

Možnosti techník RA pri operáciách končatín v detskom veku

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KAIM SZU FNsP FDR BB

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AKUTNĚ.CZ 2026

Prehlásenie

Nemám konflikt záujmov









OP končatín v detskom veku : 2024 SVK

- **Úrazy HK : 2 200 až 2 500 hospitalizácií ročne**
  zlomeniny predlaktia (1 432 prípadov)
  zlomeniny ramena (1 034 prípadov)

- **Úrazy DK : 740 až 1 100 hospitalizovaných detí ročne**
  predkolenia, členka a poranenia kolena

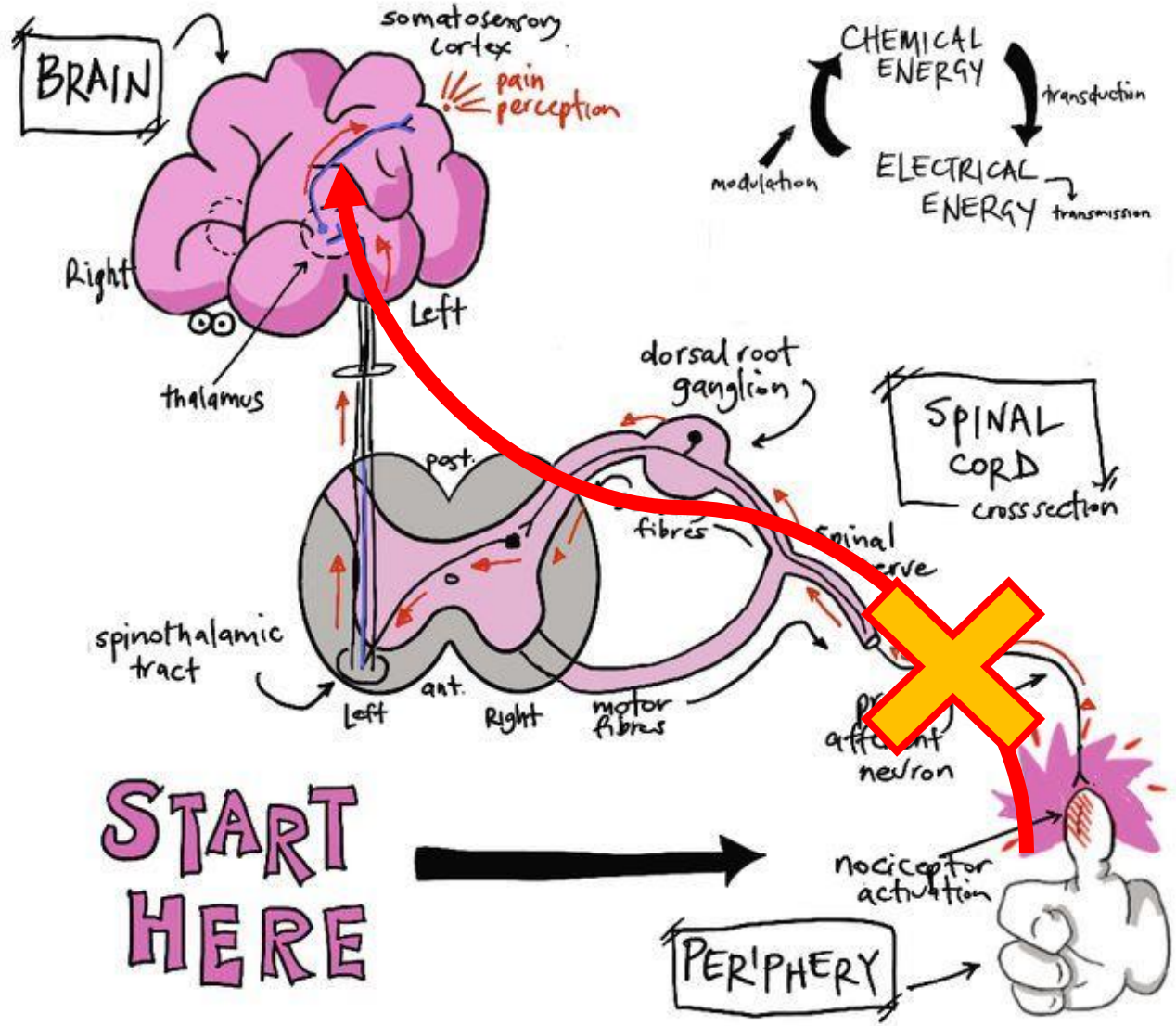
- **Amputácie (?) :** VVCH, Onko, Úrazy, Popáleniny, Ťažké infekcie

NCZI Národné centrum zdravotníckych informácií


OK...
NOW
WHAT?

PAIN PATHWAYS 2
ASCENDING

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Prevalence of and recommendation for measuring chronic postsurgical pain in children: an updated systematic review and meta-analysis

Brittany N Rosenbloom,[1,2] Simona Denise Frederiksen,[3] Vienna Wang,[4] Kathryn A Birnie,[5,6] Christine S Park,[7] Grace Gordon,[8] Nivez Rasic,[5] Jennifer N Stinson,[9] Jennifer A Rabbitts [10]

Findings The pooled prevalence of CPSP among mostly major surgeries was 28.2% (95% CI 21.4% to 36.1%). Subgroup analysis of spinal fusion surgeries identified a prevalence of 31% (95% CI 21.4% to 43.5%). Using Grading of Recommendations, Assessment, Development, and Evaluation, the certainty in prevalence estimates was moderate. Studies used a range of valid pain intensity measures to classify CPSP (eg, Numeric Rating Scale), often without pain interference or quality of life measures.



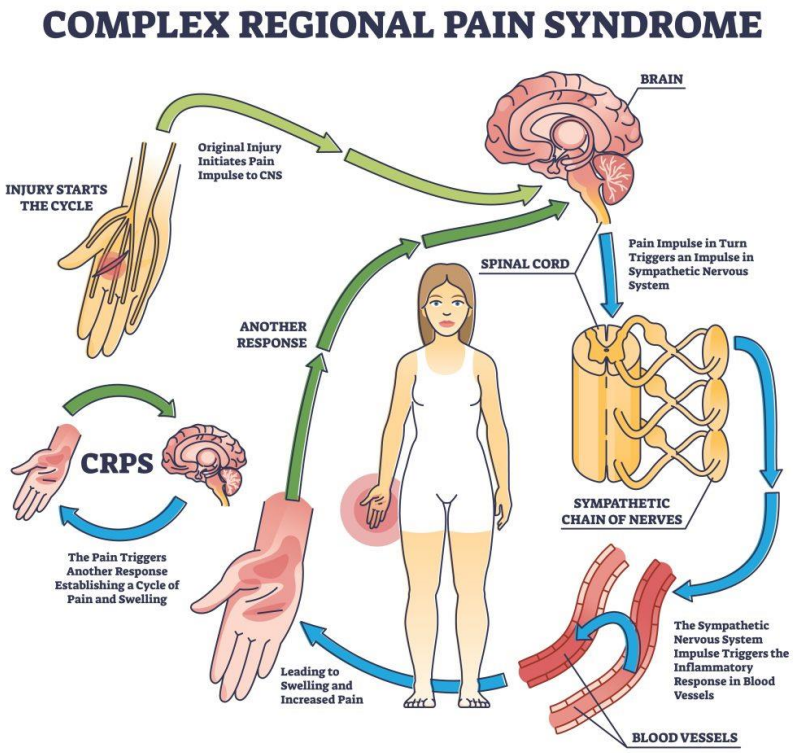
Rosenbloom BN, *et al*. *Reg Anesth Pain Med* 2025;**50**:132–143. doi:10.1136/rapm-2024-105697

Management of Phantom Limb Pain Following Amputation in Pediatrics

James G. Kwok[1,2], Tyler J. Shick[1], Lark Dunton[2], Sunil K. Jain[1,2]

American Journal of Physical Medicine & Rehabilitation 105(7):p e99-e101, July 2026.





41st ESRA Annual Congress
The art of pain management
4. — 7. Sep. 2024 Prague
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THE EUROPEAN SOCIETY OF REGIONAL ANAESTHESIA & PAIN THERAPY

DOES EPIDURAL STILL HAVE A ROLE IN MANAGING POST AMPUTATION PAIN?

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Femoral nerve block and femoral triangle block

Indications:
Anesthesia and analgesia for hip, femur, anterior thigh, knee, and patella procedures; analgesia for hip and femur fractures.
FTB: Analgesia for knee surgery.
Patient position:
Supine; leg extended and slightly externally rotated.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 10-15 mL.

Abbreviations:
FA: Femoral artery
FV: Femoral vein
FTB: Femoral triangle block
FN: Femoral nerve
LA: Local anesthetic
PFA: Profunda femoris artery

Initial transducer position: Transverse over the femoral crease to identify the FA and FV medial to the femoral nerve.
Depth: 2-4 cm.
FTB: Transverse over the upper antero-medial thigh to identify the SAM and the femoral artery deep to it. The medial border of the sartorious should be lateral to the medial border of the adductor longus.

Ideal view (FNB):
IV lateral to the FA, beneath the fascia iliaca, and proximal to the bifurcation of the FA.
Ideal view (FTB):
FA under the posterior fascia of the sartorius muscle.

Technique (FNB):
Insert the needle in-plane, lateral-to-medial between the two layers of the fascia iliaca, lateral to the FN.
Ideal spread of LA: Displacement of the FN medially away from the needle and LA around the FN.
Technique (FTB):
Insert the needle just underneath the sartorius muscle fascia and next to the FA.
Ideal spread of LA: In the femoral triangle to displace the saphenous and vastus medialis nerves.

Tips (FNB):
- Tilt the transducer cranially/caudally to optimize the image of the FN and fascia iliaca.
- Pierce the fascia iliaca lateral to the edge of the FN.
- Beware of motor weakness of the quadriceps muscle → risk of fall.

Tips (FTB):
- Maintain steady transducer pressure to avoid needle insertion and/or injection into the FV (just under the FA).

Saphenous nerve block (in the adductor canal)

Indications:
Analgesia for knee surgery and the skin of the medial aspect of the leg below the knee. In combination with a sciatic nerve block for surgery below the knee.
Patient position: Supine, thigh abducted and externally rotated.
Transducer: Linear (curved in larger patients).
Needle: 22G, 5-8 cm short bevel.
LA volume: 5-10 mL.

Abbreviations:
ADM: Adductor magnus muscle
AMM: Adductor magnus muscle
FA: Femoral artery
FV: Femoral vein
LA: Local anesthetic
SFM: Rectus femoris muscle
SAM: Sartorius muscle
SAN: Saphenous nerve
VLM: Vastus lateralis muscle
VMM: Vastus medialis muscle

Initial transducer position: Transverse over the medial thigh to identify the femoral vessels deep to the SAM.
Depth: 3-5 cm.

Ideal view:
SAN between the SAM (superficial), VMM (anteromedial), and ALM (posteromedial). The medial border of the SAM is more posterior than the medial border of the ALM.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the FA and SAN.
Ideal spread of LA: Around the SAN in the adductor canal and over the FA.

Tips:
- Apply and release transducer pressure to locate the FV before injection and reduce the risk of intravascular injection or hematoma.
- Out-of-plane needle insertion may be easier in obese patients.
- In large patients who are not expected to ambulate the first day after total knee arthroplasty, a femoral nerve block may be an easier/safer/more effective choice.

Sciatic nerve block (subgluteal level)

Indications:
Anesthesia and analgesia for foot and ankle surgery, procedures on and below the knee involving the posterior aspect of the knee, and above knee amputation.
Patient position: Prone or lateral decubitus; leg flexed at the hip and knee.
Transducer: Linear (curved in larger patients).
Needle: 22G, 8-10 cm short bevel.
LA volume: 10-20 mL.

Abbreviations:
ADM: Adductor magnus muscle
BFM: Biceps femoris muscle
GMM: Gluteus maximus muscle
GMI: Gluteus medius muscle
LA: Local anesthetic
PFCN: Posterior femoral cutaneous nerve

Initial transducer position: Transverse over the gluteal crease to identify the fascial planes between the GMM (posterior), BFM (medial), and ADM.
Depth: 4-6 cm.

Ideal view:
Sciatic nerve as a hyperechoic oval structure between the fasciae of the GMM and ADM and lateral to the insertion of the BFM.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the lateral edge of the sciatic nerve within the fascial plane.
Ideal spread of LA: Within the sheath containing the sciatic nerve.

Tips:
- Apply transducer pressure and tilt to improve visualization of the sciatic nerve.
- Reposition the needle as needed to accomplish LA spread around the sciatic nerve.
- In difficult cases, identify the sciatic nerve in the popliteal fossa first and trace proximally to the subgluteal fold.

Sciatic nerve block (in the popliteal fossa)

Indications: Foot and ankle surgery, below-knee amputation, and Achilles tendon surgery.
Patient position: Prone or lateral decubitus preferred; supine with foot on elevated footrest.
Transducer: Linear.
Needle: 22G, 5-8 cm short bevel.
LA volume: 10-20 mL.

Abbreviations:
BFM: Biceps femoris muscle
CPN: Common peroneal nerve
FV: Femoral vein
PL: Popliteal artery
PV: Popliteal vein
SemM: Semimembranosus muscle
SemT: Semitendinosus muscle
TN: Tibial nerve

Initial transducer position: Transverse, 3-5 cm above the popliteal crease posterior to sciatic nerve where the TN and CPN start diverging but are still in the common sciatic sheath (Mokri's sheath).
Depth: 3-5 cm.

Ideal view:
Sciatic nerve at the TN and CPN at the level of the bifurcation within Mokri's sheath, superficial to the PA and PV, between the BFM (lateral), and the SemM and SMM (medial).

Technique:
Insert the needle out-of-plane or in-plane lateral-to-medial direction, into Mokri's sheath between the TN and CPN.
Ideal spread of LA: Around the sciatic nerve within Mokri's sheath; separation of TN and CPN by the LA.

Tips:
- Apply transducer pressure and tilt distally to improve the image of the sciatic nerve.
- The CPN often lies in the needle path to reach the sciatic sheath, making an out-of-plane approach more practical. Choose an out-of-plane needle insertion when the TN and CPN are horizontal (as in this example), and the in-plane technique when they are stacked vertically.

Monitoring of needle-nerve relationship during nerve blocks





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Interscalene brachial plexus block

Indications:
Anesthesia and analgesia for shoulder, proximal humerus, and clavicle surgeries.
Patient position:
Supine, semi-sitting; with the head turned to the contralateral side.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 7-15 mL.

Abbreviations:
ASM: Anterior scalene muscle
BP: Brachial plexus
BPS: Brachial plexus sheath
CCA: Common carotid artery
CN: Cervical nerve
DSN: Dorsal scapular nerve
ECM: External oblique muscle
IJV: Internal jugular vein
LA: Local anesthetic
LSAM: Longus capitis muscle
LCM: Longus colli muscle
MSM: Middle scalene muscle
MT: Middle trunk
PSM: Posterior scalene muscle
RLN: Recurrent laryngeal nerve
SAM: Scalenus anterior muscle
SCM: Sternocleidomastoid muscle
SMM: Scalenus medius muscle
SVA: Suprascapular artery
SVN: Suprascapular vein
TCA: Transverse cervical artery
UT: Upper trunk
VC: Vital capacity
VN: Vagus nerve
VR: Ventilatory rate

Initial transducer position:
Transverse over the neck, 2-3 cm cephalad to the clavicle, and over the IJV/ when visible).
Depth: 3 cm.

Ideal view:
BP roots (C5-C7) as hyperechoic round structures between the ASM and MSM.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the BP. Avoid the DSN and LTN in the needle path.
Ideal spread of LA:
Around the superior (C5, C6) and middle trunks (C7) of the BP in the interscalene space between the ASM and MSM.

Tips:
- Only make additional injections if the LA doesn't spread within the interscalene space.
- Aim between the roots to reduce the nerve injury risk.
- Use color Doppler to avoid vascular structures in the needle path.
- Avoid long-acting LAs in patients unable to tolerate > 20% reduction VC (phrenic nerve paralysis).
- The inferior trunk (C8-T1) is usually spared.

Supraclavicular brachial plexus block

Indications:
Anesthesia and analgesia for shoulder, humerus, elbow, forearm, and hand surgeries.
Patient position:
Supine, semi-sitting; with the head turned to the contralateral side.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 20-25 mL.

Abbreviations:
ASM: Anterior scalene muscle
BP: Brachial plexus
BPS: Brachial plexus sheath
CCA: Common carotid artery
LA: Local anesthetic
LSAM: Longus capitis muscle
LCM: Longus colli muscle
MSM: Middle scalene muscle
MT: Middle trunk
PSM: Posterior scalene muscle
SAM: Scalenus anterior muscle
SCM: Sternocleidomastoid muscle
SVA: Suprascapular artery
SVN: Suprascapular vein
TCA: Transverse cervical artery
UT: Upper trunk
VC: Vital capacity

Initial transducer position:
Transverse just above the clavicle to identify the SA, first rib, and BP lateral and superior to the SA.
Depth: 3 cm.

Ideal view:
Collection of hypoechoic oval structures enclosed within the BP sheath posterior to the SA and superficial to the first rib. The neural elements correspond to the divisions of the UT, MT, and LT.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the BP.
1. Inject 10 mL between the first rib and LT (often referred to as "corner pocket").
2. Reposition the needle tip to inject another 10 mL between the divisions of the UT and MT.

Ideal spread of LA: Within the sheath containing the trunks and divisions of the BP.

Tips:
- Use color Doppler to identify and avoid the DSA, TCA, and SSA in the needle path.
- The BP is shallow at this location, limit the initial needle depth ≤ 1 cm.
- Avoid in patients who cannot tolerate > 20% reduction in VC (phrenic nerve paralysis) → consider an axillary or infraclavicular block.

Infraclavicular brachial plexus block

Indications: Anesthesia and analgesia for shoulder, arm, elbow, forearm, and hand surgeries.
Patient position: Supine with the head turned to the contralateral side; arm abducted 90° and flexed elbow.
Transducer: Linear.
Needle: 22G, 8-10 cm short bevel.
LA volume: 20-25 mL.

Abbreviations:
AA: Axillary artery
AV: Axillary vein
BP: Brachial plexus
LA: Local anesthetic
LC: Lateral cord
MC: Medial cord
PC: Posterior cord
PMM: Pectoralis major muscle
PMI: Pectoralis minor muscle

Initial transducer position:
Sagittal just below the clavicle to identify the PMM, PmM, posterior fascia of the PmM, and AA.
Depth: 3-5 cm.

Ideal view:
AA and AV below the fascia of the PmM, hyperechoic cords (BP) lateral (LC), medial (MC), and posterior (PC) to the AA (not always visible).

Technique:
Insert the needle in-plane, cranial-to-caudal direction, posterior to the AA while avoiding the LC.
Ideal spread of LA:
Around the AA, surrounding the BP cords (LC, MC, and PC).

Tips:
- Reduce the transducer pressure before injection to facilitate LA spread around the AA.
- Lower risk of phrenic nerve involvement compared to interscalene or supraclavicular BP blocks
- Perform another injection medial to the AA only when the first injection posterior to the AA does not result in spread on both sides of the AA.

Axillary brachial plexus block

Indications: Anesthesia and analgesia for elbow, forearm, and hand surgeries. AV shunts for dialysis.
Patient position: Supine with the head turned to the contralateral side; arm abducted 90° and flexed elbow.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 20 mL.

Abbreviations:
AA: Axillary artery
AV: Axillary vein
BP: Brachial plexus
CBM: Coracobrachialis muscle
LA: Local anesthetic
MAUN: Medial brachial cutaneous nerve
MBN: Median brachial nerve
PMM: Pectoralis major muscle
PMN: Pectoralis minor muscle
RN: Radial nerve
UN: Ulnar nerve

Initial transducer position:
Transverse over the intersection of the PMM and biceps muscle to identify the AA. The transducer should be perpendicular to the arm axis.
Depth: 3-5 cm.

Ideal view:
MN, UN, and RN as hyperechoic oval structures around the AA; MsN as a hypoechoic oval structure with a bright hyperechoic rim in the fascial layer between the biceps and CBM. When individual nerves are not immediately recognizable, the most important is to identify the axillary BP fascia where the LA is injected, regardless of the position of the nerves.

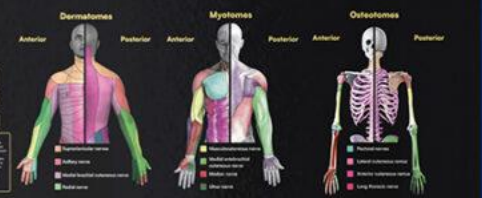
Technique:
Insert the needle in-plane, lateral-to-medial direction, posterior to the AA.
Make 3 separate injections as follows:
- 8 mL below the AA.
- 8 mL above the AA.
- 4 mL to block the MsN.

Ideal spread of LA:
Around the AA, surrounding the BP terminal branches (MN, UN, RN) and MsN.

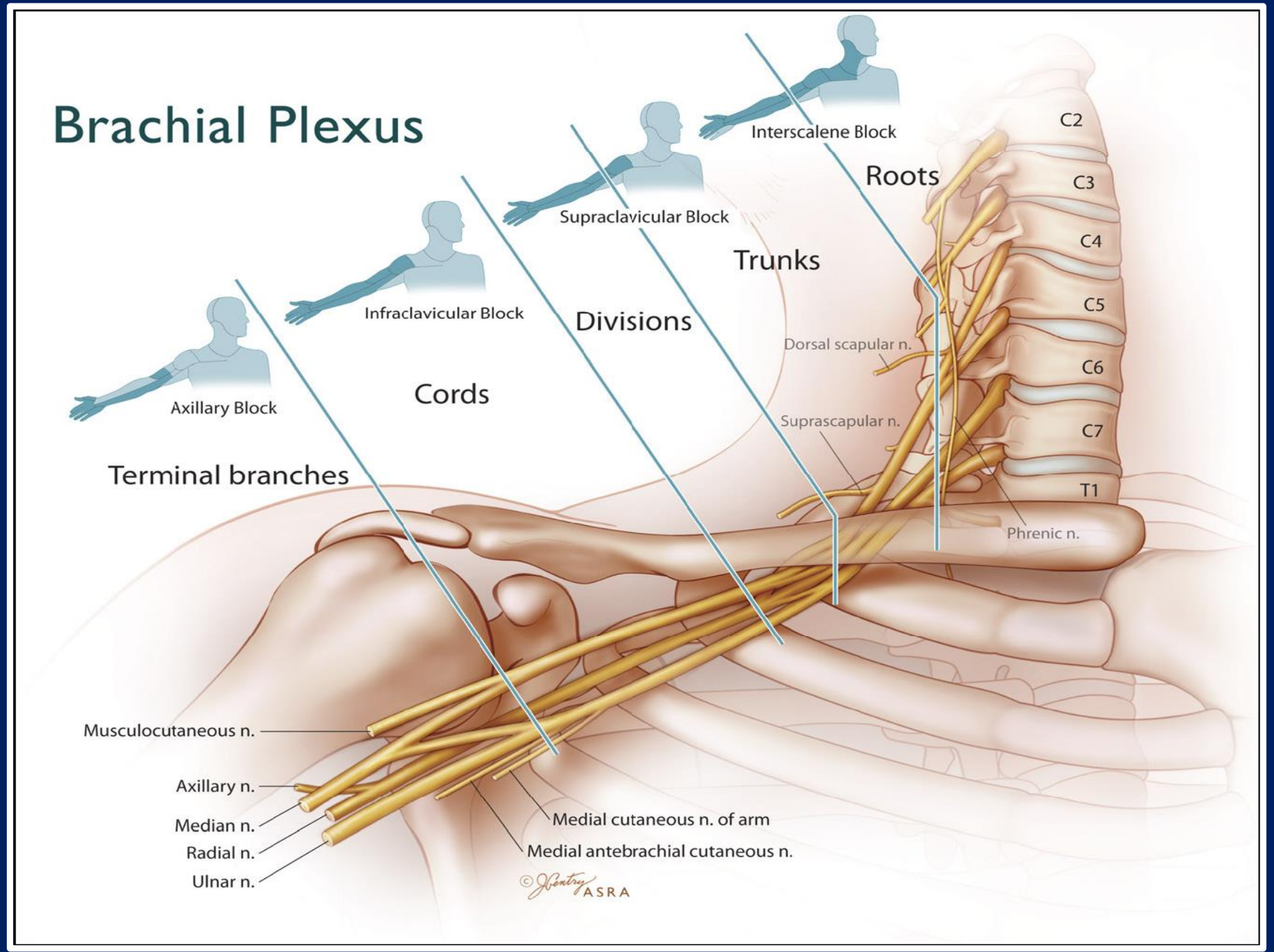
Tips:
- Avoid placing the transducer in the axillary fossa; stay perpendicular to the humerus, just below the axillary fossa crease.
- Maintain consistent transducer pressure through the procedure to avoid opening and closing of the AV and inadvertent intravascular injection.
- No separate injection needed if the MsN is bundled with the MN (< 10% of patients) or inside the BP sheath.

Monitoring of needle-nerve relationship during nerve blocks





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POSTERS


Brachial Plexus
Interscalene Block
Supraclavicular Block
Infraclavicular Block
Axillary Block
Roots
Trunks
Divisions
Cords
Terminal branches
C2
C3
C4
C5
C6
C7
T1
Dorsal scapular n.
Suprascapular n.
Phrenic n.
Musculocutaneous n.
Axillary n.
Median n.
Radial n.
Ulnar n.
Medial cutaneous n. of arm
Medial antebrachial cutaneous n.
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Adapted for SKARA by Dr. Peter Merjavy

Nervové blokády hornej končatiny

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Interskalenický blok brachiálneho plexu

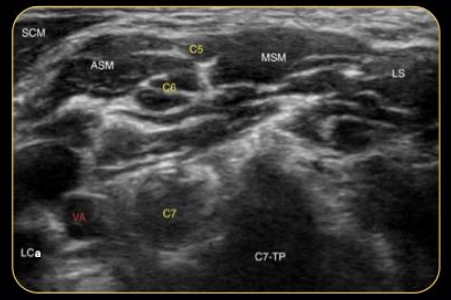
Indikácie: Anestézia a analgézia pri operáciách ramena, proximálneho humeru a distálnej kľúčnej kosti.
Poloha pacienta: V ľahu na chrbte, v polosede; hlava otočená na kontralaterálnu stranu.
Sonda: Lineárna.
Ihla: 22G, 5 cm, krátky skosený hrot.
Objem LA: 7—15 mL.

Abbreviations:

ASM	Anterior scalene muscle	**LTN**	Long thoracic nerve
BP	Brachial plexus	**MSM**	Middle scalene muscle
BPS	Brachial plexus sheath	**PHR**	Phrenic nerve
CA	Carotid artery	**RLN**	Recurrent laryngeal nerve
CL	Clavicle	**SCM**	Sternocleidomastoid muscle
C7-TP	Transverse process of C7	**SCP**	Superficial cervical plexus
DSN	Dorsal scapular nerve	**TCA**	Transverse cervical artery
EJV	External jugular vein	**VA**	Vertebral artery
IJV	Internal jugular vein	**VC**	Vital capacity
LA	Local anesthetic	**VN**	Vagus nerve
LCa	Longus capitis muscle	**LS**	Levator of the scapula



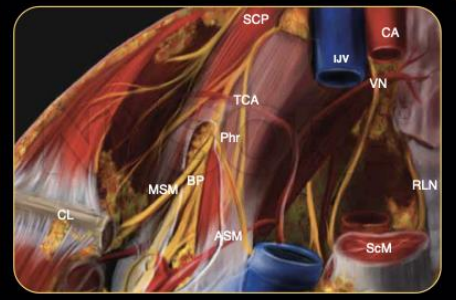
Počiatočné umiestnenie sondy: Transverzálne na krku, 2—3 cm proximálne od kľúčnej kosti, nad VJE (keď je viditeľná).
Hĺbka: 3 cm.



Ideálny obraz: Korene brachiálneho plexu (C5—C7) ako hypoechogénne okrúhle štruktúry medzi ASM a MSM.



Technika: Viesť ihlu v rovine sondy, latero-mediálnym smerom k plexu.
Ideálne rozšírenie LA: Okolo truncus superior (C5, C6) a truncus inferior (C7) brachiálneho plexu v interskalenickom priestore medzi ASM a MSM.



Tipy:
- Doplnkové injekcie vykonávať len pri nedostatočnom šírení LA v interskalenickom priestore.
- Mierif medzi korene C5/6 pričom hrot ihly umiestniť medzi plexus brachialis a MSM
- Použiť farebný Doppler na vyhnutie sa cievam v trajektórii ihly.
- Vyhnúť sa dlhodobo pôsobiacim LA u pacientov, ktorí netolerujú > 20 % redukciu vitálnej kapacity (paréza nervus phrenicus).
- Truncus inferior (C8—T1) je zvyčajne vynechaný.

Supraklavikulárny blok brachiálneho plexu

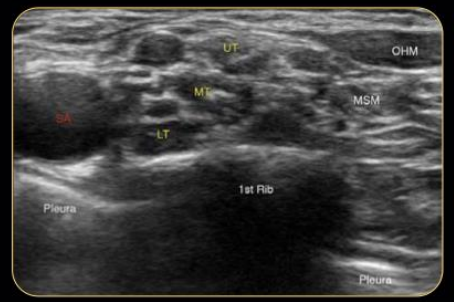
Indikácie: Anestézia a analgézia pri operáciách ramena, humeru, lakťa, predlaktia a ruky.
Poloha pacienta: V ľahu na chrbte, v polosede; hlava otočená na kontralaterálnu stranu.
Sonda: Lineárna.
Ihla: 22G, 8-10 cm, krátky skosený hrot.
Objem LA: 7—15 mL.

Abbreviations:

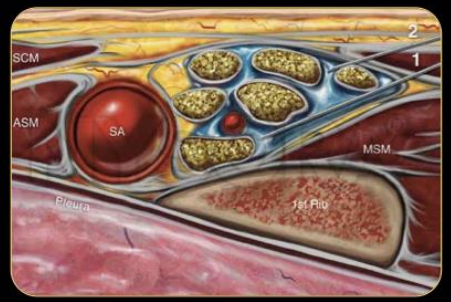
ASM	Anterior scalene muscle	**OHM**	Omohyoid muscle
BP	Brachial plexus	**SA**	Subclavian artery
BPS	Brachial plexus sheath	**SCM**	Sternocleidomastoid muscle
DSA	Dorsal scapular artery	**SSA**	Suprascapular artery
LA	Local anesthetic	**SV**	Subclavian vein
LT	Lower trunk	**TCA**	Transverse cervical artery
MSM	Middle scalene muscle	**UT**	Upper trunk
MT	Middle trunk	**VC**	Vital capacity



Počiatočné umiestnenie sondy: Transverzálne tesne nad kľúčnou kosťou, aby sa identifikovala arteria subclavia, prvé rebro, kľúčna kosť a plexus brachialis laterálne a nad arteria subclavia.
Hĺbka: 3 cm.

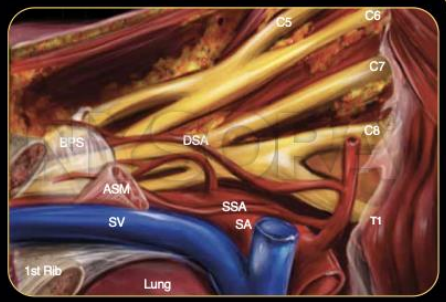


Ideálny obraz: Zhluk hypoechogénnych oválnych nervových štruktúr — trunky plexu v jeho puzdre (UT, MT, LT).

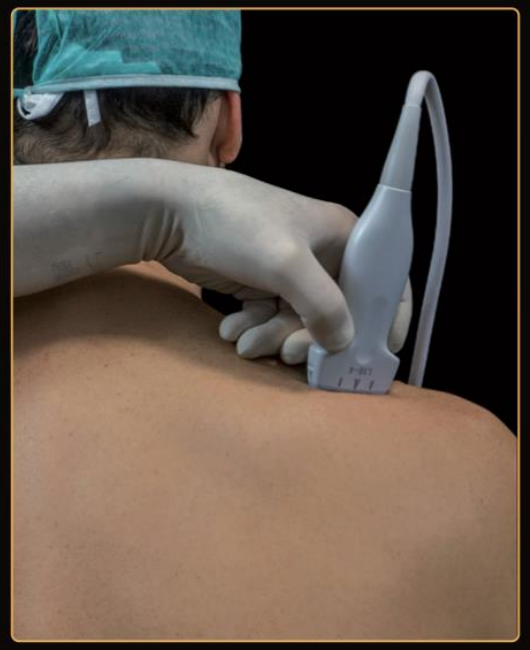


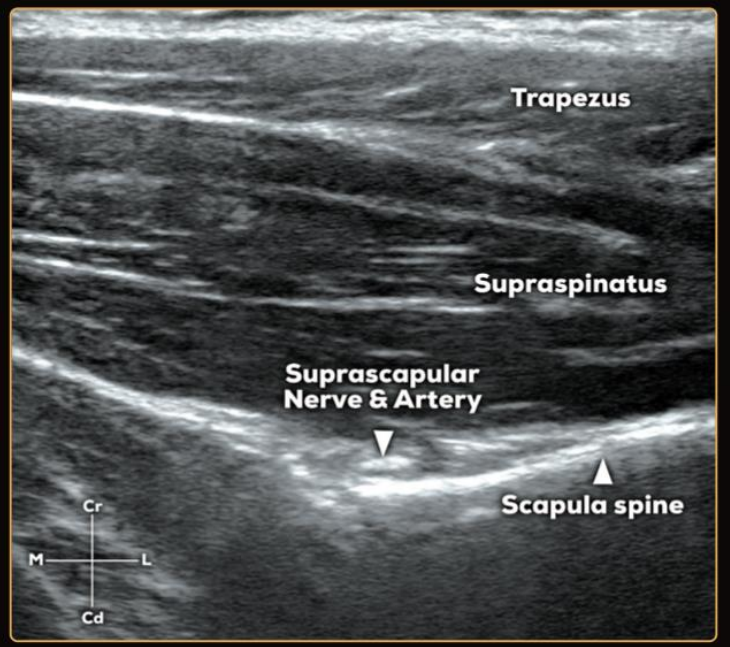
Technika: Zaviesť ihlu v rovine sondy latero-mediálnym smerom k plexu.
1. Injekcia 10 mL medzi prvé rebro a truncus inferior („corner pocket").
2. Repozícia špičky ihly a injekcia ďalších 10 mL medzi vetvy truncus superior a truncus medius.

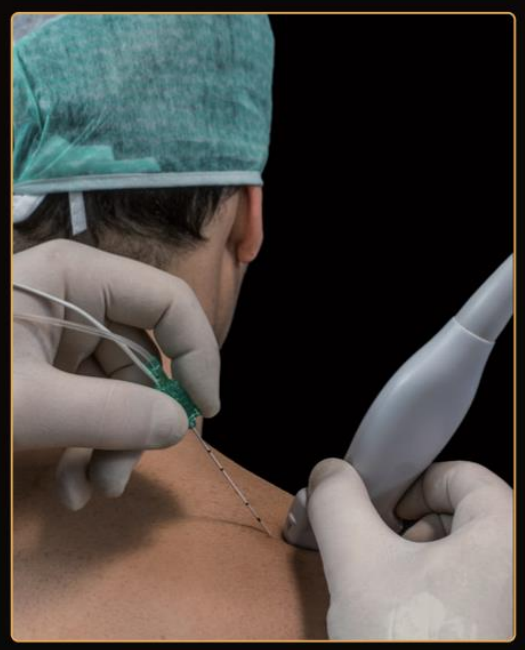
Ideálne rozšírenie LA: V puzdre obsahujúcom trunky a vetvy BP.

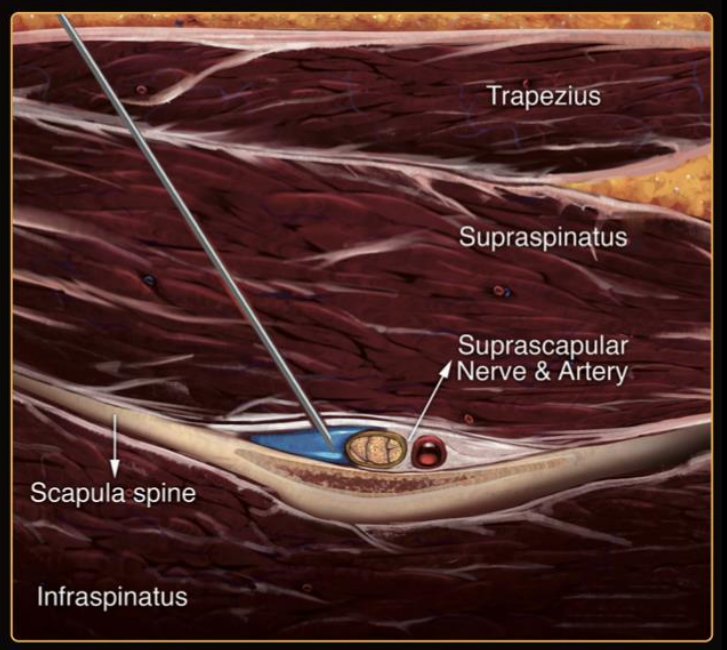


Tipy:
- Použiť farebný Doppler na identifikáciu a vyhnutie sa DSA, TCA a SSA.
- Plexus je v tejto oblasti plytký — obmedziť počiatočnú hĺbku ihly ≤ 1 cm.
- Vyhnúť sa u pacientov, ktorí netolerujú > 20 % redukciu VC (paréza nervus phrenicus) — zvážiť axilárny alebo infraklavikulárny blok.

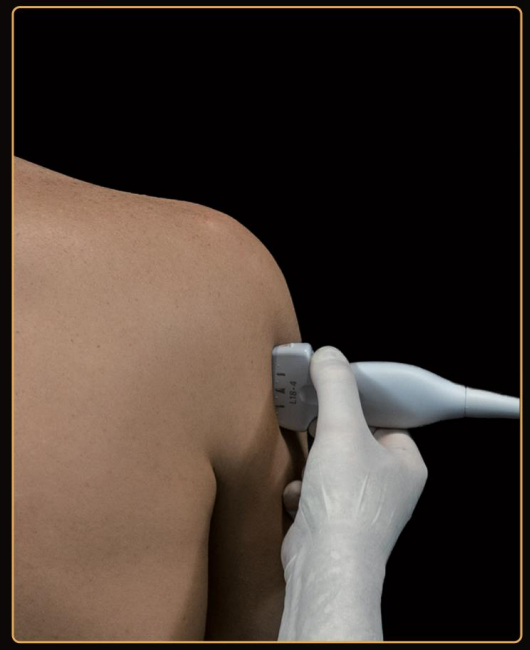


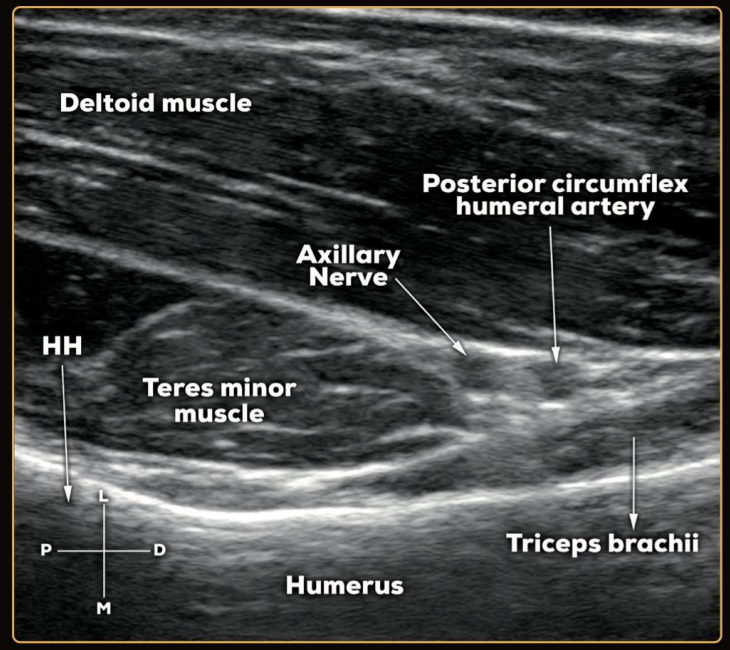

Trapezus
Supraspinatus
Suprascapular
Nerve & Artery
Scapula spine
Cr
M
L
Cd

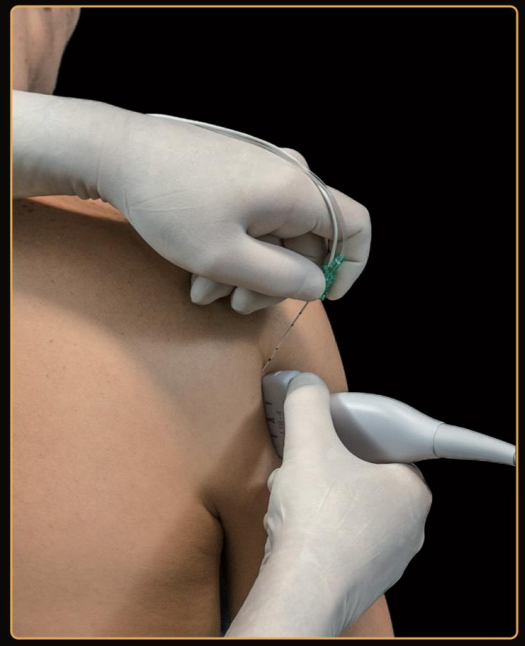


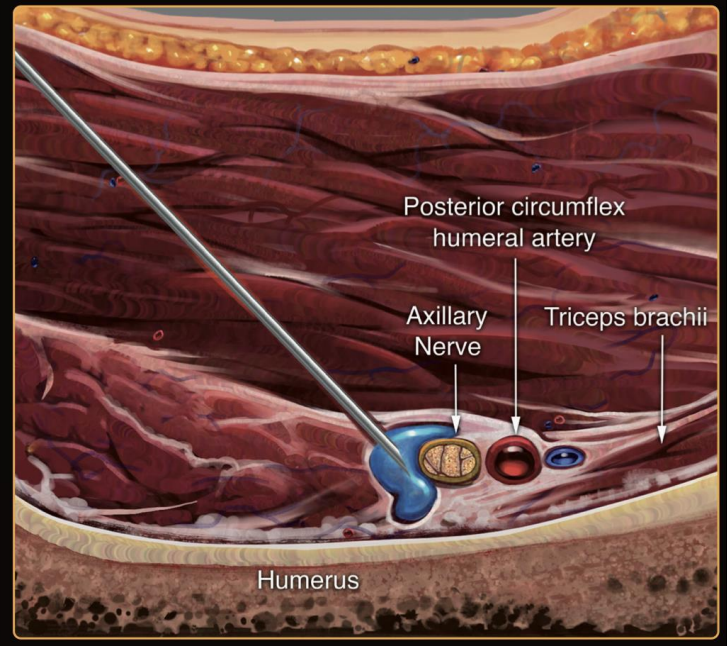

Trapezius
Supraspinatus
Suprascapular
Nerve & Artery
Scapula spine
Infraspinatus

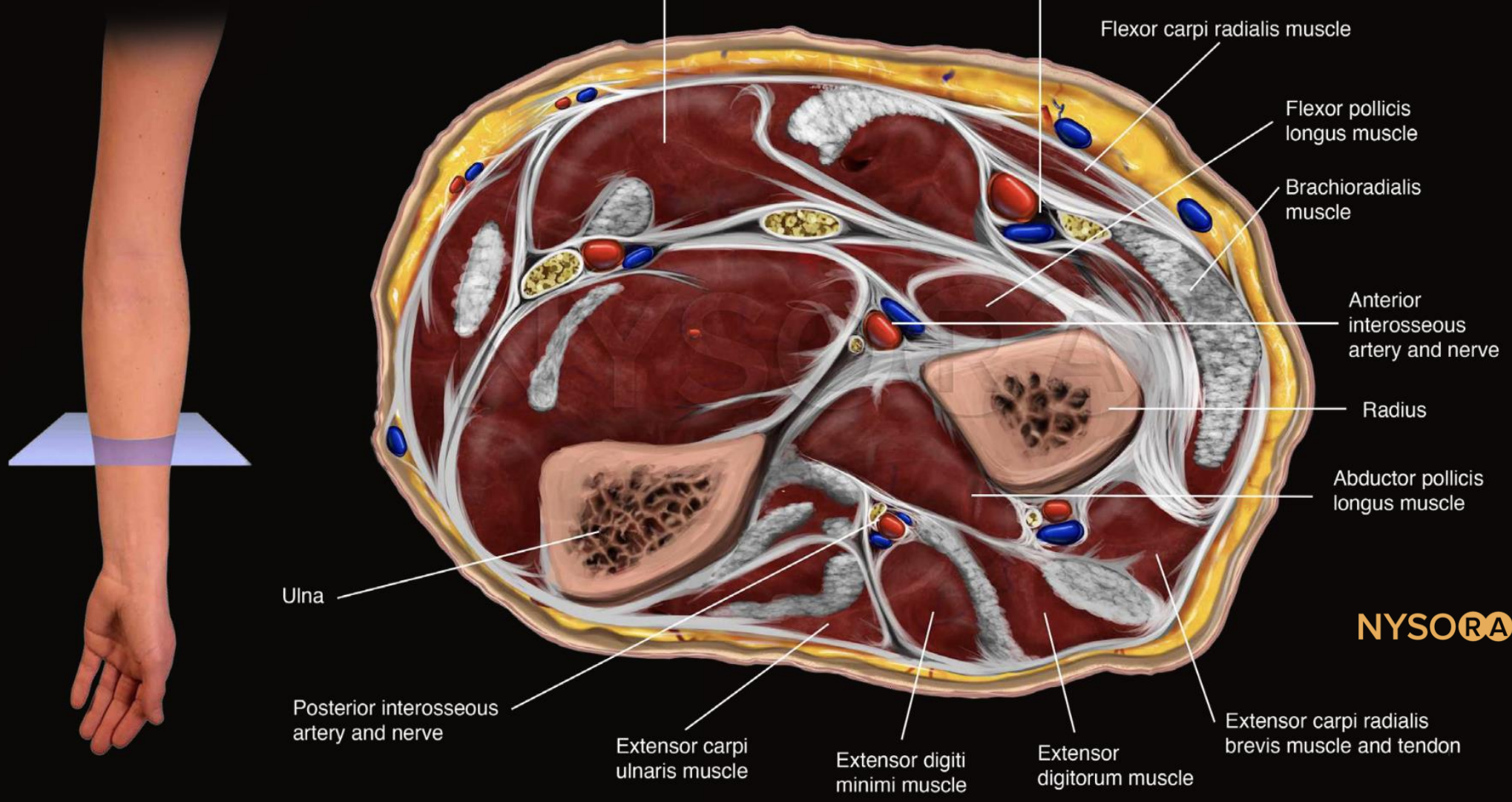
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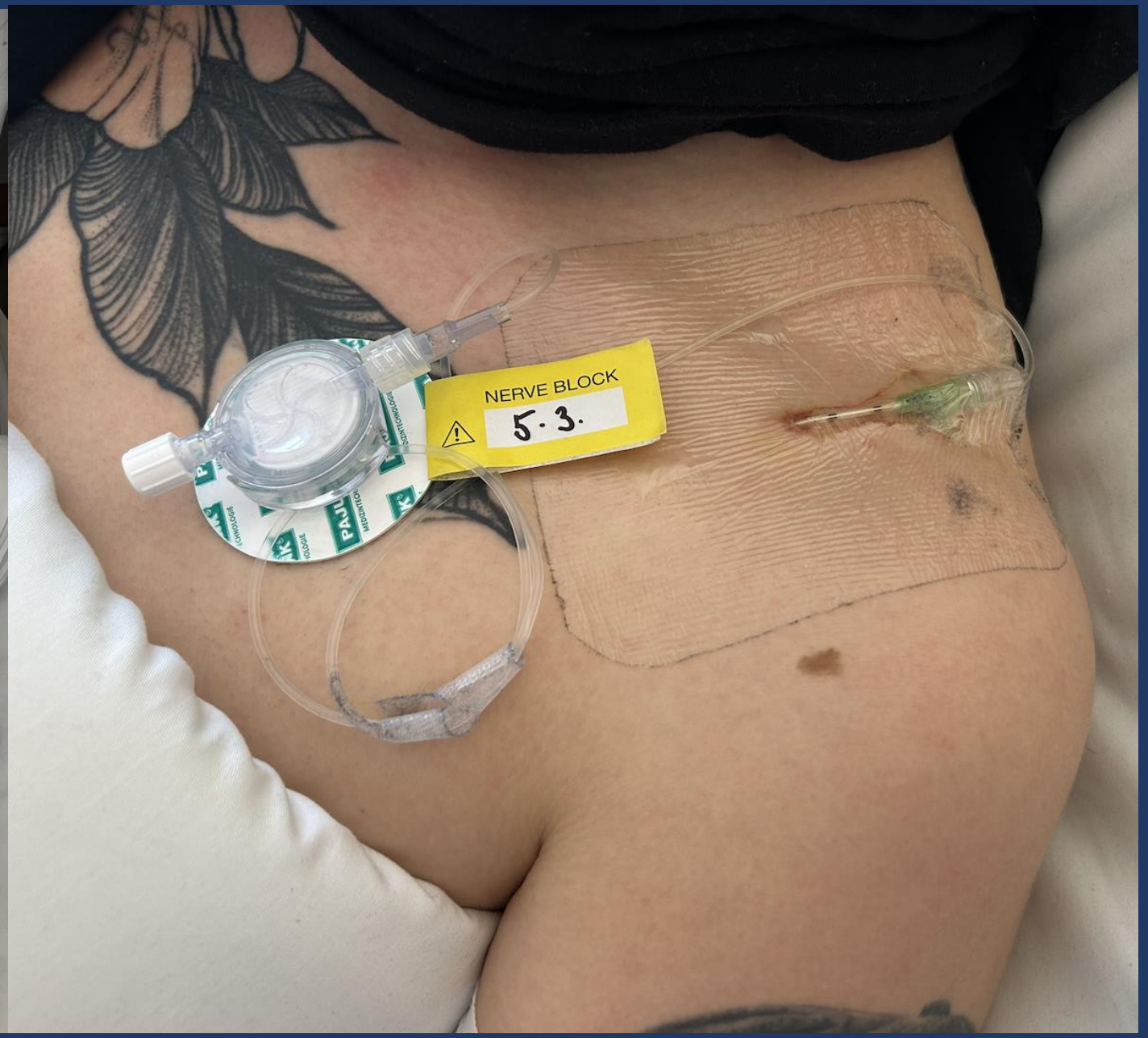

Deltoid muscle
Posterior circumflex
humeral artery
Axillary
Nerve
HH
Teres minor
muscle
L
P
D
M
Triceps brachii
Humerus




Posterior circumflex
humeral artery
Axillary
Nerve
Triceps brachii
Humerus


Flexor digitorum superficialis musclea
Radial artery and superficial branch of radial nerve
Flexor carpi radialis muscle
Flexor pollicis longus muscle
Brachioradialis muscle
Anterior interosseous artery and nerve
Radius
Abductor pollicis longus muscle
Ulna
Posterior interosseous artery and nerve
Extensor carpi ulnaris muscle
Extensor digiti minimi muscle
Extensor digitorum muscle
Extensor carpi radialis brevis muscle and tendon
NYSORA


NERVE BLOCK
5·3·


NERVE BLOCK
5·3·

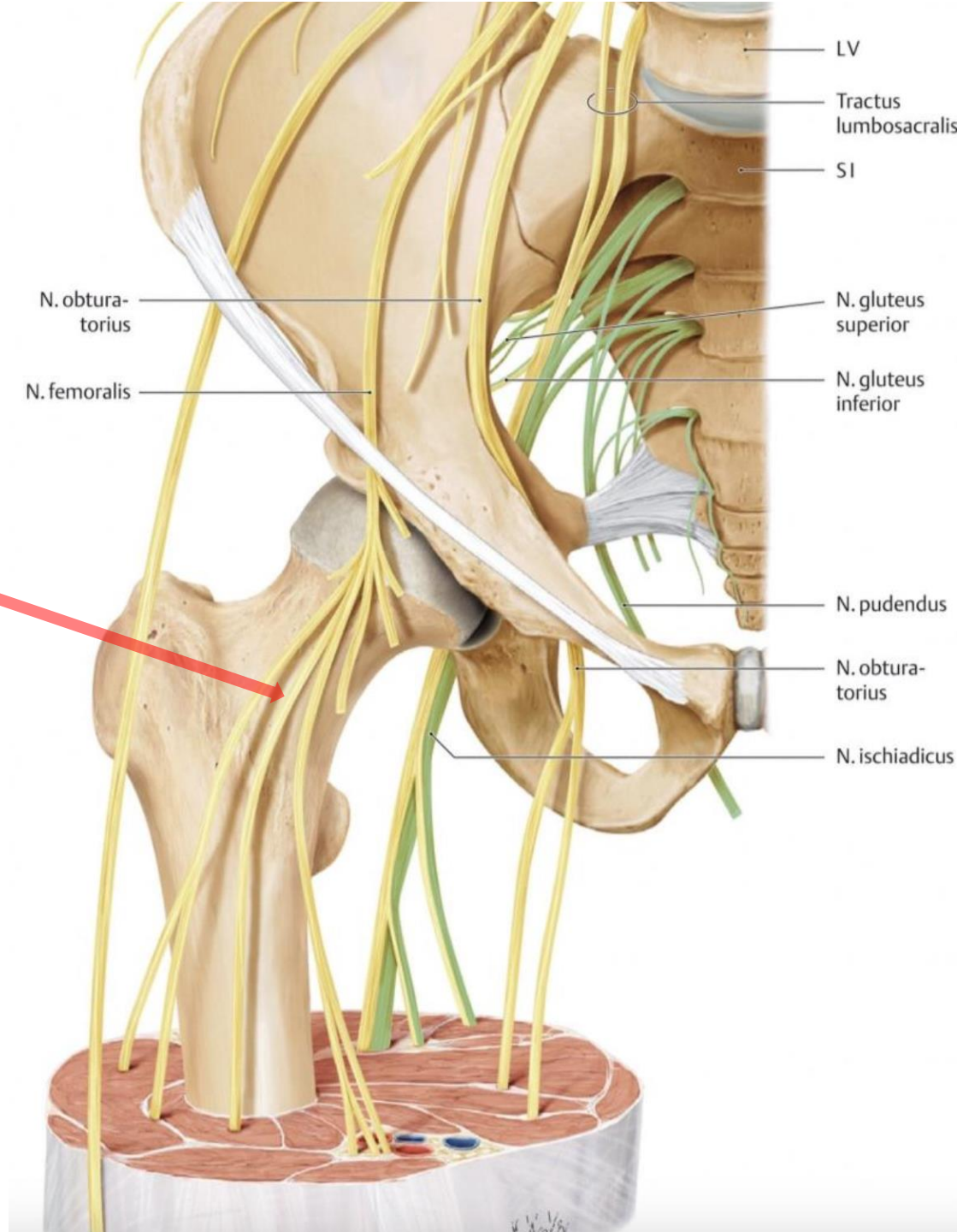
Lumbosacral plexus

- **Femoral** nerve
  - **Saphenus**
  - Nervus Vastus Medialis
  - Nervus Vastus I
  - Nervus Vastus Lateral
  - Rectus femoris

  } Quadriceps

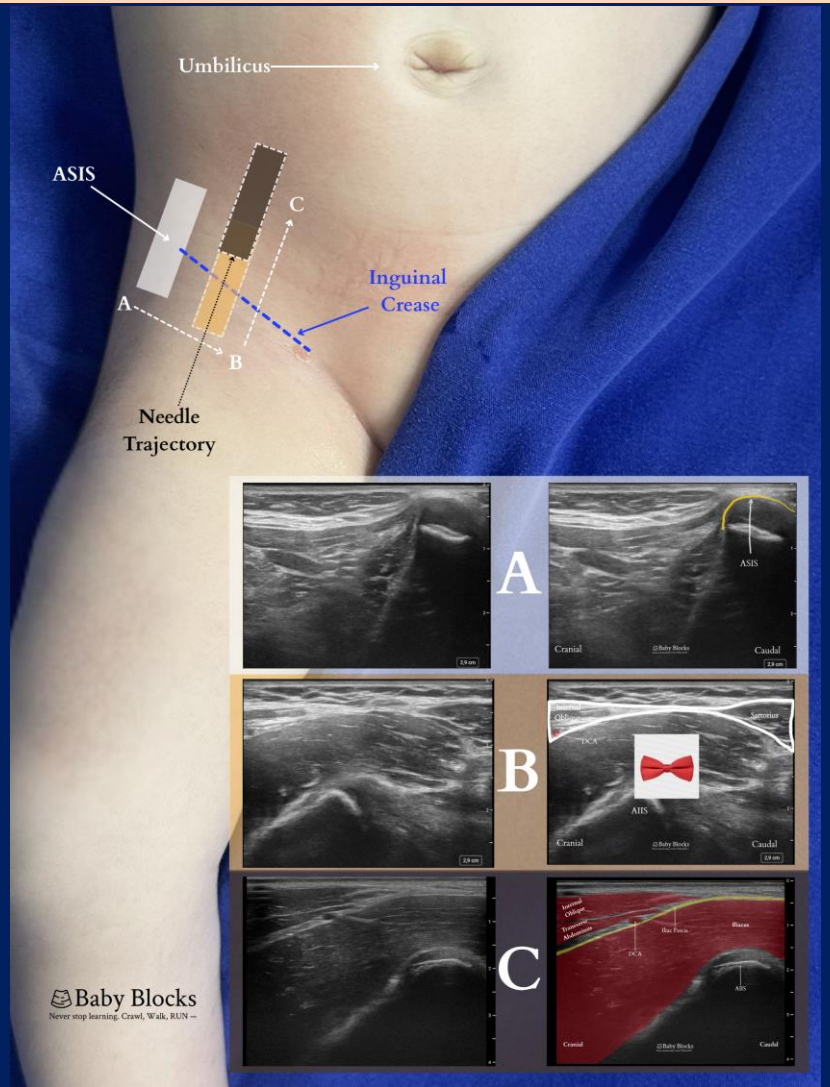
- **Sciatic** nerve
  - Peroneus communis (genicular nerves)
  - Tibial nerve (genicular nerves)

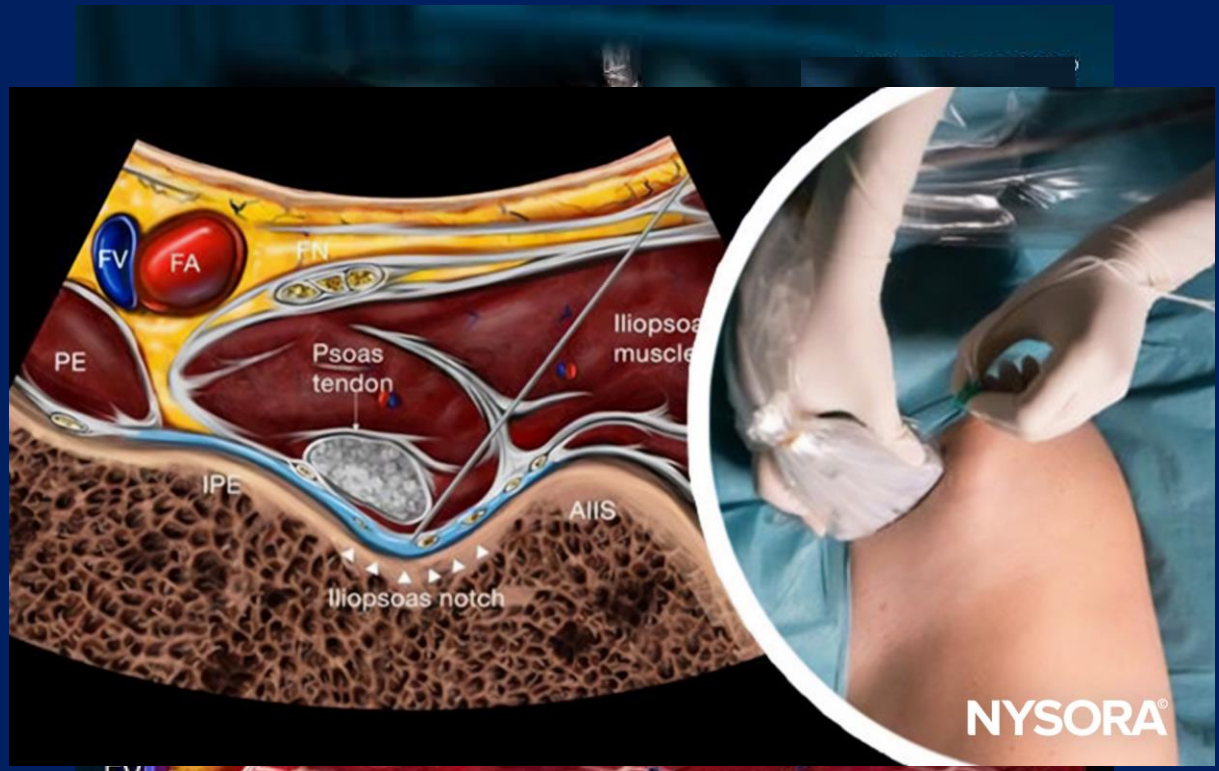
- **Obturator** nerve




pain control
versus
mobility

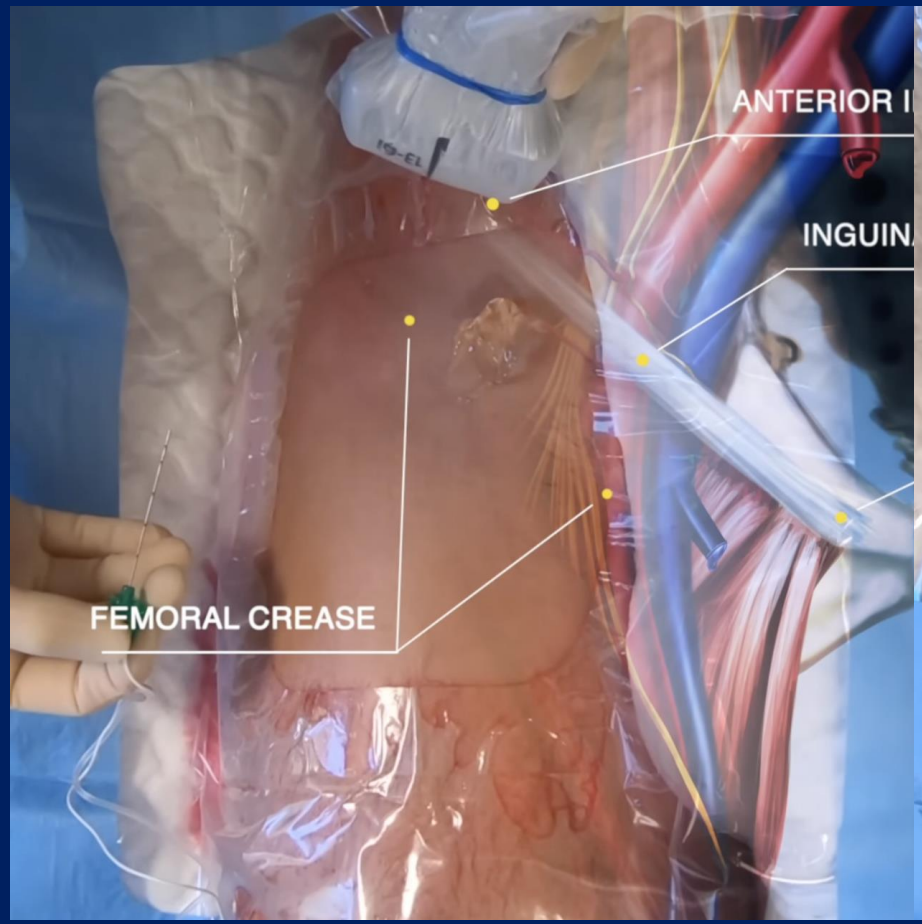
Femor : FICB (SIFI) vs PENG vs Femoral block

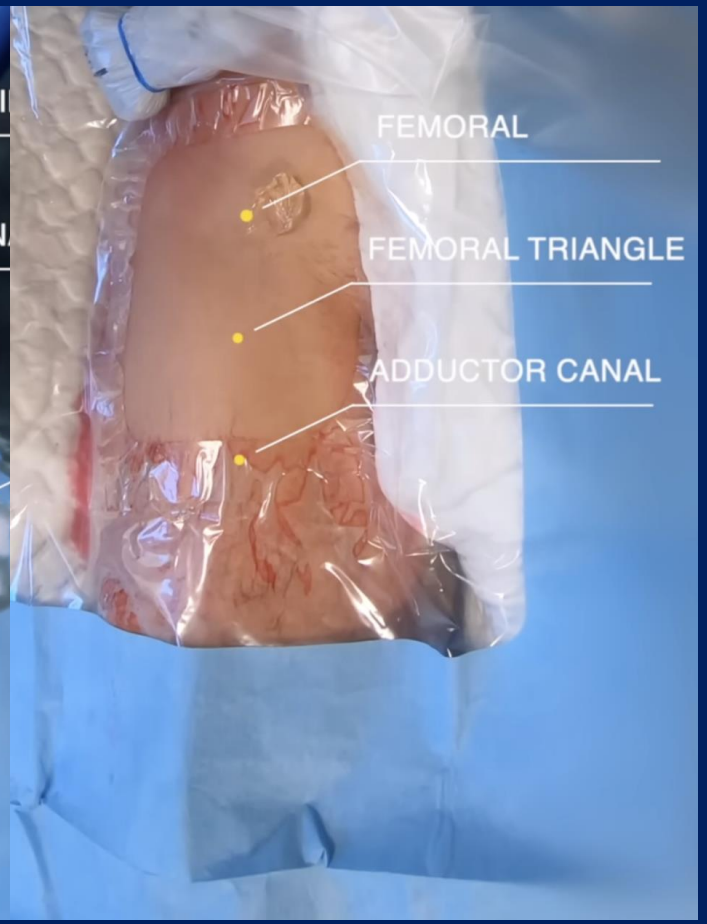


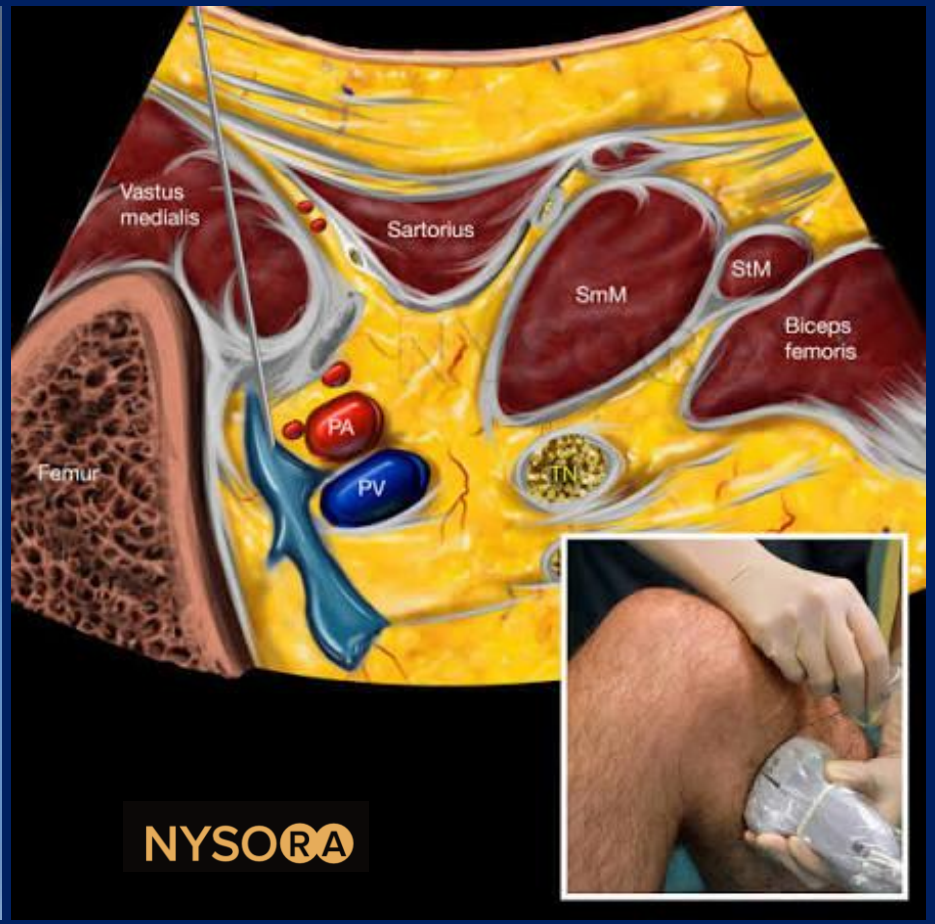




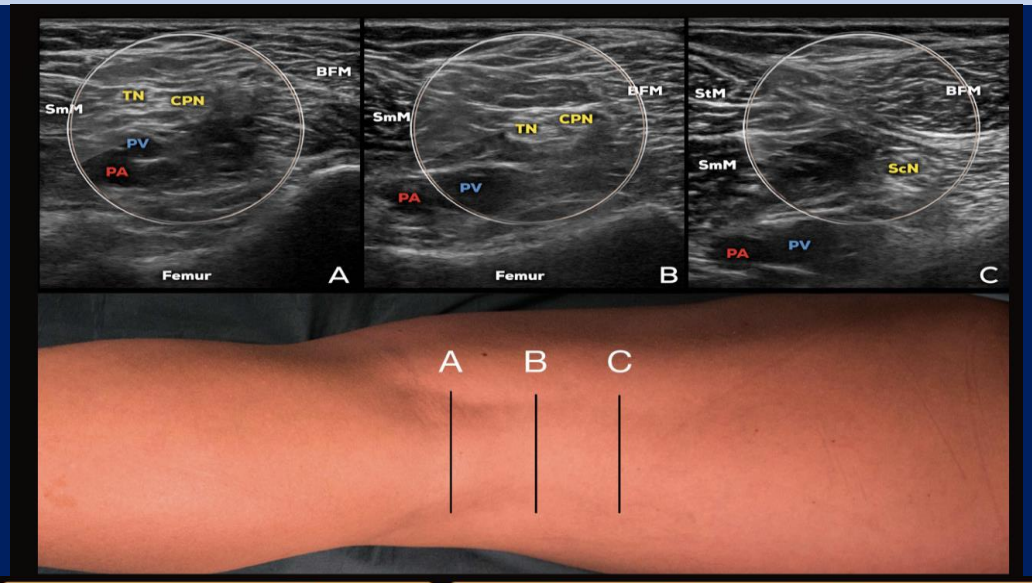
Koleno : Trigonum femoral/Adductor canal + iPACK

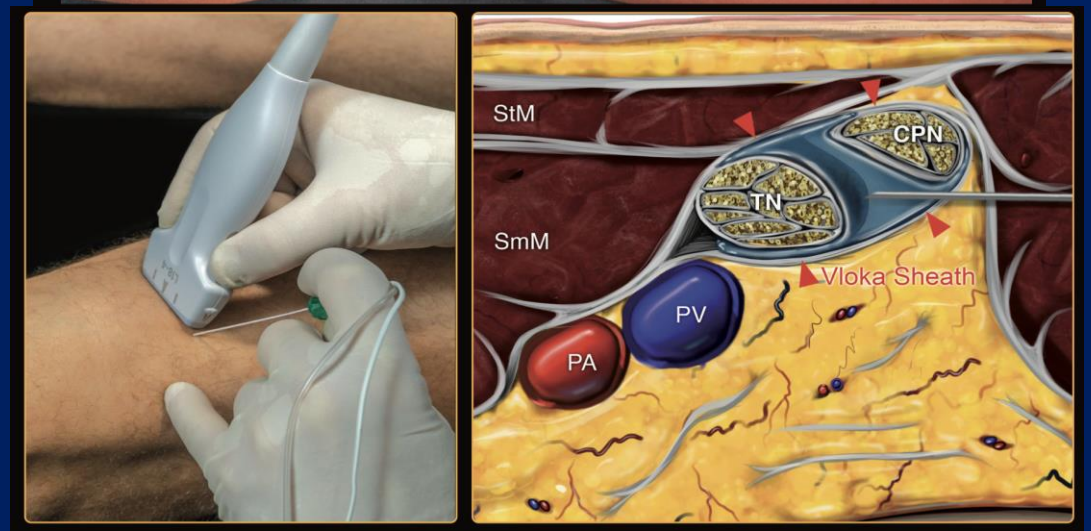


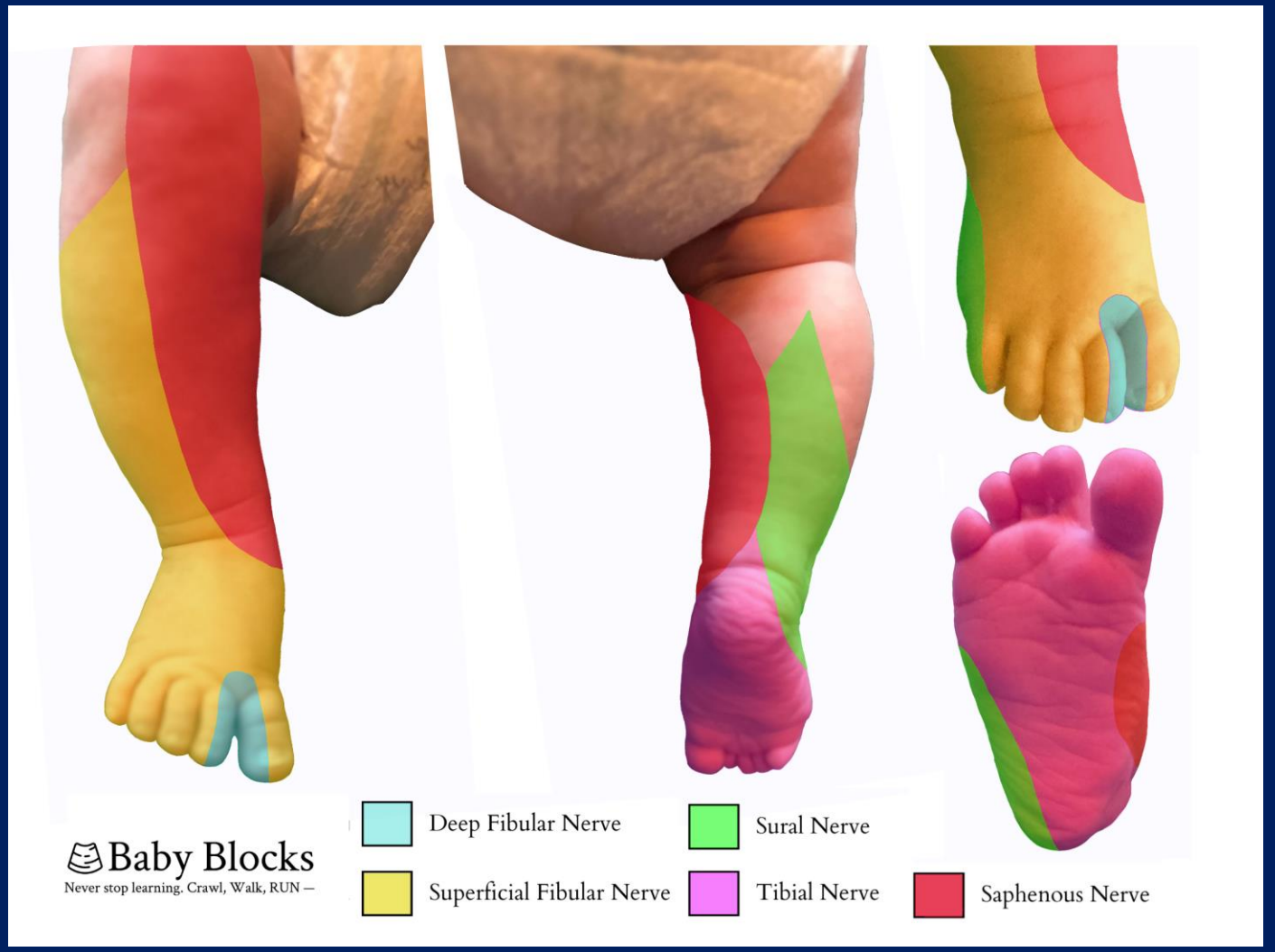




Predkolenie a chodidlo : Popliteal / Ankle block







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Lower Extremity Nerve Blocks

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Transducer Position | Sonoanatomy | Reverse Ultrasound Anatomy™ | Anatomy

Femoral nerve block and femoral triangle block

Indications:
Anesthesia and analgesia for hip, femur, anterior thigh, knee, and patella procedures; analgesia for hip and femur fractures.
FTB: Analgesia for knee surgery.
Patient position:
Supine; leg extended and slightly externally rotated.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 10-15 mL.

Abbreviations:
FA: Femoral artery
FV: Femoral vein
FTB: Femoral triangle block
FN: Femoral nerve
LA: Local anesthetic
PFA: Profunda femoris artery

Initial transducer position: Transverse over the femoral crease to identify the FA and FV medial to the femoral nerve.
Depth: 2-4 cm.
FTB: Transverse over the upper antero-medial thigh to identify the SAM and the femoral artery deep to it. The medial border of the sartorious should be lateral to the medial border of the adductor longus.

Ideal view (FNB):
IV lateral to the FA, beneath the fascia iliaca, and proximal to the bifurcation of the FA.
Ideal view (FTB):
FA under the posterior fascia of the sartorius muscle.

Technique (FNB):
Insert the needle in-plane, lateral-to-medial between the two layers of the fascia iliaca, lateral to the FN.
Ideal spread of LA: Displacement of the FN medially away from the needle and LA around the FN.
Technique (FTB):
Insert the needle just underneath the sartorius muscle fascia and next to the FA.
Ideal spread of LA: In the femoral triangle to displace the saphenous and vastus medialis nerves.

Tips (FNB):
- Tilt the transducer cranially/caudally to optimize the image of the FN and fascia iliaca.
- Pierce the fascia iliaca lateral to the edge of the FN.
- Beware of motor weakness of the quadriceps muscle → risk of fall.

Tips (FTB):
- Maintain steady transducer pressure to avoid needle insertion and/or injection into the FV (just under the FA).

Saphenous nerve block (in the adductor canal)

Indications:
Analgesia for knee surgery and the skin of the medial aspect of the leg below the knee. In combination with a sciatic nerve block for surgery below the knee.
Patient position: Supine, thigh abducted and externally rotated.
Transducer: Linear (curved in larger patients).
Needle: 22G, 5-8 cm short bevel.
LA volume: 5-10 mL.

Abbreviations:
ADM: Adductor magnus muscle
AMM: Adductor magnus muscle
FA: Femoral artery
FV: Femoral vein
LA: Local anesthetic
SFM: Rectus femoris muscle
SAM: Sartorius muscle
SAN: Saphenous nerve
VLM: Vastus lateralis muscle
VMM: Vastus medialis muscle

Initial transducer position: Transverse over the medial thigh to identify the femoral vessels deep to the SAM.
Depth: 3-5 cm.

Ideal view:
SAN between the SAM (superficial), VMM (anteromedial), and ALM (posteromedial). The medial border of the SAM is more posterior than the medial border of the ALM.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the FA and SAN.
Ideal spread of LA: Around the SAN in the adductor canal and over the FA.

Tips:
- Apply and release transducer pressure to locate the FV before injection and reduce the risk of intravascular injection or hematoma.
- Out-of-plane needle insertion may be easier in obese patients.
- In large patients who are not expected to ambulate the first day after total knee arthroplasty, a femoral nerve block may be an easier/safer/more effective choice.

Sciatic nerve block (subgluteal level)

Indications:
Anesthesia and analgesia for foot and ankle surgery, procedures on and below the knee involving the posterior aspect of the knee, and above knee amputation.
Patient position: Prone or lateral decubitus; leg flexed at the hip and knee.
Transducer: Linear (curved in larger patients).
Needle: 22G, 8-10 cm short bevel.
LA volume: 10-20 mL.

Abbreviations:
ADM: Adductor magnus muscle
BFM: Biceps femoris muscle
GMM: Gluteus maximus muscle
GMI: Gluteus medius muscle
LA: Local anesthetic
PFCN: Posterior femoral cutaneous nerve

Initial transducer position: Transverse over the gluteal crease to identify the fascial planes between the GMM (posterior), BFM (medial), and ADM.
Depth: 4-6 cm.

Ideal view:
Sciatic nerve as a hyperechoic oval structure between the fasciae of the GMM and ADM and lateral to the insertion of the BFM.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the lateral edge of the sciatic nerve within the fascial plane.
Ideal spread of LA: Within the sheath containing the sciatic nerve.

Tips:
- Apply transducer pressure and tilt to improve visualization of the sciatic nerve.
- Reposition the needle as needed to accomplish LA spread around the sciatic nerve.
- In difficult cases, identify the sciatic nerve in the popliteal fossa first and trace proximally to the subgluteal fold.

Sciatic nerve block (in the popliteal fossa)

Indications: Foot and ankle surgery, below-knee amputation, and Achilles tendon surgery.
Patient position: Prone or lateral decubitus preferred; supine with foot on elevated footrest.
Transducer: Linear.
Needle: 22G, 5-8 cm short bevel.
LA volume: 10-20 mL.

Abbreviations:
BFM: Biceps femoris muscle
CPN: Common peroneal nerve
FV: Femoral vein
PL: Popliteal artery
PV: Popliteal vein
SemM: Semimembranosus muscle
SemT: Semitendinosus muscle
TN: Tibial nerve

Initial transducer position: Transverse, 3-5 cm above the popliteal crease posterior to sciatic nerve where the TN and CPN start diverging but are still in the common sciatic sheath (Mokri's sheath).
Depth: 3-5 cm.

Ideal view:
Sciatic nerve at the TN and CPN at the level of the bifurcation within Mokri's sheath, superficial to the PA and PV, between the BFM (lateral), and the SemM and SMM (medial).

Technique:
Insert the needle out-of-plane or in-plane lateral-to-medial direction, into Mokri's sheath between the TN and CPN.
Ideal spread of LA: Around the sciatic nerve within Mokri's sheath; separation of TN and CPN by the LA.

Tips:
- Apply transducer pressure and tilt distally to improve the image of the sciatic nerve.
- The CPN often lies in the needle path to reach the sciatic sheath, making an out-of-plane approach more practical. Choose an out-of-plane needle insertion when the TN and CPN are horizontal (as in this example), and the in-plane technique when they are stacked vertically.

Monitoring of needle-nerve relationship during nerve blocks





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Upper Extremity Nerve Blocks

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Transducer Position | Sonoanatomy | Reverse Ultrasound Anatomy™ | Anatomy

Interscalene brachial plexus block

Indications:
Anesthesia and analgesia for shoulder, proximal humerus, and clavicle surgeries.
Patient position:
Supine, semi-sitting; with the head turned to the contralateral side.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 7-15 mL.

Abbreviations:
ASM: Anterior scalene muscle
BP: Brachial plexus
BPS: Brachial plexus sheath
CCA: Common carotid artery
CN: Cervical nerve
DSN: Dorsal scapular nerve
ECM: External oblique muscle
IJV: Internal jugular vein
LA: Local anesthetic
LSAM: Longus capitis muscle
LCM: Longus colli muscle
MSM: Middle scalene muscle
MT: Middle trunk
PSM: Posterior scalene muscle
RLN: Recurrent laryngeal nerve
SAM: Scalenus anterior muscle
SCM: Sternocleidomastoid muscle
SMM: Scalenus medius muscle
SVA: Suprascapular artery
SVN: Suprascapular vein
TCA: Transverse cervical artery
UT: Upper trunk
VC: Vital capacity
VN: Vagus nerve
VR: Ventilatory rate

Initial transducer position:
Transverse over the neck, 2-3 cm cephalad to the clavicle, and over the IJV/ when visible).
Depth: 3 cm.

Ideal view:
BP roots (C5-C7) as hyperechoic round structures between the ASM and MSM.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the BP. Avoid the DSN and LTN in the needle path.
Ideal spread of LA:
Around the superior (C5, C6) and middle trunks (C7) of the BP in the interscalene space between the ASM and MSM.

Tips:
- Only make additional injections if the LA doesn't spread within the interscalene space.
- Aim between the roots to reduce the nerve injury risk.
- Use color Doppler to avoid vascular structures in the needle path.
- Avoid long-acting LAs in patients unable to tolerate > 20% reduction VC (phrenic nerve paralysis).
- The inferior trunk (C8-T1) is usually spared.

Supraclavicular brachial plexus block

Indications:
Anesthesia and analgesia for shoulder, humerus, elbow, forearm, and hand surgeries.
Patient position:
Supine, semi-sitting; with the head turned to the contralateral side.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 20-25 mL.

Abbreviations:
ASM: Anterior scalene muscle
BP: Brachial plexus
BPS: Brachial plexus sheath
CCA: Common carotid artery
LA: Local anesthetic
LSAM: Longus capitis muscle
LCM: Longus colli muscle
MSM: Middle scalene muscle
MT: Middle trunk
PSM: Posterior scalene muscle
SAM: Scalenus anterior muscle
SCM: Sternocleidomastoid muscle
SVA: Suprascapular artery
SVN: Suprascapular vein
TCA: Transverse cervical artery
UT: Upper trunk
VC: Vital capacity

Initial transducer position:
Transverse just above the clavicle to identify the SA, first rib, and BP lateral and superior to the SA.
Depth: 3 cm.

Ideal view:
Collection of hypoechoic oval structures enclosed within the BP sheath posterior to the SA and superficial to the first rib. The neural elements correspond to the divisions of the UT, MT, and LT.

Technique:
Insert the needle in-plane, lateral-to-medial direction, toward the BP.
1. Inject 10 mL between the first rib and LT (often referred to as "corner pocket").
2. Reposition the needle tip to inject another 10 mL between the divisions of the UT and MT.

Ideal spread of LA: Within the sheath containing the trunks and divisions of the BP.

Tips:
- Use color Doppler to identify and avoid the DSA, TCA, and SSA in the needle path.
- The BP is shallow at this location, limit the initial needle depth ≤ 1 cm.
- Avoid in patients who cannot tolerate > 20% reduction in VC (phrenic nerve paralysis) → consider an axillary or infraclavicular block.

Infraclavicular brachial plexus block

Indications: Anesthesia and analgesia for shoulder, arm, elbow, forearm, and hand surgeries.
Patient position: Supine with the head turned to the contralateral side; arm abducted 90° and flexed elbow.
Transducer: Linear.
Needle: 22G, 8-10 cm short bevel.
LA volume: 20-25 mL.

Abbreviations:
AA: Axillary artery
AV: Axillary vein
BP: Brachial plexus
LA: Local anesthetic
LC: Lateral cord
MC: Medial cord
PC: Posterior cord
PMM: Pectoralis major muscle
PMI: Pectoralis minor muscle

Initial transducer position:
Sagittal just below the clavicle to identify the PMM, PmM, posterior fascia of the PmM, and AA.
Depth: 3-5 cm.

Ideal view:
AA and AV below the fascia of the PmM, hyperechoic cords (BP) lateral (LC), medial (MC), and posterior (PC) to the AA (not always visible).

Technique:
Insert the needle in-plane, cranial-to-caudal direction, posterior to the AA while avoiding the LC.
Ideal spread of LA:
Around the AA, surrounding the BP cords (LC, MC, and PC).

Tips:
- Reduce the transducer pressure before injection to facilitate LA spread around the AA.
- Lower risk of phrenic nerve involvement compared to interscalene or supraclavicular BP blocks
- Perform another injection medial to the AA only when the first injection posterior to the AA does not result in spread on both sides of the AA.

Axillary brachial plexus block

Indications: Anesthesia and analgesia for elbow, forearm, and hand surgeries. AV shunts for dialysis.
Patient position: Supine with the head turned to the contralateral side; arm abducted 90° and flexed elbow.
Transducer: Linear.
Needle: 22G, 5 cm short bevel.
LA volume: 20 mL.

Abbreviations:
AA: Axillary artery
AV: Axillary vein
BP: Brachial plexus
CBM: Coracobrachialis muscle
LA: Local anesthetic
MAUN: Medial brachial cutaneous nerve
MBN: Median brachial nerve
PMM: Pectoralis major muscle
PMN: Pectoralis minor muscle
RN: Radial nerve
UN: Ulnar nerve

Initial transducer position:
Transverse over the intersection of the PMM and biceps muscle to identify the AA. The transducer should be perpendicular to the arm axis.
Depth: 3-5 cm.

Ideal view:
MN, UN, and RN as hyperechoic oval structures around the AA; MsN as a hypoechoic oval structure with a bright hyperechoic rim in the fascial layer between the biceps and CBM. When individual nerves are not immediately recognizable, the most important is to identify the axillary BP fascia where the LA is injected, regardless of the position of the nerves.

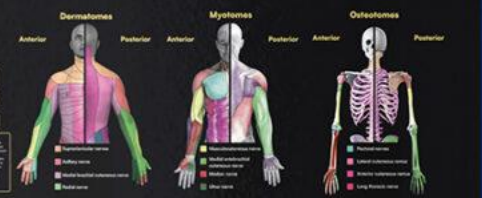
Technique:
Insert the needle in-plane, lateral-to-medial direction, posterior to the AA.
Make 3 separate injections as follows:
- 8 mL below the AA.
- 8 mL above the AA.
- 4 mL to block the MsN.

Ideal spread of LA:
Around the AA, surrounding the BP terminal branches (MN, UN, RN) and MsN.

Tips:
- Avoid placing the transducer in the axillary fossa; stay perpendicular to the humerus, just below the axillary fossa crease.
- Maintain consistent transducer pressure through the procedure to avoid opening and closing of the AV and inadvertent intravascular injection.
- No separate injection needed if the MsN is bundled with the MN (< 10% of patients) or inside the BP sheath.

Monitoring of needle-nerve relationship during nerve blocks





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Pediatric Perioperative Ultrasound & Regional Anesthesia



Take Home Message

Think about **CPSP/RA before surgery**

Think about **RA : Prevention of CPSP**

Think about **of RA for surgery**

Think about **Multimodal analgesia**

XII. BYSTRICKÝ MIKULÁŠSKY KURZ SKARA

REGIONÁLNA ANESTÉZIA
PRI OPERÁCIÁCH TRUPU



5. DECEMBRA 2026

Múzeum SNP
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Steven Coppens BE	ESRA Board member University Hospitals Leuven
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MUDr. Daniel Nalos
MUDr. Luboš Beňo
CZ
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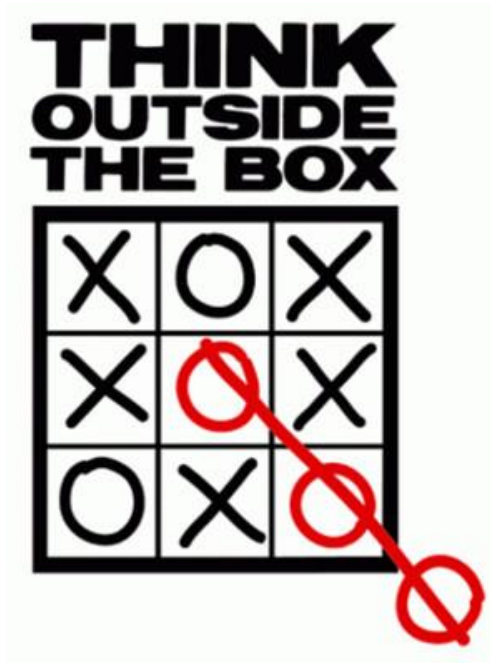
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