Common adult fractures
Axial skeleton (Spine)

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Objectives

The ability to demonstrate knowledge of the following:

- Basic anatomy of the spine and pelvis.
- Initial assessment and treatment of spinal injuries at the field.
- Principle of spinal stability.
- Understanding of neurologic syndromes caused by spinal trauma.
Spine Pathology Red Flag Conditions

Beware of:

1) Cauda Equina/severe neurologic injury (perianal numbness, decreased rectal tone, loss of movement in the extremities).

2) Tumour weakening the vertebrae (causing cord compression or vertebral fracture).

3) Infection weakening bone (causing disc/vertebral destruction or cord compression).

4) Traumatic Spine Fracture (causing vertebral angulation, pain, or neuro compromise).

Remember that spine fracture can occur without trauma.
Anatomy
Anatomy
Anatomy
Anatomy
Anatomy
Anatomy

- occiput
- occipital condyles
- lateral mass of C1
- dens
- lateral mass of C1
- C2 body
- spinous processes
- C2
- C3
Anatomy

Thoracic Vertebrae
Axial (Overhead) View  Lateral (Side) View
Anatomy
Anatomy

[Diagram of lumbar vertebra with labeled parts: Spinal Process, Superior Articular Facet, Transverse Process, Pedicle, and Inferior Articular Facet.]

[Another diagram showing vertebrae with labeled parts: Vertebral Canal, Superior Articular Process, Mamilary Process, Transverse Process, and Vertebral Body.]

[Other labeled parts: Lamina, Pars interarticularis, L3 process, Spinal process of L3 vertebra, Inerarticular process.]
Anatomy
Anatomy
Anatomy
Epidemiology

- 56,000 cases per year.
- 11,000 new spinal cord injuries.
- 15-20% multiple non-contiguous levels.
- 10% involving the cervical spine.
- 90% involving thoracolumbar spine.
- 25% have neurologic deficit.
- Age: mostly between 15-24 years.
- Gender: mostly males (4:1).
Mechanism of Injury

High energy trauma such as an MVA or fall from a height or a horse.

- MVA: 40-55%
- Falls: 20-30%
- Sports: 6-12%
- Others: 12-21%

Low energy trauma in a high risk patient (ie a patient with known spinal canal compromise such as ankylosing spondylitis, Osteoporosis or metastatic vertebral lesions)

Penetrating trauma from gunshot or knives.
Spine stability

- Cervical spine instability:
  - Compression fracture with 25% loss of height.
  - Angular displacement > 11 degrees.
  - Translation > 3.5mm.
  - Disc space separation > 1.7mm.

- Thoracic and lumbar spine: Denis three column.
The Three columns

Instability exists with disruption of any two of three columns.
Assessment

In cases of trauma, ABCDE’s must be assessed first and treated appropriately.

Patients should be examined with spinal collar until spinal pathology is excluded.

Careful log rolling keeping the head, neck and pelvis in line should be done to examine the spine properly.
Assessment

- Immobilization.

- History:
  - Mechanism of injury:
    - compression, flexion, extension, distraction
  - Other injuries.
  - Seat belt.
  - Other causalities.

- Physical examination:
  - Inspection, palpation.
  - Neurologic examination.
Immobilization
NEUROLOGIC

Muscle Test

Sensory exam

light touch, Sharp dull discrimination, Vibration sense, Proprioception and two-point discrimination

Reflexes
Signs of Spinal Trauma

- Apnea, lower cranial nerve injury VIII-XII (high C-spine).
- Deformity of the spine or neck.
- Tenderness on palpation along spinal processes.
- Paralysis or muscle weakness (which spinal level).
- Loss of sensation (which dermatomes).
- Loss of rectal tone.
- Positive Babinski sign.
Asia Score: Brief Trauma Neurologic Survey
Level of Cord Injury determines level of function

ASIA IMPAIRMENT SCALE

□ A = Complete: No motor or sensory function is preserved in the sacral segments S4-S5.

□ B = Incomplete: Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5.

□ C = Incomplete: Motor function is preserved below the neurological level, and more than half of key muscles below the neurological level have a muscle grade less than 3.

□ D = Incomplete: Motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade of 3 or more.

□ E = Normal: motor and sensory function are normal

Prognosis for Recovery of spinal Cord Injury:

Poor prognosis for recovery if:
- pt arrives in shock
- pt is complete
- pt cannot breath
- pt has a complete injury

CLINICAL SYNDROMES

□ Central Cord
□ Brown-Sequard
□ Anterior Cord
□ Conus Medullaris
□ Cauda Equina
Assessment

Severity of neurologic deficit

Complete

- Flaccid paralysis below level of injury.
- May involve diaphragm if injury above C5.
- Sympathetic tone loss if fracture above T6.

Incomplete

- ? Any sensation.
- ? Sacral sparing.
Assessment

Severity of neurologic deficit

Incomplete

Central cord syndrome:

# Characterized by disproportionally (UL>LL).
# Mechanism: hyper-extension.
# Occur with or without fractures.
# Recovery: 50% regaining function.
# Prognosis is fair.
Assessment

Severity of neurologic deficit

Incomplete

Anterior cord syndrome:

# Characterized by loss of corticospinal and spinothalamic tract with preserved posterior column.
# Mechanism: ischemia or infarction to spinal cord.
# Common injury.
# Recovery: 10%.
# Prognosis is good if progressive recovery within 24hrs, absent SS after 24hrs protends a poor outcome.
Assessment

Severity of neurologic deficit

Incomplete

Brown-Sequard syndrome:

# Characterized by hemicord injury with ipsilateral paralysis, loss of proprioception and light touch, and contralateral temperature and sharp pain loss.

# Prognosis is good, with over 90% regaining of bowel and bladder function and ambulatory capacity.
Assessment

Severity of neurologic deficit

Incomplete

Conus Medullaris syndrome:

# Seen in T12-L1 injuries.

# Loss of voluntary bowel and bladder control with preserved lumbar root function.

# Uncommon as pure lesion (mixed conus-cauda).
Assessment

Severity of neurologic deficit

Incomplete

Cauda Equina syndrome:

# Saddle anesthesia, urinary retention and stool incontinence.

# Usually due to large central disc herniation rather than fracture.

Nerve root deficit: LMN
Spinal Shock
- Transient loss of spinal reflexes.
- Lasts 24-72 hours.

Neurogenic shock
- Reduced tissue perfusion due to loss of sympathetic outflow and un-apposed vagal tone.
- Peripheral vasodilatation (hypotension and bradycardia).
- Rx: fluid resuscitation and vasopressors.
Imaging

- X-rays:
  - Cervical: 3 views.
    - AP, lateral and open mouth.
  - Thoraco-lumbar: 2 views.
    - AP & lateral.
    - Flexion-Extension views.

- CT: best for bony anatomy.

- MRI: best to evaluate soft tissue.
Management of Spinal Injuries

- Depends on:
  - Level of injury.
  - Degree and morphology of injury: **STABILITY**
  - Presence of neurologic deficit.
  - Other factors.
Some general rules:

- **Stable** injuries are usually treated conservatively.
- **Unstable** injuries usually require surgery.
- Neurologic compression requires decompression.
Specific Injuries
Cervical spine fractures

- Descriptive: depends on mechanism of injury.
  - Flexion/extension.
  - Compression/distraction.
  - Shear.

- Presence of subluxation/dislocation

- SCI:
  - high fracture results in quadriplegia.
  - Low fracture results in paraplegia.
Cervical spine fractures
Thoraco-Lumbar fractures

- Spinal cord terminates at L1/2 disc in adult
  - L2/3 in a child
- 50% of injuries occur at Thoraco-lumbar junction.
- Common fractures:
  - Wedge fracture (flexion/compression).
  - Burst (compression).
  - Chance (flexion/distraction).
Wedge fracture
Burst fracture
Chance fracture
Chance fracture
Fracture dislocation
Pathologic fractures

- Low-energy fractures.
- Osteoporotic is common.
- Usually due to infection or tumour.
- X-rays: “winking owl” sign.
Pathologic fractures
Cauda Equina Syndrome

- A surgical emergency.
- Requires full neurologic examination including rectal examination for anal tone.
- Investigations: X-rays initially, but MRI is mandatory as X-rays are usually unremarkable.
- Treatment: Emergency decompression-usually discectomy and wide laminectomy within 24 hours.
Cauda Equina Causes

- Central disc prolapse.
- Burst fractures of lumbar spine.
- Penetrating injuries such as stab wounds or bullets.
- Epidural hematoma from spinal anesthesia, or post surgery (rare).
- Tumours compressing the lower spinal nerve roots.
- Spinal Stenosis.

Disc hernia

Bullet to cauda

Tumor

Burst fracture
Cauda Equina Syndrome
Questions