Approach to neck injuries in sport

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Approach to neck injuries in sport

- Summary
  - Biomechanics of injury
  - Transient quadriparesis
    - Cervical spinal stenosis
  - Brachial plexus injuries
  - Acute cervical sprains / strains
  - Preventing neck injuries in sport
  - Return to play issues
Biomechanics of injury
Biomechanics of injury

- **Football** and **rugby** have the highest incidence of C-spine injuries in sport.
- Due to **high-velocity collisions** between players,
  - Cause acceleration or deceleration of the head on the neck leading to **whiplash**.
Biomechanics of injury

- **Spearing** is a significant cause of C-spine injuries and quadriplegia
- **Spearing** occurs when a player uses the helmet / head as the first point of contact with another player
- **Spearing** causes axial compression with the vertebrae in positions of slight flexion
Biomechanics of injury

- Normal architecture of c-spine: lordosis of the vertebrae
- Lordosis allows for controlled motion and transmission of forces to the supporting muscles and soft tissues
- When neck is slightly flexed, approximately 30°, the normal lordosis is lost, the forces of the axial load are transmitted to the bones and disks
- If the impact force is greater than the yield strength of the vertebrae, fractures and possible dislocation with cord injury can occur
Biomechanics of injury

- **Traction injury:**
  the shoulder is depressed, the neck is forced laterally away from the involved side, stretching the brachial plexus

- **Direct blow:**
  to the supraclavicular fossa, causes a percussive injury to the upper trunk of the brachial plexus.

- **Nerve compression:**
  by a combination of neck hyperextension and ipsilateral lateral flexion (like a Spurling maneuver)
Biomechanics of injury

1) Acceleration / deceleration: whiplash
2) Axial loading
3) Brachial plexus traction / compression
Transient quadriparesis
Transient quadriparesis

(Cervical cord neurapraxia)

- A rare cervical spine injury
- A "concussion" of the cervical spinal cord
- Caused by axial loading of the neck in flexion or extension
- Occurs in football players who lead with their heads when hitting an opposing player
- In the NCAA, the incidence is 1.3 per 10,000 athletes per season
Transient quadriparesis

Mechanism of injury

- Poorly understood
- Thought to result from compression and/or contusion of the spinal cord
- Hypothesis: cervical cord is compressed between the posterior margin of one vertebral body and the anterior margin of the spinous process of the vertebra below it
- Most likely to occur in a hyperextension injury with axial loading

Pincer mechanism
Transient quadriparesis

Clinical features

- Sudden post-traumatic onset of *bilateral* sensory, motor, or combined neurologic deficit
- Sensory: burning, numbness, tingling, or loss of sensation
- Motor: *weakness* or *complete paralysis*
Transient quadriparesis

- **Symptoms:**
  - **transient**
  - completely resolve within 10 minutes to 48 hours
  - Not cervical "burners" (unilateral paresis of an upper extremity, often associated with neck pain)

- **Burning hands syndrome**
  - variant of this central cord injury
  - consists only of upper-extremity symptoms, temporary burning dysesthesias and weakness of the arms and hands
Cervical spinal stenosis

- Risk factor that can predispose athletes to transient quadriparesis
- Functional spinal stenosis: the loss of cerebrospinal fluid around the spinal cord or deformation of the spinal cord (contrast-enhanced CT, MRI, or myelography)
- The stenosis is most common at the C3-C5 levels and is usually congenital, although it can be acquired (eg, in disk herniation, cervical spine instability, etc)
Evaluation

- Cervical spine X-rays
  - spinal canal stenosis
  - cervical instability
  - congenital anomalies
    (Klippel-Feil syndrome)
- MRI
  - identify and clarify pathology
- CT myelogram
  - If MRI not conclusive

The majority of athletes with TQ have spinal stenosis or another abnormality.
Transient quadriparesis

Return to play

- Does spinal stenosis increase the risk of permanent neurologic injury in athletes?
- We do not encourage patients with proven spinal stenosis to participate in contact or collision sports

- What about athletes who have no evidence of spinal stenosis or abnormality after a thorough evaluation? Should be individualized for each athlete in consultation with an experienced sport medicine team
Brachial plexus injuries
Brachial plexus injuries

- A stinger, also known as a burner, is a transient episode of shooting or electrical pain or paresthesias radiating down 1 upper extremity after an acute event, typically one involving significant contact to the head and/or shoulder.
Brachial plexus injuries

Mechanism of injury

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Brachial plexus injuries

Physical examination

- Often C5/C6 roots and the upper trunk of the brachial plexus
- Pay attention to motor function served by this distribution:
  - elbow flexion
  - shoulder abduction
  - shoulder external rotation
## Neurologic deficits in spinal cord injury

<table>
<thead>
<tr>
<th>Level of Lesion</th>
<th>Loss of Function</th>
<th>Motor*</th>
<th>Sensory level</th>
<th>Reflex*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cervical</strong></td>
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<td></td>
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<tr>
<td>C2</td>
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<tr>
<td>C3</td>
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<tr>
<td>C4</td>
<td>Spontaneous breathing</td>
<td></td>
<td>Suprasternal notch</td>
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<tr>
<td>C5</td>
<td>Shrugging and external rotation of shoulders</td>
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<td>Below clavicle</td>
<td>Biceps</td>
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<tr>
<td>C6</td>
<td>Elbow flexion Wrist extension</td>
<td></td>
<td>Thumb</td>
<td>Brachioradialis</td>
</tr>
<tr>
<td>C7</td>
<td>Elbow extension</td>
<td></td>
<td>Index and middle fingers</td>
<td>Triceps</td>
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<tr>
<td>C8</td>
<td>Finger flexion</td>
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<td>Small finger and ulnar side of hand</td>
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<tr>
<td><strong>Thoracic</strong></td>
<td></td>
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<tr>
<td>T1 - T12</td>
<td>Intercostal and abdominal muscles</td>
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<tr>
<td>T4</td>
<td></td>
<td></td>
<td>Nipple line</td>
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<tr>
<td>T10</td>
<td></td>
<td></td>
<td>Umbilicus</td>
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<tr>
<td><strong>Lumbar</strong></td>
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<tr>
<td>L1</td>
<td></td>
<td></td>
<td>Fsmoral pulse</td>
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<tr>
<td>L1 - L2</td>
<td>Hip flexion</td>
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<tr>
<td>L2 - L3</td>
<td></td>
<td></td>
<td>Medial thigh</td>
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<tr>
<td>L3</td>
<td>Hip adduction</td>
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<tr>
<td>L4</td>
<td>Hip abduction</td>
<td></td>
<td>Knee</td>
<td>Patellar</td>
</tr>
<tr>
<td>L5</td>
<td>Foot dorsiflexion</td>
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<tr>
<td><strong>Sacral</strong></td>
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<tr>
<td>S1</td>
<td>Foot plantar flexion</td>
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<td>Achilles</td>
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<tr>
<td>S1 - S2</td>
<td></td>
<td></td>
<td>Lateral foot</td>
<td></td>
</tr>
<tr>
<td>S2 - S4</td>
<td>Rectal sphincter tone</td>
<td></td>
<td></td>
<td>Perianal region</td>
</tr>
</tbody>
</table>

\* Level of injury is at or above the given location.

Brachial plexus injuries

Physical examination

- Spurling test

- performed by:
  - extending the neck
  - rotating the head
  - then applying downward pressure on the head

- Positive when the pain arising in the neck radiates in the direction of the corresponding dermatome.
Brachial plexus injuries

Pathophysiology determines severity

- **Grade I is neurapraxia**
  - A disruption of nerve function involving demyelinization
  - Axonal integrity is preserved
  - Remyelinization follows within 3 weeks.
  - EMG is typically normal.

- **Grade II is axonotmesis**
  - Axonal damage and degeneration distal to site of injury
  - Electroconduction changes on EMG within 2 to 3 weeks

- **Grade III is neurotmesis** *(not considered a stinger)*
  - Complete nerve transection
  - Causes permanent nerve damage
Brachial plexus injuries

- Return to play if:
  - Symptoms resolve rapidly (seconds to a few minutes)
  - Neurovascu larly intact
  - Full cervical and shoulder ROM without pain
  - Spurling's test is negative

Consider returning the athlete to play in the same game
Brachial plexus injuries

- It is not the first stinger of the season
- The athlete has recurrent stingers
- The severity or frequency is increasing
- Suspected persisting neurologic deficit or any deficits in cervical ROM

For athletes with an identified neurological deficit, serial examinations should be performed on the field and, subsequently, in the office over the ensuing days

- Neurologic deterioration should prompt rapid evaluation of the cervical spine, head, or plexus as indicated.

Do not return the athlete to play in the same game
Acute cervical sprains and strains
Acute cervical sprains / strains

Cervical strain:

- A nonspecific diagnosis
- ‘Doc, I jammed my neck’
- Used to describe an injury to the cervical paraspinal muscles and ligaments with associated spasm of the cervical and upper back muscles
- A reasonable dx in patients with acute axial neck and trapezius pain, where neurological dysfunction has been excluded
Acute cervical sprains / strains

Cervical strain

- Can result from poor posture and poor sleeping habits
- Symptoms
  - Pain
  - Stiffness
  - Tightness
  - Upper back or shoulder
  - Can last up to six weeks.
- Patients with chronic symptoms should not receive this nonspecific diagnosis

Acute cervical sprains / strains

- DDx is complex:
  - cervical discogenic pain
  - facet mediated pain
  - cervical spondylotic myelopathy
  - cervical radicular pain
  - myofascial pain
  - centrally mediated pain

Muscle pain alone should not be routinely considered the root cause of pain
Acute cervical sprains / strains

- Treatment
  - Posture modifications
  - Pharmacological measures
    - Acetaminophen
    - NSAIDs
    - Muscle relaxants
    - Narcotics
  - Home exercises
  - Cervical collar
  - Physiotherapy
    - Traction
Acute cervical sprains / strains

- Treatment
  - Posture modifications
Acute cervical sprains / strains

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    - Muscle relaxants
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Acute cervical sprains / strains

- Treatment
  - Home exercises
Acute cervical sprains / strains

Treatment

- Soft cervical collar
  - Routine use of cervical collars should be discouraged; regular use may actually delay improvement.
  - Studies have shown that early active mobilization significantly improves the degree of cervical movement and pain intensity compared to immobilization.
  - A soft cervical collar:
    - Remains safe and inexpensive
    - May be helpful during periods of increased pain
    - Should be worn only for short periods of time (three hours or less) during the day for a period of only one to two weeks in order to avoid the development of muscle atrophy.
Acute cervical sprains / strains

- **Treatment**
  - Physiotherapy
    - Traction
      - May provide temporary relief
Preventing neck injuries in sport
Preventing neck injuries in sport

- Eliminate dangerous behaviours
  - Change the rules
  - Penalize spear tackling
Preventing neck injuries in sport

- Change the rules
  - Eliminate leading with the head / helmet
  - Eliminate hits to the head
Preventing neck injuries in sport

- Change the rules
  - Eliminate clothesline hit / tackle
Preventing neck injuries in sport

- Emergency preparedness
  - First do no harm
  - Practice emergency protocols
Preventing neck injuries in sport

Protective equipment

- **Cowboy collar**
  - None of the collars restrict passive lateral cervical flexion
  - Limited ability of collars to prevent recurrent stingers?
  - No data on the effects of the collars during live-time play

- Any benefit that collars may offer in limiting cervical extension has to be weighed against the risks of keeping the cervical spine in a relatively flexed position during impact, which may increase the risk for injury to the spinal column

- Limiting a player's overall cervical ROM on the field may also limit their effectiveness.
Preventing neck injuries in sport

- Help athletes adapt to the demands of their sport
  - Neck strengthening exercises
Return to play issues
Approach to neck injuries in sport

- Return to play issues
  - Avoid risk of further injury
  - Full resolution of symptoms
    - Full ROM
    - Painless ROM
      - No bony pain
      - Isolated muscular pain may be acceptable in pro sports
  - No neurological signs
- Psychologically ready
  - Communication is essential
Thank you