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Neurological Surgery
Disclosure

• No financial interest with pharmaceutical company, biomedical device manufacturer, or corporation whose product or services relate to this presentation.

• Part time employment by State Fund
Years of Whiplash


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The Talk

• Epidemiology & Cost
• Rates of recovery & who?-the endless data
  - Pre & post 2001
• Pathology
• Treatment
The Short Version

- Treat early
- Mobilize, no resistance, treat trigger points
- Avoid Collars
- Radiofrequency neurotomy or disckectomy with fusion in select few
- Use a standardized functional scoring system
• “Whiplash” ➔ 2,411 articles (2,013 in 2008)

• Plus Surgery ➔ 35 hits (4 actually to do with surgery)
  • 1993, 20 pt.s with verified disc protrusions (9 did poorly, 2 good, 9 fair).
  • 1994, of 50 pts, 24 with persistent pain – 2 with instability, 8 with disc protrusions.
  • 2002, Carpal tunnel release in 30 pts with neck and shoulder pain.
  • 2004, Single, Case report of trigger point excision, in bumper care whiplash.
Whiplash?

- “... in railway accidents those passengers suffer most ... who sit with their backs turned toward the end of the train which is struck”
- “... are jerked violently against the backs of their seats and thus suffer in the first instance and by the first shock from concussion of the spine ...”
- “... have led surgeons to consider these cases as somewhat exceptional and different from ordinary accidents”

Dr. John Erichsen 1882, British surgeon in Concussion of the Spine
The Short-short, Hallmark version
Oh, well.
Four out of five doctors agree that you’re sick.

Get Well Soon
Whiplash-associated disorder (WAD) is a collection of signs and symptoms resulting from an acceleration-deceleration mechanism of energy transfer to the neck.
Common Signs & Symptoms

- Neck pain
- Headaches
- Dizziness
- Visual disturbances
- Impaired concentration
- Sensory changes in the arms
1995 Quebec Classification of Whiplash-Associated Disorders

<table>
<thead>
<tr>
<th>Grade</th>
<th>Clinical Presentation</th>
</tr>
</thead>
</table>
| 0     | No complaint about the neck  
            No physical sign(s) |
| I     | Neck complaint of pain, stiffness, or tenderness only  
            No physical signs |
| II    | Neck complaint & musculoskeletal sign(s): these include decreased range of motion and point tenderness |
| III   | Neck complaint and neurological signs(s): these include decreased of absent deep tendon reflexes, weakness, and sensory deficits |
| IV    | Neck complaint and fracture dislocation |
Some Reported Incidences

<table>
<thead>
<tr>
<th>Country</th>
<th>Per 100,000 population per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA &amp; Canada</td>
<td>70 - 380</td>
</tr>
<tr>
<td>South Australia</td>
<td>300</td>
</tr>
<tr>
<td>Sweden</td>
<td>100</td>
</tr>
<tr>
<td>Montana?</td>
<td>$9 \times 70 = 630$</td>
</tr>
<tr>
<td></td>
<td>$9 \times 380 = 3,420$</td>
</tr>
</tbody>
</table>

## Cost

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimated Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>4.5-10 billion</td>
</tr>
<tr>
<td>Canada</td>
<td>~ 3,100 per incident</td>
</tr>
<tr>
<td>South Australia</td>
<td>70 million (2001)</td>
</tr>
<tr>
<td>Sweden</td>
<td>~ 2.5 billion (1.8 billion-lost output)</td>
</tr>
<tr>
<td>Germany</td>
<td>1 billion</td>
</tr>
<tr>
<td>Europe</td>
<td>~ 12 billion</td>
</tr>
</tbody>
</table>

## Cost Perspectives

<table>
<thead>
<tr>
<th></th>
<th>Estimate of Annual cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Whiplash</strong></td>
<td>4.5 - 10 billion</td>
</tr>
<tr>
<td><strong>Breast Cancer</strong></td>
<td>6.6 billion</td>
</tr>
<tr>
<td><strong>Lung Cancer</strong></td>
<td>5 billion</td>
</tr>
<tr>
<td><strong>Colorectal CA</strong></td>
<td>6.5 billion</td>
</tr>
<tr>
<td><strong>Prostate CA</strong></td>
<td>4.7 billion</td>
</tr>
</tbody>
</table>
Reviews

1995 - Quebec Task Force (QTF) on Whiplash-Associated Disorders. A comprehensive systematic review of the literature. Monograph

- few high quality studies, the scientific quality of the literature mostly poor

- “self limited with a favorable prognosis” (based on claim closure at 31 days)

- not possible to provide evidence based recommendations concerning prognostic factors, as shortage of adequate studies.

Studies show high variability of ongoing complaints (1994 - 2001)

- 19% - 60% with complaints at 6 months

- 13% - 50% still absent from work at 6 months
Reviews

• 2001 - Cote et al
  - search yielded 2335 articles, 199 re. whiplash, 41 met initial inclusion criteria, & 13 ultimately accepted to review for prognosis; only 2 without methodological flaws

• “There is conflicting evidence . . . large discrepancies in recovery time”

  Cote et al, Spine 2001 “A Systematic Review of the Prognosis of Acute Whiplash and a New Conceptual Framework to Synthesize the Literature”

- Delete WAD grades 0 and IV
- No evidence of significant differences in outcome related to compensation claims, despite various studies with different results.
- Physiologic changes occur in peripheral and central nervous system.
- Previous mental health and current important.
- Early management should include pain intensity documentation.
- Persistent pain > 1 month – additional evaluation.
- WAD 1 - no xray needed if under 65, and no skeletal disease
- WAD 2 – plain xray or CT, CT if nerve root or spinal cord signs
- WAD 3 – CT & possibly MRI if objective neurologic signs
Rates & Variability of Recovery

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Rates of Recovery - Cote et al, Spine 2001 Review

Percent of pt.s with neck pain post injury

Rates of Recovery - Cote et al, Spine 2001 Review

Percent of pts Returned to work

- Mayou 1996, England
- Karlsborg 1997, Denmark
- Partheni 2000, Greece
- Sturzeneger 1995, Switzerland
- Obelieniene 1999, Lithuania
- Satoh 1991, Japan
- Gun 2005, Australia
Rates of Recovery  -Spine: Brison et al, 2005 (p. 1799)

Percent of pt.s with persistent Whiplash Associated Disorder (WAD)

<table>
<thead>
<tr>
<th>Frequency of Pain</th>
<th>Severity of Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Mild</td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
</tr>
<tr>
<td>Occasionally</td>
<td>0</td>
</tr>
<tr>
<td>Regularly</td>
<td>0</td>
</tr>
<tr>
<td>Daily</td>
<td>0</td>
</tr>
</tbody>
</table>
Variability & Rate of Recovery - Injury: Tomlinson et al, 2005

Gargan & Bannister classification
- A - Asymptomatic
- B - Mild symptoms not affecting work or leisure activities
- C - Intrusive symptoms interfering with work or leisure. Frequent use of analgesics, orthosis or physiotherapy
- D - Severe problems: lost job, continual reliance on analgesics, orthosis. Repeated medical consultations

Take Home
- Outcome can only be predicted at 3 months
- not confirmed until 2 years
Predicting Recovery – Telling the Future
Since 2002 ➔ May 2006 - Predictors of persistent symptoms 2006
- Sterling, Pain May (p.102)

<table>
<thead>
<tr>
<th>6 month predictor of NDI in original model</th>
<th>Still predictive at 2-3 years?</th>
</tr>
</thead>
<tbody>
<tr>
<td>High initial pain (NDI)</td>
<td>Yes</td>
</tr>
<tr>
<td>Decreased ROM</td>
<td>No</td>
</tr>
<tr>
<td>Older Age</td>
<td>Yes</td>
</tr>
<tr>
<td>Early cold hyperalgesia</td>
<td>Yes</td>
</tr>
<tr>
<td>Impaired Sympathetic vasoconstriction</td>
<td>No</td>
</tr>
<tr>
<td>Post traumatic Stress symptoms</td>
<td>Yes</td>
</tr>
<tr>
<td>Compensation status</td>
<td>No</td>
</tr>
</tbody>
</table>
Since 2002 → May 2006 - Predictors of persistent symptoms

NDI values over Time

- >1 month
  - Recovered: 19.2
  - Mild: 37.2
  - Mod/Sev: 54.7

- 6 months
  - Recovered: 2.9
  - Mild: 16.5
  - Mod/Sev: 42.8

- 2 years
  - Recovered: 2.8
  - Mild: 15.7
  - Mod/Sev: 37.1
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Odds Ratio – how much more likely to Not recover.</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (NDI)</td>
<td>13.24 times more likely</td>
</tr>
<tr>
<td>High Neck Pain Intensity ≥ 6/10</td>
<td>5.63 times more likely</td>
</tr>
<tr>
<td>WAD of 2 or 3</td>
<td>2.0 times more likely</td>
</tr>
<tr>
<td>Less than High School education</td>
<td>2.0 times more likely</td>
</tr>
<tr>
<td>Being Female</td>
<td>1.64 times more likely</td>
</tr>
<tr>
<td>Pre-injury Neck Pain (not “robust”)</td>
<td>1.59 times more likely</td>
</tr>
<tr>
<td>Pre-injury Headache (not “robust”)</td>
<td>1.22 times more likely</td>
</tr>
<tr>
<td>Older than 50 - 55</td>
<td>No Effect</td>
</tr>
<tr>
<td>Collision Parameters</td>
<td>No Effect</td>
</tr>
</tbody>
</table>
Pathology & Mechanisms

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Pathology & Mechanisms

- Biomechanics
- What’s Damaged or Pain Generators?
  - Facets
  - CNS
  - Muscles and trigger points
- Central Hypersensitivity
Pathology & Mechanisms
Rear End Collision Video: 
Actual Speed of Occupant Motion

The average rear-end collision occurs in about 250 milliseconds or ¼ second.

The injury causing portion of the collision occurs in the first 75 milliseconds, or in the blink of an eye.
Live Occupant Video

This video clearly shows the dramatic forces that occur during a low speed collision. This was a 6 mph test crash.
Motion During a Collision

0 milliseconds
At the moment of impact, the car seat just begins to move and the occupant has not yet been accelerated forward.
Motion During a Collision

50 milliseconds
As the car seatback pushes the torso forward, the spine moves forward, resulting in a straightening of the thoracic and cervical spine.

Seatback pushes torso forward

Head remains stationary

Spine straightens
Motion During a Collision
75 milliseconds

At this point in the collision, the car seat is rapidly pushing the occupant's torso forward, while the head remains stationary due to inertia.

This difference in motion between the neck and torso results in an S-shaped curve, where nearly all of the bending in the cervical spine takes place in the lower cervical spine.

This rapid bending in just a few joints can result in ligament damage in the lower spine.

Head remains stationary
Spine forms an abnormal S-shape formation
Seatback pushes torso forward
Injury Causing Motion

50 milliseconds

Spine Straightens

75 milliseconds

S-Shaped Curve
At about 150 milliseconds, the torso has pulled so far forward on the lower neck that the head is forced backwards over the head restraint.

Depending on the severity of the collision, the ligaments in the front portion of the spine can be injured during this phase of the collision.
Finally, the head and torso are thrown forward by the force of the car seat.

200 milliseconds

Head thrown forward

Force from car seat
Rear End Collision Video: Occupant Motion in Slow Motion
Seatbelts and Headrest

**Seatbelts**
- Most recent studies indicate that seatbelts (including shoulder harnesses) do not increase whiplash incidence. *Kumar 2006*

**Headrests**
- Conflicting reports of effectiveness.
- Insurers strongly advocates proper use of.
- Two studies indicate 90% are ineffectively positioned.
- Headrest should be behind center of gravity of head and back set < 60 mm (2.4 inches). *Stemper 2006*
Viano and Gargan documented the head restraint position of 1,915 vehicles at an intersection. They found that only 10% of the occupants had the head restraint in the proper position.

Causes and Provocateurs

- A complex and progressive injury
- Muscles, ligaments, facet joints and brain may be injured in sequence.
- Nonlinear
- Nociceptive input and central or sympathetic hypersensitivity may drive some chronic pain
- Cultural Mechanisms?
- Medicalization?

Kumar 2004, Olivera 2006
Differential motion between upper and lower cervical spine.

Muscle activation DOES occur during the interval in which injury occurs.

Unclear if muscle activation mitigates or exacerbates injury.

The reflex “startle” muscle contraction, may act differently than “bracing” before injury.

Posterior muscles contract more quickly and longer than anterior
Facets

- Biomechanical studies indicate altered facet loading & greater joint distortion.
- Post-mortem studies show damage can occur in facets & discs.
- Post mortem findings are consistent with biomechanical studies.
- Nociceptive peptides identified in facet synovial membranes, capsule, and subchondral bone & spinal cord.
- Pain has been substantially reduced in up to 54% of WAD pt.s by facet block, blinded and timed.

Facet Medial Branch Blocks
Bogduk (2011), Spine v36, n25s

- ~ 50% of patients (36 – 67% range) - facet is significant pain generator in multiple studies.

- Joints most commonly affected are C2-3 or C5-6 alone, followed by the C2-3 & C5-6 in combination, and less often C5-6 with C6-7.

- Concordant with biomechanical and post-mortem studies.
Central Mechanisms

- Pain can increase by:
  - Pain amplification peripherally or centrally
  - Reduced pain inhibition
- Animal models show changes in the pain processing system of the spinal cord (glutamatergic system)
- Evidence for:
  - Decreased pain threshold with pressure,
  - Increased skin hypersensitivity,
  - Decreased pain threshold for cold stimulus,
  - Decrease pain threshold for electrical stimulation.
- Above likely Not due to “painful and tender muscles”

Cultural Mechanisms - Expectation

Comparing prevalence of late (chronic) whiplash syndrome between Canada & Lithuania

- Canada - expectation of chronic symptoms high
- Lithuania - expectation of chronic symptoms low

Prevalence of symptoms in acute phase of injury
- Canada = Lithuania

Prevalence of chronic symptoms
- Canada (~ 50%) > Lithuania (rare)

Cultural Mechanisms - Expectation

Comparing prevalence of late (chronic) whiplash syndrome between **Canada & Germany**

• Ditto

Ferrari et al, 2005, J Spinal Disor Tech 18(1)
Whiplash was most prevalent injury in 3rd party MVA in New South Wales, Australia. Legislative change removed compensation for “pain and suffering” in whiplash, introduced guidelines and permitted earlier acceptance of claims & access to care.

Outcomes assessed 2 years after injury with blinded telephone interview using Functional Rating Index (FRI)

Mean FRI improved from 38.0% for 1999 group to 30.1% for 2003 group.

• Patient commonly assume recovery starts when they begin receiving health care for their injuries.

• Health care workers commonly prognosis depends on age, sex, and marker of injury severity.

• All factors may pale in comparison to non-clinical markers such as:
  - expectation of recovery & coping styles

• The expectation - A mild traffic collision can lead to chronic pain and disability.

• Not present in “non-whiplash” cultures (Greece, Germany, Lithuania).
Culture – Coping Strategies

Canadian study – large prospective cohort study. Comparing those with passive vs active strategies, with & without depression.

- Passive coping without depression – recovered 37% slower than those with little passive coping.
  - Passive + Depression - recovered 75% more slowly.

Those with depression, but little passivity recovered 4 times more quickly than Passive + Depression

Culture – Medicalization- Too Much Too Soon

- 2008 Bone & Joint Decade Task Force on Neck Pain
- 1 hour educational session with nurse focusing on fear reduction & staying active - as effective as 6 week course of exercises by physiotherapist, or immobilization followed by exercises.
- Mobilization combined with home exercise in acute phase more effective than soft collar and rest.
- Warned that high health care utilization in first weeks can delay recovery.
- Norwegian study – early multidisciplinary evaluation & advice increased risk of Chronic neck pain.
- Dutch Randomized trial – 4 visits with GP for education & advice - more effective than 13 visits of education & exercise with physiotherapist.

Current evidence suggests acute whiplash be treated with education, exercise, mobilization, reassurance, pain control, & encouragement to resume normal activity of daily living.
Take Home

- It is real
- A complex and progressive injury.
- Facets are a significant pain generation in many.
- Coping strategies and expectations play a significant role.
Treatment
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Whiplash

Treatment Summary 1993 to 2003

- Noninvasive Interventions
- Medical Interventions
- Surgical Interventions

Soft collar & immobilization of no demonstrated benefit
## NonInvasive Intervention Duration of WAD

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Duration of WAD</th>
<th>Summary of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>Acute WAD only</td>
<td>Unclear Evidence</td>
</tr>
<tr>
<td>Multimodal with exercise</td>
<td>Acute &amp; chronic WAD</td>
<td>Unclear Evidence</td>
</tr>
<tr>
<td>Mobilization</td>
<td>Acute WAD only</td>
<td>Moderate-Strong Evidence</td>
</tr>
<tr>
<td>Pulsed magnetic field treatment</td>
<td>Undefined</td>
<td>Limited-Mod. Evidence</td>
</tr>
<tr>
<td>Chiropractic Manipulation</td>
<td>Acute &amp; chronic</td>
<td>Moderate Evidence</td>
</tr>
</tbody>
</table>

Conlin 2005, Pain Res Manage

Soft collar & immobilization does not help
Medicinally based interventions

- Intra-articular Injections local &/or steroid
- Systemic Methylprednisolone
- Botulinum injections
- 3 randomized clinical trials (RCTs) (107 pt.s)
- 1 Case series (18 pt.s)
<table>
<thead>
<tr>
<th>Intervention</th>
<th>Duration of WAD</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steroid Injections</td>
<td>Acute &amp; Chronic WAD</td>
<td>Unclear evidence</td>
</tr>
<tr>
<td>Botulinum Treatments</td>
<td>Chronic WAD</td>
<td>Limited Evidence</td>
</tr>
</tbody>
</table>
Surgically based interventions

- Radiofrequency neurotomy
- Carpal tunnel release
- Anterior Cervical diskectomy & fusion
- Thoracic outlet release (no quality studies reported)
- 2 randomized clinical trials (RCTs) (41 pt.s)
- 5 Nonrandomized studies & case series (151 pt.s)
### Surgically based interventions

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Duration of WAD</th>
<th>Summary of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiofrequency neurotomy</td>
<td>Chronic WAD</td>
<td><strong>Moderate - Strong evidence</strong></td>
</tr>
<tr>
<td>Carpal tunnel decompression</td>
<td>Chronic WAD</td>
<td><strong>Limited evidence</strong></td>
</tr>
<tr>
<td>Anterior Cervical diskectomy &amp; fusion</td>
<td>Chronic WAD</td>
<td><strong>Limited evidence</strong></td>
</tr>
</tbody>
</table>

Soft collars & immobilization may delay recovery.
Radiofrequency Neurotomy

- In appropriately selected patients ~ 50% (36 - 67%) of Whiplash pts.
- 70% success rate.
- Success = 80% reduction in pain and ability to perform previously painful movements.
- Mean duration of relief 400 days.
- Success maintained in 60% with repeat treatments.
- Litigation status does not affect this outcome.

Radiofrequency Neurotomy

• Appropriate Selection is a must:
  • comparative local anesthetic or placebo-controlled blocks.

• Single Block False Positive Rates reported in 27% - 45% of patients.

• Placebo-controlled blocks reduce the number of false negatives.

Soft Collar

- Randomized controlled study
- 108 consecutive pts
- Early Mobilization & no collar vs. 3 weeks in soft collar with SAME exercise regimen.
- Evaluation at 3, 12, & 52 weeks
- Assessment by occupation, ADL score, pain score, ROM

Crawford et al 2004 - Injury
Soft Collar

- No benefit on any outcome at any time
- The collar group took significantly longer to return to work after injury mean 34.4 days vs 17 days.

Also supported by - Peeters 2001, Rosenfeld 2000, Spitzer 1995, Magee 2000

Crawford et al 2004 - Injury
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laser acupuncture - prospective, blinded, RCT, (44 pts)</td>
<td>No difference</td>
</tr>
<tr>
<td>HF-PEMF - acute WAD vs placebo</td>
<td>No difference</td>
</tr>
<tr>
<td>TENS, HF-PEMF, ultrasound, iontophoresis vs multimodal</td>
<td>No sig. difference</td>
</tr>
<tr>
<td>Intermittent traction vs collar &amp; exercise</td>
<td>No sig. difference</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Study</th>
<th>Intervention</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrari 2005</td>
<td>Education intervention with Whiplash Book summary vs. generic neck sprain sheet. N=112</td>
<td>No Effect</td>
</tr>
<tr>
<td>Brison 2005</td>
<td>Educational video - reassurance core message</td>
<td>Trend toward less severe WAD symptoms in treated group</td>
</tr>
<tr>
<td>Sullivan 2006</td>
<td>Tx-Targeted(psychosocial risk factors) plus PT vs. PT alone (control group). N=130; PT=mobilization, flexibility, endurance</td>
<td>Treatment - higher return to work rate. Not statistically compared to control.</td>
</tr>
<tr>
<td>Rosenfeld 2006</td>
<td>“Active involvement &amp; intervention” - exercise vs written info.</td>
<td>Significant cost↓ in treated groups</td>
</tr>
</tbody>
</table>
Since 2003? - Surgical

<table>
<thead>
<tr>
<th>Prushansky 2006 - radiofrequency neurotomy</th>
<th>Nonrandomized, no control</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=40</td>
<td>Improvement in up to 70% pts</td>
</tr>
</tbody>
</table>
Special Note - *Spine* July 2006

Psycho-Educational Video
"Psycho-Educational Video in ER Provides Effective Treatment for Whiplash Injuries"


- 126 pts
- Pseudo-randomized (alternate treatment & control)

<table>
<thead>
<tr>
<th>Control</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>-no video or pop quiz</td>
<td>-Viewed video on portable cart</td>
</tr>
<tr>
<td></td>
<td>-Pop quiz</td>
</tr>
<tr>
<td></td>
<td>-Discharged with instruc. Sheet &amp; video content sheet</td>
</tr>
</tbody>
</table>
“Psycho-Educational Video in ER Provides Effective Treatment for Whiplash Injuries”

Video points - 12 minutes

- 1-definition & description
- 2-possible symptomatology in first 48 hours
- 3-medical treatment in 1st 48 hours
- 4-possible symptomatology after 48
- 5-medical treatment after 48 hrs.
- 6-recovery period time frame
- 7-muscle spindles & demonstration
- 8-interview with recovered pt.
- 9-biofeedback education
- 10-explanation of muscle tension & physical & emotional triggers
- 11-muscle tension awareness & reduction techniques
- 12-home cervical exercises
- 13-breathing relaxation
- 14-follow-up emphasis on diagnosis as muscular
- 15-Summary
Doctor Visits

ER Visits

Surgical Consults

Same Trends
- Urgent Care visits
- Chiro. Visits
- PT Visits

Oliveira et al 2006 - Spine
Disability application

% of group

Month 1  Month 6

No video  Video

Income Decreased

% of group

Month 1  Month 2  Month 6

No video  Video

Oliveira et al 2006 - Spine
Legal Involvement

Prayer or meditation

Oliveira et al 2006 - Spine
Verbal Pain Scale

Short Form Musculoskeletal function Assessment

Oliveira et al 2006 - Spine
Treatment Summary

Moderate - Strong Evidence

- Mobilization (usually avoid resistance or painful stretches)
- Chiropractic
- Radiofrequency neurotomy
- “Psycho-Video” with emphasis on trigger points & mobilization
Treatment Summary

Limited – 1 study
- Pulsed magnetic field
- Botulinum injection
- Carpal Tunnel release
- Ant. Cervical diskectomy & fusion
Treatment Summary

Unclear

- Exercises
- Multimodal with Exercise
- Steroid injections
• Early gentle mobilization.
• Avoid soft collar, esp. after 48 hours.
• Approach early (most patterns are entrenched by 3 months).
• Address coping strategies, fear, activity.
• Standardize ER approach?
  - “Pschyo-educational video?”
AND

No soft collar if at all possible
Treat early - but not Too much

THE END
AND

No soft collar if at all possible
Treat early

THE END