

Brachial Plexus Approach

Transducer Placement



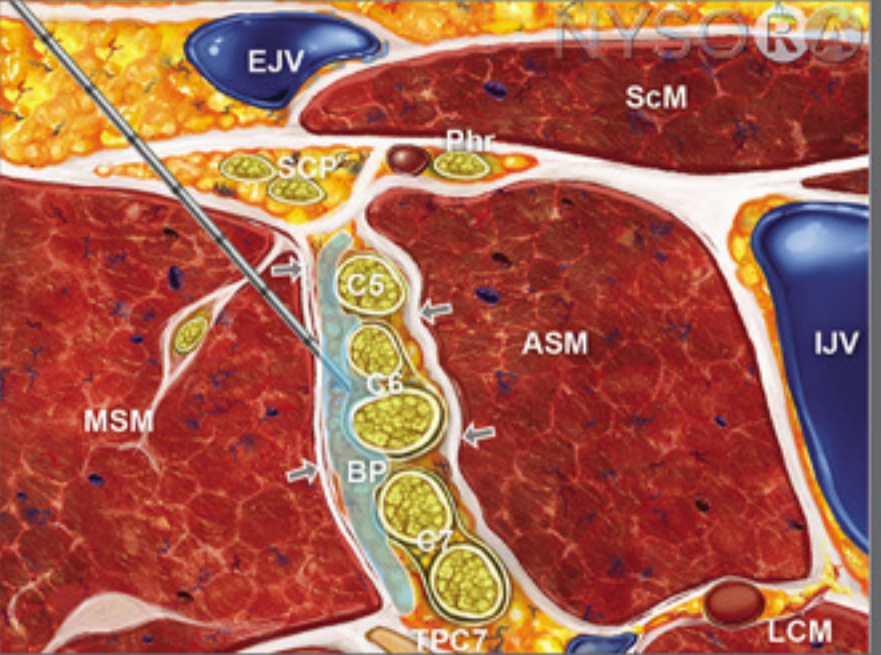
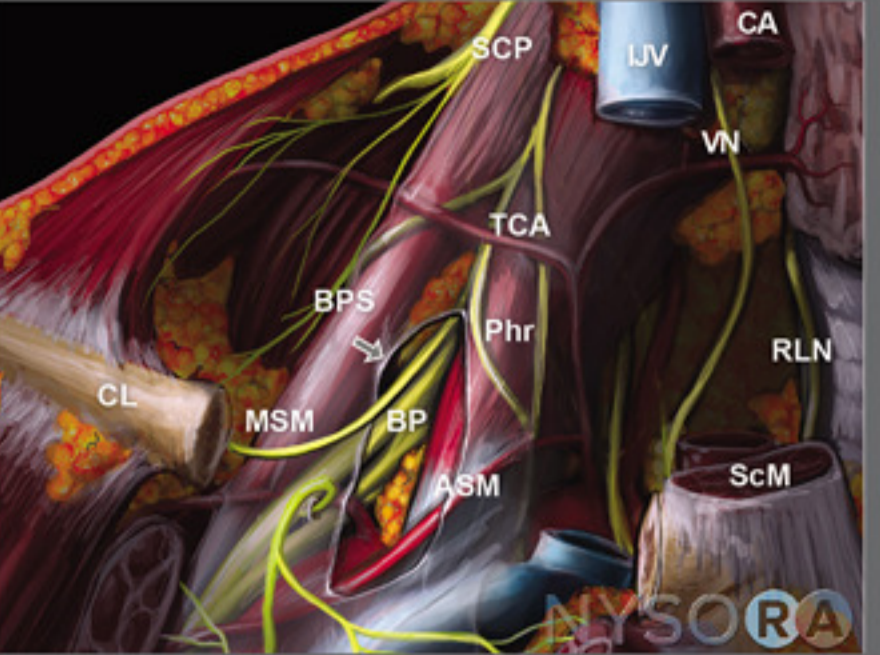
Ultrasound Image

Reverse Ultrasound Anatomy™

Anatomy

Interscalene

Indications: Anesthesia and analgesia for surgery on shoulder, distal clavicle and proximal humerus.
Patient position: Supine or semi-sitting, head facing to contralateral side.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
Common EMR obtained: Deltoid response.
LA: 10-15 ml.

Initial transducer placement: Over external jugular vein, approximately 3 cm above clavicle. Alternatively, start at supraclavicular fossa and scan proximally toward the plexus.
Initial depth setting: 3 cm.

Landmarks: ASM and MSM, 2 or 3 round hypoechoic structures (roots or trunks)
Ideal view: C5 C6 C7 nerve roots.

Technique: Needle insertion in plane (most common), lateral to medial; alternatively out of plane.
Ideal spread of LA: Within the interscalene space inside the sheath.
Number of injections: Based on spread; typically 1-2. BORE


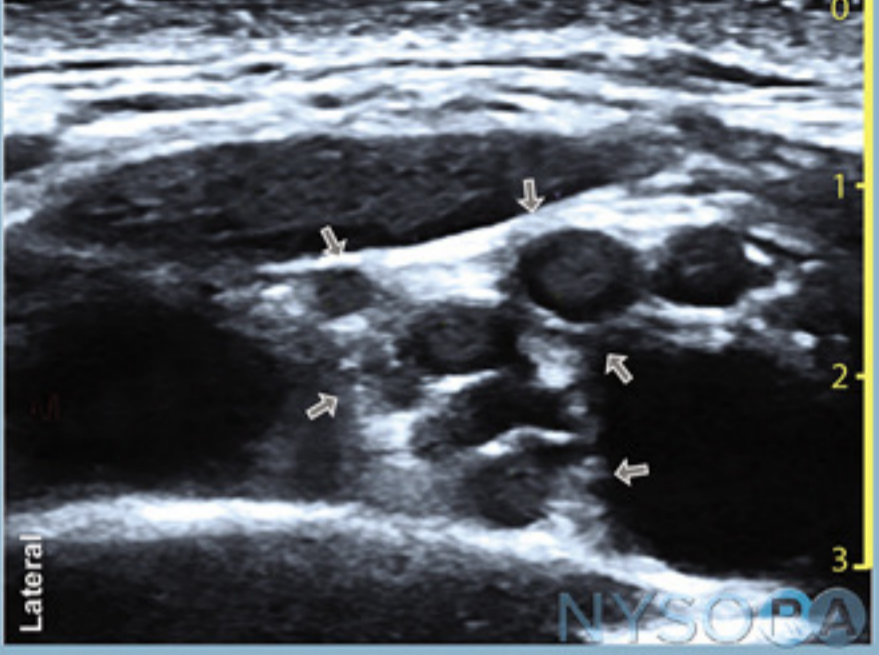
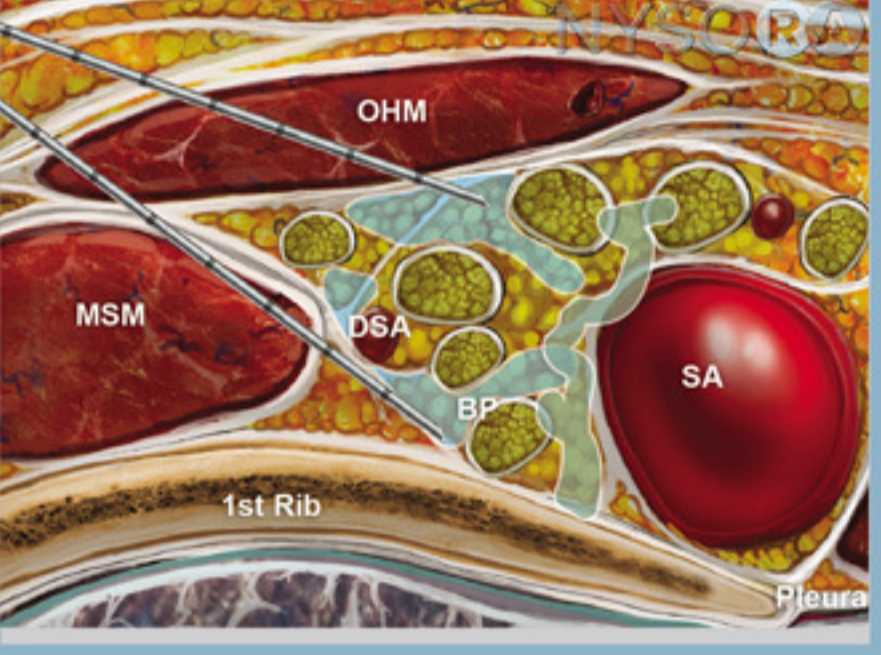
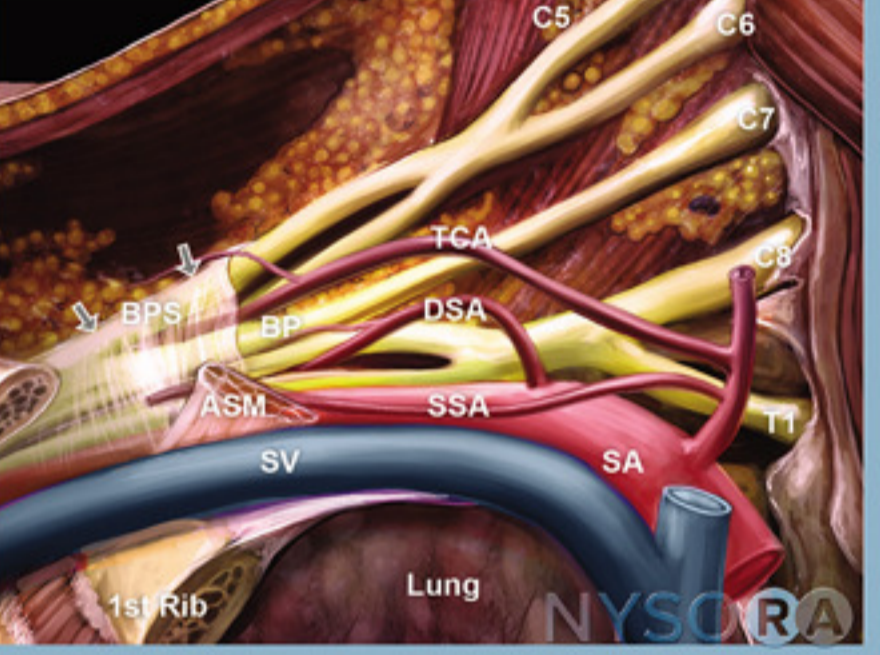
Tips: Use PD to detect and avoid blood vessels on the needle path. Reconsider in patients with history of significant respiratory disease. Use short acting LA through catheter in such patients; extend block through catheter if initial block tolerated well.

ABBREVIATIONS

ASM Anterior Scalene Muscle	LA Local Anesthetic
BP Brachial Plexus	MSM Middle Scalene Muscle
BPS Brachial Plexus Sheath	PD Power Doppler
BORE Bolus Observe Reposition	Phr Phrenic nerve
CA Carotid Artery	RLN Recurrent Laryngeal Nerve
EMR Evoked Motor Response	SCM Sternocleidomastoid Muscle
EJV External Jugular Vein	SCP Superficial Cervical Plexus
IJV Internal Jugular Vein	TPC7 Transverse Process C7
LCM Longus Coli Muscle	VA Vertebral Artery
	VN Vagus nerve

Supraclavicular

Indications: Anesthesia and analgesia for surgery on humerus, elbow, forearm and hand.
Patient position: Supine or semi-sitting, head facing to contralateral side.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
Common EMR obtained: Forearm, hand response.
LA: 20-25 ml.

Initial transducer placement: In supraclavicular fossa, lateral to clavicular head of SCM, tilted caudally.
Initial depth setting: 3 cm.

Landmarks: Subclavian artery, brachial plexus sheath (arrows), first rib and pleura.
Ideal view: Brachial plexus and subclavian artery above first rib (pleura should be visualized).

Technique: Needle insertion in plane, lateral to medial. Assess the depth of the BP, insert needle with shallow angle and adjust accordingly.
Ideal spread of LA: Within BP fascial sheath lateral to the SA but superficial to the first rib.
Number of injections: 2-3. BORE

Tips: Visualize the pleura (if unable, consider other technique). Use PD to detect and avoid TCA, DSA. Consider an alternative technique when large vessels are present within the sheath. Injection of LA should fill BPS. Reduce transducer pressure before injection of LA to facilitate spread.

ABBREVIATIONS

BP Brachial Plexus	MSM Middle Scalene Muscle
BPS Brachial Plexus Sheath	OHM Omohyoid Muscle
BORE Bolus Observe Reposition	PD Power Doppler
CA Clavicle	SA Subclavian Artery
DSA Dorsal Scapular artery	SSA Suprascapular Artery
EMR Evoked Motor Response	SV Subclavian Vein
LA Local Anesthetic	TCA Transverse Cervical Artery

Infraclavicular

Indications: Anesthesia and analgesia for surgery on humerus, elbow, forearm and hand.
Patient position: Supine with arm abducted and flexed at elbow.
Transducer: Linear.
Needle: 22G, 8-10 cm short bevel.
Common EMR obtained: Forearm, Hand.
LA: 20-25 ml






Initial transducer placement: Parasagittal, below the clavicle, medial to coracoid process.
Initial depth setting: 5 cm.

Landmarks: Axillary artery and fascia of pectoralis minor muscle (arrows).
Ideal view: Axillary artery and vein below the fascia of pectoralis minor muscle, lateral, medial, posterior cords periarterially.

Technique: Needle insertion in plane, cephalad to caudad. Release transducer pressure before injection to detect AV and CV and decrease the risk of intravenous injection. Use PD to identify vascular structures.
Ideal spread of LA: periarterially (U-shaped).
Number of injections: 1-2. BORE



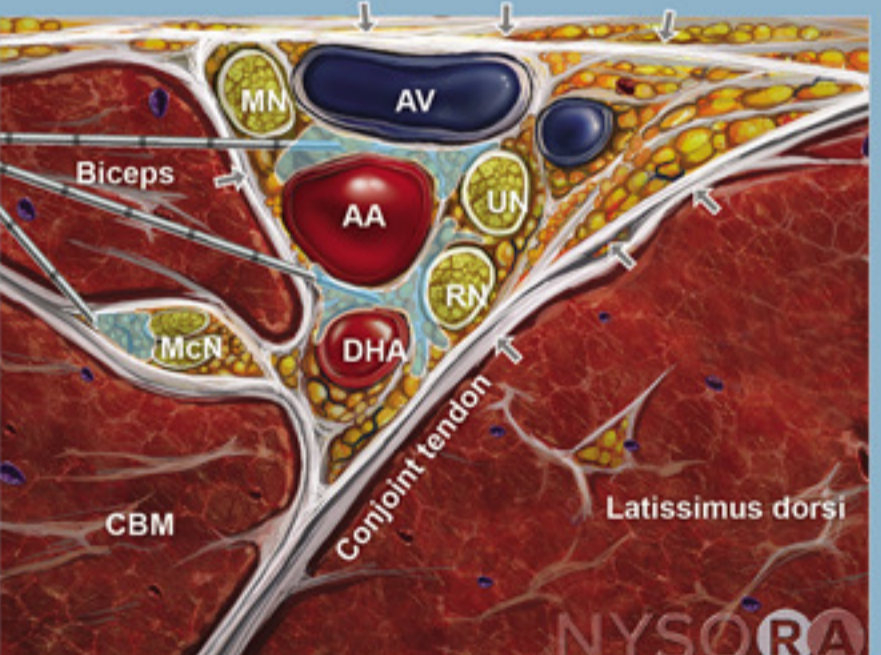
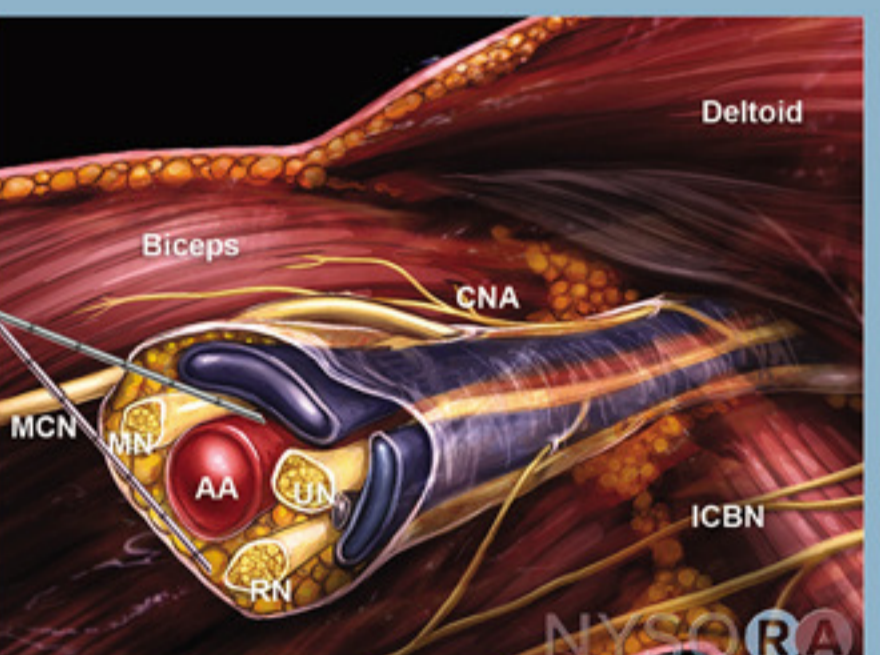
Tips: Ensure sufficient lateral placement of the transducer to avoid chest cavity. A single injection of LA is made where all cords are visible lateral to the artery, or posterior to the artery.

ABBREVIATIONS

AA Axillary Artery	MC Medial Cord
AV Axillary Vein	PC Posterior Cord
BORE Bolus Observe Reposition	PMaM Pectoralis Major Muscle
PD Power Doppler	PMIM Pectoralis Minor Muscle
CV Cephalic Vein	PN Pectoral Nerve
EMR Evoked Motor Response	SAM Serratus Anterior Muscle
LA Local Anesthetic	SsM Subscapular Muscle
LC Lateral Cord	
LPA Lateral Pectoral Artery	

Axillary

Indications: Anesthesia and analgesia for surgery on forearm and hand.
Patient Position: Supine with arm abducted and flexed at elbow.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
Common EMR obtained: Hand or fingers.
LA: 15-20 ml.

Initial transducer placement: Perpendicular to humerus in the axillary fossa, at intersection between pectoralis and biceps muscles.
Initial depth setting: 3 cm.

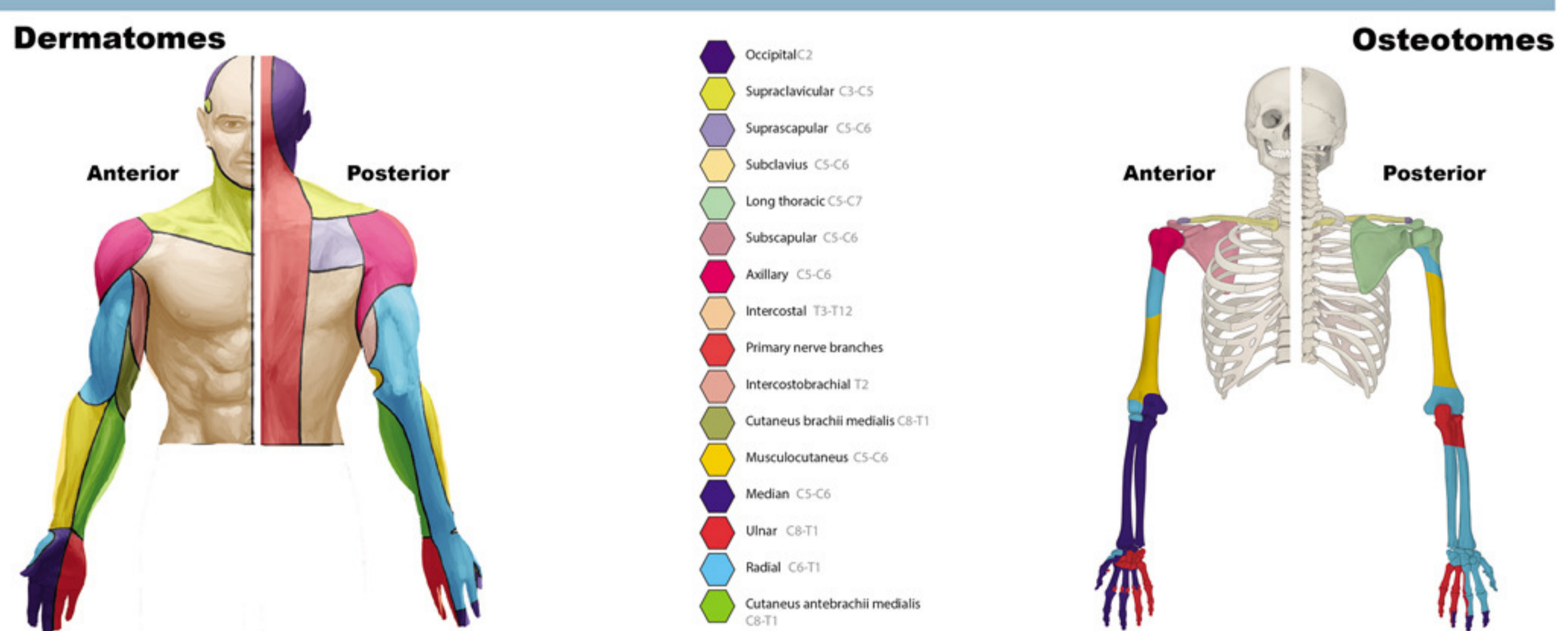
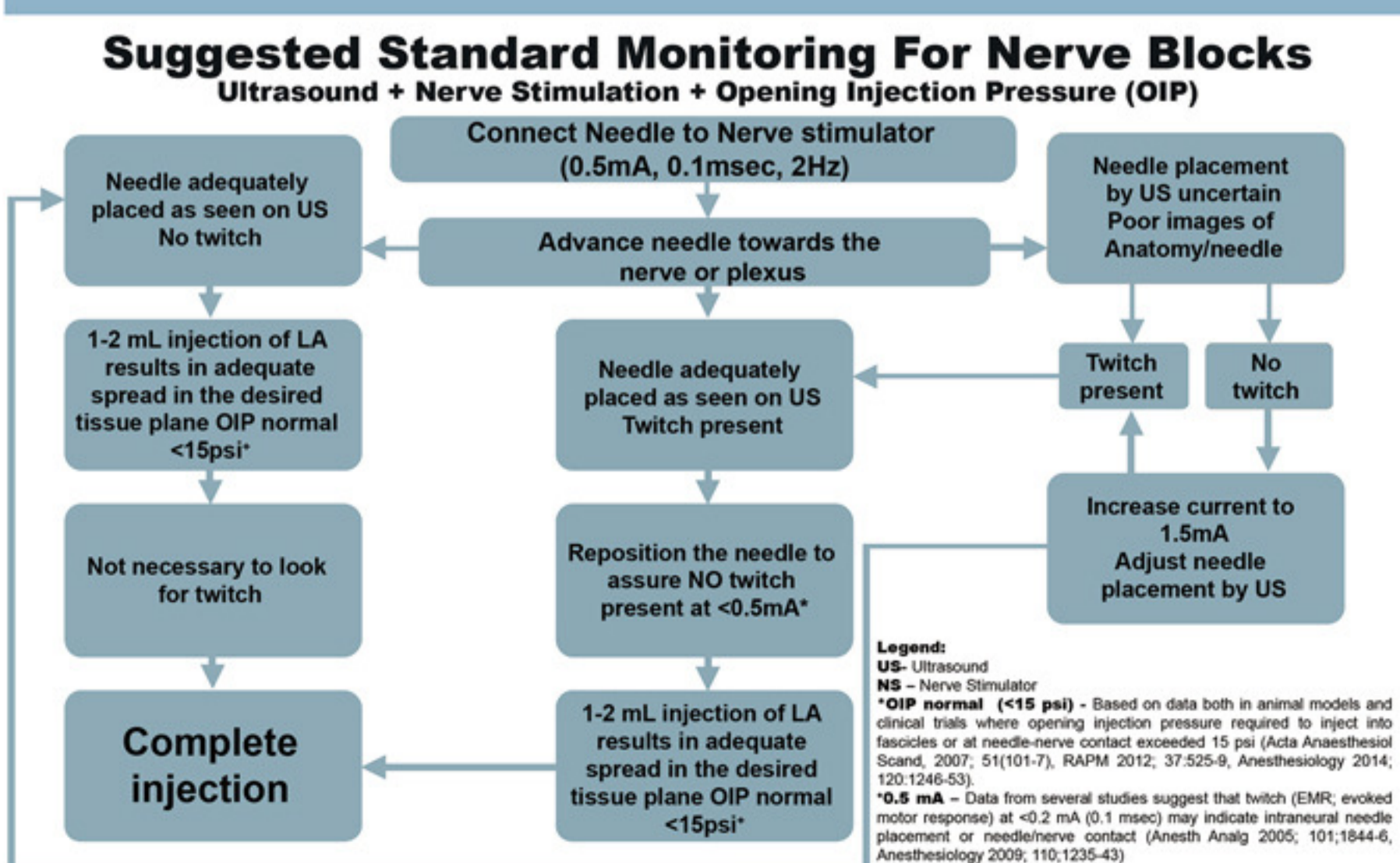
Landmarks: Axillary artery (AA) and Brachial Plexus fascial sheath (arrows).
Ideal view: MN, UN, RN scattered around AA, McN between the biceps and coracobrachialis muscles.

Technique: Needle Insertion in plane or out of plane. Injections: one above the artery, one between artery and conjoint tendon. McN is blocked separately.
LA deposit: 8ml posterior and 8ml anterior to the artery, 4ml for McN. **Ideal spread of LA:** around AA.
Number of injections: 2+McN. BORE

Tips: For extensive elbow surgery consider more proximal technique. Variations of MCN are common. McN may be attached to the MN. Pre-scan to look for common anatomical variations. Reduce transducer pressure before injection of LA to facilitate spread and to decrease the risk of intravascular injection.

ABBREVIATIONS

AA Axillary Artery	ICBN Intercostobrachial nn
AV Axillary Vein	LA Local Anesthetic
BORE Bolus Observe Reposition	MCN Musculocutaneous Nerve
CBM Coracobrachialis Muscle	MN Median Nerve
Cfx Circumflex Artery	RN Radial Nerve
CNA Cutaneous Nerve of Arm	UN Ulnar Nerve
DHA Deep Humeral Artery	
EMR Evoked Motor Response	



Nerve Block	Transducer Placement	Ultrasound Image	Reverse Ultrasound Anatomy™	Anatomy																
<p>Femoral</p> <p>Indications: Surgery on femur, anterior thigh and knee, patella fracture, quadriceps tendon repair. Analgesia for hip and femur fractures. Patient position: Supine. Transducer: Linear. Needle: 22G, 5-10cm short bevel. Common EMR obtained: Quadriceps muscle contraction. LA: 10-20 ml.</p> <p>ABBREVIATIONS</p> <table border="0"> <tr> <td>ASIS Anterior Superior Iliac Spine</td> <td>IPM Iliopsoas Muscle</td> </tr> <tr> <td>BORe Bolus Observe Reposition</td> <td>LA Local Anesthetic</td> </tr> <tr> <td>EMR Evoked Motor Response</td> <td>LFCN Lateral Femoral Cutaneous Nerve</td> </tr> <tr> <td>FA Femoral Artery</td> <td>FN Femoral Nerve</td> </tr> <tr> <td>FI Fascia Iliaca</td> <td>SaM Sartorius Muscle</td> </tr> <tr> <td>FL Fascia lata</td> <td>SAIS Superior Anterior Iliac Spine</td> </tr> <tr> <td>FN Femoral Nerve</td> <td>SCA Superficial Circumflex Artery</td> </tr> <tr> <td>FV Femoral Vein</td> <td>TFL Tensor Fascia Lata</td> </tr> </table>	ASIS Anterior Superior Iliac Spine	IPM Iliopsoas Muscle	BORe Bolus Observe Reposition	LA Local Anesthetic	EMR Evoked Motor Response	LFCN Lateral Femoral Cutaneous Nerve	FA Femoral Artery	FN Femoral Nerve	FI Fascia Iliaca	SaM Sartorius Muscle	FL Fascia lata	SAIS Superior Anterior Iliac Spine	FN Femoral Nerve	SCA Superficial Circumflex Artery	FV Femoral Vein	TFL Tensor Fascia Lata	<p>Initial transducer placement: Femoral crease, parallel and inferior to inguinal ligament, must find the common FA Initial depth setting: 4 cm.</p>	<p>Landmarks: Common femoral artery and fascia iliaca (arrows). Ideal view: Femoral nerve lateral to femoral artery, below fascia iliaca, above departure of profunda femoris artery.</p>	<p>Technique: Needle Insertion in plane, lateral to medial, alternatively out of plane. Ideal spread of LA: Under the fascia iliaca around the femoral nerve. Number of injections: One. BORE.</p>	<p>Tips: Obtain view proximal to bifurcation of the FA. Tilt the probe cranially/caudally to optimize the image of the nerve. Puncture the FI lateral to the edge of the FN. Beware: motor weakness of quadriceps muscles can occur; risk of falls.</p>
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<p>Saphenous</p> <p>Indications: Analgesia for knee surgery as a component of multimodal analgesia. In combination with sciatic nerve block for surgery below the knee. Patient position: supine with leg abducted and externally rotated. Transducer: Linear. Needle: 22G, 5-10 cm short bevel. Common EMR obtained: If used, paresthesia of medial aspect of lower leg or vastus medialis twitch can be elicited. LA: 10-15 ml</p> <p>ABBREVIATIONS</p> <table border="0"> <tr> <td>ALM Adductor Longus Muscle</td> <td>SaM Saphenous Nerve</td> </tr> <tr> <td>AMM Adductor Magnus Muscle</td> <td>PD Power Doppler</td> </tr> <tr> <td>FA Femoral Artery</td> <td>RFM Rectus Femoris Muscle</td> </tr> <tr> <td>SaM Sartorius Muscle</td> <td>VMM Vastus Medialis Muscle</td> </tr> <tr> <td></td> <td>VMN Vastus Medialis Nerve</td> </tr> </table>	ALM Adductor Longus Muscle	SaM Saphenous Nerve	AMM Adductor Magnus Muscle	PD Power Doppler	FA Femoral Artery	RFM Rectus Femoris Muscle	SaM Sartorius Muscle	VMM Vastus Medialis Muscle		VMN Vastus Medialis Nerve	<p>Initial transducer placement: Transverse view at medial aspect of lower thigh to mid-thigh level. Initial depth setting: 4 cm.</p>	<p>Landmarks: Sartorius muscle and femoral artery Ideal view: Femoral artery in the subsartorius plane at the medial edge of the vastus medialis.</p>	<p>Technique: Needle insertion in plane, lateral to medial, alternatively out of plane. Ideal spread of LA: In the fascial plane (arrows) underneath sartorius muscle on both sides of the artery Number of injections: One. BORE</p>	<p>Tips: When localization of femoral artery proves difficult, use PD and/or start scanning at the level of the femoral crease and follow the course of the femoral artery distally into the canal.</p>						
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<p>Sciatic Subgluteal level</p> <p>Indications: Anesthesia and analgesia for surgery on femur, at and below the knee. Patient position: Prone, lateral or oblique (shown). Transducer: Linear or curved in larger patients Needle: 22G, 8-10cm short bevel. Common EMR obtained: Twitch of calf or foot LA: 15-20 ml.</p> <p>ABBREVIATIONS</p> <table border="0"> <tr> <td>AMM Adductor Magnus Muscle</td> <td>IT Ischial Tubercle</td> </tr> <tr> <td>BORe Bolus Observe Reposition</td> <td>LCnN Lateral cluneal Nerves</td> </tr> <tr> <td>EMR Evoked Motor Response</td> <td>LA Local Anesthetic</td> </tr> <tr> <td>GMM Gluteus Maximus Muscle</td> <td>ScN Sciatic Nerve</td> </tr> <tr> <td>GT Great Trochanter</td> <td>STM Semitendinosus Muscle</td> </tr> <tr> <td>IGA Inferior Gluteal Artery</td> <td></td> </tr> </table>	AMM Adductor Magnus Muscle	IT Ischial Tubercle	BORe Bolus Observe Reposition	LCnN Lateral cluneal Nerves	EMR Evoked Motor Response	LA Local Anesthetic	GMM Gluteus Maximus Muscle	ScN Sciatic Nerve	GT Great Trochanter	STM Semitendinosus Muscle	IGA Inferior Gluteal Artery		<p>Initial transducer placement: Gluteal crease, scan cephalad-caudad until the best view of the oval-shaped sciatic nerve and the muscular tunnel in which it travels are visualized regardless of the level. Initial depth setting: 4-5 cm.</p>	<p>Landmarks: Sciatic nerve, gluteus maximus, fascia underneath gluteus maximus. Ideal view: Sciatic nerve in common connective tissue sheath (intermuscular tunnel).</p>	<p>Technique: Needle insertion in plane, lateral to medial, alternatively out of plane. Ideal spread of LA: Around the nerve, within the common connective tissue sheath. Number of injections: One. BORE.</p>	<p>Tips: Avoid inferior gluteal artery. Needle should enter the sheath of the ScN either at the lateral or medial aspect of the nerve. Transducer pressure and tilt often required to obtain the adequate view.</p>				
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<p>Sciatic Popliteal level</p> <p>Indications: Anesthesia and analgesia for surgery below the knee. Patient position: Prone, oblique (shown) or supine with the knee flexed. Transducer: Linear or curved in larger patients Needle: 22G, 5-10 cm short bevel. Common EMR obtained: Twitch of calf, foot or toes LA: 20 ml.</p> <p>ABBREVIATIONS</p> <table border="0"> <tr> <td>BFM Biceps Femoris Muscle</td> <td>PV Popliteal Vein</td> </tr> <tr> <td>BORe Bolus Observe Reposition</td> <td>ScN Sciatic Nerve</td> </tr> <tr> <td>CPN Common Peroneal Nerve</td> <td>SaM Semimembranosus Muscle</td> </tr> <tr> <td>EMR Evoked Motor Response</td> <td>SmM Semitendinosus Muscle</td> </tr> <tr> <td>LA Local Anesthetic</td> <td>TN Tibial Nerve</td> </tr> <tr> <td>PA Popliteal Artery</td> <td></td> </tr> </table>	BFM Biceps Femoris Muscle	PV Popliteal Vein	BORe Bolus Observe Reposition	ScN Sciatic Nerve	CPN Common Peroneal Nerve	SaM Semimembranosus Muscle	EMR Evoked Motor Response	SmM Semitendinosus Muscle	LA Local Anesthetic	TN Tibial Nerve	PA Popliteal Artery		<p>Initial transducer placement: Transverse, 4-5 cm above the popliteal crease Initial depth setting: 4-5 cm.</p>	<p>Landmarks: Popliteal artery and vein, femur, BFM. Ideal view: Sciatic nerve with TN and CPN slightly diverged within common connective tissue sheath of SN (arrows). Note: This image demonstrates separation of TN and CPN after successful injection.</p>	<p>Technique: Needle insertion in plane, lateral to medial, or out of plane. Needle tip position: Inside the common connective tissue sheath, between TN and CPN. Ideal spread of LA: In between and around TN and CPN. Number of injections: One. BORE.</p>	<p>Tips: If imaging the division of the ScN proves difficult, start scanning at the popliteal crease, where the tibial nerve is located posterolateral to the popliteal vein. After injection, scan proximally – distally to assure the LA spread around TN and CPN. Catheter is placed within the sheath.</p>				
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