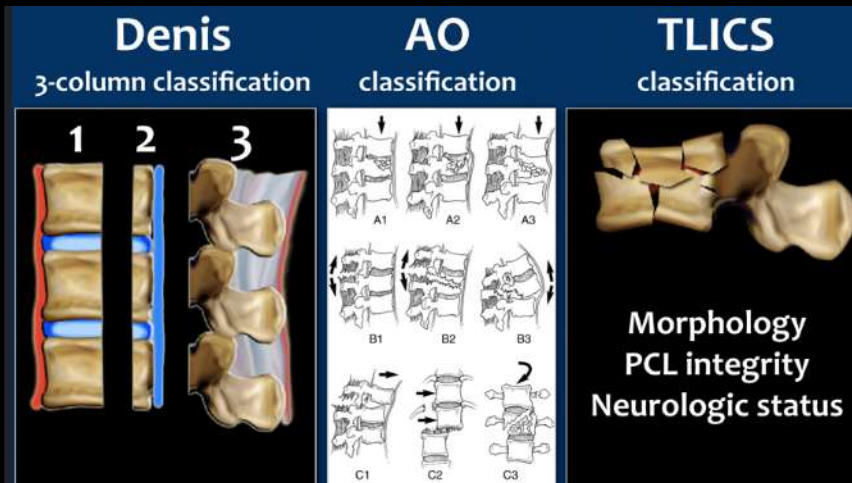
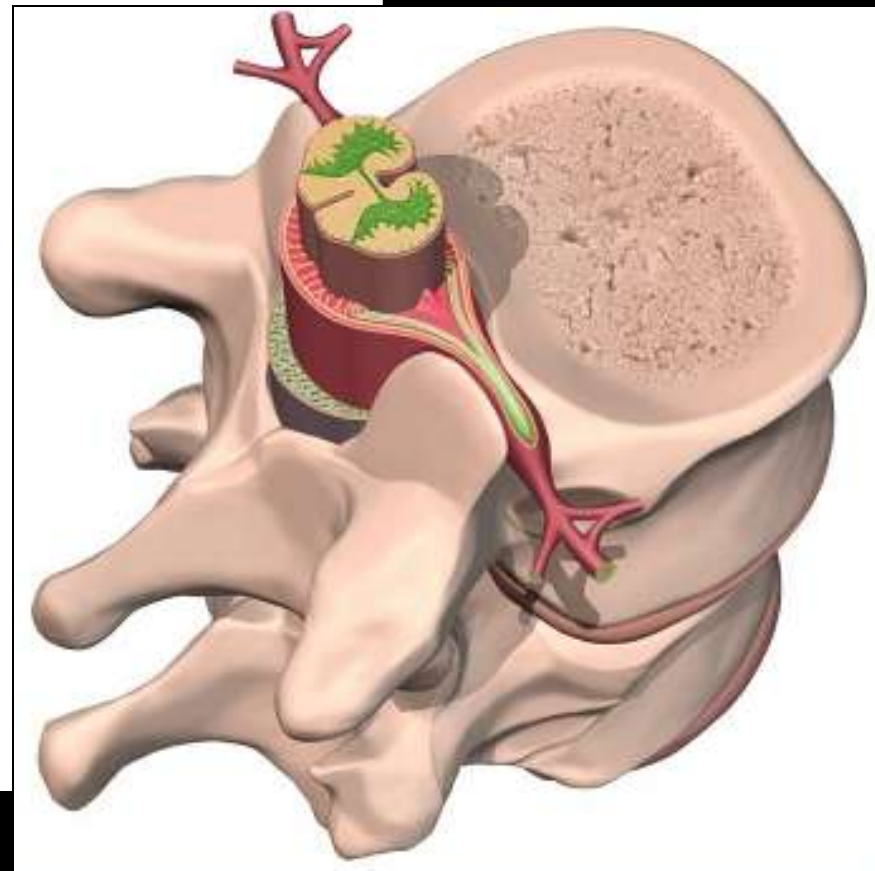
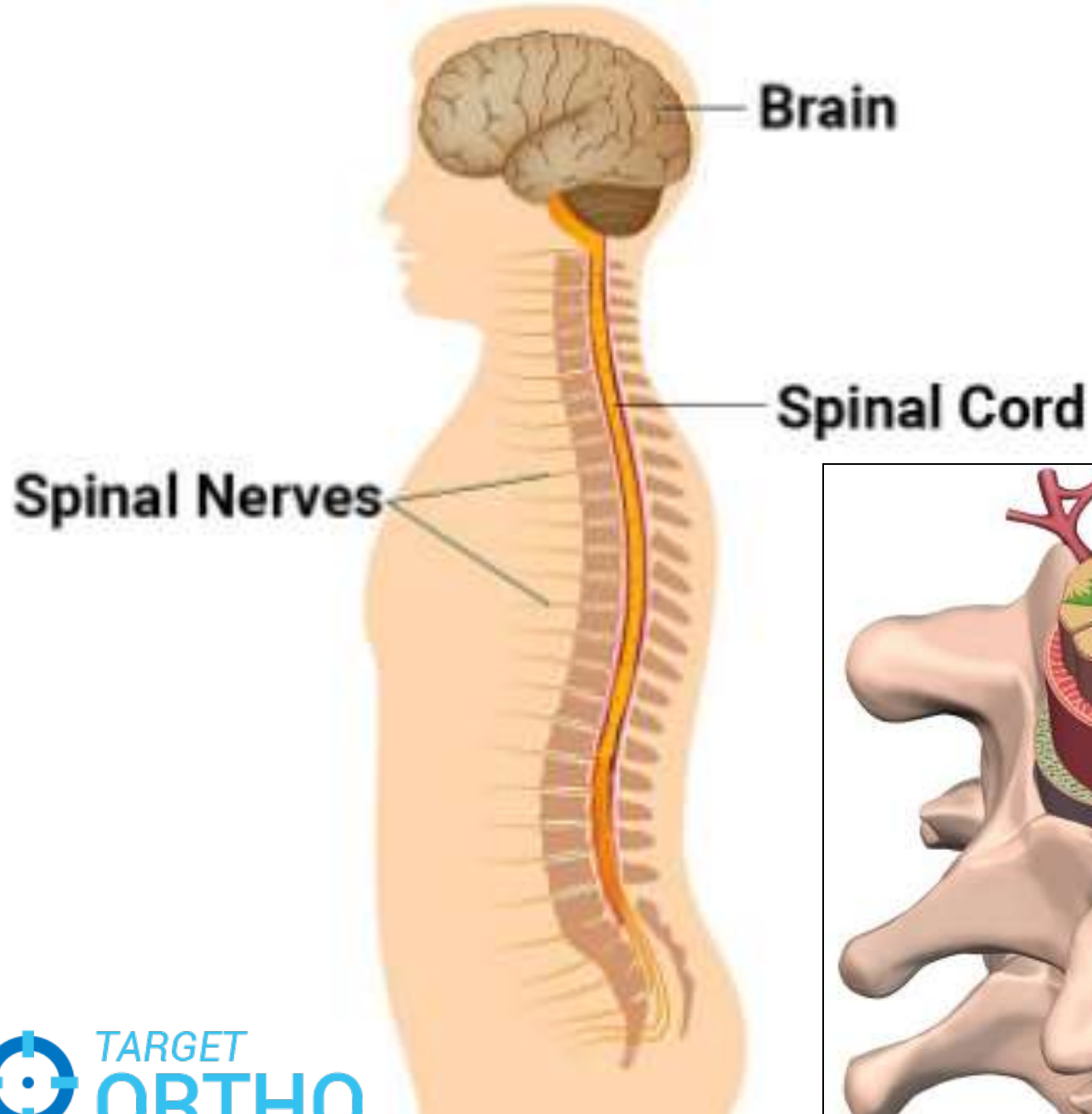
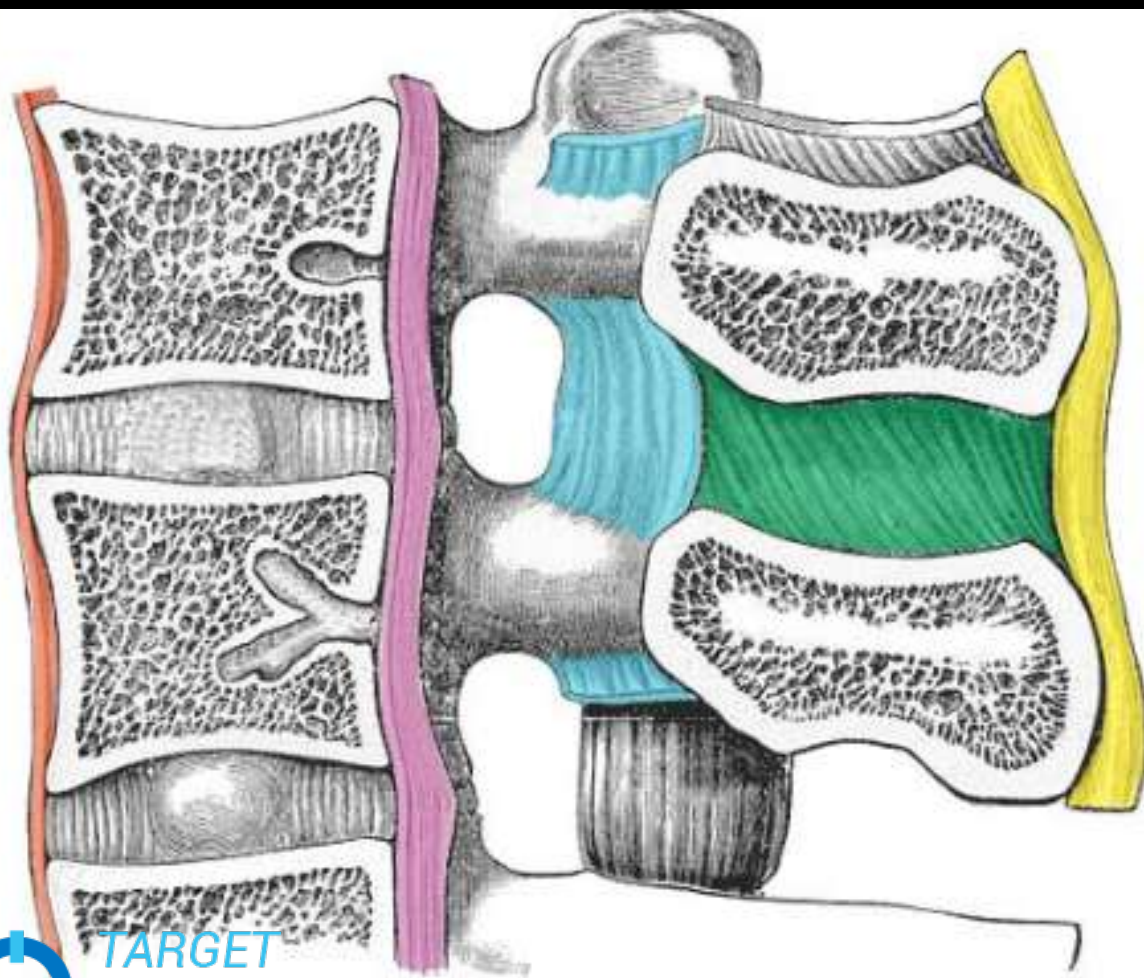


Thoraco lumbar fractures

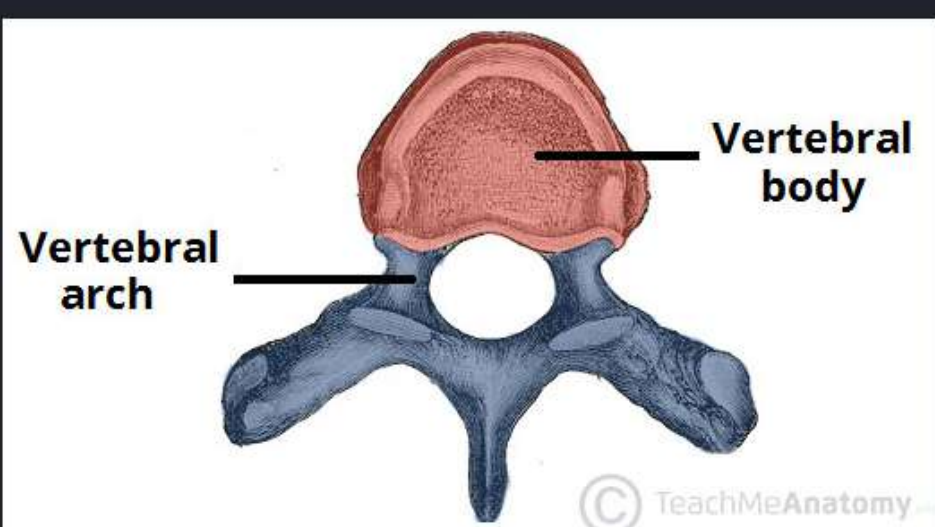


Dr.C.S.Vishnuprasath., M.S., DNB., FNB(Spine).,
Consultant spine surgeon,
SKS Hospitals, Salem.





- Anterior longit. ligament
- Posterior longit. ligament
- Ligamentum flavum
- Interspinal ligament
- Supraspinous ligament



Three biomechanical regions

T1-T8:

relatively rigid (ribcage),
kyphosis.

flexion injury pattern predominates

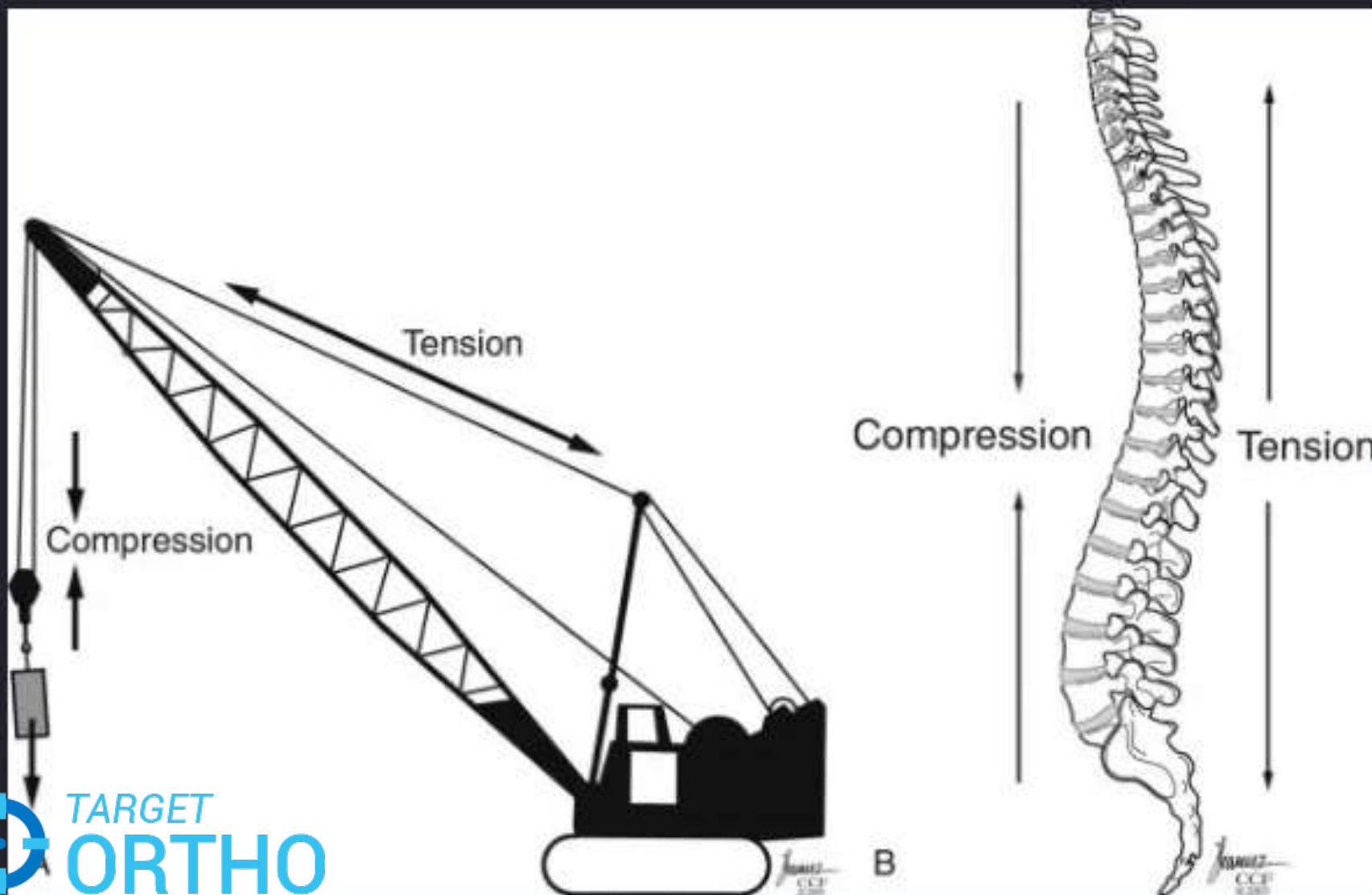
T9-L2:

transition: immobile - mobile,
transition: kyphosis - lordosis
most injuries occur here

L3-sacrum:

mobile, lordosis
axial load injuries predominate





B

Spine instability

- *loss in the ability of the spine under physiologic loads to maintain relationships between vertebrae in such a way that there is neither damage nor subsequent irritation to the spinal cord or nerve roots. In addition there is no development of incapacitating deformity or pain due to structural changes.”*

Facts about spinal injury

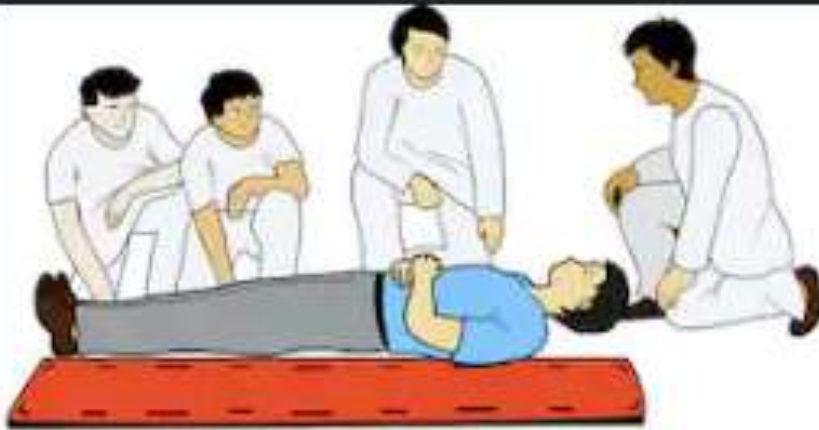
- 2,50,000 to 5,00,000 – spinal cord injury
- 80% of them due to RTA and fall from height
- 5 times more likely to die prematurely
- Young adult male (20 – 29 yrs)

Assessment of spine injury patients

- Accident site response
- Emergency room management
- Imaging protocol
- Treatment strategy

Accident site response

Logroll method



Step 1



Step 2



Step 3

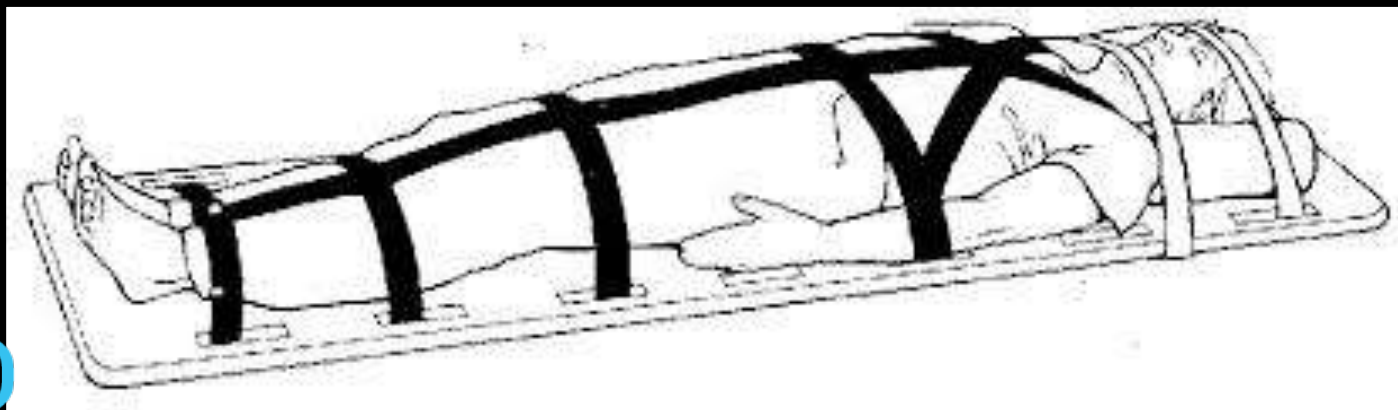


Step 4

Accident site response



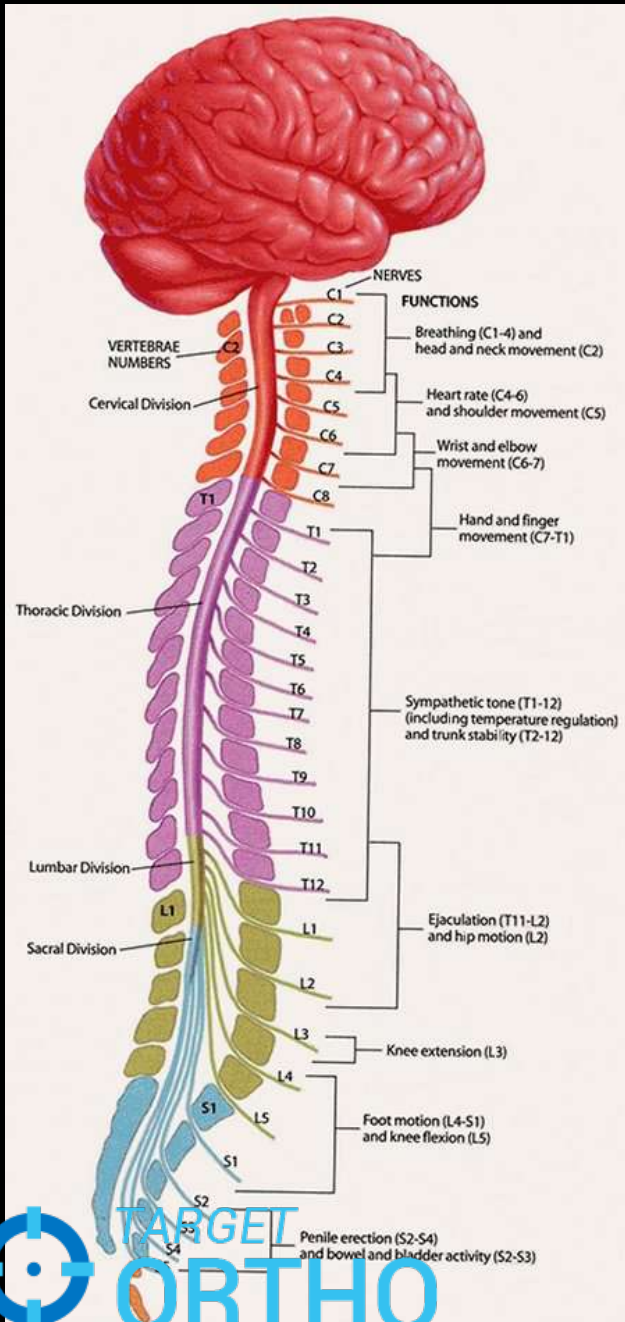
Accident site response



Emergency room management

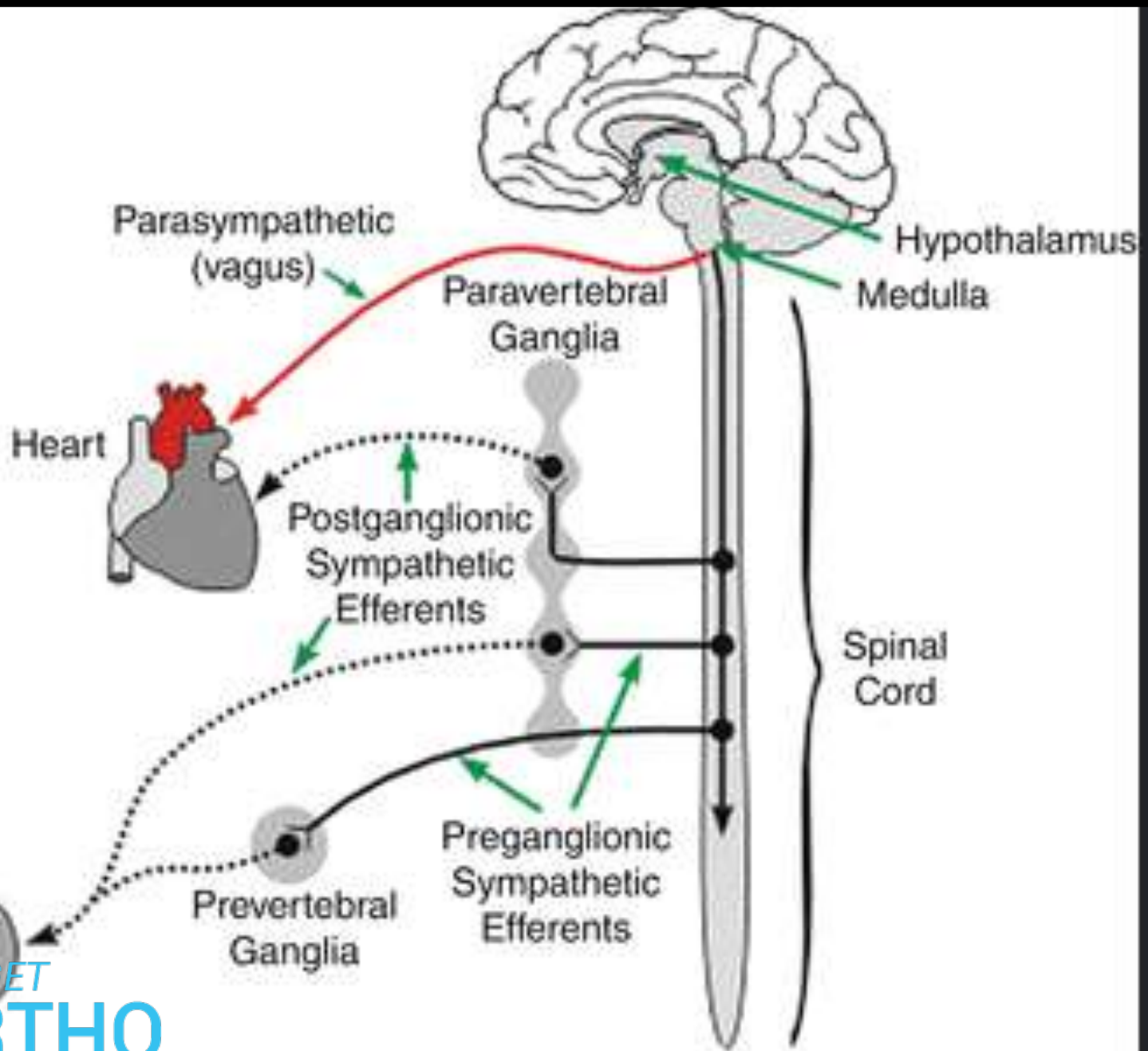


Breathing

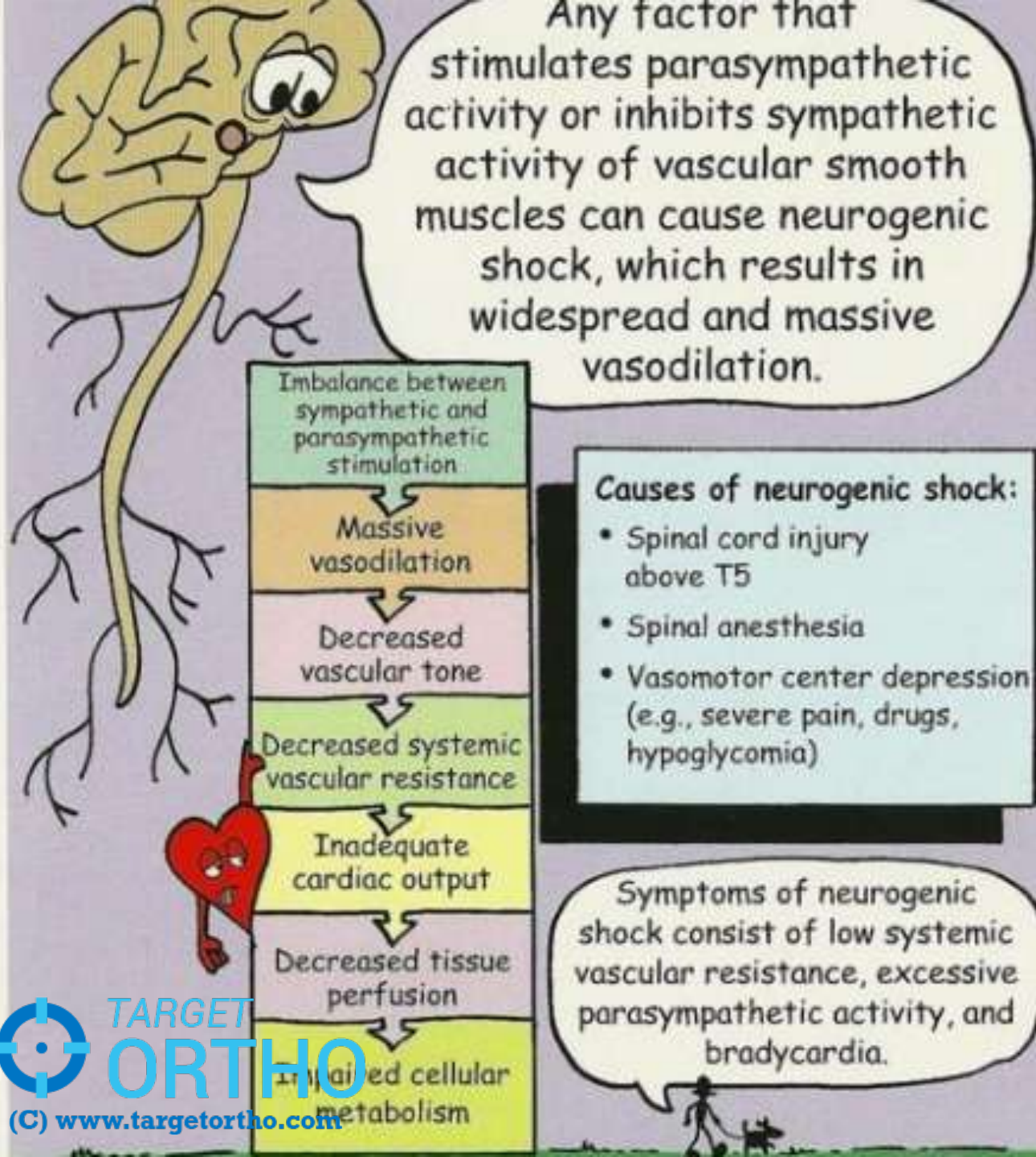


• **Cervical spine injury**- Phrenic nerve palsy and respiratory muscle palsy(c3,c4,c5)

• **Thoracic spine injury**- Chest injury



Neurogenic shock



Neurological examination of spine injury patient

Motor
power

Sensory
examination

Reflexes

Perianal
sensation

Voluntary rectal
motor function

Great toe
flexion

**Sacral sparing-
incomplete cord injury**

Spinal shock

- 50% of patients
- Physiological spinal cord shutdown in response to injury
- M/C – cervical & upper thoracic cord injuries

Flaccid paralysis

Areflexia

Lack of sensation

Spinal shock

- **Resolution of spinal shock-** *reflex arcs caudal to the level of injury begin to function again*
Bulboavernous reflex & Anal wink reflex
- Usually within 24 to 48 hours of injury.
- Absence of motor or sensory function below the level of injury after spinal shock- complete injury (***poor prognosis for neurological recovery***).
- Will not return in conus lesion and cauda equina

- International Standards for Neurology and Functional Classification of patient with injury in spinal cord

Patient Name _____

Examiner Name _____ Date/Time of Exam _____

STANDARD NEUROLOGICAL CLASSIFICATION OF SPINAL CORD INJURY

MOTOR

KEY MUSCLES
(Scoring on reverse side)

C5	☐	☐	Elbow flexors
C6	☐	☐	Wrist extensors
C7	☐	☐	Elbow extensors
C8	☐	☐	Finger flexors (distal phalanx of middle finger)
T1	☐	☐	Finger abductors (little finger)

UPPER LIMB TOTAL
(MAXIMUM) ☐ + ☐ = ☐
(25) (25) (50)

L2	☐	☐	Hip flexors
L3	☐	☐	Knee extensors
L4	☐	☐	Ankle dorsiflexors
L5	☐	☐	Long toe extensors
S1	☐	☐	Ankle plantar flexors

Voluntary anal contraction ☐
(Yes/No)

LOWER LIMB TOTAL
(MAXIMUM) ☐ + ☐ = ☐
(25) (25) (50)

NEUROLOGICAL LEVEL: ☐ R ☐ L
The most caudal segment with normal sensory and motor function.
www.targetforthe.com

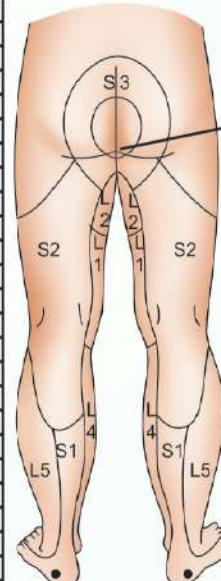
SENSORY

KEY SENSORY POINTS

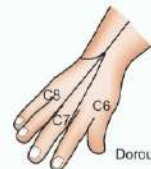
0 = absent
1 = Impaired
2 = normal
NT = not testable

LIGHT TOUCH
R L R 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				



Palm



Dorsum

Any anal sensation (Yes/No) ☐

PIN PRICK SCORE (max : 112)
LIGHT TOUCH SCORE (max : 112)

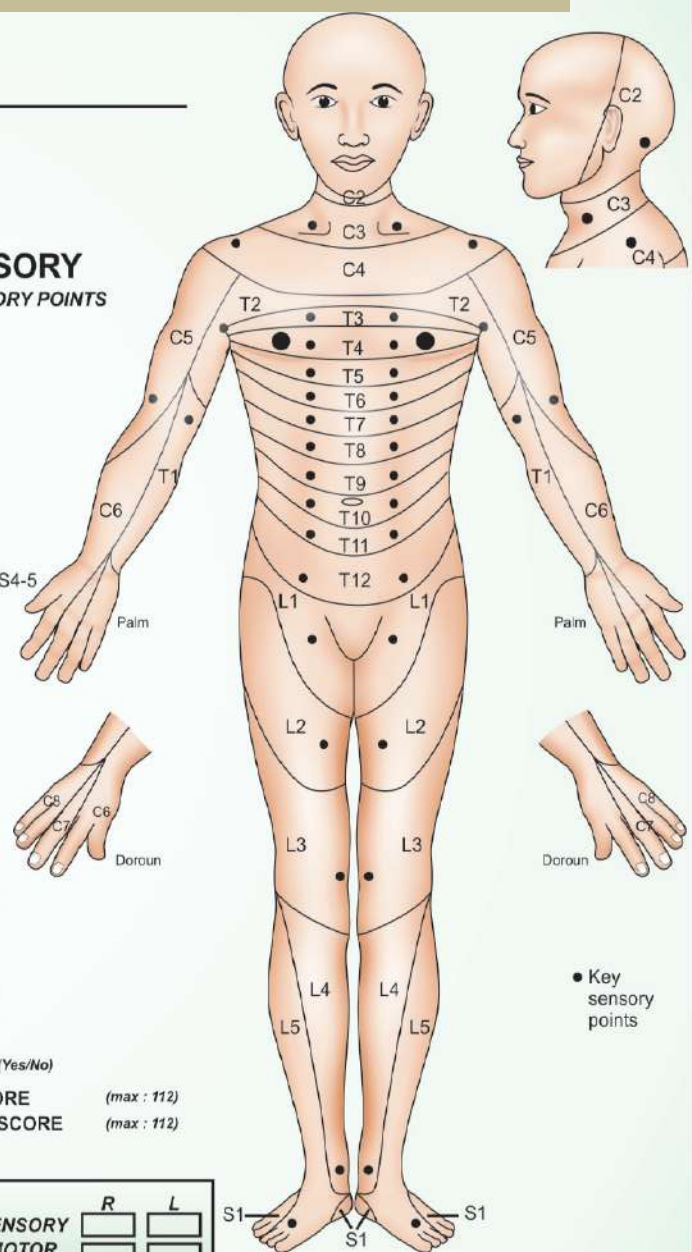
TOTALS ☐ + ☐ = ☐
(MAXIMUM) (56) (56) (56) (56)

COMPLETE OR INCOMPLETE?
Incomplete Any sensory or motor function in S4-S5

ASIA IMPAIRMENT SCALE

ZONE OF PARTIAL PRESERVATION

SENSORY ☐ R ☐ L
MOTOR ☐ R ☐ L



• Key sensory points

- **A-Complete:** No motor or sensory function
- **B-Incomplete:** Sensory function below neurological but no motor function
- **C-Incomplete:** Motor function is preserved ,more than half the muscles $< 3/5$.
- **D-Incomplete:** Motor function is preserved ,muscle grade $\geq 3/5$.
- **E-Normal:** Sensory and motor functions are normal.

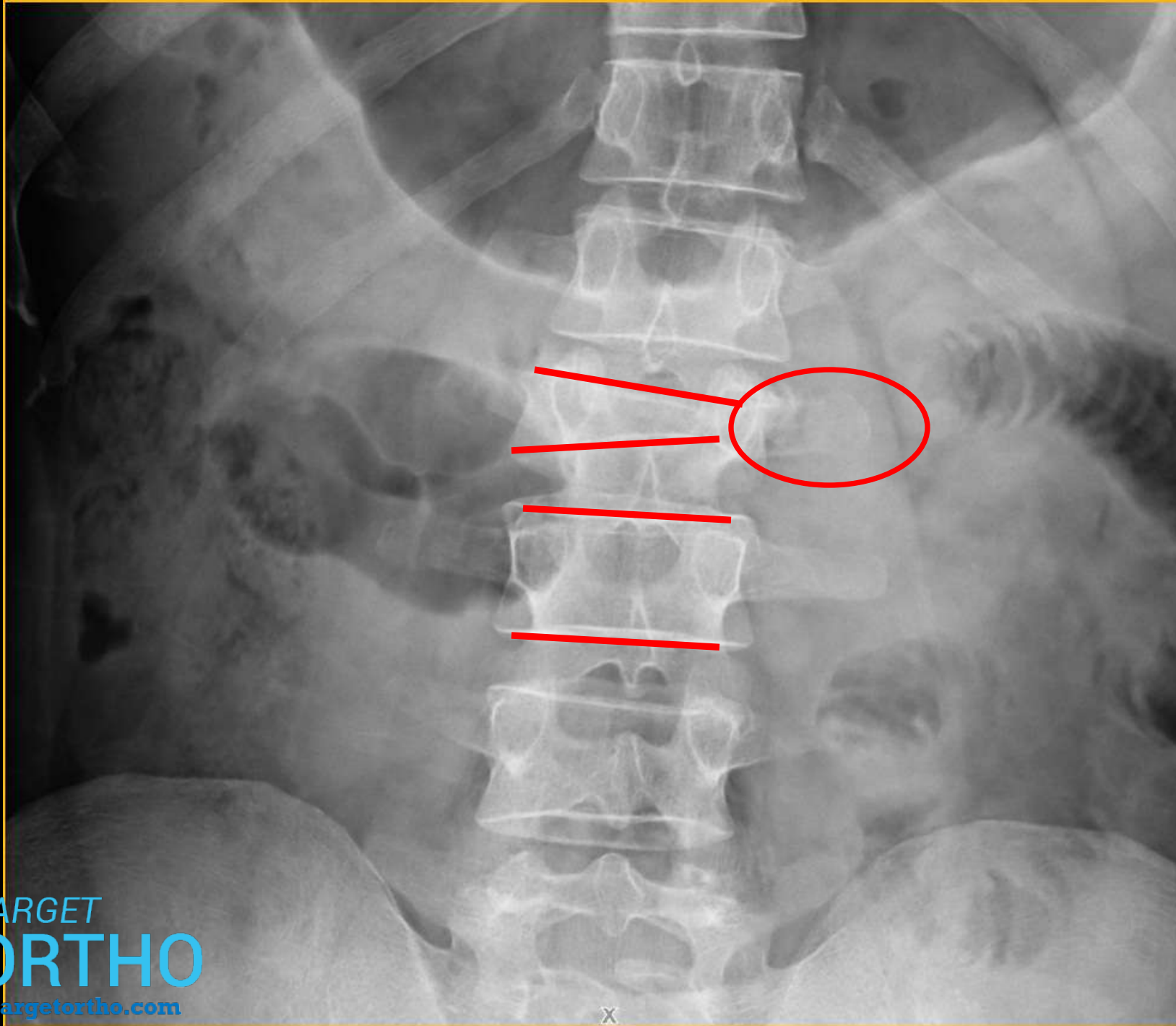
Imaging modalities

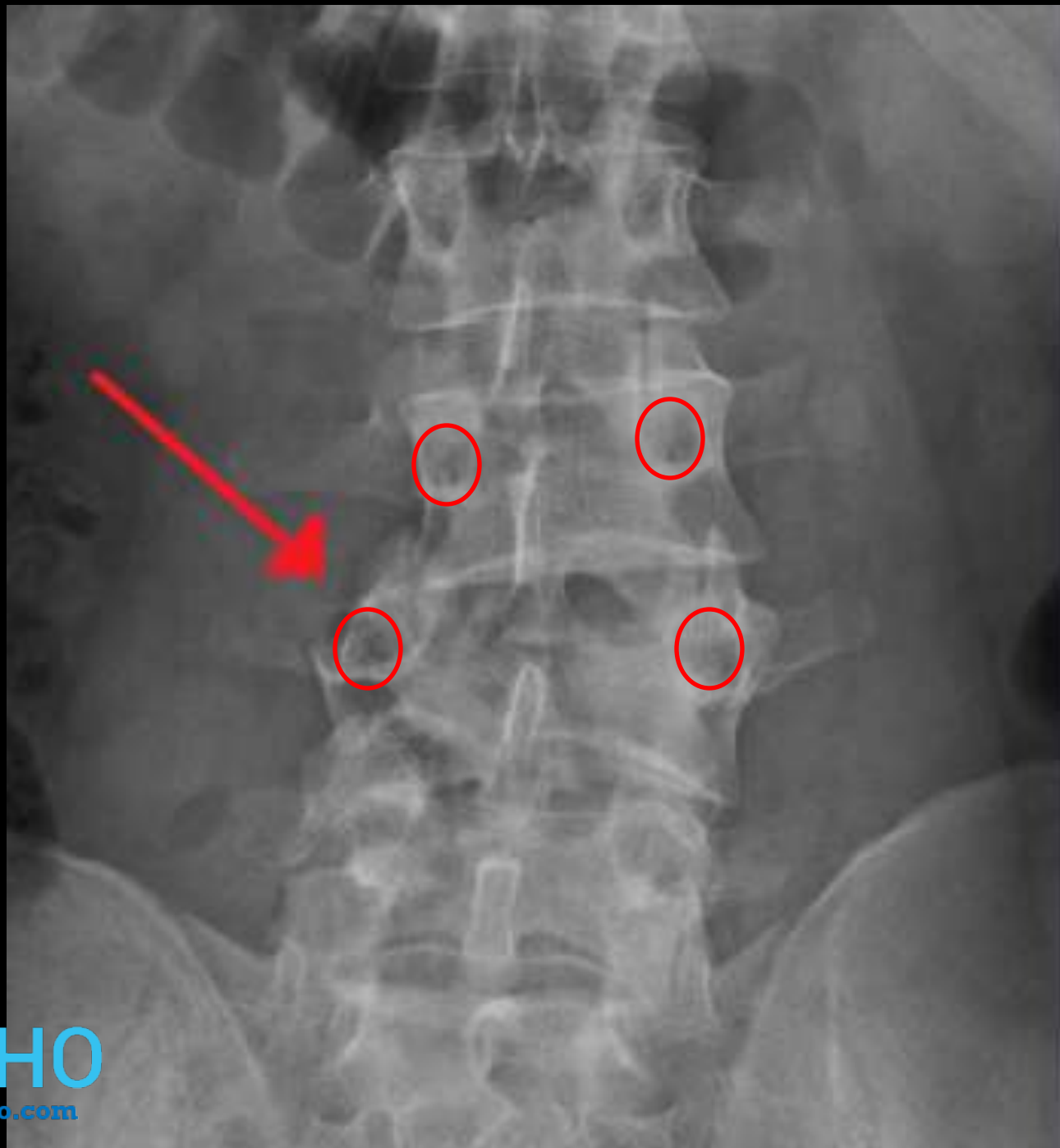
- **X-ray**
- **CT scan**
- **MRI**

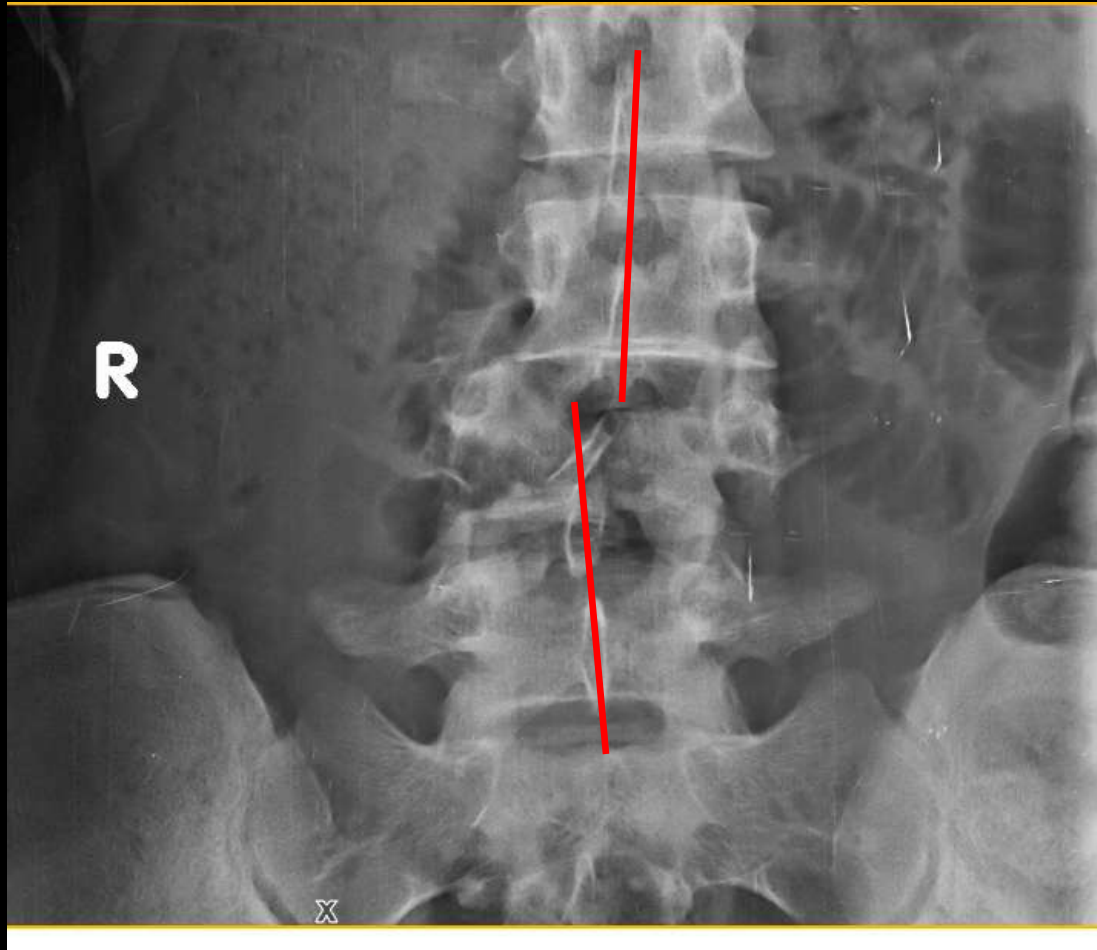
X-Ray

- Never hesitate to take X-ray of a painful spinal segment
- Unconscious pt
- Facial injury
- 80% - detection rate





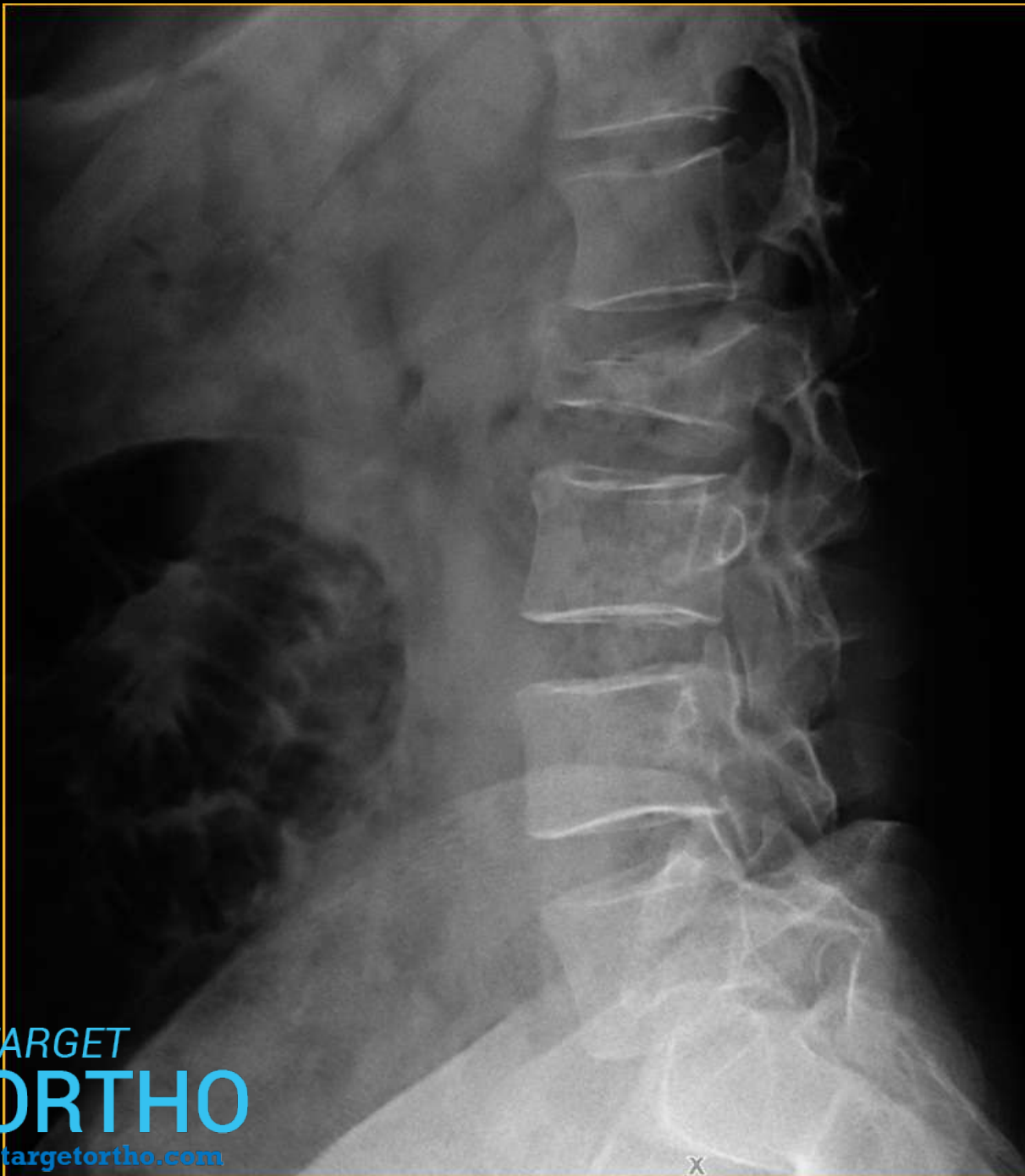






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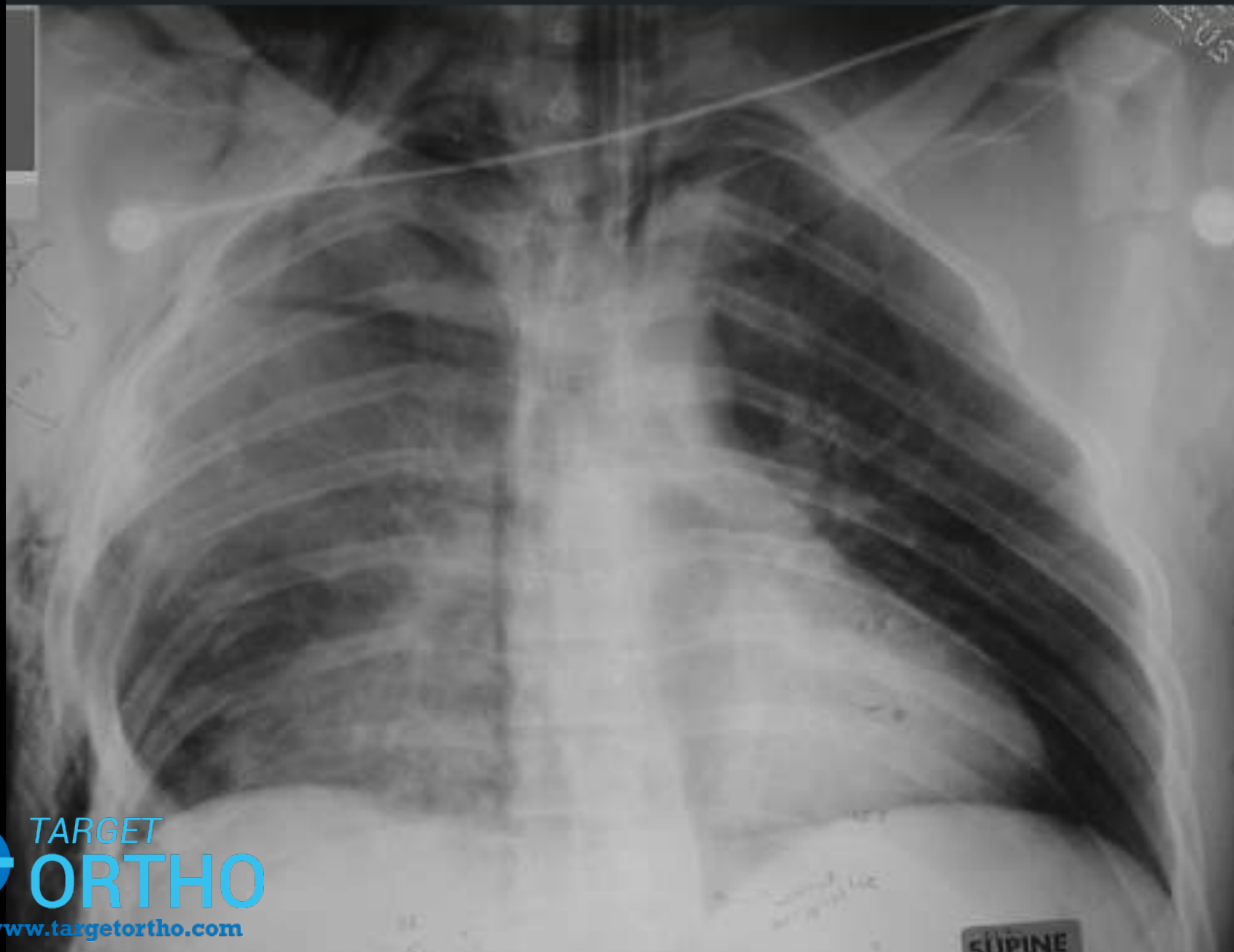




13.0

X





MRI & CT

- All patients with neurological deficit
- Normal neurology – Xray suggestive of unstable fracture

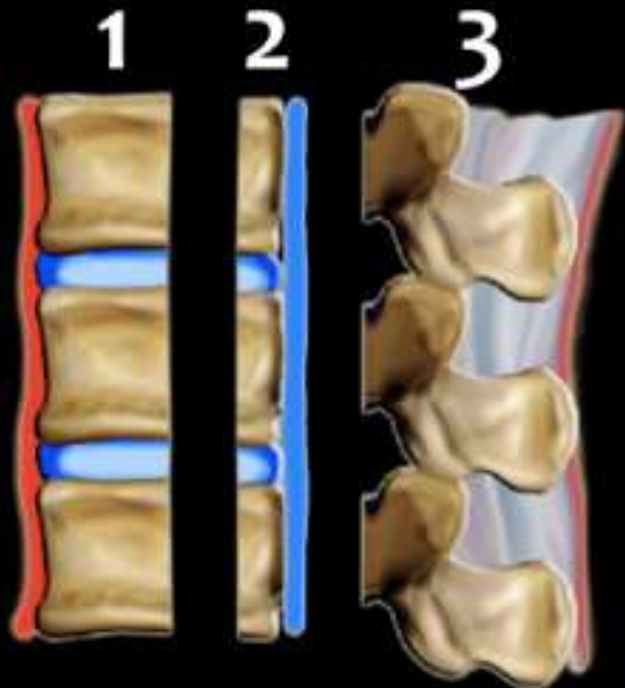
Radiographic Criteria for Instability

- Kyphosis $> 20^\circ$
- Loss of $> 50\%$ anterior vertebral body height
- Multiple adjacent compression fractures with significant spinal deformity
- Spinal dislocation of the posterior elements (i.e., facet dislocation)
- Fracture extension into spinal canal with $> 20\%$ canal compromise



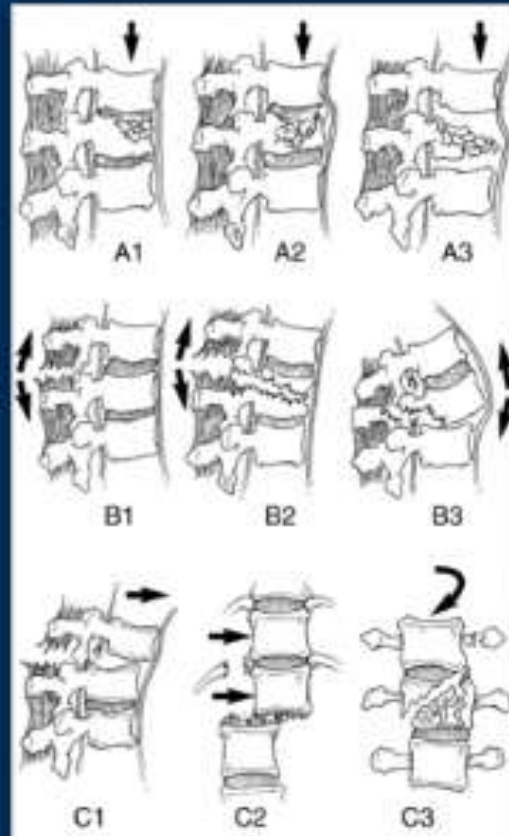
Denis

3-column classification



AO

classification



TLICS

classification



Morphology
PCL integrity
Neurologic status

Denis 3 column classification

RS



Ant. column

Ant Longit Lig

Ant annulus

Ant 2/3 vert body



Middle column

Post 1/3 of vert body

Post annulus,

Post Longit Lig



Post. column

Posterior elements

- pedicles, facets,
- lamina
- spinous proces

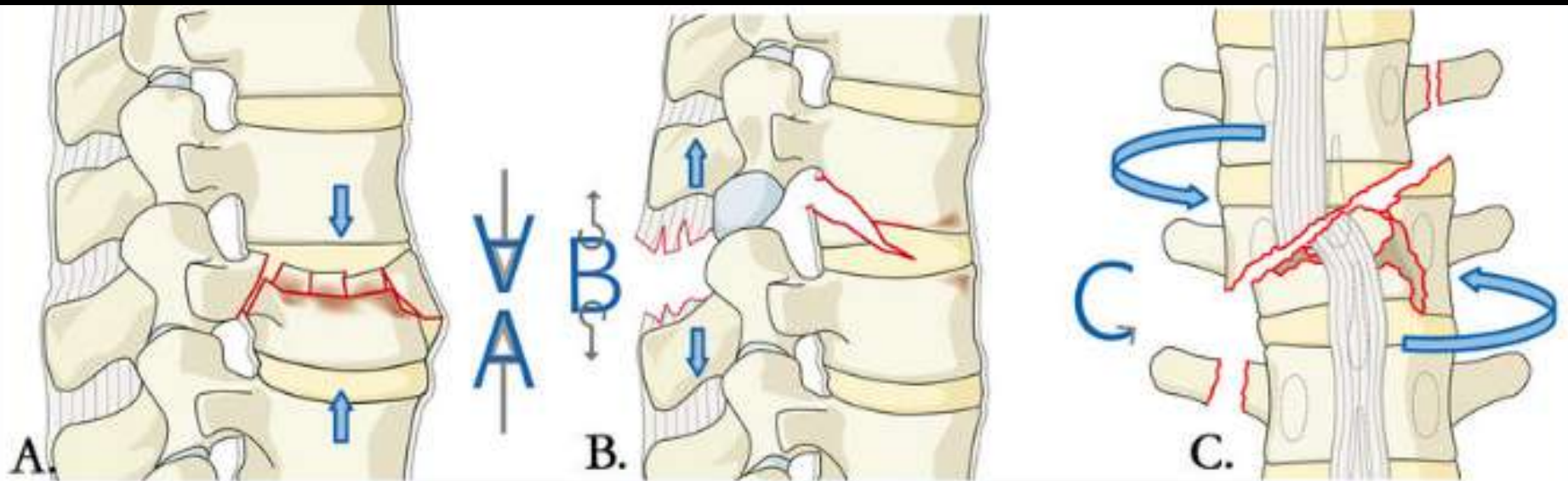
Posterior ligaments



Only anterior column



AO classification



Classification A B C

Compression injuries=shortening

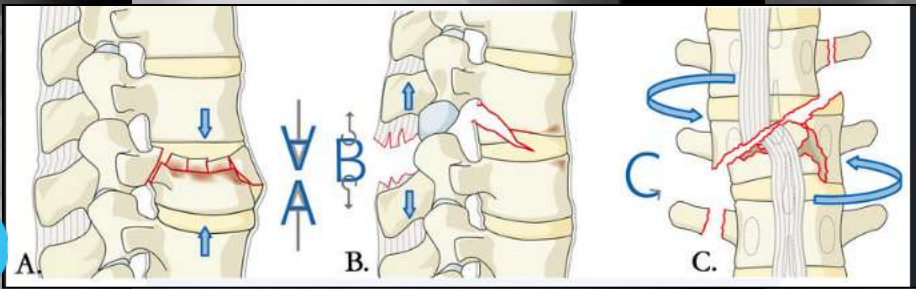
→ type A

Distraction injuries=lengthening

→ type B

Torsional injuries=rotation

→ type C



Thoracolumbar Injury

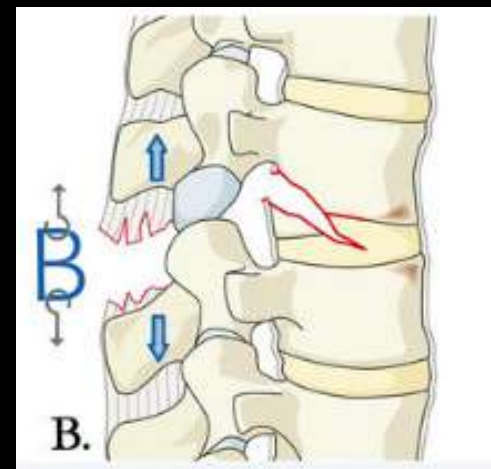
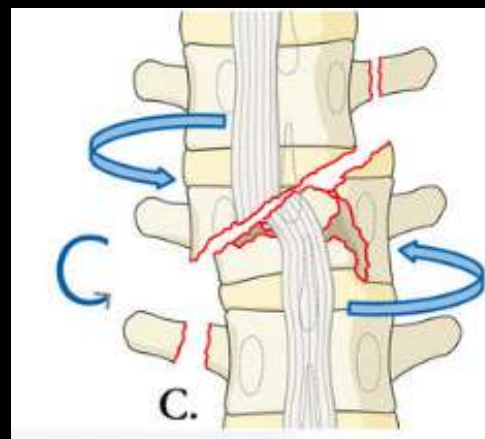
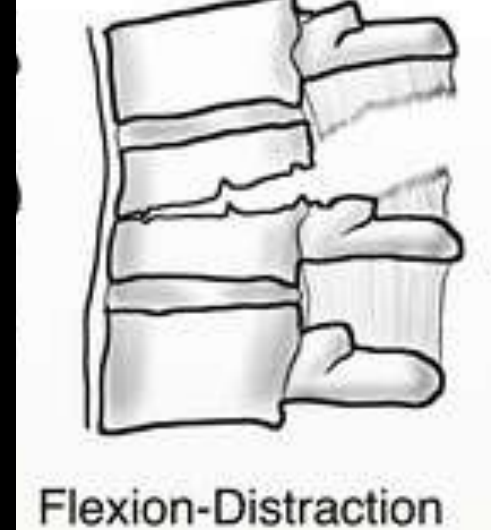
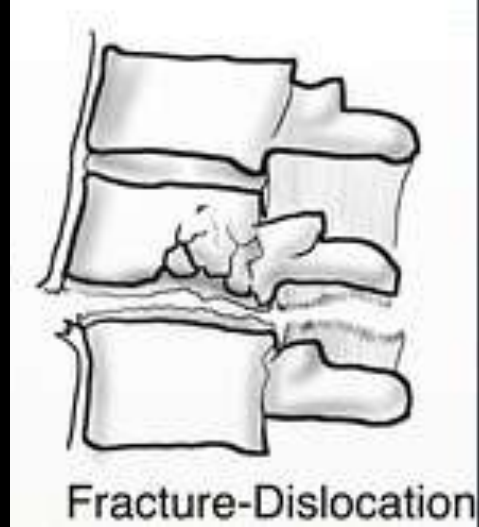
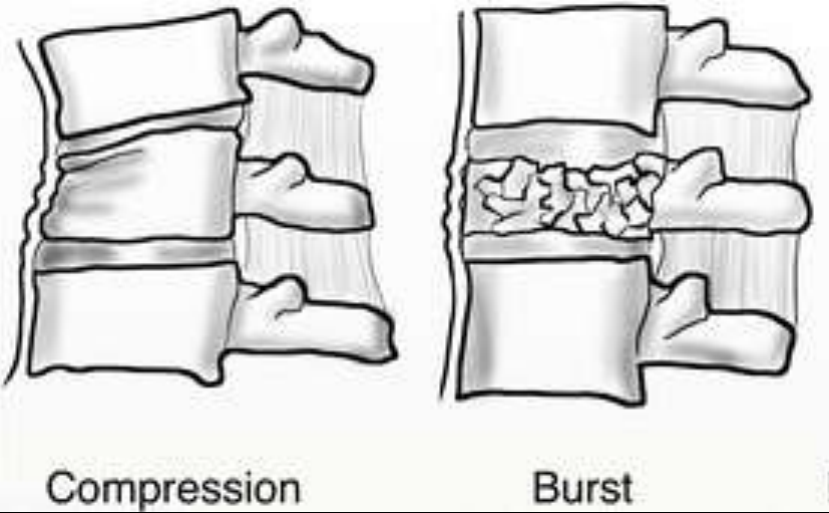
Classification and Severity Score

POINTS

- **FRACTURE MECHANISM**
- Compression fracture 1
- Burst fracture 1
- Translation/rotation 3
- Distraction 4
- **NEUROLOGICAL INVOLVEMENT**
- Intact 0
- Nerve root 2
- Cord, conus medullaris, incomplete 3
- Cord, conus medullaris, complete 2
- Cauda equina 3
- **POSTERIOR LIGAMENTOUS COMPLEX INTEGRITY**
- Intact 0
- Injury suspected/indeterminate 2
- Injured 3

TLICS 3 independent predictors

1	Morphology immediate stability	- Compression - Burst - Translation/rotation - Distraction	1 2 3 4	- Radiographs - CT
2	Integrity of PLC longterm stability	- Intact - Suspected - Injured	0 2 3	- MRI
3	Neurological status	- Intact - Nerve root - Complete cord - Incomplete cord - Cauda equina	0 2 2 3 3	- Physical examination
Predicts		- Need for surgery	0 – 3 4 > 4	- nonsurgical - surgeon's choice - surgical

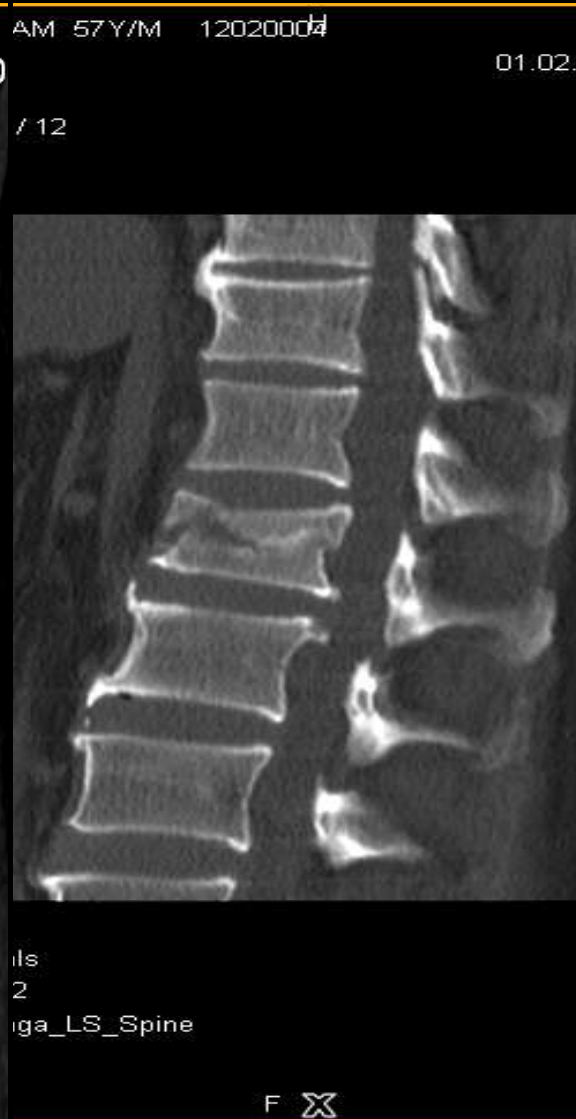


1 2

3

4







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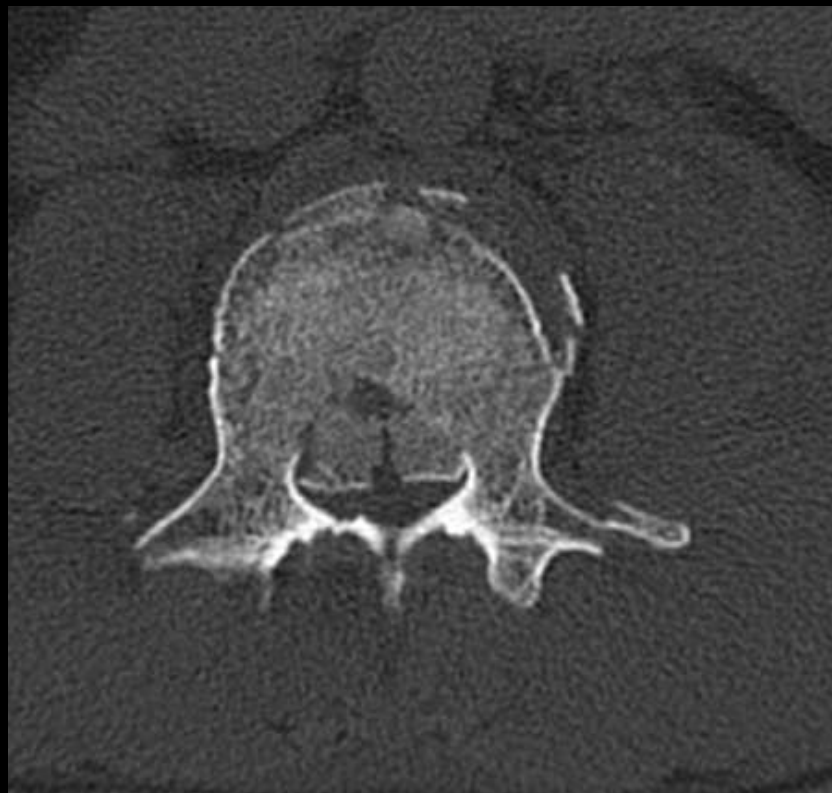
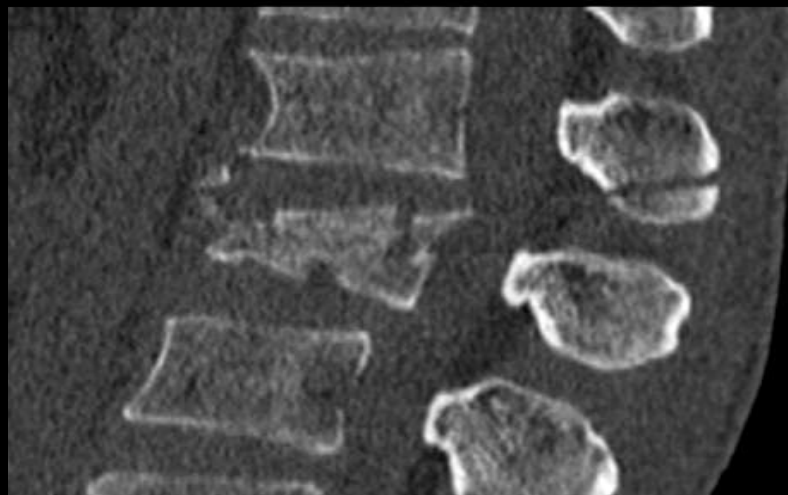
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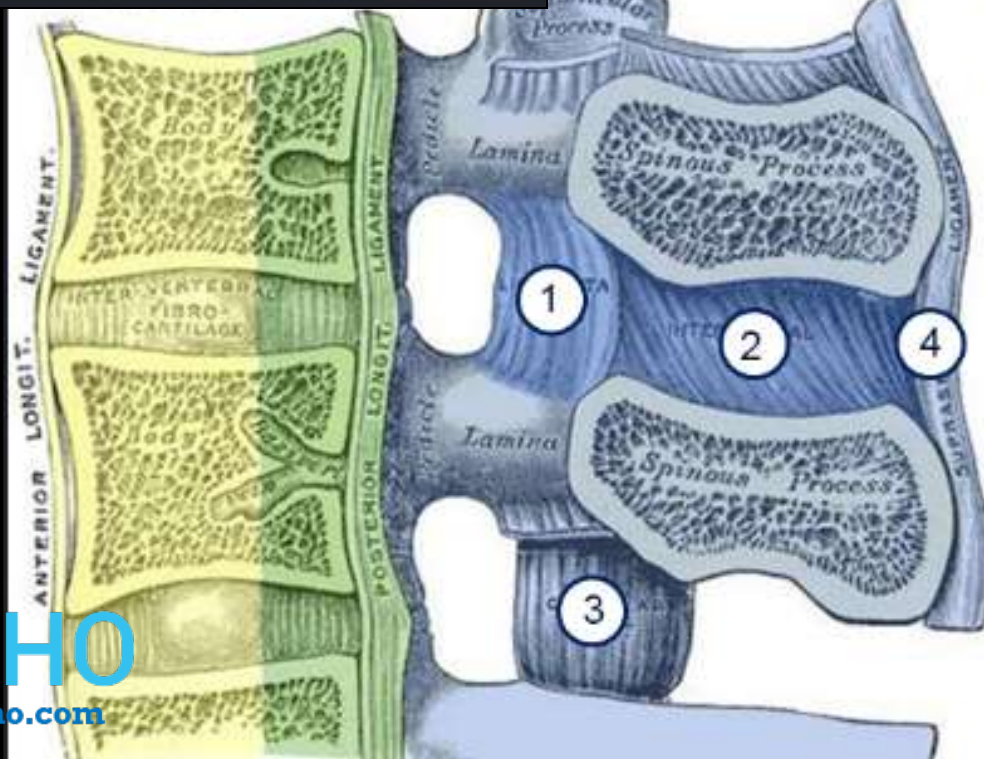
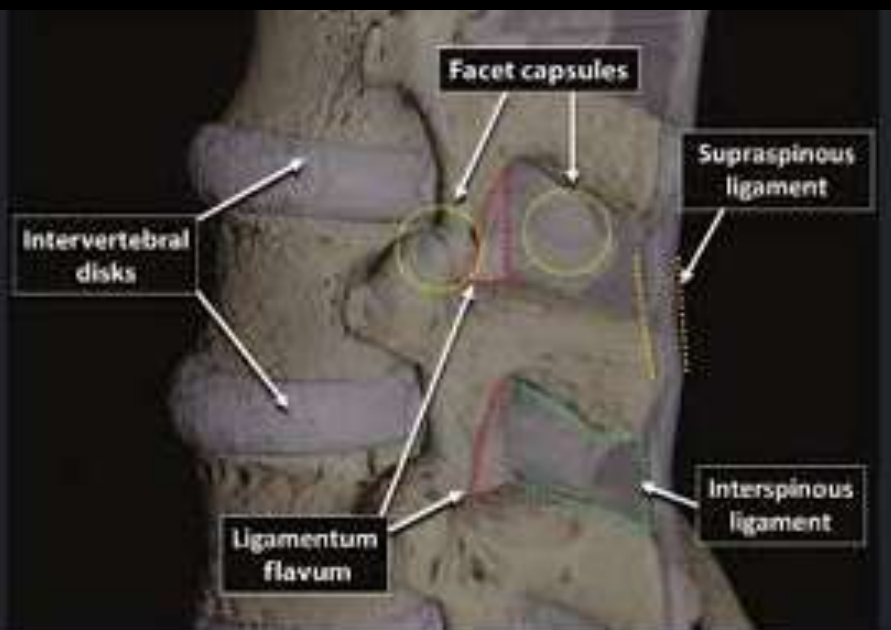


13



TLICS 3 independent predictors

1	Morphology immediate stability	- Compression - Burst - Translation/rotation - Distraction	1 2 3 4	- Radiographs - CT
2	Integrity of PLC longterm stability	- Intact - Suspected - Injured	0 2 3	- MRI
3	Neurological status	- Intact - Nerve root - Complete cord - Incomplete cord - Cauda equina	0 2 2 3 3	- Physical examination
Predicts		- Need for surgery	0 – 3 4 > 4	- nonsurgical - surgeon's choice - surgical



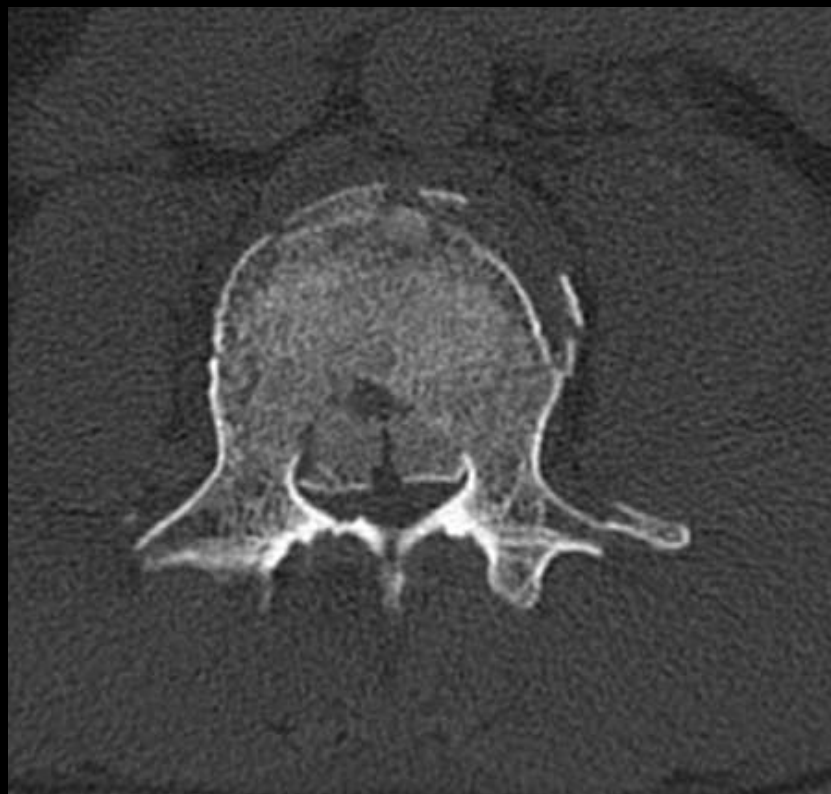
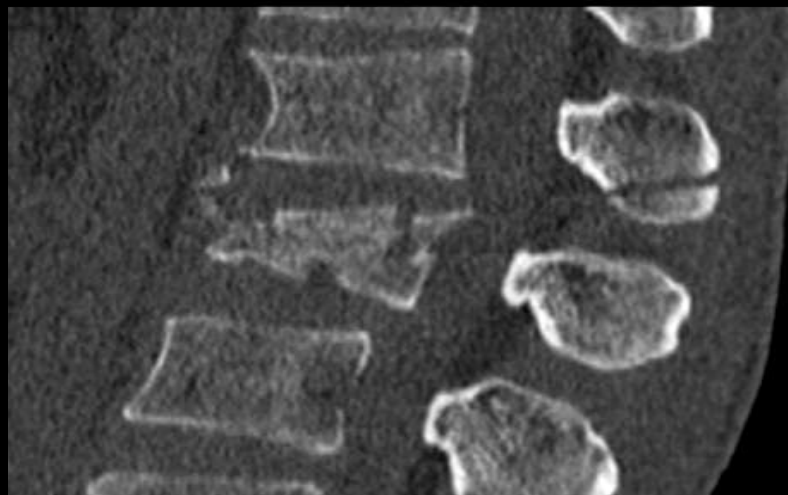
Posterior Ligamentous Complex

- ① Ligamentum flavum
- ② Interspinous ligament
- ③ Facet capsule
- ④ Supraspinous ligament

PLC integrity

Injured -3

- Palpable ligamentous gap between the spinous processes
- splaying of the spinous processes (widening of the interspinous space)
- diastasis of the facet joints/facet perch/subluxation
- translation of one vertebral body on another





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F X

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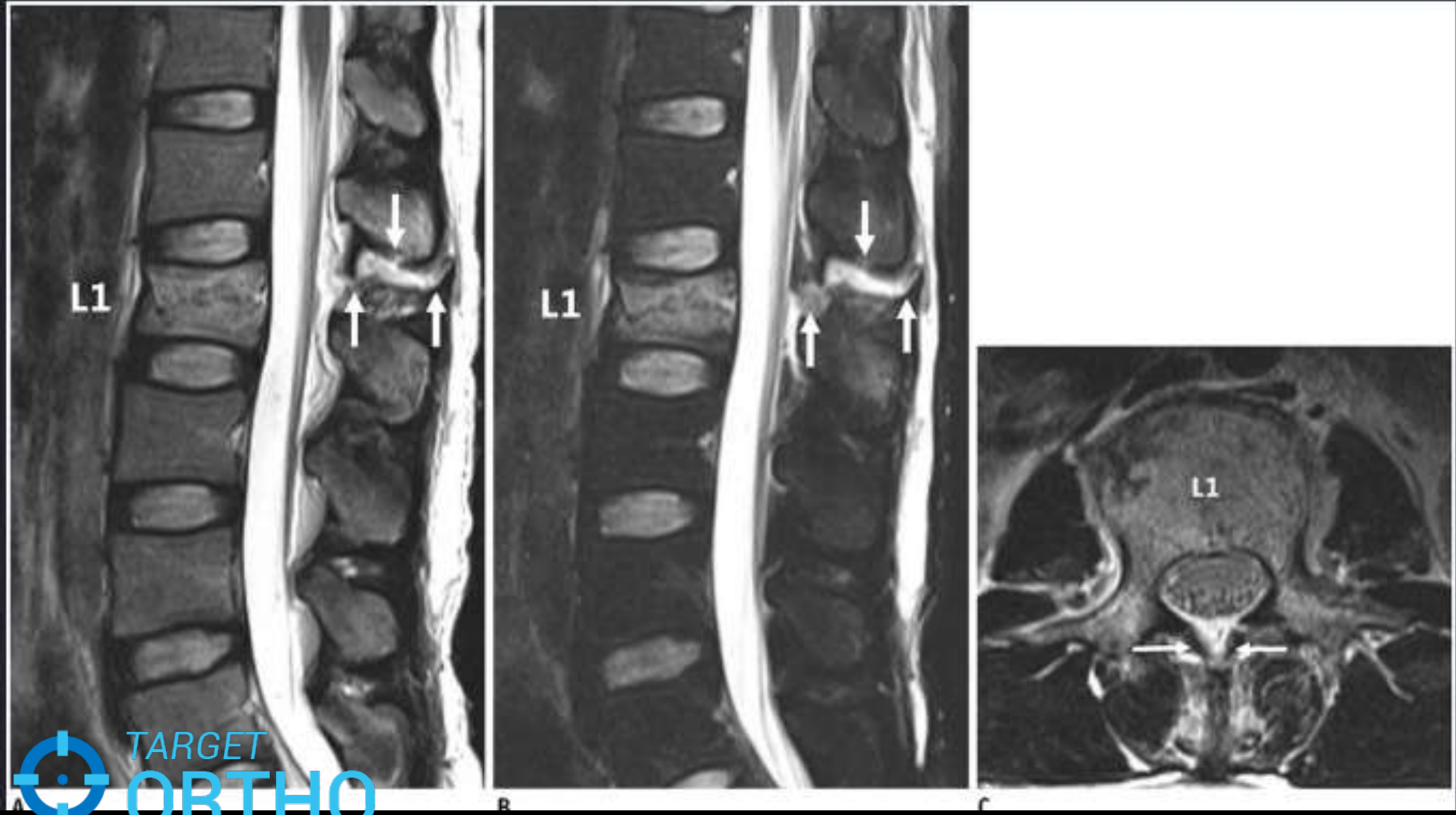
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PLC injury-Suspected

2

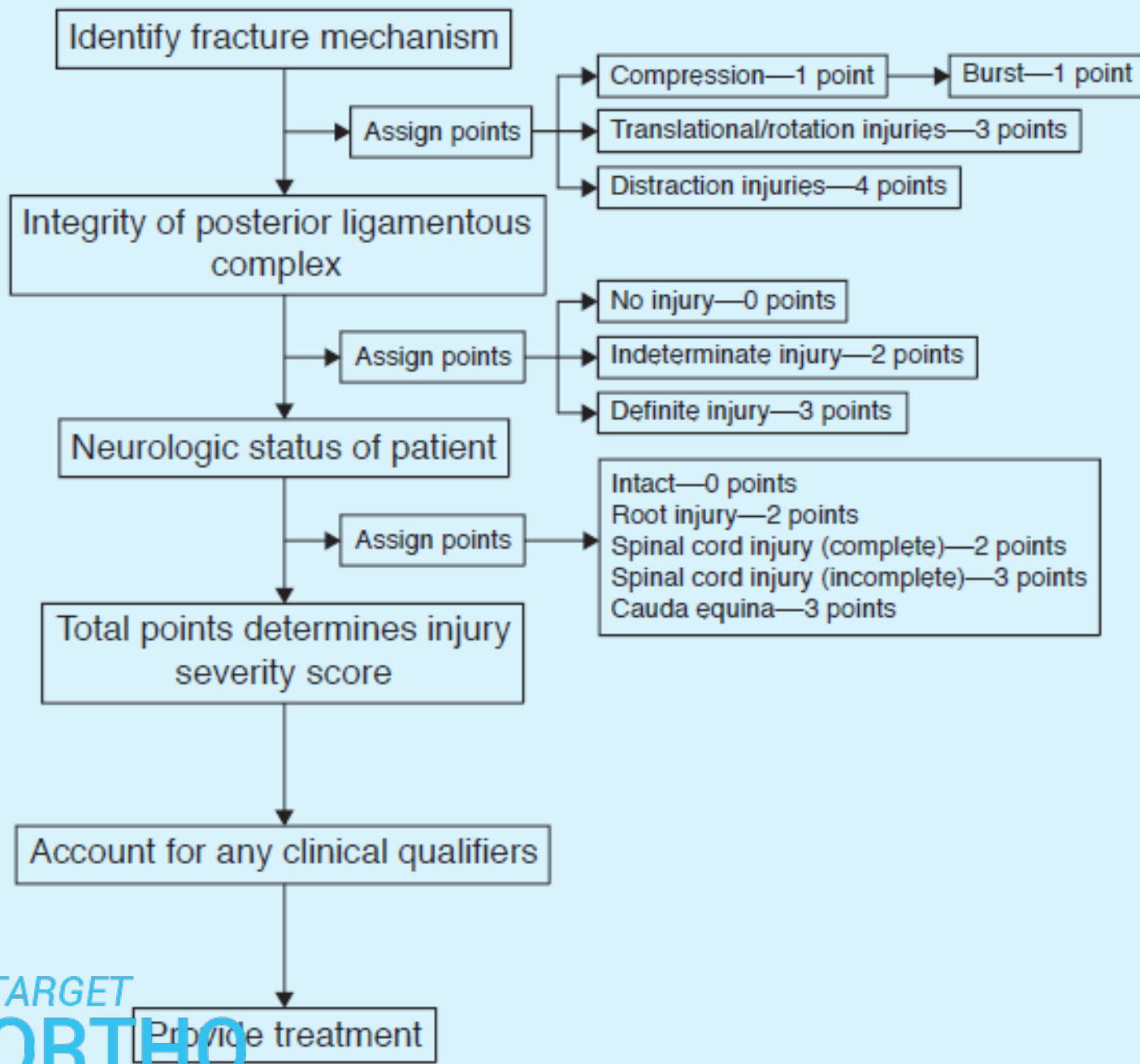


MRI signal intensity change only



Neurology

TLICS 3 independent predictors				
1	Morphology immediate stability	- Compression - Burst - Translation/rotation - Distraction	1 2 3 4	- Radiographs - CT
2	Integrity of PLC longterm stability	- Intact - Suspected - Injured	0 2 3	- MRI
3	Neurological status	- Intact - Nerve root - Complete cord - Incomplete cord - Cauda equina	0 2 2 3 3	- Physical examination
Predicts		- Need for surgery	0 – 3 4 > 4	- nonsurgical - surgeon's choice - surgical



Treatment

TLICS addresses three different categories of spine stability:

- Immediate mechanical stability, suggested by injury morphology
- Long-term stability, indicated by PLC status
- Neurologic stability, indicated by the presence or absence of a neurologic deficit

TLICS Treatment Guidelines for Spine Injury

TLICS Score	Treatment Recommendation
0–3	Nonsurgical
4	Nonsurgical or surgical
≥5	Surgical

Management

- No bed rest
- Conservative treatment for stable fractures
- Surgical treatment for unstable fractures

Goals of Nonoperative Treatment

- Preserve neurological function
- Minimize deformity progression
- Decrease pain
- Restore Function

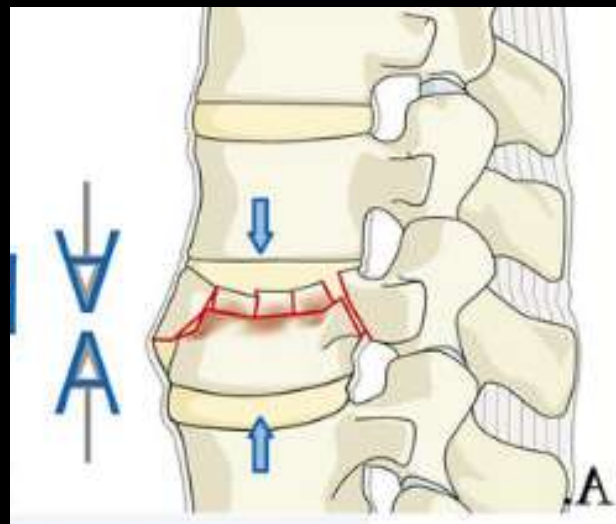
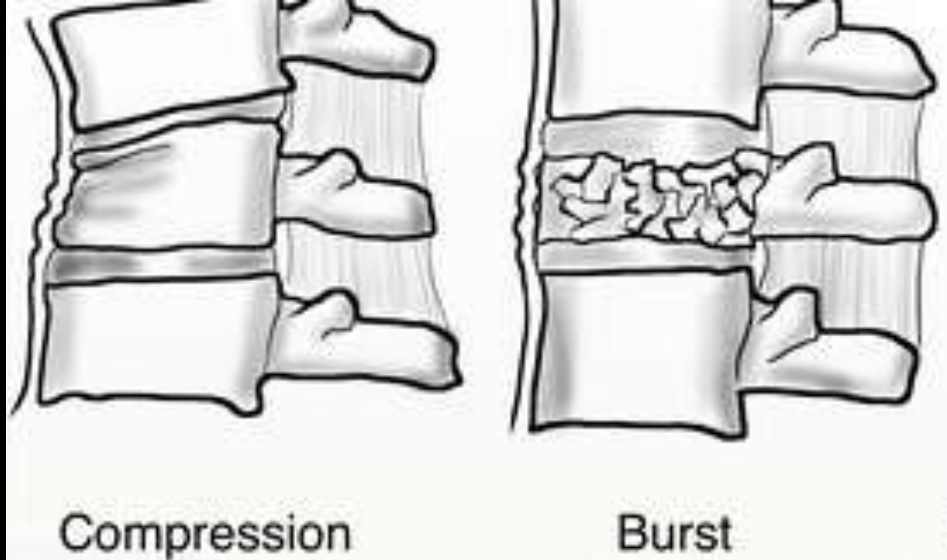
ASSUMES THE SPINE IS *STABLE*

How Do We Achieve These Goals?



Surgical management

- For all unstable fractures
- Posterior pedicle screw fixation
- Decompression – if neurological deficit is there



- Kyphosis $> 20^\circ$
- Loss of $> 50\%$ anterior vertebral body height
- Multiple adjacent compression fractures with significant spinal deformity

Posterior short segment fixation with pedicle screws

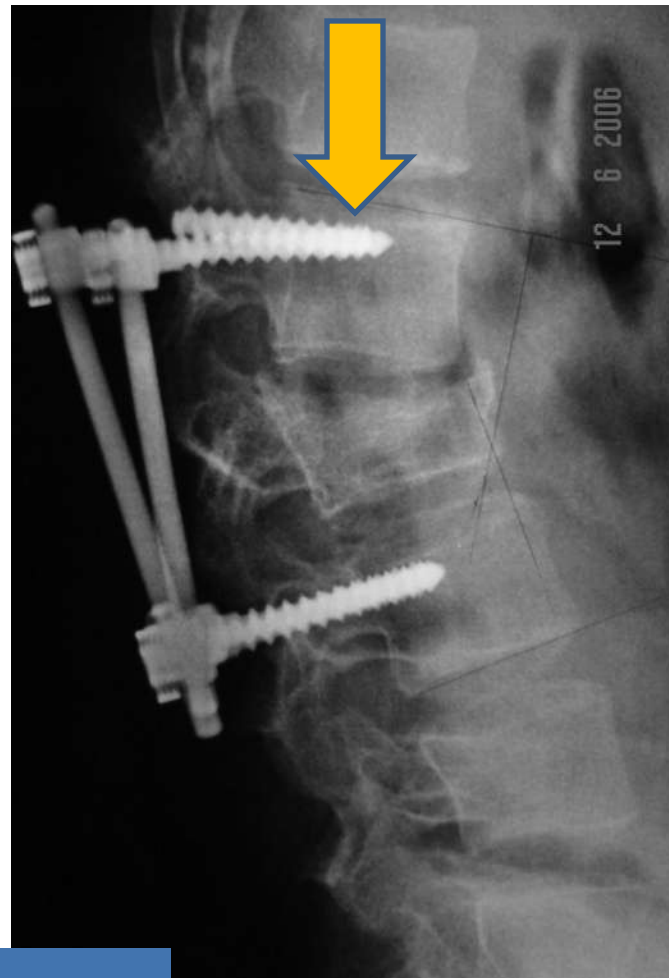
Axial load.



Cantilever effect.



High rates of failure.



McGinnis, Robert F.; Sparling, Edward; Benson, Daniel R.
J. Orthop. Res. Volume 75-A(2), February 1993.

T12 unstable burst fracture

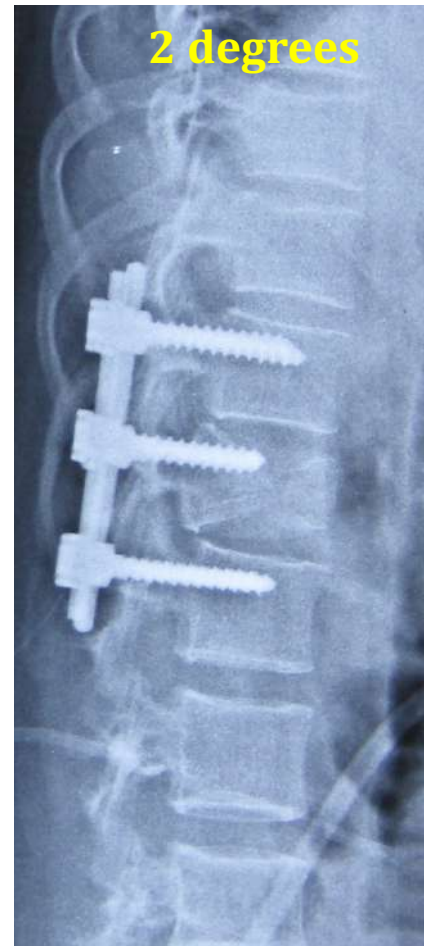


28 degrees



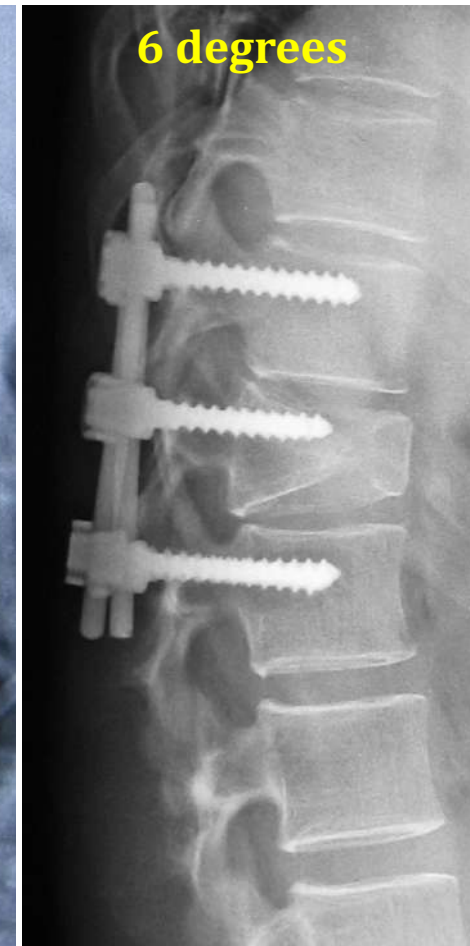
PRE-OP

2 degrees

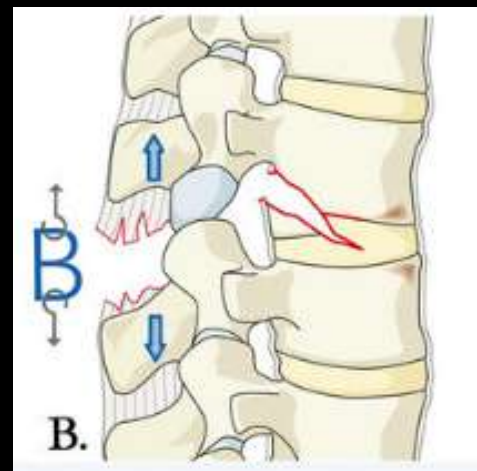
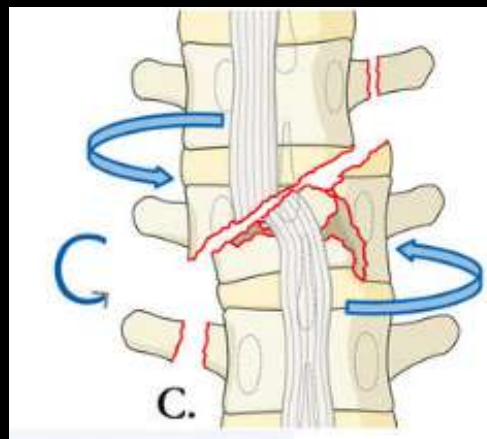
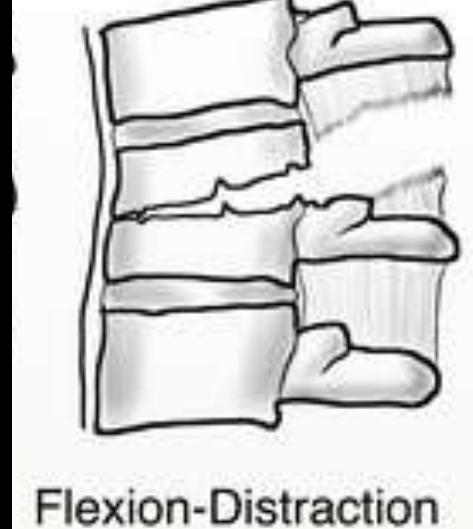
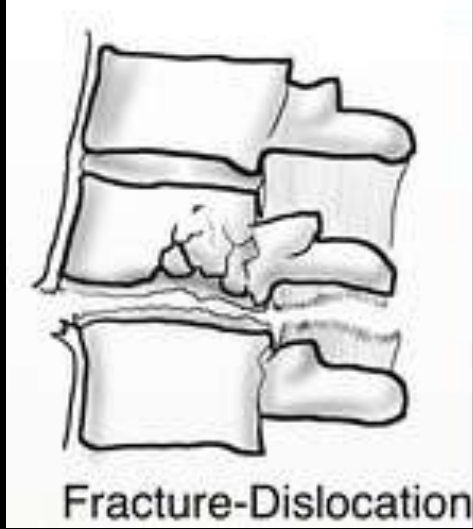


POST-OP

6 degrees

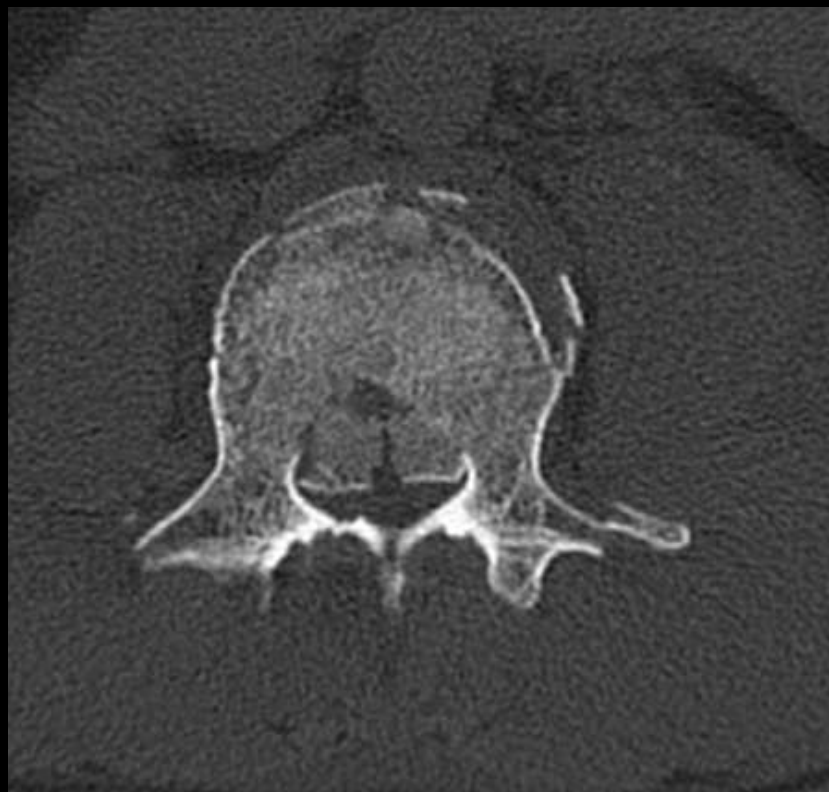
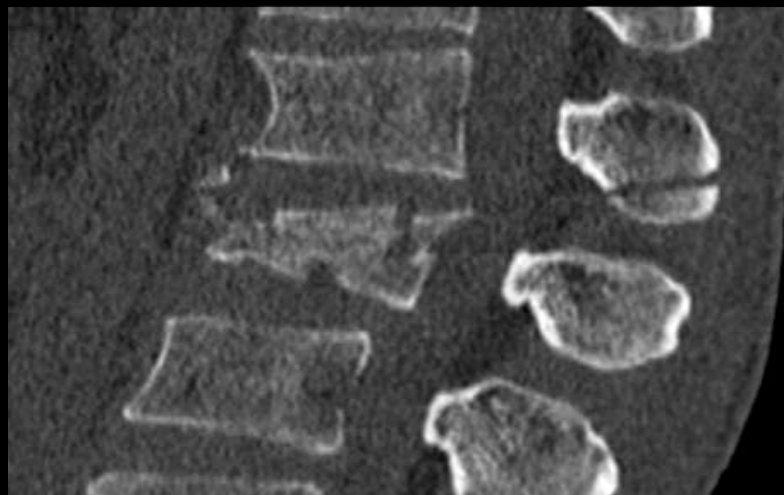


18 MONTHS FU



3

4







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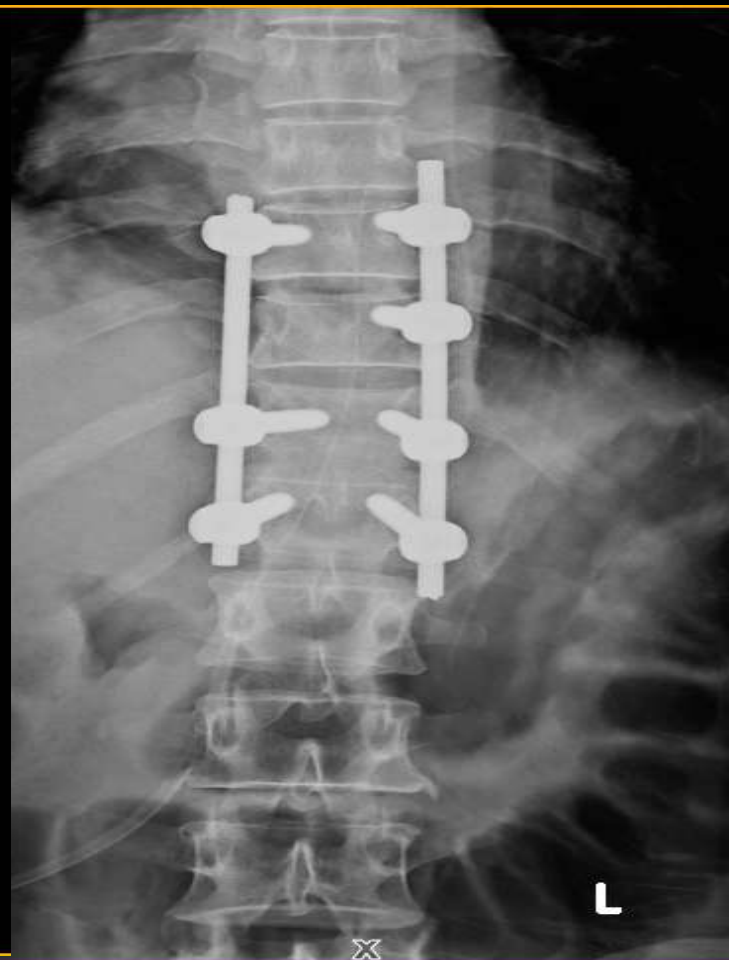
F X

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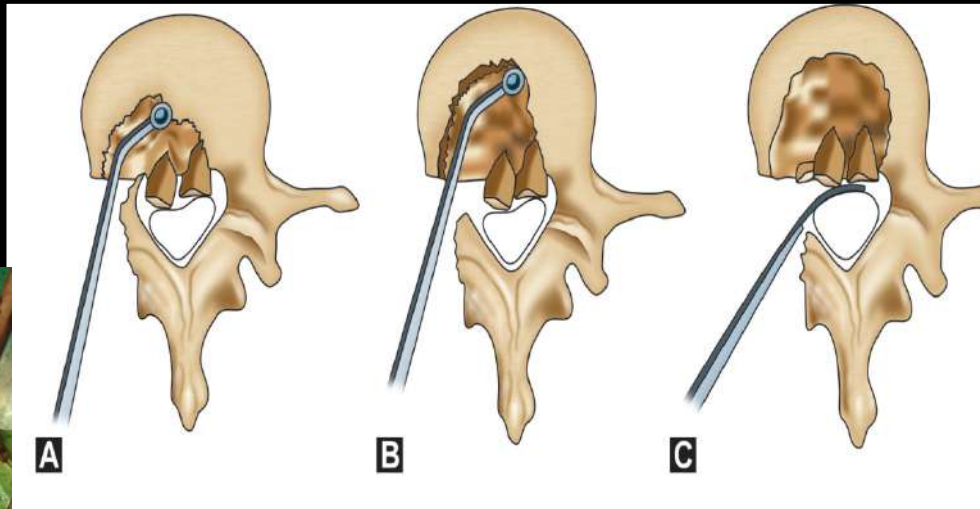
F X



Anterior approach

- Retropulsed fragment compressing the cord
- No PLC injury

Case-1 Transpedicular approach



Fracture spine

57/m L1 burst # ASIA E



RAJAMANICKAM 57Y/M 12020004
01.02.1955 M
57Y
Ser./Img.: 602 / 12
Contr:
Emotion 6
01.02.2012 05:20:52 [O]
Tab.Pos.:
Gantry: 0.0
Thickn.: 5.0mm
Pat.Pos.: HFS



Ganga Hospitals
Matrix: 512*512
Ind: Spine Ganga_LS_Spine
kV: 130
mAs: 103
TARGET ORTHO
www.targetortho.com

WC: 327
WW: 1176

RAJAMANICKAM 57Y/M 12020004
01.02.1955 M
57Y
Ser./Img.: 3 / 140
Contr:
Emotion 6
01.02.2012 05:20:52 [O]
Tab.Pos.: -112.3
Gantry: 0.0
Thickn.: 1.3mm
Pat.Pos.: HFS

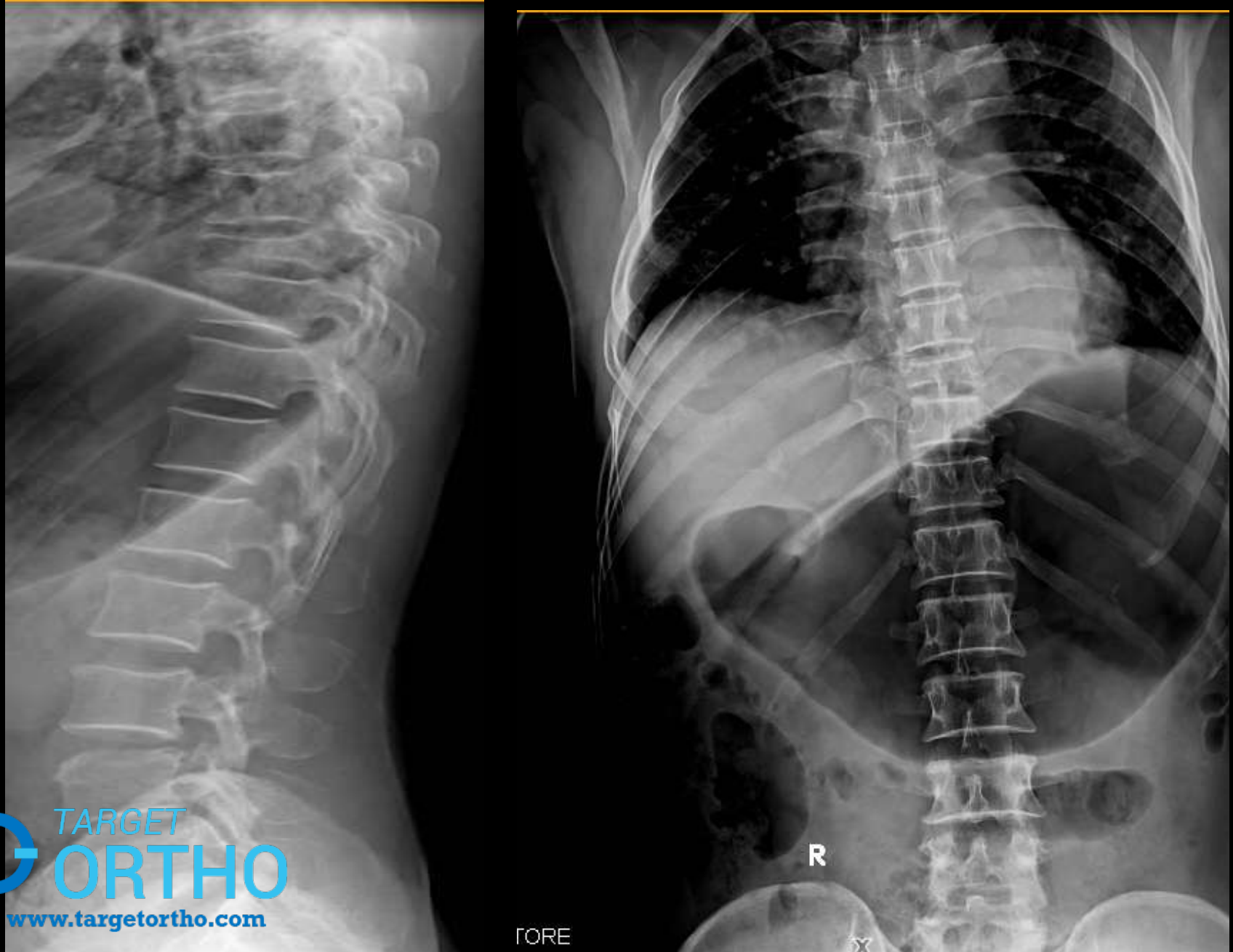


Ganga Hospitals
Matrix: 512*512
Ind: Spine Ganga_LS_Spine
kV: 130
mAs: 103

WC: 283
WW: 1676

P X

T9 # - ASIA – C neurology



H

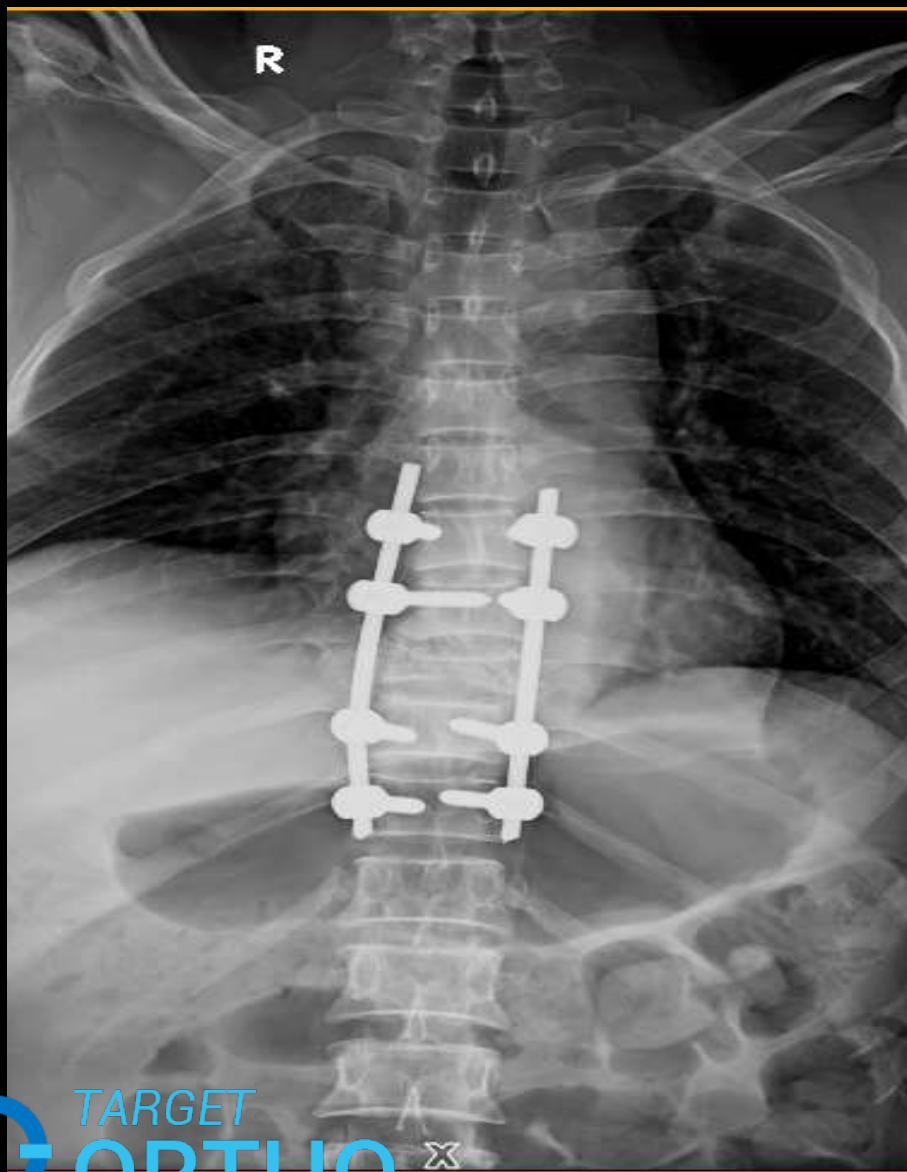




Th
P

C7

D12



L1 # - Normal neurology



013886

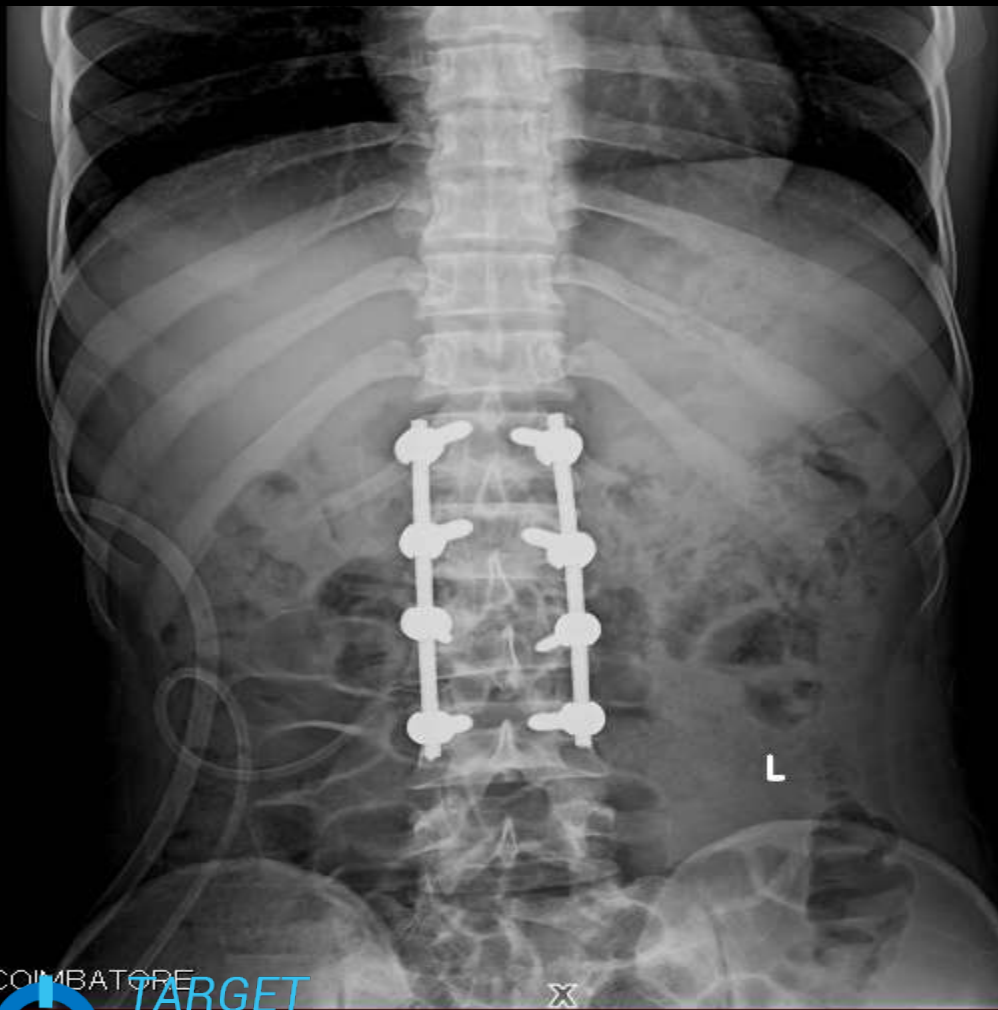
i/M 12013886
26 M

26

03 / 18

_S_Spine

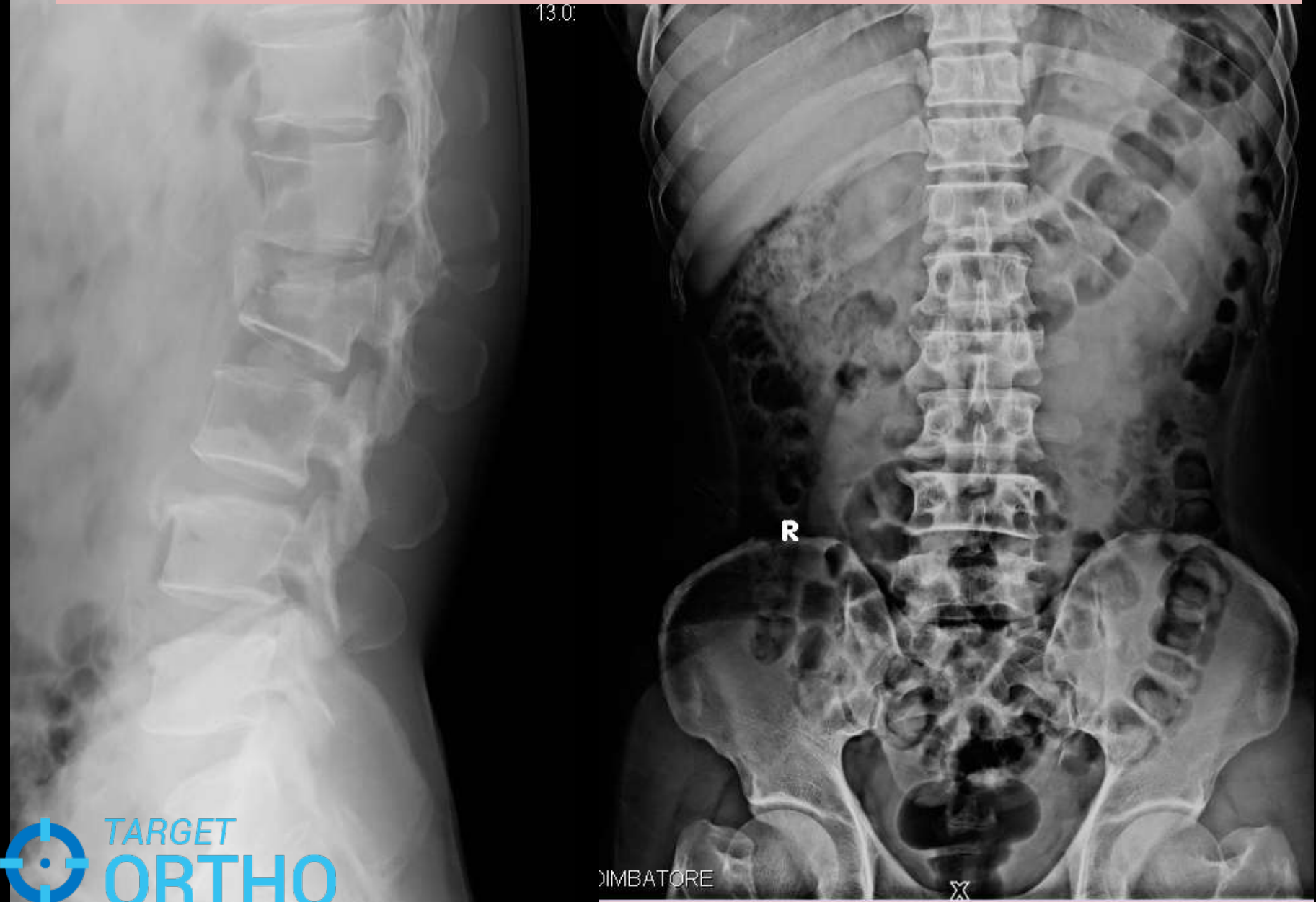
pitals
*512
Banga_LS_Spine



3886

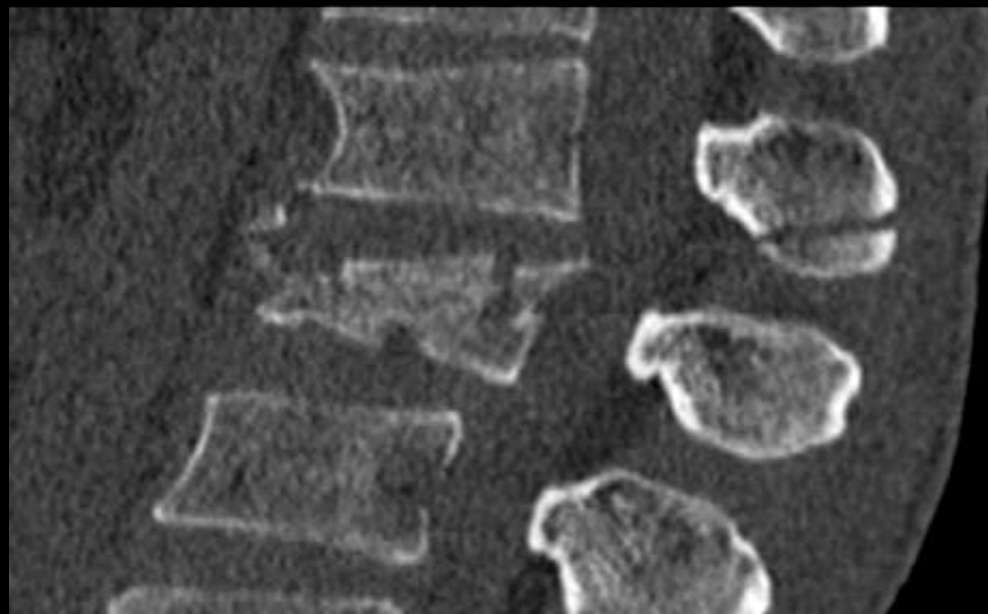


L2 FRACTURE- normal neurology



IMBATORE

M 12021999



S_Spine

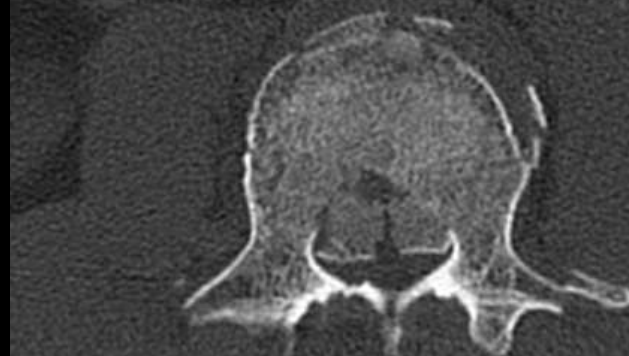


13.

M 12021999

A

13.0

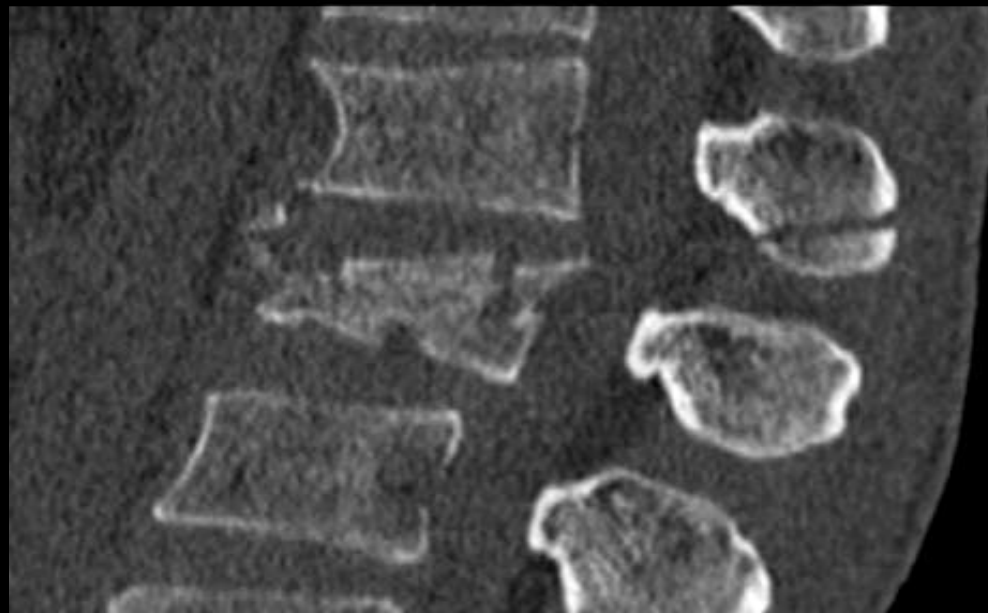


S_Spine



M 12021999

13.



S_Spine

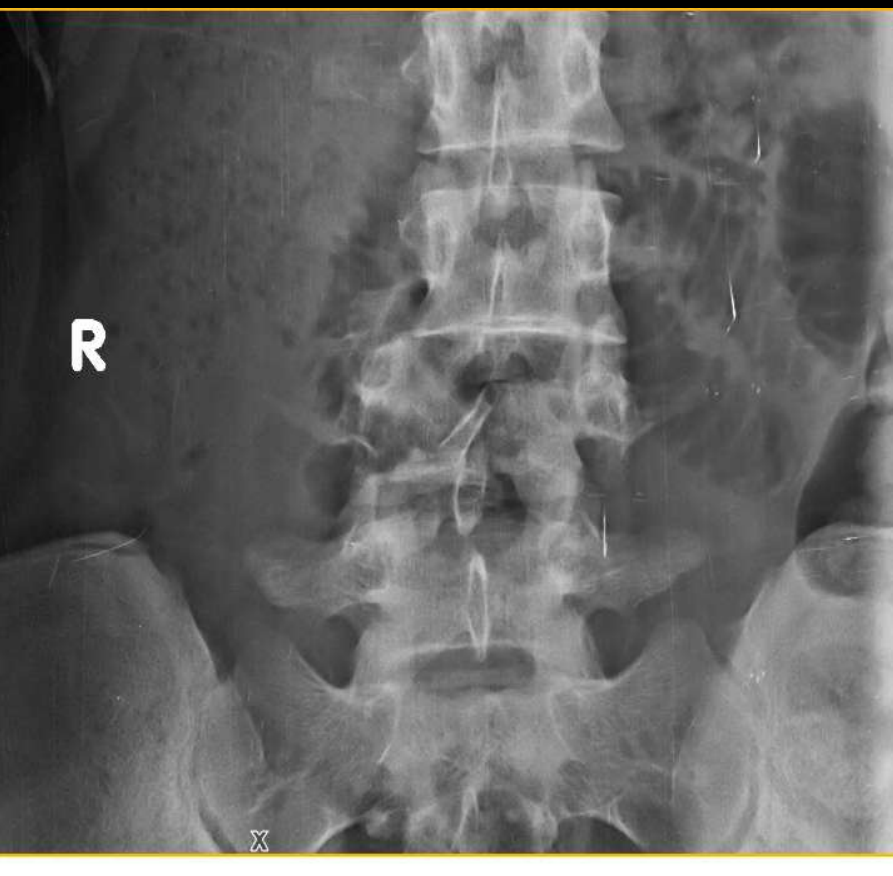
X



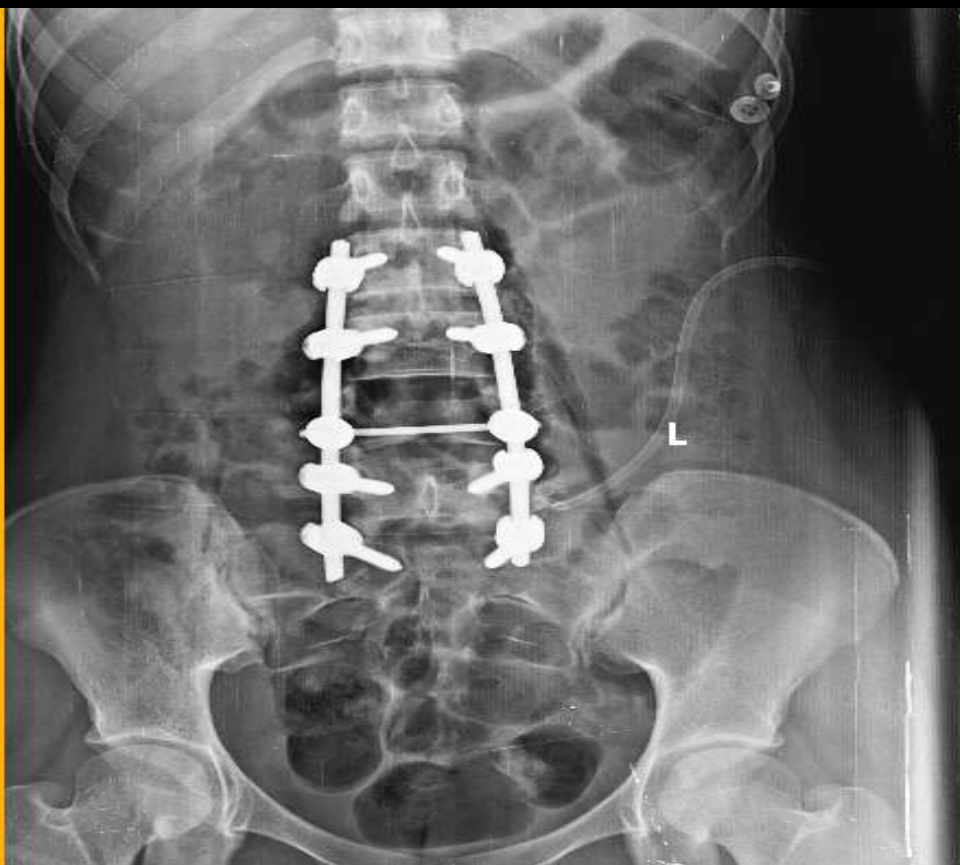
F X



- 17 / F
- L4 FRACTURE
- ASIA - A NEUROLOGY
- Alleged history of RTA due to hit by 4 wheeler while standing





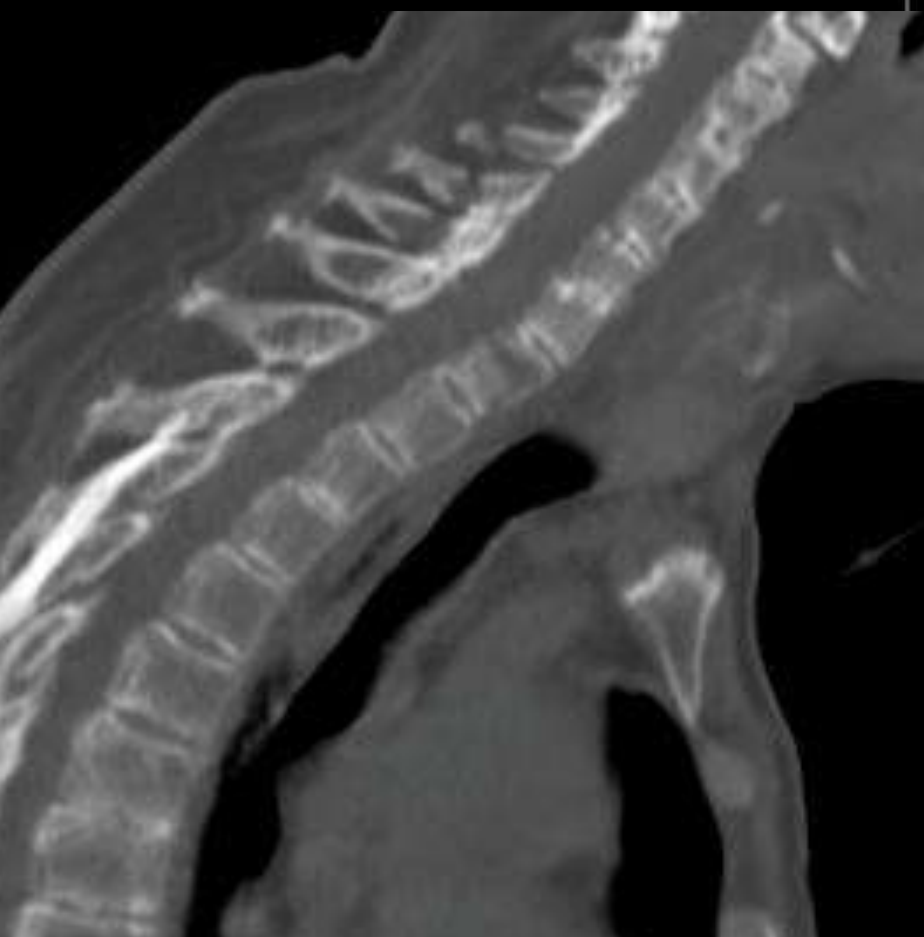


KANDHA GOUNDAR 68Y 12012542
M

NECK
18.01.2012 12:04:43 [O]



S: 205

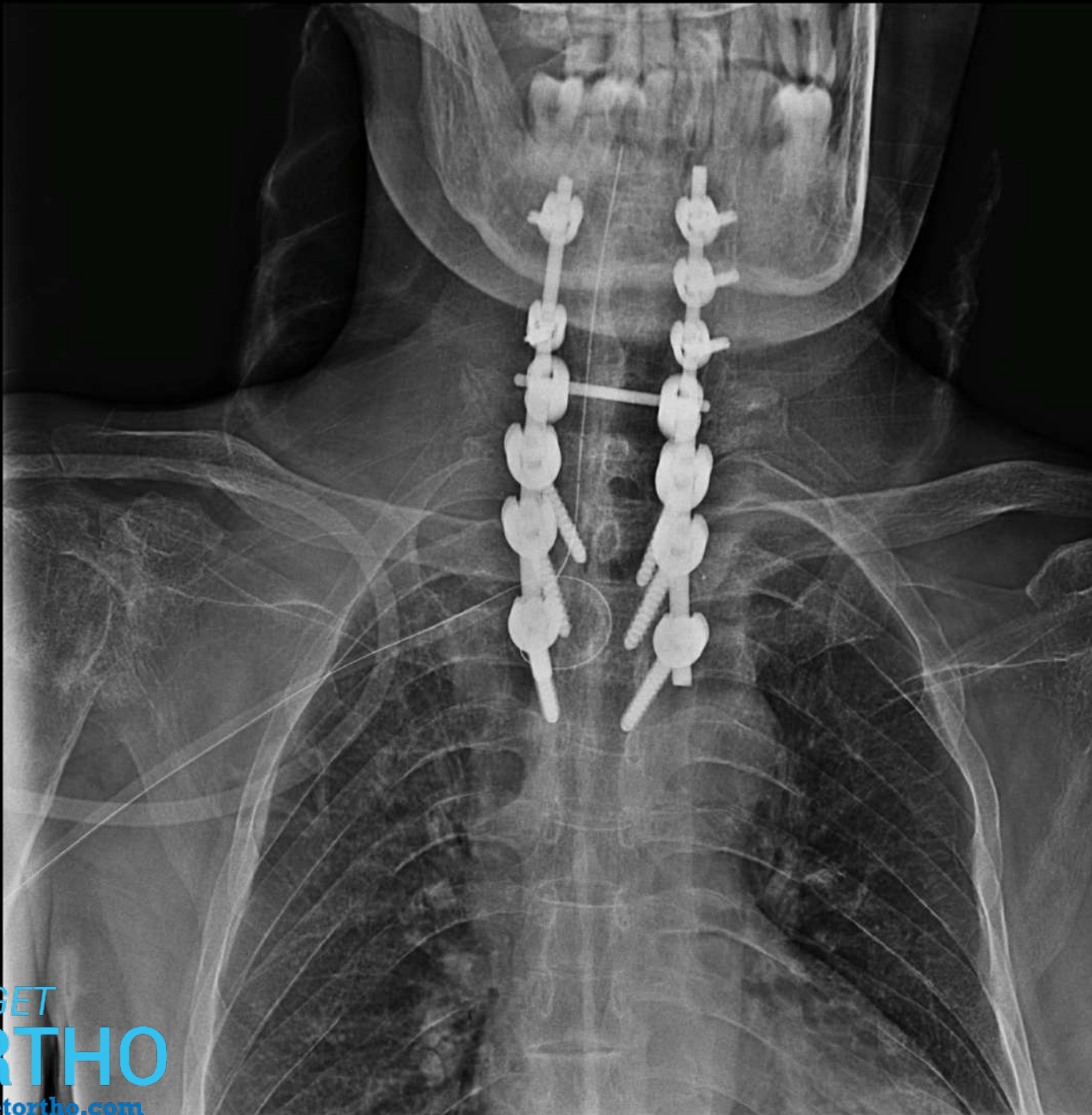


<A>











12021304



CHINNAIYAN 60Y 12021304
M

CHEST
09.02.2012 13:00:07 [O]

S: 158
Matrix: 2372*2880
GANGA HOSPITAL, COIMBATORE

LGM:



CHINNAIYAN 60/M 12021304 A
09.02.1952 M
60Y
Ser./Img.: 2 / 31
Contr:
Emotion 6
09.02.2012 15:01:11 [O]
Tab.Pos.: -129.0
Gantry: 0.0
Thickn.: 4.0mm
Pat.Pos.: HFS



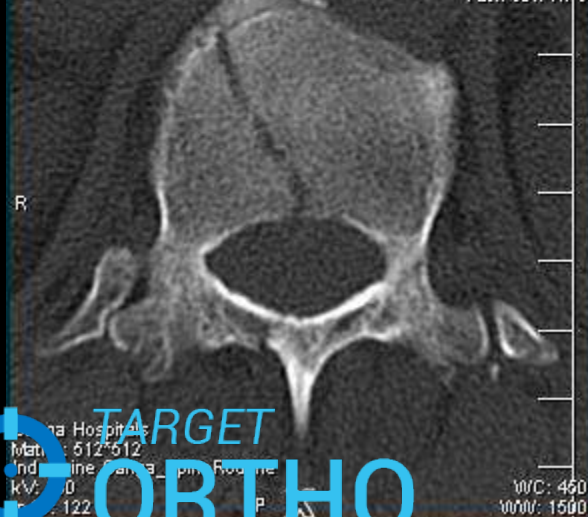
CHINNAIYAN 60/M 12021304 A
09.02.1952 M
60Y
Ser./Img.: 2 / 32
Contr:
Emotion 6
09.02.2012 15:01:11 [O]
Tab.Pos.: -133.0
Gantry: 0.0
Thickn.: 4.0mm
Pat.Pos.: HFS



CHINNAIYAN 60/M 12021304 A
09.02.1952 M
60Y
Ser./Img.: 2 / 33
Contr:
Emotion 6
09.02.2012 15:01:11 [O]
Tab.Pos.: -137.0
Gantry: 0.0
Thickn.: 4.0mm
Pat.Pos.: HFS



CHINNAIYAN 60/M 12021304 A
09.02.1952 M
60Y
Ser./Img.: 2 / 34
Contr:
Emotion 6
09.02.2012 15:01:11 [O]
Tab.Pos.: -141.0
Gantry: 0.0
Thickn.: 4.0mm
Pat.Pos.: HFS

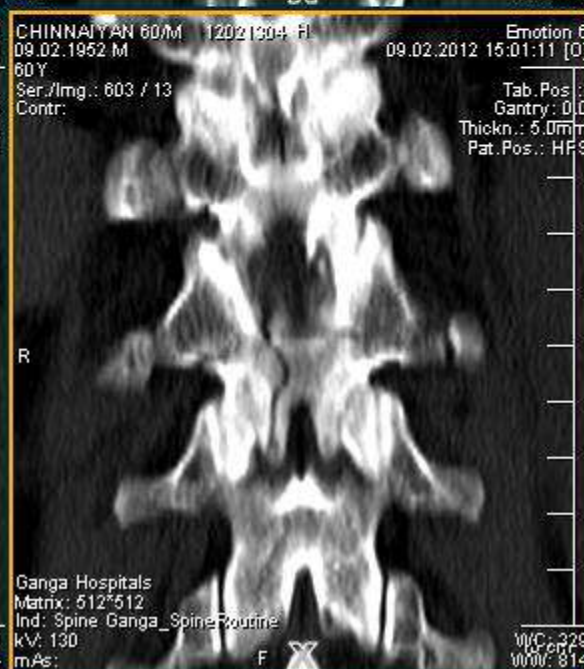


CHINNAIYAN 60/M 12021304 A
09.02.1952 M
60Y
Ser./Img.: 2 / 35
Contr:
Emotion 6
09.02.2012 15:01:11 [O]
Tab.Pos.: -145.0
Gantry: 0.0
Thickn.: 4.0mm
Pat.Pos.: HFS



CHINNAIYAN 60/M 12021304 A
09.02.1952 M
60Y
Ser./Img.: 2 / 36
Contr:
Emotion 6
09.02.2012 15:01:11 [O]
Tab.Pos.: -149.0
Gantry: 0.0
Thickn.: 4.0mm
Pat.Pos.: HFS





N 60/M 12021304

M

H

/ 6

ital
d1rr17

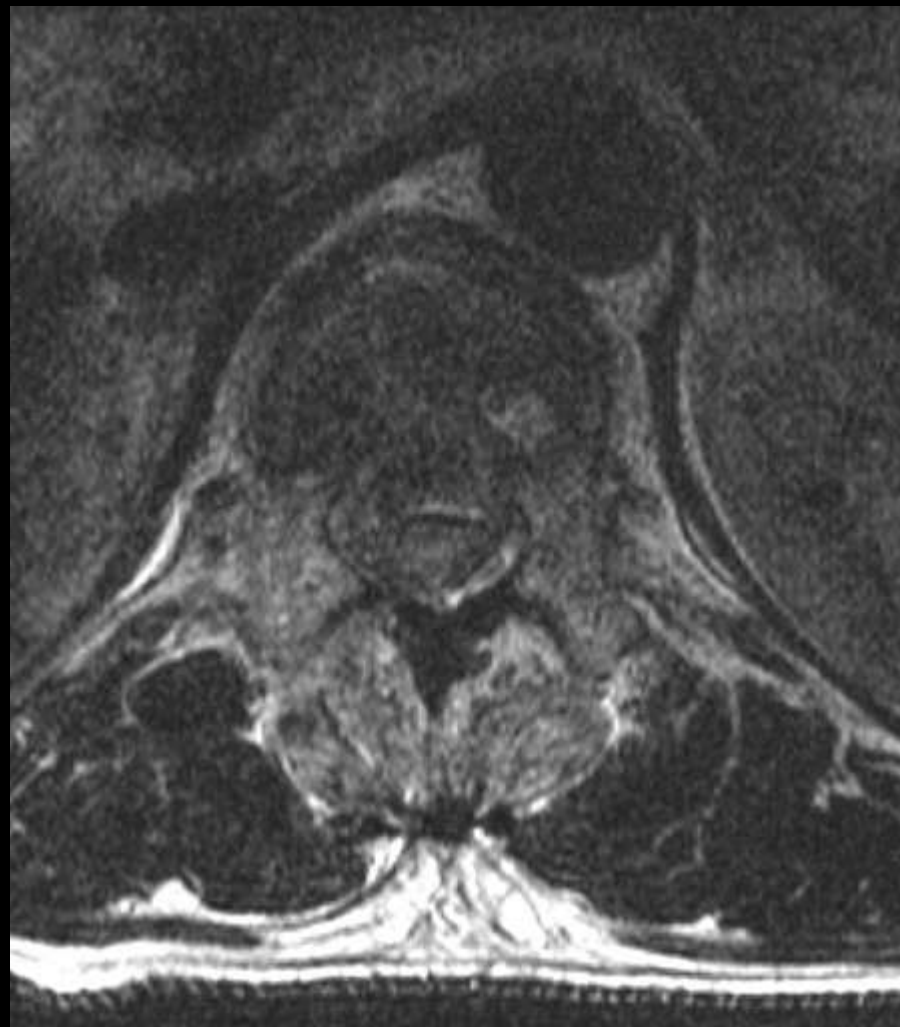
0ms

S

TARGET

ORTHO

(C) www.targetortho.com



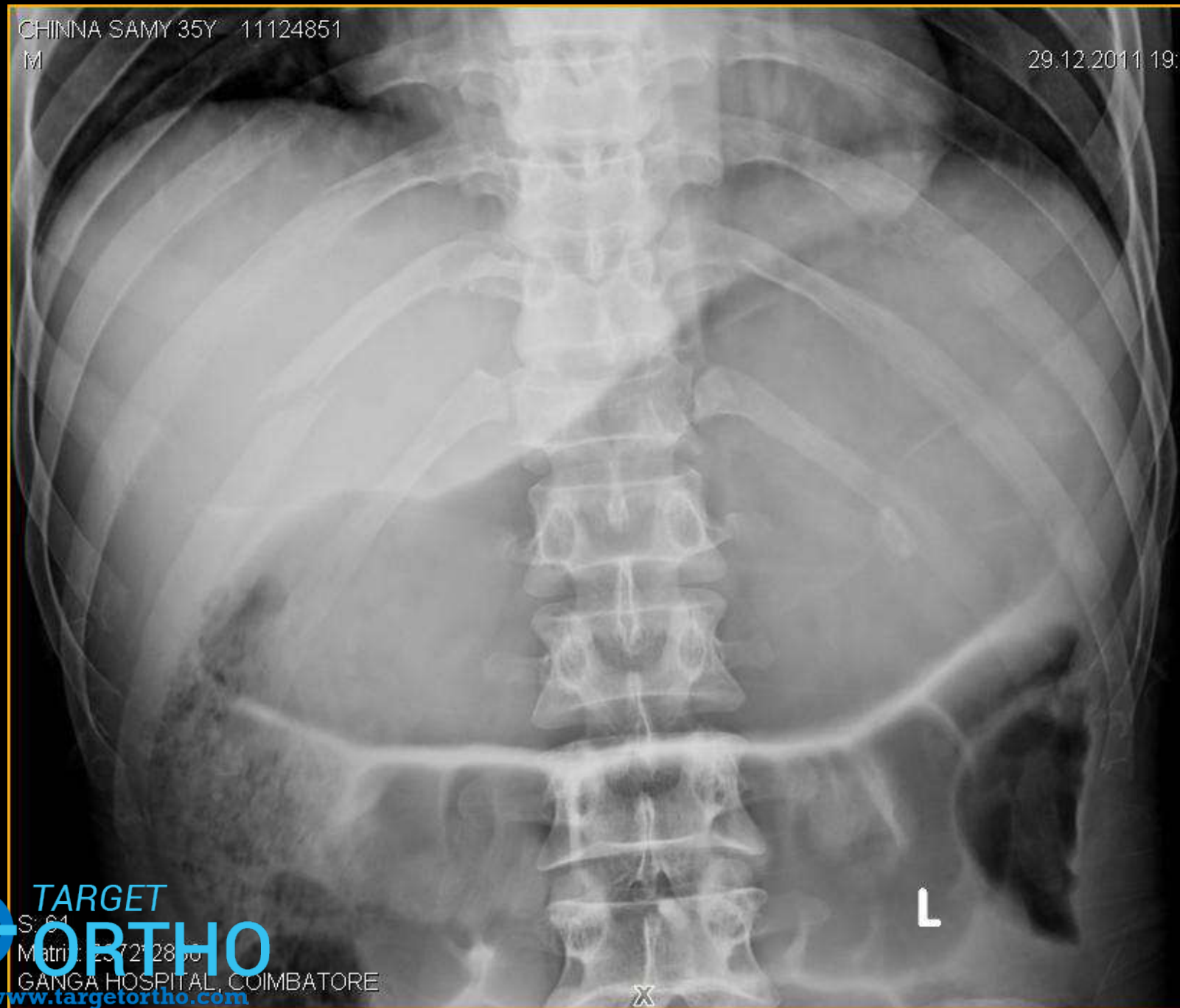


CHINNA SAMY 35Y 11124851

M

CHEST

29.12.2011 19:33:23 [O]



TARGET

ORTH0

(C) www.targetortho.com

S: 61
Matrix: 237212850
GANGA HOSPITAL, COIMBATORE

LGM:

1124851

29.12.2011



CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 7
Contr:

Enolon 6
29.12.2011 20:59:31 [0]
Tab. Pos.:
Contr.:
Gainly:
Thickn.: mm
Pal. Pos.: HFB

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 8
Contr:

Enolon 6
29.12.2011 20:59:31 [0]
Tab. Pos.:
Contr.:
Gainly:
Thickn.: mm
Pal. Pos.: HFB

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 9
Contr:

29.12.2011

Georgia Hospitals
Matrix: 512*512
Ind.: Spine Spine Routine
KV:
mAs:

VNC: 530
VMM: 1752

Georgia Hospitals
Matrix: 512*512
Ind.: Spine Spine Routine
KV:
mAs:

VNC: 530
VMM: 1752

Georgia Hospitals
Matrix: 512*512
Ind.: Spine Spine Routine
KV:
mAs:

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 10
Contr:

Enolon 6
29.12.2011 20:59:31 [0]
Tab. Pos.:
Contr.:
Gainly:
Thickn.: mm
Pal. Pos.: HFB

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 11
Contr:

Enolon 6
29.12.2011 20:59:31 [0]
Tab. Pos.:
Contr.:
Gainly:
Thickn.: mm
Pal. Pos.: HFB

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 12
Contr:

29.12.2011

Georgia Hospitals
Matrix: 512*512
Ind.: Spine Spine Routine
KV:
mAs:

VNC: 530
VMM: 1752

Georgia Hospitals
Matrix: 512*512
Ind.: Spine Spine Routine
KV:
mAs:

VNC: 530
VMM: 1752

Georgia Hospitals
Matrix: 512*512
Ind.: Spine Spine Routine
KV:
mAs:

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 13
Contr:

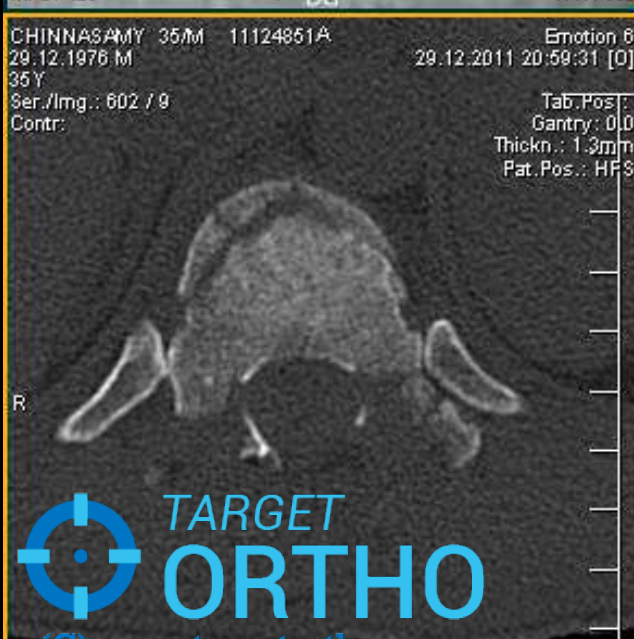
Enolon 6
29.12.2011 20:59:31 [0]
Tab. Pos.:
Contr.:
Gainly:
Thickn.: mm
Pal. Pos.: HFB

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 14
Contr:

Enolon 6
29.12.2011 20:59:31 [0]
Tab. Pos.:
Contr.:
Gainly:
Thickn.: mm
Pal. Pos.: HFB

CHIMABAMY 35M 11124851
29.12.1976 M
35Y
Ser/Jmg.: 603 / 15
Contr:

29.12.2011

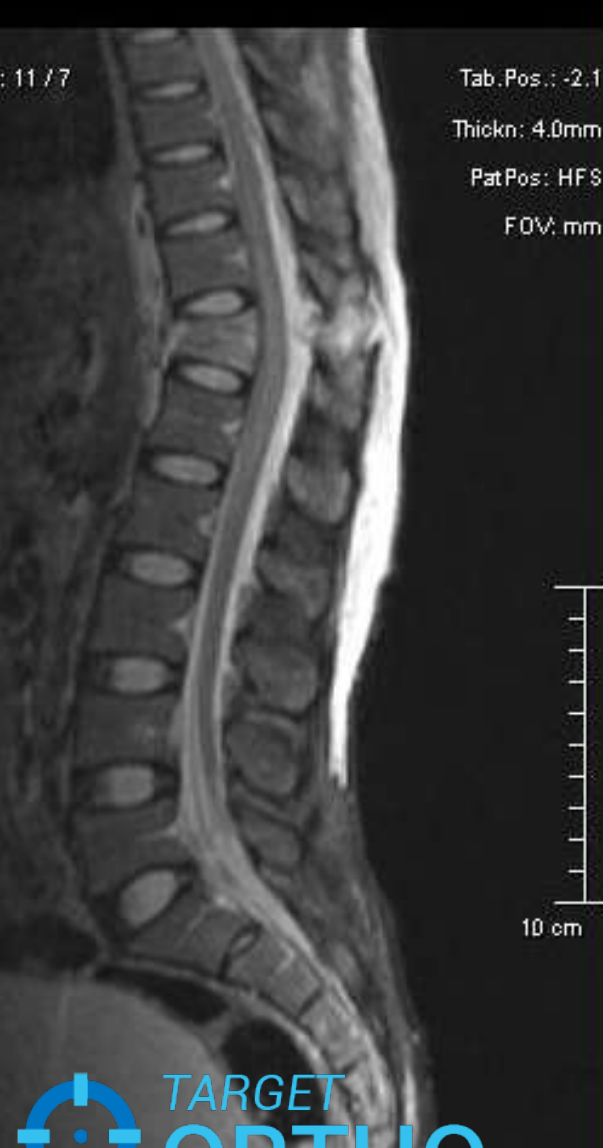


H



WHOLESALE

: 11 / 7



Tab.Pos.: -2.1

Thickn: 4.0mm

PatPos: HFS

FOV: mm

35 Y

Ser./Img.: 11 / 8

Contr:

A

10 cm



35 Y

Tab.Pos.: 2.3 Ser./Img.: 11 / 9

Thickn: 4.0mm

PatPos: HFS

FOV: mm

Contr:

A

10 cm



DURASAMY-62Y 11120585

M

PELVIS

04.12.2011 19:37:46 [O]



L

X

 **TARGET
ORTHO**

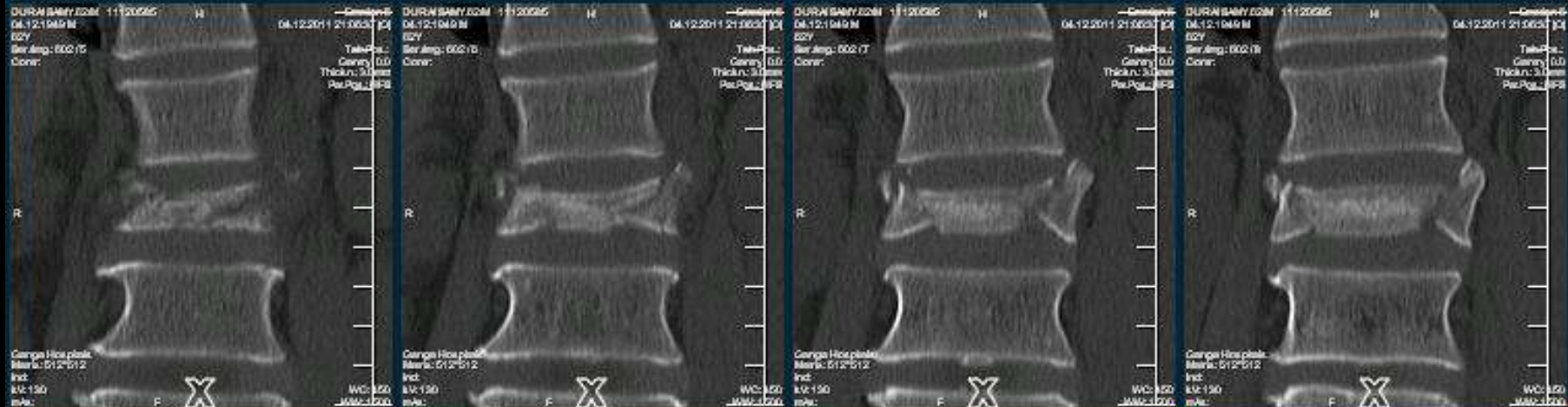
(C) www.targetortho.com
SANGHVI HOSPITAL, COIMBATORE

LGM:

120585

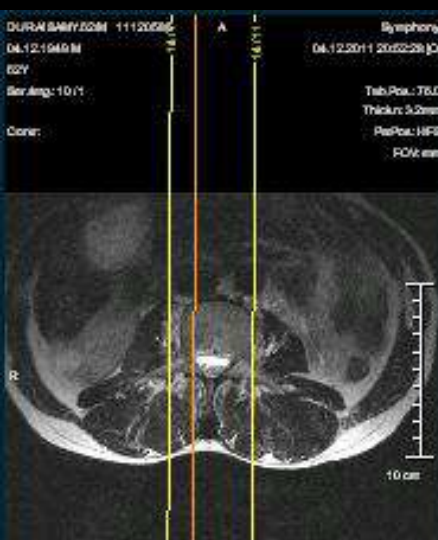
04.12



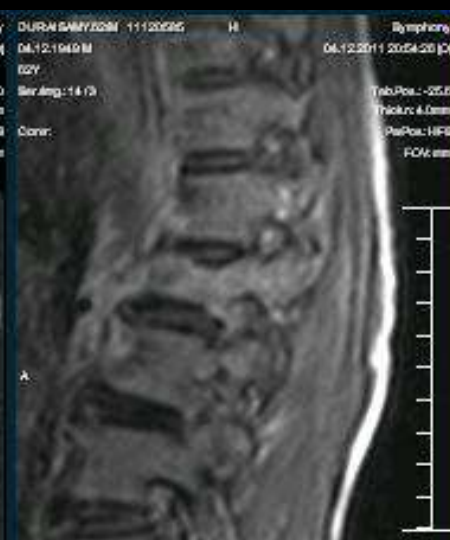








Georgis Hinc plot
Seq: *h2d1_7
NDE: 1.0
TR: 2740.000ms
TE: 56.000ms
T1: 150.000ms
T2: 150.000ms
MR Acq Type: 2D
Ind: whole-spine general



Georgis Hinc plot
Seq: *h2d1_7
NDE: 1.0
TR: 2740.000ms
TE: 56.000ms
T1: 150.000ms
T2: 150.000ms
MR Acq Type: 2D
Ind: whole-spine general



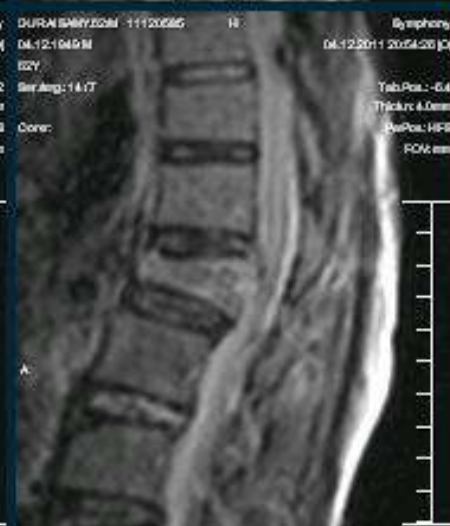
Georgis Hinc plot
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NDE: 1.0
TR: 2740.000ms
TE: 56.000ms
T1: 150.000ms
T2: 150.000ms
MR Acq Type: 2D
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TE: 56.000ms
T1: 150.000ms
T2: 150.000ms
MR Acq Type: 2D
Ind: whole-spine general



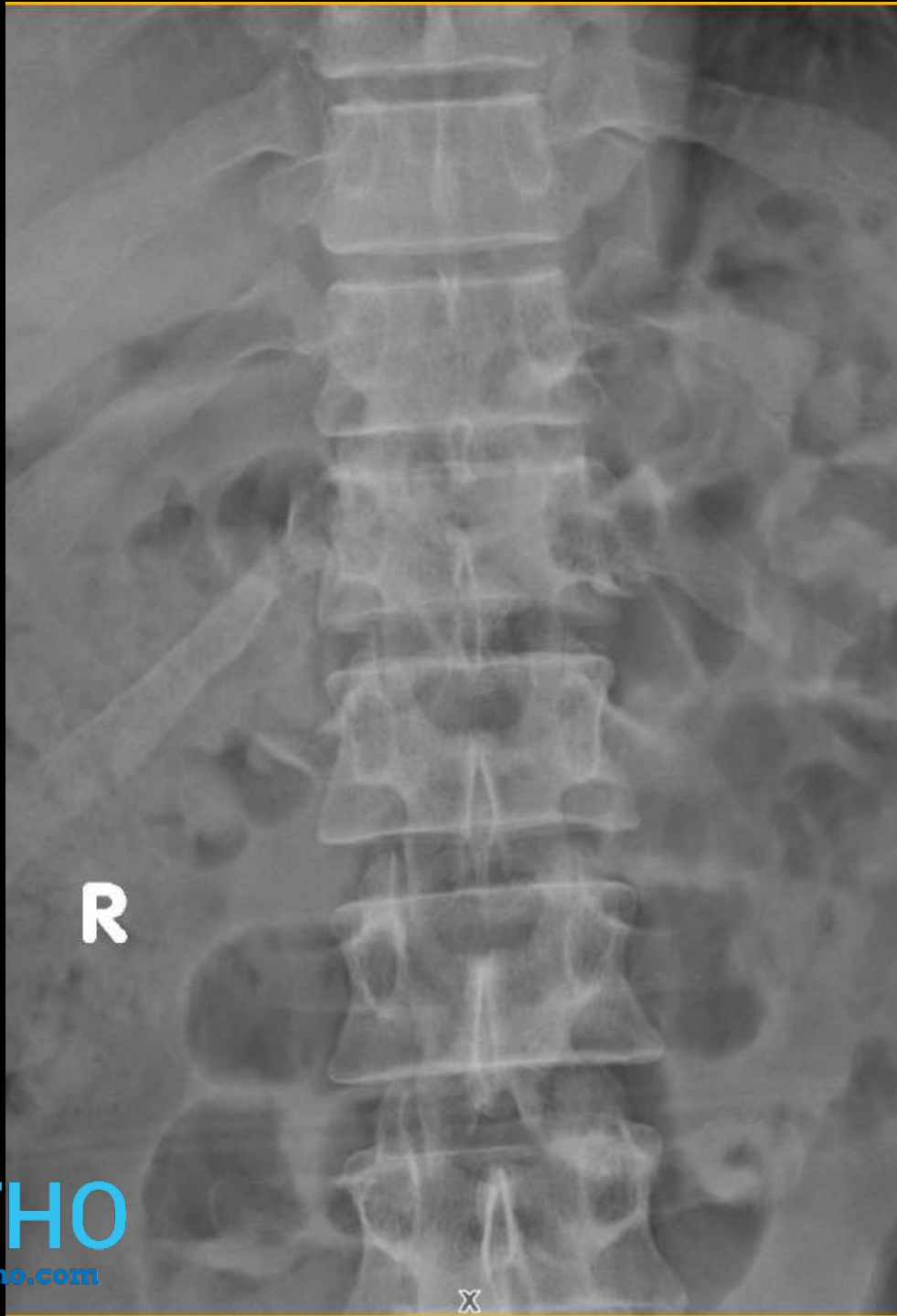
Georgis Hinc plot
Seq: *h2d1_7
NDE: 1.0
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TE: 56.000ms
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MR Acq Type: 2D
Ind: whole-spine general





H





