



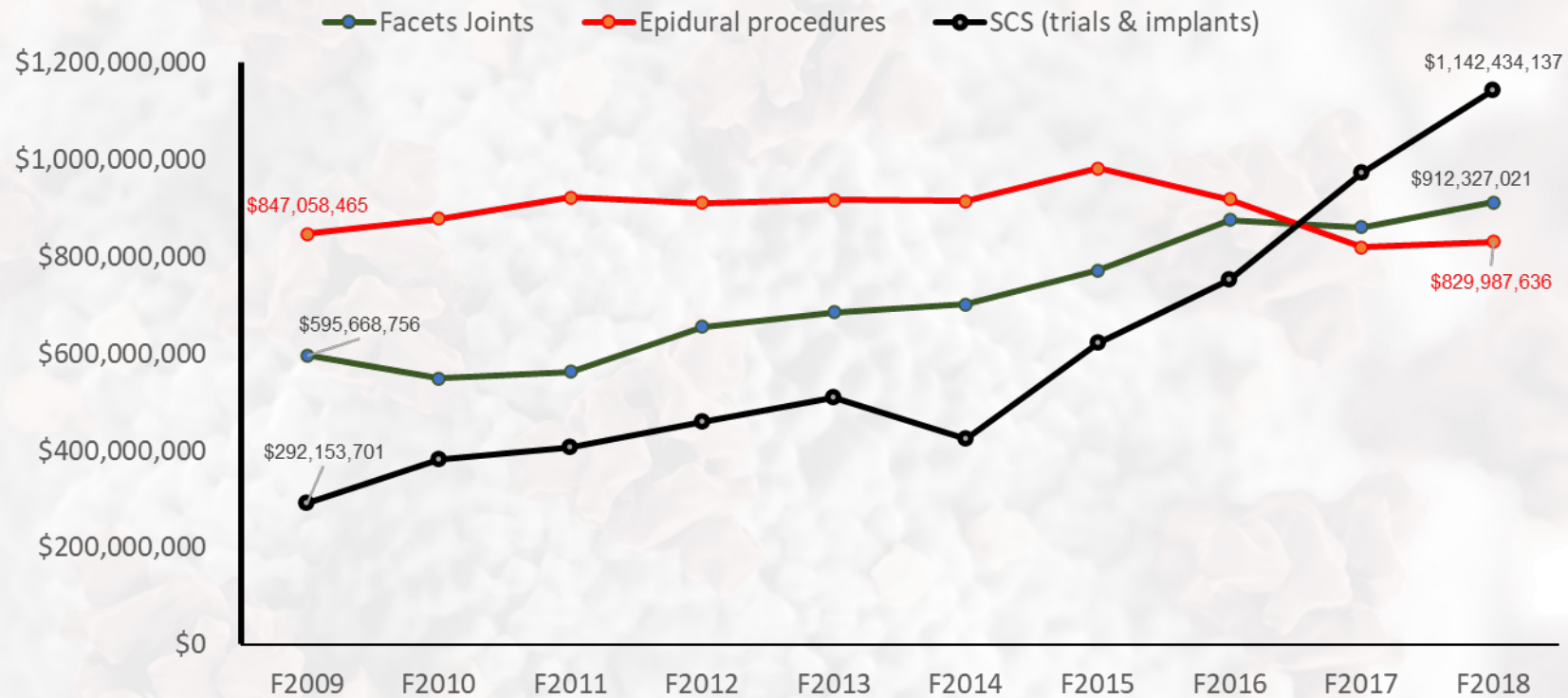
# **FACET JOINT INTERVENTIONS**

## **Evidence Basis, Clinical Relevance, and Cost Utility of Therapy**

Laxmaiah Manchikanti, MD



# Total cost for facet joints interventions, epidural services, spinal cord stimulators on Medicare Beneficiaries



# An Algorithmic Approach to Facet Joint Interventions

- ◆ Diagnostic blocks
  - = 4 components
    - Axial pain > 5
    - 3 months duration
    - Failed with conservative methods
    - No untreated radiculopathy

- ◆ First block  $\geq 80\%$  relief

Positive

Negative

Negative (false positive)

Stop Facet Joint Interventions

- ◆ Second block  $\geq 80\%$  relief

Positive

Radiofrequency or Therapeutic facet joint nerve blocks or intraarticular injections

- ◆ Bilateral at the same time
- ◆ No other procedures with facet joint interventions
- ◆ 3 months or 6 months relief

Diagnostic blocks must be repeated if there is not treatment performed in 2 years

Light sedation is permitted.

No opioids for Diagnostic Blocks.

Contraindicated in patients with anterior lumbar interbody fusion or ALIF  
Moderate sedation or MAC for RF

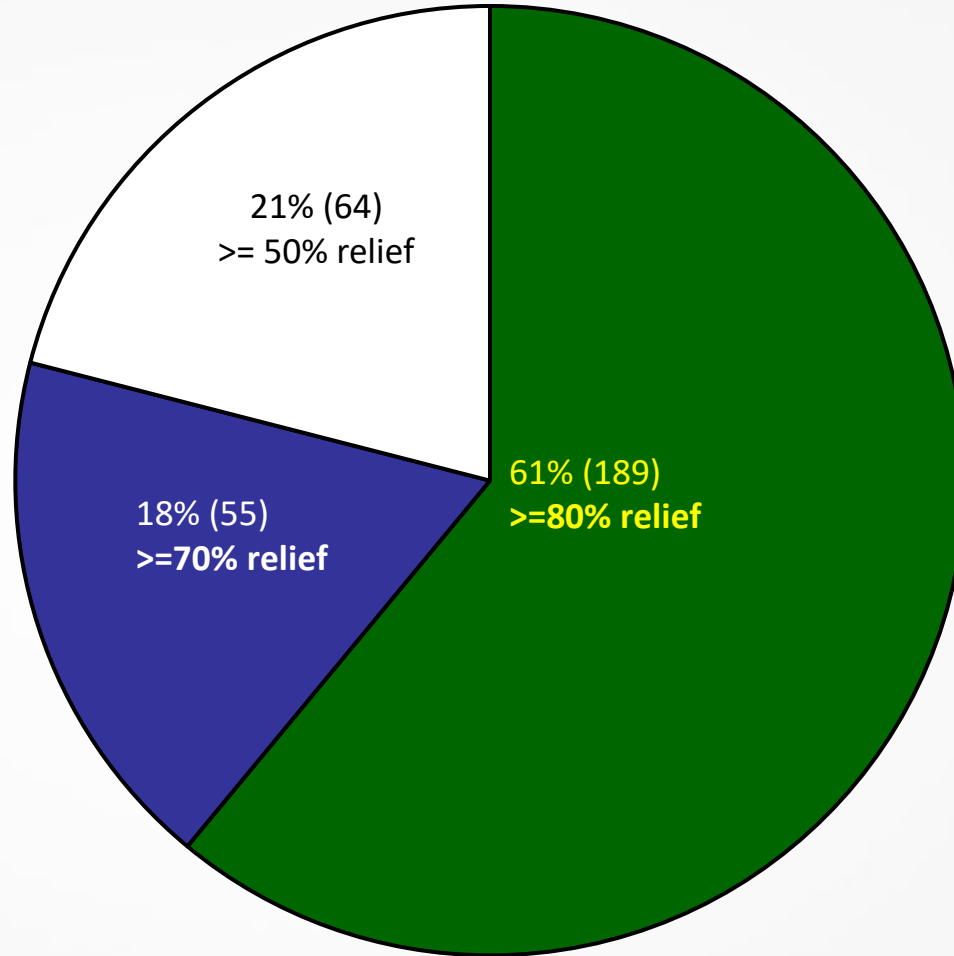


# **Practice Patterns of Facet Joint Interventions**

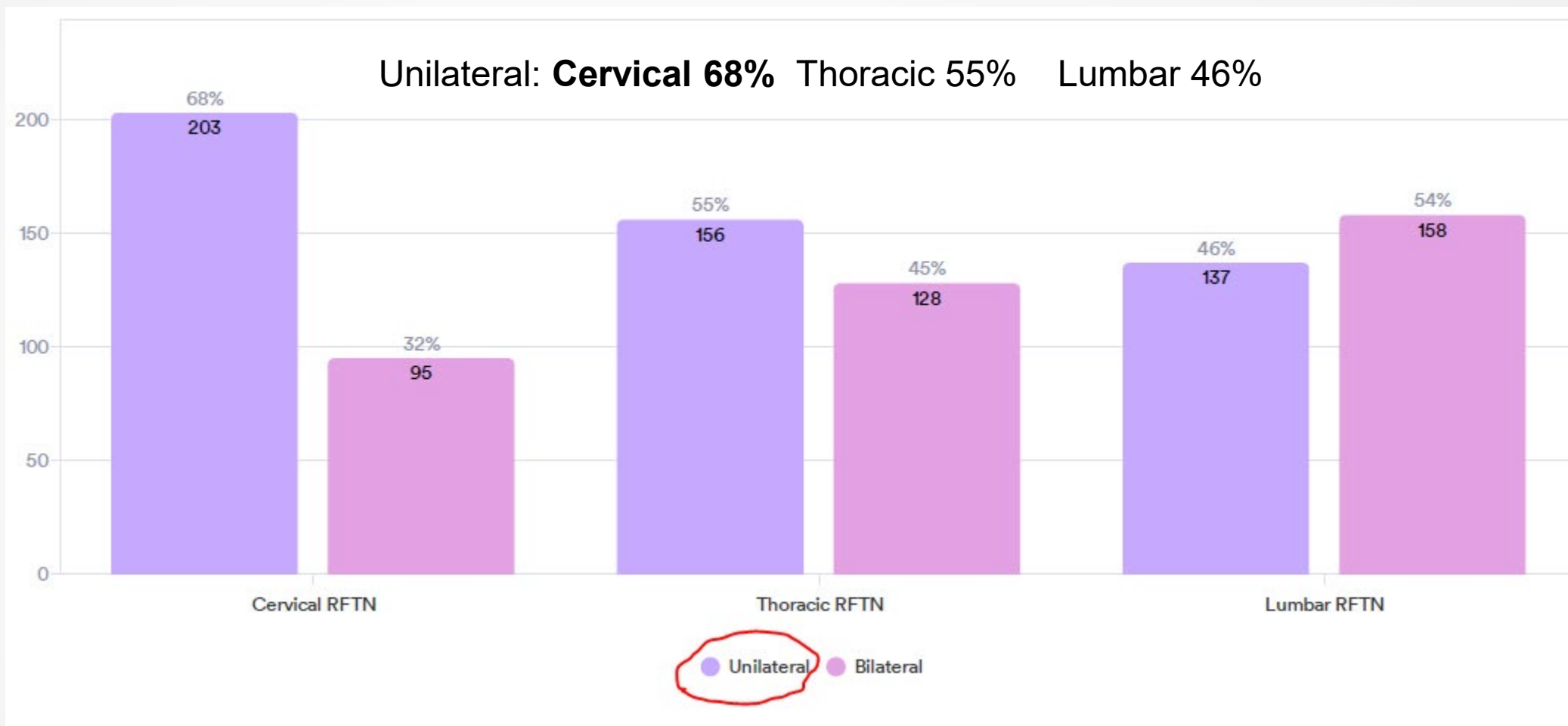
Survey Results



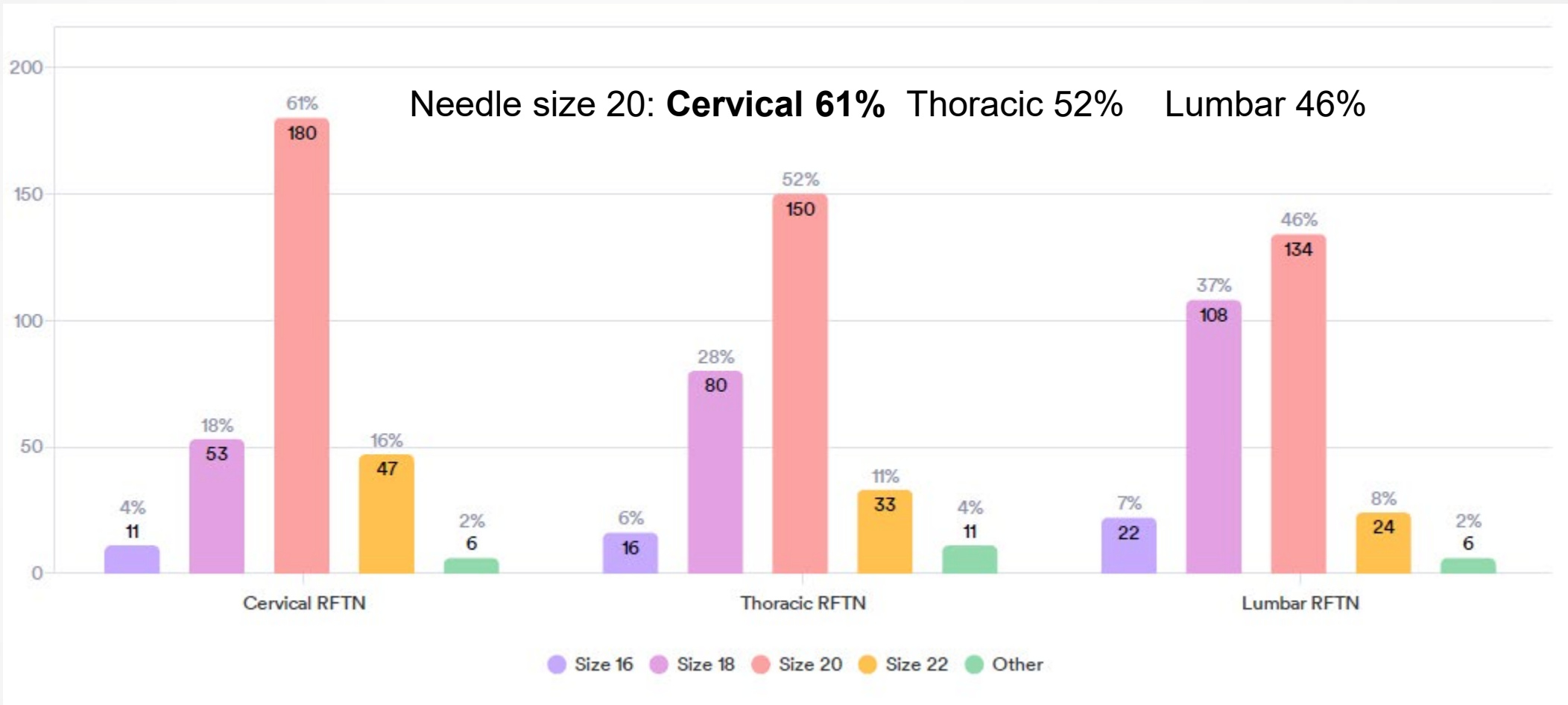
Positive Diagnosis: pain relief/function:



# Laterality: Unilateral or Bilateral

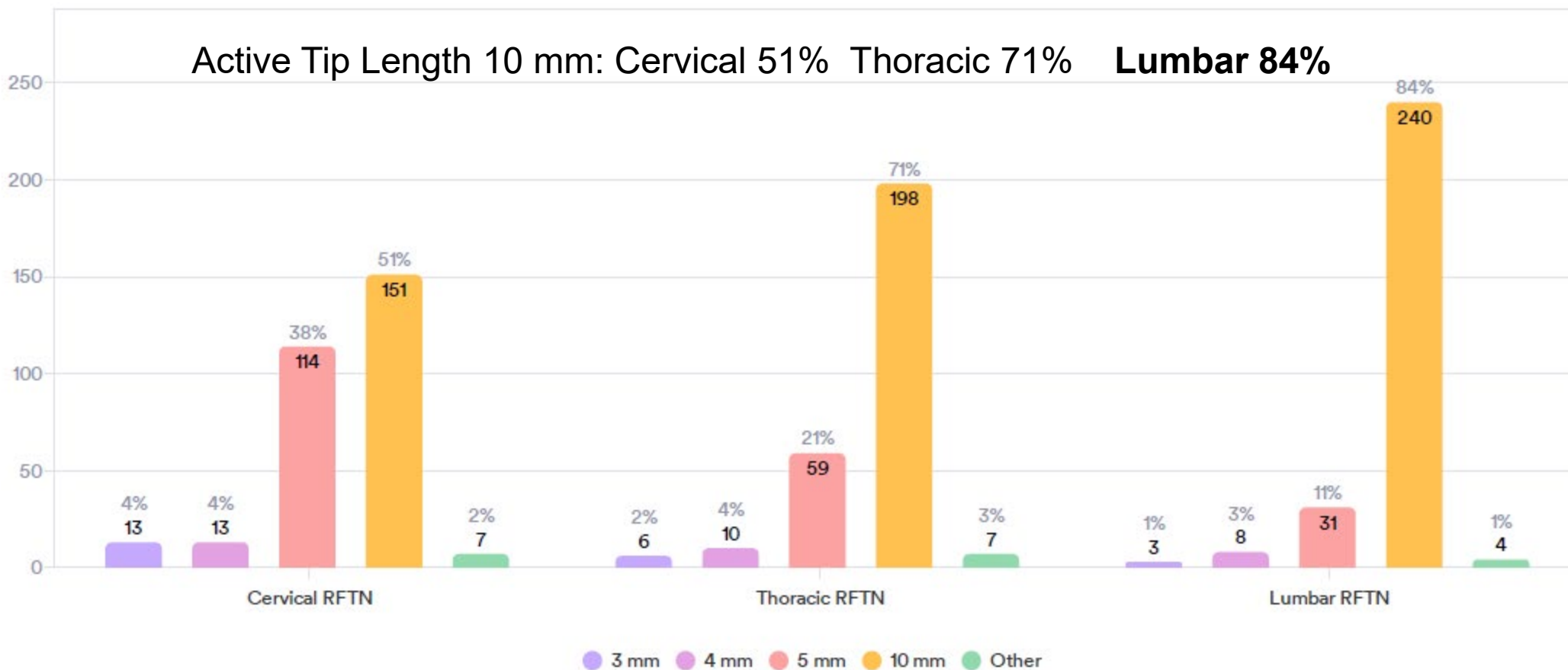


# Needle Size for RFTN

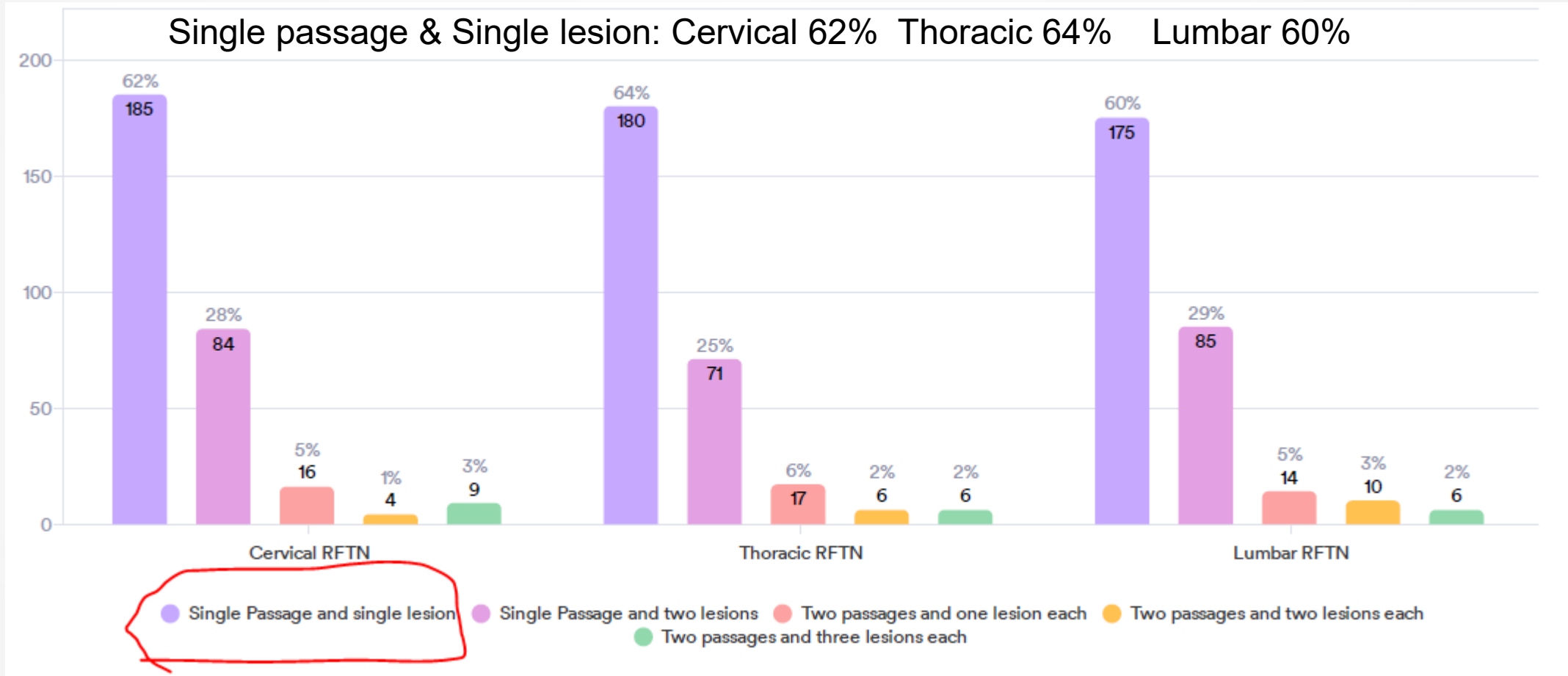


# Active Tip Length (mm)

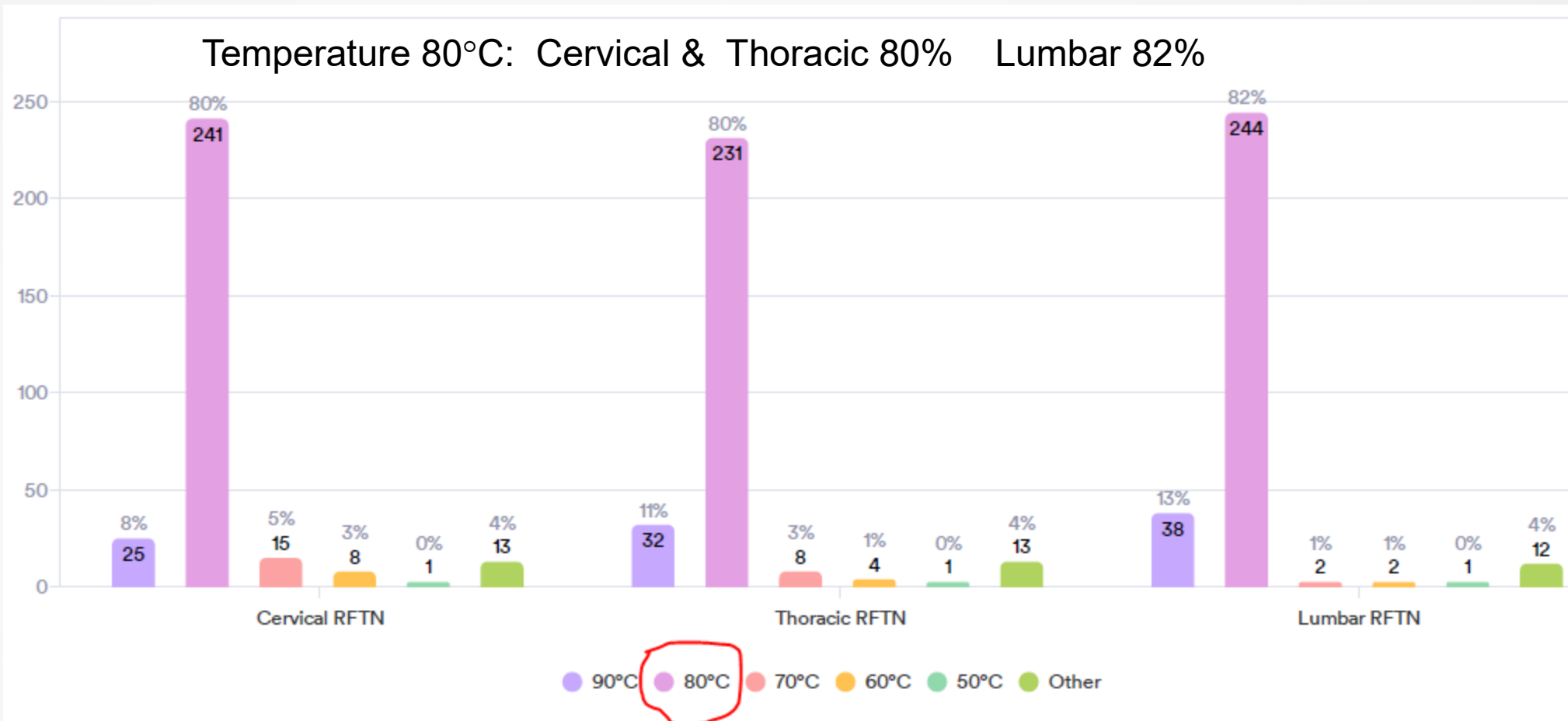
Active Tip Length 10 mm: Cervical 51% Thoracic 71% Lumbar 84%



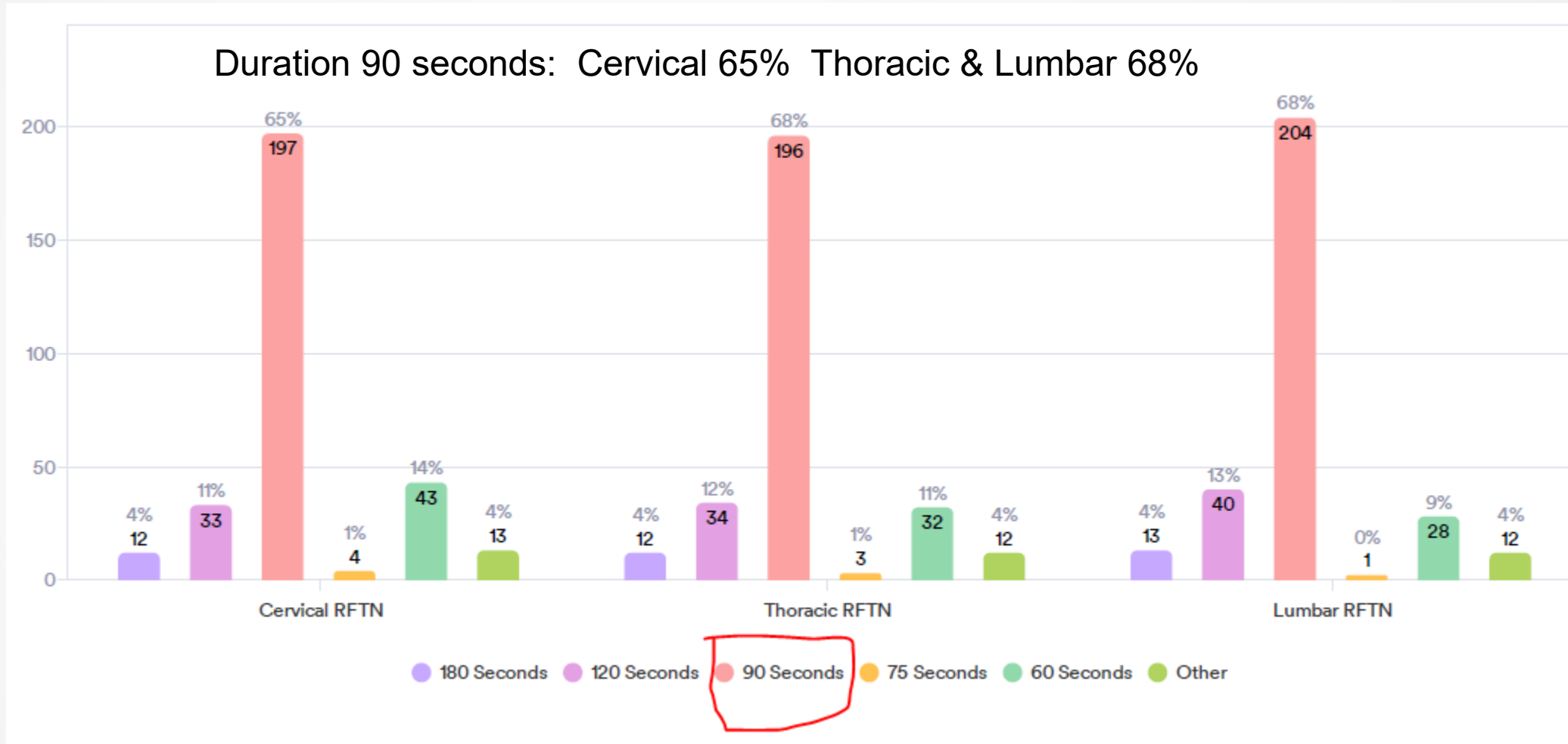
# Number of Passage and Lesions



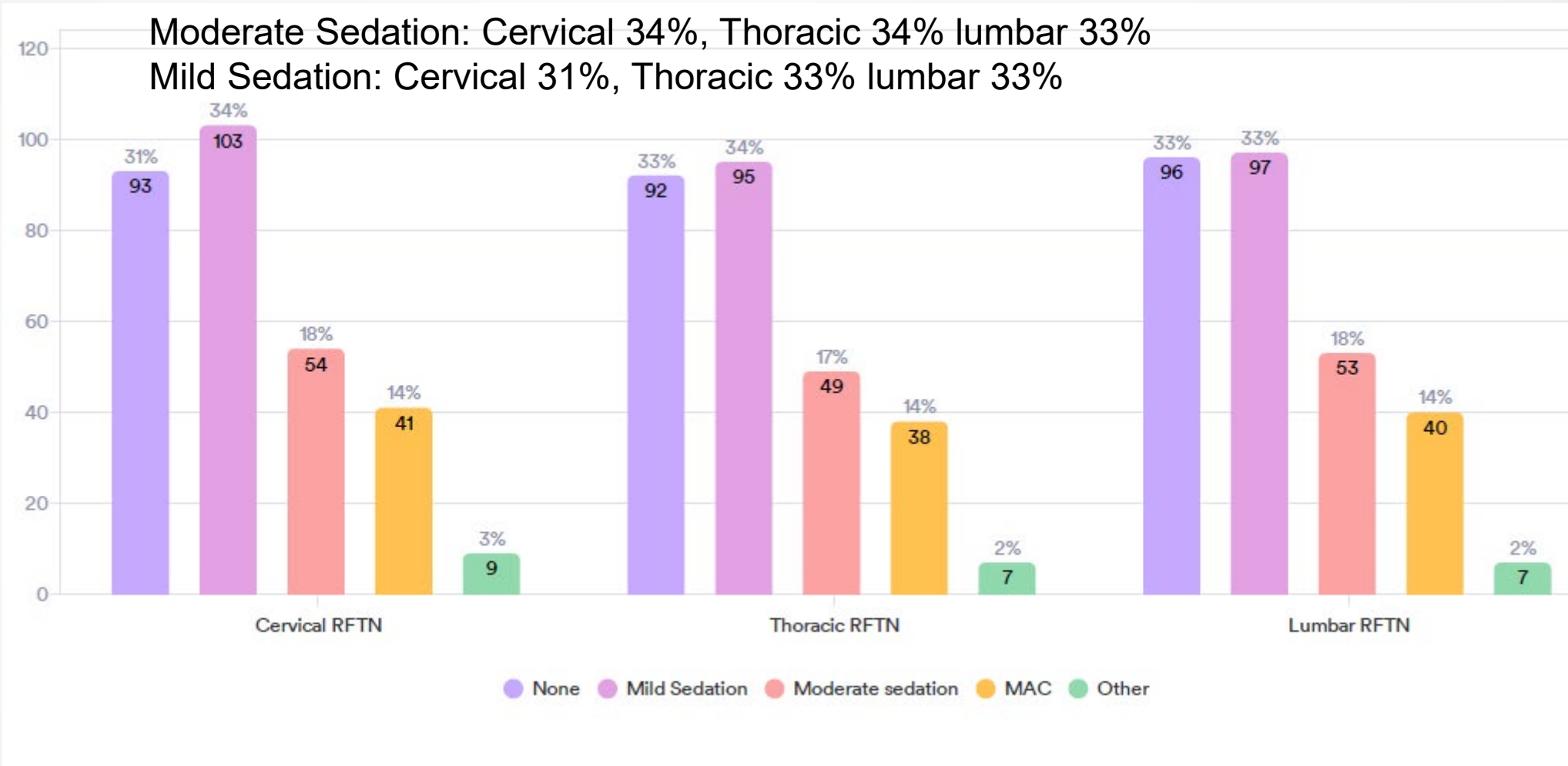
# Temperature (°C) of Lesioning



# Duration (seconds) – How long



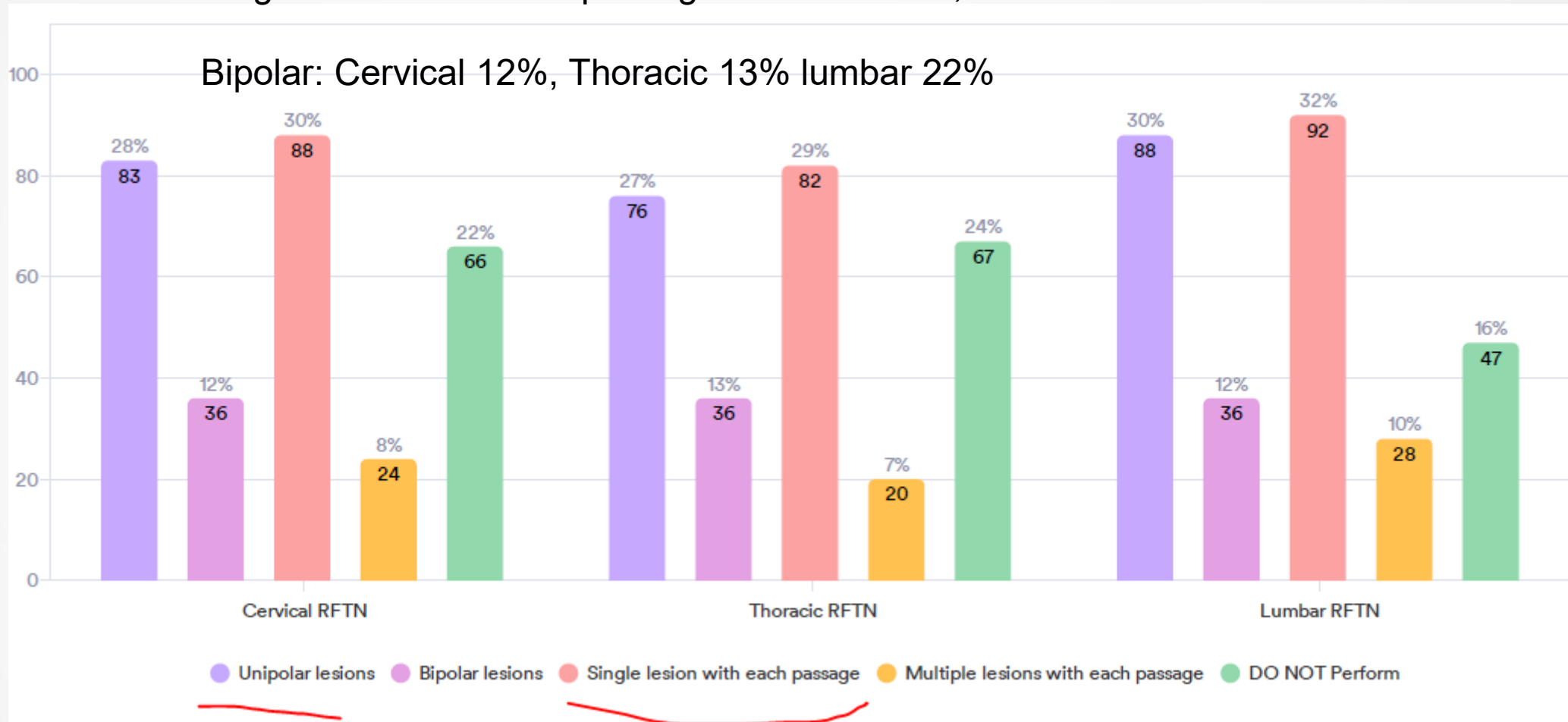
# Typical Sedation for Radiofrequency Neurotomy



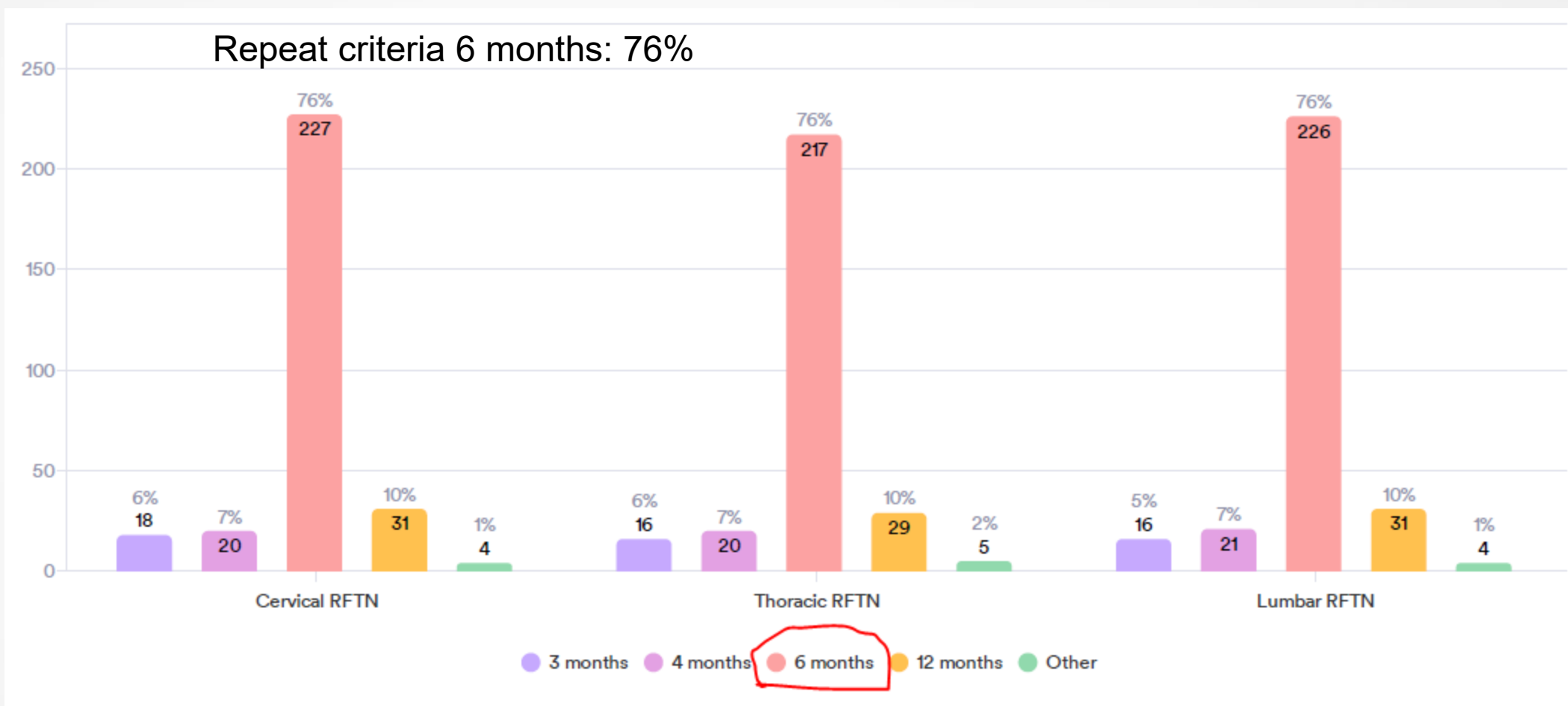
# In Patients with Cardiac Pacemakers and Defibrillators

Single lesion with each passage: Cervical 30%, Thoracic 29% lumbar 32%

Bipolar: Cervical 12%, Thoracic 13% lumbar 22%



# Repeat Criteria (Duration relief with Minimum relief of 50% or improvement in function)



# Lumbar Spine - Evidence synthesis

## Therapeutic:

- **The level of evidence is II with moderate strength of recommendation** for lumbar radiofrequency ablation with inclusion of 11 relevant randomized controlled trials (RCTs) with 2 negative studies and 4 studies with long-term improvement.
- The level of evidence is II with moderate strength of recommendation for therapeutic lumbar facet joint nerve blocks with inclusion of 3 relevant randomized controlled trials, with long-term improvement.
- The level of evidence is IV with weak strength of recommendation for lumbar facet joint intraarticular injections with inclusion of 9 relevant randomized controlled trials, with majority of them showing lack of effectiveness without the use of local anesthetic.

# Efficacy of Radiofrequency Neurotomy in Chronic Low Back Pain: A Systematic Review and Meta-Analysis


Rajesh N Janapala, Laxmaiah Manchikanti, Mahendra R Sanapati, Srinivasa Thota, Alaa Abd-Elsayed , Alan D Kaye, Joshua A Hirsch

**Results:** A total of 12 randomized controlled trials (RCTs) met the inclusion criteria for evaluating the efficacy of lumbar radiofrequency neurotomy. Radiofrequency neurotomy showed Level II evidence for efficacy for both the short term and long term.

**Conclusion:** This systematic review of the assessment of the efficacy of radiofrequency neurotomy in managing chronic low back pain was based on the inclusion of 12 RCTs with a diagnostic block and at least 6 months of follow-up results that showed Level II evidence for both short-term and long-term improvement.

# Systematic Review of the Effectiveness of Lumbar Medial Branch Thermal Radiofrequency Neurotomy, Stratified for Diagnostic Methods and Procedural Technique

*Pain Medicine*, 21(6), 2020, 1122–1141

Byron J. Schneider, MD,\* Lisa Doan , MD,† Marc K. Maes, MD,‡ Kevin R. Martinez, MD,§  
 Alan Gonzalez Cota, MD,¶ and Nikolai Bogduk, MD, PhD||; on behalf of the Standards Division of the  
 Spine Intervention Society

Summary statistics on the success rates (%) and [95% confidence intervals] of lumbar medial branch radiofrequency neurotomy

Procedural Technique		Perpendicular	Parallel				
Definition of successful outcome	100%					23 [20–26]	56 [47–65]
	80%					36 [32–40]	
	50%			64 [51–77]		58 [54–62]	
		26 [12–40]	57 [52–62]		49 [26–62]		
Diagnostic blocks	Criterion	50%	50%	80%	50%	80%	100%
	Number	1 block		1 block		2 blocks	

Success rates at six-month follow-up are plotted according to if electrodes were placed perpendicular or parallel to the target nerve, if one or two diagnostic blocks were used, if the diagnostic criterion was 50%, 80%, or 100% relief of pain, and whether outcome after treatment was 50%, 80%, or 100% relief of pain. Empty cells are ones for which there are no data in the literature.

Original Manuscript

## Equivalent Outcomes of Lumbar Therapeutic Facet Joint Nerve Blocks and Radiofrequency Neurotomy: Comparative Evaluation of Clinical Outcomes and Cost Utility

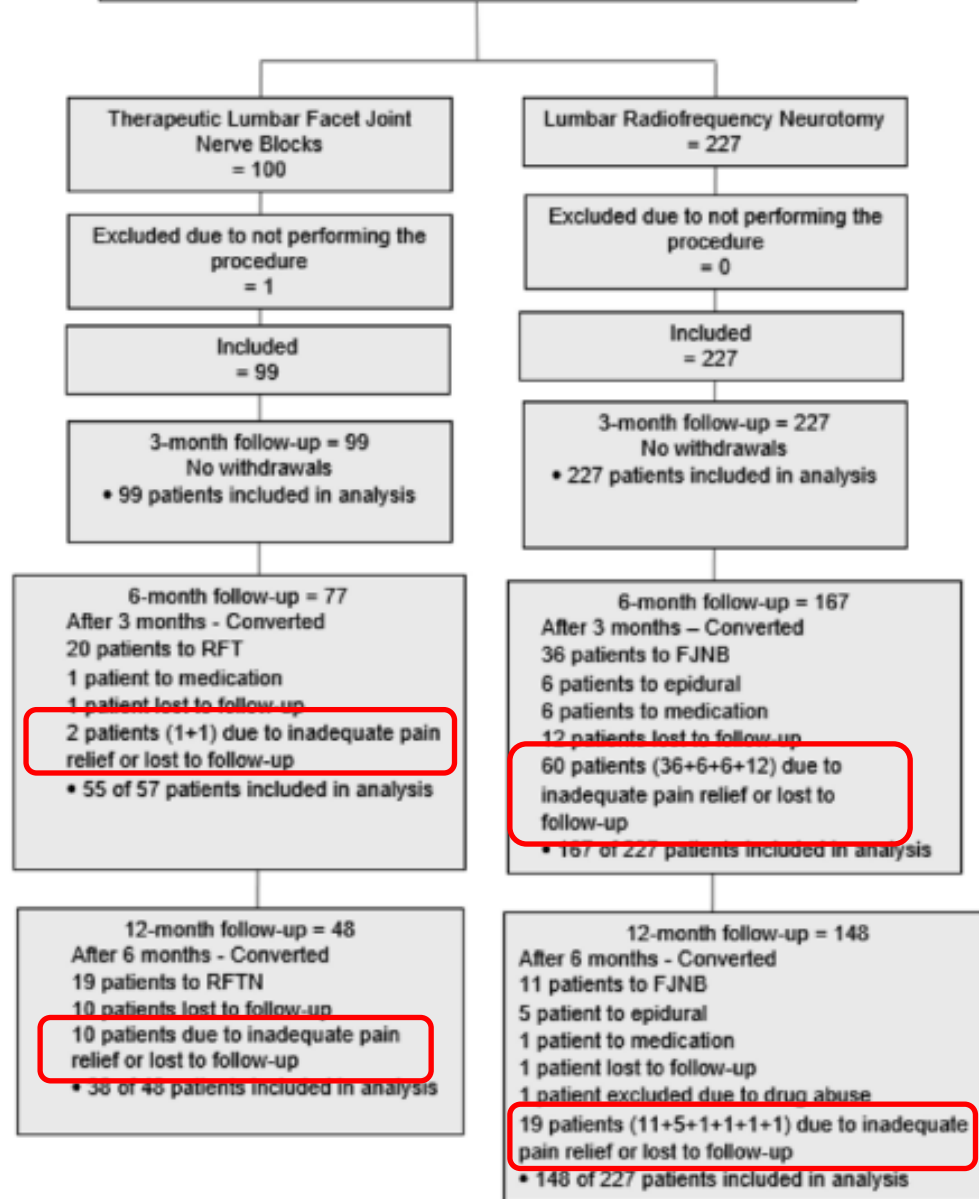
Laxmaiah Manchikanti, MD<sup>1</sup>, Radomir Kosanovic, MD<sup>1</sup>, Vidyasagar Pampati, MSc<sup>1</sup>, Mahendra R. Sanapati, MD<sup>1</sup>, Amol Soin, MD<sup>2</sup>, Nebojsa Nick Knezevic, MD, PhD<sup>3</sup>, Bradley W. Wargo, DO<sup>4</sup>, Joshua A. Hirsch, MD<sup>5</sup>

Patients experienced significant improvement in both groups from baseline to 12 months with significant pain relief ( $\geq 50\%$ ). Significant pain relief was recorded in 100%, 99%, and 79% of the patients in the facet joint nerve block group, whereas, it was 100%, 74%, and 65% in the radiofrequency neurotomy group at the 3, 6, and 12 month follow-up, with a significant difference at 6 months.

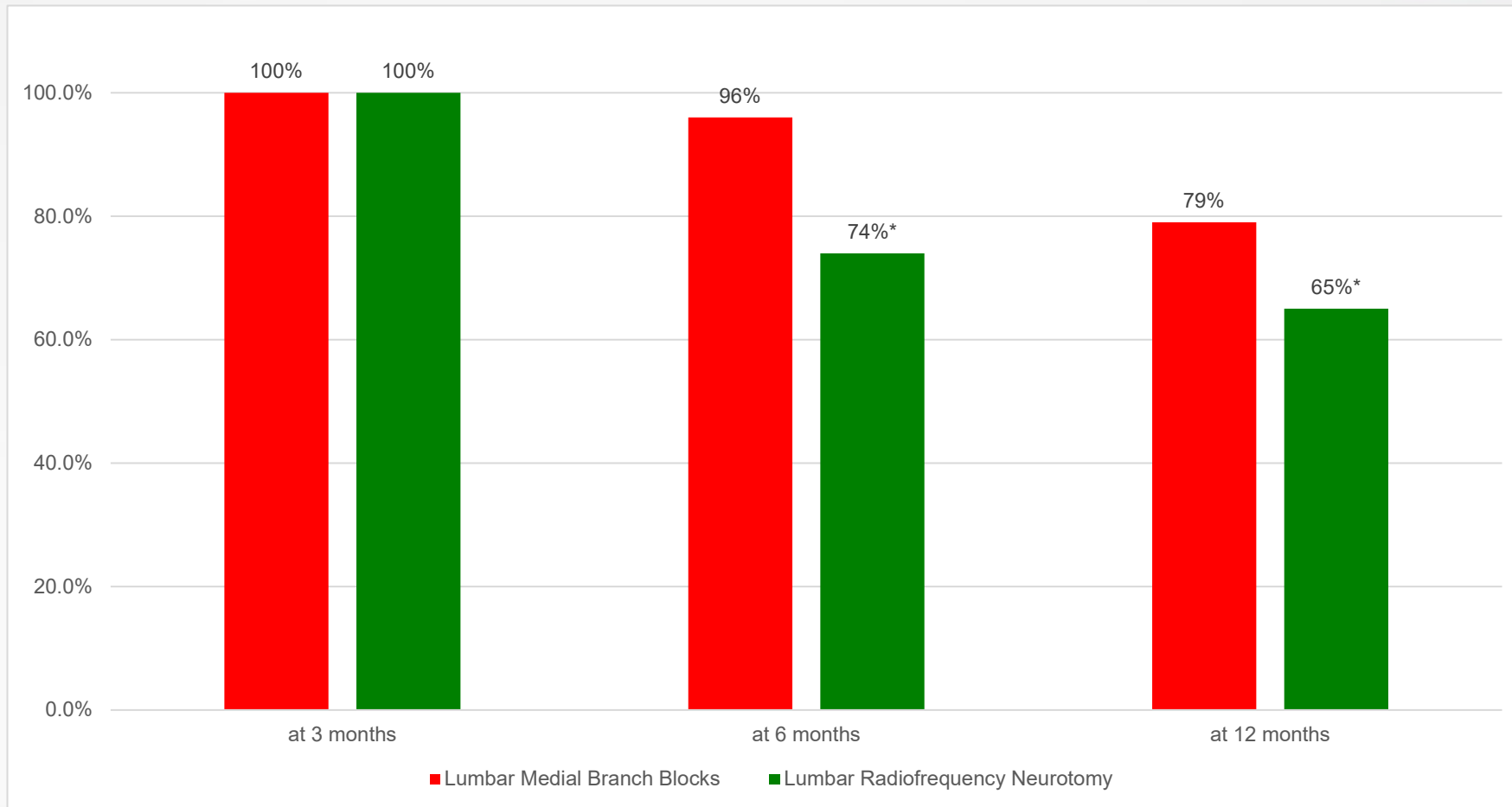
Cost utility analysis showed average costs for quality-adjusted life year (QALY) of \$4,664 for lumbar facet joint nerve blocks and \$5,446 for lumbar radiofrequency neurotomy.

Twelve patients (12%) in the lumbar facet joint nerve block group and 79 patients (35%) in the lumbar radiofrequency group were converted to other treatments, either due to side effects or inadequate relief.

## Lumbar Therapeutic Facet Joint Interventions

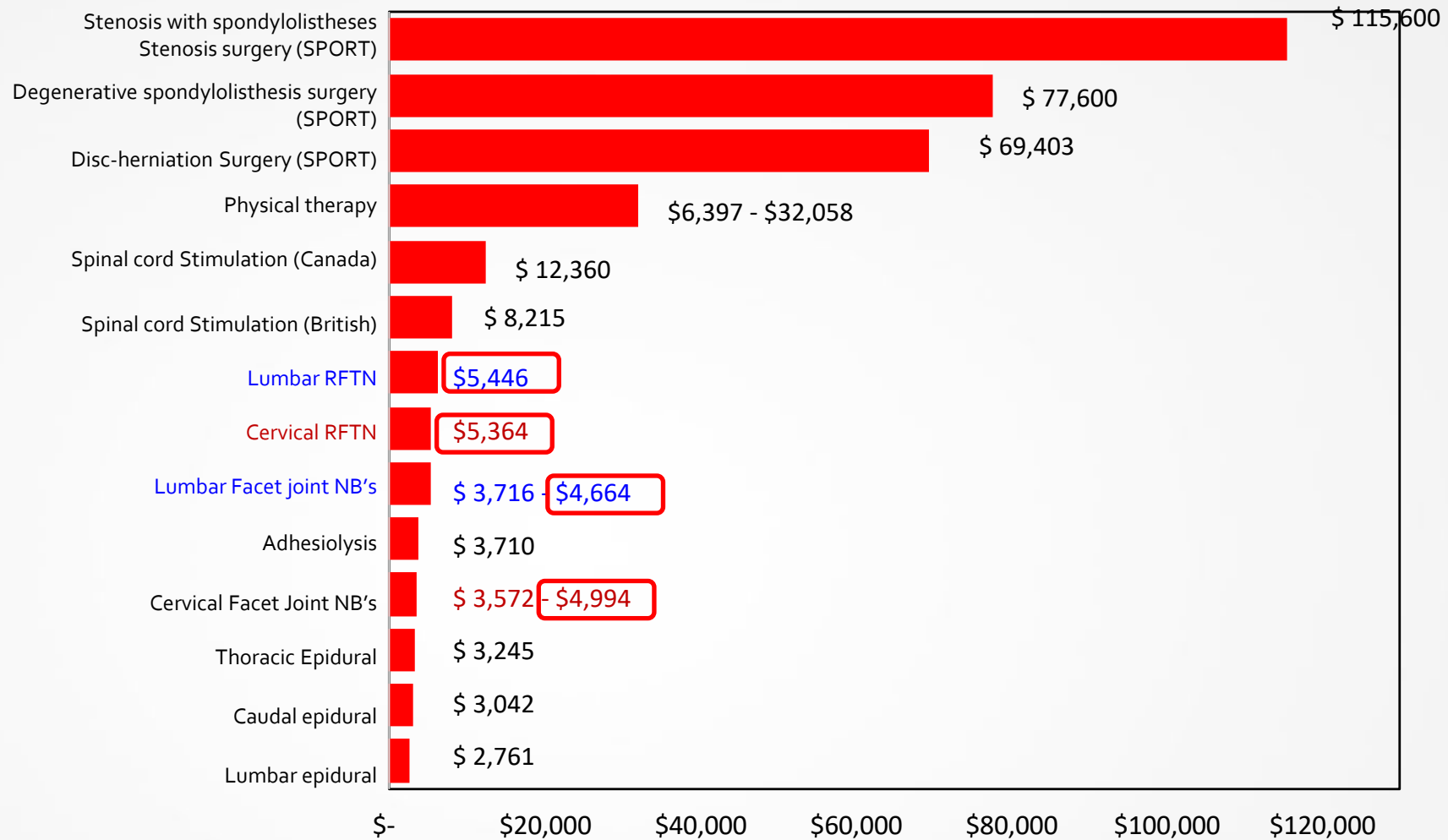


A schematic presentation of patient flow at 1-year follow-up of lumbar facet joint nerve blocks and radiofrequency neurotomy.



Proportion of patients with significant pain relief for lumbar facet joint nerve block and lumbar radiofrequency neurotomy

## Cost Effectiveness per Quality-Adjusted Life-Year (QALY)



# Cervical Spine - Evidence synthesis

## Therapeutic:

- **The level of evidence is II with moderate strength of recommendation** for cervical radiofrequency ablation with inclusion of one randomized controlled trial with positive results and 2 observational studies with long-term improvement.
- The level of evidence is II with moderate strength of recommendation for therapeutic cervical facet joint nerve blocks with inclusion of one relevant randomized controlled trial and 3 observational studies, with long-term improvement.
- The level of evidence is V with weak strength of recommendation for cervical intraarticular facet joint injections with inclusion of 3 relevant randomized controlled trials, with 2 observational studies, the majority showing lack of effectiveness, whereas one study with 6-month follow-up, showed lack of long-term improvement.

# Cervical Radiofrequency Success Rate in Neck Pain

Diagnosis	Number of patients	100% Relief		≥ 50% relief	
		Average	95% CI	Average	95% CI
100% relief Placebo Controlled	64	52%	40% - 64%	NA	NA
100% relief Controlled Comparative	125	61%	52% - 70%	NA	NA
75% relief Controlled Comparative	234	31%	25% - 37%	59%	52% - 66%

Almost all studies included multiple needle placements and multiple lesions

Procedure time: 2 to 5 hours

Engel et al 2020, Pain Medicine

# A Systematic Review and Meta-Analysis of Effectiveness of Radiofrequency Neurotomy in Managing Chronic Neck Pain and Headache

Laxmaiah Manchikanti, MD<sup>1</sup>, Nebojsa Nick Knezevic, MD, PhD<sup>2</sup>, Emilija Knezevic<sup>3</sup>, Salahadin Abdi, MD, PhD<sup>4</sup>, Mahendra R. Sanapati, MD<sup>5</sup>, Amol Soin, MD<sup>6</sup>, Mark V. Boswell, MD, PhD<sup>7</sup>, Sheri L. Albers, DO<sup>8</sup>, Joysree Subramanian, MD<sup>9</sup>, Sairam Atluri, MD<sup>10</sup>, Christopher G. Gharibo, MD<sup>11</sup>, Christopher J. Gilligan, MD<sup>12</sup>, Alaa Abd-Elsayed, MD<sup>13</sup> and Joshua A. Hirsch, MD<sup>14</sup>

- The evidence for managing occipital headache was Level III to IV with qualitative analysis and single-arm meta-analysis with inclusion of 15 patients in the treatment group in a positive RCT and 134 patients in observational studies.
- Based on the qualitative and quantitative analysis with single arm meta-analysis with inclusion of one RCT of 12 patients in the treatment group and 8 positive observational studies with inclusion of 589 patients showing positive outcomes with moderate to high clinical applicability, the evidence is Level II in managing neck pain with cervical radiofrequency neurotomy.
- An overwhelming majority of the studies produced multiple lesions.

**Comparative Effectiveness Study**

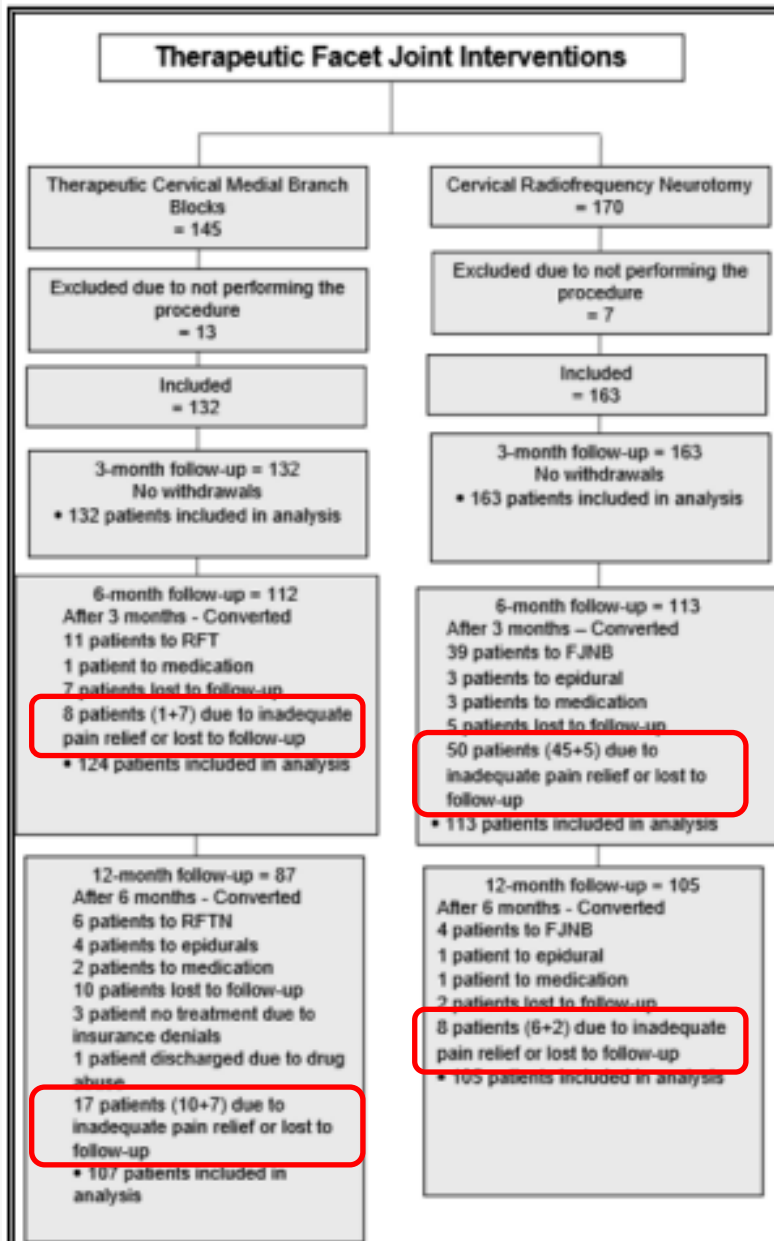
**Outcomes of Cervical Therapeutic Medial Branch Blocks and Radiofrequency Neurotomy: Clinical Outcomes and Cost Utility are Equivalent**

Laxmaiah Manchikanti, MD<sup>1</sup>, Radomir Kosanovic, MD<sup>1</sup>, Vidyasagar Pampati, MSc<sup>1</sup>, Mahendra R. Sanapati, MD<sup>1</sup>, and Joshua A. Hirsch, MD<sup>2</sup>

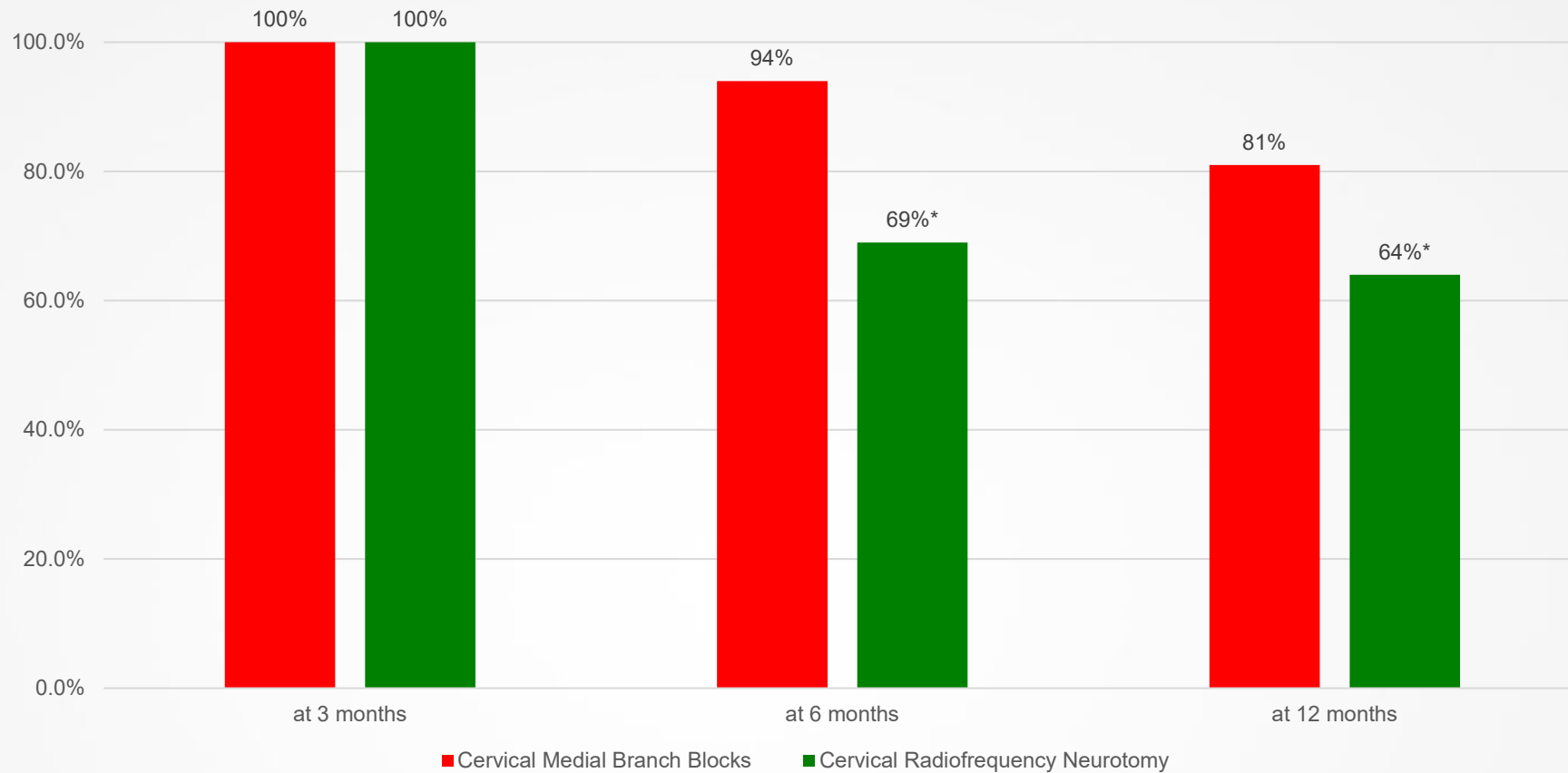
There was significant improvement in both groups from baseline to 12 months with pain relief and proportion of patients with  $\geq 50\%$  pain relief. Average relief of each procedure for cervical medial branch blocks was 13 to 14 weeks, whereas for radiofrequency neurotomy, it was 20 to 25 weeks. Significant pain relief was recorded in 100%, 94%, and 81% of the patients in the medial branch blocks group, whereas it was 100%, 69%, and 64% in the radiofrequency neurotomy group at 3, 6, and 12 month follow-up, with significant difference at 6 and 12 months.

Cost utility analysis showed average cost for quality-adjusted life year (QALY) of \$4,994 for cervical medial branch blocks compared to \$5,364 for cervical radiofrequency neurotomy.

Six of 132 patients (5%) in the cervical medial branch group and 53 of 163 (33%) patients in the cervical radiofrequency neurotomy group were converted to other treatments, either due to side effects (6 patients or 4%) or inadequate relief (47 patients or 29%).

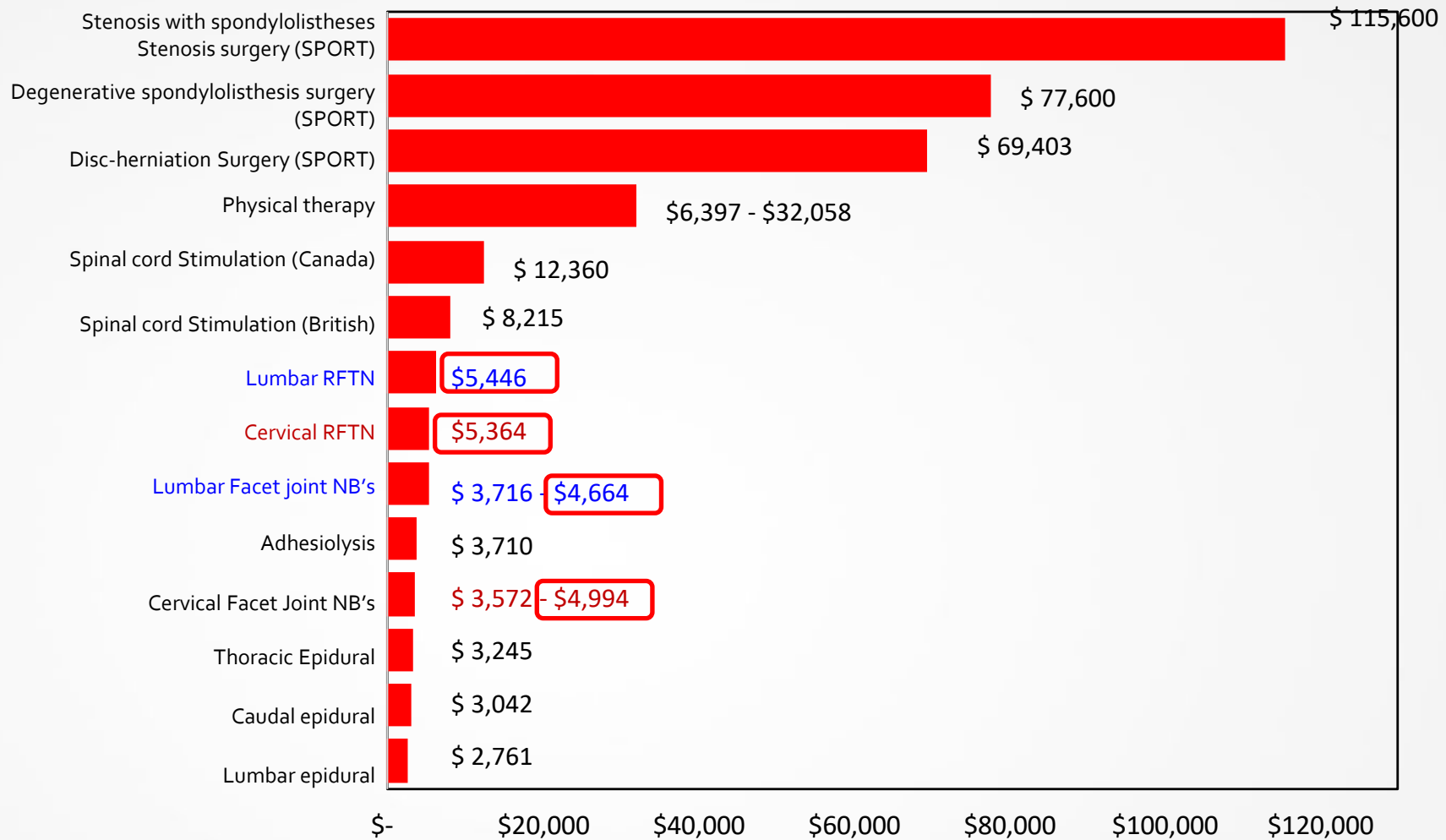


A schematic presentation of patient flow at 1-year follow-up



*Proportion of patients with significant pain relief for Cervical Medial Branch Blocks and Cervical Radiofrequency Neurotomy*

# Cost Effectiveness per Quality-Adjusted Life-Year (QALY)



# Thoracic Spine - Evidence Synthesis

## Therapeutic:

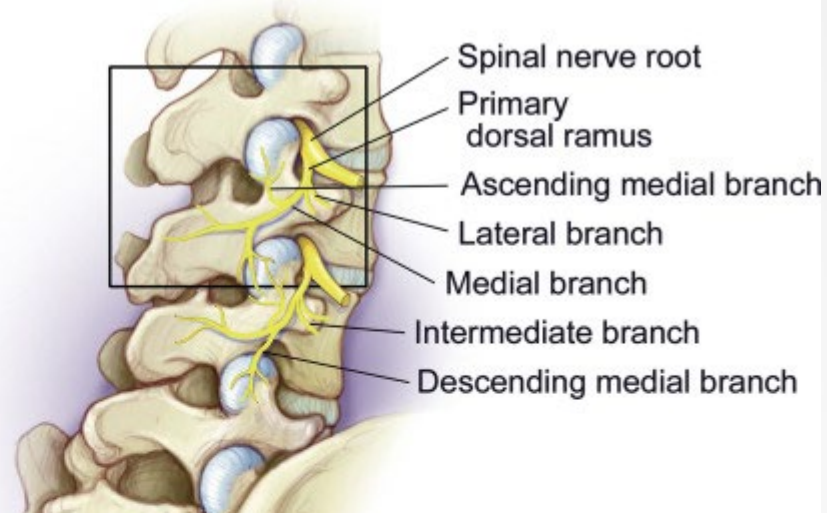
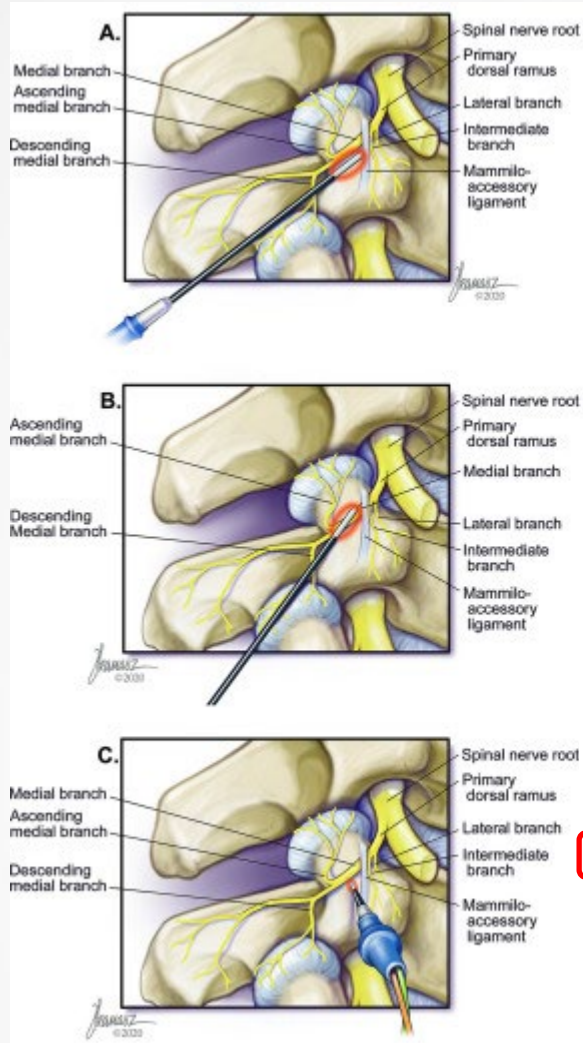
- The level of evidence is III with weak to moderate strength of recommendation with emerging evidence for thoracic radiofrequency ablation with inclusion of one relevant randomized controlled trial and 3 observational studies.
- The level of evidence is II with moderate strength of recommendation for thoracic therapeutic facet joint nerve blocks with inclusion of 2 randomized controlled trials and one observational study with long-term improvement.
- The level of evidence is III with weak to moderate strength of recommendation for thoracic intraarticular facet joint injections with inclusion of one randomized controlled trial with 6 months follow-up, with emerging evidence.

# Therapeutic Response of Radiofrequency of Neurotomy

- Diagnostic Blocks
- None
- Controlled
- 30%, 50%, 80%, 100%

# Multiple Factors

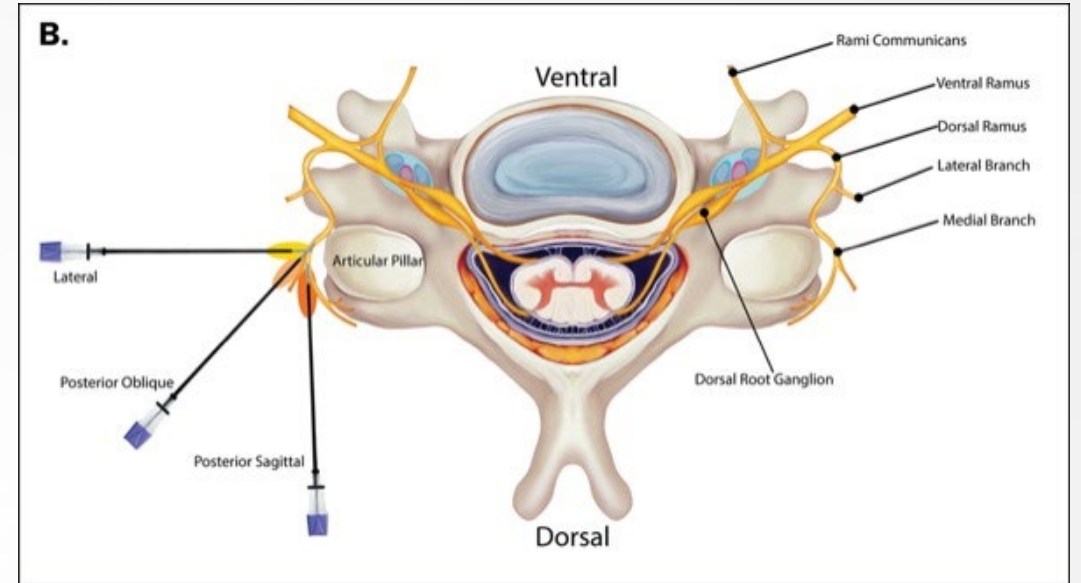
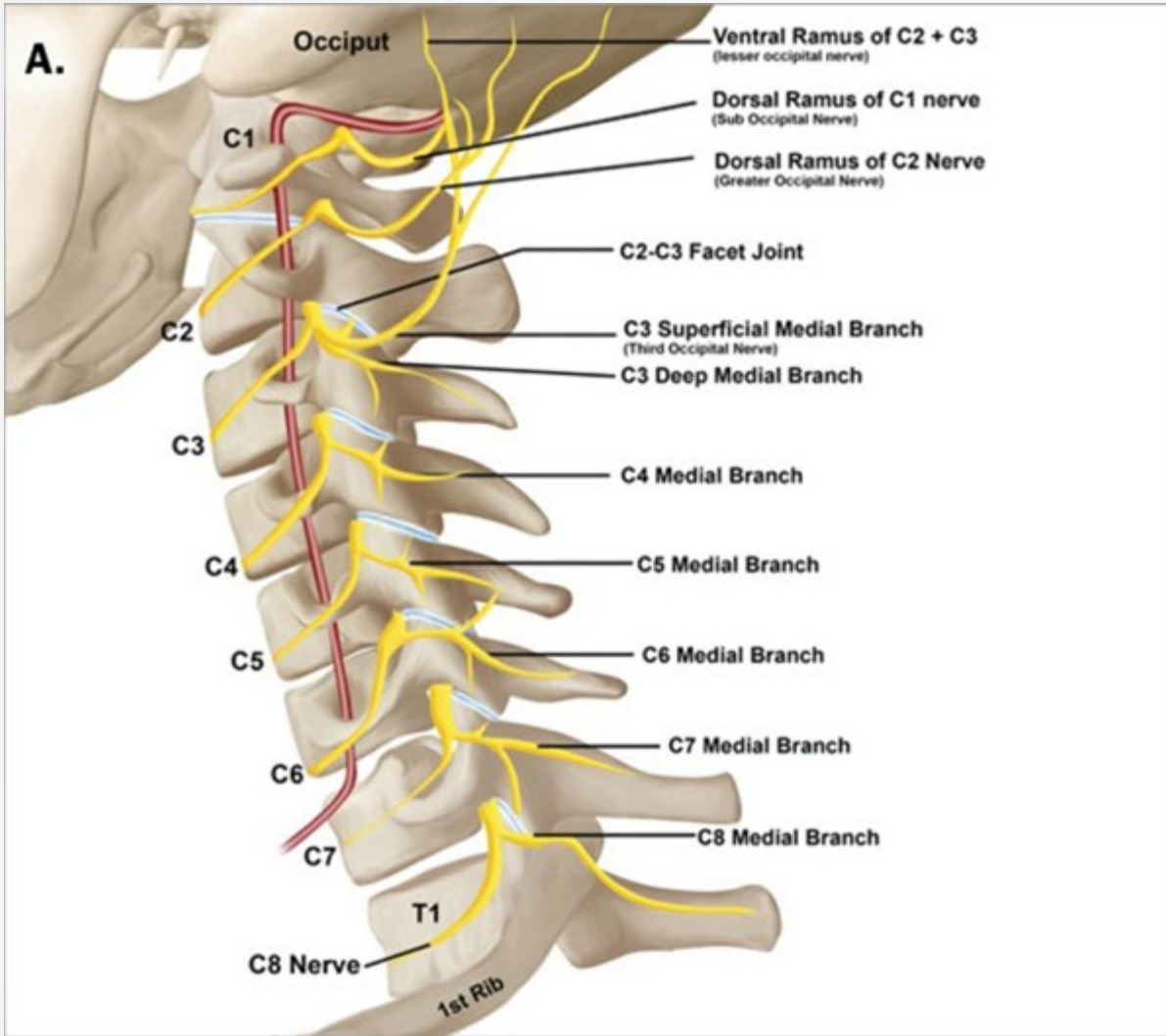
- Needle placement
- Parallel
- Perpendicular



(A) Parallel insertion of electrodes. Parallel placement may result in a higher likelihood of missing the nerve than with near-parallel orientation.

(B) Near-parallel insertion of electrodes. This may result in the highest likelihood of medial branch nerve ablation.

(C) Perpendicular insertion of electrodes. This theoretically results in the highest chance of missing the nerve, which may be more likely when the medial branch is entrapped beneath the mammilo-accessory ligament.



Posterior (A) and sagittal (B) images demonstrating the relationship between the upper cervical joints, vertebral artery and nerve supply. Hurley RW, et al. *Reg Anesth Pain Med* 2022;47:3–59. Illustrations by Mohesh Mohan.

# Procedural Issues

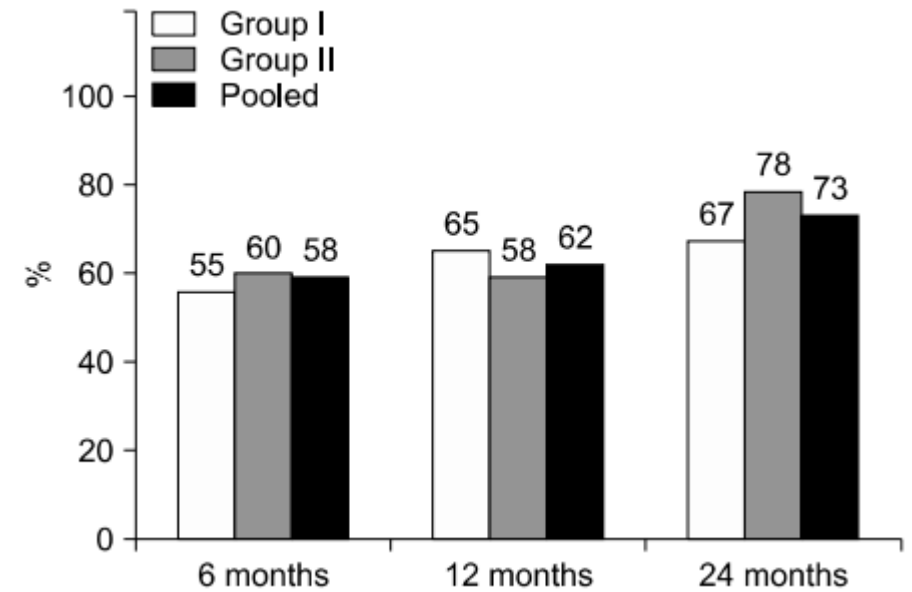
- Needle size
  - Cervical - 22, 20, 18
  - Lumbar – 22, 20, 18
  - Thoracic - 22, 20, 18
- Exposed TIP – 5 mm or 10 mm
- Number of passages and Lesions
- 1 – 3 passages
- 1- 2 Lesions
- Temperature
  - **80°**
  - < 80°
  - > 80°
- Duration Lesioning
  - 60 Seconds
  - 90 Seconds
  - 120 Seconds
  - 180 Seconds

# Therapeutic Lumbar Facet Joint Nerve Blocks

	Group I	Group II	Pooled
<b>Numeric rating score</b>			
Baseline	8.2 ± 0.8	7.9 ± 1.0	8.1 ± 0.9
6 months	3.6* ± 1.5 (83%)	3.3* ± 0.8 (93%)	3.4 ± 1.1 (88%)
12 months	3.7* ± 1.7 (82%)	3.5* ± 1.1 (85%)	3.6 ± 1.2 (83%)
24 months	3.5* ± 1.5 (85%)	3.2* ± 0.9 (90%)	3.3 ± 1.2 (87%)
<b>Oswestry disability index</b>			
Baseline	26.6 ± 4.6	25.9 ± 5.0	26.3 ± 4.8
6 months	12.7* ± 4.7 (58%)	12.2* ± 5.0 (50%)	12.3 ± 5.0 (59%)
12 months	12.3* ± 4.8 (68%)	11.8* ± 5.4 (65%)	12.1 ± 5.1 (67%)
24 months	12.0* ± 4.9 (70%)	11.0* ± 4.8 (78%)	11.5 ± 4.9 (74%)

(\*) illustrates proportion with significant pain relief ( $\geq 50\%$ ) pain and 40% disability from baseline. \*Significant difference with baseline values within the group ( $P < 0.001$ ).

## Pain Relief and Functional Assessment Evaluated by Oswestry Disability Index Characteristics in Randomized Controlled Trial of Lumbar Facet Joint Nerve Blocks

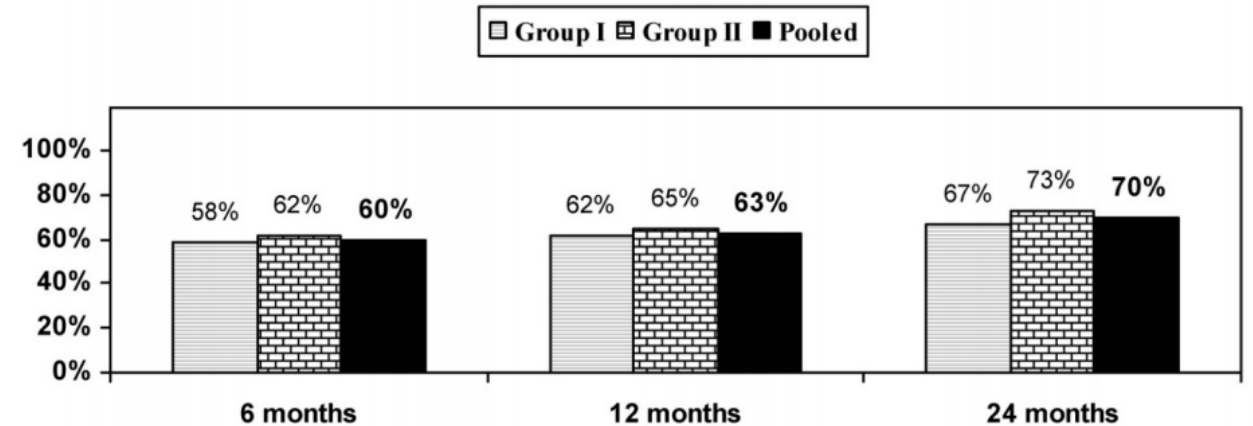


Data from randomized controlled trial of lumbar facet joint nerve blocks showing proportion of patients with significant reduction in Numeric Rating Score (NRS  $\geq 50\%$  reduction from baseline) and Oswestry Disability Index (ODI  $\geq 40\%$  reduction from baseline)

# Therapeutic Cervical Facet Joint Nerve Blocks

Numeric Rating Score	Group I	Group II	Pooled
Baseline	8.2 ± 0.8	8.2 ± 1.1	8.2 ± 1.0
6 months	3.6 ± 1.1 (87%)	3.5 ± 0.7 (95%)	3.4 ± 0.9 (91%)
12 months	3.7 ± 1.2 (85%)	3.4 ± 0.9 (91%)	3.6 ± 1.0 (88%)
24 months	3.5 ± 1.0 (85%)	3.2 ± 1.0 (93%)	3.3 ± 1.0 (89%)
<b>Neck Disability Index</b>			
Baseline	25.4 ± 5.9	25.1 ± 5.0	25.3 ± 5.5
6 months	12.2 ± 5.9 (78%)	11.6 ± 4.2 (88%)	11.9 ± 5.1 (83%)
12 months	11.9 ± 5.4 (85%)	11.7 ± 4.5 (85%)	11.8 ± 5.0 (85%)
24 months	11.5 ± 5.1 (85%)	11.0 ± 4.7 (90%)	11.2 ± 4.9 (87%)

(\_\_\_\_) illustrates proportion with significant pain relief (≥ 50%) from baseline



Proportion of patients with significant reduction in Numeric Rating Score (NRS) and Neck Disability Index (NDI) (≥ 50% reduction from baseline) with therapeutic cervical facet joint nerve blocks.

Pain relief and functional assessment evaluated by Neck Disability Index (NDI) characteristics with therapeutic cervical facet joint nerve blocks

## Cost Utility Analysis of Therapeutic Cervical Facet Joint Nerve Blocks in Managing Chronic Low Back Pain



*Thank You*



**Laxmaiah Manchikanti, MD**

Phone: (270) 554-8373 ext 101

Phone (ASIPP): (270) 554-9412

E-mail: [drm@asipp.org](mailto:drm@asipp.org)

<https://www.linkedin.com/in/laxmaiahmanchikanti>

<https://www.linkedin.com/company/american-society-of-interventional-pain-pain-physicians>

<https://www.linkedin.com/company/sipms>