

Spinal Fractures Classification System

an AOSpine Knowledge Forum initiative

- **Cervical Spine Fractures**
- **Thoracolumbar Spine Fractures**
- **Sacral Spine Fractures**

AOSpine—the leading global academic community for innovative education and research in spine care, inspiring lifelong learning and improving patients' lives.

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Endorsed by AOSpine International Board as the official AOSpine Classification.

AOSpine Knowledge Forum

- Cervical Spine Fractures Classification System

Compression injuries

Type	Description
A0	No bony injury or minor injury such as an isolated lamina fracture or spinous process fracture
A1	Compression fracture involving a single endplate without involvement of the posterior wall of the vertebral body
A2	Coronal split or pincer fracture involving both endplates without involvement of the posterior wall of the vertebral body
A3	Burst fracture involving a single endplate with involvement of the posterior vertebral wall
A4	Burst fracture or sagittal split involving both endplates

Distraction injuries

Type	Subtype	Description
B1	Posterior Tension Band Injury (bony)	Physical separation through fractured bony structures only
B2	Posterior Tension Band Injury (bony Capsuloligamentous, ligamentous)	Complete disruption of the posterior capsuloligamentous or bony capsuloligamentous structures together with a vertebral body, disk, and/or facet injury
B3	Anterior Tension Band Injury	Physical disruption or separation of the anterior structures (bone/disk) with tethering of the posterior elements

Translation injuries

Type	Description
C	Translational injury in any axis-displacement or translation of one vertebral body relative to another in any direction

Facet injuries

Type	Description
F1	Nondisplaced Facet Fracture with fragment <1 cm in height, <40% of lateral mass
F2	Facet fracture with fragment >1 cm, > than 40% lateral mass, or displaced
F3	Floating lateral mass
F4	Pathologic subluxation or perched/dislocated facet
BL	Bilateral injury

Neurology

Type	Description
N0	Neurologically Intact
N1	Transient neurologic deficit
N2	Radiculopathy
N3	Incomplete spinal cord injury
N4	Complete spinal cord injury
NX	Neurological status unknown
+	Ongoing cord compression in setting of incomplete neurologic deficit or nerve injury

Modifiers

Type	Description
M1	Posterior Capsuloligamentous Complex injury without complete disruption
M2	Critical disk herniation
M3	Stiffening/metabolic bone disease (ie.: DISH, AS, OPLL, OLF)
M4	Vertebral artery abnormality

Classification

- Injuries are first classified by their level and primary injury type, either C, B, or A. If there are multiple levels, the most severe level is classified first. The secondary injuries are parenthesized.

For example, a C6-C7 translational injury (C) with a C7 compression fracture (A1) would be classified as:

C6-C7:C
(C7:A1)

And a C5-C6 flexion distraction injury (B2) with a C6 compression fracture (A1) would be classified as:

C5-C6:B2
(C6:A1)

Classification—Facet Injuries

- Included in parenthesis are the remaining subgroups in the order of: facet injuries, neurological status, and any modifiers.
- For bilateral facet injuries, the “BL” modifier is added after the facet injury if the injuries are the same. For example, a C6-C7 flexion distraction injury (B2) with bilateral facet dislocation (F4) would be classified as:

**C6-C7:B2
(F4 BL)**

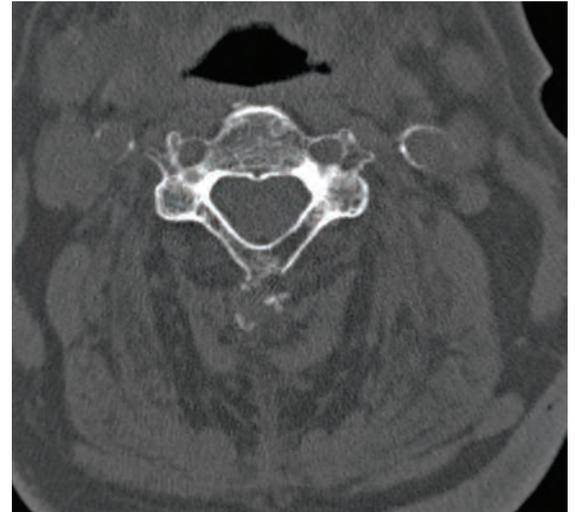
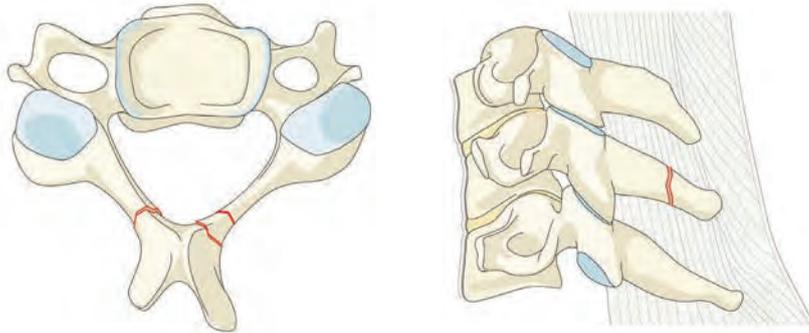
- When there are different facet injuries to the same level, the right side is listed first, then the left. For example, a C6-C7 flexion distraction injury (B2) with right sided facet dislocation (F4) and a left sided displaced facet fracture (F2) would be classified as:

**C6-C7:B2
(F4, F2)**

- If there are multiple injuries to the same facet (For example: small fracture (F1) and dislocation (F4), only the highest level facet injury is classified (F4).
- If only facet injuries are identified (No A, B, or C injury), they are listed first after the level of injury.

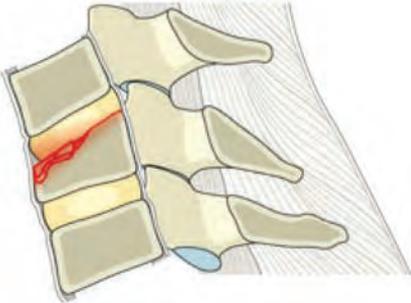
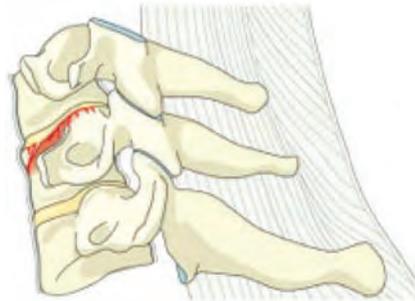
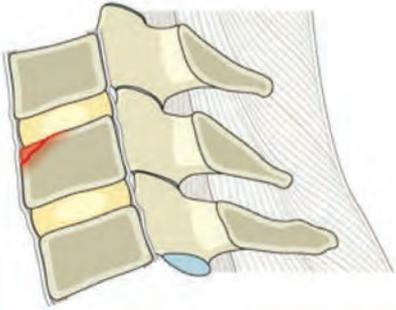
Type A: Compression injuries

A0. No bony injury or minor injury such as an isolated lamina fracture or spinous process fracture



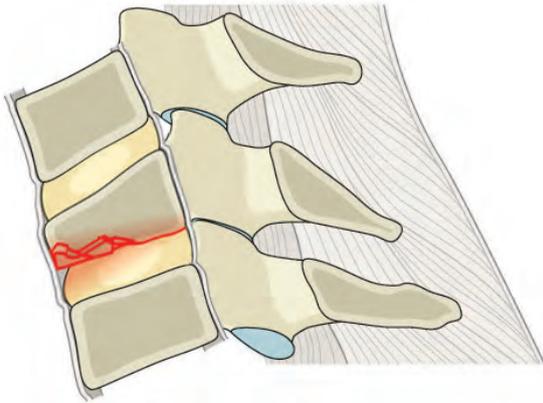
Type A: Compression injuries

A1. Compression fracture involving a single endplate without involvement of the posterior wall of the vertebral body



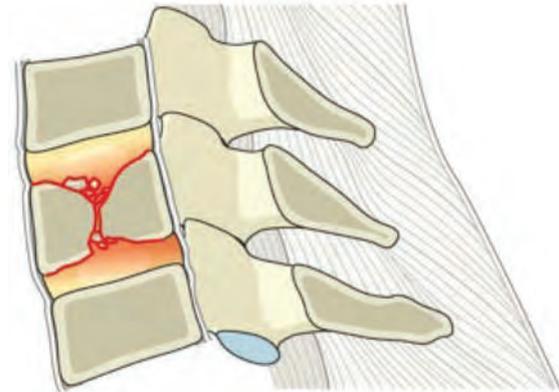
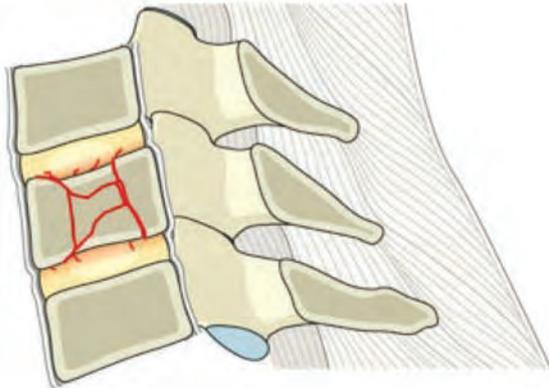
Type A: Compression injuries

- A1. Compression fracture involving a single endplate without involvement of the posterior wall of the vertebral body



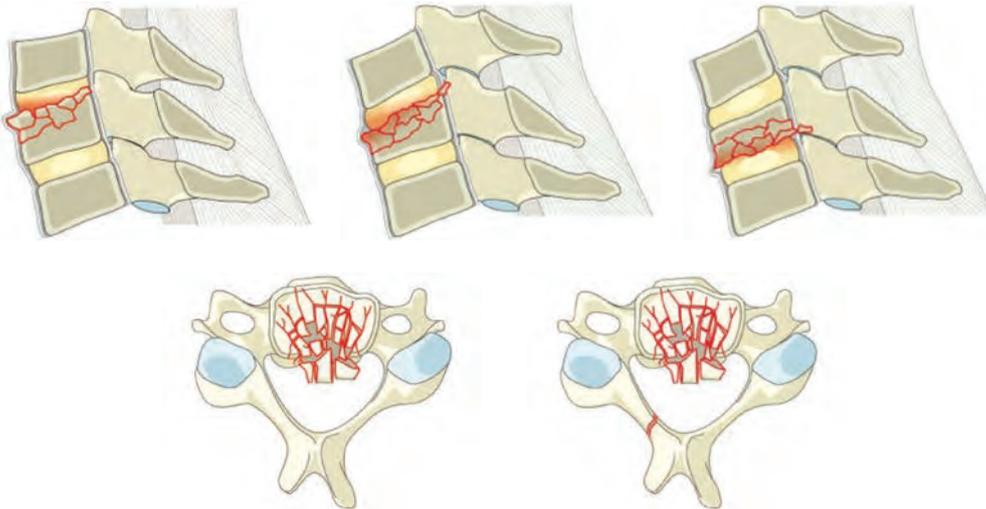
Type A: Compression injuries

A2. Coronal split or pincer fracture involving both endplates without involvement of the posterior wall of the vertebral body



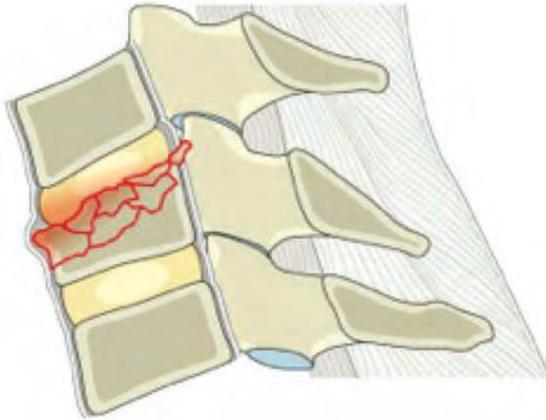
Type A: Compression injuries

A3. Burst fracture involving a single endplate with involvement of the posterior vertebral wall



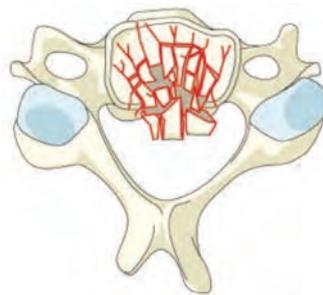
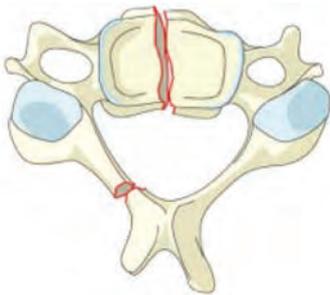
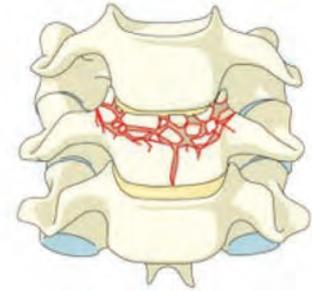
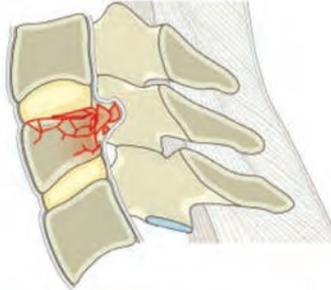
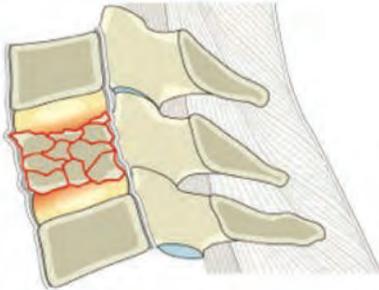
Type A: Compression injuries

A3. Burst fracture involving a single endplate with involvement of the posterior vertebral wall



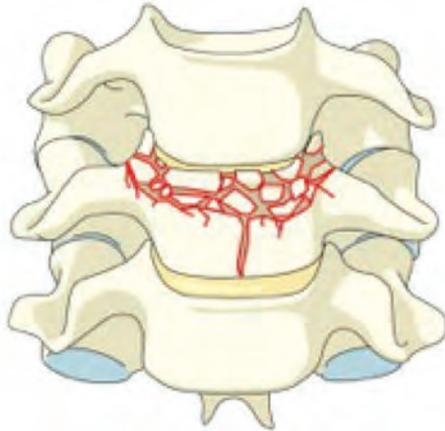
Type A: Compression injuries

A4. Burst fracture or sagittal split involving both endplates



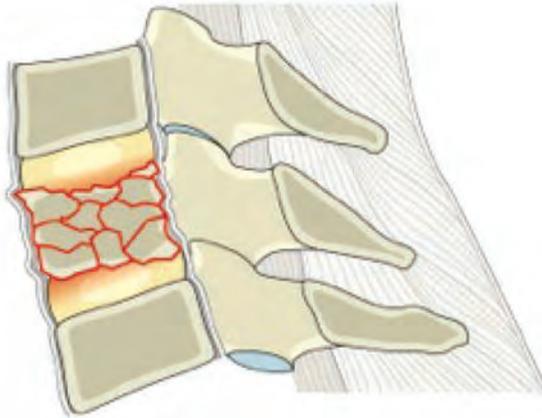
Type A: Compression injuries

A4. Burst fracture or sagittal split involving both endplates



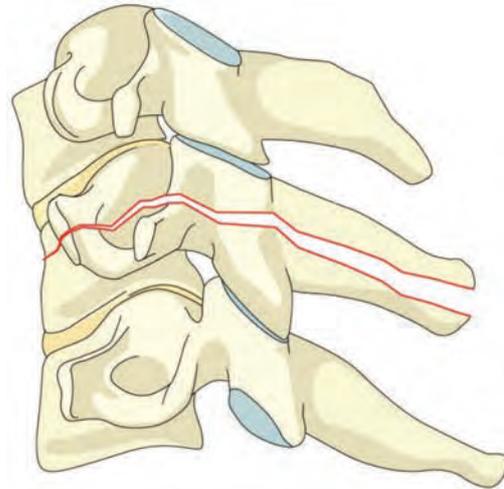
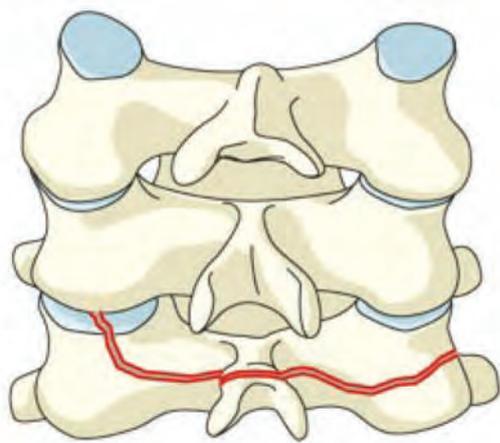
Type A: Compression injuries

A4. Burst fracture or sagittal split involving both endplates



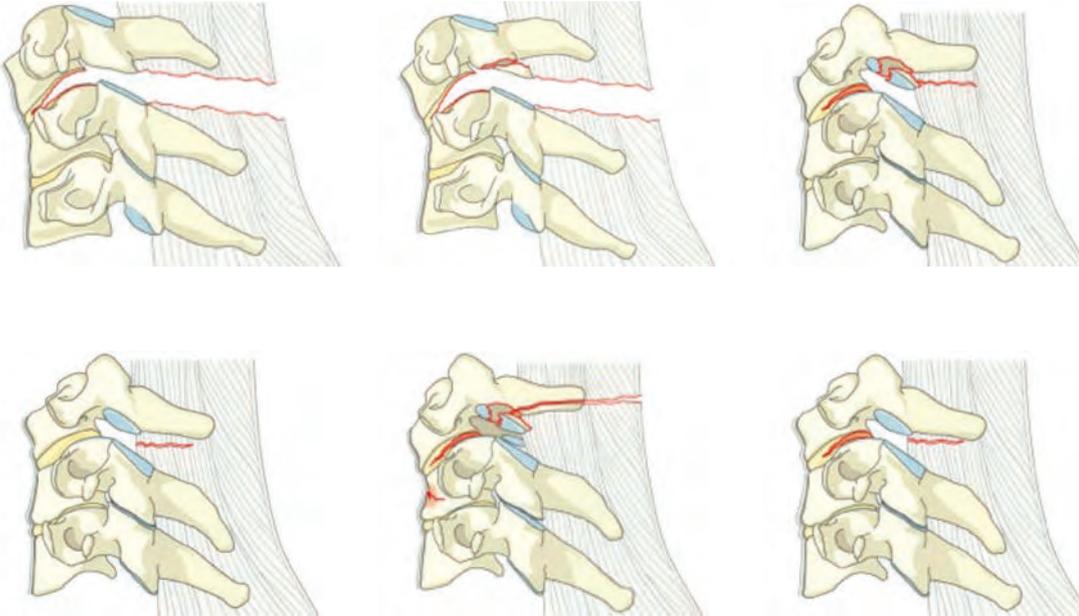
Type B: Distraction injuries

B1. Posterior tension band injury (bony)



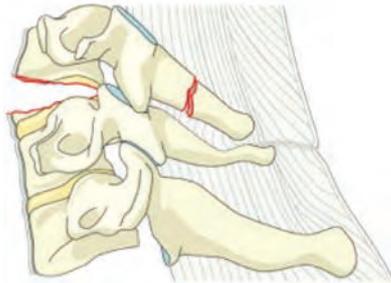
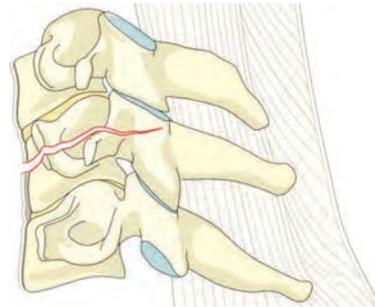
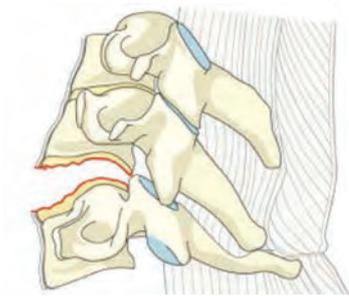
Type B: Distraction injuries

B2. Posterior tension band injury (bony capsuloligamentous, ligamentous)



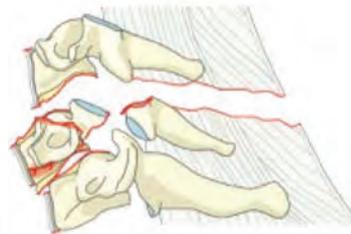
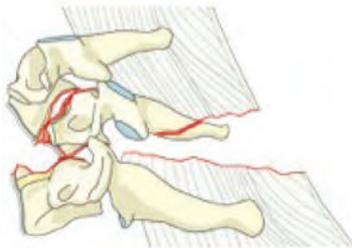
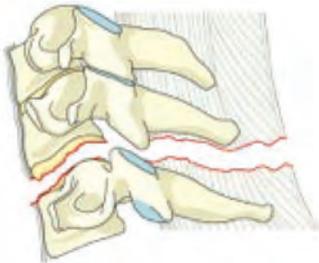
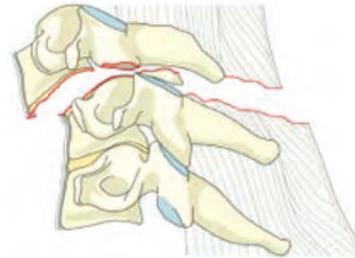
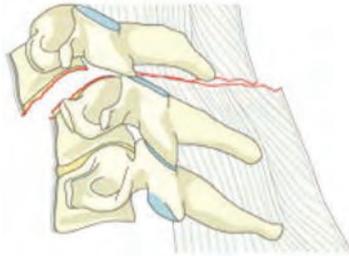
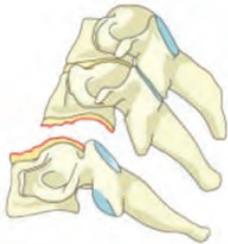
Type B: Distraction injuries

B3. Anterior tension band injury



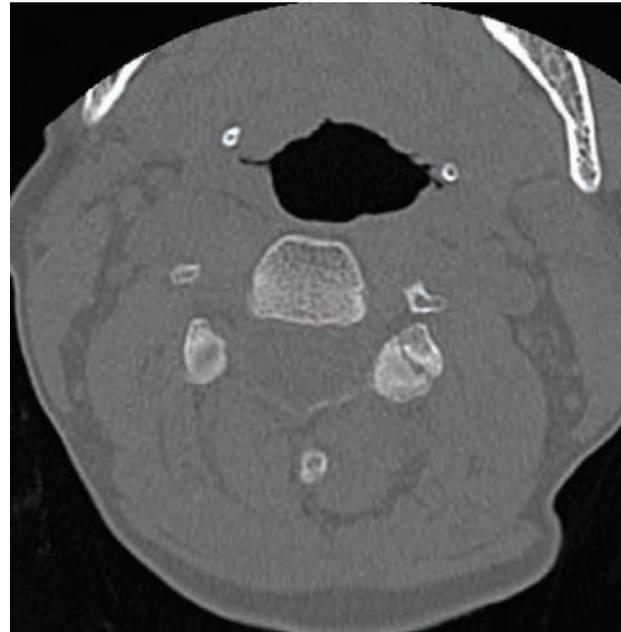
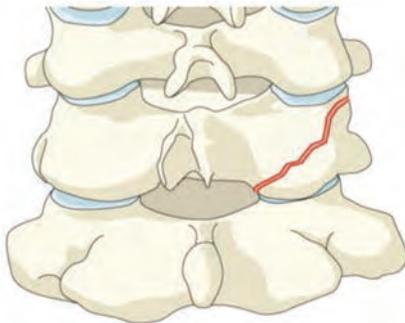
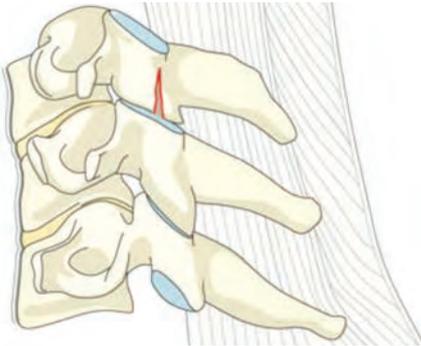
Type C: Translation injuries

C. Translational injury



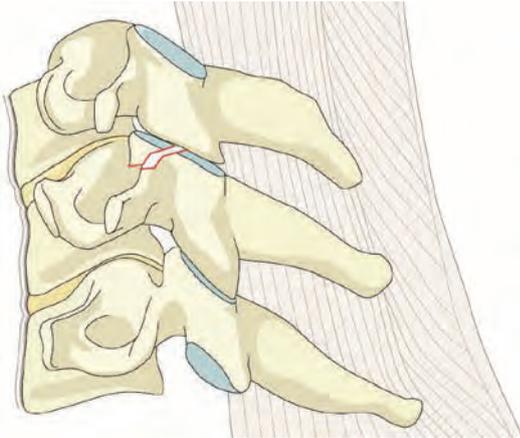
Facet injuries

F1. Nondisplaced facet fracture (Fragment < 1 cm, $< 40\%$ lateral mass)



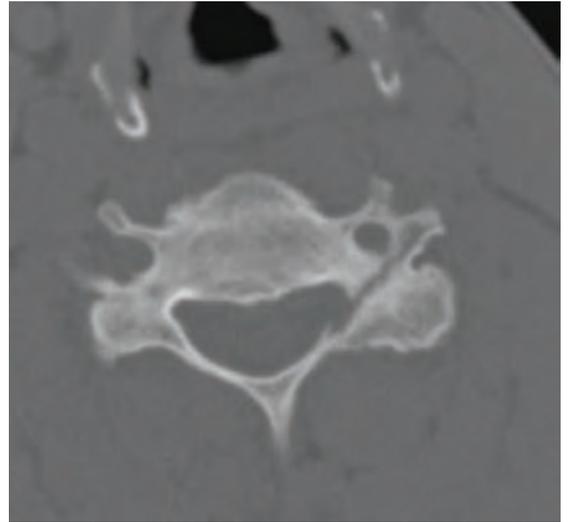
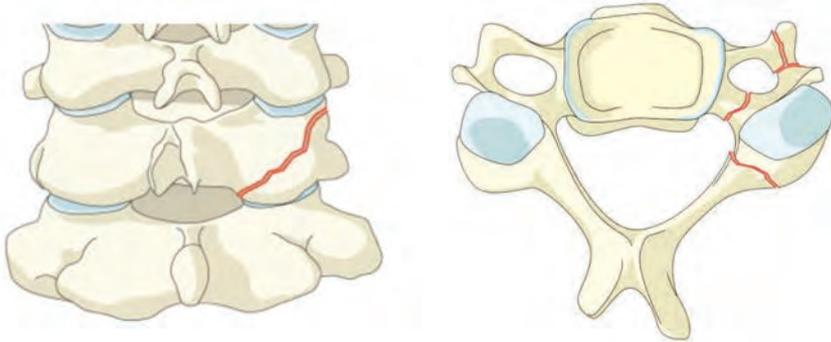
Facet injuries

F2. Facet fracture with fragment >1 cm,
> 40% lateral mass or displaced



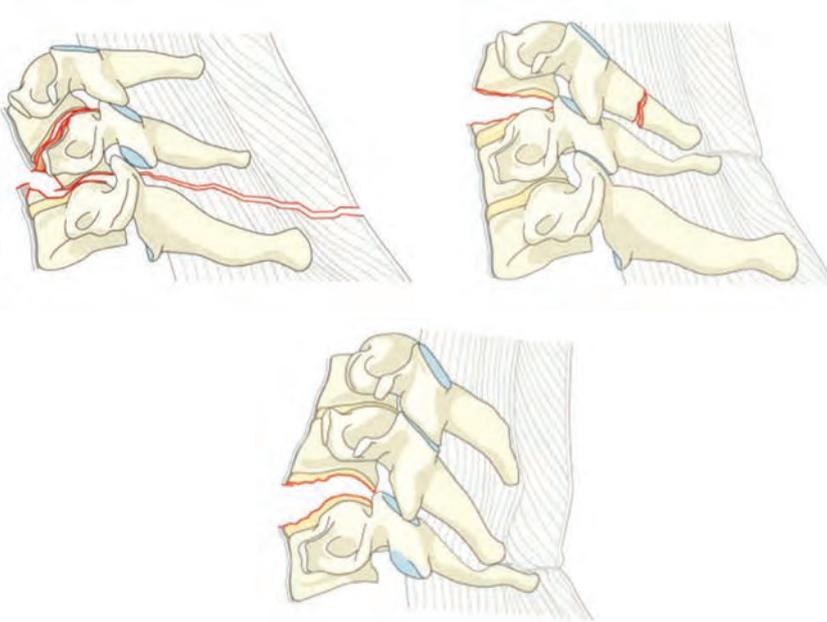
Facet injuries

F3. Floating lateral mass



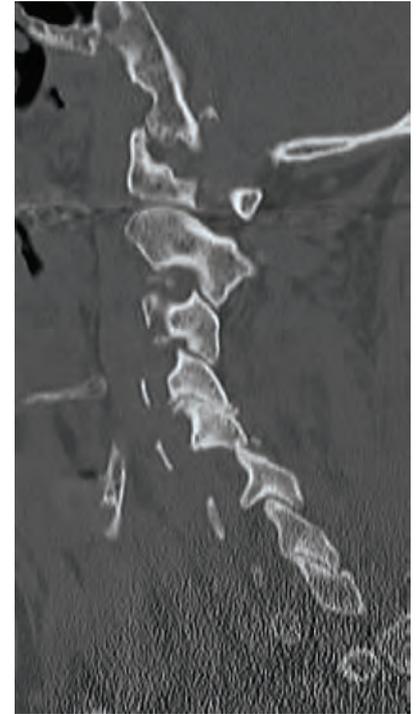
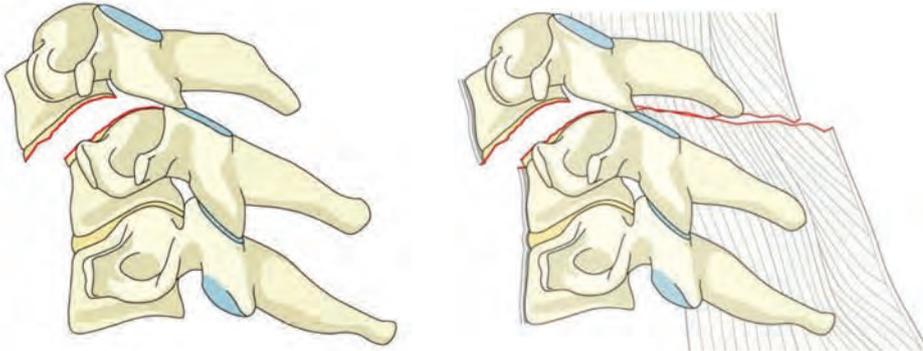
Facet injuries

F4. Pathologic subluxation or perched/dislocated facet



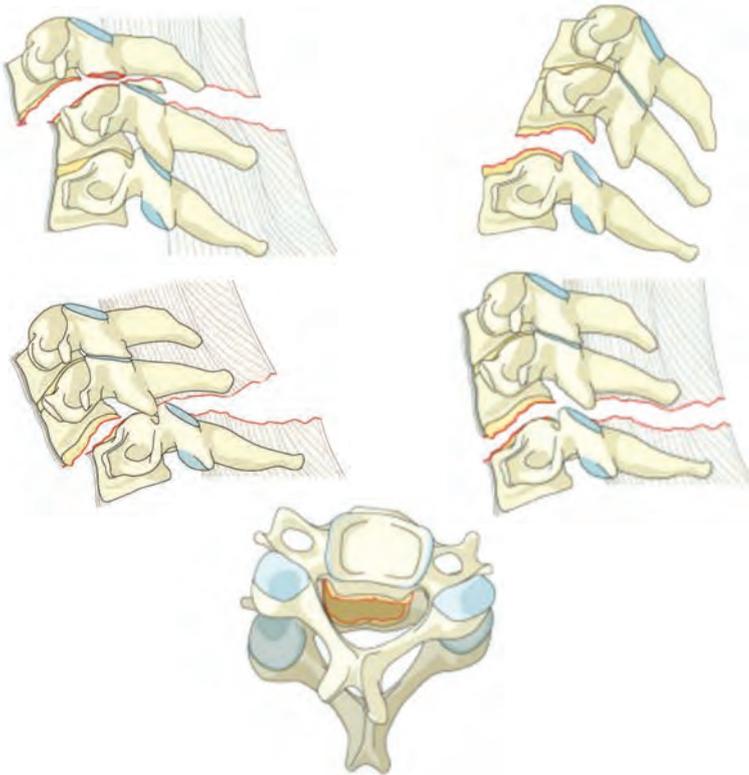
Facet injuries

F4. Pathologic subluxation or perched/dislocated facet



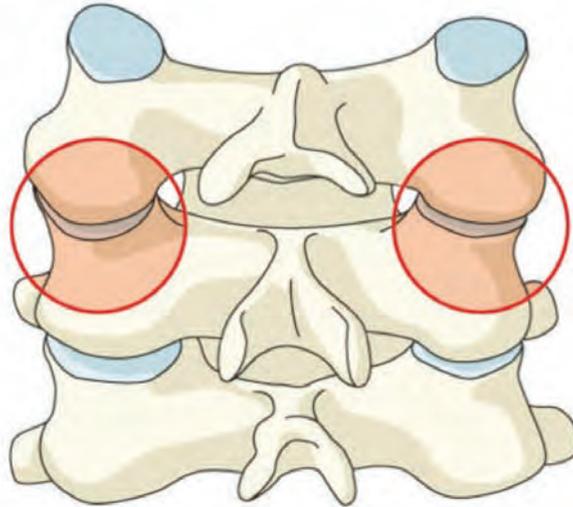
Facet injuries

F4. Pathologic subluxation or perched/dislocated facet



Facet injuries

BL. Bilateral injury



Case Example 1.

25 year old male involved in high speed MVA, complete SCI

C7-T1: C

(T1:A1; F4 BL; N4)

(assume bilateral)



Case Example 1.

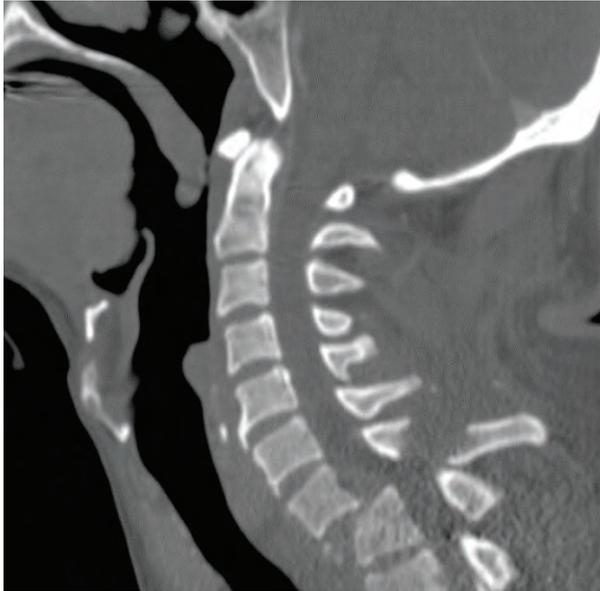
25 year old male involved in high speed MVA, complete SCI

C7-T1: C

(T1:A1; F4 BL; N4)

Translational injury (C), with compression fracture at T1 (A1), bilateral facet dislocations (F4 BL), complete SCI (N4)

(assume bilateral)

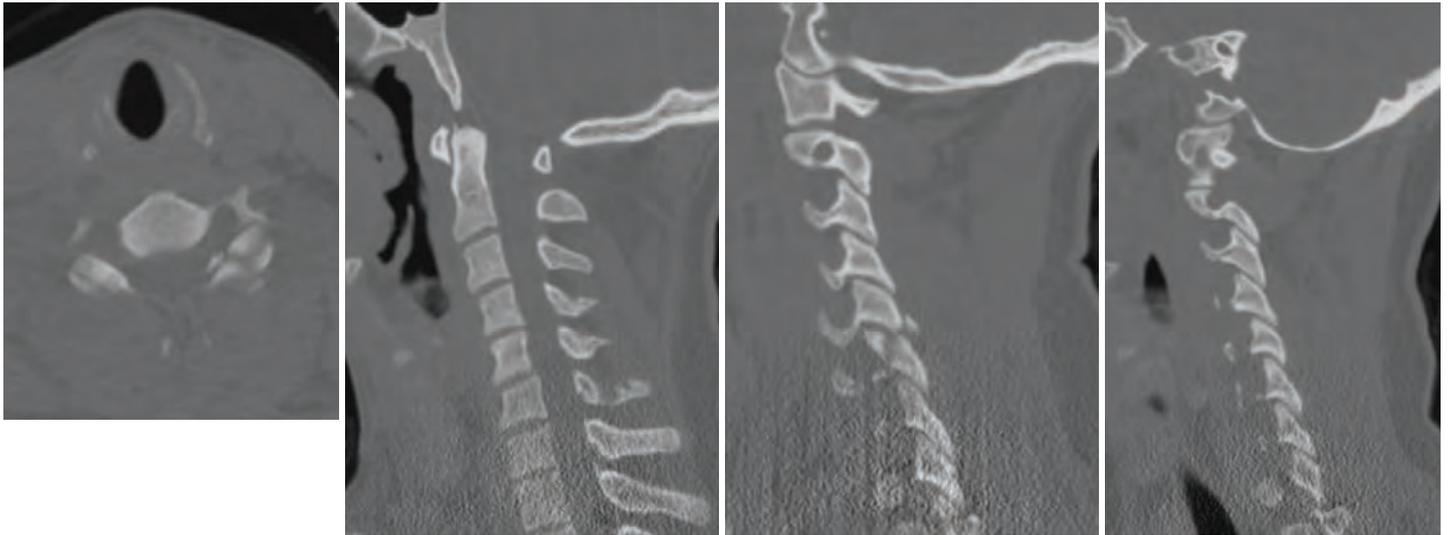


Case Example 2.

42 year old male involved in high speed MVA, radiculopathy

C5: F2, C6: F2

(N2; M1)

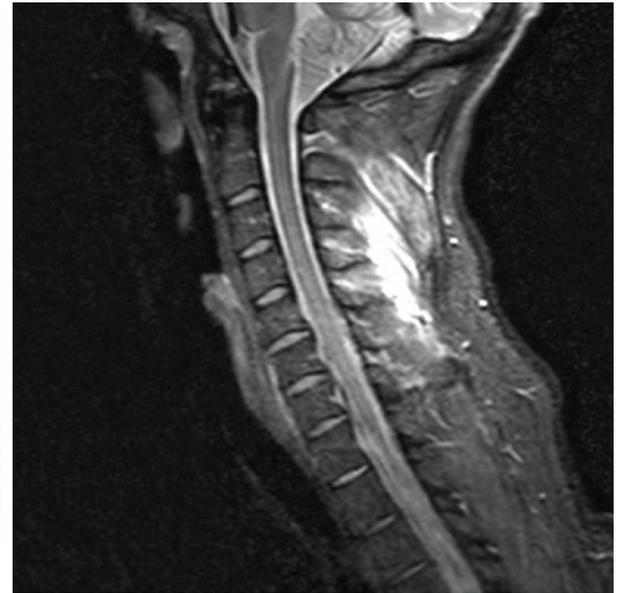


Case Example 2.

42 year old male involved in high speed MVA, radiculopathy

C5: F2, C6: F2
(N2; M1)

C5 and C6 displaced facet fractures (F2),
radiculopathy (N2), posterior capsuloligamentous
complex injury without complete disruption (M1)



AOSpine Knowledge Forum

- Thoracolumbar Spine Fractures Classification System

Thoracolumbar Fractures—Overview

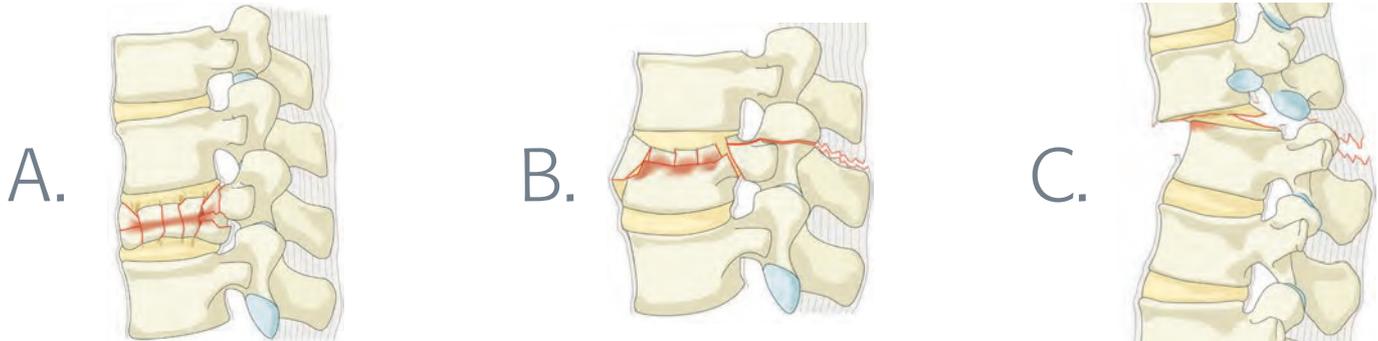
This classification and injury severity system is based on the evaluation of three basic parameters:

- 1. Morphologic classification of the fracture**
- 2. Neurologic injury**
- 3. Clinical modifiers**

1. Morphologic classification

This is based on the Magerl classification modified by the AOSpine Classification Group. For this evaluation radiograms and CT scans with multiplanar reconstructions are essential. In some cases additional MR images might be necessary. Three basic types are identified on the basis of the mode of failure of the spinal column:

- **Type A:** Compression injuries. Failure of anterior structures under compression.
- **Type B:** Failure of the posterior or anterior tension band.
- **Type C:** Failure of all elements leading to dislocation or displacement.



Type A

Describe injury to the vertebral body without tension band (PLC) involvement.

There are five subtypes and no further sub-classification.

These subtypes are also used as description of vertebral body fracture in B and C Types.

Type		Description
A0	Minor, nonstructural fractures	Fractures, which do not compromise the structural integrity of the spinal column such as transverse process or spinous process fractures.
A1	Wedge-compression	Fracture of a single endplate without involvement of the posterior wall of the vertebral body.
A2	Split	Fracture of both endplates without involvement of the posterior wall of the vertebral body.
A3	Incomplete burst	Fracture with any involvement of the posterior wall; only a single endplate fractured. Vertical fracture of the lamina is usually present and does not constitute a tension band failure.
A4	Complete burst	Fracture with any involvement of the posterior wall and both endplates. Vertical fracture of the lamina is usually present and does not constitute a tension band failure.

Type B

Describe the failure of posterior or anterior constraints (in case of TL this is the tension band or PLC / Posterior Ligamentary Complex or the anterior longitudinal ligament).

Is to be combined with subtypes A when appropriate. There are three subtypes:

Type		Description
B1	Transosseous tension band disruption / Chance fracture	Monosegmental pure osseous failure of the posterior tension band. The classical Chance fracture.
B2	Posterior tension band disruption	Bony and/or ligamentary failure of the posterior tension band together with a Type A fracture. Type A fracture should be classified separately.
B3	Hyperextension	Injury through the disk or vertebral body leading to a hyperextended position of the spinal column. Commonly seen in ankylotic disorders. Anterior structures, especially the ALL are ruptured but there is a posterior hinge preventing further displacement.

Type C

Describe displacement or dislocation.

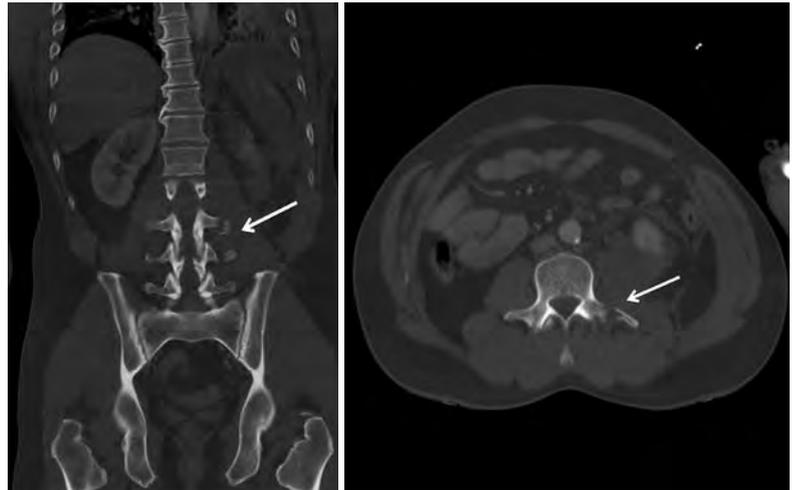
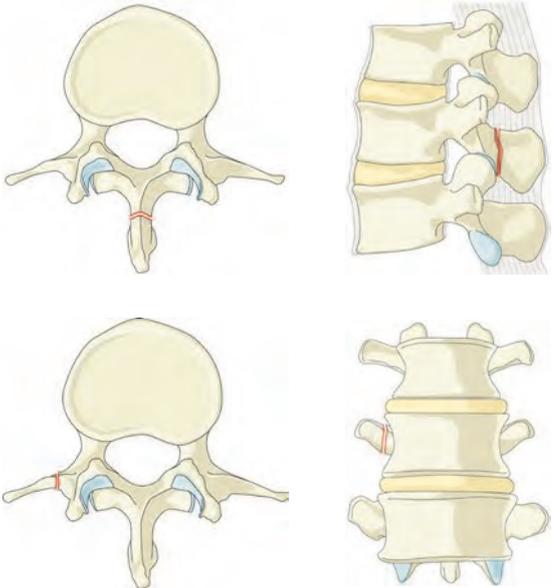
There are no subtypes as because of the dissociation between cranial and caudal segments various configurations are possible in different images.

Is combined with subtypes of A if necessary.

Type A

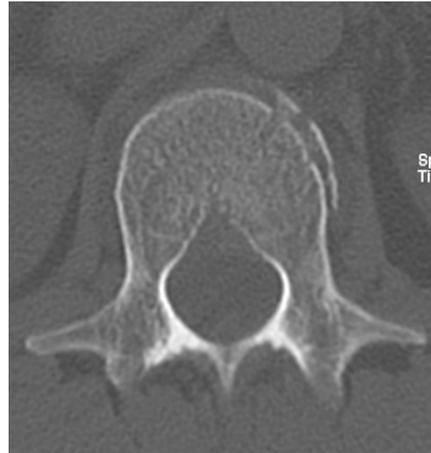
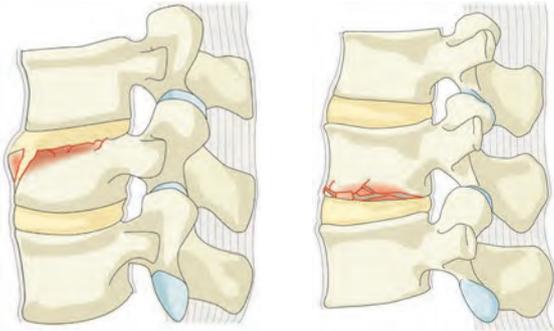
A0. Minor, nonstructural fractures

Fractures, which do not compromise the structural integrity of the spinal column such as transverse process or spinous process fractures.



Type A

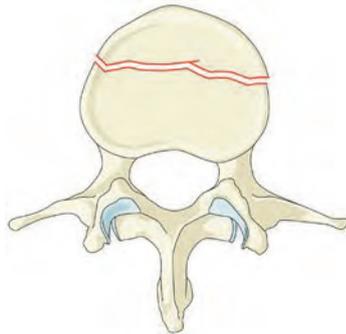
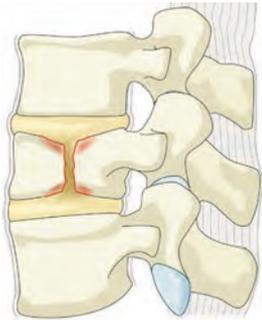
- A1. Wedge-compression
Fracture of a single endplate without involvement of the posterior wall of the vertebral body.



Type A

A2. Split

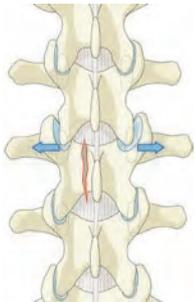
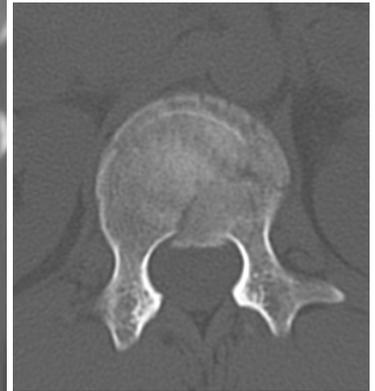
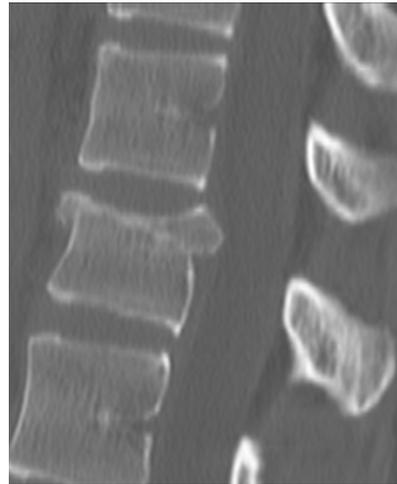
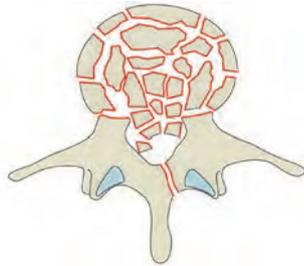
Fracture of both endplates without involvement of the posterior wall of the vertebral body.



Type A

A3. Incomplete burst

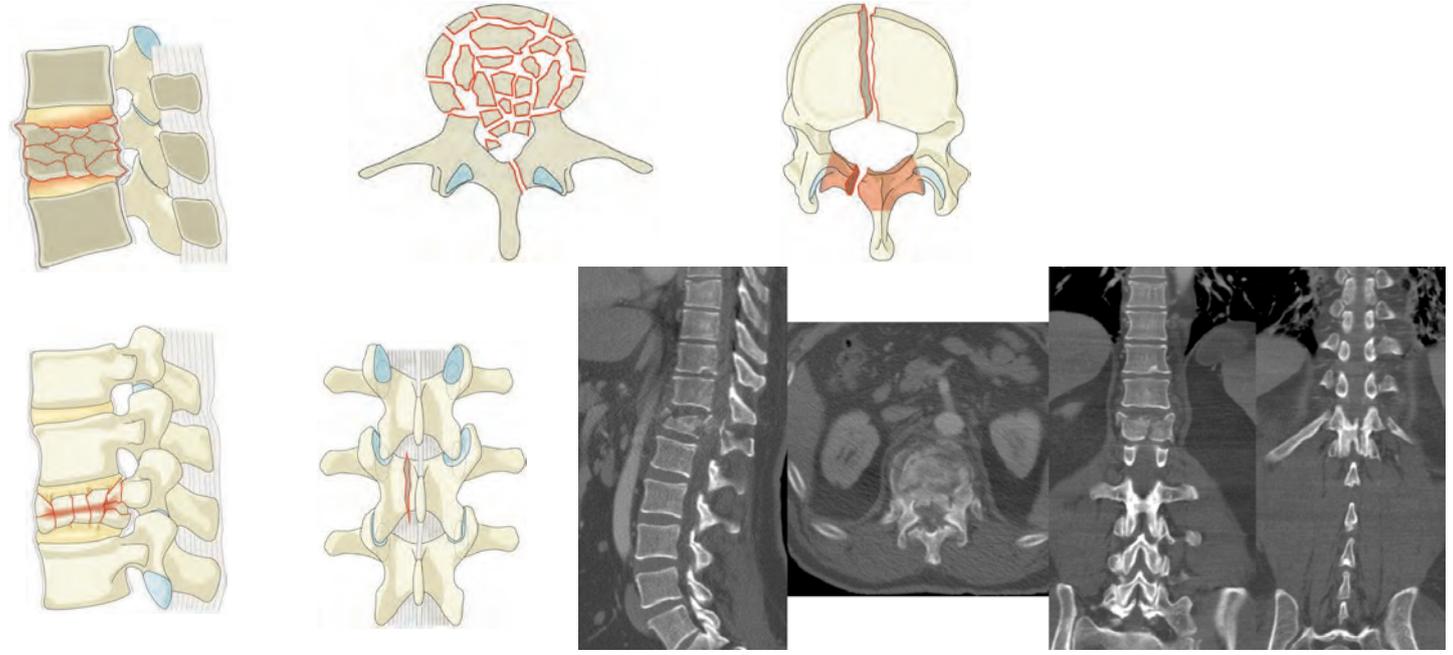
Fracture with any involvement of the posterior wall; only a single endplate fractured. Vertical fracture of the lamina is usually present and does not constitute a tension band failure.



Type A

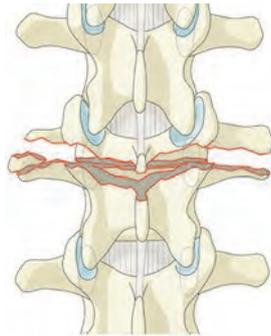
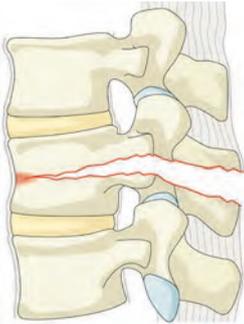
A4. Complete burst

Fracture with any involvement of the posterior wall and both endplates. Vertical fracture of the lamina is usually present and does not constitute a tension band failure.



Type B

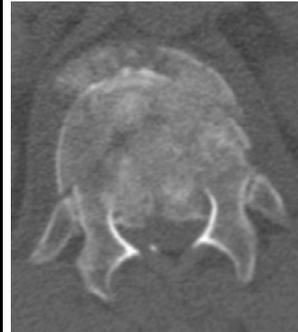
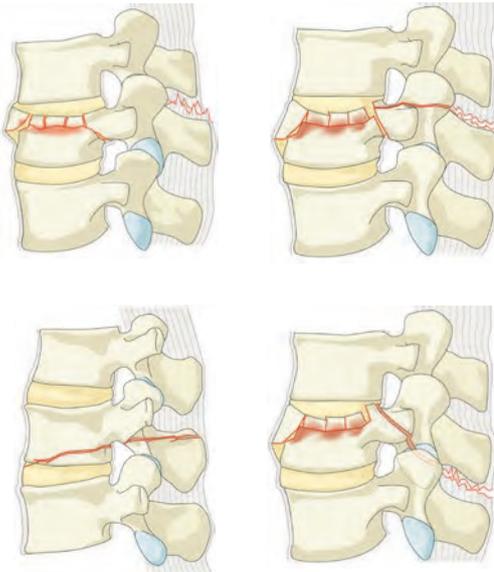
- B1.** Transosseous tension band disruption / Chance fracture
Monosegmental pure osseous failure of the posterior tension band.
The classical Chance fracture.



Type B

B2. Posterior tension band disruption

Bony and/or ligamentary failure of the posterior tension band together with a Type A fracture. Type A fracture should be classified separately.

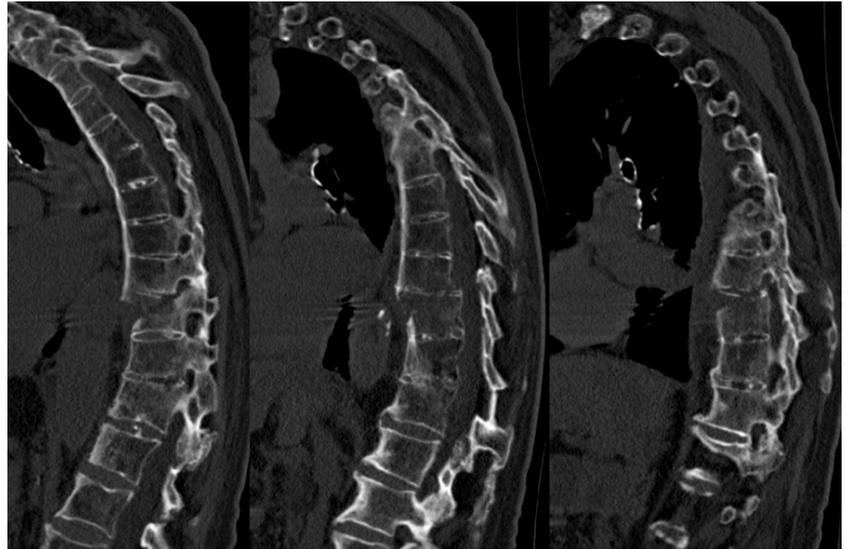
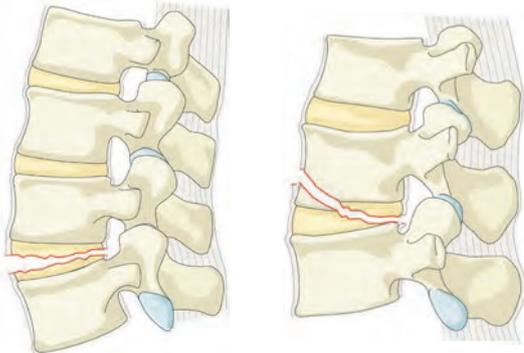


Example: This should be classified as: T12-L1 Type B2 with T12 A4 according to the combination rules.

Type B

B3. Hyperextension

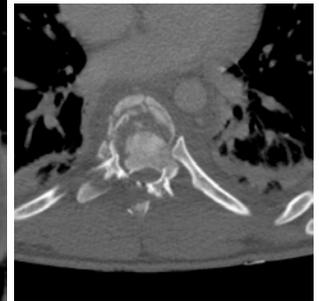
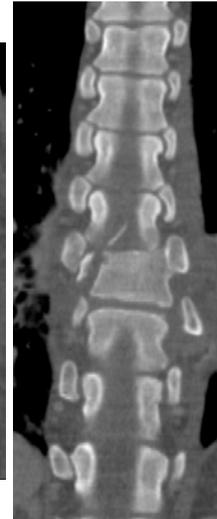
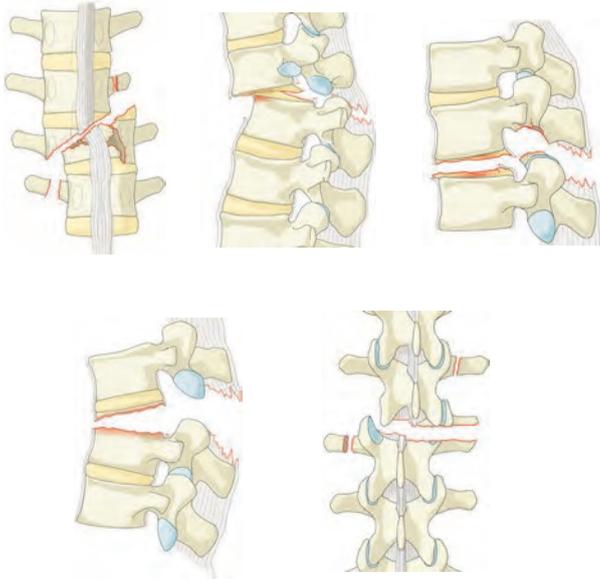
Injury through the disk or vertebral body leading to a hyperextended position of the spinal column. Commonly seen in ankylotic disorders. Anterior structures, especially the ALL are ruptured but there is a posterior hinge preventing further displacement.



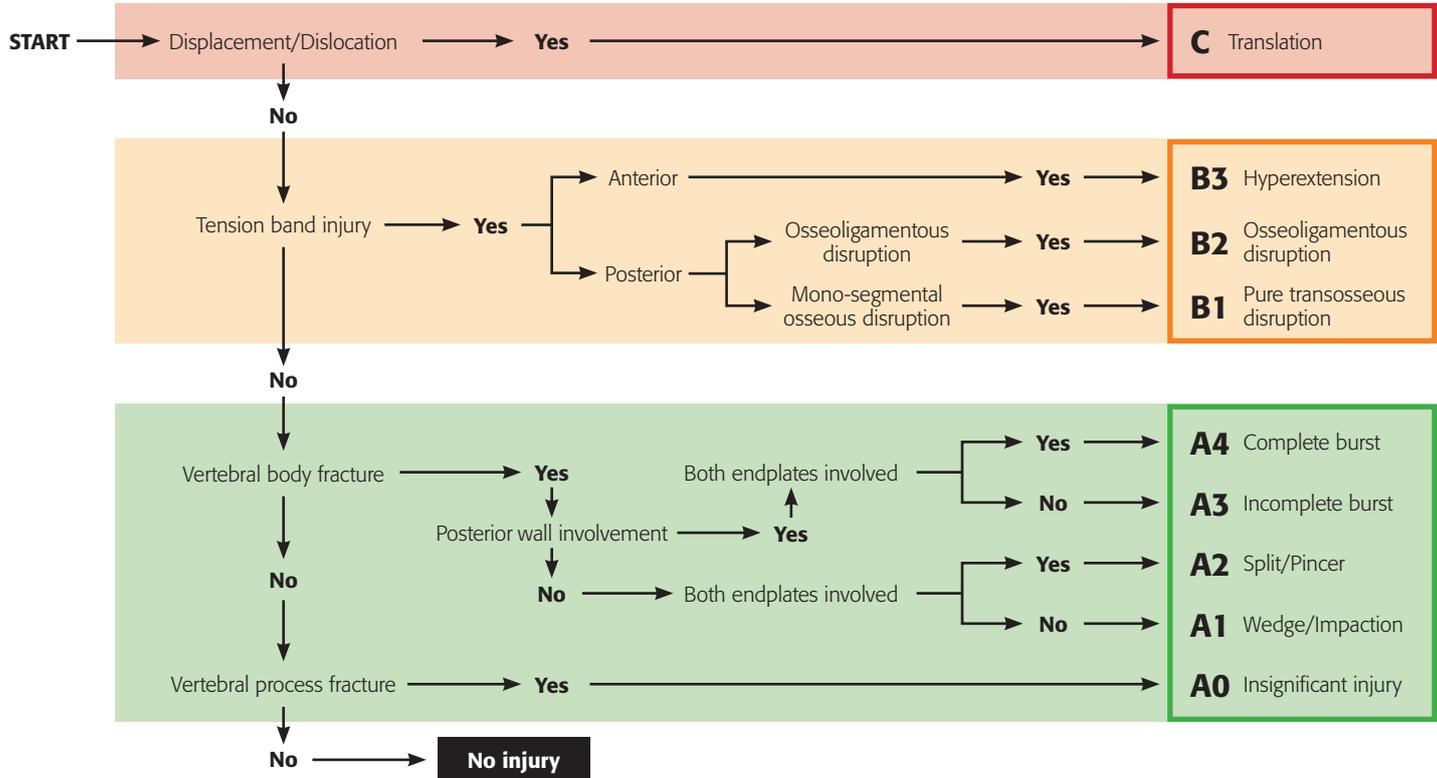
Type C

C. Displacement or dislocation

There are no subtypes as because of the dissociation between cranial and caudal segments various configurations are possible in different images. Is combined with subtypes of A if necessary.



Algorithm for morphologic classification



2. Neurologic injury

Neurologic status at the moment of admission should be scored according to the following scheme:

Type	Description
N0	Neurologically intact
N1	Transient neurologic deficit, which is no longer present
N2	Radicular symptoms
N3	Incomplete spinal cord injury or any degree of cauda equina injury
N4	Complete spinal cord injury
NX	Neurologic status is unknown due to sedation or head injury

3. Modifiers

There are two modifiers, which can be used in addition to ad 1 and 2:

Type	Description
M1	This modifier is used to designate fractures with an indeterminate injury to the tension band based on spinal imaging with or without MRI. This modifier is important for designating those injuries with stable injuries from a bony standpoint for which ligamentous insufficiency may help determine whether operative stabilization is a consideration.
M2	Is used to designate a patient-specific comorbidity, which might argue either for or against surgery for patients with relative surgical indications. Examples of an M2 modifier include ankylosing spondylitis or burns affecting the skin overlying the injured spine.

AOSpine Knowledge Forum

- Sacral Spine Fractures Classification System

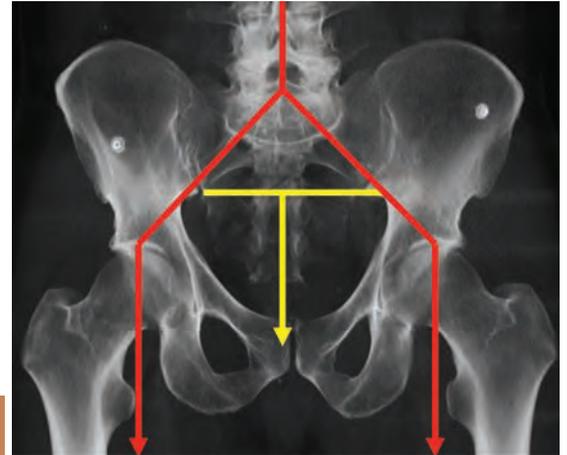
Sacral Fractures—Overview

- **Hierarchical system progressing from least to most unstable**
- **Type A.** Lower Sacro-coccygeal Injuries
No impact on posterior pelvic or spino-pelvic instability
- **Type B.** Posterior Pelvic Injuries
Minimal to no impact on spino-pelvic stability
- **Type C.** Spino-Pelvic Injuries
Spino-pelvic instability

Type A: Sacrocccygeal Fractures

Definition:

- Injuries below the S-I joint
- No impact on posterior pelvic stability
- No impact on spino-pelvic stability
- *May* have impact on neurology



Type	Description
A1	<ul style="list-style-type: none">• Coccygeal or sacral compression vs ligamentous avulsion fractures
A2	<ul style="list-style-type: none">• Nondisplaced transverse injuries below S-I joint• Usually neuro intact
A3	<ul style="list-style-type: none">• Displaced transverse injuries below S-I joint• Often have cauda equina injuries

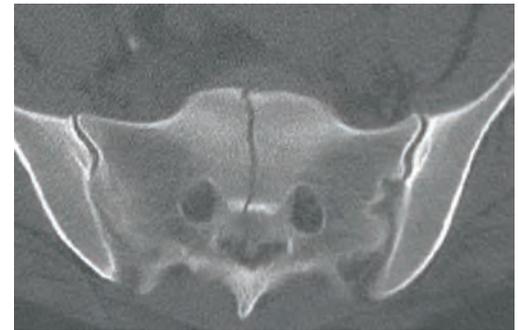
Type B: Posterior Pelvic Injuries

Definition:

- Unilateral longitudinal sacral fractures
- Primary impact is on posterior pelvic stability
- Minimal to no impact on spino-pelvic stability*
(*Except B4 – Injuries extending into facet)
- Framework is variation of Denis Zones I through III injuries
- Usually treated with sacroiliac screw fixation



Type	Description
B1	<ul style="list-style-type: none"> • Central Fracture that involves spinal canal, but with primarily longitudinal fracture pattern • Longitudinal injuries only – rare type of Denis Zone III injuries • Does not have the same impact on spino-pelvic stability nor same propensity for cauda equina injury as transverse fxs involving canal • Very low likelihood of neurological injury



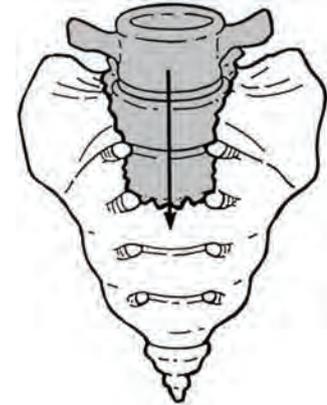
Type	Description	
B2	<ul style="list-style-type: none"> • Transalar fracture: Does not involve foramina or spinal canal • Denis Zone I injury • Approx 5% chance of neuro injury 	
B3	<ul style="list-style-type: none"> • Transforaminal fracture: Involves foramina but not spinal canal • Denis Zone II injury • Approx 25% chance of neuro injury 	
B4	<ul style="list-style-type: none"> • Any unilateral B-subtype that involves fracture of ipsilateral L5-S1 facet joint • MAY IMPACT SPINO-PELVIC STABILITY (Isler), thus potentially most unstable of B-subtypes 	

Type C: Spino-Pelvic Injuries

Definition:

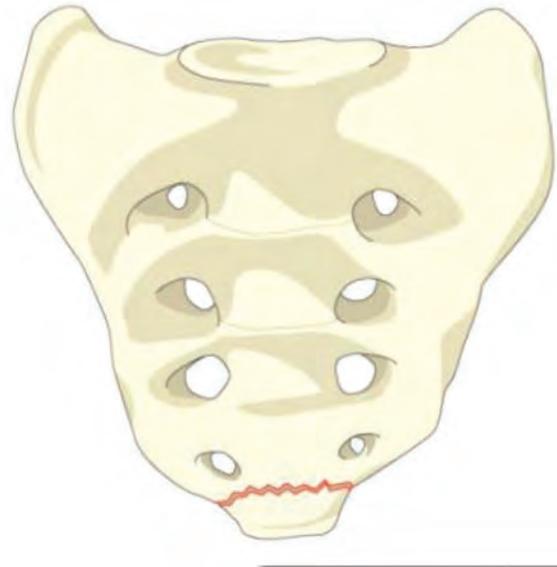
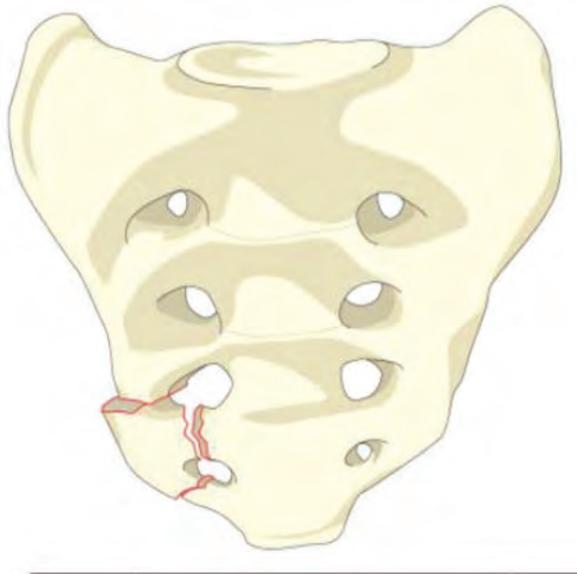
- Injuries resulting in spino-pelvic instability

Type	Description
C1	<ul style="list-style-type: none">• Nondisplaced sacral U-type fracture• Commonly seen as low-energy insufficiency fracture
C2	<ul style="list-style-type: none">• Bilateral Type B injuries without transverse fx• More unstable and higher likelihood of neuro injury than C1, but lower than C3
C3	<ul style="list-style-type: none">• Displaced sacral U-type sacral fracture• Worst combination of instability and likelihood of neuro injury• Displaced transverse sacral fx = canal compromise



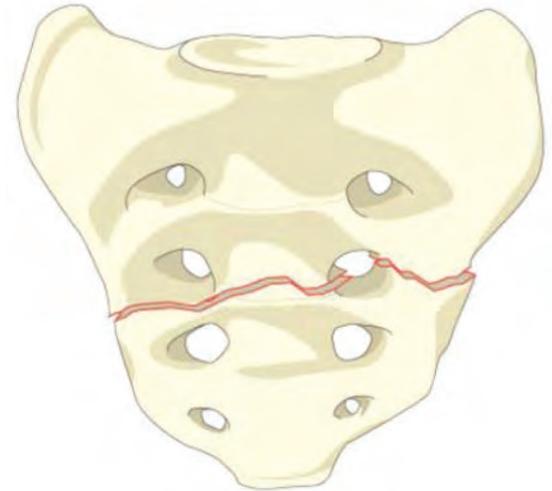
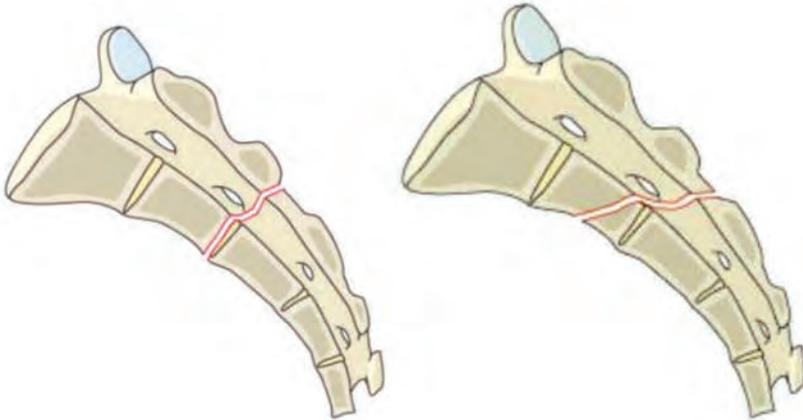
Type A: Sacrocccygeal Fractures

A1. Coccygeal or compression vs ligamentous avulsion fractures



Type A: Sacroccygeal Fractures

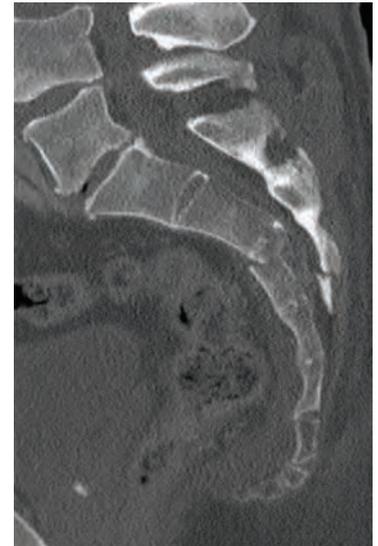
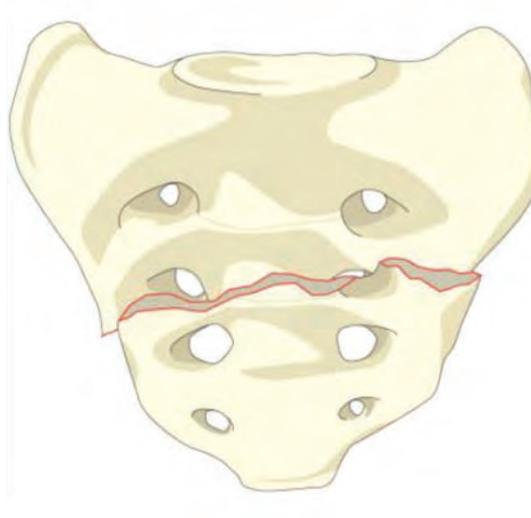
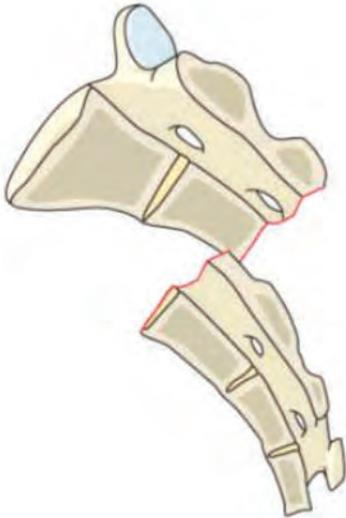
- A2. Non-displaced transverse fractures below the S-I joint
- No implications on stability
 - Low likelihood of cauda equina injury



Type A: Sacroccygeal Fractures

A3. Displaced transverse fractures below the S-I joint

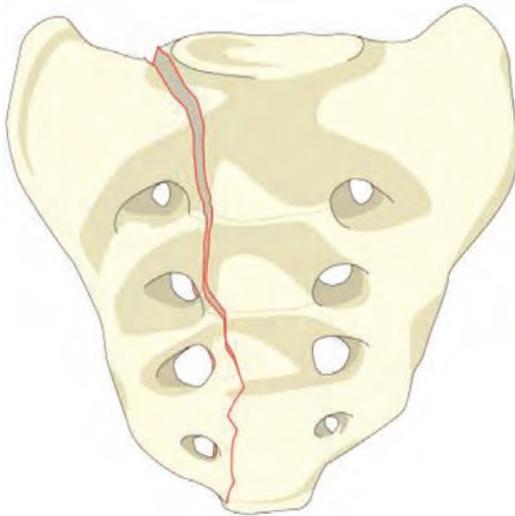
- Higher likelihood of neuro injury than A1 or A2
- May possibly benefit from reduction & stabilization



Type B: Posterior Pelvic Injuries

B1. Central Fracture

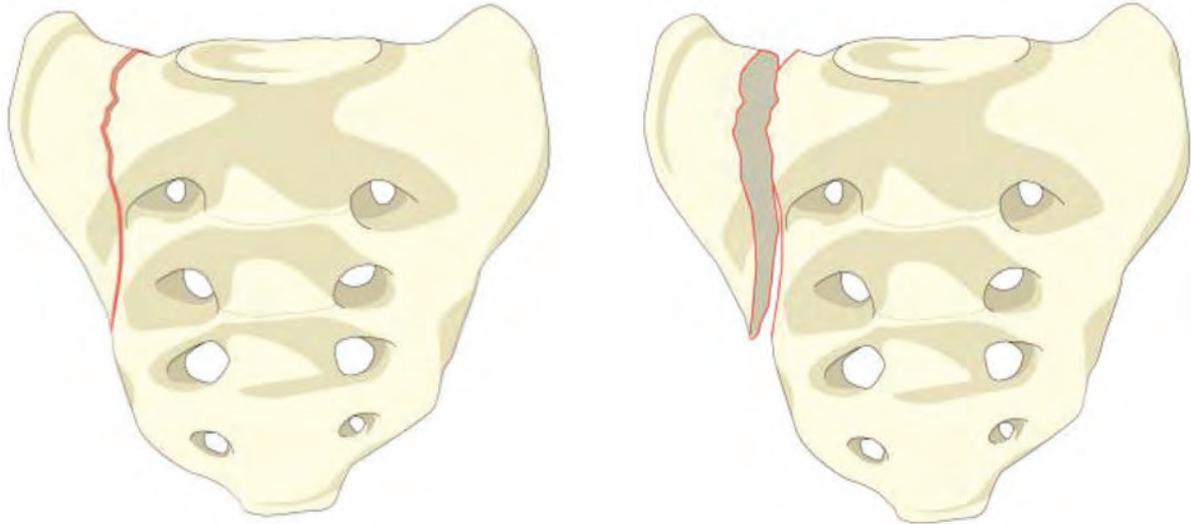
- Rare type of Denis Zone III injury—primary longitudinal pattern only



Type B: Posterior Pelvic Injuries

B2. Transalar Fracture

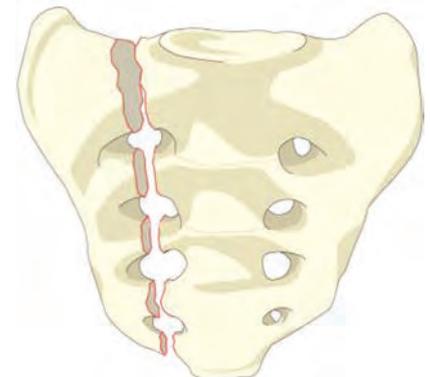
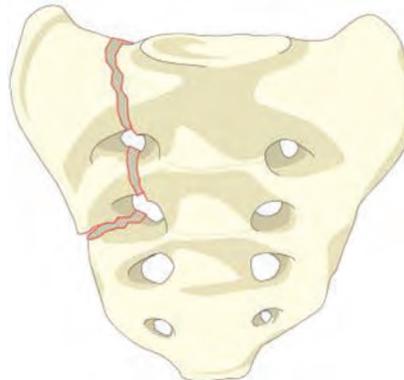
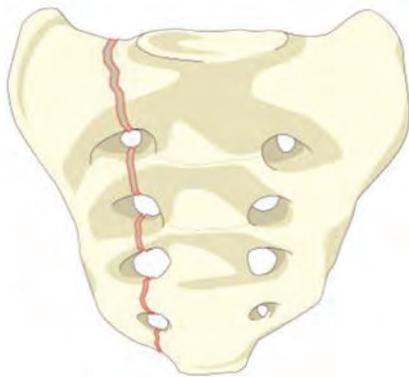
- 5% chance of neurological injury (primarily L5)



Type B: Posterior Pelvic Injuries

B3. Transforaminal Fracture

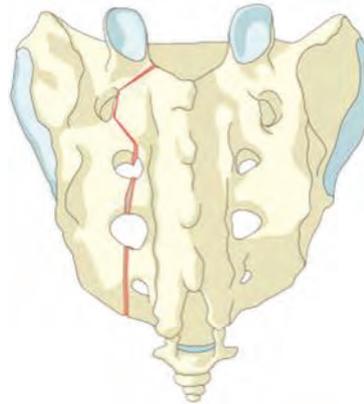
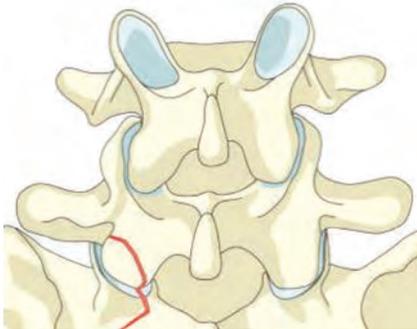
- Approx 25% chance of neuro injury



Type B: Posterior Pelvic Injuries

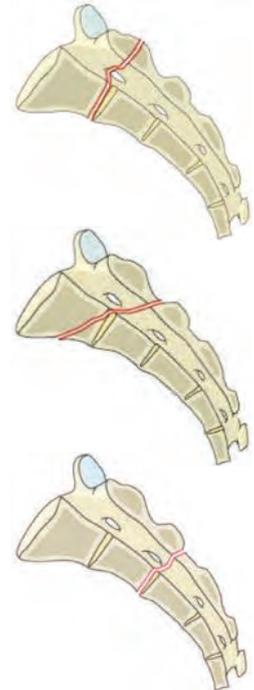
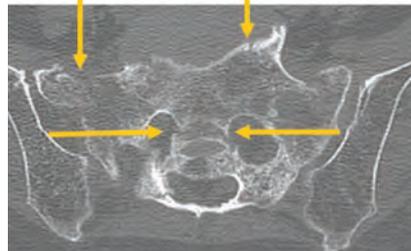
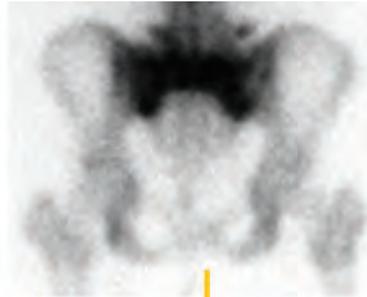
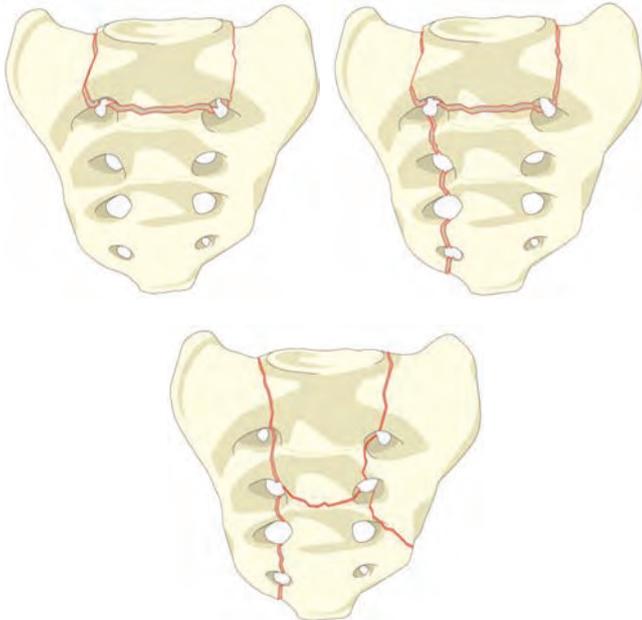
B4. Any Unilateral B-subtype that involves L5-S1 facet joint

- Usually B3
- May impact spino-pelvic stability (Isler)



Type C: Spino-Pelvic Injuries

- C1. Nondisplaced sacral U-type variant
- Commonly seen low-energy insufficiency fracture

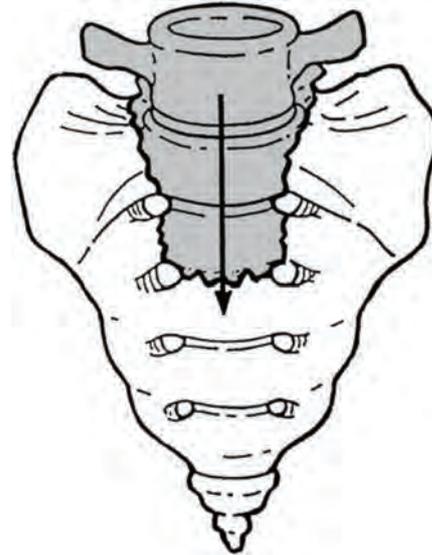
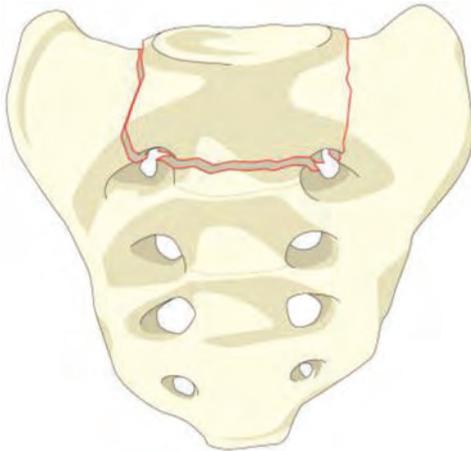


Type C: Spino-Pelvic Injuries

C1. (alternative)

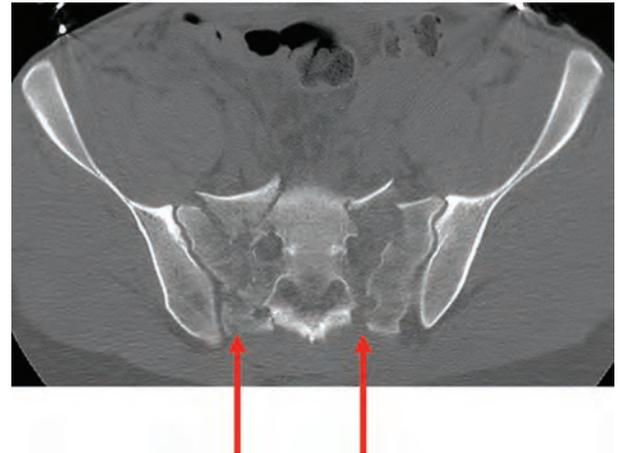
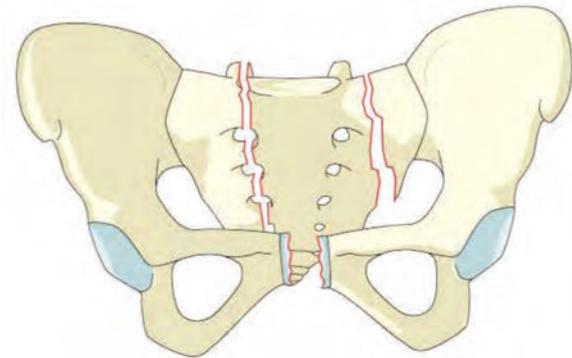
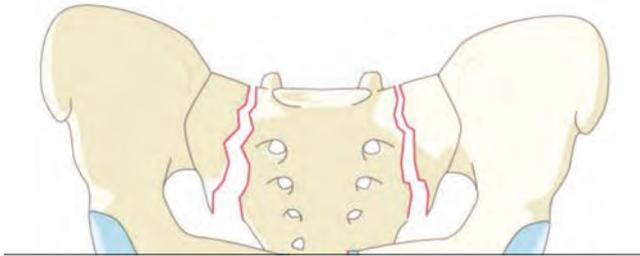
Sacral U-type variant without posterior pelvic instability

- Either displaced or non-displaced
- Spino-pelvic instability without posterior pelvic instability



Type C: Spino-Pelvic Injuries

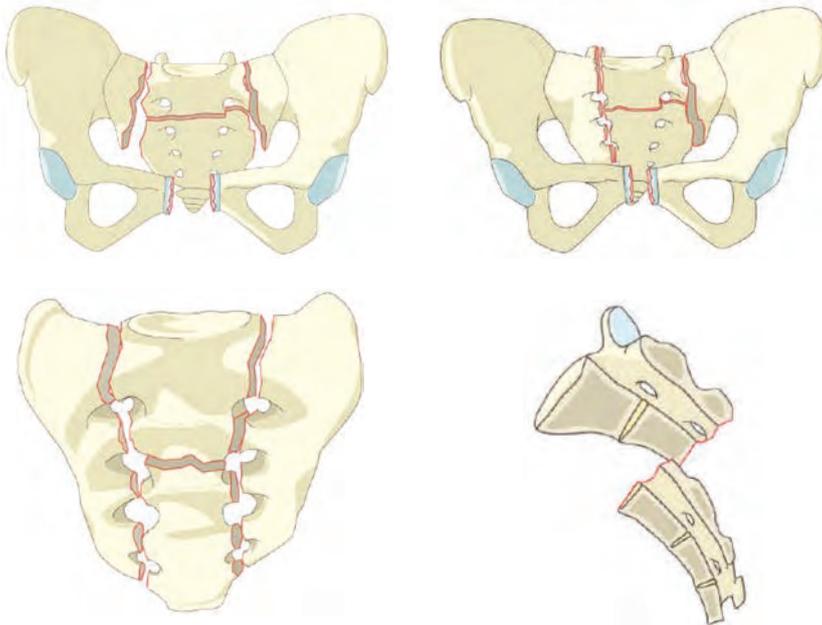
- C2. Bilateral Type B injuries without transverse fracture
- More unstable and higher likelihood of neuro injury than C1



Type C: Spino-Pelvic Injuries

C3. Displaced U-type sacral fracture

- Similar instability profile to C2, but higher likelihood of neuro injury due to transverse fracture displacement & canal compromise





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