Co je nového v intraneurálním podání LA?

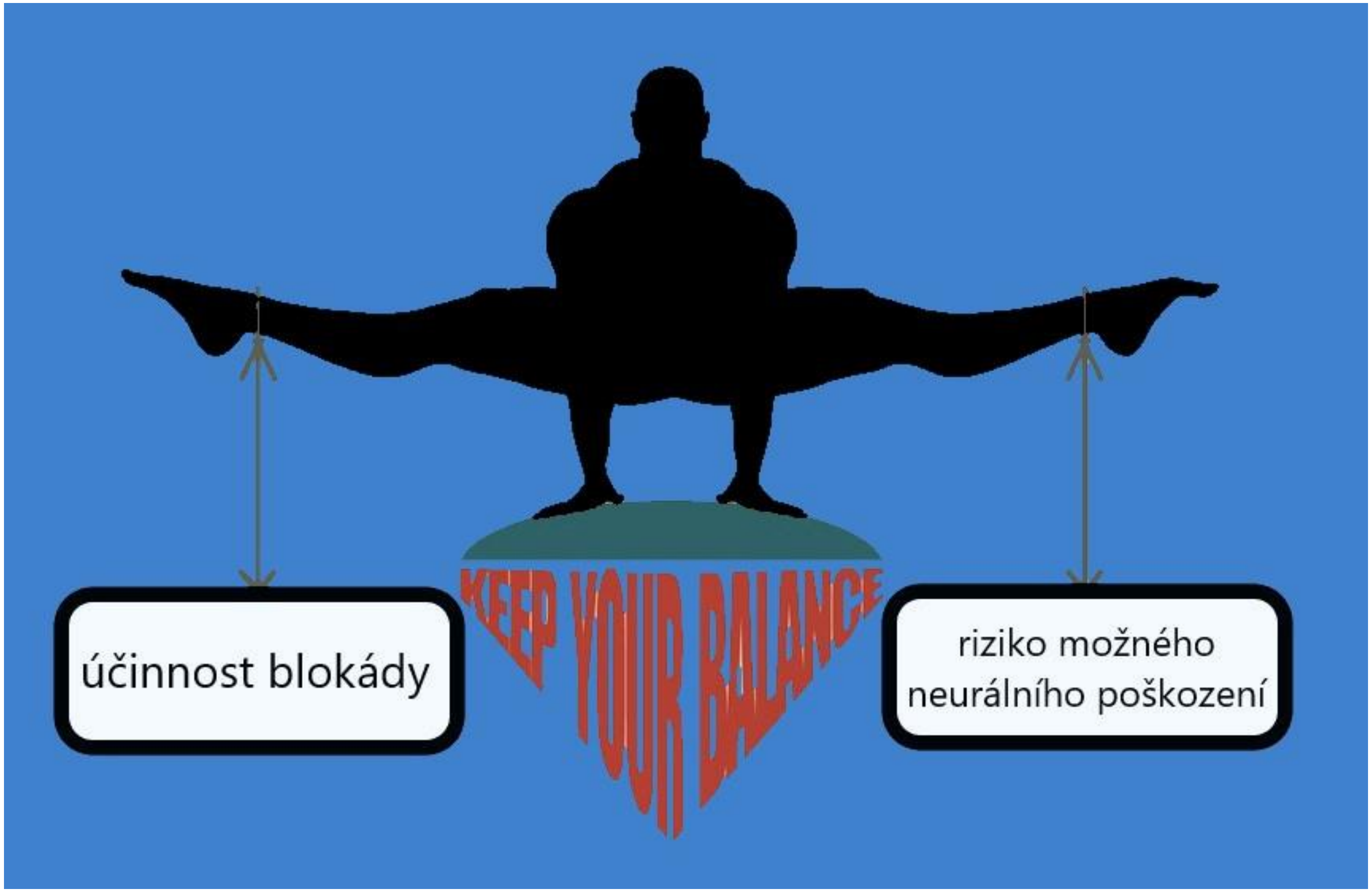
Milan Jelínek

XXVI. kongres ČSARIM

BRNO 2019

FAKULTNÍ NEMOCNICE U SV. ANNY V BRNĚ

Důvody intraneurálního podání ?



Hledání „sweet spotu“- ideálního místa pro podání LA a zvedení katetru

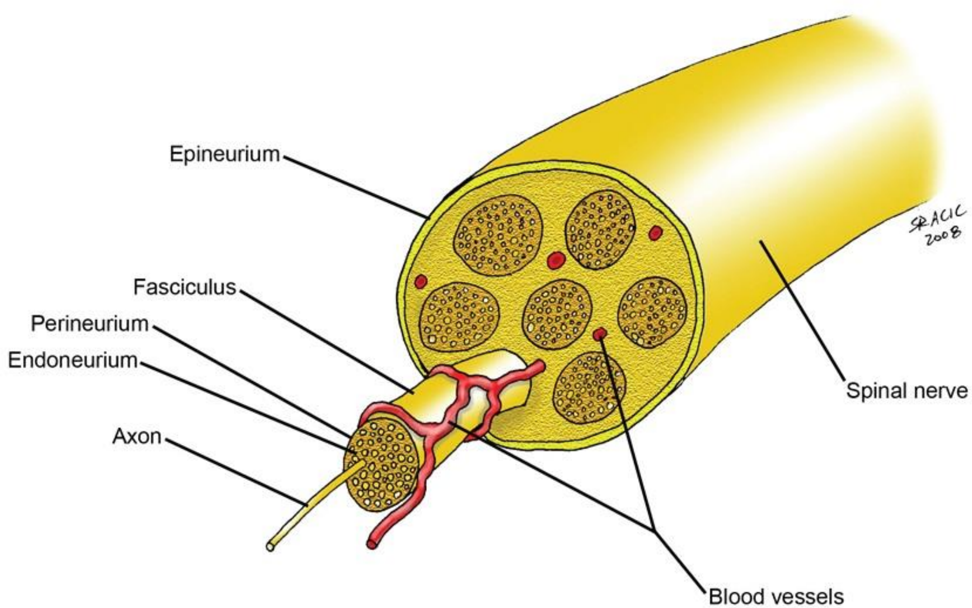
EDITORIAL VIEWS

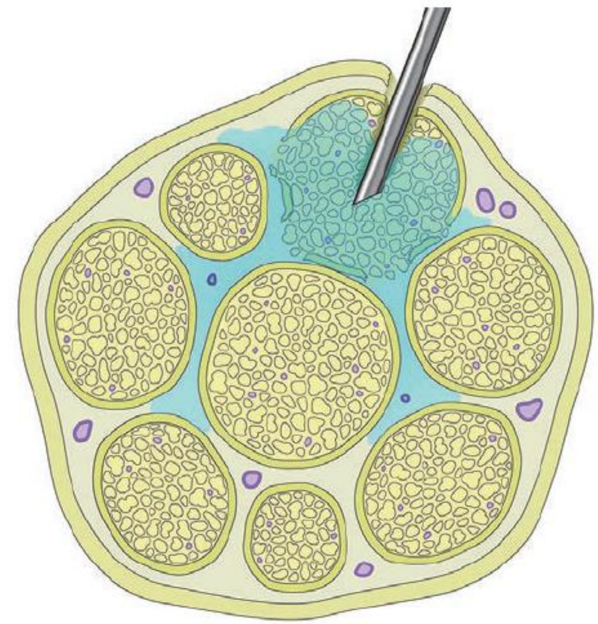
Intraneural Injection

Is the Jury Still Out?

Kamen Vlassakov, M.D., Philipp Lirk, M.D., Ph.D., James P. Rathmell, M.D.

Anesthesiology 2018; 129:221-4





"… the distinction between reversible nerve blockade and reversible nerve injury may be fuzzier than we dare to admit."

The Second ASRA Practice Advisory on Neurologic Complications Associated With Regional Anesthesia and Pain Medicine

Executive Summary 2015

Joseph M. Neal, MD, Michael J. Barrington, MBBS, FANZCA, PhD,† Richard Brull, MD,‡ Admir Hadzic, MD,§ James R. Hebl, MD,|| Terese T. Horlocker, MD,|| Marc A. Huntoon, MD,** Sandra L. Kopp, MD,|| James P. Rathmell, MD,†† and James C. Watson, MD||*

Místo aplikace LA

Needle Tip Location, Choice of Local Anesthetic, and Paresthesia

- Intraneural needle insertion does not invariably lead to functional nerve injury (Level 3)
- Intrafascicular needle insertion and injection should be avoided because it can cause histological and/or functional nerve injury (Level 2)
- Paresthesia during needle advancement or on injection of local anesthetic is not entirely predictive of PNI (Level 3)

Nedoporučují úmyslnou intraneurální aplikaci

Poloha jehly k nervu podle způsobu lokalizace

Nerve Localization Techniques

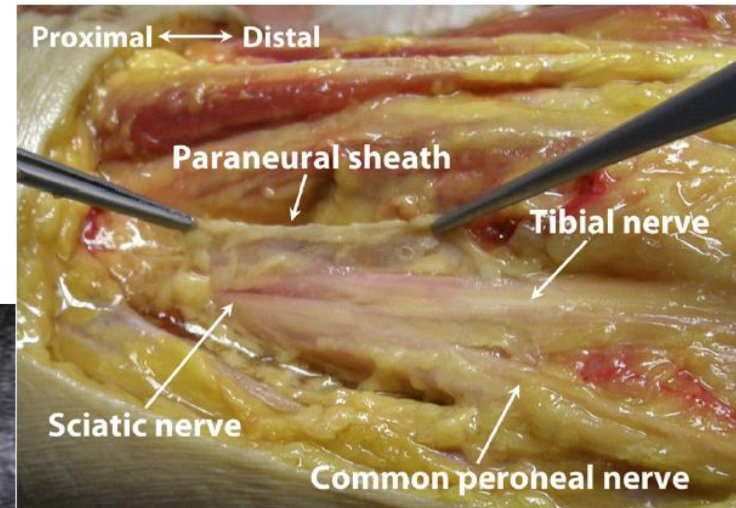
- There are no human data to support the superiority of 1 nerve localization technique over another with regard to reducing the likelihood of PNI (Level 3)
- *Peripheral Nerve Stimulation*
  - Presence of an evoked motor response at a current of <0.5 (0.1 ms) indicates intimate needle-nerve relationship, needle-nerve contact, or an intraneural needle placement (Level 2)
  - Absence of a motor response at current of up to 1.8 mA does not exclude needle-nerve contact or intraneural needle placement (Level 3)
- *Injection Pressure* Monitoring
  - Animal data have linked high injection pressures to subsequent fascicular injury, but there are no human data that confirm or refute the effectiveness of injection pressure monitoring for limiting PNI (Level 2)
  - Injection pressure monitoring can detect needle-nerve contact for interscalene brachial plexus block (Level 3)
  - The common practice of subjectively assessing injection pressure by "hand feel" is inaccurate (Level 3)
- *Ultrasound*
  - Ultrasound can detect intraneural injection (Level 2)
  - Current ultrasound technology does not have adequate resolution to discern between an interfascicular and intrafascicular injection (Level 2)
  - Adequate images of needle-nerve interface are not consistently obtained by all operators and in all patients (Level 2)

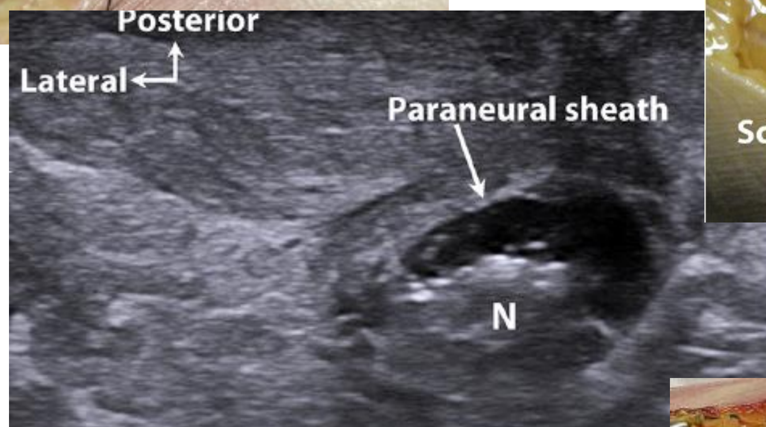
Injection Inside the Paraneural Sheath of the Sciatic Nerve

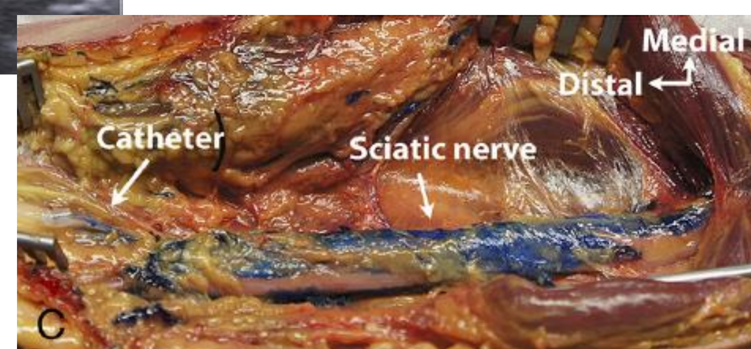
Direct Comparison Among Ultrasound Imaging, Macroscopic Anatomy, and Histologic Analysis

Henning Lykke Andersen, MD, Sofie L. Andersen, MD,† and Jørgen Tranum-Jensen, MD‡*

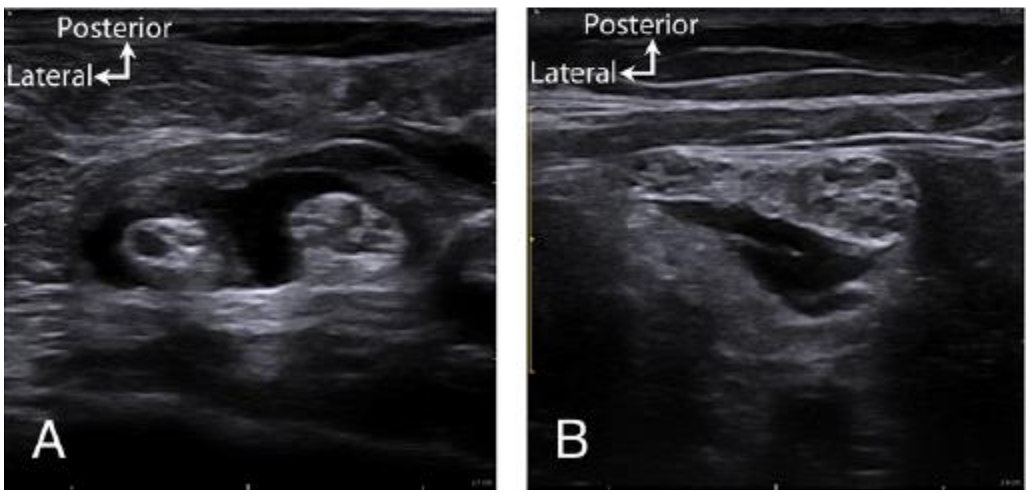
(*Reg Anesth Pain Med* 2012;37: 410–414)

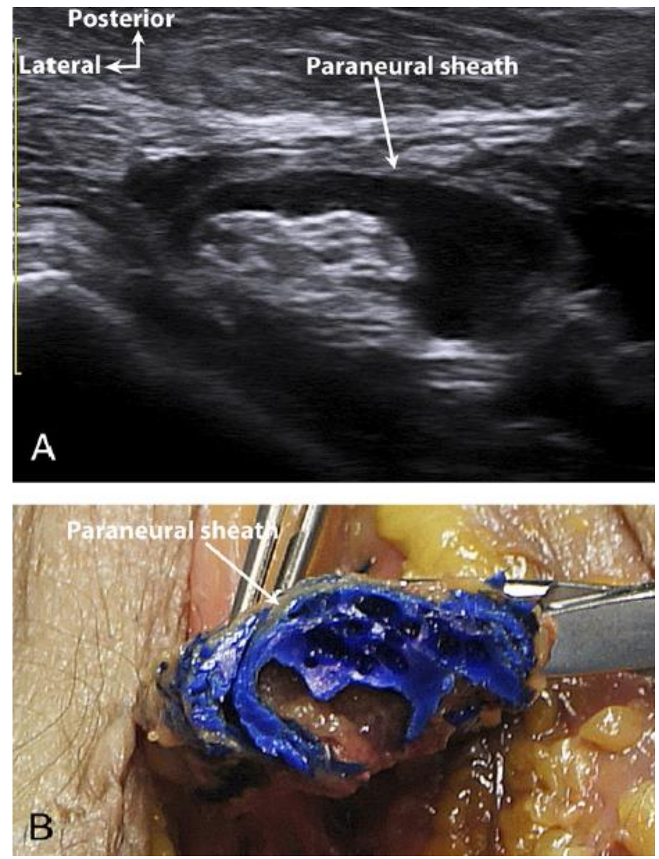




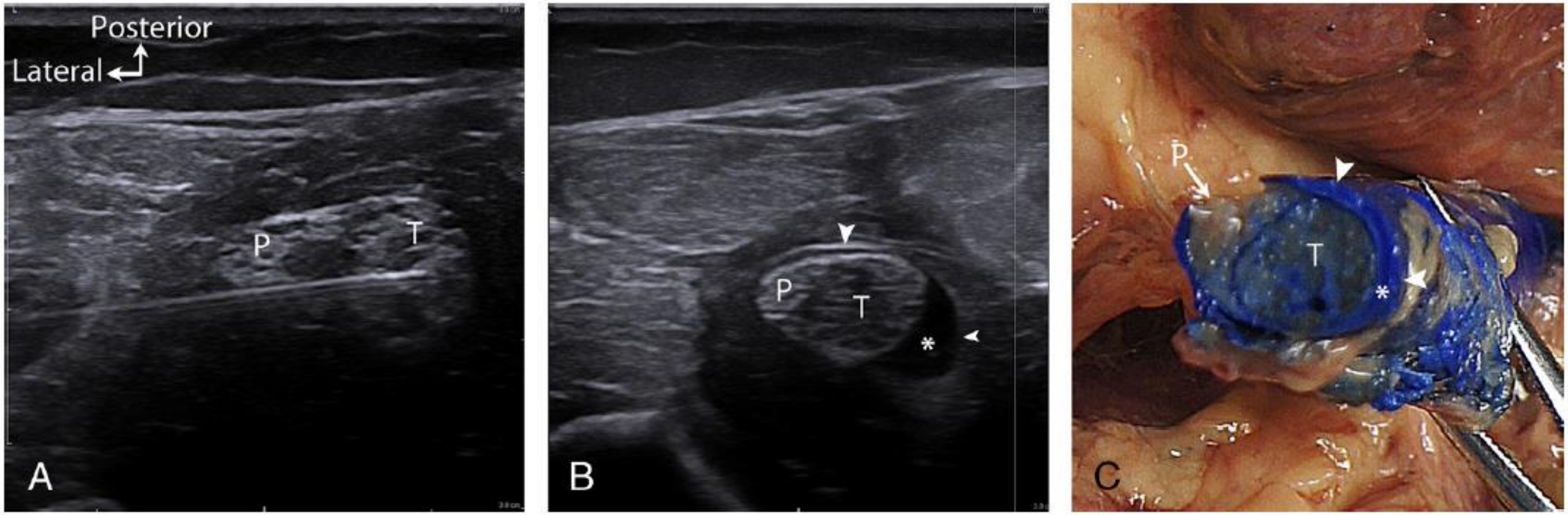



Medial
Distal
A
B
C


Posterior
Lateral
A
Posterior
Lateral
B


Posterior
Lateral
Paraneural sheath
A
Paraneural sheath
B

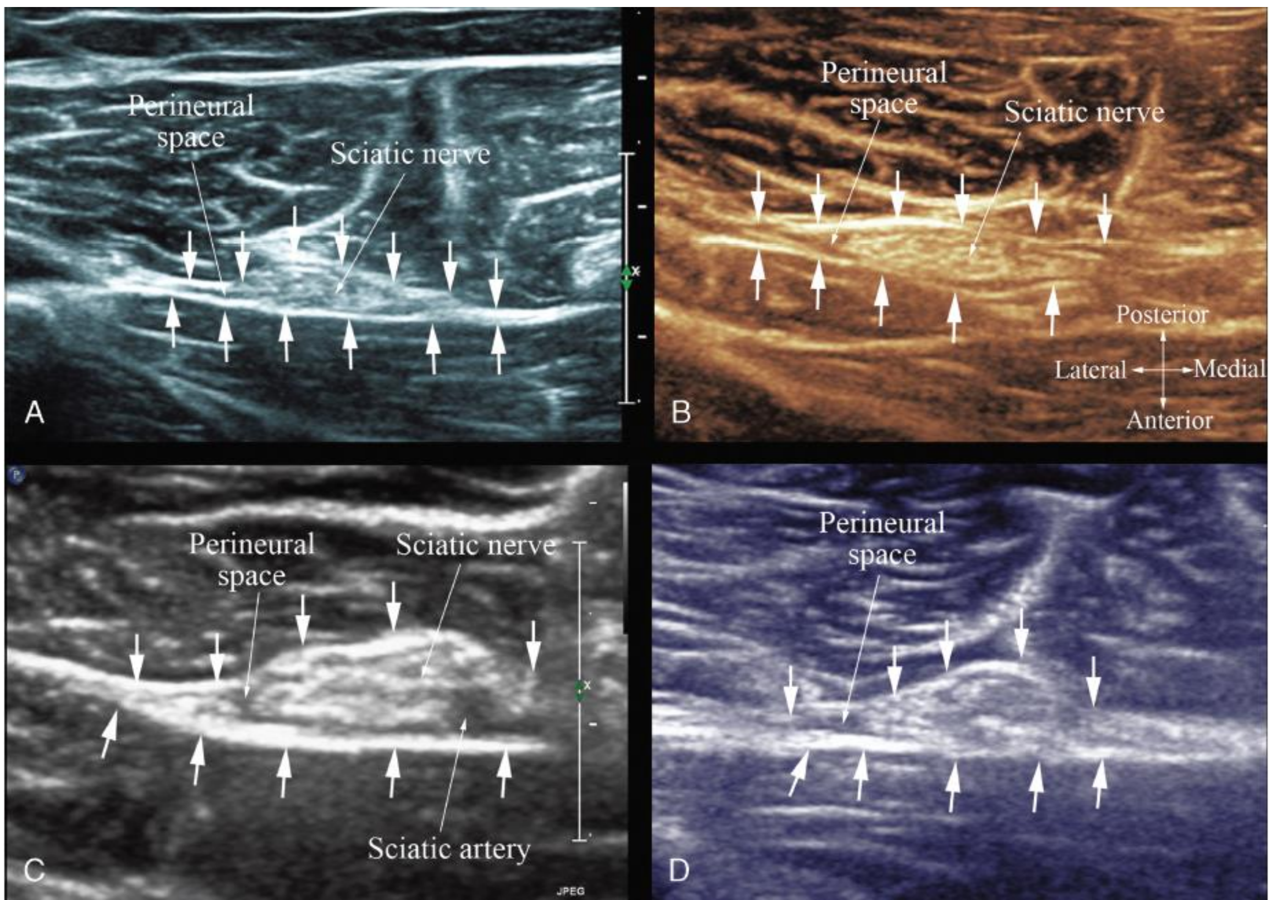
Intraneurální subepineurální aplikace



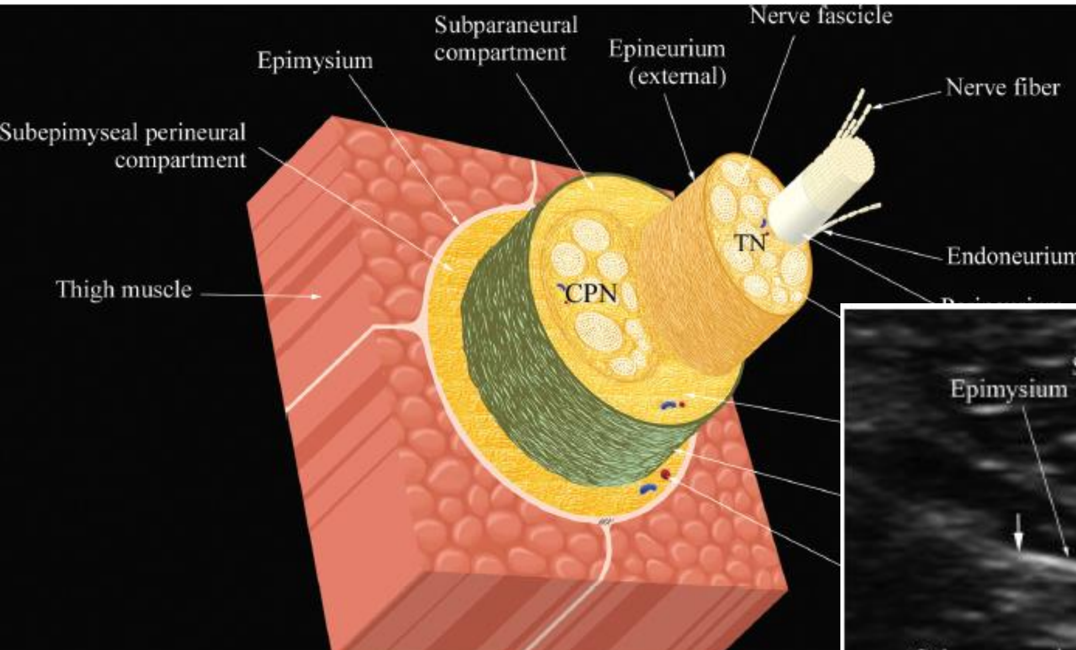
High-Definition Ultrasound Imaging Defines the Paraneural Sheath and the Fascial Compartments Surrounding the Sciatic Nerve at the Popliteal Fossa

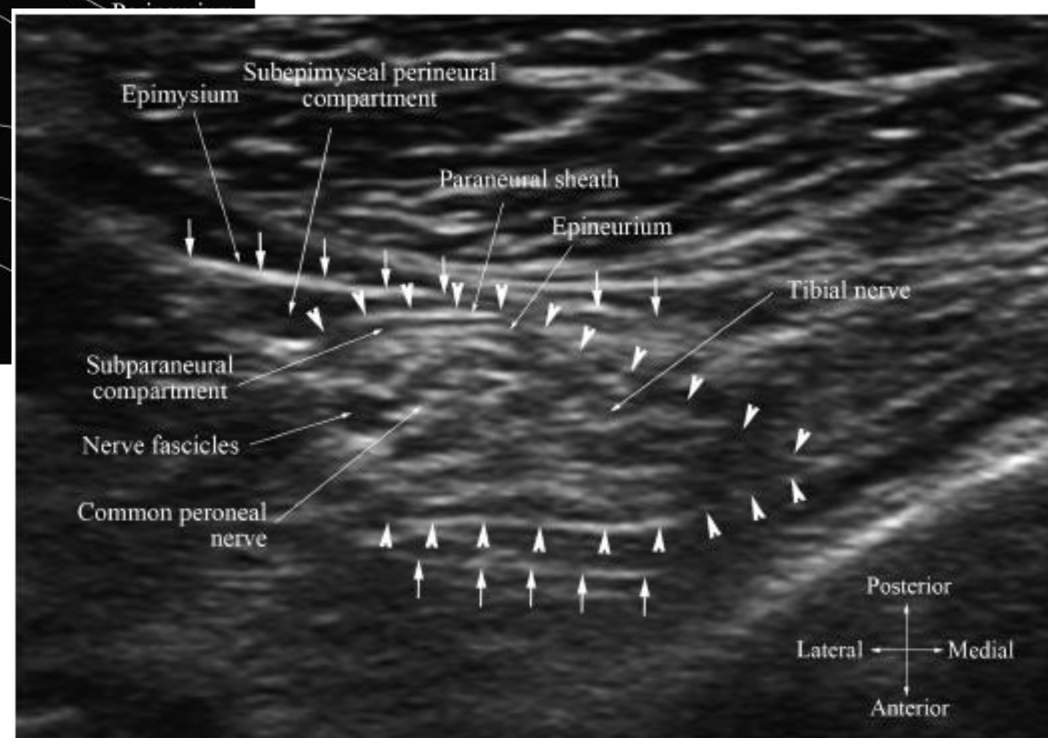
Manoj Kumar Karmakar, MD, Ali Nima Shariat, MD,† Pawinee Pangthipampai, MD,**
and Junping Chen, MD†

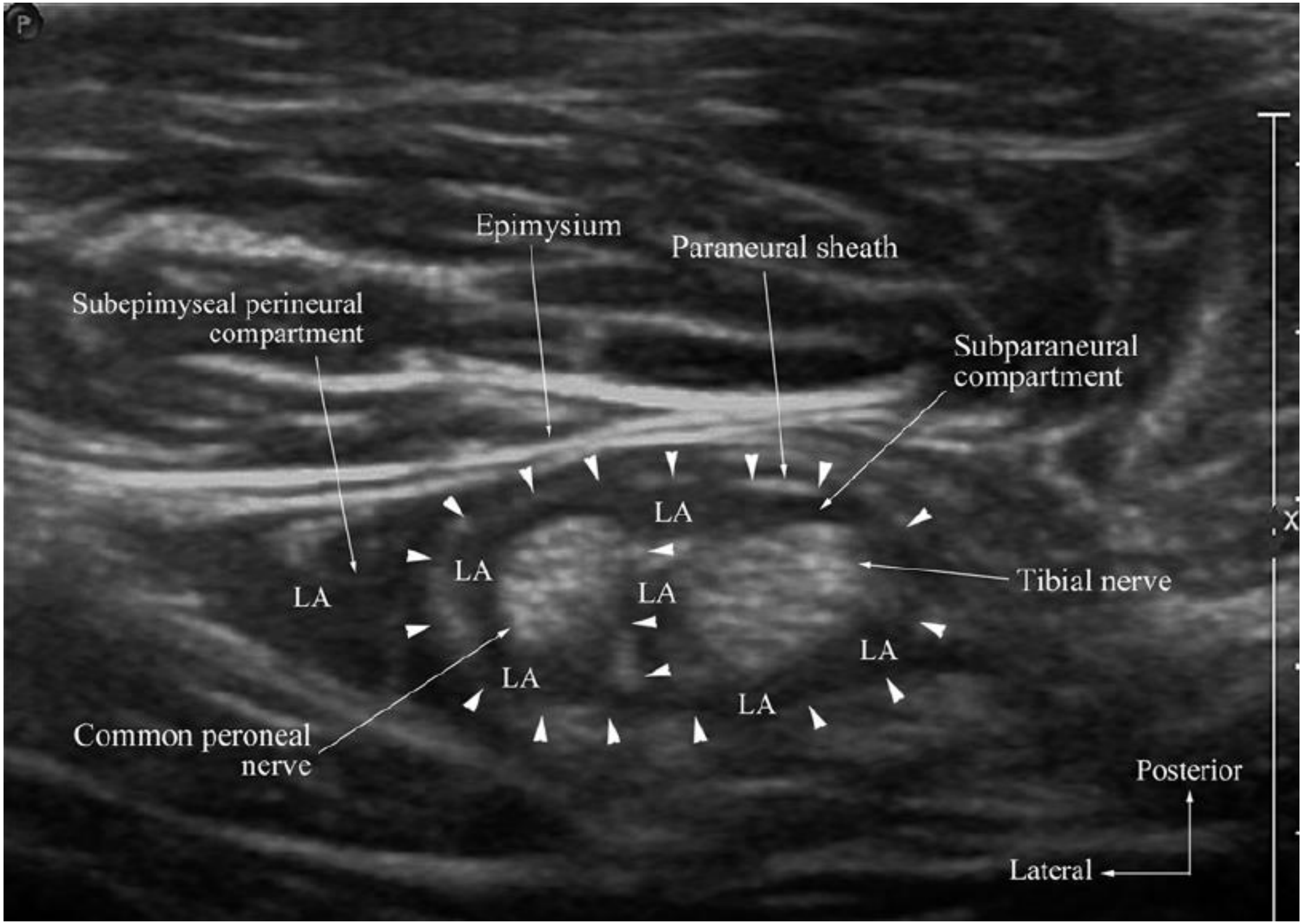
(*Reg Anesth Pain Med* 2013;38: 447–451)



Paraneurium, circumneural sheat, gliding apparatus





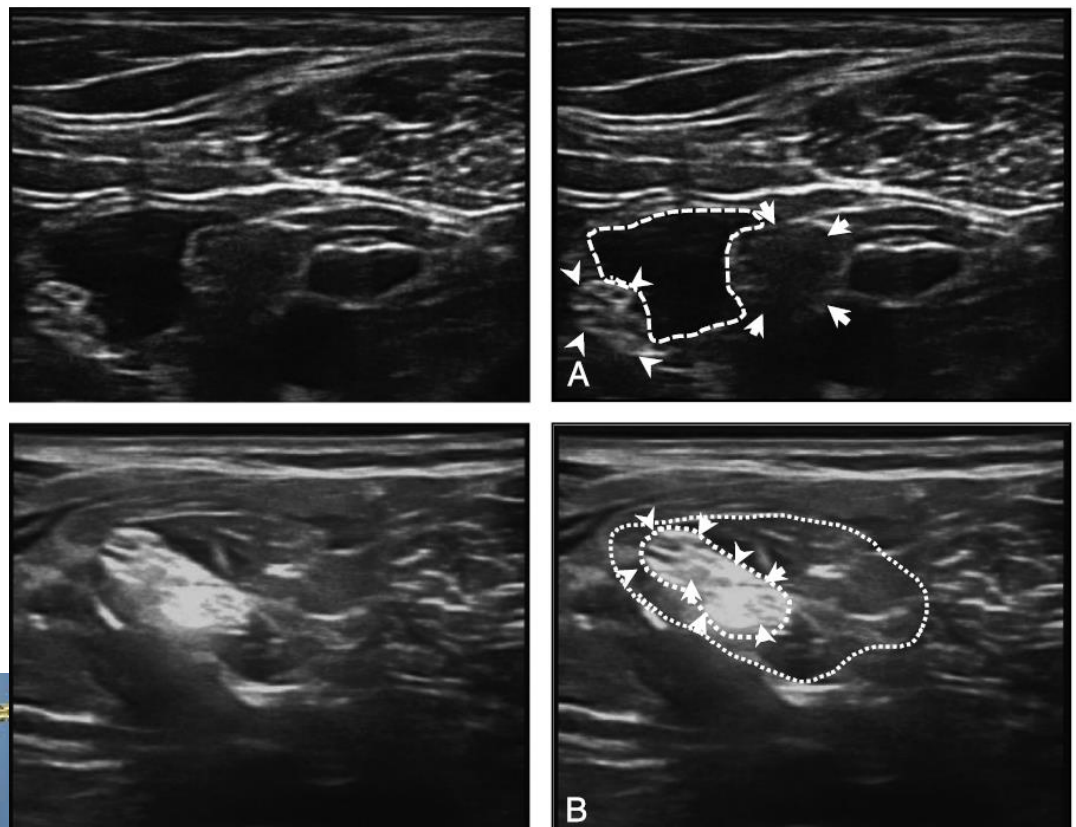

Epimysium
Paraneural sheath
Subepimyseal perineural compartment
Subparaneural compartment
LA
LA
LA
LA
Tibial nerve
LA
LA
LA
Common peroneal nerve
Posterior
Lateral

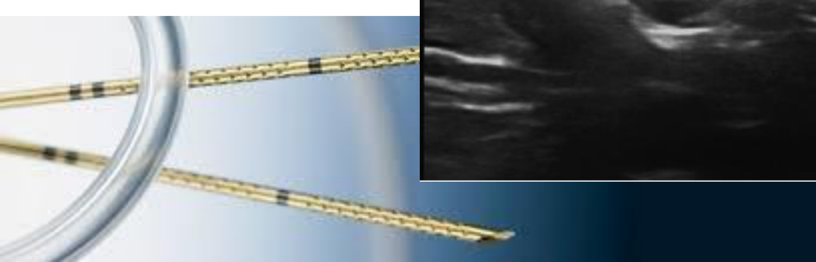
Subparaneural Versus Circumferential Extraneural Injection at the Bifurcation Level in Ultrasound-Guided Popliteal Sciatic Nerve Blocks

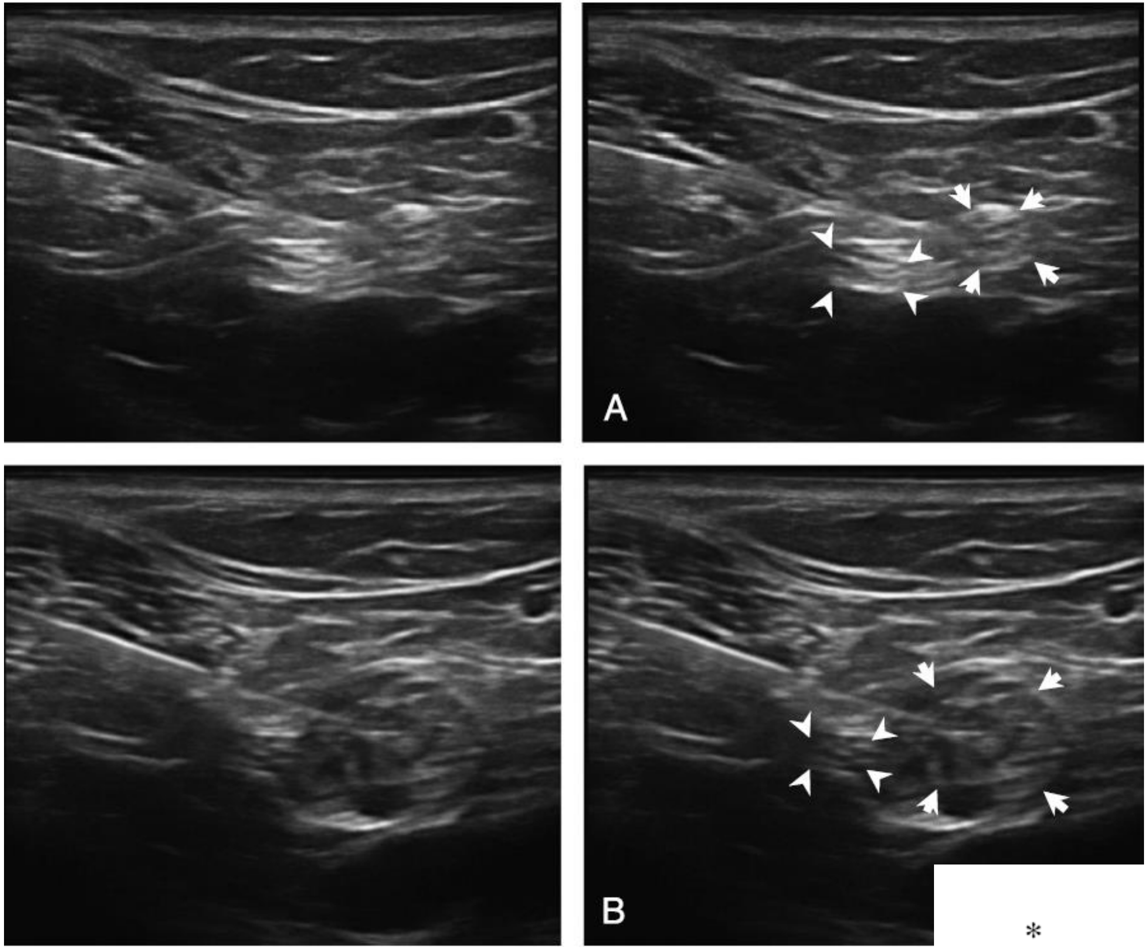
A Prospective, Randomized, Double-Blind Study

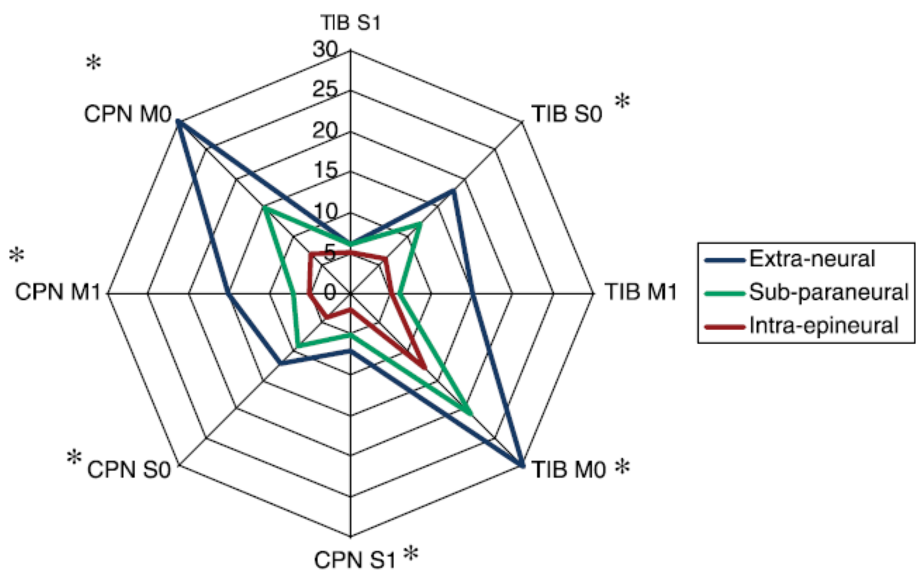
Olivier Choquet, MD, Guillaume Brault Noble, MD, MSc,* Bertrand Abbal, MD,**
Didier Morau, MD, MSc, Sophie Bringuier, PharmD, PhD,†‡ and Xavier Capdevila, MD, PhD*§*

(*Reg Anesth Pain Med* 2014;39: 306–311)



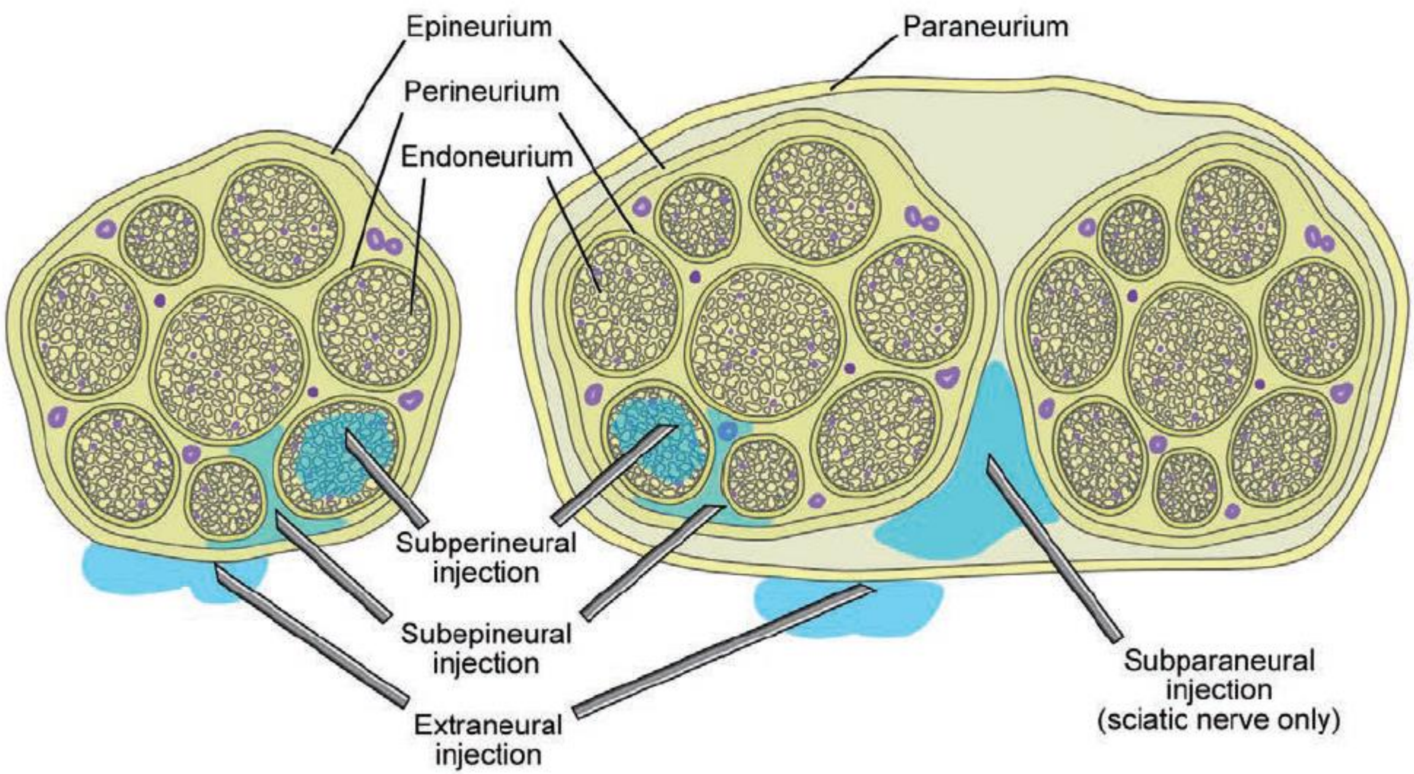



A
B


TIB S1
30
25
20
15
10
5
0
TIB S0 *
TIB M1
TIB M0 *
CPN S1 *
* CPN S0
* CPN M1
* CPN M0
Extra-neural
Sub-paraneural
Intra-epineural

Peripheral Nerve

Sciatic Nerve (Popliteal Fossa)

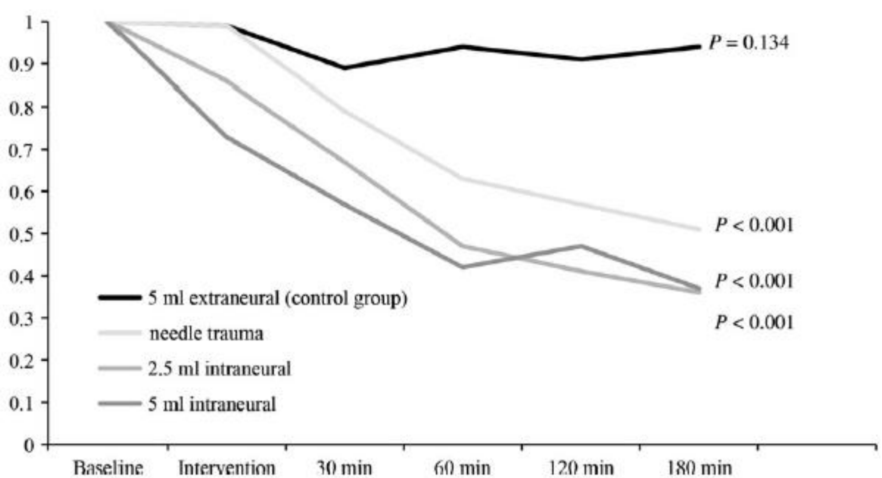


ORIGINAL ARTICLE

Neurophysiological effects of needle trauma and intraneural injection in a porcine model: a pilot study

L. Kirchmair[1,2], M. Ströhle[3], W. N. Löscher[4], J. Kreutziger[3], W. G. Voelckel[1,2] and P. Lirk[5]

Acta Anaesthesiologica Scandinavica **60** (2016) 393–399



Methods: The experimental set-up was elaborated in four pre-test animals. In the remaining animals ($n = 11$), 22 sciatic nerves were randomly assigned to one of four groups: needle trauma ($n = 5$) generated by ultrasound-guided forced needle advancement; intraneural injection of 2.5 ml saline ($n = 6$); intraneural injection of 5 ml saline ($n = 6$); extraneural injection of 5 ml saline ($n = 5$) as control group. Compound muscle action potential (CMAP) amplitudes as well as latencies were taken as outcome parameter and monitored over 180 min. Sonographic assessments were performed simultaneously.

Results: Following needle trauma and intraneural injection, CMAP amplitudes declined significantly over 180 min ($P < 0.001$). The control group showed no electrophysiological alterations. At 60 min, decreases in amplitude were significant after needle trauma ($P = 0.04$) and intraneural injection of 2.5 ml ($P = 0.045$), and highly significant after injection of 5 ml ($P = 0.006$) when compared to controls. Sustained nerve swelling was observed after intraneural injection, but not after needle trauma and perineural injection.

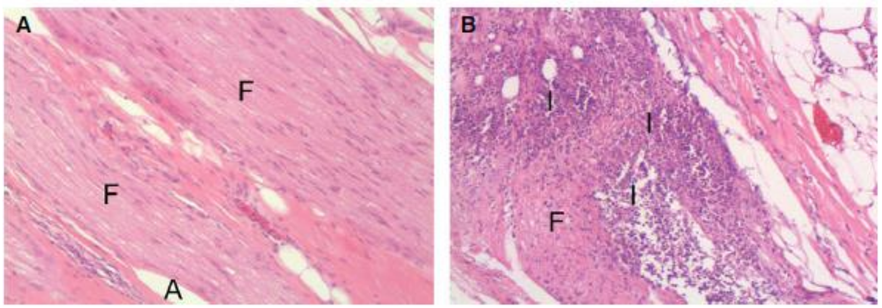
Conclusions: Isolated mechanical trauma caused by forced needle advancement alone or in combination with intraneural injection of saline was followed by a significant decline in CMAP amplitudes indicating conduction block due to disruption of myelin or axon loss (pseudo-conduction block).

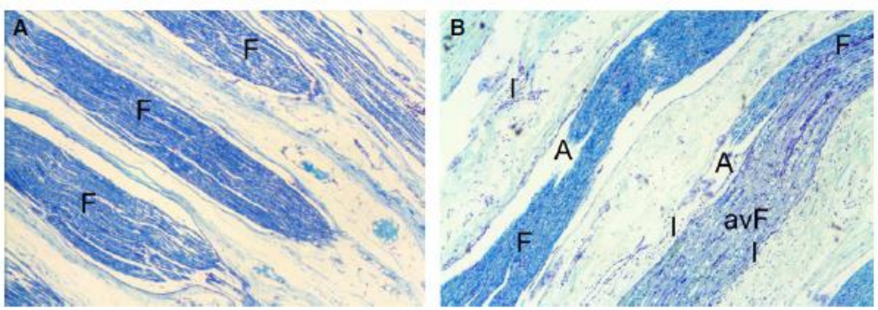
ORIGINAL ARTICLE

Intraneural injection of a test dose of local anesthetic in peripheral nerves – does it induce histological changes in nerve tissue?

T. Wiesmann[1], T. Steinfeldt[1,2], M. Exner[1], W. Nimphius[3], J. De Andres[4], H. Wulf[1] and U. Schwemmer[5]

Acta Anaesthesiologica Scandinavica (2016)





Background & Objectives: Most anesthesiologists use the injection of a test dose of local anesthetic in order to evaluate the final needle tip position. Thus, the intraneural injection of a full dose can be avoided. The aim of this study was to analyze whether an intraneural injection of a test dose of bupivacaine could trigger histological changes.

Methods: Intraneural injections under direct vision were performed in 40 brachial plexus nerves in seven anesthetized pigs. Tibial nerves served as positive and negative controls. Two milliliter of bupivacaine 0.5% was injected in three nerves on the left brachial plexus. For control of local anesthetic's toxicity Ringer's solution was applied intraneurally on the right side. After maintaining 48 h of general anesthesia, the nerves were resected. The specimens were processed for histological examination and assessed for inflammation (hematoxylin and eosin stain, CD68-immunohistochemistry) and myelin damage (Kluver–Barrera stain). The degree of nerve injury was rated on a scale from 0 (no injury) to 4 (severe injury).

Results: Statistical analysis showed no significant differences between the bupivacaine group [median (interquartile range) 1 (1–1.5)] and the Ringer's solution group [1 (0.5–2) $P = 0.772$]. Mild myelin alteration was found in 12.5% of all specimens following intraneural injection, irrespective of the applied substance.

Conclusions: "In our experimental study, intraneural injection of 2 ml of bupivacaine or Ringer's solution showed comparable mild inflammation. Nevertheless, inflammation can only be prevented by strictly avoiding nerve perforation followed by intraneural injection, as mechanical nerve perforation is a key factor for evolving inflammation.

Intraneural Ultrasound-guided Sciatic Nerve Block

Minimum Effective Volume and Electrophysiologic Effects

Gianluca Cappelleri, M.D., Andrea Luigi Ambrosoli, M.D., Marco Gemma, M.D.,
Valeria Libera Eva Cedrati, M.D., Federico Bizzarri, M.D., Giorgio Francesco Danelli, M.D

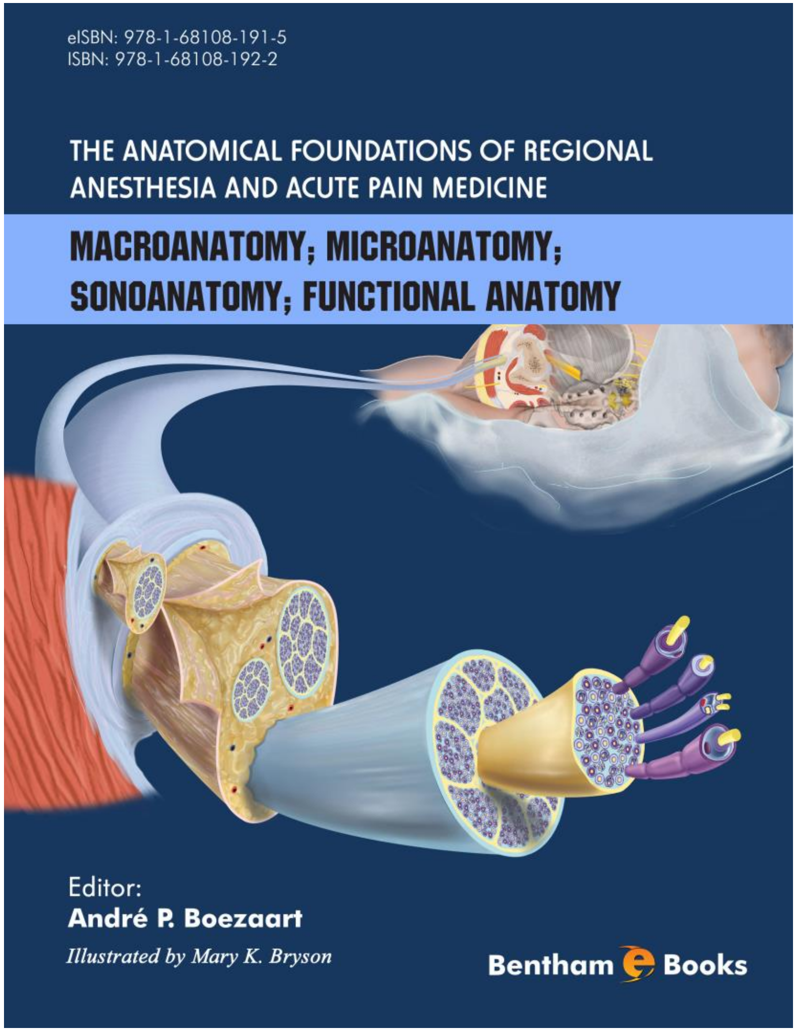
ABSTRACT

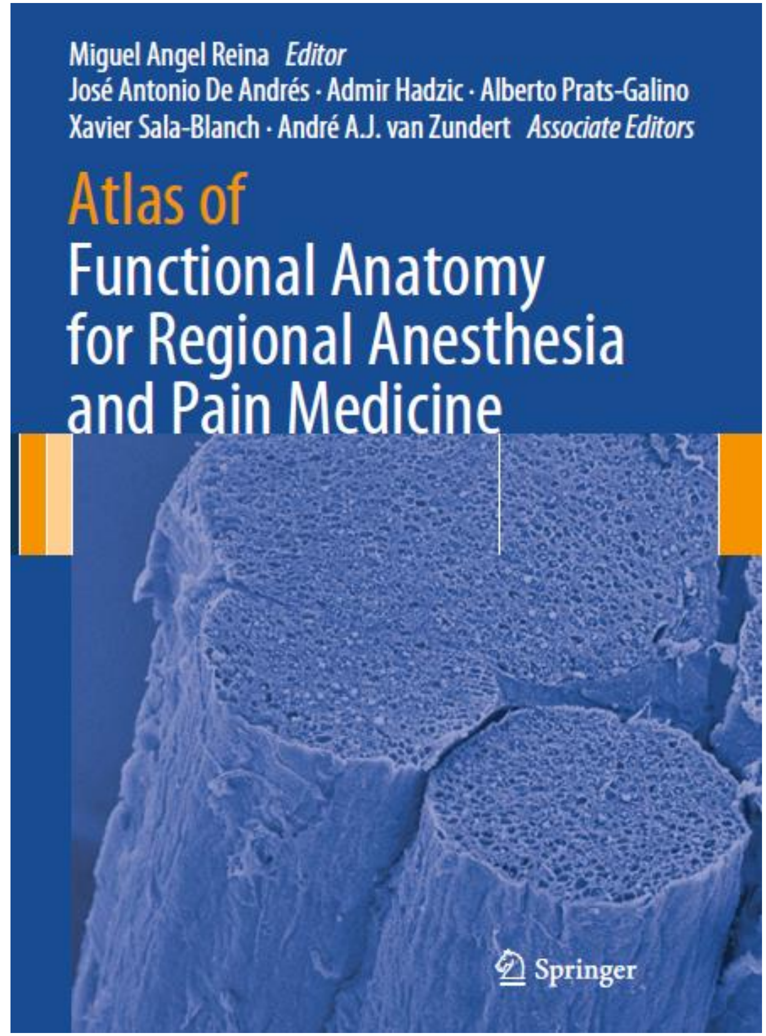
Background: Both extra- and intraneural sciatic injection resulted in significant axonal nerve damage. This study aimed to establish the minimum effective volume of intraneural ropivacaine 1% for complete sensory-motor sciatic nerve block in 90% of patients, and related electrophysiologic variations.

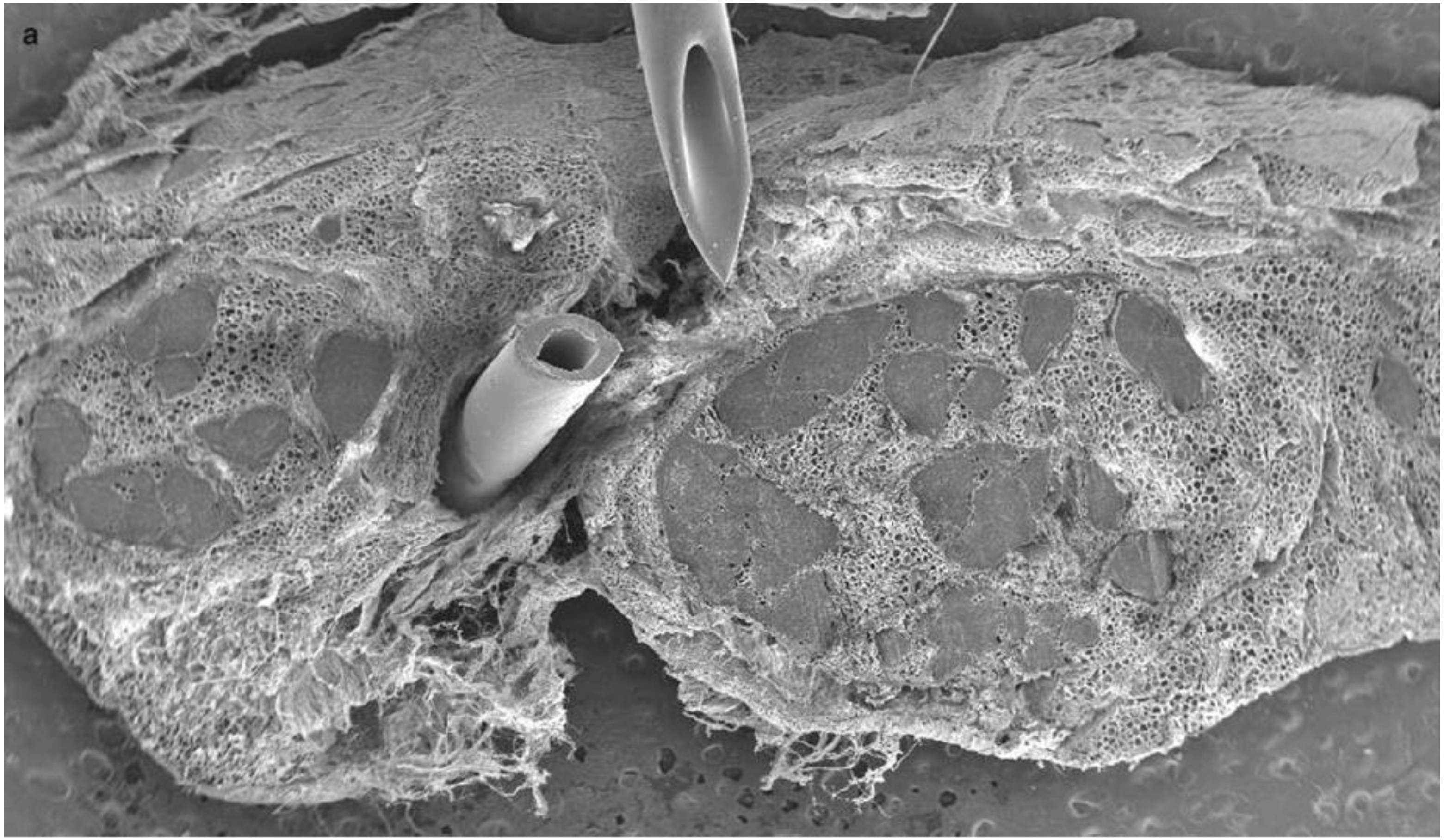
Methods: Forty-seven consecutive American Society of Anesthesiologists physical status I-II patients received an ultrasound-guided popliteal intraneural nerve block following the up-and-down biased coin design. The starting volume was 15 ml. Baseline, 5-week, and 6-month electrophysiologic tests were performed. Amplitude, latency, and velocity were evaluated. A follow-up telephone call at 6 months was also performed.

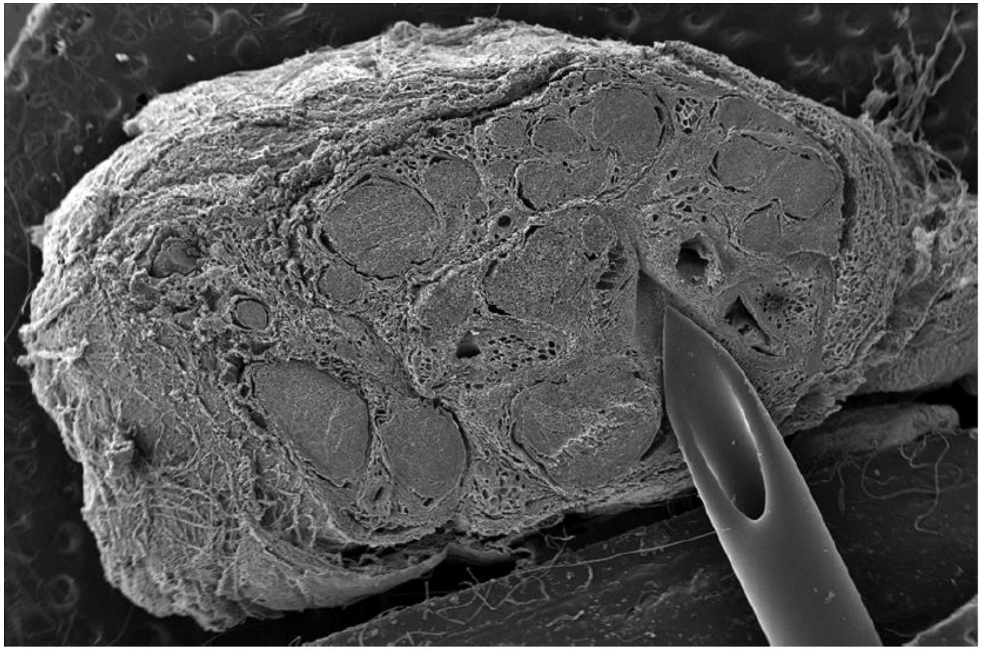
Results: The minimum effective volume of ropivacaine 1% in 90% of patients for complete sensory-motor sciatic nerve block resulted in 6.6 ml (95% CI, 6.4 to 6.7) with an onset time of 19 ± 12 min. Success rate was 98%. Baseline amplitude of action potential (mV) at ankle, fibula, malleolus, and popliteus were 8.4 ± 2.3, 7.1 ± 2.0, 15.4 ± 6.5, and 11.7 ± 5.1 respectively. They were significantly reduced at the fifth week (4.3 ± 2.1, 3.5 ± 1.8, 6.9 ± 3.7, and 5.2 ± 3.0) and at the sixth month (5.9 ± 2.3, 5.1 ± 2.1, 10.3 ± 4.0, and 7.5 ± 2.7) ($P < 0.001$ in all cases). Latency and velocity did not change from the baseline. No patient reported neurologic symptoms at 6-month follow-up.

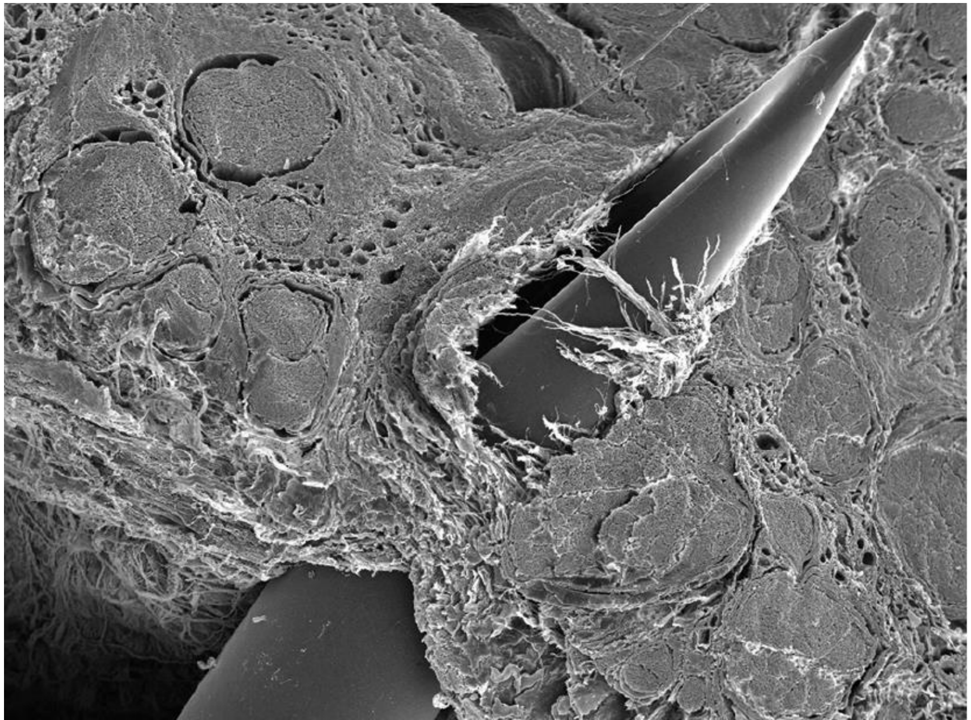
Conclusions: The intraneural ultrasound-guided popliteal local anesthetic injection significantly reduces the local anesthetic dose to achieve an effective sensory-motor block, decreasing the risk of systemic toxicity. Persistent electrophysiologic changes suggest possible axonal damage that will require further investigation. (ANESTHESIOLOGY XXX; XXX:00-00)


eISBN: 978-1-68108-191-5
ISBN: 978-1-68108-192-2
THE ANATOMICAL FOUNDATIONS OF REGIONAL ANESTHESIA AND ACUTE PAIN MEDICINE
MACROANATOMY; MICROANATOMY; SONOANATOMY; FUNCTIONAL ANATOMY
Editor:
André P. Boezaart
Illustrated by Mary K. Bryson
Bentham e Books

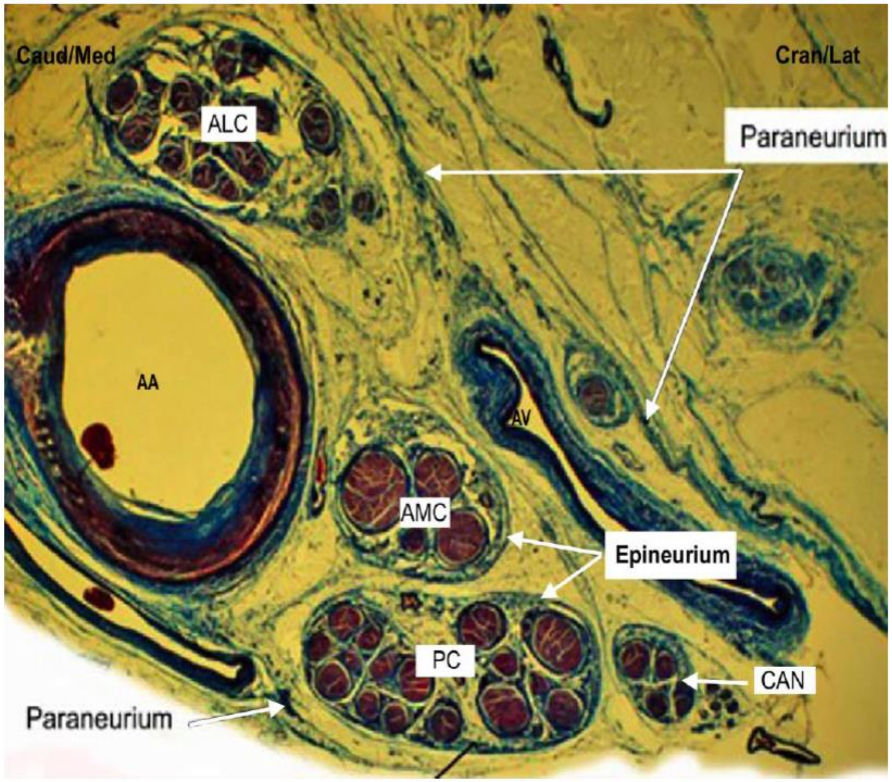

Miguel Angel Reina Editor
José Antonio De Andrés · Admir Hadzic · Alberto Prats-Galino
Xavier Sala-Blanch · André A.J. van Zundert Associate Editors
Atlas of
Functional Anatomy for Regional Anesthesia and Pain Medicine
Springer

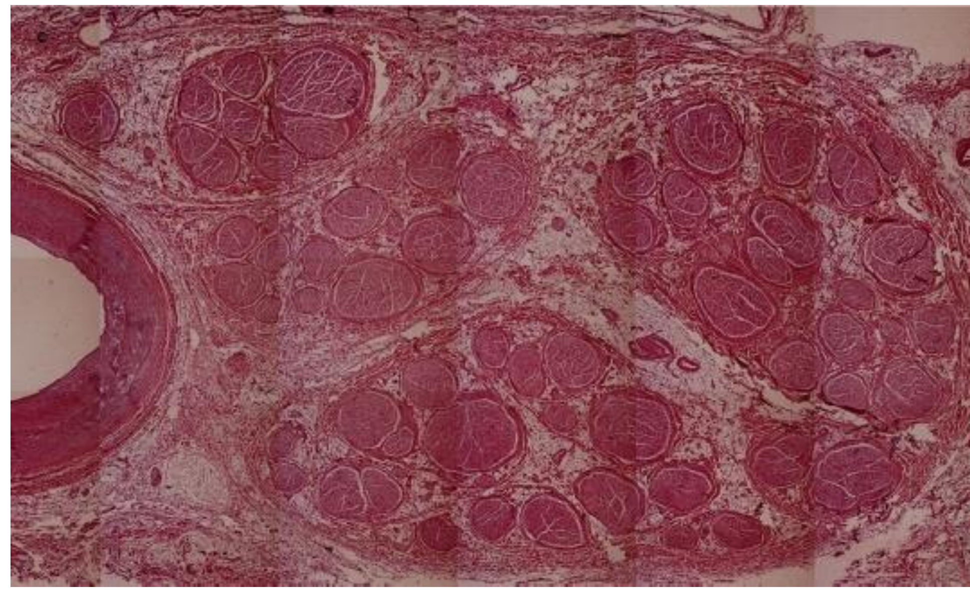

a

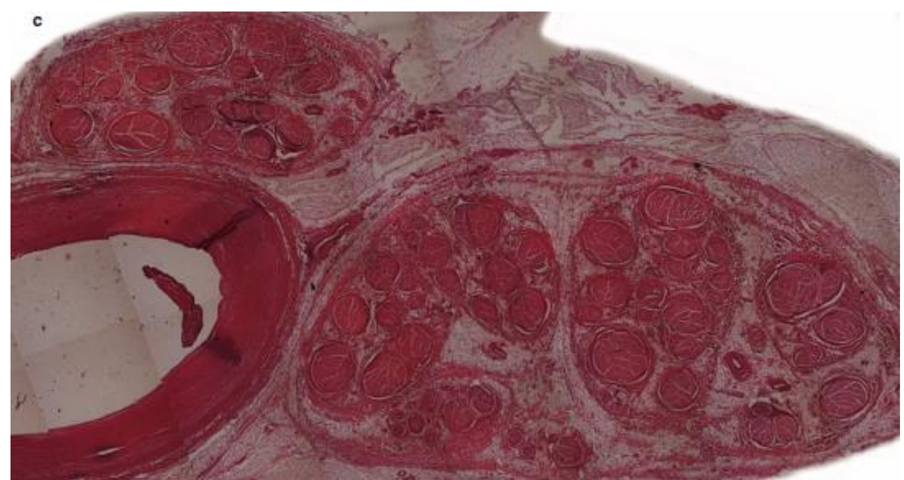


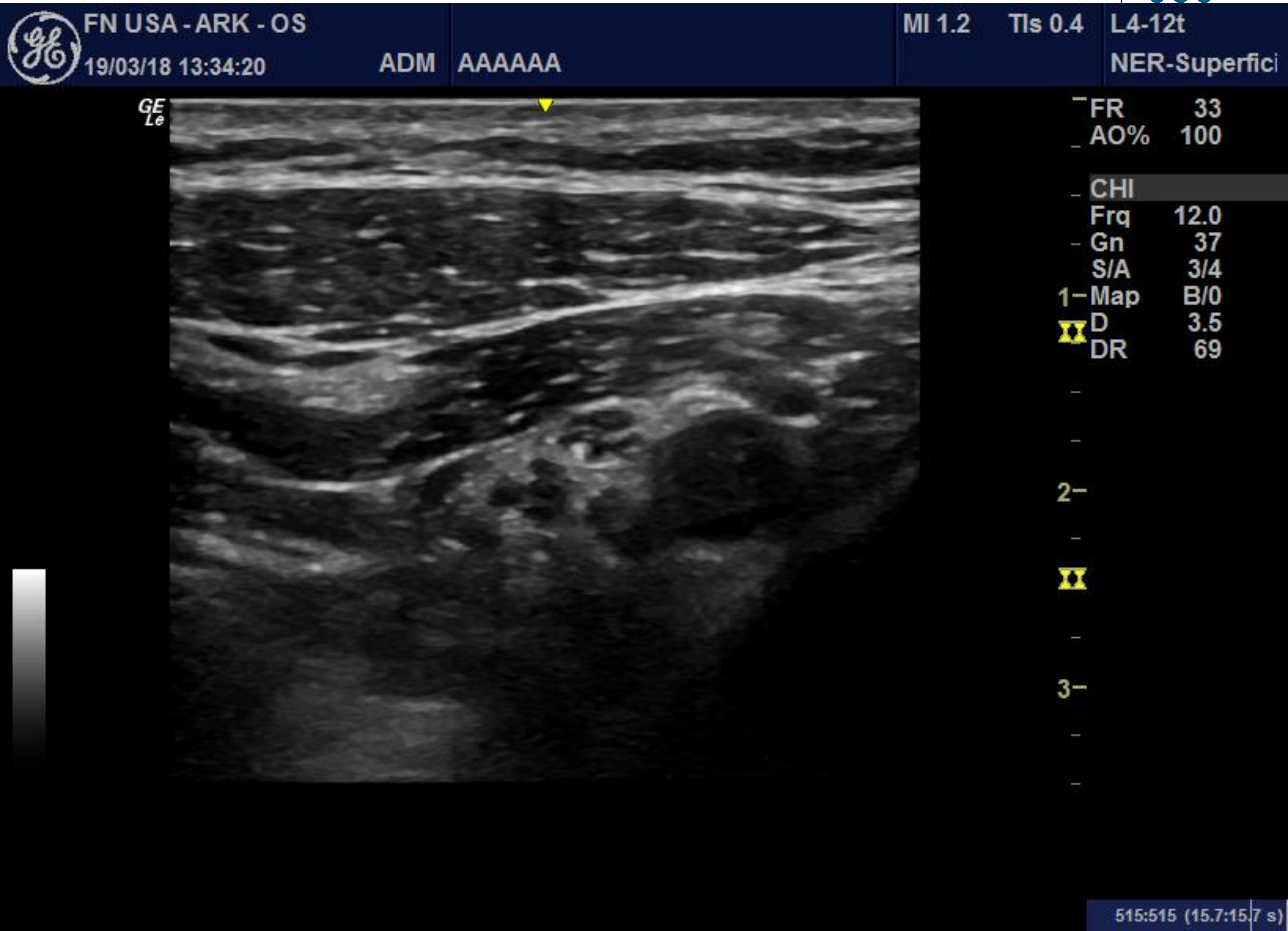


Paraneurium v infraclaviculární oblasti

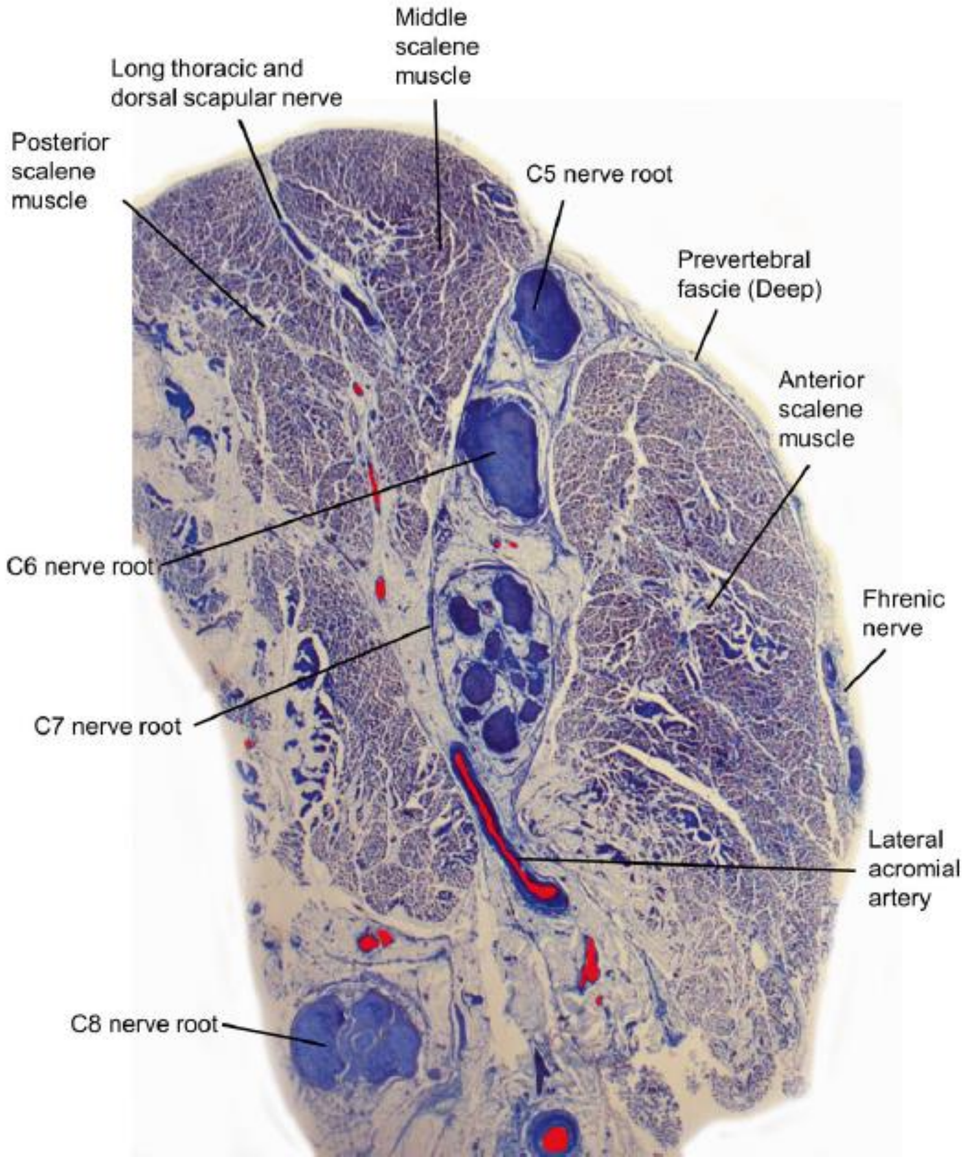







FN USA - ARK - OS
19/03/18 13:34:20
ADM
AAAAAA
MI 1.2
TIs 0.4
L4-12t
NER-Superfici
GE Le
FR 33
AO% 100
CHI
Frq 12.0
Gn 37
S/A 3/4
Map B/0
D 3.5
DR 69
1
2
3
515:515 (15.7:15.7 s)

Paraneurium v interscalenické oblasti

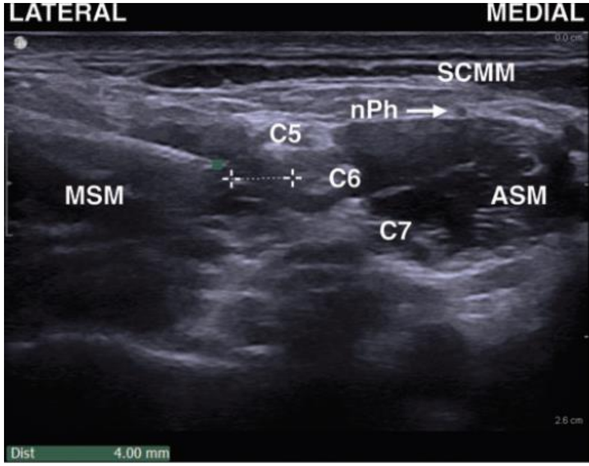


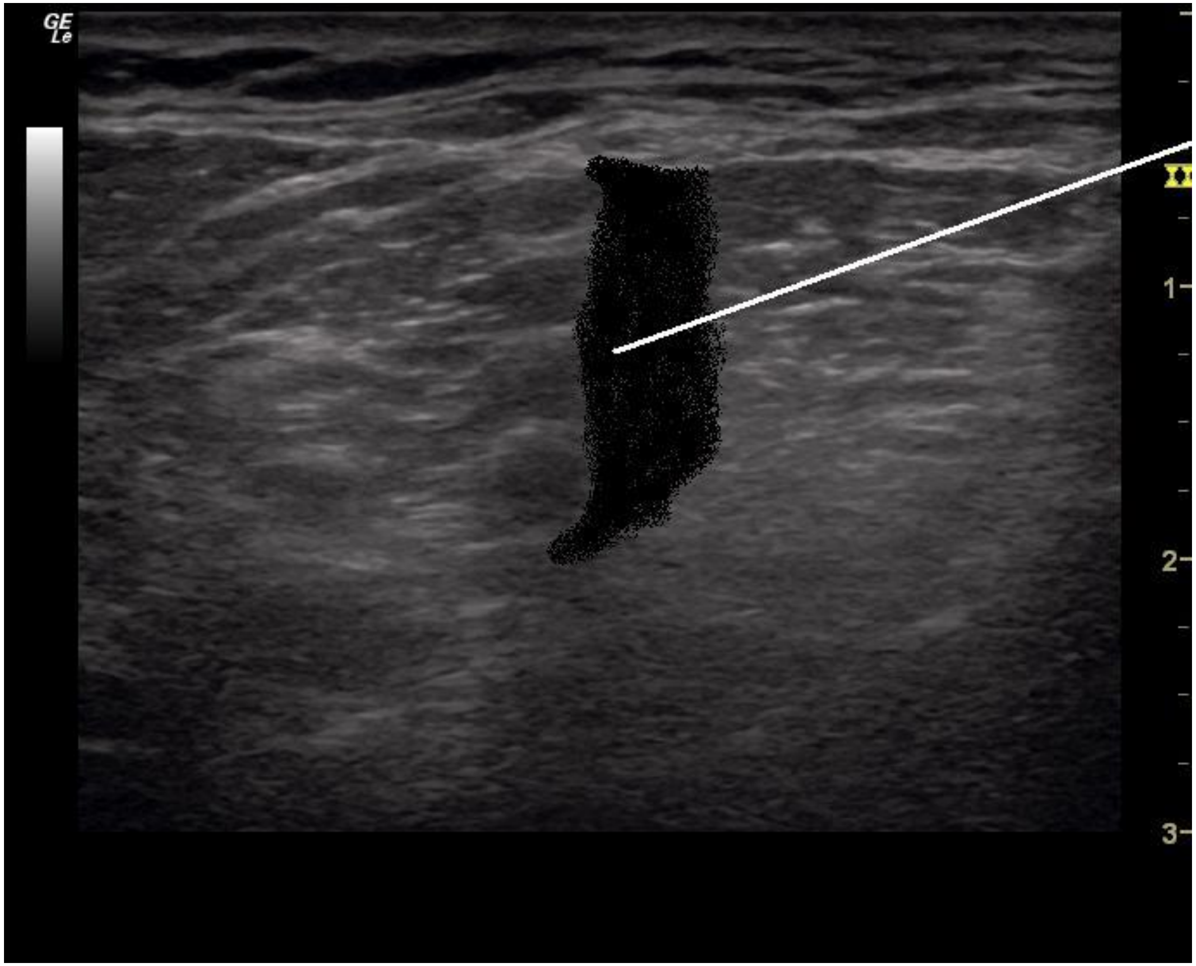
Extrafascial injection for interscalene brachial plexus block reduces respiratory complications compared with a conventional intrafascial injection: a randomized, controlled, double-blind trial†

N. Palhais[1], R. Brull[3], C. Kern[1], A. Jacot-Guillarmod[1], A. Charmoy[1], A. Farron[2] and E. Albrecht[1,*]

British Journal of Anaesthesia, 116 (4): 531–7 (2016)

Background: Hemidiaphragmatic paresis after ultrasound-guided interscalene brachial plexus block is reported to occur in up to 100% of patients. We tested the hypothesis that an injection lateral to the brachial plexus sheath reduces the incidence of hemidiaphragmatic paresis compared with a conventional intrafascial injection, while providing similar analgesia.
Methods: Forty ASA I-III patients undergoing elective shoulder and clavicle surgery under general anaesthesia were randomized to receive an ultrasound-guided interscalene brachial plexus block for analgesia, using 20 ml bupivacaine 0.5% with epinephrine 1:200 000 injected either between C5 and C6 within the interscalene groove (conventional intrafascial injection), or 4 mm lateral to the brachial plexus sheath (extrafascial injection). The primary outcome was incidence of hemidiaphragmatic paresis (diaphragmatic excursion reduction >75%), measured by M-mode ultrasonography, before and 30 min after the procedure. Secondary outcomes were forced vital capacity, forced expiratory volume in 1 s, and peak expiratory flow. Additional outcomes included time to first opioid request and pain scores at 24 h postoperatively (numeric rating scale, 0–10).
Results: The incidences of hemidiaphragmatic paresis were 90% (95% CI: 68–99%) and 21% (95% CI: 6–46%) in the conventional and extrafascial injection groups, respectively (P<0.0001). Other respiratory outcomes were significantly better preserved in the extrafascial injection group. The mean time to first opioid request was similar between groups (conventional: 802 min [95% CI: 620–984 min]; extrafascial: 973 min [95% CI: 791–1155 min]; P=0.19) as were pain scores at 24 h postoperatively (conventional: 1.6 [95% CI: 0.9–2.2]; extrafascial: 1.6 [95% CI: 0.8–2.4]; P=0.97).
Conclusions: Ultrasound-guided interscalene brachial plexus block with an extrafascial injection reduces the incidence of hemidiaphragmatic paresis and impact on respiratory function while providing similar analgesia, when compared with a




GE
Le
1
2
3

Je subparaneurální prostor „sweet spot“ ?

- Ano – n. ischiadicus a oblast brachiálního plexu těsně kolem klíčku

- Je paranerium uniformní v celém PNS ? - jistě ne
- Funkce paraneuria- gliding apparatus- v místě zatížení nervu, umožňující klouzání fasciculů

Hledání „sweet spotu“v jednotlivých částech PNS

Děkuji za pozornost