

# Spinal Injuries

Traumatology

RHS 231

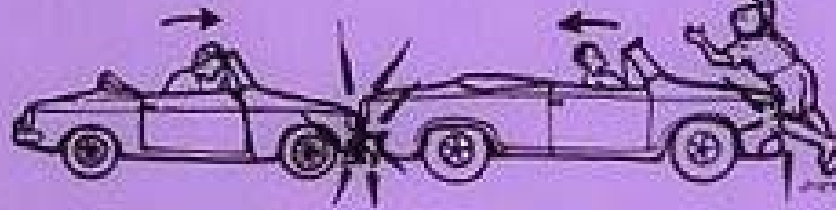
Dr. Einas Al-Eisa

# FRACTURES OF THE SPINE

## CAUSATION

Entire Spine

Cervical Spine



FORCED FLEXION

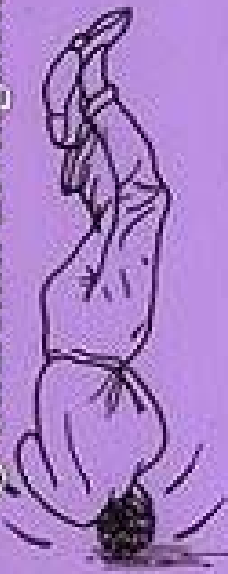
FORCED EXTENSION

ASSOCIATED  
WITH  
HEAD  
INJURY

with or without Rotation

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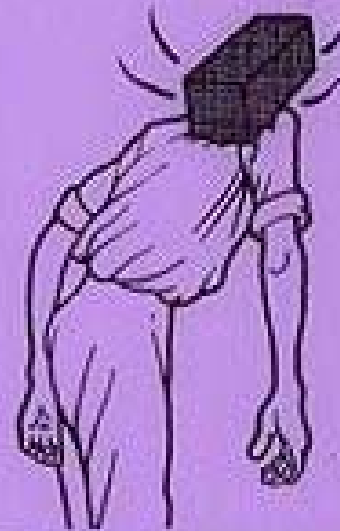
Entire Spine



FALL ON HEAD



FALL FROM HEIGHT



FORCED FLEXION  
ROTATION OF SPINE

# Cervical spine injuries

- Can be caused in four ways:
  1. Flexion
  2. Extension
  3. Vertical compression
  4. Rotation

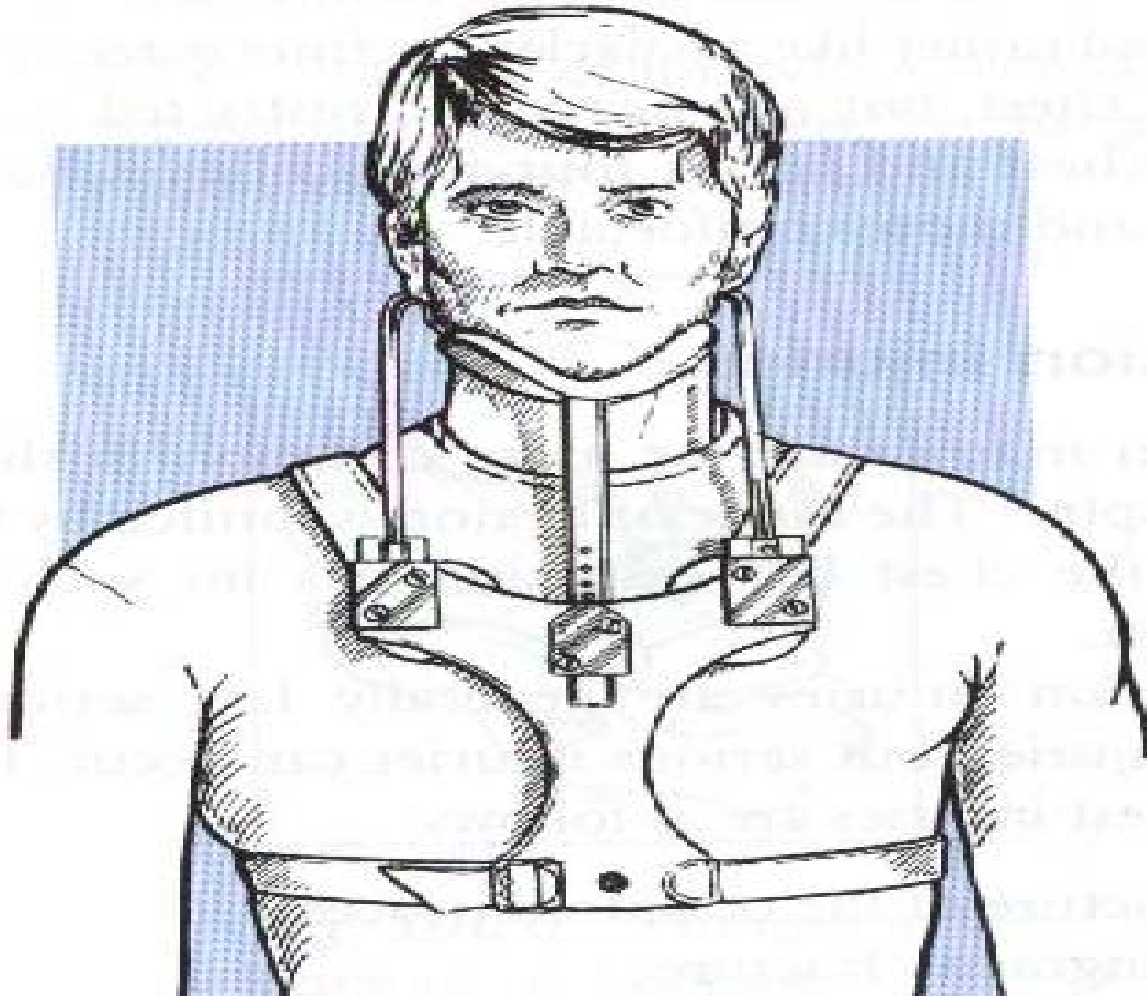
# Flexion injuries

- The commonest & most serious cervical injuries
- Usually seen in the lower part of the cervical spine

# Flexion injuries

- **Crush fractures:**
  - Due to vertical compression with flexion
  - Stable
  - Cause severe pain in the neck
  - *Treatment:* symptomatic relief with a four-post collar and analgesics for approximately 6 weeks

# A Four-Post Collar



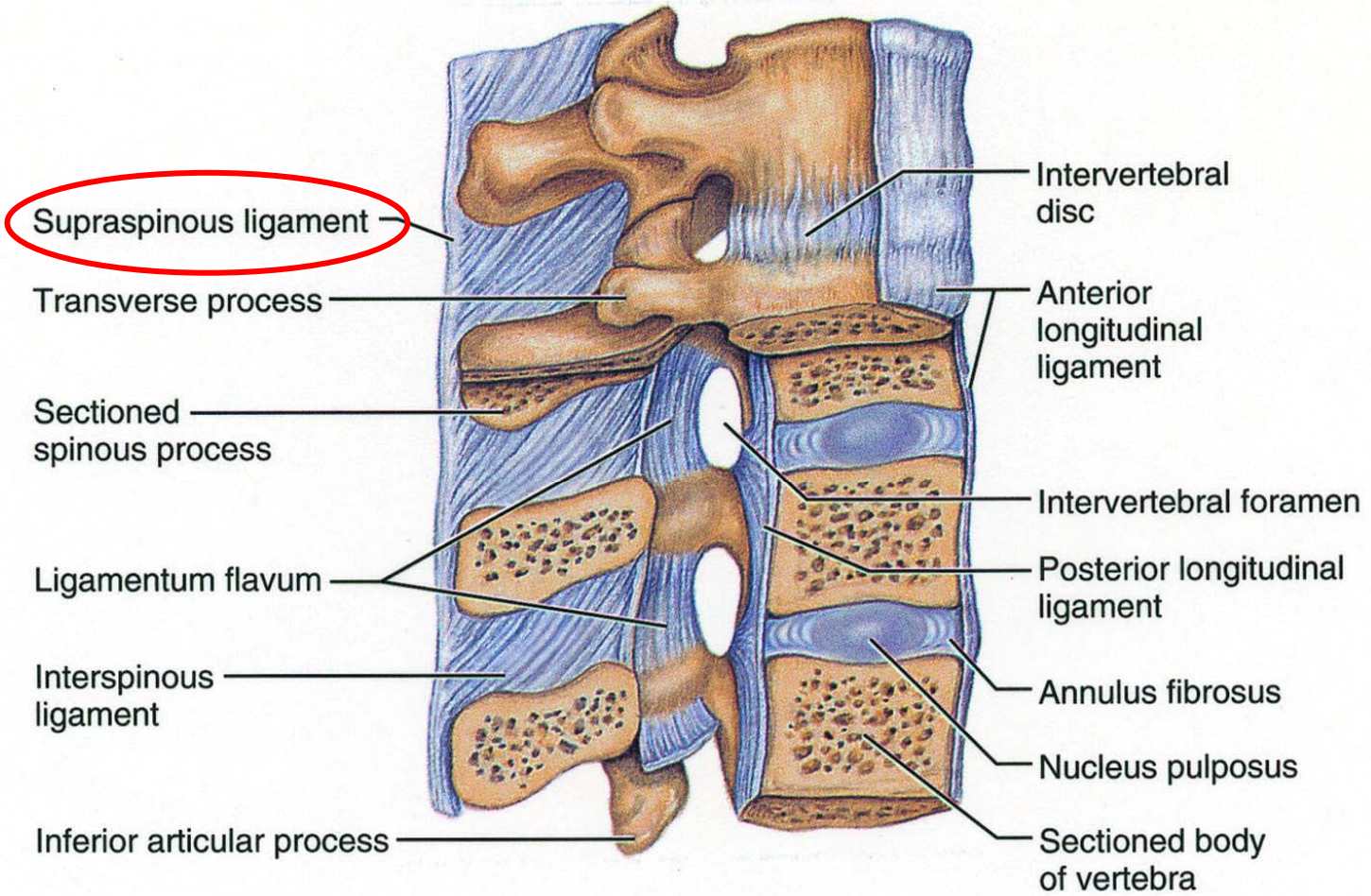
# Flexion injuries

- **Rupture of the supraspinous ligament:**
  - Violent flexion of the neck can tear the supraspinous ligament or avulse a spinous process
  - Very unstable  $\longrightarrow$  neurological damage can occur if flexion is repeated

# Flexion injuries

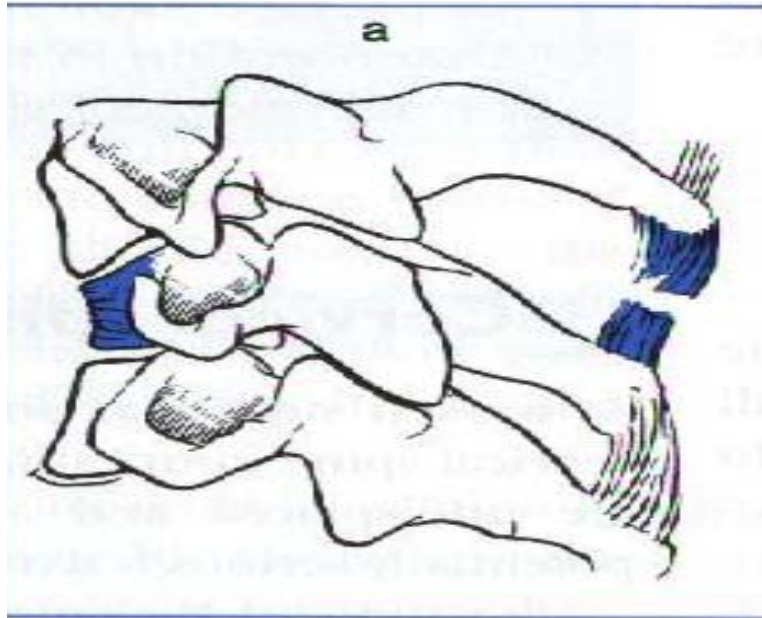
- **Rupture of the supraspinous ligament:**
  - *Treatment:* a supporting collar to hold the cervical spine in extension while the soft tissues heal





(a)

*Lateral view*



**Flexion injury** with crush fracture of the vertebral body and rupture of the supraspinous ligament

# Flexion injuries

- **Dislocations:**

- Forward flexion with rotation may cause one or both of the facet joints to jump over the facet below and dislocate
- Associated with soft tissue injury
- Neurological damage is unusual

# Flexion injuries

- **Dislocations:**

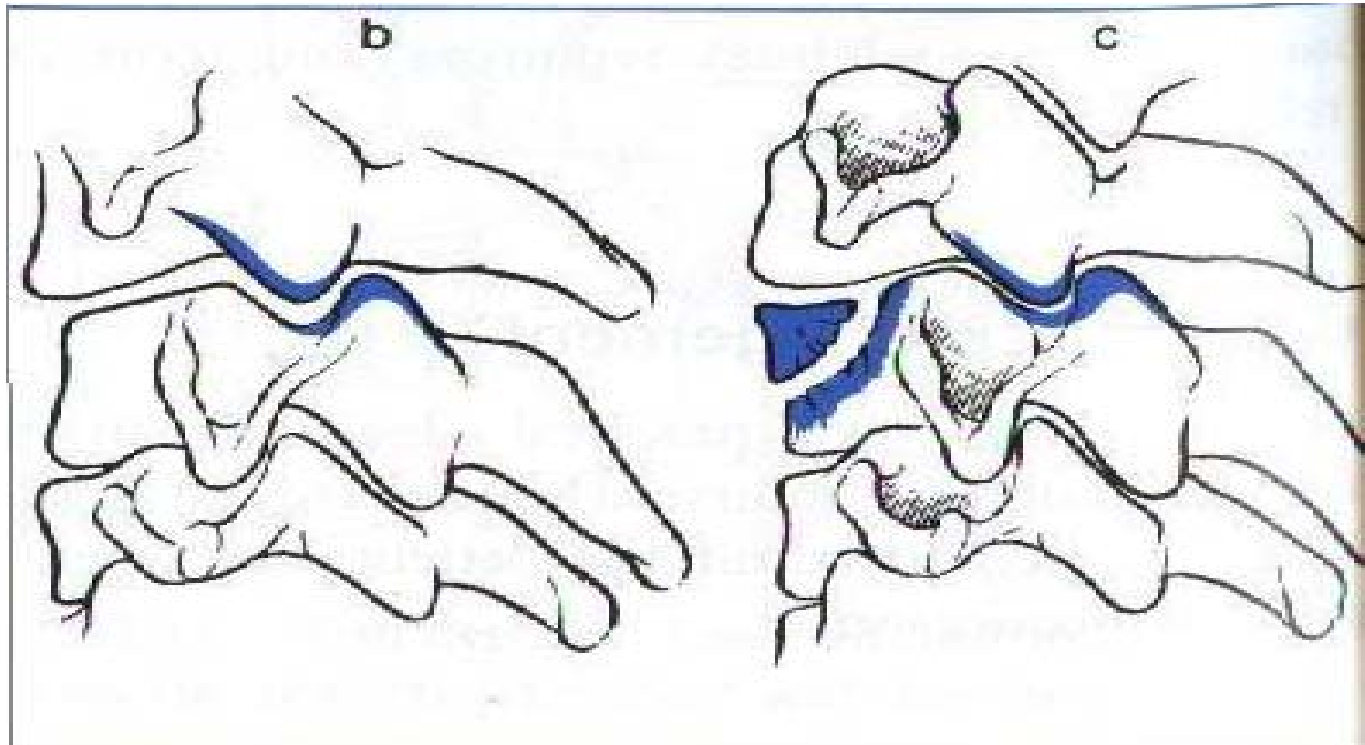
- *Treatment:* traction or careful manipulative reduction (by experienced surgeon)

# Flexion injuries

- **Fracture dislocations:**
  - Caused by a fall onto the head (e.g., falling off a horse)
  - The vertebral bodies and facet joints are disrupted
  - Often lead to paraplegia

# Flexion injuries

- **Fracture dislocations:**
  - *Treatment:* reduce and stabilize the fracture (by traction and fixation) until it has united



Locked facets

Locked facets with  
fracture of the  
vertebral body

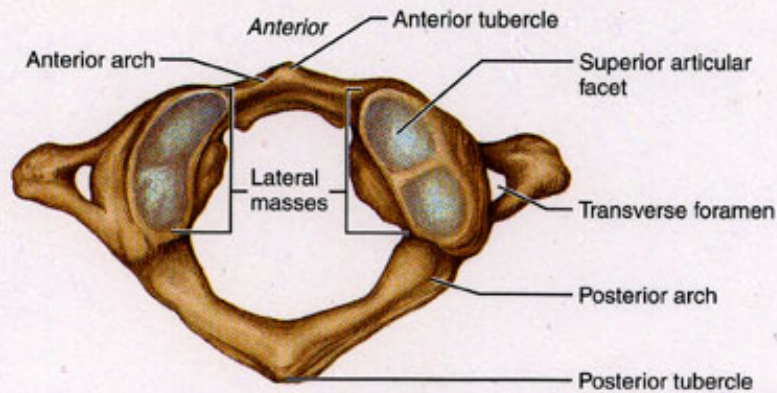
# Extension injuries

- More common in the upper cervical spine
- Generally less serious than flexion injuries (but serious injuries can occur)

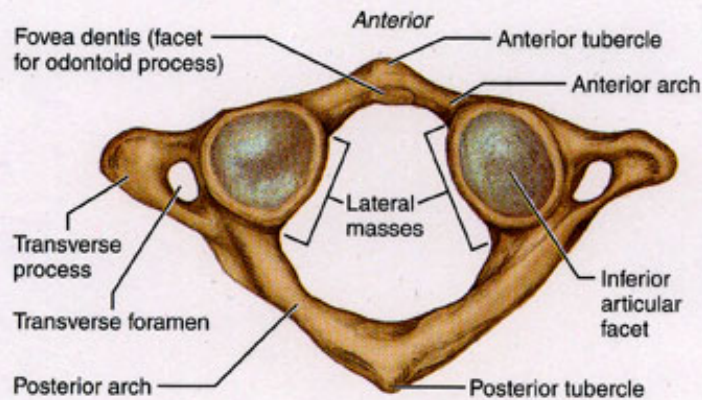


# Extension injuries

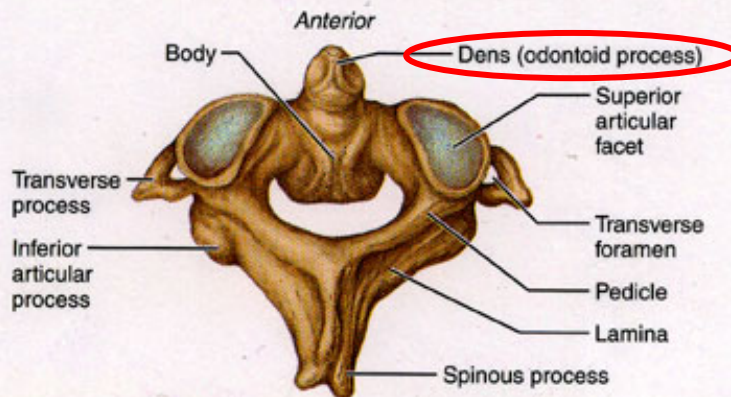
- **Fracture of the odontoid process (dens):**
  - Difficult to diagnose (often missed in emergency department)
  - Causes a feeling of unsteadiness in the neck and pain at the base of the skull



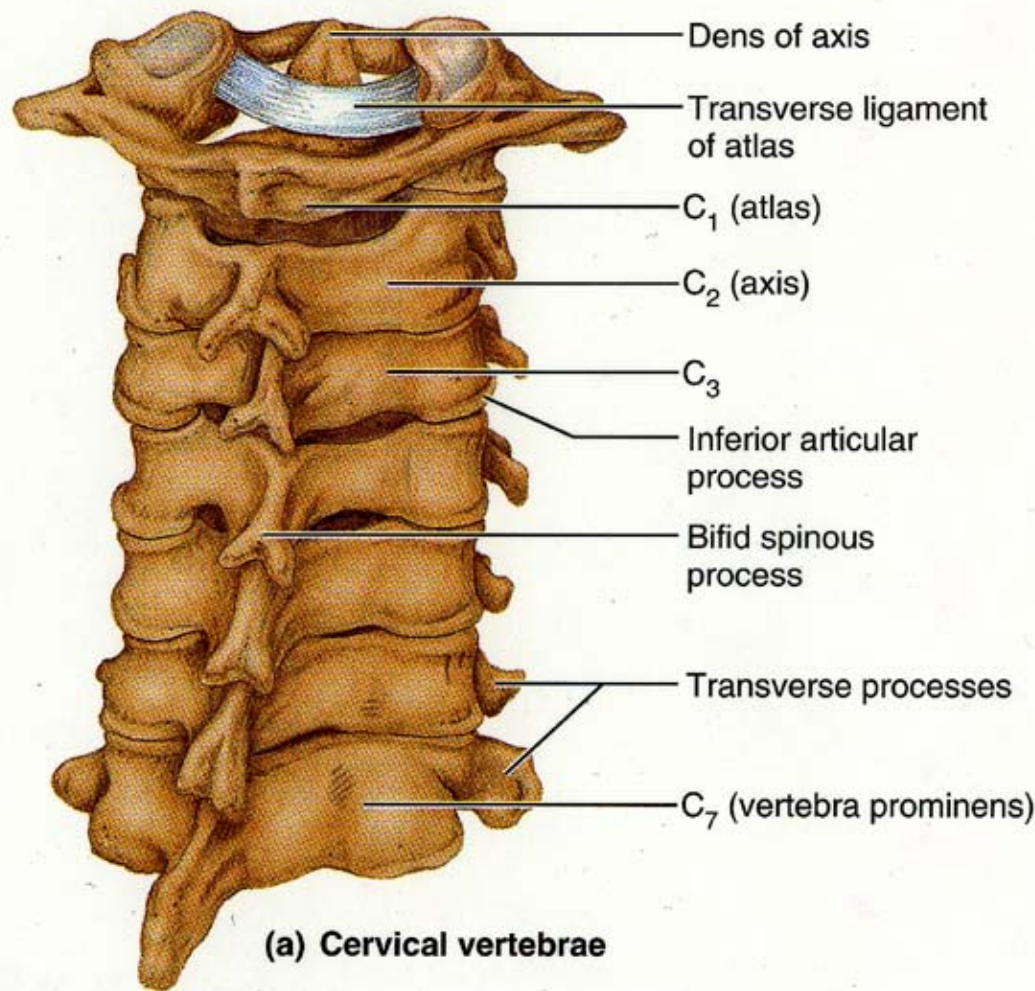
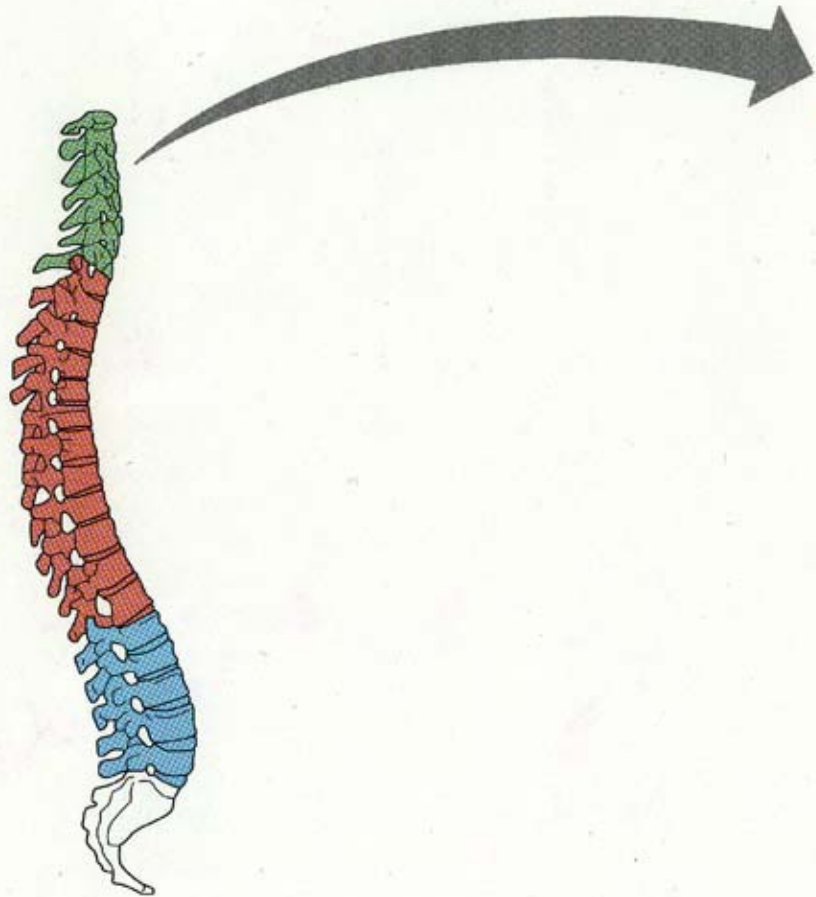
(a) Superior view of atlas ( $C_1$ )



(b) Inferior view of atlas ( $C_1$ )



(c) Superior view of axis ( $C_2$ )

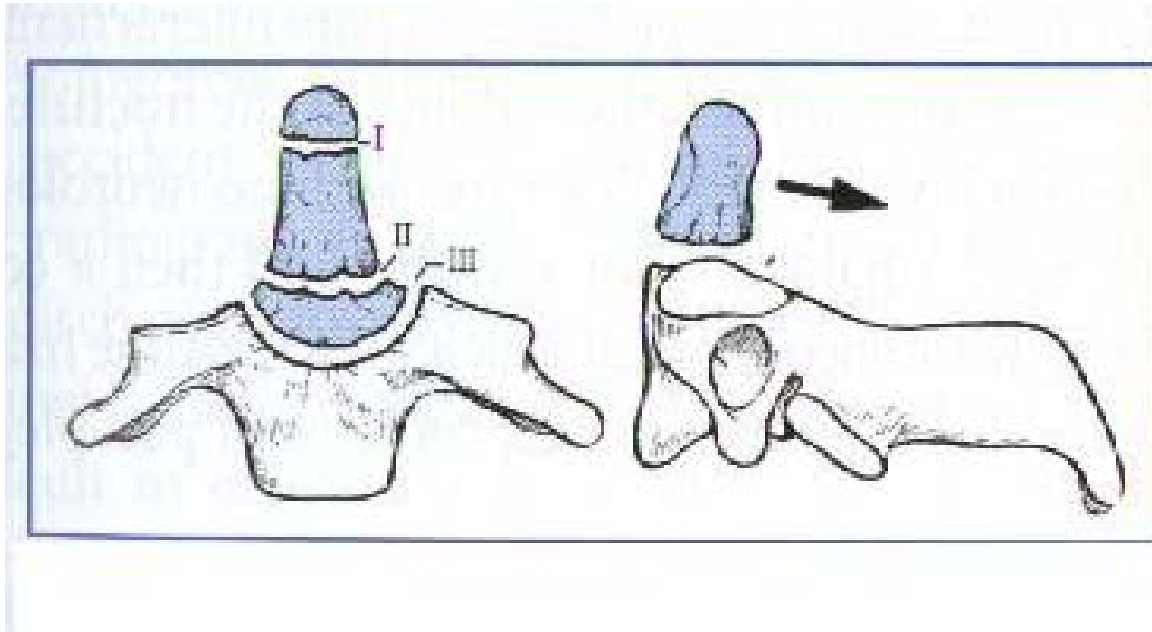


**(a) Cervical vertebrae**

**“ Does it hurt when I do this? ”**



# Fractures of the odontoid process



Types: **I** fracture of the apex

**II** fracture of the middle

**III** fracture of the base

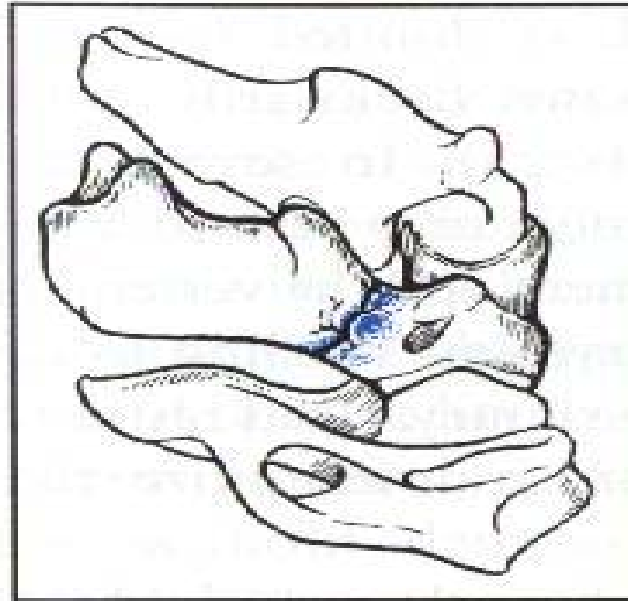
# Extension injuries

- **Fracture of the odontoid process (dens):**
  - *Treatment:* support in a halo-vest for up to 4 months
  - Type II fracture of the dens have approximately 50% incidence of non-union and may need atlantoaxial fusion to stabilize the neck

# Extension injuries

- **Hangman's fracture:**
  - Judicial hanging fractures the spine by distraction and hyperextension (or a person slipping under a seat belt)
  - The fracture occurs through the pedicles of C2 with a traumatic *spondylolisthesis* (vertebral slipping) of C2 on C3

# Hangman's Fracture



A fracture through the *pars interarticularis* of the second cervical vertebra



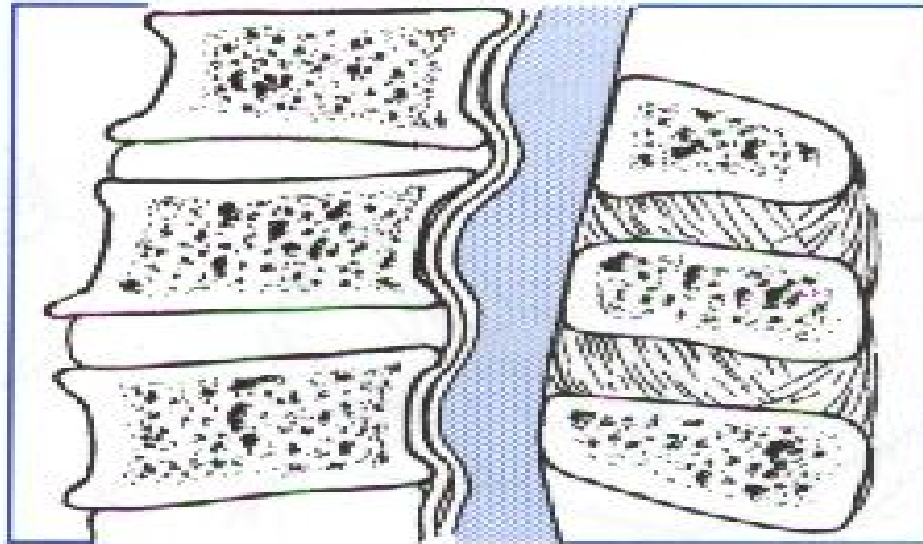
# Extension injuries

- **Hangman's fracture:**
  - Treatment: holding the head steady with the minimum of traction
  - Too much traction can cause neurological damage (that is how hanging kills)

# Extension injuries

- **Anterior spinal artery syndrome:**
  - Hyper extension of the degenerative cervical spine (in the elderly) →  
may kink the *posterior longitudinal ligament* →  
compress the *anterior spinal artery* →  
central cord damage →  
weakness and sensory symptoms in the upper limb

# Anterior spinal artery compression



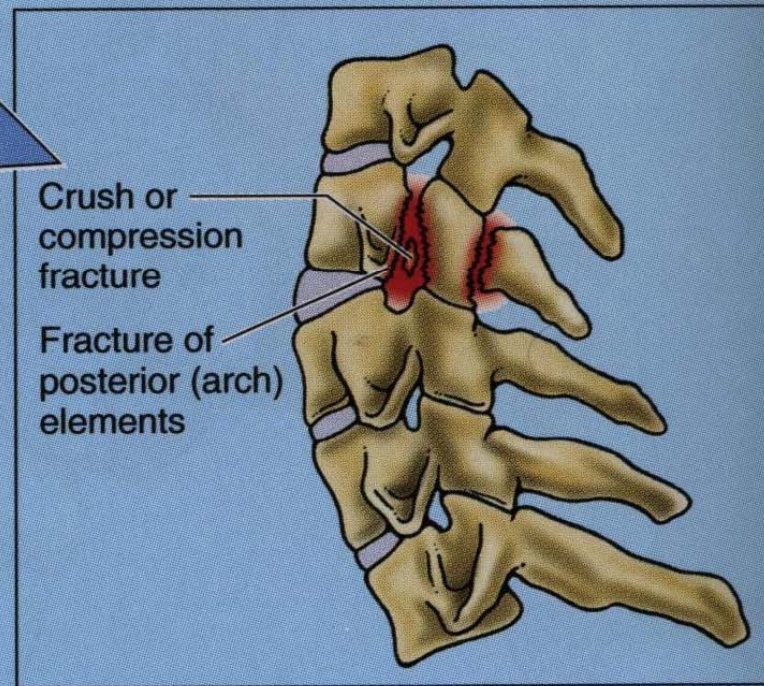
Kinking of the *posterior longitudinal ligament* in an elderly patient may cause pressure on the front of the spinal cord and damage to the *anterior spinal artery*

# Extension injuries

- **Anterior spinal artery syndrome:**
  - *Treatment:* immobilization in a collar



# Extension injuries

- **Fracture of vertebra with disc prolapse:**
  - May cause permanent damage to the spinal cord
  - *Treatment:* urgent decompression and stabilization



**(A) Hyperextension of neck**

# Injuries caused by vertical compression

- Uncommon
- If the vertical force is in front of the axis of rotation  causes flexion
- If the vertical force is behind the axis of rotation  causes extension

# Injuries caused by vertical compression

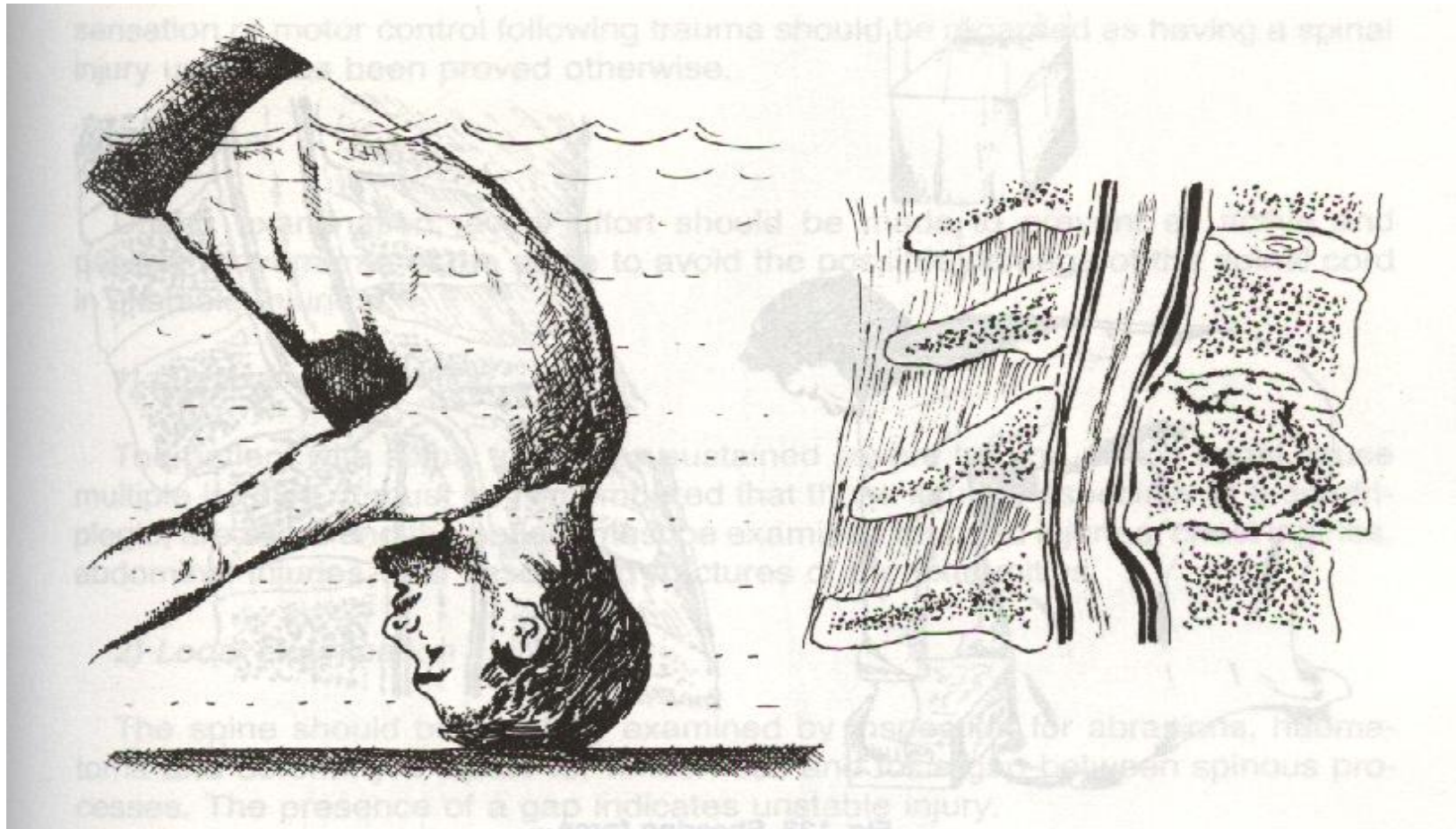
- **Fracture of the atlas arch:**
  - Caused by something landing on the head or the patient falling directly on the vertex
  - *Treatment:* immobilization in a halo-vest for 6 weeks, followed by a collar for 2 weeks





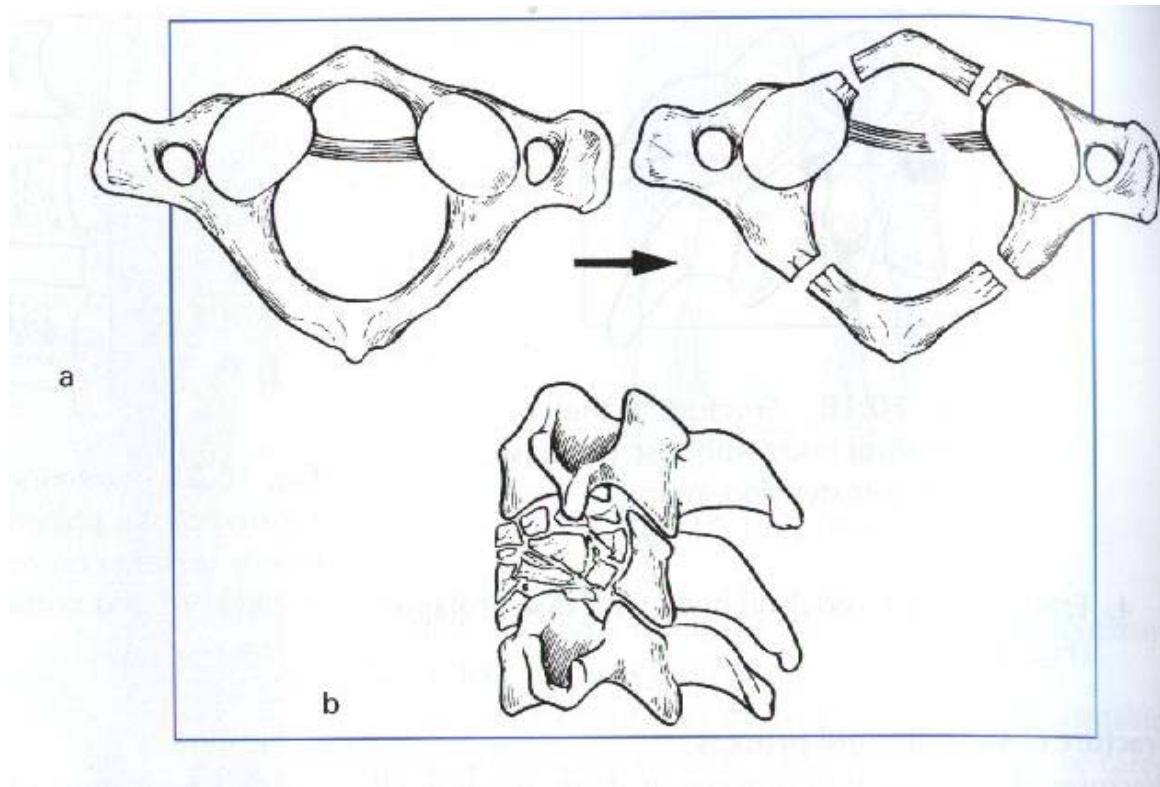
**Halo-vest traction:** a halo fixed to the skull and attached to bars mounted on a chest piece

# Compression Injury



# Injuries caused by vertical compression

- **Burst fracture:**
  - Fracture of the vertebral bodies
  - *Treatment:* immobilization in a halo-vest for 6 weeks, followed by a collar for 2 weeks
  - If there is neurological damage, rehabilitation must begin as soon as possible






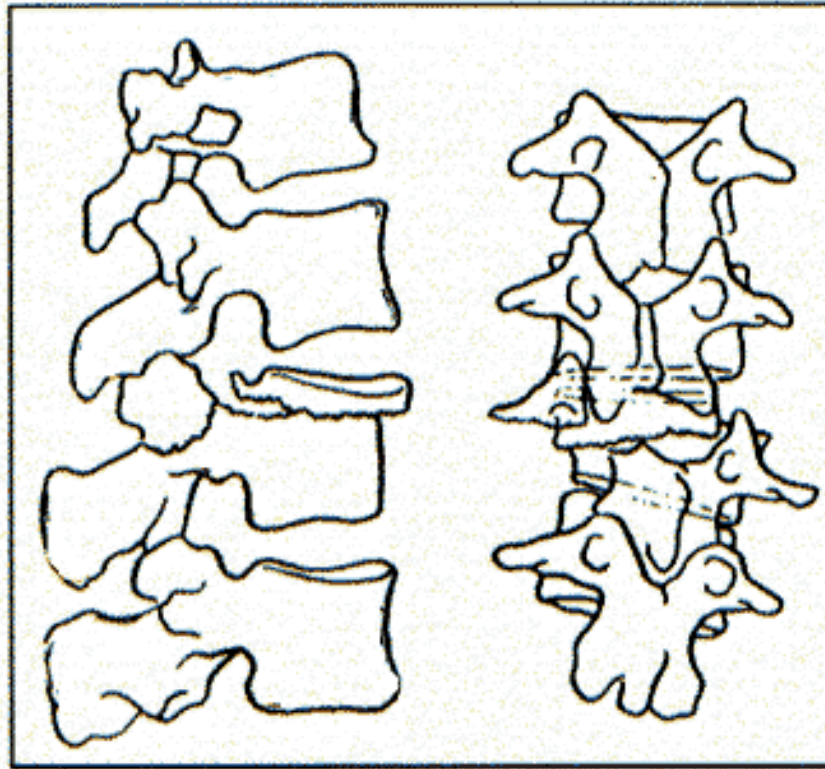
**Burst fractures of the (a) atlas and (b) axis**

# Rotation injuries

- Most injuries are the result of a combination of forces
- Rotational forces are involved in many flexion injuries (particularly falls onto the head)

# Rotation injuries

- Rotation with flexion  dislocation of one facet joint
- Rotation with compression  causes splits in the vertebral bodies
- Rotation with extension  damages the posterior elements (pedicles, pars interarticularis)



**Rotation injuries:** main cause of dislocation if accompanied with flexion

# Rotation injuries

- Treatment: depends on the stability of the fracture and neurological involvement
- Fracture with no neurological involvement: halo-vest for 6 weeks followed by a collar
- Fractures with neurological deficit need the same fixation and early rehabilitation for the problems of paraplegia





# Whiplash injury

- Combined extension-flexion
- Common in road traffic accidents






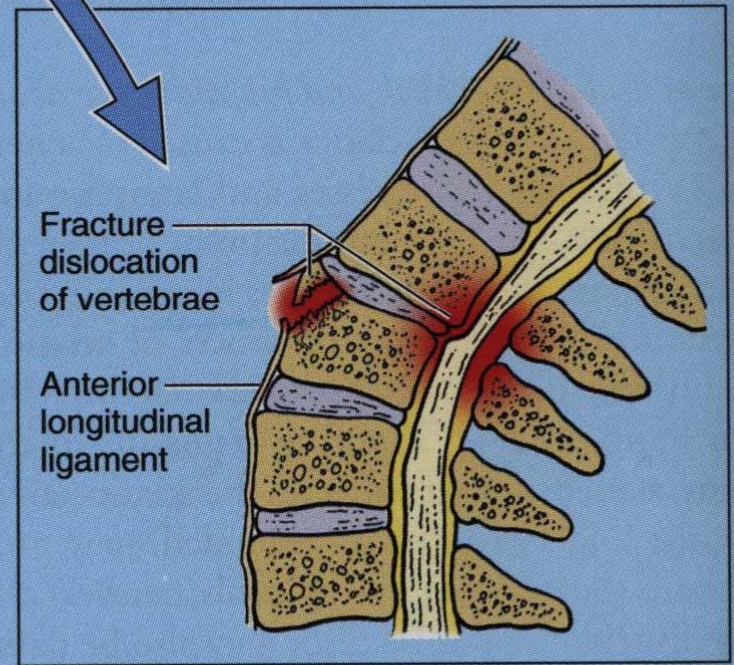
**Whiplash injury**

# Whiplash injury

- When a car is hit from behind  the head of the person is thrown backward (neck hyperextension)  the anterior longitudinal ligament may be torn (in severe cases)
- Head restraints are recommended to limit the range of hyperextension

# Whiplash injury

- When the vehicle decelerates rapidly at the moment of impact  the head is thrown forward (cervical spine flexion)  flexion will be limited by the chin hitting the chest  there could be a longitudinal distraction (just like hanging) in severe cases neurological damage can occur



**(B) Hyperextension (whiplash) injury**

# Whiplash injury

- **Clinical features:**

- There may be no symptoms until 6-12 hours after the injury
- Pain and stiffness in the neck
- Aching across the shoulders and arms
- Dysphagia (sometimes)
- Tingling or numbness may be present

# Whiplash injury

- **Clinical features:**
  - Prognosis is unknown
  - 90% of patients are free of symptoms within 2 years
  - Some patients may be unable to turn the head enough to reverse a car

# Whiplash injury


- **Treatment:**
  - A soft supporting collar and analgesics in the first few days after the injury
  - The collar should be discarded as soon as possible and physiotherapy begins to restore neck movement and avoid stiffness



# Thoracic spine injuries

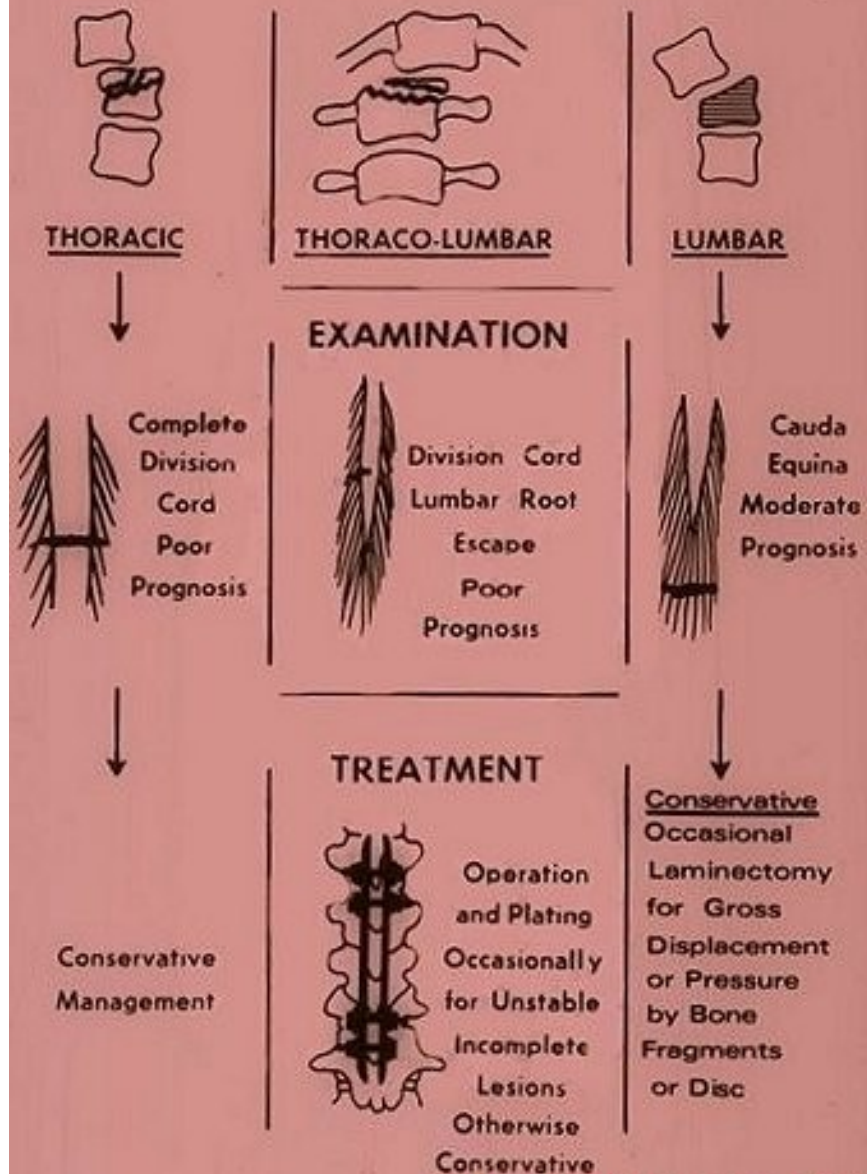
- The thoracic spine is protected from injury by its rigidity (little mobility)
- But thoracic spine injuries are generally severe causing paraplegia because:
  - The spinal canal is narrow relative to the spinal cord in this area
  - The displacement of fragments at the fracture may damage the cord

# Lumbar spine injuries

- The lumbar spine is freely mobile like the cervical spine  major and minor injuries can occur

# FRACTURES OF THE SPINE

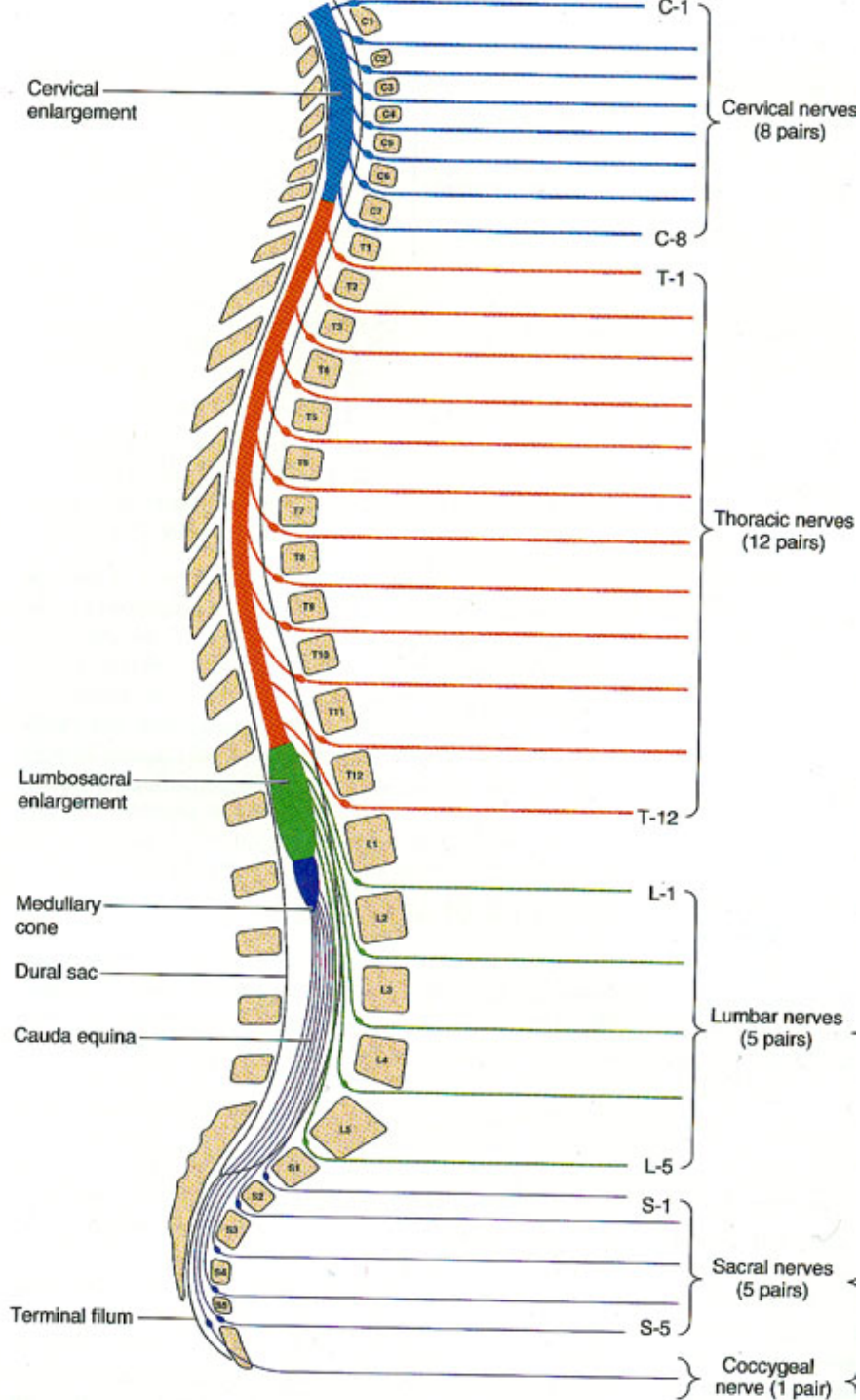
## UNSTABLE AND MAJOR THORACIC AND LUMBAR

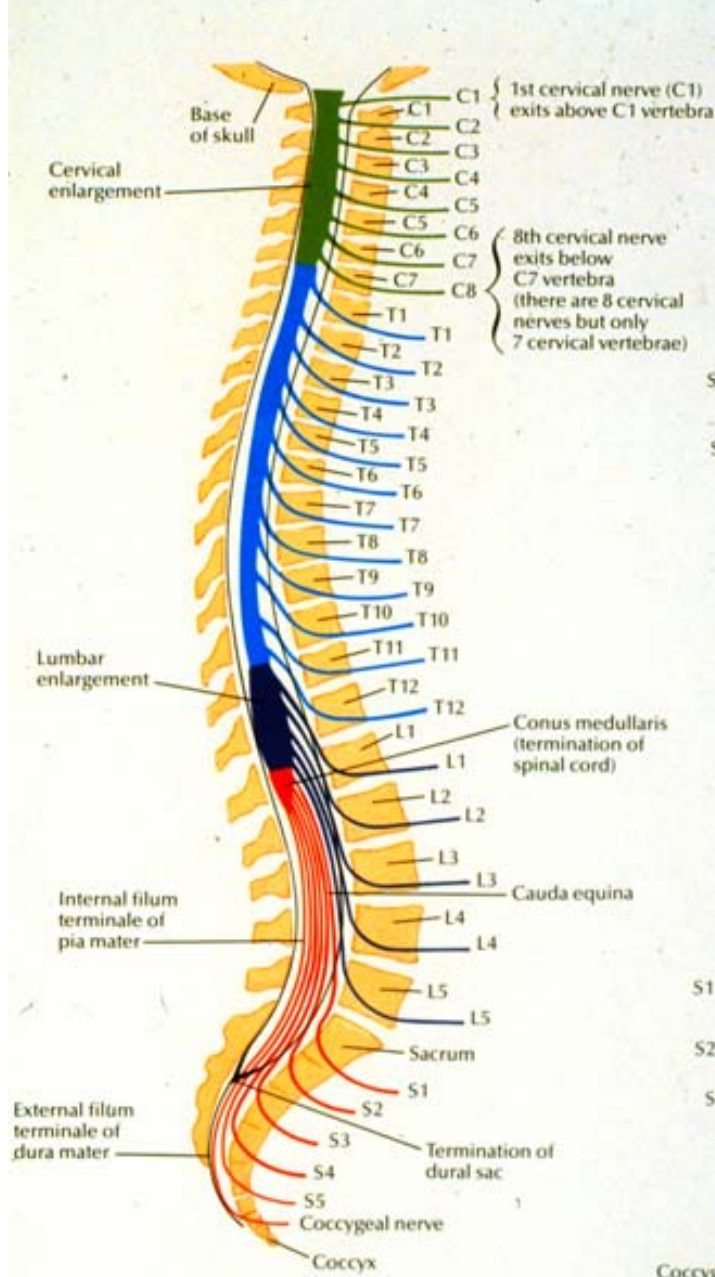


As there can be some recovery of cauda equina lesions, there is a place for stabilization of the thoracolumbar spine with plates, spinal rods or cables.

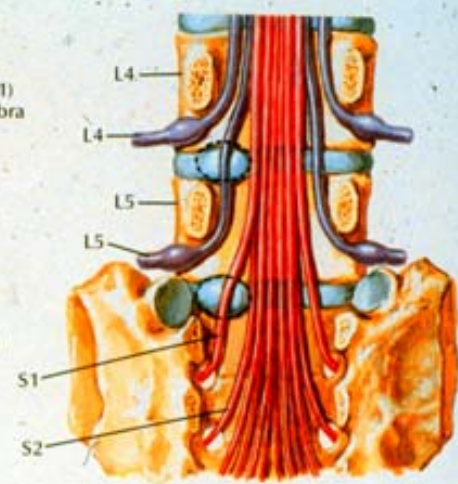
In fractures and fracture dislocations of the lumbar spine below the level of L2, the cauda equina rather than the cord may be damaged. This is because the spinal cord in the adult ends at the upper border of L2.

There is much more room in the lumbar spinal canal than in the thoracic spine. As a result, unstable fractures of the lumbar spine are usually treated conservatively without operation. The exception, however, is sometimes a burst fracture of a lumbar vertebra which is usually a stable fracture. However, some of the bone from the fracture may press on the cauda equina and require urgent removal.

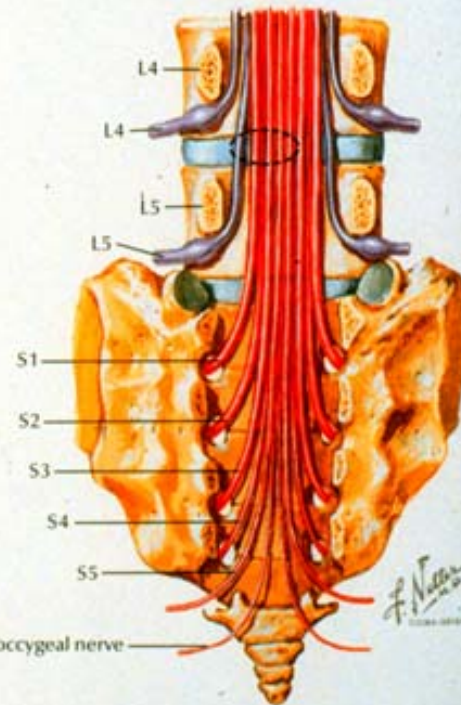




- Cervical nerves
- Thoracic nerves
- Lumbar nerves
- Sacral and coccygeal nerves



Lumbar disc protrusion does not usually affect nerve exiting above disc. Lateral protrusion at disc level L4-5 affects 5th lumbar nerve, not 4th lumbar nerve. Protrusion at disc level L5-S1 affects 1st sacral nerve, not 5th lumbar nerve.

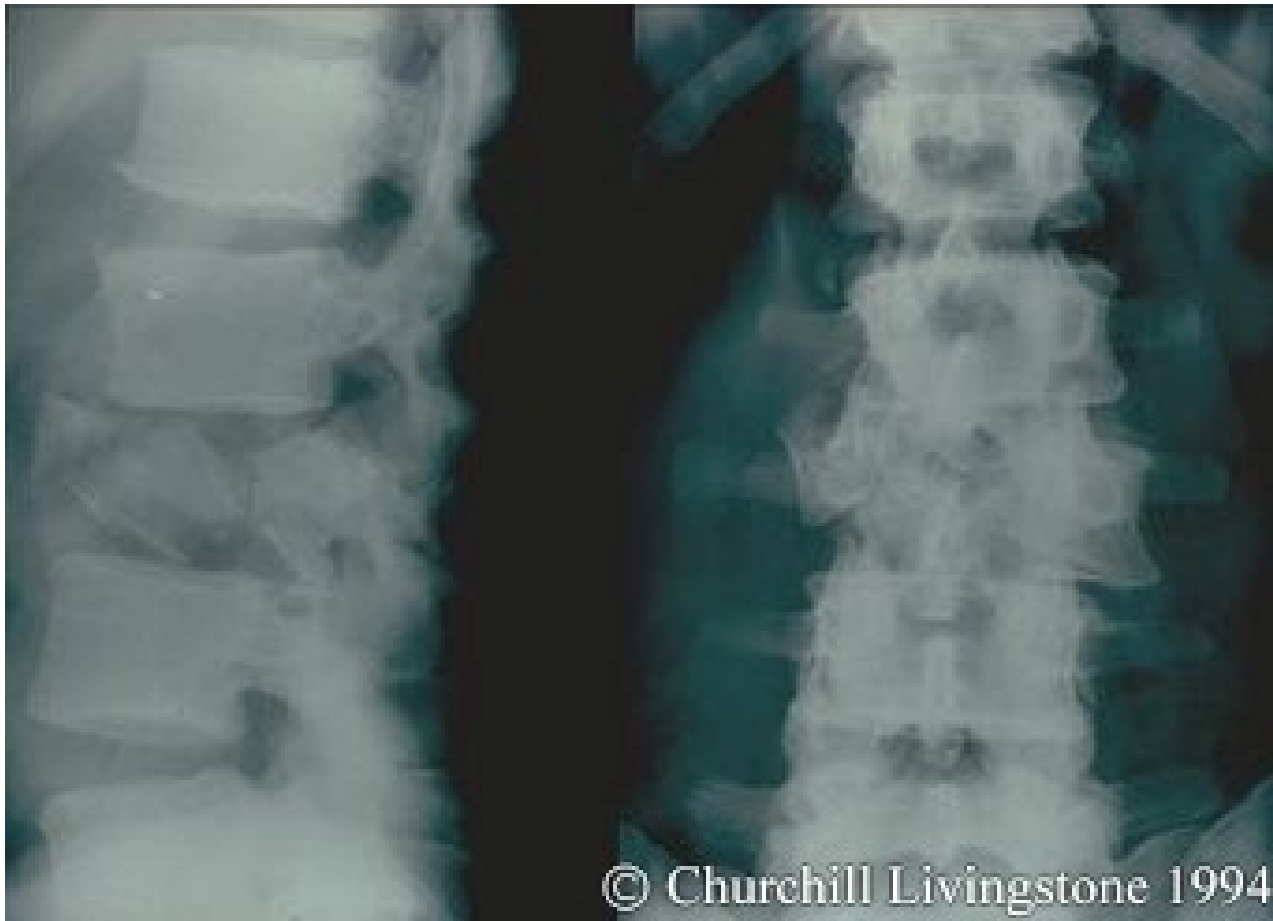


Medial protrusion at disc level L4-5 rarely affects 4th lumbar nerve but may affect 5th lumbar nerve and sometimes 1st-4th sacral nerves

A lightweight spinal support for injuries of the thoracic and upper lumbar spine







**Burst fracture** of the 3rd lumbar vertebra which required removal of bone fragments which were pressing on the cauda equina

# FRACTURES OF THE CERVICAL SPINE

## MOTOR EXAMINATION

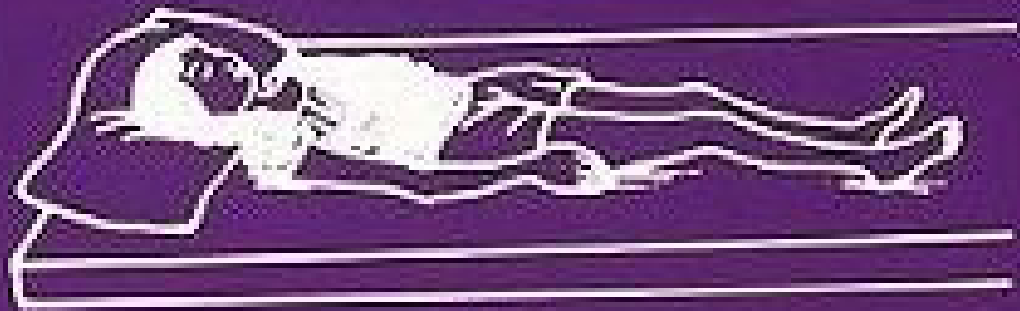
Complete Transection of Cord

Paralysis Diaphragm



C. 4.

Complete Flaccid Paralysis



C. 5

C 4 and above - death due to respiratory paralysis  
C 5 - complete flaccid paralysis



**Abduction Flexion Supination**

**C 6.**

**C 5. Root Irritation**



**Adduction Pronation**

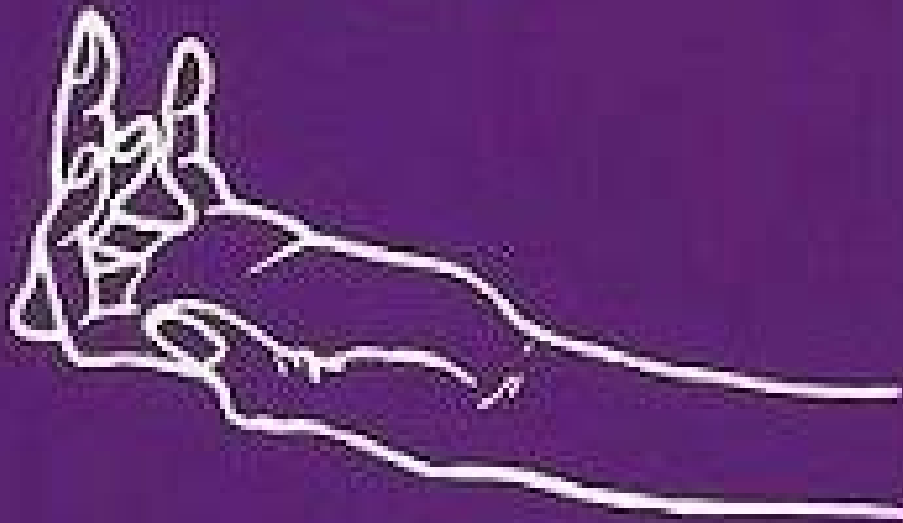
**C 7.**

**C 6. Root Irritation**

C 6 / C 5 - root irritation leading to abduction of the arm, flexion of the elbows and supination of the forearms.

C 7 / C 6 - root irritation with adducted arms and pronated forearms.

**Paralysis Small Muscles  
of Hand**



**C 8 T 1**

**BELOW LESION**

**Complete Motor +  
Sensory Paralysis +  
Positive Anal Reflex**

**= Bad Prognosis  
after 3 days.**

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**C 8 & T 1 - paralysis of the small muscles of the hand**