Cervical Spine Trauma

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What we’re going to talk about

- Epidemiology
- Normal Anatomy
- Fracture Patterns
- Initial Evaluation
- C-Spine Clearance
- Case Study
Epidemiology

- Traumatic SCI is 40/Million in the US
  - 12,500 new per year
  - Does not include those who die at the scene
- Male: Female 4:1
- Average age at injury is 42
  - Was 29 in the 1970’s
Causes

EVERYTHING HAPPENS FOR A REASON.
BUT SOMETIMES THE REASON IS THAT YOU’RE STUPID AND YOU MAKE BAD DECISIONS.
Causes

38% Vehicular
30% Falls
14% Violence
9% Sports
5% Medical/Surgical
Neurologic Level

45% Incomplete Tetraplegia
21% Incomplete Paraplegia
20% Complete Paraplegia
14% Complete Tetraplegia
BRACE YOURSELVES

THE ANATOMY IS COMING
Cervical Anatomy
Cervical Anatomy

The first two cervical vertebrae: the atlas and the axis

- Anterior arch of atlas
- Atlas
- Dens (odontoid process)
- Axis
- Posterior arch of atlas
- Ligament that enables rotation (as in shaking the head to indicate "no")
- Joint that permits nodding (as in indicating "yes")

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Cervical Anatomy
Cervical Anatomy
Cervical Anatomy - MRI
Questions So Far?

The motorcycle is generally known as the "Neurosurgeon's Training Device."
C1- Jefferson Fx

- Axial load fracturing arch(s) or lateral mass with lateral displacement on C2

- Instability results from Transverse Ligament disruption (if lateral displacement is > 7mm combined on open mouth view, ligament rupture likely)
C1 Anterior Arch Avulsion

- Hyperextension causing avulsion of the C1 tubercle
- Stable if isolated; seen on lateral view
C1 Anterior Arch Avulsion
C1 Posterior Arch Fracture

- Hyperextension with fracture due to wedging of arch between Occ and C2
- Stable
C1 Posterior Arch Fracture
C1 Transverse Ligament Disruption

- Crucial to maintain C1-2 Alignment
- Common in elderly, can occur from direct blow to Occiput
- Evaluate predental space on lateral film
  - > 3mm suggests damage
  - >5 mm implies rupture
C1 Transverse Ligament Disruption

- Superior articular facet
- Dens of C2 (axis)
- Anterior arch of C1 (atlas)
- Ligament

Superior view of atlas
Predental Space Evaluation
C1 Summary

SUPERIOR VIEW OF C1 ON C2

Axis: spinous process

Superior articular facet, atlas

Posterior arch, atlas

Transverse lig., atlas

Anterior arch, atlas

Red: Jefferson Fracture
Orange: Lateral Mass Fx
Blue: Bony Avulsion TL
Green: Midsulb. Tear TL
C2- Odontoid Fracture

- Flexion loading is primary cause but multiple mechanisms possible
- Types
  - Type 1- avulsion of tip (stable)
  - Type 2- Fx at base of odontoid (unstable)
  - Type 3 – Fx at base into the body of C2 (unstable)
Hangman's Fracture

- Extension injury which fractures both C2 pedicles
- Unstable but often neurologically intact
discontinuity of the central axial spinal pillar
Hangman’s Fracture

Axis (C2) - Hangman Type Fracture

VirtualMedStudent.com
Hangman’s Fracture
Clay Shoveler's Fracture

- Intense flexion against contracted erector spinae muscles, most often C7
- Stable
BROKEN NECK?

YOU MEAN A FINE DAY FOR A RIDE ON MY SCOOTER
Cervical Burst Fracture

- Direct axial load *with vertical fracture through vertebral body*; fragments may displace in all directions
Burst Fracture
Flexion Injury

- A range of injuries from mild sprain to bilateral locked facets
- Posterior ligaments are injured with interspinous widening
- Unilateral locked facet - flexion + rotation
- Bilateral locked facets - Hyperflexion
Perched vs. Jumped
Jumped Facets
Reduction with G-W Tongs

Gardner-Wells tongs applied in emergency room; cervical traction pulley with adjustable arm clamped to examining table.
Fracture Disclocation
Questions?

Have you ever heard of a spine transplant?
Neither have we.
Take care of the one you have.
Initial Eval and Treatment

PLEASE, KEEP TALKING ON YOUR CELL WHILE I'M EXAMINING YOU

WHEN YOU ARREST, JUST TEXT "DNR" TO 911

DIYLOL.COM
ABC's

- Do 'em just like you would with any other trauma patient
- No blood or O2 going to spine not acceptable
- Assume shock is due to hypovolemia
When you should be suspicious

High Speed (>35 mph) MVA
MVA with death
Ped struck
Fall from height > 10ft
CHI
Neuro symptoms referable to C-Spine
Pelvic or multiple extremity injuries
Intracranial hemorrhage
Specific Spine Findings

Respiratory Dysfunction -

Evaluate oxygen saturation, use of accessory muscle to breathe, quadriplegia

May indicate high cervical injury
Specific Spine Findings

- **Anal Wink** - mild noxious stim results in involuntary contraction
- **BC Reflex** – contraction of anal sphincter in response to pinching penile shaft or tug on Foley
- **Cremasteric Reflex** - pin on medial thigh causes scrotal contraction
Specific Spine Findings

- **Areflexia** – Loss of DTR's can indicate significant SCI

- **Priapism** - Indicates a complete SCI; complete loss of sympathetic tone
Specific Cord Injury Patterns

If you act like you know what you're doing, you can do anything you want - except neurosurgery.

Sharon Stone
Cord Syndromes

Complete Cord Injury - No motor or sensory function below the level of injury

Incomplete Cord Injury - Sensory, motor or both are partially present below injury
Anterior Cord Syndrome

- Direct cord compression or occlusion of the anterior spinal artery

- Complete paralysis with loss of temp and pain

- Preservation of proprioception and vibratory sense
Central Cord Syndrome

- Hyperextension assoc with cervical stenosis
- Primarily upper extremity weakness with loss of pain and temperature sensation
Brown-Sequard

- Unilateral cord injury
- Ipsilateral weakness, loss proprioception
- Contralateral loss of pain and temperature
Cauda Equina Syndrome

- Due to lumbar nerve root compression
- Loss of motor and sensory
- Saddle anesthesia
- Bowel and bladder loss
Neurogenic Shock

Warm, vasodilated and hypotensive- Loss of peripheral sympathetic tone

Bradycardic- Loss of sympathetic cardiac innervation (T1-4) results in unopposed vagal tone and/or absent reflex tachycardia

A diagnosis of exclusion in the trauma patient
Neurogenic Shock

- Fill the tank - volume resuscitation to fill dilated peripheral vessels
- If needed, pressor agents once volume replaced to maintain MAP 85-90
Spinal Shock

Temporary loss or depression of spinal reflex activity occurring below a complete or incomplete SCI

May result in an incomplete injury presenting as a complete injury

May persist days to weeks with bulbocavernosus reflex among the first to return
C-Spine Clearance

- NEXUS Criteria
- Canadian Rules (eh?)
NEXUS Criteria

Absence of midline tenderness
Alert and conscious
NO evidence of intoxication
No focal neuro deficits
Absence of painful distracting injury
Nexus Criteria

NO imaging indicated if all criteria met
-99.6% sensitive
COMMON SENSE
So rare, it's a superpower
Canadian C-Spine Rules

Consists of three questions

If the answer is Yes to all, imaging is not indicated

100% sensitivity in original report
Question #1 - High Risk Factors

Age 65 or older
Dangerous Mechanism
  - Fall > 3 ft
  - Axial Loading
  - High speed MVA, rollover, ejection, bike or ATV accident
Paresthesias
Question #2 - Low Risk Factors

Simple rear end MVA’s
Able to sit up in ED
Ambulatory at any time
Delayed onset of neck pain
Absence of midline tenderness
Question #3

Can rotate 45 degrees to left and right
Plain Films

- **Advantages** - quick, commonly available, r/o instability with F/X

- **Disadvantages** - radiation, low sensitivity to minor fractures, poor visualization of neural elements
CT

- Advantages – highly sensitive
- Disadvantages – Radiation, does not rule out ligamentous instability, poor visualization of neural elements
MRI

- Advantages – No radiation, excellent visualization of neural elements and soft tissues, can suggest ligamentous injury
- Disadvantages - Poor osseous visualization
CASE Study

CEASE ALL ACTIVITIES THOU ART ENGAGED IN

THE HOUR OF THE HAMMER IS UPON US
Case # 2

Just the Facts

• 42 y/o male Guest of the State

• While involuntarily domiciled, “fell” from a bunk striking the back of his head

• Brought to a Level I Trauma Center with complaints of neck pain
What Else Do You Want to Know?

- Other Symptoms
- Other Pertinent History
- Exam Findings
What You Got

• Man, My neck hurts. Can I get some pain pills?
• No, see they got the wrong guy, can you tell 'em to let me out since I'm hurt?
• Exam
  – You're really busy but everything seems to work while he's handcuffed to the wheelchair
Studies Obtained
Hmmm.....
Patient was sent out
And then...

- Patient continued to experience neck discomfort

- Unable to keep up with his fellow inmates, he was returned by his hosts to your attention 2 days later
Symptoms

• Severe lower neck pain

• Weak grip

• Weak lower extremities

• Denied loss of bowel or bladder control
Signs

- 4/5 grip
- T2 Sensory Level
- 4/5 Lower Extremities
- + Bulbocavernosus Reflex
Some more radiation
Treatment

• Reduce in G-W Tongs

• Anterior and Posterior fusion with instrumentation
Questions?