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Regional Anaesthesia
& Pain Therapy

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ESRA Italian Chapter

XXVIII CONGRESSO NAZIONALE

Terapia mini invasiva: le radiofrequenze e la crioablazione

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Pain Therapy Unit

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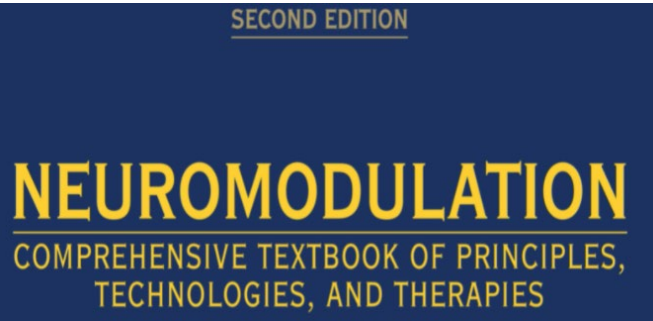


Purposes of Neuromodulation

- **Effect:** selective alteration of pain transmission properties within a region of the nervous tissue
- **Result:** ↓ nociception
- **Mechanism:** related to nerve activity
- **Objective:** to maximize nociceptive block, minimize tissue destruction



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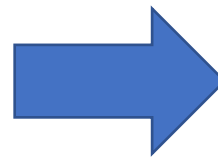


“The alteration of nerve activity through targeted delivery of a stimulus, such as electrical stimulation or chemical agents, to specific neurological sites in the body”

The International Neuromodulation Society

- inhibition
- stimulation
- modification
- regulation
- therapeutic alteration

electrically or chemically

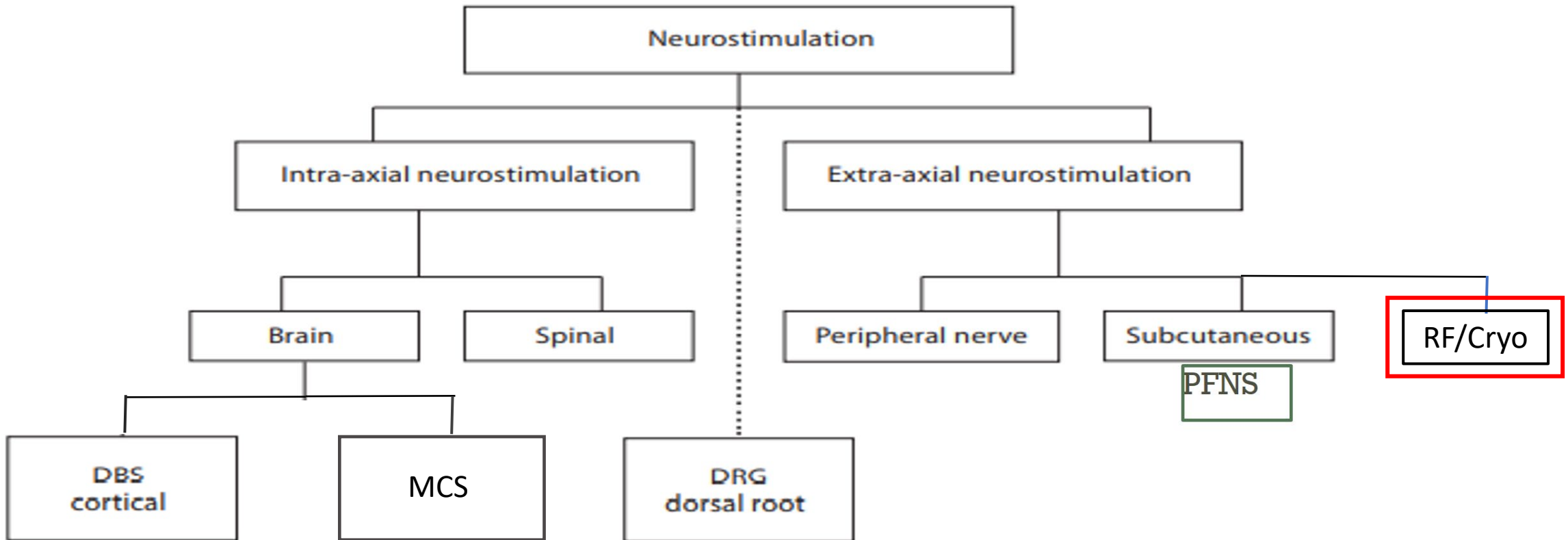


activity in the central, peripheral, or autonomic nervous system

Neuromodulation techniques can be divided into electrical and chemical neuromodulations.



Electrical neuromodulation (Neurostimulation) includes:



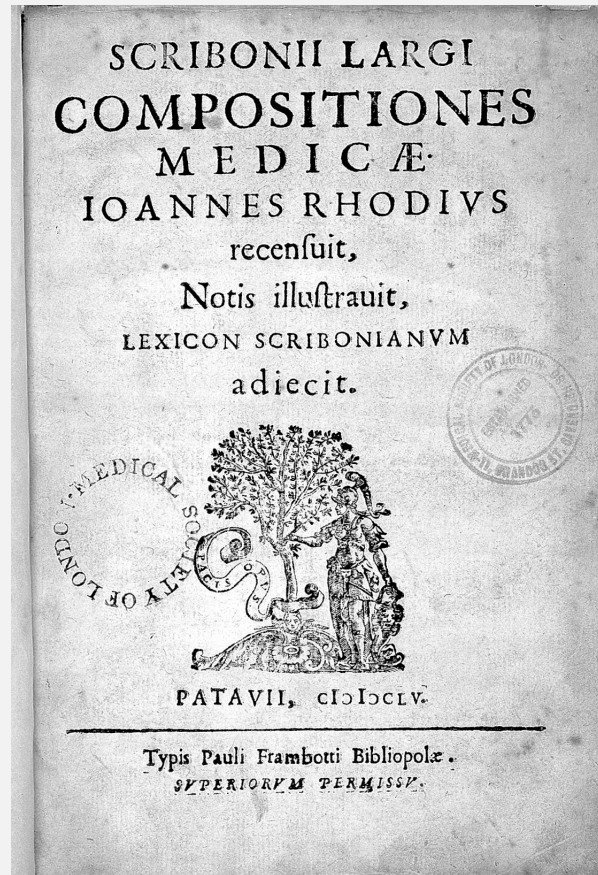
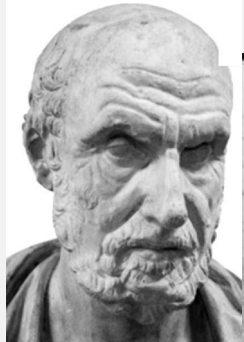


Terapia mini invasiva: le radiofrequenze e la crioablazione



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The power of fire





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RADIOFREQUENCY

Variety of percutaneous procedures in medicine

- Aesthetic and restorative medicine
- Type of energy used to create heat and cause tissue changes
- An alternating electric current used to treat pain, at a high frequency (300-500 KHz)
 1. Heat formation
 2. Generation of high intensity alternate electric field





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RADIOFREQUENCY

CONTINUOUS (1949)

- 500 kHz with sine wave
- Temperatures between 50 and 90 °C
- Variable voltage → fixed temperature
- Damage of nerve fibers

PULSED (1998)

- 500 kHz with sine wave
- 2 pulses lasting 20 msec/second (2Hz)
- 480 msec pause
- Maximum 42 ° C
- 45V → temperature <42 ° C
- Minimal neurolesion or neuromodulation (?)



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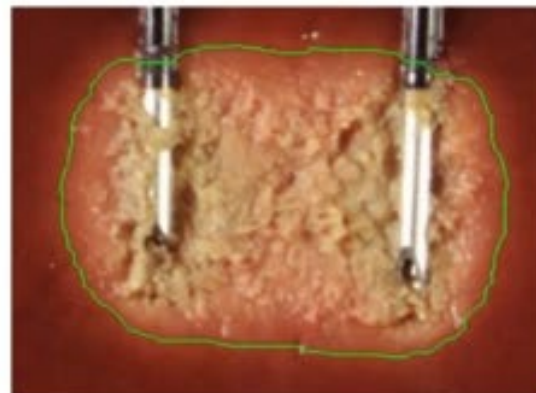


DIFFERENT TYPES of CONTINUOUS RADIOFREQUENCY



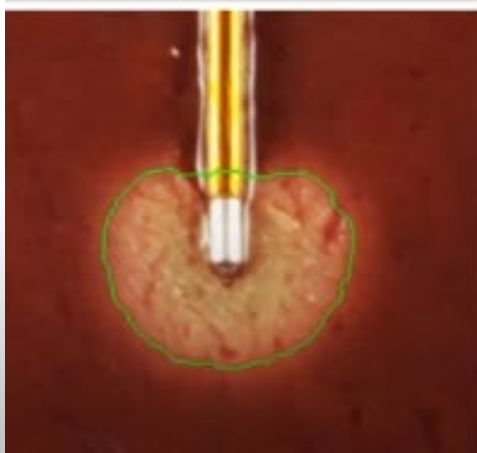
Monopolar

- Tissue heated
- Egg-shaped or spherical ablation
- Most procedures



Bipolar

- Tissue heated
- RF between electrodes
- No ground pad
- Large brick-shaped ablation
- Eg SIJ Joint, Thoracic MB



Cooled

- Tissue heated
- Spherical ablation
- Electrode cooled



Two cross sections of one ablation





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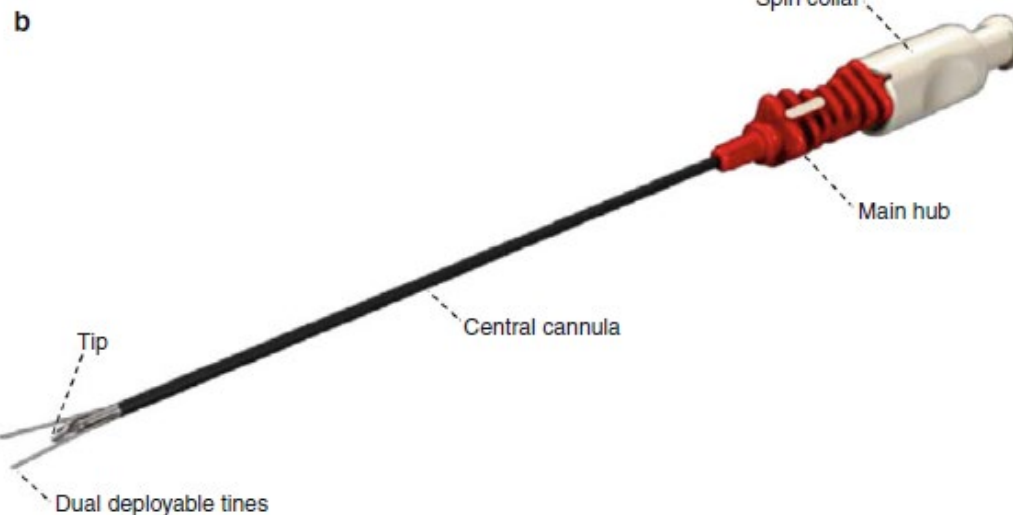
CHRONIC AND INTERVENTIONAL PAIN

ORIGINAL ARTICLE

Ultrasound-Guided Cervical Medial Branch Radiofrequency Neurotomy *Can Multitined Deployment Cannulae Be the Solution?*



theridge,





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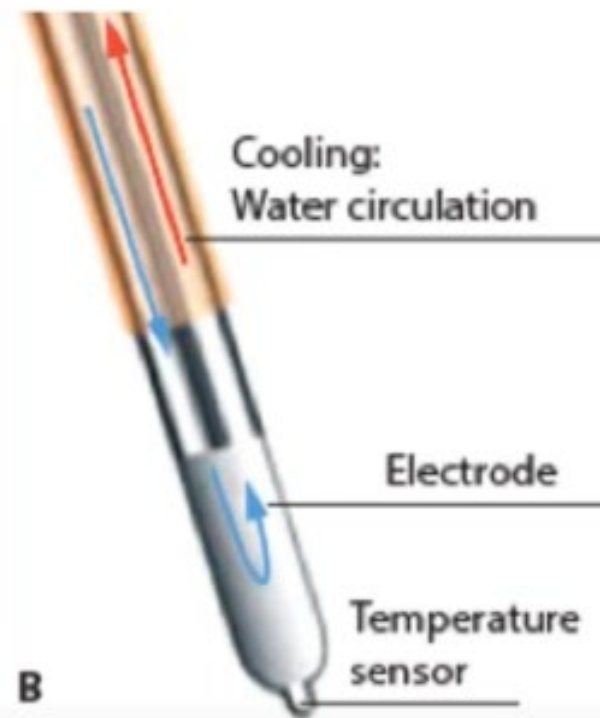
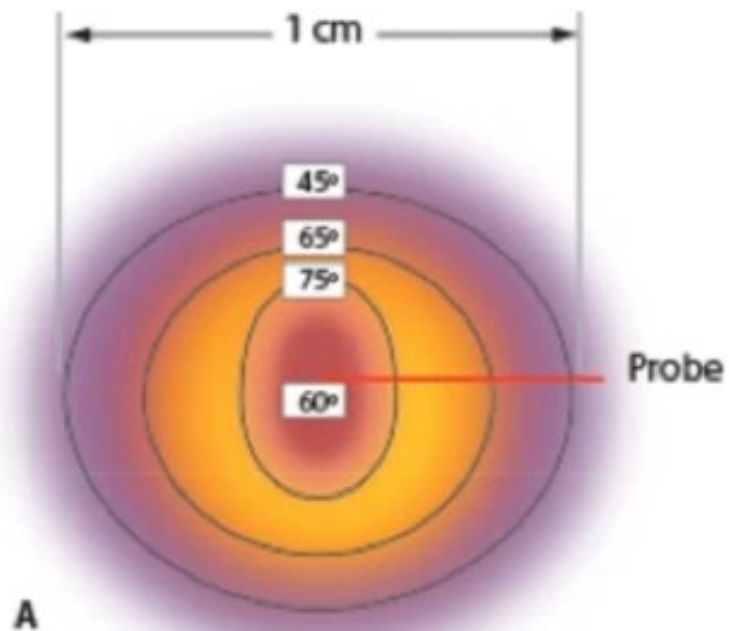


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COOLED RADIOFREQUENCY





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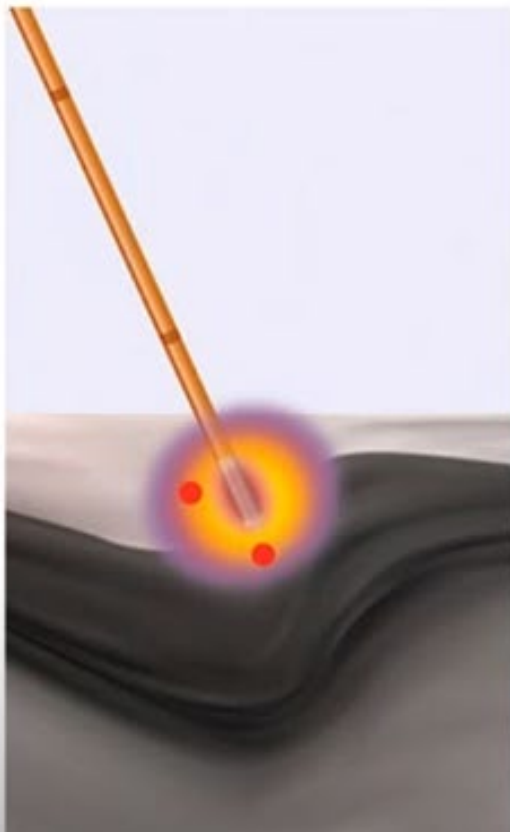
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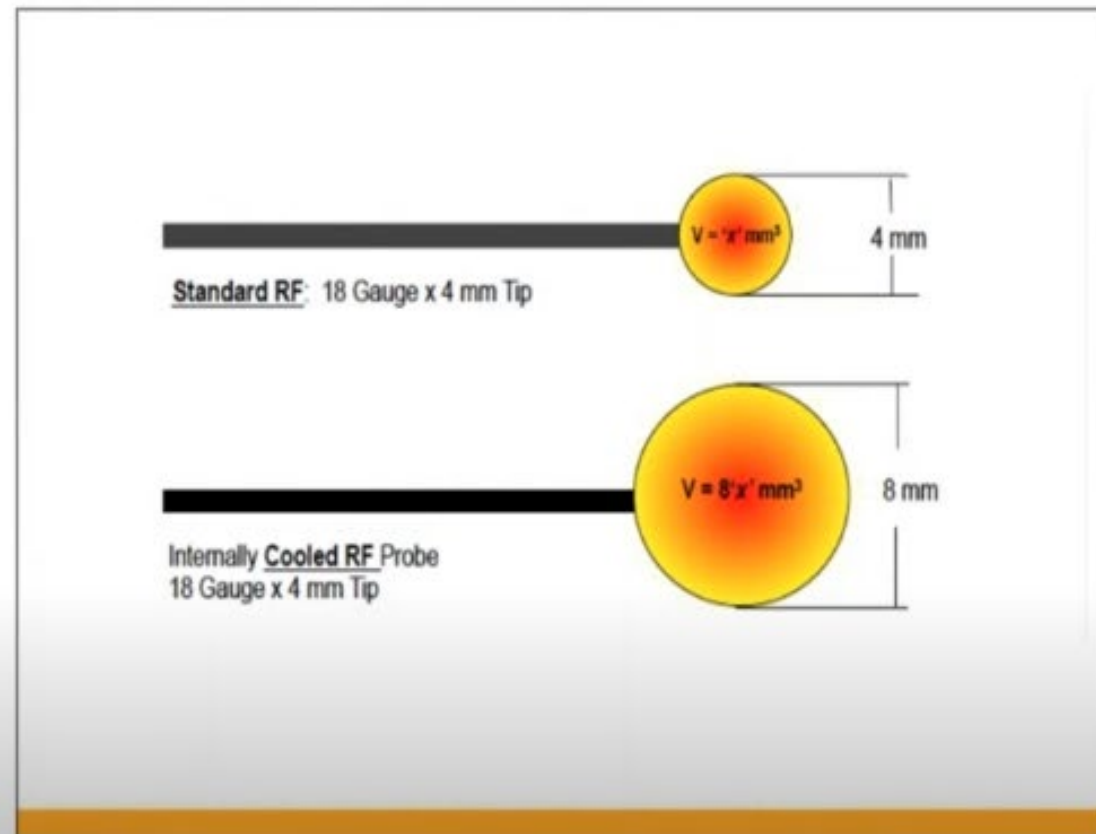
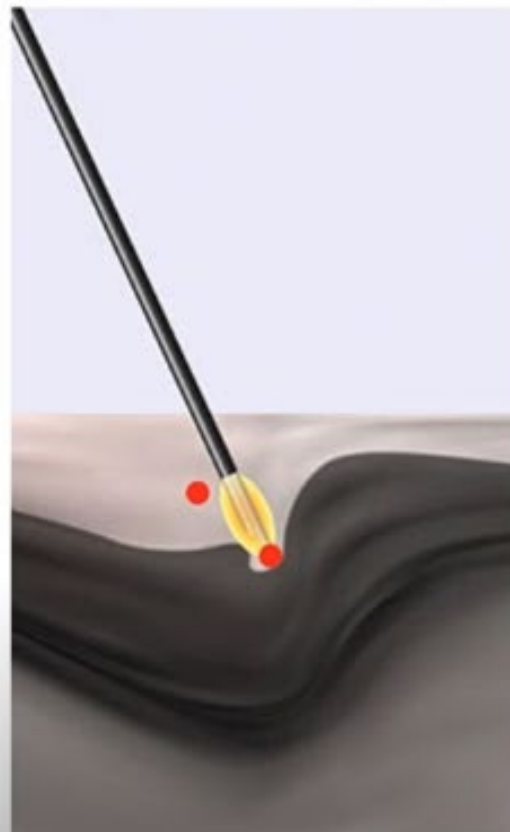


COOLED RADIOFREQUENCY

COOLIEF*



Standard RF





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open access to scientific and medical research

 Open Access Full Text Article

ORIGINAL RESEARCH

Radiofrequency Ablation for the Knee Joint: A Survey by the American Society of Pain and Neuroscience

Journal of Pain Research 2022:15 1247–1255

VARIABLES



Use of diagnostic nerve block/s and image guidance

- 1 or 2
- Type, volume and location of LA



Image guidance used during needle placement:

- Fluoroscopy vs Ultrasound



The type of modulation

- pRF or cRF (Temperature, Pulse duration, Procedure duration)
- 1 or 2 lesions



The type of cannula used in procedural approach

- Curved or Straight, Gauge, tip



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The power of ice



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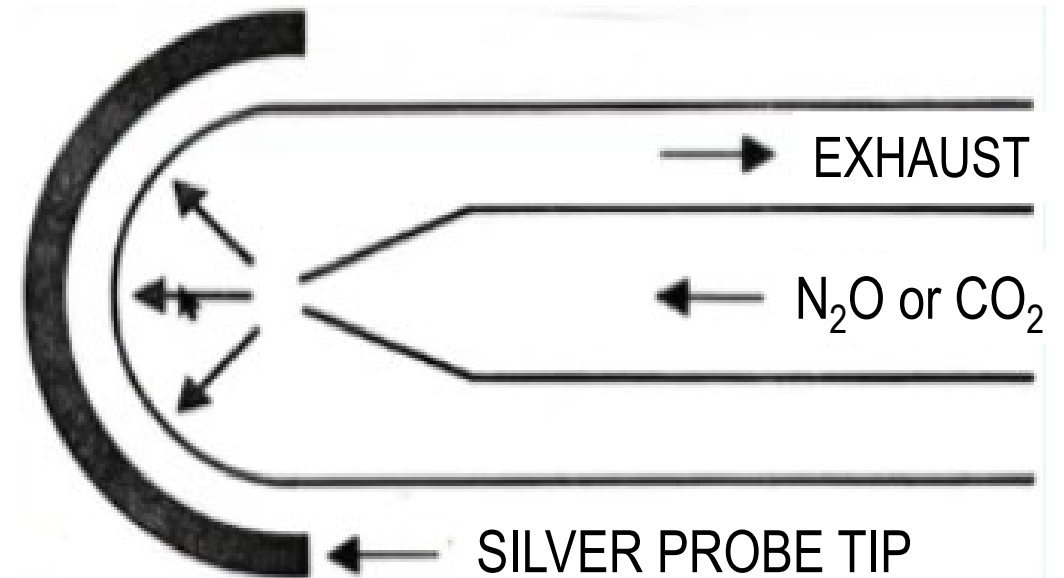


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- A compressed gas (N_2O or CO_2) is released through a tiny opening and expands
- The tip goes to $-70^{\circ}C$ (Joules-Thompson effect)





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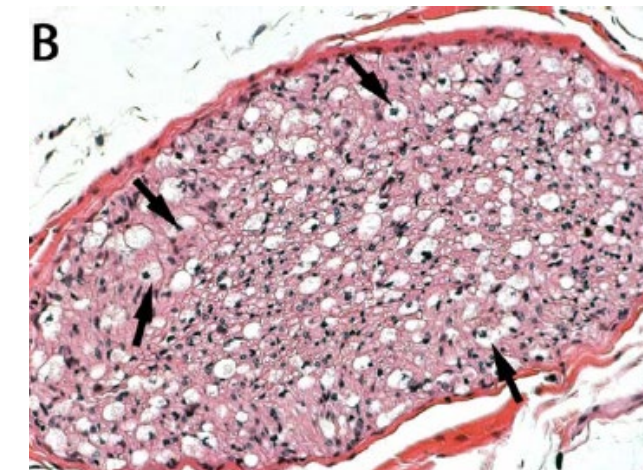
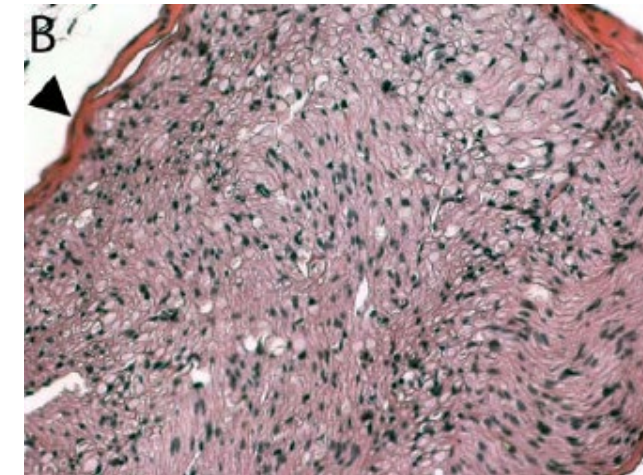
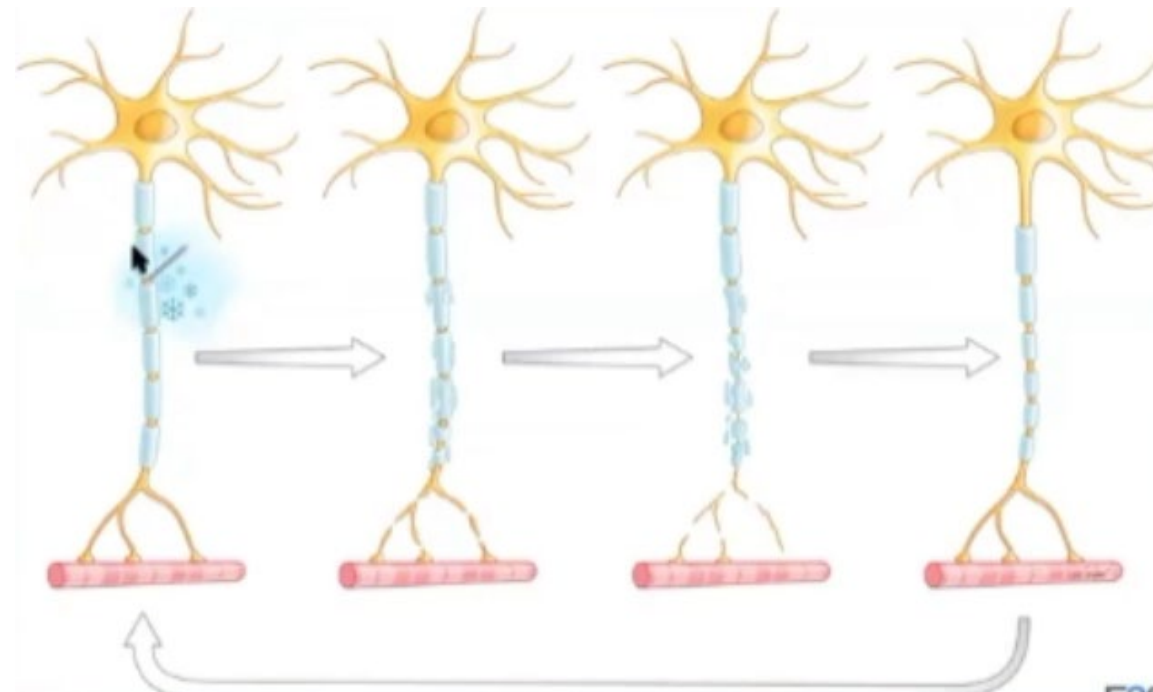
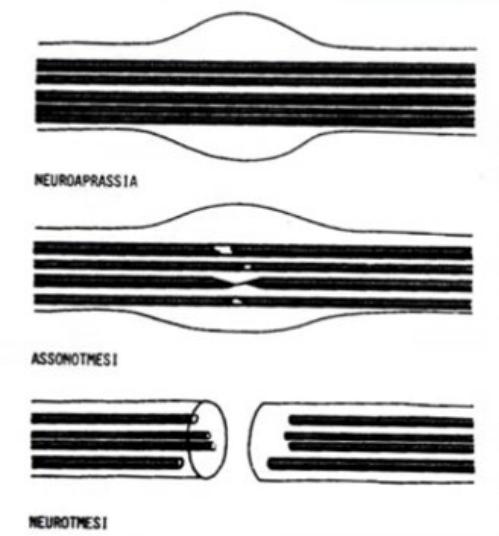
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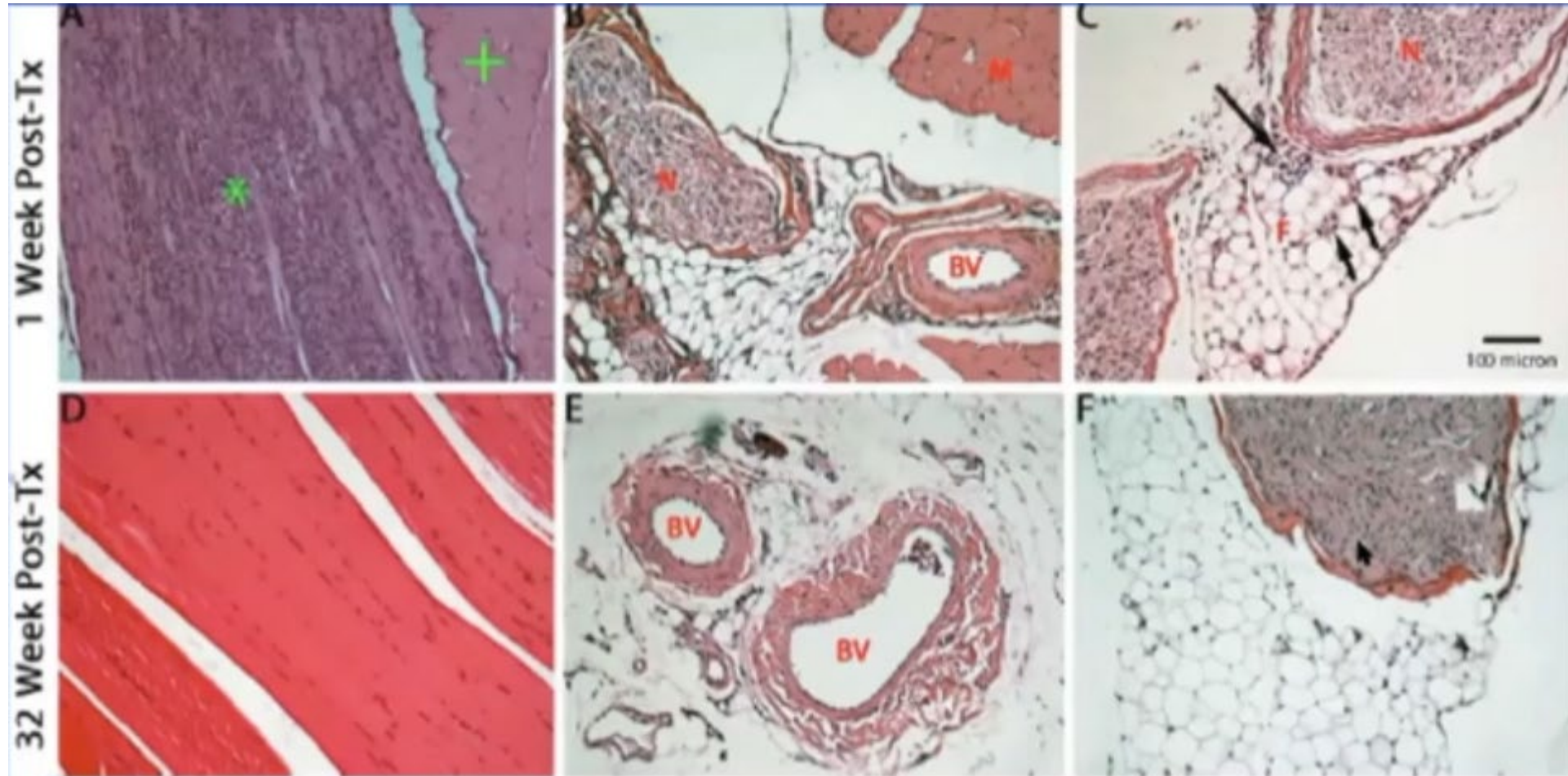
WALLERIAN DEGENERATION AND RECOVERY OF MOTOR NERVES AFTER MULTIPLE FOCUSED COLD THERAPIES

MUSCLE & NERVE February 2015





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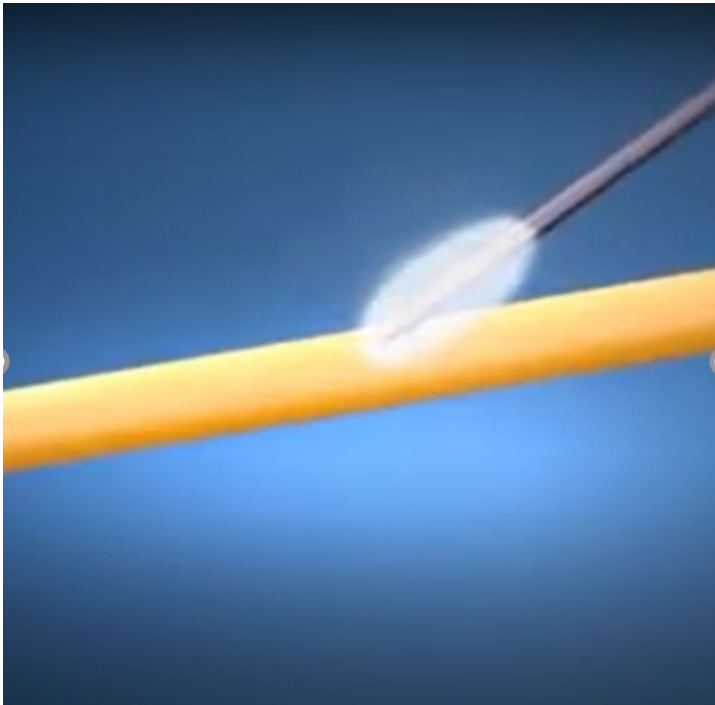
MUSCLE

BLOOD VESSELS

FAT



Successful lesion



- Function of the size of the ice ball
 - Size of probe
 - Freeze time (until the ice ball acts as insulator)
 - Tissue permeability to water
 - Heat sink
- Function of proximity to nerve
 - Meticulous nerve stimulation
- Function of the correct diagnosis



Cryo advances

- Cryoneuroablation is resurging because of a combination of:
 - New recognition of peripheral nerve pathologies
 - New imaging techniques (Ultrasound)
 - New equipment
- Is the treatment of choice for entrapment of large, myelinated nerves





Cryo advantages

- Immediate pain reduction
- No neuroma formation, with no risk of secondary pain
- High efficiency: pain reduction from 6 months to 2 years
- Can be repeated (nerve grows back)
- Simple diagnostic (Ultrasound or Fluoroscopy)
- No scar tissue formation
- Suitable for patients with PM or stimulators
- No risk of vessel proliferation and obliteration



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	RF	CRYO	PRF
Myelinated nerves	Irreversible lesion	reversible	reversible
Motor loss	Yes	yes	no
Sensory loss	yes	yes	no
Neuroma formation, potential for worse pain	yes	no	no
Targets in non-cancer pain	Small, non-myelinated nerves only	All nerves	All nerves
Cancer pain (end stage)	All nerves	All nerves	All nerves
Placement	Easy	Harder	Easy
Denervation certainty	✓	✓✓	X
Pain relief	✓✓	✓✓	✓
How long it lasts?	6M+	6M*	?



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Indication	RF-Lesion	Pulsed -RF	Cryoanalgesia
Lumbar Facet Denervation	+++	-	+++
Cervical/thoracic Facet Denervation	+++	-	++
Sacroiliac Joint Denervation	bipolar, cooled	-	+++
DRG Denervation	- (C2 ??)	+++	-
Ganglion Gasseri	+++	+/-	-
Occipital nerve	++	-	+++
Infrapatellar nerve	+	+/-	+++
Postthoracotomy	-	+/-	+++
Postherniotomy	-	+/-	+++
Stump pain	++	+/-	+++
Coccygodynia	-	++	++

Tronnier V, University of Lübeck



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Evidence and Recommendations for RF

TYPE of PAIN	ASP	ASIPP	NeuPSIG
Cervical root pain	pRF not recommended pRF of C2 DRG	pRF not recommended	inconclusive
Carvical axial pain	Level IIB		
Lumbar root pain	pRF not recommended pRF of lumbar DRG: good efficacy (+TFESI), bipolar	pRF not recommended	inconclusive
Lumbar axial pain	Level IIA		
Postherpetic Neuralgia		US-guided pRF on DRG more effective	NRS reduction > 50% applied on DRG at 6 months
Trigeminal Neuralgia	Gasser: pRF + cRF	US-guided pRF (high voltage and duration)	
Occipital Neuralgia	pRF more effective and long-lasting than block with LA and CS		
Morton Neuroma		More-definitive evidence is needed	
Pudendal Neuralgia		US-guided pRF with similar results to CT-guided	



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- Diagnostic and therapeutic interventions for pain management are based on image-guided procedures.
- There are three types of imaging:
 - Fluoroscopy (F),
 - Ultrasonography (US),
 - Computed Tomography (CT).
- The gold standard today is Fluoroscopy.



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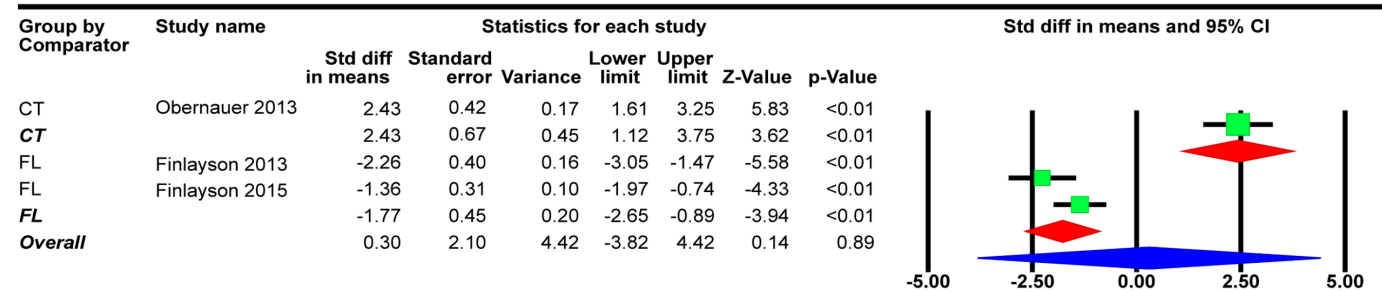
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ANNALS OF HEADACHE MEDICINE JOURNAL

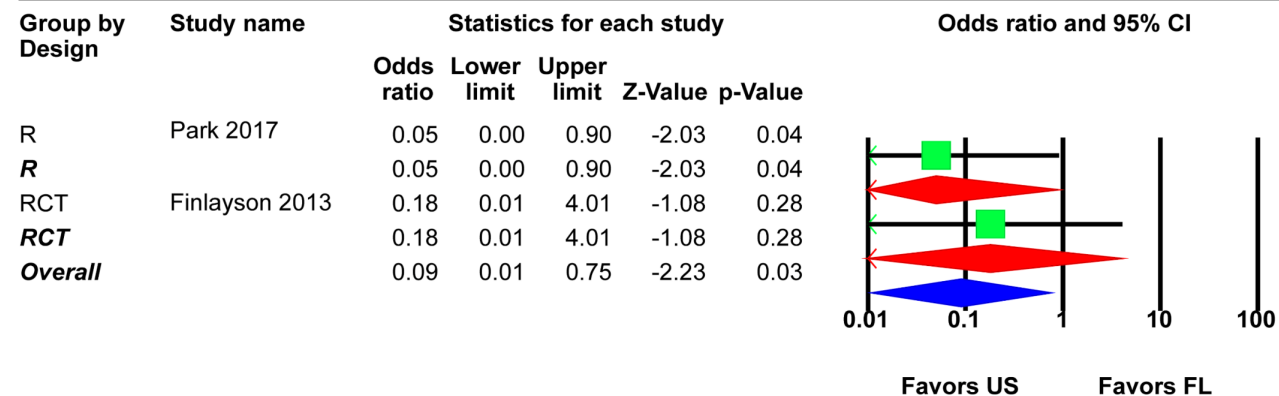
Ultrasound-Guided Cervical Medial Branch Blocks: A Systematic Review and Meta-Analysis

Article Information

DOI: [10.30756/chmj.2020.03.01](https://doi.org/10.30756/chmj.2020.03.01)



Incidence of Vascular Puncture





Ultrasound of the cervical spine

PAIN MEDICINE

Ultrasonography of the Cervical Spine

An In Vitro Anatomical Validation Model

Maarten van Eerd, M.D., F.I.P.P., Jacob Patijn, M.D., Ph.D., Judith M. Sieben, Ph.D.,
Mischa Sommer, M.D., Ph.D., Jan Van Zundert, M.D., Ph.D., F.I.P.P.,
Maarten van Kleef, M.D., Ph.D., F.I.P.P., Arno Lataster, M.Sc.

- There were no validated ultrasound approaches for the cervical spine
- Delicate and vital structures in a very small area



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Why Ultrasound?

1. Most typical imaging examinations and interventional procedures performed under fluoroscopy have also been reportedly performed under ultrasound guidance

Hurdle MF. Phys Med Rehabil Clin N Am. 2016;27(3):673–86.

2. For certain types of cervical pain injection therapy, there is also evidence that ultrasound provides noninferior guiding effects when compared with computed tomography

Yue Ley et Al. ì. Clin J Pain. 2023;39(2):68–75..

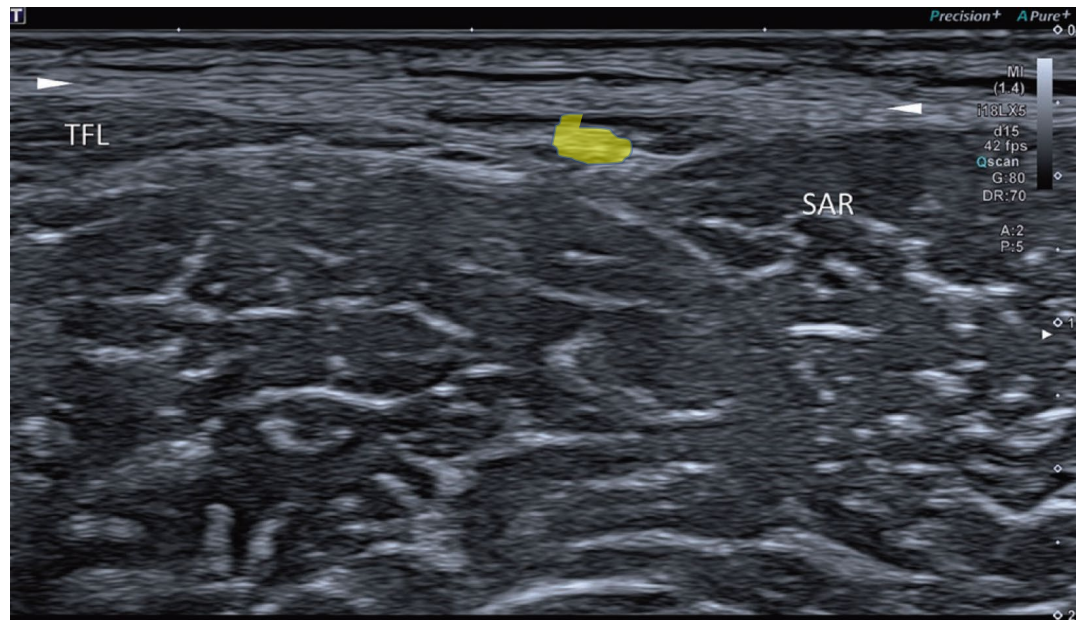
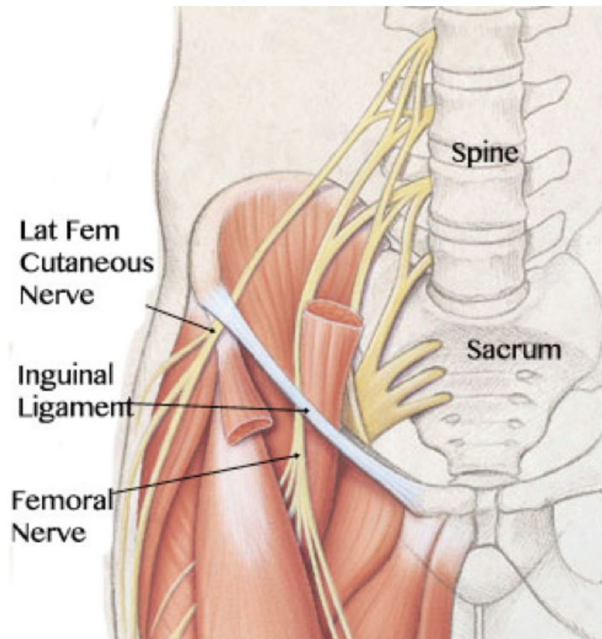
3. Many advantages:

- no ionizing radiation,
- real-time guidance,
- high spatial resolution,
- excellent soft tissue contrast,
- ability to identify and avoid critical structures



Pain Management

- Ensure **accuracy** of procedures



Landmark guide: 5-40%

US-guidance: 95-100%



Pain Management

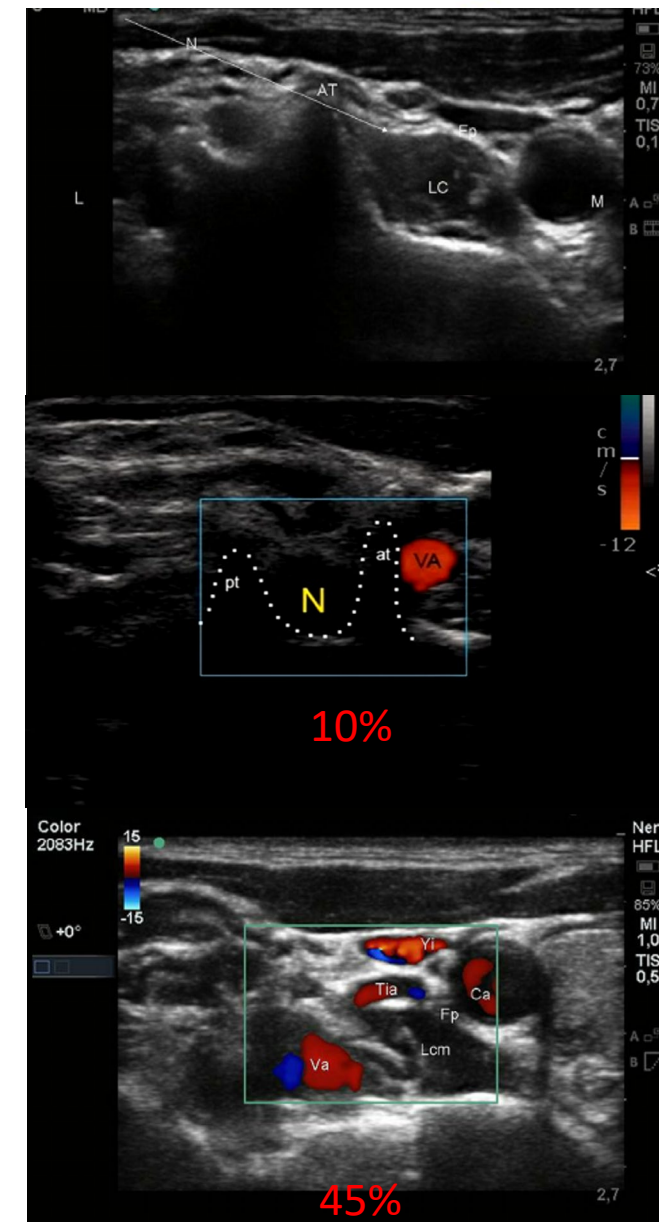
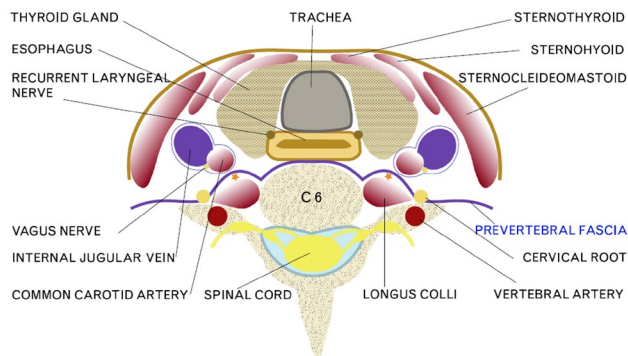
- Ensure **safety** of procedures

Can J Anesth/J Can Anesth (2012) 59:1040–1047
DOI 10.1007/s12630-012-9779-4



REPORTS OF ORIGINAL INVESTIGATIONS

Evaluation of sonoanatomy relevant to performing stellate ganglion blocks using anterior and lateral simulated approaches: an observational study





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Only positive properties?





THANKS



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