

# Postoperative complications of spine surgery: a radiological perspective

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# Introduction



- OVERVIEW OF SPINE SURGERY INDICATIONS



- IMPORTANCE OF EARLY COMPLICATION RECOGNITION



- ROLE OF IMAGING IN DIAGNOSIS AND MANAGEMENT

# Indications of Spine Surgery



| Indication                  | Relative Frequency (Bar Length) |
|-----------------------------|---------------------------------|
| Degenerative                | High                            |
| Spinal deformities          | High                            |
| Traumatic Injuries          | High                            |
| Infections                  | High                            |
| Tumors                      | High                            |
| Failed conservative therapy | High                            |

Degenerative

Spinal deformities

Traumatic Injuries

Infections

Tumors

Failed conservative therapy

# Early Recognition is the Key



Complications can range from minor to life threatening



Timely intervention may prevent permanent neurological deficits, sepsis or chronic pain



Delayed recognition may lead to reoperation, poor outcome, prolonged hospitalization



Clinical symptoms may be nonspecific or masked by postoperative changes, making Imaging Critical



# 3 Commonest Causes of Poor Result

- ▶ Wrong Level
- ▶ Wrong Level
- ▶ Wrong Level



# Complications of Spine Surgery

## General

- ▶ Mortality
- ▶ Anesthetic
- ▶ DVT/PE
- ▶ Chest/urinary infections

## Local

- Nerve Injury
- Dural Tear
- Bleeding
- Infection





# Imaging Modalities Used

- ▶ • X-ray: Hardware position, alignment
- ▶ • CT: Hardware detail, bone fusion, hemorrhage
- ▶ • MRI: Soft tissue, infection, cord changes
- ▶ • Nuclear Medicine: Infection detection



# Broad Categories of Complications

- ▶ • Mechanical
- ▶ • Infectious
- ▶ • Neurological
- ▶ • Vascular
- ▶ • Adjacent Segment Disease



# Mechanical Complications

- Hardware failure: screw loosening, rod fracture

- Pseudarthrosis: non-union

- Malalignment: sagittal or coronal imbalance

- Imaging Examples (CT/X-ray)

# Hardware Failure

Causes:

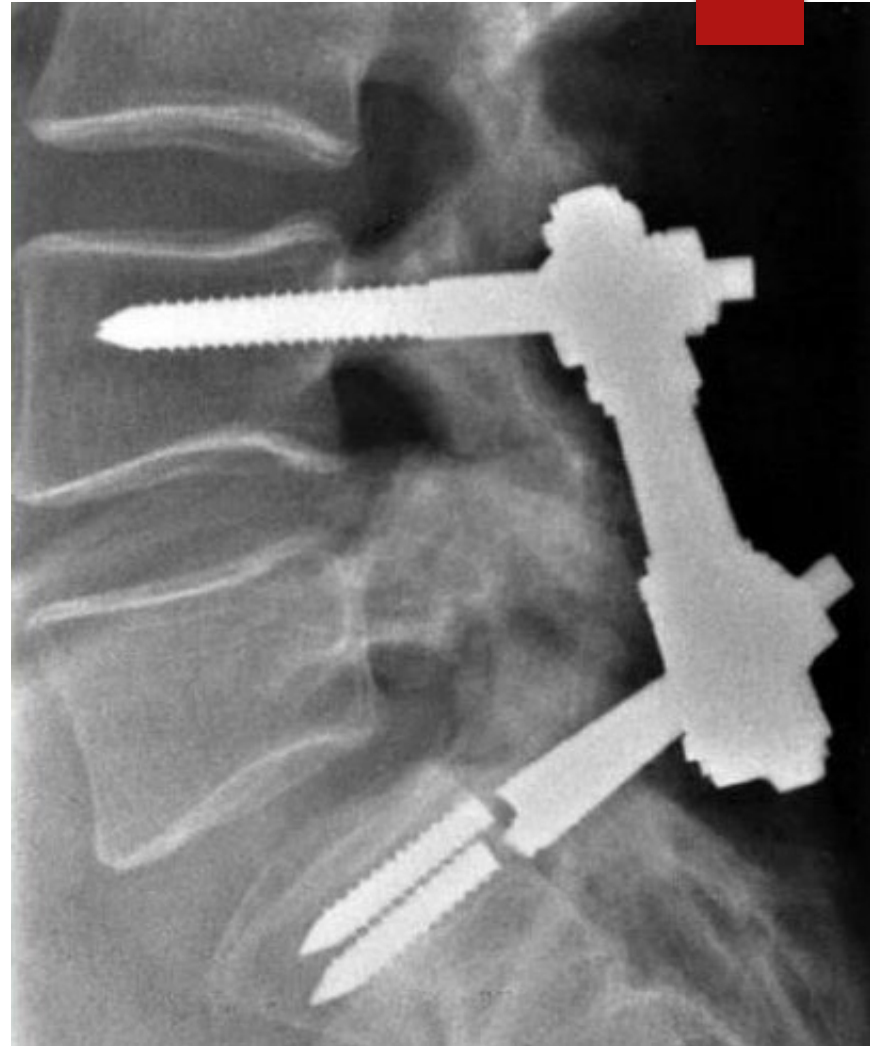
Short Screws

Small Screws

Short Insertion

Long fusions

Anterior column  
insufficiency





# Pedicle Screw Fracture

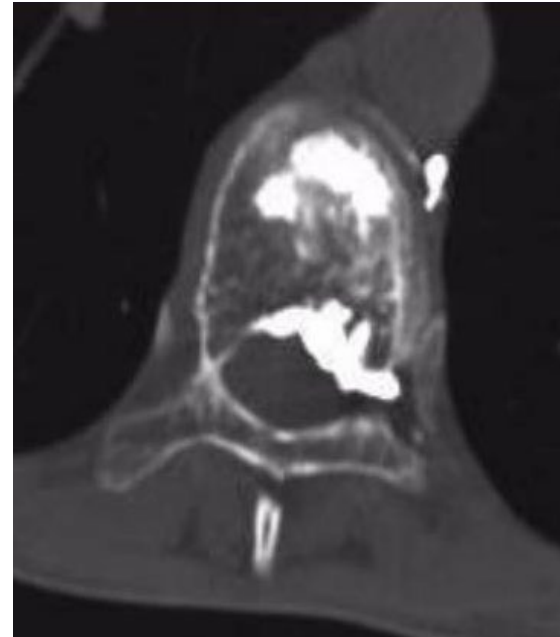
- ▶ Causes
- ▶ Malposition
- ▶ Screw too large
- ▶ Tapping Injury
- ▶ Osteoporosis

## Consequences

Reduced Hold

Dural tear

Nerve Root



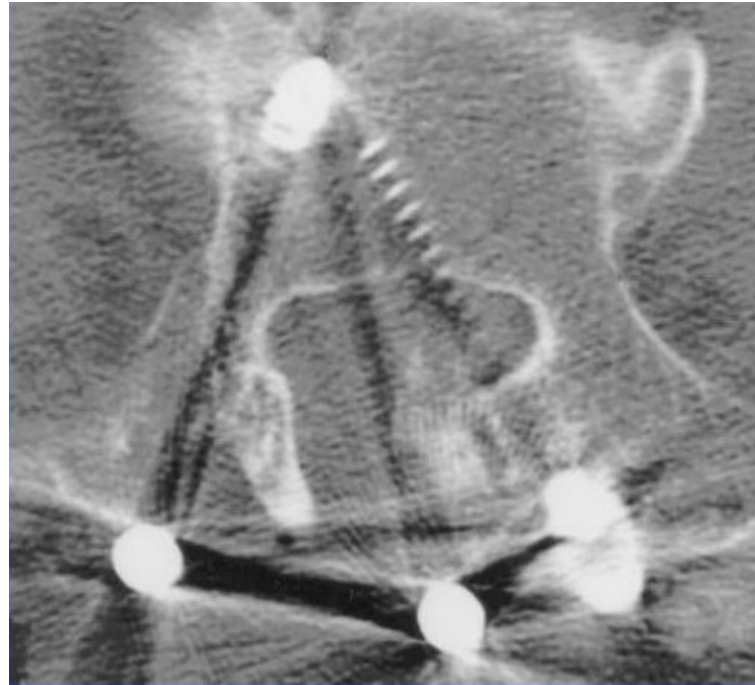
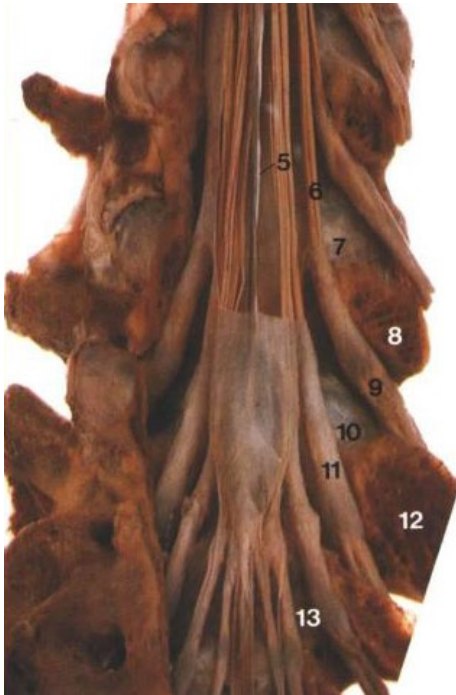
Post Vertebroplasty- Cement Leak



# Subsidence

► Collapse or settling of bone located immediately next to an implantable device in direction of the loading force. It can lead to a loss of the desired postoperative result and to further complications.





## Malpositioned Screw- Dural Tear





# Implant Loosening



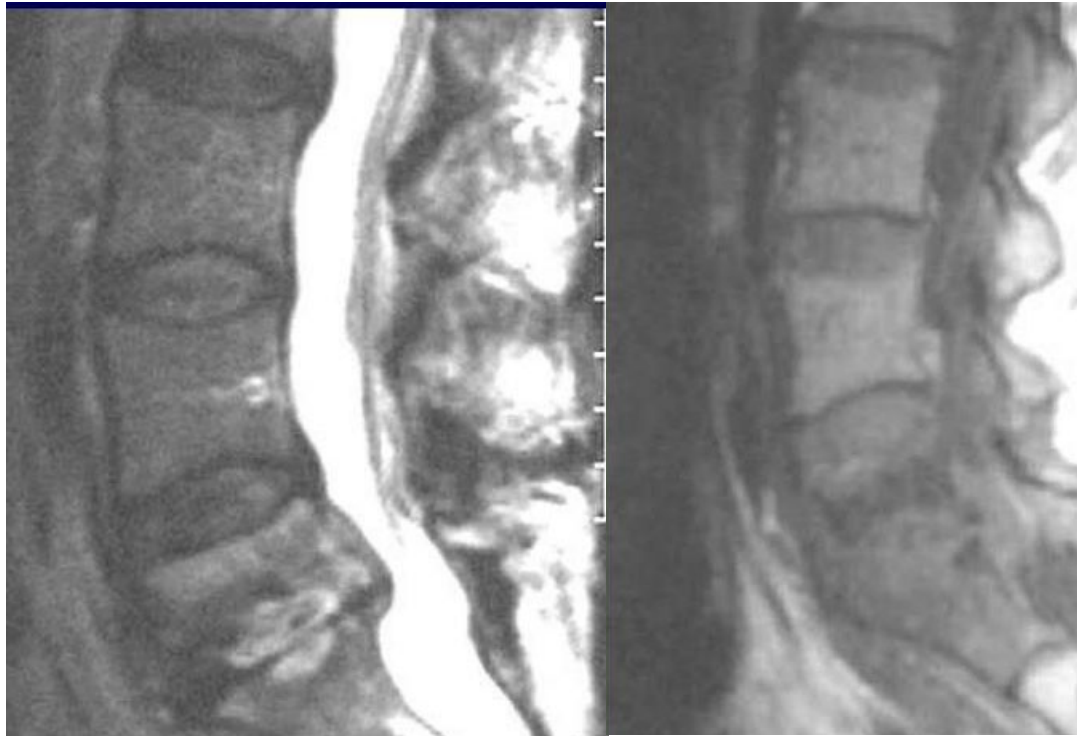
Malposition





## Infectious Complications

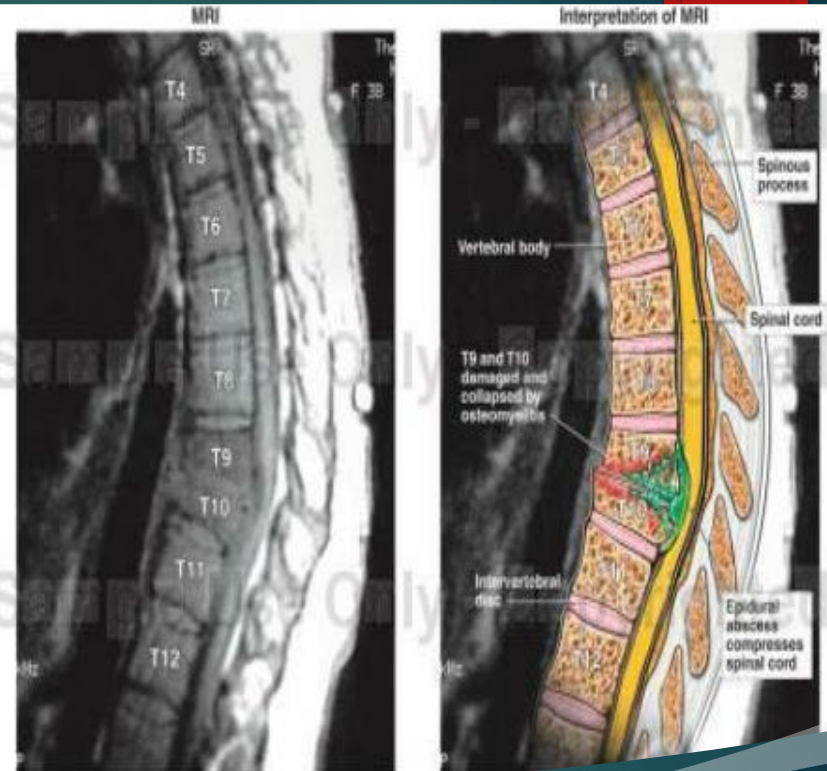
- ▶ • Postoperative infection: superficial vs deep
- ▶ • Discitis/Osteomyelitis
- ▶ • Epidural abscess
- ▶ • MRI: T1 hypointensity, T2/STIR hyperintensity, enhancement
- ▶ • CT: Bony destruction



Infectious  
Discitis  
Osteomyelitis



- Usually bacterial (staphylococcus is common).
- Spread through:
  - hematogenous route.
  - Adjacent focus.
  - Direct inoculation.



# Epidural Abscess



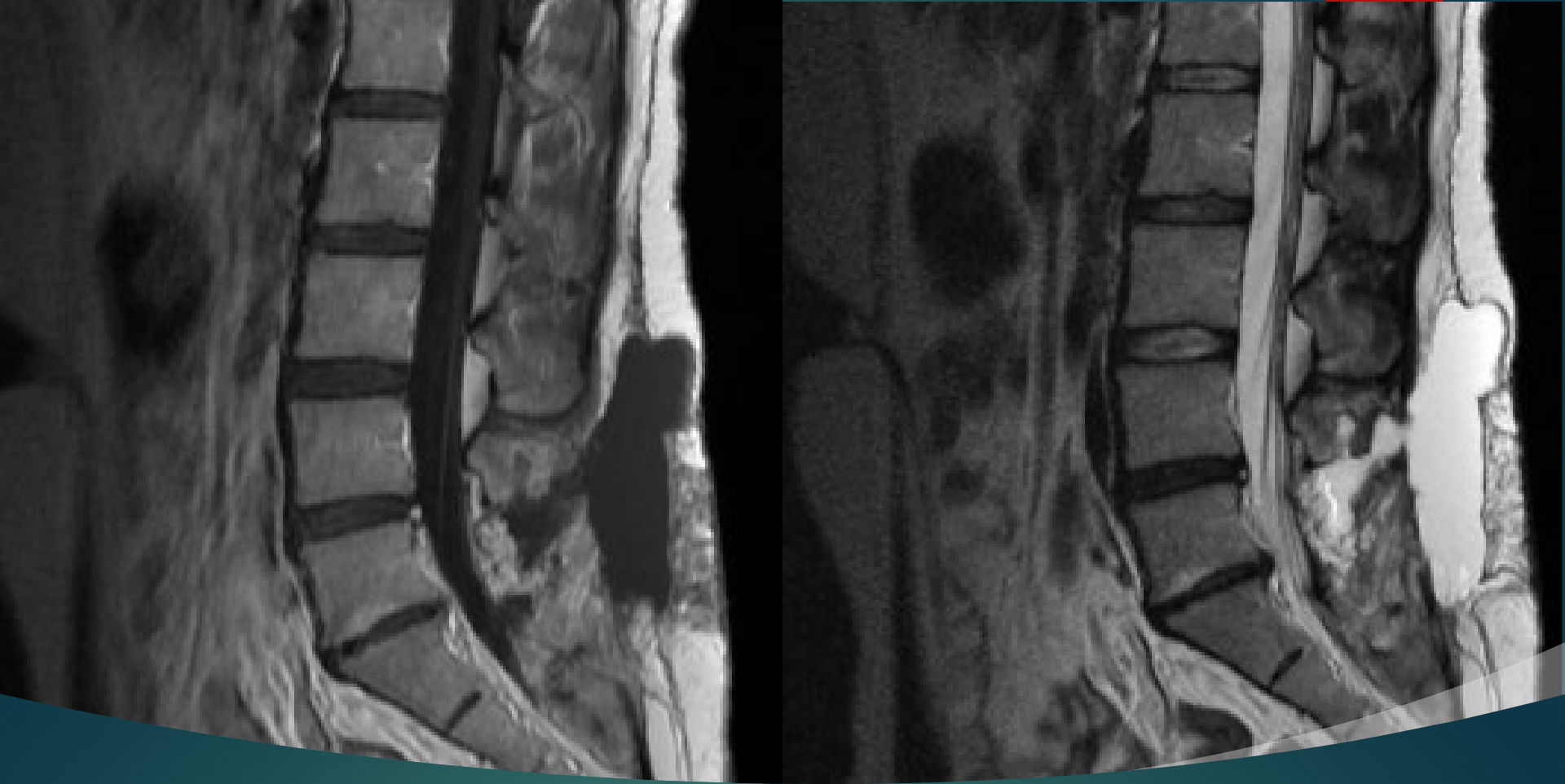
# Neurological Complications

- Epidural hematoma

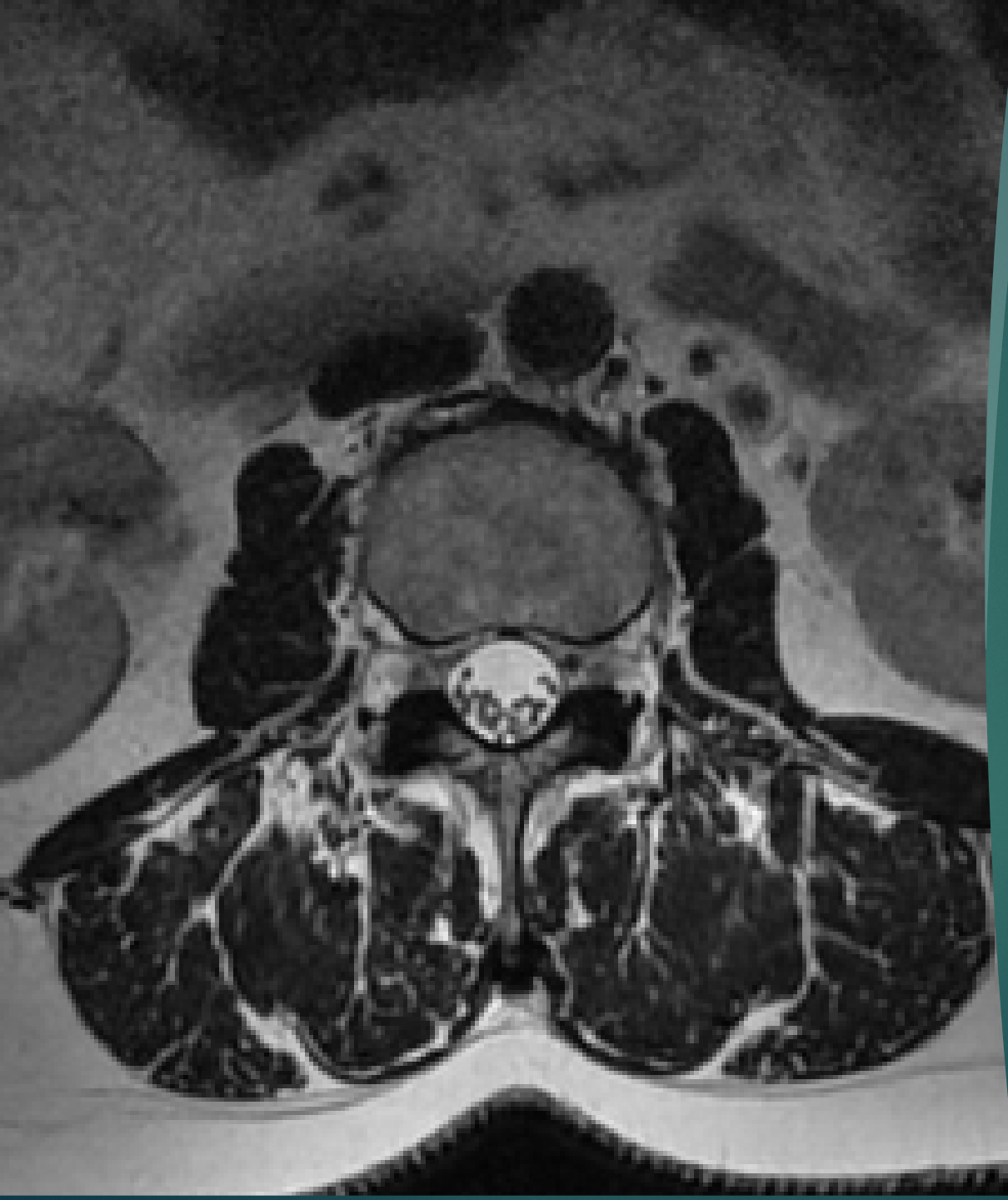
- Cord/nerve root compression

- CSF leak / pseudomeningocele

Arachnoiditis



CSF Leak/Pseudomeningocele



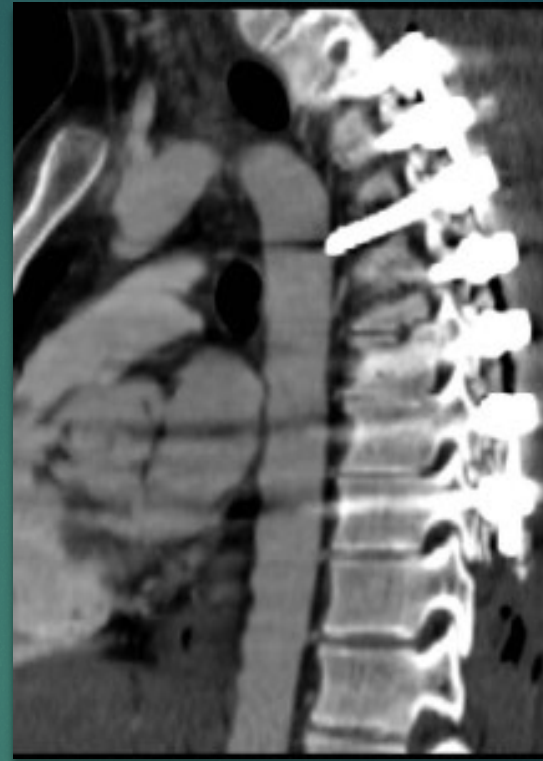
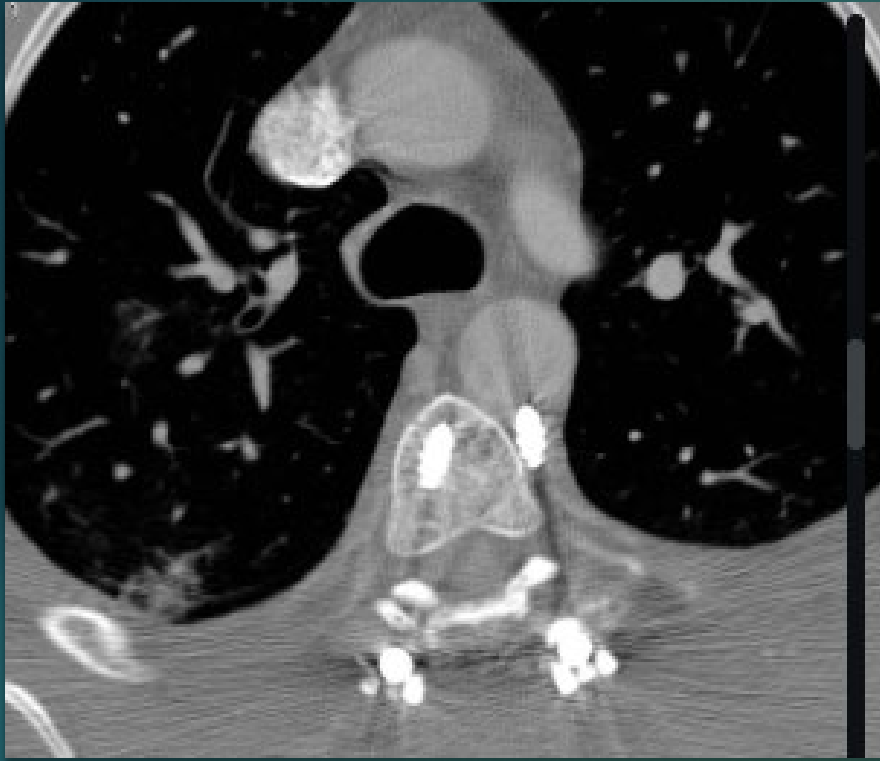
Arachnoiditis





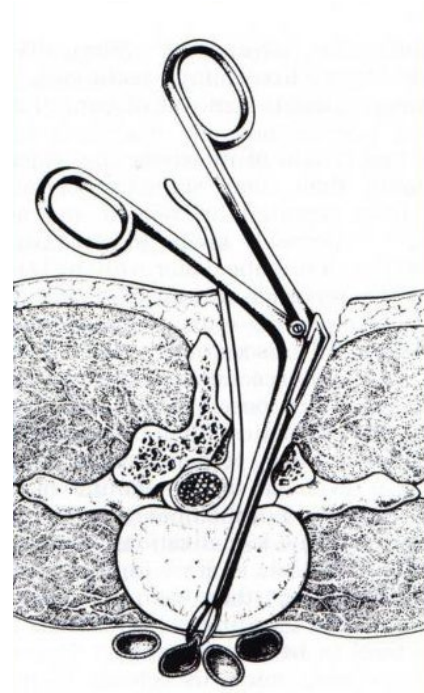
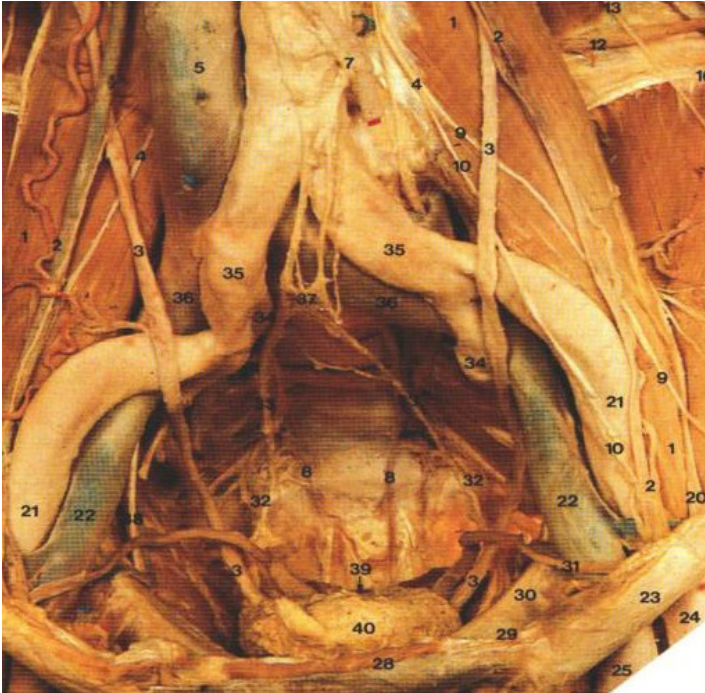
# Vascular Complications

- ▶ • Vessel injury: vertebral/segmental arteries
- ▶ • Postoperative hematoma
- ▶ • CT angiography / MRI
- ▶ • Rare but catastrophic



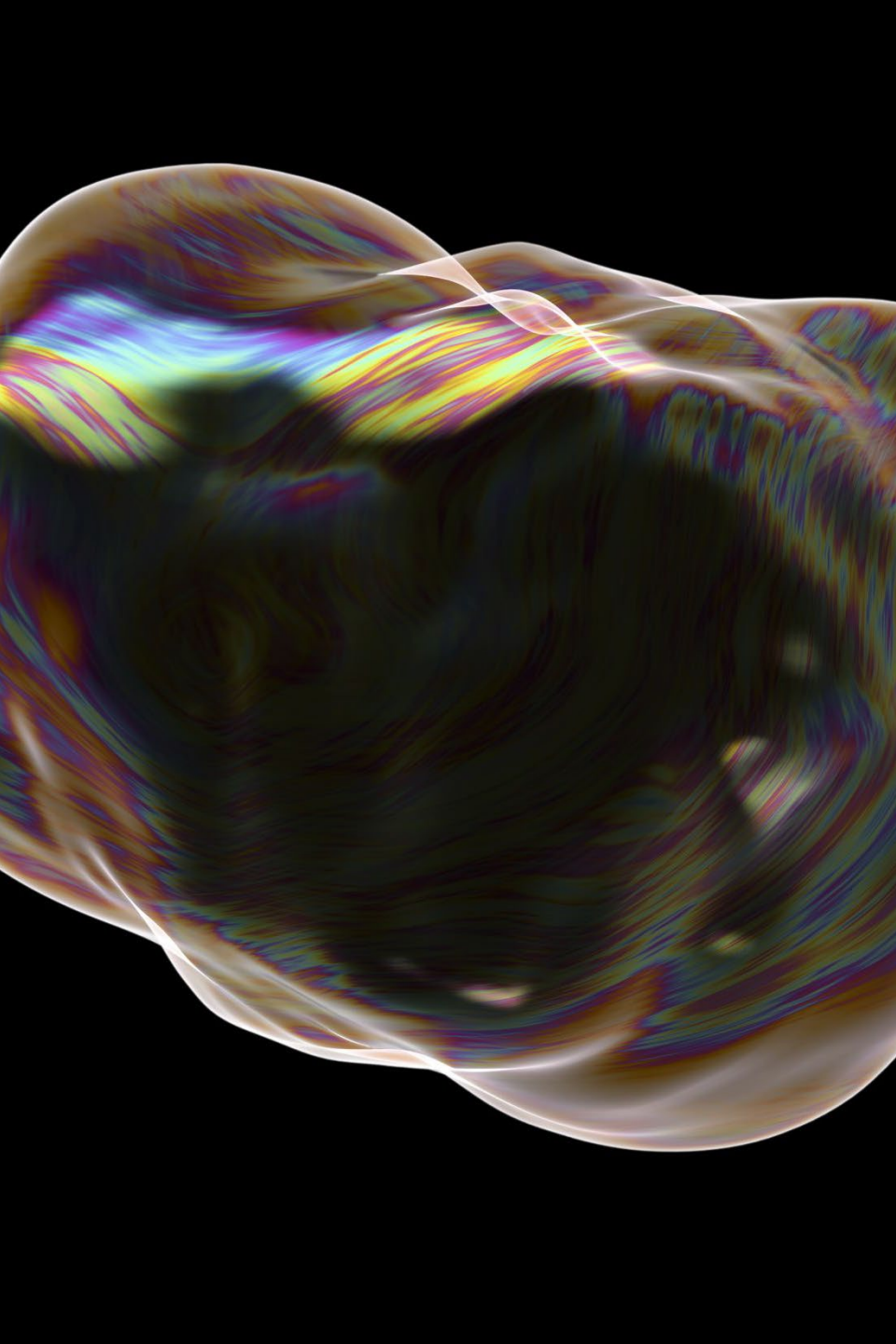
Vessel Injury





Bleeding: Major Vessel Damage





# Adjacent Segment Disease

- ▶ • Accelerated degeneration above/below fusion
- ▶ • Imaging: new disc degeneration, listhesis, facet arthropathy
- ▶ • MRI and dynamic X-rays helpful

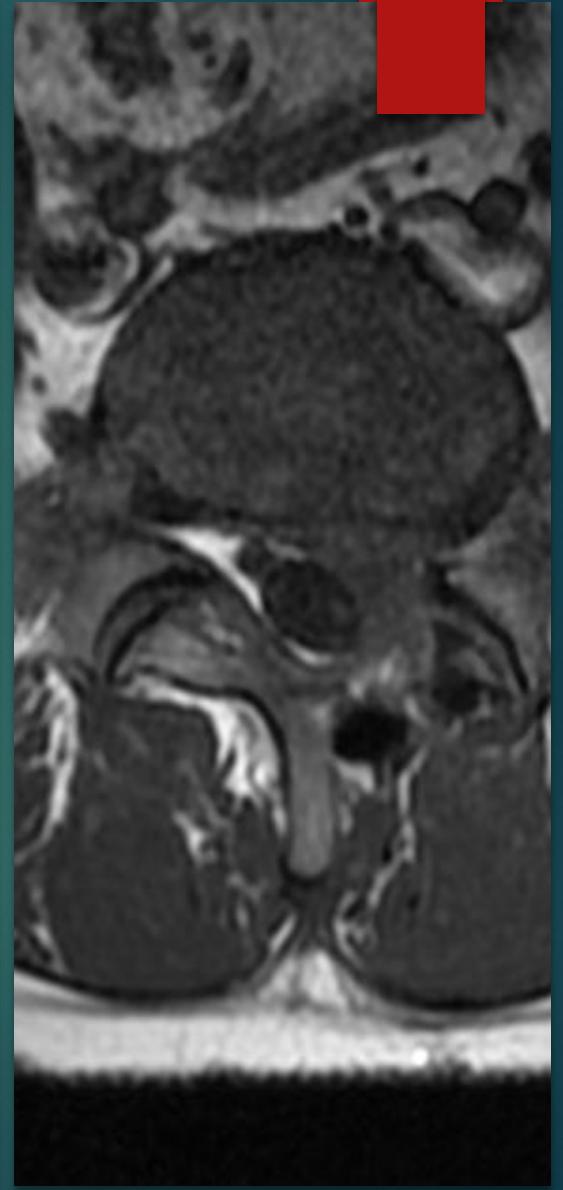
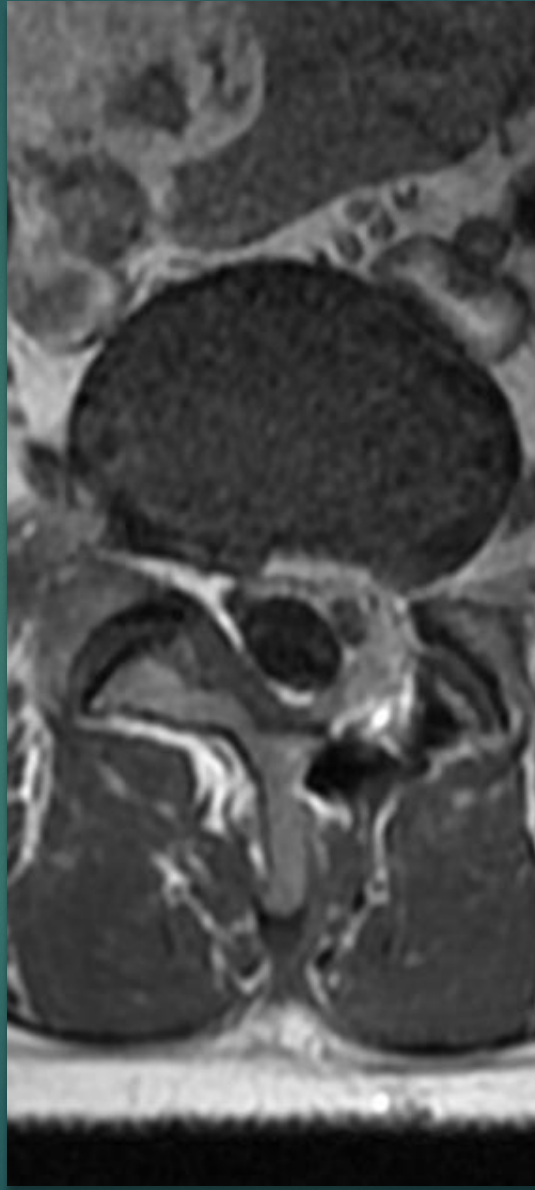
# Spinal Cord and Nerve Root Injury

- ▶ • Cord contusion (MRI)
- ▶ • Myelomalacia or syrinx formation
- ▶ • Nerve root avulsion or scarring
- ▶ • MRI + DTI (optional)



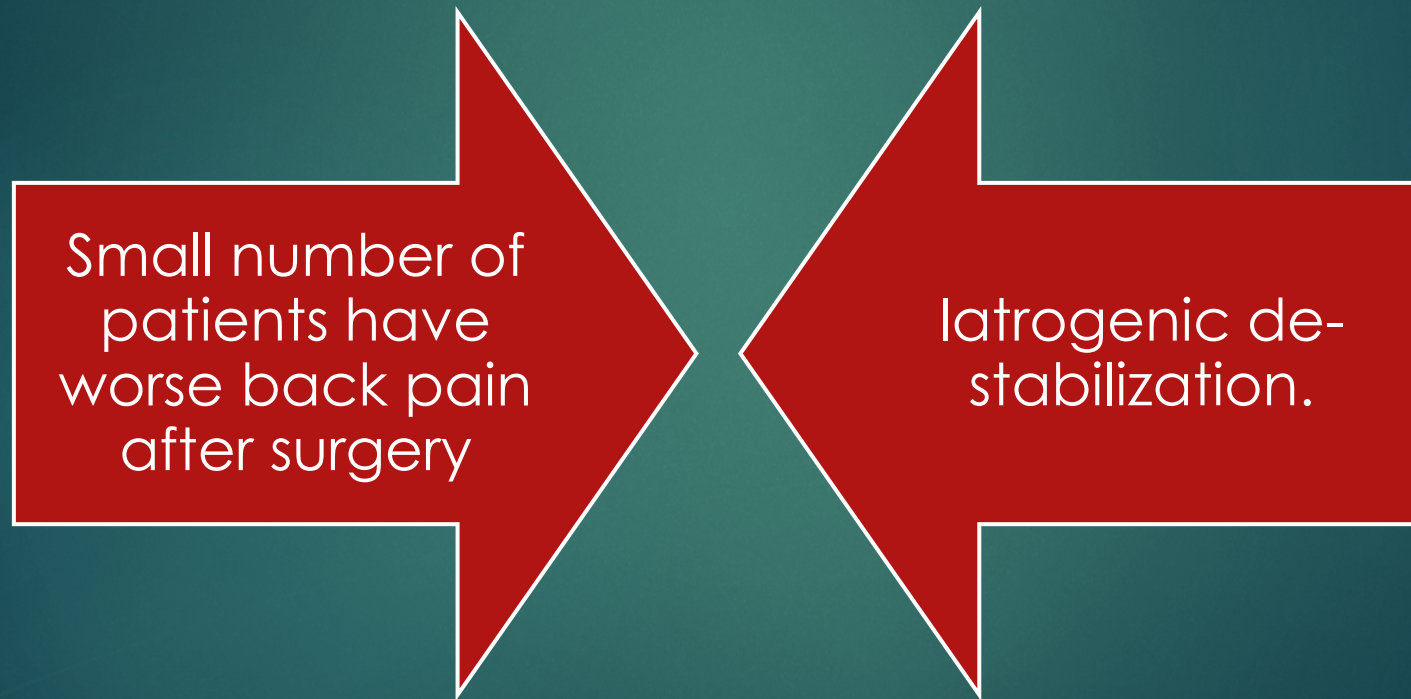
# Postoperative scar vs Disc

► Post-operative scar around left S1 nerve root with early enhancement, irregular borders and retraction whereas disc shows no or delayed enhancement.





# Back Pain/Instability



# Failed Back or Post- Laminectomy Syndrome

- ▶ Persistent leg and/back pain after a surgical procedure. The pathophysiology of this syndrome is complex, as often the operation was technically successful.

# Summary



- Timely imaging is critical



- Choose modality based on suspected complication



- Multidisciplinary approach improves outcomes



# Questions



- THANK YOU!



- ANY QUESTIONS?

# References

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- ▶ 4. Joaquim AF, et al. Mechanical complications in adult spine deformity surgery. J Clin Med. 2021;10(1):165.
- ▶ 5. Chou D, et al. Complications of Spinal Instrumentation. RadioGraphics. 2007;27(4):905–926.