Cervical Spine Injury

1st November 2013

Introduction

- Vertebral column injury should always be considered in patients with multiple trauma

- 55% of spinal injuries occur in cervical region

1. Cervical spine is vulnerable to injury due to mobility and exposure
2. Diameter of spinal canal below level of C3 is much smaller relative to the diameter of the spinal cord

Clearing the cervical spine

- Patient is alert and awake: absence of pain or tenderness along the spine in a neurologically intact patient virtually excludes the presence of a significant spinal injury

- Depressed level of consciousness: difficult, need imaging to help

Clearing the cervical spine

1. No posterior midline tenderness
2. Full pain-free active range of motion
3. No focal neurological deficit
4. Normal level of alertness
5. No evidence of intoxication
6. No distracting injury

Immobilization of C-spine

- Excessive manipulation and inadequate immobilization can cause additional neurologic damage and worsen patient's outcome
- Neck collar + logroll
- Spinal board should be used as a patient transport device, it should be removed as quickly as possible in order to reduce the risk of decubitus ulcers

Assessment of spinal cord injury

- Supine, neutral position, proper immobilization

- Primary survey:

- Airway: assess airway while protecting C-spine +/- definitive airway
- Breathing: adequate oxygenation and ventilatory support
- Circulation: differentiate hypovolaemic shock from neurogenic shock

If patient develops hypotension

- Hypovolaemic shock:
- decreased BP, increased HR, cool extremities
- Important to look for concommitant injuries
- Inability to perceive pain may mask a potentially serious injury elsewhere

- Neurogenic shock:
- decreased BP, decreased HR, warm extremities

Neurogenic shock VS Spinal shock

- Neurogenic shock : impairment of descending sympathetic pathways in the cervical or upper thoracic spinal cord

1. Loss of vasomotor tone→vasodilation of visceral and lower-extremity blood vessels → pooling of blood and hypotension
2. Loss of cardiac sympathetic tone → relative bradycardia in response to hypovolaemia

Neurogenic shock

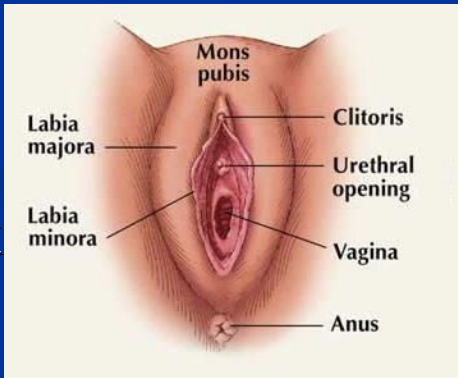
- BP may not be restored by fluid alone, massive fluid resuscitation may result in fluid overload and pulmonary edema
- Usually require use of vasopressor after moderate volume replacement
- Atropine may be used to counteract the haemodynamically significant bradycardia

Spinal shock

- Not any form of shock
- Flaccidity (loss of muscle tone) and loss of reflexes seen after spinal cord injury
- Return of bulbocavernosus reflex hallmarks the end of spinal shock

Bulbocavernosus reflex

- Contraction of the anal sphincter in response to stimulation of the trigone of the bladder with either squeeze on the glans penis, tap on the mons pubis or pull on a urethral catheter
- Absence of this reflex indicates spinal shock
- Presence of complete lesion after spinal shock resolved→ virtually nonexistent chance of neurologic recovery



Duration of spinal shock

- Study to determine the duration of spinal shock in spinal cord injury (SCI)- first reflex to return
- 116 patients with spinal shock following SCI
- Sensory, motor, reflex activities were examined daily

No. of patients	Duration of spinal shock
59 (51%)	<1 week
10 (8.6%)	1-2 weeks
15 (13%)	2-3 weeks
4 (5%)	3-6 weeks
28 (25%)	>6 weeks

Duration of spinal shock in spinal cord injuries, Orthopaedics Proceedings, 2010

Duration of spinal shock

- In 76 patients (85.4%), bulbocarvernosus reflex was the first reflex to return either alone or simultaneous with other reflexes
- Shorter in children than adults
- Increased progressively down the spine and spinal cord from cervical to thoracic to lumbar region

Duration of spinal shock in spinal cord injuries
Orthopaedics Proceedings, 2010

Secondary survey

- AMPLE history
- Assess GCS and pupils

- Assess the spine:
- Palpate the entire spine posteriorly by careful logrolling
- Deformity +/- swelling
- Increased pain with palpation
- Contusions and lacerations

Secondary survey

- Assess for pain, paralysis, paresthesia
- Pinprick sensation in all dermatomes
- Assess motor function
- Deep tendon reflexes
- Document and repeat examination regularly

Grading of neurologic injury

- Complete spinal cord injury:
- No sensation or voluntary motor function noted caudal to the level of injury in the presence of an intact bulbocavernosus reflex
- Prognosis for recovery is extremely poor

- Incomplete spinal cord injury:
- Some neurologic function persists caudal to the level of injury after return of bulbocavernosus reflex
- Greater the function distal to the lesion, the faster the recovery, the better the prognosis

Patterns of incomplete spinal cord injury

- Central cord syndrome
- Brown-Sequard syndrome
- Anterior cord syndrome

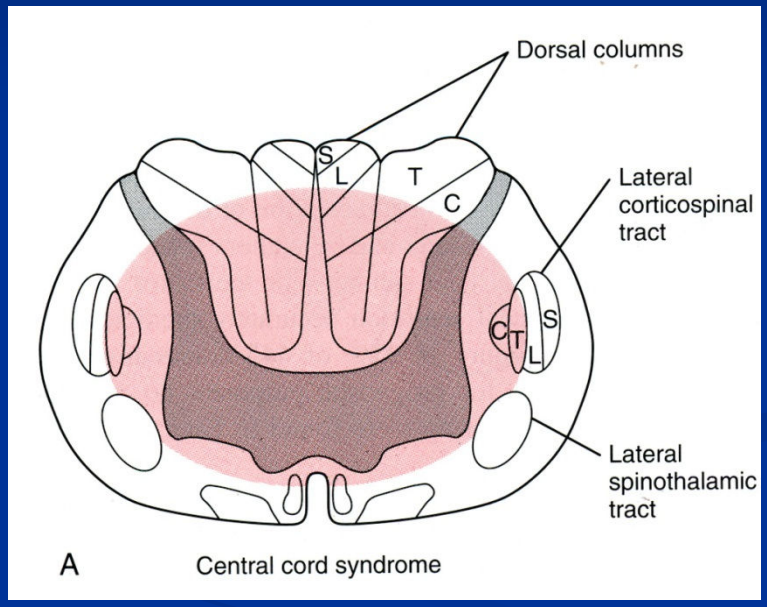
Central cord syndrome

- Most common
- Extension injury to an osteoarthritic spine in a middle-aged person (preexisting cervical canal stenosis)
- Forward fall that resulted in a facial impact

- Disproportionately greater loss of motor power in the upper extremities than in the lower extremities, with varying degrees of sensory loss

Central cord syndrome

- Motor fibres of upper limb are more centrally located→ affected more



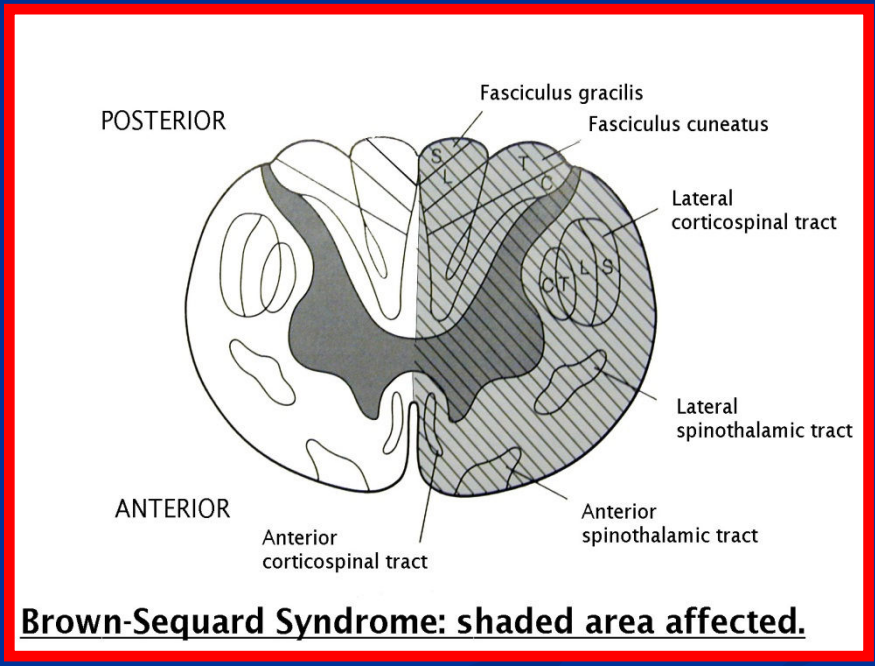
Central cord syndrome

- Radiographs frequent demonstrate no fracture or dislocation, pincer effect between anterior osteophytes and posterior infolding of ligamentum flavum
- Prognosis fair, 50-60% of patients regain motor and sensory function to the lower limbs
- Permanent central gray matter destruction→ poor hand function

Brown-Sequard syndrome

- Hemisection of the cord
- Usually as a result of penetrating trauma

- Ipsilateral motor loss (corticospinal tract) + loss of position sense (posterior column)
- Contralateral loss of pain and temperature sensation (spinothalamic tract)



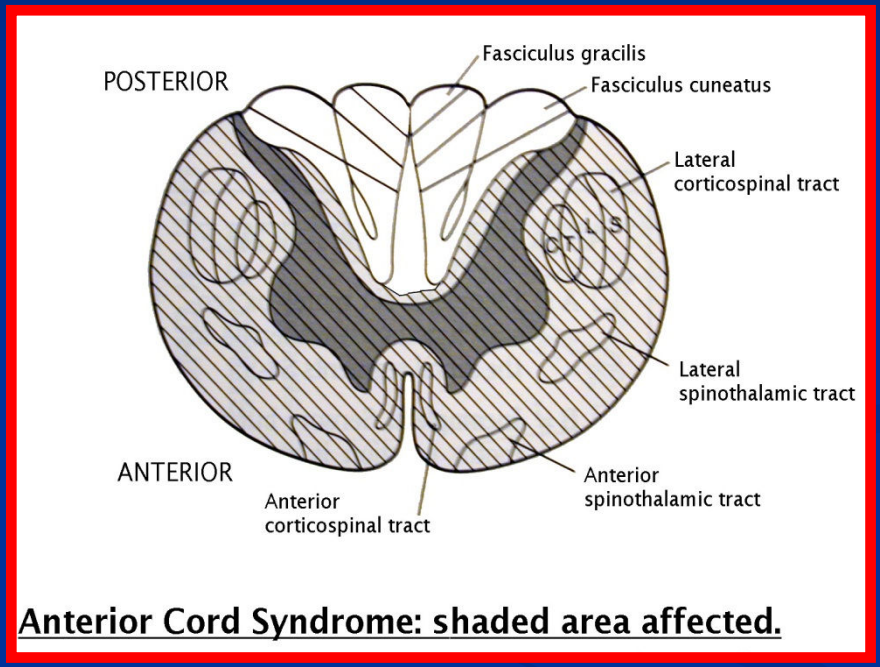
Brown-Sequard Syndrome: shaded area affected.

Brown-Sequard syndrome

- Prognosis is good
- >90% of patients regain bowel and bladder function and ambulatory capacity

Anterior cord syndrome

- Paraplegia + loss of pain and temperature sensation (corticospinal + spinothalamic tracts)
- Preserved light touch and proprioception (dorsal columns)



Anterior Cord Syndrome: shaded area affected.

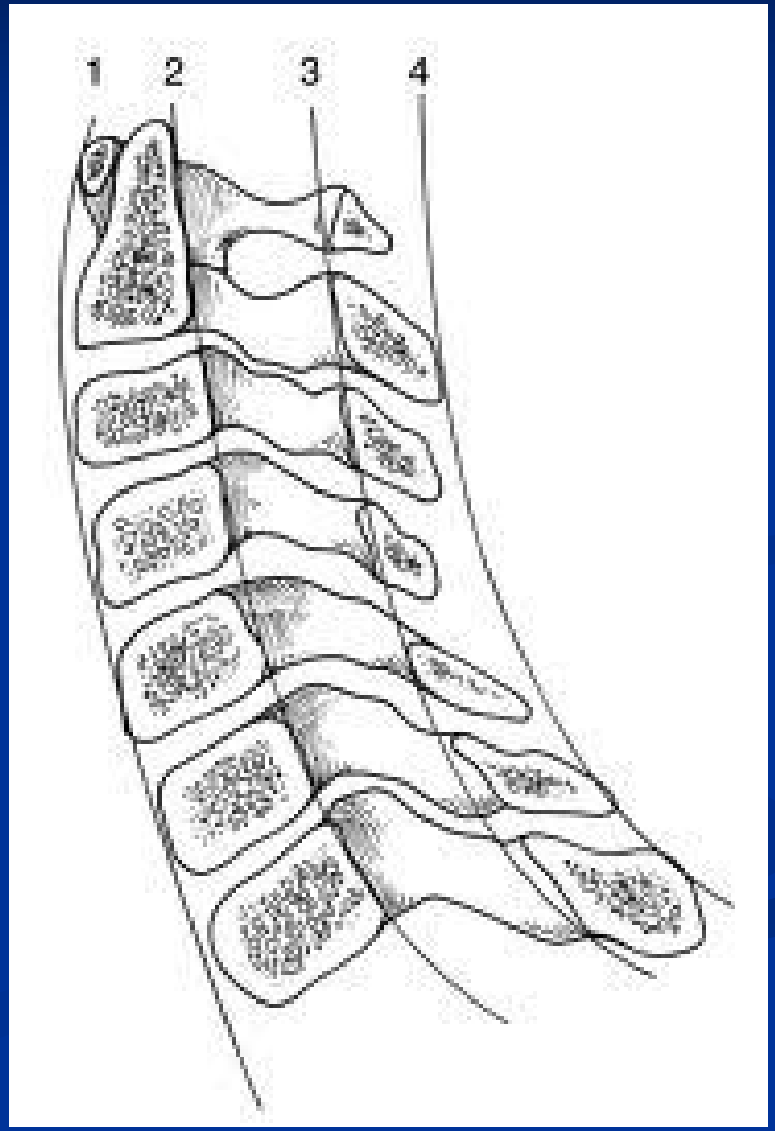
Anterior cord syndrome

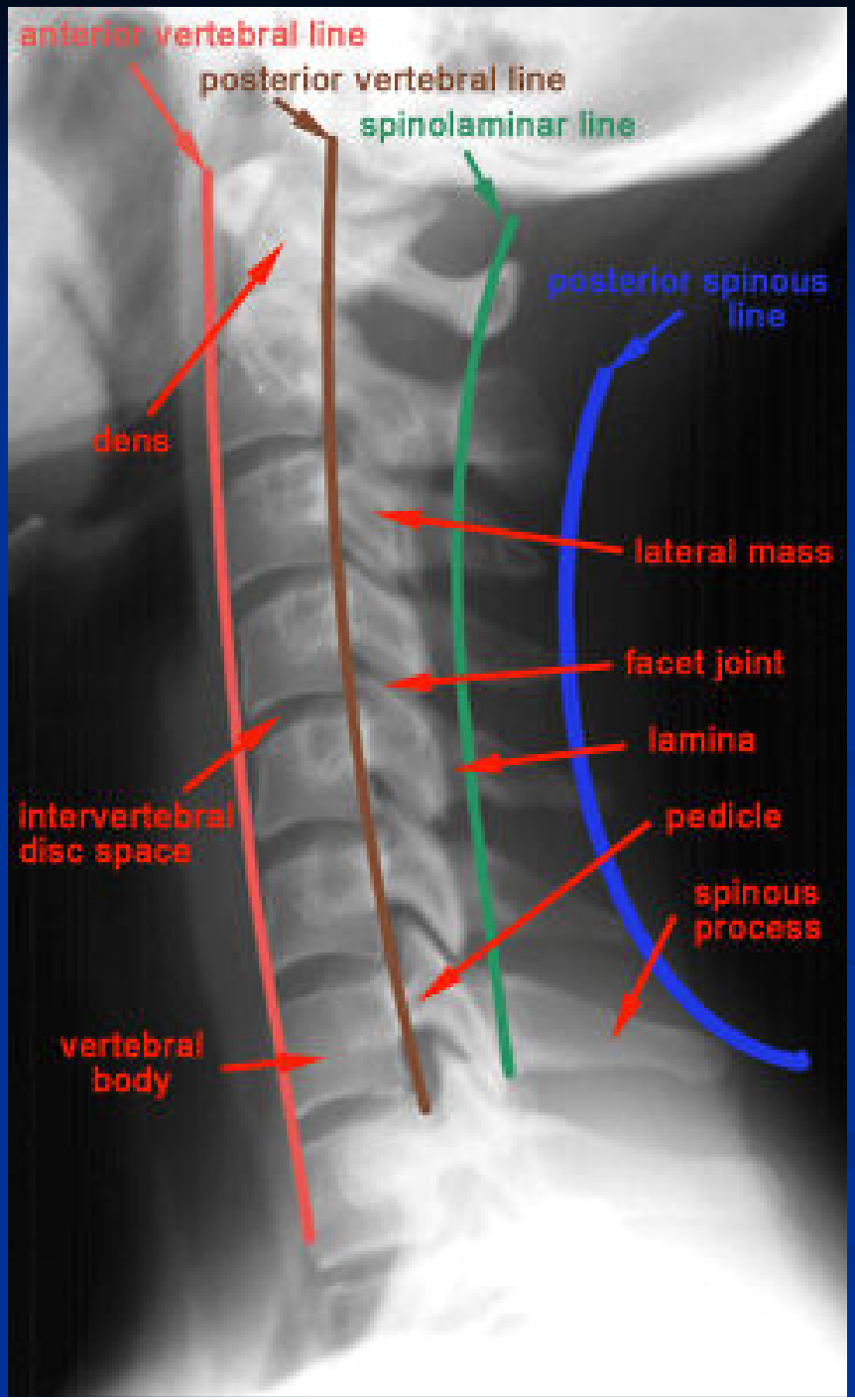
- Infarction of the cord in the territory supplied by anterior spinal artery
- Poorest prognosis among incomplete injuries

C-spine XR assessment

1. Anterior spinal line
2. Posterior spinal line
3. Spinolaminar line
4. Spinous process line

- Examine all vertebrae for preservation of height, facets, spinous processes



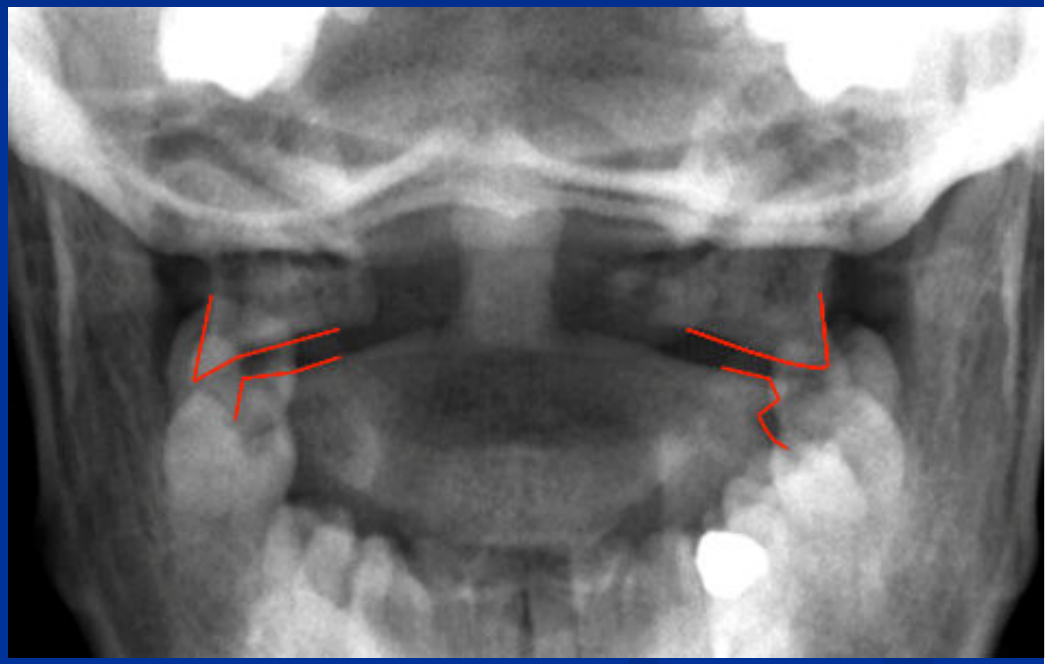

anterior vertebral line
posterior vertebral line
spinolaminar line
posterior spinous line
dens
lateral mass
facet joint
lamina
intervertebral disc space
pedicle
spinous process
vertebral body

Anything wrong?

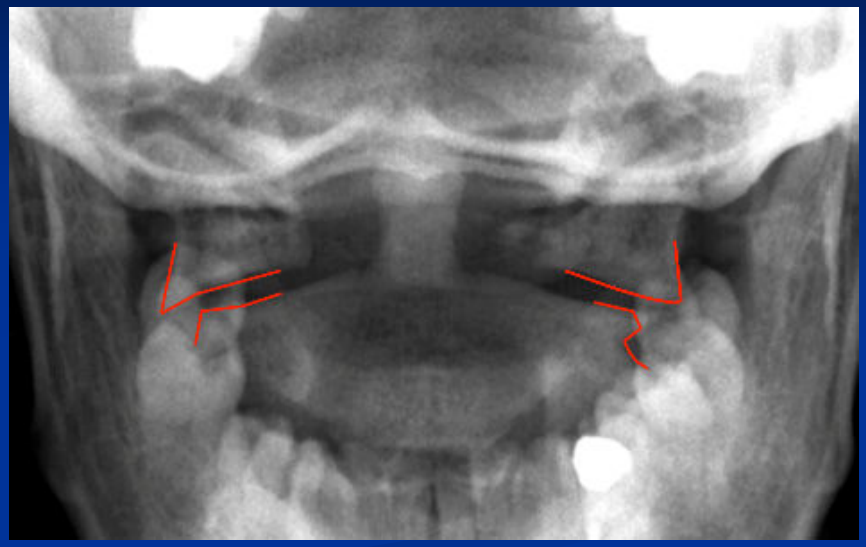
- Bilateral facet dislocation of C4/5

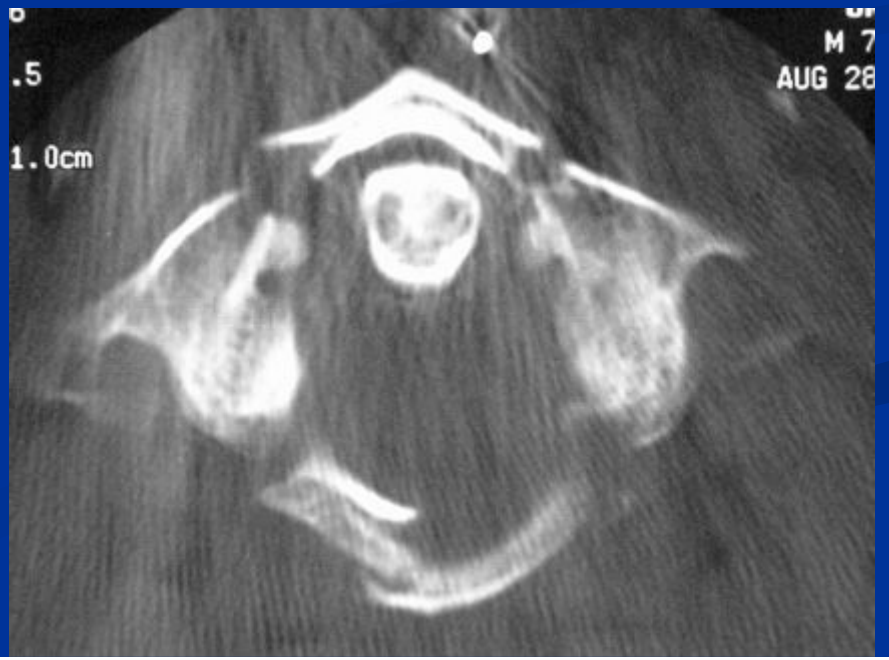
Anything wrong?

- Jefferson fracture (burst fracture of C1 ring)
- Axial loading injury



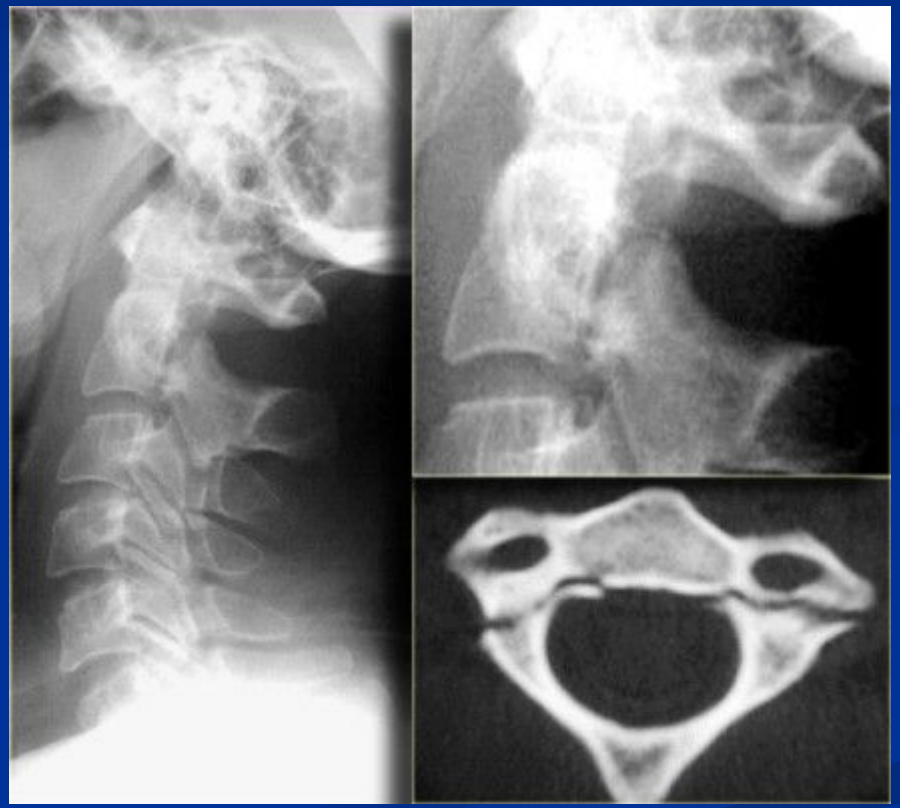
Open mouth view





Anything wrong?

- Hangman fracture
- Posterior elements of C2 –pars interarticularis
- Bilateral fractures through the lateral masses or pedicles



Treatment

- Immobilization !!!
- Steroid useful? (inhibit lipid peroxidation → prevent microvascular damage and axonal damage→ neuroprotection)

- ?Surgical decompression:

  studies have shown controversial results, depends on the discretion of individual spine surgeon

NASCIS Study

- National Acute Spinal Cord Injury Study
- NASCIS II study, NEJM 1990
- NASCIS III study, JAMA 1997

NASCIS II Study

- Multicenter randomized, double-blind, placebo-controlled trial
- Efficacy and safety of methylprednisolone and naloxone in patients with acute spinal cord injury

- 162 patients: MP 30mg/kg→ 5.4mg/kg/hr x 23 hrs
- 154 patients: N 5.4mg/kg→ 4mg/kg/hr x 23 hrs
- 171 patients: placebo with bolus and infusion

NASCIS II Study

- Primary outcome: motor and sensory functions on admission, 6 weeks and 6 months after injury

- Patients with acute spinal cord injury, treatment with MP improves neurologic recovery when given within 8 hrs after injury
- Naloxone does not improve neurologic recovery after acute spinal cord injury

NASCIS III Study

- Double-blind, randomized control, multicenter
- Compare efficacy of MP x 24 hrs vs MP x 48 hrs vs tirilazad mesylate x 48 hrs (non-glucocorticoid, inhibit lipid peroxidation)

- All patients given MP 30mg/kg before randomization
- MP-24 (166)→ 5.4mg/kg/hr x 24 hrs
- MP-48 (167)→ 5.4mg/kg/hr x 48 hrs
- TM-48 (166)→ 2.5mg/kg q6h x 48 hrs

NASCIS III Study

- Motor and functional change between initial presentation, at 6 weeks and 6 months at injury

- MP-48→ improved motor recovery at 6 weeks and 6 months after injury among patients with therapy initiated 3-8 hrs after injury; more severe sepsis and pneumonia than MP-24 and TM-48
- Patients treated with TM-48 and MP-24 showed equivalent motor recovery rates

NASCIS III Study

- Conclusion:

1. patients with acute spinal cord injury who receive MP within 3 hrs of injury should be maintained on treatment regime x 24 hrs
2. MP initiated 3-8 hrs after injury, patients should be maintained on steroid therapy x 48 hrs

Take home message

- Immobilization should be done for suspected spinal injury
- Spinal board should be used for transfer only
- Differentiate between neurogenic shock and spinal shock
- Differentiate complete vs incomplete spinal cord injuries help us to prognosticate patients
- Controversies on the treatment modalities

The End

Thank you