

PANBC Annual Education Day

**REGIONAL ANESTHESIA –
CLINICAL UPDATE AND
REVIEW**

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OBJECTIVES

- **Why use a regional technique?**
 - Is it safe? Better than a GA?
- **Discuss commonly used regional techniques:**
 - Outcomes, rationale, and safety
 - Upper and Lower extremity blocks
 - Relevant anatomy
 - Commonly used peripheral nerve blocks
- **Discuss local anesthetic toxicity (LAST) and other peri-op complications**
- **Discuss perioperative management/discharge management of patients receiving single shot peripheral nerve blocks and indwelling perineural catheters**
 - Ensuring adequate discharge pain control and avoiding secondary injury to a blocked limb

WHY USE REGIONAL ANESTHESIA?

- Isn't a general anesthetic simpler and equally effective?
- Aren't the outcomes the same regardless of when a regional technique is used or not?



General Anesthesia vs Regional Anesthesia

- *Regional anesthesia* helps:
 - Avoid a **difficult airway**
 - Minimize sedatives / opioids in **high-risk patients**
 - COPD, Obstructive Sleep Apnea, Chronic Pain
 - Avoid physiologic effects of general anesthesia in **fragile or highly comorbid patients**
 - Obesity, significant cardiac or respiratory disease, renal failure
 - **AV Fistula creation surgery**



General Anesthesia vs Regional Anesthesia

Continued...

- **Reduce Post-op Nausea and Vomiting (PONV)** in susceptible patients
- **“Fast-track”** healthy patients to post-recovery areas, improving PACU efficiency
 - If minimal sedation, patients can bypass PACU and progress to daycare earlier
 - **Healthy Patients**

IS A REGIONAL BLOCK FOR EVERYONE?

IMPORTANT QUESTIONS TO ASK THE PATIENT

- Coagulation status
 - Detailed Pain History
 - Significant Medical Comorbidities
 - Previous history of any anesthetic complications
 - Occupation
-
- These areas will help determine the optimal patients for a nerve block

AREN'T THE OUTCOMES THE SAME ?

- ***Regional Anesthesia:***

- Improves pain control & increases satisfaction¹
- Reduces opioid consumption²
- Reduces risk of chronic post-operative pain³
- In some patient populations, reduces pulmonary complications & mortality⁴
- Reduces hospital length-of-stay⁵



1-White et al. *Anesth Analg* 2005. 101:25-s22.

2-Paul et al. *Anesthesiology* 2010. 113(5); 1144-62

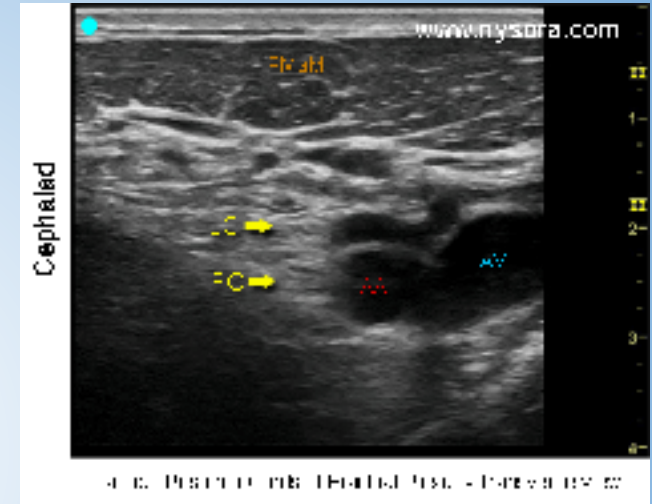
3-Andreae et al. *Cochrane Database Syst Rev* 2012

4-Neuman et al. *Anesthesiology* 2012. 177: 72-92

5-Lenart et al. *Pain Med* 2012. 13: 828-34

WHAT ABOUT COMPLICATIONS?

- ***Regional Anesthesia*** is associated with:
 - Failed Blocks (a frustrating nuisance...)
 - Intravascular Injection
 - Infection
 - Pneumothorax
 - Nerve Injury
 - Permanent and Transient
 - Surgical Complications (in rare instances; i.e. masked compartment syndrome)
 - Local Anesthetic Toxicity (LAST)



Fortunately, through careful patient selection, effective multidisciplinary communication, and the onset of Ultrasound for block placement, **serious complications are extremely rare!**

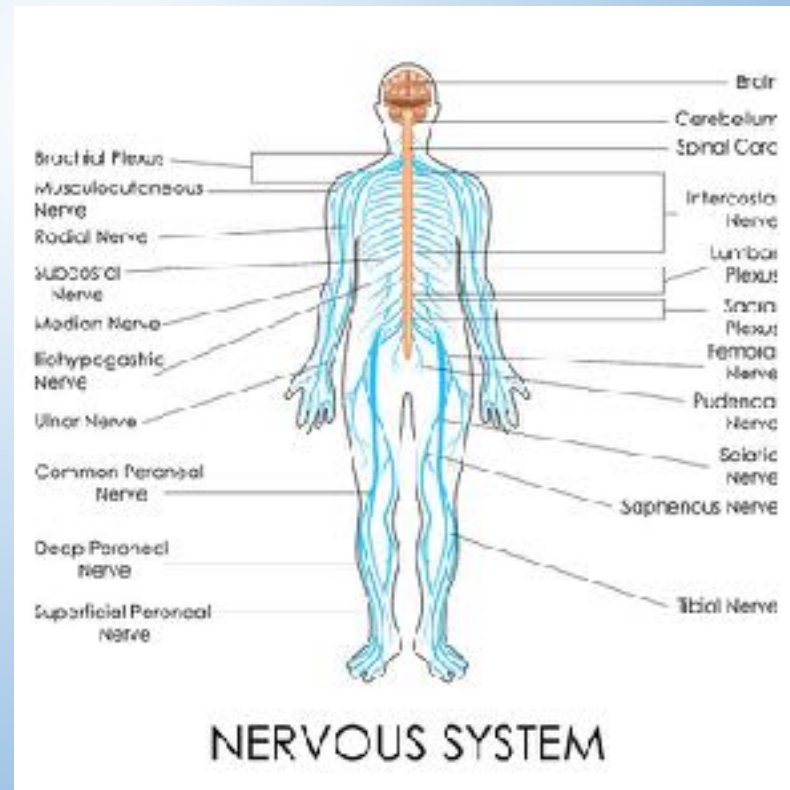
- A risk:benefit discussion must be completed with every patient prior to starting the block

WHY REGIONAL? - SUMMARY

- In the correct patient population regional anesthesia is very **safe** and can contribute to **better pain control** and **decreased post-operative complications**

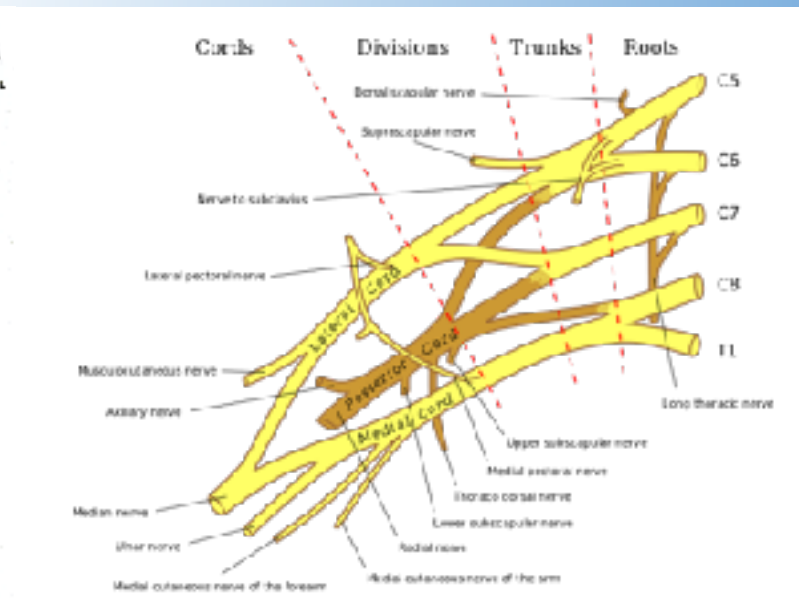
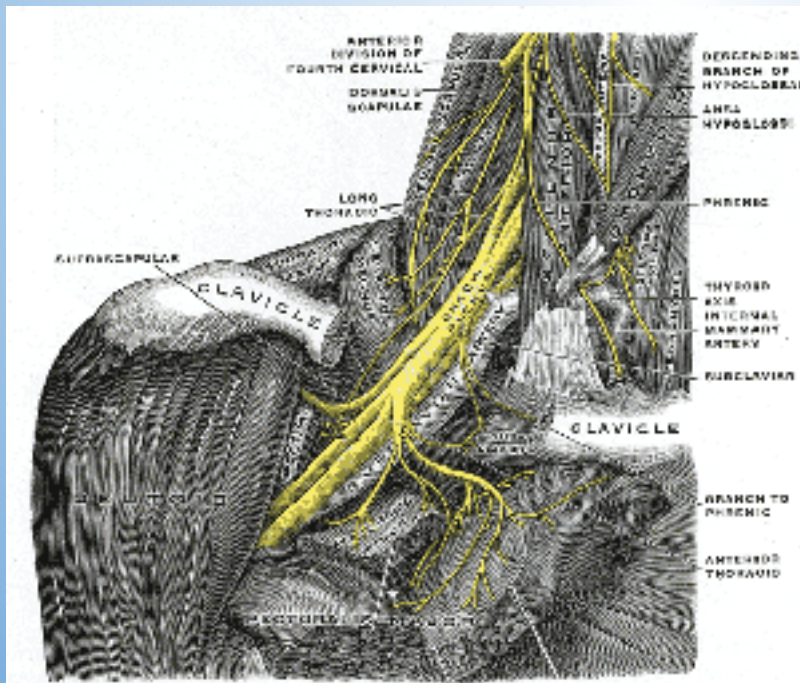
REGIONAL ANESTHESIA TECHNIQUES

- Essentially **ANY peripheral nerve**, plexus, or group of nerves contained within the neuraxis can be blocked!
- Upper extremity blocks
- Lower extremity blocks



UPPER EXTREMITY BLOCKS

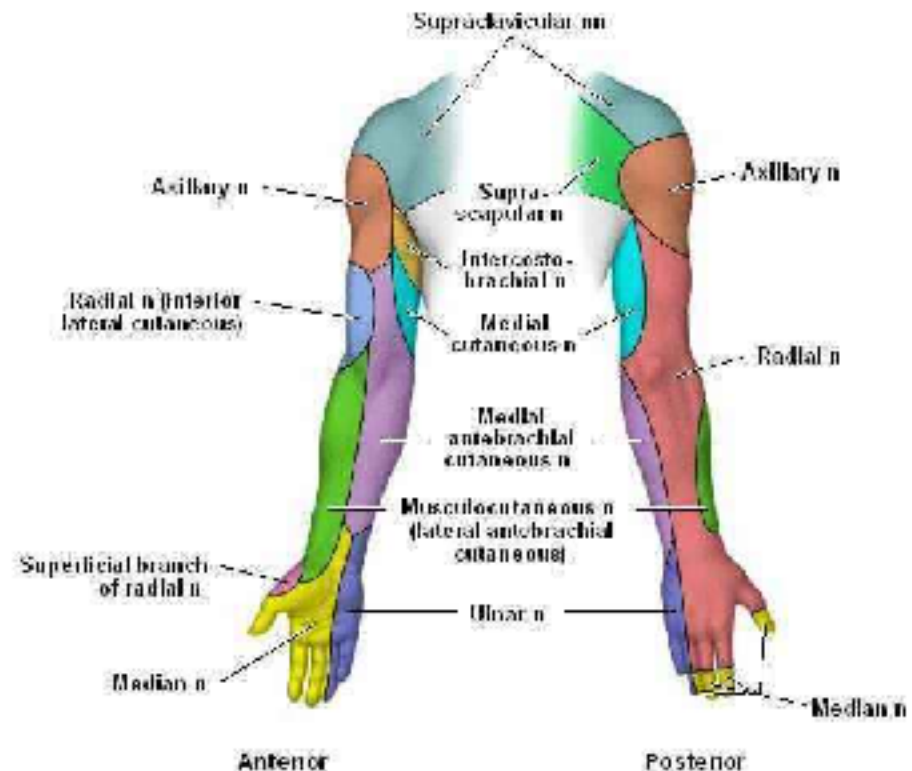
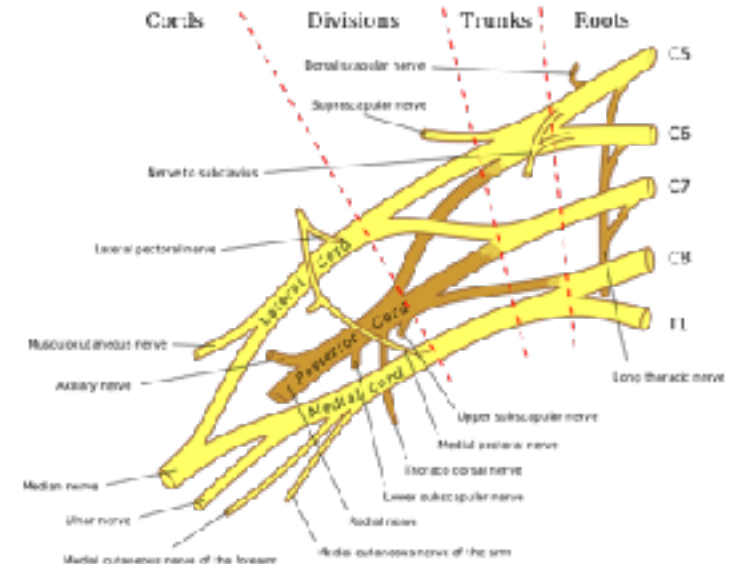
- Surgical anaesthesia of the upper extremity can be achieved by two general means:
 - Blockade at the **brachial plexus** level
 - Blockade of specific **peripheral nerves**
- The brachial plexus is derived from spinal nerve roots from the **C5-T1 levels**



UPPER EXTREMITY – BRACHIAL PLEXUS

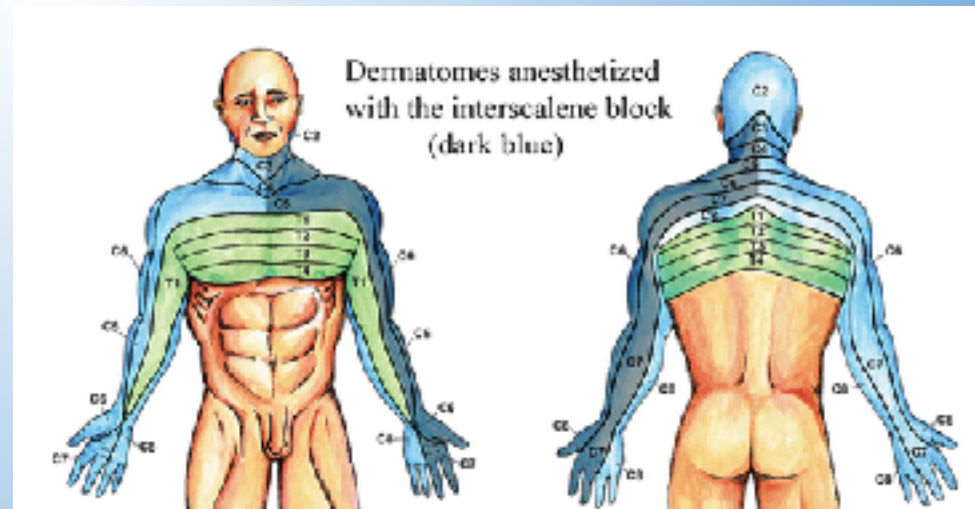
- An appropriate block is chosen based on ***sensory distribution*** of brachial plexus branches
- Not all brachial plexus blocks provide the same block distribution.

http://www.asra.com/mhp_cdf/Fig11

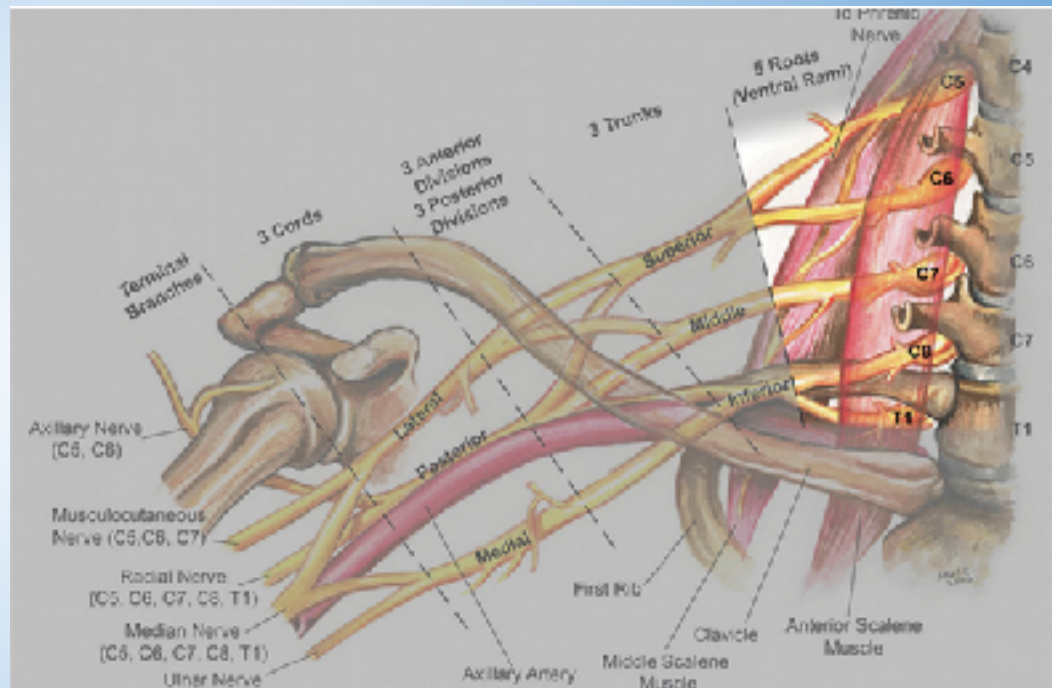
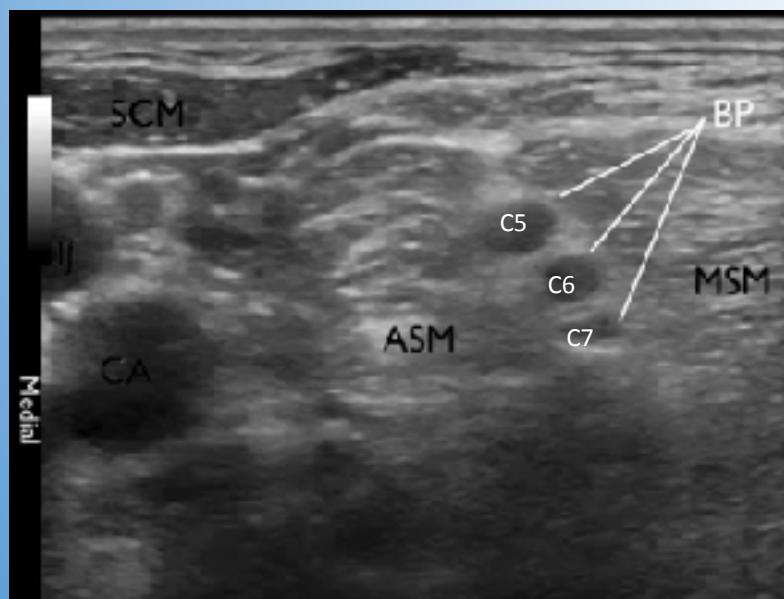


BRACHIAL PLEXUS – INTERSCALENE

- Appropriate for anesthesia of lateral ***shoulder***, ***upper arm***, and ***elbow***
- Frequently spares lowest nerve roots (C8/T1)
 - Not the best for ***hand surgery***
- Ideal for ***shoulder & clavicle surgery***

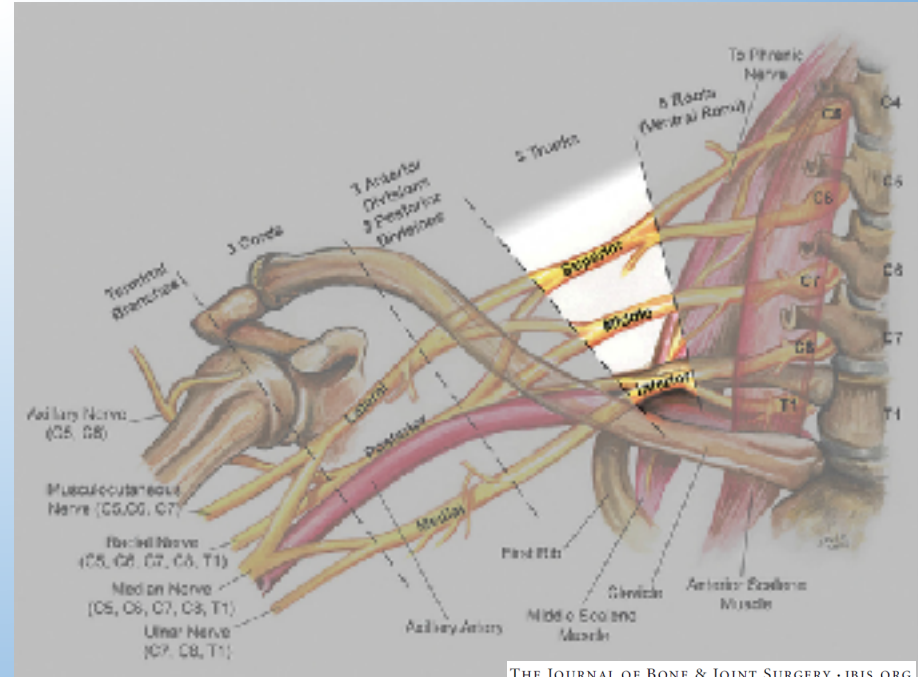
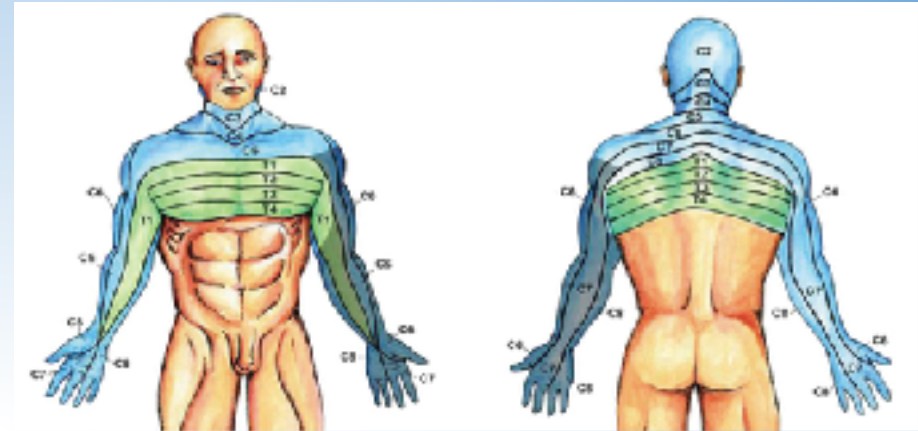


BRACHIAL PLEXUS – INTERSCALENE

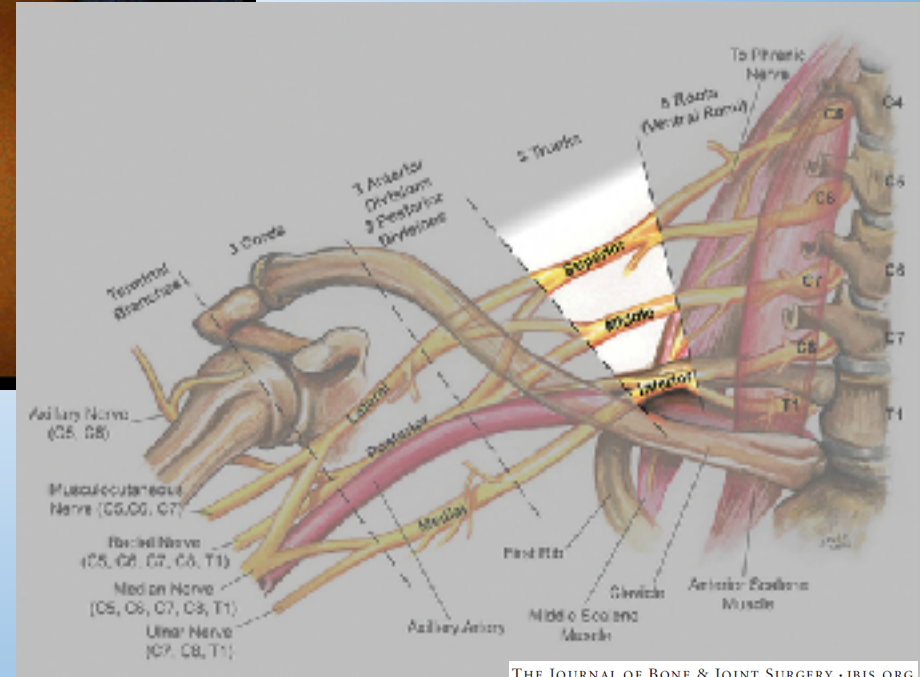
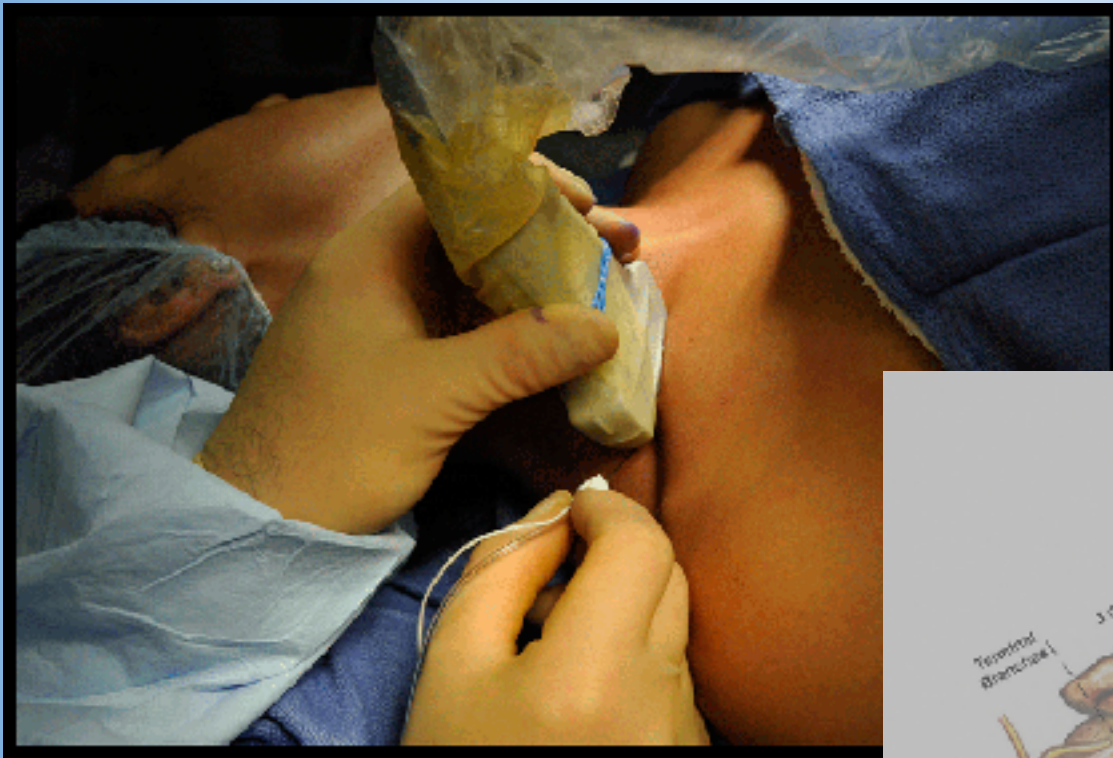


BRACHIAL PLEXUS – SUPRACLAVICULAR

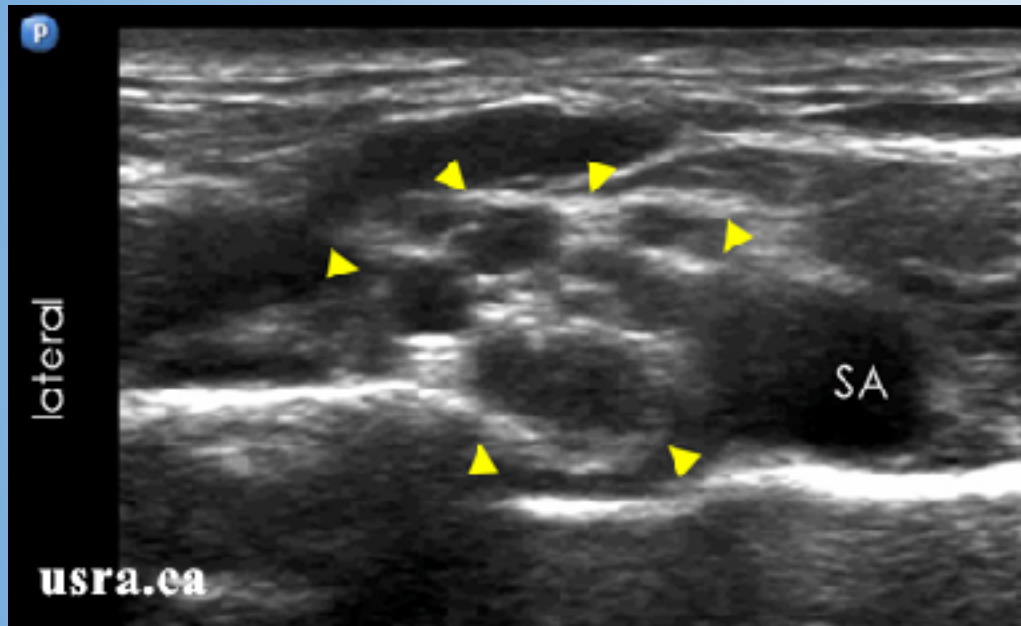
- Most versatile brachial plexus block.
Most common upper extremity block
 - The '*Spinal of the arm*'
- Generally for surgery ***below*** mid-humerus
 - I.e. not appropriate for shoulder surgery
- Rapid onset, dense block



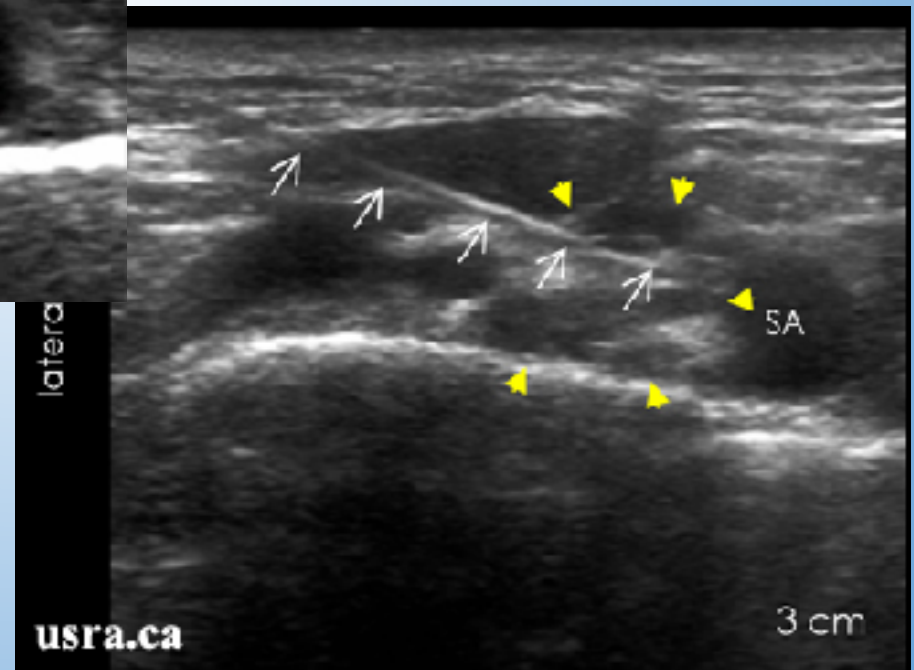
BRACHIAL PLEXUS – SUPRACLAVICULAR



BRACHIAL PLEXUS – SUPRACLAVICULAR

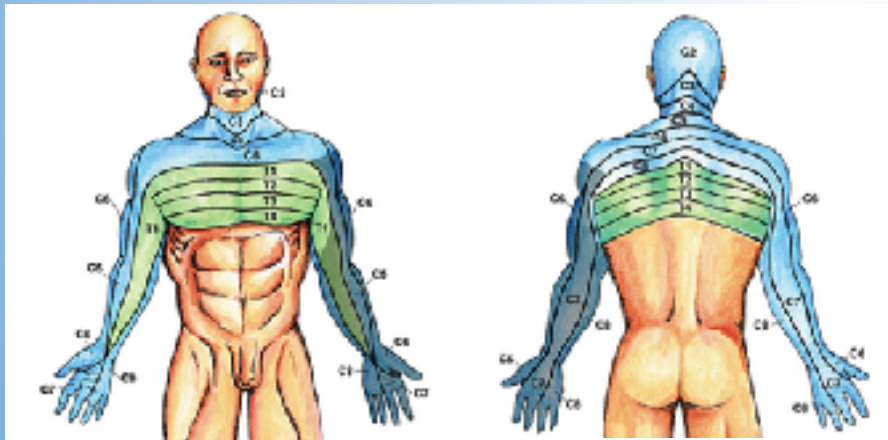


“In plane” lateral to medial approach
to *supraclavicular brachial plexus block*

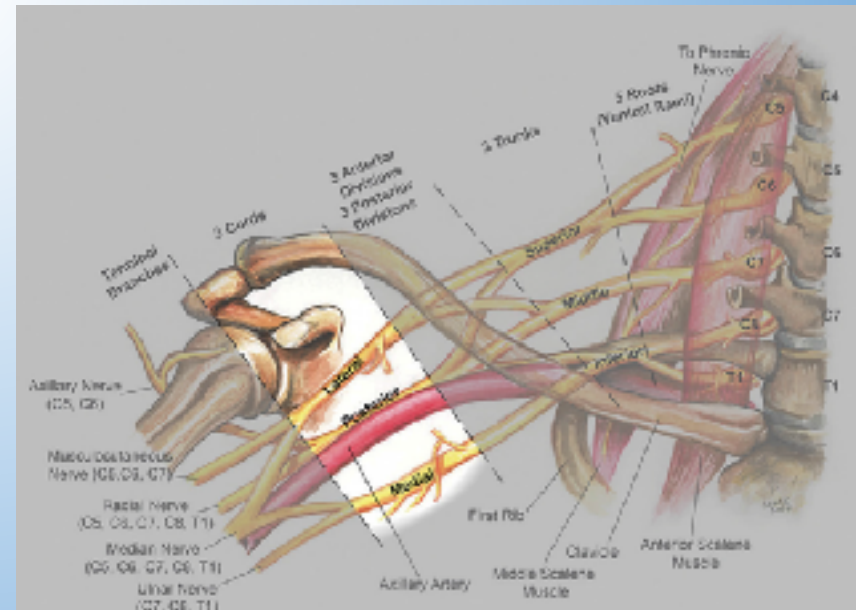


BRACHIAL PLEXUS – INFRACLAVICULAR

- Similar uses as supraclavicular block
 - NOT suitable for upper arm / shoulder surgery
 - Most commonly used for ***hand / wrist surgery***
- Approach to the brachial plexus is below the clavicle as the nerve bundle comes together with the axillary artery



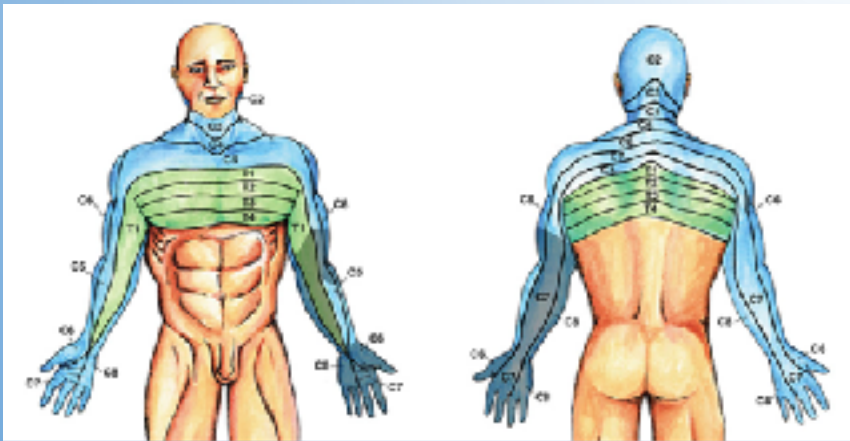
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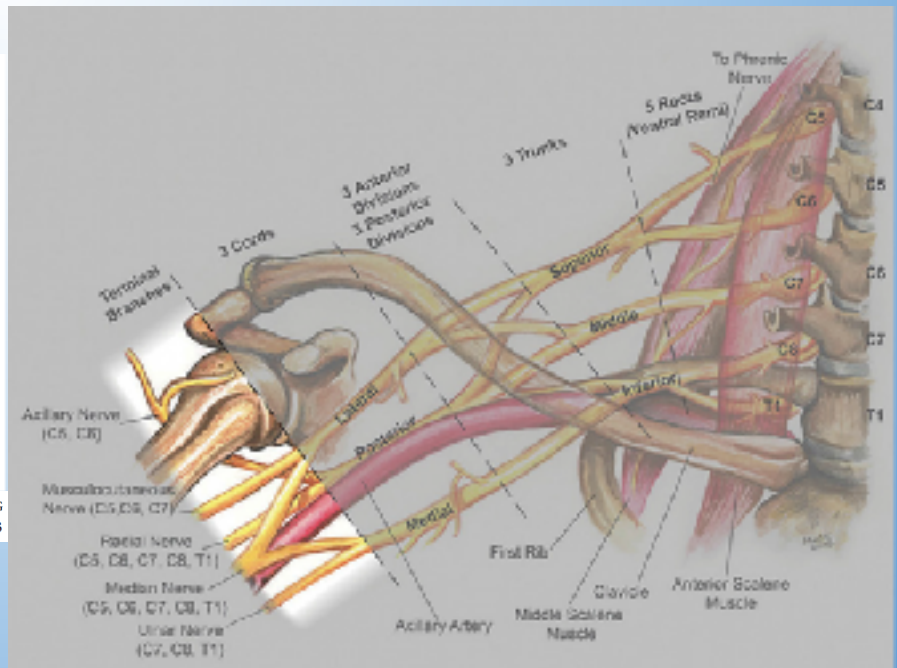


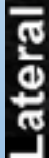
BRACHIAL PLEXUS – AXILLARY

- Block of the **distal nerve branches**
- Higher incidence of 'patchy' blocks or unblocked areas
 - Due to the fact that branches of plexus are starting to separate this distal from cervical roots
- ***Musculocutaneous*** nerve commonly missed
 - Anterolateral forearm / wrist



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BRACHIAL PLEXUS BLOCKS: POTENTIAL SIDE EFFECT AND COMPLICATIONS

- **Horner's Syndrome**
 - Interscalene > Supraclavicular > Infraclav
- **Symtoms:** Ptosis, Miosis, Anhydrosis
- **Cause:** Local anesthetic spread to the sympathetic chain that innervates the eyes and face
- **Treatment:** Self limiting once LA wears off

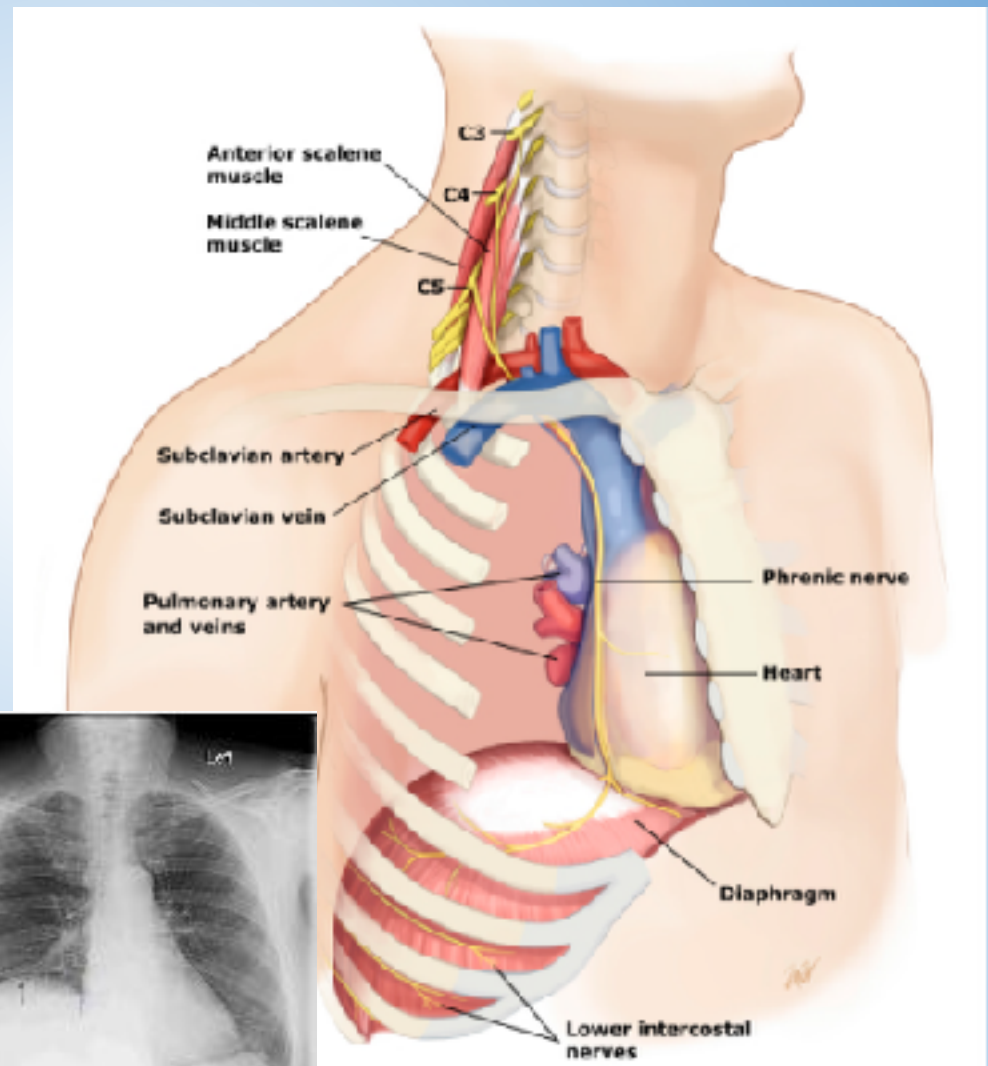


BRACHIAL PLEXUS BLOCKS: POTENTIAL SIDE EFFECT AND COMPLICATIONS

Phrenic Nerve Palsy

Common with interscalene and supraclavicular blocks

- **Symptoms**: Dyspnea or low Oxygen saturation
- **Cause**: Local anesthetic spread to the phrenic nerve.
- **Treatment**: Supplemental Oxygen
- **Sitting Position**
 - Will improve once LA wears off
 - Must ensure that dyspnea is **not caused by a more serious etiology**
 - **R/O pneumothorax**



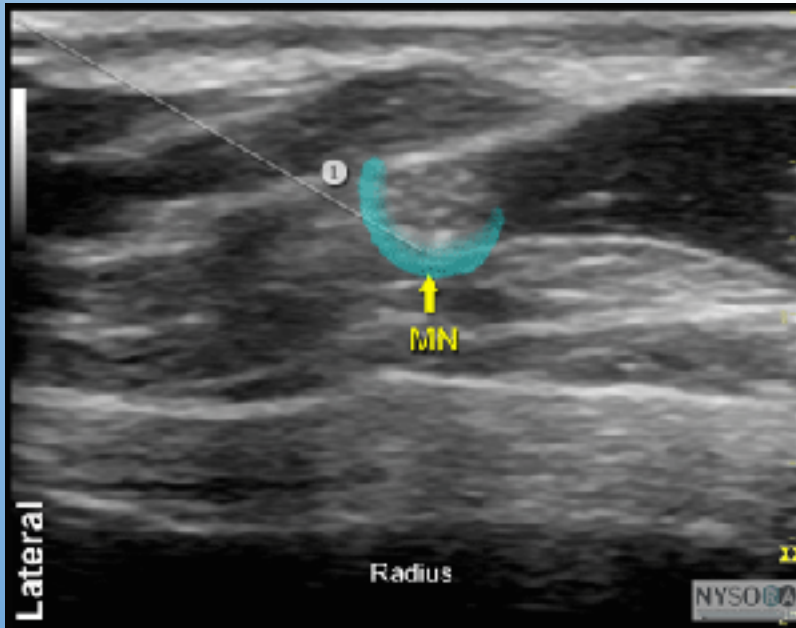
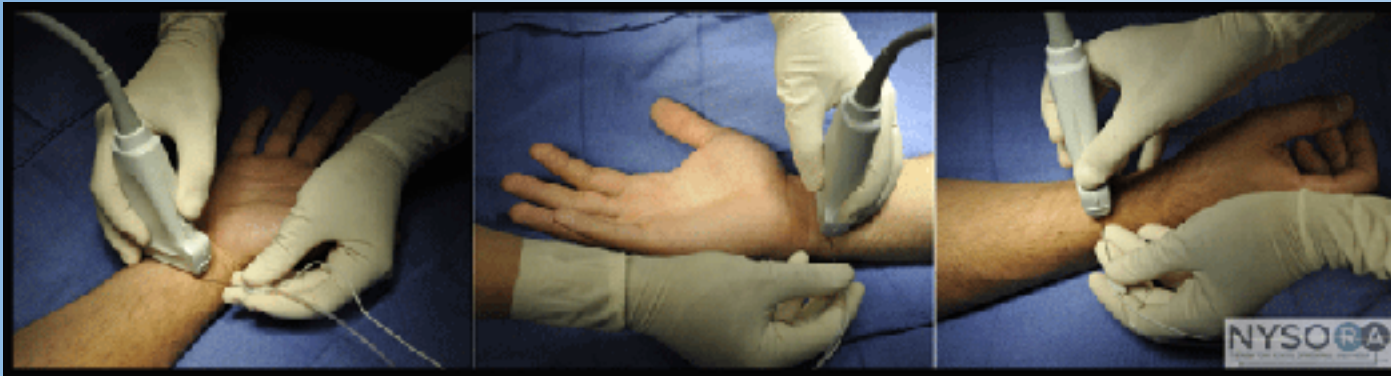
BRACHIAL PLEXUS BLOCKS: POTENTIAL SIDE EFFECT AND COMPLICATIONS

Secondary Injury to the Arm

- The majority of the arm is anesthetized for several hours.
- Predisposes it to injury and burns
- Require diligent protection of the arm!
- Wear the provided arm sling
- Avoid boiling liquids

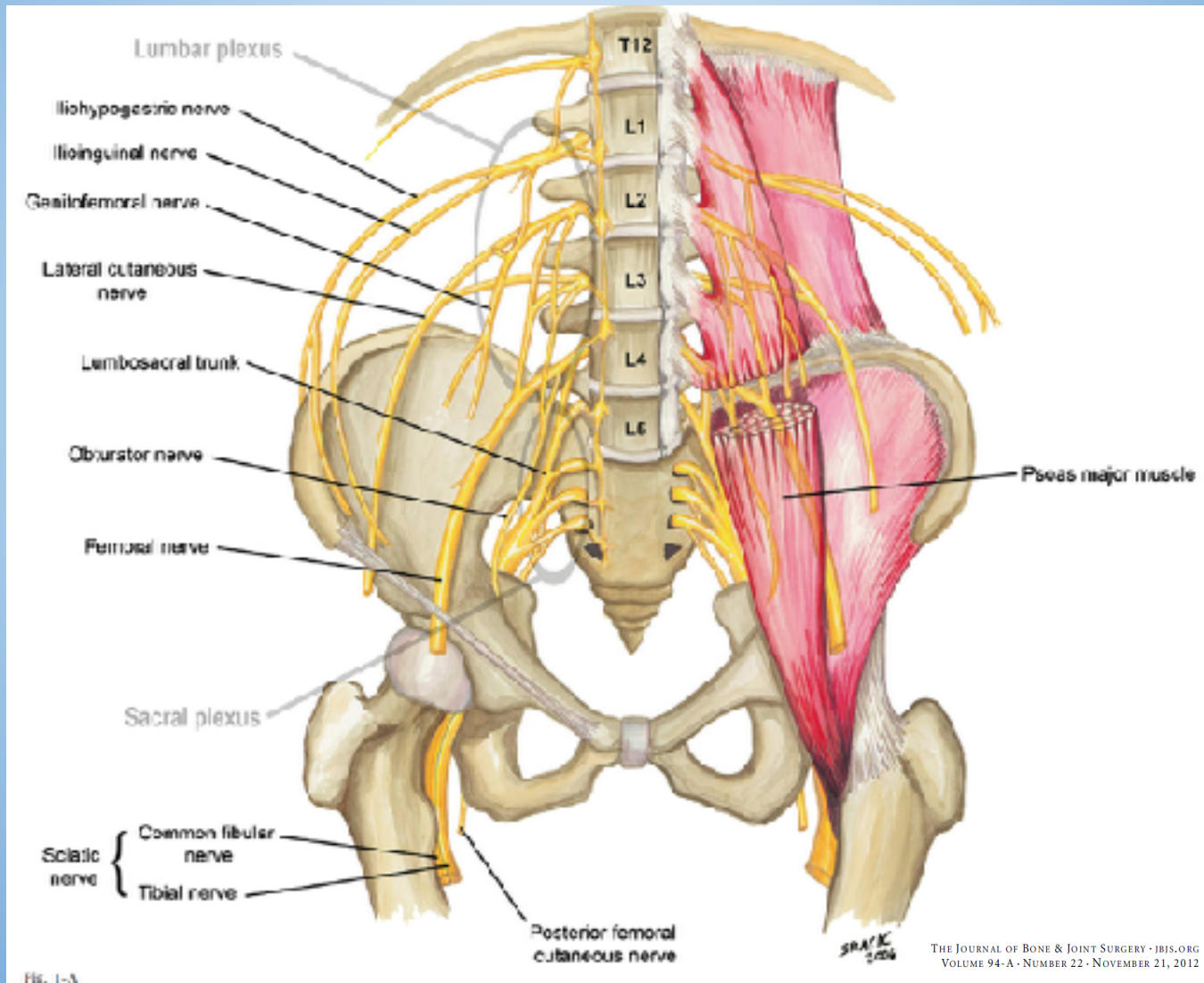


PERIPHERAL NERVE BLOCKS



- The peripheral nerves to the hand or ankle can be blocked distally.
- This is primarily done for very **small surgical procedures** or as part of a **rescue block**

LOWER EXTREMITY – LUMBAR PLEXUS



LOWER EXTREMITY – SACRAL PLEXUS

Sciatic nerve is the primary nerve arising from the sacral plexus

- Largest nerve in the body
- Derived from nerve roots of **L4-S3**
- Provides the bulk of sensation from the leg

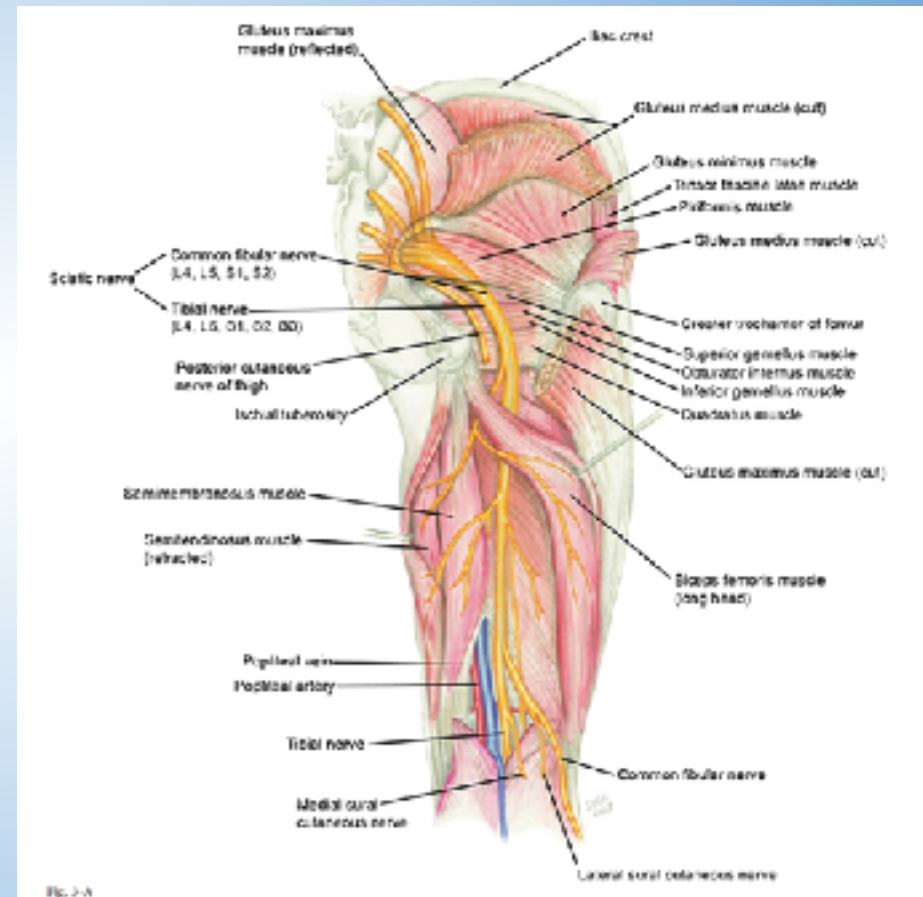
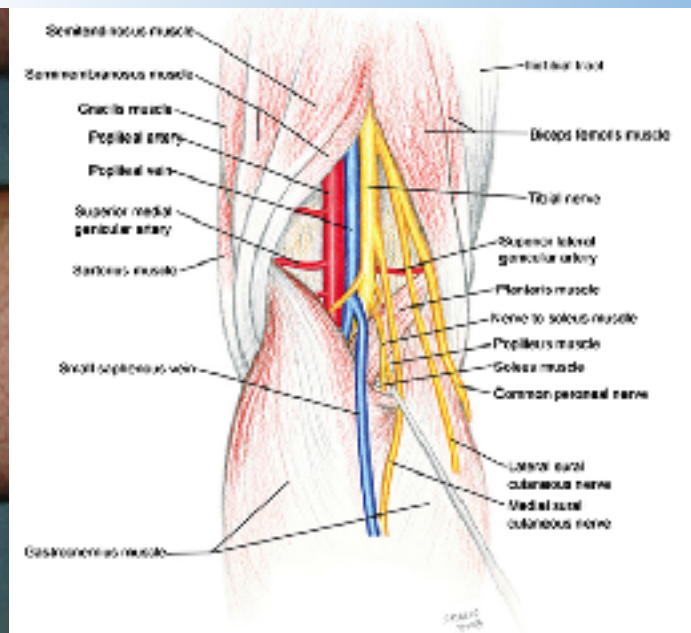
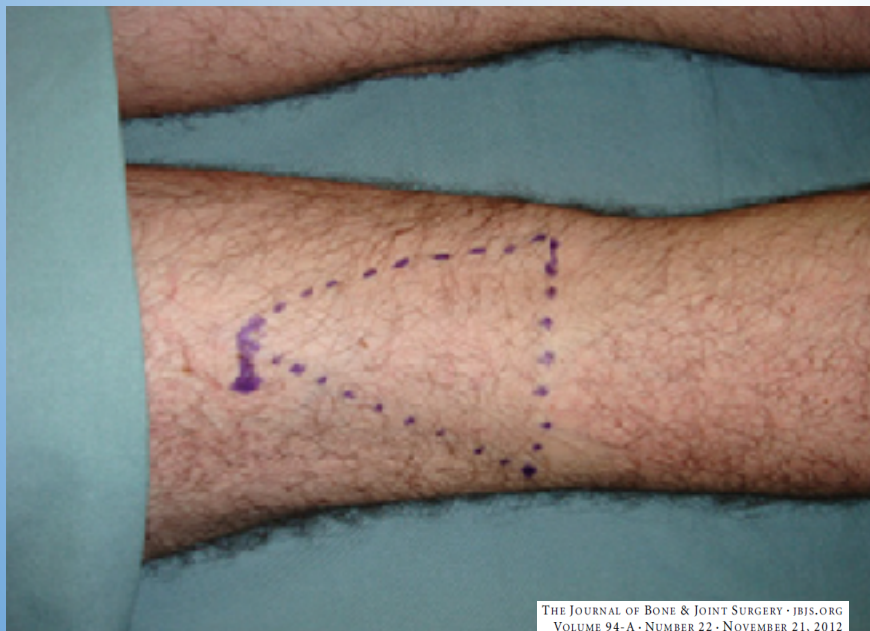


Fig. 3-4

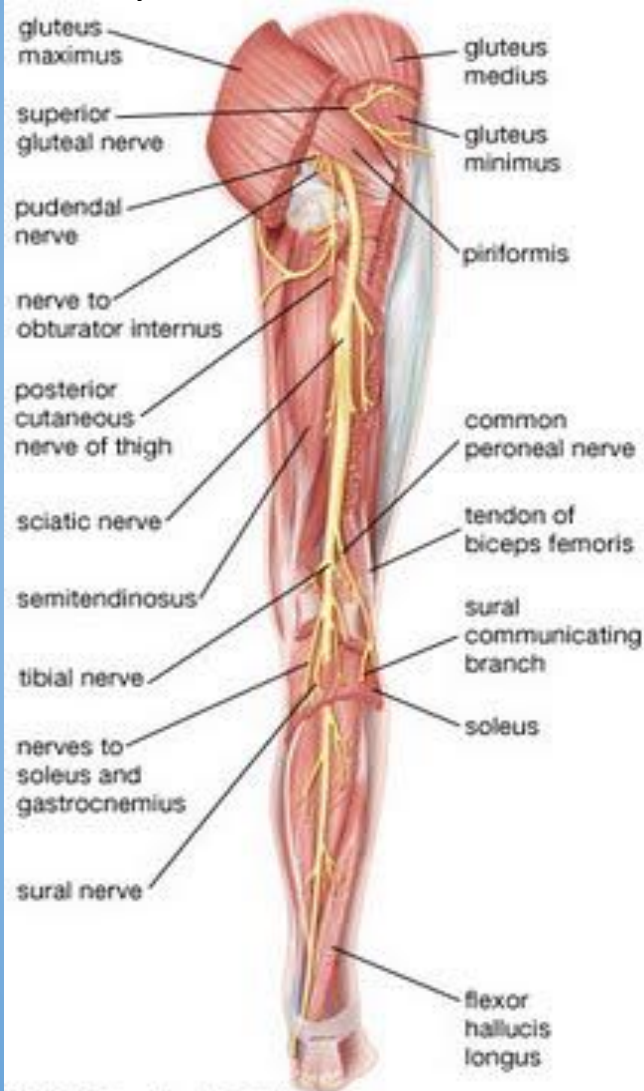
LOWER EXTREMITY – SCIATIC NERVE

- ***Sciatic nerve block*** is useful for:
 - Surgery of foot, ankle and lower leg
 - Adjunct to femoral block in knee surgery
 - Combined with femoral, can achieve almost total anesthesia of lower extremity



LOWER EXTREMITY – SCIATIC NERVE

Anatomy and Dermatomes



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Sciatic Nerve and Posterior Cutaneous Nerve of Thigh



Posterior cutaneous nerve of thigh

Common fibular (peroneal) nerve via lateral sural cutaneous nerve (lateral cutaneous nerve)

Medial sural cutaneous nerve (lateral cutaneous nerve)

Superficial fibular (peroneal) nerve (lateral cutaneous nerve)

Deep fibular (peroneal) nerve

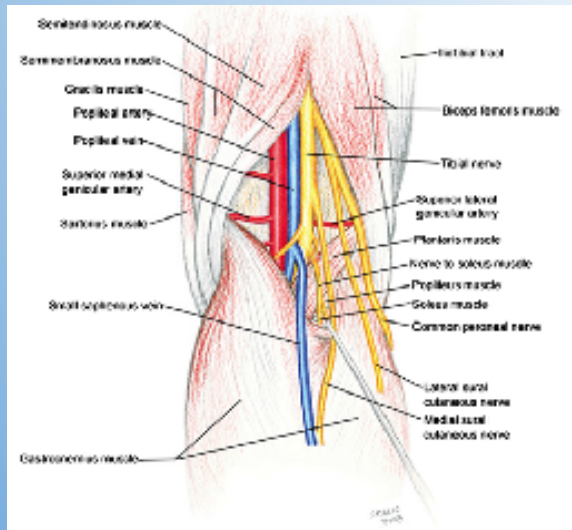
Tibial nerve via medial calcaneal branch (lateral cutaneous nerve)

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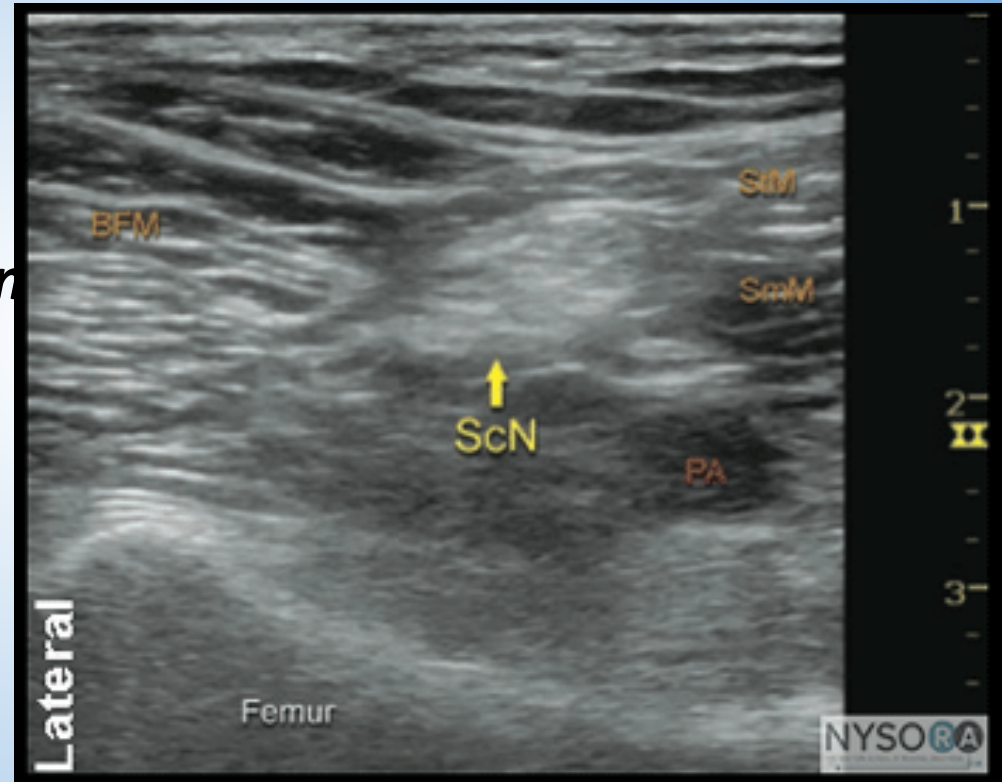
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SCIATIC / POPLITEAL NERVE BLOCK

- In the popliteal fossa, the sciatic divides into ***peroneal & tibial*** branches
- Goal is to find the ***bifurcation*** and block proximal to that

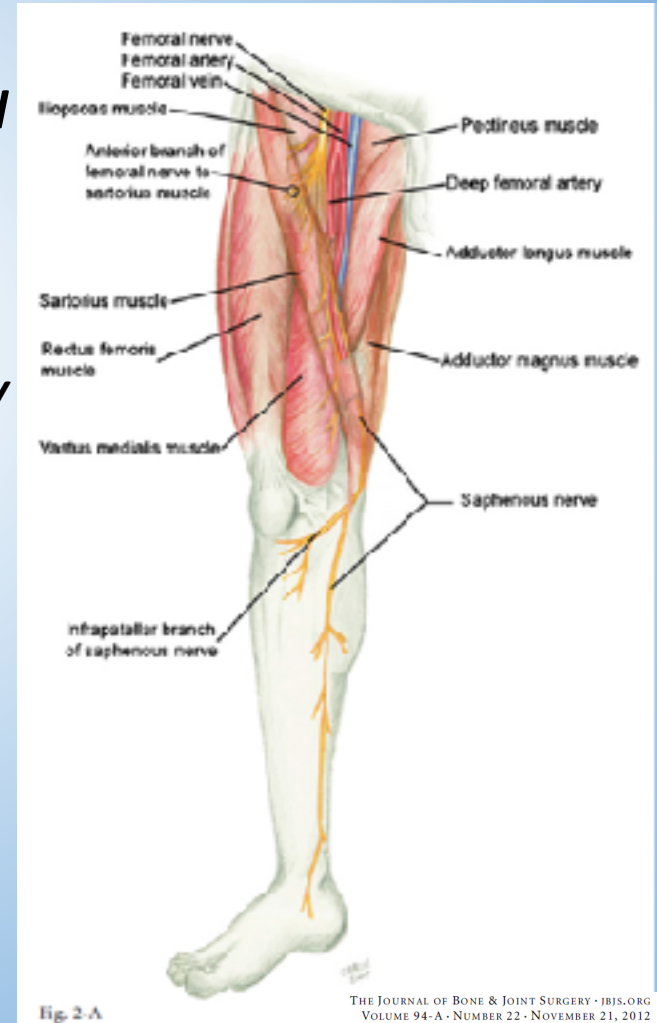


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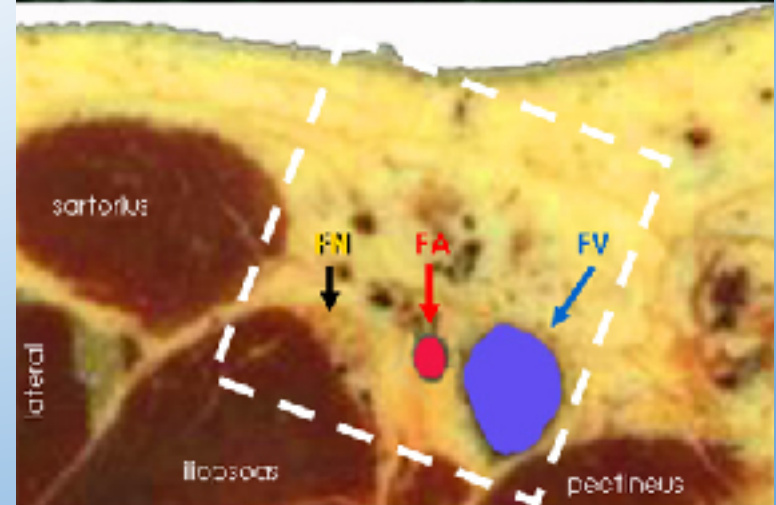
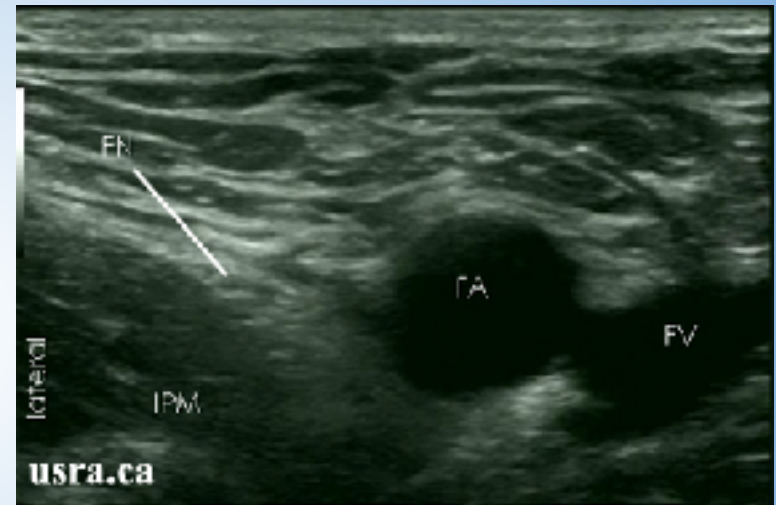


LOWER EXTREMITY – FEMORAL NERVE

- Easy and useful block for ***pain management of the knee, shin and medial ankle***
- Seldom adequate for surgical anesthesia
- Mainly used for orthopedics procedures
 - Vast majority are ***Knee replacement and Foot/Ankle surgery***
 - ***Causes Motor Weakness of the Quads –not ideal for post-op physiotherapy***
- Provides good analgesia of anterior thigh, femur, and anterior knee
- Combined with ***sciatic block***, you can achieve very good lower limb analgesia



LOWER EXTREMITY – FEMORAL NERVE



Ultrasound guided femoral nerve block

LOWER EXTREMITY – SAPHENOUS NERVE BLOCK

- The goal is to block this **sensory nerve** after it has split from the primary femoral nerve
- Ideally, no significant leg weakness will result after the block
- Great for knee replacement surgery where mobility is encouraged postoperatively

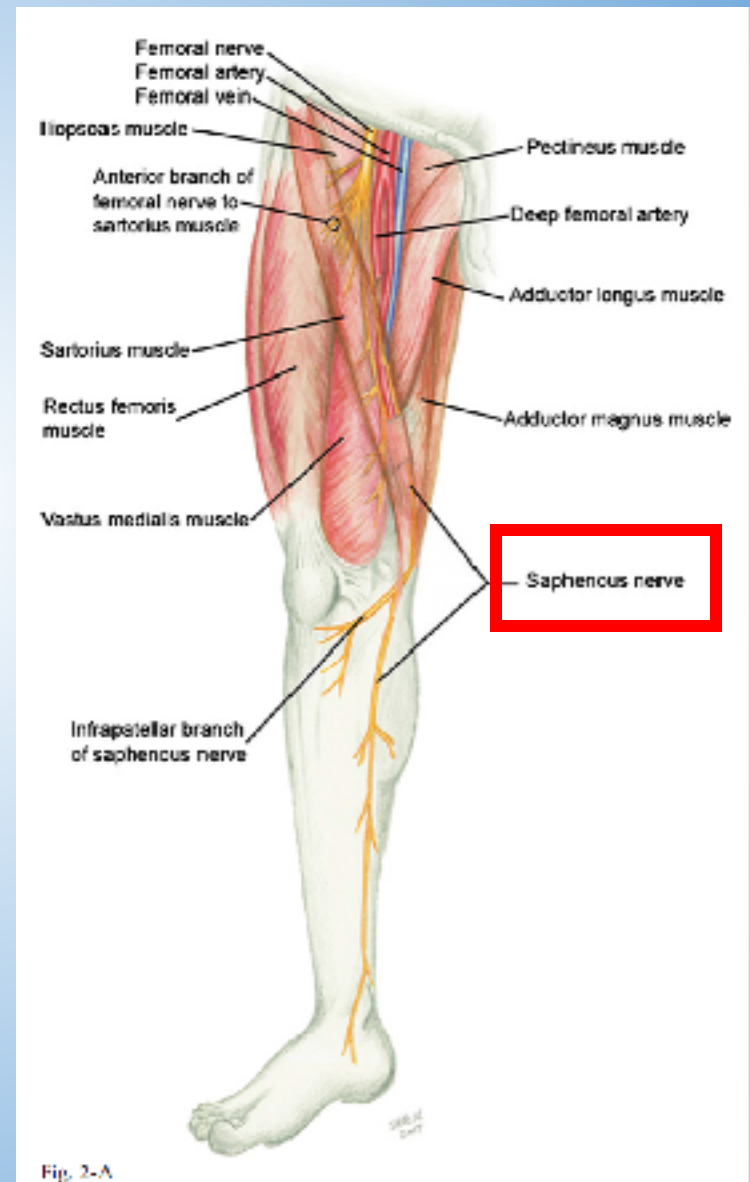
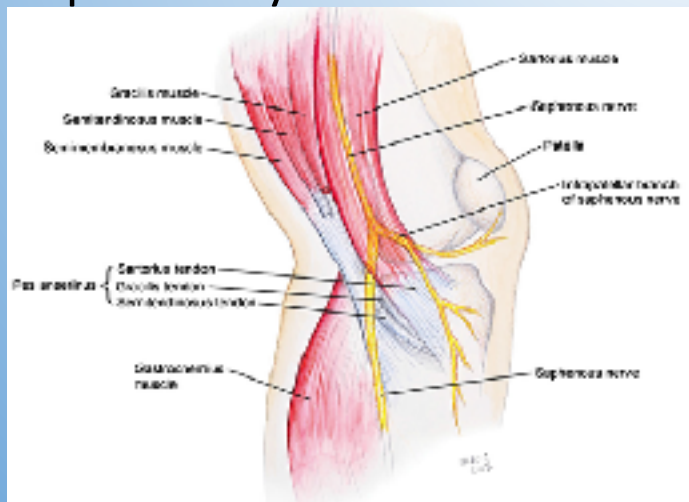
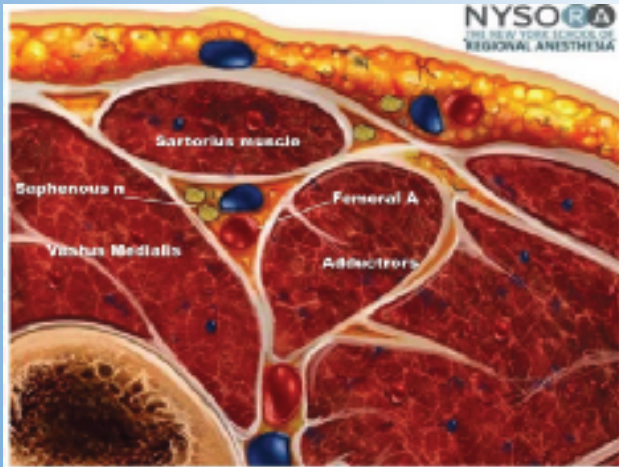


Fig. 2-A

SAPHENOUS NERVE BLOCK



COMBINATION: SAPHENOUS AND SCIATIC BLOCK

- Used for lower extremity surgery
- Provides **complete analgesia to leg below knee**
- Foot and ankle will require boot or other protective device.
 - Patient will require crutches or wheel chair

PERIPHERAL NERVE BLOCK DURATION

- The duration of the block is dependent on the type of local anesthetic used
 - Lidocaine vs Ropivacaine/Bupivacaine
- New adjuvant medications are being added to the local anesthetic to increase the duration of analgesia
- This is an area of ongoing research
- Lysosomal Lidocaine preparations are being developed that can provide **>48hr blocks**

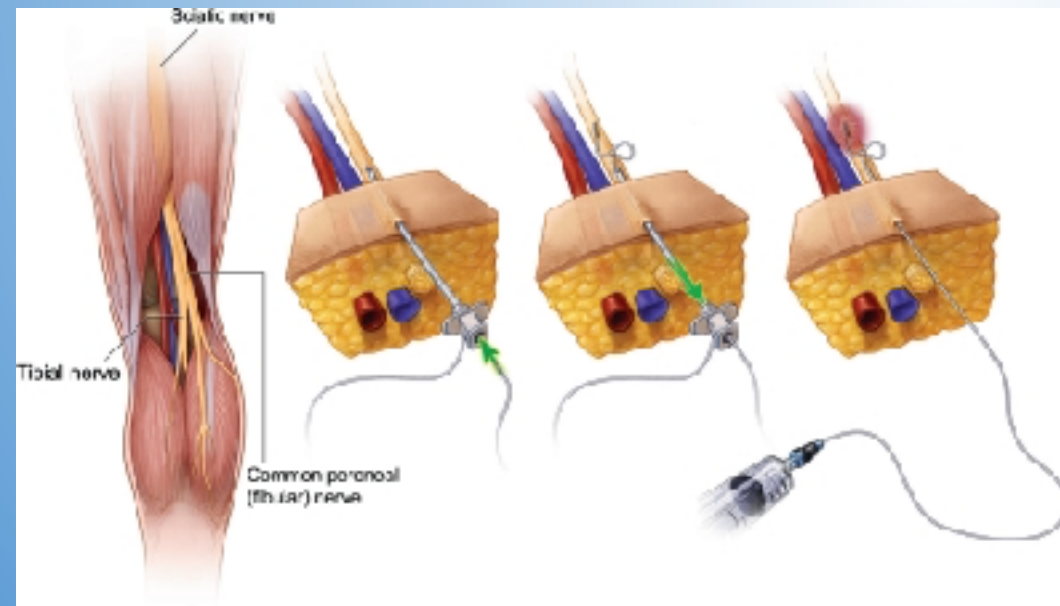
Rough Estimate (Ropivacaine):

- Upper Extremity
 - 12-24hrs
- Lower Extremity
 - 24-30hrs



PERINEURAL CATHETERS

- Essentially all peripheral nerve blocks can be made '**continuous**' with a perineural catheter
- Practically speaking, the following are most common / useful:
 - **Sciatic** (Extensive foot / ankle surgery)
 - **Infracavicular** (Extensive hand / wrist surgery)
 - **Interscalene** (Extensive shoulder surgery)



PERINEURAL CATHETERS

- Common **local anesthetic** infusions for perineural catheters include:
 - Bupivacaine 0.125% (6-10mL/hr)
 - Ropivacaine 0.1 - 0.2% (6-10mL/h)
- The goal is excellent ***analgesia***, with preserved motor function - these solutions are generally dilute enough that profound motor block is avoided
- Infusion pumps are available in most hospitals
- Patient controlled infusion pumps (with bolus options) are also available
 - Similar to opioid PCA



PERINEURAL CATHETERS – AT HOME

- **Home** perineural catheters can easily be used by most patients!
- Disposable, single-use pumps are available, cost-effective, and safe
- Can significantly improve pain control allowing day-surgery booking for cases that would otherwise require admission for pain control
- **Patient removes catheter at home** when local anesthetic is finished, if block not longer effective, or if LA side effects are obvious



HOME PERINEURAL CATHETERS



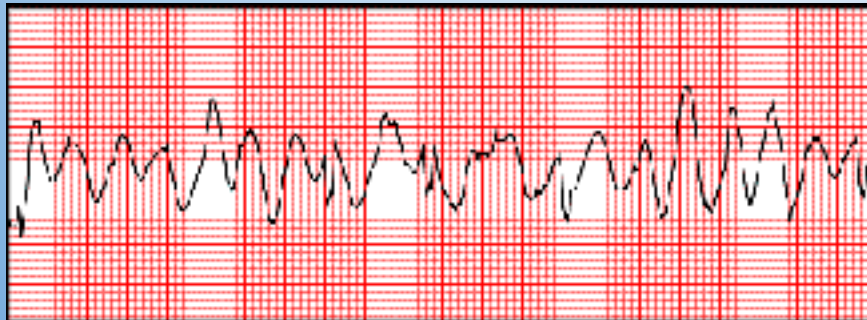
LOCAL ANESTHETIC - TOXICITY!

- Max doses:
 - Lidocaine (5-7 mg/kg)
 - Bupivacaine / Ropivacaine (2 - 3mg/kg)
- ***A simple rule-of-thumb calculation:***
 - 1mL/kg of 0.25% solution = **2.5mg/kg**
 - 0.5mL/kg of 0.5% solution = **2.5mg/kg**
 - These are the max volumes you should give either as a ***single bolus dose***, or over ***4 hours as an infusion***

LOCAL ANESTHETICS - TOXICITY!

- Signs / Symptoms of Toxicity

- Peri-oral numbness / Dizziness / Tinnitus
- Blurred vision / Disorientation / Drowsiness
- Muscle Twitching / Convulsions / Seizure
- Coma / Respiratory Depression
- ***Cardiovascular Collapse!***



LOCAL ANESTHETICS - TOXICITY!

Initial management:

- Declare emergency, call for help, call code blue, O2, IV access
- ***STOP any ongoing LA infusions!*** (i.e. epidural)
- Bring crash cart and airway box to bedside, attach defibrillator leads and paddles
- ACLS

Evidence supports **20% Intralipid** as a rescue therapy in CV collapse from LA toxicity





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REGIONAL ANESTHESIA AND PAIN MEDICINE

Checklist for Treatment of Local Anesthetic Systemic Toxicity

The Pharmacologic Treatment of Local Anesthetic Systemic Toxicity (LAST) Is Different from Other Cardiac Arrest Scenarios

- ☐ **Get Help**
- ☐ **Initial Focus**
 - ☐ **Airway management:** ventilate with 100% oxygen
 - ☐ **Seizure suppression:** benzodiazepines are preferred; **AVOID propofol** in patients having signs of cardiovascular instability
 - ☐ **Alert** the nearest facility having **cardiopulmonary bypass** capability
- ☐ **Management of Cardiac Arrhythmias**
 - ☐ **Basic and Advanced Cardiac Life Support (ACLS)** will require adjustment of medications and perhaps prolonged effort
 - ☐ **AVOID** vasopressin, calcium channel blockers, beta blockers, or local anesthetic
 - ☐ **REDUCE** individual epinephrine doses to **<1 mcg/kg**
- ☐ **Lipid Emulsion (20%) Therapy** (values in parenthesis are for 70kg patient)
 - ☐ **Bolus 1.5 mL/kg** (lean body mass) intravenously over 1 minute (~100mL)
 - ☐ **Continuous infusion 0.25 mL/kg/min** (~18 mL/min; adjust by roller clamp)
 - ☐ Repeat bolus once or twice for persistent cardiovascular collapse
 - ☐ Double the infusion rate to 0.5 mL/kg/min if blood pressure remains low
 - ☐ **Continue infusion** for at least 10 minutes after attaining circulatory stability
 - ☐ Recommended upper limit: Approximately 10 mL/kg lipid emulsion over the first 30 minutes
- ☐ **Post LAST events at** www.lipidrescue.org and report use of lipid to www.lipidregistry.org

PERIOPERATIVE MANAGEMENT AND DISCHARGE CRITERIA

Single shot peripheral nerve blocks

- D/C criteria as per your local hospital
- Ensure the blocked limb is safe
- Discuss a post-op pain control plan
- Screen for Sx/Sx of complications from the nerve block
 - LAST
 - Dyspnea
 - Horner's Syndrome
 - Pneumothorax

PERIOPERATIVE MANAGEMENT AND DISCHARGE CRITERIA CONTINUED...

- **The block WILL WEAR OFF**
 - High incidence of **pain crisis** after block resolves. Patients must be instructed in adequate pain control options (PO meds)
 - Many patients require Emergency visits for the pain crisis
 - We instruct our patients to **begin taking the PO opioids PRIOR to the block wearing off**
 - Ask the block physician when that will be.



PERIOPERATIVE MANAGEMENT AND DISCHARGE CRITERIA

Indwelling perineural catheters

- The attending anesthesiologist will ensure that appropriate instructions have been given to the patient
- Admitted patients will be seen daily by the **acute pain service**
- Home infusion pump will be set up and programmed by attending anesthesiologist
- Patients receive daily phone calls to review the effectiveness of the block and to rule out any signs of local anesthetic toxicity

SUMMARY

- Regional anesthesia can be used for increased patient comfort and/or to avoid a general anesthetic in specific patient groups
- Regional anesthesia is safe and effective
- There are upper and lower extremity nerves that can be blocked, depending on the specific surgery
- Complications from the nerve blocks are rare but must be recognized early
- Patients must be given appropriate teaching regarding effective pain management strategies and avoiding secondary injury to blocked limbs prior to discharge

THE END!

- References:

- nysora.com (NY School of Regional Anesthesia)
- usra.ca (Ultrasound Guided Regional Anesthesia)
- neuraxiom.com
- netterimages.com
- The Journal of Bone and Joint Surgery 2012

- Questions?

