Keynote: A Conversation with Seahawks Legend Marcus Trufant

Virginia Mason Franciscan Health™
Center for Neurosciences & Spine

Targeted Pain Management: A Practical Guide

Virginia Mason Franciscan Health™

Center for Neurosciences & Spine

Diffuse vs. Direct:

Understanding the Spine Injection Spectrum

Dan Warren, MD
Anesthesiology and Pain Medicine
5/9/2026

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Disclosures: no financial relationships

- No duality of interest- financial or otherwise
- I have no intention to promote or discourage the use of any device or product.
- The opinions expressed do not necessarily represent those of Virginia Mason Medical Center or Common Spirit.

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NOTE: Off-Label use of steroid preparations will be discussed.

In 2014, the FDA required label warnings for injectable corticosteroids (including methylprednisolone) stating that epidural use can result in rare but serious adverse events.

This discussion will be evidence-based and include practices which are part of regional standards of care, and when applicable, will reflect national consensus statements on safe use of injectable agents.

Objectives:

- Identify indications for commonly utilized injection therapy for spine related pain.

- Recognize common limitations and contraindications to spine interventions.

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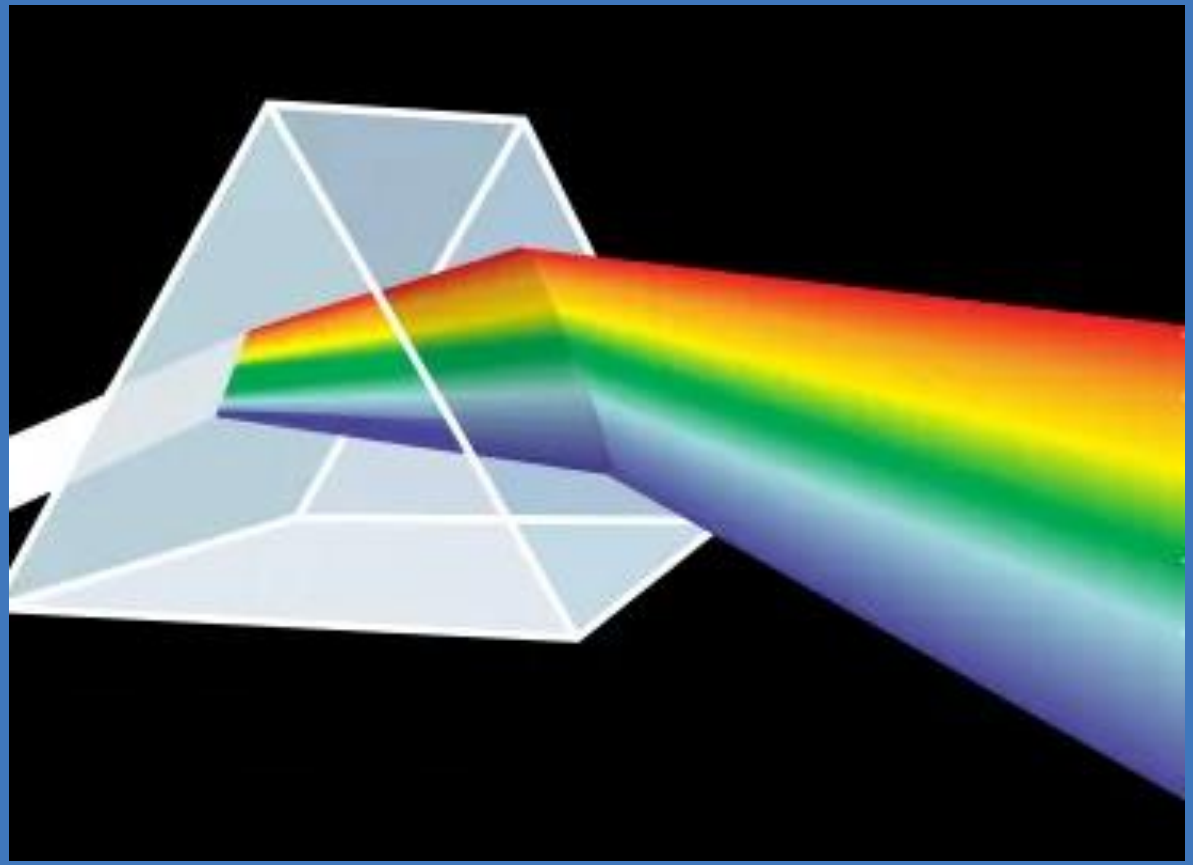

Therapeutic
- Broad
- Targeted
Diagnostic
Prognostic
Ablative

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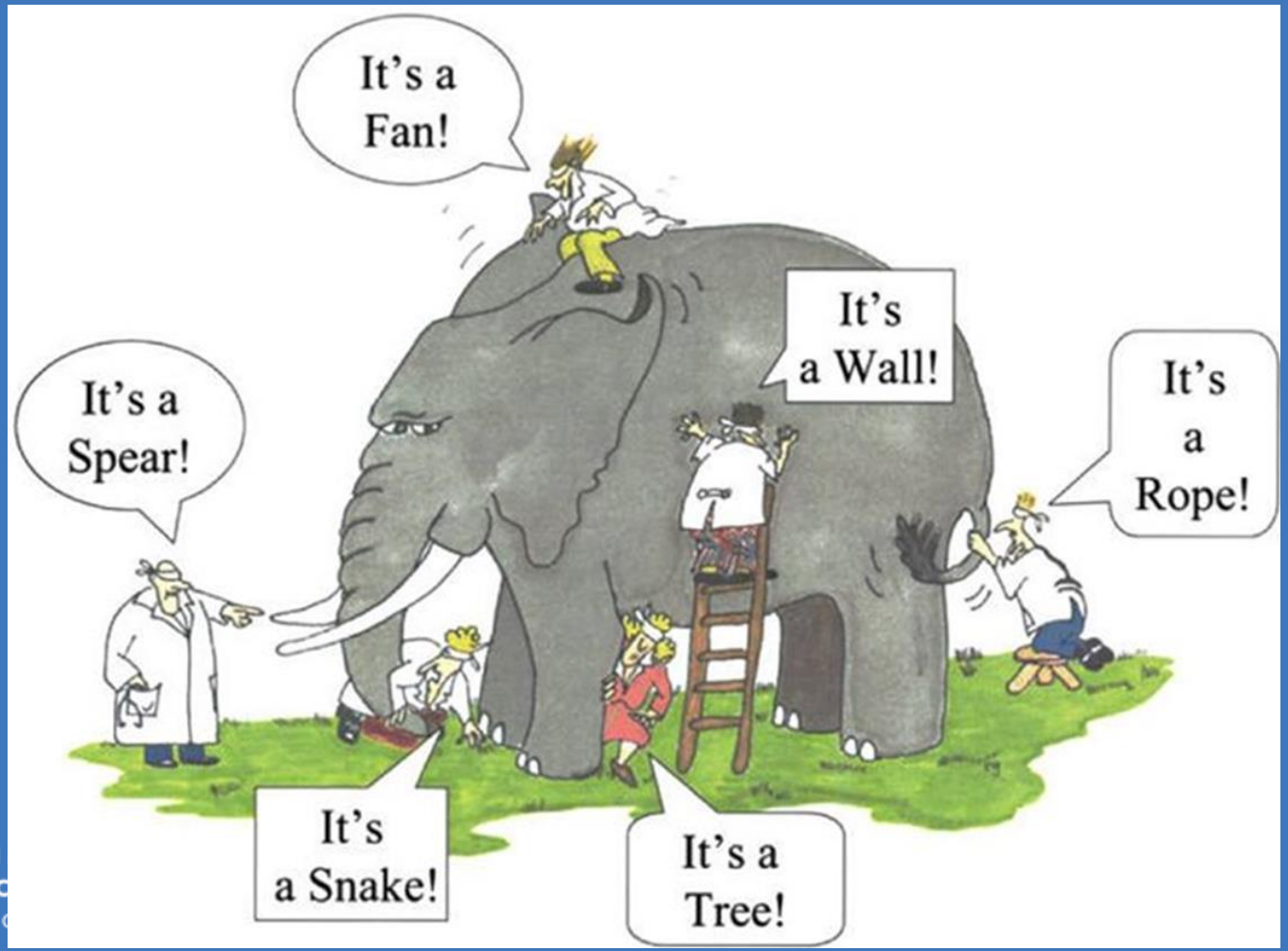
Themes:

The Data are Supportive/Conflicting

Injections Best/Only as Part of Comprehensive Care

Any Therapy can be Over Applied


It's a Fan!
It's a Spear!
It's a Wall!
It's a Rope!
It's a Snake!
It's a Tree!

“Pain Generators”

- Several potential sources of nocicept
- Many overlapping presentations
- Requires focused history and physical
- Imaging appropriateness

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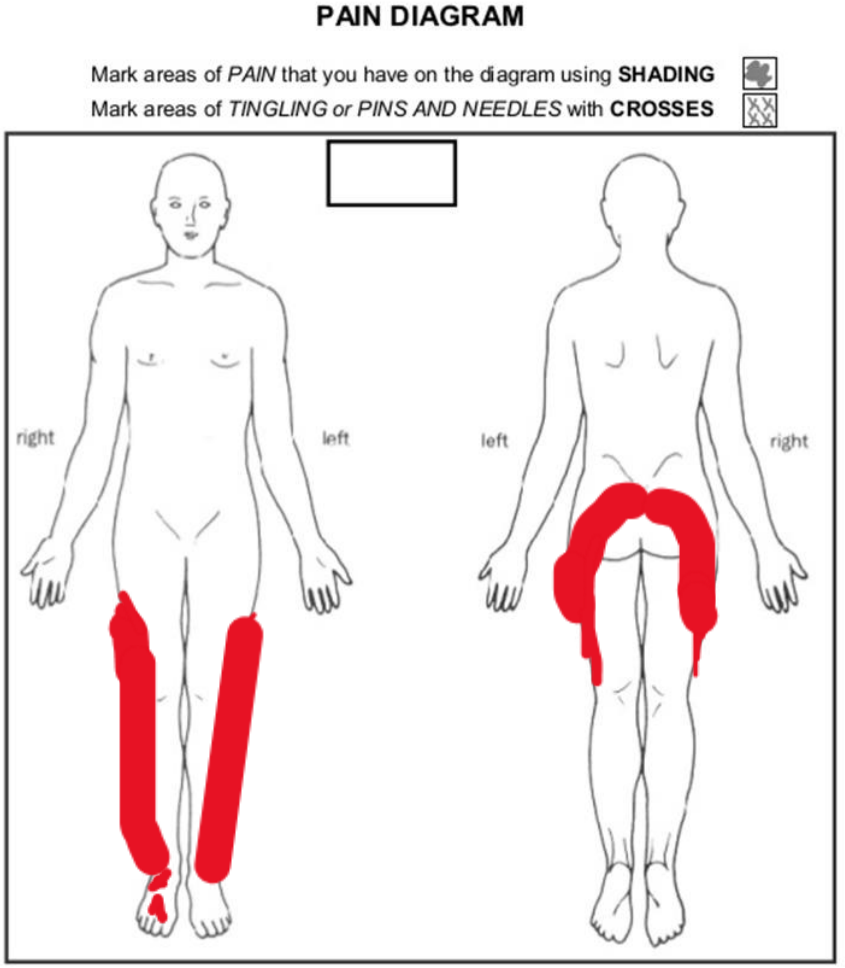
Lumbar Radiculitis

50 year old with lifting injury

- Burning/electric pain in legs
- No weakness or red flags
- Oral analgesics- minimal
- Physical therapy 6+ weeks
- Interfering with work, ADLs



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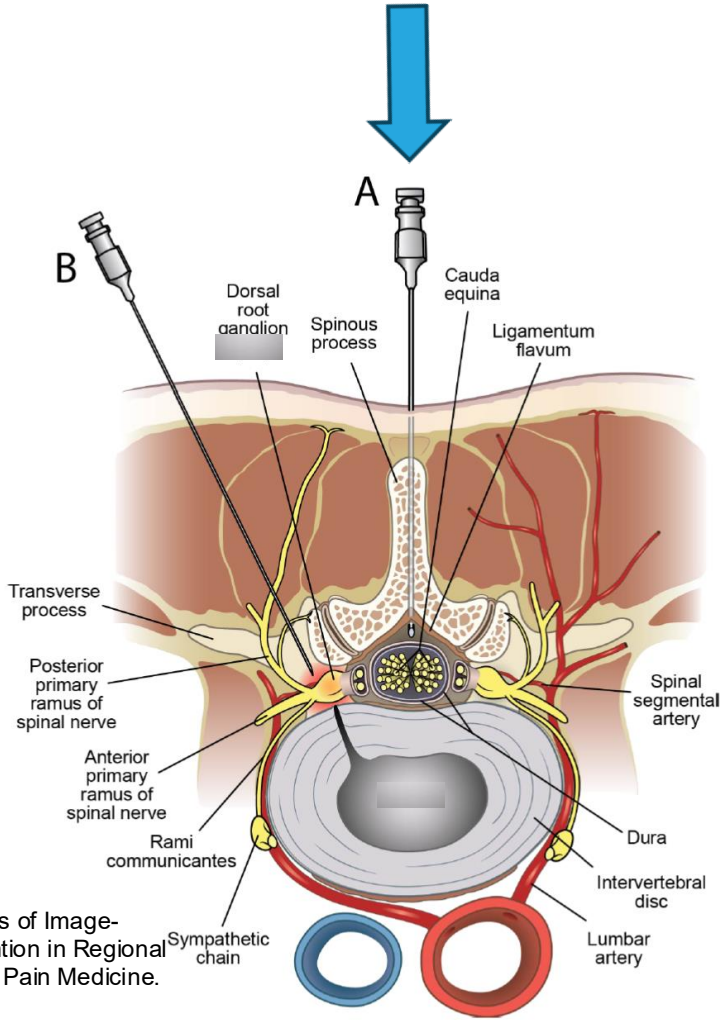
Epidural Steroid Injection (off-label)



Rathmell J. Atlas of Image-Guided Intervention in Regional Anesthesia and Pain Medicine. 2nd ed. 2012

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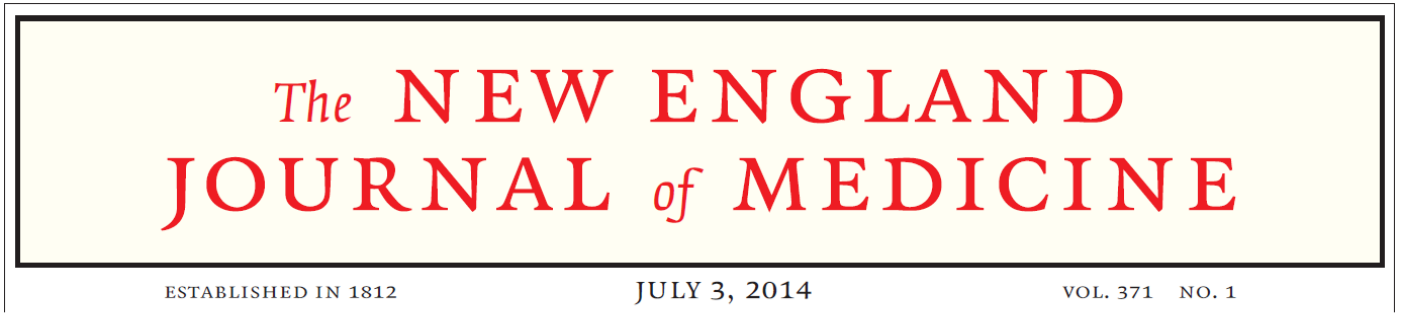
NEJM Publication (and Editorial)



The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JULY 3, 2014 VOL. 371 NO. 1

A Randomized Trial of Epidural Glucocorticoid Injections for Spinal Stenosis

Janna L. Friedly, M.D., Bryan A. Comstock, M.S., Judith A. Turner, Ph.D., Patrick J. Heagerty, Ph.D., Richard A. Deyo, M.D., M.P.H., Sean D. Sullivan, Ph.D., Zoya Bauer, M.D., Ph.D., Brian W. Bresnahan, Ph.D., Andrew L. Avins, M.D., M.P.H., Srdjan S. Nedeljkovic, M.D., David R. Nerenz, Ph.D., Christopher Standaert, M.D., Larry Kessler, Ph.D., Venu Akuthota, M.D., Thiru Annaswamy, M.D., Allen Chen, M.D., M.P.H., Felix Diehn, M.D., William Firtch, M.D., Frederic J. Gerges, M.D., Christopher Gilligan, M.D., Harley Goldberg, M.D., David J. Kennedy, M.D., Shlomo Mandel, M.D., Mark Tyburski, M.D., William Sanders, M.D., David Sibell, M.D., Matthew Smuck, M.D., Ajay Wasan, M.D., Lawrence Won, M.D., and Jeffrey G. Jarvik, M.D., M.P.H.

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Multi-Society Pain Workgroup (MPW)

1. American Academy of Neurological Surgeons (AANS)
2. American Academy of Pain Medicine (AAPM)
3. American Academy of Physical Medicine and Rehabilitation (AAPM&R)
4. American College of Radiology (ACR)
5. American Pain Society (APS)
6. American Society of Anesthesiologists (ASA)
7. American Society of Neuroradiology (ASNR)
8. American Society of Regional Anesthesia (ASRA)
9. American Society of Spine Radiology (ASSR)
10. Congress of Neurological Surgeons (CNS)
11. International Spine Intervention Society (ISIS)
12. North American Neuromodulation Society (NANS)
13. North American Spine Society (NASS)
14. Society of Interventional Radiology (SIR)

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1. Cervical interlaminar (IL) ESIs are associated with a rare risk of catastrophic neurologic injury.
2. Transforaminal (TF) ESI using particulate steroid is associated with a rare risk of catastrophic neurovascular complications.
3. All cervical interlaminar (IL) epidural steroid injections should be performed using image-guidance, with appropriate AP, lateral or contra-lateral oblique views, and a test- dose of contrast medium.
4. Cervical transforaminal ESIs should be performed by injecting contrast medium under real-time fluoroscopy and/or DSA, in a frontal plane, before injecting any substance that may be hazardous to the patient.
5. Cervical interlaminar epidural steroid injections are recommended to be performed at C7-T1, but preferably not higher than the C6-C7 level.
6. No cervical interlaminar epidural steroid injection should be undertaken, at any segmental level, without reviewing, before the procedure, prior imaging studies that show there is adequate epidural space for needle placement at the target level.
7. Particulate steroids should not be used in cervical TF injections.
8. All lumbar IL ESIs should be performed using image-guidance, with appropriate AP, lateral or contralateral oblique views, and a test-dose of contrast medium.
9. Lumbar TF ESIs should be performed by injecting contrast medium under real-time fluoroscopy and/or DSA, in a frontal plane, before injecting any substance that may be hazardous to the patient.
10. A non-particulate steroid (e.g. dexamethasone) should be used for the Initial injection in lumbar transforaminal epidural injections.
11. There are situations where particulate steroids could be used in the performance of lumbar TF ESIs.
12. Extension tubing is recommended for all TF ESIs.
13. A face mask and sterile gloves must be worn during the procedure.
14. The ultimate choice of what approach or technique (IL vs. TF ESI) to use should be made by the treating physician by balancing potential risks vs. benefits with each technique for each given patient.
15. Cervical and lumbar IL-ESIs can be performed without contrast in patients with documented contra-indication to use of contrast (e.g. significant history of contrast allergy or anaphylactic reaction).
16. TF ESIs can be performed without contrast in patients with documented contraindication to use of but in these circumstances, particulate steroids are contraindicated and only preservative free, particulate free steroids should be used.
17. Moderate to heavy sedation is not recommended for epidural steroid injections, but if light sedation is employed, the patient should remain able to communicate pain or other adverse sensations or events.

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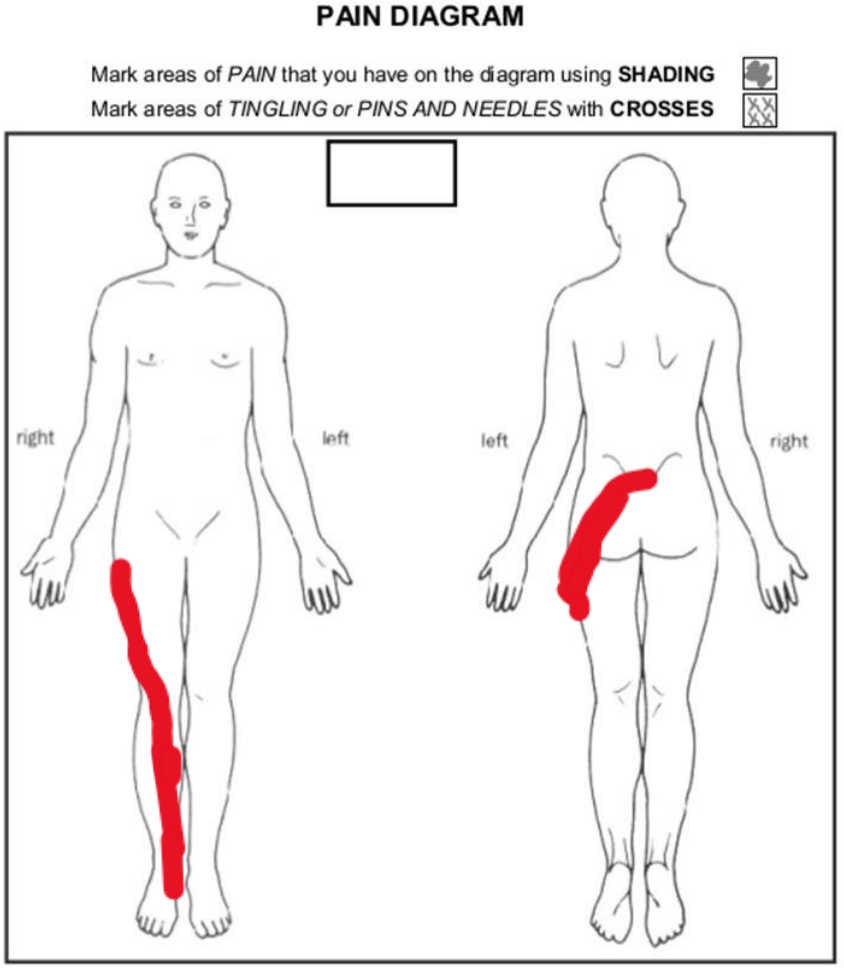
Lumbar Radiculitis

51 year old S/P Laminectomy

- Burning/electric pain in R leg
- No weakness or red flags
- Oral analgesics- minimal
- Physical therapy 6+ weeks
- Interfering with work, ADLs
- MRI with Right L4 impingement



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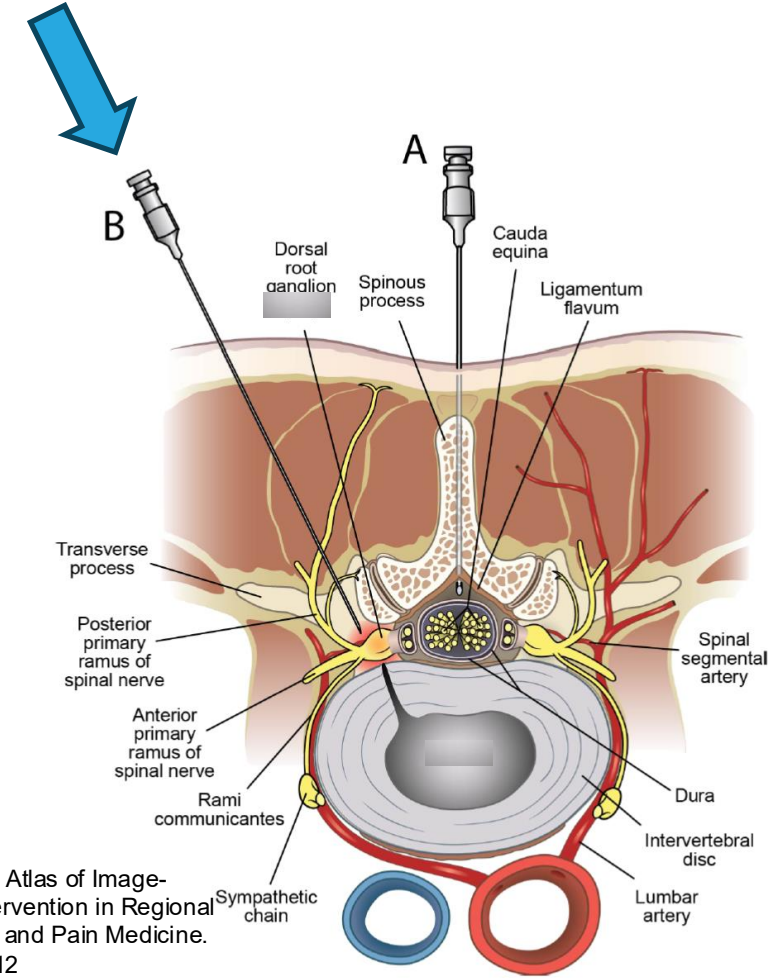
Epidural Steroid Injection- Transforaminal (off-label)



Rathmell J. Atlas of Image-Guided Intervention in Regional Anesthesia and Pain Medicine. 2nd ed. 2012

Selective Nerve Root Blocks- Diagnostic, Surgical planning

Precision Treatment of Adult Lumbar Degenerative Scoliosis Complicated by Lumbar Stenosis with the Use of Selective Nerve Root Block

Yan Liang[1], Yongfei Zhao[2], Tianhao Wang[2], Zhenqi Zhu[1], Haiying Liu[1], Keya Mao[2]

BACKGROUND: Use of short-segment or long-segment fusion is controversial in treatment of adult lumbar degenerative scoliosis (ALDS). The aim of this study was to explore efficacy and feasibility of precision treatment of ALDS with selective nerve root block.

CONCLUSIONS: Precision treatment of ALDS with selective nerve root block can achieve favorable clinical outcomes and good fusion with less surgical injury and low complications. Deformity correction is limited, which requires further study.

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Sacroiliac Joint Pain

- Vague back pain
- Aggravated by sitting
- Referred pain to thigh

- Imaging findings unreliable
- Provocative Maneuvers are key

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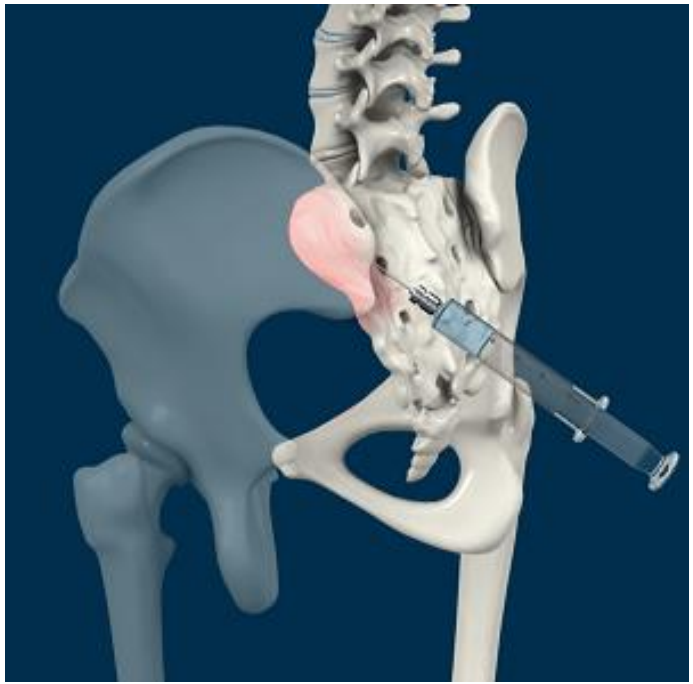
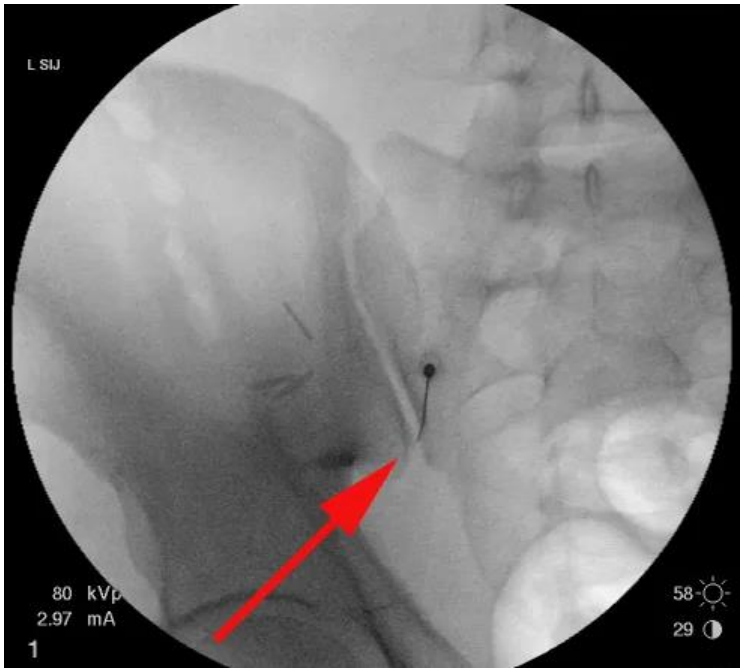
SI Joint Injections- Therapeutic or Prognostic (SI Fusion)





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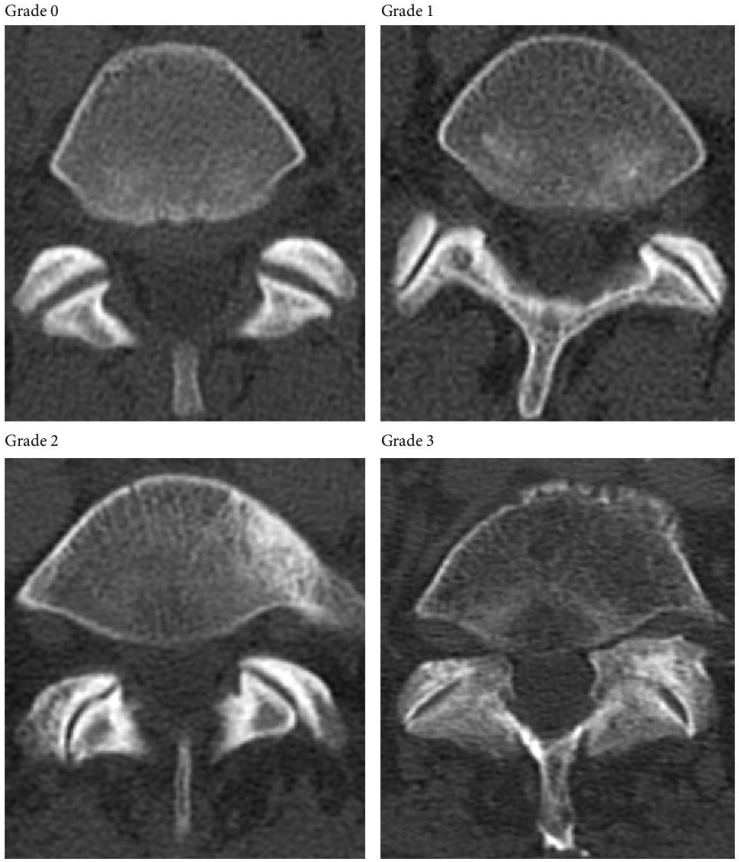
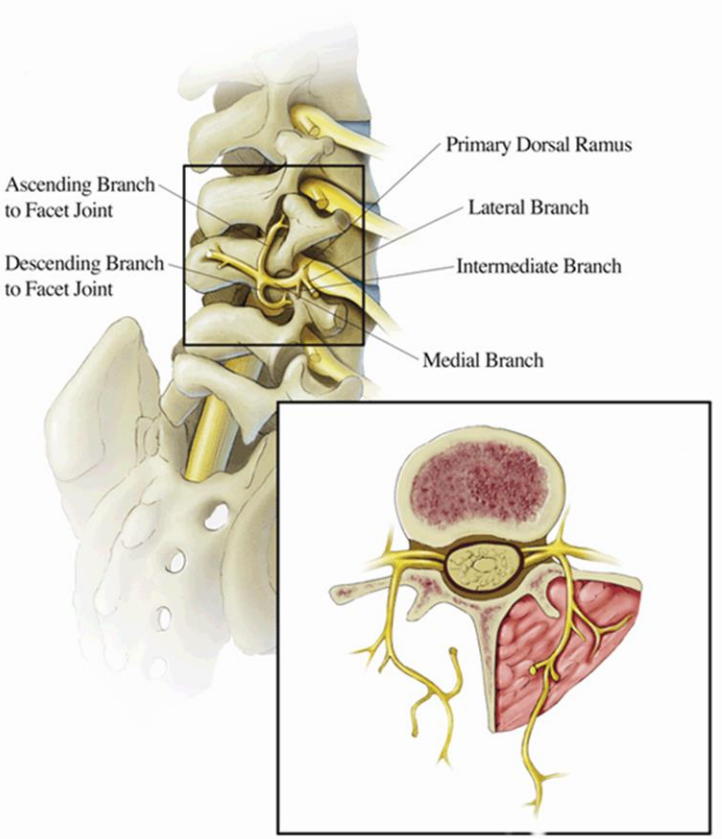
Facet Arthropathy- Steroid vs Nerve Ablation





SPECIAL ARTICLE

Interventional Spine and Pain Procedures in Patients on Antiplatelet and Anticoagulant Medications (Second Edition)

Guidelines From the American Society of Regional Anesthesia and Pain Medicine, the European Society of Regional Anaesthesia and Pain Therapy, the American Academy of Pain Medicine, the International Neuromodulation Society, the North American Neuromodulation Society, and the World Institute of Pain

Samer Narouze, MD, PhD, Honorio T. Benzon, MD,† David Provenzano, MD,‡ Asokumar Buvanendran, MD,§ José De Andres, MD,|| Timothy Deer, MD,** Richard Rauck, MD,†† and Marc A. Huntoon, MD‡‡*

Regional Anesthesia and Pain Medicine • Volume 43, Number 3, April 2018

PAIN SCALE

Mark on the line the *AVERAGE* level of your **BACK PAIN** in the past week

No pain 0 ——————————— 10 Worst pain imaginable

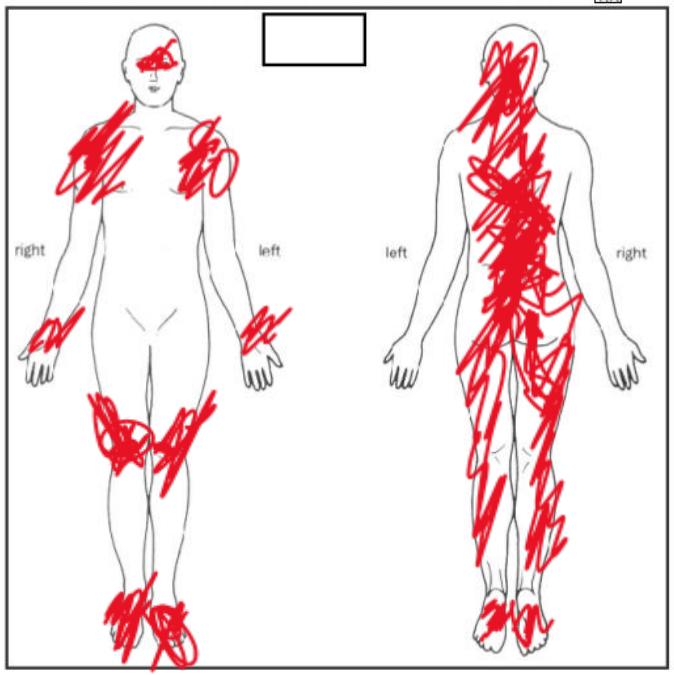
Mark on the line the *AVERAGE* level of your **LEG PAIN** in the past week

No pain 0 ——————————— 10 Worst pain imaginable

PAIN DIAGRAM

Mark areas of *PAIN* that you have on the diagram using **SHADING**

Mark areas of *TINGLING or PINS AND NEEDLES* with **CROSSES**



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Share Diverse Perspectives!

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Thank you for attending!

Q&A portion to come

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What does a "nerve ablation" mean? What is the target?

Christine Oryhan, MD
Pain Medicine Fellowship Program Director,
Anesthesiologist and Pain Medicine Physician
May 9th, 2026

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Disclosures

I have no disclosures.

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Radiofrequency Ablation (RFA)

- What is it and how does it work?
- What is the target and indication?
- Who performs the procedure and how?
- How successful is RFA?

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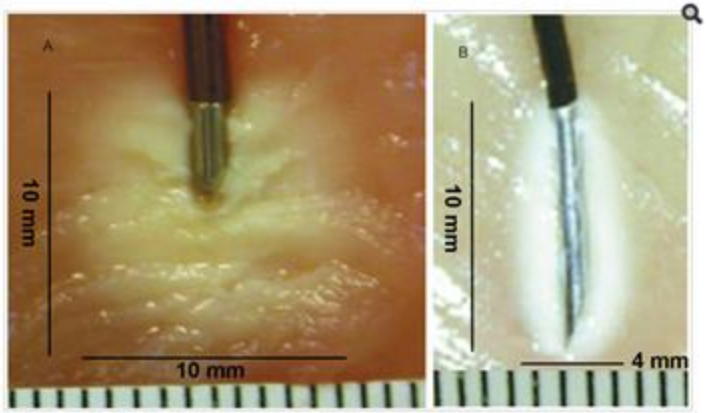
Radiofrequency Ablation (RFA)

- RFA, rhizotomy, “burning the nerves”
- Uses localized heat generated by radiofrequency waves to target specific tissues within the body
- Thermal ablation, cooled RFA, pulsed RFA



Cohen SP, Hurley RW, et al. Randomized placebo-controlled study evaluating lateral branch radiofrequency denervation for sacroiliac joint pain. Anesthesiology. 2008 Aug; 109(2): 279–288.

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What are the targets of radiofrequency ablation?

- Axial facet joint pain (cervical, thoracic, lumbar medial branch nerves)
- Vertebrogenic pain (basivertebral nerves)
- Intercostal neuralgia
- Shoulder pain (suprascapular or related nerves)
- Knee pain (genicular nerves)
- Hip pain
- Inguinal and abdominal wall pain
- Post-amputation or neuroma-related pain

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Michaud, K., Cooper, P., Abd-Elsayed, A. *et al.* Review of Radiofrequency Ablation for Peripheral Nerves. *Curr Pain Headache Rep* 25, 63 (2021). https://doi.org/10.1007/s11916-021-00981-0

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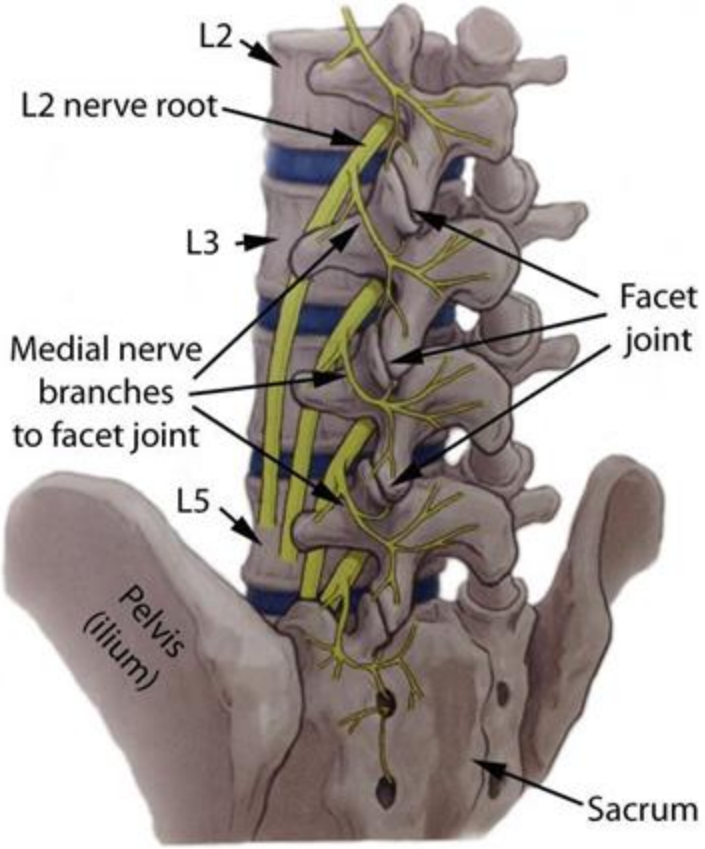

Facet Joint Anatomy

- Paired synovial joints
- Enable spinal flexion, extension and rotation
- Innervated by medial branch nerves that originate from the dorsal ramus of the spinal nerve above and below joint

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Facet Joint Pain

- Can be one sided or bilateral
- Typically a deep, dull, and achy pain
- Can refer to the groin, buttocks, hip or lateral/posterior thigh, rarely below the knee
- May be worse with extension, twisting, prolonged standing/sitting
- Radiographic findings of facet arthropathy are not always present
- Can be challenging to differentiate from other causes of low back pain

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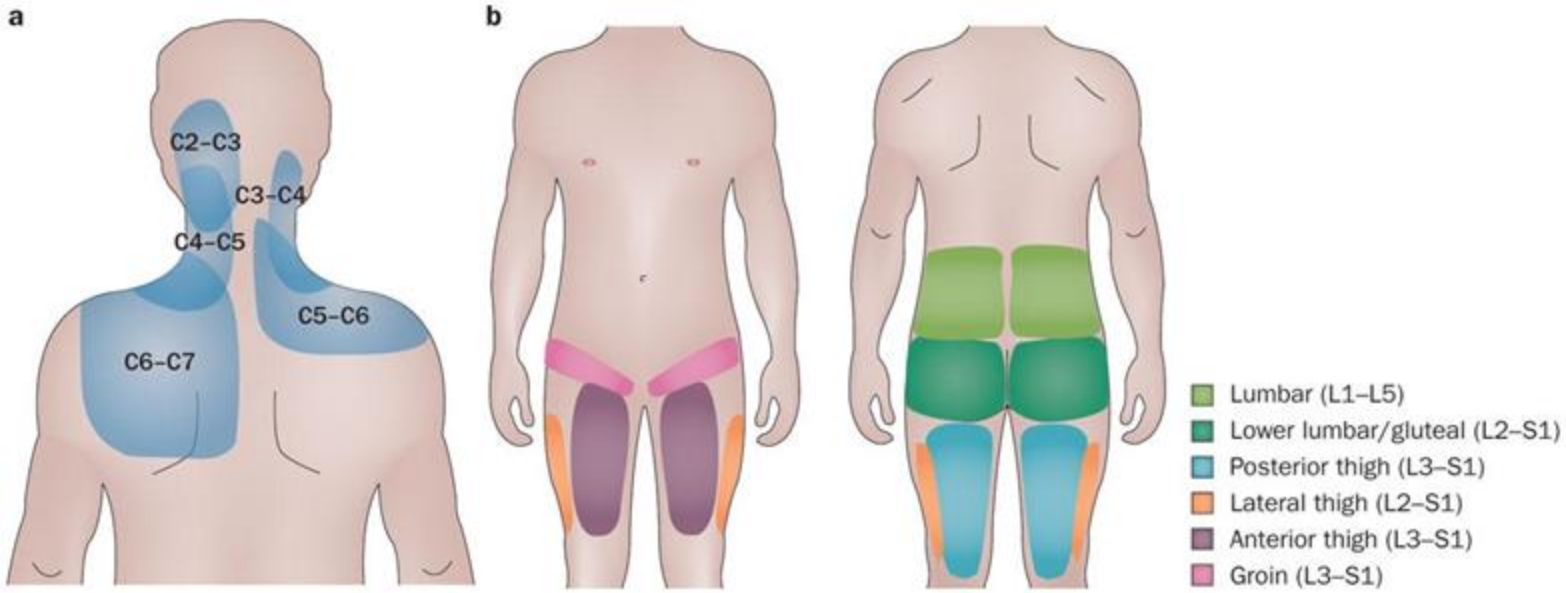
Facet Joint Pain Referral Patterns



Part a adapted with permission from Lippincott Williams & Wilkins ©
Dwyer, A. *et al*. Cervical zygapophyseal joint pain patterns. I: A study in normal volunteers. *Spine (Phila Pa 1976)* **15**, 453–457 (1990)

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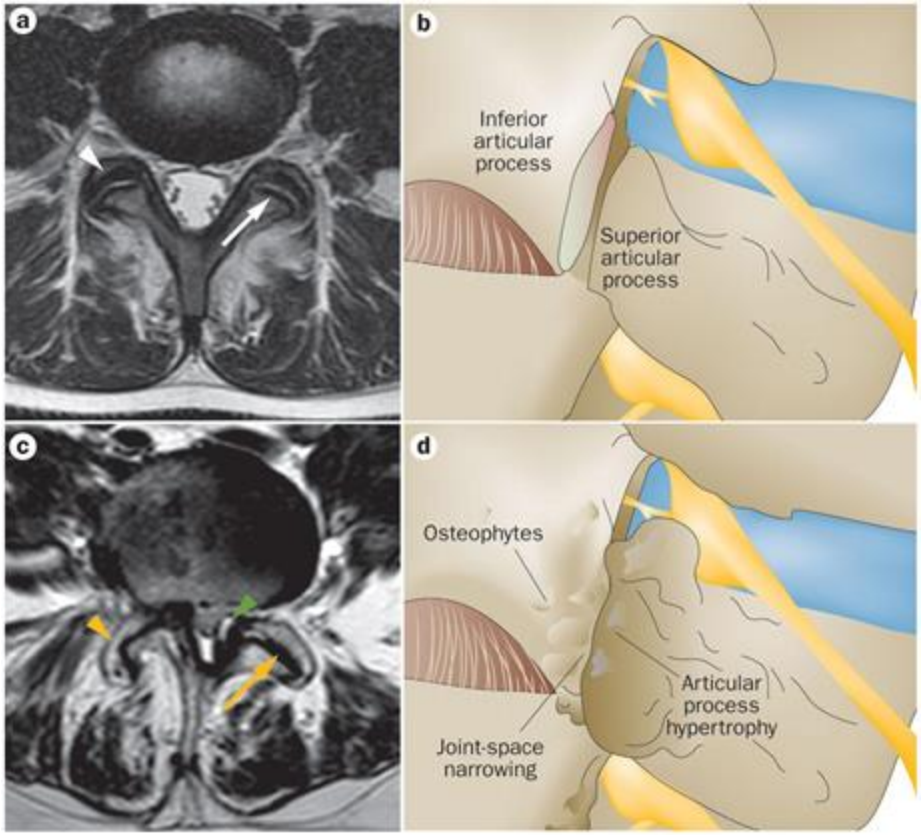
Normal facet joints and advanced facet joint osteoarthritis



Gellhorn, A. C. *et al.* (2012) Osteoarthritis of the spine: the facet joints *Nat. Rev. Rheumatol*. doi:10.1038/nrrheum.2012.199

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What is the pathway to RFA?

- Referral to an Interventional Pain Physician
  - Board certified, can come from numerous primary specialties (ie Anesthesiology, Physiatry, Neurology, Radiology, Emergency Medicine, Internal Medicine, Family Medicine)
  - Only performed after rigorous screening
  - Pain greater than 3 months, predominantly axial, failed conservative treatment (including physical therapy, medications)
  - **Dual diagnostic medial branch blocks with >80% relief**
  - 80C-90C for 90-150 seconds per nerve (conventional, thermal)

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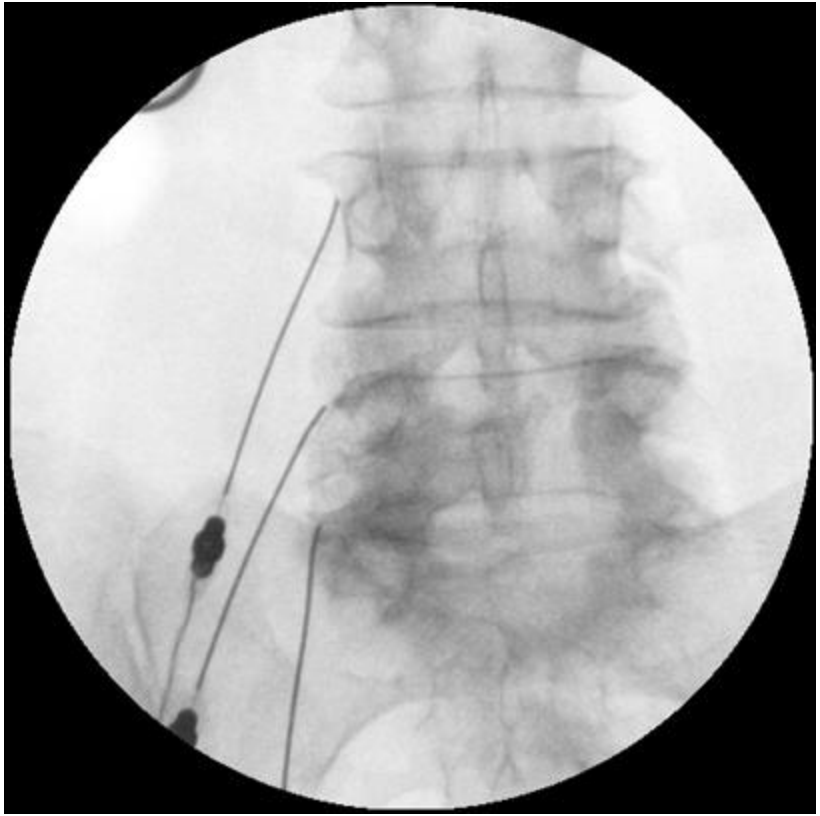
THERAPEUTIC LUMBAR MEDIAL BRANCH RFA TARGETING LEFT L4-5 AND L5-S1 FACETS



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Lumbar RFA Outcomes

- Benefit can take up to 3-4 weeks to take effect
- At 1 year follow-up in study of thermal radiofrequency ablation at 80 deg C for 90 second after successful diagnostic medial branch blocks (MBBs)
  - 60% of patients had >80% relief
  - 80% of patients had >60% relief
- If patients receive greater than 50% improvement for at least 6 months, the RFA may be repeated without repeating diagnostic MBBs

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Dreyfuss P, Halbrook B, et al. Efficacy and validity of radiofrequency neurotomy for chronic lumbar zygapophysial joint pain. Spine 2000; 25: 1270-1277.

Evidence for and against lumbar RFA outcomes

- Leclaire et al., 2001 – negative/limited benefit
- van Wijk et al., 2005 – mixed/negative sham-controlled findings
- Nath et al., 2008 – positive randomized trial
- Leggett et al., 2014 – systematic review showing mixed but supportive evidence in selected patients
- Cohen et al., 2020 – consensus guidelines supporting RFA for appropriately selected patients
- Mekhail et al., 2025 – randomized evidence that higher RFA temperature may improve magnitude and duration of relief

RFA outcomes and adverse effects

- Success reliant upon appropriate patient selection and effective procedure performance under imaging guidance by trained physicians
- Serious complications are rare
- Minor complication rate about 1%
  - Localized pain lasting more than 2 weeks
  - Neuritis lasting less than 2 weeks
- Slightly higher risk in cervical region

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Kornick C, Kramarich SS, et al. Complications of lumbar facet radiofrequency denervation. Spine 2004; 29(12):1352-4.

Conclusions

- Early referral to an interventional pain physician is appropriate if pain is functionally limiting and conservative treatment has failed or is not tolerated
- Radiofrequency ablation for axial back or neck pain can be effective and safe when performed by trained physicians using appropriate patient selection, standard care and imaging guidance

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Dan Warren, MD

VMMC Downtown Seattle Interventional Pain Clinic Faculty

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Thank you

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New Targets of Interventional Pain Therapies

Josiah Perez MD

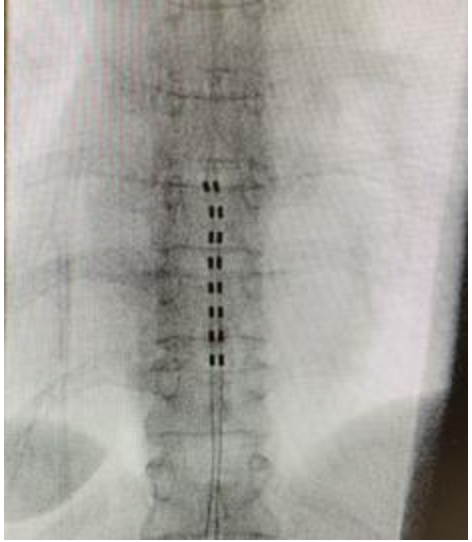
May 9th, 2026

Financial Disclosures

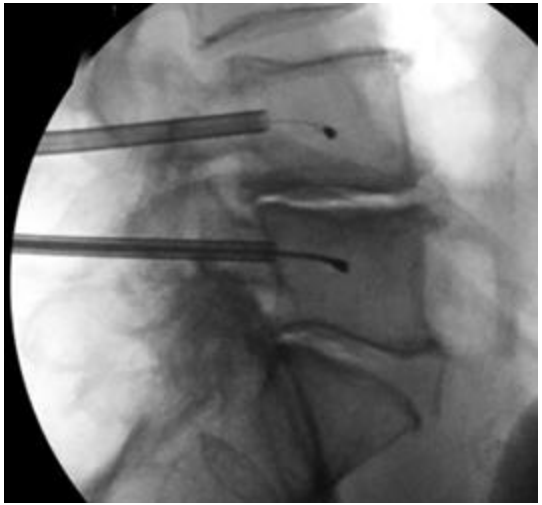
None

Advanced Interventional Pain Procedures

- Spinal Cord Stimulation



- Basivertebral Nerve Ablation



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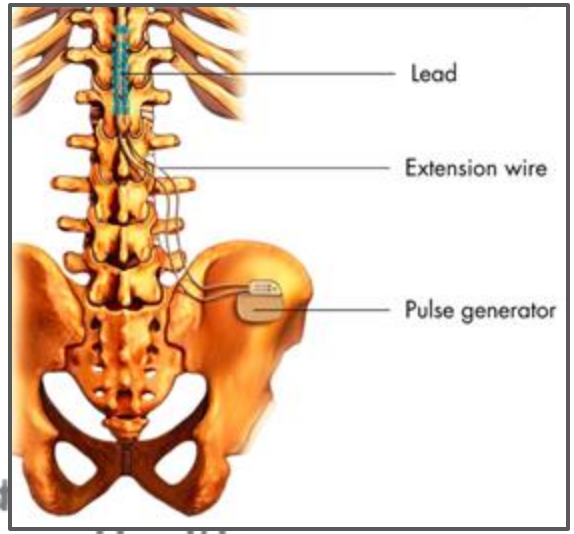
Spinal Cord Stimulation

- Traditional SCS: Tonic Stimulation
  - Gate control therapy of pain
  - Paresthesias overlap with area of pain
  - 50% of pts: 50%+ reduction in pain intensity



https://prospinepain.com/spinal-cord-stimulation-scs/

19 November 1965, Volume 150, Number 3699

SCIENCE

Pain Mechanisms: A New Theory

A gate control system modulates sensory input from the skin before it evokes pain perception and response.

Ronald Melzack and Patrick D. Wall

The nature of pain has been the subject of bitter controversy since the turn of the century (*1*). There are currently two opposing theories of pain: (i) specificity theory, which holds that pain is a specific modality like vision or hearing, "with its own central and peripheral apparatus" (*2*), and (ii) pattern theory, which maintains that the nerve impulse pattern for pain is produced by intense stimulation of nonspecific receptors since "there are no specific fibers and no cialization and an implicit psychological assumption (*8*, *9*). Consider the proposition that the skin contains "pain receptors." To say that a receptor responds only to intense, noxious stimulation of the skin is a physiological statement of fact; it says that the receptor is specialized to respond to a particular kind of stimulus. To call a receptor a "pain receptor," however, is a psychological assumption: it implies a direct connection from the receptor to a brain center where pain is

after amputation of a limb), and the peripheral neuralgias (which may occur after peripheral nerve infections or degenerative diseases) provide a dramatic refutation of the concept of a fixed, direct-line nervous system. Four features of these syndromes plague patient, physician, and theorist (*8*, *10*).

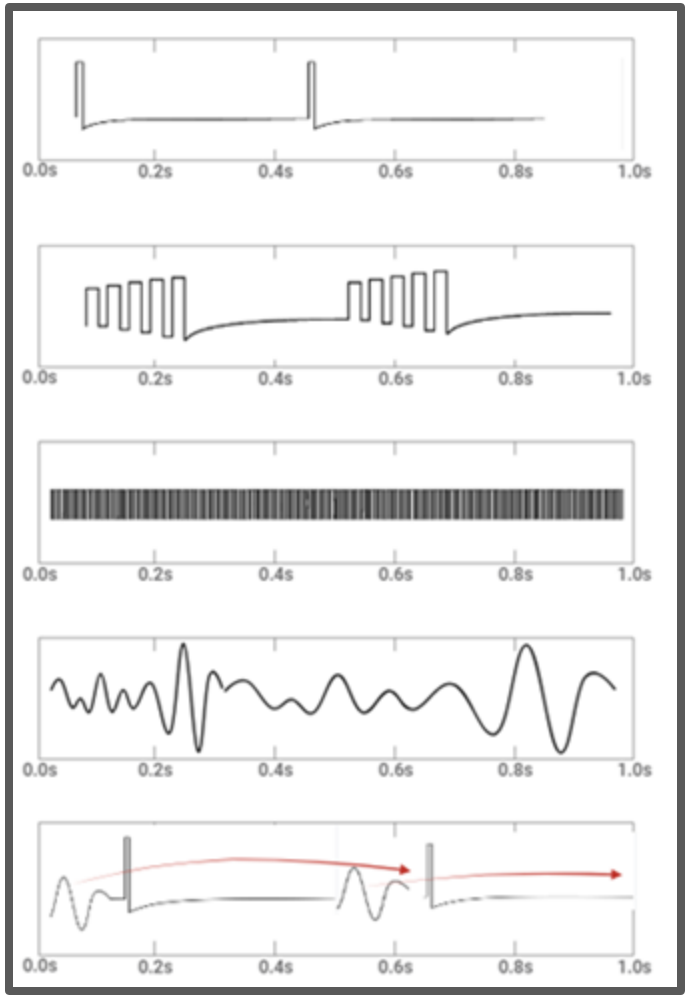
1) Surgical lesions of the peripheral and central nervous system have been singularly unsuccessful in abolishing these pains permanently, although the lesions have been made at almost every level (Fig. 2). Even after such operations, pain can often still be elicited by stimulation below the level of section and may be more severe than before the operation (*8*, *10*).

2) Gentle touch, vibration, and other nonnoxious stimuli (*8*, *10*) can trigger excruciating pain, and sometimes pain occurs spontaneously for long periods without any apparent stimulus. The fact that the thresholds to these stimuli are raised rather than lowered in causalgia and the neuralgias (*10*), together with the fact that referred pain can often be triggered by mild stimulation of normal skin (*8*),

Spinal Cord Stimulation

- Traditional SCS: Tonic Stimulation
  - Gate control therapy of pain
  - Paresthesias overlap with area of pain
  - 50% of pts: 50%+ reduction in pain intensity

- Novel SCS: sub-perception
  - Burst Stimulation
  - High Frequency
  - Differential Target Multiplexed
  - Evoked Compound Action Potential
  - → 80% of pts: 50%+ reduction in pain intensity



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Spinal Cord Stimulation

Chronic neuropathic pain of the trunk and limbs

Select FDA-approved Indications:

- Post-laminectomy syndrome
- Non-surgical back pain
- Radicular pain syndrome
- Complex regional pain syndrome
- Painful diabetic peripheral neuropathy

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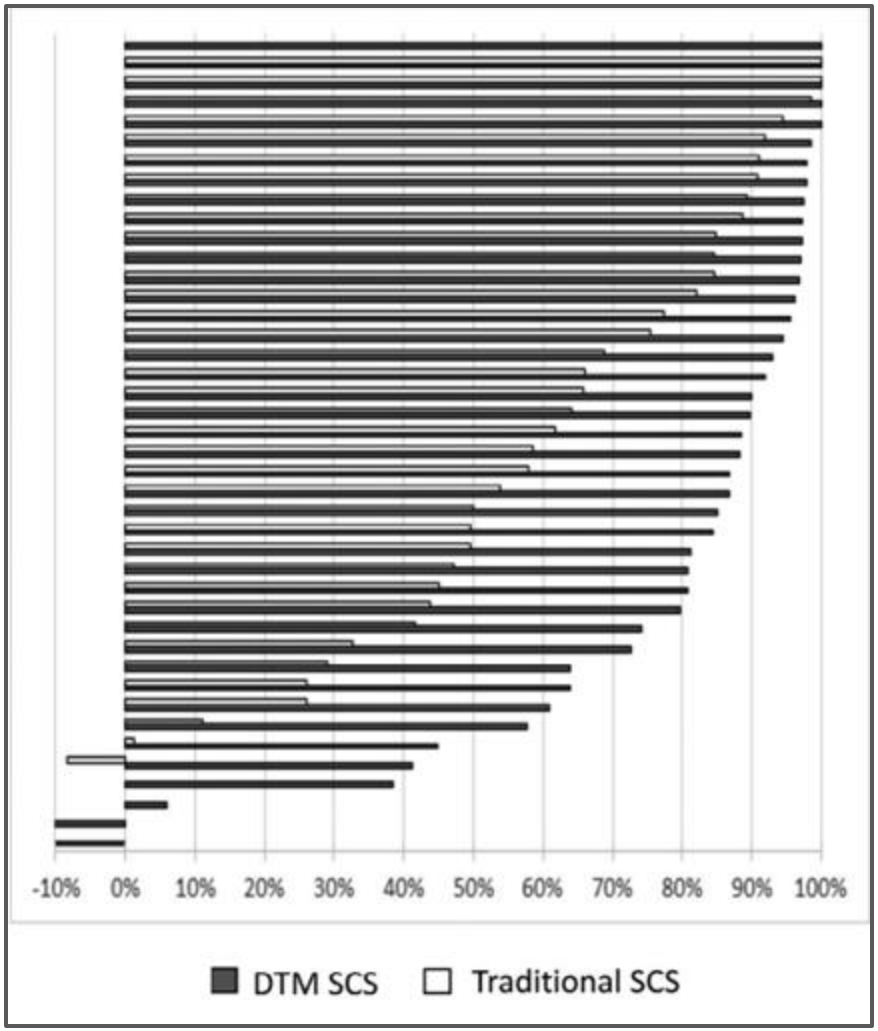
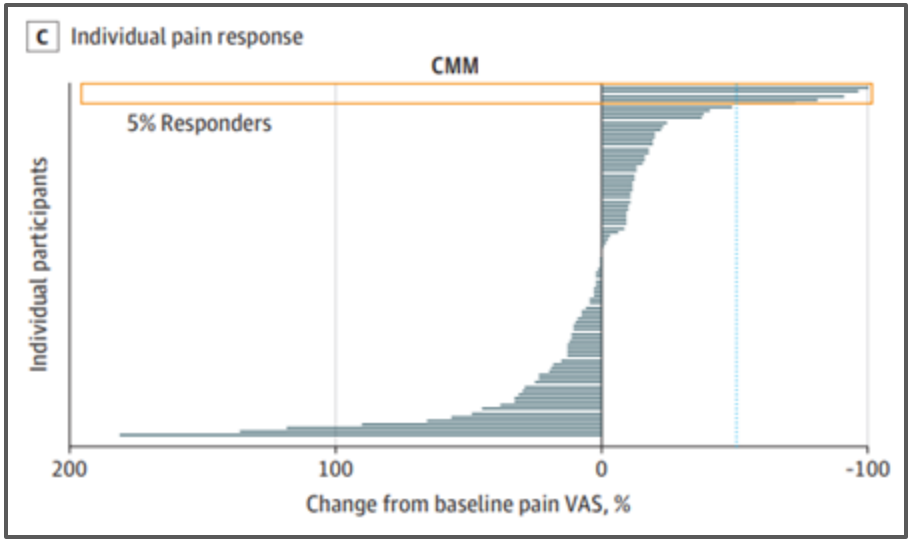
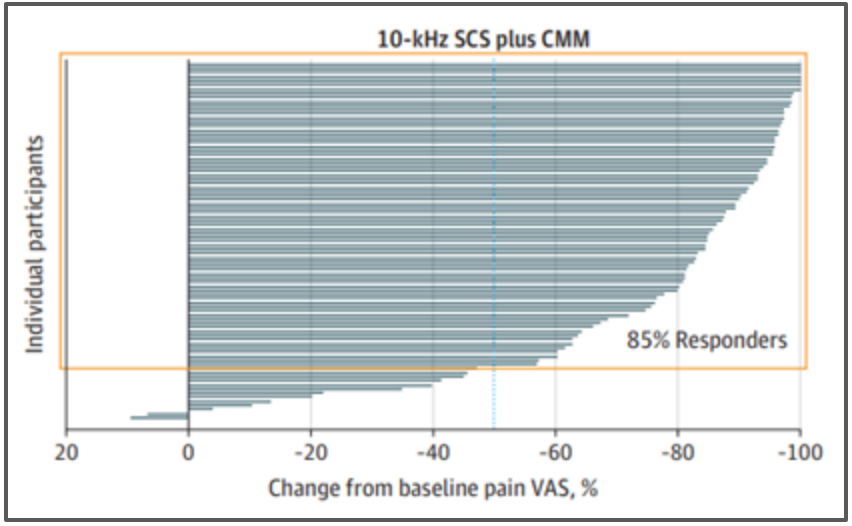

-10%
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
DTM SCS
Traditional SCS


C
Individual pain response
CMM
5% Responders
Individual participants
200
100
0
-100
Change from baseline pain VAS, %


10-kHz SCS plus CMM
Individual participants
85% Responders
20
0
-20
-40
-60
-80
-100
Change from baseline pain VAS, %

JAMA Network | Open

Original Investigation | Neurology

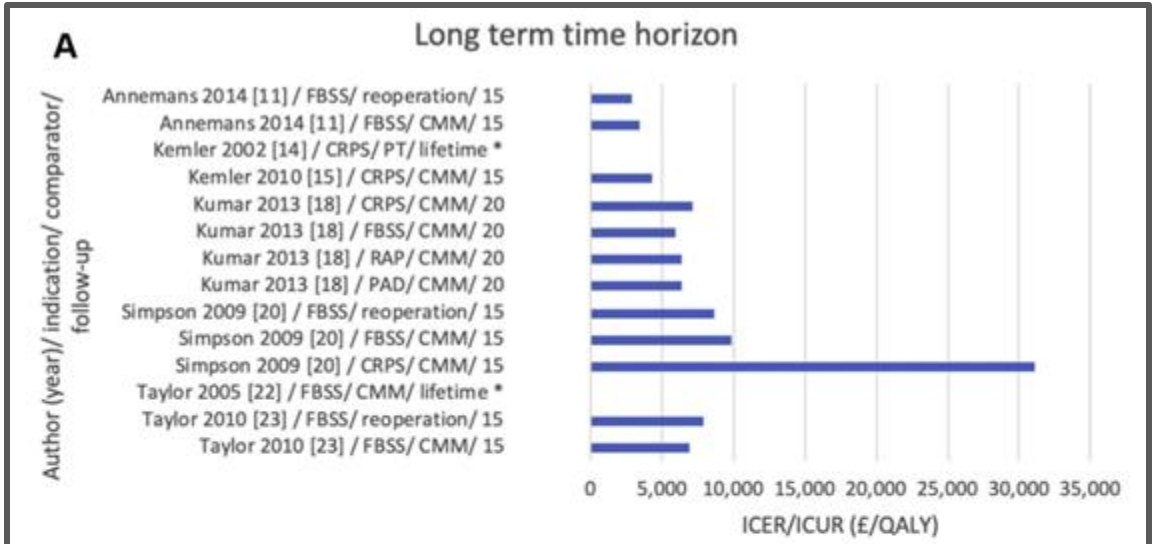
Spinal Cord Stimulation vs Medical Management for Chronic Back and Leg Pain
A Systematic Review and Network Meta-Analysis

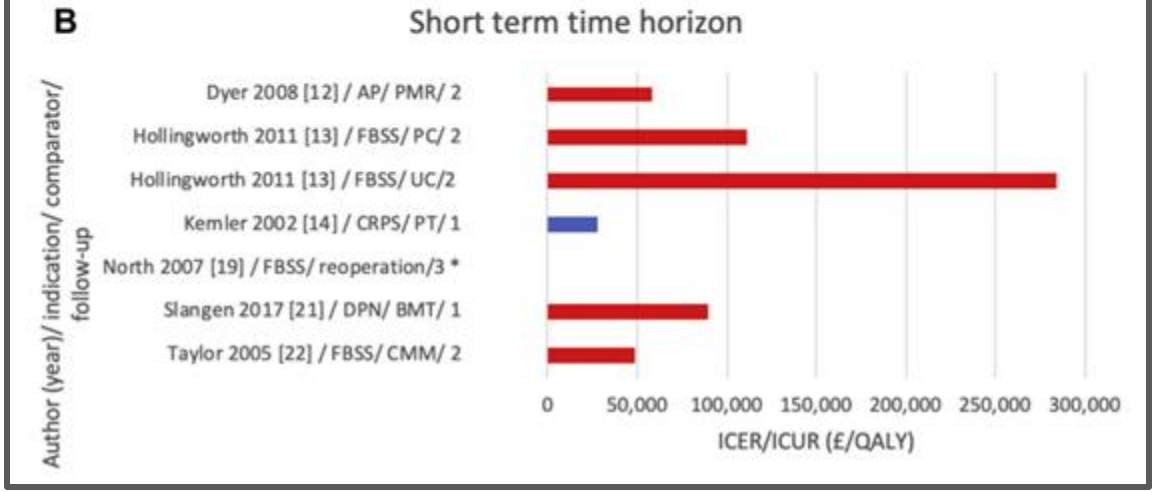
Frank J. P. M. Huygen, PhD, MD; Konstantinos Soulanis, MSc; Ketevan Rtveladze, MSc; Sheily Kamra, BPharmacy; Max Schlueter, MSc

Measure	Total sample size	Novel SCS vs. Conventional Medical Management (95% CrI)
Proportion of patients: ≥50% pain reduction in back	5 studies (n=683)	OR: 8.76 (3.84 to 22.31)*
Proportion of patients: ≥50% pain reduction in leg	7 studies (n=831)	OR: 10.13 (0.45 to 129.31)
Pain intensity in back	6 studies (n=738)	MD: -2.34 (-2.96 to -1.73)*
Pain intensity in leg	10 studies (n=1014)	MD: -4.01 (-5.31 to -2.75)*
EQ-5D Index score	6 studies (n=700)	MD: 0.17 (0.13 to 0.21)*
Oswestry Disability Index	3 studies (n=367)	MD: -4.98 (-10.78 to 0.62)

*: statistical significance; CrI: Credible interval; OR: odds ratio; MD: mean difference; EQ-5D: EuroQol-5 dimensions

Cost-Effectiveness





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Trial Period

- ≥50% reduction in pain

- Functional Improvement

- Reduction in opioid requirement

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Nociceptive or Neuropathic?

“Do you have a position of comfort?”

Concerns / Contraindications

- Active psychosis
- Ongoing substance use disorder (including EtOH)
- Poorly controlled depression
- High BMI
- Currently smoking
- Chronic opioid therapy

Washington State Health Care Authority

Health Technology Clinical Committee
Final Findings and Decision

Topic: Spinal cord stimulation (SCS)
Meeting date: May 17, 2024
Final adoption: June 14, 2024

Number and coverage topic:
20240517A – Spinal cord stimulation

HTCC coverage determination:
SCS is a **covered benefit with conditions** for treatment of failed back surgery syndrome, non-surgical refractory back pain, and painful diabetic neuropathy.

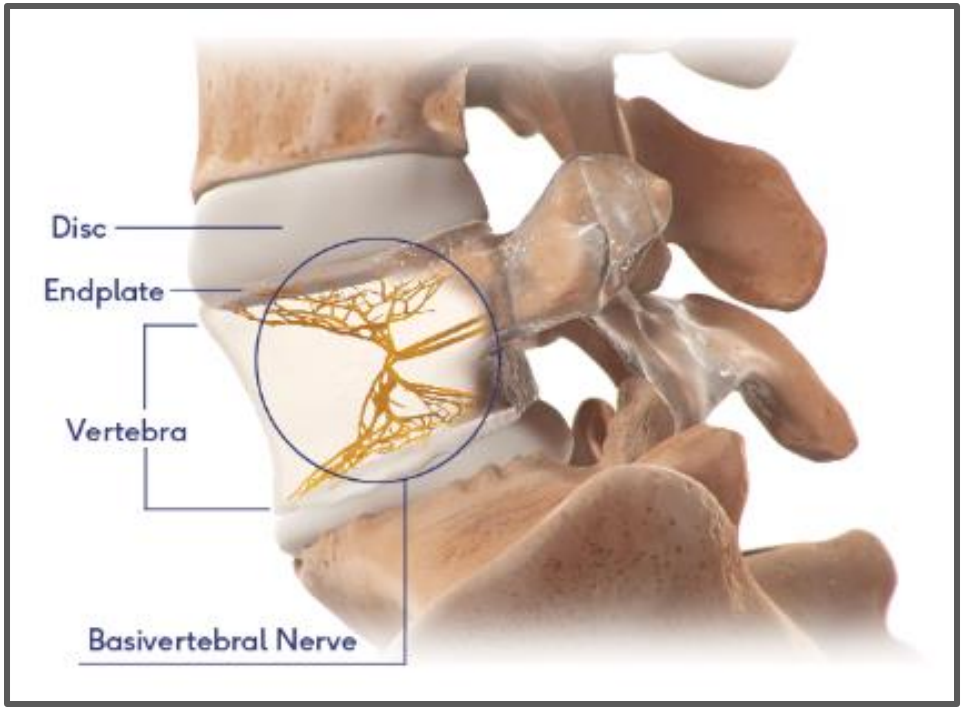
SCS is **not a covered benefit** for treatment of complex regional pain syndrome.

Franciscan Health

Basivertebral Nerve Ablation

Chronic axial low back pain

- Vertebrogenic pain
- Modic I and II changes on MRI



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Vertebrogenic Pain

Journal of Spinal Disorders & Techniques
Vol. 15, No. 2, pp. 118–126
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A Histologic Study of Fractured Human Vertebral Bodies

*M. Darryl Antonacci, †Dina R. Mody, ‡Kevin Rutz, †Donald Weilbaecher, and ‡Michael H. Heggeness

*Institute for Spine and Scoliosis, and Spine Diagnostic and Treatment Center–Graduate Hospital, Philadelphia, Pennsylvania; †Department of Pathology, Methodist Hospital, Baylor College of Medicine, Houston; and ‡Center for Orthopaedic Research and Education, St. Luke's Episcopal Hospital, Houston, Texas, U.S.A.

- Term “Basivertebral nerves” coined
- Entered through postetrior vascular foramen
- More prevalent in areas of osteoporotic fracture

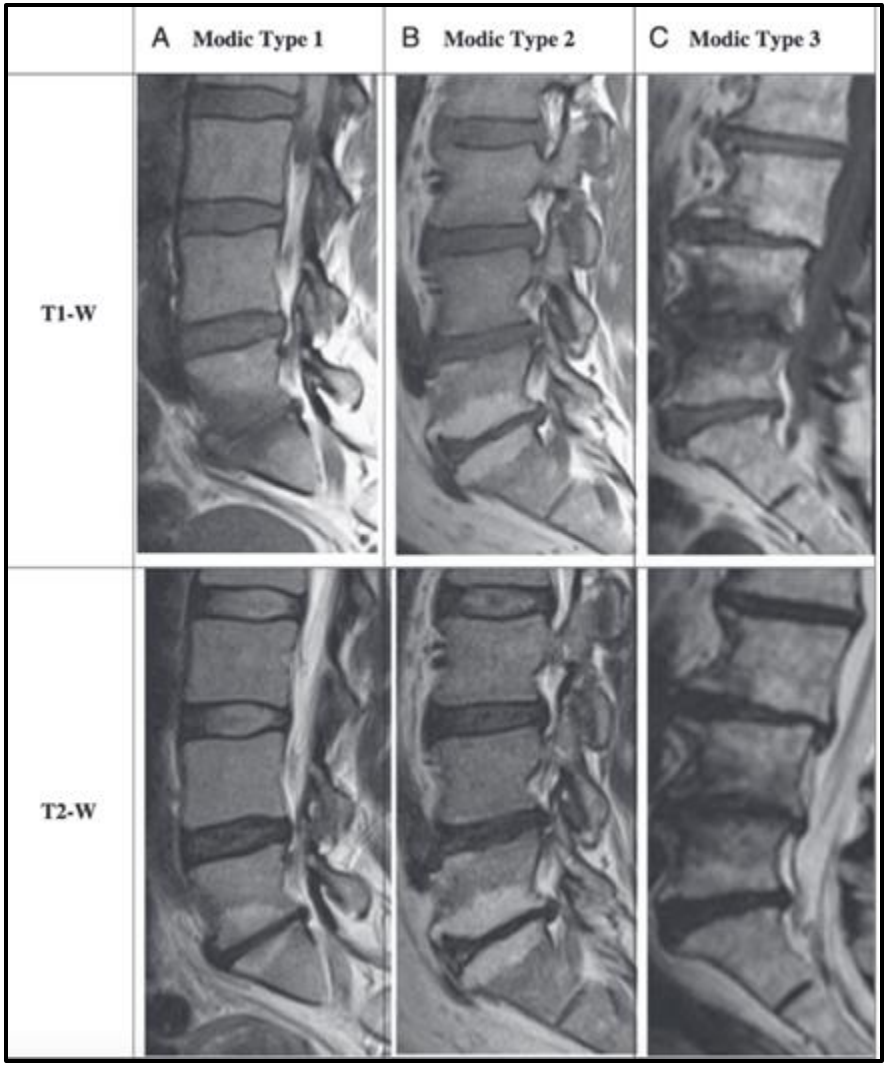
ELSEVIER
The Spine Journal
Volume 3, Issue 1, January–February 2003, Pages 63-67

Clinical studies

Substance P–containing nerves within the human vertebral body: an immunohistochemical study of the basivertebral nerve ☆, ☆☆

Christian Fras MD [a], Philip Kravetz MD [b], Dina R Mody MD [c], Michael H Heggeness MD, PhD [c]

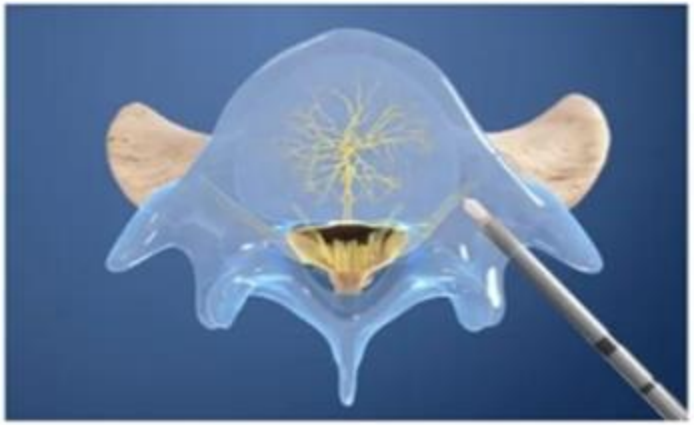
- Substance P suggesting nerves carry nociceptive signals



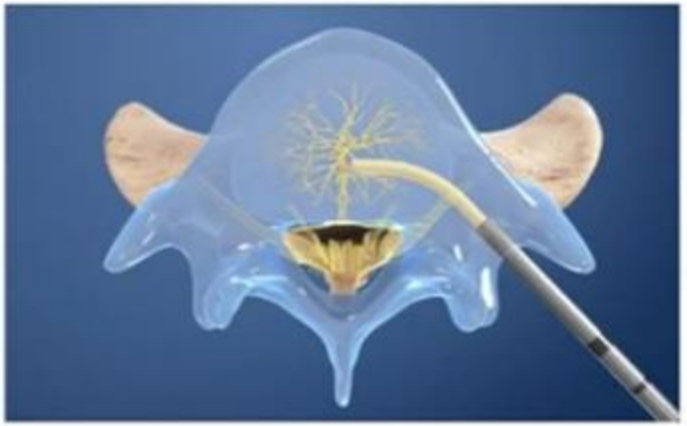
Modic Changes

- I: Marrow edema and inflammation
- II: fat infiltration in marrow
- III: trabecular microfracture and sclerosis

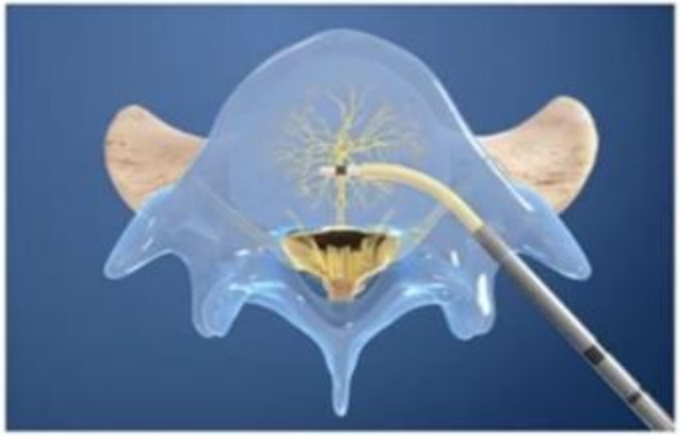
1. Enter Vertebra



2. Reach BVN



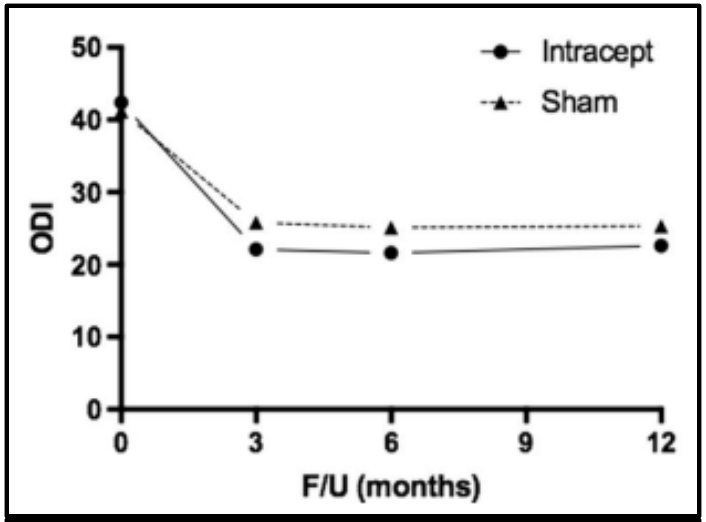
3. Place the Probe

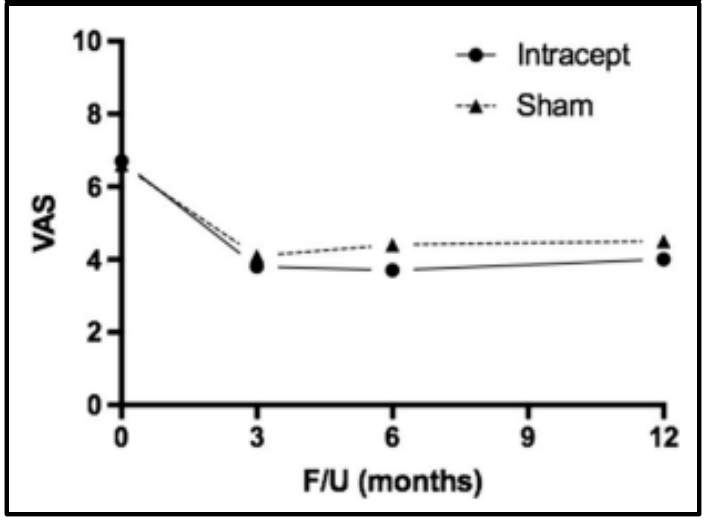


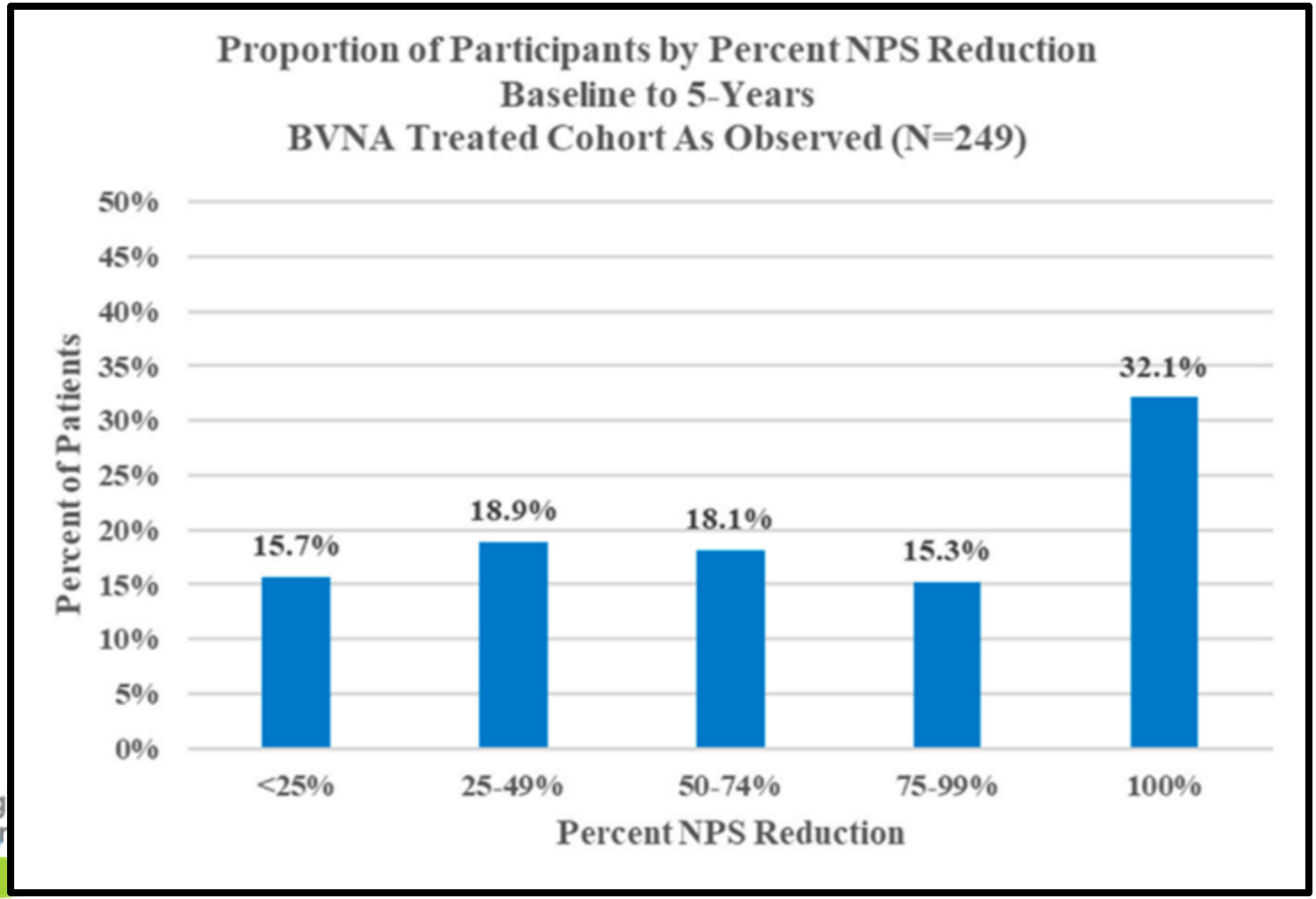
4. Heat the BVN

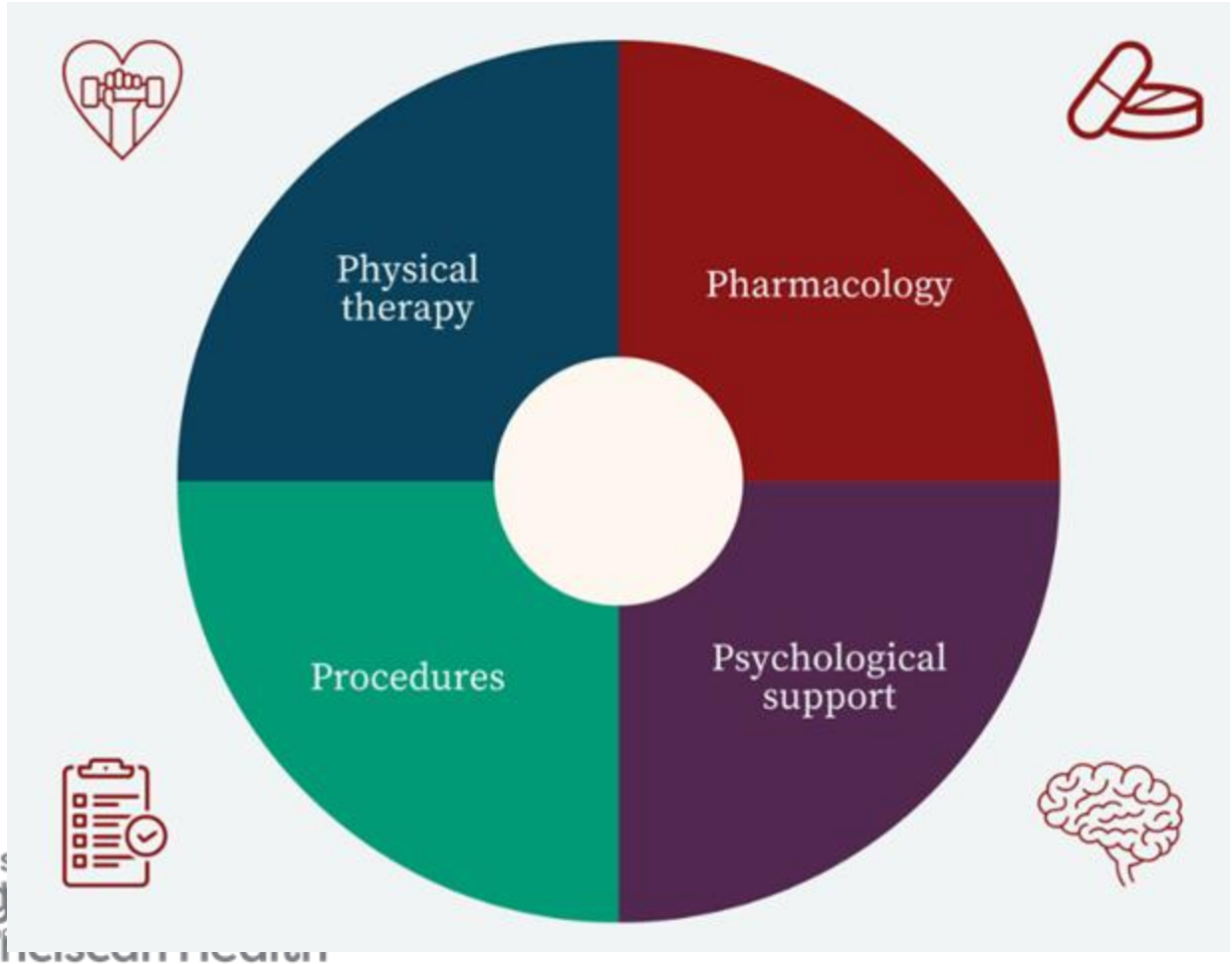
Follow-up period	Outcome	BVN	Sham Control Arm	
ODI				
Baseline	ODI score	42.4 (10.92)	41.2 (10.38)	
3 months	ODI score	22.1 (15.39)	25.8 (17.44)	0.019
	ODI improvement from baseline	− 20.3 (15.56)	− 15.5 (17.87)	
6 months	ODI score	21.6 (14.92)	25.1 (15.29)	0.078
	ODI improvement from baseline	− 20.8 (15.92)	− 16.1 (16.38)	
12 months	ODI score	22.6 (15.71)	25.3 (14.92)	0.153
	ODI improvement from baseline	− 19.8 (16.18)	− 15.9 (16.20)	
VAS				
Baseline	VAS score	6.73 (1.38)	6.64 (1.34)	
3 months	VAS score	3.80 (2.63)	4.14 (2.64)	0.083
	VAS improvement from baseline	− 2.90 (2.64)	− 2.47 (2.49)	
6 months	VAS score	3.74 (2.68)	4.41 (2.76)	0.008
	VAS improvement from baseline	− 2.98 (2.64)	− 2.21 (2.45)	
12 months	VAS score	3.96 (2.83)	4.46 (2.78)	0.038
	VAS improvement from baseline	− 2.76 (2.89)	− 2.16 (2.69)	

* *p* values from ANCOVA with factors of treatment group, analysis center and treatment group by analysis center interaction, and a covariate of baseline ODI or VAS score






Proportion of Participants by Percent NPS Reduction
Baseline to 5-Years
BVNA Treated Cohort As Observed (N=249)
Percent of Patients
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
15.7%
18.9%
18.1%
15.3%
32.1%
<25%
25-49%
50-74%
75-99%
100%
Percent NPS Reduction


Physical therapy
Pharmacology
Procedures
Psychological support

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3. Huygen FJPM, Soulanis K, Rtveladze K, Kamra S, Schlueter M. Spinal Cord Stimulation vs Medical Management for Chronic Back and Leg Pain: A Systematic Review and Network Meta-Analysis. JAMA Netw Open. 2024;7(11):e2444608.
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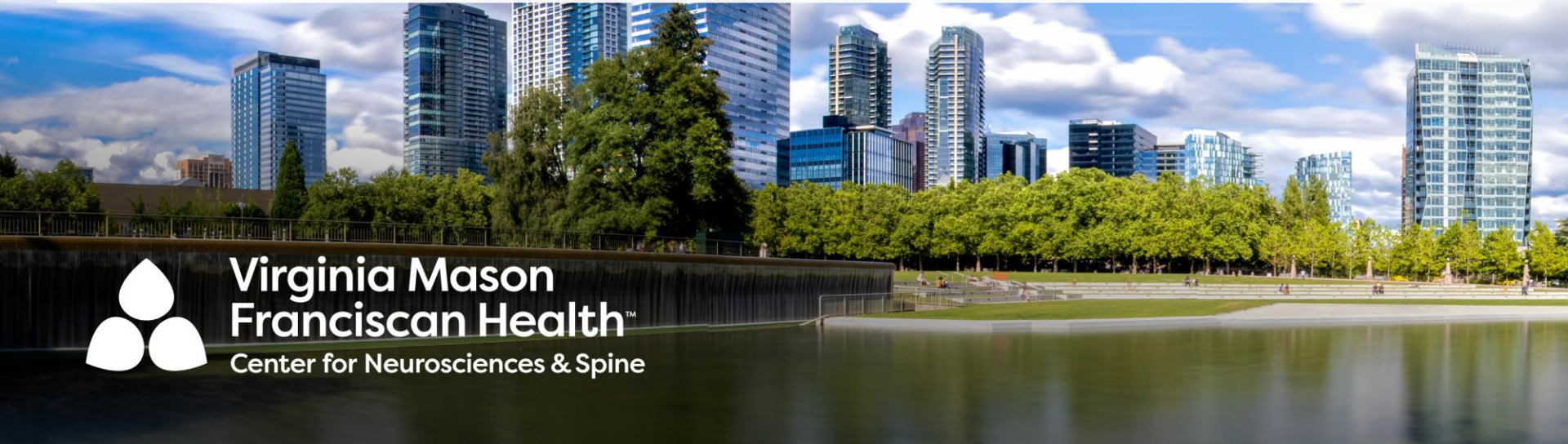
Question & Answer

Audience - please raise hand for roaming mic

Virtual Attendees - please click on Q&A button



Exhibits and Refreshments

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