The Future of Interventional Pain Medicine

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- **Board of Directors**: Spine Intervention Society (SIS), Pacific Spine and Pain Society (PSPS), American Board of Pain Medicine (ABPM)
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- **Consulting**: Saol Therapeutics, SI Bone, Stryker

The Future of Interventional Pain Medicine

- *Context: Policy*
- *Emerging Science and Care Paradigms*
- *Education and Training*
- *Professional Societies*

Context - Policy

CDC GUIDELINE FOR PRESCRIBING OPIOIDS FOR CHRONIC PAIN

Promoting Patient Care and Safety

THE US OPIOID OVERDOSE EPIDEMIC

The United States is in the midst of an epidemic of prescription opioid overdoses. The amount of opioids prescribed and sold in the US quadrupled since 1999, but the overall amount of pain reported by Americans hasn't changed. This epidemic is devastating American lives, families, and communities.

More than 40 people die every day from overdoses involving prescription opioids.[1]

Since 1999, there have been over 165,000 deaths from overdose related to prescription opioids.[1]

4.3 million Americans engaged in non-medical use of prescription opioids in the last month.[2]

Among the 12 recommendations in the Guideline, there are three principles that are especially important to improving patient care and safety:

- Nonopioid therapy is preferred for chronic pain outside of active cancer, palliative, and end-of-life care.
- When opioids are used, the lowest possible effective dosage should be prescribed to reduce risks of opioid use disorder and overdose.
- Clinicians should always exercise caution when prescribing opioids and monitor all patients closely.

DETERMINING WHEN TO INITIATE OR CONTINUE OPIOIDS FOR CHRONIC PAIN

1 OPIOIDS ARE NOT FIRST-LINE THERAPY

Nonpharmacologic therapy and **nonopioid pharmacologic therapy** are preferred for chronic pain. Clinicians should consider opioid therapy only if expected benefits for both pain and function are anticipated to outweigh risks to the patient. If opioids are used, they should be combined with nonpharmacologic therapy and nonopioid pharmacologic therapy, as appropriate.

2 ESTABLISH GOALS FOR PAIN AND FUNCTION

Before starting opioid therapy for chronic pain, clinicians should establish treatment goals with all patients, including realistic goals for pain and function, and should consider how opioid therapy will be discontinued if benefits do not outweigh risks. Clinicians should continue opioid therapy only if there is clinically meaningful improvement in pain and function that outweighs risks to patient safety.

Nonpharmacologic therapies and nonopioid medications include:

- Nonopioid medications such as acetaminophen, ibuprofen, or certain medications that are also used for depression or seizures
- Physical treatments (eg, exercise therapy, weight loss)
- Behavioral treatment (eg, CBT)
- Interventional treatments (eg, injections)

3 DISCUSS RISKS AND BENEFITS

Before starting and periodically during opioid therapy, clinicians should discuss with patients known risks and realistic benefits of opioid therapy and patient and clinician responsibilities for managing therapy.

PAIN MANAGEMENT

BEST PRACTICES

PAIN MANAGEMENT BEST PRACTICES INTER-AGENCY TASK FORCE REPORT

Updates, Gaps, Inconsistencies, and Recommendations

PAIN MANAGEMENT

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PAIN MANAGEMENT BEST PRACTICES
INTER-AGENCY TASK FORCE REPORT

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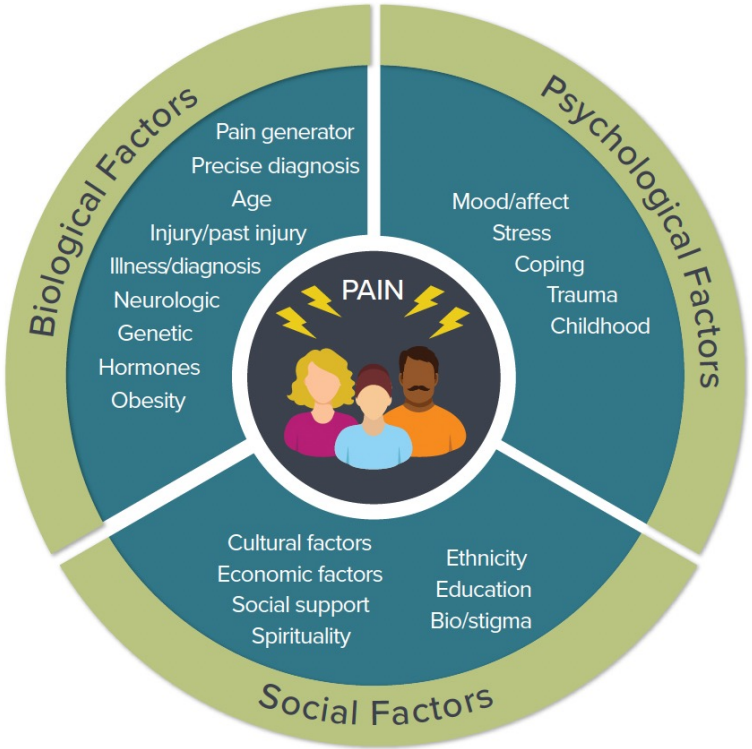

Figure 5: The Biopsychosocial Model of Pain Management

PAIN MANAGEMENT

BEST PRACTICES

PAIN MANAGEMENT BEST PRACTICES
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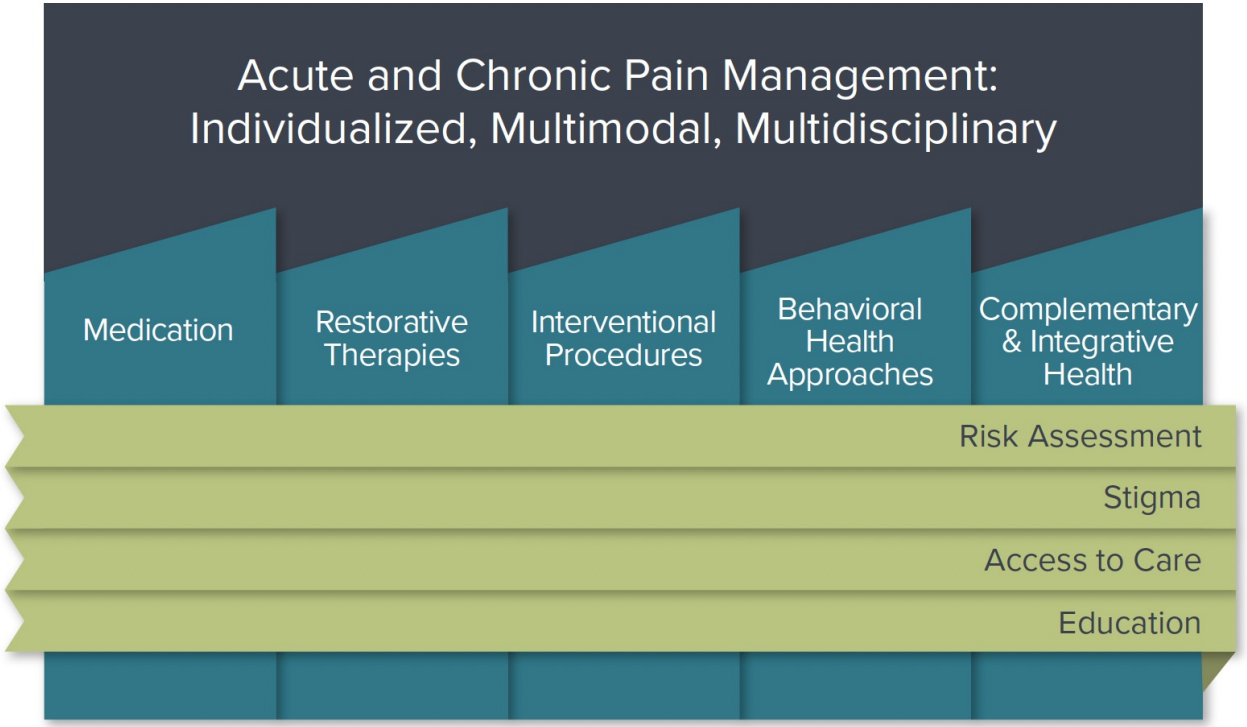

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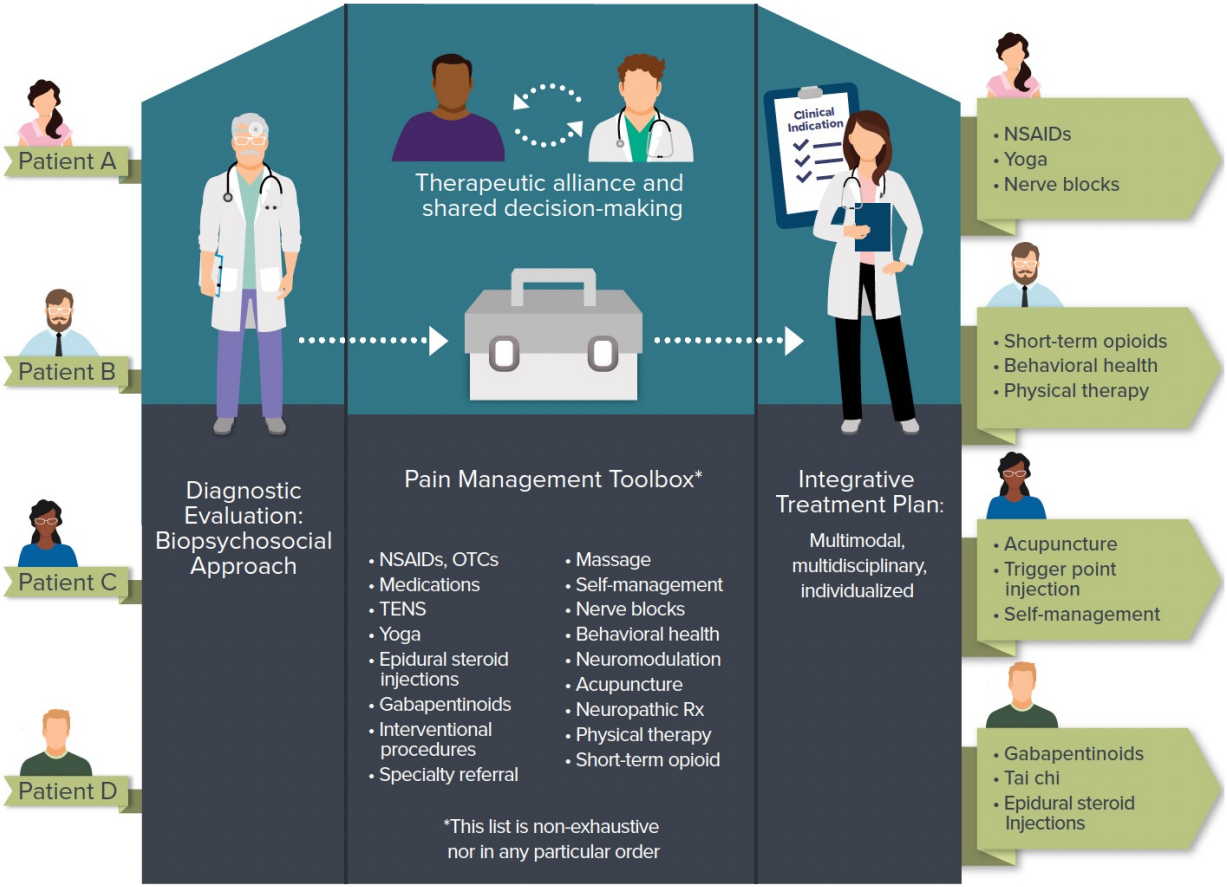


Figure 6: Individualized Patient Care Consists of Diagnostic Evaluation That Results in an Integrative Treatment Plan That Includes All Necessary Treatment Options

Contents

SUPERSEDED | Local Coverage Determination (LCD)

Facet Joint Interventions for Pain Management

L38773

Expand All | Collapse All

SUPERSEDED

To see the currently-in-effect version of this document, go to the Public Versions section.

Contractor Information

LCD Information

Document Information

LCD ID
L38773

LCD Title
Facet Joint Interventions for Pain Management

Proposed LCD in Comment Period
N/A

SUPERSEDED Local Coverage Determination (LCD)

Facet Joint Interventions for Pain Management

- Facet Steroid Injections
- Time between MBBs and RFA
- Number of levels
- Frequency/treatment episodes per year
- Documentation of assessment using a validated functional outcome measure

CMS Budget = relatively fixed

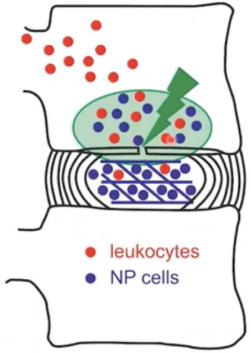
New procedures vs. established procedure reimbursement

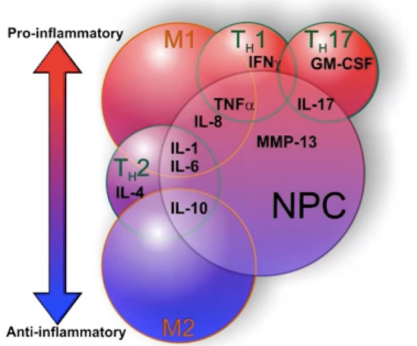
-> Zero-sum game

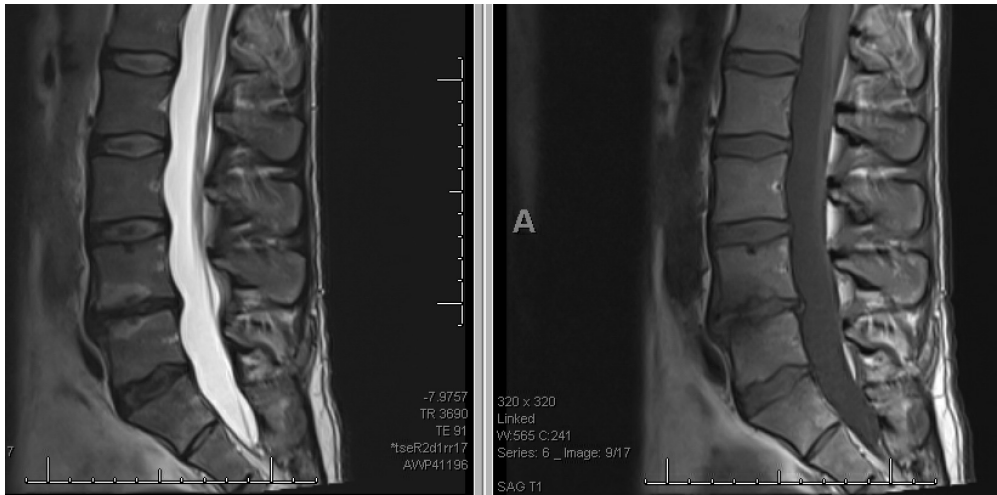
Emerging Science and Care Paradigms

Discovertebral Pain

Discovertebral Pain







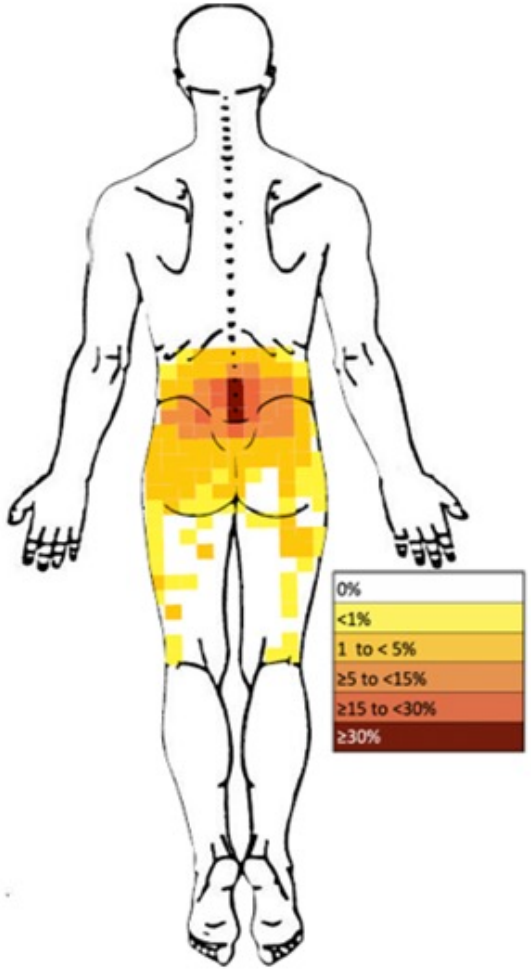
Clinical Phenotype

1. Chronic axial LBP

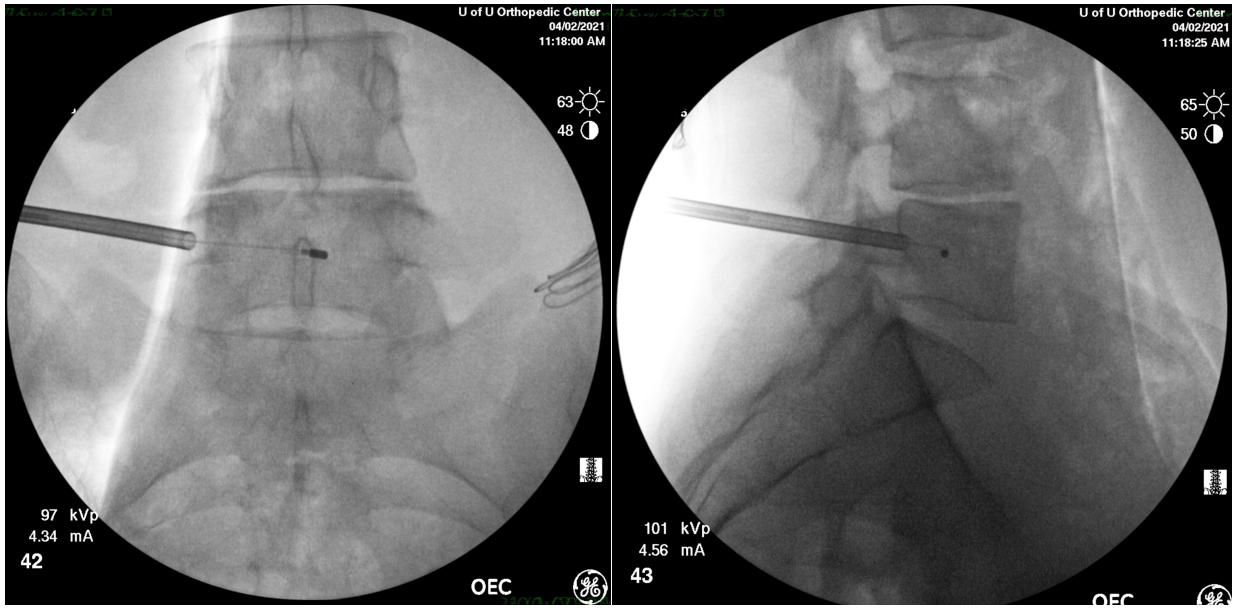
2. ***Mid-line predominant***, possible gluteal referral

3. ***Worse*** with activity, ***not worse*** with lumbar extension

4. **Type 1 or 2 Modic** Changes
   - DDD grade and Endplate defect characteristics ***may not be related***



Basivertebral Nerve Radiofrequency Ablation



Pain Medicine, 23(S2), 2022, S50–S62
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Review Article

OXFORD

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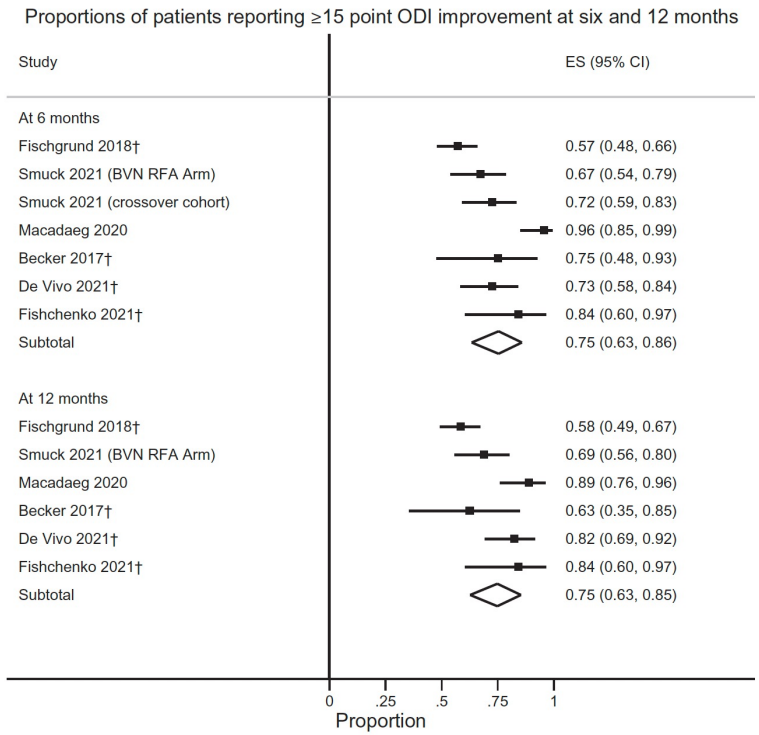
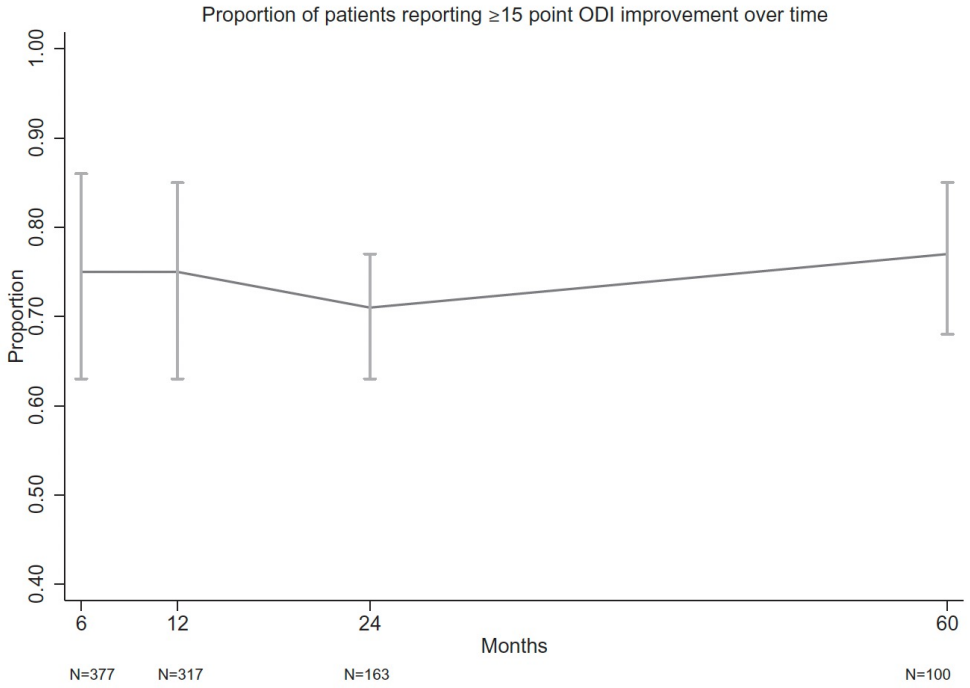


Participants with *Improvement* in ODI of ≥15



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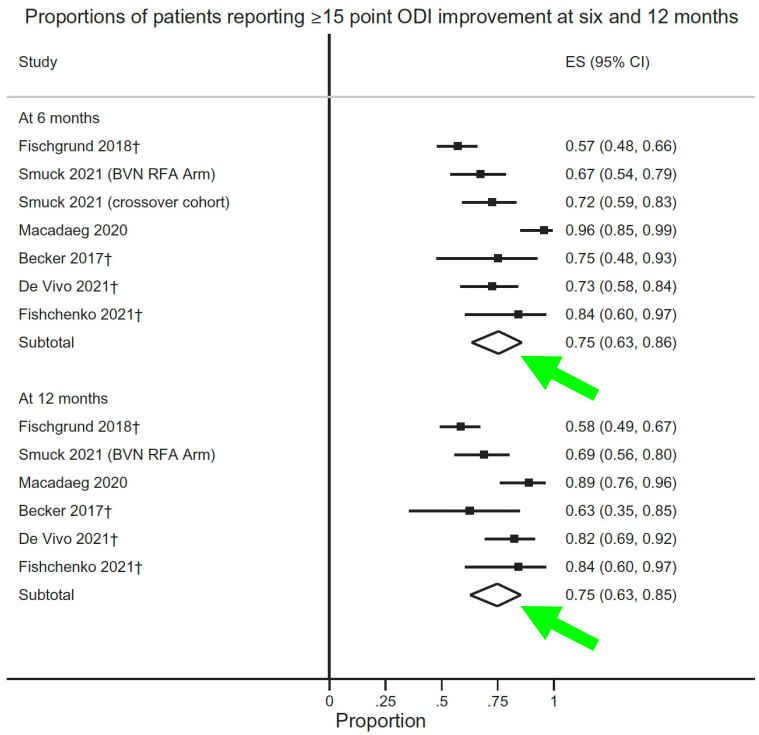

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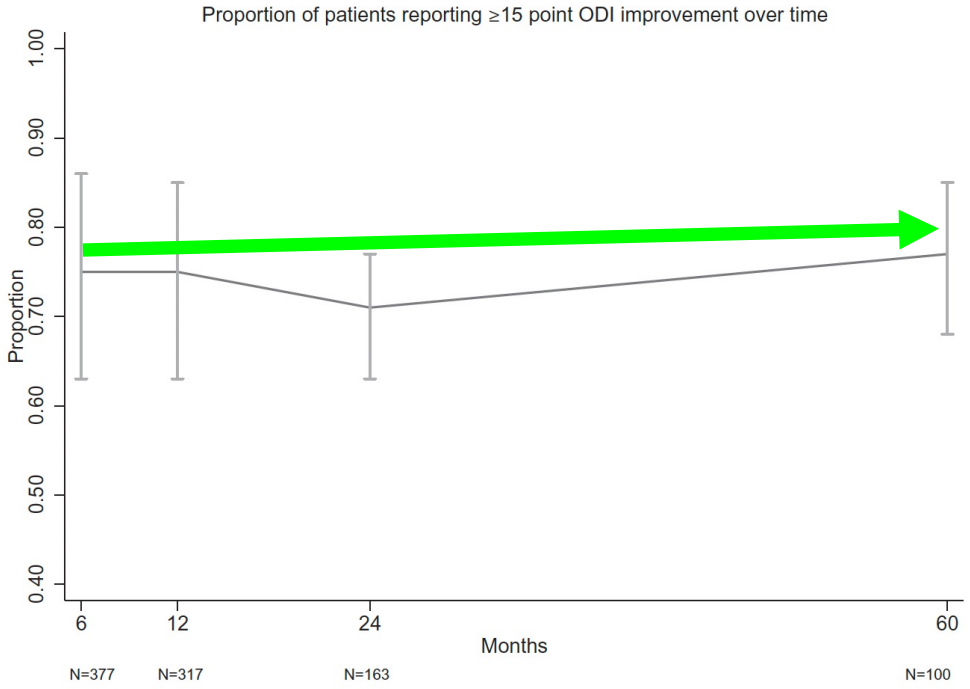
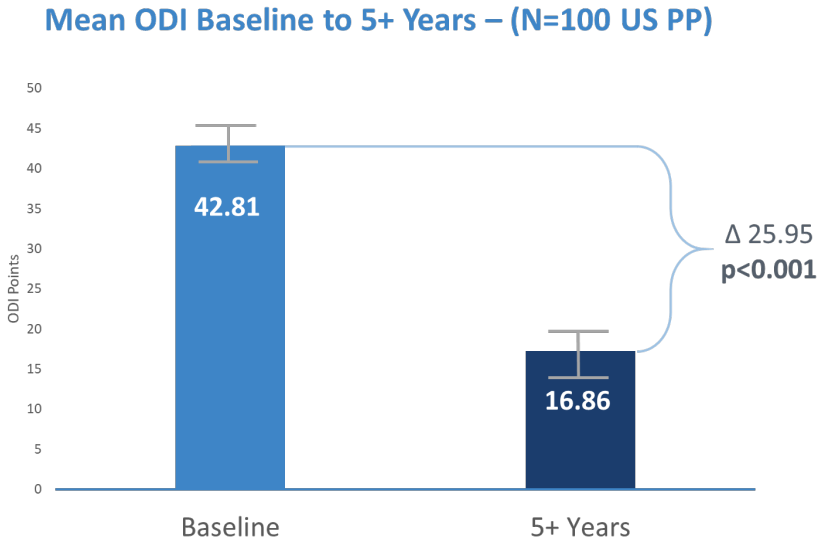
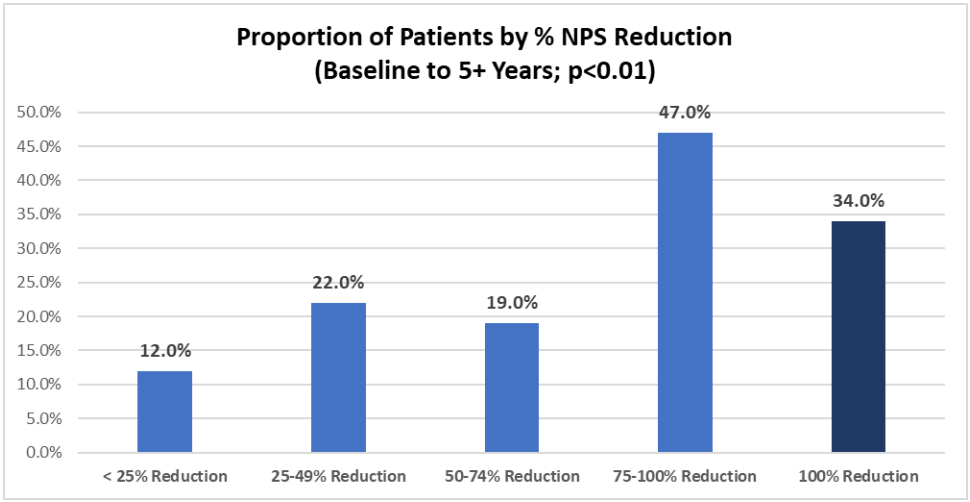


5-year outcomes





Opioids: 60% *reduction in opioid use* at 5 years

Injections: 93% *reduction in injection use* for LBP at 5 years

Post Ablation Procedures: 8% of patients progressed to a fusion (*5/8 at a single study site)*

Future Directions

- **Selection in patients with additional spinal pathology?** *i.e stable spondy, mild to moderate scoliosis, adjacent fusion level, mixed pain*
- **Interventional selection methods?** *i.e. discography, discoblock, other?*
- **Novel imaging biomarker(s)?**

Neuromodulation – *expanding indications*

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Table 1. Study characteristics*

Author, Year [Ref]	Study Design	Patient Population	SCS Waveform, Hz	Control	Primary Outcome Measures	Secondary Outcome Measures†
Brinzeu 2019 [21]	Prospective, single cohort	Back and leg pain	Multiple devices	N/A	NPRS	N/A
Al-Kaisy 2018 [22]	Prospective, single cohort	Predominant axial low back pain	10 kHz	N/A	VAS	ODI
Russo 2018 [23]	Prospective, single cohort	Back and leg pain	Not reported	N/A	VAS	ODI
Veizi 2017 [24]	Open-label prospective vs retrospective analysis	Back and leg pain	Mean 59.8 ± 109.3 Hz	Tonic SCS, frequency not reported	NRS	N/A
Gatzinsky 2017 [25]	Prospective, single cohort	Back and leg pain	Mean 60 ± 31 Hz	N/A	VAS	EQ-5D
Kapural 2016‡ [26]	Randomized, controlled	Back and leg pain	10 kHz	SCS 39.2 ± 15.0 Hz	NRS	ODI, PGIC
Kapural 2015‡ [27]	Randomized, controlled	Back and leg pain	10 kHz	SCS 39.2 ± 15.0 Hz	NRS	ODI, PGIC
Al-Kaisy 2014 [28]	Prospective, single cohort	Back and leg pain	10 kHz	N/A	VAS	ODI
Van Buyten 2013 [29]	Prospective, single cohort	Predominant axial low back pain	10 kHz	N/A	VAS	ODI
De Vos 2012 [30]	Prospective, single cohort	Back and leg pain	Not reported	N/A	VAS	N/A

NPRS = numeric pain rating scale; NRS = numeric rating scale; ODI = Oswestry Disability Index; PGIC = patient global impression of change; SCS = spinal cord stimulation; VAS = visual analog scale.

*Studies reporting categorical data.

†As measured by a validated, standardized survey instrument.

‡One patient population followed across multiple publications.

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Conclusions

The published evidence suggests that 10-kHz SCS may be an effective treatment for axial LBP in patients with both refractory axial predominant LBP (very low-quality evidence) and combined axial back and leg pain (very low- to low-quality evidence depending on the comparator), primarily in the FBSS population. There is insufficient evidence to evaluate the long-term effectiveness of burst SCS beyond six months for axial LBP reduction. Traditional low-frequency SCS appears minimally effective for reducing axial LBP pain (very low-quality evidence), though newer low-frequency systems show promise in nonrandomized studies (very low-quality evidence). Investigator-driven, non-industry-funded studies with long-term outcome assessment are needed in this area of clinical research.

Neuromodulation – *expanding indications*

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Research Paper

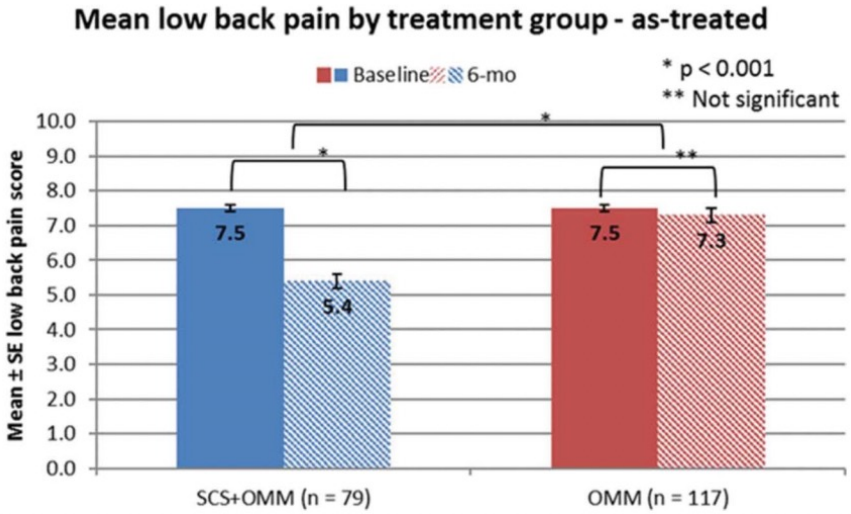
PAIN

OPEN

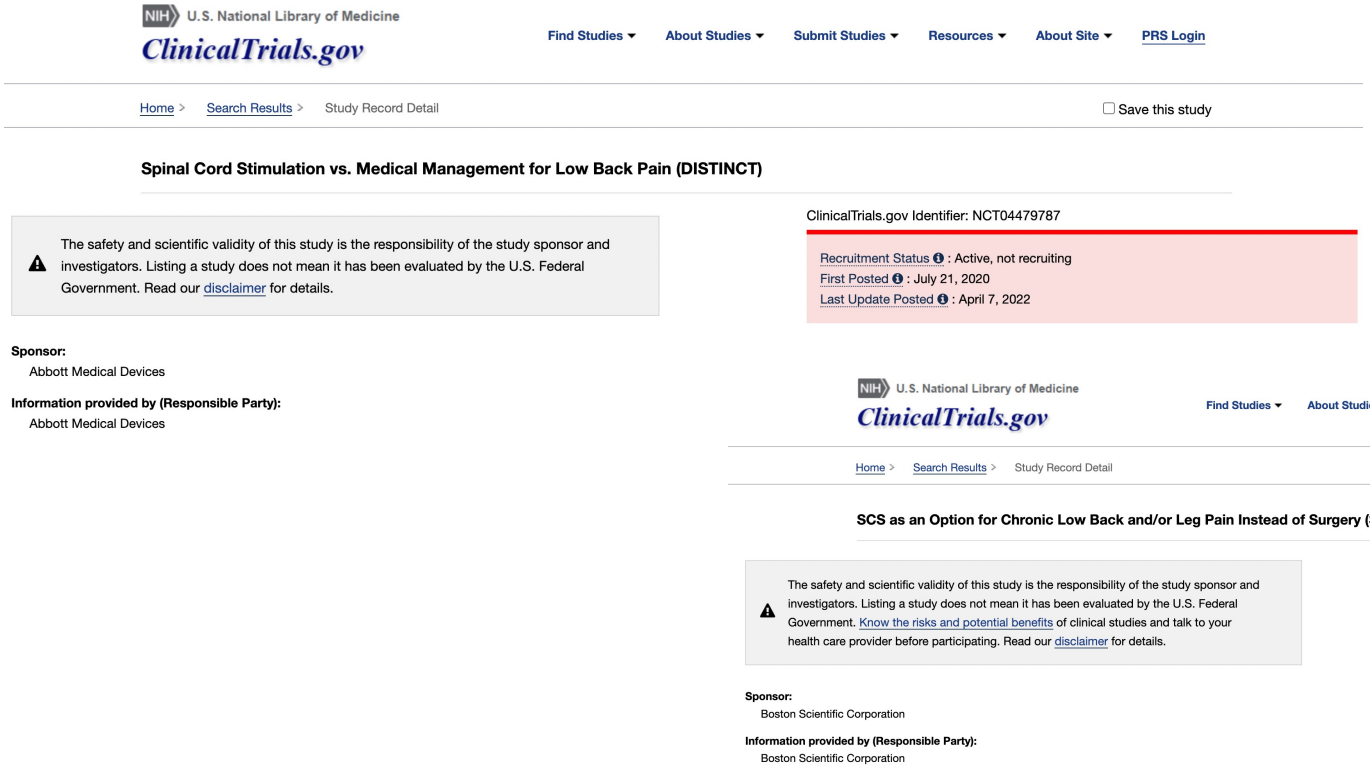
Multicolumn spinal cord stimulation for predominant back pain in failed back surgery syndrome patients: a multicenter randomized controlled trial

Philippe Rigoard[a,b,c,*], Surajit Basu[d], Mehul Desai[e,f], Rod Taylor[g], Lieven Annemans[h], Ye Tan[i], Mary Jo Johnson[i], Carine Van den Abeele[j], PROMISE Study Group, Richard North[k,l]

160 (2019) 1410–1420



Surgically-naïve Refractory LBP



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Save this study

Spinal Cord Stimulation vs. Medical Management for Low Back Pain (DISTINCT)

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. Read our disclaimer for details.

ClinicalTrials.gov Identifier: NCT04479787

Recruitment Status : Active, not recruiting
First Posted : July 21, 2020
Last Update Posted : April 7, 2022

Sponsor:
Abbott Medical Devices

Information provided by (Responsible Party):
Abbott Medical Devices

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SCS as an Option for Chronic Low Back and/or Leg Pain Instead of Surgery (SOLIS)

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. Know the risks and potential benefits of clinical studies and talk to your health care provider before participating. Read our disclaimer for details.

ClinicalTrials.gov Identifier: NCT04676022

Recruitment Status : Recruiting
First Posted : December 19, 2020
Last Update Posted : July 13, 2022

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“Multifidus Restoration”

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ARTICLE IN PRESS

Neuromodulation: Technology at the Neural Interface

Received: September 29, 2021 Accepted: October 12, 2021

https://doi.org/10.1016/j.neurom.2021.10.011

Long-Term Outcomes of Restorative Neurostimulation in Patients With Refractory Chronic Low Back Pain Secondary to Multifidus Dysfunction: Two-Year Results of the ReActiv8-B Pivotal Trial

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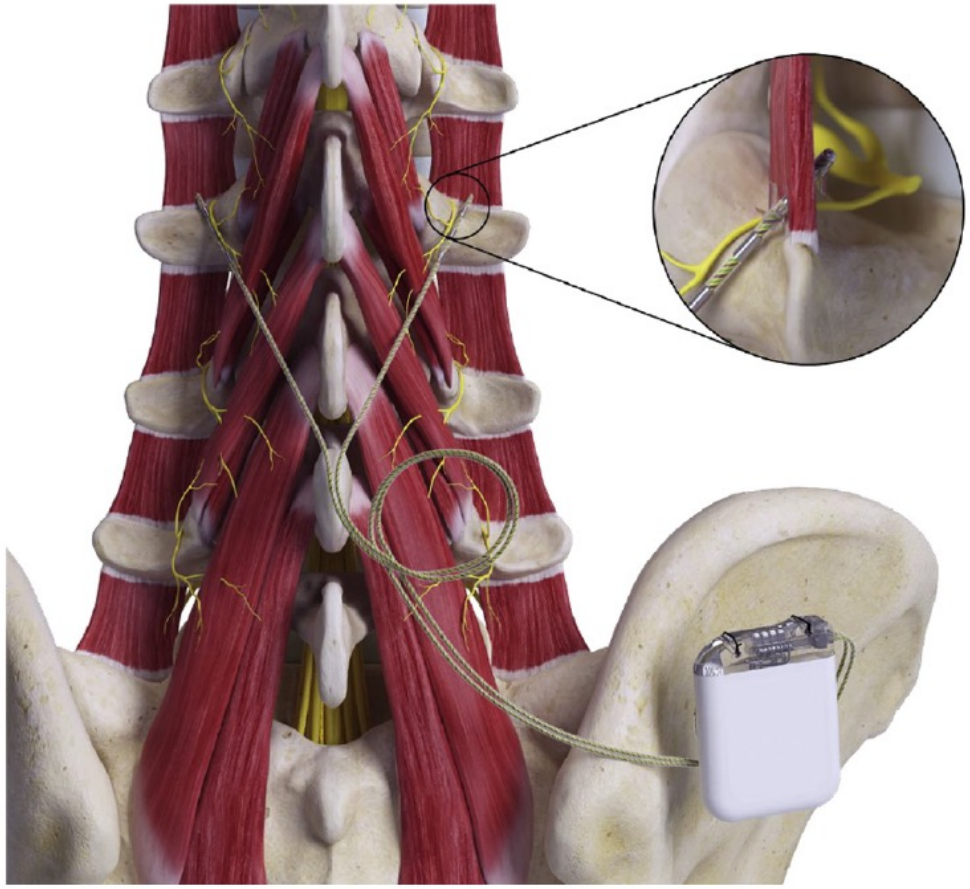

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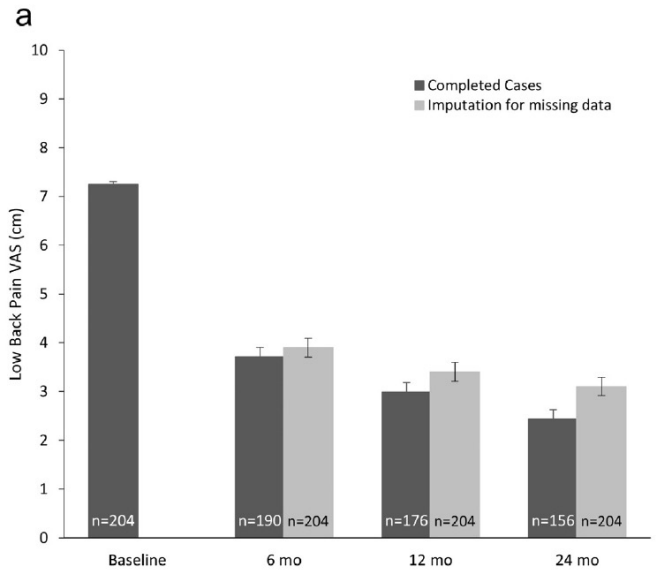

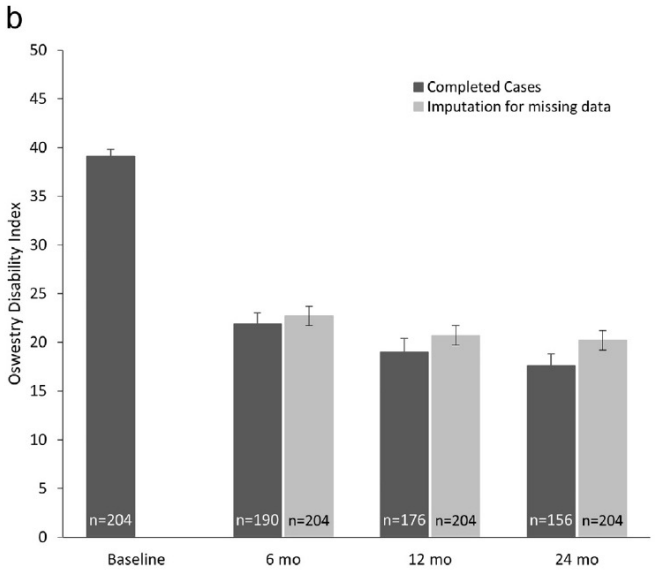

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https://doi.org/10.1016/j.neurom.2021.10.011

Long-Term Outcomes of Restorative Neurostimulation in Patients With Refractory Chronic Low Back Pain Secondary to Multifidus Dysfunction: Two-Year Results of the ReActiv8-B Pivotal Trial

Christopher Gilligan, MD[1]; Willem Volschenk, MD[2]; Marc Russo, MD[2]; Matthew Green, MD[3]; Christopher Gilmore, MD[4]; Vivek Mehta, MD[5]; Kristiaan Deckers, MD[6]; Kris De Smedt, MD[7]; Usman Latif, MD, MBA[8]; Peter Georgius, MD[9]; Jonathan Gentile, MD[10]; Bruce Mitchell, MD[11]; Meredith Langhorst, MD[12]; Frank Huygen, MD, PhD[13]; Ganesan Baranidharan, MD[14]; Vikas Patel, MD[15]; Eugene Mironer, MD[16]; Edgar Ross, MD[1]; Alexios Carayannopoulos, DO, MPH[17]; Salim Hayek, MD, PhD[18]; Ashish Gulve, MD[19]; Jean-Pierre Van Buyten, MD, PhD[20]; Antoine Tohmeh, MD[21]; Jeffrey Fischgrund, MD[22]; Shivanand Lad, MD, PhD[23]; Farshad Ahadian, MD[24]; Timothy Deer, MD[25]; William Klemme, MD[26]; Richard Rauck, MD[27]; James Rathmell, MD[1]; Greg Maislin, MS[28]; Jan Pieter Heemels, MSc[29]; Sam Eldabe, MD[19]; On Behalf of the ReActiv8-B Investigators

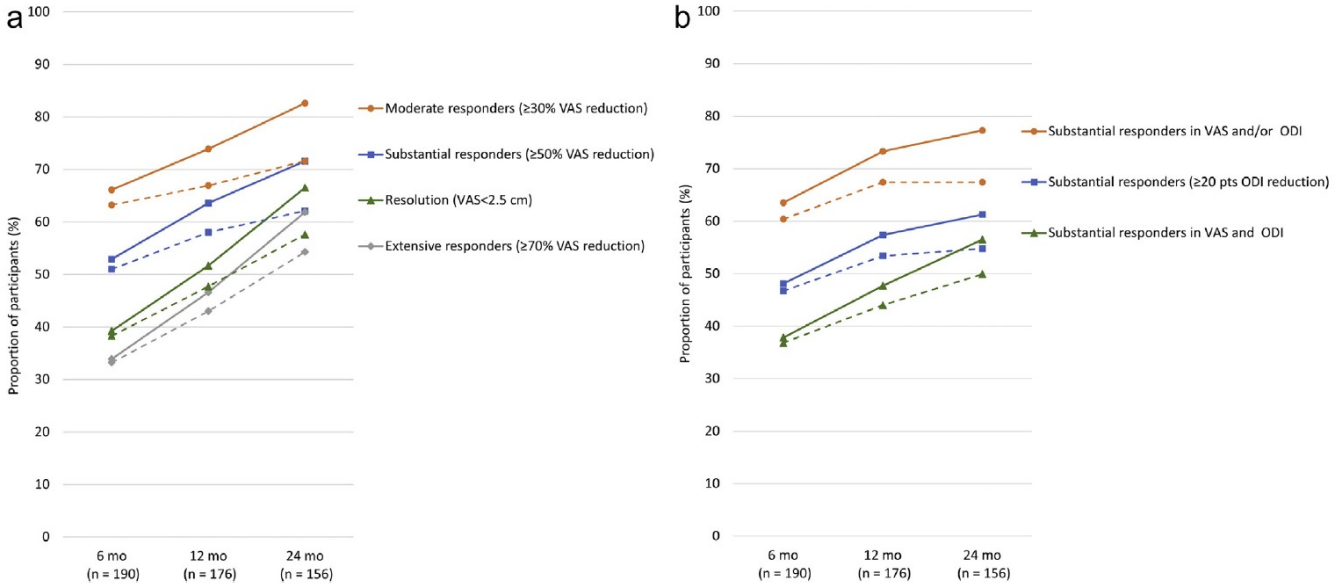

Figure 4. Response rates at common clinical importance thresholds for a. VAS (reduction ≥50% and 70%, and absolute VAS ≤ 2.5 cm), and b. ODI (≥20 points) and composites of VAS and ODI (≥50% and/or 20 points, ≥50% and/or 20 points). Solid lines represent completed cases, and dashed lines represent imputation for missing data (N = 204). [Color figure can be viewed at www.neuromodulationjournal.org]

RESEARCH ARTICLE

Treatment of chronic axial back pain with 60-day percutaneous medial branch PNS: Primary end point results from a prospective, multicenter study

Christopher A. Gilmore MD[1] | Mehul J. Desai MD, MPH[2] | Thomas J. Hopkins MD, MBA[3] | Sean Li MD[4] | Michael J. DePalma MD[5] | Timothy R. Deer MD[6] | Warren Grace MD[6] | Abram H. Burgher MD[7] | Puneet K. Sayal MD, MPH[2] | Kasra Amirdelfan MD[8] | Steven P. Cohen MD[9] | Meredith J. McGee PhD[10] | Joseph W. Boggs PhD[10]

Pain Practice. 2021;21:877–889.

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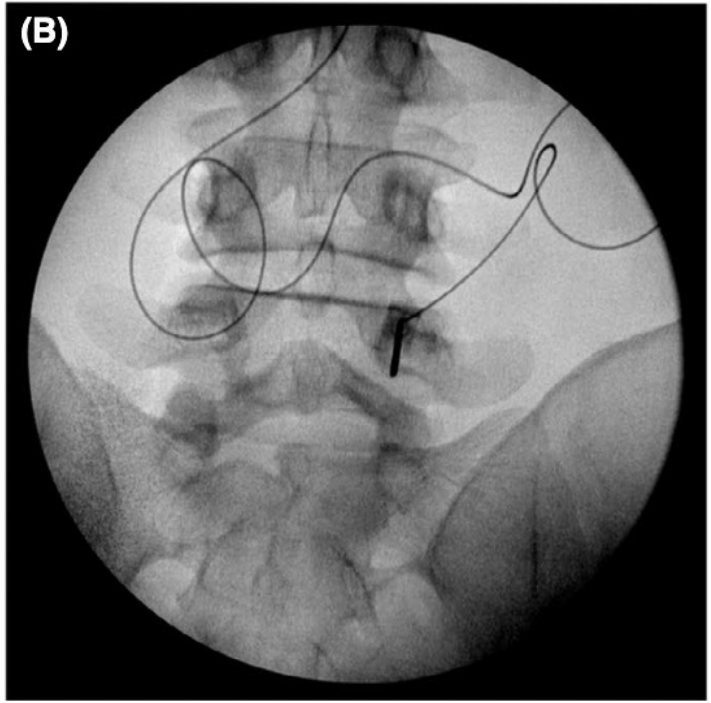
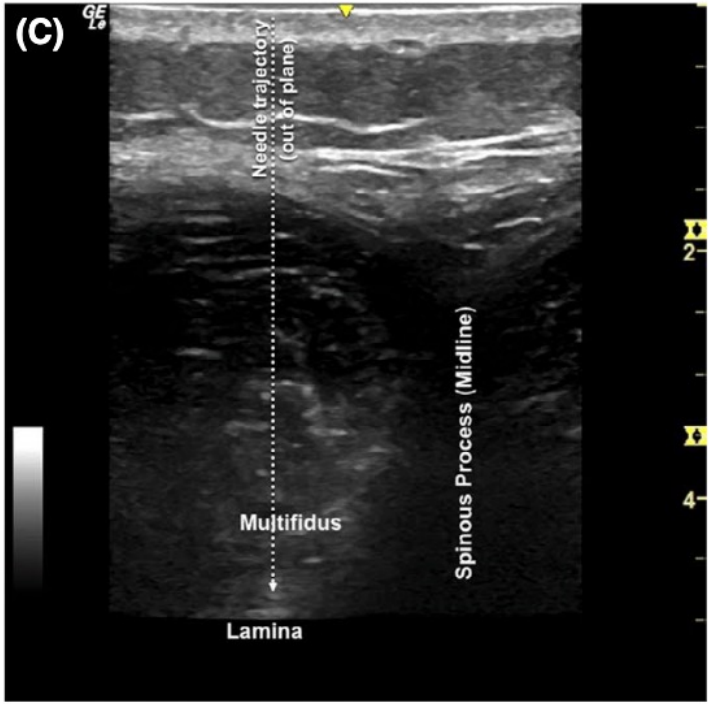
Pain Practice. 2021;21:877–889.





RESEARCH ARTICLE

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Pain Practice. 2021;21:877–889.

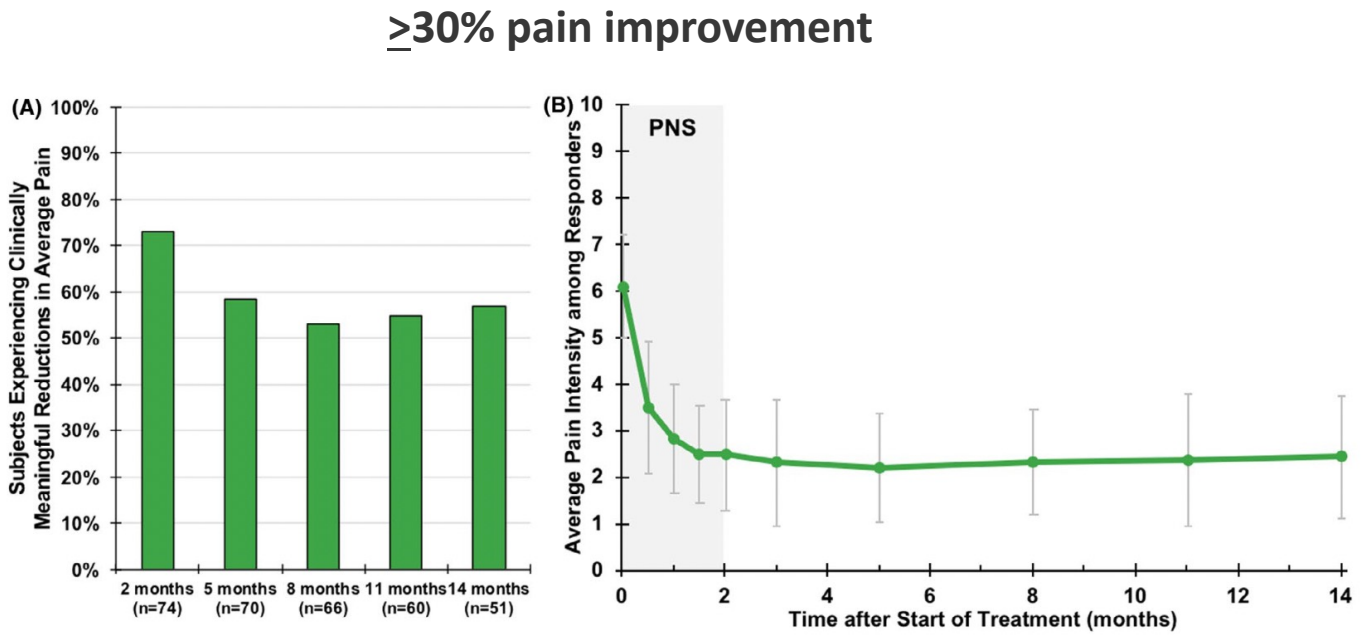

FIGURE 3 Reductions in average back pain intensity. (a) Shows the proportion of participants responding with clinically meaningful reductions in average pain intensity (Brief Pain Inventory, question 5 [BPI-5]) over time. Data collection is complete for follow up visits through 8 months (including the primary end point at 2 months), with data reported thereafter (months 11–14) as observed, while prospective follow-up is ongoing. (b) Shows the average pain intensity scores (mean ± SD) among responders. PNS, peripheral nerve stimulation

RESEARCH ARTICLE

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Pain Practice. 2021;21:877–889.

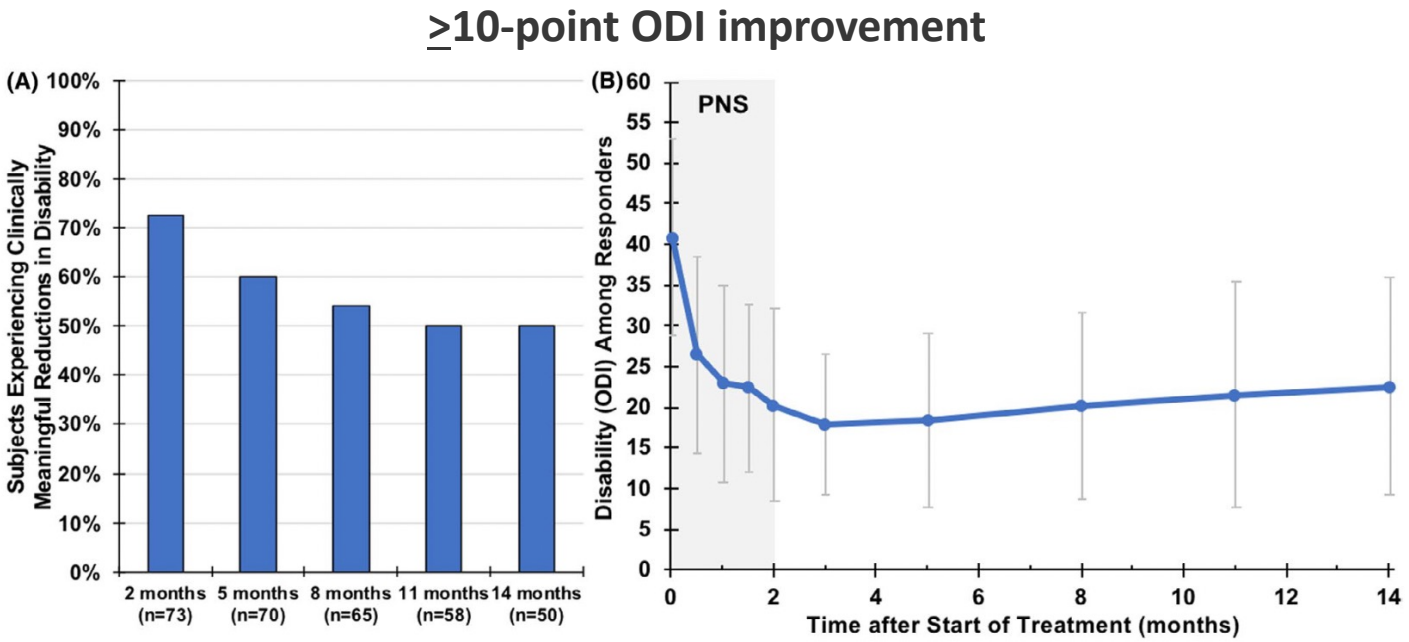


FIGURE 4 Reductions in back pain-related disability. (a) Shows the proportion of participants responding with clinically meaningful reductions in back pain-related disability (Oswestry Disability Index [ODI]) over time. Data collection is complete for visits through 8 months, with data reported thereafter (months 11–14) as observed, while prospective follow-up is ongoing. (b) Shows the disability scores (mean ± SD) among responders. PNS, peripheral nerve stimulation

SPRINT® Peripheral Nerve Stimulation for the Treatment of Back Pain

ClinicalTrials.gov Identifier: NCT04246281

Recruitment Status : Recruiting
First Posted : January 29, 2020
Last Update Posted : July 29, 2022

See Contacts and Locations

Sponsor:
SPR Therapeutics, Inc.

Collaborator:
United States Department of Defense

Information provided by (Responsible Party):
SPR Therapeutics, Inc.

Peripheral Joint Denervation

Continued Pain and Disability Despite Treatment

Weight loss

Bracing

Cane/assistive device

Ice/cryotherapy, Heat

Oral Anti-inflam meds

Targeted Exercise
- Quad, hip girdle, core
- Bike/swimming

Formal Physical Therapy
- Strength, mobility
- Gait
- Ergonomics
- Pacing
- Graded home exercise program

Joint Injection
- Steroid
- Hyaluronic Acid
- Regenerative agents

Joint Denervation or Neuromodulation
- Radiofrequency
- Phenol/alcohol

Surgery
-Arthroplasty

Joint Denervation or Neuromodulation
- Radiofrequency
- Phenol/alcohol
- Peripheral nerve stimulation?
- Dorsal root ganglion stimulation?
- Spinal cord stimulation?

Knee Joint Denervation

Current Outcome Literature

LITERATURE REVIEW

The Effectiveness of Fluoroscopically Guided Genicular Nerve Radiofrequency Ablation for the Treatment of Chronic Knee Pain Due to Osteoarthritis

A Systematic Review

Alexandra E. Fogarty, MD, Taylor Burnham, DO, Keith Kuo, BS, Quinn Tate, MD, Beau P. Sperry, BA, Cole Cheney, MD, David R. Walega, MD, MSCI, Lynn Kohan, MD, Steven P. Cohen, MD, Daniel M. Cushman, MD, Zachary L. McCormick, MD, and Aaron Conger, DO

American Journal of Physical Medicine & Rehabilitation • Volume 101, Number 5, May 2022

- Genicular RFA > sham RFA (Choi)
- Genicular RFA > IA steroid injection (Davis)
- Genicular RFA > IA hyaluronic acid + prp (Shen)
- Genicular RFA > PT and NSAIDs

50% pain reduction responder rate at 6-month f/u: **55-75%**

**practice audit data demonstrates responder rate as low as 35%*

Pain Medicine, 0(0), 2019, 1–3
doi: 10.1093/pm/pnz095
Letter to the Editor

Severity of Knee Osteoarthritis and Pain Relief After Cooled Radiofrequency Ablation of the Genicular Nerves

L. McLean House II, MD,* Marc A. Korn, MD,† Ankur Garg, , MD, MBA,‡ Michael J. Jung, MD, MBA,* Mark C. Kendall, MD,§ David R. Walega, MD, MSCI,† and Zachary L. McCormick, MD¶

Table 1. Covariates associated with treatment success. Covariates passing backwards elimination criteria ($\alpha < 0.20$) for multivariate analysis are shown. Symptom duration was handled as a continuous variable where the odds ratio is the per-unit increase in covariate. Area under the receiver operating characteristics curve = 0.765; $P<0.0001$.

Variable	OR	OR 95% CI	*P* Value
Worst compartment KL grade = 4	4.43	1.22–19.3	0.023*
Bilateral procedure	2.39	0.87–6.84	0.09
Prior meniscal repair or scope	2.92	0.85–11.9	0.09
Symptom duration, mo	0.99	0.97–0.999	0.044*

CI = confidence interval; KL = Kellgren Lawrence; OR = odds ratio.
*Statistically significant.

Pain Medicine 2018; 19: 1628–1638
doi: 10.1093/pm/pnx286

OXFORD

NEUROMODULATION & INTERVENTION SECTION

Original Research Article

A Prospective Randomized Trial of Prognostic Genicular Nerve Blocks to Determine the Predictive Value for the Outcome of Cooled Radiofrequency Ablation for Chronic Knee Pain Due to Osteoarthritis

Zachary L. McCormick, MD,* Rajiv Reddy, MD,† Marc Korn, MD,‡ David Dayanim, MD, MS, MHA,§ Raafay H. Syed, MD,¶ Meghan Bhave, MD,‖ Mikhail Zhukalin, DO,‖ Sarah Choxi, MD,** Ali Ebrahimi, MD,†† Mark C. Kendall, MD,‡‡ Robert J. McCarthy, PharmD,‡ Dost Khan, MD,‡ Geeta Nagpal, MD,‡ Karina Bouffard, MD, MPH,§ and David R. Walega, MD, MSCI‡

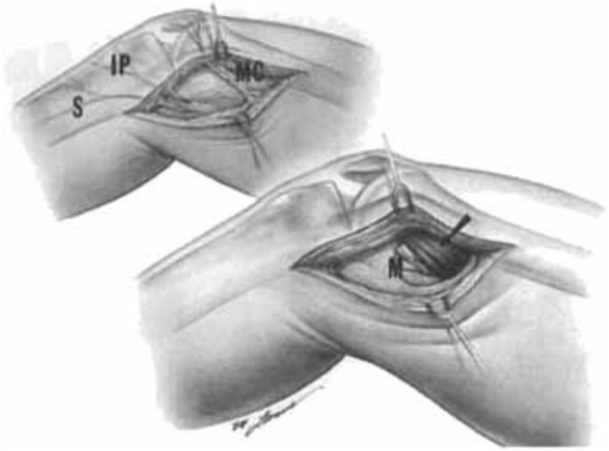
Prognostic Block: 1mL of 2% lidocaine; ≥50% relief

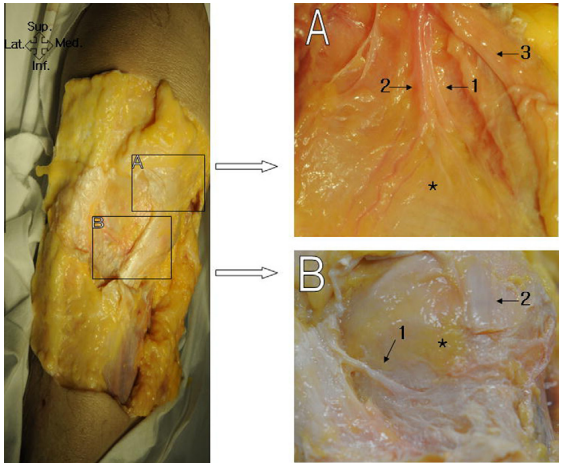
Table 2 Responder analysis for pain relief from prognostic block

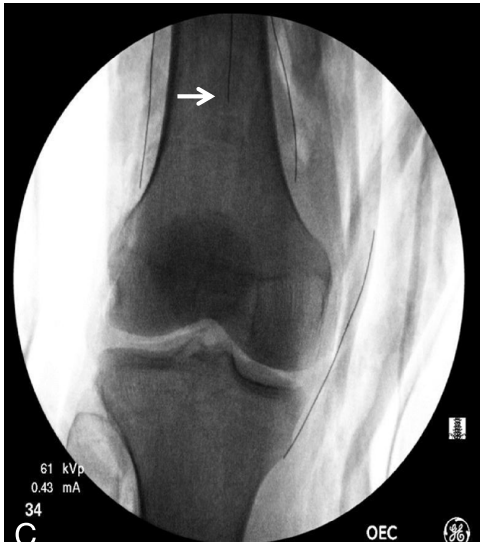
Relief from Prognostic Block	Outcome	Met Outcome Criteria, %
≥50	NRS < 50% of baseline	41.7
	PGIC < 3	31.8
	WOMAC > 15-point decrease	44.8
≥80	NRS < 50% of baseline	51.9
	PGIC < 3	31.8
	WOMAC > 15-point decrease	54.5
≥90	NRS < 50% of baseline	60.0
	PGIC < 3	37.5
	WOMAC > 15-point decrease	56.3

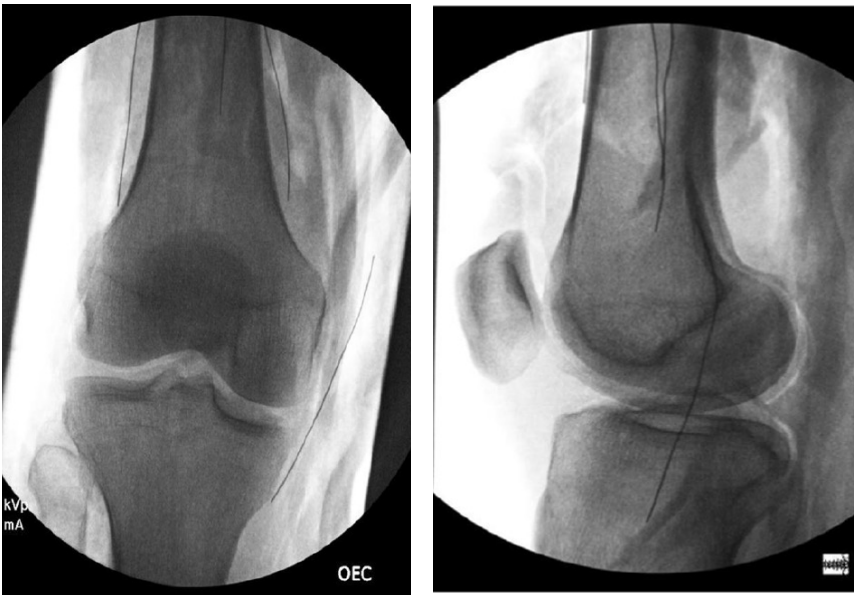
NRS = numeric rating scale for pain (0–10) where 0 = no pain and 10 = worst pain imaginable; PGIC = Patient Global Impression of Change where 1 = very much improved and 7 = very much worse; WOMAC = Western Ontario and McMaster Universities Osteoarthritis Index.

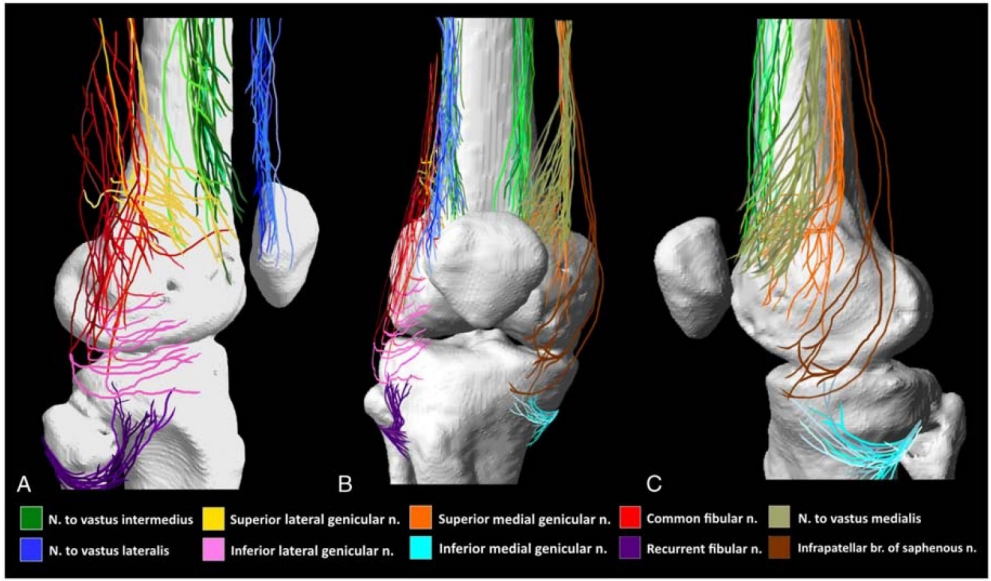
Do we have the *correct* targets?











Franco C, Buvanendran A, Petersohn J, Menzies R, Menzies L. Innervation of the anterior capsule of the human knee. Implications for radiofrequency ablation. Reg Anesth *Pain Med* 2015; 5:363–8.

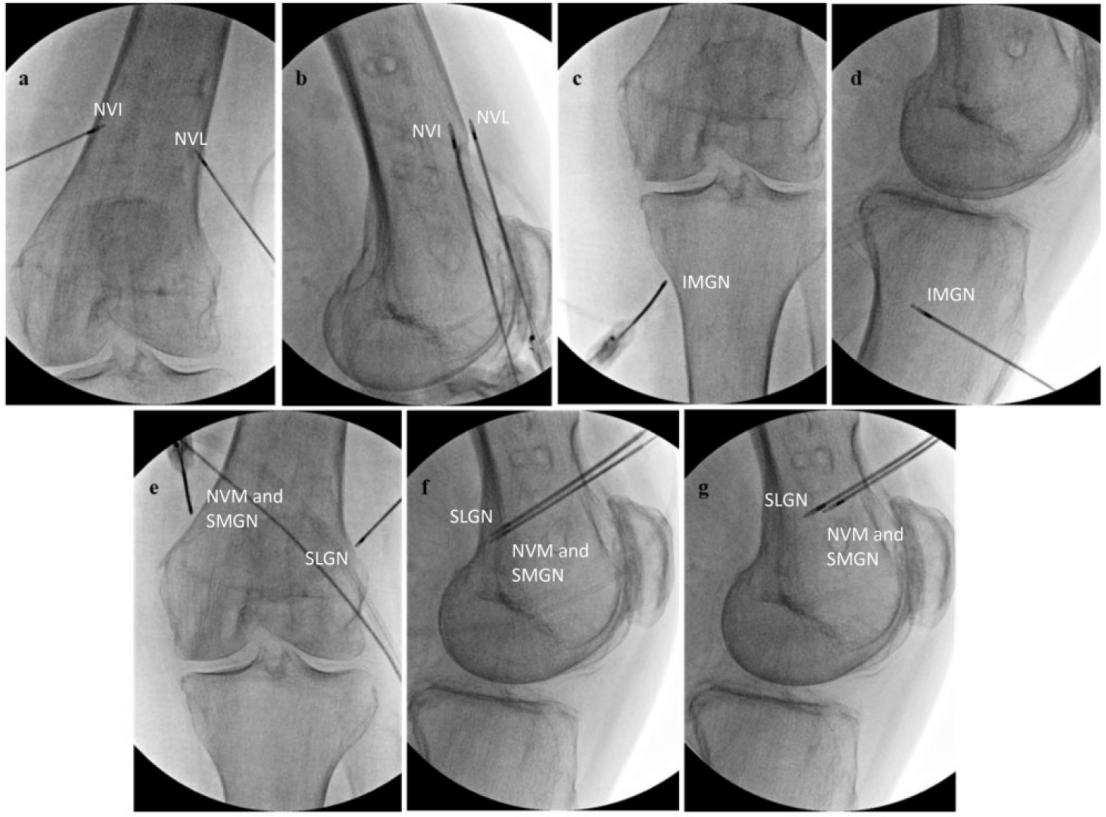
Tran et al. 2018. Anatomical Study of the Innervation of Anterior Knee Joint Capsule: Implication for Image-Guided Intervention. *Regional Anesthesia and Pain Medicine.*

RFA Technique Optimization

A Pilot Study of an Expanded Genicular Nerve Radiofrequency Ablation Protocol for the Treatment of Chronic Knee Pain

Quinn Tate, MD,*,† James B. Meiling, DO,‡ Taylor R. Burnham, DO, MS,*
Aaron Conger, DO,* and Zachary L. McCormick, MD*

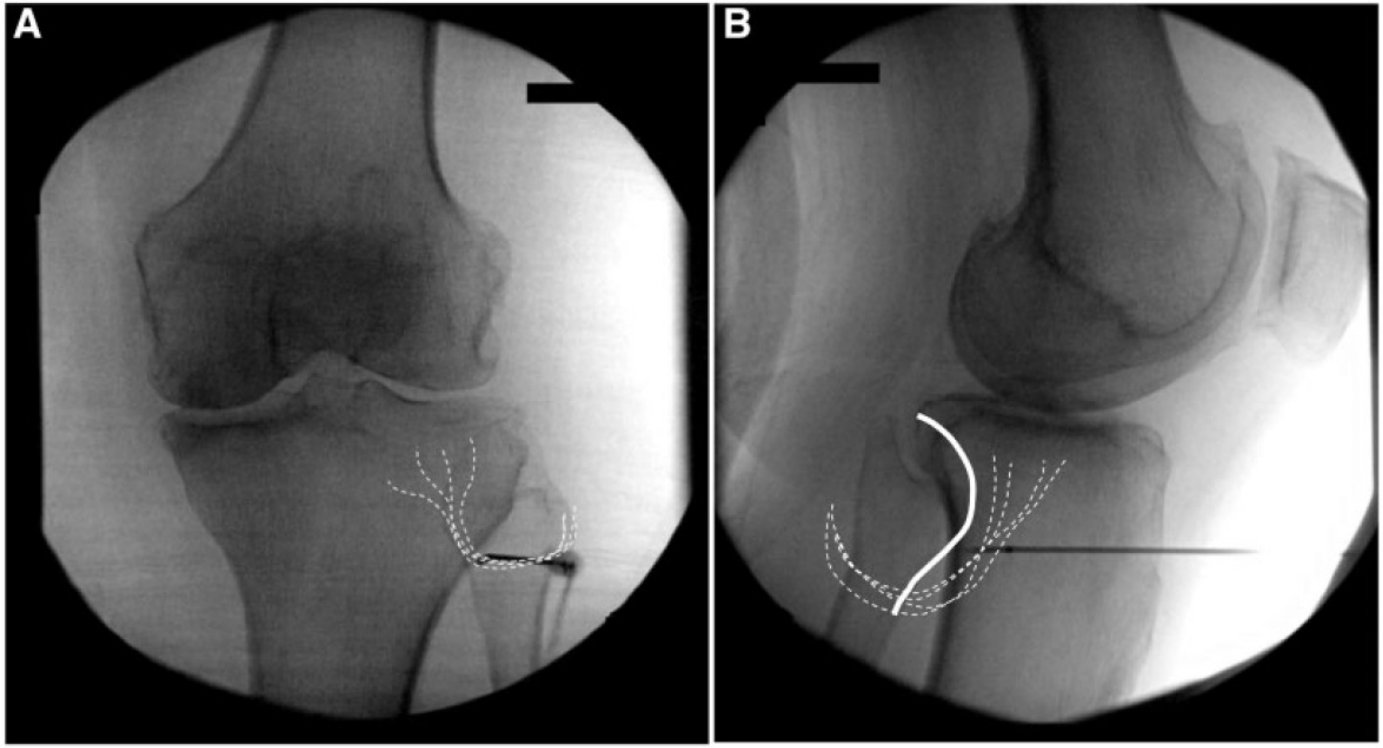
Pain Medicine, 00(0), 2021, 1–4
doi: 10.1093/pm/pnab329
Advance Access Publication Date: 17 November 2021
Letter to the Editor



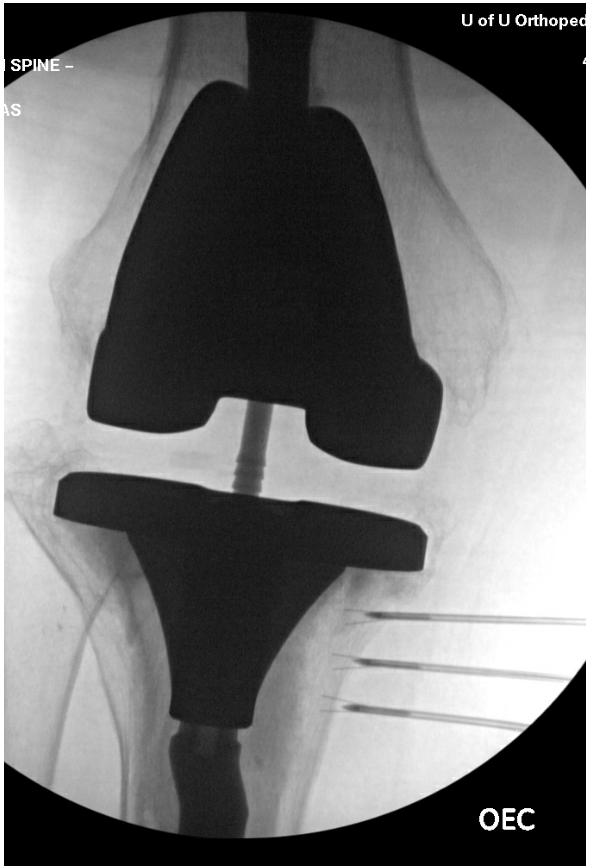
A Proposed Protocol for Safe Radiofrequency Ablation of the Recurrent Fibular Nerve for the Treatment of Chronic Anterior Inferolateral Knee Pain

Beau P. Sperry,* Aaron Conger, DO,† Lynn Kohan, MD‡ David R. Walega, MD, MSCI§ Steven P. Cohen, MD¶ and Zachary L. McCormick, MD†

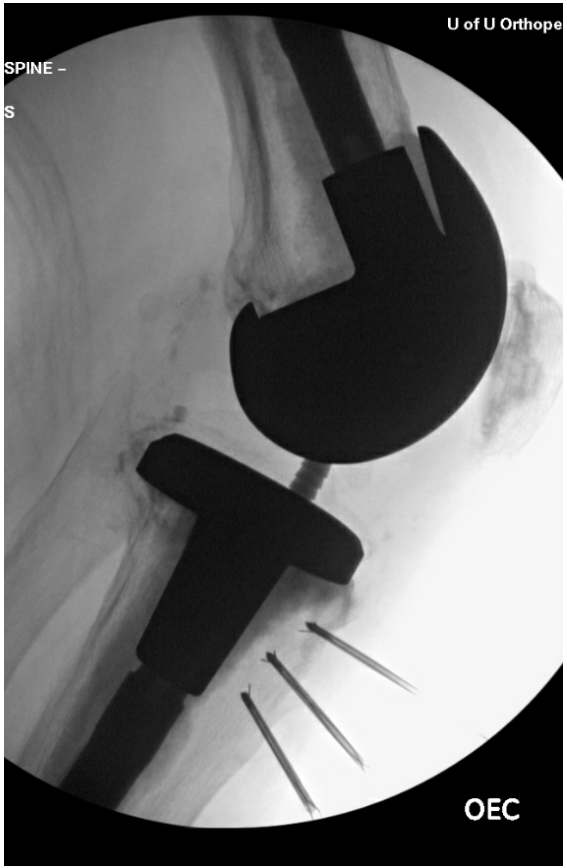
Pain Medicine, 00(0), 2020, 1–4
doi: 10.1093/pm/pnaa291
Letter to the Editor



AP view IPBSN RFA



Lateral view IPBSN RFA



Technical considerations for genicular nerve radiofrequency ablation: optimizing outcomes

Zachary L McCormick [1], Steven P Cohen [2], David R Walega,[3] Lynn Kohan [4]

SKOAP
A Sequenced-strategy for improving outcomes in people with Knee OsteoArthritis Pain (SKOAP Trial)

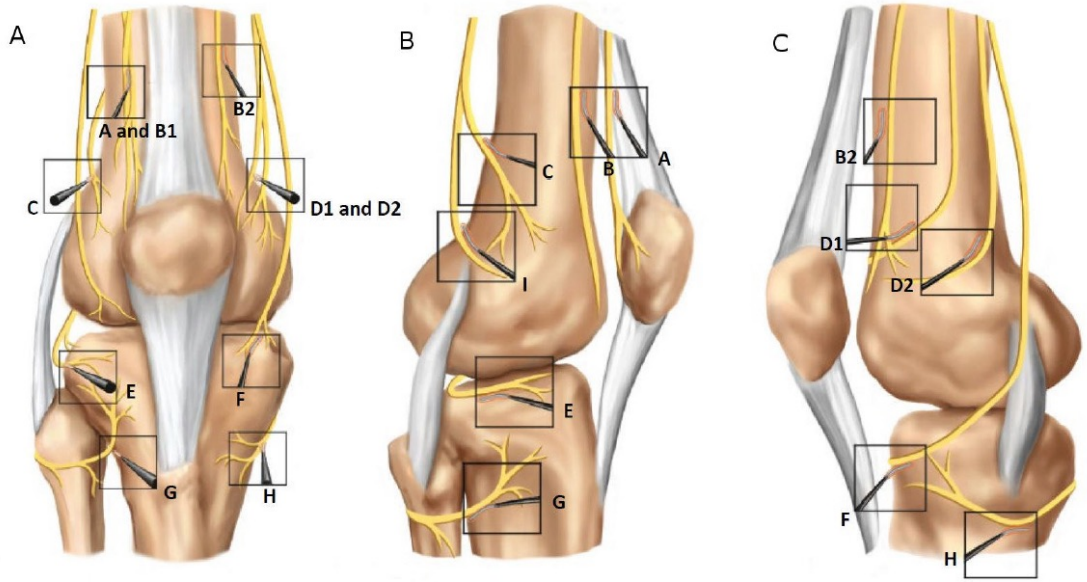


Figure 2 Innervation of the anterior knee joint with target nerves. (A) Anterior view, (B) lateral view, (C) medial view. (A) Nerve to vastus lateralis, B1. Lateral branch of nerve to vastus intermedius, B2 medial branch nerve to vastus intermedius, C. Superior lateral genicular nerve, D1. Nerve to vastus medialis, D2. Superior medial genicular nerve, E. Inferior lateral genicular nerve, F. Infrapatellar branch of saphenous, G. Recurrent fibular nerve, H. Inferior medical genicular nerve, I. Terminal articular branch of the common fibular nerve.

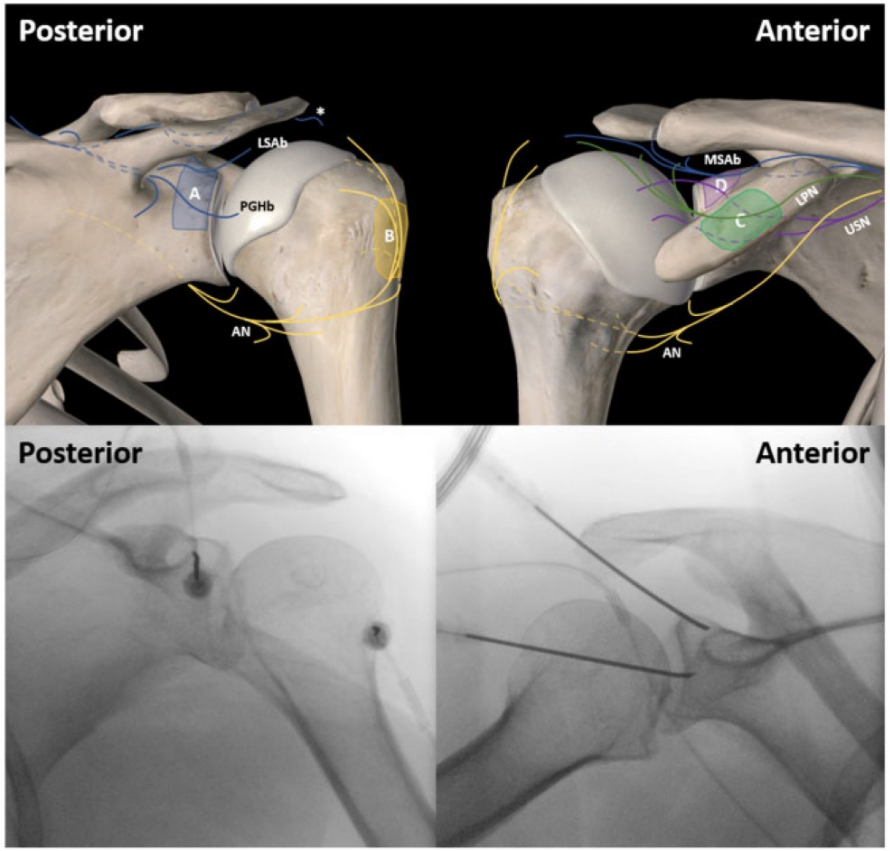
Shoulder Joint Denervation

Shoulder Joint Denervation

Pain Medicine, 22(S1), 2021, S2–S8
doi: 10.1093/pm/pnab152
Review Article

Putting Our Shoulder to the Wheel: Current Understanding and Gaps in Nerve Ablation for Chronic Shoulder Pain

Maxim S. Eckmann, MD,* Zachary L. McCormick, MD,† Colby Beal, DO,* Jonathan Julia, MD,* Cole W. Cheney, MD,† and Ameet S. Nagpal, MD*



Pain Medicine, 21(4), 2020, 868–871
doi: 10.1093/pm/pnz335
Advance Access Publication Date: 10 February 2020
Letter to the Editor

OXFORD

LETTER TO THE EDITOR

Terminal Sensory Articular Nerve Radiofrequency Ablation for the Treatment of Chronic Intractable Shoulder Pain: A Novel Technique and Case Series

Maxim S. Eckmann, MD,* Justin Johal,† Brittany Bickelhaupt, MD,‡ Zachary McCormick, MD,§ Rany T. Abdallah, MD, PhD,¶ Robert Menzies, MD,‖ Sameer Soliman, MD,‖ and Ameet Singh Nagpal, MD, MS, MEd*

Table 1. Characteristics and outcomes of patients

Subject Number	Age, y	Sex	Weight, kg	Primary Diagnosis	Duration of Shoulder Pain	Procedure	Nerves Involved	Relief Duration, mo	Percent Relief
Responders									
1*	64	M	136.1	Painful rotator cuff tendinopathy	>6 mo	TRFA	abAN, abSN, abLPN	3	80
2†	70	M	61.2	Osteoarthritis of the shoulder	>6 mo	TRFA	abAN, abSN, abLPN	3	60
3‡	90	M	61.2	Osteoarthritis of the shoulder	>6 mo	TRFA	abLPN	10	>50
4‡	85	M	108.9	Osteoarthritis of the shoulder	>6 mo	CRFA	abAN, abSN	10	100
5	77	M	Unk	Painful rotator cuff tendinopathy	>1 y	CRFA	abAN, abSN, abLPN	5	70
6*	89	F	72.9	Osteoarthritis of the shoulder	>6 mo	CRFA	abAN, abSN, abLPN	5	>50
7†,§	66	F	103.4	Painful rotator cuff tendinopathy	>6 mo	CRFA	abAN, abSN, abLPN	9	100
8†	71	F	81.7	Osteoarthritis of the shoulder	>6 mo	CRFA	abAN, abSN, abLPN	4	50
9†	57	F	72.9	Osteoarthritis of the shoulder	>6 mo	CRFA	abAN, abSN, abLPN	8	80
Subject Number	Age, y	Sex	Weight, kg	Primary Diagnosis	Duration of Shoulder Pain	Procedure	Nerves Involved	Follow-up Duration, mo	Percent Relief
Nonresponders									
10	85	F	55.3	Osteoarthritis of the shoulder	>6 mo	TRFA	abAN, abSN, abLPN	3	0
11*	53	F	98.9	Complex regional pain syndrome, type 1	4 y	TRFA	abAN, abSN, abLPN	1	30
12¶	47	F	81.6	Adhesive capsulitis of both shoulders	>1 y	TRFA	abAN, abSN, abLPN	4	0
13¶	47	F	81.6	Adhesive capsulitis of both shoulders	>1 y	TRFA	abAN, abSN, abLPN	3	0
14	61	M	109.3	Osteoarthritis of the shoulder	>6 mo	TRFA	abAN, abSN, abLPN	3	0
15	75	F	76	Osteoarthritis of the shoulder	>6 mo	TRFA	abAN, abSN, abLPN	2	40
16*	52	F	127	Sprengel deformity	3 y	CRFA	abAN, abSN, abLPN	2	20
17	63	F	79.4	Osteoarthritis of the shoulder	>6 mo	CRFA	abAN, abSN, abLPN	1	0
18*	88	M	Unk	Osteoarthritis of the shoulder	4 y	CRFA	abAN, abSN, abLPN	1	10
19‡,§	34	M	83.9	Painful rotator cuff tendinopathy	3 y	CRFA	abSN	10	0

abAN = axillary nerve; abLPN = lateral pectoral nerve; abSN = suprascapular nerve; CRFA = cooled radiofrequency ablation; TRFA = traditional radiofrequency ablation; Unk = unknown.

*History of shoulder surgery.

†Ongoing relief at time at last follow-up.

‡Fewer than three terminal nerve branches were ablated.

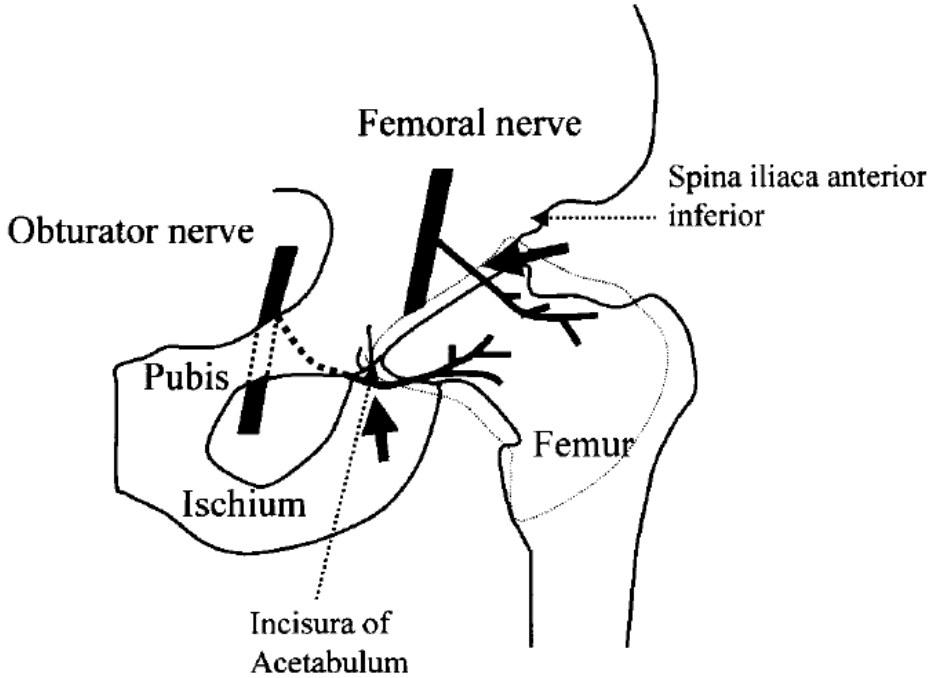
§History of arthroplasty surgery.

¶More than one ablative procedure.

Hip Joint Denervation?

Reg Anesth Pain Med. 2001 Nov-Dec;26(6):576-81.

Percutaneous radiofrequency lesioning of sensory branches of the obturator and femoral nerves for the treatment of hip joint pain.

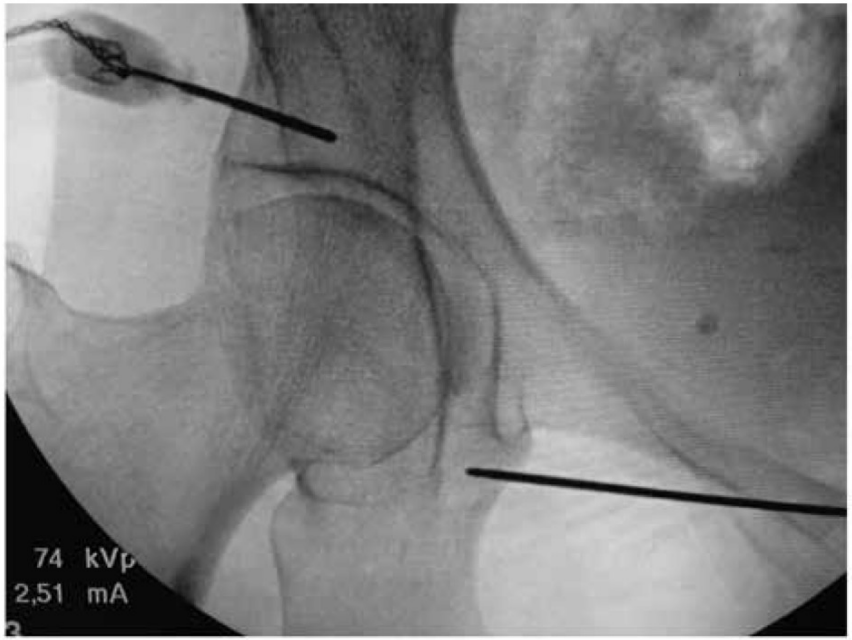


Pain Physician 2018; 21:279-284 • ISSN 1533-3159

Observational Study

Cooled Radiofrequency Neurotomy of the Articular Sensory Branches of the Obturator and Femoral Nerves – Combined Approach Using Fluoroscopy and Ultrasound Guidance: Technical Report, and Observational Study on Safety and Efficacy

Leonardo Kapural, MD, PhD, Suneil Jolly, MD, Joao Mantoan, MD, Harish Badhey, MD, and Ty Ptacek, MD



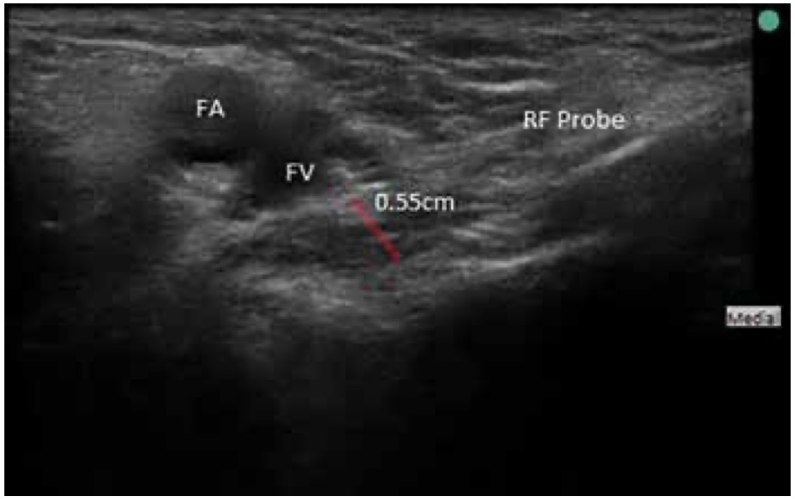


Fig. 2. *US guided passage of RF introducer and probe of femoral neurovascular bundle. Careful US guided advancement of RF probe just next to the femoral vein (FV). Lateral to the vein is a femoral artery (FA). Measured distance of RF electrode to femoral vein was 0.55 cm.*

Author, Year	N	Time of Follow-up Assessment	Outcome
Akatov, 1997	13	36 months	92% (12) patients with “pain relief”*
Kawaguchi, 2001	14	1 month - 11 months	86% (12) patients with >50% pain reduction* - 60% pain reduction†
Malik, 2003	4	3 months - 1-3 months	75% (3) patients with >50% pain reduction* - 30-70% pain reduction†
Rivera, 2012	18	6 months	44% (8) patients with > 50% pain reduction - 33% pain reduction at 6 months†
Cortiñas-Sáenz, 2014	3	1 month - 6 months	100% (3) of patients with >50% pain reduction* ** 50-80% pain reduction - 100% (3) of patients with >50% pain reduction** 50-80% pain reduction†
Kapural, 2018	23	6 months	>80% pain reduction*

*Categorical
†Continuous
**Calculated from primary data

Limitations

- Multiple nerves supply sensation to the hip joint
  - Obturator nerve branches
  - Femoral nerve branches
  - Accessory femoral and accessory obturator nerves
  - Nerve to the quadratus femoris
  - Superior gluteal nerve
  - Direct branches from the sciatic nerve
- Parallel placement of electrode?
- Femoral Artery and Vein

Posterior Innervation?

Pain Medicine, 22(5), 2021, 1072–1079
doi: 10.1093/pm/pnab057
Advance Access Publication Date: 10 February 2021
Original Research Article

NEUROMODULATION & MINIMALLY INVASIVE SURGERY SECTION

Innervation of the Posterior Hip Capsule: A Cadaveric Study

Ameet S. Nagpal, MD, MS, MEd,* Caroline Brennick, DO,* Annette P. Occhialini, MD,† Jennifer Gabrielle Leet, MD,‡ Tyler Scott Clark, MD,‡ Omid B. Rahimi, PhD,†Kendall Hulk, DO,‡ Brittany Bickelhaupt, MD,§ and Maxim S. Eckmann, MD*

Pain Medicine, 22(5), 2021, 1072–1079
doi: 10.1093/pm/pnab057
Advance Access Publication Date: 10 February 2021
Original Research Article

Innervation of the Posterior Hip Capsule: A Cadaveric Study

Ameet S. Nagpal, MD, MS, MEd,* Caroline Brennick, DO,* Annette P. Occhialini, MD,† Jennifer Gabrielle Leet, MD,‡ Tyler Scott Clark, MD,‡ Omid B. Rahimi, PhD,†Kendall Hulk, DO,‡ Brittany Bickelhaupt, MD,§ and Maxim S. Eckmann, MD*

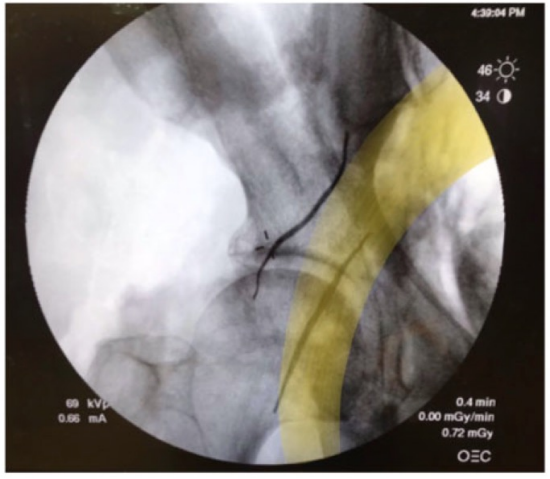


Figure 7. PA fluoroscopic image at zero degrees of ipsilateral obliquity of a right hip in the prone position. The cephalad radio-opaque marker is overlying the articular branches of the SGN. The caudal radio-opaque marker is overlying the NQF. The location of the sciatic nerve is demonstrated by the translucent yellow structure.

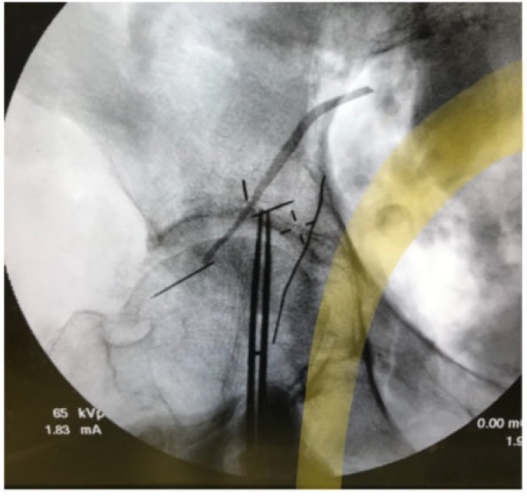


Figure 8. PA fluoroscopic image of the right hip in the prone position with twenty degrees of ipsilateral obliquity. The needle which is held in place by forceps over the superomedial portion of the acetabulum is approaching the NQF's terminal innervation zone of the quadratus femoris muscle. The dissection pin which is overlying the cephalad portion of the femoral head is used to identify the articular branches of the SGN, which are potential locations where a block can be performed. The cephalad radio-opaque marker is overlying the articular branches of the SGN. The caudal radio-opaque marker is overlying the NQF. The location of the sciatic nerve is demonstrated by the translucent yellow structure.

Use of Cooled Radiofrequency for the Treatment of Hip Pain Associated With Hip OA Compared to Intra-articular Steroid Injections

ClinicalTrials.gov Identifier: NCT04329884

Recruitment Status : Unknown
Verified March 2020 by Antonia Faustina Chen, Brigham and Women's Hospital.
Recruitment status was: Recruiting
First Posted : April 1, 2020
Last Update Posted : April 1, 2020

Sponsor:
Brigham and Women's Hospital

Collaborator:
Rothman Institute Orthopaedics

Information provided by (Responsible Party):
Antonia Faustina Chen, Brigham and Women's Hospital

Regenerative Medicine and Orthrobiologics

Regenerative Medicine and Orthrobiologics

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Check for updates

The SPINE JOURNAL

The Spine Journal 22 (2022) 226–237

Systematic Review/Meta-Analysis

The effectiveness of intradiscal biologic treatments for discogenic low back pain: a systematic review

Byron J. Schneider, MD[a,*], Christine Hunt, DO[b], Aaron Conger, DO[c], Wenchun Qu, MD, PhD[d], Timothy P. Maus, MD[e], Yakov Vorobeychik, MD, PhD[f], Jianguo Cheng, MD, PhD[g], Belinda Duszynski, BS[h], Zachary L. McCormick, MD[i]

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Table 1
Treatment success rates defined as ≥50% pain reduction reported in individual randomized controlled trials and observational studies; the studies are grouped by biologic agent

	Inclusion Criteria	Imaging Criteria	Discography	Outcom	# Patients	Total	Follow-Up	Responder Rate
	Platelet Rich Plasma (PRP)							
	Observational Studies							
Navani 2015	discogenic LBP ≥6 mos; failed conservative tx	disc height of ≥50%; degenerative discs, annular tears, or contained disc protrusion on CT	concordant pain on discography	Verbal Pain Scale	6	6	q2-4 weeks for 6 months	6 months: 6/6 100%
Levi 2016	back pain greater than leg pain with an intensity of 40mm on a 100mm VAS; facet pain excluded by blocks	feature suggestive of discogenic pain (e.g. HIZ, disc protrusion, decreased signal intensity on T2 imaging or Modic changes)	not required, but some had prior discogram	VAS	22	22	1,2,6 months	1 month: 7/22 [32% (12-51%)] 2 months: 9/22 [41% (20-61%)] 6 months: 9/22 [41% (20-61%)]
Akeda 2017	discogenic LBP ≥3 mos	disc degeneration, grade 3 on MRI; disc height ≥50%	concordant pain on discography or disc block	VAS	14	14	4,8,16,24, 32,40,48 weeks	4 weeks: 10/14 [71% (48-95%)] 24 weeks: 7/14 [50% (24-76%)] 48 weeks: 6/14 [43% (17-69%)]
	Bone Marrow Aspirate Concentrate - Autologous							
	Observational Studies							
Pettine 2015	centralized LBP≥6 mos; failed conservative tx≥3 mos; ODI of at least 30/100; VAS of at least 40/100	MRI modified Pfirmann score of 4-7; Modic I or II; disc height loss of <30%	not required, but 7 had discogram to confirm affected levels	VAS	26	26	3,6,12 months	6 months: 19/26 [73% (56-90%)] 12 months: 16/26 [62% (43-80%)]
Wolff 2020			positive discogram	NRS	33	33	2,6,12,24, 52 weeks	As reported: 2 weeks 4/29 (13.8%, 95% CI: 1.2-26.3%) 6 weeks 11/24 (45.8%, 95% CI: 25.6-65.8%) 12 weeks 7/17 (41.1%, 95% CI:17.8-64.6%) 24 weeks 4/17 (23.5%, 95% CI: 3.3-43.7%) 52 weeks 7/18 (38.9%, 95% CI: 16.4-61.4%) Worst Case analysis: 2 weeks 4/33 (12.1%, 95% CI: 1.0-23.3%) 6 weeks 11/33 (33.3%, 95% CI: 17.2-49.4%) 12 weeks 7/33 (21.2%, 95% CI: 7.3-35.2%) 24 weeks 4/33 (12.1%, 95% CI: 1.0-23.3%) 52 weeks 7/33 (21.2%, 95% CI: 7.3-35.2%)
	Mesenchymal Stem Cells - Autologous							17.8-64.6%) 24 weeks 4/17 (23.5%, 95% CI: 3.3-43.7%) 52 weeks 7/18 (38.9%, 95% CI: 16.4-61.4%) Worst Case analysis: 2 weeks
	Observational Studies							4/33 (12.1%, 95% CI: 1.0-23.3%) 6 weeks 11/33 (33.3%, 95% CI: 17.2-49.4%) 12 weeks 7/33 (21.2%, 95% CI: 7.3-35.2%) 24 weeks
Kumar 2017	discogenic LBP ≥3 mos; failed conservative tx; ≥4/10 VAS; ≥30% disability ODI	MRI (Pfirmann stages 3 or 4); decrease in disc height of >20%	degenerative symptomatic discs on discography	VAS	10	10	1 week, 1,3,6,9,12 months	4/33 (12.1%, 95% CI: 1.0-23.3%) 52 weeks 7/33 (21.2%, 95% CI: 7.3-35.2%)

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The SPINE JOURNAL

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Conclusion

When appropriate inclusion criteria were applied, some observational data suggests that intradiscal biologic agents may be effective treatments for discogenic LBP. When aggregation of data was possible, 22/42 (52.4%, 95% CI: 37%–67%) study participants achieved >50% relief of LBP following intradiscal injection of PRP with a minimum follow-up of six months. For MSC therapies, depending on how loss-to-follow-up is counted, success rates of >50% improvement in LBP at six months were 23/43 (53.5%, 95% CI: 38.6%–68.4%) (as reported) or 23/59 (39.0%, 95% CI: 26.5-51.4%) (worst-case analysis) at six months. According to GRADE the published evidence supporting the use of intradiscal MSCs and PRP is of very low quality. Given the poorly regulated and rapidly expanding US direct-to-consumer stem cell industry, high quality explanatory trials are needed to better assess the true effectiveness of these treatments.

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The Spine Journal 21 (2021) 212–230

THE SPINE JOURNAL

Clinical Study

Allogeneic mesenchymal precursor cells treatment for chronic low back pain associated with degenerative disc disease: a prospective randomized, placebo-controlled 36-month study of safety and efficacy

Kasra Amirdelfan, MD[a,*], Hyun Bae, MD[b], Tory McJunkin, MD[c], Michael DePalma, MD[d], Kee Kim, MD[e], William J. Beckworth, MD[f], Gary Ghiselli, MD[g], James Scott Bainbridge, MD[g,1], Randall Dryer, MD[h], Timothy R. Deer, MD[i], Roger D. Brown, BA[j]

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[f] *Department of Orthopaedics, Emory University School of Medicine, 59 Executive Park South, Suite 3000, Atlanta, GA 30329, USA*
[g] *Denver Spine, 7800 E. Orchard Rd, Suite 100, Greenwood Village, CO 80111, USA*
[h] *Central Texas Spine Institute, 6818 Austin Center Blvd, Suite 200, Austin, TX 78731, USA*
[i] *The Center for Pain Relief, Inc., 400 Court St, Suite 100, Charleston, WV 25301, USA*
[j] *Mesoblast Inc., 12912 Hill Country Blvd, Building F, Suite 230, Bee Cave, TX 78738, USA*
Received 10 December 2019; revised 1 October 2020; accepted 2 October 2020

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The Spine Journal 20 (2020) 138–149

THE SPINE JOURNAL

Basic Science

In vitro and in vivo evaluation of discogenic cells, an investigational cell therapy for disc degeneration

Lara Ionescu Silverman, PhD[a,b,*], Galina Dulatova, PhD[a], Terry Tandeski, PhD[a], Isaac E. Erickson, PhD[a], Beverly Lundell, PhD[c], David Toplon, DVM, DACVP[c], Tricia Wolff[d], Antwain Howard, DVM, DACLAM[d], Subba Chintalacharuvu, PhD[d], Kevin T. Foley, MD[a,b,e]

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Received 8 April 2019; revised 13 August 2019; accepted 14 August 2019

International Journal of Spine Surgery, Vol. 14, No. 2, 2020, pp. 239–253
https://doi.org/10.14444/7033

VAST Clinical Trial: Safely Supplementing Tissue Lost to Degenerative Disc Disease

DOUGLAS P. BEALL, MD,[1] GREGORY L. WILSON, DO,[2] RANDOLPH BISHOP, MD,[3] WILLIAM TALLY, MD[4]

[1] *Summit Medical Center, Edmond, Oklahoma,* [2] *Invictus Healthcare, Tulsa, Oklahoma,* [3] *Neurological and Spine Institute, Savannah, Georgia,* [4] *Athens Orthopaedic Clinic, Athens, Georgia*

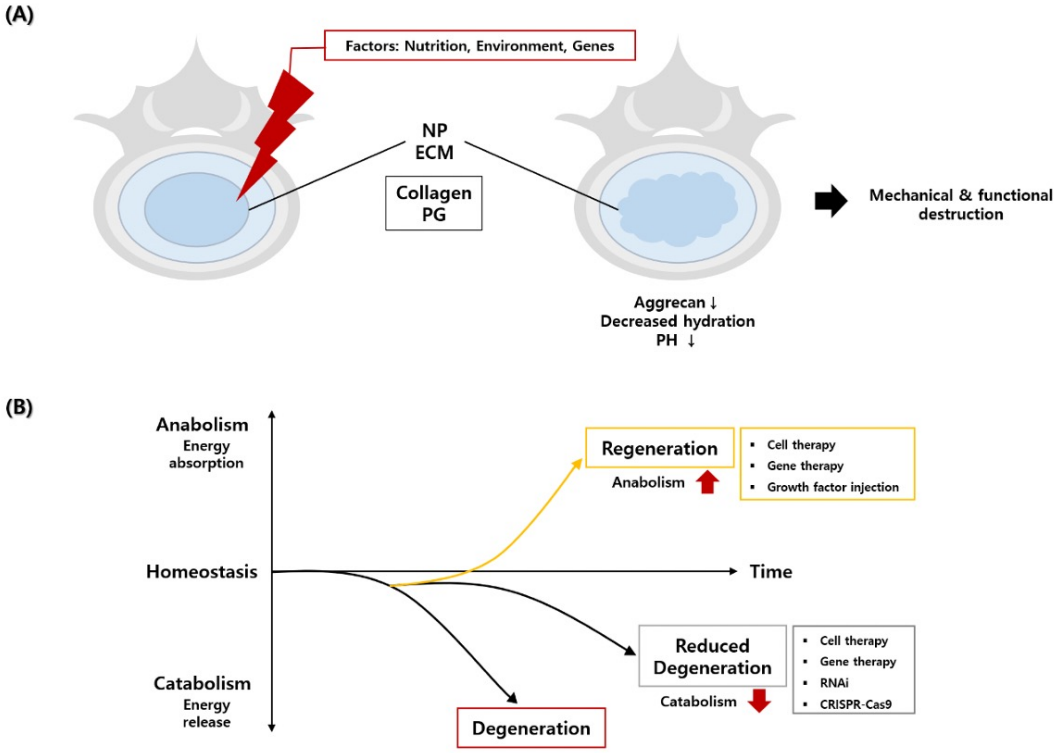
International Journal of
Molecular Sciences

MDPI

Review

Genetic Therapy for Intervertebral Disc Degeneration

Eun Ji Roh [1,2,†], Anjani Darai [1,2,†], Jae Won Kyung [1], Hyemin Choi [1], Su Yeon Kwon [1], Basanta Bhujel [1,2], Kyoung Tae Kim [3,4] and Inbo Han [1,*]



TGF-β Pathway

The SPINE JOURNAL NASS ADVANCING GLOBAL SPINE CARE

ABSTRACT ONLY | VOLUME 15, ISSUE 10, SUPPLEMENT , S119, OCTOBER 01, 2015

Intradiscal Injection of YH14618, a First-in-Class Disease-Modifying Therapy, Reduces Pain and Improves Daily Activity in Patients with Symptomatic Lumbar Degenerative Disc Disease

Young-Joon Kwon, MD, PhD • Eun Sang Kim, MD, PhD • Sung-Min Kim, MD, PhD • Hee Park, MD, PhD • Hae Mi Byun • Su-Youn Nam, MD, PhD

DOI: https://doi.org/10.1016/j.spinee.2015.07.093

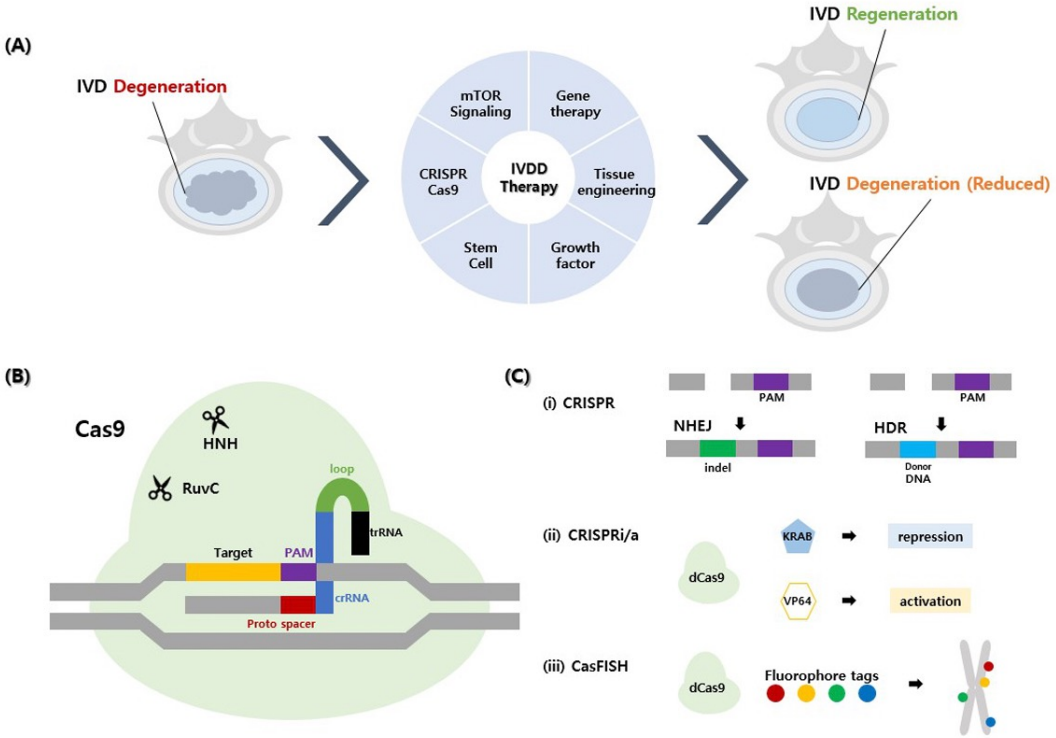
International Journal of
Molecular Sciences

MDPI

Review

Genetic Therapy for Intervertebral Disc Degeneration

Eun Ji Roh [1,2,†], Anjani Darai [1,2,†], Jae Won Kyung [1], Hyemin Choi [1], Su Yeon Kwon [1], Basanta Bhujel [1,2], Kyoung Tae Kim [3,4] and Inbo Han [1,*]



Minimally Invasive Pain Surgery

Pain Medicine, 23(4), 2022, 625–634
doi: 10.1093/pm/pnac028
Advance Access Publication Date: 15 February 2022
Original Research Article

OXFORD

INTERVENTIONAL PAIN & SPINE MEDICINE SECTION

The MOTION Study: A Randomized Controlled Trial with Objective Real-World Outcomes for Lumbar Spinal Stenosis Patients Treated with the *mild*® Procedure: One-Year Results

Timothy R. Deer, MD,* Shrif J. Costandi, MD,† Edward Washabaugh, MD,‡ Timothy B. Chafin, MD,§ Sayed E. Wahezi, MD,¶ Navdeep Jassal, MD,| Dawood Sayed, MD,||

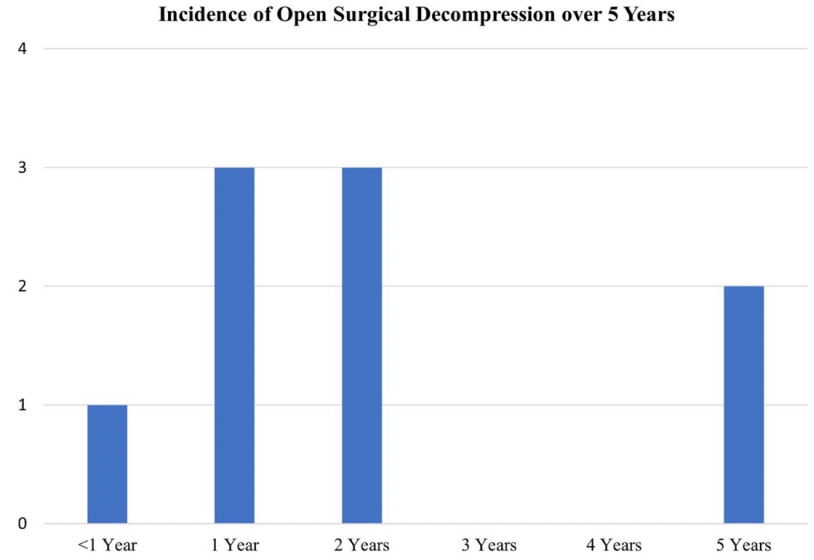
DOI: 10.1111/papr.13020

RESEARCH ARTICLE

The durability of minimally invasive lumbar decompression procedure in patients with symptomatic lumbar spinal stenosis: Long-term follow-up

Nagy Mekhail MD, PhD | Shrif Costandi MD | George Nageeb BS | Catherine Ekladios MD | Ogena Saied MS

Pain Practice. 2021;21:826–835.



DOI: 10.1111/papr.13111

RESEARCH ARTICLE

The incidence of lumbar spine surgery following Minimally Invasive Lumbar Decompression and Superion Indirect Decompression System for treatment of lumbar spinal stenosis: a retrospective review

Jonathan M. Hagedorn MD[1] | Abhishek Yadav MD[2] | Ryan S. D'Souza MD[3] | Nathan DeTemple MD[4] | Jason S. Wolff MD[1] | James B. Parmele MD, MBA[1] | Timothy R. Deer MD[5]

Pain Practice. 2022;22:516–521.

TABLE 4 (Continued)

Patients who underwent Superion procedure only, *n* = 124	
Degree of Lumbar Spinal Stenosis	Severe
Specific Level(s) Treated with Superion	L4-5
Time Between Procedure and Last Follow-up (days)	942
Size of Superion Implant	10
Type of Surgery	Laminectomy and Fusion
Time Between Procedure and Surgery (days)	291
Levels Targeted in Surgery	L4-5
Discharge Location	Home

Note: No patients who underwent both MILD and Superion had subsequent spine surgery.

[a]Note that two patients had MILD procedures performed twice.

Position Statement
on
Arthrodesis of the Spine by the Non-Spine Surgeon

Position Statement

Optimal patient care and patient safety are best served when surgical diseases affecting the spine are managed by neurosurgeons and orthopaedic spinal surgeons trained in the full spectrum of spinal biomechanics, including instrumentation and fusion techniques. Therefore, arthrodesis or any other intervention that alters the biomechanics of the spine should not be performed by practitioners in other fields outside of specialty-trained neurosurgery or orthopaedic spinal surgeons.

NASS Insider

March 01, 2022

NASS Positions on Specialty Scope of Practice and on Arthrodesis of the Spine

NASS Position Statement on Arthrodesis of the Spine:

Optimal patient care and patient safety are best served when surgical diseases affecting the spine are managed by neurosurgeons and orthopaedic spinal surgeons trained in the full spectrum of spinal anatomy and biomechanics, including instrumentation and fusion techniques. A unique range and depth of surgical skills are acquired throughout the neurosurgeon's and orthopaedic surgeon's career, including residency, fellowship, and post-training continuing education and practice. Patient safety advocates that only qualified surgeons administer procedures that affect the structure and biomechanics of patients with spine problems. Arthrodesis or any other intervention that alters the biomechanics of the spine should not be performed by practitioners trained in fields other than neurosurgery and orthopaedic spinal surgery.

2022 REGULAR SESSION

HB941 by Representative John "Big John" Illg , Jr.

PHYSICIANS: Provides requirements and limitations relative to certain procedures performed on the spine

Current Status: Pending House Health and Welfare - Considered 5/11/22

Text ▸ | Amendments ▸ | Digests ▸ | Authors ▸

Date	Chamber	Journal Page	Action
04/05	H	15	Read by title, under the rules, referred to the Committee on Health and Welfare.
04/04	H	36	Read by title. Lies over under the rules.

sort history by ascending dates

May 10, 2022

Health and Welfare Committee
Louisiana House of Representatives
Box 94062
900 North 3rd Street
Baton Rouge, LA 70804

via Email: h-hw@legis.la.gov

Re: House Bill 941

Dear Representative Illg, Chairman Bagley, and members of the Health and Welfare Committee:

The undersigned medical specialty societies, comprising physicians who utilize and/or perform interventional spine procedures to accurately diagnose and treat patients suffering from spine pathologies, are writing to express serious concerns regarding proposed House Bill 941 which seeks to establish restrictions on the physician specialties that can perform specific spine procedures.

Our societies have an established track record demonstrating commitment to research, education, and tracking patient outcomes to promote the safest and most effective patient care. While we certainly support any efforts to ensure that patients receive quality care from qualified physicians, this bill is extremely problematic in its attempt to use legislation to outline which physicians are appropriately trained to perform specific procedures. Our societies stand firmly against state legislatures making such decisions.

Physicians, including anesthesiologists, physiatrists, radiologists, and neurologists, with extensive experience performing image-guided spine procedures, are effectively and safely performing minimally invasive procedures worldwide.

American Academy of Pain Medicine

American Academy of Physical Medicine and Rehabilitation

American College of Radiology

American Society of Anesthesiologists

American Society of Neuroradiology

American Society of Spine Radiology

Society of Interventional Radiology

Spine Intervention Society

Education and Training

Education and Training

- *2-year* fellowship?
- *Increase* advanced procedure requirements?
- *New* sub-specialty track all together?
- Professional Society guidelines?

Professional Societies

Professional Societies

More MPW collaboration?

More multi-society guidelines?

Multi-society training and educational initiatives?

Too many societies = fragmenting of influence… must develop synergies and collaborate

SPECIAL ARTICLES

Safeguards to Prevent Neurologic Complications after Epidural Steroid Injections

Consensus Opinions from a Multidisciplinary Working Group and National Organizations

James P. Rathmell, M.D., Honorio T. Benzon, M.D., Paul Dreyfuss, M.D., Marc Huntoon, M.D., Mark Wallace, M.D., Ray Baker, M.D., K. Daniel Riew, M.D., Richard W. Rosenquist, M.D., Charles Aprill, M.D., Natalia S. Rost, M.D., M.P.H., Asokumar Buvanendran, M.D., D. Scott Kreiner, M.D., Nikolai Bogduk, M.D., Ph.D., D.Sc., Daryl R. Fourney, M.D., Eduardo Fraifeld, M.D., Scott Horn, D.O., Jeffrey Stone, M.D., Kevin Vorenkamp, M.D., Gregory Lawler, M.D., Jeffrey Summers, M.D., David Kloth, M.D., David O'Brien, Jr., M.D., Sean Tutton, M.D.

The Future of Interventional Pain Medicine

- Context -> *HHS, CDC, CMS Policy*
- Emerging Science and Care Paradigms
  - *Discovertebral Pain Paradigm*
  - *New Indications/Applications for Neuromodulation*
  - *Peripheral Joint Denervation*
  - *Regenerative Medicine and Orthobiologics*
  - *Minimally Invasive Pain Surgery*
- Education and Training -> *longer and/or more formal training? Accountability*
- Professional Societies -> *Need collaboration and synergy*

Thank you!

Zachary L. McCormick, MD

Vice Chair and Associate Professor, PM&R

Chief, Division of Spine and Musculoskeletal Medicine

Founding Director, Clinical Spine Research Program

Founding Director, Interventional Spine Fellowship

University of Utah School of Medicine

HEALTH
UNIVERSITY OF UTAH

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