

# Fractures thoracolombaires

**Dante G. Marchesi MD**

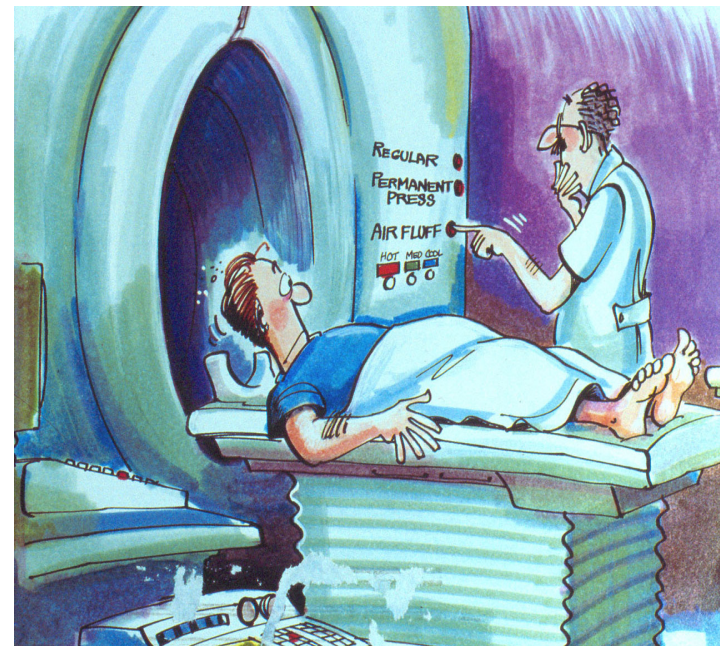
**HIRSLANDEN** 

Clinique Bois-Cerf  
Lausanne / Switzerland

# Spinal pathologies

## Radiological Assessment

- Standard radiographs  
start with plain films  
good quality pictures
- CT
- MRI
- Myelogram
- Myelo-CT





# Spinal pathologies

## Radiological Assessment

### Standard radiographs

Lumbar spine

AP upright

Lat “

Oblique (45° )

Barsony (15-20° )

Flex/ext

Lat bending



# Spinal pathologies

## Radiological Assessment

### Standard radiographs

Lumbar spine

AP upright

Lat “

Oblique (45° )

Barsony (15-20° )

Flex/ext

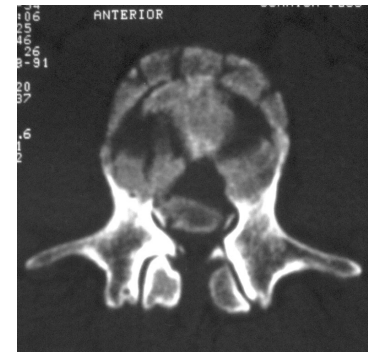
Lat bending



# Spinal pathologies

## Radiological Assessment

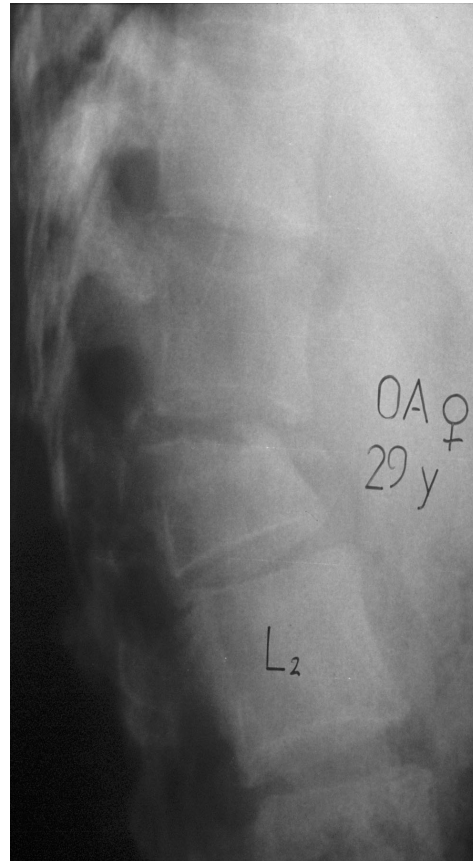
CT



# Spinal pathologies

## Radiological Assessment

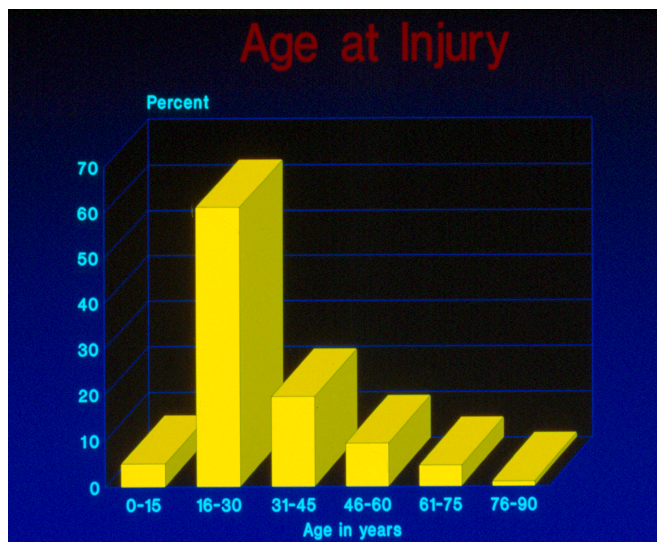
### MRI





# Spinal Injuries

The incidence of complex spinal injuries is increasing with growing numbers of motor vehicle accidents, industrial injuries, and patients surviving with malignancy.



# Spinal Injuries

## TRAUMA

First Aid

Transportation

Clinical Admission

Diagnosis

→ **Classification**

**TREATMENT**



diagnosis

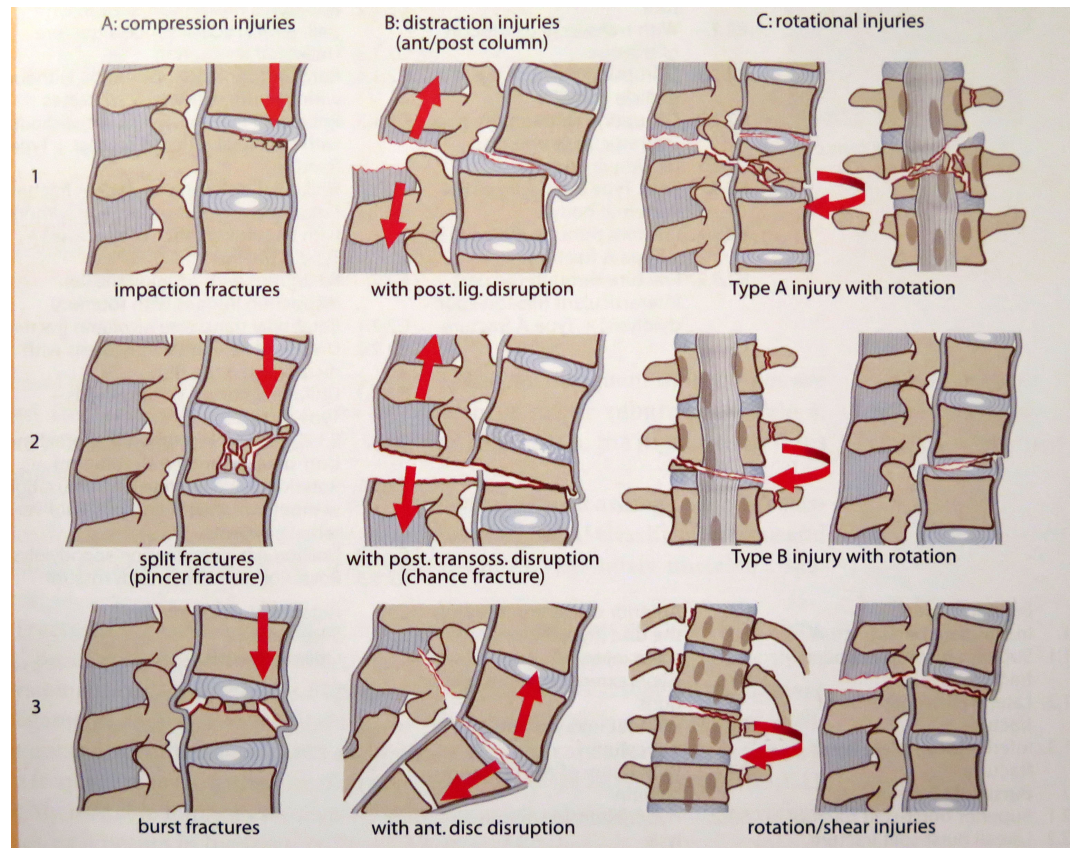
first goal : identify which fracture pattern will result in spinal instability



# Spinal Injuries

## A comprehensive classification of thoracic and lumbar injuries

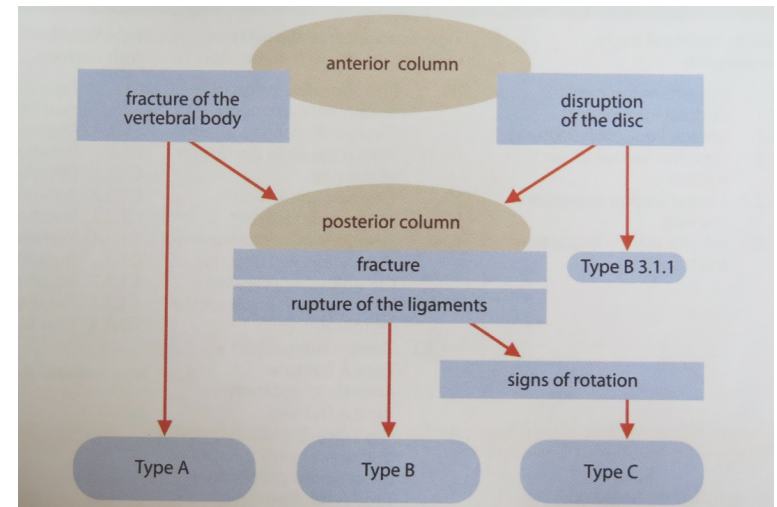
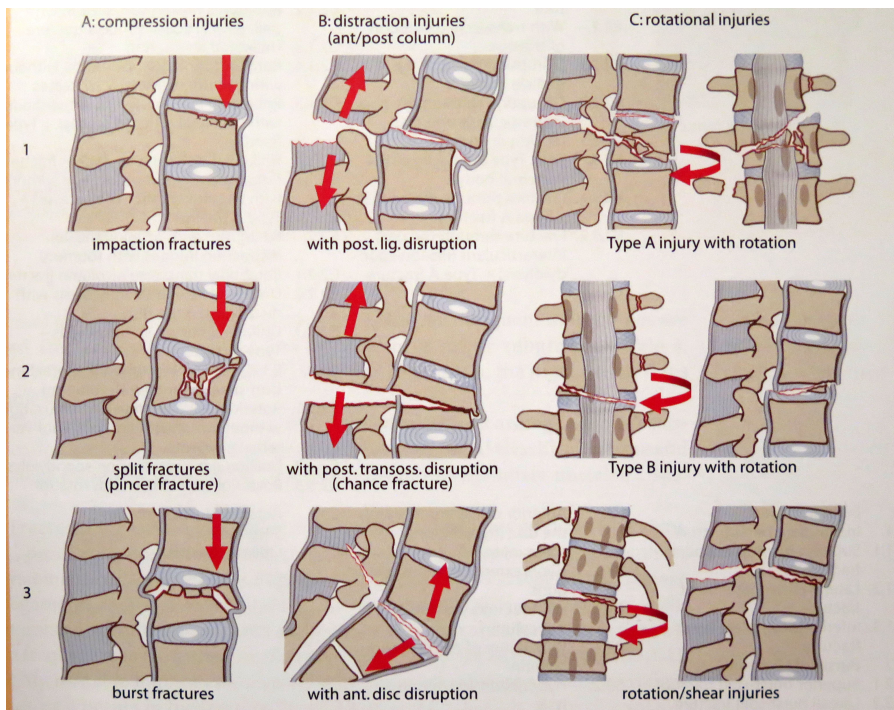
Magerl et al, Eur Spine J 1994



# Spinal Injuries

## A comprehensive classification of thoracic and lumbar injuries

Magerl et al, Eur Spine J 1994






# Spinal Injuries



## A comprehensive classification of thoracic and lumbar injuries

Magerl et al, Eur Spine J 1994

### frequency of fracture types

	Case	Percentage of total	Percentage of type
<b>Type A</b>	<b>956</b>	<b>66.16</b> 	
A1	502	34.74	52.51
A2	50	3.46	5.23
A3	404	27.96	42.26
<b>Type B</b>	<b>209</b>	<b>14.46</b>	
B1	126	8.72	60.29
B2	80	5.54	38.28
B3	3	0.21	1.44
<b>Type C</b>	<b>280</b>	<b>19.38</b>	
C1	156	10.80	55.71
C2	108	7.47	38.57
C3	16	1.11	5.71

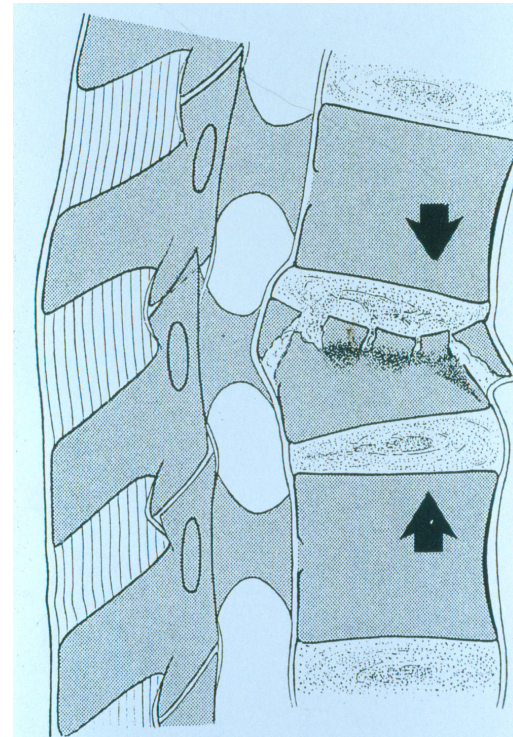
### frequency of neurol. deficits

Types and groups	Number of injuries	Neurological deficit (%)
<b>Type A</b>	<b>890</b>	<b>14</b>
A1	501	2
A2	45	4
A3	344	32
<b>Type B</b>	<b>145</b>	<b>32</b> 
B1	61	30
B2	82	33
B3	2	50
<b>Type C</b>	<b>177</b>	<b>55</b> 
C1	99	53
C2	62	60
C3	16	50
<b>Total</b>	<b>1 212</b>	<b>22</b>

# Spinal Injuries

## Type A Vertebral Body Compression

- caused by axial compression with or without flexion
- affects almost exclusively the vertebral body (ant. column)
- height of vertebral body is reduced
- post. ligamentous complex is intact
- no sagittal translation



# Spinal Injuries

## Type A Vertebral Body Compression

### A1 - Impaction fractures

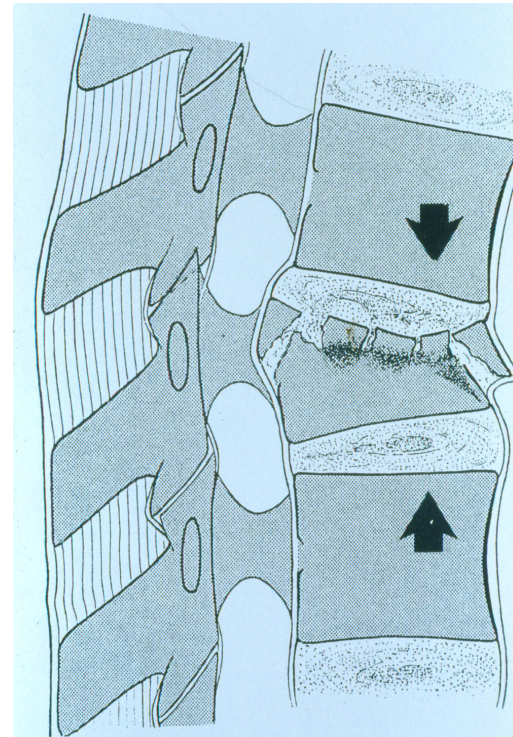
- A1.1 endplate impaction
- A1.2 wedge impaction fracture
- A1.3 vertebral body collapse

### A2 - Split fractures

- A2.1 sagittal split fracture
- A2.2 coronal split fracture
- A2.3 Pincer fracture

### A3 - Burst fractures

- A3.1 incomplete burst fracture
- A3.2 burst - split fracture
- A3.3 complete burst fracture





# Spinal Injuries

## Type A Vertebral Body Compression

kyphosis  
(20 - 30° ?)

collapse  
(50%)

stenosis  
(50%)

- acceptable ?

- need correction ?





# Spinal Injuries

## Type A Vertebral Body Compression

kyphosis

(20 - 30° ?)

- acceptable ?

collapse

(50%)

- need correction ?

stenosis

(50%)

correction

- cast (hyperextension)
- vertebro/kyphoplasthy
- post. instrumentation  
(ligamentotaxis)
- ant. instrumentation

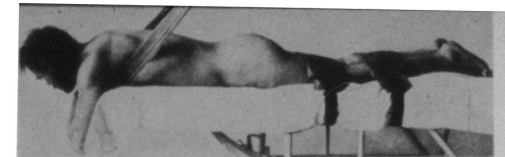


Abb. 467, am 17. 10. 32.

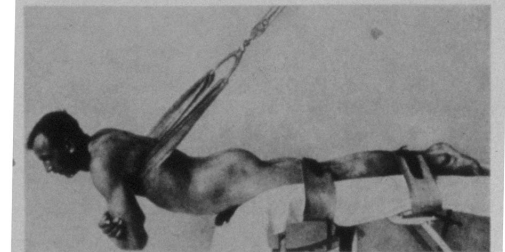


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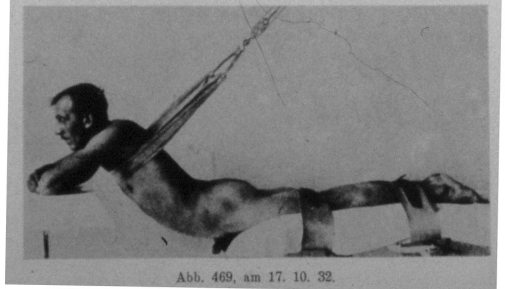


Abb. 469, am 17. 10. 32.

Böhler L, 1951

# Spinal Injuries

## Type A Vertebral Body Compression

kyphosis

(20 - 30° ?)

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(50%)

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stenosis

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Chow et al, Spine 1996

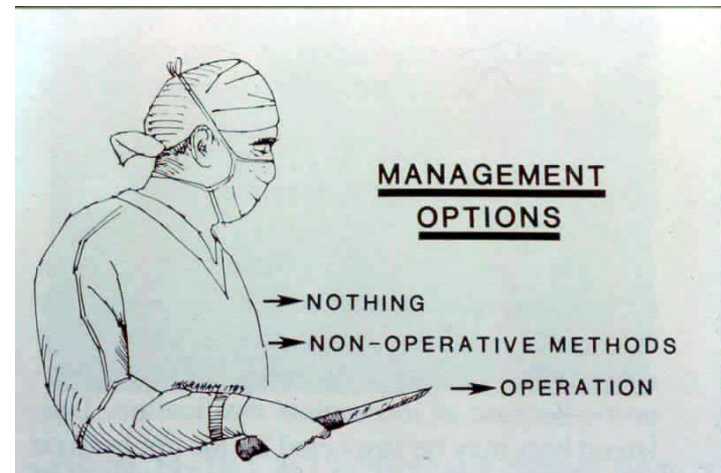
**will heel in this position?**

# Spinal Injuries

## Type A Vertebral Body Compression

### General objectives of treatment

- restoration of spinal alignment
- restoration of spinal stability
- preservation or improvement of neurological function
- avoidance of collateral damage



# Spinal Injuries

## Type A Vertebral Body Compression

### Favorable indications for non-operative treatment

- pure osseous lesions
- absence of neurological deficits
- only mild to moderate pain on mobilization
- absence of malalignment
- absence of gross bony destruction
- absence of osteopenia/osteoporosis

# Spinal Injuries

## Type A Vertebral Body Compression

### Post-traumatic kyphosis (moderate) – chronic back pain

some evidence

Gertzbein S et al, Spine 1992

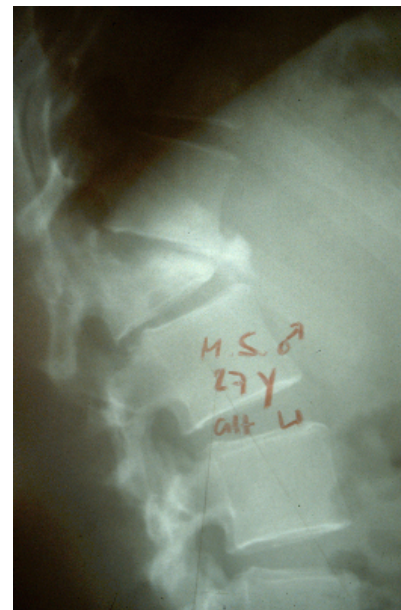
no direct relationship

Cantor J et al, Spine 1993

Kraemer W et al, J Orthop Trauma 1996

Munford J et al, Spine 1993

Weinstein J et al, Spine 1988



# Spinal Injuries

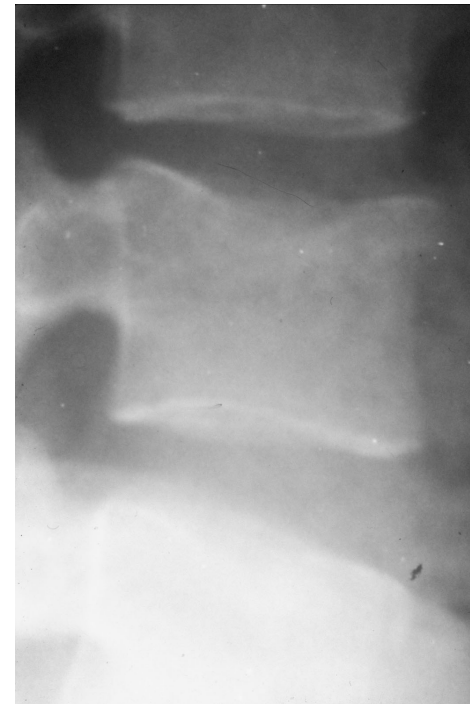
## Type A Vertebral Body Compression

- A1 impaction A1.1 endplate
- A1.2 wedge ( $>10-15^\circ$  )
- A1.3 VB collapse

- . deformation of the vertebral body due to compression of the cancellous bone rather than to fragmentation
- . post. column intact
- . no narrowing of the spinal canal
- . neurological deficits very rare

A2 split

A3 burst



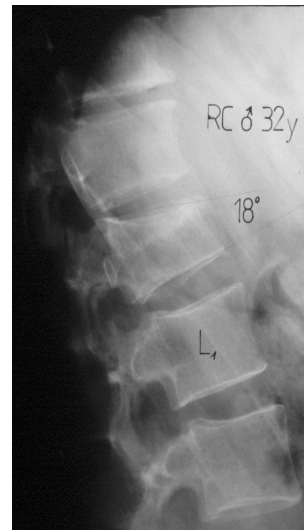


# Spinal Injuries

## Type A Vertebral Body Compression

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- brace
- vertebroplasty
- kyphoplasty

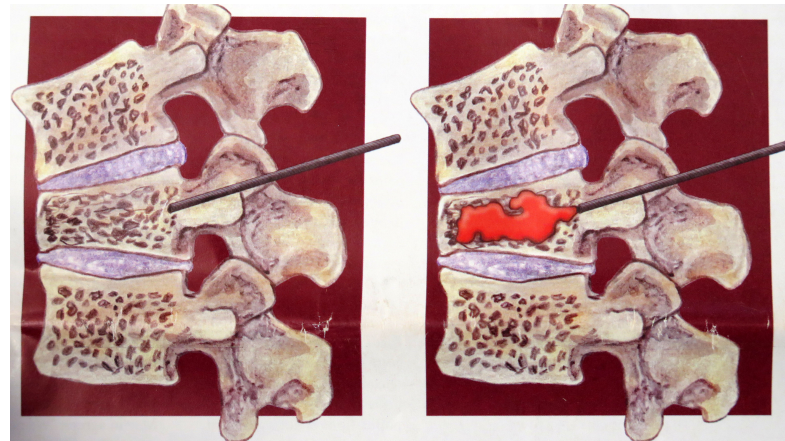


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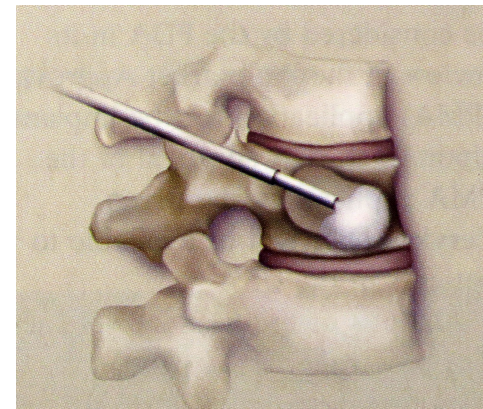
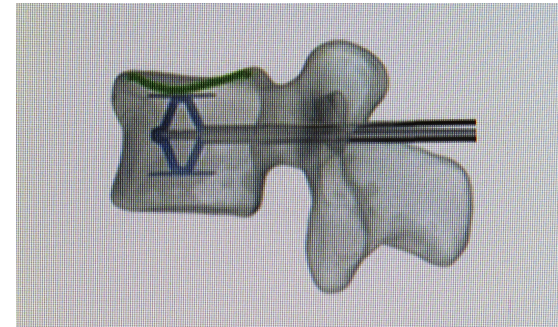


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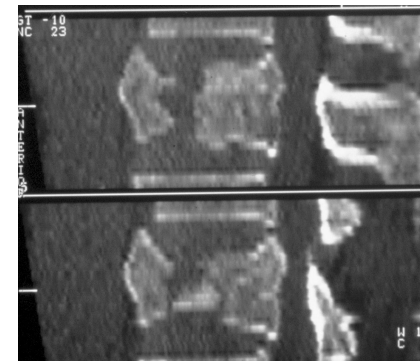
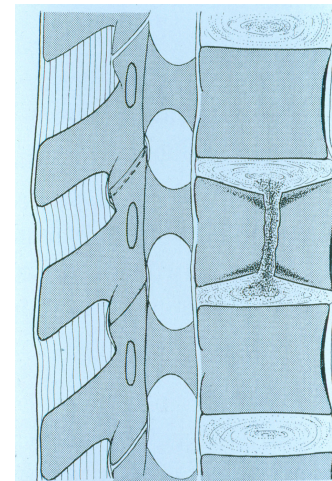
A1 impaction

A2 split fractures    A2.1    sagittal  
    A2.2    coronal  
    A2.3    « pincer »

- . vertebral body is split with variable degree of dislocation of the main fragment
- . when significantly dislocated the gap is filled with disc material and non-union is very common
- . neurological deficits uncommon

**A2.3** bad healing potential  
 indication for **surgical ttt** (ANT)

A3 burst





# Spinal Injuries

## Type A Vertebral Body Compression

A1 impaction

A2 split fractures

**A3 burst**      A3.1 incomplete  
                         A3.2 burst - split  
                         A3.3 complete

- . vertebral body partially or completely comminuted with centrifugal extrusion of fragments
- . fragments of post. wall are retropulsed into the spinal canal
- . post. ligamentous complex intact
- . if injury of the arch : vertical split
- . neurological deficits common



# Spinal Injuries

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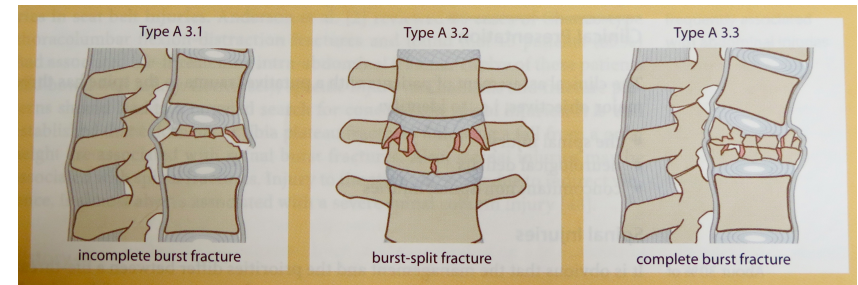
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# Spinal Injuries

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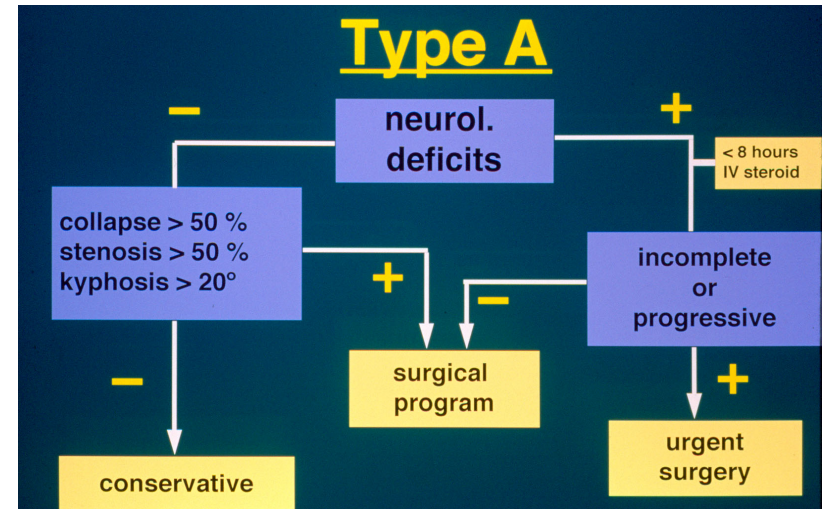
. vertebral body partially or completely comminuted with centrifugal extrusion of fragments

. fragments of post. wall are repulsed into the spinal canal

. post. ligamentous complex intact

. if injury of the arch : vertical split

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**controversial management**

from bracing to combined ant/post approach all with acceptable results

# Spinal Injuries

## Type A Vertebral Body Compression

### Indications for surgical treatment

#### Absolute

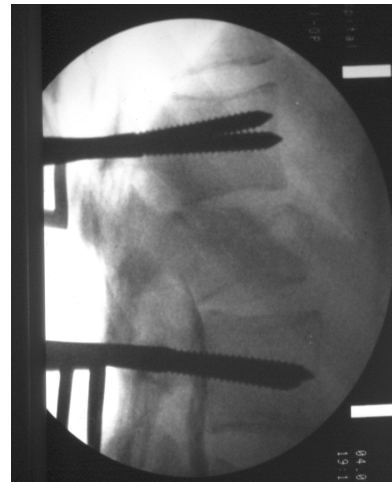
- incomplete paraparesis
- progressive neurol deficit
- spinal cord compression w/o neurol deficit
- fracture dislocation (B-C)
- severe segmental kyphosis ( $>30^\circ$  )
- predominant ligamentous injuries (B)

#### Relative

- pure osseous lesions
- desire for early return to regular activity
- avoidance of secondary kyphosis
- concomitant injuries (thoracic, cerebral,...)
- facilitating nursing in paraplegic patients

# Spinal Injuries

## Type A Vertebral Body Compression



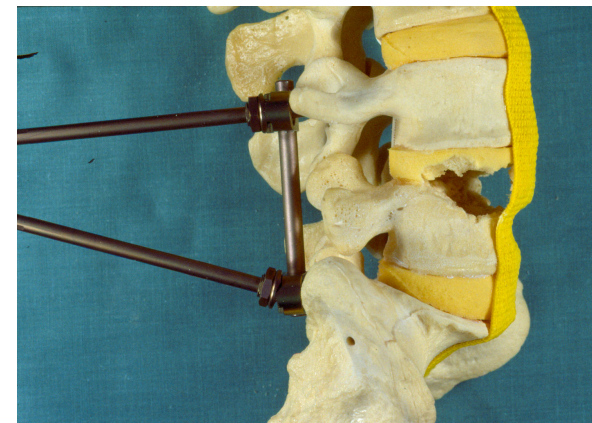
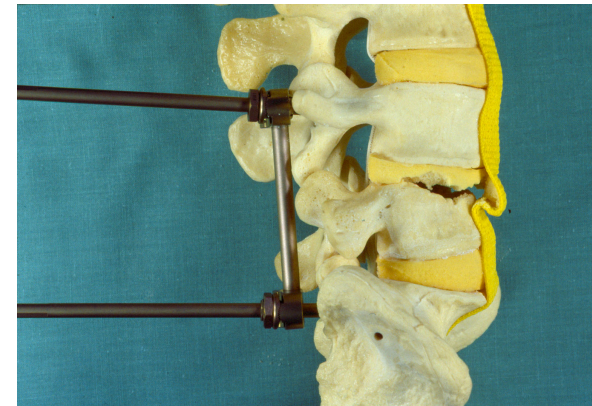
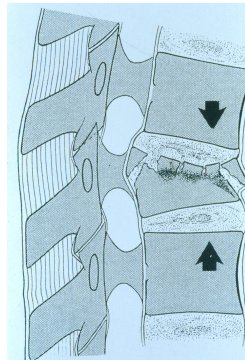
# Spinal Injuries

## Type A Vertebral Body Compression

### Decompression

post. distraction system can reduce fragments from the spinal canal as long as they are held by the intact post. longitudinal ligament.

### ligamentotaxis





# Spinal Injuries

## Type A Vertebral Body Compression

### Decompression

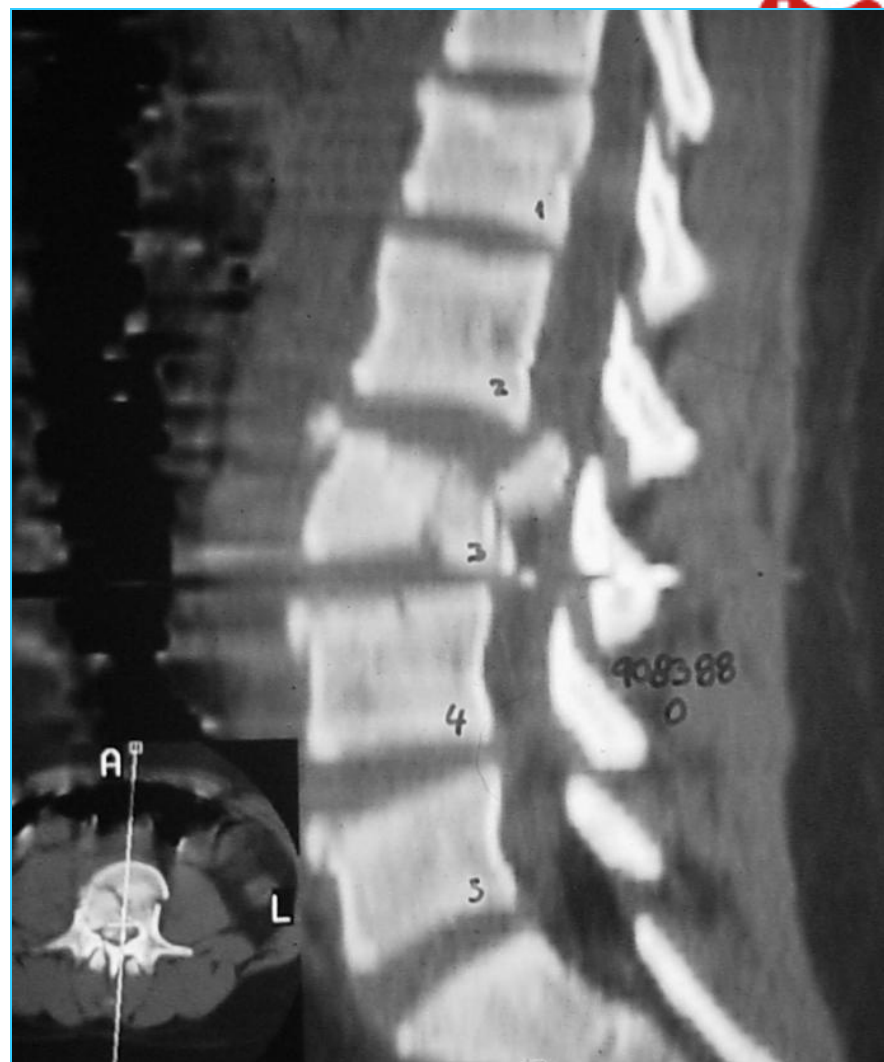
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### ligamentotaxis



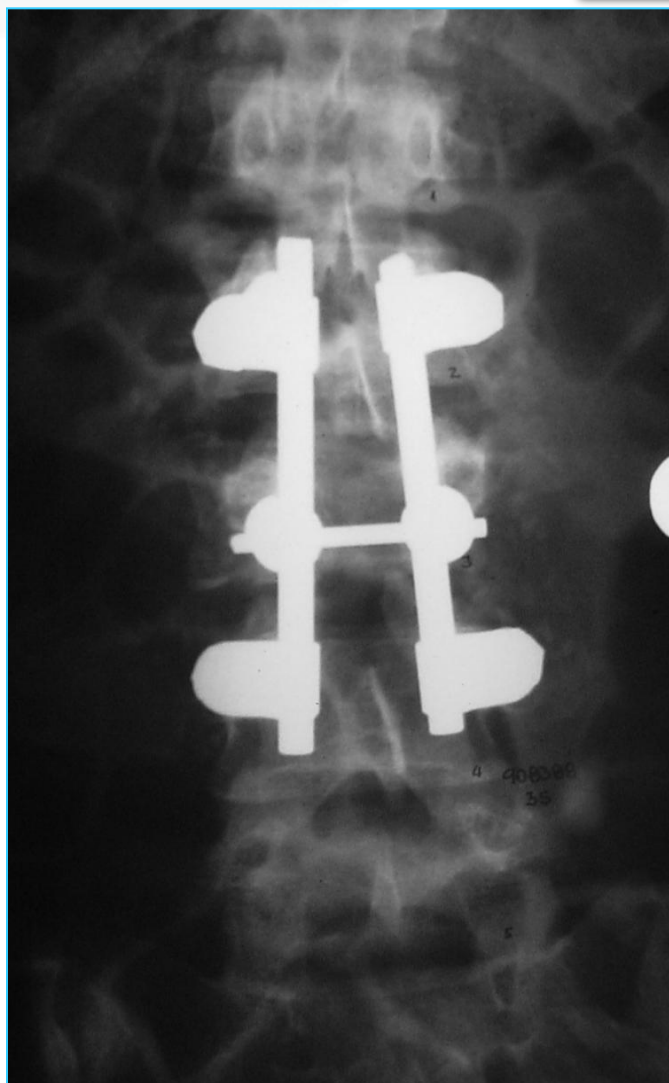
C.M.S, female, 15 years  
fall from height; neuro: MIS 86; Frankel: D2





postop

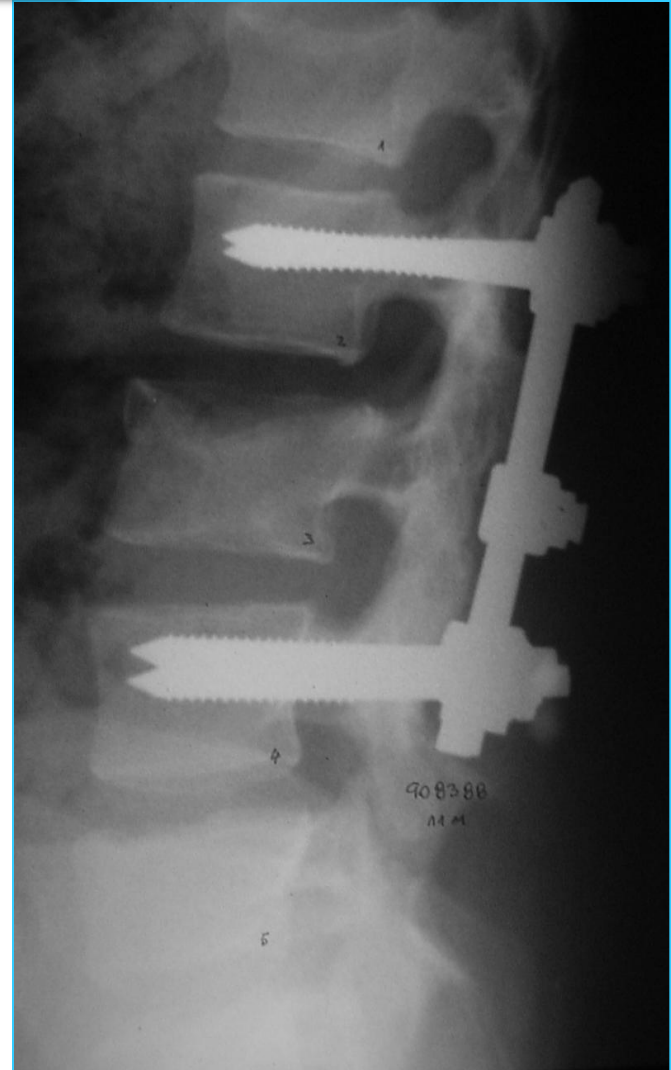
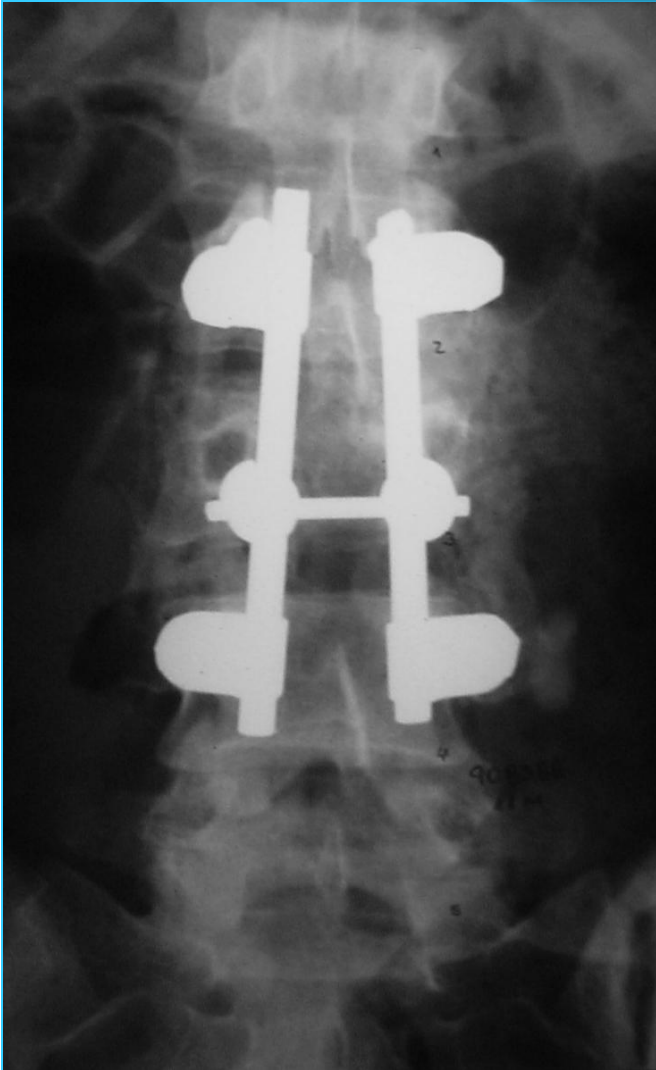
MEDICOL



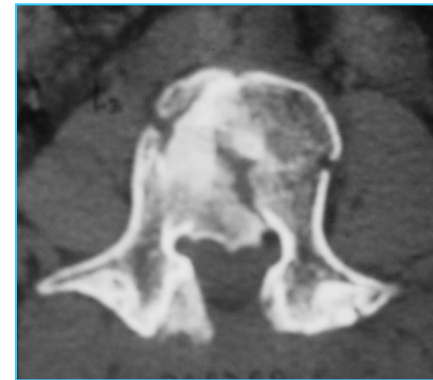
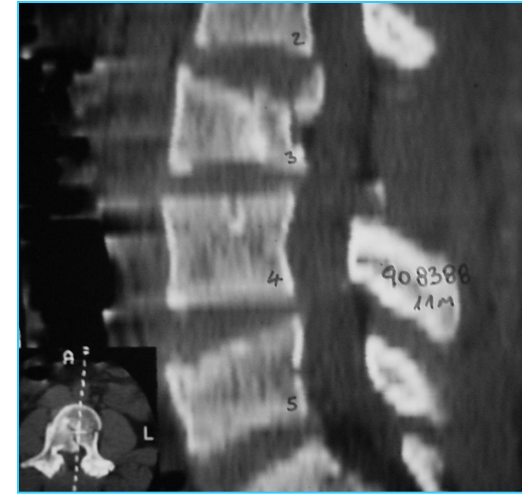


11m postop

MEDICOL



24m postop



## Posterior Instrumentation

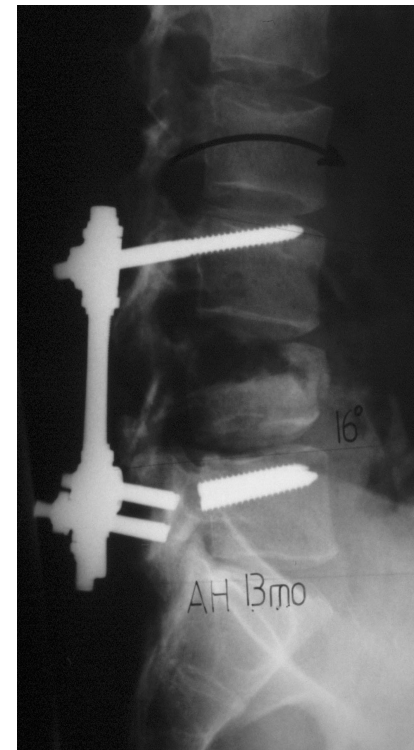
importance of the ant. bone defect

no ant. column load sharing system

→ ↗ cantilever bending loads  
in pedicle screw implants

risk of implant failure

loss of correction



# Spinal Injuries

## Type A injuries

instrumentation failure

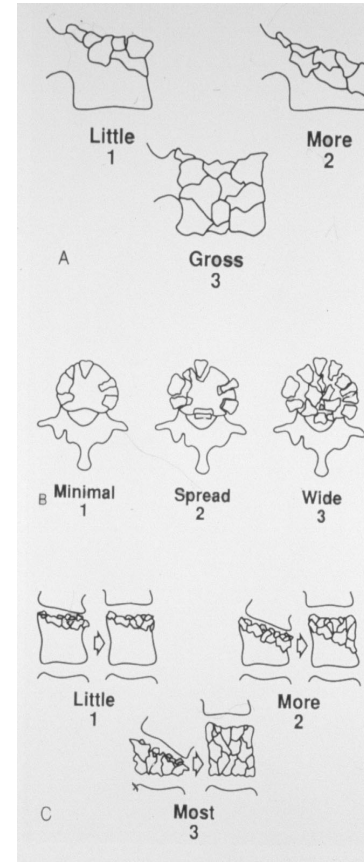
and

loss of correction

## The load sharing classification of spine fractures

McCormack et al, Spine 1994

failure with > 7 points

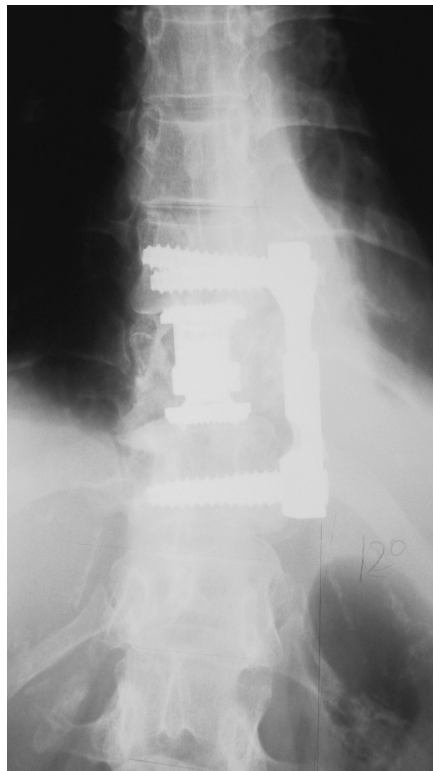




# Spinal Injuries

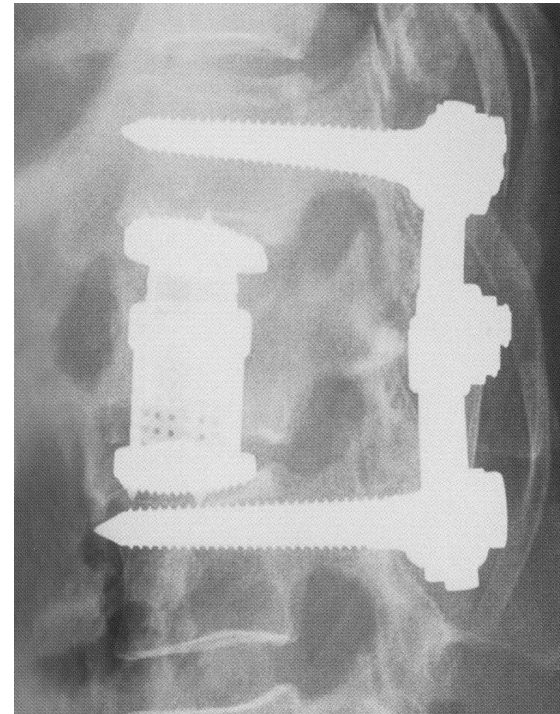
## Type A injuries

### Ant. approach



# Spinal Injuries

## Type A injuries



**combined post / ant** (in 2 OR sessions?)

# Spinal Injuries

## Type A injuries

### management

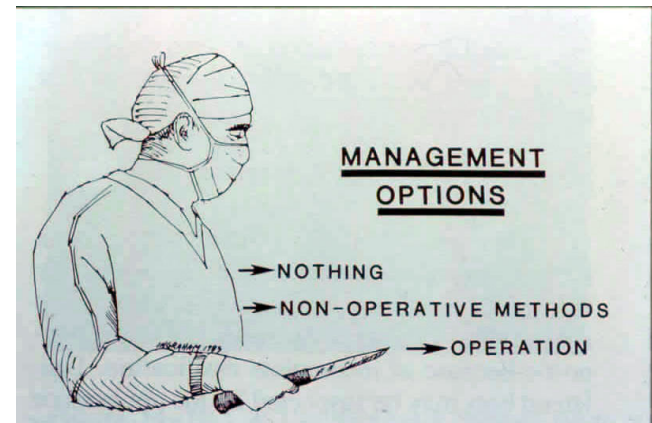
operative vs nonoperative treatment

Wood K et al, JBJS Am, 2003

anterior vs posterior treatment

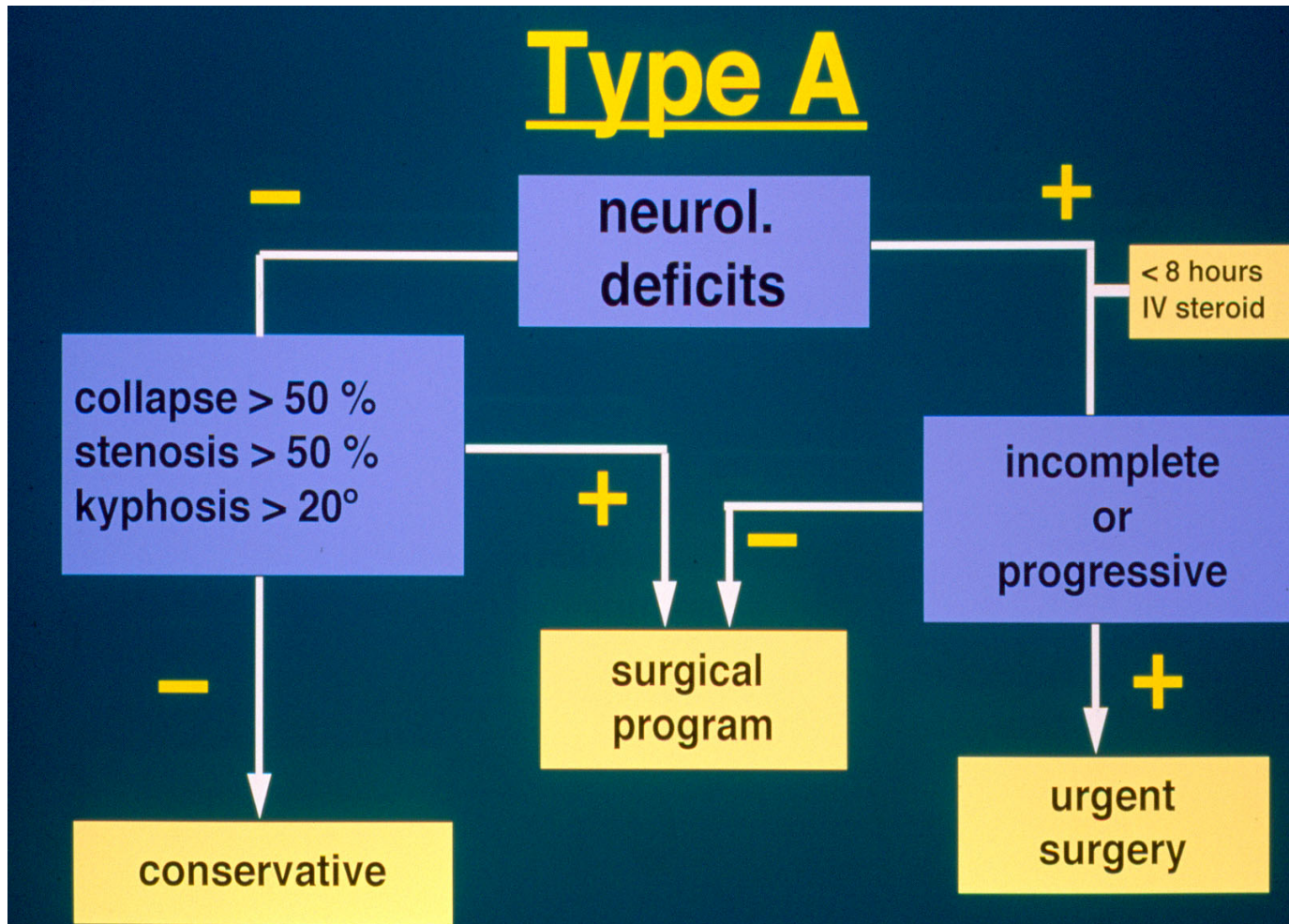
Wood K et al, Spine 2005

no significant difference





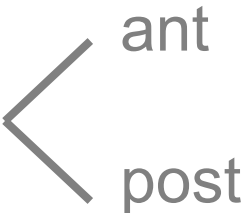
# Spinal Injuries





# Spinal Injuries

## Neurological deficits

- complete vs incomplete
- timing for surgery
- approach 
  - ant
  - post

no clear consensus and evidence in the literature for an anterior approach

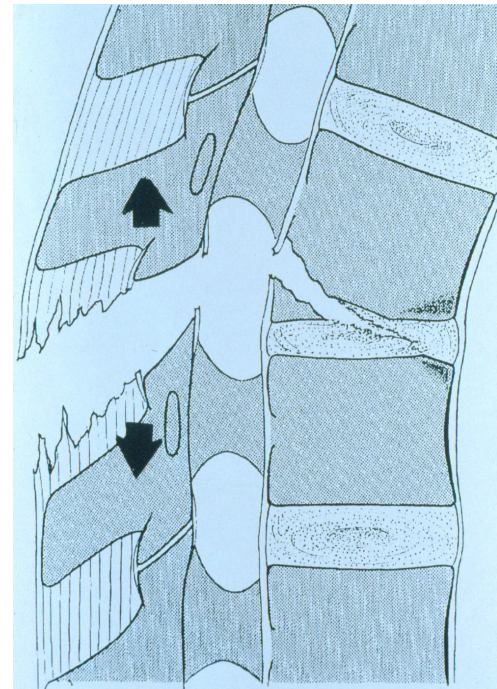


Fehling M et al, Injury 2005

# Spinal Injuries

## Type B Injury of ant. and post. elements with DISTRACTION

- flexion - distraction initiates post. disruption and elongation (B1, B2)
- **Type A fractures** reoccur in these two groups (necessary for complete definition of the injury)
- hyperextension with or without anteropost. shear causes ant. disruption and elongation (B3)
- neurol. deficits > than in Type A

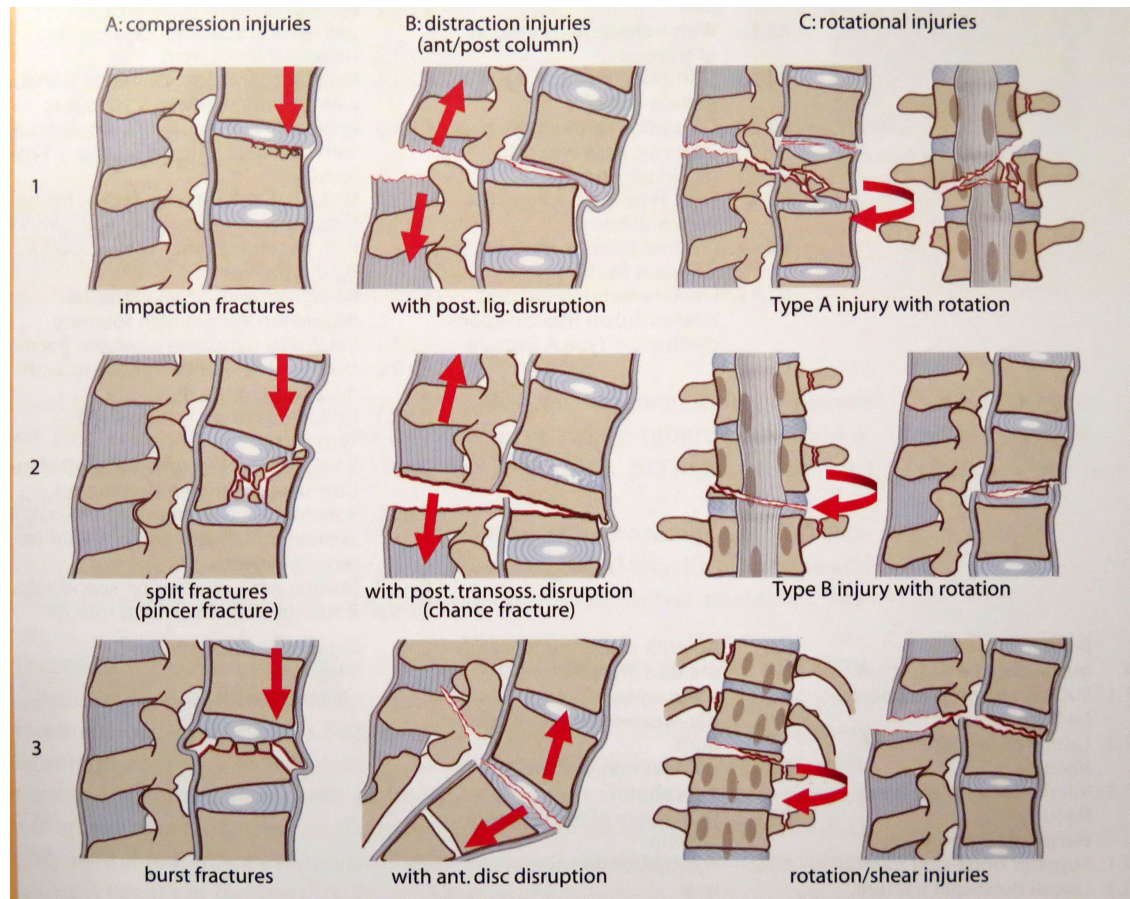


**unstable injuries!!**

# Spinal Injuries

## A comprehensive classification of thoracic and lumbar injuries

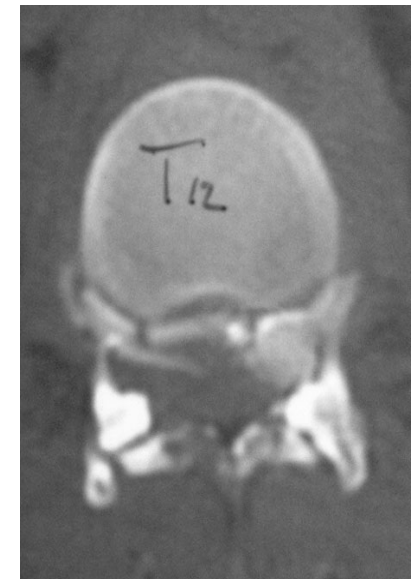
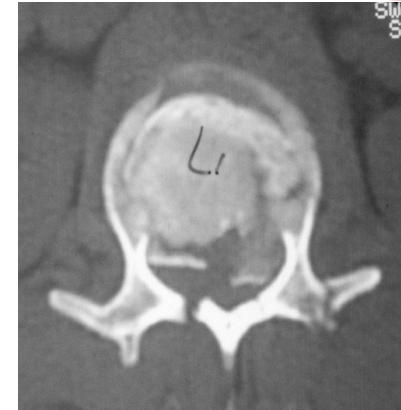
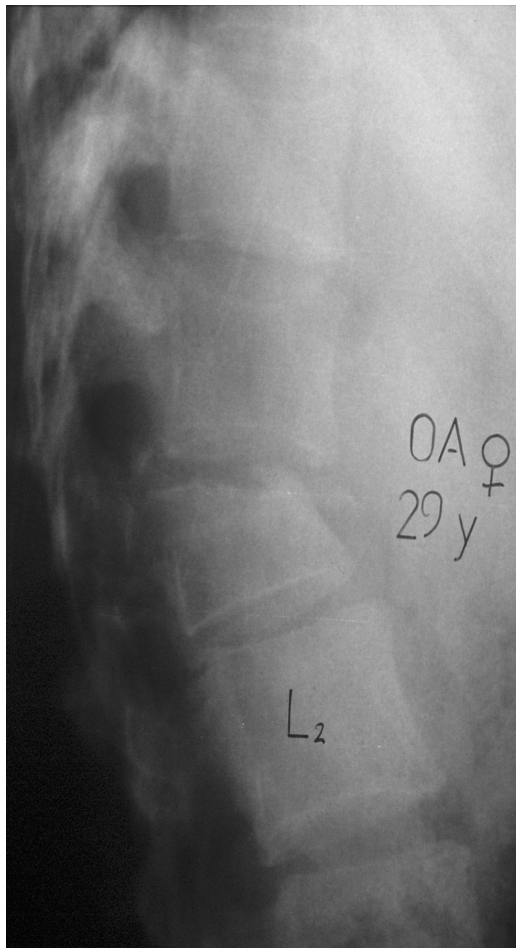
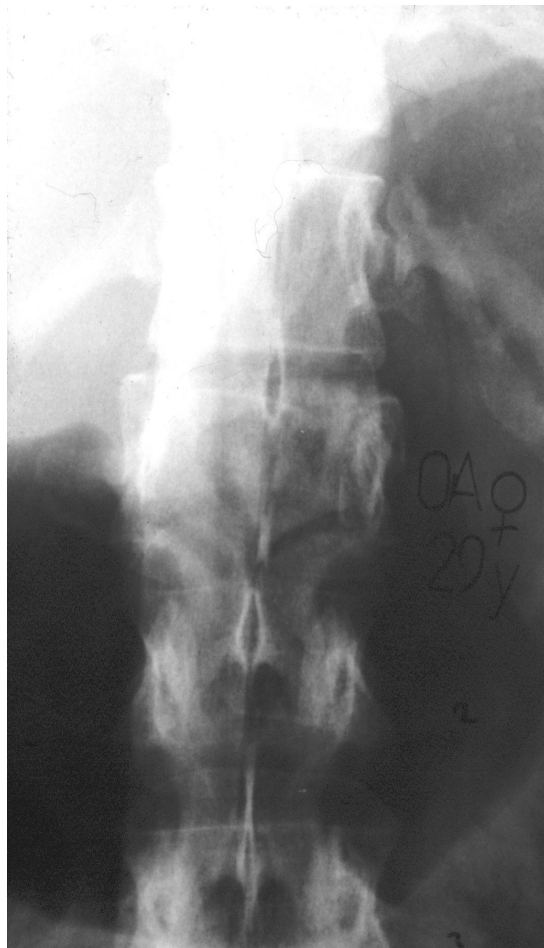
Magerl et al, Eur Spine J 1994





# Spinal Injuries

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# Spinal Injuries

## Type B injuries

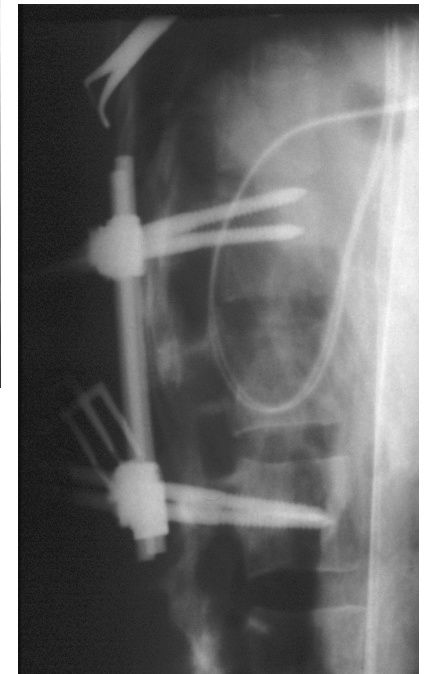
post. elements disrupted  
ant. elements disrupted

→ **↑ instability**

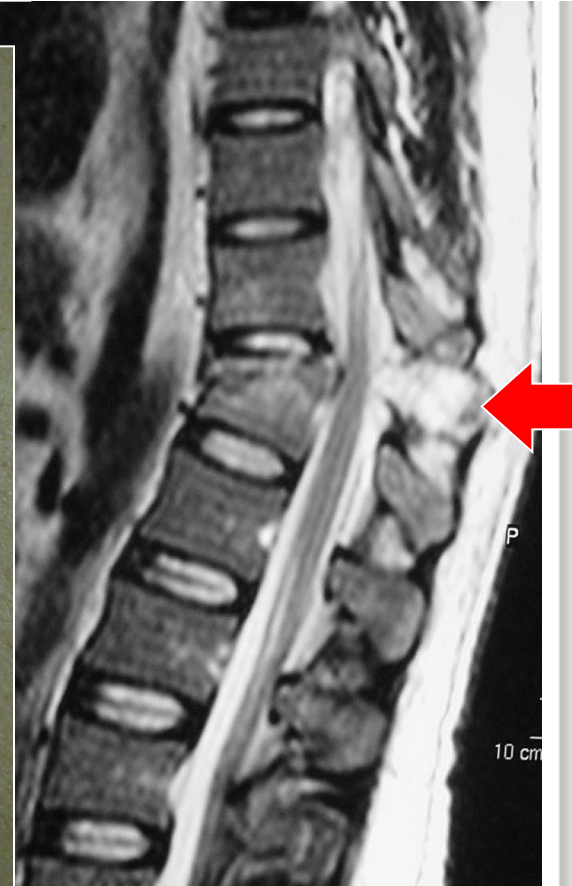
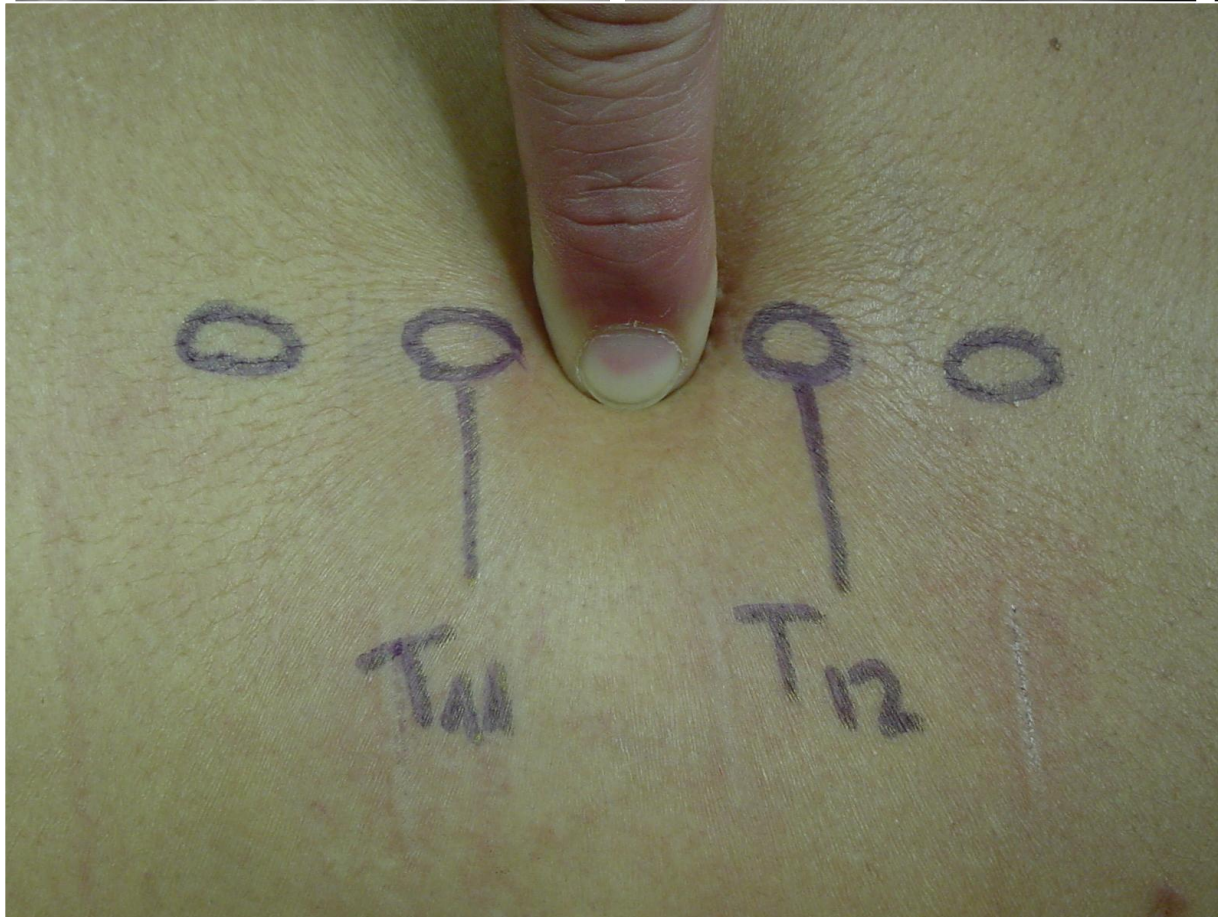
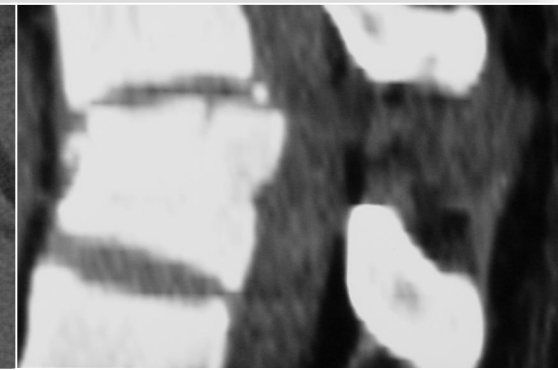
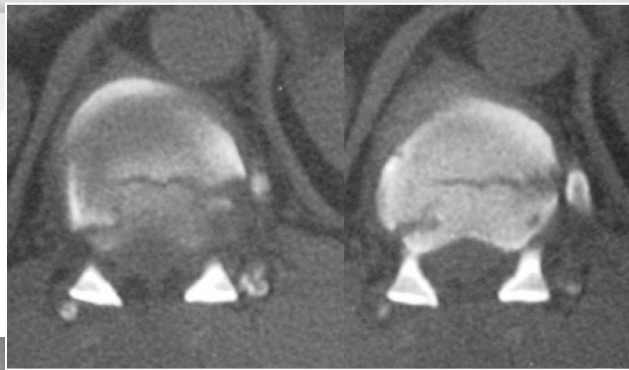
→ **stabilization**

in most of the cases

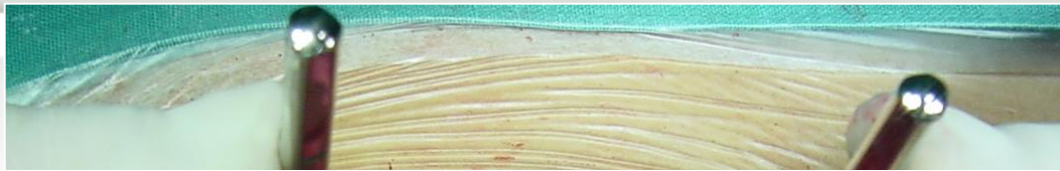
**post. or combined post/ant**



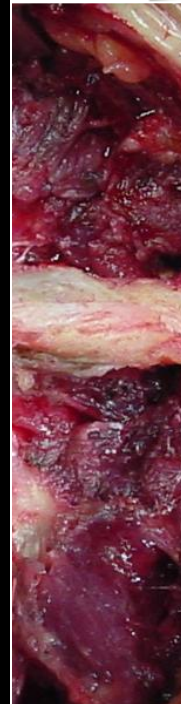
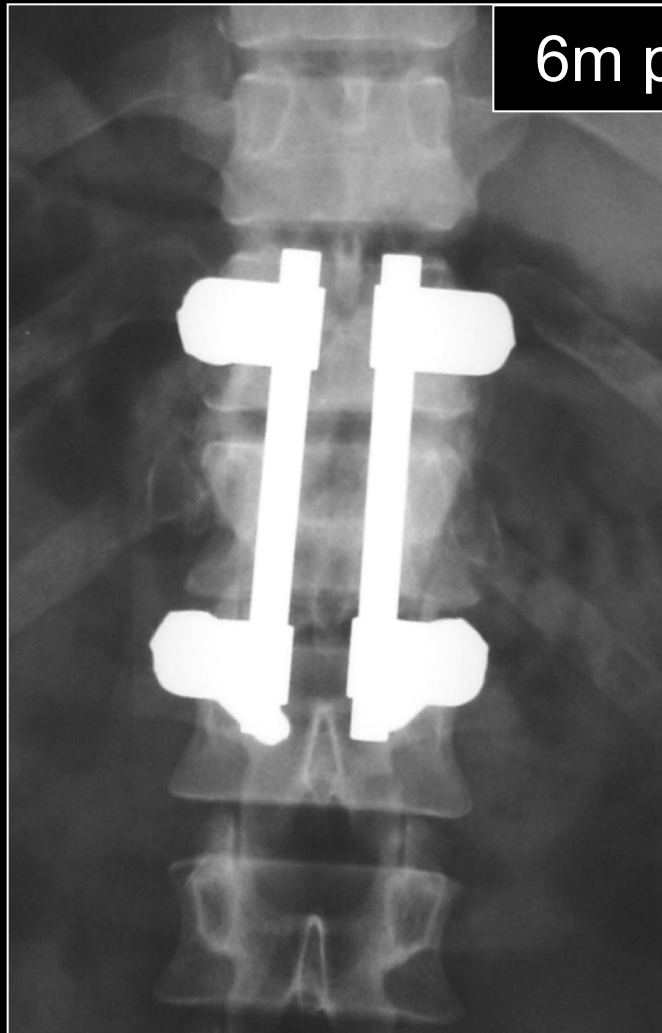
# Type B 1:







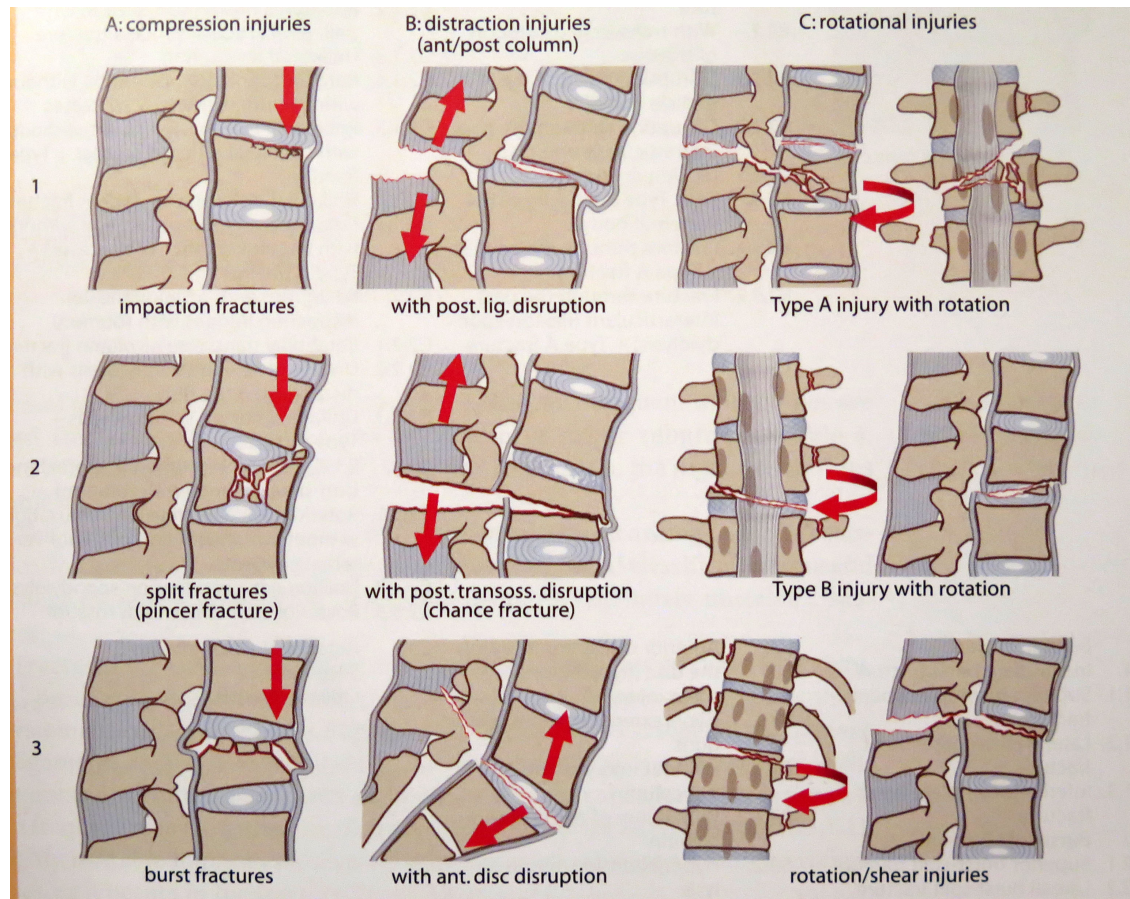
6m postop



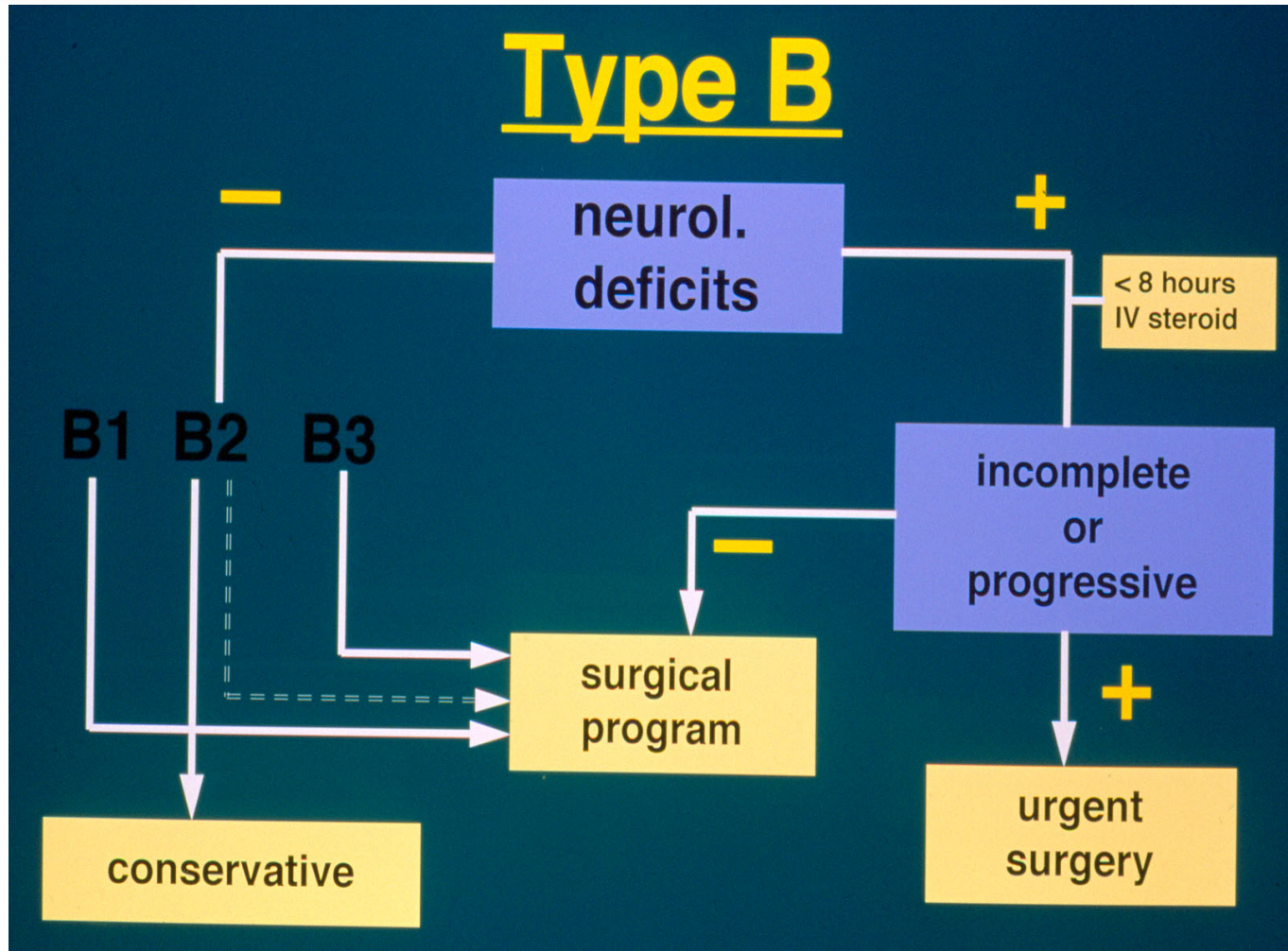
# Spinal Injuries

## A comprehensive classification of thoracic and lumbar injuries

Magerl et al, Eur Spine J 1994







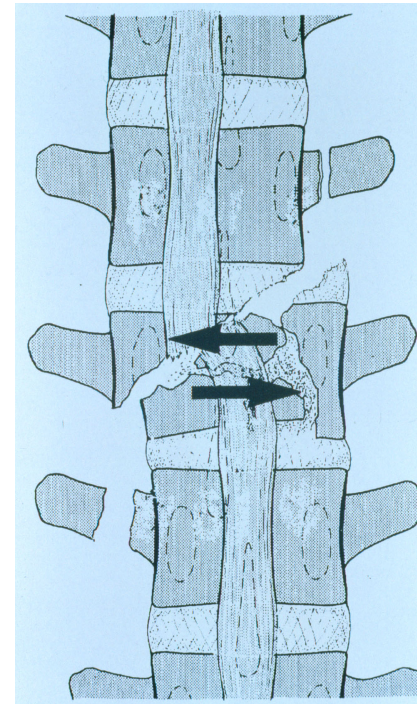
## Type C Injury of ant. and post. elements with ROTATION

- the most severe injuries of the thoracolumbar spine
- the most unstable lesions (instability in axial torque is superimposed on the instability already present in Type A or B injuries)
- potential for translational displacement in all directions of the horizontal plane
- highest rate of neurol deficits
- poor healing potential



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# Spinal Injuries

## Type C injuries





# Spinal Injuries

## Type C injuries

post. elements disrupted

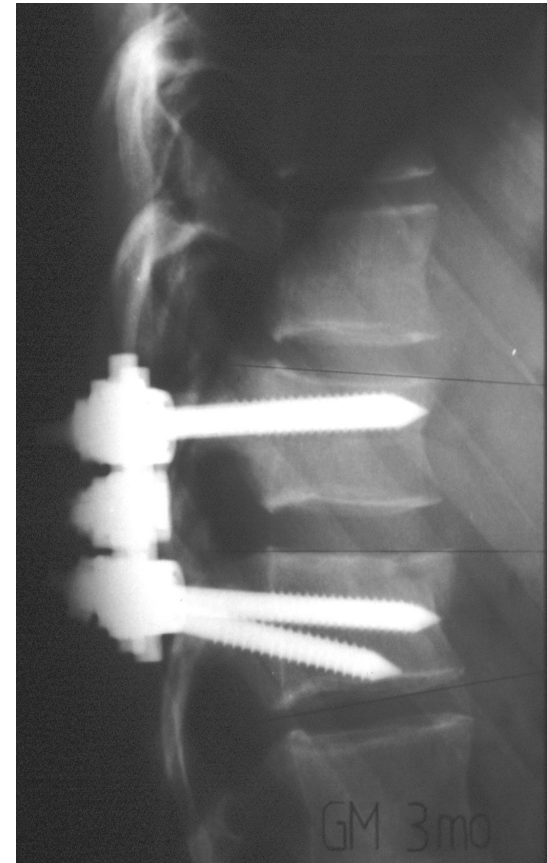
ant. elements disrupted

→ **very instable**

→ **require stabilization**

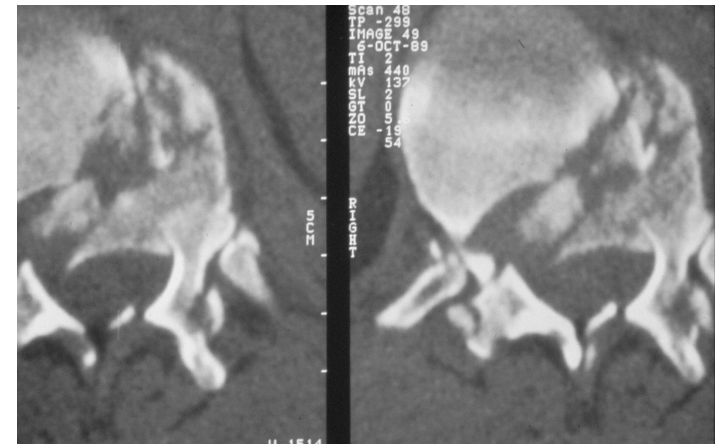
. post. instrumentation

. combined post / ant



# Spinal Injuries

## Type C injuries



# Spinal Injuries

## Type C injuries

