Evidence Based Treatment Strategies for the Cervical Spine
Shondell Jones, DPT, CLT, CSCS, COMT

Provider Disclaimer

- Allied Health Education and the presenter of this webinar do not have any financial or other associations with the manufacturers of any products or suppliers of commercial services that may be discussed or displayed in this presentation.
- There was no commercial support for this presentation.
- The views expressed in this presentation are the views and opinions of the presenter.
- Participants must use discretion when using the information contained in this presentation.

Overview

I. Anatomy Review
II. Injury Assessment
III. Cervical Pain Classification
   A. Assessment
   B. Intervention
Objectives

1. Describe basic anatomy and physiology and movement of the cervical spine.

2. Identify subjective and objective indicators of specific clinical presentations for various cervical pathologies.

3. Create an effective treatment plan for various cervical pathologies that is based on current evidence.

The Cervical Spine

• Most mobile spinal area
• 2 distinct areas
  - Craniovertebral/Upper Cervical
    - O-C1-C2
  - Lower Cervical
    - C3-7
    - C2-3 contains the first disc
    - Virtually no cervical nucleus pulposus after 45 yo.
    - HNP rare

The Cervical Spine

• Zygapophyseal (facet) joints — synovial, planar, diarthrodial
  - weight bearing in upright postures
The Cervical Spine

OA Joint
- Convex-concave joint
- Capsule blends with the anterior atlanto-occipital membrane and ALL.

The Cervical Spine

AA Joint
- C1-2
- 50% cervical rotation
- C2 dens and anterior arch of atlas (C1)

The Cervical Spine

C2-7
- Facets at 45 degrees b/t frontal and horizontal planes
- 20-25% flexion at OA and AA joints
- C5-6 greatest range of flexion and extension; pivot point for lateral flexion
- C6-T2 reduced motion = significant stress
The Cervical Spine

Uncinate Joints (von Luschka)
- Formed by uncovertebral process
- Raised lip on superior-lateral surface of vertebra
- Limits lateral flexion and guides flexion and extension

The Cervical Spine

Ligaments

Alar
- From C2 dens superior-lateral to medial occipital condyles
- Tension increased with contra lateral cervical rotation
- Relaxed in extension; Tensed in flexion

The Cervical Spine

Ligaments

Cruciform
- Transverse and Longitudinal bands
  - Holds atlas in place yet allows rotation on the axis

Nuchal Ligament
- Broad ligament
- From C7 to external occipital protuberance
- Increases depth of spinous processes for ms attachment
The Cervical Spine

Neural Structures
- 8 pair cervical nerves
- C1 exits above C1 vertebra
- C8 exits below C7 vertebra

The Cervical Spine

Occipitals
Scalenes
Trapezius
Levator Scapulae
Semispinalis Capitus and Cervicus
Splenius Capitus and Cervicus

The Cervical Spine

Muscles
SCM
Longus colli

A Note about arthrokinematics
- several models but no consensus
Injury to the Cervical Spine

- Very common
- 25% of patients in outpatient PT practice
- Prevalent in 5th decade
- 70% of population will experience
- Women > Men

Outcomes are generally good but rates of recurrence and chronicity are high.

- 42% of workers with neck and UE injuries missed > 1wk work with 26% recurrence within a year.
- Estimated 30% chronic symptom development with pain >6 months
- 5% of adult population will be disabled by neck pain

Cost $19.6 billion annually in loss work time
Subjective Examination

APTA's Current Concepts:
1. Head and Neck Medical Screening Questionnaire
2. Pain Diagram w/ Numeric Pain Rating Scale
3. Neck Disability Index
4. Fear Avoidance Beliefs Questionnaire

Head and Neck Questionnaire

NAME: ________________________________________ DATE: _____________
Medical Record #: ____________________________ Yes No

1. Are you currently being treated for high blood pressure?
2. Have you recently had difficulty with speaking?
3. Have you noticed an increased clumsiness or weakness in your arms or legs?
4. Do you frequently have headaches?
5. Have you noticed a recent decreased ability of concentrate?
6. Do you experience dizziness?
7. Have you noticed a recent change in your vision or ability to see?
8. Have you recently experienced a blow to the head or a whiplash injury?
9. Have you been experiencing nausea and/or vomiting?
10. Do you currently have a fever, or have you had a fever recently?
11. Have you recently been living in close quarters, such as in a dormitory?
12. Do you have a depressed immune system?
13. Are your eyes sensitivity to light?
14. Have you recently had a seizure?

Head and Neck Questionnaire

• Questions 1-6, & 9 screen for Subarachnoid hemorrhage/ischemic stroke
• 6-9 more closely related to vertebrobasilar insufficiency
• Questions 10-14 related to meningitis
• If 4, 8, 9, 13, 14 related to mild brain injury, postconcussion or subdural hematoma.
Neck and Shoulder Screening Questionnaire

NAME: ___________________________________ DATE: _____________
Medical Record #: _________________________

1. Have you recently experienced a blow to the head or a whiplash injury?
2. Do you have rheumatoid arthritis?
3. Are you currently taking steroids or have you been on prolonged steroid therapy?
4. Have you noticed any recent weakness, tingling, or numbness in your arms or legs?
5. Have you noticed a recent onset of difficulty with retaining your urine?
6. Do you now smoke or have you been a smoker in the past?
7. Do you administer medicine or drugs to yourself for which you need to inject using a needle?

Questions 1-4 = fracture or ligament instability
Questions 3-5 = central cord lesions
Question 6 = pancoast/lung tumor
Question 7 = risk for sepsis or septic arthritis

Canadian Cervical Spine Rule

Questions to ask:
1. Any high risk factors?
   \[\geq 2\] = radiograph
2. Can ROM be assessed?
   no = radiograph?
3. If ROM can be assessed:
   \[\leq 45\] degrees rotation bilaterally = radiographs?
Pain Scale and diagram

- Injections in C2-3 and 6-7 show distinguishable pattern of pain (Dwyer et al 1990) hence pain diagrams construction
- 9/10 patients pain diagram allowed prediction of affected facet joint level (Aprill et al 1990)
- Numeric Pain rating scale
  10 cm line numbered 0-10

Neck Disability Index

Highly researched questionnaire
10 items (4 subjective, 4 ADL, 2 discretionary activities)
Score 0-5 for each question to give a total percentage perceived disability.
Minimal detectable change = 9.5 points
Minimal clinical important difference = 10 points
Fear Avoidance Beliefs Questionnaire

- 16 questions with 2 subscales:
  - Work
  - Physical activity
- Higher Score = higher fear avoidance
- Work subscale directly correlated with pain and disability and predicts future disability.

Clinical Patterns and Pathology

1. Neck pain with mobility deficits
2. Neck pain with headaches
3. Neck pain with movement coordination impairment
4. Neck pain with radiating pain

Neck Pain With Mobility Deficits

- Cervicalgia or T-spine pain
- Typically <50 years old
- Neck pain <12 wks
- Restricted cervical ROM
- Often unilateral
Neck Pain With Mobility Deficits

• Primary intervention is manual therapy and exercises
• Prior to placing in this category assess for hypermobility!
• Sharp Purser Test
  • Subluxation of the atlas on the axis
  • Sn 0.96 Sp 0.69
  • + with post cranial movement

Neck Pain With Mobility Deficits

Alar Ligament Test Video

• Assess alar ligament integrity
• Patient supine
• PT pincer grip on C2 SP
• Sidebend patient head opposite thumb on C2
• Delayed movement of C2 is positive; compare sides

Hoffman et al (2000) identified those who are low probability of injury:
1. No midline cervical tenderness
2. No focal neurologic deficit
3. Normal alertness
4. No intoxication
5. No painful, distracting injury
  • Identified all but 8/818 patients among >34k patients in multicenter study
  • Sn 99%, SP 12.9%
Neck Pain with Mobility Deficits

- What about VBI
  - Utility not well established in literature
  - Still worth consideration
- Symptoms— vertigo, tinnitus, dizziness, diploplia, drop attacks, dysarthria, dysphagia
- Pain in head and neck***

Neck Pain with Mobility Deficits

- Physical Assessment for VBI
  - AROM; patient actively looks over shoulder
  - Pre-manipulative hold
    - 10-15 seconds

Motion Testing

- AROM/PROM testing
  - Goniometer
  - Fluid Filled inclinometer
- Accessory Motion Testing
  - Clear down to T4
  - Centrally and/or unilaterally
- Muscle Length Testing
  - Pects
  - Scalene
  - Traps
  - Levator
Motion Testing

- Remember that PA forces will create movement in the entire C-spine (Lee et al 2006)
- High inter-therapist variability but low intra-therapist variability
  - Accuracy for pain diagnostic = Sn 0.82, Sp 0.79 (Childs et al 2008)

Interventions

Twofold:
1. Manual Tx to improve painful motions
2. Strengthening, coordination, endurance training to maintain mobility and functional gains

Joint Mobilizations — typically PA or unilateral PA

Maitland (2001) noted 5 cycles PA pressures at C5 grade III = increased movement in entire C-spine. Increases in cervical lordosis noted

  - thrust vs non-thrust
  - Group receiving single manipulation = better AROM in all planes and decreased pain at rest

- Gross et al 2010 Cochrane review
  - 21 RCT’s
  - Thrust vs non-thrust
  - Similar effects on pain, function, and patient satisfaction
  - Mobilization plus exercise recommended

- Gross et al 2004 Cochrane review
  - 33 RCT’s
  - Thrust and mobilizations alone vs thrust and mobilization with exercise
  - Thrust and mobilization with exercises = better pain reduction and patient satisfaction
Interventions

- Exercises vs General Practitioner vs Manual Tx (Hoving et al 2006)
  - Over 7wks recovery = manual therapy > exercises > GP
- Neuromodulatory effect
  - Fernandez 2007 & Cleland 2004
  - C5-6 manipulation increase pain threshold in lateral epicondylalgia
  - Local tx alone = avg 9.7 visits vs 5.6 visits for those with local tx and cervical mobilization
- Manual tx and exercise vs Exercise with posture advice, Rom exercises, US, and continued prescription meds (Walker et al 2008)
  - Manual Tx group sought medical care at ½ rate of exercise group over period of one year.

Interventions

- TM Kay 2012 Cochrane Review
  - Exercises for Mechanical neck pain
  - Low to moderate evidence to reduce pain, disability, function, patient satisfaction for cervical and scapular specific strengthening and stretching
  - Moderate evidence for little benefit for UE strengthening and stretching
- Tseng et al 2007 defined predictors of benefactors from cervical manipulation:
  1. NDI score <= 11.5 (23%)
  2. Bilateral involvement pattern
  3. No sedentary work > 5 hours per day
  4. Moving neck feels better
  5. No worse when moving neck
  6. Diagnosis of spondylosis without radiculopathy
  Presence of 4 or more increases success probability with manipulation from 60-89%

Interventions

Thoracic Manipulation CPR:
1. Symptoms > 30 days
2. No symptoms distal to the shoulder
3. Looking up does not aggravate pain
4. FABQ <12
5. Decreased upper thoracic kyphosis (T3-5)
6. Cervical extension <30 degrees
- 3 variables present = increased likelihood of success from 54% to 86% (Cleland et al 2007)
Interventions

Thoracic vs "Sham" manipulation
- Greater pain reduction (15mm vs 4mm on pain scale), reduced disability scores, greater perceived improvement (Globat Rating of Change Scale) in thoracic manipulation group (Cleland 2007)

TENS and heat vs TENS and heat with thoracic manipulation
- 16mm and 26 mm relative improvement at 2 and 4 wk follow up
- 8.8 points improvement in disability score
- Pain rating score improved 2.3 points on numeric pain scale (Gonzalez et al 2009)
- Size of in session change directly correlated with between session change (Tuttle et al 2005)

Neck Pain with Headaches

- Typically patients with lateral headache in suboccipital and neck region
- Headache unilateral, noncontinuous
- Produced or aggravated by manipulation of cervical fascia, joints, cervical ROM, or segmental mobility along with abnormal performance on Cranial Cervical Flexion (CCF) test.

Neck Pain with Headaches

AROM assessment
- Special attention to rotation
- Primary motion of C1-C2; 45 degrees of rotation
- Differentiate between upper and lower cervical spine Sn 86% Sp 100%
- Less cervical ROM in flex/ext in those with cervicogenic HA vs those with migraines (Zito et al 2006)
Neck Pain with Headaches

Segmental motion assessment
- UPA motion at articular pillars of C1
- C2 assessed by central PA at SP and unilateral over TPs
- Sn and Sp at 100% in one study by Jull et al 1988; poor reliability however in relation to pain replication

Cervical Muscle Endurance and Strength Tests

- Cranial Cervical Flexion Test (CCF)
  - Measure control and endurance
  - Patient supine
  - Pneumatic pressure feedback inflated to 20mmHg under neck
  - Do chin tuck/CCF in 5 increments (22, 24, 26, 28, 30 mmHg)
  - Hold for 10 seconds

  - Reach at least 6mmHg increased pressure
  - Normal b/t 26-30 mmHg
  - Performance Pressure Score = (pressures increase amt held 10 sec) x (reps performed)
  - Those with cervicogenic headaches = lower scores than those without and increased forward head posture (Perez de-Heredia, 2007)
Cervical Muscle Endurance and Strength Tests

Neck Flexor Endurance Test
• Patient supine in hooklying
• Do chin tuck and raise head from table
• PT places hand under patients head while pt holds
• Measure hold time; norm is 38.95 seconds (Olsen et al 2006)

Interventions
• Address deficits in muscle strength, endurance at low and moderate intensity contractions
  • Jull et al 2002
    • Patients with cervico-genic headache
    • Compared manual tx and exercise
    • 1 year f/u >10% more pts had reduction in headache frequency with manual tx and exercise vs other groups

  • Martinez 2006, Cochrane Review
    • Manual tx and exercise combined > manual tx or exercise alone
    • Neither manual tx or exercise superior to the other
  • Mongini et al 2008, 2009
    • Workplace educational and physical exercise program
    • Reduced frequency of HA and neck and shoulder pain over 2, 8, 12 month intervals

Neck Pain with Impaired Movement Coordination
• Common presentation
  • Sprain/strain of cervical spine; often linked to trauma
  • Pain >12 weeks
  • Poor performance on CCF test and neck flexor endurance test
  • Coordination, strength, endurance deficits of longus colli, mid trap, low trap, serratus
  • Flexibility deficits of hypertonic ms
  • Poor ergonomics/posture
Motion Testing

- Muscle Strength
  - CCF test
  - Deep neck flexor endurance test
  - Johnston 2008 demonstrated poor performance in female office workers with these tests
  - Prushansky 2005 = reduced isometric strength near 90% in both genders after whiplash
- Ligament instability tests
- AROM tests; note QUALITY of movement; true planar motions
- Falla 2007 showed ROM with chronic disorders = 25-35% less than norms
- Accessory motion testing (if not muscle guarding)

Interventions

- Early intervention
  - Emphasizing posture control, education, reassurance, and WFL cervical rotation exercise (Rosenfeld et al 2006)
  - Kongsted et al 2007 found similar outcomes after 1 year b/t immobilization followed by AROM, advice to act as usual, and an active mobility program
  - Posture and muscle education is key
    - Cervical ms training = reduced change in cervical angle across duration of computer task (O’Leary et al 2007)
    - CCF exercises vs general cervical flexor endurance = CCF exercises giving improved pain pressure threshold, mechanical hyperalgesia, perceived pain during AROM.
- Training cervical muscles during an UE task might not = better activation during functional tasks Falls et al 2008
  - Dusuncelit et al 2009 compared TENS/US/IR Radiation vs isometric exercises vs stabilization ex
    - At 9 and 12 month f/u only stabilization group still had reduced pain levels
- Jull et al 2007 compared proprioceptive training and CCF training finding both benefit joint position error (slight edge with proprioceptive training)
- Multimodal treatment
  - Strengthening (endurance and CCF training)
Interventions

- Craniocervical Flexion Progression
  - Same set up as the test but repeated with more therapist input to assist
- Cervical Flexor muscle training
  - Lift head slightly off table with CCF position
  - Lift further clearing the table holding CCF position

Neck Pain With Radiating Pain

- Clinical findings:
  - UE symptoms aggravated by Spurlings maneuver relieved by distraction test
  - Positive upper limb tension test
  - Decreased ipsilateral rotation < 60 degrees
  - Signs of nerve root compression
  - Neurological testing
    - N&T, weakness
    - Upper motor neuron screen
      - Hyper reflexia
      - Clumsy gait
      - Clonus
      - Diffuse sensory changes
      - General weakness below level of compression
  - Hoffman's test, 94% sensitive

Neurological testing

- Lower motor neuron
  - Hyporeflexia or absent reflexes
  - Decreased sensation in dermatomal pattern
  - M's weakness in myotomal pattern (C5-T1)
  - CS (biceps) reflex absent or decreased = increased chance of radiculopathy from 23 to 59%. (Wainner and Fritz et al 2003)
Neck Pain With Radiating Pain

• Median neural tension
  • 97% sensitivity; negative LR of 0.12
  • Negative reduces chance of radiculopathy

Neck Pain With Radiating Pain

• Spurling's test
  • Passive SB to symptomatic side and add compression
  • Sensitivity 50%
  • Specificity 90%
  • 3.5 positive LR

Neck Pain With Radiating Pain

• Distraction test
  • Manual distraction in supine
  • Look for reduction of symptoms
  • 44% sensitivity, 90% specificity
  • Valsalva maneuver
  • Take deep breath and hold and attempt to exhale for 2-3 sec
  • 94% specificity, 3.5 positive LR
Cluster of 4 tests gives greatest diagnostic info:
• Ipsilateral cervical rot < 60 degrees
• Positive distraction test
• Positive Spurlings test
• Positive median tension test
• 3 positive = 6.1 + LR
• 4 positive = 30.4 + LR
• Most sensitive test = median neural tension test

3 positive = 6.1 + LR
4 positive = 30.4 + LR
Most sensitive test = median neural tension test

Success with Treatment:
• Age <54 years old
• Non-dominant arm affected
• Looking down does not worsen symptoms
• Multimodal treatment used
• 4 variables present = 90% probability of success
• 3 variables present = 85% probability of success

Interventions
• Multimodal treatment
  • Intermittent cervical traction (ICT), thoracic manipulation, and exercise = centralized symptoms in each pt (Wainner et al, 2003)
  • Cervical lateral glides in UE neurodynamic position, thoracic manip, deep cervical flexor strengthening, scapulo-thoracic exercises, intermittent mechanical traction
  • 10/11 had improved Global Pain Rating Score (Cleland et al 2005)

Interventions
• Traction?
  • Graham et al 2006 syst review
  • Favored use of intermittent traction
  • Did not support use of continuous traction
  • Joghataei et al 2004
    • 30 pts comparing US and other ex vs 10 sessions ICT
    • ICT = greater grip strength after 5 sessions but no difference at discharge
  • Clinical Prediction Rule for successful use of traction:
    • Peripheralization with lower c-spine mobility testing
    • Positive shoulder abduction sign
    • >/= 55 years old
    • Positive median nerve tension test
    • Symptom relief with manual distraction test
    • 4 or more variables = increased probability from 44 to 94%. (3 = 53%)
    • Manual traction can be used. (Rawley et al, 2009)
Interventions

- Young et al 2009 RCT
  - Manual Tx and exercise with ICT vs sham traction
  - Addition of ICT yielded no additional benefit
- Neural mobilization vs cervical/upper quadrant mobilization
  - Treating cervico-brachial syndrome
  - Both groups had improved pain and function
  - Neural mobs group significant difference in pain reduction

Other Considerations

- Strategies for Mobilization and Manipulation
- Hold time and pressure for traction
- Best exercise progression for deep cervical flexor strengthening
- Education strategies for posture and post trauma
- Hands on training