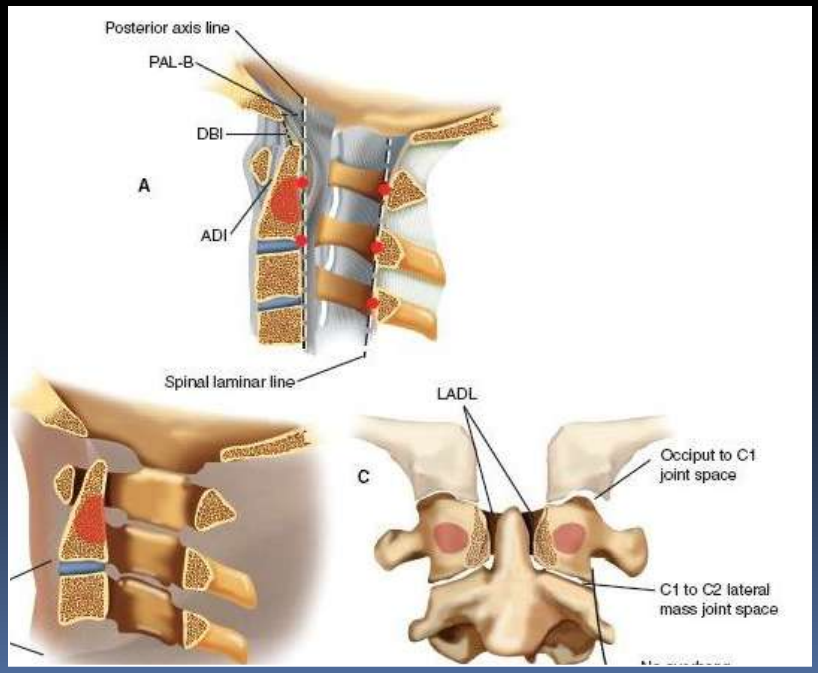
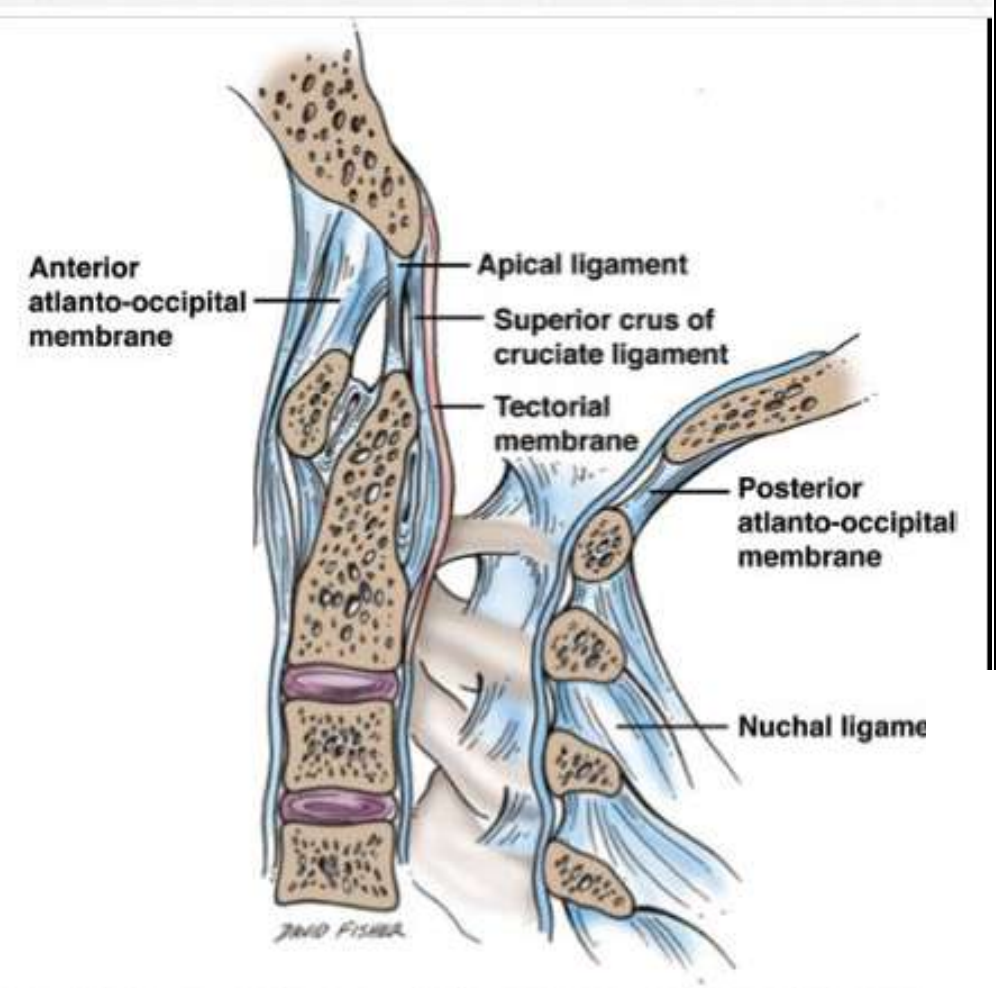
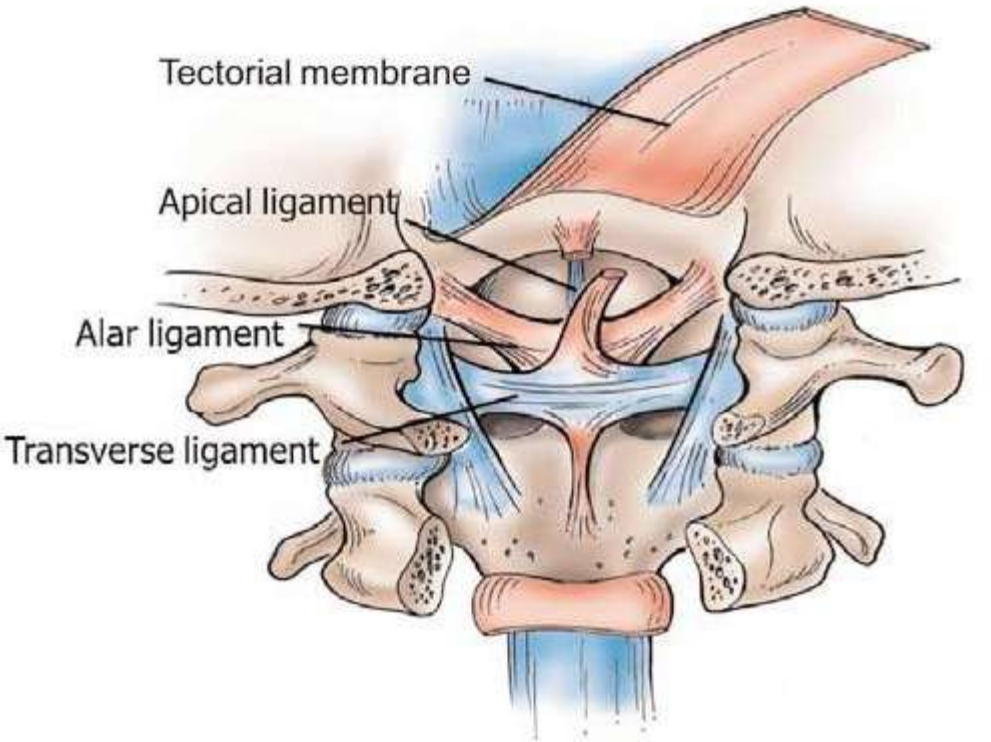
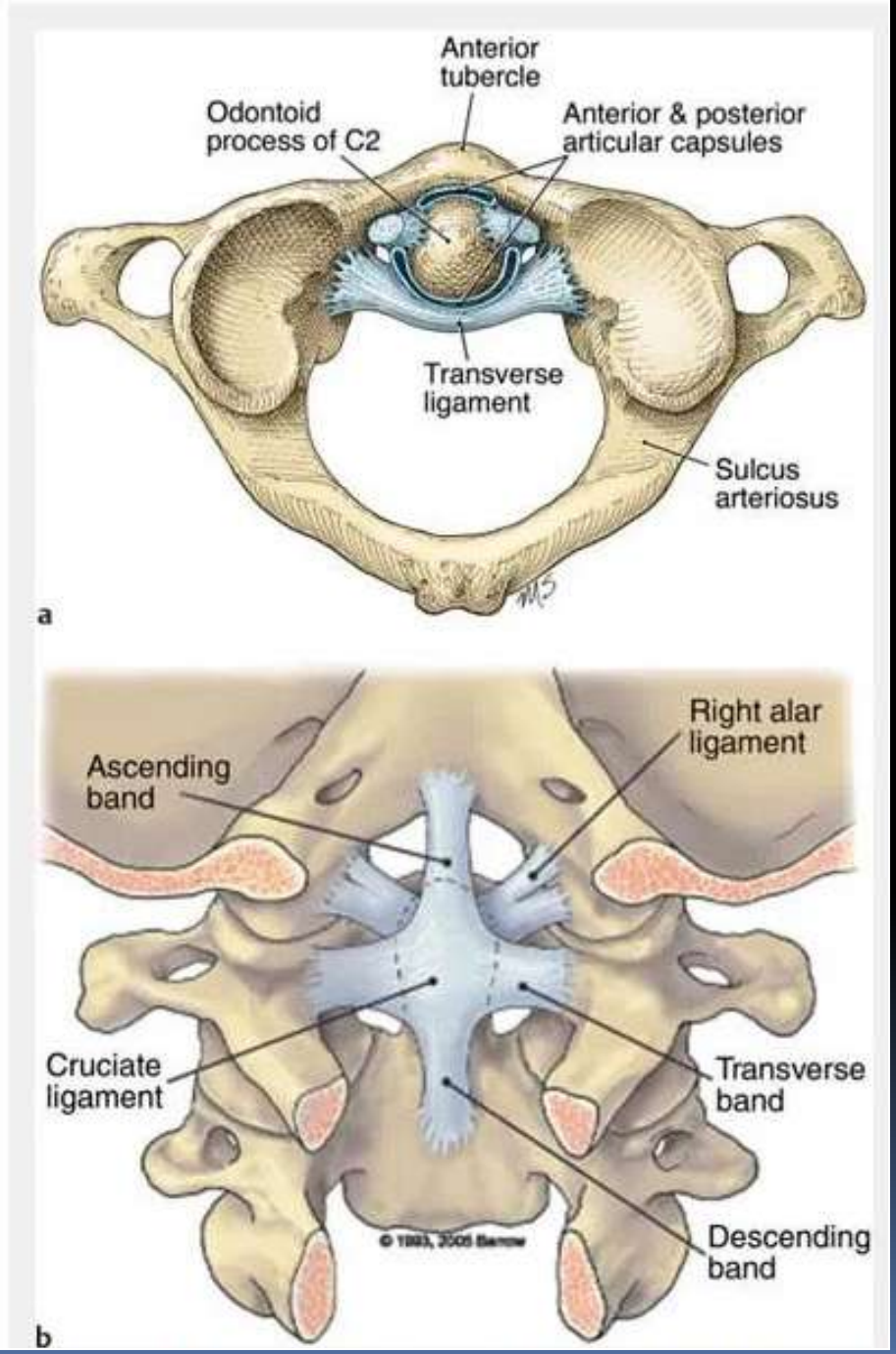
Occipito cervical trauma

- Rare to see the pt in hospital
- 5% - 12% of traffic fatalities
- Pedestrians struck by car

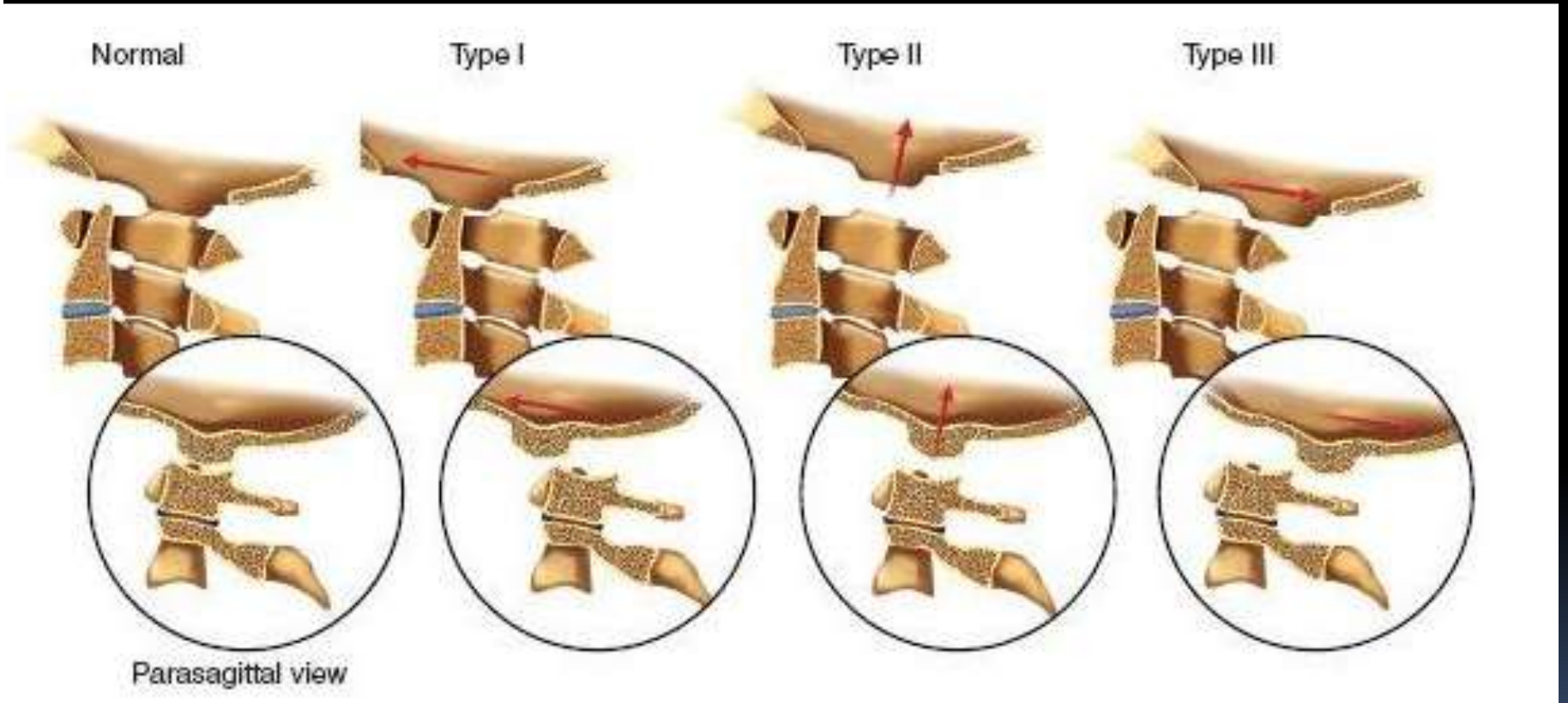


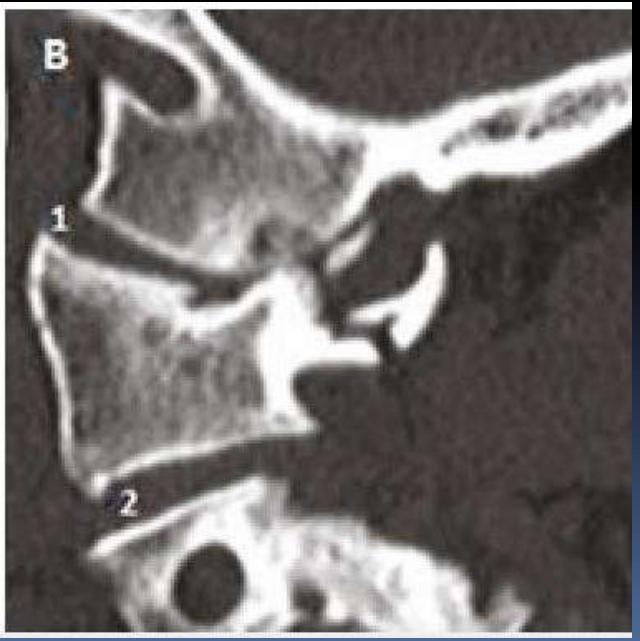




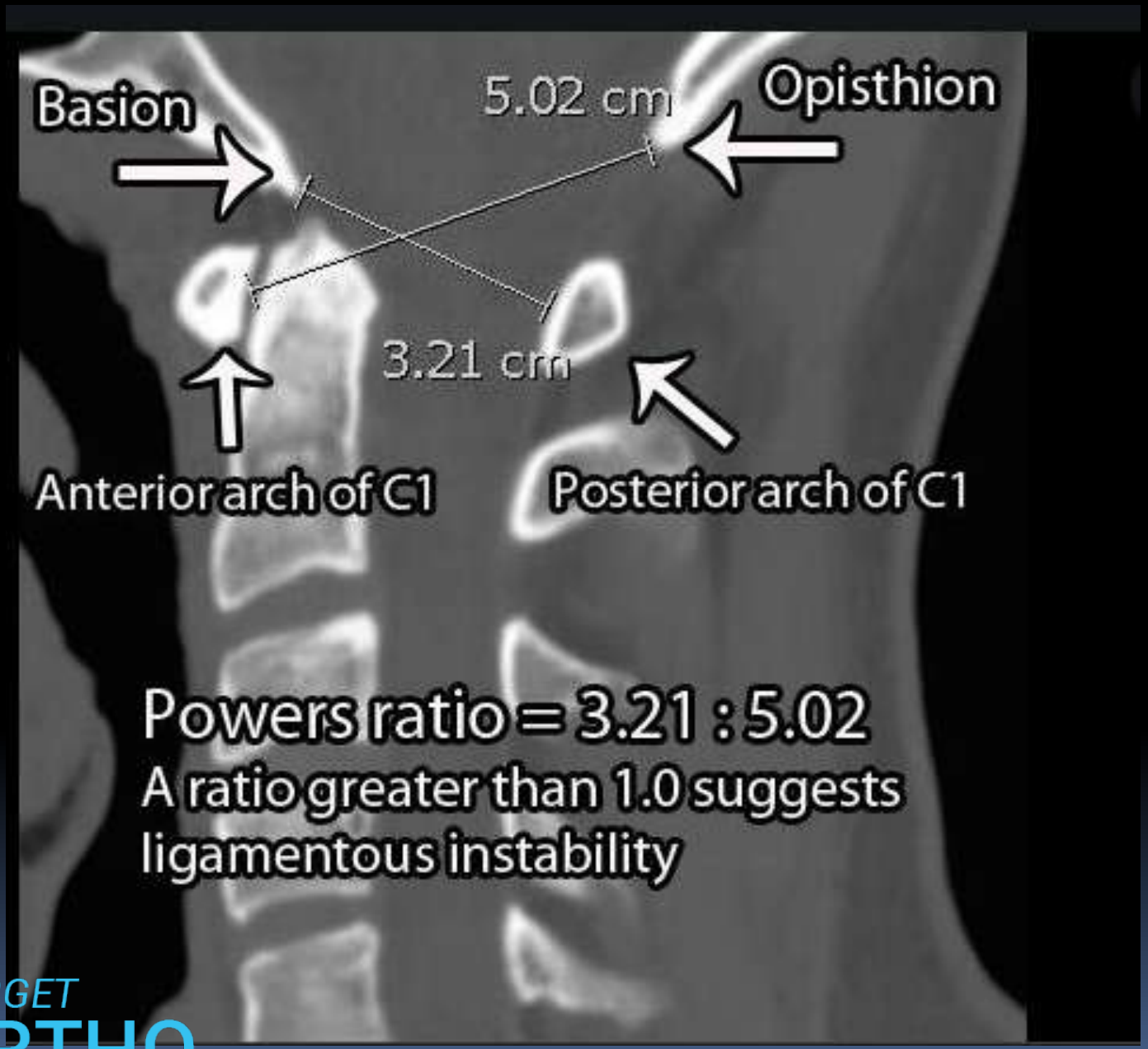


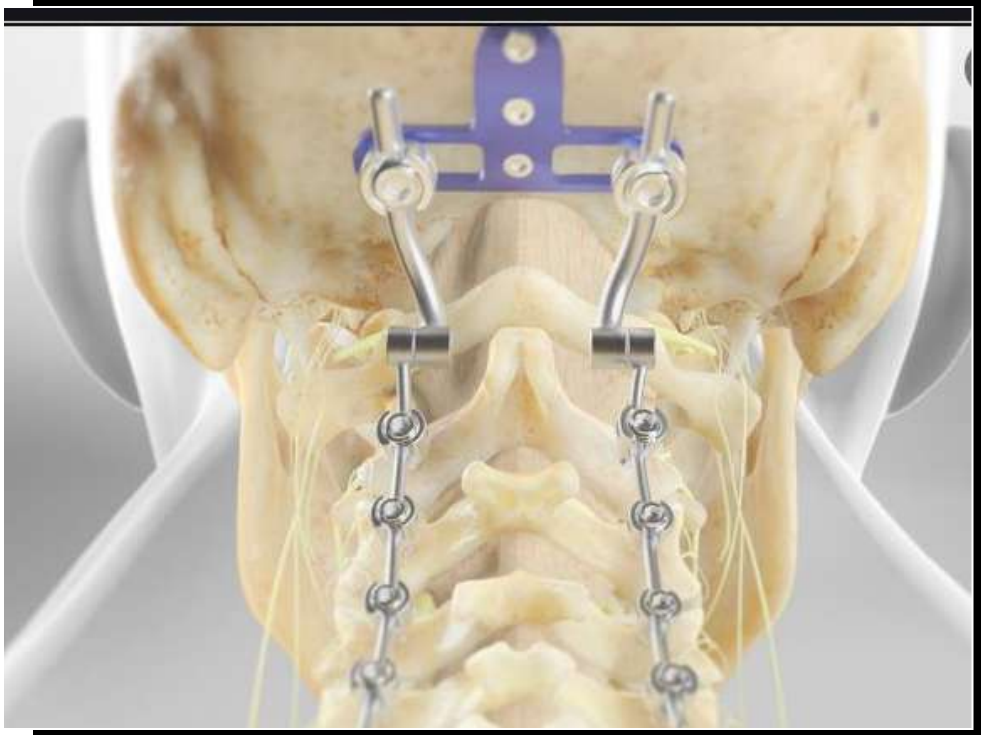
OC dislocations- Traynelis classification



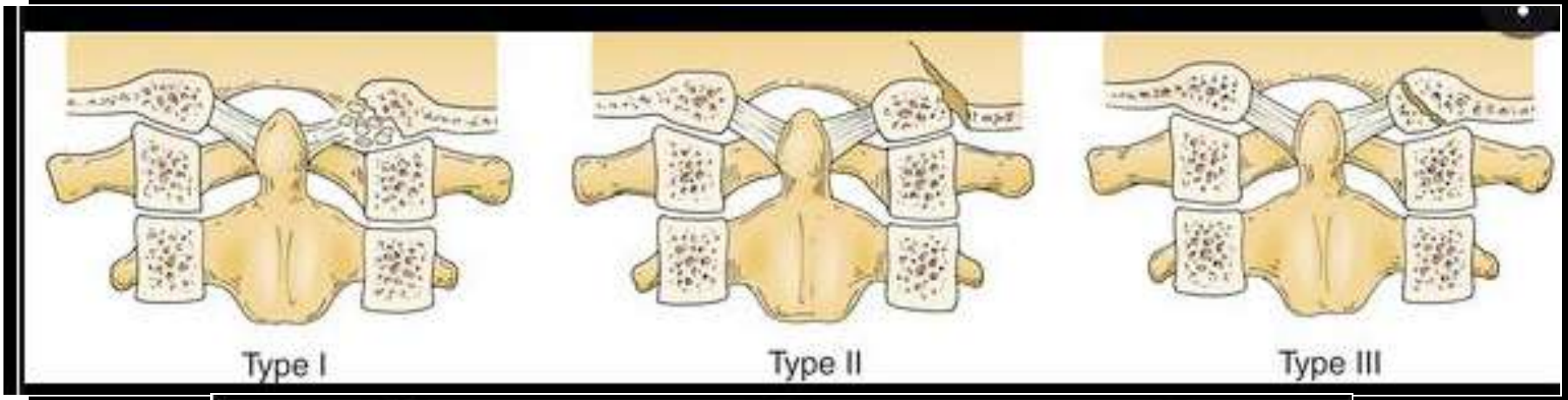


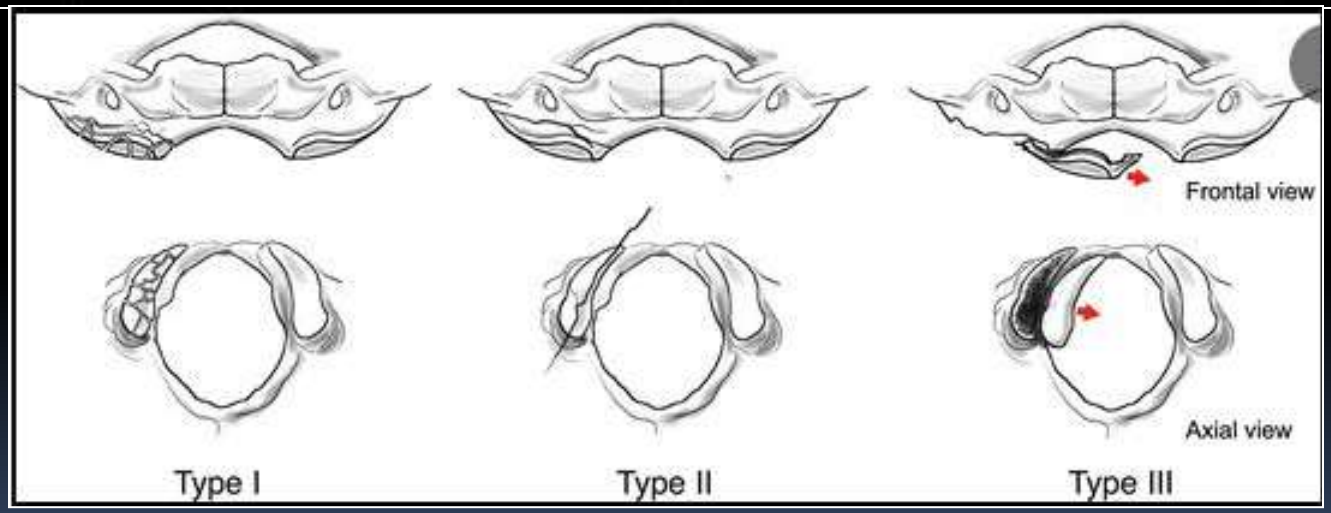
$$\text{Powers ratio} = \frac{AB}{CD}$$



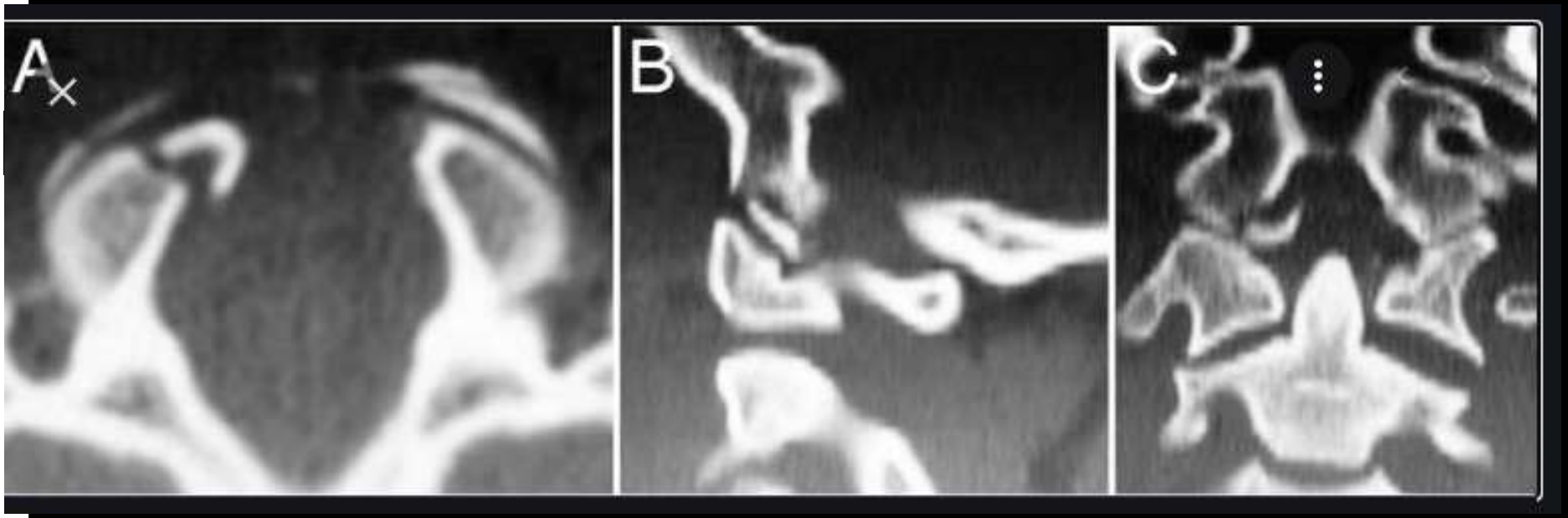


Occipital condyle fracture
Anderson classification





1- axial loading of skull on atlas
2- direct blow to the skull
3- rotation / lateral bending injury

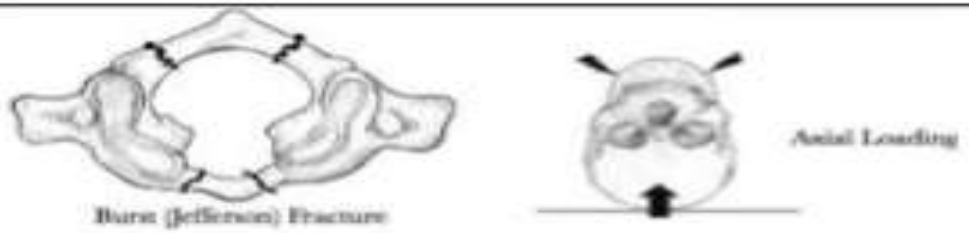
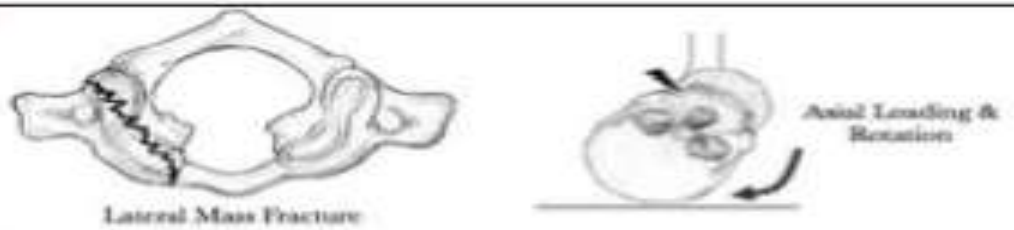


Type 1 & 2 – collar for 6- 8 weeks

Type-3- rigid collar for 8-12 weeks (halo)- associated with **hypoglossal nerve palsy** / **Wallenbergh syndrome** (horners sign, hemiparesis, cerebellar ataxia)

ATLAS FRACTURES

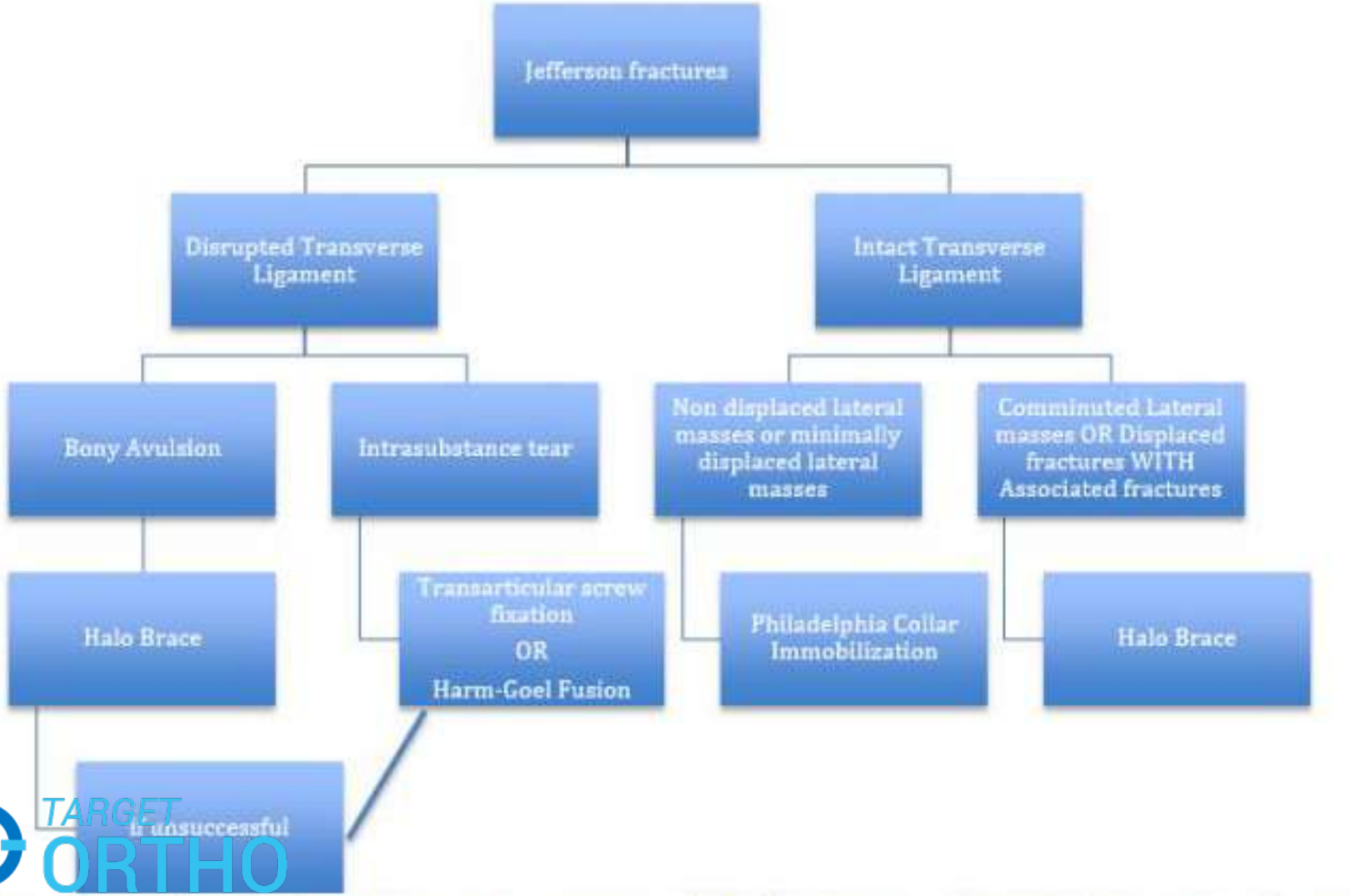
- Burst fracture of the ring of C1 - "Jefferson fracture"
- MOI: **axial loading** is the primary force
  - C1 lateral masses are wedge shaped - axial loading creates a hoop stress and bone failure occurs at the weakest points that are just anterior and posterior to the lateral masses.

TYPE OF INJURY	BIOMECHANICS	LIGAMENT INJURY
CLASSIC Jefferson fracture	Axial loading	 Burst (Jefferson) Fracture
Lateral mass fracture	Axial loading with supraphysiological rotation	 Lateral Mass Fracture
Anterior arch fracture	Pathologocal flexion. Associated with complex injuries of the CVJ	Crutiate ligament damage (all or none phenomenon) Tectorial membrane rupture Dural tears if severe  Anterior Arch Fracture
Posterior arch fracture	Hyperextension Rarest of injuries	Alar ligament, Tectorial membrane, Crutiate ligament, accessory atlantoaxial ligaments exposed to severe shearing stress  Posterior Arch Fracture

Landells and Van Peteghem modified Jefferson's classification

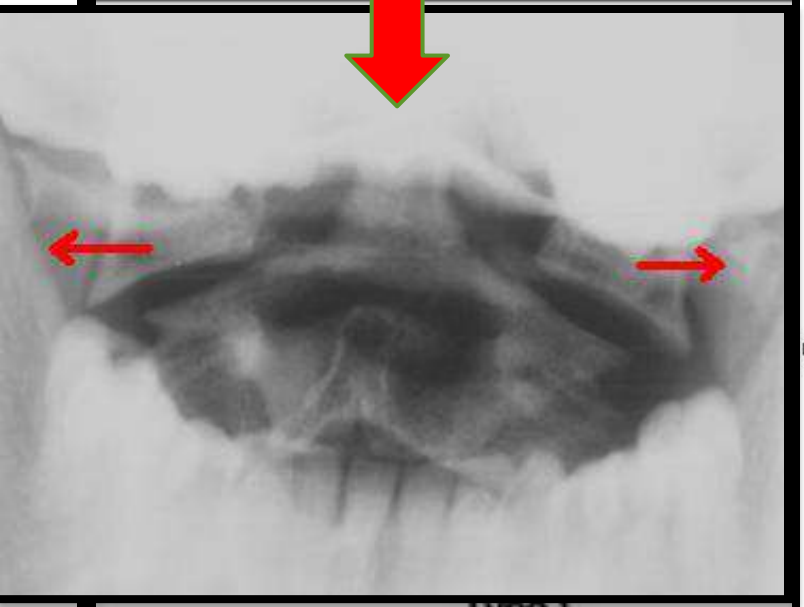
- Type I : isolated anterior or posterior arch fractures
- Type II : involve the anterior and posterior portion of the ring
- Type III: involve the lateral mass with or without a fracture of the ring.

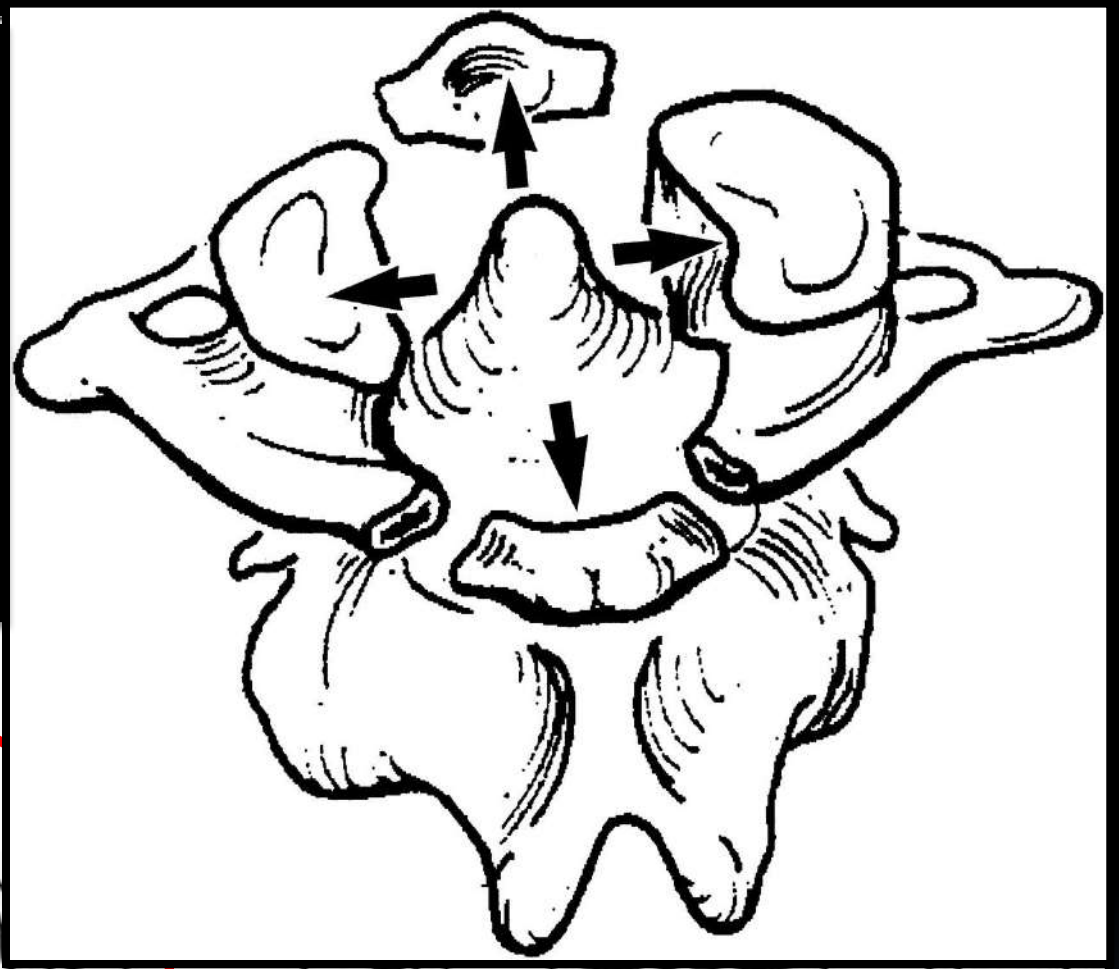
- Treatment



Jeffersons fracture

- Jefferson - burst fracture of the atlas
- First described in 1920.
- Jefferson's fractures represent **3% to 13%** of all cervical spine injuries .
- Associated with **odontoid or C2 pars fracture** fractures in 40 to 50%.

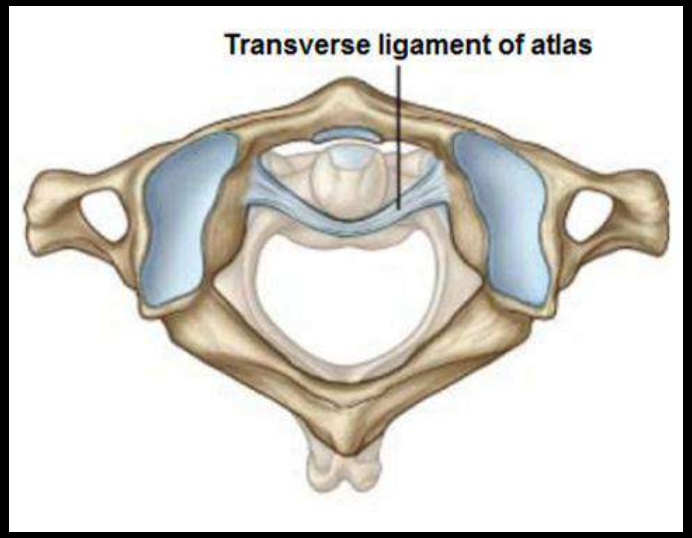




Type I

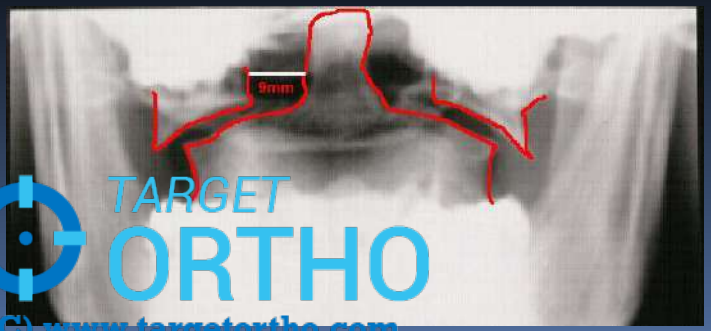
Type III

Type IV



- Transverse ligament Insufficiency - dislocation of the lateral masses – Displacement of >8mm

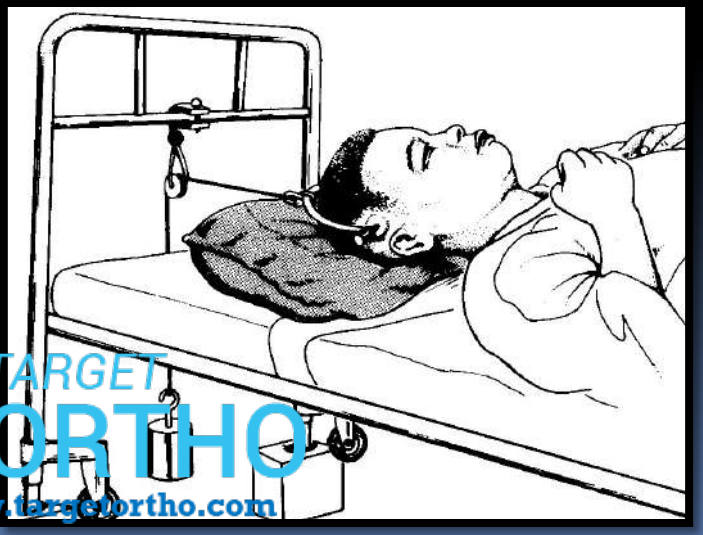
- Atlanto-occipital and atlanto-axial incongruity

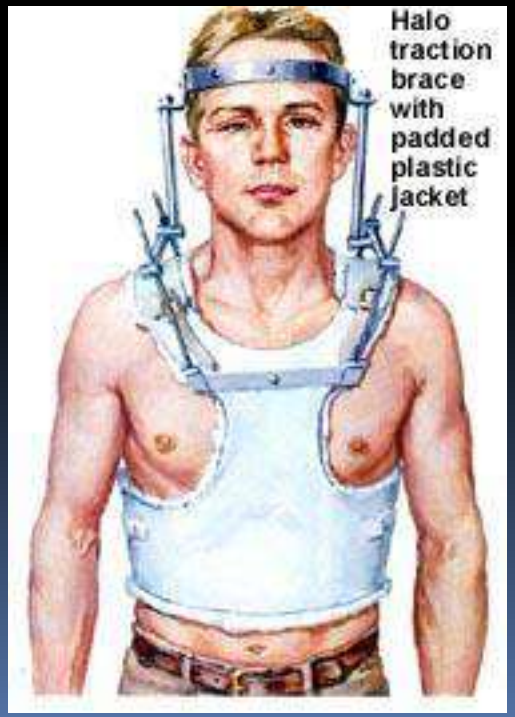


- Atlanto-axial instability.

Treatment

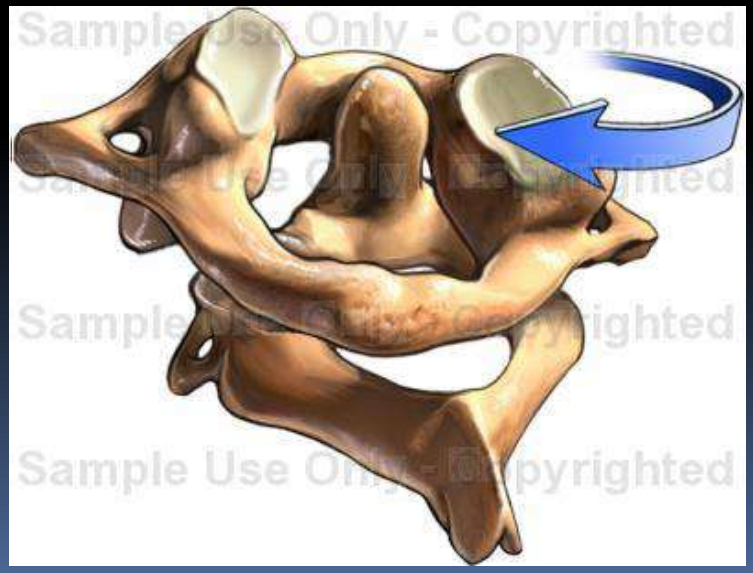
- Achieving union of C1 arch – regains stability in spite of transverse ligament rupture
- Unstable C1 burst – prolonged traction in bed for 6 weeks – then halo vest for 6 weeks
- Less popular than it was previously.





Treatment

- Posterior C1-C2, or Co-C2 fusion.
- Advantage - simpler and familiar approach & low complication rate .
- Disadvantage - severe restriction of cervical motion .



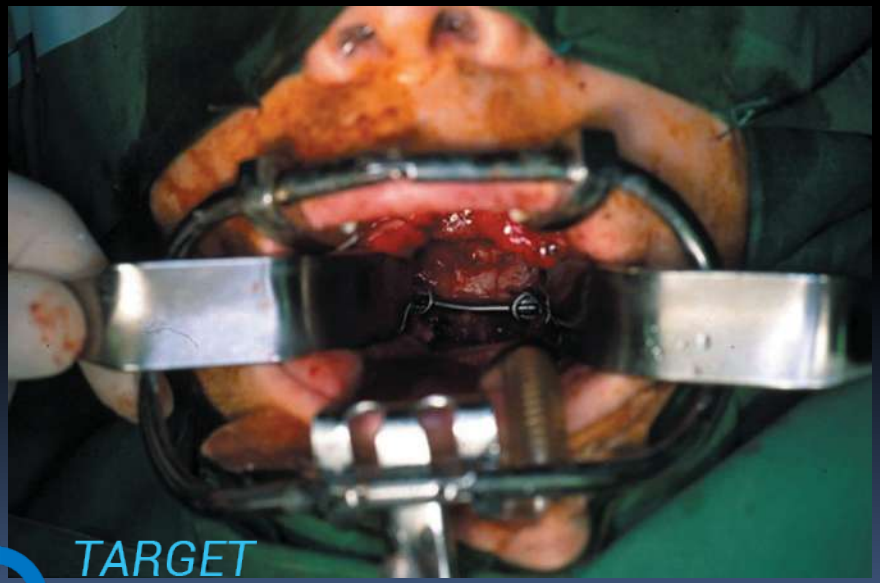
SPINE Volume 29, Number 7, pp 823–827

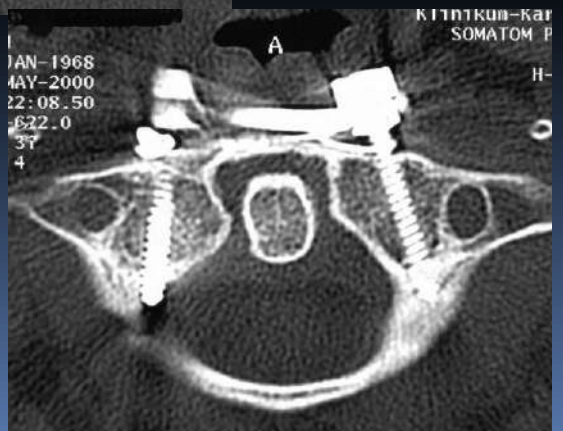
Transoral Reduction and Osteosynthesis C1 as a Function-Preserving Option in the Treatment of Unstable Jefferson Fractures

Michael Ruf, MD, Robert Melcher, MD, and Jürgen Harms, MD

- Anterior reduction and C1 osteosynthesis by a transoral approach

Union without movement restriction.





SPINE Volume 29, Number 7, pp 823–827

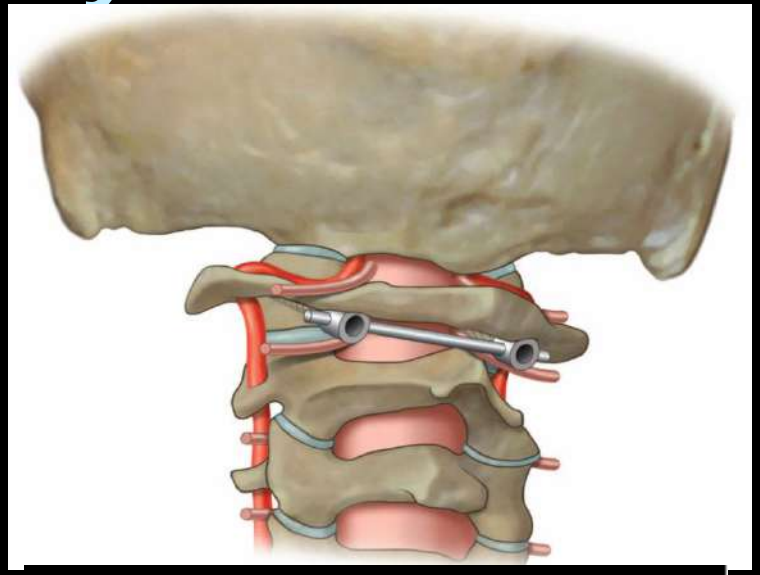
Transoral Reduction and Osteosynthesis C1 as a Function-Preserving Option in the Treatment of Unstable Jefferson Fractures

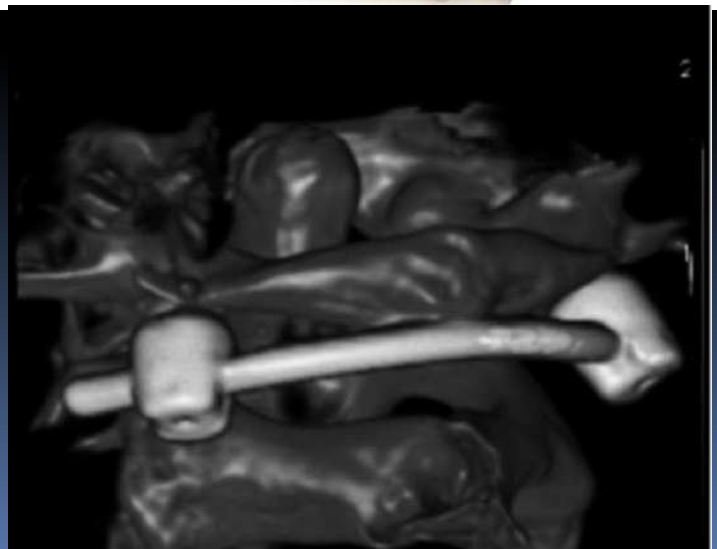
Michael Ruf, MD, Robert Melcher, MD, and Jürgen Harms, MD

- High complication rate - 75% in the literature.
- Wound complications, Ventilation, swallowing, and speech difficulties.
- Anterior approach – less familiar , complex and its morbidity remains high

Navigation based Posterior C1 Osteosynthesis

- Safer surgical stabilisation of C1
- Retaining the movement
- Familiar approach



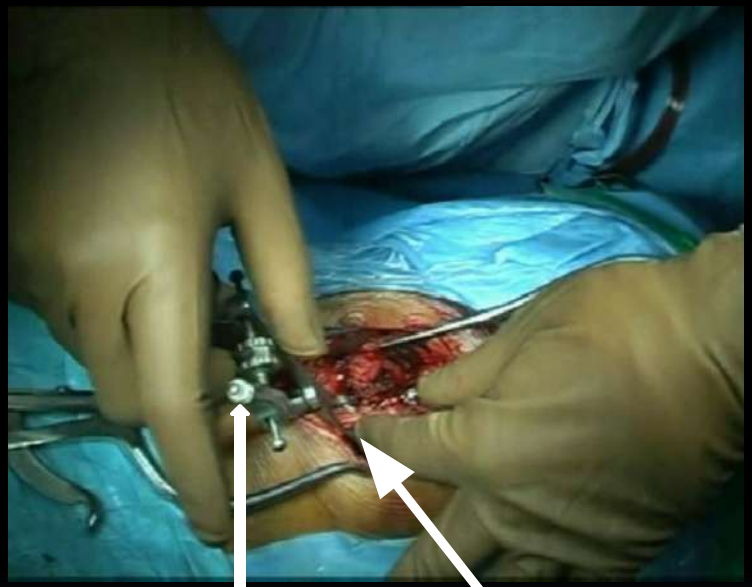


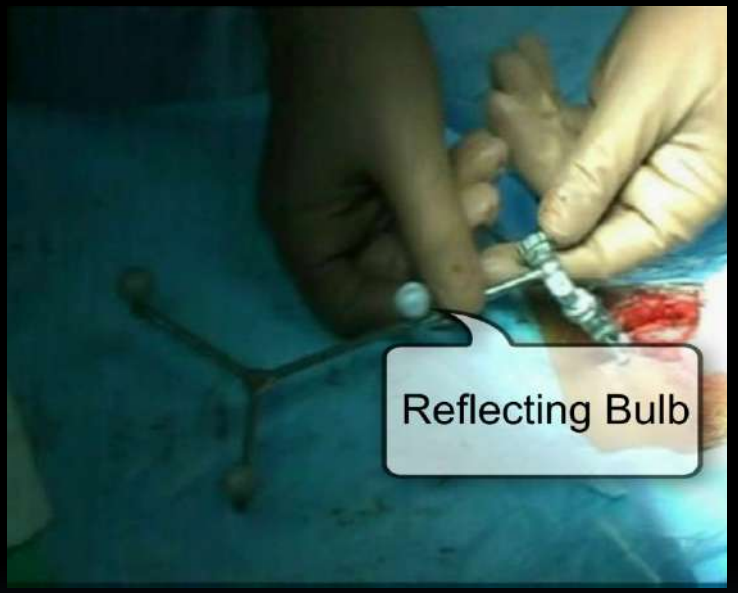
Operative procedure

- Prone position over a carbon fiber radiolucent operating table (Hobo, China),.
- Head stabilised by mayfield clamp

- Reduction achieved by longitudinal traction.
- The posterior elements of C1, C2 and C3 are exposed through a posterior midline approach.

The MIRA assembly





Clamp Spinous process

The minimally invasive reference array (MIRA) is attached to the base of C_3 spinous process.

Registration process

Iso C 3D C arm - capturing images

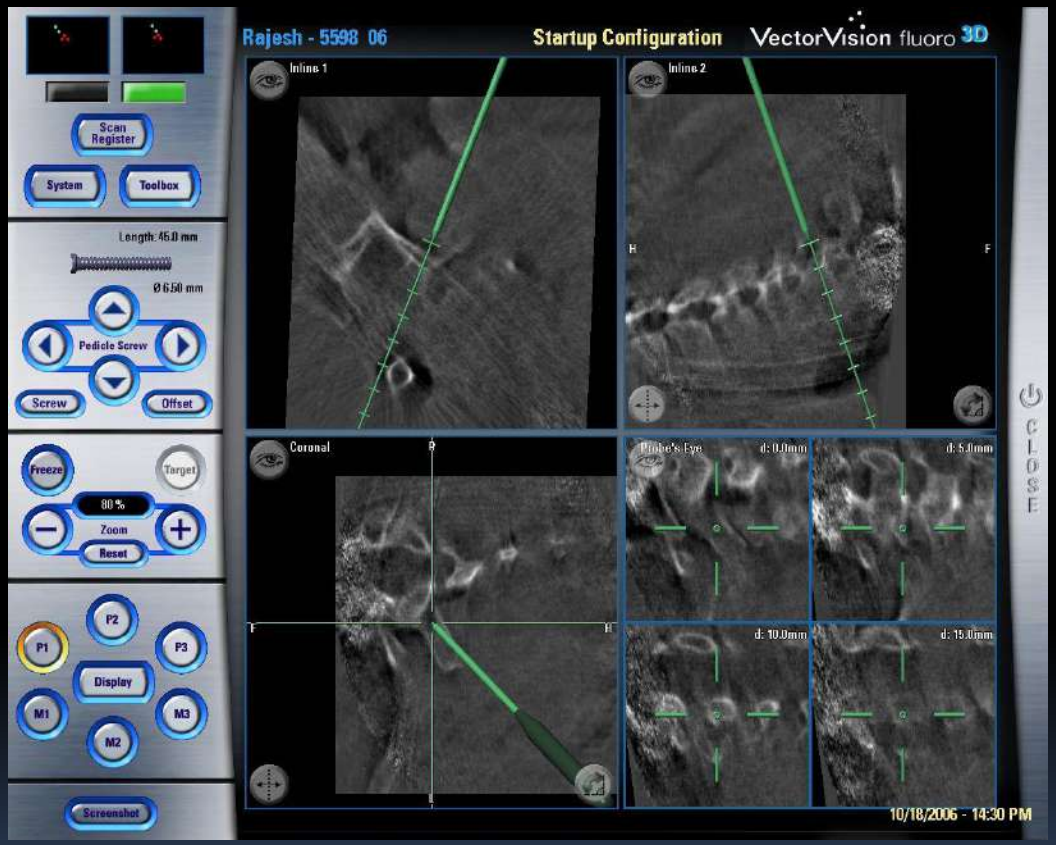
Electro optic cameras

Computer work station

Operative field

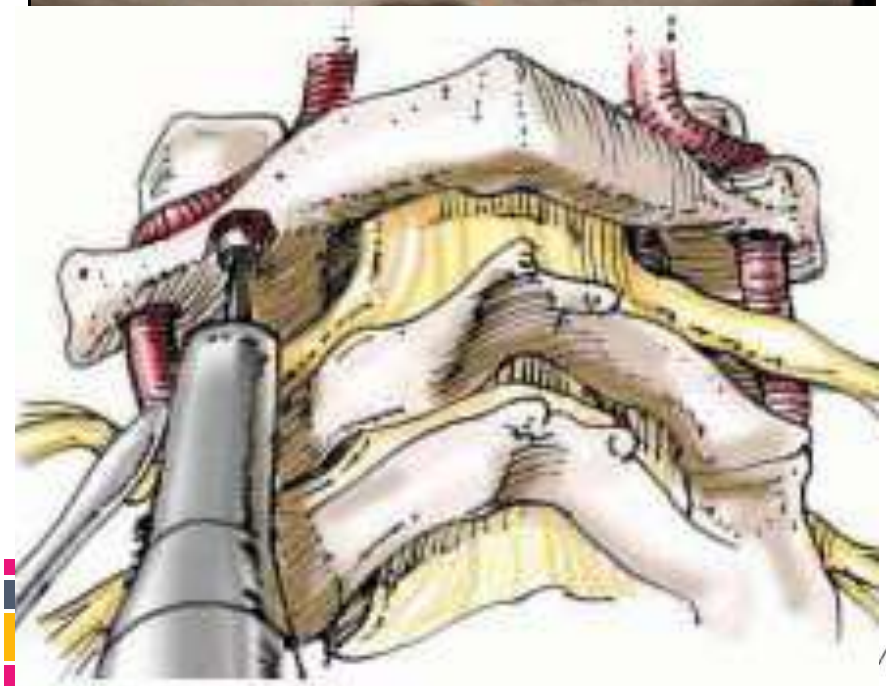
Testing the accuracy of registration

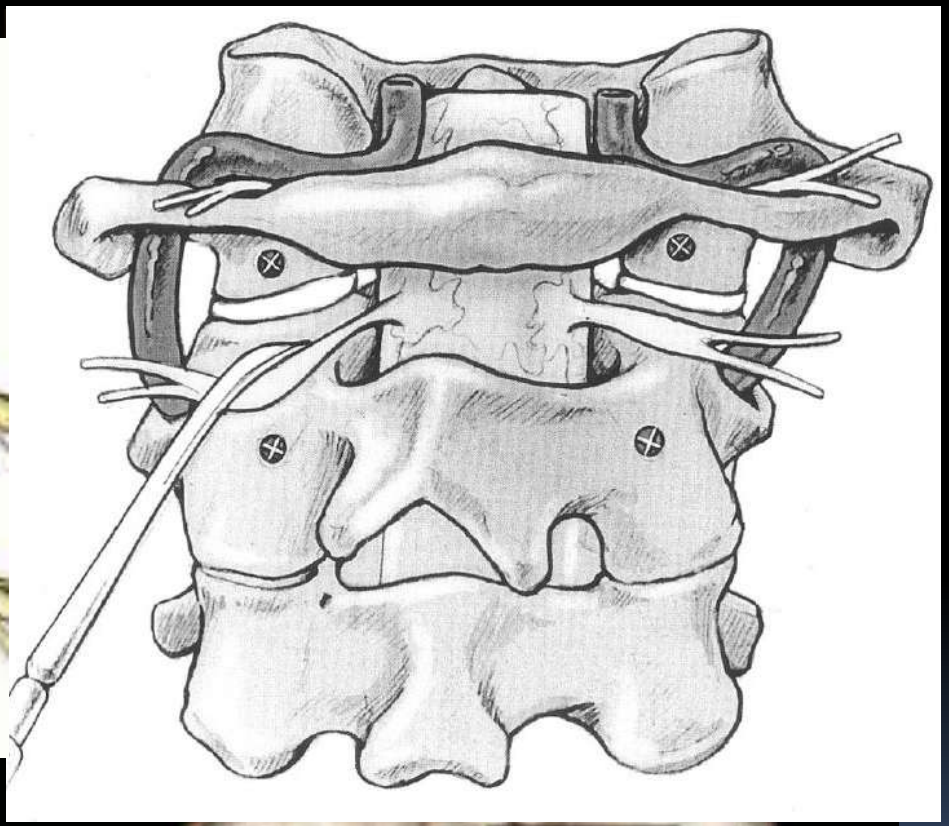
Navigation tool



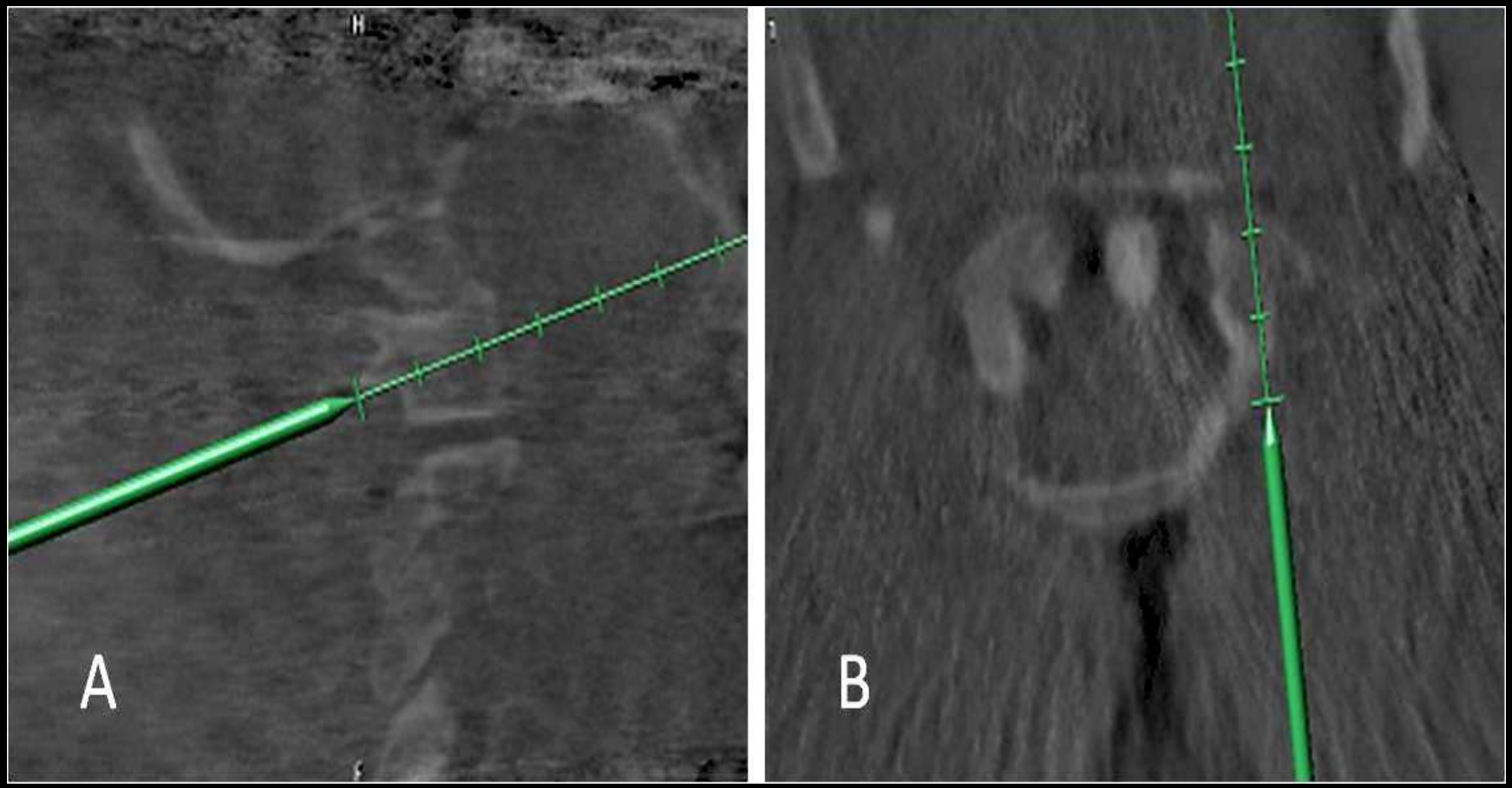
Correlation on the Navigation Platform

Entry points

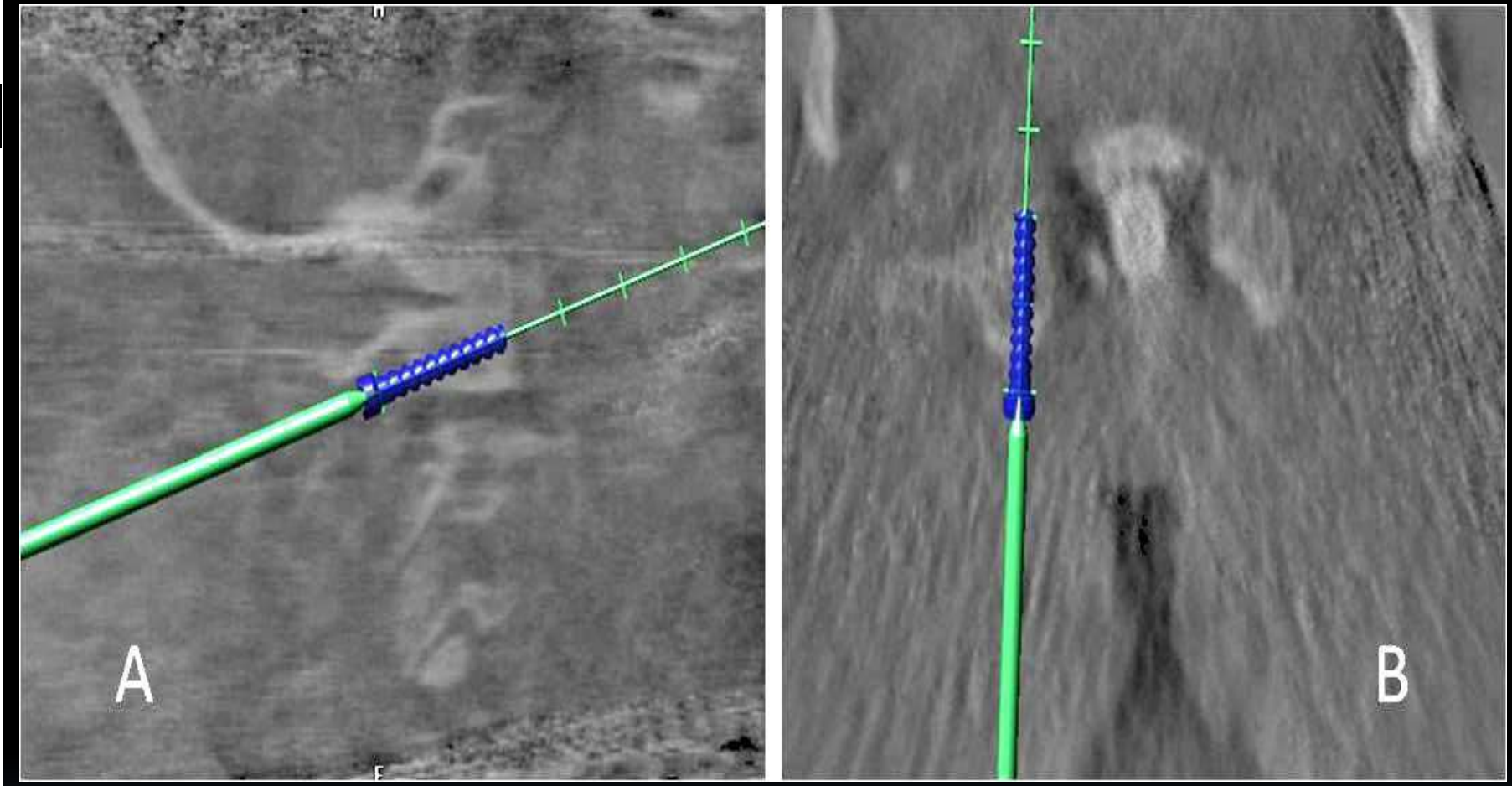




Standard

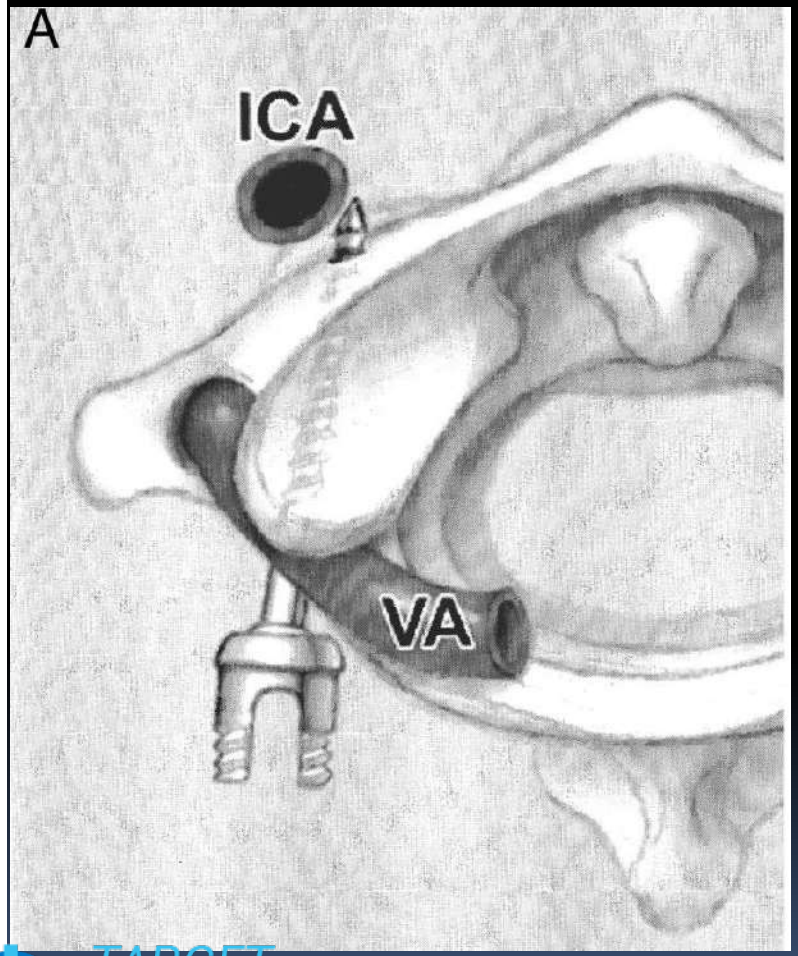


Screws are inserted under navigation guidance which predetermines the trajectory



The diameter and length of the screw required measured accurately.

Atlas – important relations



Vertebral artery (dashed arrow),

Internal carotid artery (long arrow),

Hypoglossal nerve (short arrow).

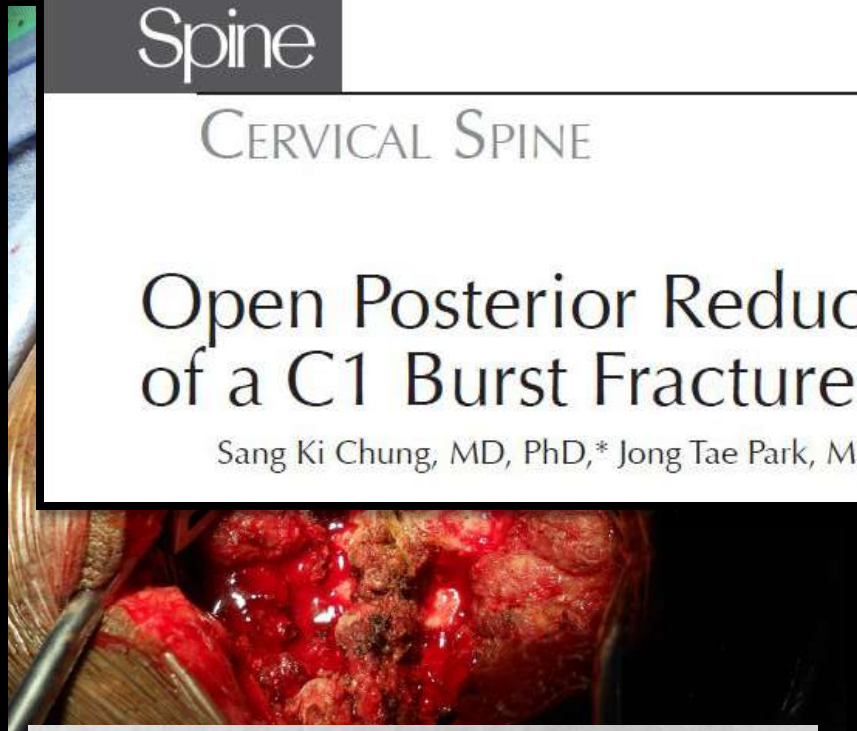
Spine

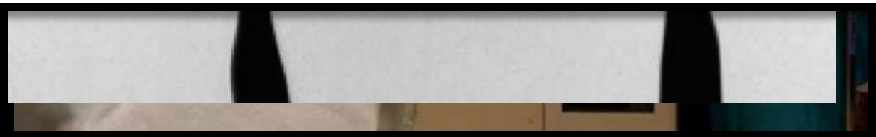
SPINE Volume 36, Number 5, pp E301–E306

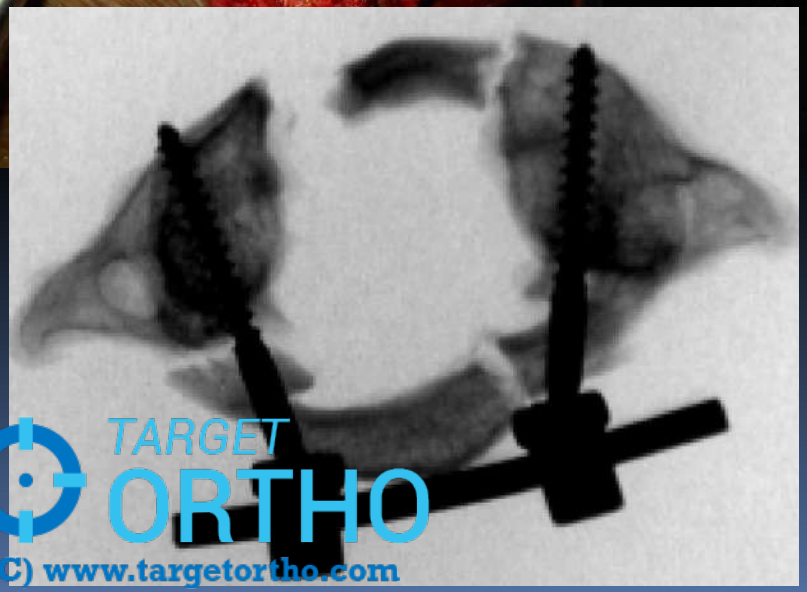
CERVICAL SPINE

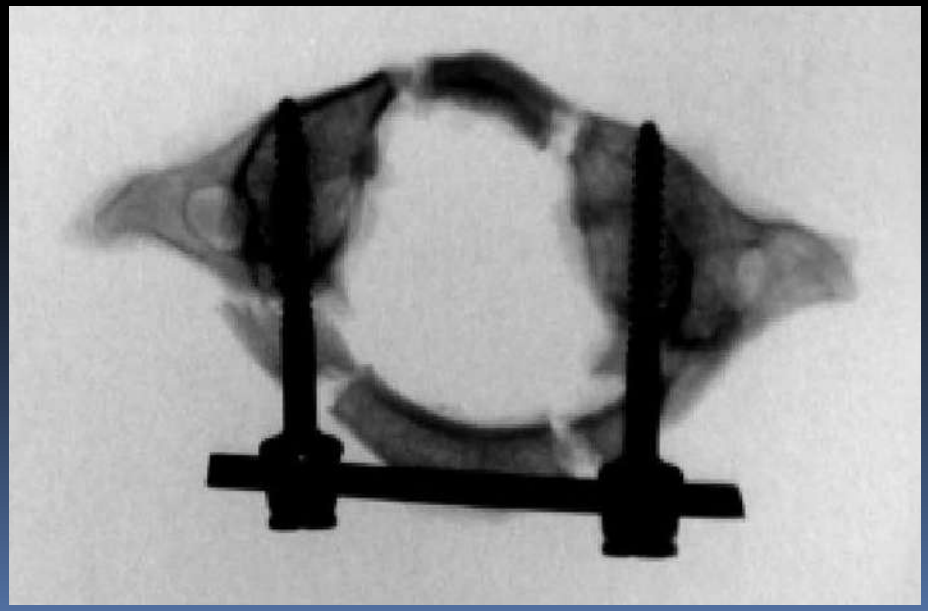
Open Posterior Reduction and Stabilization of a C1 Burst Fracture Using Mono-axial Screws

Sang Ki Chung, MD, PhD,* Jong Tae Park, MD, PhD,† Jesse Lim, PhD,‡ and Jon Park, MD, FRCS(C)‡





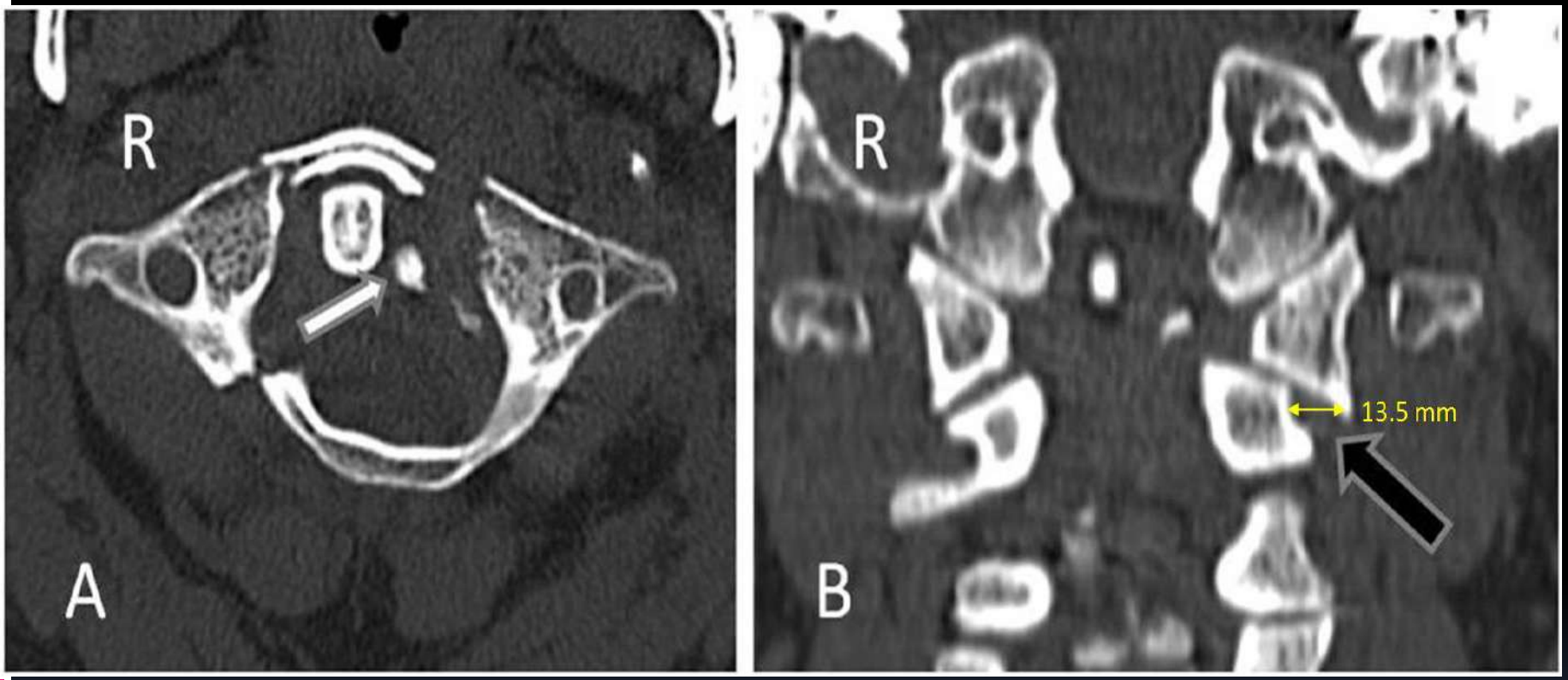




Case-1

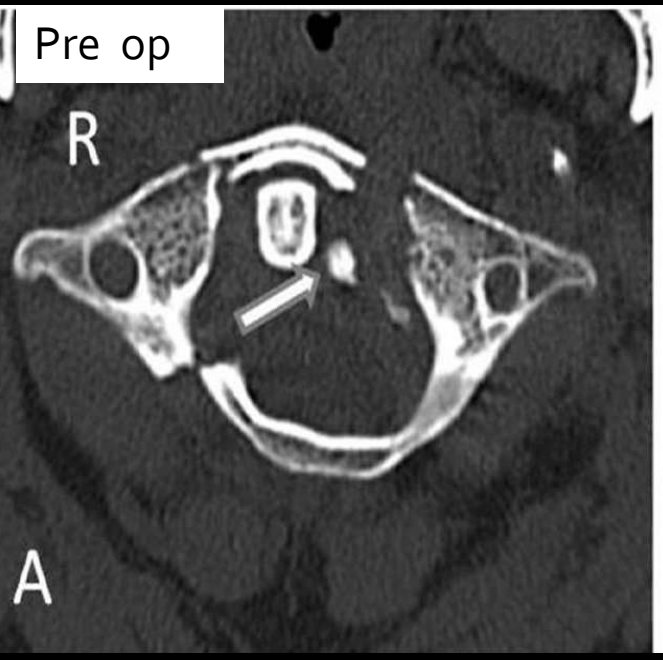
A 45 years male travelling on a two wheeler was hit head-on by a lorry

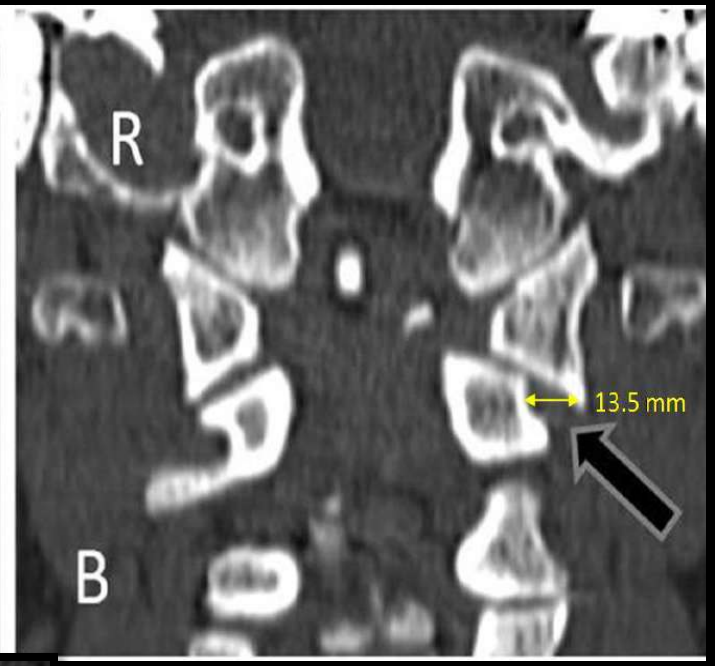
Pre-op CT

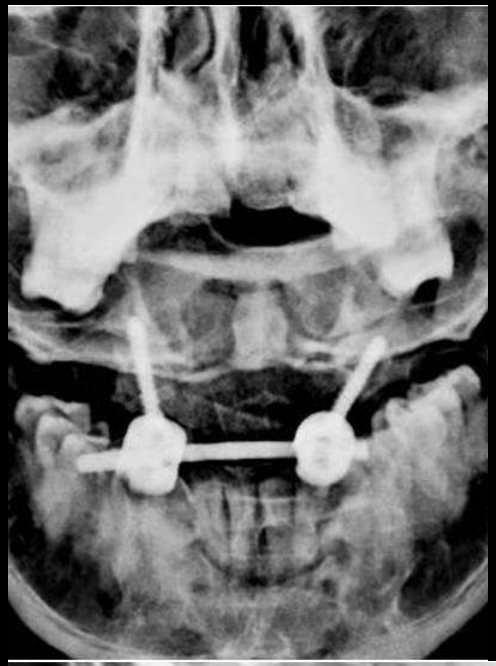


- Total lateral mass overhang of 13.5mm
- Avulsion fracture of the medial edge of the left lateral mass

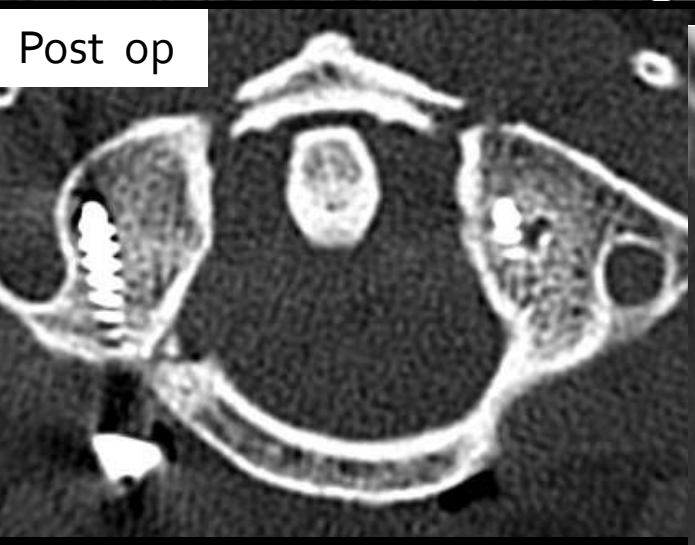
Pre op



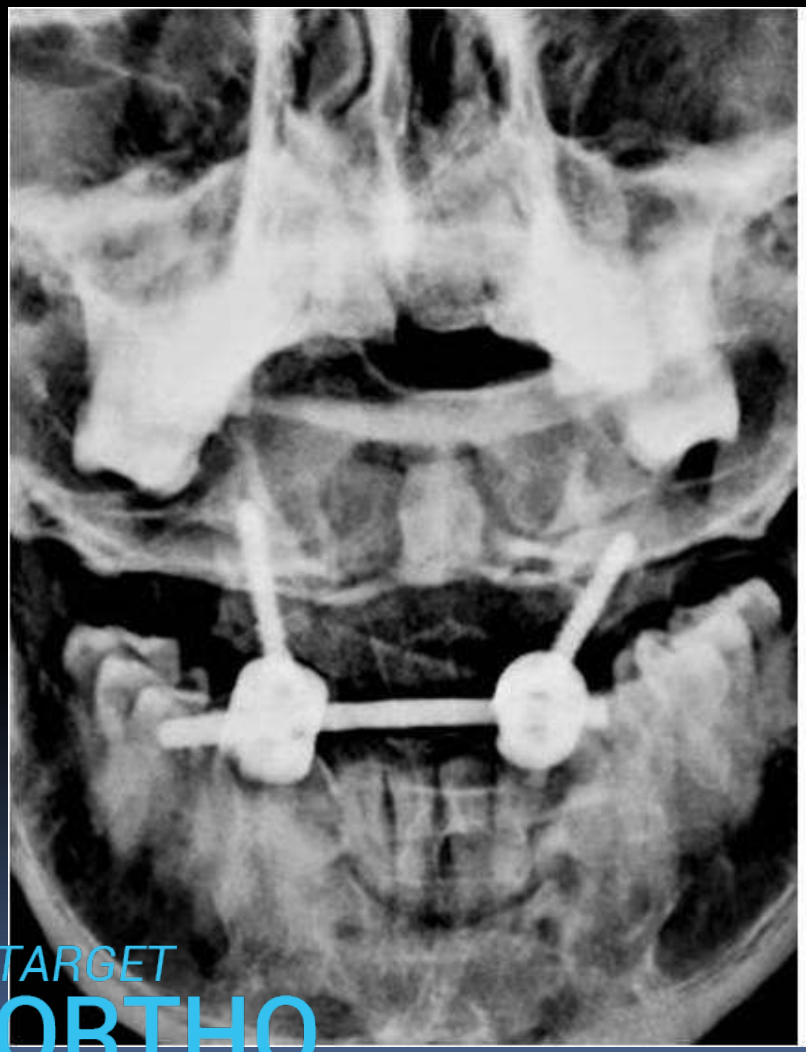




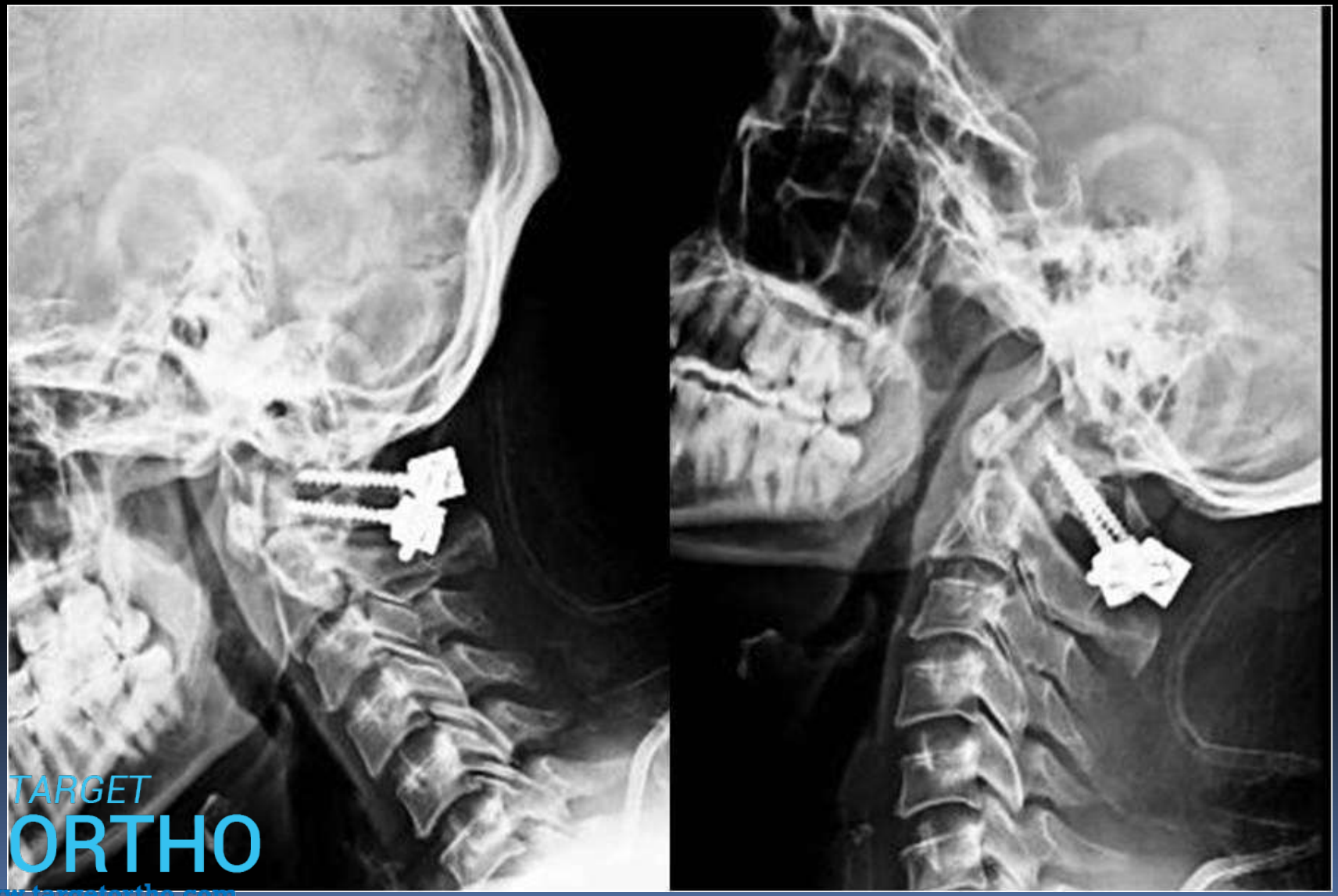
Post op



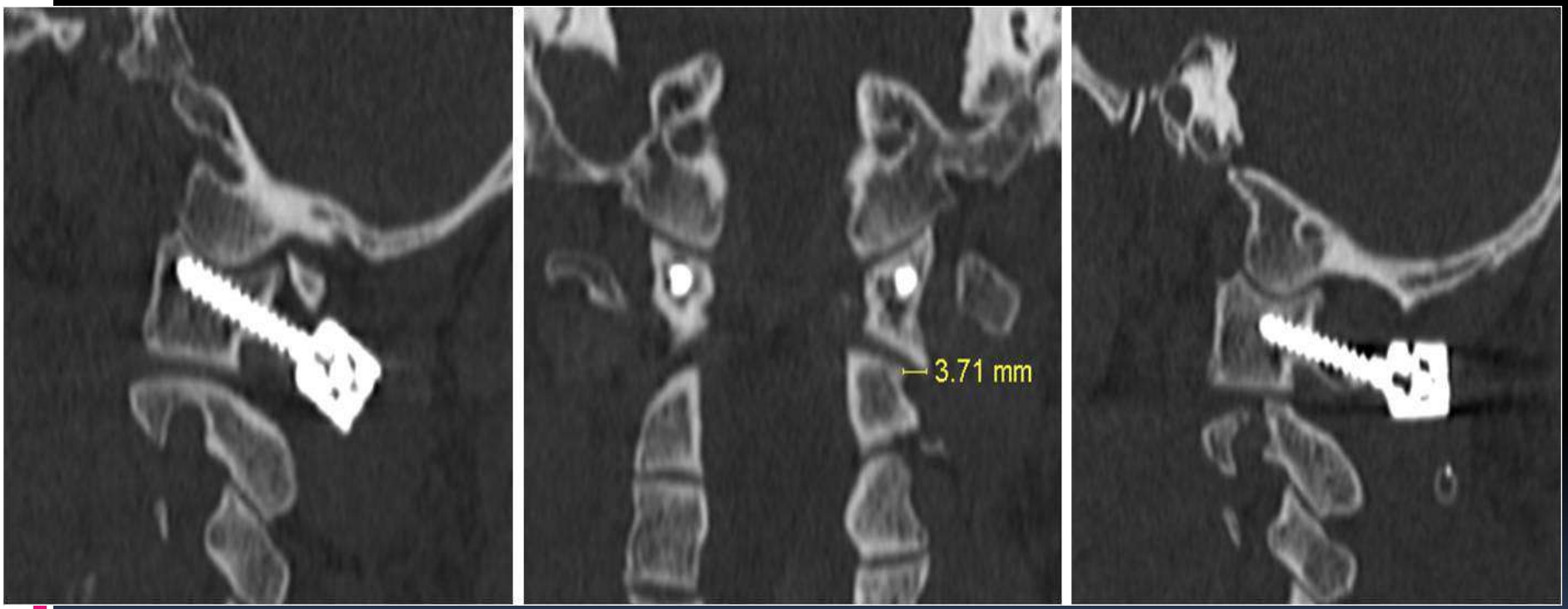
Post-op X-ray



6 weeks post-op

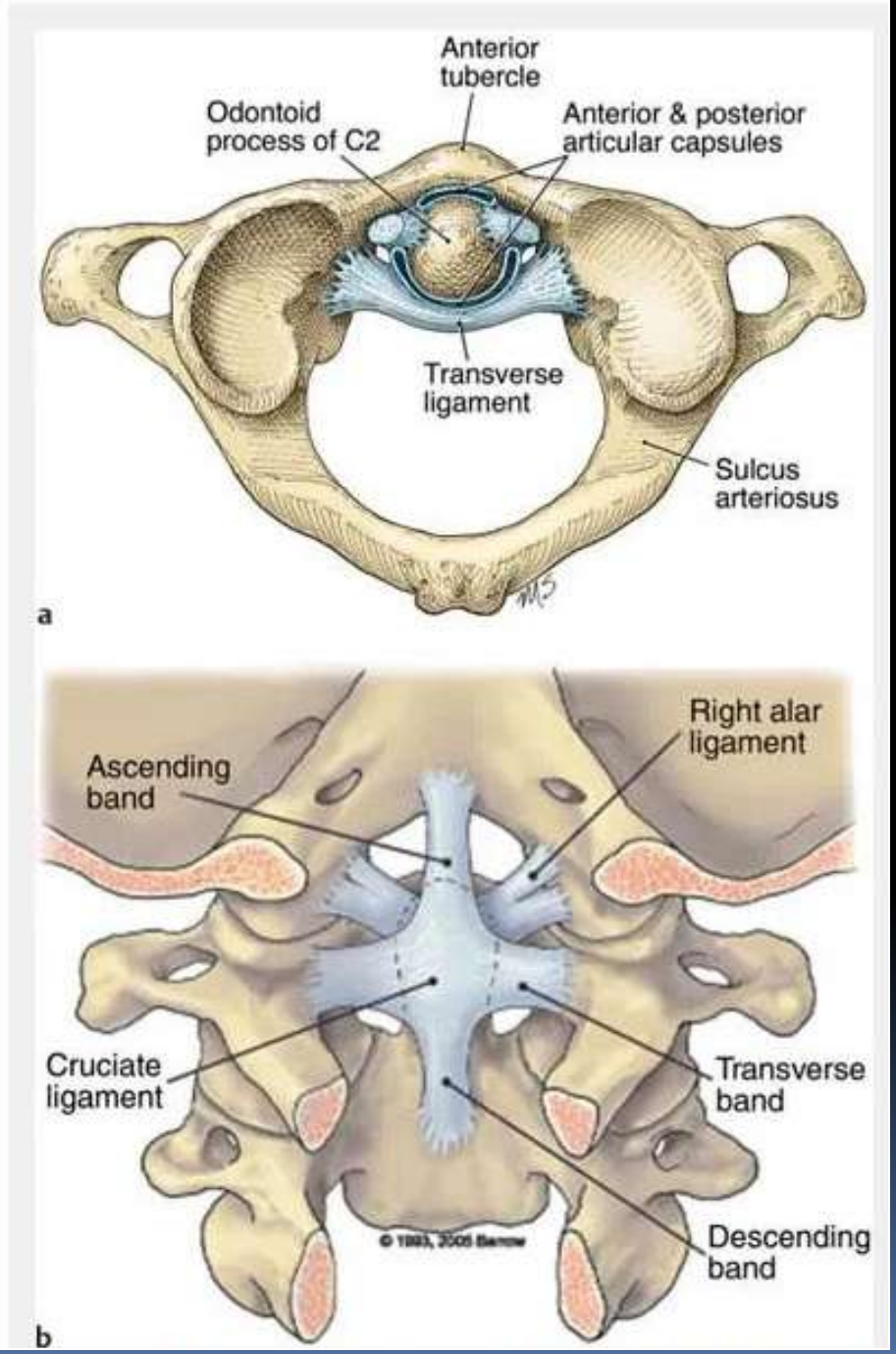


Post-op CT scan

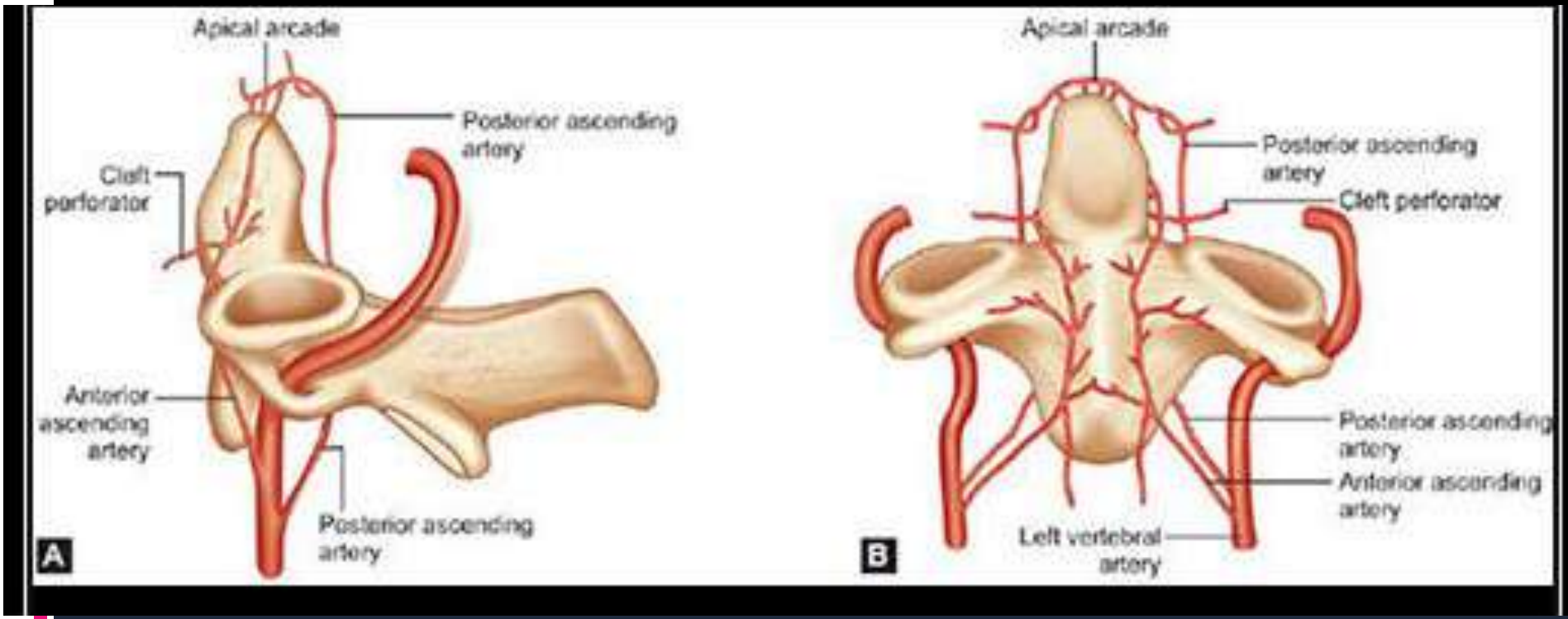


Odontoid fractures

- C1-C2 articulation- 50% rotation – highly mobile
- Stability mainly by ligaments- Alar / transverse ligaments

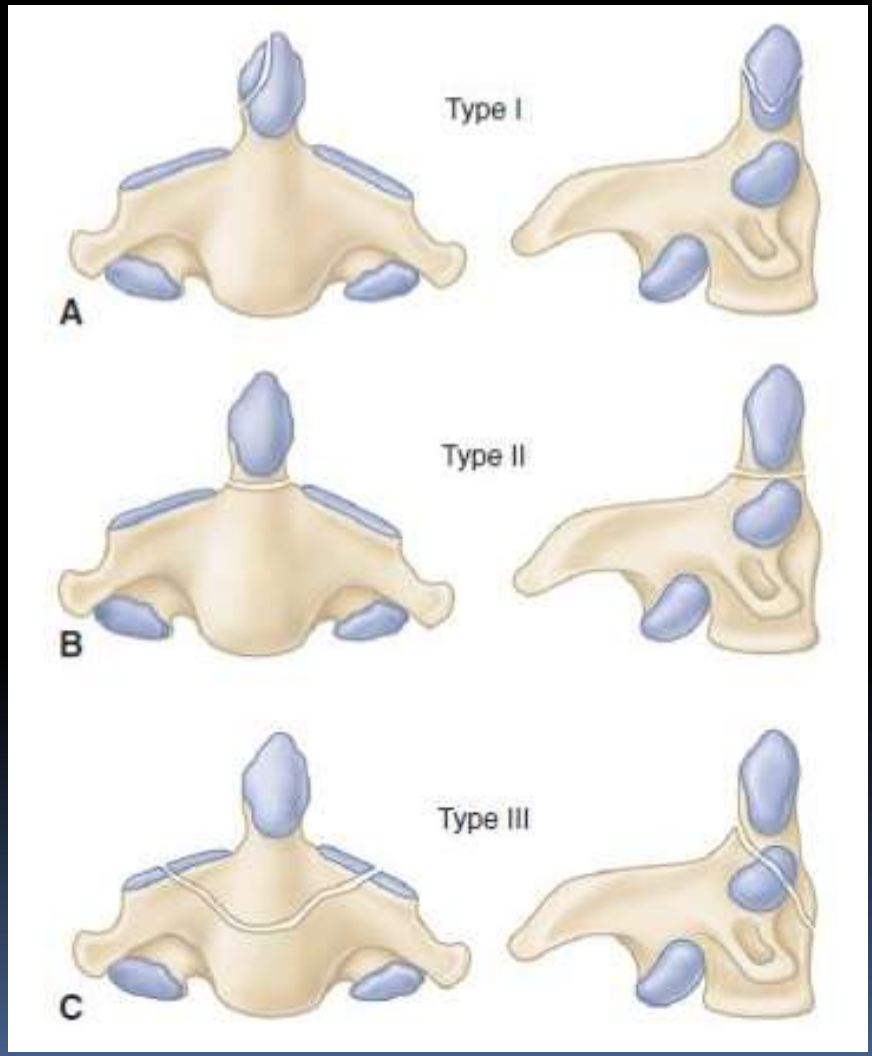


Blood supply of odantoid



ODONTOID FRACTURES

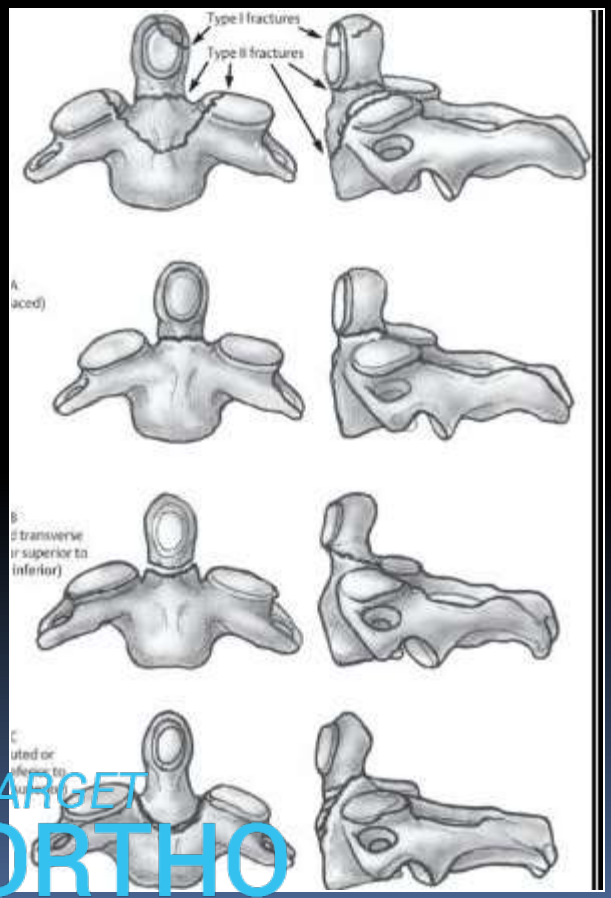
- **Anderson and D'Alonzo classification(1974).**
  - **type I** - avulsion of the tip of the odontoid;
  - **type II** - fracture through the base or waist of the odontoid process
  - **type III** -fractures of the body below the base of the odontoid



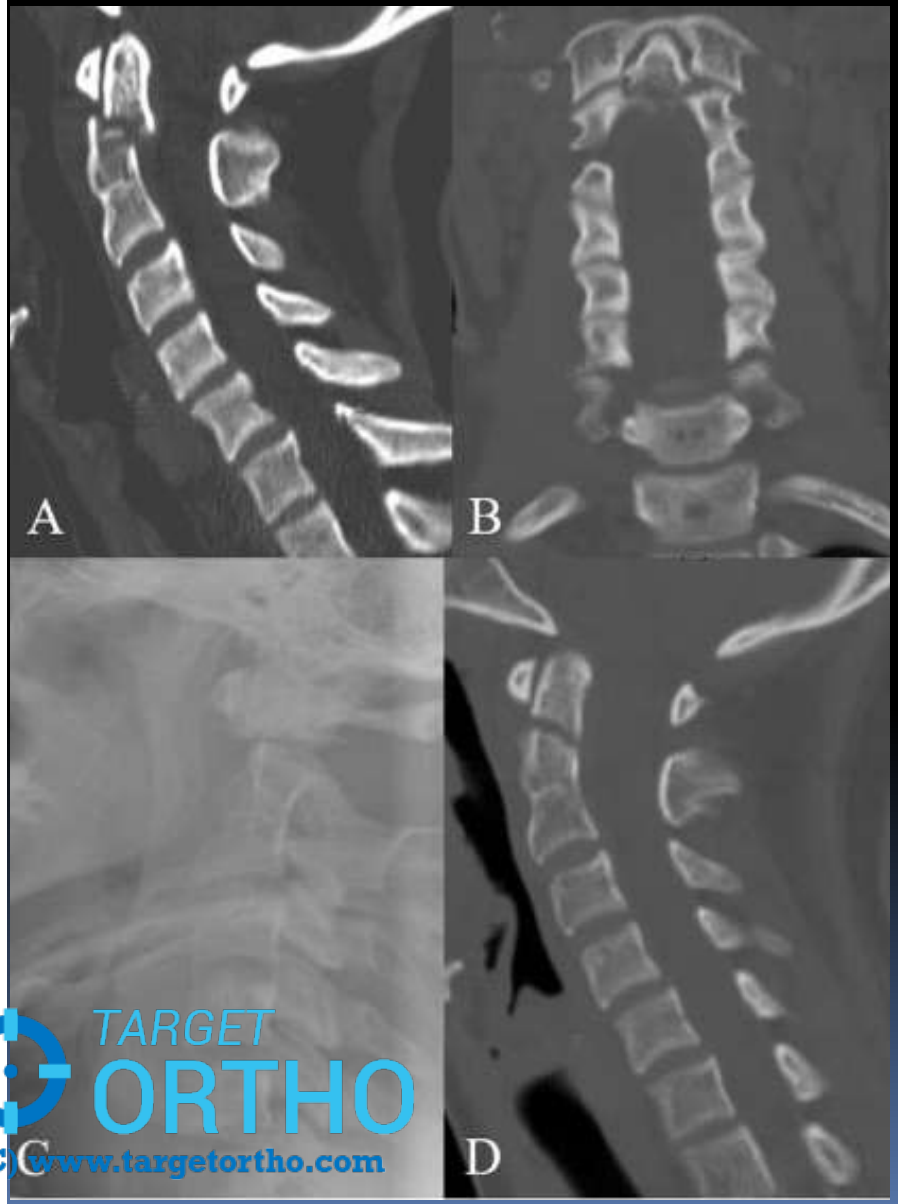
- **Treatment:**
  - **Isolated type I and type III fractures** - rigid immobilization
    - halo vest immobilization

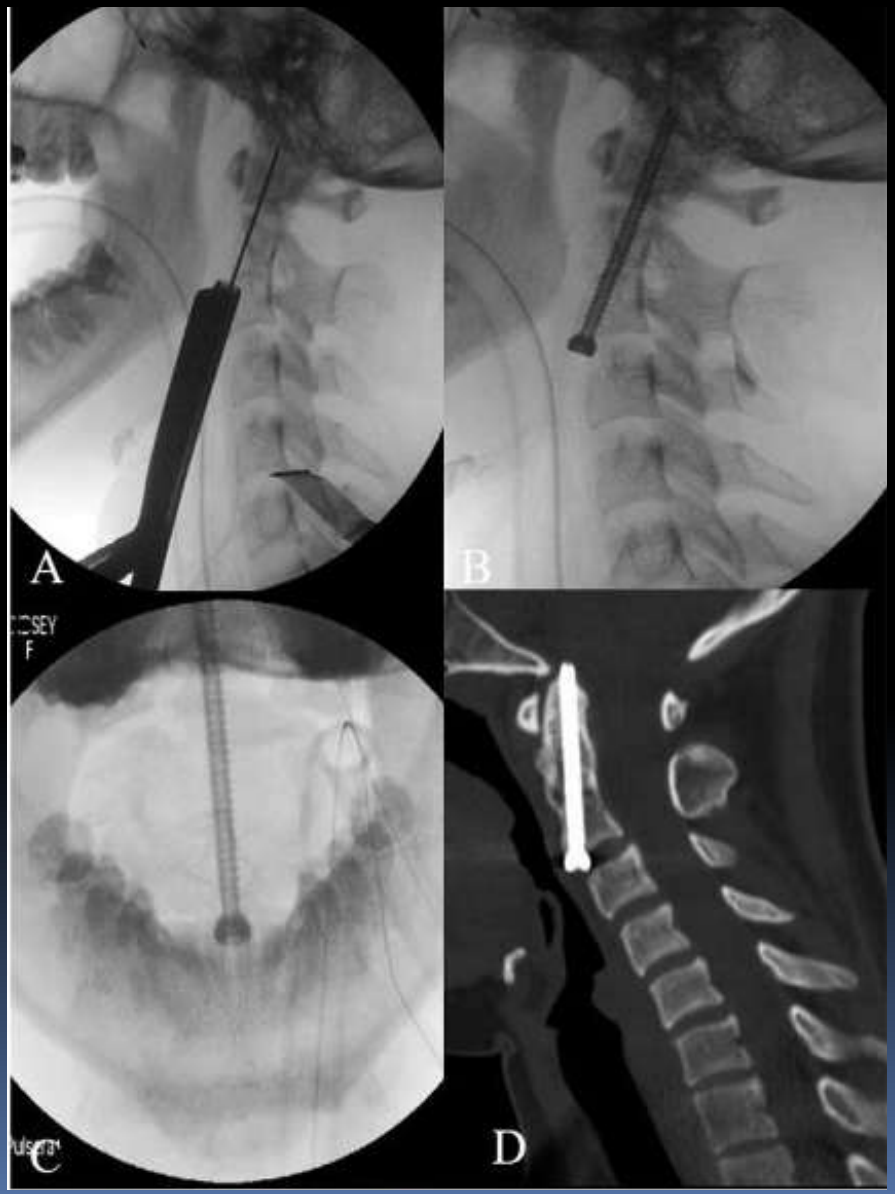
Type II fractures

- Minimally displaced - halo vest immobilization

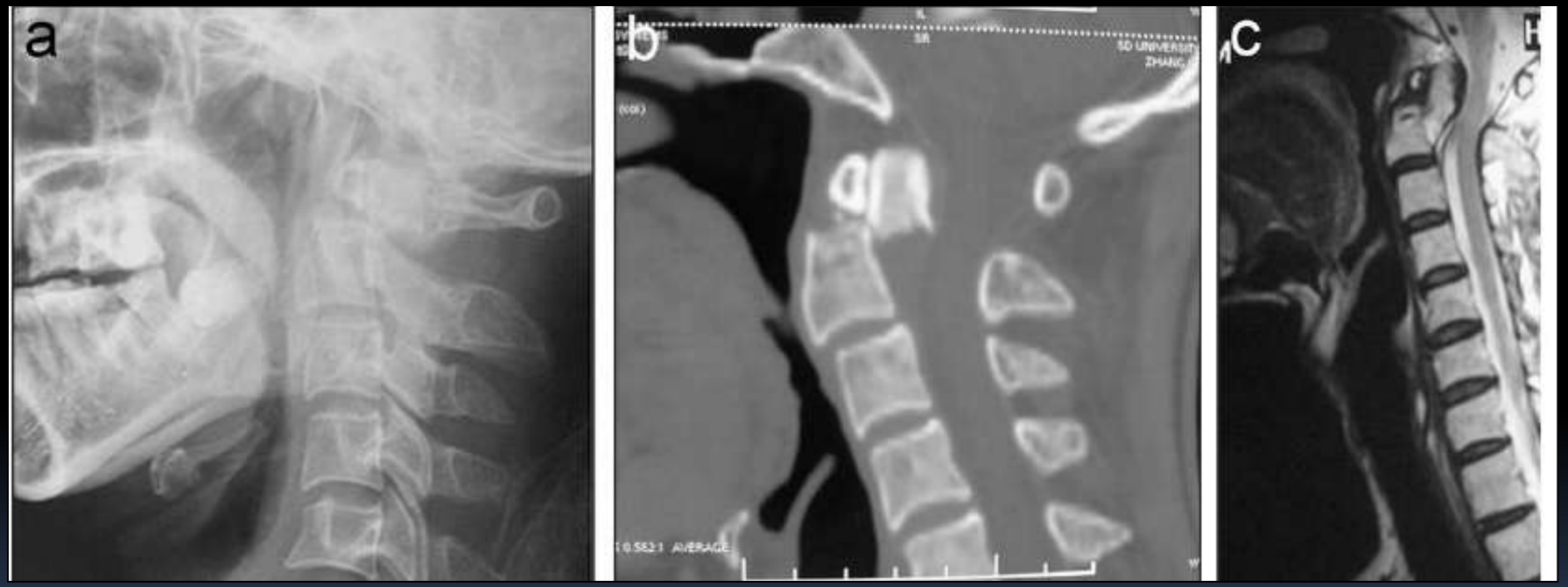


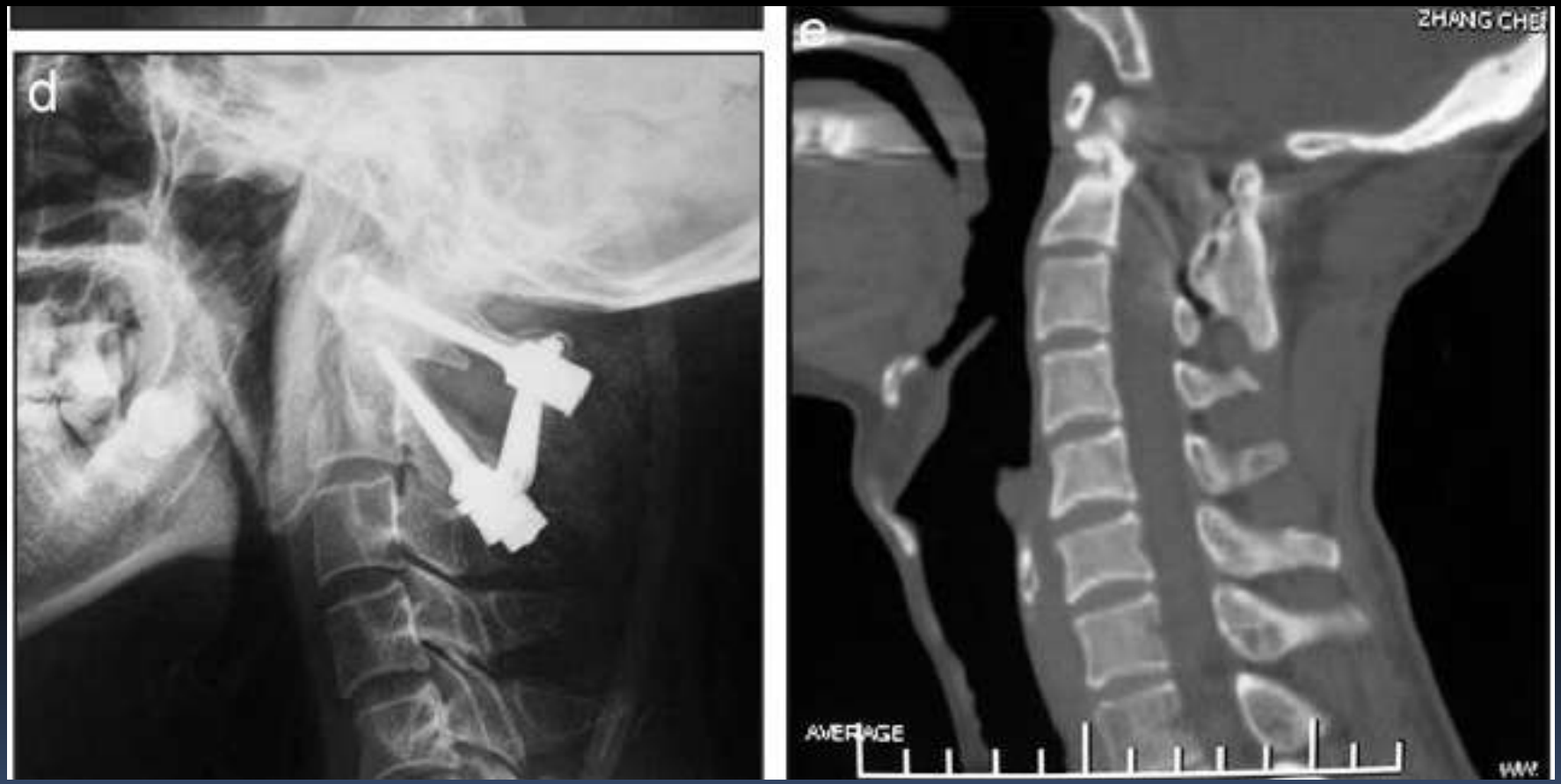
Case example -1





Case example -2

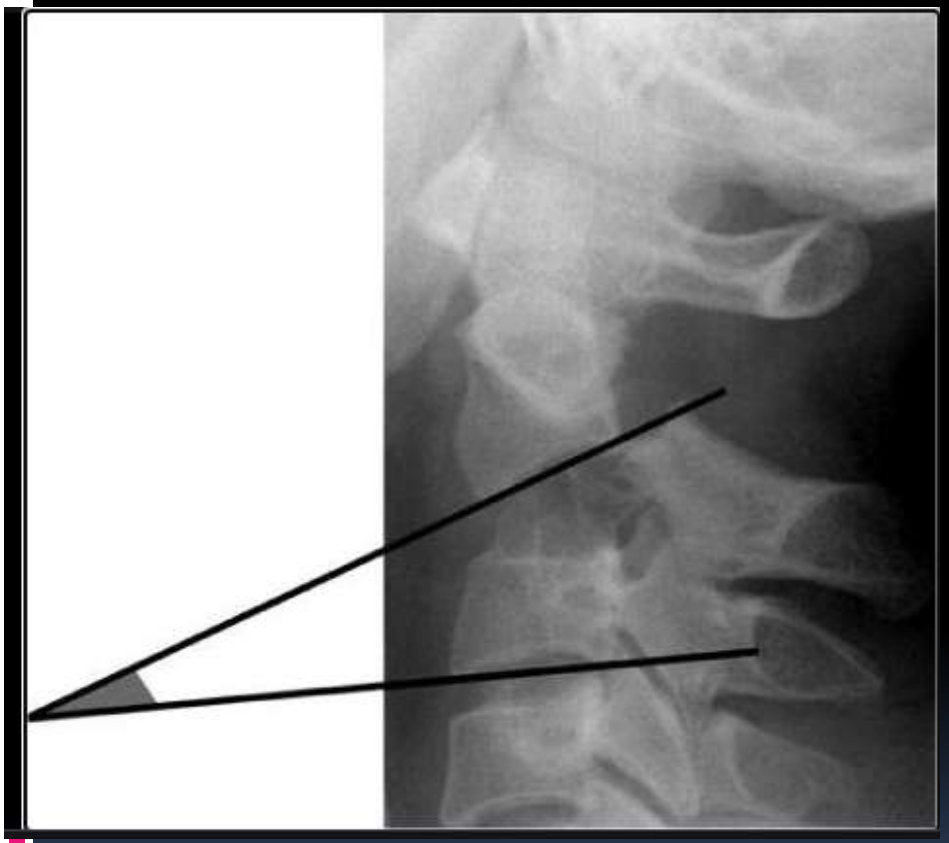




TRAUMATIC SPONDYLOLISTHESIS OF THE AXIS (HANGMAN FRACTURE)

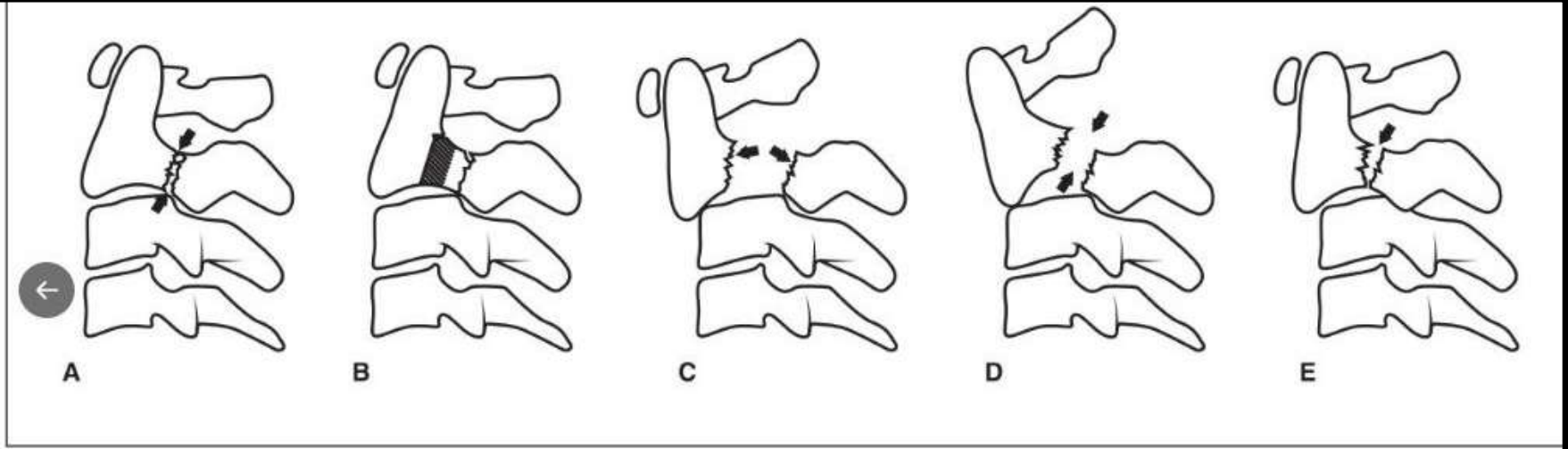
- Mechanism for the typical injury due to RTA is quite different from that occurring with a judicial hanging

- Usual mechanism – hyperextension and axial loading
  - although some injury patterns involve flexion.



Effendi et al. Classification:

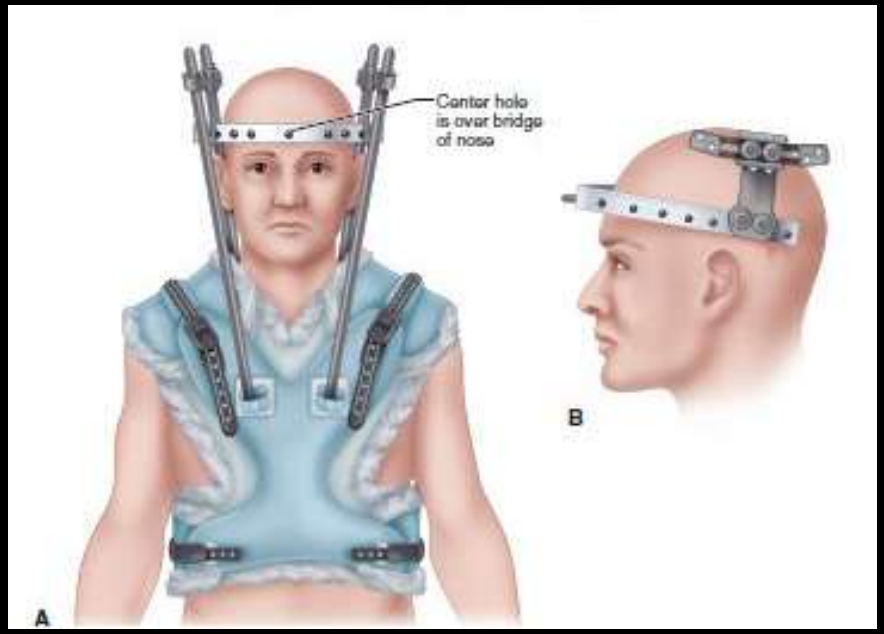
- based on mechanism of injury and the radiographic characteristics.
- **Type I injury**
  - Hyperextension
  - 0 to 2 mm of translation of the C2 body relative to C3
  - no kyphosis through the disc space.
- **Type II injury**
  - hyperextension and axial loading followed by flexion.
  - Fracture line is relatively vertical in orientation
  - at least 3 mm of translation through the C2 disc.



Illustrations demonstrating five injury patterns in traumatic spondylolisthesis. **A,** Type I. **B,** Type IA. **C,** Type II. **D,** Type IIA. **E,** Type III.

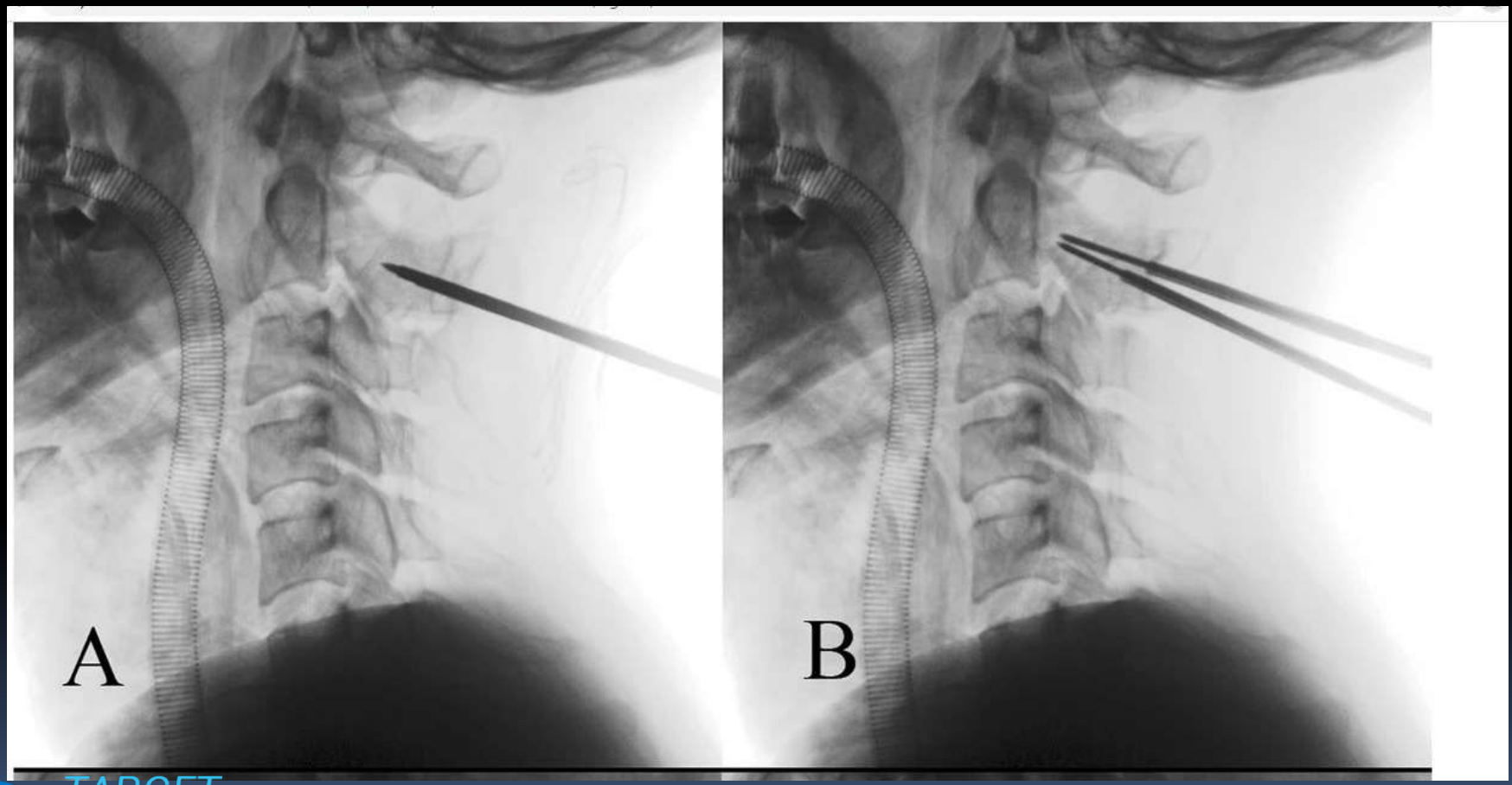
- **Levine and Edwards modified the Effendi type II fracture**
  - include a flexion-distraction injury
  - relatively horizontal fracture line and significant kyphosis through the C2 disc
  - posterior annulus disruption
  - but minimal translation of C2 on C3
- **Type III fractures**
  - flexion-compression injuries,
  - traumatic spondylolisthesis + dislocation of the C2-C3 facet joints

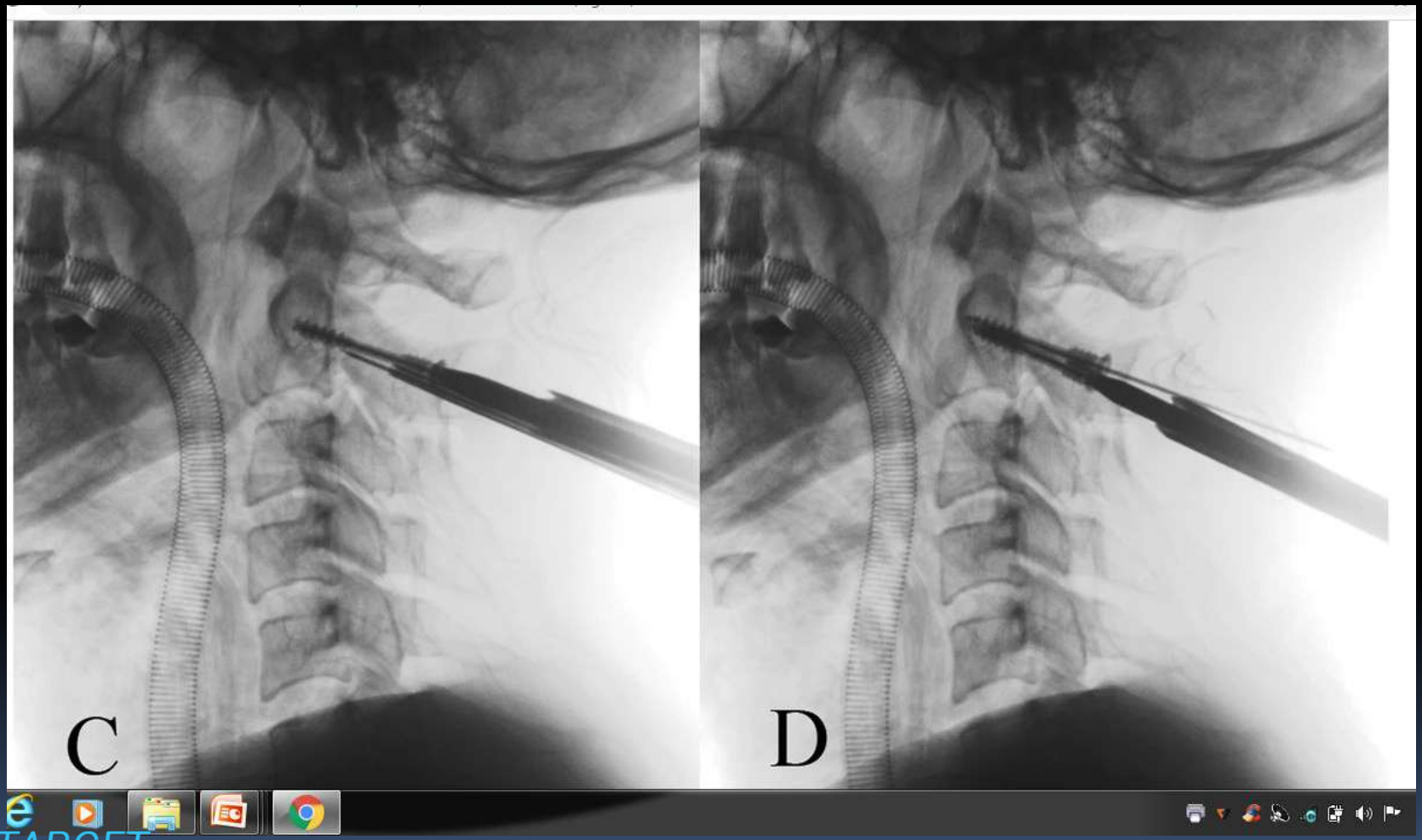
- Treatment:
  - Type I –
    - no associated ligamentous injuries
    - a rigid collar.
  - Type II –
    - reduced with traction- a halo vest for 12 weeks.
  - Type IIa-
    - Should not be placed in traction - becoz of the posterior discal disruption
    - reduced with gentle manual extension and slight compression
    - halo vest for 12 weeks



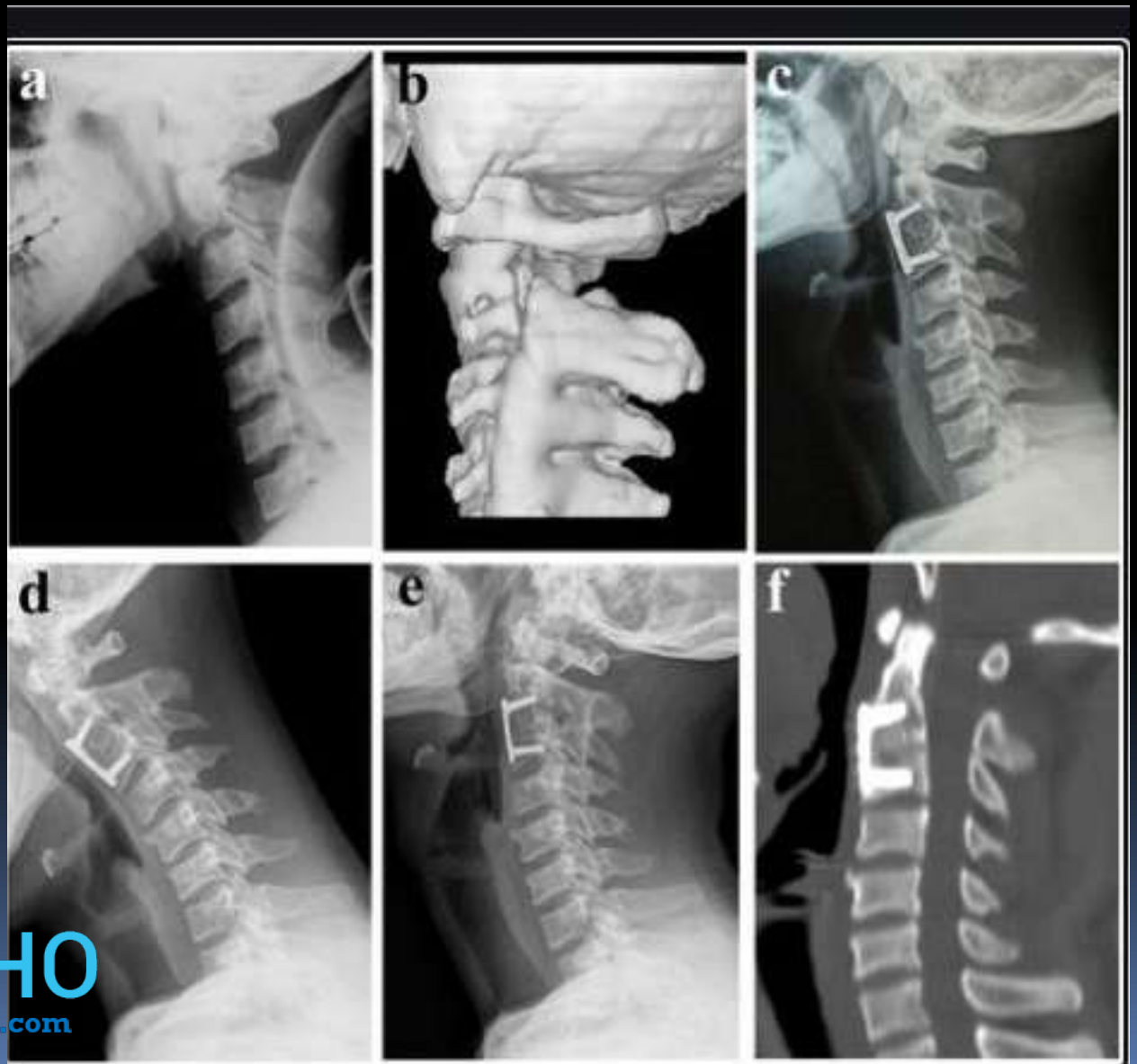
- Type III fracture-dislocations
  - require open reduction of the dislocation
  - C2 pedicle screws
  - If the C2 level cannot be stabilized with screw placement
    - C1-C3 fusion
  - Anterior C2-C3 stabilization

Pars fixation





C2- C3 ACDF for Hangmans



Posterior C1-C3 fixation for Hangmans