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Hospital and Trauma Center

# Post-Fracture Pain Management: Non-Opioid Solutions

16<sup>th</sup> Annual Orthopaedic Trauma Course

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# Disclosures

- No disclosures

# Pain Management – Talk Outline

## Opioid Review

- Still a cornerstone of acute pain care
- Several advantages over non-opioid treatments
- Side effects and societal impact

## Multimodal Analgesia

- Acute pain pathway is complex
- Single modality pain control often ineffective
- Regional blocks should always be considered

## Promising Future Techniques

- Neuromodulation
- New stimulation methods
- Study results

# Debate...

Opioid Review

Multimodal Analgesia

Future Techniques

EDITORIAL

## Opioid-free Anesthesia: Time to Regain Our Balance

Evan D. Kharasch, M.D., Ph.D., J. David Clark, M.D., Ph.D.

Fashions come and fashions go. Changes in clothing, automobiles, and restaurants follow popular trends and are often periodic and cyclical. Ideally, medical change is driven not by fashion but instead by concepts of effectiveness and safety, and these concepts should improve and refine as better data become available. Trends hold true also in anesthesia practice, where for example intraoperative opioid selection has swung from long-duration to ultra-short duration and then at least partially back again.<sup>1</sup> Recent years have witnessed a new fashion in anesthesiology: “opioid-free anesthesia.” For some, the opioid pendulum has swung clear past rational opioid use in balanced anesthesia to eliminating opioids intraoperatively and sometimes



**“Opioid-free anesthesia may be feasible. Nevertheless, it appears neither logical nor beneficial to patients.”**

major noncardiac surgery received intraoperative balanced anesthesia featuring opioids (remifentanyl infusion and morphine) or dexmedetomidine infusion (opioid-free) and postoperative morphine. The primary outcome was a composite of opioid-related adverse events (hypoxemia, ileus, or cognitive dysfunction) in the 48 h postoperatively. Secondary outcomes included postoperative pain, opioid consumption, nausea and vomiting, and times to extubation and postanesthesia care unit discharge.

Frighteningly, the investigation was stopped prematurely because of safety concerns. Specifically, there were five cases of severe bradycardia in the dexmedetomidine group, including three cases of asystole. The composite primary endpoint

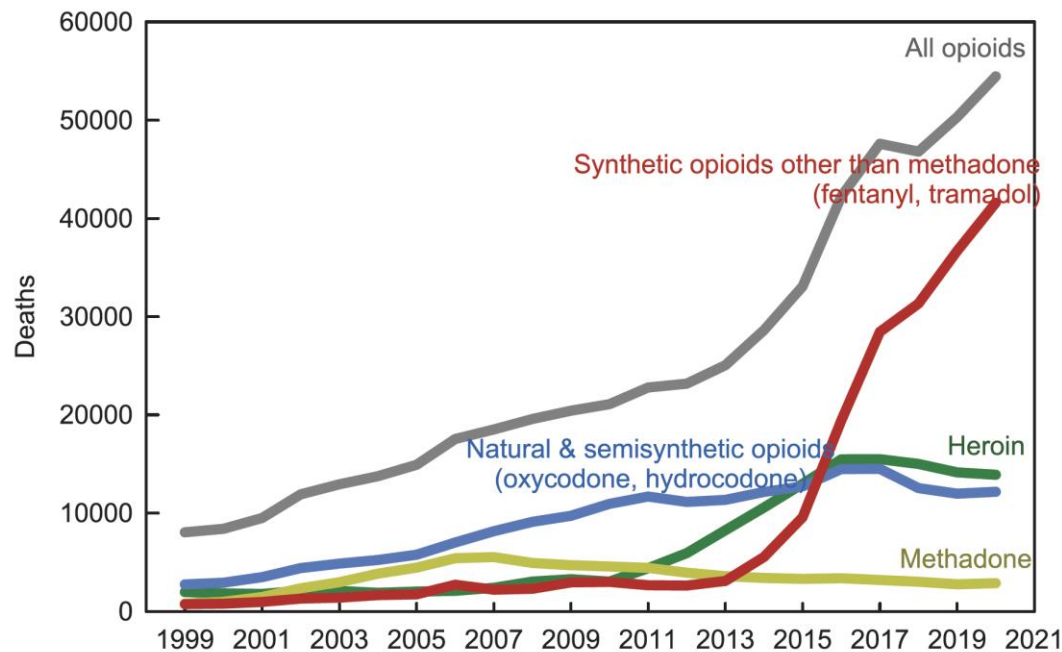
Kharasch ED, Clark JD. Opioid-free anesthesia: time to regain our balance. *Anesthesiology*. 2021;134(4):509-514.

# Opioids are Central to Analgesia, but...

Opioid Review

Multimodal Analgesia

Future Techniques



**Fig. 1.** U.S. drug overdose deaths involving opioids 1999 to 2020 (November), by type of opioid. The data can be accessed at <https://www.cdc.gov/nchs/nvss/vsrr/drug-overdose-data.htm>.

Kharasch ED, Clark JD. Opioid-free anesthesia: time to regain our balance. *Anesthesiology*. 2021;134(4):509-514.

# Relevance to Orthopedic Trauma?

Opioid Review

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Where do orthopedic surgeons rank as prescribers?

- 5.8% of total volume of prescribed (7/1/16-6/30/17)<sup>1</sup>
- 438.7 prescriptions per provider (**highest among surgeons**, 3<sup>rd</sup> highest after Pain Medicine and PMR)<sup>1</sup>

How much opioid do orthopedic trauma patients receive on discharge?

- 135 patients presenting during 1 month at a Trauma Center in NC
- Mean equivalent of **oxycodone 20mg Q6H ATC for 7 days**<sup>2</sup>

How many orthopedic trauma patients are higher risk for medication misuse?

- 16.4% positive BAC, cocaine, or methamphetamine<sup>2</sup>
- 21.8% history of anxiety, 20.9% history of depression<sup>2</sup>

<sup>1</sup>Guy GP, Zhang K. Opioid prescribing by specialty and volume in the U.S. *American Journal of Preventive Medicine*. 2018;55(5):e153-e155.

<sup>2</sup>Ruder J, Wally MK, Oliverio M, Seymour RB, Hsu JR, the PRIMUM Group. Patterns of opioid prescribing for an orthopaedic trauma population. *Journal of Orthopaedic Trauma*. 2017;31(6):e179-e185.



# Multimodal – The Theory

Opioid Review

Multimodal Analgesia

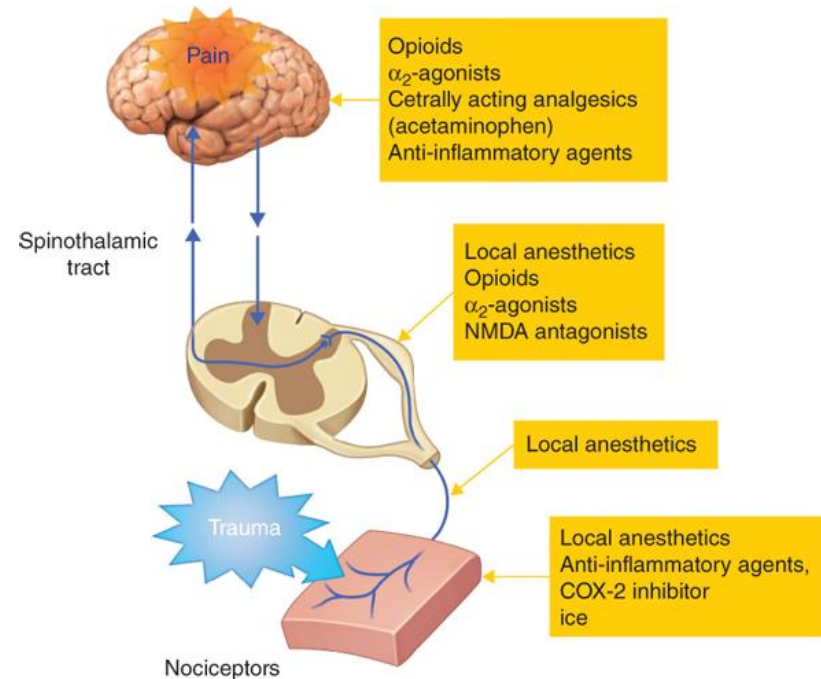
Future Techniques

Interrupt pain pathway at multiple points

Reduce total dose of opioids

Improve side effect profile

Achieve greater function



Source: Sylvia C. McKean, John J. Ross, Daniel D. Dressler, Danielle B. Scheurer: Principles and Practice of Hospital Medicine, Second Edition, [www.accessmedicine.com](http://www.accessmedicine.com)  
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# Multimodal - Routes

Opioid Review

Multimodal Analgesia

Future Techniques

All Patients

Topical

Oral

When Needed

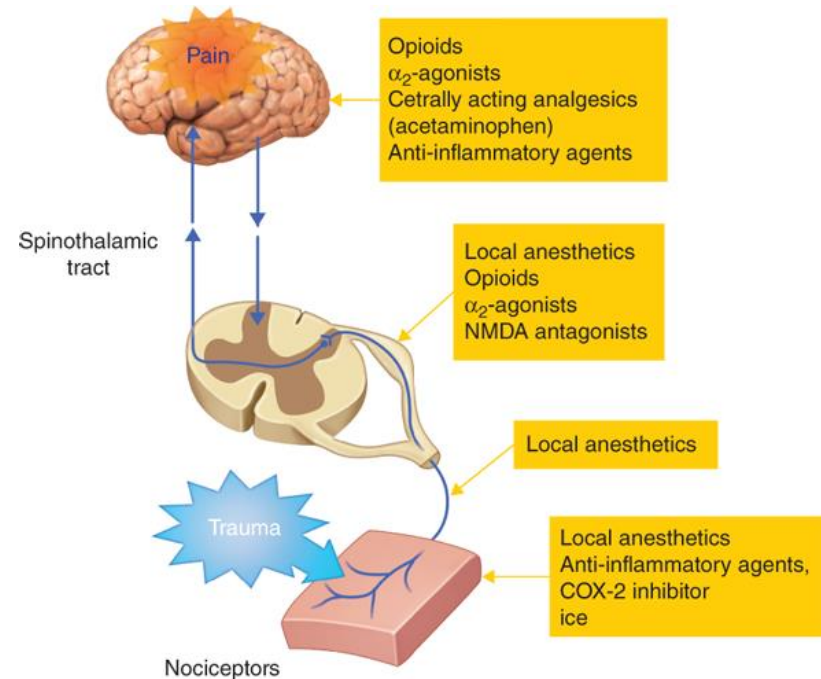
Intravenous Push

IV PCA

If Available

Regional

Neuraxial



Source: Sylvia C. McKean, John J. Ross, Daniel D. Dressler, Danielle B. Scheurer: Principles and Practice of Hospital Medicine, Second Edition, [www.accessmedicine.com](http://www.accessmedicine.com)  
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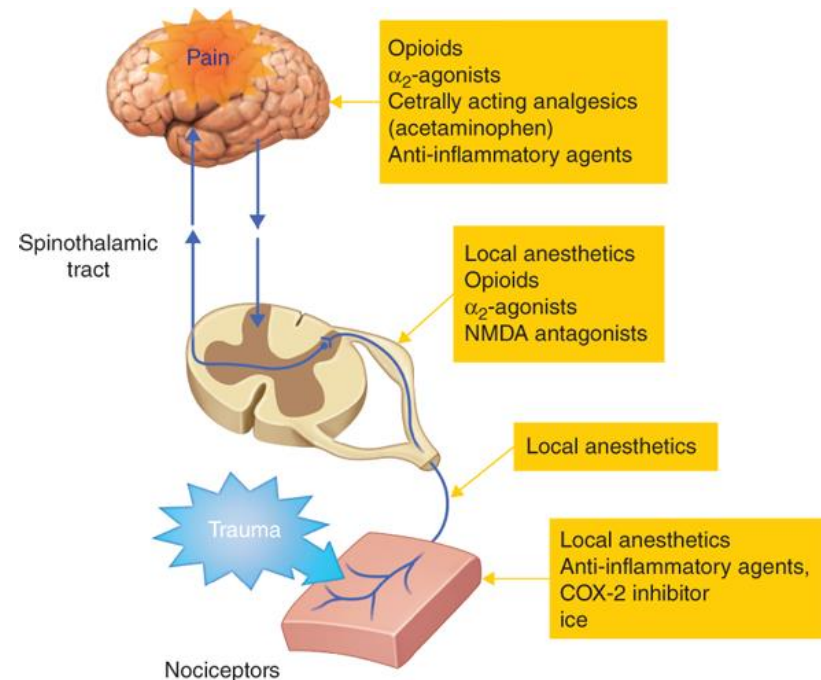
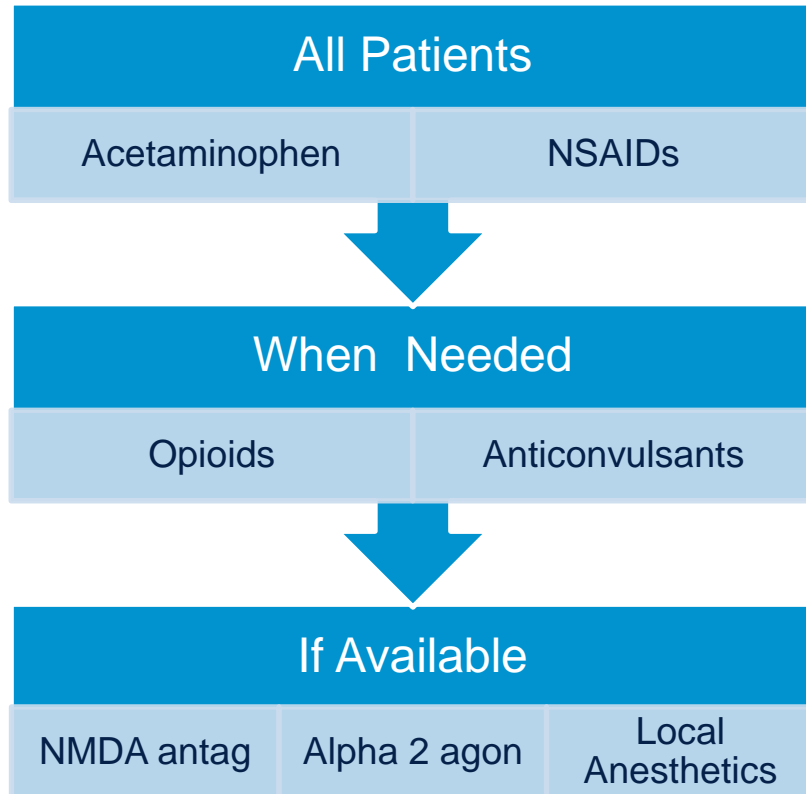


# Multimodal – Drug Classes

Opioid Review

Multimodal Analgesia

Future Techniques



Source: Sylvia C. McKean, John J. Ross, Daniel D. Dressler, Danielle B. Scheurer: Principles and Practice of Hospital Medicine, Second Edition, [www.accessmedicine.com](http://www.accessmedicine.com)  
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# Medication Tips – Non-Opoids

Opioid Review

Multimodal Analgesia

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## NSAIDs

- Multiple formulations available (oral, IV, topical)
- Opioid sparing effect
- Avoid in cardiovascular disease, elderly, dehydrated patients

## Tylenol

- IV formulation has quicker onset
- 3gm daily max for hospitalized patients, less for liver failure
- Be wary of combination drugs

## Gabapentin

- Excellent for neuropathic pain – but is not a panacea
- Reduced bioavailability with increasing dose (60% → 35%)
- Recent FDA warning over sedation

# Medication Tips – Ketamine

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## Mechanism

- NMDA antagonist (↓ glutamate release)
- Sigma opioid agonist

## Indications

- Spine surgery (↓ pain scores/opioid requirement)
- Burn pain (↓ pain scores/hyperalgesia)
- Emergency room (efficacy similar to morphine)

## Administration

- Bolus dose: 0.1-0.35 mg/kg IV
- Infusion: 2-15 mcg/kg/min IV
- Avoid in CAD, severe HTN, schizophrenia

# Medication Tips – Lidocaine

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## Mechanism

- Na<sup>+</sup> channel blockade
- Prevents generation of action potentials
- Anti-inflammatory properties?

## Indications

- Lumbar spine surgery (↓ pain scores)
- Abdominal surgery in ICU
- Opioid refractory cancer pain in hospice

## Administration

- Loading dosing 1-1.5mg/kg IV
- Infusion: 0.5-1.5mg/kg hour
- Avoid in patients receiving regional

# Medication Tips - Regional

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## What?

- Local anesthetic placed near nerves
- Often uses ultrasound imaging
- Can bolus or place catheter for infusion



## Why?

- Site specific analgesia
- No opioid related side effects
- May prevent chronic pain
- Shorter length of stay



## Where?

- Hip fracture – femoral nerve block
- Ankle fracture – popliteal, saphenous
- Shoulder/upper extremity – brachial plexus block



## Risks?

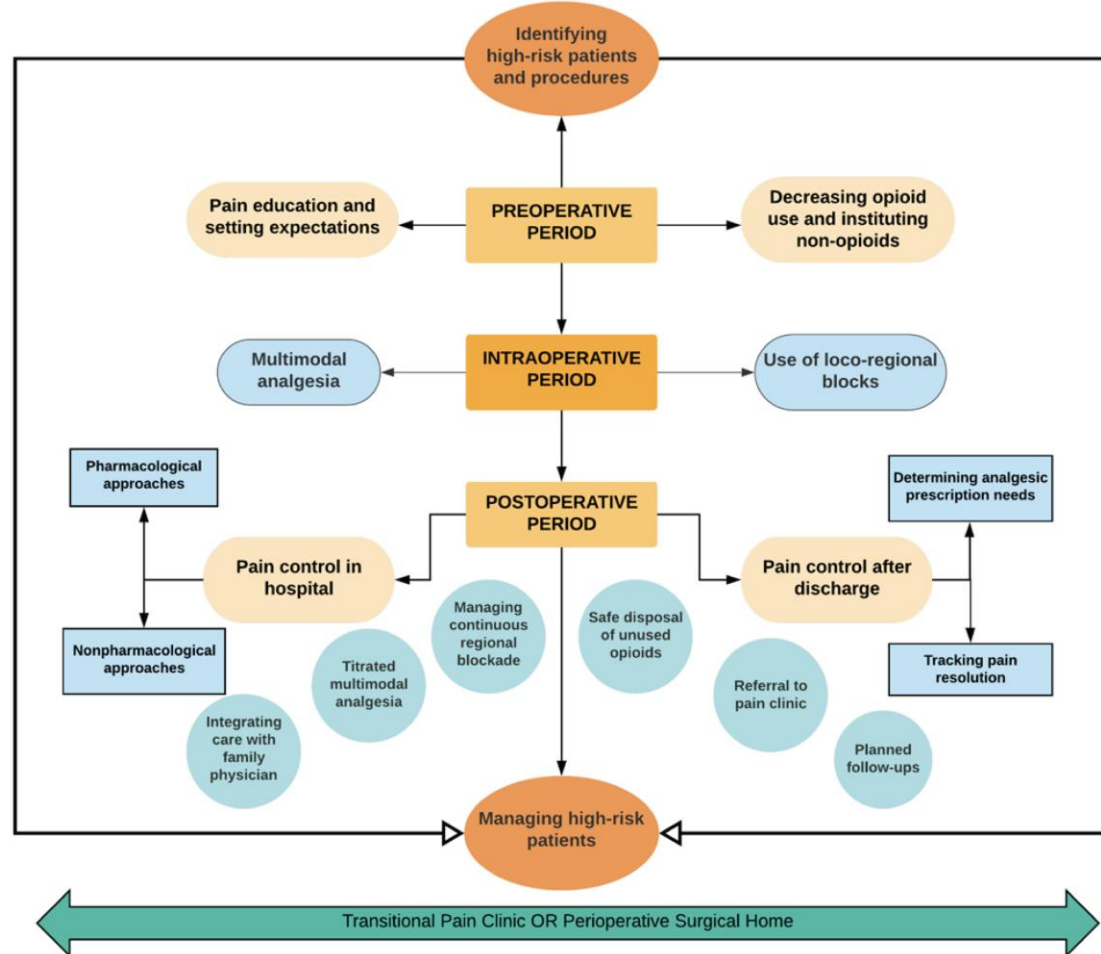
- Local anesthetic toxicity
- Compartment syndrome?

# Perioperative Pain Care

Opioid Review

Multimodal Analgesia

Future Techniques



Shanthanna H, Ladha KS, Kehlet H, Joshi GP. Perioperative opioid administration. *Anesthesiology*. 2021;134(4):645-659.



# Where do we go from here?

Opioid Review

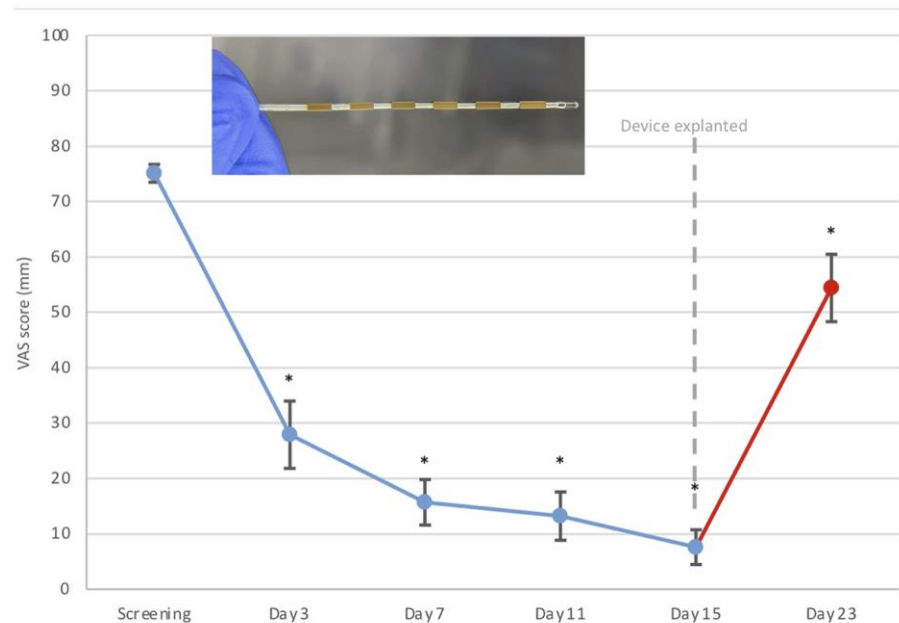
Multimodal Analgesia

Future Techniques

Regional anesthesia provides the purest form of pain control

Modulating the nervous system through electrical stimulation is already done (TENS, spinal cord stimulation)

New techniques (ultralow frequency) show promise for effective, reversible pain control, with no motor block.



**Fig. 6.** Effect of ULF current on VAS scores in back pain—I. Mean VAS scores for back pain (primary pain generator) across time. Error bars represent SEM \* $P < 0.001$ . Inset photograph shows contacts at the tip of the spinal lead.

Jones MG, Rogers ER, Harris JP, et al. Neuromodulation using ultra low frequency current waveform reversibly blocks axonal conduction and chronic pain. *Sci Transl Med.* 2021;13(608):eabg9890.

# Where do we go from here?

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Peripheral nerve stimulators gaining in popularity during last decade

- Sciatic nerve for major foot/ankle surgery
- Femoral nerve for ACL reconstruction
- Brachial plexus for rotator cuff repair

- 90% reduction in opioid use over 7 days (5mg vs 48mg)
- Reduction in average pain intensity from 3 to 1 out of 10 over same time

## ANESTHESIOLOGY

### **Percutaneous Peripheral Nerve Stimulation (Neuromodulation) for Postoperative Pain: A Randomized, Sham-controlled Pilot Study**

Brian M. Ilfeld, M.D., M.S., Anthony Plunkett, M.D., Alice M. Vijjeswarapu, M.D., Robert Hackworth, M.D., Sandeep Dhanjal, M.D., Alparslan Turan, M.D., Steven P. Cohen, M.D., James C. Eisenach, M.D., Scott Griffith, M.D., Steven Hanling, M.D., Daniel I. Sessler, M.D., Edward J. Mascha, Ph.D., Dongsheng Yang, M.S., Joseph W. Boggs, Ph.D., Amorn Wongsarnpigoon, Ph.D., Harold Gelfand, M.D., on behalf of the PAINfRE Investigators\*

*ANESTHESIOLOGY* 2021; 135:95–110

Ilfeld BM, Plunkett A, Vijjeswarapu AM, et al. Percutaneous peripheral nerve stimulation (Neuromodulation) for postoperative pain: a randomized, sham-controlled pilot study. *Anesthesiology*. Published online April 15, 2021.



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# Thank You

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