

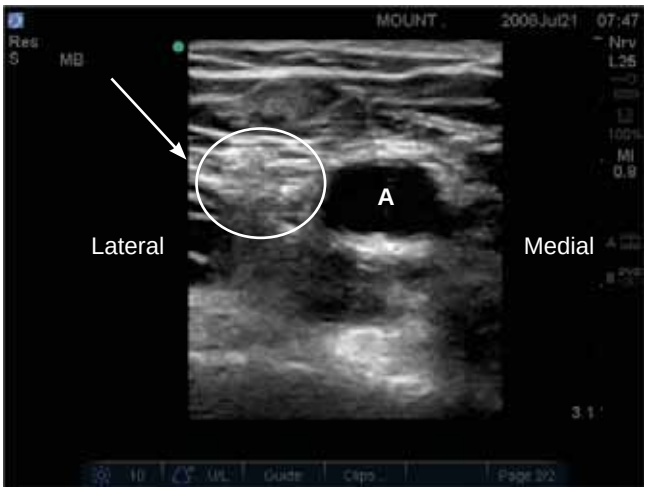
THE REVERSE SWEEP!

How do you make sure you are there?



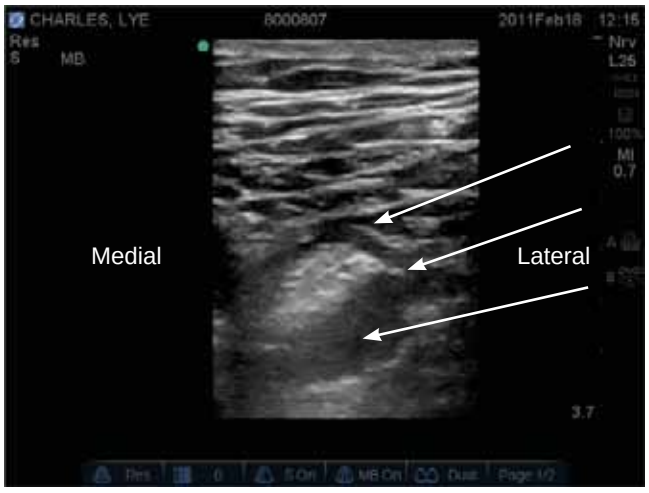
Femoral block

- 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

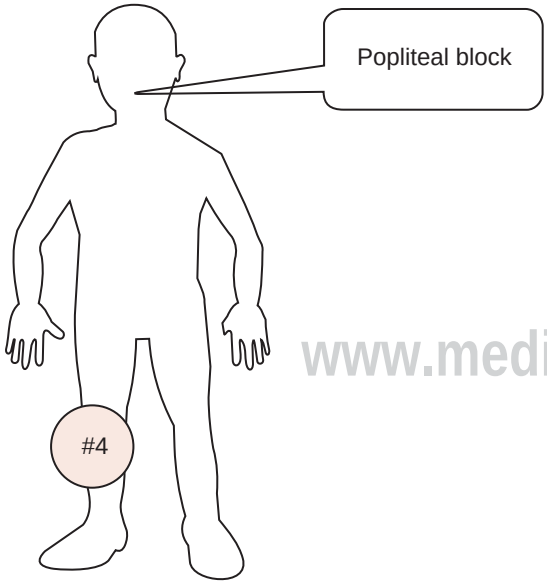
- Block of sciatic nerve
  - Prior to division
    - Tibial n
    - Common peroneal n
- Sensory below knee
  - Except saphenous distribution
- Avoidance of spinal anesthesia
- Avoidance of general anesthesia
- Watch for tourniquet use!
- Prone or lateral approaches



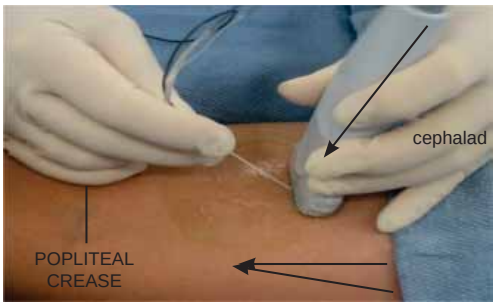
Ultrasound guidance improves the success of sciatic nerve block at the popliteal fossa

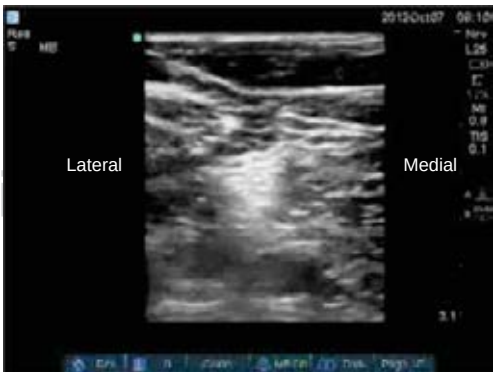
- 74 patients
- 15 mL 2% lido/epi + 0.5% bupiv
- US or NS 10 cm proximal to crease
- Blinded observer assess block
- Similar procedure time
- Significantly higher block success
  - 89.2 *versus* 60.6%

Perlas. RAPM 2008;33:259

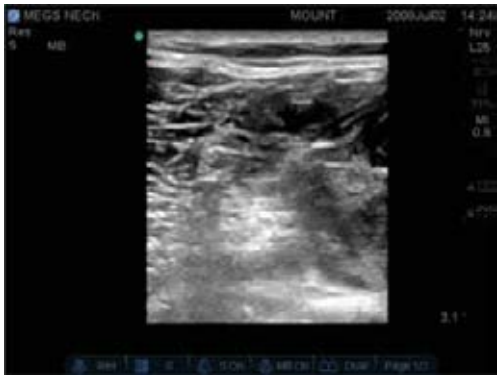


Popliteal Block

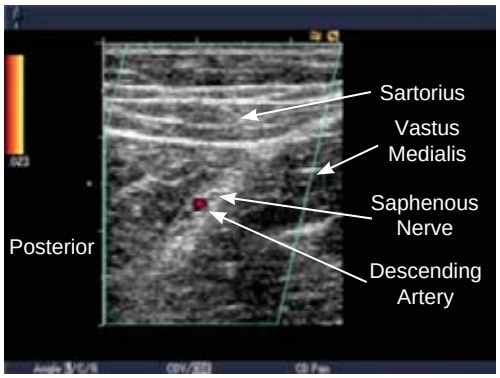




Start at the level of the popliteal crease!!!



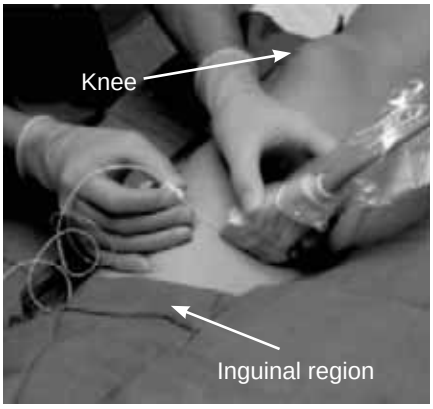
Saphenous block - near adductor canal

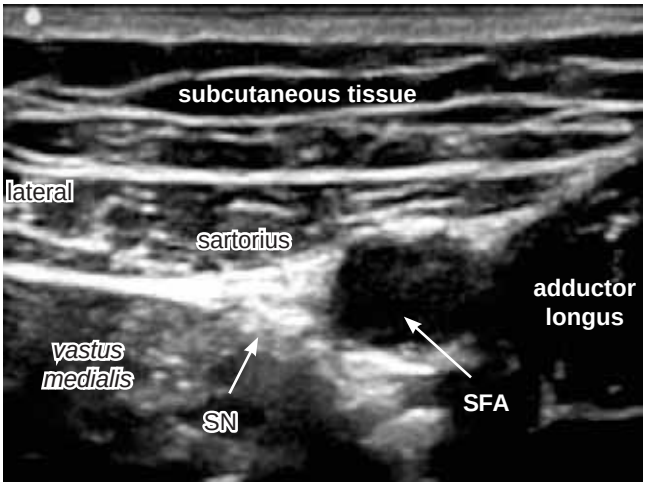


Krombach. RAPM 2007;32:369.

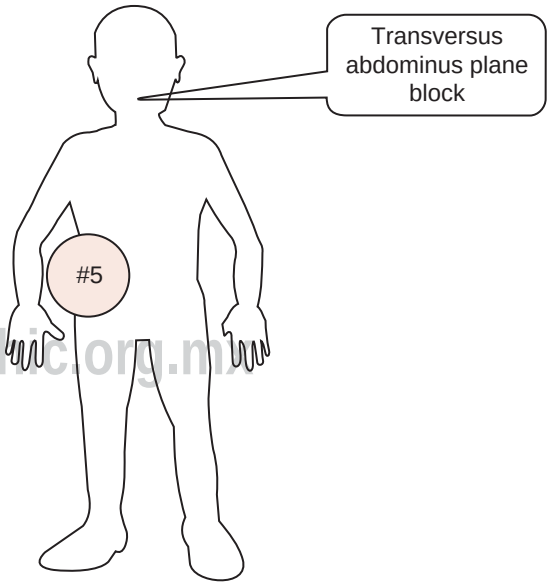
SFAST block

- 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*



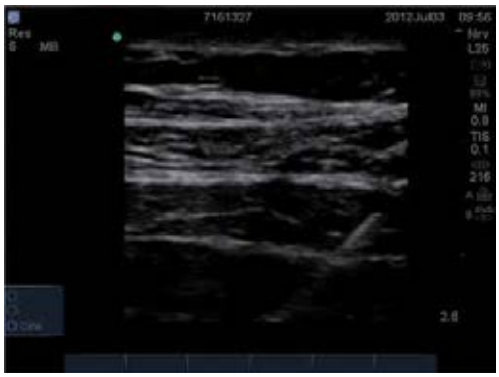


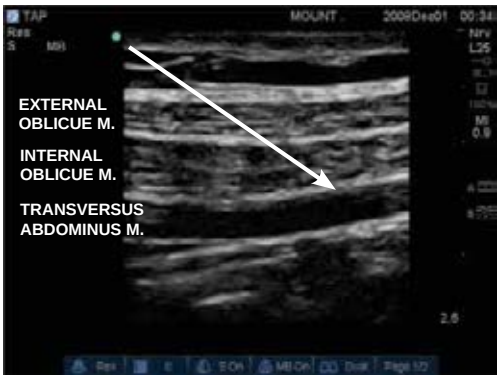
Kirpatrick. RAPM 2010;35:222.

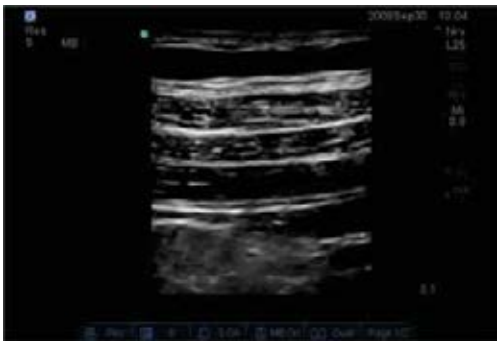


Transversus abdominus plane (TAP) block

- Effective postoperative analgesia for:
  - Midline incisions
  - Paramidline incisions
  - Laparoscopic surgery
- Innervation of anterior abdominal wall
  - Intercostal nerves
  - Subcostal neres
  - 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 cm^3:
  - Saline
  - .25% ropivacaine
  - .5% ropivacaine
- Postop
  - Ibuprofen 400 mg q 6˚
  - Hydromorphone/acetamnophen pain > 4
- Blinded observer for 24˚
  - Quality of recovery score
  - Analgesic use

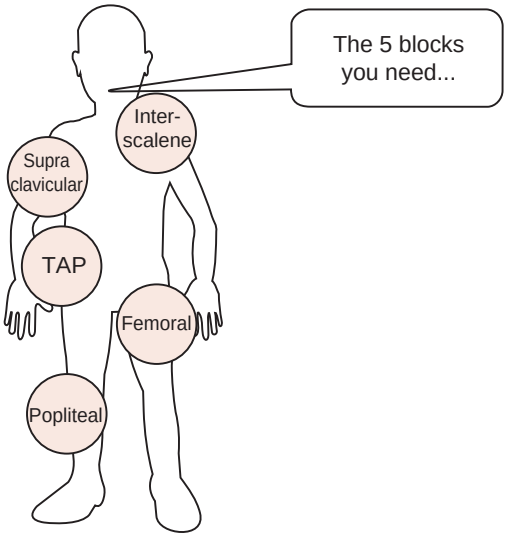
Physical comfort
Physical independence
Pain
Emotional status
Psychological support
Overall

De Oliveria. A&A 2011;113:1218.

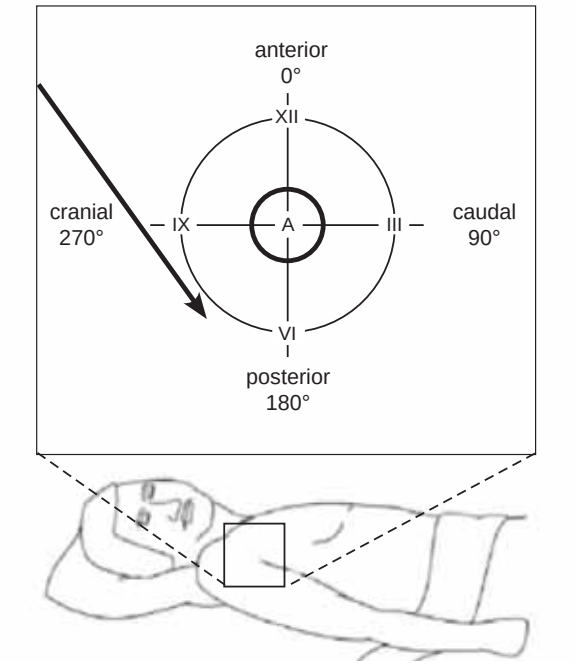
- TAP block is an effective adjunct
  - Reduced pain
  - Decreased opioid consumption
  - Provided earlier discharge readiness
  - Associated with better quality of recovery

Table I.

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

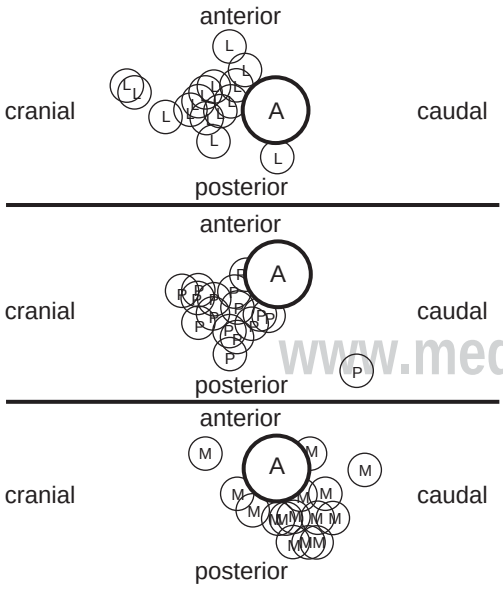


De Oliveria. A&A 2011;113:1218.

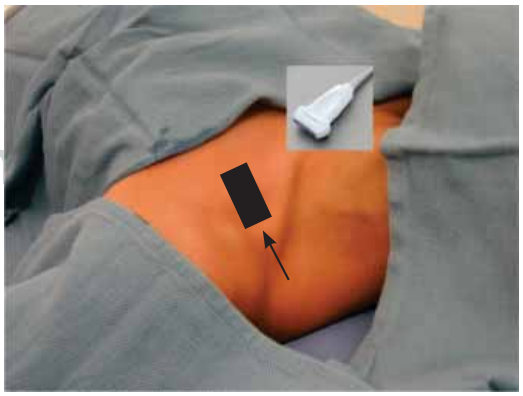


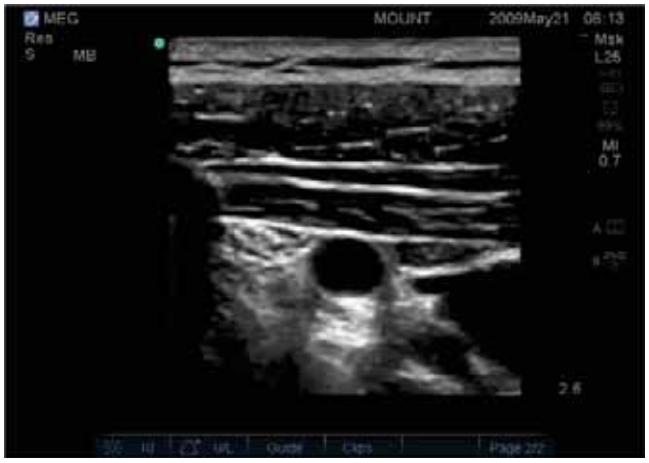
BONUS BLOCKS

Infraclavicular block



Sauter. A&A. 2006;103:1574.



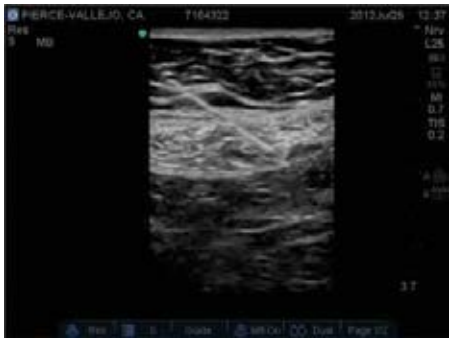


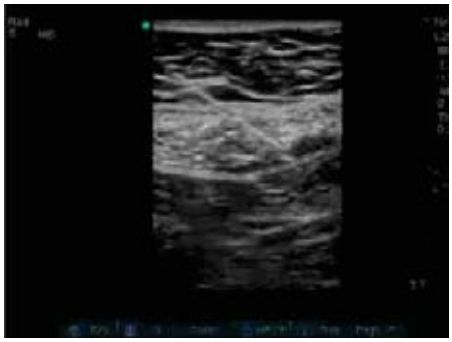
A comparison of a single or triple injection technique for ultrasound-guided infraclavicular block: a prospective randomized controlled study

- 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

Desgagnes. A&A 2009;109:668.

RECTUS SHEATH BLOCK





ULTRASOUND AND CATHETERS

Considerations

- For mildly painful procedures
  - Manageable with oral opioids
- Patients/caretaker must be responsible
  - For pump management
  - Catheter removal
- Understand written instructions
- Must have a «proven» catheter
  - High percentage of secondary block failure
  - Establish surgical block through catheter

Table II.

Total interscalene catheters	190
Interventions	
Patient education issues[a]	3
Equipment malfunction[a]	2
Inadequate pain control[a]	8
Total interventions	*13*
Complications	0
Infection	0
Toxicity (seizures, perioral numbness)	0
Nerve injury	0
Total complications	*0*

Table III.

Total femoral nerve catheters	206
Interventions	
Patient education issues[a]	5
Equipment malfunction[a]	1
Inadequate pain control[a]	2
Total interventions	*8*
Complications	
Infection	0
Toxicity (seizures, perioral numbness)	0
Permanent nerve damage	0
Total complications	*0*

Table IV.

Total sciatic nerve catheters	224
Interventions	
Patient education issues[a]	1
Equipment malfunction[a]	1
Inadequate pain control[a]	3
Total interventions	*5*
Complications	
Infection	0
Toxicity (seizures, perioral numbness)	0
Nerve injury	2
Total complications	*2*

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

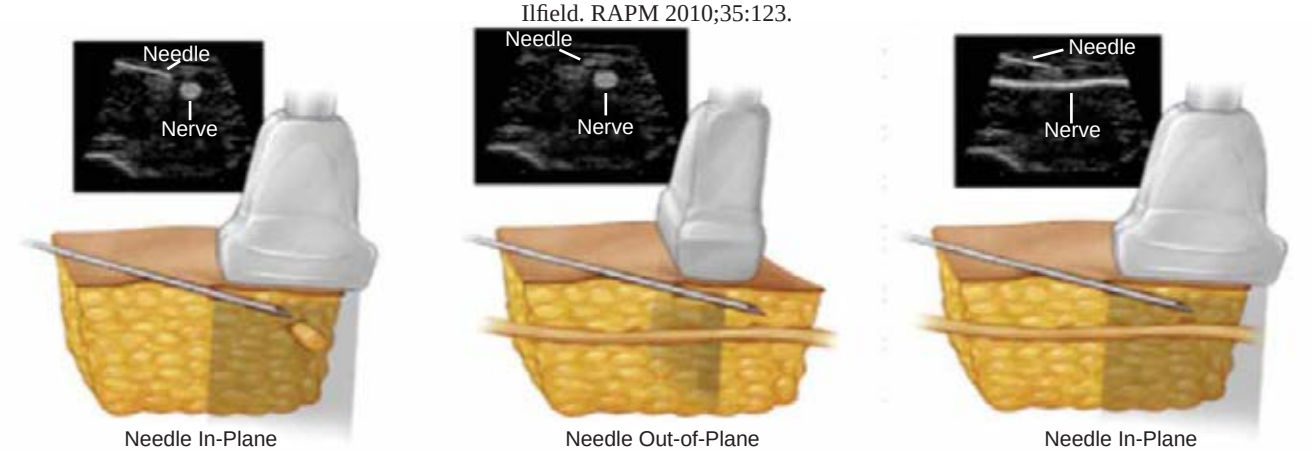
- 20-gauge polyamide epid caths /18-gauge needles
- Ultrasound ONLY—no stimulation
- Documentation prior to d/c of:
  - Motor weakness
  - Loss of temperature and light touch
- Test dose - 3 mL 0.25% bupi with epi 5 ug/mL
- Infusate 0.25% bupivacaine @ 5 mL/hour
- Oral breakthrough analgesics prescribed

Swenson. A&A 2006;103:1436.

- 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

Swenson. A&A 2006;103:1436

Ilfield. RAPM 2010;35:123.



Needle In-Plane
Nerve Short Axis

Needle Out-of-Plane
Nerve Short Axis

Needle In-Plane
Nerve Long Axis

Needle-IP
Nerve-short axis:

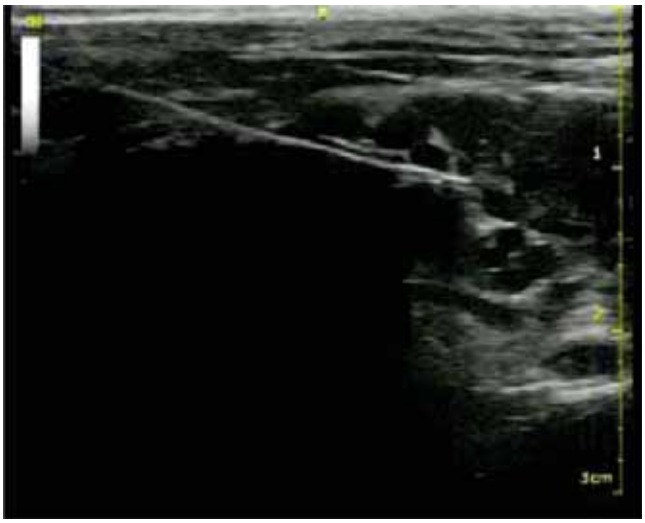
- Easy nerve ID
- See structures
- Single injection
- Cath bypasses nerve on insertion

Needle-OOP
Nerve-short axis:

- Familiar
- Vasc access
- Can't see tip
- Cath near nerve

Needle-IP
Nerve-long axis:

- Theoretically ideal
- Difficult to keep nerve, needle and cath in plane



- 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

A prospective randomized comparison of ultrasound and neurostimulation as needle end points for interscalene catheter placement

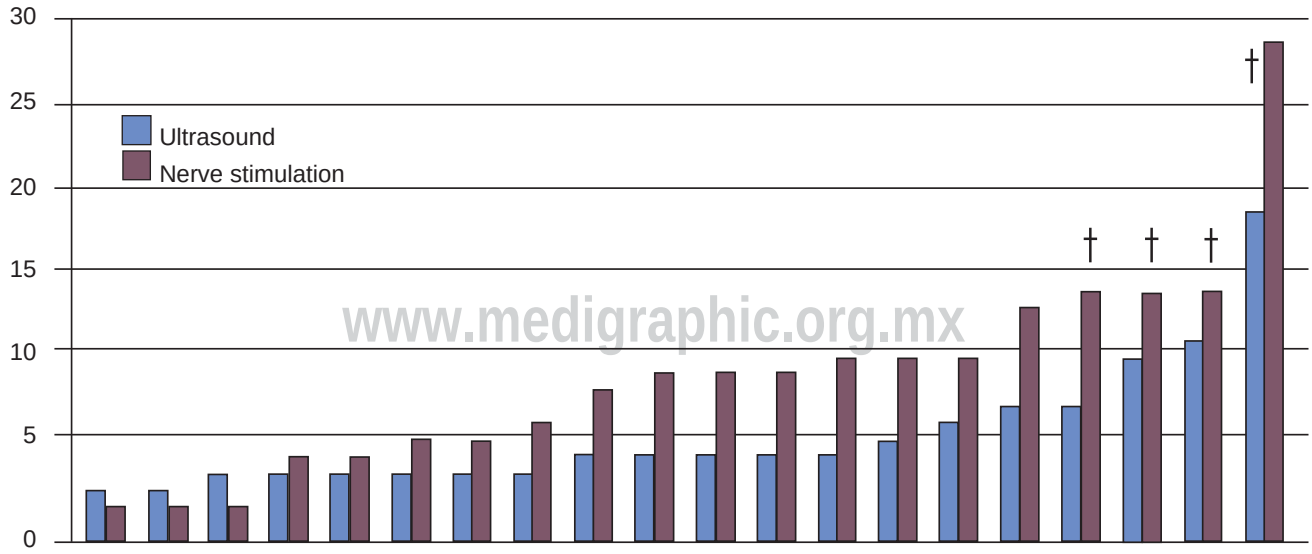
Table V.

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

Fredrickson. A&A 2009;108:1695.

Mariano. J Ultrasound Med 2009;28:1211.

Time for Catheter Placement

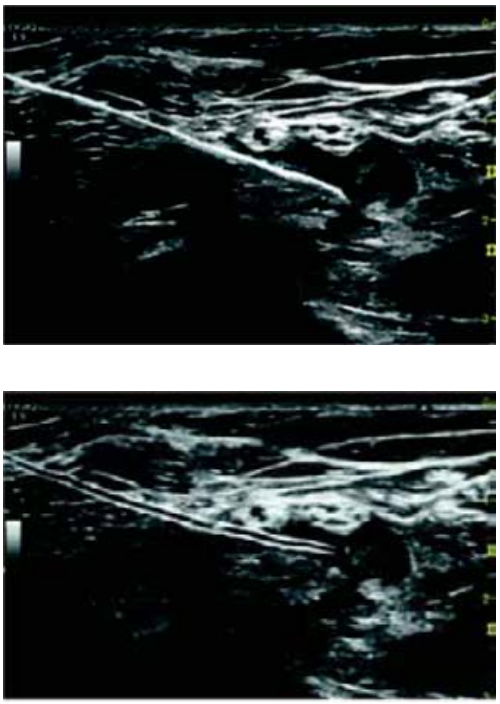


Catheter fixation

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

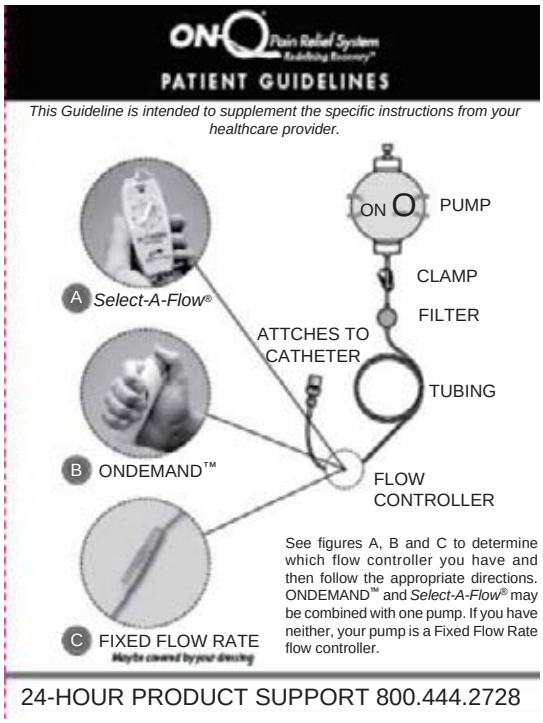
Catheter over needle

- 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



Complications

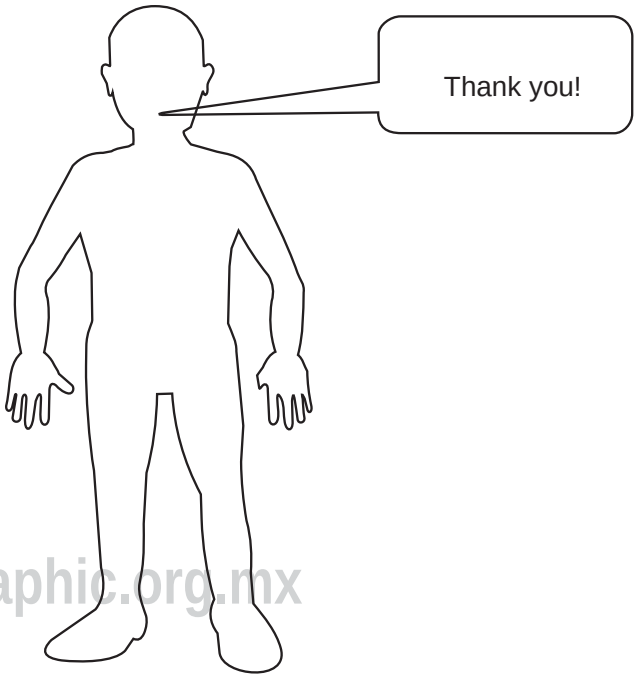
- Block failure
- Inadvertent catheter removal
- Kinking, knotting and looping
- Infection
- Vascular puncture/hematoma
- Delayed local anesthetic toxicity

Conclusions

- US has had a dramatic and positive impact
- Decreases in time to place blocks/catheters and improve ments 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

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



Ilfeld. Reg Anesth Pain Med 2003;28:418.

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