A detailed anatomical illustration of a section of the human cervical spine, showing the vertebrae, intervertebral discs, and the surrounding soft tissue structures. The illustration is rendered in a light, sketch-like style and is positioned on the left side of the slide, partially overlapping the text box.

Safety and Efficacy of Cervical Spine Outpatient Minimally Invasive Decompression. Treatment of Cervical Radiculopathy --- Foraminal Stenosis

Michael C. Weiss, DO, FAOAO  
Chairman, Department of Surgery



## Disclosures

- No disclosures to report



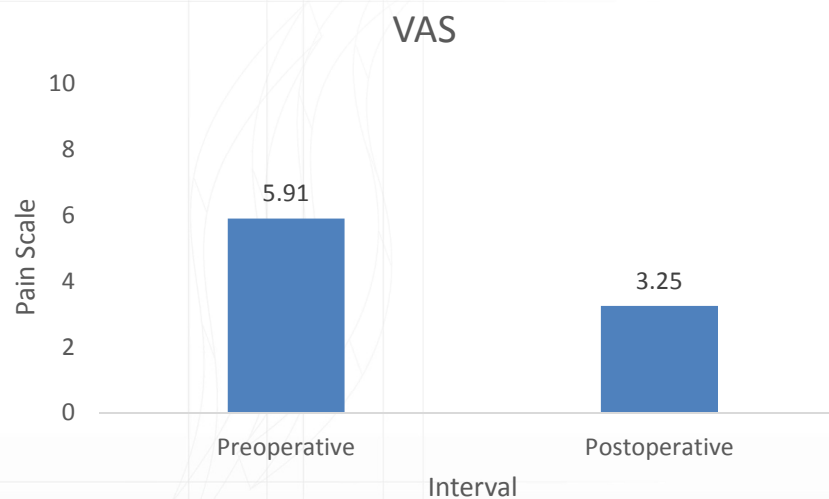
## Background & Methods

- Data was collected on 1,695 patients who underwent a minimally invasive decompression (single and multilevel) via posterior laminotomy and foraminotomy between October, 2010 and July, 2016
  - Follow up ranges from 3-60 months postoperative
    - Average follow up was 263 days
- Questionnaires (preoperative and 3-60 months postoperative)
  - Visual Analog Scale (VAS)
    - Self-reported pain with a possible score ranging from 0-10
  - Neck Disability Index (NDI)
    - Self-reported disability with a possible score ranging from 0-50
      - A range of 0-100 was used in case studies
  - Return to Work (RTW)
    - Self-reported interval at which the patient returned to their usual occupation



# VAS

Measure	N	Mean	Std. Dev.	P-Value
VAS				
Preoperative	1695	5.91	2.26	<.001
Postoperative		3.25	2.79	
Difference		2.66		

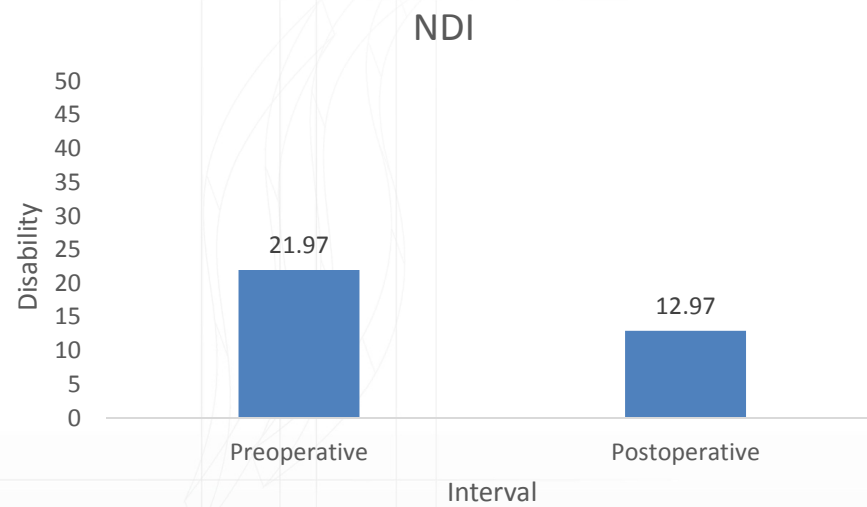


\*Calculated using Student t-test in Stata



# NDI

Measure	N	Mean	Std. Dev.	P-Value
NDI				
Preoperative	1695	21.97	8.61	<.001
Postoperative		12.97	10.55	
Difference		9		



\*Calculated using Student t-test in Stata



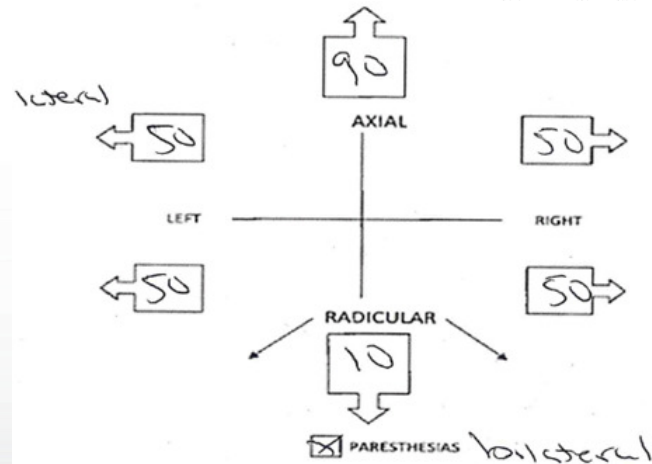
## Return to Work

- 1,240 patients were included in the analysis
  - 1,516 patients responded
    - 276 patients were removed for indicating *disabled, retired, or homemaker*
- 1,083 (87.3%) patients reported returning to their usual occupation at their follow up interval
  - 1,005 (81%) patients returned within 3 months
    - 490 (39.5%) patients returned in less than one month



## Case Study 1 - History

- 61 year old white male with cervical spine issues
- BMI of 28.56
- No previous spine surgeries
- CHIEF COMPLAINT: Patient reports neck pain for last 2 years that radiates down both arms to fingertips with numbness and tingling.





## History of Present Illness

- Patient has experienced neck pain for 2 years
  - Numbness and tingling radiates down both arms to fingertips
  - Pain increased with any activity, turning/tilting head, twisting/turning, everything
    - Daily activities adversely affected by pain
  - Medication only reduces pain
- Failed/minimal relief conservative treatments
  - Anti-inflammatory medication, muscle relaxants, narcotic pain relievers
- Intensity - On a scale of 1-10, with 10 being the worst pain imaginable, the patient reports their average pain level when resting as 9-10, when active as 10-10, now as 9-10



## Physical Examination

- Spinal Exam
  - Deep Tendon Reflexes = Biceps left: 1+. Biceps right: 2+. Brachioradialis left: 1+. Brachioradialis right: 2+. Patellar left: 2+. Patellar right: 2+ Triceps left: 1+. Triceps right: 2+. Achilles left: 2+. Achilles right: 2+.
  - No LE Edema, no UE Edema
  - No atrophy
  - Heel walk = left, normal : right, normal
  - Toe walk = left, normal : right, normal
  - Gait = normal
- Spinal Exam – Sensory/Palpation
  - Dermatomes
    - Left – Cervical: Normal
    - Right – Cervical: Normal
  - Spinal Tenderness
    - Cervical: C1/2: No pain. C2/3: No tenderness. C3/4: Both. C4/5: Both. C5/6: Both. C6/7: Both. C7/T1: Both.



# Physical Examination Continued

- Spinal Exam – Range of Motion
  - Cervical: Flexion painful. Flexion limited. Hyperextension limited. Hyperextension painful. Lateral Flexion painful: Bilateral. Lateral Flexion limited: Bilateral. Rotation painful: Bilateral. Rotation limited: Bilateral.
- Spinal Exam – Provocative Tests
  - Cervical Tests
    - Clonus test – Left: negative. Right: negative
    - Hoffman’s Test – Left: negative. Right: negative
    - Froment’s Test – Left: negative. Right: negative.
    - Jackson’s Compression Test – Left: positive. Right: positive.
    - Phalen’s Test – Left: positive. Right: positive.
    - Spurling’s (Foraminal Compression) Test – Left: positive. Right: positive.
  - Lumbar Tests
    - Babinski’s test – left : negative. Right : negative
    - Lasegue’s test – left : negative. Right : negative
- Spinal Exam – Muscle Strength
  - Cervical: Deltoid normal. Biceps (elbow flexion) normal. Triceps (elbow extension) normal. Trapezius normal. Wrist flexion normal. Wrist extension normal. Extrinsic normal. Intrinsic normal. Motor grip normal.



## Imaging Dictation

- C3-4: There is right greater than left neural foraminal narrowing secondary to spondylosis which indents the thecal sac.
- C4-5: There is mild left sided neural foraminal narrowing secondary to spondylosis.
- C5-6: There is no focal posterior disc herniation. There is no high-grade central canal, lateral recess or neural foraminal stenosis. The facet joints are unremarkable. The paravertebral soft tissues are normal.
- C6-7: There is a central disc protrusion indenting the thecal sac. The facet joints are unremarkable. The paravertebral soft tissues are normal.



# Imaging



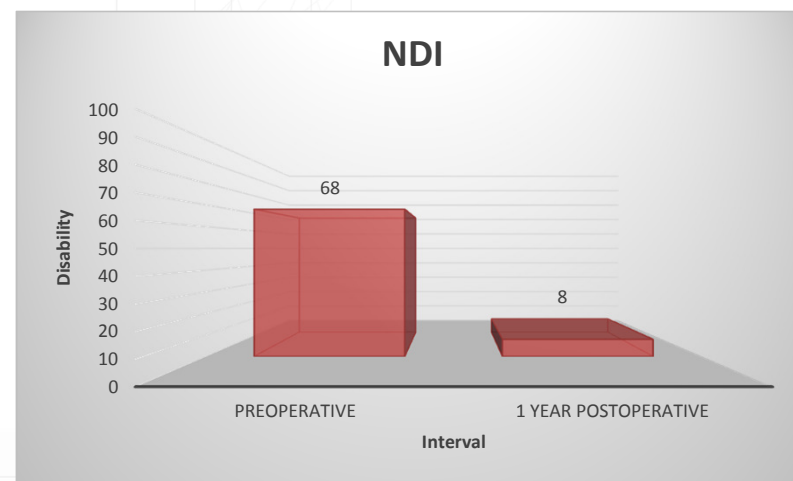
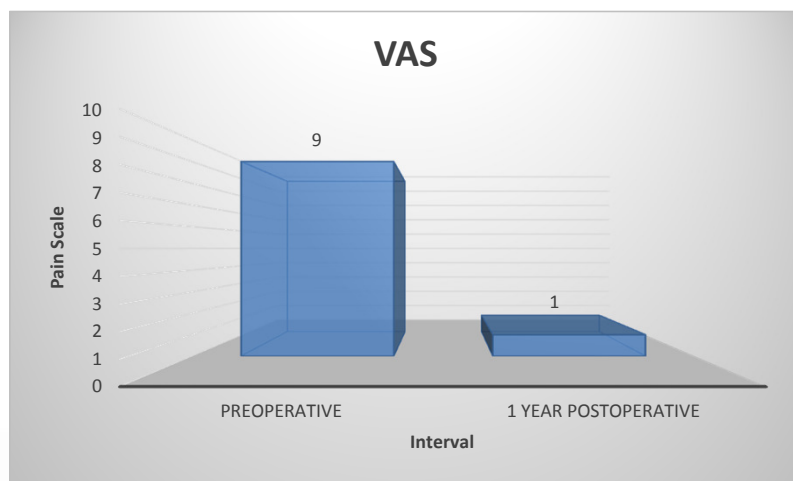


## Summary

- Based on the patient's history, failed conservative treatments, and diagnostic exams, this patient has been recommended for an outpatient laminotomy and foraminotomy for decompression of the nerve root (LFD) with a positive selective nerve root block (SNRB).
  - MRI Discussion Surgical Order –SNRB, if + LFD, C3/4 Right. If negative DFIs bilaterally at C3/4, C4/5 and C5/6 and if + DTAs. Destruction via Thermal Ablation of the Paravertebral Facet Joint(s) Nerve C3/4 Left, C4/5 Bilateral, C5/6 Bilateral.
    - SNRB provided 70% relief
  - Surgery Performed – C3/4 Right cervical laminotomy and foraminotomy including partial facetectomy with decompression of the nerve root.



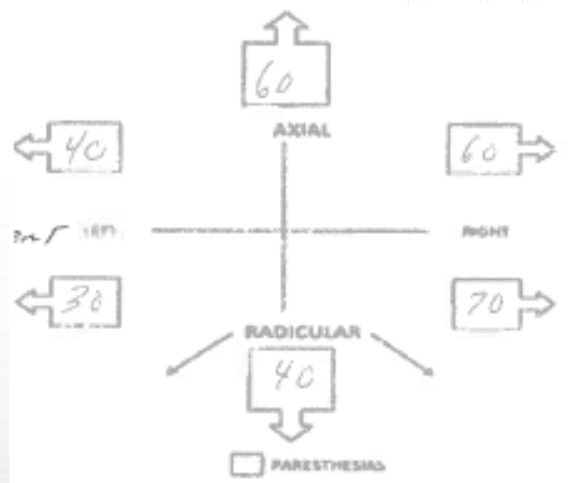
# Outcome





## Case Study 2 - History

- 43 year old Hispanic male with cervical spine issues
- BMI of 22.59
- No previous spine surgeries
- CHIEF COMPLAINT: Patient reports chronic 15 year history with right greater than left axial neck pain and upper extremity radicular symptoms that radiate down the posterior aspect of his arm in a predominant C7 dermatomal distribution in addition to intrascapular discomfort.





## History of Present Illness

- Patient has experienced neck pain for 18 years, worsening over last 6 years
  - Pain in neck with right greater than left, radiates into bilateral arms
  - Pain increased when looking up, driving
    - Daily activities adversely affected
  - Massage and stretching reduces pain
- Failed conservative treatments
  - Anti-inflammatory medication, physical therapy, chiropractor
- Intensity - On a scale of 1-10, with 10 being the worst pain imaginable, the patient reports their average pain level when resting as 5-6, daily as 5-6, when active as 8-9, now as 5-6



## Physical Examination

- Spinal Exam
  - No Scar
  - Deep Tendon Reflexes = Biceps left: 1+. Biceps right: 1+. Brachioradialis left: 1+. Brachioradialis right: 1+. Triceps left: 1+. Triceps right: 1+.
  - Pedal Pulses = Dorsalis Pedis: 2+. Posterior Tibial: 2+.
  - No LE Edema, no UE Edema
  - No atrophy
  - Heel walk = left, normal : right, normal
  - Toe walk = left, normal : right, normal
  - Gait = normal
- Spinal Exam – Sensory/Palpation
  - Dermatomes
    - Left – Cervical: C7, C8: Hypo-esthetic
    - Right – Cervical: C7, C8: Hypo-esthetic
  - Spinal Tenderness
    - Cervical: C6/7, C7/T1: Bilateral



## Physical Examination Continued

- Spinal Exam – Range of Motion
  - Cervical: Flexion painful. Flexion limited. Hyperextension limited. Hyperextension painful. Lateral flexion painful: Bilateral. Lateral flexion limited: Bilateral. Rotation painful: Bilateral. Rotation limited: Bilateral.
- Spinal Exam – Provocative Tests
  - Cervical Tests
    - Clonus test – Left: negative. Right: negative
    - Hoffman’s Test – Left: negative. Right: negative
    - Cervical Distraction Test – Left: positive. Right: positive
    - Froment’s Test – Left: negative. Right: negative.
    - Jackson’s Compression Test – Left: positive. Right: positive.
    - Phalen’s Test – Left: positive. Right: positive.
    - Tinel’s Test – Left: negative. Right: negative.
    - Spurling’s (Foraminal Compression) Test – Left: negative. Right: negative.
  - Lumbar Tests
    - Babinski’s test – left : negative. Right : negative
    - Lasegue’s test – left : negative. Right : negative
    - Romberg test – negative
- Spinal Exam – Muscle Strength
  - Cervical: Deltoid normal. Biceps (elbow flexion) normal. Triceps (elbow extension) normal. Trapezius normal. Wrist flexion normal. Wrist extension normal. Extrinsic normal. Intrinsic normal. Motor grip normal.

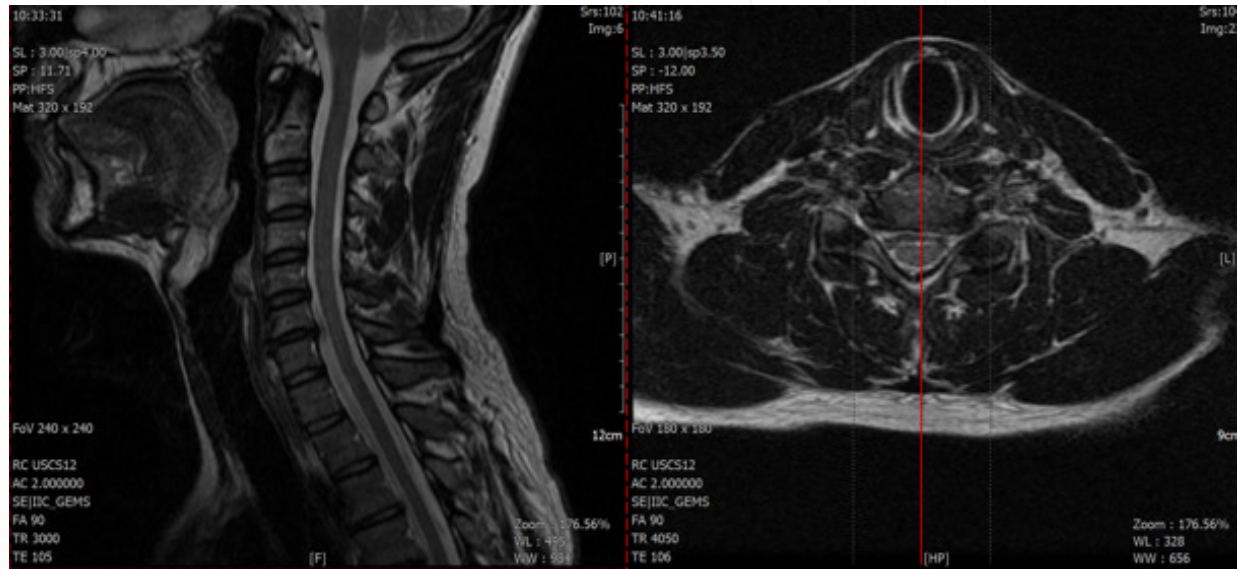


## Imaging Dictation

- C5-6: There is a shallow disc osteophyte complex with prominent Left subarticular and foraminal components. There is moderate facet hypertrophy asymmetric to the left. Changes contribute to moderate left neural foraminal narrowing.
- C6-7: There is a broad-based disc osteophyte complex/uncovering related to listhesis. There is moderate facet hypertrophy. Changes contribute to moderate-to-severe right and severe left neural foraminal narrowing.
- C7-T1: The spinal canal and neural foramen are patent.



# Imaging



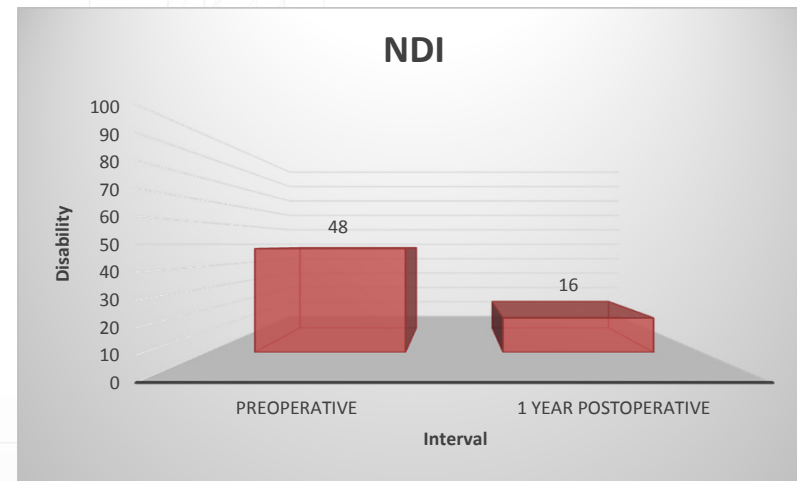
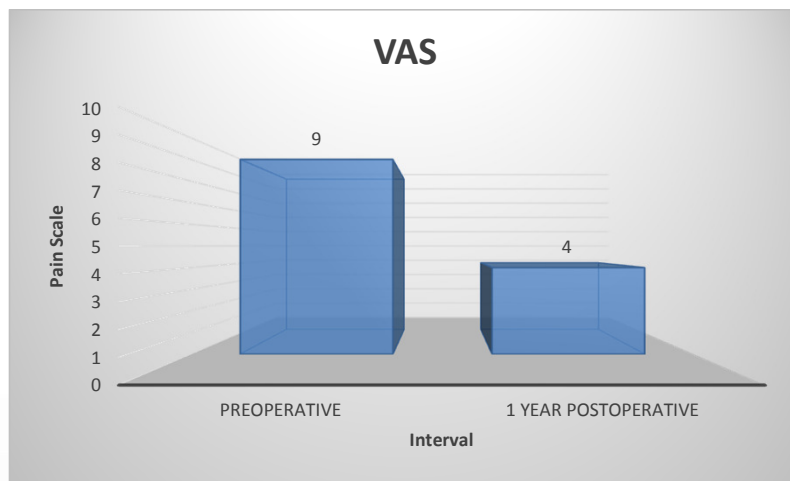


## Summary

- Based on the patient's history, failed conservative treatments, and diagnostic exams, this patient has been recommended for an outpatient Laminotomy and Foraminotomy for decompression of the nerve root (LFD).
  - MRI Discussion Surgical Order –
    - Surgery 1: LFD C6/7 Right
    - Surgery 2: LFD C6/7 Left, possible need for ACDF in future
  - Surgery Performed – Right C6-7 Cervical laminotomy and foraminotomy including partial facetectomy with decompression of the nerve root.



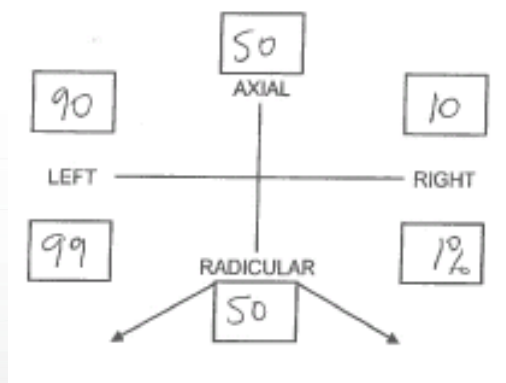
# Outcome





## Case Study 3 - History

- 50 year old African-American female with cervical spine issues
- BMI of 30.72
- No Previous spine surgeries
  
- CHIEF COMPLAINT: Patient reports neck pain that radiates to the scalp and bilateral arms, beginning gradually 18 months ago, now worse and constant.





## History of Present Illness

- Patient has experienced neck pain for 1.5 years
  - Radiates to scalp and bilateral arms. Numbness and tingling in both hands and last 3 fingers. Burning and weakness in left arm.
  - Pain increased turning/tilting head and computer work
    - Daily activities adversely affected by pain, pain so severe awakens her from sleep at night
  - Nothing provides relief from pain
- Failed conservative treatments
  - Narcotic medications
- Intensity - On a scale of 1-10, with 10 being the worst pain imaginable, the patient reports their average pain level when resting as 8-9, daily as 8-10, active as 9-10, now as 9-9



## Physical Examination

- Spinal Exam
  - No Scar
  - Deep Tendon Reflexes = Biceps left: 1+. Biceps right: 2+. Patellar left: 1+. Patellar right: 1+. Triceps left: 2+. Triceps right: 2+. Achilles left: 1+. Achilles right: 1+.
  - No LE Edema, no UE Edema
  - No atrophy
  - Heel walk = left, normal : right, normal
  - Toe walk = left, normal : right, normal
  - Gait = normal
- Spinal Exam – Sensory/Palpation
  - Dermatomes
    - Left – Cervical: C6, C7: Hypo-esthetic
    - Right – Cervical: Normal
  - Spinal Tenderness
    - Cervical: Normal



# Physical Examination Continued

- Spinal Exam – Range of Motion
  - Cervical: Flexion normal. Hyperextension normal. Lateral flexion normal. Rotation normal.
- Spinal Exam – Provocative Tests
  - Cervical Tests
    - Clonus test – Left: negative. Right: negative
    - Hoffman’s Test – Left: negative. Right: negative
    - Phalen’s Test – Left: negative. Right: negative.
    - Tinel’s Test – Left: positive. Right: negative.
    - Spurling’s (Foraminal Compression) Test – Left: negative. Right: negative.
  - Lumbar Tests
    - Babinski’s test – left : negative. Right : negative
    - Lasegue’s Test – Left: negative. Right: negative
- Spinal Exam – Muscle Strength
  - Cervical: Deltoid normal. Biceps (elbow flexion) normal. Triceps (elbow extension) normal. Trapezius normal. Wrist flexion normal. Wrist extension normal. Extrinsic normal. Intrinsic normal. Motor grip normal.



## Imaging Dictation

- C4-5: there is a mild disc osteophyte complex which indents the ventral aspect of the thecal sac, but with no central canal stenosis, lateral recess or neural foraminal narrowing.
- C5-6: There is a more focal central bulge, suggesting small disc bulge, with T2 hyper-intensity suggesting the possibility of an annular tear. This bulge lies centrally and measures approximately 2mm in thickness. Immediately inferior to that is the remainder of the disc osteophyte complex which is broad-based and narrows both lateral recesses left more than right. On the left this also combines with uncovertebral joint hypertrophy with narrowing of the inferior aspect of the left C5-6 neural foramen and minimally that of the right.
- C6-7: There is minimal disc osteophyte complex without significant lateral recess, central canal or neural foraminal narrowing.

Images are no longer available

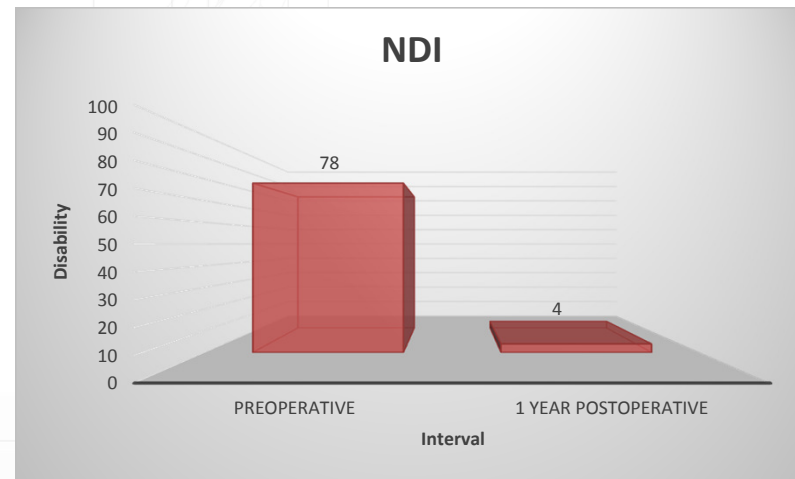
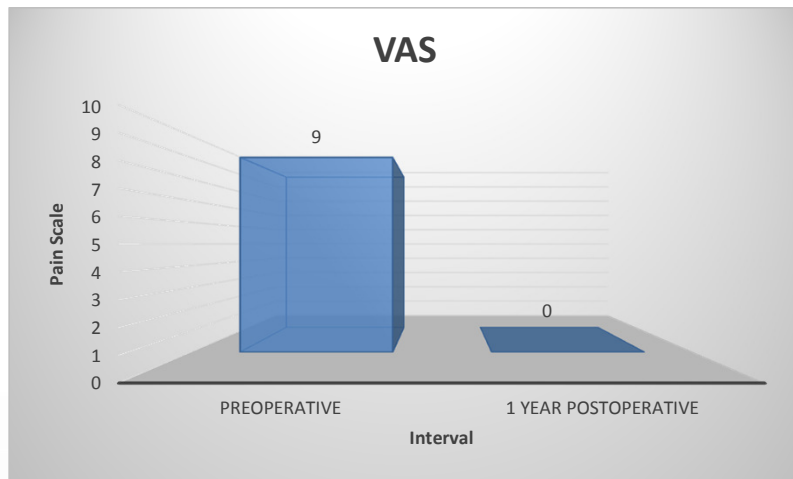


## Summary

- Based on the patient's history, failed conservative treatments, and diagnostic exams, this patient has been recommended for an outpatient laminotomy and foraminotomy for decompression of the nerve root (LFD).
  - MRI Discussion Surgical Order – C5/6 Left LFD with possible partial facetectomy
  - Surgery Performed – C5/6 Left cervical laminotomy and foraminotomy including partial facetectomy with decompression of the nerve root



# Outcome





## Conclusions

- Preliminary data suggests that minimally invasive decompression via posterior laminotomy and foraminotomy for the treatment of cervical radiculopathy on the parameters of foraminal stenosis can be performed safely and effectively in an outpatient setting
- Data will continue to be collected going forward to increase the sample size and further evaluate this study
- A comparison with standard ACDFs and open posterior decompressions will soon be performed
  - A recent study suggests that performing a posterior cervical foraminotomy does not put patients at increased risk for revision surgery at the same level\*

\*Wang, Timothy Y.; Lubelski, Daniel; Abdullah, Kalil G.; Steinmetz, Michael P.; Benzel, Edward C.; Mroz, Thomas E..

Rates of anterior cervical discectomy and fusion after initial posterior cervical foraminotomy. In *The Spine Journal*. 1 May 2015 15(5):971-976

