Cervical spine clearance

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Cervical spine clearance

- Not again
- Same old story
- Evergreen
- so what……

Cervical spine clearance

Suspect Spinal Injury

- High-speed crash
- Unconscious patient
- Multiple injuries
- Neurological deficit
- Spinal pain / tenderness

Cervical spine clearance

In case of spinal cord injury

Goal:

Reduction of resulting neurological deficit

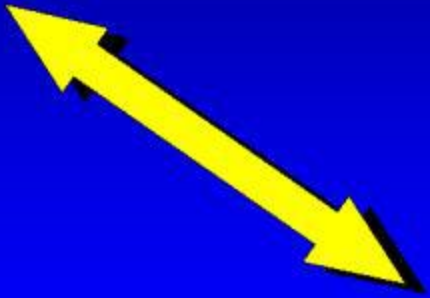
and

prevention of any additional loss of neurological function

Chiles and Cooper, N Engl J Med 334: 514-520, 1996

Management of spinal cord injury

Resuscitation



Evaluation

Resuscitation

- Spinal immobilization
- Airway management
- Cardiovascular resuscitation
- Pharmacologic treatment
- Adjunct treatment

Spinal immobilization

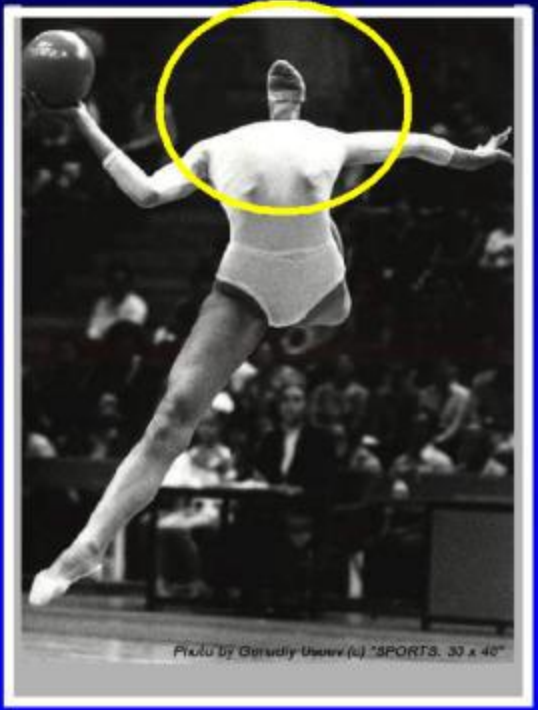
Protection	⇒	priority
Detection	⇒	secondary

- Rigid cervical collar
- "Log rolling"
- Rigid transportation board (remove ASAP)


POLICE
TRAUMA
CENTRE

Cervical spine clearance

Now the problem starts



Cervical spine clearance

1. Which patient should be cleared ?
2. When should it be done ?
3. What needs to be done ?
4. Who should do it ?
5. Whom can I ask ?

Cervical spine clearance

Cervical spine clearance

The problem is not any more to get
a collar on
it is very difficult
to get it off

Cervical spine clearance

Concious patient

Altered LOC

Cervical spine clearance

Diagnosis of spinal injuries

Clinical
and radiological
evaluation

Cervical spine clearance

Clinical evaluation (spine)

Inspection and palpation

Occiput to coccyx

"Do the extreme and look at your patient"

Otmar Trentz, Switzerland

Cervical spine clearance

Clinical evaluation (spine)

Inspection and palpation
Occiput to coccyx

Cervical spine clearance

Clinical evaluation (spine)

Inspection and palpation
Occiput to coccyx

Cervical spine clearance

Clinical evaluation (spine)

Inspection and palpation

Occiput to coccyx

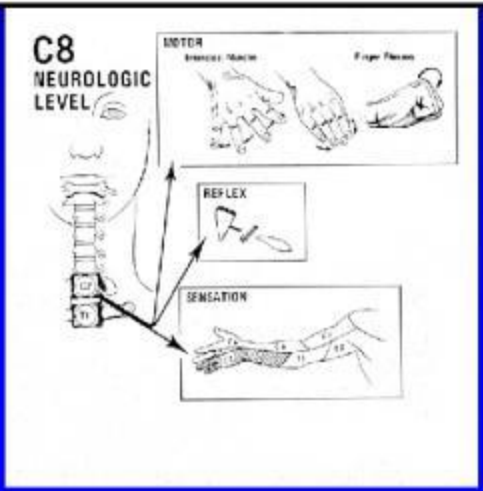
- Pain with movement
- Tenderness
- Gap or step
- Edema and bruising
- Spasm of associated muscles

Cervical spine clearance

Clinical evaluation (spine)

Neurological assessment

- Sensation
- Motor function
- Reflexes
- Rectal examination



STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR

KEY MUSCLES

	R	L	
C2			
C3			
C4			
C5			Elbow flexors
C6			Wrist extensors
C7			Elbow extensors
C8			Finger flexors (distal phalanx of middle finger)
T1			Finger abductors (little finger)
T2			
T3			
L2			Hip flexors
L3			Knee extensors
L4			Ankle dorsiflexors
L5			Long toe extensors
S1			Ankle plantar flexors
S2			
S3			
S4-5			

0 = total paralysis
1 = palpable or visible contraction
2 = active movement, gravity eliminated
3 = active movement, against gravity
4 = active movement, against some resistance
5 = active movement, against full resistance
NT = not testable

Voluntary anal contraction (Yes/No)

TOTALS ____ + ____ = ____ MOTOR SCORE

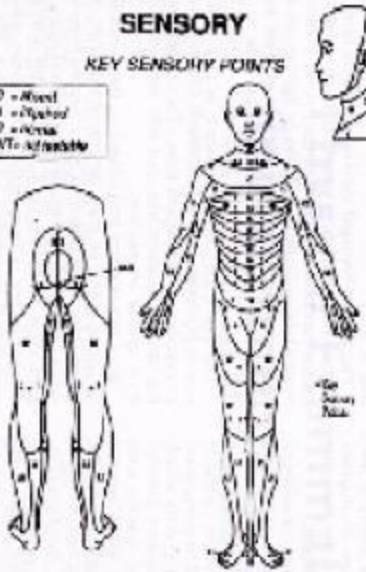
(MAXIMUM) (50) (50) (100)

SENSORY

KEY SENSORY POINTS

	LIGHT TOUCH R	LIGHT TOUCH L	PIN PRICK R	PIN PRICK L
C2				
C3				
C4				
C5				
C6				
C7				
C8				
T1				
T2				
T3				
T4				
T5				
T6				
T7				
T8				
T9				
T10				
T11				
T12				
L1				
L2				
L3				
L4				
L5				
S1				
S2				
S3				
S4-5				

0 = Absent
1 = Impaired
2 = Normal
NT = not testable



Any anal sensation (Yes/No)

TOTALS ____ + ____ = ____ PINPRICK SCORE (max: 112)

____ + ____ = ____ LIGHT TOUCH SCORE (max: 112)

(MAXIMUM) (56) (56) (56) (56)

NEUROLOGICAL LEVEL	SENSORY / MOTOR	R	L
The most caudal segment with normal function			

COMPLETE OR INCOMPLETE? ____

Incomplete = presence of any sensory or motor function in lowest sacral segment

ZONE OF PARTIAL PRESERVATION	SENSORY / MOTOR	R	L
Partially innervated segments			

A

Cervical spine clearance

Radiological assessment

X-rays

Cervical spine clearance

Radiological evaluation

Cervical spine

- No uniform consensus on imaging of cervical spine.
- Plain x-ray is still widely used.
- Has a limited role in severely injured multi trauma patients.
- CT is routinely used in Level 1 Trauma Centers.

Cervical spine clearance

Radiological evaluation

Cervical spine

X-ray Guidelines (cervical)

- **A**dequacy, **A**lignment
- **B**one abnormality, **B**ase of skull
- **C**artilage, **C**ontours
- **D**isc space
- **S**oft tissue


C7
C7
T1

Cervical spine clearance

Radiological evaluation

Cervical spine

X-ray Guidelines (cervical)

- **A**dequacy, **A**lignment
- **B**one abnormality, **B**ase of skull
- **C**artilage, **C**ontours
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Cervical spine clearance

Radiological evaluation

Cervical spine

X-ray Guidelines (cervical)

- **A**dequacy, **A**lignment
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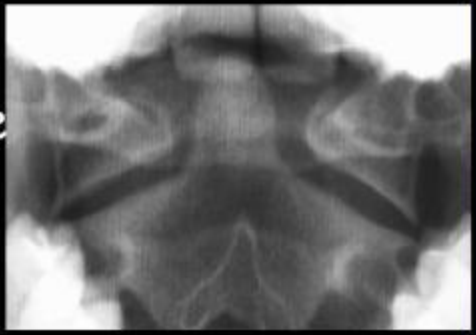


Cervical spine clearance

Concious patient

Altered LOC

Cervical spine clearance

Concious patient

Cervical spine clearance

Alert, sober, neurologically normal patient

1. If no neck or spine pain or tenderness to palpation or voluntary movement
2. Remove c-collar
3. If still no pain or tenderness with voluntary movement
4. No further spine evaluation or c-spine x-ray necessary

Cervical spine clearance

Alert, sober, neurologically normal patient

- Neck of spine pain or tenderness to palpation or voluntary movement?
- After removal of c-collar?

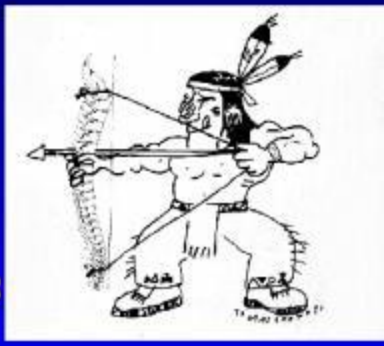
- If "yes" to any question

  ⇒ Protect c-spine

  ⇒ Obtain necessary x-ray

Cervical spine clearance

- Radiographic: Normal x-rays
- Clinical:
  - ⇒Normal neurological exam and
  - ⇒Absence of spinal pain / tenderness



Drugs, alcohol, distraction injuries may mask an injury

Cervical spine clearance

If pain or some kind of neurology is present further titrated evaluation

- » CT
- » MRI

Cervical spine clearance

Concious patient

Altered LOC

Cervical spine clearance

Altered LOC

Cervical spine clearance

- Multi trauma patients have an unstable cervical spine injury until proven otherwise.
- May not be clinically apparent.
- Need for complete and adequate radiological survey of cervical spine.

Cervical spine clearance

- 1.5-3% of multi trauma patients sustain cervical spine injury (CSI).
- 10% severe head injured patients have a CSI.
- 5-8% of patients with fractures may have normal plain x-ray.
- Incidence of delayed diagnosis: 4.2 - 22.9%

Cervical spine clearance

- Most common reason for delayed diagnosis (53%) is inadequate radiographic evaluation
- Upper and lower cervical spine injuries are commoner that mid cervical injuries

Cervical spine clearance

Radiological evaluation

Cervical spine

- 21 centers participated in the National X Radiography Utilisation Study.
- 34,069 blunt trauma patients enrolled.
- Studies included plain x-ray, CT, MRI.
- Standard three views were obtained on all patients supplemented by other views and CT/MRI.

Hoffmann et al.Ann Emerg Med 32: 461-469

Cervical spine clearance

Radiological evaluation

Cervical spine

RESULTS

- Incidence of CSI > 2.4%.
- 818 patients had one or more CSIs.
- 570 (69.6%) of these had complete and adequate set of radiographs.

Cervical spine clearance

Radiological evaluation

Cervical spine

- 33.5% of patients sustaining CSI were not detected on plain x-rays.
- Can expect one totally occult CSI in every 1,481 blunt trauma evaluation

  or

- less than one unstable injury every 6,500 screening evaluation

Cervical spine clearance

Radiological evaluation

Cervical spine

- New protocol developed to
  - > standardize imaging
  - > provide a complete radiological assessment
  - > implemented 07/2001
- Required categorising patients in one of three groups.

Cervical Spine Imaging Protocol

Trauma Conscious = V1

AP, Lateral, PEG plain X-ray

Review by Radiologist or Senior ED Consultant

Cervical CT
Occiput to C3 [1mm helical + sagittal & coronal reformats]
C2 to C6 [3mm helical + sagittal reformats]
Top C6 to T4/5 [3mm sagittal reformats] or
As indicated by Plain X-rays
(e.g. Poor Quality X-ray, Fusion, Degenerative changes >2 levels)

Normal plain films

Abnormal plain films

Clinical Evidence of Spinal Cord Injury

Spinal MRI when stable

Normal Imaging but [illegible]

Active Flexion/Extension after review & when stable

Spinal MRI if indicated

Major Trauma (Un)conscious = V2

AP, Lateral, Plain X-ray

Cervical CT
Occiput to C3 [1mm helical + sagittal & coronal reformats]
C2 to C6 [3mm helical + sagittal reformats]
Top C6 to T4/5 [3mm helical+ sagittal reformats]

Normal Imaging

Stop

Spinal MRI, only if clinically indicated

Abnormal Imaging

Spinal MRI Scan

Major Trauma & Spinal Cord Injury = V3

AP, Lateral, Plain X-ray

Cervical CT
Occiput to C3 [1mm helical + sagittal & coronal reformats]
C2 to C6 [3mm helical + sagittal reformats]
Top C6 to T4/5 [3mm helical + sagittal reformats]

Spinal MRI Scan ASAP

Developed by Dr Dinesh Varma, MB BS FRANZCR
Consultant Radiologist, Trauma ED

Cervical spine clearance

Major Trauma & Spinal Cord Injury = V3

AP, Lateral, Plain X-ray

↓

Cervical CT

Occiput to C3 [1mm helical + sagittal & coronal reformats]

C2 to C6 [3mm helical + sagittal reformats]

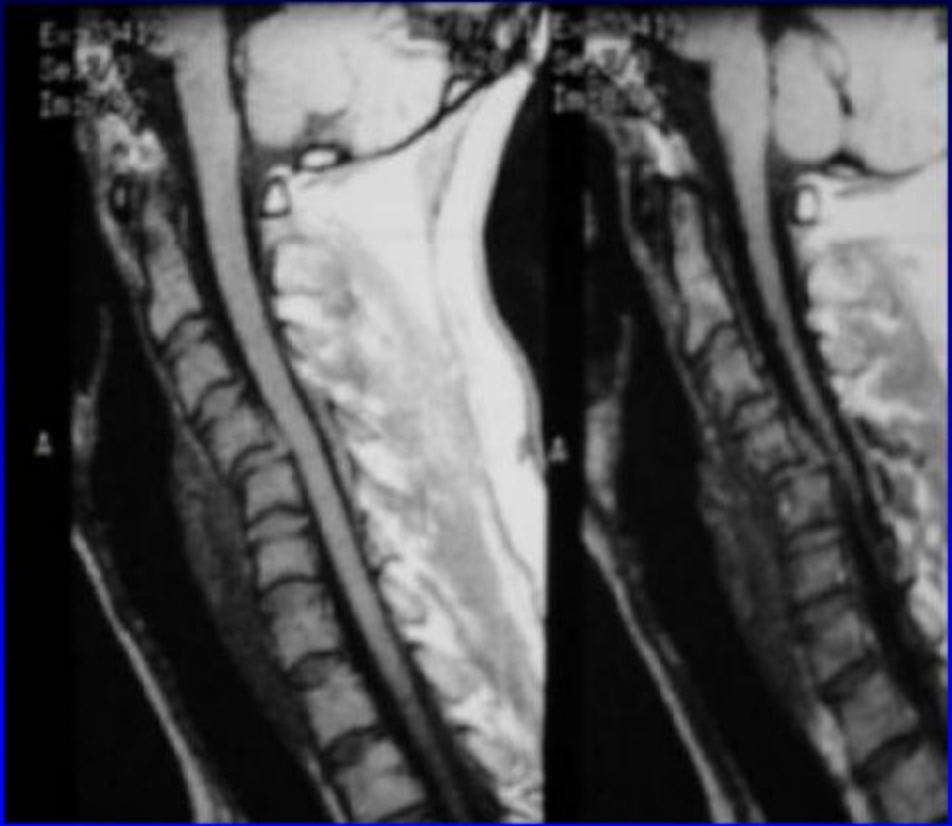
Top C6 to T4/5 [3mm helical + sagittal reformats]

↓

Spinal MRI Scan ASAP

- 34 yr old female
- High speed MCA
- GCS 13 at scene
- Fracture right femur and pelvis


C3
C4
C5



- 10% o… …ture have …us verte…
- Ident… … anoth…
- Radio… …oine requi…

Cervical spine clearance

- Treat life-threatening injuries first
- Immobilize
- Appropriate spine films
- Document examination
- Neurosurgical / orthopedic consult
- Transfer unstable fracture / cord injury

Cervical spine clearance

Major Trauma (Un)conscious = V2

AP, Lateral, Plain X-ray

↓

Cervical CT

Occiput to C3 [1mm helical + sagittal & coronal reformats]

C2 to C6 [3mm helical + sagittal reformats]

Top C6 to T4/5 [3mm helical+ sagittal reformats]

Normal Imaging

↓

Stop

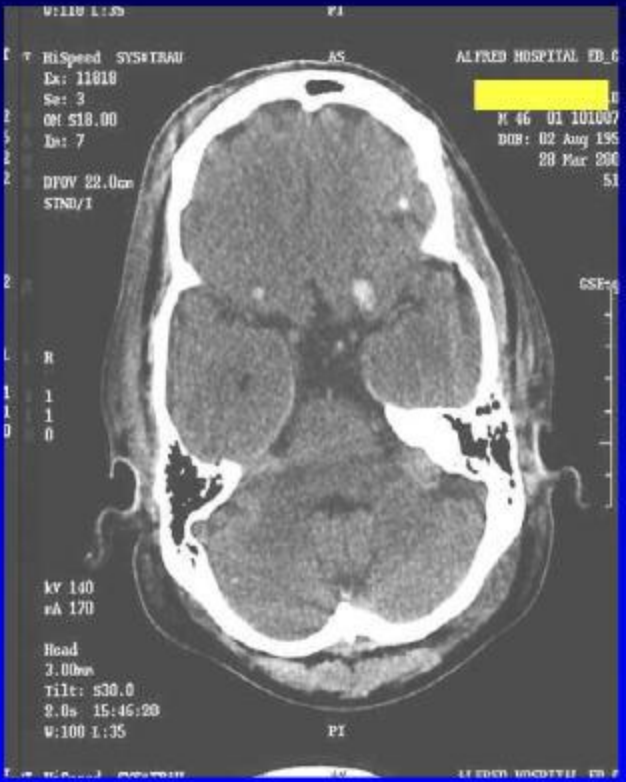
Spinal MRI, only if clinically indiacted

Abnormal Imaging

↓

Spinal MRI Scan

47m
bicycle rider
GCS 6
left temporal / parietal skull fracture
DAI
bilateral frontal and left temporal contusions
dislocated shoulder



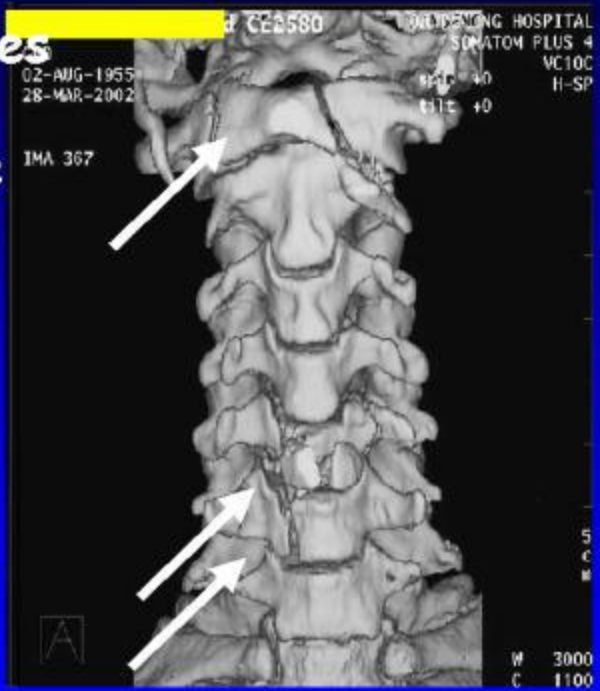
47m
bicycle rider
GCS 6
left temporal / parietal skull fracture
DAI
bilateral frontal and left temporal contusions
dislocated shoulder

C5/C6 burst fractures

Jefferson fracture

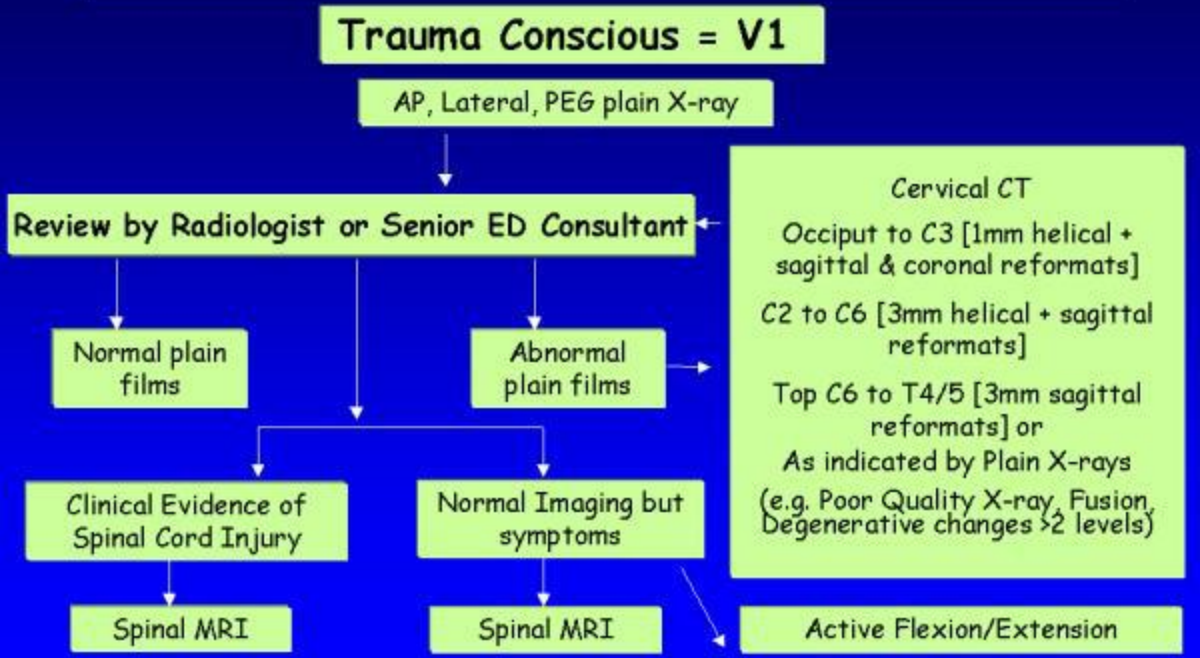
C5/C6 burst fractures

Jefferson fracture



Jefferson fracture
C5 burst fractures

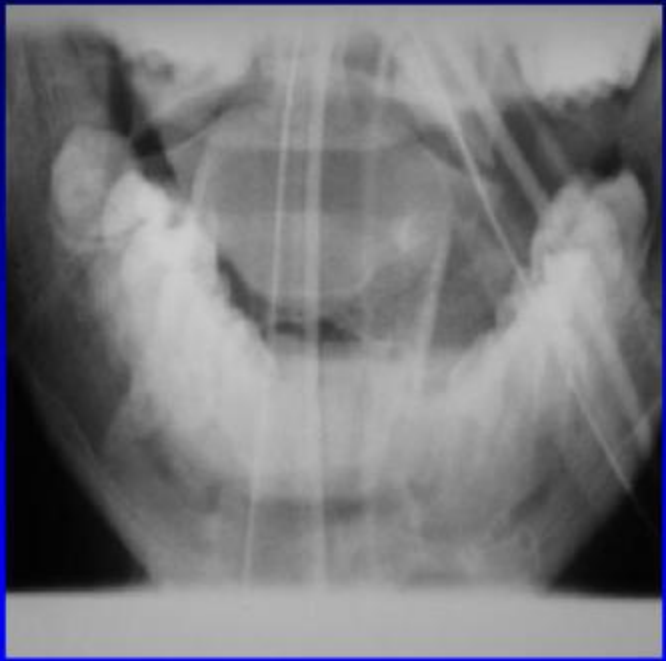
Cervical spine clearance



38M hit from behind
Medium speed
GCS 15
No other injuries
Neck pain

38M hit from behind
Medium speed
GCS 15
No other injuries

Neck pain

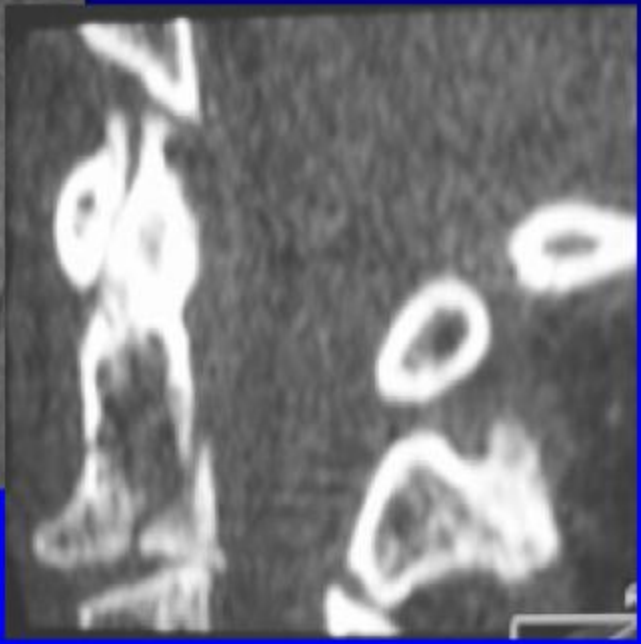



28 Oct
0cm
A:N

72M
medium speed
MCA
GCS 13
neck pain

72M
medium speed
MCA
GCS 13

Neck pain

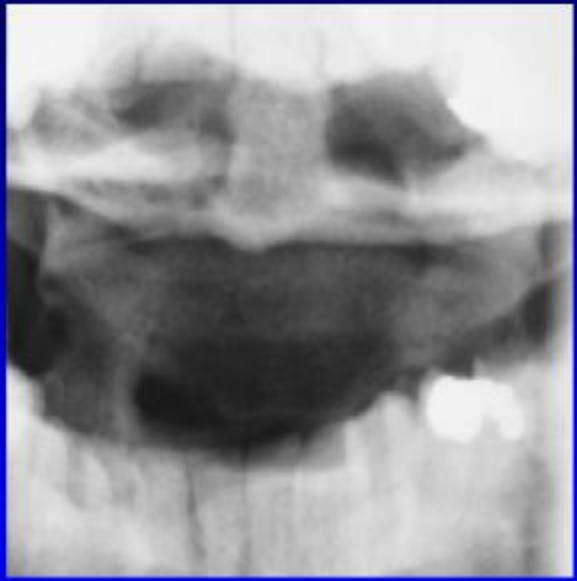


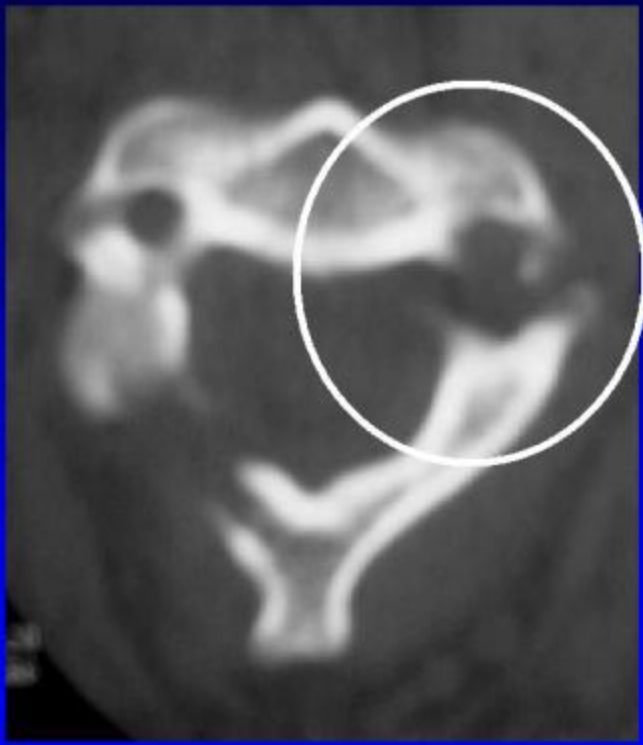
42 F
roll over, GCS 15
No other injuries

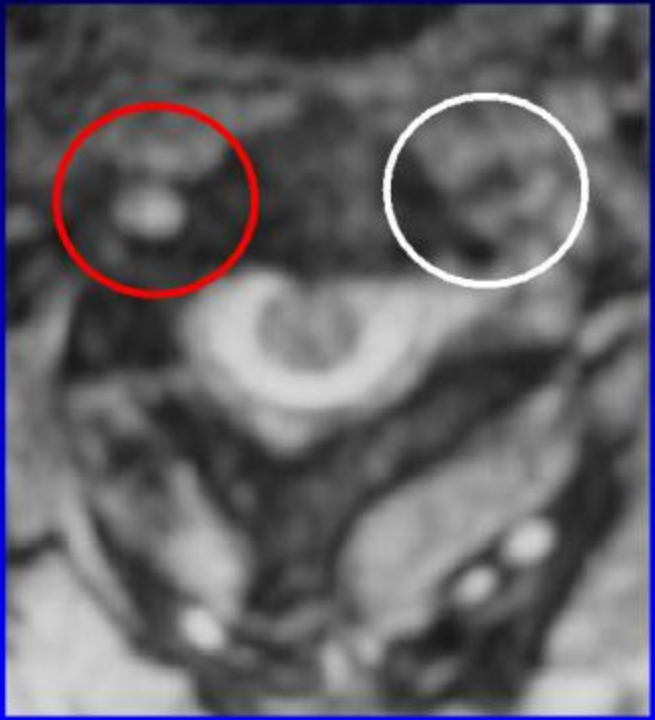
Neck pain

42 F
roll over, GCS 15
No other injuries

Neck pain





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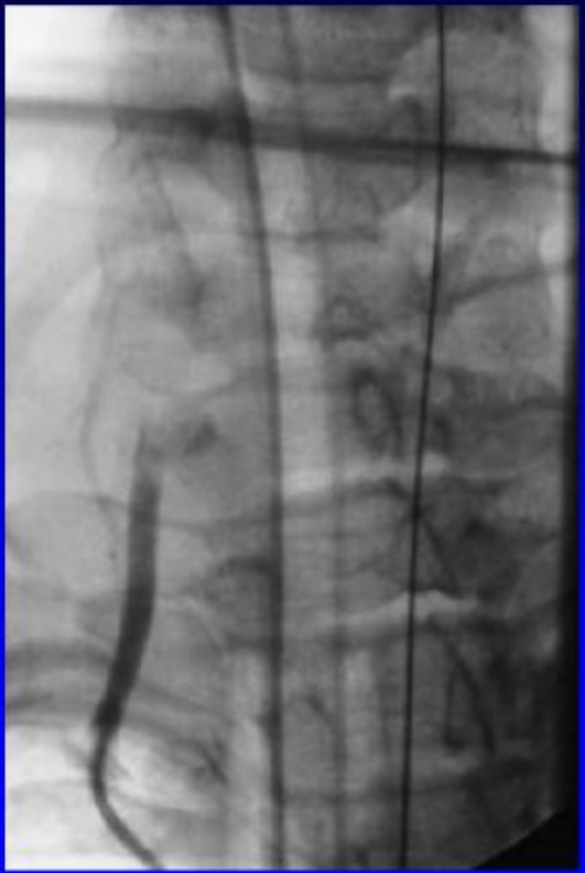


Cervical spine clearance

- Oblique and Swimmer's views removed from our imaging protocol.
- Low threshold for CT of cervico-cranial and cervico-thoracic region.
- MRI being increasingly used
  - in the appropriate clinical setting.

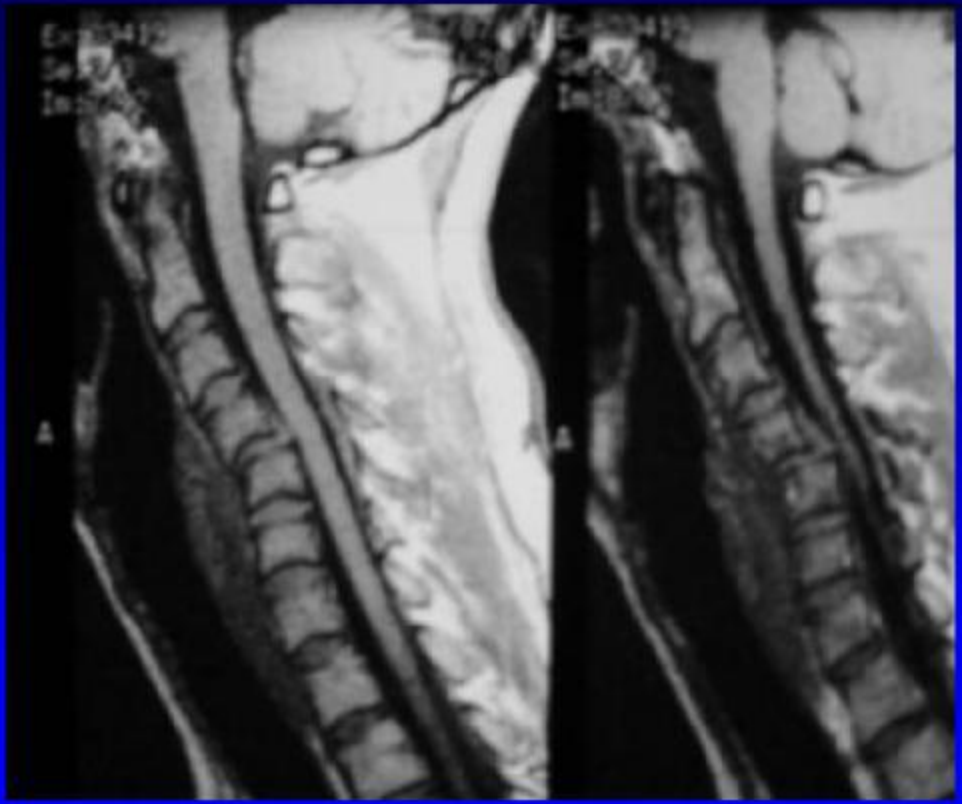
Cervical spine clearance

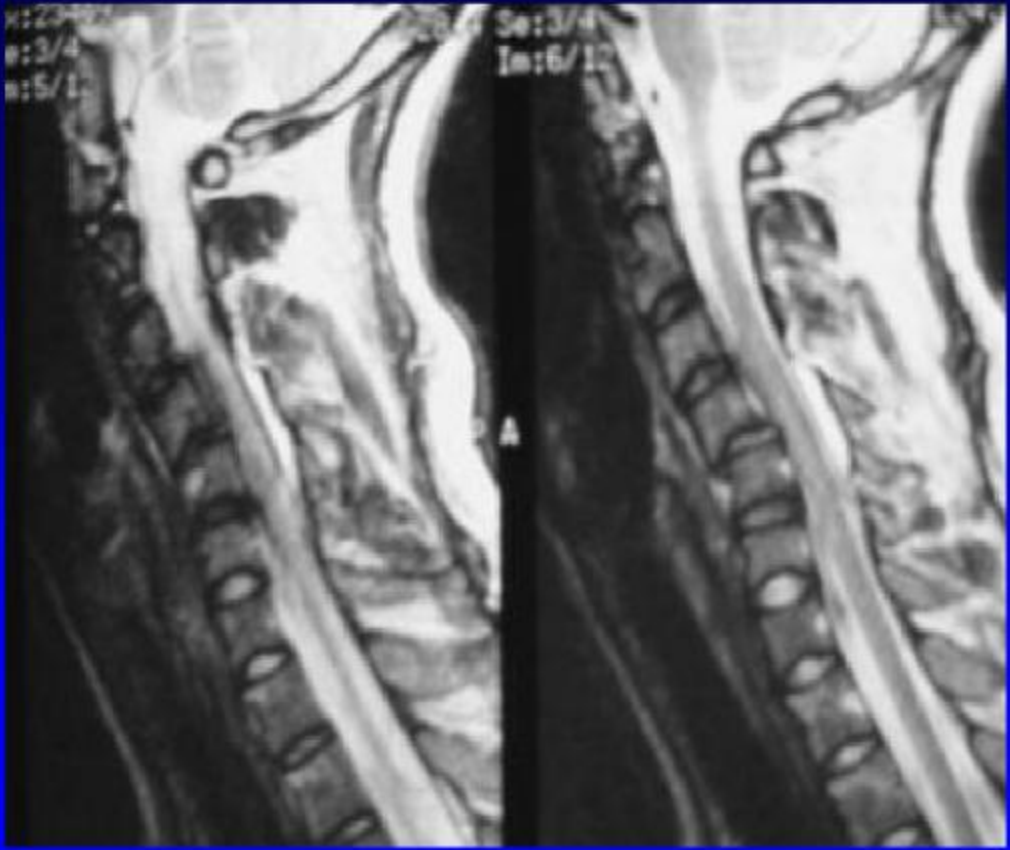
- ↑ Number of patients scanned
- No repeated attempts at plain x-ray
- More subtle injuries identified.
- CT not a stand-alone clearance tool
- Combination of plain X ray and CT sensitivity of 98% in fracture detection

Cervical spine clearance

Role of MRI

- Definite role in assessing cord injury, ligamentous & disc integrity
- Brachial plexus injuries
- Persistent symptoms in the presence of normal plain films and CT

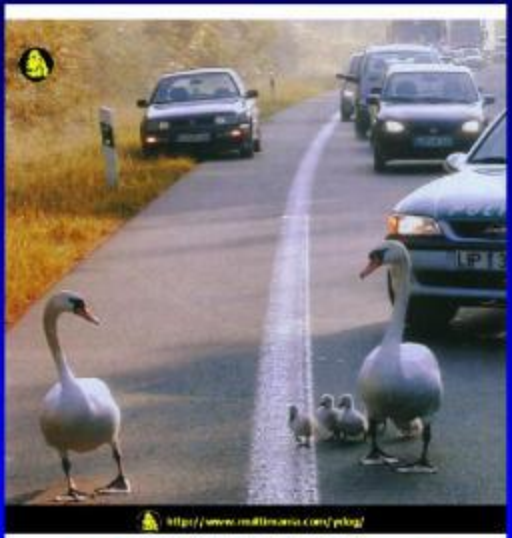




FUTURE

- Plain x-ray has and will have an ongoing place in imaging protocols.
- Given the role of various modalities every Institution will have to formulate their own protocols.
- Level 1 Trauma Centers routinely use CT given the complexity of their patient population.
- MRI is being used more widely as their availability increases.

Cervical spine clearance



Get the collar off
But today !!

Priorities

Speed up the process of spinal clearance

Do not miss any cervical spinal injury


Thank you.