Subaxial Cervical Spine Trauma
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Introduction

Trauma to the cervical spine accounts for 50% of all spine injuries.
Subaxial cervical spine is involved in 2/3’s of cervical spine fractures and >3/4’s of all spinal dislocations.
50% of injuries occur between C5 and C7.
22% of all lower cervical spine injuries are extension-distraction injuries.

Anatomic Considerations

Motion afforded by the unique cervical spine anatomy predisposes to major injury and subsequent instability.
Facet capsules, ligamentum flavum, interspinous ligaments, and supraspinous ligaments provide posterior tensile strength.
Consideration of the vertebral artery course and potential injury.
Diagnostic Imaging

- Standard x-rays include AP/Lat/Open mouth odontoid
  - Difficulty visualizing the cervicothoracic junction
  - Subtle findings: soft-tissue swelling, hypolordosis, disc-space narrowing or widening, widening of the interspinous distance

CT

- Multi-planar CT scans have improved diagnostic accuracy
  - 99% sensitivity, 100% specificity in some series
  - Plain radiographs: sensitivity 70%
- Must maintain index of suspicion for ligamentous injuries
MRI

- Often used in patients with SCI, translational, or distraction type injuries
- Can identify ventral and dorsal compressive lesions (disc herniations, hematoma, ligamentum)
- Critical for assessing the disc-ligamentous complex
  - ALL, PLL, disc, joint capsules, additional posterior ligaments
  - Overall high sensitivity, low specificity (rule in, does not rule out)

Injury Classification

- Numerous classification systems have been described
  - Magerl
  - Allen and Ferguson
  - SLIC
  - AO Spine SCST

Allen and Ferguson

- Based on static x-rays and documented/inferred mechanism of injury
- Research instrument
- Six phylogenies
  - Flexion-compression
  - Vertical compression
  - Flexion-distraction
  - Extension-compression
  - Extension distraction
  - Lateral flexion
- Series of stages based on the severity of the anatomic disruption
SLIC

Based on three major characteristics:
- Injury morphology, integrity of DLIC, neurologic status of the patient.
- Treatment is dictated by the final score:
  - <4 points supports conservative treatment.
  - 5 or more points supports surgical treatment.

Cervical Body Fractures
- Compression Fracture
- Burst Fracture
- Flexion Teardrop Fracture
- Extension Teardrop Avulsion Fracture
Compression Fracture

- Characterized by compressive failure of the anterior body cortex with disruption of the posterior body
- No posterior retropulsion
- Often associated with posterior ligamentous disruption

Burst Fracture

- Fracture extension through the posterior cortex with retropulsion
- Often associated with posterior ligamentous injury
- Often associated with complete and incomplete spinal cord injuries
- Most require surgical stabilization

Treatment Algorithms Based on SLIC

- Vertebral Burst Fracture
  - Morphology
  - DLQ (Office pool)
  - Neurology (Cord Injury + Compression)
  - SLIC Total

- Anterior Cervical Transforaminal Cage or Stent Graft (U/L or Auto)
- Anterior Cervical Plate
Flexion Teardrop Fracture

- Anterior column failure in flexion/compression
- Posterior body retropulsion
- Posterior column failure in tension
- Associated with SCI
- Unstable and requires surgery

Extension Teardrop Avulsion Fracture

- Small fleck of bone of the anterior endplate
- Most occur at C2
- Must differentiate from a true teardrop fracture
- Stable injury pattern and not associated with SCI

Treatment Algorithms Based on SLIC
Non-Operative Treatment

- Nonoperative
  - Stable fractures, no evidence of DLC injury, no significant kyphosis
  - Collar immobilization for 6-12 weeks
  - Remove collar at that time and initiate PT without any restrictions if patient has no pain and no neurologic abnormality

Operative Treatment

- Indications
  - Fracture with >11 degrees of angulation or 25% loss of height
  - Unstable burst fracture with cord compression
  - Unstable tear-drop fracture with cord compression

Unilateral Facet Fracture/Dislocation

- Most frequently missed injury on plain x-rays
- Up to 25% subluxation on x-ray
- Associated with monoradiculopathy that tends to resolve over time
Closed Reduction

- Up to 70% of fractures can be reduced with traction
- Weight necessary is usually 5-10 lbs per level of injury
- Close radiological and neurological monitoring is required
- Cannot perform if patient is obtunded, inebriated, sedated, intubated or cannot comply with the neurological examination
- Perform MRI to identify traumatic disc herniation

Treatment Algorithms Based on SLIC

- Cervical or Bilateral Tilt Subluxation or Perched Fracture
  - Neurology (Cord Injury - Compression) - 0 - 6
  - SLIC Tool

- MRI shows disc herniation into neural space
- MRI shows disc and posterior ligamentous disruption without herniation
Unilateral Facet Dislocation

- Good evidence suggesting similar outcomes comparing anterior or posterior approaches.
- No difference in patient-reported outcomes at 12 months following anterior or posterior procedures.
- Anterior based had lower pain scores, but had high rates of associated dysphagia.

Anterior Open Reduction

- After disc and PLL resection, pins are placed in 15°-20° of convergence.
- For unilateral dislocation, pins are also placed with 10°-15° of coronal separation to allow for rotation.
- Distactor placement results in local kyphosis thereby allowing facet to be unlocked.
- Reduction achieved with posteriorly directed force on the rostral body.
- Intraspinal traction can additionally help.
- Placement of a Cobb elevator in the disc space can help to unlock the facet.

Posterior Open Reduction
Bilateral Facet Dislocation

- Up to 50% subluxation on x-ray
- Mechanism - flexion and distraction forces +/- rotation

Which of the following does NOT contribute to stability of the cervical spine?

- Facet Joint
- Intervertebral Disk
- Vertebral Artery
- Posterior Ligaments

A. Facet Joint
B. Intervertebral Disk
C. Vertebral Artery
D. Posterior Ligaments
Which of the following earns a higher neurologic score in the SLIC classification?

1. Intact
2. Root Injury
3. Complete Spinal Cord Injury
4. Incomplete Spinal Cord Injury

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Which of the following is CT Scan NOT reliable in assessing?

1. Compression Fracture
2. Ligamentous Injury
3. Burst Fracture
4. Tear-Drop Fracture
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