SPINE FRACTURES
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PALMETTO PRIMARY CARE: CHARLESTON NEUROLOGY

OBJECTIVES
- At the end of this session the participant should be able to:
  - Describe the different types of fractures
  - Discuss stable vs. unstable fractures
  - Identify the treatment options for each type

Cervical spine Anatomy
Vertebral Arches

- **Anterior Arch**
  - Vertebral body
  - Anterior 1/3 pedicles
- **Posterior Arch**
  - Posterior 2/3 pedicles
  - and posterior elements
  - Arch forms the vertebral foramen

Upper Cervical Vertebrae

- Ociopocervical junction
  - No disc
- Atlas (C1)
  - Articulates with skull (Cl) and Axis (C2)
- Atlantoaxial junction
  - No disc
- Axis (C2)
  - Articulates with C1 and C3

Lower Cervical Vertebrae

- C3 to C7
  - Subaxial
  - Normal lordosis is 20° to 40°
  - Evaluate each patient individually
  - Disc at every level
CERVICAL SPINE INJURIES

- Ligament injuries
- Fractures - stable/unstable
- SCI

Whiplash Injuries (WAD)

- Defined as traumatic injury to the muscles, ligaments, disc or facet joints.
- Usually due to hyperflexion, hyperextension or rotational injuries in the absence of fractures, dislocations or disc herniation.
- Most common non-fatal automobile injury.
WHIPLASH INJURIES
- Grade 0 - no complaints, no signs, normal exam, no x-rays
- Grade 1 - neck pain, stiffness, no tenderness, plain x-rays
- Grade 2 - neck pain with decreased ROM flex/ext x-rays
- Grade 3 - neck pain with weakness, sensory deficits, absent DTR's, x-rays and MRI
- Grade 4 - fracture or dislocation
- Grade 3 & 4 treat as SCI

Normal
- Sagittal X-ray
- Alignment
- Disc Height
- Intervertebral foramen
- Lateral mass

Cervical fractures
CERVICAL FRACTURES

- Occipital condyle fractures
- Atlantoaxial subluxation/dislocation
- Atlas fractures (C-1)
- Axis fractures (C-2)
- Odontoid fractures
- C1-2 fractures
- C3-7 fractures

All patients treated as SCI

- All victims of significant trauma
- Trauma with loss of consciousness
- Trauma with neck pain
- Abdominal breathing
- Priapism (autonomic dysfunction)

Occipital condyle fractures

- Uncommon (0.4% of trauma patients)
- May present with hypoglossal nerve palsy, mono, para or quadriplegia
- Diag CT scan and MRI to assess ligaments (Plain x-rays may miss)
- Treatment: hard collar if normal alignment Halo if misaligned
- Surgery- occipital to C1 fusion
Atlantoaxial subluxation/dislocation (cont)

Treatment - traction, halo, hard collar 6-8 weeks. If no improvement surgical fusion.

Atlantoaxial subluxation/dislocation

- Types: rotatory - usually seen in children
- anterior - more ominous, 1/3 site
- posterior - rare, usually from erosion of odontoid

CAUSE: trauma, RA, respiratory tract infection in pediatrics (Grisel syndrome). Inflammation may cause mechanical and chemical injury to the facet capsule and/or the transverse atlantal ligament (TAL).

Atlantoaxial subluxation/dislocation (cont)

Treatment - traction, halo, hard collar 6-8 weeks. If no improvement surgical fusion.
ATLAS FRACTURES

- 3-19% of cervical fractures
- 21% have head injuries
- TYPES: I - involving a single arch
- Ia - burst or Jefferson fracture - unstable
- Ib - lateral mass fractures - unstable
Diag: CT and MRI - Assess TAL

Most Common

2nd Most Common

Least Common

- Bilateral posterior arch
- Burst "Jefferson"
- Lateral mass FX

Lateral Mass Fracture
AXIS FRACTURES (C-2)

20% of cervical spine fractures

TYPES:
- Odontoid - most common
  - Hangman’s - bilateral fracture through PARS, disruption of the C2-3 disc - unstable
  - Miscellaneous

Diagnosis:
- CT
- MRI - to assess disc
- CTA - if fracture involves the vertebral foramen

Treatment:
- Hard Collar - most will heal in 12 weeks
- HALO - if unstable
- Surgical stabilization - if severe angulation of C2-3, disruption of disc space

ODONTOID FRACTURES

10-15% of all fractures - older patients with minor trauma
- Younger patients - MVA, falls, skiing

Types:
- Type I - Fracture through tip
- Type II - Fracture through base of C2
- Type III - Fracture through body of C2
C2 (Axis): Dens Fractures

- Usually caused by violent trauma
- Frequently missed
- Poorly localized posterior cervical pain
- Limited range of motion and/or instability of the head on the neck

Odontoid Fractures

- Open Mouth View X-Ray

- Normal Open Mouth View X-Ray

- Open Mouth View Showing Dens Fracture
ODONTOID FRACTURES (cont)

Treatment:

TYPE I - Halo vest - 72% fusion rate
- Hard Collar - 53% fusion rate

TYPE II - III - consider surgery if displacement > or = 5 mm or inability to maintain alignment with external immobilization or disruption of the transverse ligament.

MISCELLANEOUS C-2 FRACTURES

20% of all C-2 fractures
Include fractures of the spinous process, lamina, facet, lateral mass or C2 body

- Treatment for spinous process or lamina - hard collar
- Facet, lateral mass, or C2 body - HALO

SUBAXIAL FRACTURES (C3-C7)

Refers to injury to disc, ligament and bony injuries

Stability - compromise of anterior elements produces more instability in extension.

Compromise of posterior elements produces more instability in flexion.
Guidelines for diagnosing instability

- Anterior elements destroyed (2)
- Posterior elements destroyed (2)
- Positive stretch test (2)
- Spinal cord damage (2)
- Nerve root damage (1)
- Narrow canal <13 mm (1)
- Greater than 3.5mm displacement (2)
- UNSTABLE IF TOTAL SCORE IS
- > OR = 5

Lateral mass & facet fractures (cont)

SURGICAL TREATMENT
Posterior fusions- lateral mass screws and rods
- Flexion injuries
- Posterior ligament injuries
- Traumatic subluxation
- Unilateral or locked facets
- Simple wedge compression fracture
AB 25 year old, Brother threw him into wall.

CT SCAN

AB Post-op
Thoracolumbar fractures

VERTEBRAL COMPRESSION FRACTURE
- OSTEOPOROSIS
- MENOPAUSE
- STEROIDS
- FEMALE PREDOMINATE
- LOW IMPACT
STUDIES
- Plain Spine X-rays
- Previous X-rays
- MRI with enhancement
- Bone scan
- CT scan (if patient has pacemaker)

EXAM
- Point tenderness
- No neurological deficit
Thoracolumbar Fractures

- Types:
  - Compression fracture: anterior column, most common (T6-T8 and T12-L3)
  - Posterior column rare
  - Lateral column rare
- Diagnosis: x-ray and CT scan to check canal
- Treatment: brace and analgesics

NO NEUROLOGICAL DEFICITS!!!!!
treatment

- Analgesics - oxycodone, hydrocodone, muscle relaxers (avoid in the elderly)
- Bracing - thoracic TLSO jewett
- LUMBAR FRACTURES
  - stable - bracing (cybertec)
  - UNSTABLE - rods and screws

Vertebral Structures

Classification of Fractures

- Stable and Unstable
  - Stable
    - Spine can withstand physical loads
    - No significant displacement or deformity to bone or soft tissue
  - Unstable
    - Spine may not be able to carry normal load
    - Most likely have significant deformity and pain
    - Potential for catastrophic neurologic injury
Traumatic Forces

- Axial
  - Fibers are pushed together in a crushing manner
  - Tends to fracture vertebrae in multiple pieces
  - Usually associated with flexion, extension, or rotational injuries

- Distraction
  - Bony, disc, or soft tissue elements are pulled apart
  - Usually associated with flexion or extension injuries

Denis Classification Method

- Used to grade thoracolumbar and cervical fractures
- Based on 3-column theory of the spine:
  - Anterior = ALL and anterior 2/3 of vertebral body/disc
  - Middle = posterior 1/3 of vertebral body/disc and PLL
  - Posterior = pedicles, lamina, facets, post. ligaments
- Middle column is key to stability

L3 Fracture
50 year old MVA

CHANCE FRACTURE (old seat belt fracture)
- Cause: trauma
- Compression of the anterior column and distraction failure of middle and posterior columns
- No neuro deficits
- Treatment: Brace

BURST FRACTURES
- Most common at T10-L2
- Cause: Trauma
- Diagnosis: x-rays, CT - check bone and MRI - to check canal
- Presentation: 50% will have initial leg numbness, tingling or weakness which may subside.
- Treatment: Mild Brace
  severe-surgery
BURST FRACTURE

- SEVERE
- Anterior body height < 50% posterior height
- Canal diameter < 50%
- Kyphotic angulation > 20%
- Any Neurological deficits

UNSTABLE - SURGERY

KW’s Post-op x-ray

KW 34 yr old Unbelted MVA
Fracture/dislocation

- Failure of all three columns due to tension, rotation, or sheer causing subluxation
- 75% paraplegic
- UNSTABLE
- Treatment: SURGERY to avoid prolong bedrest

THANK YOU