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**Whiplash Associated Disorders**

*After the Crash*

Tom Denninger, PT, DPT, OCS, FAAOMPT

March 3rd, 2016
Learning Objectives
After the course, participants will be able to independently list at least two appropriate important subjective and objective examination findings informing patient prognosis.

After the course, participants will accurately describe at least three appropriate manual and exercise interventions for patients with WAD.

After the course, participants will be able to outline the proposed pathogenesis of at least three persistent WAD symptoms.

Schedule
0-5 Min  Background and Review of Learner Objectives
5-10 Min  Case Descriptions
10-25 min  WAD Pathogenesis and Pathoanatomy
25-50 min  Key Examination Findings
50-65 min  The Role of Central Sensitivity in Persistent Pain
65-80 min  Treatment of the Non-complex Patient with WAD
80-110 min  Treatment of the Complex Patient with WAD
110-120 min  Q&A, Summary

A Tale of Two Sisters
Meet Amanda and Sarah
- Two 33 year old sisters who are
- Both married
- Each have 2 children
- Both nurses at neighboring hospital systems
- Similar health related factors, activity profiles
- Drive similar make and model sedans
A Tale of Two Sisters

One unfortunate day...

- Around the same time
- Both struck from behind while stopped at a traffic light
- Mid sized SUV's travelling about 35 mph
- Driven by middle aged adults with car insurance
- Neither strike the car in front of them
- Neither had passengers in the car
- No air bags deployed

A Tale of Two Sisters

- Neither Amanda or Sarah suffer obvious injury
- Both complain of some midline neck soreness and left shoulder pain
- Both refuse EMS services, neither go to hospital
- Both are picked up by family members and brought home after cars were towed

Expected Outcome

Regarding Amanda and Sarah's neck and shoulder pain what do we expect in terms of prognosis?

- Full recovery vs. lingering issues?
- Time?
Despite what we might think...

Demographics
Whiplash Associated Disorder:
Annual incidence of 600 per 100,000 (approx. 2 million Americans every year)

$29 Billion per year in the US

Prognosis:
30-50% with have moderate to severe symptoms 6 months post injury
- (Whiplash Commission, 2005)
- 50% of those with chronic symptoms define their pain as continuous and interfering with daily life
- (Carroll, 2008)

Research
Mechanics of Whiplash

[Diagrams showing the mechanics of whiplash]

- No immediate response
- Postural shift as soft tissues adapt
- Peak of neck motion
- Further neck extension from whiplash
- Peak of head full of head
- Peak of head full of head
- Neck soft in motion

[Diagram of cervical spine injuries]

- Most prevalent for whiplash: C3-C5
- Gradual articular compression
- Cervical sliding/shearing + capsular strain

[Diagram of cervical spine injuries]

- C1
- C2
- C3
- C4
- C5
- C6
- T1
- T2

[Diagram of cervical spine injuries]

- Gradual articular compression
- Cervical sliding/shearing + capsular strain
Suspected Involved Anatomy
Facet Joint
Joint Capsule
Ligaments
TMI
Intervertebral Disc
Shoulder Complex
Local and Global muscles
Nerve Root (Dorsal Ganglia)
Immune System
Brain

Facet Joints
Hemarthroses
Capsular tears
Cartilage damage
Joint fracture
Capsular rupture

DRG and Nerve Roots
Largely undetected by contemporary imaging
Disc Injuries
Cervical disc injury in 20-25% of subjects post MVA

Ligaments
Concern of upper cervical instability
Sub failure throughout cervical spine

"...recent clinical MRI findings that showed 66% of whiplash patients have high grade signal fluctuations in the alar ligament, attributed to structural damage" (Kazle et al. 2005)

"...58% of rear impact exhibited potential alar damage."

"...upper cervical spine ligament injury is also supported by biomechanical evidence that has shown the upper cervical spine exceeds physiological extensions in low severity rear impact..." (Panjabi et al. 2004, Bogduk 2006, 2002)

Tissue Injury
YES
There are tissue injuries that occur in MVA's of different forces

Does not explain high levels of variability in presentation
Quebec Task Force Classification

<table>
<thead>
<tr>
<th>Grade</th>
<th>Clinical Presentation</th>
</tr>
</thead>
</table>
| 0     | No complaint about neck pain  
|       | No physical signs |
| I     | Neck complaints of pain, stiffness or tenderness only  
|       | No physical signs |
| II    | Neck complaints  
|       | Musculoskeletal signs including: Decreased range of movement Point tenderness |
| III   | Neck complaints  
|       | Musculoskeletal signs  
|       | Neurological signs including: Decreased or absent deep tendon reflexes Muscle weakness Sensory deficits |
| IV    | Neck complaints and fracture or dislocation |

Escalated Quickly
Quebec Classification (Modified)

<table>
<thead>
<tr>
<th>Quebec Classification Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modified</strong></td>
</tr>
<tr>
<td>MILD</td>
</tr>
<tr>
<td>Motor impairment</td>
</tr>
<tr>
<td>• Decreased RCM</td>
</tr>
<tr>
<td>• Altered motor recruitment patterns (CMTP)</td>
</tr>
<tr>
<td>Sensory impairment</td>
</tr>
<tr>
<td>• Anhidrosis</td>
</tr>
<tr>
<td>• Hypoesthesia</td>
</tr>
<tr>
<td>• Muscle weakness</td>
</tr>
<tr>
<td>• Bone deformity</td>
</tr>
<tr>
<td>• Other</td>
</tr>
<tr>
<td>MILD II</td>
</tr>
<tr>
<td>Motor impairment</td>
</tr>
<tr>
<td>• Decreased RCM</td>
</tr>
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<td>• Altered motor recruitment patterns (CMTP)</td>
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<tr>
<td>• Muscle weakness</td>
</tr>
<tr>
<td>• Bone deformity</td>
</tr>
<tr>
<td>• Other</td>
</tr>
<tr>
<td>MILD III</td>
</tr>
<tr>
<td>Motor impairment</td>
</tr>
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<tr>
<td>• Muscle weakness</td>
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<tr>
<td>• Bone deformity</td>
</tr>
<tr>
<td>• Other</td>
</tr>
<tr>
<td>MILD IV</td>
</tr>
<tr>
<td>Motor impairment</td>
</tr>
<tr>
<td>• Decreased RCM</td>
</tr>
<tr>
<td>• Altered motor recruitment patterns (CMTP)</td>
</tr>
<tr>
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<tr>
<td>• Bone deformity</td>
</tr>
<tr>
<td>• Other</td>
</tr>
</tbody>
</table>

Back To Out Sisters

Amanda reports some pain (5/10) and stiffness in her neck that has been bothersome for a few days but over all is improving.

Sarah reports severe pain (9/10), stiffness, reduced range of motion, with intermittent paresthesias in her right arm. She currently hates anyone to touch her on her neck and feels a if she is worsening.
First Step

Red Flags and WAD

**Urgent Investigation:**
- B paresthesias in UL or LL
- Gait Disturbance
- Spastic paresis
- Shooting pain in all four limbs with cervical flexion (Lemmette’s sign)
- Hyper-reflexia
- 2+ adjacent level nerve root signs
- Worsening neurology
- Unremitting, severe, non-mechanical pain

**Precautions to Treatment:**
- History of cancer
- Rheumatoid Arthritis
- Long term steroid use
- Osteoporosis
- Systemically unwell
- Uninvestigated structural deformity

Potential Red Flag Conditions

- Fracture
- Upper Cervical Instability
- Cervical Artery Disruption
Screening for Fracture

Canadian C-Spine Rules

Table 4. Sensitivity, Specificity, and Negative Predictive Value of the Two Rules for 142 Cases of "Clinically Important" Injury among 7485 Patients.*

<table>
<thead>
<tr>
<th>Result of Assessment</th>
<th>Canadian C-Spine Rule</th>
<th>NCXUS Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Injury</td>
<td>No Injury</td>
</tr>
<tr>
<td>Positive (no.)</td>
<td>161</td>
<td>3995</td>
</tr>
<tr>
<td>Negative (no.)</td>
<td>3281</td>
<td>15</td>
</tr>
<tr>
<td>Sensitivity (%)</td>
<td>99.4</td>
<td>(95% CI, 96-100)</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>45.1</td>
<td>(95% CI, 44-47)</td>
</tr>
<tr>
<td>Negative predictive value (%)</td>
<td>100</td>
<td>99.4</td>
</tr>
</tbody>
</table>

Missed Cervical Fractures

Clinical Identifiers for Bouncing Underlying Closed Cervical Fractures

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
<th>False Positive Probability</th>
<th>False Negative Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≤ 10 years</td>
<td>36.1 (9.1)</td>
<td>97.9 (9.9)</td>
<td>0.02</td>
<td>0.13</td>
</tr>
<tr>
<td>Single marital status</td>
<td>15.1 (5.1)</td>
<td>99.9 (9.9)</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Head-entire length</td>
<td>97.9 (9.9)</td>
<td>99.9 (9.9)</td>
<td>0.01</td>
<td>0.05</td>
</tr>
<tr>
<td>Duration of symptoms ≥ 6 weeks</td>
<td>46.1 (13.1)</td>
<td>89.7 (10.9)</td>
<td>0.01</td>
<td>0.07</td>
</tr>
<tr>
<td>Impact energy</td>
<td>41.8 (12.9)</td>
<td>89.9 (10.9)</td>
<td>0.01</td>
<td>0.07</td>
</tr>
<tr>
<td>Impact force</td>
<td>67.1 (17.4)</td>
<td>99.9 (9.9)</td>
<td>0.01</td>
<td>0.05</td>
</tr>
</tbody>
</table>
Upper Cervical Instability
Disruption of sub-failure to:
- Transverse Ligament
- Alar Ligaments
- Tectorial Membrane (secondary)

- Presentation
  - Occipital headache and/or facial numbness
  - Severe limitation in neck active range of motion
  - Signs of cervical myelopathy

Modified Sharp-Purser Test

Purpose: presence of upper cervical spine instability
Description: Patient seated in semi-flexed position. Examiner places the palm of one hand on the patient’s forehead and index finger of opposite hand on the spinous process of C2. Posterior pressure is applied through the forehead.
Positive test: sliding motion of the head, often accompanied by a reduction in symptoms
Accuracy: Sensitivity = 0.69  Specificity = 0.96
- LR = 32  +LR = 17.3

Modified Sharp-Purser Test
Alar Ligament Stress Test

**Purpose:** Assess the integrity of the Alar ligament

**Description:** Patient sitting or supine, head slightly flexed. Clinician stabilizes the C2 spinous process using a pincer grip. Either side flexion or rotation is initiated, the clinician attempts to feel movement of C2.

**Positive:** If the clinician fails to “feel” movement of C2 during side flexion or rotation it assumed there is damage to the Alar ligament

**Accuracy:**?

---

Alar Ligament Stress Test

---

Cervical Arterial Dysfunction

**Positional Testing**
- Questionable reliability and validity

**Diagnosis better based on**
- Blood Pressure
- Palpation/Auscultation of carotid artery
- Upper motor neuron testing
- Cranial nerve examination
Cranial Nerve Exam

### Cranial Nerve Number and Function

<table>
<thead>
<tr>
<th>Cranial Nerve Number</th>
<th>Function</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>II. Olfactory</td>
<td>Sensory from olfactory projection.</td>
<td>Assess the ability to smell common scents.</td>
</tr>
<tr>
<td>III. Optic</td>
<td>Sensory from retina of eye.</td>
<td>Assess peripheral vision by having person read an eye chart.</td>
</tr>
<tr>
<td>IIII. Oculomotor</td>
<td>Motor for closure, controlling eyelid movement and facial eye movements, as well as pupil constriction.</td>
<td>Assess pupil reaction to light.</td>
</tr>
<tr>
<td>VII. Tongue</td>
<td>Motor for muscles controlling downward and upward eye movements.</td>
<td>Assess the ability to move eye downward and upward by asking patient to follow your finger.</td>
</tr>
</tbody>
</table>

Cranial Nerve Exam

### Cranial Nerve Number and Function

<table>
<thead>
<tr>
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<th>Function</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. Trigeminal</td>
<td>Sensory from face and motor to muscles of mastication.</td>
<td>Test sensation of face and cheeks as well as corneal reflex. Assess the patient's ability to close the teeth.</td>
</tr>
<tr>
<td>VI. Abducens</td>
<td>Motor to muscles that move eye laterally.</td>
<td>Assess patient's ability to move eye away from nose to opposite side. Assess ability to move eye toward nose.</td>
</tr>
<tr>
<td>VII. Facial</td>
<td>Motor to muscles of facial expression and sensing to anterior tongue.</td>
<td>Assess innervation and strength of facial muscles. Assess ability to move and sense anterior 1/3 of tongue.</td>
</tr>
<tr>
<td>VIIII. Vestibulocochlear</td>
<td>Hearing and balance.</td>
<td>Assess by rolling fingers by each ear. Patient should hear distinctly. Ask patient to close eyes and see if they can balance on one foot.</td>
</tr>
</tbody>
</table>

Cranial Nerve Exam

### Cranial Nerve Number and Function

<table>
<thead>
<tr>
<th>Cranial Nerve Number</th>
<th>Function</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>IX. Glossopharyngeal</td>
<td>Controls gag reflex and sensory to posterior tongue.</td>
<td>Assess gag reflex and taste on the posterior tongue.</td>
</tr>
<tr>
<td>X. Vagus</td>
<td>Controls muscles of pharynx, voice box, and swallowing. Provides sensory to thoracic and abdominal internal organs.</td>
<td>Ask patient to say &quot;AH&quot; and listen for elevation of soft palate.</td>
</tr>
<tr>
<td>XI. Accessory</td>
<td>Motor to larynx and demyelinated muscles.</td>
<td>Nerve testing of larynx.</td>
</tr>
<tr>
<td>XII. Hypoglossal</td>
<td>Motor to muscles of the tongue.</td>
<td>Ask patient to stick tongue straight out. Tongue will deviate toward hypoglossal side.</td>
</tr>
</tbody>
</table>
Red Flag Findings
Sarah was worked up by her PCP and found to be negative for fracture, cervical instability, and minimal suspicion of vascular pathology.

Both sisters were referred to physical therapy.

Sarah however was given a soft collar to wear for comfort and unloading

Use of Cervical Collars
Randomised, controlled outcome study of active mobilisation compared with collar therapy for whiplash injury

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Neck pain intensity (VAS) and self-assessed disability of study groups A (collar therapy) and group B (exercise therapy) at the start of the study and six weeks after injury.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>Mean VAS</td>
</tr>
<tr>
<td>Pain</td>
<td>4.74</td>
</tr>
<tr>
<td>Disability</td>
<td>2.69</td>
</tr>
<tr>
<td>A</td>
<td>5.45</td>
</tr>
<tr>
<td>B</td>
<td>4.75</td>
</tr>
</tbody>
</table>

Additional Frustrations
- Diagnostic Uncertainty vs. Imaging Findings
  Baseline anatomical progressions
  - Anatomical gray hairs
  - Bulging Disc
  - Spondylolisthesis
  - Facet arthropathy
  - Degenerative disc disease

Refusal of claims based off of the pre-existing and benign nature of these variations
Physical Impairments Often Seen in Patients with WAD

- Reduced range of motion
- Muscle hypertonicity
- Altered Muscle Recruitment
- Decreased Pressure Pain Threshold
- Cold Hyperalgesia
- Impaired Gaze Tracking
- Increased Joint Position Error

Clinical Assessment of the Deep Cervical Flexor Muscles: The Craniovertebral Flexion Test

- With patient supine, hook lying
- Supine on pressure cuff
- Perform upper cervical flexion in five increasing stages
- Hold each position for 10 seconds
- 2 mm Hg each position
- Start at 20 mm Hg, End at 30 mm Hg
- Not a strength but precision & endurance task

Altered Muscle Recruitment
Multifidus Fatty Infiltration

Mechanical Hyperalgesia
Prognostic utility of PPT testing

- Lower PPT and elevated cold pain threshold at sites distal to the neck have been identified in a subset of the acute WAD population, and have been related to poor short and long-term outcomes (Sterling et al. 2004).

Intrarater reliability = excellent
- 0.96 UFT
- 0.97 TA

Interrater reliability = substantial and excellent
- 0.81 UFT
- 0.90 TA

Cold hyperalgesia

Found in individuals with higher pain and disability
- Subsequent poorer outcomes

Wagner FPX Algometer

ADVANCED SIMPLICITY
HAND-HELD UTILITY
DIGITAL CLARITY

$395
Increased JPE (Joint Position Error)

Additional Patient Reports Prolonged Symptoms

- Dizziness
- Visual and auditory disturbances
- Temporomandibular joint dysfunction
- Photophobia
- Dysphonia
- Dysphagia
- Fatigue
- Cognitive difficulties
- Poor Concentration
- Memory Loss
- Anxiety
- Insomnia
- Depression

There Must Be Something Beyond the Facet
Proposed Nervous System Involvement

Furthermore

Stress System Response
Acutely increased physiological stress response
- Increased sympathetic nervous system activation
- Peripheral vasoconstriction response
- Reduced reactivity of the hypothalamic-pituitary adrenal axis
  - Catechol O-methyltransferase (COMT)
    - Degradation of catecholamines
      - Adrenaline
      - Norepinephrine
      - Dopamine
  - Genetic association for predisposition for chronic pain and anxiety disorders
    - [Diatchenko I, 2005] (Woo 2002)
Changes in Motor and Muscle Function
Loss of movement (ROM)
Altered motor recruitment patterns
Morphological changes in muscles mass
Disturbed eye movement control
Loss of balance and joint repositioning error
Decreased muscle strength

Closed Loop

Vestibular Reflexes
- Vestibulo-ocular reflex - keeps the eyes still while the head moves
- Vestibulo-colic reflex - keeps the head still or level when you walk
- Vestibular-spinal reflex - adjusts posture for rapid changes in position
### Vestibular / Labyrinthine Apparatus

- Vestibular Afferents (VCR)
- Vestibular Ocular Reflex (VOR)
- Vestibulo Spinal Reflex (VSR)
- Tonic Neck Reflex (TNR)
- Cervico Collic Reflex (CCR)
- Cervico Ocular Reflex (COR)

### Sensimotor Theory:
- Cervical Pain / Trauma
- *change of afferents from Cervical nerve endings*
- *dysfunction of reflex and central activity*
- *needs assessing*
- *treatment as necessary.*

### Assessment

<table>
<thead>
<tr>
<th>Method</th>
<th>Positive finding (All = we if reproduction of symptoms esp Dizziness / NB Pain / repo NOT acceptable)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Head-righting (eyes open)</strong></td>
<td>CCR, VOR, TNR, CCR</td>
</tr>
<tr>
<td><strong>Head-righting (eyes closed)</strong></td>
<td>Labyrinth, CCR, VOR, TNR</td>
</tr>
<tr>
<td><strong>Cervical Joint Position Sense (JPS)</strong></td>
<td>CCR, VOR</td>
</tr>
</tbody>
</table>

### Oculomotor 1: Smooth pursuit (SP)
- CCR, VOR, OKR
- Head stable (neutral). Eyes follow target. Inability to keep up with target (eyes play "catch up"). Loss of smoothness.

### Oculomotor 2: Smooth pursuit neck torsion (SPNT)
- a/a + CCR
- a/a but set with 45deg trunk rotation. a/a = esp when target crosses mid-line. Difference between SP and SPNT = probable neck afferent dysfunction.

### Oculomotor 3: Gaze stability
- a/a
- Maintain gaze while moving head. Inability to focus. Loss of motor quality.

### Oculomotor 4: Saccadic eye movement
- a/a (esp OKR)
- Fix and follow fast moving target/separate targets. Inability to quickly change gaze/focus. Nystagmus.

### Oculomotor 5: Eye-Head coordination
- a/a (esp CCR/OKR)
- Move eyes and head together to maintain focus on moving target. a/a

### Oculomotor 6: Peripheral vision
- a/a
- Focus on target (e.g. number), read target on periphery. Inability to read peripheral target number.
Systemic Nociceptive Processing Mechanisms in WAD

Decreased Pain Thresholds
- Mechanical Pressure
- Thermal Stimulus
- Cold
- Heat
- Electrical stimulation
- Vibration

Local and Remote
- Upper Trap
- Anterior Tibialis

Nociceptive Pathway Dysfunction

Imprecision in sensory discrimination
- Patients with WAD when injected with hypertonic saline solution in anterior tibialis
  - Compared to controls
  - Higher pain scores
  - Longer duration of pain
  - Larger area of local and referred pain
  - Whole leg
  - Contralateral side

Disinhibition/Expansion of receptive fields
- Somatosensory Cortex (fMRI)
- Spinal cord hyper-excitability (withdrawal reflex)

So maybe these patients aren’t crazy?
Depends on your definition I suppose...

Psychological Presentation of WAD

Pain catastrophization
Fear of movement
Depressive symptoms
Distress

Catastrophization

• “an excessively negative orientation toward pain”

• “persons who catastrophically misinterpret innocuous bodily sensations, including pain, are likely to become fearful of pain”

• “An exaggerated negative mental state brought to bear during actual or anticipated painful experience”

Catastrophization is a coping mechanism emphasizing the communal model of pain.

“Displays of distress can be used, consciously or unconsciously, to maximize proximity, or to solicit assistance or empathetic responses from others in the social environment.”

Patients classified as high catastrophizers demonstrate higher rating of pain (NPRS) to noxious stimulus and demonstrate higher levels of expressive pain (facial features, language).

Results:
– High catastrophizers demonstrated greater pain behavior when in the presence of a rater than when alone.
– No difference in pain behaviors in low catastrophizers.

Pain Catastrophizing Scale

• Initially created by Sullivan 1995
• 13 item questionnaire about a persons pain experience and beliefs
• Further validated for subgroups and high reliability

• Three separate aspects of pain experience
  – Rumination (perseveration)
  – Magnification
  – Helplessness
Fear of Movement

Less important in WAD than in LBP
- WAD began with a often stressful MVA
- More highly associated with anxiety and stess
  - Event onto them as opposed to idiopathic or movement based onset

FEAR AVOIDANCE MODEL

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FEAR AVOIDANCE MODEL
Depression

Confounding variable in the development of chronic pain

Associated with worse outcomes

Highly associated with levels of catastrophization and post traumatic stress responses

Depression Screening

• “During the past month, have you often been bothered by feeling down, depressed, or hopeless?”
• “During the past month, have you often been bothered by little interest or pleasure in doing things?”

• Sensitivity = 0.96 -LR = 0.77
• Specificity = 0.57 +LR = 2.2

Case-Finding Instruments for Depression

Two Questions Are as Good as Many

Mary A. Hirschey, MD, Andrew L. Ayne, MD, MPH, Jacanna Mirandits, PhD, Warren E. Browne, MD, MPH

• Similar or improved screening properties as compared to
  – Primary Care Evaluation of Mental Disorders patient questionnaire
  – Center for Epidemiologic Studies Depression Scale
  – Beck Depression Inventory
  – Symptom-Driven Diagnostic System for Primary Care
  – Medical Outcomes Study depression measure
  – Quick Diagnostic Interview Schedule
Clinical Application

Post Traumatic Stress Response

Associated with traumatic onset on pain

- Motor vehicle accident

- Typically develops high levels of stress response following an exposure to an event that is perceived to be threatening

Post traumatic Stress Response

- Presentation
  - Re-experiencing the event in the form of intrusive thoughts, nightmares, dissociative flashbacks, and psychophysiological reactivity to cues of the traumatic event
  - Avoidance of thoughts, people, and places that resemble the traumatic event, emotional numbing, an absence of emotional attachment, and an inability to feel the range of passive emotions
  - Symptoms of hyperarousal, including heightened startle sensitivity, sleep problems, attentional difficulties, and the presence of irritability, anger, or rage
Post Traumatic Stress Response

Not all traumatic events cause PTSD

Other important factors
- Prior exposure to traumatic events
- Age at time of exposure
- Family instability
- Social support
- Additional life stressors
- Personal characteristics

Pain and PTSD

• Rates of PTSD in patients for which pain is secondary to an MVA range 30-50%
• 24-47% of patients with fibromyalgia patients attribute the onset of their symptoms to a physical injury associated with MVA
Cortisol & ANS Activation

Central Stress Response

Impact of Events Scale

Initially proposed in 1979 by Horowitz

- 14 item questionnaire of symptoms associated with traumatic event
- 2 Subscales
  - Intrusion Items
  - Avoidance Items
Impact of Event Scale: psychometric properties

EVA C. SUNNIN and MARDI J. HOROWITZ

BRITISH JOURNAL OF PSYCHIATRY (2004), 188, 285-299

- Test-retest reliability:
  - 0.87-0.79 for 1 week
  - 0.56-0.74 for 1 year

- Validity
  - Good internal consistency
  - Good correlation to other measures of post traumatic stress and anxiety

---

**IMPACT OF EVENTS SCALE**

On __________ you experienced a motor vehicle accident.

Below is a list of comments made by people after stressful life events. Please check each item, indicating how frequently these comments were true for you DURING THE PAST SEVEN DAYS. If they did not occur during that time please mark the 'NOT AT ALL' column.

<table>
<thead>
<tr>
<th>Item</th>
<th>1. Thought about it when I didn’t mean to</th>
<th>Not at all</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Avoided feeling upset when I thought about it or was reminded of it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>3. Tried to remove it from memory</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>4. Had trouble falling asleep or staying asleep because of it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>5. Had vivid dreams about it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>6. Stayed away from reminders about it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>7. Felt as if it hadn’t happened or it wasn’t real</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>8. Felt I had to talk about it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>9. Pictures about it popped into my mind</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>10. Other things kept making me think about it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>11. I was aware that I still had a lot of feelings about it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>12. I had a memory of it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>13. I tried not to think about it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>14. Any reminder brought back feelings about it</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
<tr>
<td></td>
<td>15. My feelings were kind of numb</td>
<td>Not at all</td>
<td>Rarely</td>
<td>Sometimes</td>
<td>Often</td>
</tr>
</tbody>
</table>

Scoring: Not at all = 0; Rarely = 1; Sometimes = 3; Often = 6; Total = total the scores.

Intrusive subscale: sum of items 1, 4, 5, 6, 10, 11 and 14.

Avoidance subscale: sum of items 2, 3, 7, 8, 9, 12, 13 and 15.

Total score: 0-3 (mild range); 4-9 (moderate range); 10-15 (severe range).
Trajectories: PTSD symptoms

Treating the Uncomplicated Patient

Overall great prognosis in the absence of hyperalgesia and psychosocial factors

- Reassurance
- Pain modulation (manual therapy, modalities)
- Local muscle retraining

Clinical Guidelines

Neck Pain:

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

Oral and written education
Education with exercise
Behavioral programs

Appear effective for reducing pain and disability

In acute WAD, education seems sufficient

Population: n=141, (59% female)
WAD I-III

PT referral: exercise, advice, AROM, manual therapy
Starting PT within 3 mos. of injury or after 3 mos.

Outcomes: GROC, Bournemouth Questionnaire
Results

2/3 of patients in Group 1 improved
83% of patients in both groups improved

Patients in early group did significantly better than the late group

![Graph showing improvement of patients in both groups](image1)

Treatment of the Complex Patient with WAD

Population: n = 134, WAD I-II
Methods: Randomized to one of two groups, exercise and advice or advice only
Outcomes: Pain, Bothersomeness, PSFS, NDI, Global perceived effect measured at 6 and 12 weeks

![Graph showing treatment outcomes](image2)
Results

Compared with advice alone, exercise produced significant reductions in pain intensity, bothersomeness and improvements in function, disability and global perceived effect in patients at 6 weeks.

- Subjects with higher initial levels of pain and disability experienced a greater treatment effect than subjects with lower levels.
- Subjects in the advice group were more likely to seek additional treatment during and following the study period.
Population: n = 71
Methods: Randomized to multimodal physical therapy, (MPT) program or self management program, (SMP) consisting of advice and exercise
Primary outcome: NPI

Results

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>MPT</th>
<th>SMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>NPI (%)</td>
<td>-10.4 ± 14</td>
</tr>
<tr>
<td>Secondary</td>
<td>ROM (%)</td>
<td>+9.6 ± 13.2</td>
</tr>
<tr>
<td>Flexion</td>
<td>14.1 ± 11.9</td>
<td>+9.5 ± 9.0</td>
</tr>
<tr>
<td>Lateral flexion</td>
<td>10.2 ± 7.1</td>
<td>+10.6 ± 6.7</td>
</tr>
</tbody>
</table>

(Jull et al, Pain, 2007)

Results

- Multimodal physical therapy program (MPT) consisting of manual therapy, exercises and psychological strategies can gain immediate reduction in self-reports of pain and disability in patients with chronic WAD
  - Significantly greater changes in NPI scores in the MPT group
  - Improvement in pattern of muscle control was only evident in MPT
Components of Treatment
- Education
- Exercise
- Goal Setting
- Somatosensory Retraining

**Differentiation**

- Arthritis Res Ther. 15, 272.

Mechanisms-based classifications of musculoskeletal pain: Part 2 of 3: Symptoms and signs of peripheral nociceptive pain in patients with low back/leg pain

Mechanisms-based classifications of musculoskeletal pain: Part 3 of 3: Symptoms and signs of nociceptive pain in patients with low back/leg pain
### Nociceptive Dominant

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermittent</td>
<td>4.25</td>
</tr>
<tr>
<td>Localized</td>
<td>69.79</td>
</tr>
<tr>
<td>Clear aggs/ease</td>
<td>18.41</td>
</tr>
<tr>
<td>Dysesthesias</td>
<td>0.15</td>
</tr>
<tr>
<td>Night Pain</td>
<td>0.22</td>
</tr>
<tr>
<td>Burning</td>
<td>0.28</td>
</tr>
</tbody>
</table>

SN= 0.91  SP= 0.91  +LR=10.10  -LR=0.10

### Neuropathic Dominant

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of Nerve Injury</td>
<td>12.64</td>
</tr>
<tr>
<td>Dermatomal Distribution</td>
<td>24.29</td>
</tr>
<tr>
<td>Positive Nerve Sensitivity Tests</td>
<td>14.64</td>
</tr>
</tbody>
</table>

SN= 0.86  SP= 0.96  +LR=21.57  -LR=0.14

### Central Sensitivity Dominant

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain disproportionate to injury</td>
<td>15.19</td>
</tr>
<tr>
<td>Disproportionate agg/eases</td>
<td>30.69</td>
</tr>
<tr>
<td>Psychosocial symptoms</td>
<td>7.65</td>
</tr>
<tr>
<td>Diffuse painful palpation</td>
<td>27.57</td>
</tr>
</tbody>
</table>

SN= 0.92  SP= 0.98  +LR=40.64  -LR=0.08
CHANGING BELIEFS

Nociception and pain is synonymous
Pain is an input driven system
Nervous system as a wire
Assumption that there is a direct link between the amount of tissue damage and the level of pain experienced
All pain is caused by injury and increased pain means more damage
Pain is either physical or psychological (mental vs. physical)
In chronic pain tissues are not healing and damage is ongoing
END RESULT... HOW DANGEROUS IS THIS?

HOMEOSTATIC SHIFT IN SURVIVAL

NORMAL
GOAL SETTING
Common areas of failure
- Patient has no goals
- The patient has goals, but they are so unrealistic, they are likely never to get there, so they might as well not try

GOAL SETTING
Many Components
- Graded exposure
- Graded exercise
- Part to whole building options
Key Components
- Remove vagueness
- Make them functional
  - Measured
  - Meaningful

GOAL SETTING
Smaller manageable goals that will not flare someone
- “Clean my house”
- “What makes up cleaning the house?”
- “Which one specific task?”
- “How many rooms?”
- “If you could do only one room?”
- “How much of the one room could you go home do today and still be okay, not wiped on the couch?”
GOAL SETTING

<table>
<thead>
<tr>
<th>Day</th>
<th>1A</th>
<th>Day</th>
<th>2A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>1B</td>
<td>4</td>
<td>2B</td>
</tr>
<tr>
<td>5</td>
<td>1C</td>
<td>6</td>
<td>2C</td>
</tr>
<tr>
<td>7</td>
<td>1D</td>
<td>8</td>
<td>2D</td>
</tr>
<tr>
<td>9</td>
<td>1E</td>
<td>10</td>
<td>2E</td>
</tr>
</tbody>
</table>

Consider:
- Meals do not have to be cooked in one session
- Laundry does not have to be done in one day
- Answering 5 emails at a time is progress
- Weeding a garden can be broken up with stakes

Sensorimotor Retraining
- Oculo Head Righting Reflex
- Labrythne Head Righting Reflex
- Cervical JPE
- Oculomotor Tracking
- Peripheral Vision Training
- Quick Eye Movement Training

JPE Training
Other Principles
Timed Duration more so than sets and Reps
  ♦ Graded Exercise
  ♦ Avoidance of Wind Up (Temporal Summation)
Manual Therapy
  ♦ Should be non-noxious
  ♦ Lower grades of mobilization

Questions?

tdenninger@gmail.com