Intraneural Injection: the controversy

Mafeitzeral Mamat

Anaesthesiology & Critical Care

UiTM

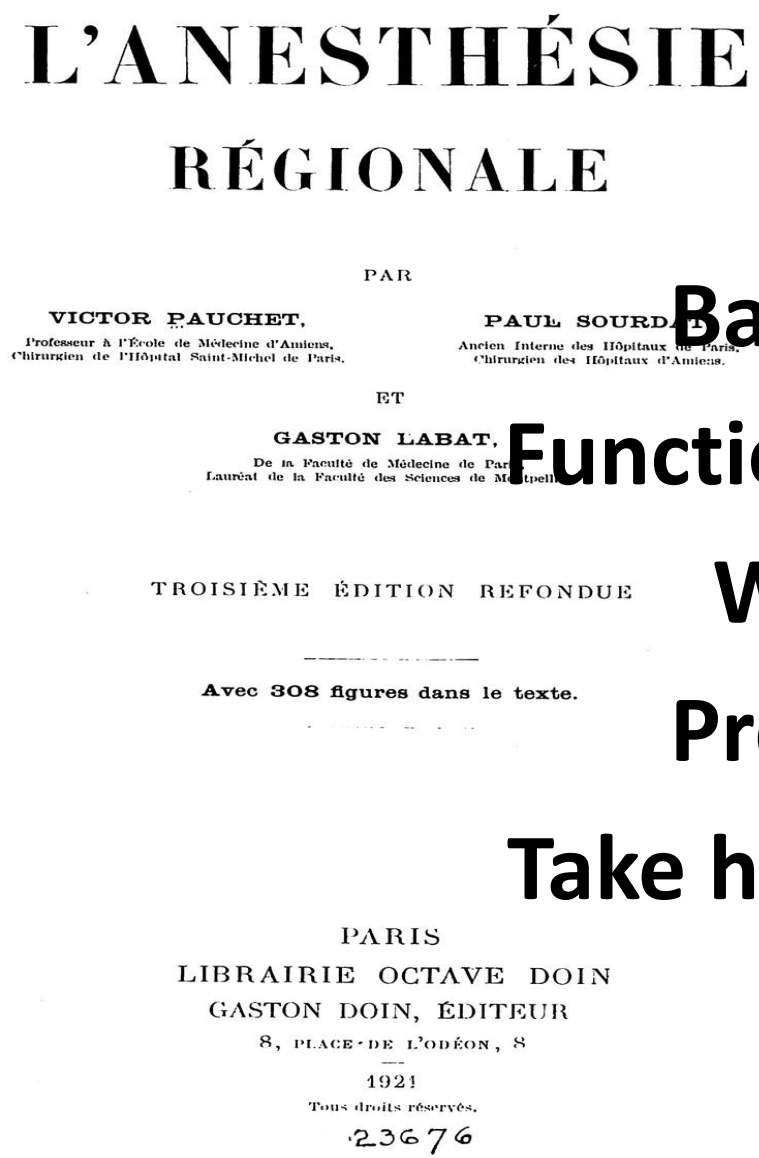
THEME

Riding the Waves of Change

19 - 22 April 2012

The Zenith Hotel

Kuantan, Pahang, Malaysia



L'ANESTHÉSIE
RÉGIONALE

PAR

VICTOR PAUCHET,
Professeur à l'École de Médecine d'Amiens,
Chirurgien de l'Hôpital Saint-Michel de Paris.

PAUL SOURDAT,
Ancien Interne des Hôpitaux de Paris,
Chirurgien des Hôpitaux d'Amiens.

ET

GASTON LABAT,
De la Faculté de Médecine de Paris,
Lauréat de la Faculté des Sciences de Montpellier.

TROISIÈME ÉDITION REFONDUE

Avec 308 figures dans le texte.

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1921

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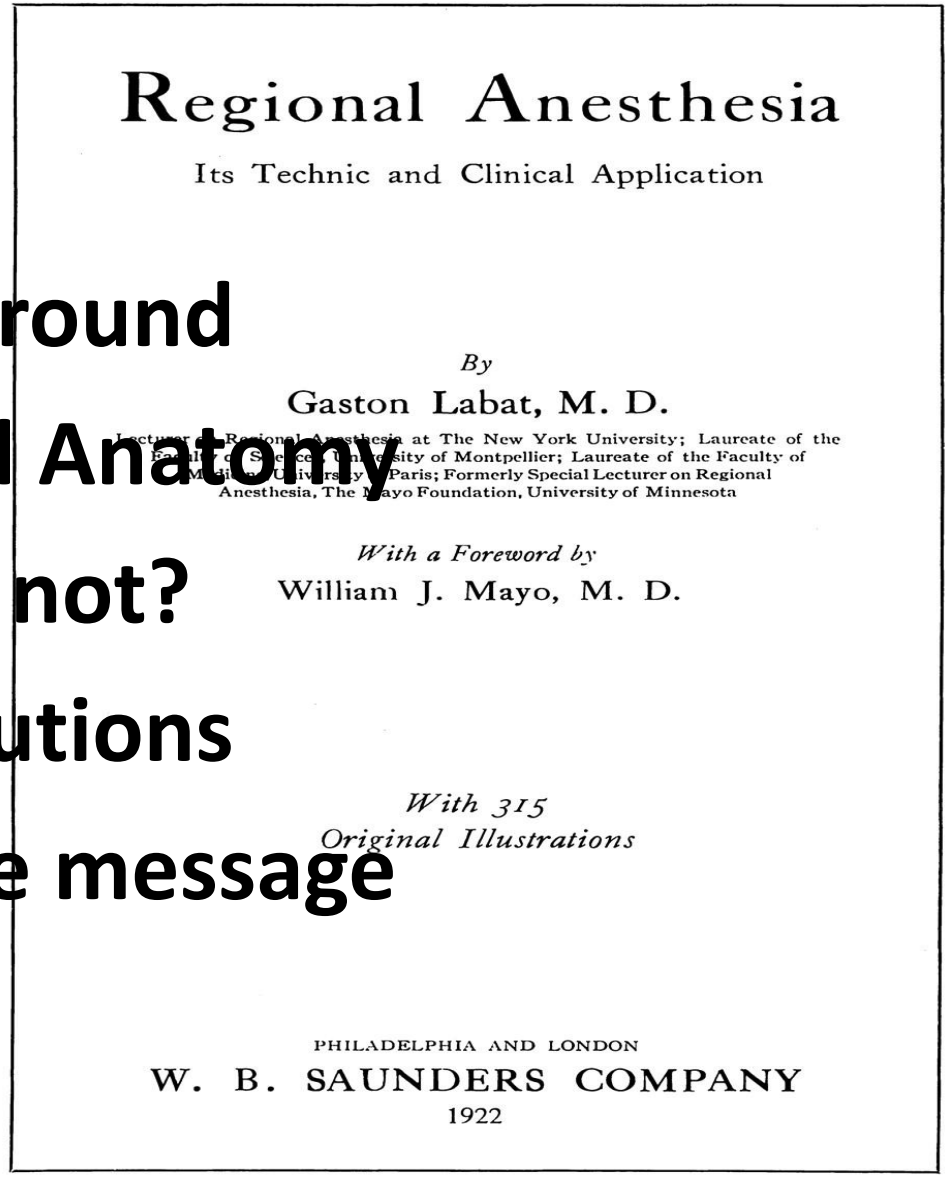
23676



Regional Anesthesia

Its Technic and Clinical Application

By

Gaston Labat, M. D.

Lecturer on Regional Anesthesia at The New York University; Laureate of the Faculty of Sciences, University of Montpellier; Laureate of the Faculty of Medicine, University of Paris; Formerly Special Lecturer on Regional Anesthesia, The Mayo Foundation, University of Minnesota

With a Foreword by

William J. Mayo, M. D.

With 315
Original Illustrations

PHILADELPHIA AND LONDON
W. B. SAUNDERS COMPANY
1922

Background

Functional Anatomy

Why not?

Precautions

Take home message

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IGNORANCE IS BLISS

Especially when there is a human arm up your ass.

TASTE OF AWESOME.COM

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Summary

Preventing an intraneural injection of a local anesthetic (LA) during peripheral nerve blockade is considered important to avoid neurologic injury.

- Background
- Functional Anatomy
- Why not?
- Precautions
- Summary

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paraesthesia

Nerve stimulator

Ultrasound guided

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1922

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- 1885, Dr William Stewart Halsted, a New York surgeon, demonstrated the first peripheral nerve blockade using cocaine.

In 1911, Hirschel described the first percutaneous approach to the brachial plexus.

His axillary approach involved injection both below and above the axillary artery.

Hirschel G: Anaesthesia of the brachial plexus for operations on the upper extremity. *Med Wochenschr* 1911; 5:1555-1960.

In 1911 as well, Kulenkampff in Germany described the first “blind” supraclavicular approach to blocking the brachial plexus.

Interestingly, he perfected his technique by trying the block on himself

Kulenkampff D: Die Anasthesia des plexus brachialis. *Zentralbl Chir* 1911; 38:1337.

L'ANESTHÉSIE RÉGIONALE

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PAUL SOURDAT,
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Chirurgien des Hôpitaux d'Amiens.

ET

JULES LABOURÉ, d'Amiens.
(Anesthésie de la face et du cou.)

DEUXIÈME ÉDITION, CORRIGÉE ET AUGMENTÉE

Avec 220 figures dans le texte.

PARIS
OCTAVE DOIN ET FILS, ÉDITEURS
8, PLACE DE L'ODÉON, 8

1917

Regional Anesthesia

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By

Gaston Labat, M. D.

Laureate of the Faculty of Sciences, University of Montpellier, France; Laureate of the Faculty of Medicine, University of Paris, France; Clinical Professor of Surgery, New York University and Bellevue Hospital Medical College; Clinical Professor of Oral and Minor Surgery, in charge of Regional Anesthesia, New York University College of Dentistry; Visiting Regional Anesthetist, The Presbyterian Hospital, New York City; formerly Special Lecturer on Regional Anesthesia, The Mayo Foundation, University of Minnesota; Consultant in Regional Anesthesia, The Woman's Hospital, New York Orthopedic Hospital, Mount Sinai Hospital

With a Foreword by

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Second Edition, Revised
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1928

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Nerve injury after peripheral nerve blockade (PNB) is a potentially devastating complication that can result in permanent disability.[1] Data from a recent review of published studies suggest that the incidence of neuropathy after PNB varies depending on the anatomical location, ranging from 0.03% for supraclavicular blocks to 0.3% for femoral blocks to up to 3% for interscalene blocks.[2] Fortunately, the vast majority of these neuropathies seem to be temporary and resolve over weeks to months. However, the etiology of neurologic injury related to

2. Brull R, McCartney CJL, Chan VWS, et al. Neurological complications after regional anesthesia: contemporary estimates of risk. *Anesth Analg*. 2007;104: 965–974.

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An Ultrasonographic and Histological Study of Intraneural Injection and Electrical Stimulation in Pigs

Vincent W. S. Chan, MD*

Richard Brull, MD*

Colin J. L. McCartney, MB, ChB*

Daquan Xu, MB†

Sherif Abbas, MD†

Patrick Shannon, MSc, MD‡

BACKGROUND: In this study we evaluated the minimum stimulating current associated with intraneural needle placement and sonographic appearance of intraneural injection.

METHODS: We inserted a needle 2 cm inside 28 pig nerves (brachial plexus *in vivo*), recorded the minimum current to elicit a motor response, and injected dye (5 mL) under ultrasound (US) imaging.

RESULTS: The minimum current to elicit a motor response was 0.43 mA (range: 0.12–1.8 mA). Nerve expansion was visualized by US in 24 of 28 nerves. Histology revealed penetration of the epineurium in these same 24 nerves. There was no evidence of dysplasia within the fascicle of any nerve.

CONCLUSIONS: US may prove useful to detect intraneural injection, whereas a motor response above 0.5 mA may not exclude intraneural needle placement. The correlation between intraneural injection and neurological dysfunction remains unclear.

(Anesth Analg 2007;104:1281–4)

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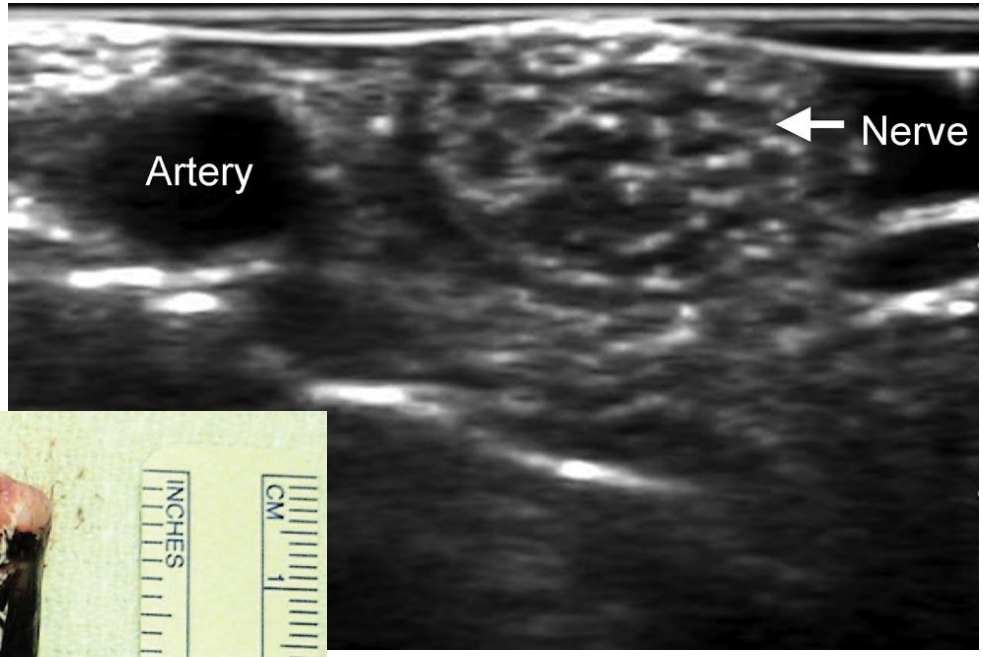

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U/S signs of intraneural injection

- Visualization of the needle inside the nerve (within outer epineurium) at the time of injection
- Increase in nerve diameter and cross-sectional area of the nerve by $\geq 15\%$
- Separation of the fascicles and/or fascicular bundles by the injectate
- Diffusion of the LA within epineurium in a proximal and distal direction

Clinical reports: Intraneural injection safe?

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4. Sala-Blanch X, Lopez AM, Carazo J, et al. Intraneural injection during nerve stimulator-guided sciatic nerve block at the popliteal fossa. *Br J Anaesth.* 2009; 102:855–861.
5. Robards C, Hadzic A, Somasundaram L, et al. Intraneural injection with low-current stimulation during popliteal sciatic nerve block. *Anesth Analg.* 2009;109:673–677.
6. Bigeleisen PE, Moayeri N, Groen GJ. Extraneural versus intraneural stimulation thresholds during ultrasound-guided supraclavicular block. *Anesthesiology.* 2009; 110:1235–1243.
7. Bigeleisen PE. Nerve puncture and apparent intraneural injection during ultrasound-guided axillary block does not invariably result in neurologic injury. *Anesthesiology.* 2006;105:779–783.

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European Journal of Pain Supplements 5 (2011) 485–488

Contents lists available at SciVerse ScienceDirect

European Journal of Pain Supplements

journal homepage: www.EuropeanJournalPain.com

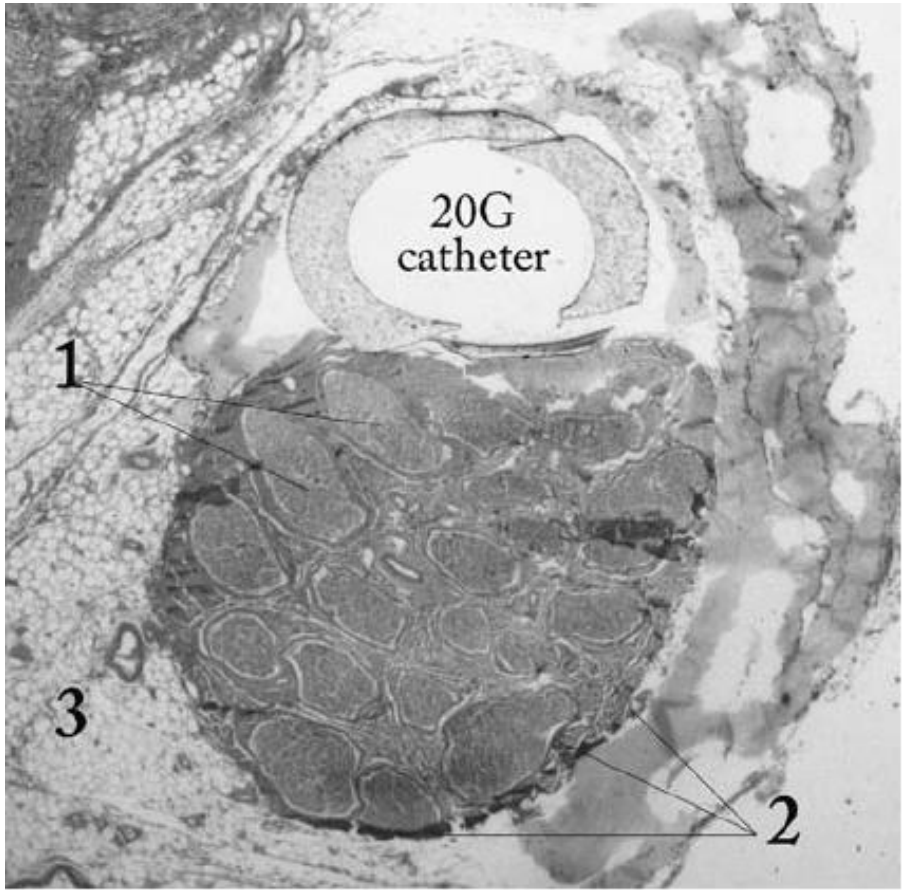
A preliminary assessment of the ability of anesthesiologists to purposefully perform intra- or perineural injection of local anesthetic for sciatic nerve block

Marco Baciarello *, Cristina Sacchetti, Alessandro Marchignoli, Silvia Ferri, Simonetta Adamanti, Enrico Iotti, Guido Fanelli

The incidence of unintended intraneural injection was 10% in this case series. Concordance between operators' judgment and *post-hoc* evaluation of intraneural vs. perineural LA deposition was high (Cohen's kappa = 0.914). The mean maximum change in sciatic nerve diameter was 1.46 (1.14–1.78) after intraneural injection; 1.13 (0.99–1.26) after perineural injection.

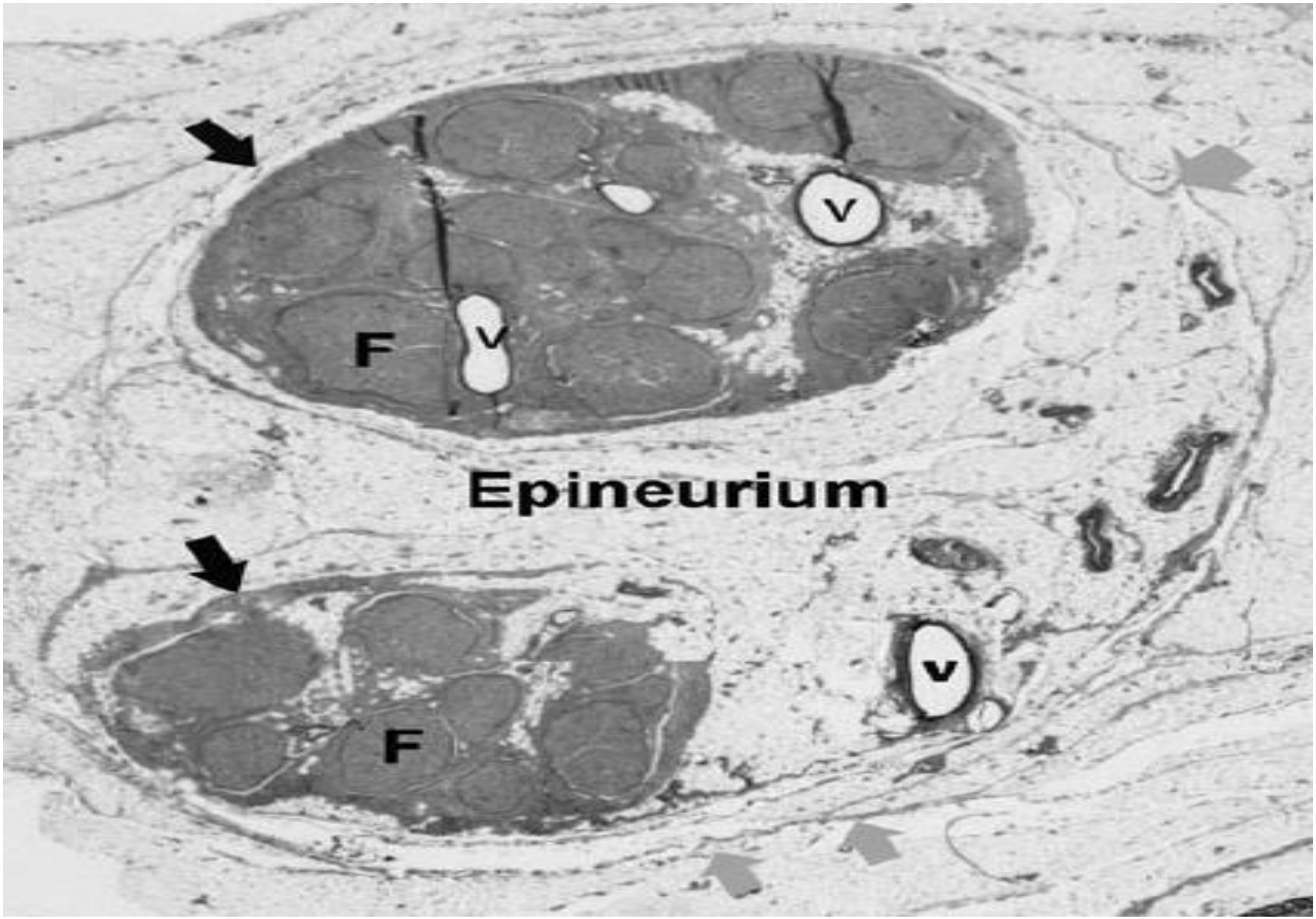
In the controlled setting of a clinical trial, anesthesiologists showed higher ability to predict intraneural injection of LA using images alone than seen in observational data based on electrical stimulation.

Functional Histology



- 1 : bundles of nerve fibre
- 2: Perineurium
- 3: epineurium

Figure 1. *Histology of the peripheral nerve. Bundles of nerve fibers (1) can be seen within a fascicle, which is surrounded by perineurium (2). The loose, connective tissue of the epineurium (3) surrounds the fascicle. A 20-gauge plastic catheter has been inserted for comparison into the epineurium immediately adjacent to the fascicle.*


V
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Epineurium
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“Nerve sheaths”

Various tissues which surrounds the peripheral nerves

- Conduit for LA injection
- A path allowing nerve gliding
- A layer of protection against nerve trauma

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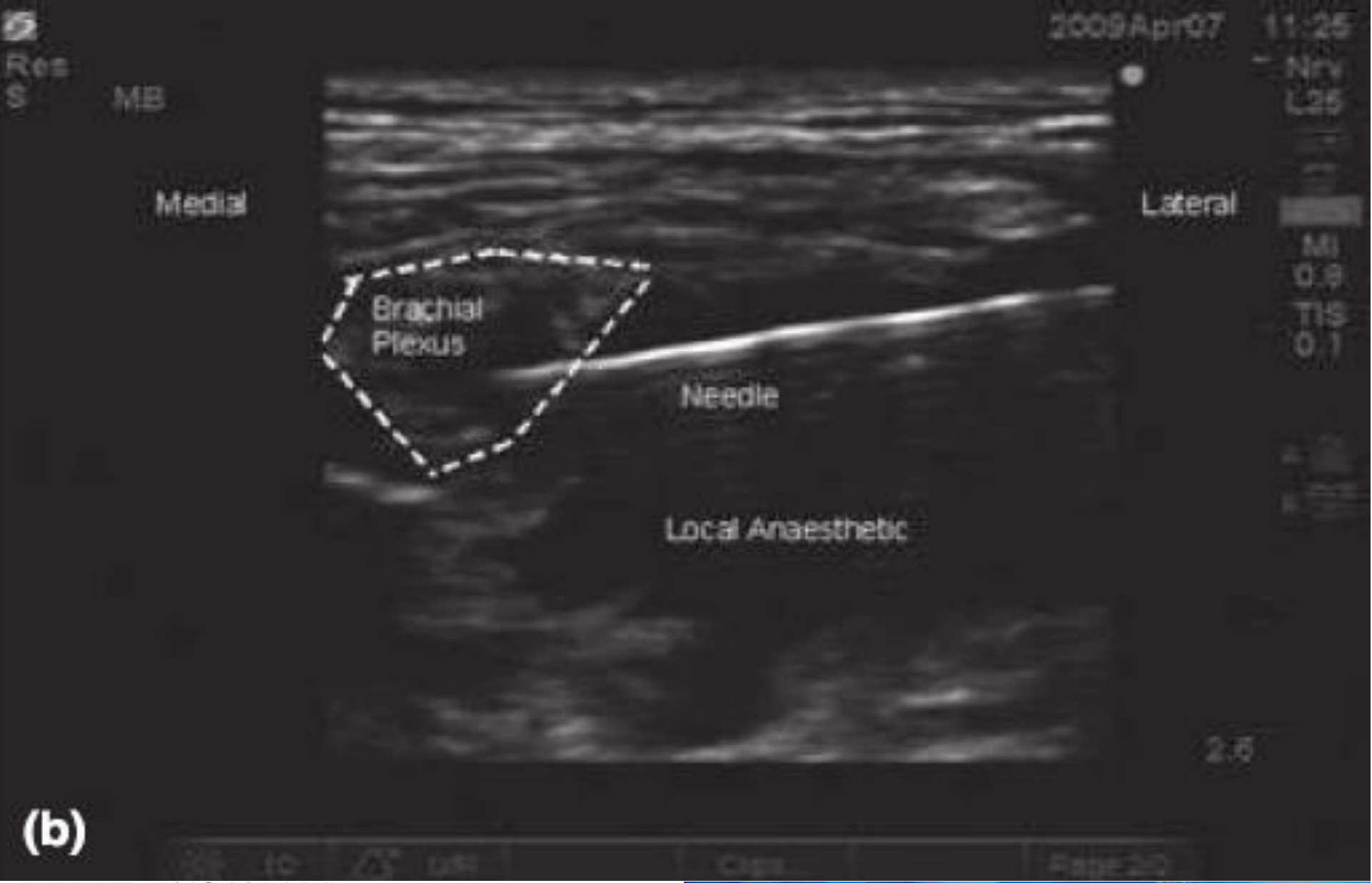
U/S signs of intraneural injection

- Visualization of the needle inside the nerve (within outer epineurium) at the time of injection
- Increase in nerve diameter and cross-sectional area of the nerve by $\geq 15\%$
- Separation of the fascicles and/or fascicular bundles by the injectate
- Diffusion of the LA within epineurium in a proximal and distal direction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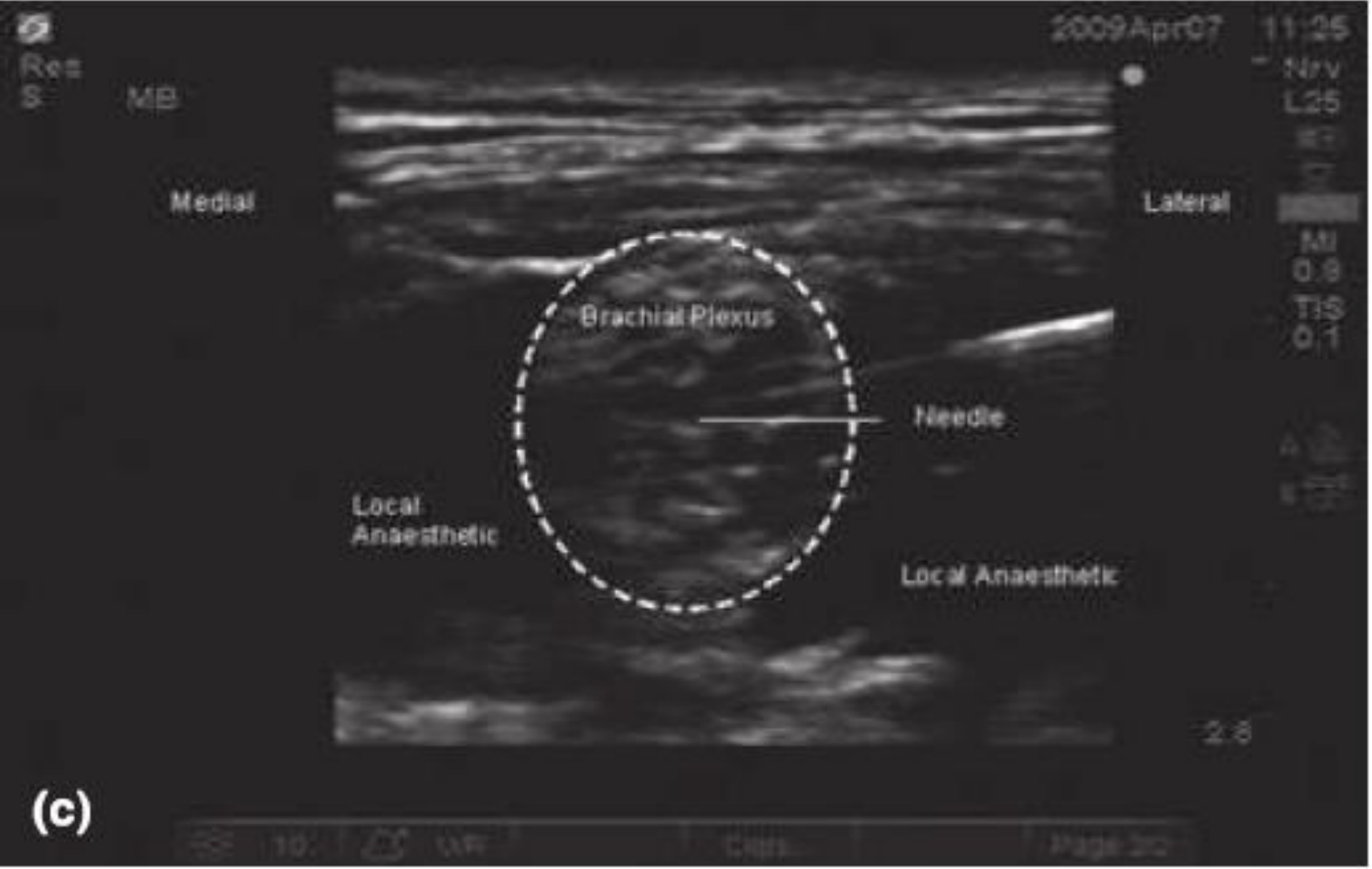
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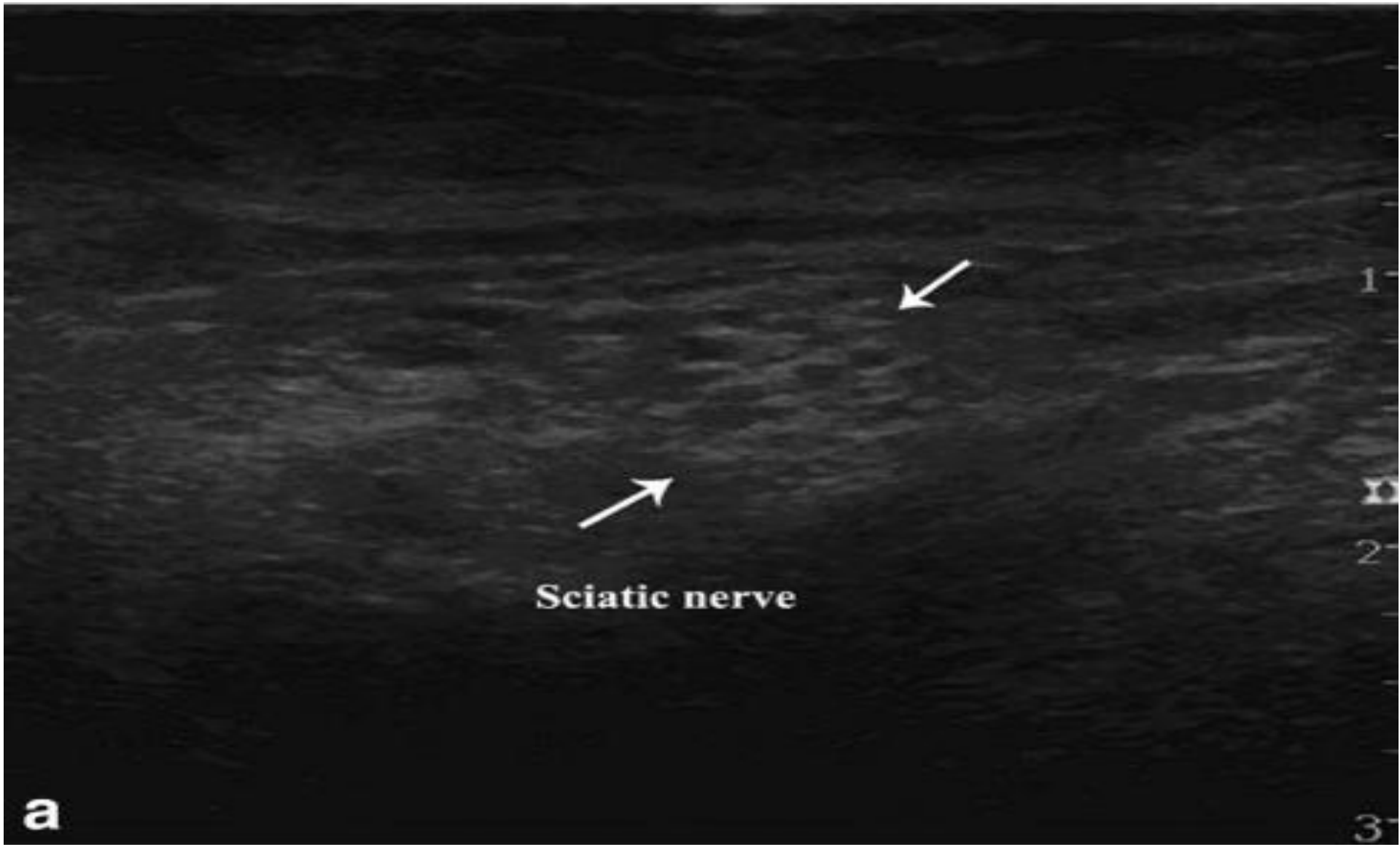

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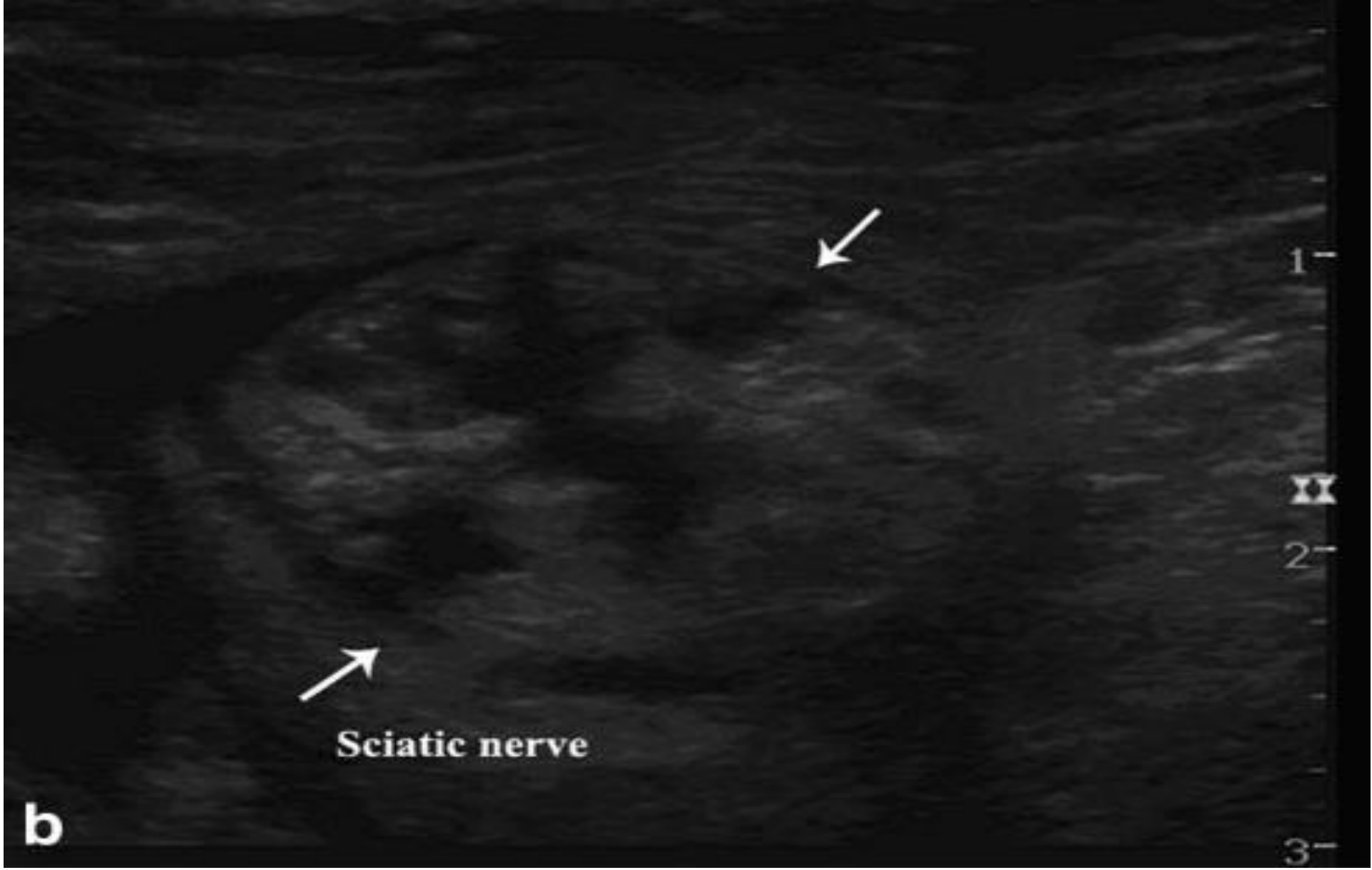

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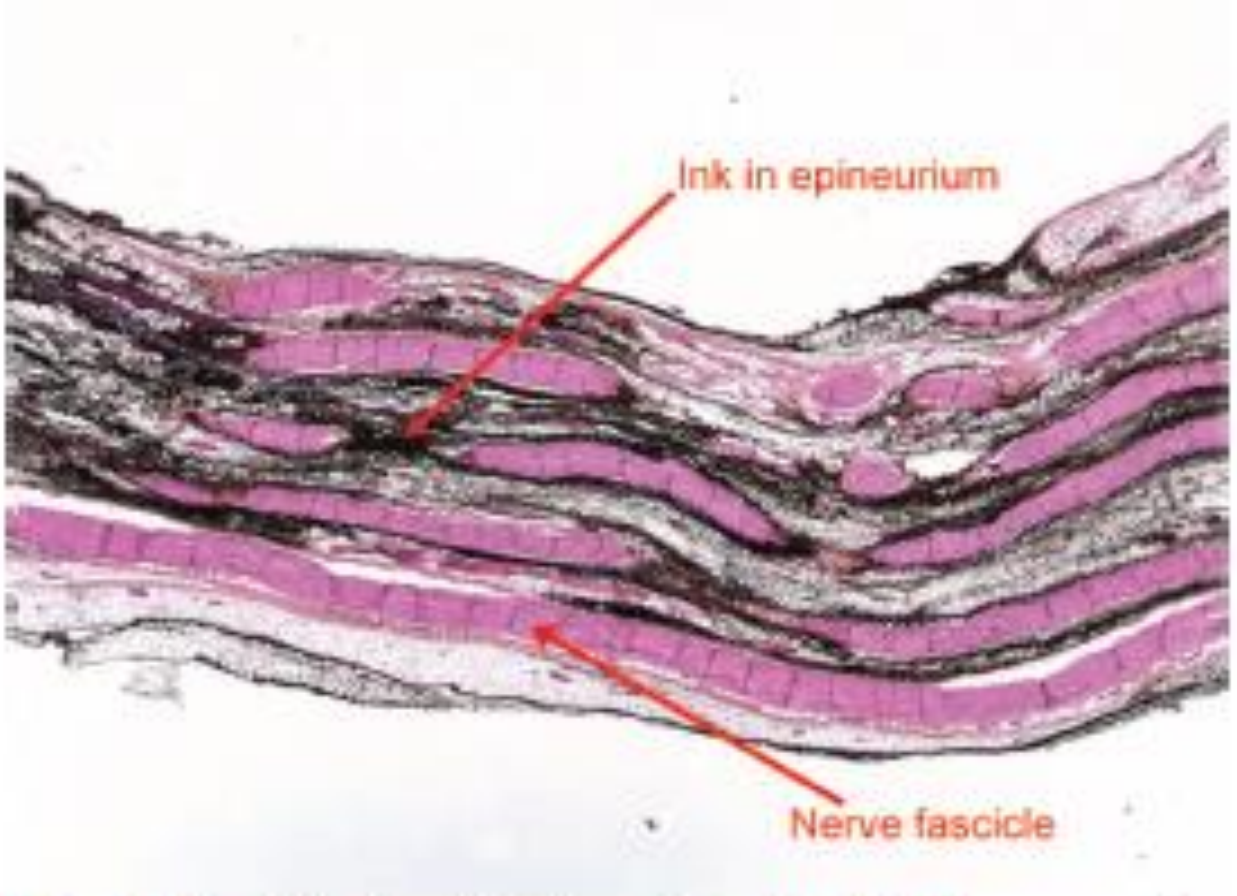

Figure 4. Postinjection histology. Longitudinal nerve section at ×15 magnification. This specimen demonstrates ink in the epineurium which is indicative of intraneural injection.


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Anaesthesia
Journal of the Association of Anaesthetists of Great Britain and Ireland

Anaesthesia, 2011, **66**, pages 168–174 doi:10.1111/j.1365-2044.2011.06619.x

ORIGINAL ARTICLE

Incidence of unintentional intraneural injection and postoperative neurological complications with ultrasound-guided interscalene and supraclavicular nerve blocks*

S. S. Liu,[1] J. T. YaDeau,[2] P. M. Shaw,[3] S. Wilfred,[4] T. Shetty[5] and M. Gordon[6]

Summary

It is proposed that ultrasound guidance decreases the risk of intraneural injection and associated postoperative neurological complications. However, the incidence of unintentional intraneural injection with ultrasound is unknown. Two hundred and fifty-seven patients were enrolled in a prospective, single-blind observational study. All patients underwent a pre-operative neurological examination before ambulatory shoulder arthroscopy with sedation and ultrasound-guided interscalene or supraclavicular block. Patients were followed up at 1 week and at 4–6 weeks postoperatively. Two blinded anaesthesiologists viewed the same video of the ultrasound image during the block offline to determine intraneural trespass. Intraneural injection occurred in 42 patients (17%; 95% CI 12–22%). No patient suffered from postoperative neurological complications (0%; 95% CI 0–1.6%) at follow-up.

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INTERNATIONAL ANESTHESIOLOGY CLINICS
Volume 49, Number 4, 1–12

A Practical Review of Perineural Versus Intraneural Injections: A Call for Standard Nomenclature

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Brussels, Belgium

John J. Laur, MD, MSc
The University of Iowa Roy J. and Lucille A. Carver College of Medicine
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College of Physicians and Surgeons, Columbia University
New York, New York

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Intraneural Injection	
	Intrafascicular Injection
Frequency	Very rare
Paresthesia*	Paresthesia common but not always present in unpremedicated patients*
Evoked motor response with nerve stimulation (0.1 msec)*	Often present with ≤0.2-0.3 Ma
Injection pressure	High opening pressure (≥15 psi), initially; the pressure rapidly declines upon needle dislodgment or perineural rupture
Patient symptoms†	Pain or paresthesia common
Block onset	Rapid
Risk of nerve injury	High

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Intraneural Injection	
	Injection Into Interfascicular Epineurium
Frequency	Uncommon
Paresthesia*	Paresthesia common but not always present in unpremedicated patients
Evoked motor response with nerve stimulation (0.1 msec)*	Often present with <1.0 mA
Injection pressure	Normal opening pressure (≤15 psi), may increase during the injection
Patient symptoms†	Paresthesia, sensation of numbness, cold or warm temperatures
Block onset	Rapid
Risk of nerve injury	Low

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Intraneural Injection	Injection Under Outer Epineurium
Frequency	Frequent
Paresthesia*	Occasional paresthesia or general discomfort on injection
Evoked motor response with nerve stimulation (0.1 msec)*	May be absent even with current intensity up to 1.5 mA
Injection pressure	Normal opening pressure (≤ 15 psi), the pressure remains constant throughout injection
Patient symptoms†	Often asymptomatic
Block onset	Normal
Risk of nerve injury	Very low

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Intraneural Injection	Perineural Injection
	Perineural Injection
Frequency	Frequent
Paresthesia*	Occasional paresthesia or general discomfort on injection
Evoked motor response with nerve stimulation (0.1 msec)*	May be absent even with current intensity up to 1.5 mA
Injection pressure	Normal opening pressure (≤15 psi), the pressure remains constant throughout injection
Patient symptoms†	Often asymptomatic
Block onset	Slow, block may fail or be partial
Risk of nerve injury	No risk

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Take home message

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Intraneural Injections

Accepted for Publication: 13 September 2010

To the Editor:

We respectfully disagree with Drs. Bigeleisen and Chelly's boldly assertive stance on benefits and apparent safety of intraneural injections. The dismissal of the dangers of intraneural

We agree with Drs. Bigeleisen and Chelly that the discussion on this and other emerging anecdotal observations with ultrasound-guided blocks should regularly take place at a national leadership level. Until a consensus on safety of intraneural injections is reached, our position is that such should not be recommended as standard practice.

Wojciech Reiss, MD

Ali Nima Shariat, MD

Sushmitha Kurapati, MD

Admir Hadzic, MD, PhD

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St Luke's–Roosevelt Hospital Center

New York, NY

Regional Anesthesia and Pain Medicine • Volume 36, Number 1, January-February 2011