Imaging of Trauma to the Spine

Orthopedic Diplomate Program
University of Bridgeport
College of Chiropractic
Jefferson Fracture


Thanks to Dr. John Taylor for this slide
Posterior Arch Fracture

- Most common C1 fracture
- Hyperextension
- Stable
- Usually bilateral
- 80% have other fracture

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Thanks to Dr. John Taylor for this slide
Unstable Atlanto-Axial Joint
Odontoid Fracture with increased translation
Hangman’s Fracture
28 y.o. male

• Reportedly fell while chasing a puppy in the street a night after a party

  • Head hit the curb and was forced into hyperextension

  • Significant pain (10/10) in neck & with all attempts at motion
Teardrop Fracture

- ALL rupture
- Hyperextension
- Avulsion of anterior-inferior corner of body
- Severely unstable
- Most common at C2
- Look for other injuries
- Frequent neurologic deficit
Teardrop Fracture

© Greenspan, Slide Atlas of Orthopedic Radiology
Teardrop Fracture
Burst Fracture

- Vertical compression combined with flexion
- Comminution of body by nucleus pulposus
- Retropulsion
- Kyphosis, spinous fanning, facet dislocation
- 85% neurologic deficit
Burst Fracture

Type III. Fracture through entire vertebral body with fragmentation of its anterior portion. Posterior cortex intact but projects into spinal canal causing damage to cord and/or nerve roots.

X-ray film: Type III fracture of C5
Burst Fracture

Special thanks to Northwestern Health Science University
Burst Fracture

Special thanks to Northwestern Health Science University for this case
Burst Fractures

CT
22 y.o Male

Attempting to ride his bike across the U.S.

Hit on a straight, flat stretch of road by motorist not paying attention
Burst Fracture & ?
Burst Fracture & Odontoid Frx
Cervical Spine Dislocation

- Unilateral facet dislocation
- Bilateral facet dislocation
- Transverse ligament rupture
Unilateral Facet Joint Dislocation
35 y.o. UBCC student

- Involved in MVA while in army approx. 12 yrs ago
  - Neck injury (films?)
  - Has been getting adjusted weekly (2X times a week) by local chiropractor since leaving the service
    - For approx. 7 yrs with great relief
    - The results are what inspired him to attend UBCC
  - Incoming student screening exam referred for cervical films
Chronic Unilateral Facet Joint Dislocation
Acute Compression Fractures

RADIOGRAPHIC FINDINGS:

• Wedge deformity
• Zone of impaction
• Step defect
• Paraspinal edema and hemorrhage
• Abdominal ileus—excessive gas
Spinal Trauma

- Compression fractures

- Axial rotation with fulcrum at about the posterior inferior vertebral corner

- Causes compression on anterior body
Compression vs Burst fracture
# Hemorrhage on MRI

<table>
<thead>
<tr>
<th>AGE</th>
<th>BLOOD PRODUCTS</th>
<th>T1 SIGNAL</th>
<th>T2 SIGNAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyperacute (0-1 day)</td>
<td>Oxyhemoglobin/serum</td>
<td>Isointense to cord</td>
<td>Bright</td>
</tr>
<tr>
<td>Acute (1-3 days)</td>
<td>Deoxyhemoglobin</td>
<td>Isointense to chord</td>
<td>Dark</td>
</tr>
<tr>
<td>Early Subacute (4-7 days)</td>
<td>Intracellular methemoglobin</td>
<td>Bright</td>
<td>Dark</td>
</tr>
<tr>
<td>Late Subacute (&gt;7 days)</td>
<td>Extracellular Methemoglobin</td>
<td>Bright</td>
<td>Bright</td>
</tr>
<tr>
<td>Chronic (&gt;2 weeks)</td>
<td>Hemosiderin</td>
<td>Dark</td>
<td>Dark</td>
</tr>
</tbody>
</table>
Compression Fracture

T1WI

T2WI

STIR
Fat-saturated Image
## Compression Fractures

**DETERMINING AGE OF FRACTURES:**

<table>
<thead>
<tr>
<th></th>
<th>OLD</th>
<th>NEW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shape</strong></td>
<td>Wedge</td>
<td>Wedge</td>
</tr>
<tr>
<td><strong>Step defect</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Band of condensation</strong></td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Degenerative disc</strong></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Bone Scan</strong></td>
<td>-/+ (2 yr)</td>
<td>+</td>
</tr>
</tbody>
</table>

Thanks to Dr. John Taylor for this slide

Yochum & Rowe 2nd ed. 1996, Table 9.11
Compression Fractures

Acute trauma

2 yrs after trauma
Pars Interarticulares

• Younger patients (under 30 yrs old) with low back pain
  • Significant possibility of pars defects
  • Especially in athletes
30 yr old female w/LBP
Spondylolysis
Spondylolysis
Spondylolysis
Stability of the Spine

• Typically assumed no more than 3.5 mm. translation in cervical spine
  • Anything more considered excessive/instability

• Lumbar translation
Recumbant vs upright imaging

Lying Down

Upright, Weight-Bearing

Case courtesy of M. Rose, MD, Rose Radiology Centers
Ligamentous Rupture Associated With Spinal Instability
The interspinous ligamentous rupture at the L4/5 level

Case courtesy of F. W. Smith, MD University of Aberdeen, Scotland
Arachnoiditis

• Post-traumatic (post-surgical, *post-pantopaque*)

• Inflammatory process often d/t components being injected into subarachnoid space (i.e. contrast agents, anesthetics) or intrathecal hemorrhage forming adhesions

  • Clumping of nerve roots instead of gently arching nerve roots
  • May adhere to the dura resulting in empty appearing thecal sac
Arachnoiditis

Case courtesy of Dr. Marcin Czarniecki, Radiopaedia.org, rID: 26210
Case 5: 75 yr old male

- Radicular symptoms along L4/L5 nerve root dermatome
  - Mild low back pain
  - History of fall 2 yrs previous no films or follow-up
  - History of psoriatic arthritis
Case 5: 75 yr old male
Case 5: 75 yr old male
Case 5: 75 yr old male
Case #6: 39 y.o. female
Case #6: 39 y.o. female
Case #7

T1 Neutral

T2 Neutral

T2 Flexion
Case #7: Os Odontoideum
End of Spinal Trauma Section