

Book notes: Fractures

Saturday, October 25, 2008
11:14 AM

Spinal Fractures (general)

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

Cervical spine fractures

Level	Name	Description	Incidence	Mechanism	Best seen on	Positive Roentgenometric
Atlas	Jefferson's/Burst fracture	Bursting of ring Fractures through ant. and post. Arches Lateral masses usually displace laterally Usually bilateral	1/3 of Atlas fractures	Compression via a full force blow through the occipital condyles transmitted to the Atlas via the C1 lateral masses (Diving into shallow water)	AP Open mouth	Atlantoaxial alignment
Atlas	Posterior arch fracture	Fracture through the neural arch Usually bilateral	~50% of Atlas fractures	Posterior arch has been compressed b/t the occiput and the posterior arch of C2 under severe hyperextension	Lateral Cervical	Possible spinolaminar line
Atlas	Anterior arch fracture	Horizontal avulsion fracture of anterior arch at ALL or Longus coli attachment	2% of neck fractures	Hyperextension	Lateral Cervical	None
Atlas	Lateral mass fracture	Avulsion fracture at the insertion of the transverse lig. At medial aspect of lateral mass	--	Axial loading w/ hyperflexion	CT	None
Atlas	Rupture of Transverse lig.	Abnormally large ADI (> 3 mm adults, 5 mm children)	Rare	Associated w/ Jefferson's fracture, Inflammatory arthritis, Down's syndrome	Flexion Cervical	Spinolaminar line
Axis	Hangman's Fracture	Bilateral disruption through the pedicles of the Axis	40% of Axis fractures	MVA (motor vehicle accident) causing hyperextension	Lateral Cervical, CT	George's line Retropharyngeal space
Axis	Teardrop	Avulsion of triangle bone fragment from ant. Inf. corner of axis body	Low (associated w/ Hangman's)	Acute hyperextension	Lateral Cervical	Anterior body line
Axis	Odontoid process fracture	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	40-50% Axis fractures	Type I=apical or alar lig. stress Type II=hyperflexion Type III=severe hyperflexion	AP Open Mouth, CT/MRI	George's line Retropharyngeal space
Cervical Vertebral body	Wedge fracture	Sharp anterior triangular wedging of superior vertebral endplate (3mm smaller anterior body than posterior)	2/3 at C5, C6, C7	Mechanical compression b/t adjacent vertebra bodies from forced hyperflexion	Lateral Cervical	Retropharyngeal space
Cervical Vertebral body	Burst fracture	Vertical fracture through vertebral body (AP) Flattened central body (Lat)	--	Vertical compression to the head pushing NP through endplate into vertebral body	Lateral Cervical, AP Cervical	None
Cervical Vertebral body	Teardrop	Triangular shaped bone separated from ant. Inf. body	--	Hyperextension (avulsion) Hyperflexion (shearing)	Lateral Cervical	None
Cervical Pillar	Pillar fracture	Vertical fracture through pillars (lateral view) Flattened/altered shape of pillars (pillar view)	40% at C4-C7	Compression Hyperextension/lateral flexion injuries (MVA)	Pillar view, Lateral Cervical	Anterior body line
Cervical SP	Clay Shoveler's fracture	Avulsion injury of spinous process goes posterior (lateral view) and lateral (AP view)	C6, C7, T1	Abrupt flexion of head (MVA, diving, wrestling, repetitive stress)	Lateral Cervical, AP Cervical	Double spinous sign
Cervical Lamina and TP	Lamina fracture	Fracture plane through the lamina	C5, C6	Severe trauma w/ lateral flexion	CT, Obliques ?	None
Cervical Lamina and TP	TP fracture	Fracture plane through the TP	Rare (C7)	Severe trauma w/ lateral flexion	CT, Obliques ?	None

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 herniations, 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

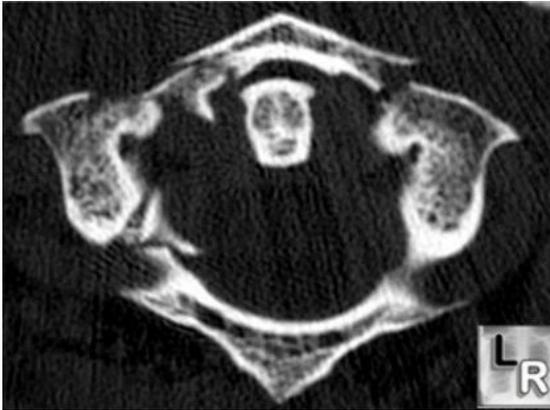
Bone scan

Pictures

Jefferson's Fracture



Jefferson's fracture CT



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/out 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 boney 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 interfacetal dislocation

Unilateral interfacetal 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**"

Thoracic spine

Name	Description	Incidence	Mechanism	Best seen on	Positive Roentgenometric
Compression fracture	Wedge shaped change in vertebral body due to failure of superior endplate	Most common at T11-T12	Combination of axial and flexion injury	Lateral Thoracic	Thoracic Kyphosis
Fracture-dislocation	Lost of body height, displacement, widened interpediculated distance and widened paraspinal widening	Most common at T4-7	MVA	AP view	None

Lumbar spine

Name	Description	Incidence	Mechanism	Best seen on	Positive Roentgenometric
Compression fracture	<p>Ant. Column=ALL to mid body Middle Column=mid body to PLL Post. Column=PLL to supraspinous ligament</p> <p>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)</p>	Most common at T12-L1	Combination of flexion and axial compression	Lateral Lumbar	None
Burst fracture	<p>Special compression fracture w/ posterosuperior fragment displacement into the spinal canal Vertical fracture line will widen interpeduncular space May have Coronal cleft=vertically oriented split in vertebral body</p>	--	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
Kummel's Disease	Post traumatic vertebral body collapse	--	Likely due to avascular necrosis	--	None
TP fracture	<p>Jagged radiolucent separation of 1 part of TP from another (usually near the body) Mostly avulsion fractures from the paraspinal muscles</p>	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	<p>Vertically oriented jagged radiolucent fracture line Broken neck on the Scotty Dog Acute fractures=unilateral Spondylolysis=bilateral</p>	L4-L5	Violent hyperextension	Oblique Lumbar	Percentage method
Chance (Lap Seat Belt) fracture	<p>Horizontal splitting of the spine and neural arch Failure of the posterior and middle columns Patterns</p> <p>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)</p>	Upper Lumbar spine	Focal flexion and distraction forces	AP Lumbar, Lateral Lumbar	