Beyond the chin tuck, advanced topics in post-operative treatment of the cervical spine

Amanda LeMarier, PT, DPT
Michael Schmidt, PT, DPT

DukeHealth
Objectives

- Review anatomical and surgical considerations of the post-operative cervical spine patient
- Analyze current treatment guidelines and recommendations for optimal post-operative recovery
- Demonstrate focused clinical examination of a post-operative cervical spine patient
- Application of evidence based treatment interventions and relevance to outcome
- Synthesize learning objectives for practical application through patient scenarios
History of spine surgery

• 500 BC Hippocrates described deformities of the spine consistent with scoliosis and proposed the first recorded treatment
• Attributed spine pain to habitual poor posture and developed an extension apparatus for treatment
• Hippocratic ladder
• Hippocratic board
History of spine surgery
History of spine surgery

• 1839, Jules Guerin was the first to attempt surgical correction in patients with scoliosis.
• Banned from practicing medicine and exiled from France to Belgium after a lawsuit for multiple revision surgeries.
• Surgical intervention in patients with scoliosis would not be attempted again until the 20th century.
History of spine surgery

• 1885, Wilhelm Roentgen won the Nobel Prize in Physics for inventing the X-ray
• Launched the formation of new spinal fusion methods that utilized exogenous metal or bone
History of spine surgery

- 1891 Berthold successfully used wires wound around adjacent spinous processes in a case of fracture dislocation of the cervical spine
History of spine surgery

• In 1909, Dr. Fritz Lange, was the first to do spinal fusion surgeries by straightening the spine with celluloid bars, steel, and silk wiring

• “Artificial spinal column of steel”
History of spine surgery

• Procedures in the 1900s were mainly for progressive deformities from tuberculosis
History of spine surgery

• 1970-1980 introduction of CT scan, MRI
• 1989 – First generation of cervical disc prosthesis
• 2000-2011 continued technological advantages of surgical techniques and hardware
Future of spine surgery

• Genetic repair and spinal cord regeneration with stem cell
• Transplantation
• Nanotechnology and bionics
Types of surgery
Surgery – Cervical/Thoracic Spine

- Laminectomy
- Discectomy
- Foraminotomy
- Disc replacement
- Laminoplasty
- Anterior cervical discectomy and fusion (ACDF)
- Posterior spinal fusion (PSF)
- Corpectomy
Discectomy

Herniated disc

Discectomy

©MMG 2002

©MMG 2000

http://www.orthogate.org/patient-education/lumbar-spine/lumbar-discectomy.html

http://www.eorthopod.com/content/cervical-discectomy
Foraminotomy
Disc Replacement

http://www.methodistorthopedics.com/cervical-artificial-disc-replacement
Laminoplasty

- Screw
- Retaining plate (titanium)
- Cut edge of lamina
- Bridging plate (titanium)
- Cut edge of lateral mass

X-ray image of cervical spine.
Anterior cervical discectomy and fusion (ACDF)
Anterior cervical discectomy and fusion (ACDF)
Anterior cervical discectomy and fusion (ACDF)
Posterior Spinal Fusion (PSF)
Posterior Spinal Fusion (PSF)
Posterior Spinal Fusion (PSF)

Incision

http://www.eorthopod.com/content/posterior-cervical-fusion

http://www.spineuniverse.com/professional/case-studies/gordon/fusion-nonunion-progressive-kyphosis
Corpectomy

http://www.southeasternspine.com/?attachment_id=413
Corpectomy

Figure 21. Anterior corpectomy

Corpectomy
Physical Therapy Examination following surgery
Subjective exam
Subjective Exam

- Red flags
- Yellow flags
- Complications
- Functional deficits since surgery
Red flags

• Balance impairments
  “I am falling over when I walk”
• Coordination impairments
  “I am dropping things”
• Redness, heat or swelling over surgical site
• Reports of progressive weakness
Yellow flags

• Optimal Screening for Prediction of Referral and Outcome Yellow Flag (OSPRO-YF)
  – Depressive symptoms,
  – Anxiety
  – Fear-avoidance beliefs
  – Catastrophizing
  – Self-efficacy
  – Pain acceptance
### OSPRO-YF ASSESSMENT TOOL

#### Negative Mood Domain

Over the last 2 weeks, how often have you been bothered by any of the following problems?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Not at All</th>
<th>Several Days</th>
<th>More Than Half the Days</th>
<th>Nearly Every Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Poor appetite or overeating†</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Read each statement and circle the appropriate number to the right of the statement to indicate how you generally feel.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Almost Never</th>
<th>Sometimes</th>
<th>Often</th>
<th>Almost Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. I am content</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Some unimportant thoughts run through my mind and bother me*</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4. I am a hotheaded person†</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5. When I get mad, I say nasty things</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6. It makes me furious when I am criticized in front of others</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Fear-Avoidance Domain

Circle the number next to each question that best corresponds to how you feel.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Somewhat Disagree</th>
<th>Somewhat Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. I wouldn’t have this much pain if there weren’t something</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>potentially dangerous going on in my body††</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using the following scale, please indicate the degree to which you have these thoughts and feelings when you are experiencing pain.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not at All</th>
<th>To a Slight Degree</th>
<th>To a Moderate Degree</th>
<th>To a Great Degree</th>
<th>All the Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. I can’t seem to keep it out of my mind††</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Circle the number from 0 to 6 to indicate how much physical activities affect your current pain.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Completely Disagree</th>
<th>Completely Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Physical activity might harm my painful body region</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>10. I cannot do physical activities which (might) make my pain worse††</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>11. My work is too heavy for me††</td>
<td>0</td>
<td>6</td>
</tr>
</tbody>
</table>
Use the rating scale below to indicate how often you engage in each of the following thoughts or activities.

| 12. During painful episodes it is difficult for me to think of anything besides the pain | Never | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Positive Affect/Coping Domain | Always |
| Please rate how confident you are that you can do the following things at present, despite the pain. | Not at All | Complete |
| 13. I can live a normal lifestyle, despite the pain | Confident | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Please rate the truth of each statement as it applies to you.

| 14. It's OK to experience pain* | Never True | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 15. I lead a full life even though I have chronic pain* | Always True | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 16. Before I can make any serious plans, I have to get some control over my pain | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

Please rate your degree of certainty in performing various tasks during rehabilitation based on the following statements.

| 17. My therapy no matter how I feel emotionally* | Certain | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

| I Cannot | Do It | I Can Do It |

Abbreviation: OSPRO-YF, Optimal Screening for Prediction of Referral and Outcome cohort yellow flag assessment tool.
*Items included in the 10-item version.
†Items included in the 7-item version.
Complications

- Anesthesia
- Infection
- Blood vessel damage
- Dural tear
- Nerve Damage
- Spinal cord damage
- Non-union
- Adjacent segment disease
Reported rates of common post-operative complications

- Dysphagia: 18%
- Dysphonia: 10%
- C5 nerve palsy: 4%
- Overall: 10%
Adjacent segment disease progresses 2.9% per year in 10 years following ACDF.

25.6% will have new symptomatic neck pain within 10 years.
Adjacent Segment Disease Location

![Graph showing prevalence of new disease and motion per level over different spinal segments.](image)
Risk factors for ASD

- Smoking
- Location of fusion
- Number of levels fused
- Quality of bone
- Diabetes
Functional deficits since surgery

- Level of assistance needed
- Activity level since surgery
- Use of cervical collar or not
- Medication use
Objective exam
Make sure everything is working…

<table>
<thead>
<tr>
<th>Disc Level</th>
<th>Nerve Root</th>
<th>Sensory distribution</th>
<th>Motor distribution</th>
<th>Reflex</th>
<th>Radicular Pain Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2–3</td>
<td>C3</td>
<td>Posterior upper neck, occiput, ear</td>
<td>none</td>
<td>none</td>
<td>Posterior upper neck, occiput</td>
</tr>
<tr>
<td>C3–4</td>
<td>C4</td>
<td>Base of neck, medial shoulder</td>
<td>Some neck extension; elevation of scapula (dorsal scapula–rhomboids)</td>
<td>none</td>
<td>Neck, upper scapula</td>
</tr>
<tr>
<td>C4–5</td>
<td>C5</td>
<td>Lateral upper arm</td>
<td>Deltoid–arm abduction; supraspinatus, infraspinatus</td>
<td>Brachioradialis</td>
<td>Scapula border, lateral upper arm</td>
</tr>
<tr>
<td>C5–6</td>
<td>C6</td>
<td>Bicep area, lateral forearm, thumb and 1st finger</td>
<td>Biceps, brachioradialis, wrist extensors</td>
<td>Bicep</td>
<td>Lateral forearm, thumb and 1st finger</td>
</tr>
<tr>
<td>C6–7</td>
<td>C7</td>
<td>Posterior forearm, middle finger</td>
<td>Triceps–Elbow extension; wrist flexors, finger extension</td>
<td>Triceps</td>
<td>Scapula, posterior arm, dorsum of forearm, 3rd finger</td>
</tr>
<tr>
<td>C7–T1</td>
<td>C8</td>
<td>Ulnar forearm and 5th finger</td>
<td>Thumb flexors, abductors, intrinsic hand muscles</td>
<td>none</td>
<td>Shoulder, ulnar forearm, 5th finger</td>
</tr>
</tbody>
</table>
Physical Performance Measures

Deep neck flexor endurance testing

- Men – 38.9 seconds
- Women 29.4 seconds
Physical Performance Measures

Scapular Muscle Endurance Test

• 1 kg resistance
• 53.4 seconds
Thera-Band® Resistance Levels

<table>
<thead>
<tr>
<th>Color</th>
<th>Pounds</th>
<th>Kilograms</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAN</td>
<td>2.4/1.1</td>
<td></td>
</tr>
<tr>
<td>YELLOW</td>
<td>3/1.3</td>
<td></td>
</tr>
<tr>
<td>RED</td>
<td>3.7/1.7</td>
<td></td>
</tr>
<tr>
<td>GREEN</td>
<td>4.6/2.1</td>
<td></td>
</tr>
<tr>
<td>BLUE</td>
<td>5.8/2.6</td>
<td></td>
</tr>
<tr>
<td>BLACK</td>
<td>7.3/3.3</td>
<td></td>
</tr>
<tr>
<td>SILVER</td>
<td>10.2/4.6</td>
<td></td>
</tr>
<tr>
<td>GOLD*</td>
<td>14.2/6.5</td>
<td></td>
</tr>
</tbody>
</table>

Pounds/Kilograms of Force at 100% Elongation

* Gold Available in Bands only
Patient reported outcome measures

• Neck Disability Index
• Patient Specific Functional Scale
• PROMIS – Patient Reported Outcomes Measurement Information System
  - Physical Function
  - Anxiety
  - Depression
  - Fatigue
  - Sleep Disturbance
  - Ability to participate in social roles and activities
  - Pain interference
  - Pain intensity
Intervention
ICF Applied: HIAPEP

“H”ealth Condition

• “I”mpairment
  – Body Function/Structures
  – PRIMARY Impairment

• “A”ctivity

• “P”articipation

• “E”nvironmental Factors

• “P”ersonal Factors
Primary Impairment

• "That impairment MOST related to activity limitation"

• Direct focus of care

• Guides consideration of other impairments

• The patient's life, activity, and participation
Patient Centered Intervention
Guided by Function

• Out of Task-----> In Task
Exercise Considerations Level of Control

- “RAMS”
  - R: Retrain
    - Control of muscle
  - A: Attain
    - Available range for task
  - M: Maintain
    - Maintain/control position against gravity
  - S: Sustain
    - Sustain control during activity
Exercise Considerations Level of Control

- Preparation Phase
- Phase I: Static Stabilization
- Phase II: Transitional Stabilization
- Phase III: Dynamic Stabilization
- Function
Clinical Practice Guidelines

Neck Pain: Revision 2017

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the American Physical Therapy Association


SUMMARY OF RECOMMENDATIONS ......................... A2
INTRODUCTION ........................................... A4
METHODS ................................................. A5
CLINICAL GUIDELINES:
Imprint/Position-Based Diagnosis ..................A11
CLINICAL GUIDELINES:
Emanation ............................................. A18
CLINICAL GUIDELINES:
Interventions ......................................... A25
AUTHOR/REVIEWER AFFILIATIONS AND CONTACTS ..A44
REFERENCES .......................................... A65

REVIEWERS: Roy O. Allman, MD • Paul Beattie, PT, PhD • Eugene Boeglin, DPT
Joshua A. Cleveland, PT, PhD • John D. Childs, PT, PhD • John Dettroit, DPT • Timothy W. Flynn, PT, PhD
Amanda Helfand, DPT • Sandia Kapust, PT, PhD • Sheila Kilkian, PhD • Leslie Leibov, DPT

For authors, contributors, and reviewer affiliations, see end of text. ©2017 Orthopaedic Section, American Physical Therapy Association (APTA), Inc. and the Journal of Orthopaedic & Sports Physical Therapy. The Orthopaedic Section, APTA, Inc., and the Journal of Orthopaedic & Sports Physical Therapy consent to the reproduction and distribution of this guideline for educational purposes. Address correspondence to Brenda Johnson, DPT, Based Clinical Practice Guidelines Coordinator, Orthopaedic Section, APTA, Inc., 2300 East Avenue South, Suite 200, La Crosse, WI 54602. E-mail: info@orthopro.org
Current Treatment Guidelines

• Examination 2017 recommendations
• A: Clinicians should use validated self-report questionnaires for patients with neck pain, to identify a patient’s baseline status and to monitor changes relative to pain, function, disability, and psychosocial functioning.
Where would you place post op conditions of the cervical spine?
Surgery Versus Nonsurgical Treatment of Cervical Radiculopathy

A Prospective, Randomized Study Comparing Surgery Plus Physiotherapy With Physiotherapy Alone With a 2-Year Follow-up

Markus Engquist, MD,*† Håkan Löfgren, MD, PhD,‡ Birgitta Öberg, PhD, RPT,§ Anders Holtz, MD, PhD,¶ Anneli Peolsson, PhD, RPT,§ Anne Söderlund, PhD, RPT,|| Ludek Vavruch, MD, PhD,‡ and Bengt Lind, MD, PhD**††
Objective

- To study the outcome of *anterior cervical decompression and fusion* combined with a *structured physiotherapy program* compared with the same physiotherapy program alone for patients with *cervical radiculopathy*. 
Methods

- Sixty-three patients were randomized to surgery with postoperative physiotherapy (n = 31) or physiotherapy alone (n = 32).
- The surgical group was treated with anterior cervical decompression and fusion. The physiotherapy program included general/specific exercises and pain-coping strategies.
Results

- The result from the repeated-measures analysis of variance showed **no significant between-group difference for Neck Disability Index** ($P = 0.23$).
- For neck pain intensity, the repeated-measures analysis of variance showed a **significant between-group difference during the study period in favor of the surgical group** ($P = 0.039$).
- For **arm pain intensity**, no significant between-group differences were found according to the repeated-measures analysis of variance ($P = 0.580$).
- **87%** of the patients in the surgical group rated their symptoms as “better/much better” at the 12-month follow-up compared with **62%** in the nonsurgical group ($P < 0.05$).
Conclusions

• It was shown that surgery with physiotherapy resulted in a more rapid improvement during the first postoperative year, with significantly greater improvement in neck pain and the patient's global assessment than physiotherapy alone,

• Differences between the groups decreased after 2 years. Structured physiotherapy should be tried before surgery is chosen.
ORIGINAL RESEARCH

PHYSICAL THERAPY FOLLOWING ANTERIOR CERVICAL DISCECTOMY AND FUSION: A STUDY OF CURRENT CLINICAL PRACTICE AND THERAPIST BELIEFS

1Brian T. Swanson
2Robin R. Leger
Take away Points

• Manual therapy has been supported by the best available evidence for the treatment of cervical radiculopathy, however there seems to be a general lack of consensus regarding the use of joint mobilizations following ACDF.

• While certainly contraindicated at the level of fusion, there may be a role for manual therapies directed at the surrounding levels/tissues.

• We were unable to identify any randomized trials evaluating the effects of physical therapy during the Post-operative period following cervical spine surgery.
Effect of Two Contrasting Types of Physical Exercise on Chronic Neck Muscle Pain

LARS L. ANDERSEN,¹ MICHAEL KJÆR,² KAREN SØGAARD,¹ LONE HANSEN,¹ ANN I. KRYGER,² AND GISELA SJØGAARD¹
Phase 1

- 0-4 weeks to 0-6 weeks
- No lifting > 5 pounds
- ROM pain free
- Postural Education
- Body Mechanics
- No driving > 30 mins
- Walking program
Phase 2

- 4-8 weeks to 6-12 weeks
- Lifting up to 10#
- UBE no resistance
- Postural/Scapula strengthening
- Cervical Postural strengthening
Phase 3

- 8-12 weeks to 12+ weeks
- Lifting as tol up to 25#
- Dynamic Multi-plane ex
- Higher level balance/coordination/ Proprioception
- Progress cardiovascular ex
Phase 4

- 12+ weeks
- Return back to work/sport
- Resume running/jogging
- Return back to gym
Case Example
Case Example

• 46 yo F neck pain with radiating bilateral hand numbness/tingling after she injured the neck while riding a roller coaster
• Pain starts at the base of the neck and radiates down her hands and has also started to radiate into her feet as well.
• Tried a medrol dose pack one time with good relief but is not interested in taking more due to prediabetes.
• Pain Score: 4/10
• Neck Disability Index Score: 32%
<table>
<thead>
<tr>
<th>Cervical AROM</th>
<th>Normal/ Painful into both arms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>Normal/ Painful into both arms</td>
</tr>
<tr>
<td>Extension</td>
<td>Normal/ Painful into both arms</td>
</tr>
<tr>
<td>Lateral Bending Right</td>
<td>Normal/ Painful into both arms</td>
</tr>
<tr>
<td>Lateral Bending Left</td>
<td>Normal/ Painful into both arms</td>
</tr>
<tr>
<td>Rotation Right</td>
<td>Decreased/ Painful into both arms</td>
</tr>
<tr>
<td>Rotation Left</td>
<td>Normal/ Painless</td>
</tr>
<tr>
<td>Reflexes</td>
<td>Right</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Biceps</td>
<td>Normal</td>
</tr>
<tr>
<td>Brachioradialis</td>
<td>Normal</td>
</tr>
<tr>
<td>Triceps</td>
<td>Normal</td>
</tr>
<tr>
<td>Hoffman</td>
<td>Absent</td>
</tr>
<tr>
<td>Inverted Brachioradialis</td>
<td>Absent</td>
</tr>
<tr>
<td>Clonus</td>
<td>Negative</td>
</tr>
<tr>
<td>Motor</td>
<td>Right</td>
</tr>
<tr>
<td>---------------</td>
<td>-------</td>
</tr>
<tr>
<td>Deltoid</td>
<td>5/5</td>
</tr>
<tr>
<td>Biceps</td>
<td>5/5</td>
</tr>
<tr>
<td>Triceps</td>
<td>5/5</td>
</tr>
<tr>
<td>Wrist Extensor</td>
<td>5/5</td>
</tr>
<tr>
<td>Wrist Flexor</td>
<td>5/5</td>
</tr>
<tr>
<td>Thumb Extension</td>
<td>5/5</td>
</tr>
<tr>
<td>Grip</td>
<td>5/5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensation</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>C5</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>C6</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>C7</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>C8</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>T1</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Special Tests</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Spurling</td>
<td>Pain both arms</td>
</tr>
<tr>
<td>Distraction</td>
<td>No change</td>
</tr>
</tbody>
</table>
Treatment

- Cervical retraction with overpressure
- Cervical AROM
- Manual cervical traction
- Scapular strengthening
Visit 2

- No change in numbness/tingling in hands but increased in feet and feeling like she catches her toe when walking
- Report of right hand feeling weaker
<table>
<thead>
<tr>
<th>Motor</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deltoid</td>
<td>4/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Biceps</td>
<td>4/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Triceps</td>
<td>4/5</td>
<td>4/5</td>
</tr>
<tr>
<td>Wrist Extensor</td>
<td>3/5</td>
<td>3/5</td>
</tr>
<tr>
<td>Wrist Flexor</td>
<td>3/5</td>
<td>3/5</td>
</tr>
<tr>
<td>Thumb Extension</td>
<td>3/5</td>
<td>3/5</td>
</tr>
<tr>
<td>Grip</td>
<td>3/5</td>
<td>3/5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sensation</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>C5</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>C6</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>C7</td>
<td>Diminished</td>
<td>Diminished</td>
</tr>
<tr>
<td>C8</td>
<td>Diminished</td>
<td>Diminished</td>
</tr>
<tr>
<td>T1</td>
<td>Diminished</td>
<td>Diminished</td>
</tr>
<tr>
<td>Reflexes</td>
<td>Right</td>
<td>Left</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Biceps</td>
<td>Hyperreflexia</td>
<td>Hyperreflexia</td>
</tr>
<tr>
<td>Brachioradialis</td>
<td>Hyperreflexia</td>
<td>Hyperreflexia</td>
</tr>
<tr>
<td>Triceps</td>
<td>Normal</td>
<td>Normal</td>
</tr>
<tr>
<td>Hoffman</td>
<td>Present</td>
<td>Present</td>
</tr>
<tr>
<td>Inverted Brachioradialis</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Clonus</td>
<td>Positive</td>
<td>Positive</td>
</tr>
</tbody>
</table>
What would you do now?
6 week follow-up from surgery

- Significant improvement in feet symptoms and strength following surgery
- Report of neck feeling “stiff”
- Pain: 1/10 in neck
<table>
<thead>
<tr>
<th>Cervical</th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deltoid</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Biceps</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Triceps</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Wrist Extensor</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Wrist Flexor</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Grip</td>
<td>5/5</td>
<td>5/5</td>
</tr>
<tr>
<td>Intrinsics</td>
<td>5/5</td>
<td>5/5</td>
</tr>
</tbody>
</table>
Primary treatment following surgery

- Mulligan cervical rotation with patient overpressure
- Cervical retraction with clinician and patient overpressure
- Cervical AROM
- Scapular endurance training
- Deep cervical neck flexor training
Demonstration of techniques
Mulligan Self SNAG
Mulligan Cervical Mobilizations
Cervical retraction in sitting