

Management of acute cervical injuries

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“Or ever the silver cord be loosed ...”

Ecclesiastes xii, 6.



Anatomy

- ❖ The neck comprises the region between the thoracic inlet and the base of the head
- ❖ It serves as a protective conduit for the spinal cord and nerve roots
- ❖ Its complex articulations and musculature allow for a high degree of motion



Cervical vertebrae - 7

- ❖ 3 atypical

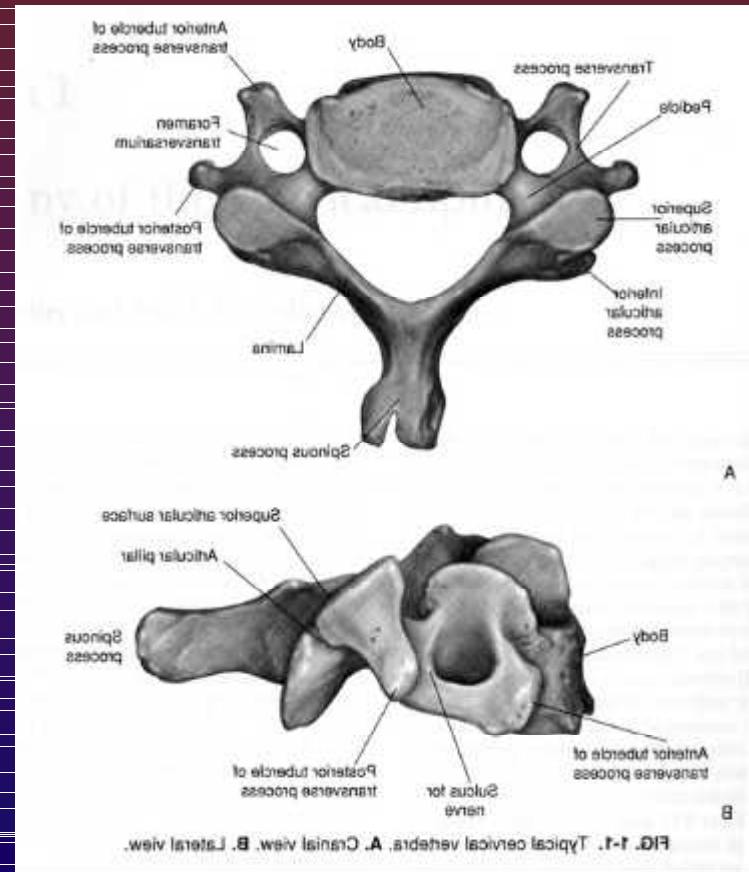
 - ❖ 1st, 2nd, 7th

- ❖ 4 typical

 - ❖ C3 – C6

Typical cervical vertebrae

- ❖ Vertebral body
- ❖ Vertebral arch
- ❖ Several processes for muscular attachment & articulations



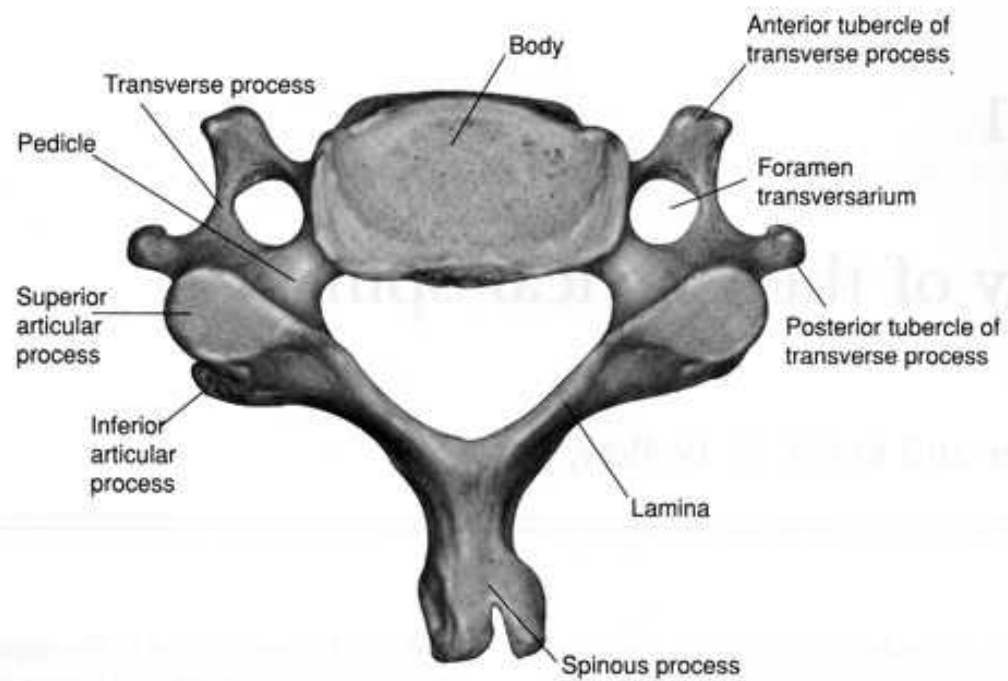


Typical cervical vertebra

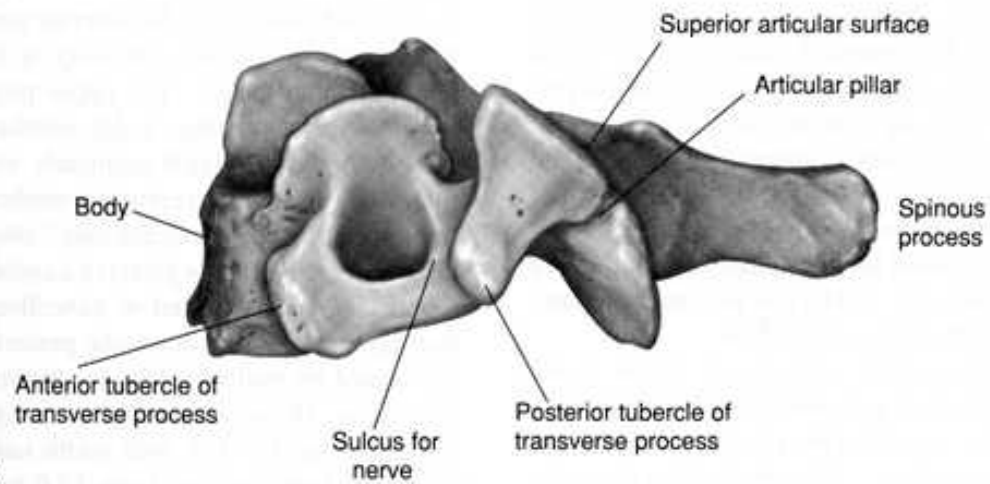
- ❖ Vertebral body – strength & support for two thirds of the vertebral load
- ❖ Upper projection on the lateral superior surface : *uncus* or hook
- ❖ Related intimately to lateral inferior surface of vertebra below
- ❖ Articulations: *uncovertebral joints* or *joints of Luschka*



- ❖ From the posterior lateral aspect of the vertebral joints project pedicles that together with the lamina form the vertebral arch.
- ❖ The vertebral arch encloses the vertebral foramen, which combines with the foramen at other levels to form the spinal canal
- ❖ The lateral mass forms at the junction of the lamina and pedicle and gives rise to the superior and inferior facets
- ❖ The superior facet faces upward and posteriorly; the inferior facet faces downward and anteriorly
- ❖ They articulate to form the zygoapophyseal joints

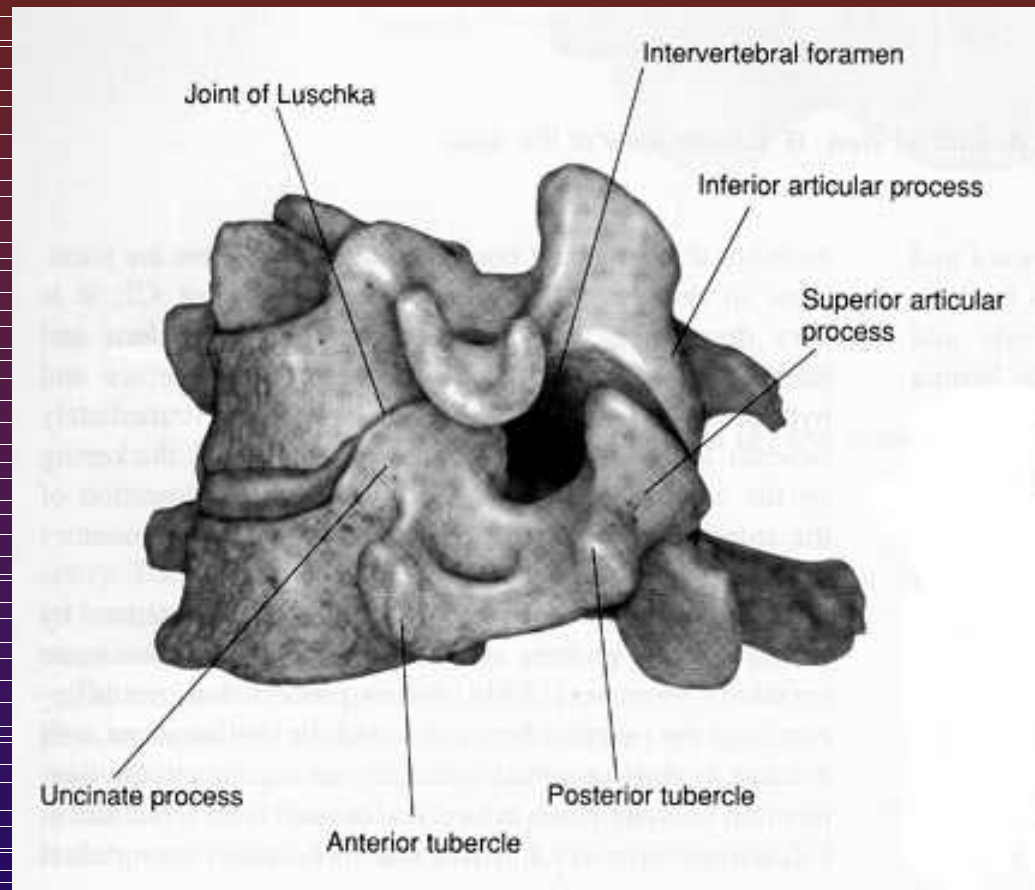


A



B

FIG. 1-1. Typical cervical vertebra. **A.** Cranial view. **B.** Lateral view.



Atypical cervical vertebrae

- ❖ C1 : the atlas
- ❖ Lacks a body & spinous process
- ❖ Ring-like structure
- ❖ The lateral mass carries the weight bearing articular facets
- ❖ Widest cervical vertebra

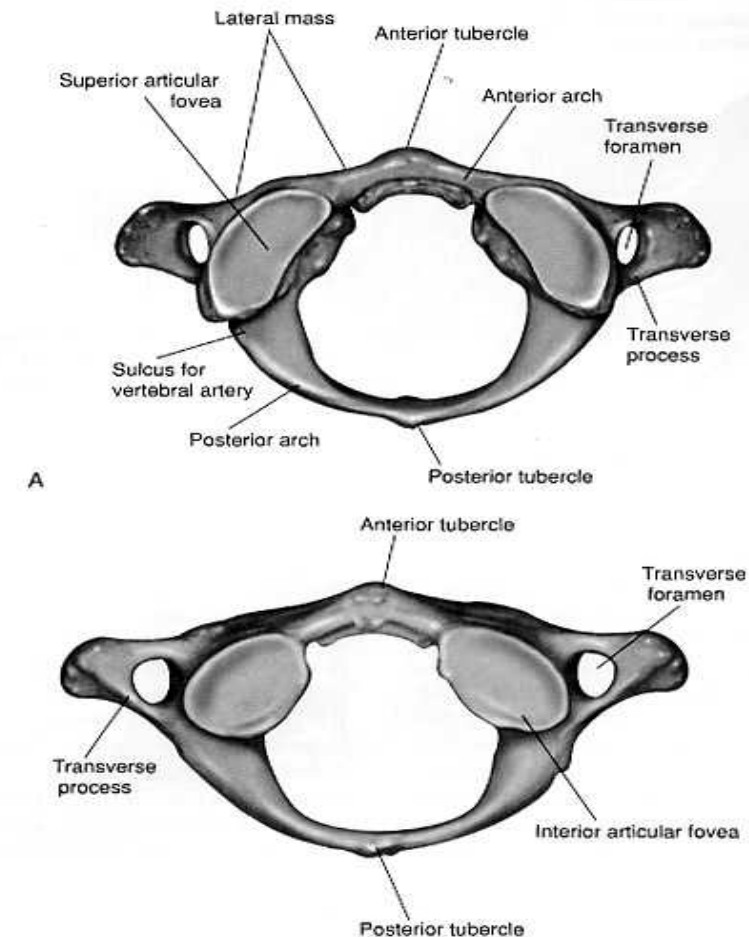
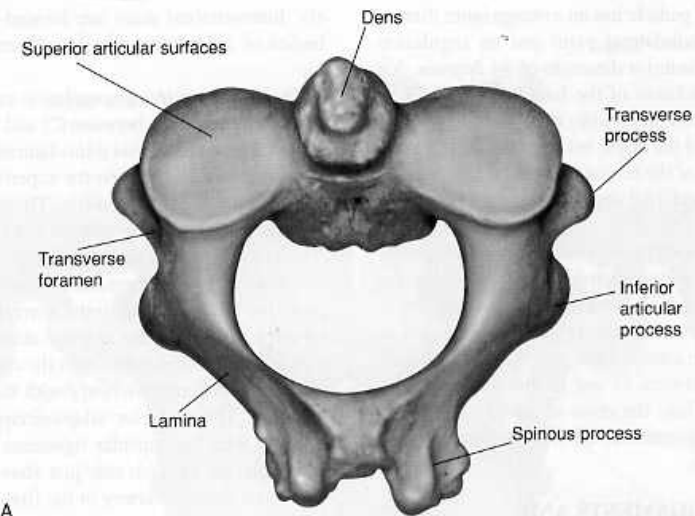


FIG. 1-4. The atlas. A. Cranial view. B. Caudal view of the atlas.

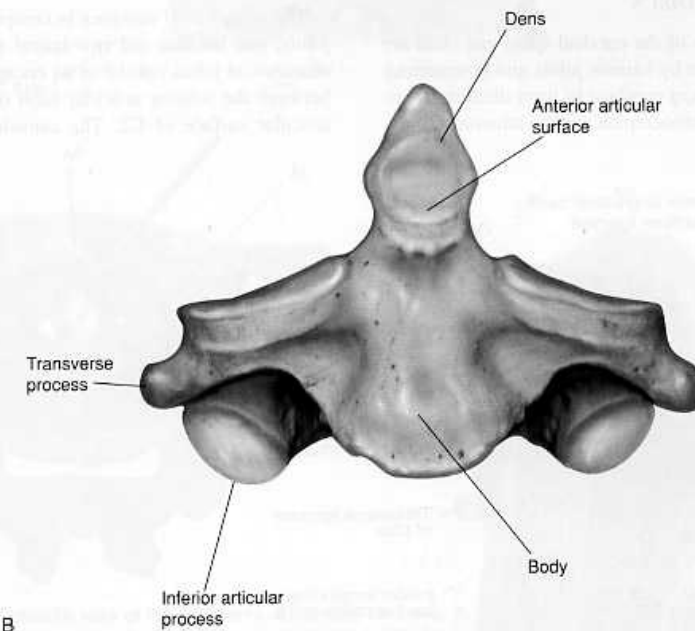
❖ C2 : the axis

❖ Characterised by the dens or odontoid process, projecting up from the body between a pair of massive weight bearing lateral masses

❖ The laminae are thick & rounded & project posteriorly into a massive spinous process



A



B

FIG. 1-5. Cranial (A) and anterior (B) views of the atlas.



Atypical cervical vertebra

❖ *C7 : vertebrae prominens*

❖ prominent spine

❖ Spine is not bifid

❖ foramen in the transverse process does not transmit the vertebral artery



Articulations, ligaments & intervertebral discs

- ❖ Osseous elements of the cervical spine and skull are connected to one another by various joints and ligamentous processes
- ❖ Distinct articular complexes are present at the atlantooccipital & atlantoaxial levels
- ❖ Intervertebral discs are located between the vertebral bodies of all cervical vertebrae, except C1 and C2



Intervertebral discs

- ❖ Fibrocartilagenous joints – shock-absorbing pads between the borders of adjacent cervical vertebrae
 - ❖ Inner nucleus pulposus
 - ❖ Semigelatinous central portion – collagen, connective tissue, cartilage cells, amorphous extracellular material
 - ❖ Outer circumferential annulus fibrosis
 - ❖ Spirally arranged and layered fiber bundles
 - ❖ Separated from the vertebral bone by thin cartilaginous end plate
 - ❖ Thin layer of hyaline cartilage



Acute cervical injuries

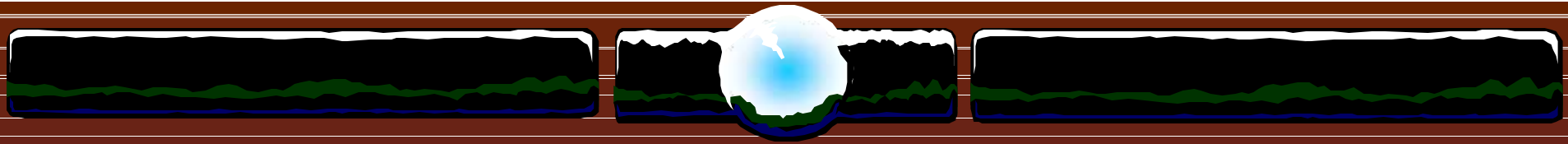
- ❖ With or without neurological deficit

- ❖ Numerous classifications
 - ❖ Biomechanical
 - ❖ Axial loading, flexion, extension, rotation, lateral bending, distraction
 - ❖ Severity of the neurological deficit
 - ❖ Level, incomplete vs. complete paraplegia, incomplete vs. complete quadriplegia
 - ❖ Spinal cord syndromes
 - Central cord syndrome, anterior cord syndrome, Brown-Sequard
 - ❖ Regional
 - ❖ Upper C0-C1-C2, middle C2-C5, lower C5-T1



Screening

- ❖ 1. The presence of paraplegia or quadriplegia is presumptive evidence of spinal instability
- ❖ 2. Patients who are awake, alert, sober, neurologically normal and have no neck pain and have no other painful distracting injury
 - ❖ Extremely unlikely to have an acute c-spine fracture/subluxation
 - ❖ Position patient supine => remove collar & palpate spine => no tenderness, ask patient to voluntarily move neck => no pain, cervical films not mandatory.



- ❖ 3. Patients who are awake & alert, are neurologically normal, but do have neck pain
 - ❖ Perform: lateral, AP, & open-mouth x-rays of the cervical spine and supplementary CT scan.
 - ❖ If normal => dynamic flexion/extension views (with at least 30 degrees excursion in each direction) are safe and effective for detecting the majority of “occult” cervical spine injuries.
 - ❖ If unable to cooperate with dynamic views => maintain in collar until able to be studied by MRI.

- ❖ *It is recommended that cervical spine immobilization in awake patients with neck pain or tenderness and normal cervical spine x-rays (including supplemental CT) be discontinued following:*
 - ❖ *Normal and adequate dynamic flexion/extension views*
 - ❖ *Normal MRI within 48 hours of injury.*



❖ 4. Patients who are comatose or have an altered level of consciousness

- ❖ All such patients should *at least* have a lateral and an AP c-spine x-ray.
- ❖ Cervical spine immobilization with normal x-rays (including supplemental CT) may be discontinued:
 - ❖ Following dynamic flexion/extension studies under fluroscopic guidance
 - ❖ Following a normal MRI study obtained within 48 hours of injury; or
 - ❖ At the discretion of the treating physician

5. When in doubt, leave the collar on



❖ 6. Consult:

- ❖ The neurosurgery or orthopaedic service should be consulted in all cases where a spinal injury is detected or suspected.

❖ 7. Never force the neck:

- ❖ Under no circumstances should a patient's neck be forced into flexion or extension. When performed voluntarily by the patient these maneuvers are generally safe.

❖ 8. Emergency situations:

- ❖ Eg.: presence of an intracranial haematoma => patient may be rushed to theatre before a complete work-up of the c-spine can be completed. Leave collar on and move patient as though a spinal fracture were present. Neck should be protected throughout the operation.

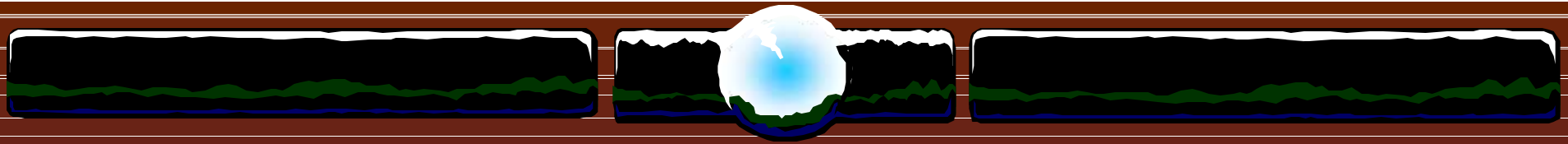


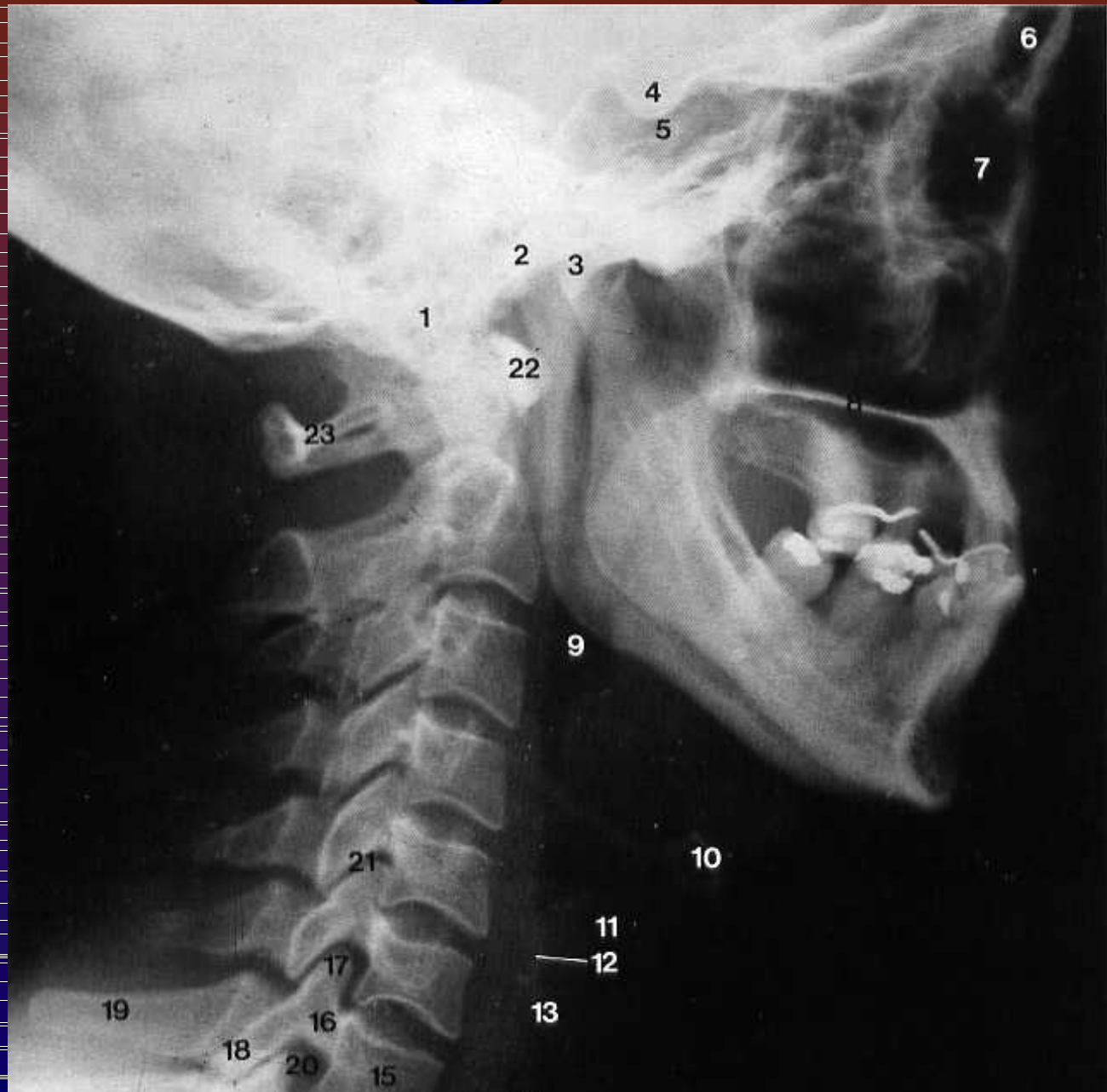
- ❖ 9. Assessment of the C-spine film

- ❖ A. Bony deformity
- ❖ B. Fracture of the vertebral body or processes
- ❖ C. Loss of alignment of the posterior aspect of the vertebral bodies
- ❖ D. Increased distances between the spinous processes at one level
- ❖ E. Narrowing of the vertebral canal
- ❖ F. Decreased disc space height
- ❖ G. Loss of cervical lordosis
- ❖ H. Increased prevertebral soft-tissue space.

- ❖ 10. Beware the noncontiguous vertebral column fracture

- ❖ Approximately 10% of patients with a c-spine fracture have a second noncontiguous vertebral column fracture (and vice-versa).
- ❖ Complete radiographic screening of spine







Management

❖ 1. Immobilization

- ❖ Reduces the likelihood of neurological deterioration in patients with unstable cervical spine injuries
- ❖ Immobilization of the entire spinal column is necessary until a spinal column injury or a spinal cord injury has been excluded
- ❖ Technique: rigid cervical collar with supportive blocks on a rigid backboard with straps for transport



❖ 2. Intravenous fluids

- ❖ Maintenance levels unless shocked
- ❖ NB.: Quadriplegic patient may *fail* to become tachycardic, as a result of loss of cardiac sympathetic tone
- ❖ Hypovolaemic shock: tachycardic
- ❖ Neurogenic shock: bradycardic
- ❖ Shocked – fluid challenge +/- vassopressors
- ❖ Overzealous fluid administration may cause pulmonary oedema in SCI
- ❖ Fluid status uncertain: consider Swann-Ganz catheter
- ❖ Monitor urine output with urinary catheter – removed a few days later, with intermittent catheterization



4. Pharmacotherapy

❖ Steroids:

- ❖ Lack of conclusive evidence for “*a significant clinical benefit from the administration of methylprednisolone in the treatment of patients after ASCI for either 24 or 48 hours*”
- ❖ the neurological recovery benefit of methylprednisolone when administered within 8 hours has been “*suggested but not convincingly proven*”
- ❖ “*significant increase in severe medical complications*”
- ❖ Concluded:
 - ❖ “*methylprednisolone in the treatment of acute human SCI is recommended as an option that should only be undertaken with the knowledge that the evidence suggesting harmful side effects is more consistent than the suggestion of clinical benefit.*”

❖ GM-1 Ganglioside

- ❖ Lack of convincing evidence



5. Transfer

- ❖ Optimal care:
 - ❖ Early transfer to a definitive care facility post resuscitation & immobilization
 - ❖ Cervical spinal cord injuries \Rightarrow high incidence of airway compromise and pulmonary dysfunction
 - ❖ ? Tubed
 - ❖ If not, respiratory support measures available in transit



6. Definitive stabilization

- ❖ Reduction
 - ❖ Free cord compression
- ❖ Closed reduction
 - ❖ Early closed reduction of cervical spinal fracture-dislocation injuries with cranio-cervical traction is recommended for the restoration of anatomic alignment of cervical canal
 - ❖ Permanent neurological complication rate 1%
 - ❖ If fails, require a detailed radiological study prior to:
- ❖ Open reduction
 - ❖ Presence of significant disc herniation a relative indication for an open anterior decompression procedure

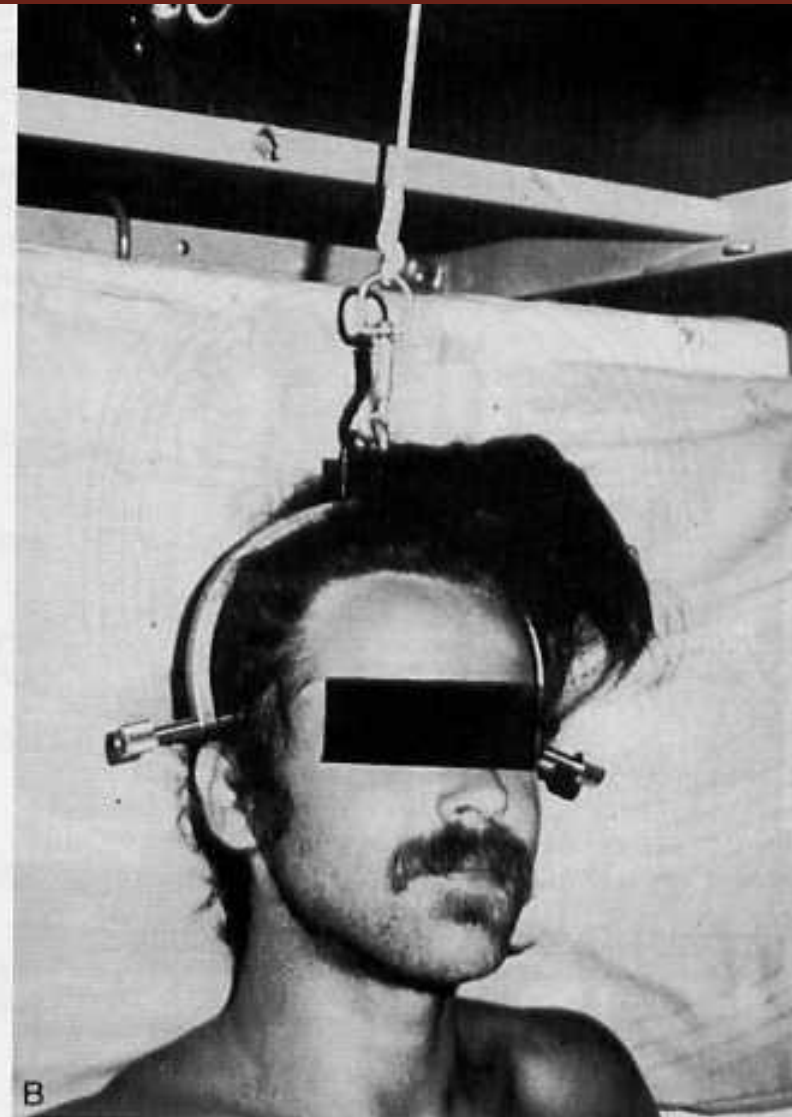
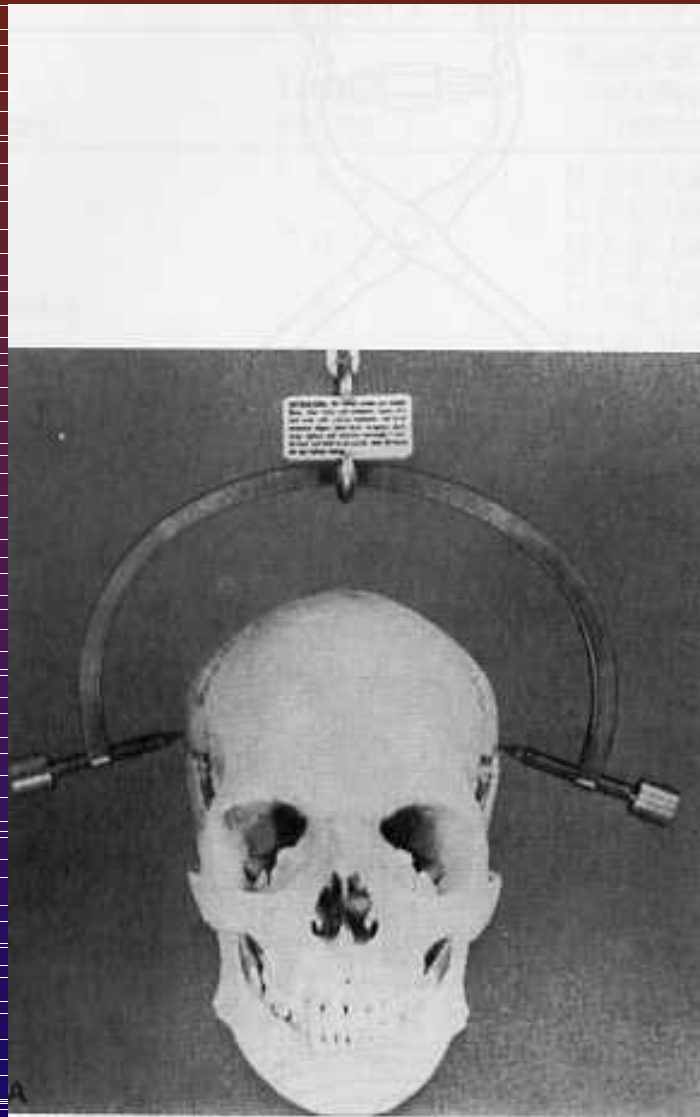


FIG. 7-15. A and B. Gardner-Wells tongs. Instructions for use are printed on the tongs. The points are directed upward to decrease the risk of pulling out. One pin is spring loaded to indicate 30 pounds of pressure.



The future

❖ Superman

- ❖ Adult CNS contains a population of cells that can be purified, expanded and transplanted and under specific conditions form synaptic connections
 - ❖ => stem cell transplantation
- ❖ Adult CNS myelin inhibits the the sprouting of mature & injured axons
 - ❖ => antibodies against myelin-associated growth inhibitors
- ❖ Neural transplantation
 - Injured regions of cord may be “bypassed” by transplanted tissue
 - Surgical grafting