Cervical Spine Stingers and Transient Quadriplegia

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Disclosures

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Stingers
Stingers

Common

• 50 to 65% of college players
  – Clancy 1977
  – Sallis 1992
### Table 20-1. Brachial Plexus Stretch and Compression Injuries in the National Football League, 1980–1997

<table>
<thead>
<tr>
<th>Position</th>
<th>N (#cases)</th>
<th>Days Lost (Sum)</th>
<th>Days Lost (Mean)</th>
<th>Games Missed (Sum)</th>
<th>Games Missed (Mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linebacker</td>
<td>98</td>
<td>1953</td>
<td>20</td>
<td>191</td>
<td>2</td>
</tr>
<tr>
<td>Offensive lineman</td>
<td>92</td>
<td>1974</td>
<td>21</td>
<td>173</td>
<td>2</td>
</tr>
<tr>
<td>Defensive lineman</td>
<td>73</td>
<td>1036</td>
<td>14</td>
<td>106</td>
<td>1</td>
</tr>
<tr>
<td>Secondary</td>
<td>39</td>
<td>938</td>
<td>24</td>
<td>93</td>
<td>2</td>
</tr>
</tbody>
</table>

Permission to use statistics authorized by the National Football League.

Weinstein and Herring 2000
Pathomechanics

- **Tensile injury** to brachial plexus or cervical nerve root/spinal nerve complex
- **Compression injury** to brachial plexus or cervical nerve root/spinal nerve complex

Pathomechanics

- May be dependent upon skill level of athlete
  - Watkins 1986
Neuroanatomy

- Resistance to tensile force
  - Number of funiculi

- Sunderland
  1978
Neuroanatomy

- Resistance to tensile force
  - Number of funiculi
  - Amount of perineural tissue

- Sunderland
  1978
Neuroanatomy

- Resistance to tensile force
  - Number of funiculi
  - Amount of perineural tissue
  - Structure of dorsal & ventral roots

- Sunderland 1978
Neuroanatomy

- Resistance to tensile force
  - Number of funiculi
  - Amount of perineural tissue
  - Structure of dorsal & ventral roots
  - Linear vs. plexiform architecture
    - Sunderland 1978
Neuroanatomy

• Resistance to compressive force
  – Neuroforaminal narrowing
  – Epineural tissue of the brachial plexus

- Sunderland 1978
Neuroanatomy

- The nerve root/spinal nerve complex is the most susceptible area to tensile or compressive injury
- C5 – C7 (especially motor fibers) most vulnerable
  - Shortest
  - Direct alignment with upper trunk of plexus

- Sunderland 1978
Persistent stingers

• Case study – 55 football players
  – 11 professional, 37 collegiate, 7 scholastic
  – Levitz 1997
Persistent stingers

- 83% extension/compression mechanism
- 70% Spurling’s sign

– Levitz 1997
Persistent stingers

- 87% disc disease by MRI
- 93% disc disease or foraminal narrowing by MRI
- 53% Torg ratio <0.8

– Levitz 1997
Persistent stingers

- 266 collegiate football players
- 40 problematic stingers

– Meyer 1994
Persistent stingers

- 85% extension/compression
- 15% brachial plexus stretch

– Meyer 1994
Persistent stingers

- Pre-participation C-Spine X-rays
- 10 cervical MRI’s – normal
- 5 myelogram/ CT’s – normal
- 8 electrodiagnostic studies – 6 normal

– Meyer 1994
Persistent stingers

- 47.5% of stinger group had Torg ratio <0.8
- 25.1% of asymptomatic group had Torg ratio <0.8
  - p-value = 0.02
  - Meyer 1994
Stingers

Torg ratio

Foramen/ vertebral body ratio
Stingers

- Torg ratio
  - <0.8 scholastic
  - <0.7 collegiate
- Foramen/ vertebral body ratio
  - <0.73 (average) scholastic

- Castro 1997 Kelly 2000
Persistent stingers – Work-up

- Cervical spine x-rays
  - A/P & lateral
  - Obliques
  - Flexion/extension
- MRI
- Myelogram/CT
- EMG
Persistent Stingers- Treatment

• Rest
Persistent Stingers - Treatment

- Rest
- Rehabilitation
Persistent Stingers-Treatment

scap retraction on ball
Persistent Stingers - Treatment
Persistent Stingers- Treatment

weighted ball
Persistent Stingers-Treatment

- Rest
- Rehabilitation
- Medications
  - Oral
  - Selective injections
Persistent Stingers - Treatment

- Rest
- Rehabilitation
- Medications
  - Oral
  - Selective injections
Persistent Stingers - Treatment

- Rest
- Rehabilitation
- Medications
  - Oral
  - Selective injections
Persistent Stingers - Treatment

- Rest
- Rehabilitation
- Medications
  - Oral
  - Selective injections
- Equipment modifications
Persistent Stingers - Treatment

- Rest
- Rehabilitation
- Medications
  - Oral
  - Selective injections
- Equipment modifications
- Surgery
  - Foraminotomy
  - Fusion
Case Report
Stinger

- 23 year old professional football player
- 9/29/02 made tackle on special teams
- Extension/rotation of head to right
- Cervical and shoulder girdle region pain and burning
Case Report
Stinger

- Physical examination (09/29/02)
  - + Spurling’s maneuver to the right side
  - C5 verses upper trunk weakness (4+/5) on right side
  - Subtle diminished sensation lateral deltoid on right side
  - Normal reflexes
Case Report
Stinger

- 10/09/02
  - Spurling’s maneuver
  - External rotation and isolated supraspinatus testing 4+ to 5/-5
  - Normal sensation
Case Report
Stinger

What to do?
Case Report
Stinger

- Rehabilitation
- Equipment modification
- Return to play decision
  - 10/14/02
  - No recurrent stingers
  - 1/03 normal strength
  - Pro Bowl
Persistent Stingers

- Time to resolution of 1\textsuperscript{st} stinger
- Recurrences
- Spurling’s vs. painless weakness
- Imaging studies-compression vs “battered nerve”
Transient Quadriparesis
Transient Quadripareisis
High Stakes Decision

Maddox checks out 'perfectly normal,' now must get over shock of scary injury

By Alan Robinson, Associated Press, 11/19/2002 18:42
Cervical Spinal Cord Injury
Types

• “Neurapraxia”
  – transient motor and/or sensory loss
  – 2-4 limbs affected
  – duration up to 36 hrs.

• Contusion
  – permanent injury
  – various patterns
Transient Quadriparesis
Mechanisms

- Metabolic
- Vascular
- Structural
  - Instability
  - Spinal stenosis
    - Congenital
    - Acquired
Cervical Spinal Stenosis Controversies

• How to define
  – bony dimensions
  – other factors

• How to measure
  – sensitivity
  – specificity
Cervical Spinal Stenosis

- Direct Measurement
  - lateral c-spine x-ray with known magnification
  - cross sectional imaging with CT or MRI

- Values for canal diameters (bony)
  - normal >15 mm (C2-C7)
  - narrow < 12mm
Cervical Spinal Stenosis

- Torg (Pavlov) ratio, 1986
  - indirect measure
  - avoids magnification error
  - positive if <0.8
  - high sensitivity, >90%
Cervical Spinal Stenosis
Subsequent Studies

- Herzog et al, Spine 1991
  - 49% of professional football players had a Torg ratio <0.8 at one or more levels
  - only 13% had true spinal stenosis by advanced imaging

- Odor et al, AJSM 1990
  - 32% professional and 34% rookie football players had Torg ratio <0.8 at one or more levels
Torg Ratio Pitfalls

- Athletes have large vertebral bodies
- Ratio is skewed toward stenosis
- Anatomic relationship of spinal cord and canal varies
Functional Reserve of Spinal Canal

- Amount of CSF surrounding spinal cord
- Shape of spinal cord
Return to Play
Torg & Glasgow, CJSM 1991

• No restriction
  – no hx of TQ; Torg ratio <0.8
• Relative restriction
  – one episode TQ; Torg ratio <0.8
• Absolute contraindication
  – TQ with instability, hard disc, cord compression, symptoms > 36 hrs., more than one episode
Return to Play
Cantu, Exercise and Sports Sciences Reviews 1995

• No restriction
  – one episode of TQ with full recovery and normal work-up

• Relative restriction
  – one episode of TQ as a result of minimal contact; minimal or mild disc herniation

• Absolute contraindication
  – TQ with functional spinal stenosis
Cervical Cord Neurapraxia
Torg et al, J Neurosurg 1997

- 110 athletes with CCN
- 63 (57%) RTP
- 35 (56%) 2nd episode of CCN
  - 3.1 +/- 4.0 episodes (range 2-25)
- Imaging (105 x-rays, 53 MRIs)
  - only 7% nl x-ray, 8% nl MRI
  - 34% spinal cord compression
Cervical Cord Neurapraxia
Torg et al, J Neurosurg 1997

• Risk of recurrence ~ spinal stenosis
  – smaller Torg ratio
    • (0.65 vs 0.72mm)
  – smaller disc level canal diameter
    • (8.7 vs 10.1mm)
  – less space available for the cord
    • (1.1 vs 2.0mm)

• No permanent neurological injuries
Cervical Cord Neurapraxia
Torg et al, J Neurosurg 1997

- Correlation
  - Canal stenosis
  - Recurrence

![Graph showing the probability of recurrence vs MRI disc level canal diameter (mm)]
Cervical Cord Neurapraxia

Torg et al, J Neurosurg 1997

- “May be advised not at increased risk of permanent neurologic injury with return”
- “Presence of stenosis does not result in irreversible cord injury”
Cervical Cord Neurapraxia  
Torg et al, J Neurosurg 1997

- Uncontrolled case studies
- No physical exam data
- Imaging
  - 110 athletes, 53 MRI’s
- Follow-up
  - 15-228 months
Cervical Cord Neurapraxia
Torg et al, J Neurosurg 1997

- 10 players with cord compression
- Repeat assessment over time
- Subgroup susceptible?
- Outcome was return to play
Return to Play
Torg et. al. JBJS 2002

• No restriction
  – no hx of CNN; Torg ratio ≤0.8

• Relative restriction
  – one episode CNN; Torg ratio ≤0.8
  – one episode CNN with DDD or DJD
  – one episode CNN with cord deformation
Return to Play
Torg et. al. JBJS 2002

• Absolute contraindication
  – CNN with instability, symptoms > 36 hrs.,
    and/or more than one episode
  – CNN with cord defect or cord edema
Transient Quadriparesis
Return to Play

• Is there a risk of permanent spinal cord injury following TQ?

• How should a team physician counsel a player:
  – with TQ and normal work-up?
  – with TQ and cervical disc herniation?
  – with TQ and spinal stenosis?
  – with TQ who is a high school athlete?
If this was your son or daughter?
Return to Sport After Cervical Injury

Brigham 2003

• Professional football player - 1998
  – Lhermitte’s sign
  – Neck flexion
  – Spear tackle
Return to Sport After Cervical Injury

Brigham 2003

• Tackling 2000
  – Burning 4 extremities
  – Persistent upper extremity dysesthesias
  – C6 Radiculopathy
Return to Sport After Cervical Injury
Brigham 2003

• 3 Months
  – Burning C6
  – LE parasthesias