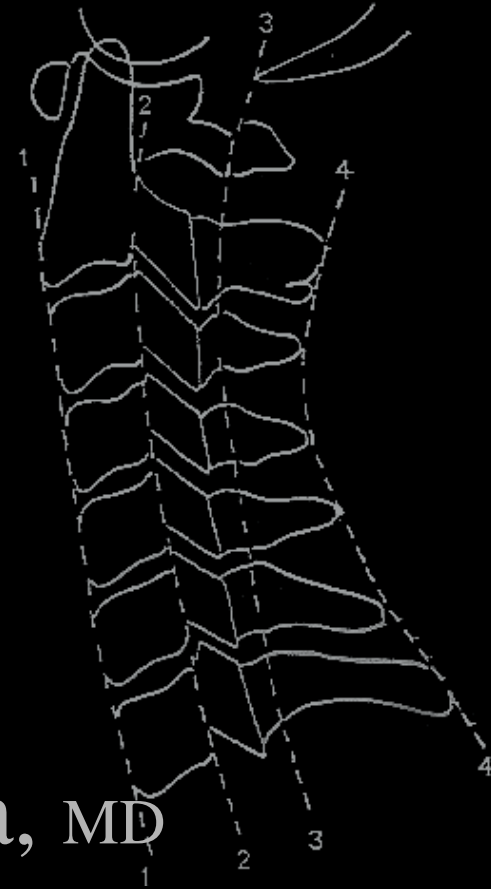
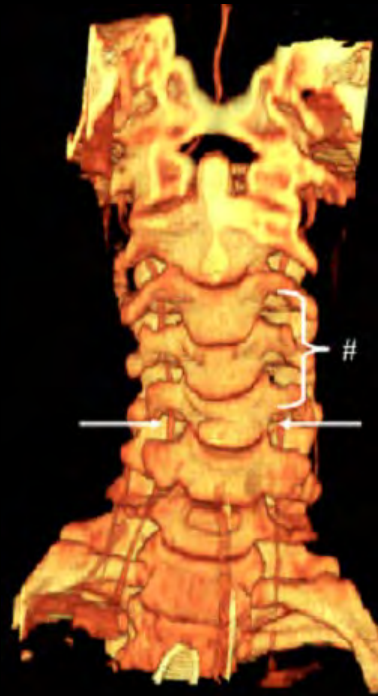
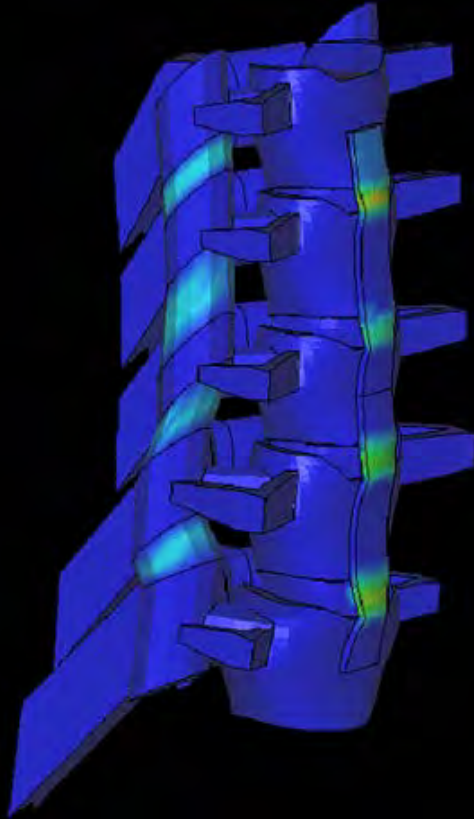


Cervical Spine Injuries in the Athlete:



The pain in the neck

Brian Braaksma, MD
Orthopedic Spine Surgeon

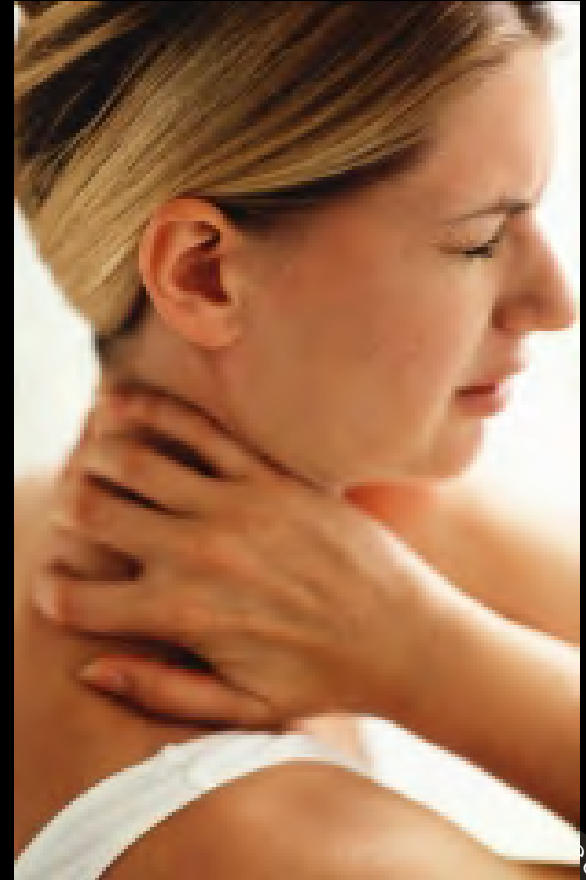


Outline

- **Incidence**
- Pathophysiology
- Diving injuries
- Football
 - Sprain
 - Stingers and burners
 - Transient Quad
 - Fractures & dislocation
 - Return to play

Incidence

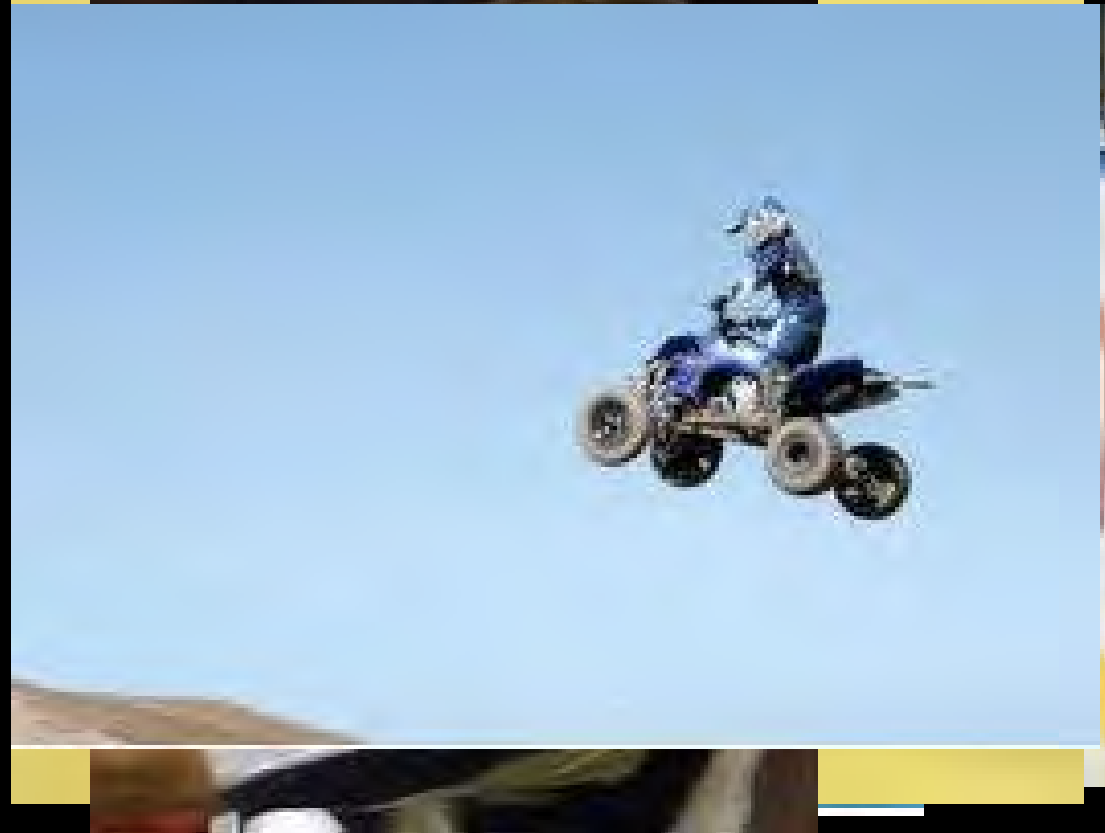
- Hard to calculate
- 1/10 spine injuries
- 223 football players neurologic injury/25yrs



Maroon JC, Bailes JE. Athletes with cervical spine injury. *Spine* 20; 1996: 2294-2299.

Much of this Is Sports Specific

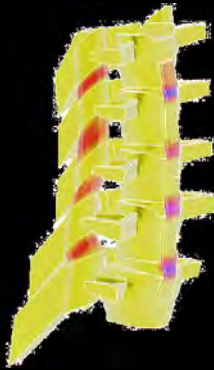
- Trampoline
- Football
- Water sports
- Gymnastics
- Rugby
- Ice Hockey
- Wrestling



Outline

- Incidence
- **Pathophysiology**
- Diving injuries
- Football
 - Sprain
 - Sting and burn
 - Transient Quad
 - Fx & dislocation
 - Return to play

Pathophysiology

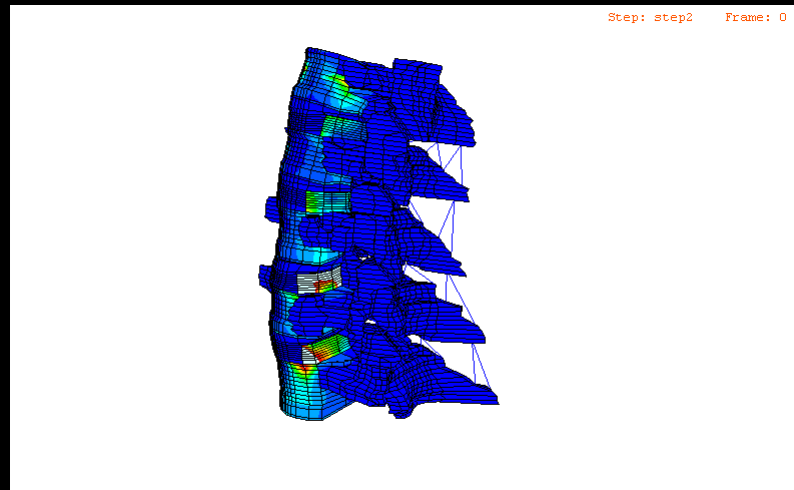


- C spine:
Heavy head on small
narrow spine
- Protective mechanism:
 - Lordosis
 - Muscles
 - Ligaments
 - Bones



What determines injury

- Position of Neck
- Direction of applied of load



Outline

- Incidence
- Pathophysiology
- **Diving injuries**
- Football
 - Sprain
 - Sting and burn
 - Transient Quad
 - Fx & dislocation
 - Return to play

Diving Injuries

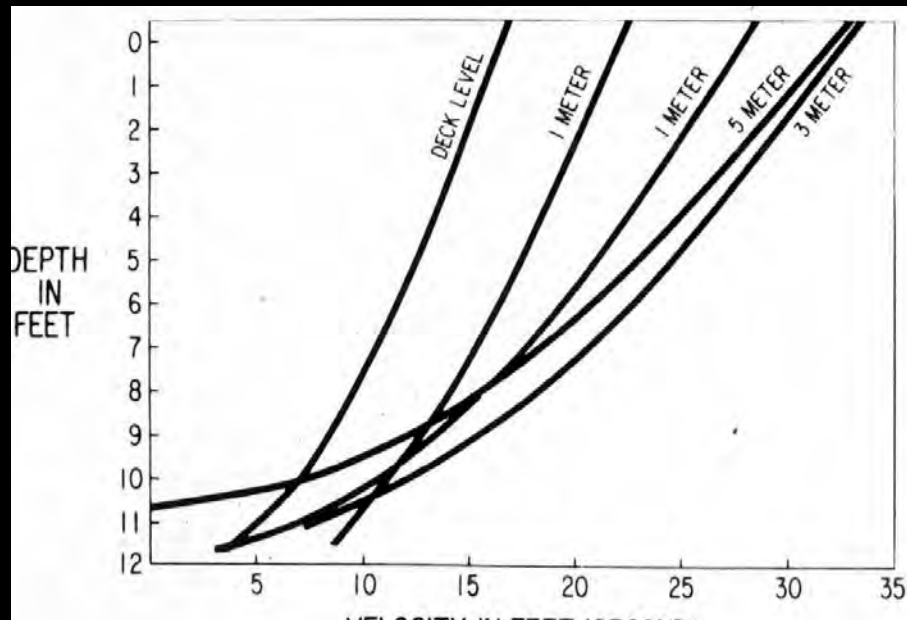


- Classic axial compression injuries
 - Average patient
 - Male, 13 yr or older
 - No formal diving training
 - 50% - alcohol involved
 - Evenly divided pool/natural water bodies
 - Avg. depth 1-7 ft.



Diving Injuries

- Avg underwater deceleration velocity
 - Entry speed 15-33 ft/sec
 - Velocity dissipation – approx. 12 ft.



Diving Injuries

- Prevention
 - Nationally Coordinated Education Program
 - Increased awareness
 - Reminders with on site warning signs



Outline

- Incidence
- Pathophysiology
- Diving injuries
- **Football**
 - Sprain
 - Sting and burn
 - Transient Quad
 - Fx & dislocation
 - Return to play

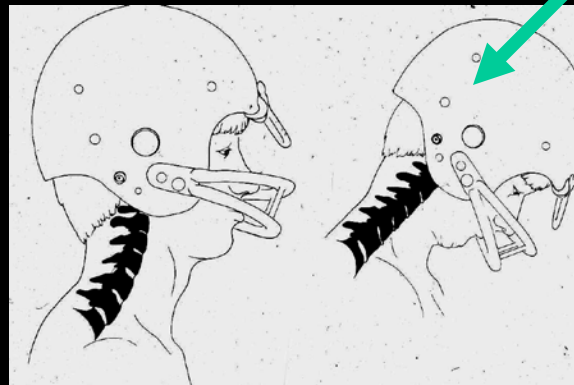


Football

- Next classic example of sports related cervical spine injury mechanism
 - Primarily axial loading

Football

- Primary cause of injury is poor technique
 - Spearing
 - Flexed neck becomes a “segmented column”
 - Negates the potential for buckling



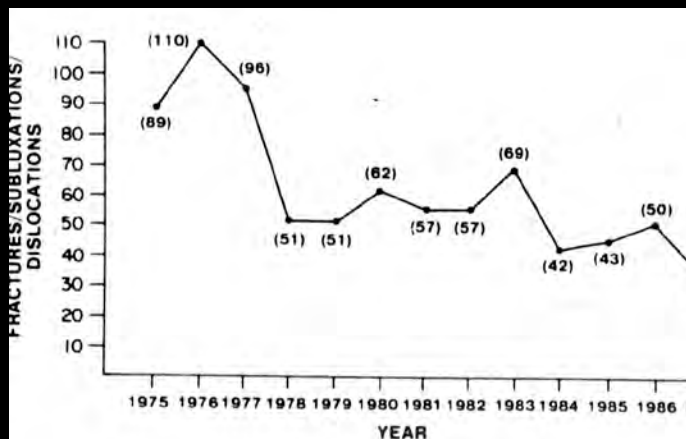
Football

- Prevention linked to education
 - Head Up – “See What You Hit”
 - Knees Bent at Impact
 - Drive Through with Legs
 - Goal of maintaining normal cervical lordosis



Football

- Spear tackling outlawed 1976
 - Clear decrease in cervical injuries
 - Shows that a mechanism can be identified and corrected



Football Safety Improved

- Review of football injury registry
 - Historic introduction of helmets lead to
 - 66% decr. intracranial hemorrhage
 - 204% incr. c-spine fx, dislocation
 - 116% incr. quadriplegia
 - A new “weapon” had been introduced



Outline

- Incidence
- Pathophysiology
- Diving injuries
- Football
 - **Sprain**
 - Sting and burn
 - Transient Quad
 - Fx & dislocation
 - Return to play

Cervical Sprain

- Ligamentous injury
- Usually due to direct collision
- Presentation
 - pain localized to neck without radiation into arms
 - decreased cervical motion
 - no focal tenderness



Cervical Sprain

- Management
 - cervical immobilization
 - radiographic evaluation
 - rehabilitation if necessary
- Return to play
 - pain free
 - normal ROM
 - full motor strength



Outline

- Incidence
- Pathophysiology
- Diving injuries
- Football
 - Sprain
 - **Sting and burn**
 - Transient Quad
 - Fx & dislocation
 - Return to play

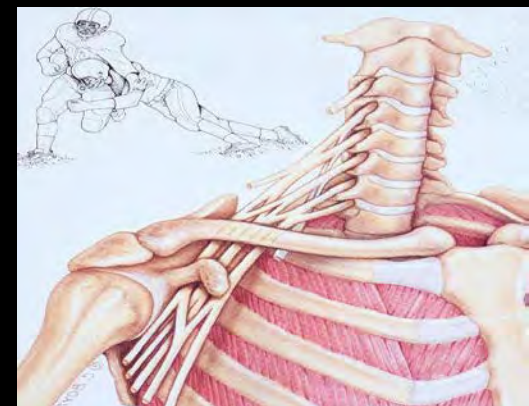
Burners/Stingers

- Transient root symptoms
- “dead arm”
- Under reported



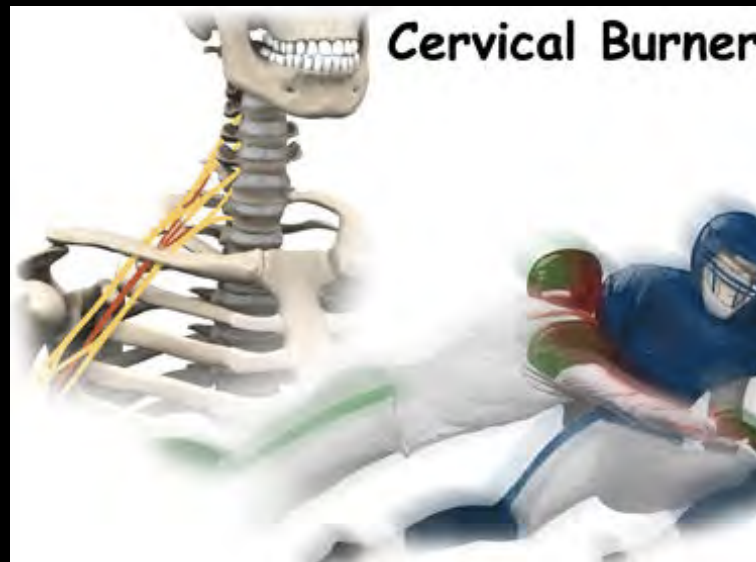
Burners/Stingers

- 2 different etiologies
 - Root compression
 - Extension and ipsilateral deviation
 - Compression at foramen
 - Plexus stretch
 - Contralateral deviation
 - Depression of shoulder
 - Pulls on brachial plexus



Burners / Stingers

- These are very common
 - One predisposes for the next
 - Most common C spine injury in football
 - 7.7% year. 65% during a players life time



Management

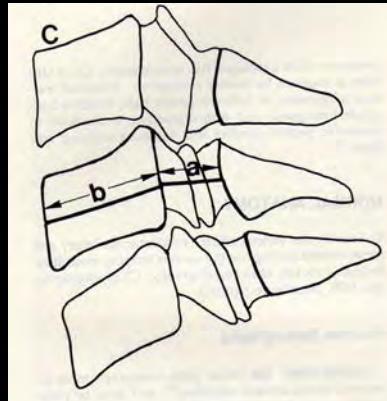
- Remove from activity- Pt examination
- Stingers – may return to event if:
 - Complete resolution of sx
- Significant/sustained stinger (first time)
 - MRI to r/o disk herniation or structural abnormality
- Persistent sx
 - Cervical radiographs, MRI
 - +/- CT or SPECT is suspect occult fx



Vaccaro et al., *The Spine J* 2002

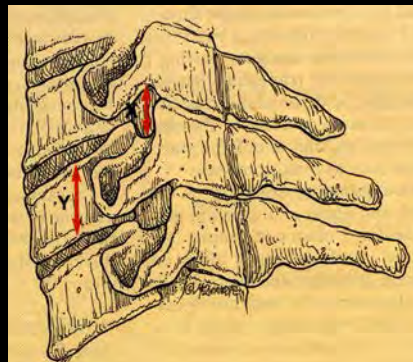
Torg Ratio

- Postulated to correlate
- Based on lateral cervical radiograph
 - Width of canal divided by vertebral body (a/b)
 - $<0.8 \rightarrow 3x$ risk for stinger (Meyer, AmJSportsMed 1994)
 - Potentially related to associated narrow foramen



Foraminal Stenosis

- Foraminal / vertebral body ratio
 - Measured off oblique film
 - May be better predictor of root symptoms such as burners / stingers
 - normal and critical value unknown



Outline

- Incidence
- Pathophysiology
- Diving injuries
- Football
 - Sprain
 - Sting and burn
 - **Transient Quad**
 - Fx & dislocation
 - Return to play

Transient Quadraplegia

- Variable extent of symptoms
 - True deficit to burning hands
 - Prob variant of central cord syndrome
- More sense to be related to Torg ratio
- Transient
 - usually complete recovery in 10 - 15 minutes but may take up to 48 hours.



Torg's Ratio

- Abnormal ratio
 - 93% of those with transient quadriplegia
 - As compared to 3- fold increase in stingers
- But what do we do with this information?



Functional Stenosis

- A canal size (space available for the cord) that precludes or obliterates the protective cushion of CSF or causes deformation of the cord in any position.
- Takes into account soft tissues, dynamic nature of stenosis.
 - Increased risk of permanent quadriplegia after fracture dislocation (100% vs 80%)
 - In every case of quadriplegia without fracture/dislocation functional stenosis was present



Outline

- Incidence
- Pathophysiology
- Diving injuries
- Football
 - Sprain
 - Sting and burn
 - Transient Quad
 - **Fx & dislocation**
 - Return to play



Fractures and Dislocations

- Full range of cervical injuries may be encountered
 - May be challenging to determine on the field
 - Err on immobilizing and pursuing evaluation
 - Question of helmet / pads often arises
 - Leave all on in the field if question of injury



Cervical Spine Trauma

- The diagnosis of an unstable spinal injury and its subsequent management can be difficult
- A missed spinal injury can have devastating long term consequences
- As such, spinal column injury must therefore be presumed until it is excluded



-
- Missed or delayed diagnosis
 - often attributed to failure to suspect cervical injury
 - Guidelines are needed to maximize sensitivity and efficiency in the evaluation of potentially unstable spine injuries
 - Protect spine at all times during the management of the multiply injured patient.
 - Up to 5% of spinal injuries have a second, possibly non adjacent, fracture elsewhere in the spine



MOTOR

KEY MUSCLES

	R	L
C2		
C3		
C4		
C5		
C6		
C7		
C8		
T1		
T2		
T3		
T4		
T5		
T6		
T7		
T8		
T9		
T10		
T11		
T12		
L1		
L2		
L3		
L4		
L5		
S1		
S2		
S3		
S4-5		

- Elbow flexors
- Wrist extensors
- Elbow extensors
- Finger flexors (distal phalanx of middle finger)
- Finger abductors (little finger)

0 = total paralysis
 1 = palpable or visible contraction
 2 = active movement, gravity eliminated
 3 = active movement, against gravity
 4 = active movement, against some resistance
 5 = active movement, against full resistance
 NT = not testable

Voluntary anal contraction (Yes/No)

MOTOR SCORE

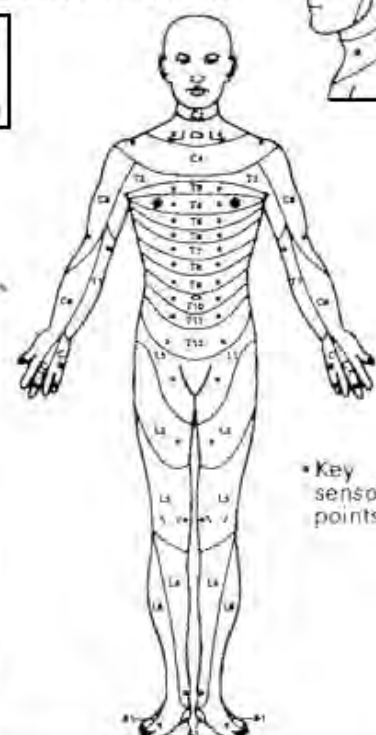
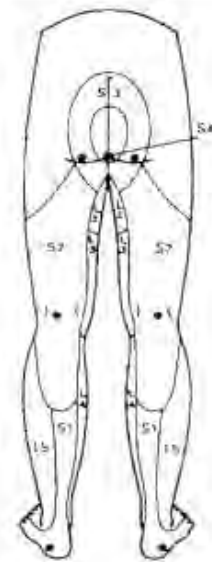
TOTALS (MAXIMUM) (50) (50) = (100)

SENSORY

KEY SENSORY POINTS

0 = absent
 1 = impaired
 2 = normal
 NT = not testable

	LIGHT TOUCH		PIN PRICK	
	R	L	R	L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				



• Key sensory points

Any anal sensation (Yes/No)

PIN PRICK SCORE (max: 112)

LIGHT TOUCH SCORE (max: 112)

TOTALS (MAXIMUM) (56) (56) = (56) (56)

NEUROLOGICAL LEVEL

The most caudal segment with normal function

	R	L
SENSORY	<input type="checkbox"/>	<input type="checkbox"/>
MOTOR	<input type="checkbox"/>	<input type="checkbox"/>

COMPLETE OR INCOMPLETE?

Incomplete = presence of any sensory or motor function in lowest sacral segment

ZONE OF PARTIAL PRESERVATION

Partially innervated segments

	R	L
SENSORY	<input type="checkbox"/>	<input type="checkbox"/>
MOTOR	<input type="checkbox"/>	<input type="checkbox"/>



Trauma Radiographs

- An adequate cervical spine series should include 3 views:
 - a true lateral view: include all 7 cervical vertebrae as well as the C7-T1 junction.
 - an AP view.
 - an open-mouth odontoid view.
- A swimmer's view may additionally allow adequate visualization of the cervical spine



Trauma Lateral

Cervical Spine Trauma Protocolization

Cross-table lateral

Additional views: AP, open mouth,

Swimmers (when cannot see C7-T1)

Obliques, flexion-extension

Entire spine (with any fracture of spine)

CT:

Axial, sagittal and coronal reformats, 3D

MRI C-spine

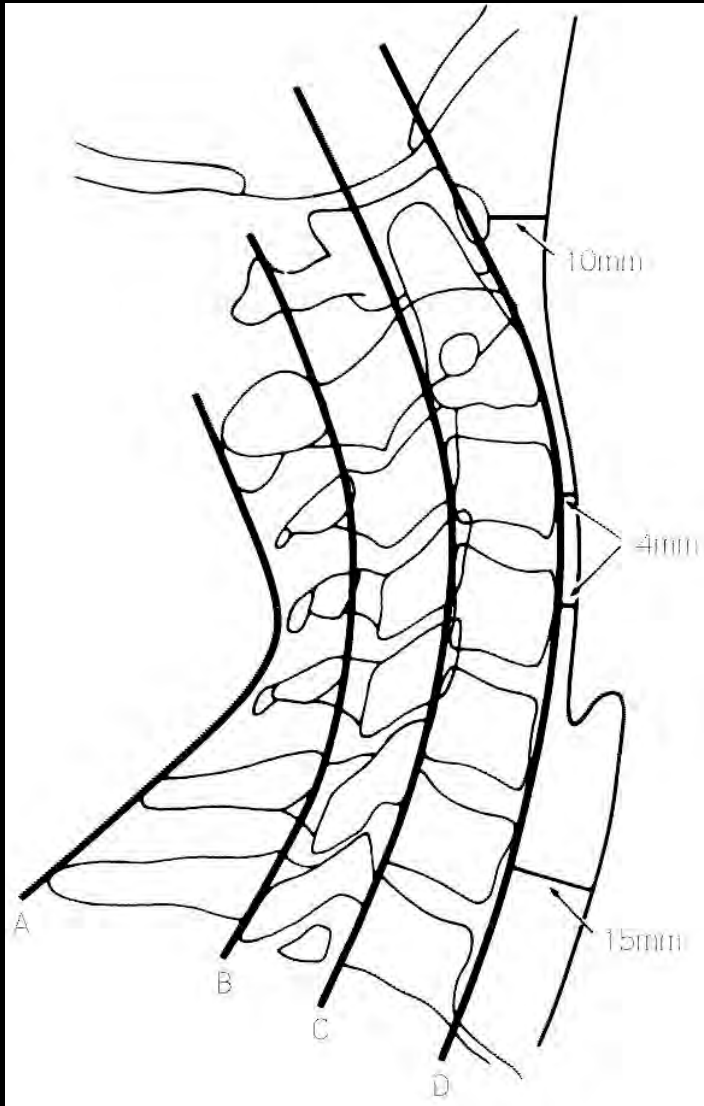
Neurologic deficit referable to C Spine:

Surgical subspecialty consultation and MRI and C-spine

Note: CT and/or MRI are not always available



Trauma Lateral C-Spine



Lateral C-Spine

Soft Tissues

Remember:

"Six at Two and 22 at Six"

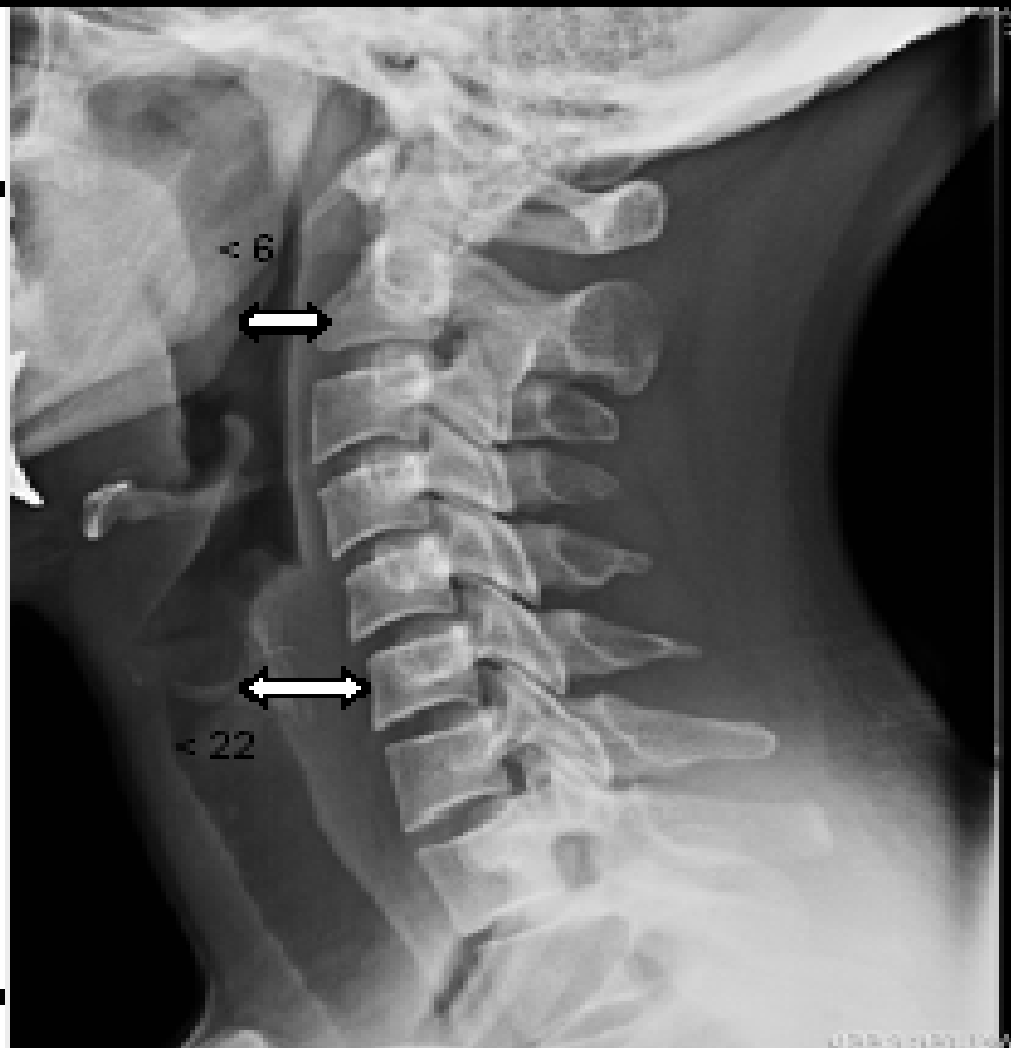
6 mm soft tissue allowed
at C2

(or 1/2 AP vert body)

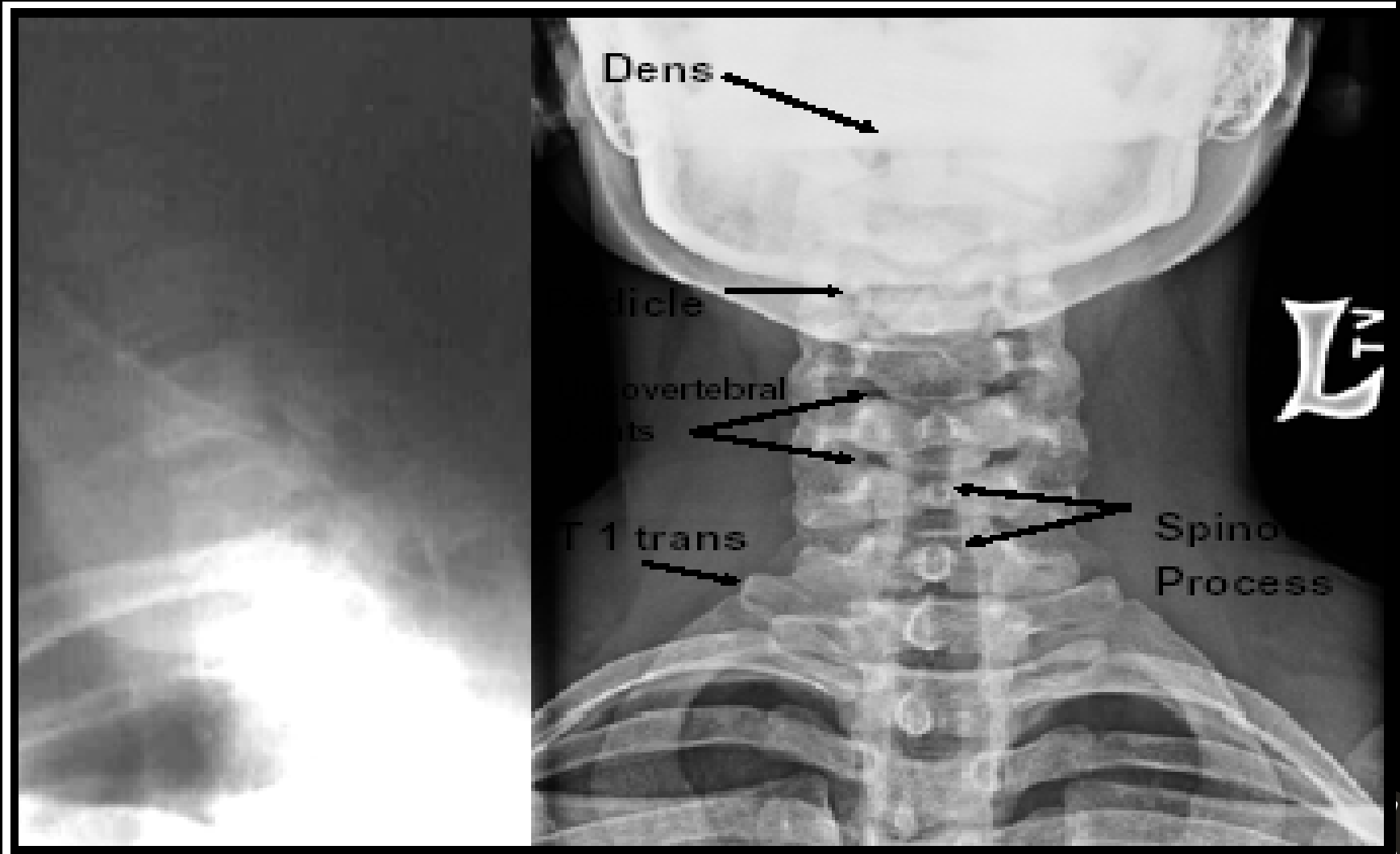
22 mm allowed at C6

(or 1 AP vert body)

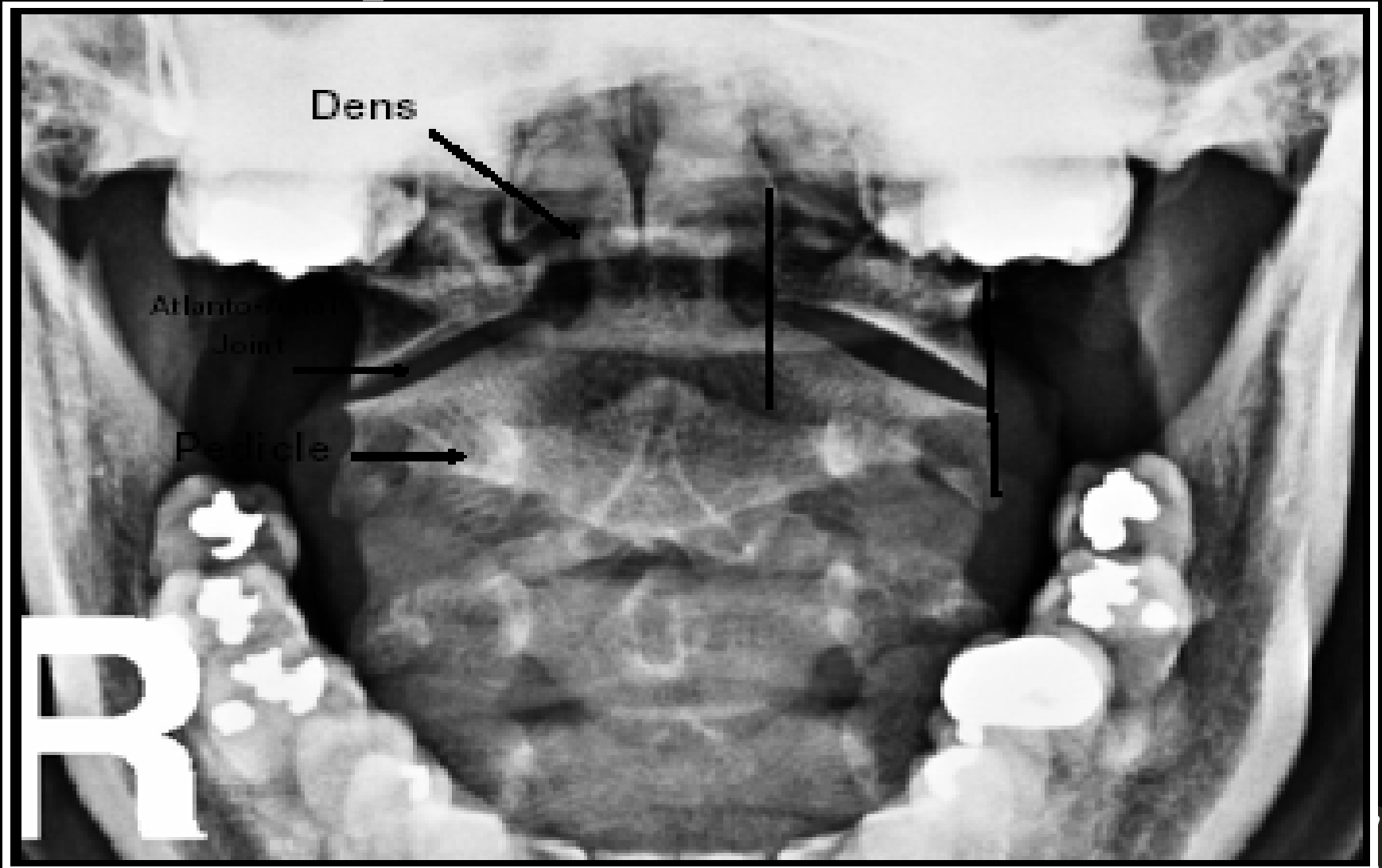
Prevertebral soft-tissue
hematomas are common
in avulsion fractures or
hyperextension injury



AP Cervical Spine



Open Mouth Odontoid



Fractures and Dislocations



Outline

- Incidence
- Pathophysiology
- Diving injuries
- Football
 - Sprain
 - Sting and burn
 - Transient Quad
 - Fx & dislocation
 - **Return to play**

Survey of 346 Physicians

- 10 case examples (Morganti et al., Spine 2001)
 - Inconsistent recommendations
 - Lower level of play recommended by more senior physicians (only significant in 3 cases)
 - Spine specialists recommended higher level of play (only significant in 3 cases)
 - NO CONSENSUS



Return to Play

- Vaccaro et al. (*The Spine J* 2002, *Orthopaedics* 2001)
 - Review of current literature and criteria
 - Torg & Ramsey-Emrheim, *Med Sci Sports Exerc* 1997
 - Cantu et al., *Clin Sports Med* 1998
 - Maroon & Bailes, *Spine* 1996
 - Weinstein, *Clin Sports Med* 1998



Absolute Contraindications

- Cervical myelopathy
- Cord abnormality on MRI
- Asymptomatic ligamentous laxity
- C1-C2 hypermobility (ADI >4mm)
- Multi-level Klippel-Feil deformity
- Basilar invagination
- Arnold-Chiari malformation
- AS, DISH



Vaccaro et al., The Spine J 2002

Absolute Contraindications

- Continued cerv discomfort, neuro deficit, or ↓ ROM
- Symptomatic disk herniation
- Healed subaxial fx with kyphotic or coronal deformity
- >2 prev episodes of transient quadripleg
- H/O cervical laminectomy
- H/O C1-C2 fusion
- H/O three-level cervical fusion



No Contraindications

- Healed, stable C1-C2 fx (non-op), normal ROM
- Torg ratio <0.8 in an asymptomatic pt
- H/O cerv DDD successfully treated
- Stable healed subaxial fx, no kyphotic deformity
- S/P single level ACF (healed) or single / multi-level post cerv microlaminoforaminotomy
- H/O 2 stingers in same or multiple seasons

Relative Contraindications

- H/O transient quadriplegia/quadriparesis with full return baseline strength, ROM, mild-mod stenosis on imaging
- 3 or more stingers in same season
- Stable, healed 2-level subaxial ACF or PCF +/- instr



Return To Play Criteria

- *Pt and family understand possibility of recurrent injury*
- Clearly no consensus

Common sense



Legal concerns

Scientific evidence

Summary

- Cervical strains are common
- More significant injuries less common but significant potential sequelae
- Safety measures have been proposed
 - Alteration in sport rules
 - Definition of return to play criteria
- Certainly consensus is lacking
- Often safer to say NO, dialogue with patient

