

# ULTRASOUND GUIDED NERVE BLOCKS



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## Objectives

- Review indications and uses for ultrasound guided nerve blocks (USGNB)
- Review the anatomy for USGNB
- Discuss the procedure of USGNB
- Discuss the pitfalls associated with USGNB



## Case 1

- 75 y/o AAF presents to the ED with c/o hip pain s/p a witnessed fall from standing height after slipping on a wet floor with her walker.
- PMHx: dementia, HTN, CAD
- VS: BP 95/53, P 63, R16, Pox 99% (RA)
- PE: thin, frail, AAF, appears in pain
  - Lungs: CTA B
  - CV: RRR, symmetric distal pulses B
  - Ext: L leg is shortened and internally rotated, +TTP



## Case 1: X-Ray



## Case 1

- Pt is tearful and moaning in pain
- Pt is confused at baseline, but trying to get out of bed
- BP 90/50
- What are your pain control options?



## Nerve Block Indications

- Acute extremity pain management
- Procedural anesthesia of extremity
- Procedural sedation alternative
- Narcotics alternative
  - Head injury patients
  - Altered mental status



## Contraindications

- ❑ Allergy to local anesthetic
- ❑ Acute infection at injection site
- ❑ Injury at risk of compartment syndrome
- ❑ Uncooperative patient
- ❑ Pre-existing neurologic deficit
- ❑ Extreme obesity
- ❑ Anticoagulation (relative)



## Types of Nerve Blocks

### Type of Block

- Interscalene Plexus Block
- Supraclavicular Plexus Block
- Infraclavicular Plexus Block
- Axillary Plexus Block
- Median Nerve Block
- Radial Nerve Block
- Ulnar Nerve Block
- Femoral Nerve Block
- Popliteal Nerve Block
- Tibial Blocks
- Deep Peroneal Blocks
- Saphenous Nerve Block
- Sural Nerve Block



nerve

below the knee

distal to the knee



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## Nerve Block Procedure

- High frequency linear probe
- Sterile cover
- Chloreprep
- Anesthesia of choice
- Spinal needle, 25G
- Large syringe, 20cc



## Anesthesia

- Bupivacaine (0.5%)
- Lidocaine (1%)
- Mepivacaine (1%)
- With epinephrine
  - Extends analgesia
  - Avoid Epi:
    - In end organ areas
    - PAD
    - Injuries involving vascular compromise



## Local Anesthetic Doses for Infiltration

Anesthetic	Duration without Epi (min)	Duration with Epi (min)	Max Dose without Epi, mg/kg	Max Dose with Epi, mg/kg
Lidocaine (1%)	30 – 120	60 – 400	4.5	7
Bupivacaine (0.5%)	120-240	240-480	2.5	3.3



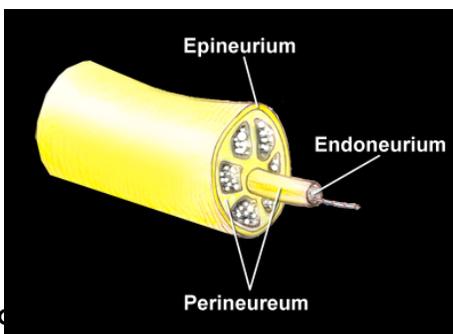
## Lidocaine vs Bupivacaine

	LIDOCAINE	BUPIVACAINE	ADVANTAGE
Onset	2-5 min	2-5 min	Equal
Effectiveness (equianesthetic dose)	Excellent	Excellent	Equal
Duration	1-2 hr	4-6 hr	B
Infection potential	No	No	Equal
Administration pain	Less	More	L
Maximum volume*— plain lidocaine	Less	More	B
Maximum volume— epinephrine	Less	More	B
Toxic potential	Less cardiotoxic; equal CNS	More cardiotoxic; equal CNS	L



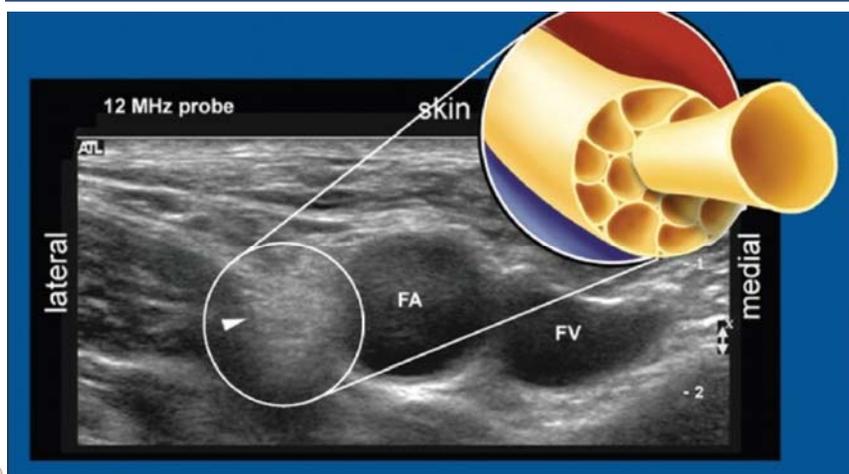
## Nerves on US

- Variable sonographic echotexture
- Nerve fascicles (hypoechoic) embedded within (hyperechoic) perineurium and endoneurium
- Honeycomb in transverse plane
- Nerves may be oval, round or triangular



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## Nerves on US



## Procedural Set Up

- Prep patient with US machine placed in view
- Turn down room lights if possible for best screen view
- Set up as a moderate sedation
  - ▣ Cardiac monitor
  - ▣ IV access
  - ▣ Crash cart available
  - ▣ Airway equipment available
- Ensure initial pain control
  - ▣ IV narcotics
  - ▣ Lidocaine to anesthetize injection site separate

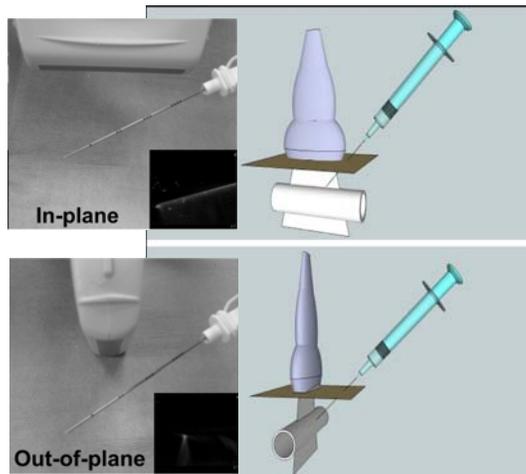


## Set Up



## In-Plane Approach

- Needle in long axis view
- Watch length of needle as it move through soft tissue
- More difficult due to needle diameter



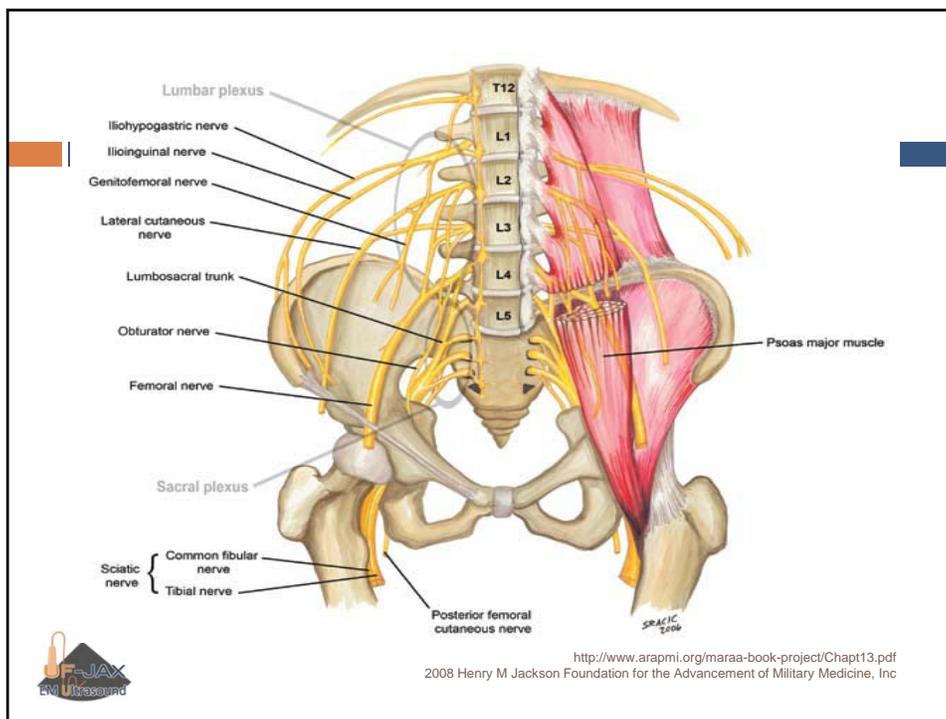
## Femoral Nerve Block

- Types
  - Femoral
  - 3 in 1
    - Femoral
    - Lateral cutaneous
    - Obturator



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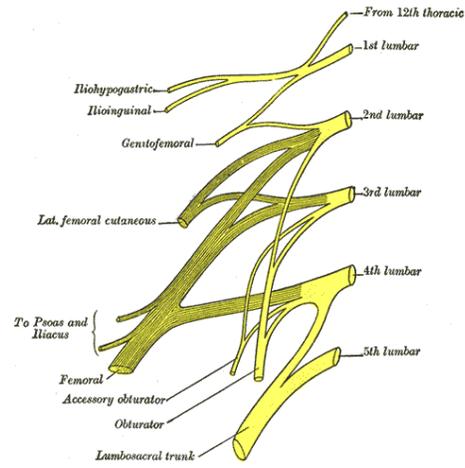


## Pertinent Nerves of the Lumbar Plexus

- **Ilioinguinal and iliohypogastric nerves (L1)**
  - ▣ Innervate the inferior abdominal wall and inferior to medial aspect of inguinal ligament
- **Lateral femoral cutaneous nerve (L2-3)**
  - ▣ Innervates anterolateral and posterior aspect of thigh
- **Femoral nerve (L2-4)**
  - ▣ Anterior division innervates anterior medial aspect of thigh
  - ▣ Posterior division typically supplies articular branch to the knee and innervates the medial leg from the tibia to the medial aspect of the foot (via the saphenous nerve)
- **Obturator nerve (L2-4)**
  - ▣ Variably innervates the posterior medial thigh and medial knee



# Lumbar Plexus



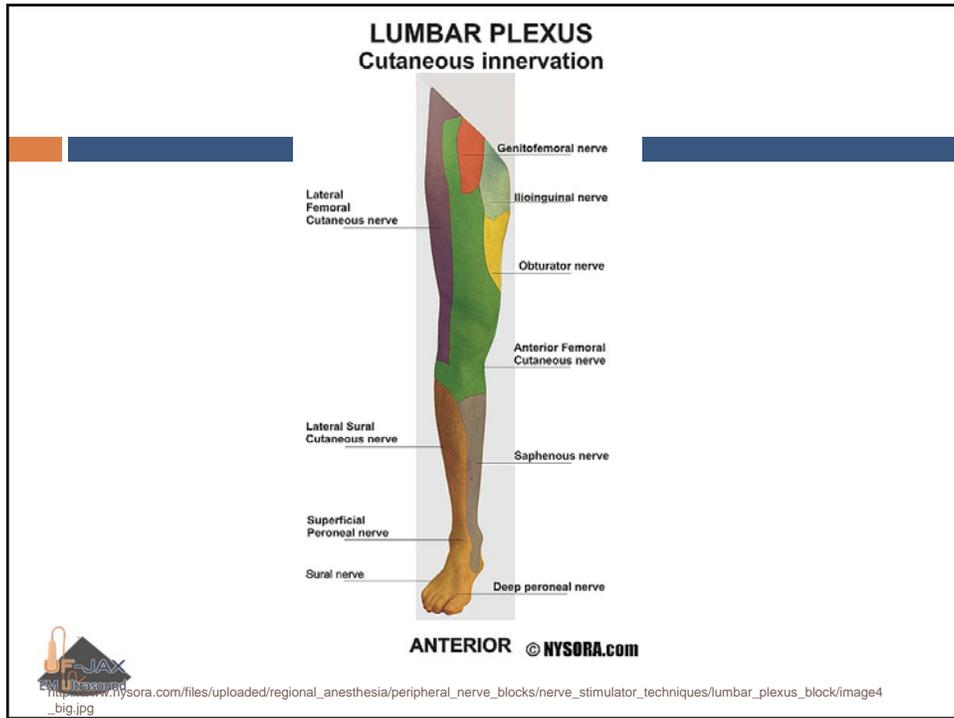
[http://psychology.wikia.com/wiki/Lumbosacral\\_plexus](http://psychology.wikia.com/wiki/Lumbosacral_plexus)



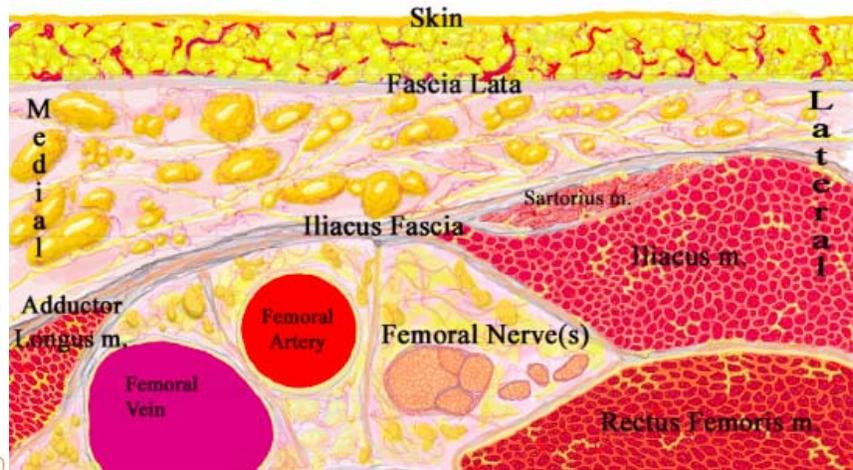
# Lower Extremity Dermatomes



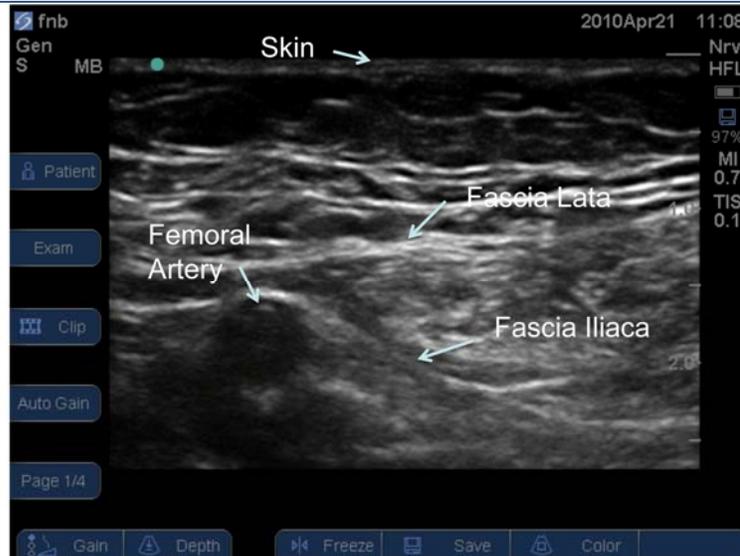
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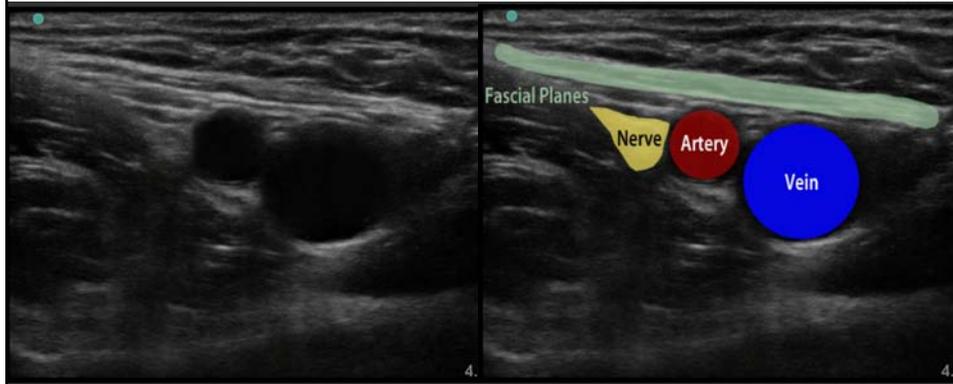
# Anatomy: NAVeL



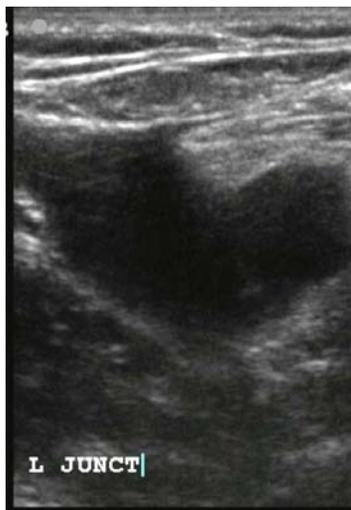
# Femoral View



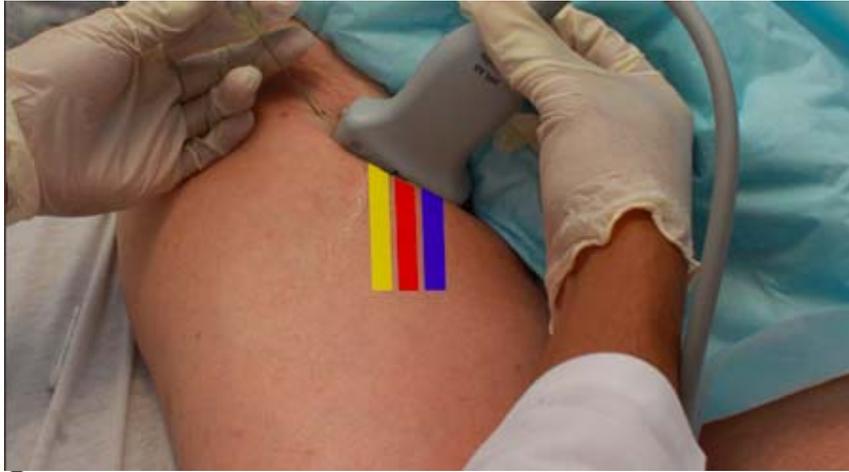
# Femoral Vein Anatomy



# Find Your Position



## US placement



## Needle Insertion



## Femoral Nerve Block Video

- Femoral Nerve Block



Needle enters fascia iliaca compartment from right side and local anesthetic is injected forming hypoechoic “lake”

## Clinical Pearls

- In plane, needle at 45 degree angle to skin at lateral aspect of US transducer
- Pop through skin, advance at steady rate towards “white triangle” formed by fascia iliaca and femoral nerve
- Feel/see “pop” thru fascia lata and fascia iliaca
- Aspirate, inject LA – look for fascia iliaca rising and spread around nerve



## Case 2

- 16 y/o WM presents to the ED with a large laceration to his calf after trying to jump a barb wire fence
- PMHx: none
- VS: BP 118/73, P 98, R16, Pox 99% (RA)
- PE: muscular, WM, crying and appears in pain
  - Lungs: CTA B
  - CV: RRR, symmetric distal pulses B
  - Ext: L leg with 15cm linear laceration to the lateral calf



## Case 2: laceration



## Popliteal Nerve Block

- Sciatic nerve
  - Deep proximally
  - Superficial distally
  - Bifurcates
    - Common Peroneal nerve
    - Tibial nerve



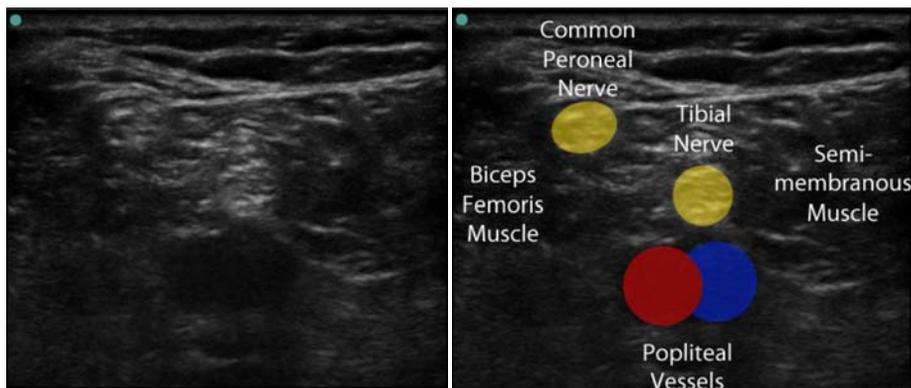
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## Probe Placement



## Popliteal Anatomy



## Clinical Pearls

- Ensure that all nerves are blocked.
- The tibial nerve can be large and easily mistaken for the sciatic nerve leading to no anesthesia in the region of the peroneal nerves.
- Maintain a shallow needle angle
- If blocking the femoral nerve as well, monitor the combined doses to avoid toxicity.
- If the nerve does not appear hyperechoic to surrounding structures, rock or tilt the probe.
- Avoid injecting too much local anesthetic into the surrounding muscle



## Complications

- **Nerve Injury**
  - ▣ Chemical irritation (Most Common)
    - Using recommended volume.
  - ▣ Direct trauma
    - Use smaller needle (25G)
    - Bevel Parallel to the long axis of nerve.
    - Avoid extensive movement near nerve.
  - ▣ Ischemia from intraneural injection
    - Withdraw needle 1-2 mm once paresthsia is elicited before injections
- **Intravascular injection/systemic toxicity**
  - ▣ Aspirate before injection
  - ▣ Can see blanching of the skin
  - ▣ Vasospasm (Epi)
    - Tx: phentolamine
- **Limb Injury**
- **Infection**
- **Hematoma**
  - ▣ Apply pressure



NERVE	VOLUME (mL)
<b>Axillary</b>	40-50*
<b>Elbow</b>	
Ulnar	5-10*
Radial	5-15*
Median	5-15*
<b>Wrist</b>	
Ulnar	5-15*
Radial	5-15*
Median	3-5*
<b>Hip</b>	
Femoral	10-20*
Three-in-one	25-30*
<b>Knee</b>	
Tibial	5-15*
Peroneal	5-10*
Saphenous	5-10*
<b>Ankle</b>	
Posterior tibial	5-10*
Deep peroneal	3-5*
Saphenous, sural, and superficial peroneal	4-10*
Intercostal	5-15*
<b>Hand</b>	
Metacarpal and web space	2-4 <sup>†</sup>
Finger	1-2 <sup>†</sup>
<b>Foot</b>	
Metatarsal	10-15 <sup>†</sup>
Web space	3-5 <sup>†</sup>
Toe	2-5 <sup>†</sup>



## Questions???

- Special Thanks to Yare!!!

