1 Sports-Related Head & Neck Injuries
Bernard F. Hearon, M.D.
- Clinical Assistant Professor of Surgery, University of Kansas School of Medicine – Wichita
- Board Certified in Orthopaedic Sports Medicine
- www.drhearon.com

2 Traumatic Brain Injury
Epidemiology
- Highest incidence in football, ice hockey (helmet required)
- Similar incidence in soccer, lacrosse (no helmet)
- 19% of all high school football injuries
- Up to 8.5% college football injuries

3 Mechanism of Injury
- Player-to-player contact
- Stick contact (field hockey)
- Ball contact (baseball, women’s softball & lacrosse)

4 Focal Brain Injuries
- Subdural hematomas – venous disruption
- Epidural hematomas – arterial (middle meningeal)
- Cerebral contusions – surface parenchymal vessels
- Intracerebral hemorrhages – parenchymal arterioles

5 Diffuse Brain Injuries
Concussions
- Immediate but transient impairment of neurologic function from mechanical forces
- Hallmark symptom is confusion
- Loss of consciousness is not required
- 5–10% associated w/cervical spine injury

6 Concussion
Signs and Symptoms
- Headache
- Dizziness
- Confusion
- Disorientation
- Blurred vision
- Amnesia
- LOC

7 Concussion Severity
- Grade I is confusion w/o amnesia
- RTP after CV stress test
- Grade II is confusion w/amnesia
- RTP after asymptomatic for 1 week
- Grade III is LOC which requires CT scan
- RTP after asymptomatic for 1 month
8 Grade III Concussion

- Assume every head–injured athlete has a cervical spine injury until proven otherwise
- C-spine immobilization
- Transport by ambulance
- Neurologic examination
- Head CT scan
- Overnight observation

9 Diagnostic Imaging

- CT scan is superior to MRI for head evaluation
- Skull fractures
- Intracranial bleeding
- Focal injuries

10 Neuropsychologic Testing

- Standard neurologic examination
- Standard Assessment of Concussion (SAC)
- Comprehensive neuropsych tests (e.g., HeadMinder)
- Balance Error Scoring System (BESS)

11 Concussion

No Return to Play

- Loss of consciousness
- Symptoms > 15 minutes
- Symptoms recur after exertion
- Amnesia (retrograde worse)
- Prior concussion

12 Concussion

Return to Play Sequence

- Asymptomatic
- Cardiovascular challenge
- Non-contact sport–specific activity
- Full unrestricted practice
- Full unrestricted play

13 Complications of Head Injury

- Recurrent concussion (higher risk)
- Seizures (first week post–injury)
- Post–concussive syndrome
- Chronic traumatic encephalopathy (dementia pugilista)
- Second impact syndrome

14 Second Impact Syndrome

- Inappropriate return to play
- Second impact before full recovery from first injury
- May be trivial, minor blow
- Young adolescent males
- 50% Mortality!
15 Second Impact Syndrome
   • On the field observations
     • Conscious, but stunned
     • Collapses, semicomatose
     • Pupils dilate, respiratory failure
   • Pathophysiology
     • Vascular congestion
     • ↑ICP, brain herniation
     • Brain stem failure (2–5 min)

16 Soccer Ball Heading
   • Concussion may occur in soccer
   • Mechanism is head contacting ground, goal post or opponent
   • Heading is not dangerous
   • Heading does not cause cognitive deficits

17 How to Play It Safe
   Concussion
   • Preseason neuropsychologic testing
   • Restrict play after concussion
   • Thorough neurologic evaluation
   • Follow return to play criteria
   • Suspect concomitant cervical injury

18 Cervical Spine Injuries
   • Nerve root or brachial plexus neuropraxia (burner/stinger)
   • Ligamentous sprain
   • Acute intervertebral disc rupture
   • Fractures / dislocations
   • Cervical cord neuropraxia (transient tetraplegia)
   • Cord axonotmesis / neurotmesis (permanent tetraplegia)

19 Burners / Stingers
   Dead Arm Syndrome
   • Brachial plexopathy
   • Most common cervical injury
   • Burning dyesthesia
   • Unilateral, non–dermatomal
   • Weakness deltoid, cuff, biceps
   • Full pain–free cervical ROM
   • Often resolves quickly

20 Burners / Stingers
   Mechanisms of Injury
   • Traction
   • Blunt trauma
   • Nerve root compression

21 Burners / Stingers
   Traction Mechanism
Sudden shoulder depression with lateral head deviation and neck flexion to the opposite side
Younger athletes
Weak neck musculature
Poor tackling technique
Erb’s point (upper trunk)

22 [Burners / Stingers]
Blunt Trauma Mechanism
- Direct compression of the brachial plexus
- Poorly fitted shoulder pad
- BP pinched between shoulder pad and superomedial scapula
- Compression at Erb’s point

23 [Burners / Stingers]
Nerve Root Compression
- Neck extension, ipsilateral nerve root compression and head rotation to the affected side
- Intervertebral foraminal narrowing
- Pre-existing cervical OA, degenerative disc disease
- Older athletes, college, professional

24 [Burners / Stingers]
Immediate Return to Play
- Burning symptoms resolve
- Neuro exam is normal
- Negative Spurling’s test
- Negative brachial plexus stretch
- Painless full cervical ROM
- Full motor strength

25 [Burners / Stingers]
Restrict Play
- Persistent weakness
- Multiple episodes
- Positive Spurling’s test
- Cervical collar
- Cervical spine radiographs
- EMG helpful, not required
- RTP when strength recovered

26 [Injury Prevention]
- Neck and shoulder strengthening
- Posture improvement (chest out, chin tuck, scapula retraction)
- Thermoplastic total contact neck–shoulder–chest orthosis (cowboy collar)
- Well-fitted shoulder pads
- U-shaped neck roll
• Pads at base of neck
• Proper tackling technique

27 Sideline Red Flags – suspect more serious injury
• Bilateral
• Lower extremity
• Persistent burning
• Painful cervical ROM
• Axial tenderness
• Neurologic deficit

28 Axial loading of the cervical spine is the primary mechanism for severe neck injuries in football.

29 Cervical Spine Axial Loading
• Neck flexed 30 degrees
• Loss of cervical lordosis
• Forces directed to straight segmented column
• Less dissipation of forces

30 Cervical Spine Failure
• Angular deformation, cervical spine failure in flexion

31 Flexion Teardrop Fracture
• 90% Permanent Tetraplegia

32 Transient Tetraplegia
• Pincher mechanism
• Cervical cord neuropraxia
• Axial load w/hyperflexion or hyperextension
• Motor symptoms from mild weakness to complete paralysis
• Recovery minutes to hours
• Associated w/congenital cervical stenosis

33 Cervical Stenosis
• Spinal canal diameter < 13 mm
• Pavlov ratio (a/b) < 0.8
• Not accurate in large athletes
• Not predictive of cervical injury
• Can be acquired (spear tackling)

34 Stenosis is not predictive of injury, but permanent partial cervical spinal cord paralysis has been reported in a professional football player who had only congenital stenosis.

35 Transient Tetraplegia
Risk of Recurrence
• Recurrence inversely correlated with Pavlov ratio
• Recurrence inversely correlated with canal diameter

36 Spear Tackler’s Spine
• Head–first tackling
• Developmental stenosis
• Post-traumatic abnormalities
• Loss of normal lordotic curve
• Loss of vertebral body height
• Disc space narrowing
• Absolute contraindication to participation in contact sports

37  Play Heads-Up Football
38  Contraindications to Play after Transient Tetraplegia
• Stenosis w/instability
• Neurological symptoms > 36 hours
• More than one recurrence
• Disc disease w/cord compression
• Significant cervical arthrosis
• Cord defects/edema on MRI

39  Contraindications to Play
• Odontoid anomalies
• Occipito-Atlanto-axial disorders
• Klippel-Feil syndrome
• Unstable vertebral body fracture
• Fracture or disc rupture w/neuro symptoms
• Cervical instability
• Multi-level cervical fusion
• Acute central disc herniation

40  Cervical Spine Injuries
Management
• Neurologic evaluation
• Immobilize neck
• Remove facemask
• Leave helmet & pads
• Transport to hospital

41  Remove Facemask for Airway Access
• Quickest & safest method is to cut plastic facemask clips

42  Don’t Remove the Helmet!
• Helmet alone results in cervical kyphosis
• Shoulder pads produce cervical lordosis
• Helmet and shoulder pads maintain balance

43  Helmet Removal
• Indications for removal
  • Unable to access airway
  • Neck unstable w/helmet
• Trained personnel required
• Technique for removal
  • Pop out cheek pads
  • Avoid spreading helmet
• Maintain neck stability
• Rotate back to front

44 How to Play It Safe
Cervical Spine Injuries
• Neck & shoulder strengthening
• Good equipment, properly fitted
• Proper tackling technique
• High index of suspicion for cervical fracture
• Follow approved guidelines for RTP

45 References