Spinal Fractures (general)

Most commonly found at C1-2, C5-7, and T12-L2

<table>
<thead>
<tr>
<th>Level</th>
<th>Name</th>
<th>Description</th>
<th>Incidence</th>
<th>Mechanism</th>
<th>Best seen on</th>
<th>Positive Roentgenometric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlas</td>
<td>Jefferson's/Burst fracture</td>
<td>Bursting of ring Fractures through ant. and post. Arches Lateral masses usually displace laterally Usually bilaterally</td>
<td>1/3 of Atlas fractures</td>
<td>Compression via a full force blow through the occipital condyles transmitted to the Atlas via the C1 lateral masses (Diving into shallow water)</td>
<td>AP Open mouth</td>
<td>Atlantoaxial alignment</td>
</tr>
<tr>
<td>Atlas</td>
<td>Posterior arch fracture</td>
<td>Fracture through the neural arch Usually bilateral</td>
<td>~50% of Atlas fractures</td>
<td>Posterior arch has been compressed b/t the occiput and the posterior arch of C2 under severe hyperextension</td>
<td>Lateral Cervical</td>
<td>Possible spinolaminar line</td>
</tr>
<tr>
<td>Atlas</td>
<td>Anterior arch fracture</td>
<td>Horizontal avulsion fracture of anterior arch at ALL or Longus col attachment</td>
<td>2% of neck fractures</td>
<td>Hyperextension</td>
<td>Lateral Cervical</td>
<td>None</td>
</tr>
<tr>
<td>Atlas</td>
<td>Lateral mass fracture</td>
<td>Avulsion fracture at the insertion of the transverse lig. At medial aspect of lateral mass</td>
<td>--</td>
<td>Axial loading w/ hyperflexion</td>
<td>CT</td>
<td>None</td>
</tr>
<tr>
<td>Axis</td>
<td>Hangman's Fracture</td>
<td>Bilateral disruption through the pedicles of the Axis</td>
<td>40% of Axis fractures</td>
<td>MVA (motor vehicle accident) causing hyperflexion</td>
<td>Lateral Cervical, CT</td>
<td>George's line Retropharyngeal space</td>
</tr>
<tr>
<td>Axis</td>
<td>Teardrop</td>
<td>Avulsion of triangle bone fragment from ant. Inf. corner of axis body</td>
<td>Low (associated w/ Hangman's)</td>
<td>Acute hyperextension</td>
<td>Lateral Cervical</td>
<td>Anterior body line</td>
</tr>
<tr>
<td>Axis</td>
<td>Odontoid process fracture</td>
<td>Type I=avulsion of tip of odontoid Type II=fracture at dens/body junction Type III=fracture below the base of dens attachment to the body</td>
<td>40-50% Axis fractures</td>
<td>Type I=apical or alar lig. stress Type II=hyperflexion Type III=severe hyperflexion</td>
<td>AP Open Mouth, CT/MRI</td>
<td>George's line Retropharyngeal space</td>
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<tr>
<td>Cervical Vertebra body</td>
<td>Wedge fracture</td>
<td>Sharp anterior triangular wedging of superior vertebra endplate (3mm smaller anterior body than posterior)</td>
<td>2/3 at C5, C6, C7</td>
<td>Mechanical compression b/t adjacent vertebrae bodies from forced hyperflexion</td>
<td>Lateral Cervical</td>
<td>Retropharyngeal space</td>
</tr>
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<td>Cervical Vertebra body</td>
<td>Burst fracture</td>
<td>Vertical fracture through vertebral body (AP) Flattened central body (Lat)</td>
<td>--</td>
<td>Vertical compression to the head pushing NP through endplate into vertebral body</td>
<td>Lateral Cervical, AP</td>
<td>None</td>
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<td>Cervical Vertebra body</td>
<td>Teardrop</td>
<td>Triangular shaped bone separated from ant. Inf. body</td>
<td>--</td>
<td>Hyperflexion (avulsion) Hyperflexion (shearing)</td>
<td>Lateral Cervical</td>
<td>None</td>
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<tr>
<td>Cervical Pillar</td>
<td>Pillar fracture</td>
<td>Vertical fracture through pillars (lateral view) Flattened/ altered shape of pillars (pillar view)</td>
<td>40% at C4-C7</td>
<td>Compression Hyperextension/lateral flexion injuries (MVA)</td>
<td>Pillar view, Lateral Cervical</td>
<td>Anterior body line</td>
</tr>
<tr>
<td>Cervical Sp</td>
<td>Clay Shoveler's fracture</td>
<td>Avulsion injury of spinous process goes posterior (lateral view) and lateral (AP view)</td>
<td>C6, C7, T1</td>
<td>Abrupt flexion of head (MVA, diving, wrestling, repetitive stress)</td>
<td>Lateral Cervical, AP</td>
<td>Double spinous sign</td>
</tr>
<tr>
<td>Cervical Lamina and TP</td>
<td>Lamina fracture</td>
<td>Fracture plane through the lamina</td>
<td>C5, C6</td>
<td>Severe trauma w/ lateral flexion</td>
<td>CT, Obliques ?</td>
<td>None</td>
</tr>
<tr>
<td>Cervical Lamina and TP</td>
<td>TP fracture</td>
<td>Fracture plane through the TP</td>
<td>Rare (C7)</td>
<td>Severe trauma w/ lateral flexion</td>
<td>CT, Obliques ?</td>
<td>None</td>
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Whiplash
Mechanism=forced hyperextension/hyperflexion of the C/s most commonly associated w/ rear end MVA
Whiplash is a layperson's term (we should say Cervical Sprain/Strain Injury)
~85% of posterior neck pain is sourced from Cervical facet joints
Pain is typically dull and achy that is sharp w/ movement
Pain may radiate into the head, shoulder, arm or interscapular region
Other complaints
Headache, visual problems, memory problems, and dizziness
Mostly soft tissue problems (poor radiographic imaging)
Imaging is done to rule out fractures and dislocations

Conventional imaging findings
Series=AP, Lat, obliques
70-90% have positive lateral film
Use Davis series (7 view) to see everything the best

Abnormal Soft Tissues
Widened retropharyngeal space (<6mm in kids and adults)
- ALL tear
- Hematoma
- Edema in longus coli
- Torn discovertebral junction
Widened retrotracheal space (<14 mm in kids/<22 mm in adults)
- Hematoma
- Edema in esophagus/longus coli
- ALL tear
- Discovertebral junction tear
Displacement of prevertebral fat stripe
- Hematoma
- Edema in longus coli, Scalenes
- ALL tear
- Discovertebral junction tear
Compression fractures/endplate fractures
Tracheal deviation and laryngeal dislocation
- Hematoma
- Torticollis
Watch for elevation of the hyoid bone (tracheal transection)
Soft tissue emphysema
- Tracheal laceration/transection
- Pneumomediastinum
- Pneumothorax

Abnormal vertebral alignment
Loss of lordosis
Acute kyphotic angulation
- Two adjacent spinous processes widely separated is suggestive of disruption of Posterior Ligamentous Complex
- Most commonly found at C5-C6
- Associated w/ significant facet subluxation (almost to true luxation)
- Naked facet
Widened interspinous space
Altered flexion patterns
- No intersegmental motion is seen in 25% of cases
- Suggestive of soft tissue injury
- One level of intersegmental motion in 25% of cases
- Suggestive of soft tissue injury
- Two levels of intersegmental motion in 30% of cases
- Three levels (or more) of intersegmental motion in 20% of cases
- Normal

Altered movement
A flexion-extension intersegmental motion of greater than 11.5° is evidence of significant ligamentous injury
Lateral flexion disruption is seen w/ adjacent endplate diversion that is suggestive of facet instability and possible joint capsule disruption or a unilateral facet luxation
Rotation may be the result of torticollis or artifactual rotation of the head
May also result from unilateral subluxation or luxation of a cervical facet joint
Sagittal translation greater than 3.5 mm indicates intersegmental instability
Torticollis evaluate in relation to the inferior aspect of the mandible

Abnormal joints
Widened median atlantoaxial joint
Widened or narrowed intervertebral disc
Vacuum phenomenon=small smooth lucent cleft adjacent to anterior vertebral endplate (evidence of annular avulsion) (likely degenerative in nature)
Displaced ring epiphysis
Widened Z joint if greater than 2 mm may denote tearing of facet capsule

CT
- Detect and assess fractures, disc hemiations, prevertebral lesions and hematomas, relationship of bone fragments to the cord, and actual cord lesions

MRI
- Detection of soft tissue injuries in acute and chronic settings

Bone scan

Pictures
Jefferson’s Fracture
Dislocations of the Cervical Spine

Atlanto-occipital dislocation
- Rare and usually fatal injury
- Mechanism: hyperextension and distraction applied to head
- Usually MVA

Atlantoaxial dislocation
- Anterior dislocation see "Rupture of transverse ligament"
- Rotatory fixation is poorly understood
- Presentation: Torticollis w/ pain
- Type I: Rotatory fixation w/o anterior displacement and w/in normal ROM
- Most common
- Type II: Rotatory fixation w/ 3-5 mm of anterior displacement
- Type III: Rotatory fixation w/ >5 mm of anterior displacement
- Type IV: Rotatory fixation w/ posterior displacement of the atlas
- Deficient odontoid required to occur
- CT needed for true diagnosis

Bilateral interfacet dislocation
- Mechanism: severe hyperflexion injury
- Most common at C4-C7
- Soft tissue injuries rather than bony ones
- PLL, Posterior ligamentous complex, AF, and occasionally ALL
- Disc herniations are common
- High instability produces high incidence of cord injuries
- Facets will be "locked" (superior facet fully anterior to inferior facet, Naked Facet)
  - This will pull the facet into the IVF
  - The superior vertebral body is typically 1/2 vertebral body width anterior from the inferior one
- Chip fracture of articular processes often found w/ bilateral interfacet dislocation

Unilateral interfacet dislocation
- Mechanism: flexion-rotation
- Lateral film will show forward displacement of the vertebral body
- Alteration of the superimposed articular pillars represents a sign of UID
- The combination of the above will produce a "bow tie sign"

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<th>Thoracic spine</th>
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<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Compression fracture</td>
</tr>
<tr>
<td>Fracture-dislocation</td>
</tr>
<tr>
<td>Name</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
</tbody>
</table>
| Compression fracture        | **Ant. Column**=ALL to mid body  
**Middle Column**=mid body to PLL  
**Post. Column**=PLL to supraspinous ligament  
- **Step deficit**=buckling of anterior cortex adjacent to the Sup. Endplate (will move anteriorly)  
- **Wedge deformity**=anterior depression of vertebral body w/ no loss in posterior body height  
--Will result in focal kyphosis  
- **Linear zone of condensation**=white band seen inferior to the endplate that has been fractured  
- **Displaced endplate**=Paraspinal hematoma  
- **Abdominal ileus**=seen in severe trauma (excessive amounts of small or large bowel gas in a distended lumen) | Most common at T12-L1  
Combination of flexion and axial compression | Lateral Lumbar | None |
| Burst fracture              | Special compression fracture w/ posteri orsuperior fragment displacement into the spinal canal  
Vertical fracture line will widen interpeduncular space  
May have **Coronal cleft**=vertically oriented split in vertebral body | -- | Severe axial compression and flexion | AP Lumbar, CT | George's line |
| Post. Apophyseal Ring fracture | Separation of posterior vertebral body ring apophysis | Young adults and adolescents  
Most common at L4-L5, L5-S1 | Trauma, MVA, Gymnastics | Lateral Lumbar, CT | George's line |
| Kümmel’s Disease           | Post traumatic vertebral body collapse | -- | Likely due to avascular necrosis | -- | None |
| TP fracture                 | Jagged radiolucent separation of 1 part of TP from another (usually near the body)  
Mostly avulsion fractures from the paraspinal muscles | 2nd most common fractures in Lumbar spine  
Most common at L2, L3 | Severe hyperextension and lateral flexion | AP Lumbar | Hadley’s S-curve |
| Pars Interarticularis fracture | Vertically oriented jagged radiolucent fracture line  
Broken neck on the Scotty Dog  
Acute fractures=unilateral  
Spondylosis=bilateral | L4-L5 | Violent hyperextension | Oblique Lumbar | Percentage method |
| Chance (Lap Seat Belt) fracture | Horizontal splitting of the spine and neural arch  
Failure of the posterior and middle columns  
**Patterns**  
- **Chance**=horizontal splitting of the SP and pedicle continuous through the posterior vertebral body to involve the superior endplate  
- **Horizontal splitting**=horizontal division of the SP, pedicle, and posterior vertebral body w/out involving the endplate  
- **Smith injuries**=rupture through the interspinous ligaments partially rupturing the disc (type A), avulsing the posterior inferior corner of the vertebral body (type B), or fracturing the superior articular process (type C)  
- **Empty vertebra**=a wide radiolucent gap b/t two fractured segments (seen on AP)  
Radiolucent split through the SP, lamina, pedicle, and the upper corner of the posterior aspect of the body (see on Lat) | Upper Lumbar spine | Focal flexion and distraction forces | AP Lumbar, Lateral Lumbar |