SPINAL FRACTURES

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Spinal injuries are due either to direct force or much more commonly, indirect force.

A variety of mechanisms come into play, often simultaneously: axial compression, flexion, extension, rotation, shear and distraction.
• The injury carries a double threat: damage to the vertebral column and damage to the neural tissues.

• Neurological injury is not always immediate and may occur (or be aggravated) only if and when there is movement and displacement of the vertebral fracture or dislocation.
CLASSIFICATION OF FRACTURES

• Stable: the vertebral components will not be displaced by normal movements.

• Unstable: there is a significant risk of displacement and consequent damage – or further damage – to the neural tissues.
In assessing spinal stability, three structural elements must be considered:

the **posterior column** consisting of the pedicles, facet joints, posterior bony arches, interspinous and supraspinous ligaments.

the **middle column** comprising the posterior 1/3 of the vertebral body, the posterior part of the intervertebral disc and the posterior longitudinal ligament.

the **anterior column** composed of the anterior 2/3 of the vertebral body, the anterior part of the intervertebral disc and the anterior longitudinal ligament.
• All fractures involving the middle column and at least one other column should be regarded as unstable.

• Spinal injuries heal slowly. Non-union is rare but malunion is common and may lead to progressive deformity of the spine.
PRINCIPLES OF DIAGNOSIS AND MANAGEMENT

• If there is the slightest possibility of spinal trauma in an injured patient, the spine must be immobilized until the patient has been resuscitated and other lifethreatening injuries have been identified and treated.
HISTORY

• Symptoms and signs may be minimal.
• Every patient with a blunt injury above the clavicle, a head injury or loss of consciousness should be considered to have a cervical spine injury until proven otherwise.
• Every patient who is involved in a fall from a height, a crushing accident or a high-speed deceleration accident should similarly be considered to have a thoracolumbar injury.
EXAMINATION

• The **neck** is examined for deformity, bruising or a penetrating injury.
• The bones and soft tissues of the neck are palpated; tenderness, bogginess or an abnormal space between adjacent spinous processes suggests an unstable injury of the posterior part of the cervical spine.
• **Back** : The patient is ‘log-rolled’ to avoid movement of the thoracolumbar spine. The spine is inspected and palpated as before.
• X-ray examination is mandatory for all accident victims complaining of pain or stiffness in the neck or back.

• Accident victims who are unconscious should have spine x-rays as part of the routine work-up.

• ‘Difficult’ areas, such as the lower cervical and upper thoracic segments which are often obscured by shoulder and rib images, may require CT.

• for displaying the intervertebral discs, ligamentum flavum and neural structures we do an MRI.
TREATMENT

• The objectives of treatment are:
  1) To preserve neurological function.
  2) To relieve any reversible neural compression.
  3) To restore alignment of the spine.
  4) To stabilize the spine.
  5) To rehabilitate the patient.
CERVICAL SPINE INJURIES

• The patient usually gives a history of a fall from a height, a diving accident or a vehicle accident in which the neck is forcibly moved.

• An abnormal position of the neck is suggestive, and careful palpation may elicit tenderness.

• Pain or paraesthesia in the limbs is significant, and the patient should be examined for evidence of spinal cord or nerve root damage.
• X-ray:

Anteroposterior view: the lateral outlines should be intact, and the spinous processes and tracheal shadow in the midline. An open-mouth view is necessary to show C1 and C2 (for odontoid and lateral mass fractures).

The lateral view must include all seven cervical vertebrae and the upper half of T1, otherwise a serious injury at the cervicothoracic junction will be missed.
FRACTURE OF C1 (JEFFERSON FRACTURE)

• Axial loading.
• The fracture is seen on the open-mouth view; the lateral masses are spread away from the odontoid peg.
• A CT scan is particularly helpful in defining the fracture.
• If the fracture is undisplaced, the injury is stable and the patient needs only a rigid collar until the fracture unites. If there is much sideways spreading of the lateral masses, the injury is unstable and should be treated either by skull traction or by the application of a halo–body orthosis for 6 weeks, followed by another 6 weeks in a semi-rigid collar.
Fractures of the atlas are associated with injury elsewhere in the cervical spine in up to 50% of cases; odontoid fractures and ‘hangman’s fractures’ in particular should be excluded.
C2 PARS INTERARTICULARIS FRACTURES (HANGMAN’S FRACTURE)

• Traumatic spondylolisthesis of C2 as a result of bilateral fracture of the C2 pars interarticularis.
• Varying degrees of extension, compression and flexion.
• Neurological damage, however, is unusual because the fracture of the posterior arch tends to decompress the spinal cord. Nevertheless, the fracture is potentially unstable.
classification:

1) Type I: stable fracture with less than 3mm displacement.

2) Type II: the most common type, unstable fracture, significant translation and some angulation.
• Stable undisplaced fractures are treated in a semi-rigid collar or halo–vest until united (6–12 weeks). Displaced fractures may need reduction before immobilization in a halo–vest for 12 weeks.
FRACTURE OF THE ODONTOID PROCESS

• uncommon.
• Usually occur as flexion injuries in young adults due to high-velocity accidents or severe falls; less often they occur in elderly, osteoporotic people as a result of low-energy trauma in which the neck is forced into hyperextension, e.g. a fall onto the face or forehead.
• Neurological injury occurs in about one-quarter of cases.
-**Type I**: avulsion of the tip. Treated only by using a rigid collar until discomfort subsides.

-**Type II**: fracture through the junction between the odontoid and the body of C2. If stable: treated by using a halo-vest. If displaced: reduced by traction until it’s stable then held by operative screw fixation or halo-vest.

-**Type III**: fracture through the body of C2. If undisplaced it’s treated by halo-vest for 8-12 W. If it’s displaced it’s reduced by traction then immobilized by halo-vest for 8-12 W.
WEDGE COMPRESSION FRACTURE

- usually occurs in the middle and lower cervical segments.
- pure flexion injury causes compression of the anterior part of the vertebral body (wedge compression).
  * It is a single column fracture
  It affects only the anterior part of the body.
  * It is stable, comfortable collar for 6–8 weeks.
BURST AND COMPRESSION–FLEXION FRACTURES

• result from axial compression of the cervical spine, usually in diving or athletic accidents.
• Persistent neurological injury is common.
• x-rays show either a crushed vertebral body (a burst fracture) or a flexion deformity with a small triangular fragment separated from the anteroinferior edge of the fractured vertebra ‘tear-drop fracture’.
• The x-ray should be carefully examined for evidence of middle column damage and posterior displacement of the main body fragment.
• Traction must be applied immediately.
• CT or MRI should be performed to look for retropulsion of bone fragments into the spinal canal.
  * immobilization in a halo-vest if no neurological deficit is found.

Neurological deficit calls for urgent anterior decompression followed by immobilization for 6-8 w.
THORACOLUMBAR INJURIES

• Most injuries of the thoracolumbar spine occur in the transitional area (T11–L2) between the somewhat fixed thoracic spine and the more mobile lumbar spine.

• Spinal canal in that area is relatively narrow, so cord damage is not uncommon; when it does occur it is usually complete.

• The spinal cord ends at L1 and below that level it is the lower nerve roots that are at risk.
• Examination:

Patients complaining of signs of bruising and tenderness over the spine, as well as those suffering head or neck injuries, chest injuries and pelvic fractures should undergo a careful examination of the spine and a full neurological examination, including rectal examination to assess sphincter tone.
• **X-rays:**
  - examine for loss of vertebral height or splaying of the vertebral body.
  - Widening of the distance between the pedicles or an increased distance between successive spinous processes suggests posterior column damage.

• The lateral view is examined for vertebral alignment and structural integrity. Look particularly for evidence of fragment retropulsion towards the spinal canal.

• **Rapid screening CT scans** are more reliable than x-rays in showing bone injuries.

• **MRI** also may be needed to evaluate neurological or other soft-tissue injuries.
• **Treatment** depends on:

(a) the type of anatomical disruption.
(b) whether the injury is stable or unstable.
(c) whether there is neurological involvement
(d) the presence or absence of concomitant injuries.
**FLEXION–COMPRESSION INJURY**

- The **most common** type of vertebral fracture.

→ **Mechanism:** **pure flexion**, posterior ligaments remain intact, mostly in **osteoporotic** patients due to a minimal trauma.

→ very painful

→ **stable:** only the anterior column is damaged (posterior ligaments are intact).

→ neurological damage is rare.

→ **Treatment:**

a) minimal wedging: the patient is kept in bed for a week or 2 until pain subsides + muscle strengthening exercises, no support is needed.

B) marked wedging (anterior vertebral height reduces by 20-40%) needs a thoraco-lumbar brace or body cast for 3 months. If vertebral compression is even more severe **posterior fusion** may be needed.
AXIAL COMPRESSION OR BURST INJURY

→ Severe axial compression may ‘explode’ the vertebral body, shattering the posterior part and extruding fragments of bone into the spinal canal. The injury is usually unstable.

**Diagnosis** → The x-ray appearance may superficially resemble the wedge compression fracture but the posterior border of the vertebral body is damaged; this is seen most clearly on CT scans.

**Treatment** → If there is minimal retropulsion of bone, no neurological damage and minimal anterior wedging, the patient is kept in bed until the acute symptoms settle and is then mobilized in a thoracolumbar brace, which is discarded at about 12 weeks. Surgery is needed only if there is progressive neurological deterioration.
FRACTURE–DISLOCATION

-Mechanism → Segmental displacement may occur with various combinations of flexion, compression, rotation

→ Injury is unstable.
→ These are the most dangerous injuries, and are often associated with neurological injury.

-Diagnosis →
X-rays may show fractures through the vertebral body, pedicles, articular processes and laminae; there may be varying degrees of subluxation or even bilateral facet dislocation. CT is helpful in demonstrating the degree of spinal canal occlusion.

-treatment →
Most fracture–dislocations will benefit from early surgery.
-Open reduction and internal fixation.
JACK-KNIFE INJURY (THE CHANCE FRACTURE)

• Combined flexion and posterior distraction (seen typically in severe seat-belt injuries).
• cause the midlumbar spine to jack-knife around an axis anterior to the vertebral column.
• little or no crushing of the vertebral body; the tear passes transversely through the bones or the ligament structures, or both. Because the posterior and middle columns fail, the injury is by definition unstable but neurological damage is uncommon.
• The injury usually heals quite rapidly. Three months in a body cast or well-fitting brace will usually suffice.
THANK YOU!