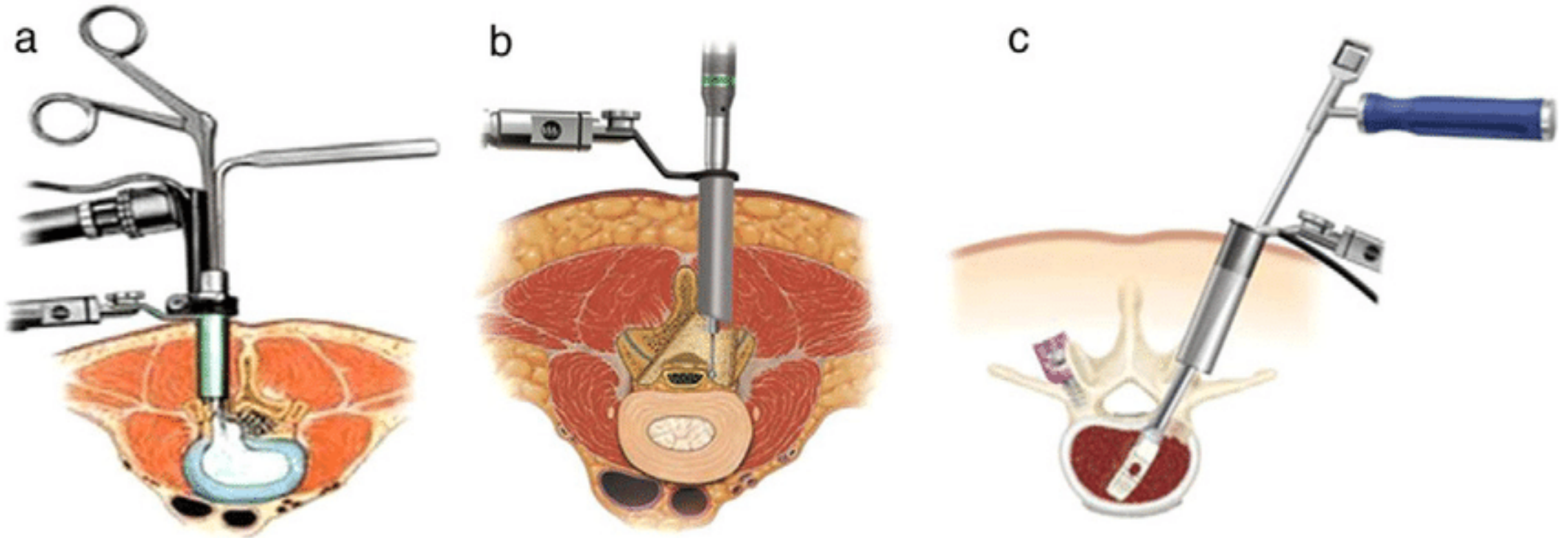


Minimally Invasive Spine Surgery (MIS)

Will Mangham, MD

16 May 2024

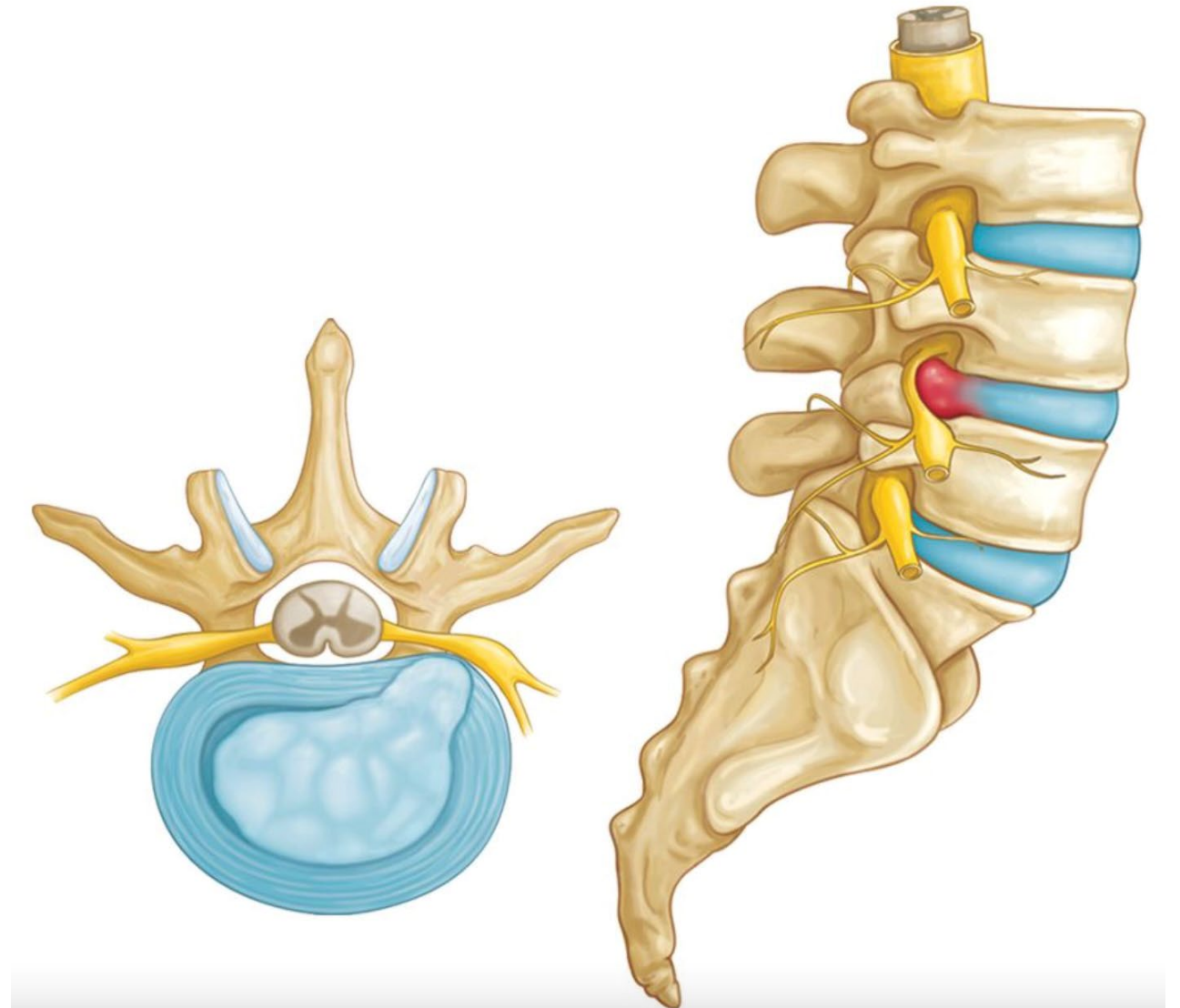


Disclosures

- None

Agenda

- Anatomy
- Indications for Spine Surgery
- Traditional Spine Surgery
- History of MIS
- MIS approaches
- Future of MIS

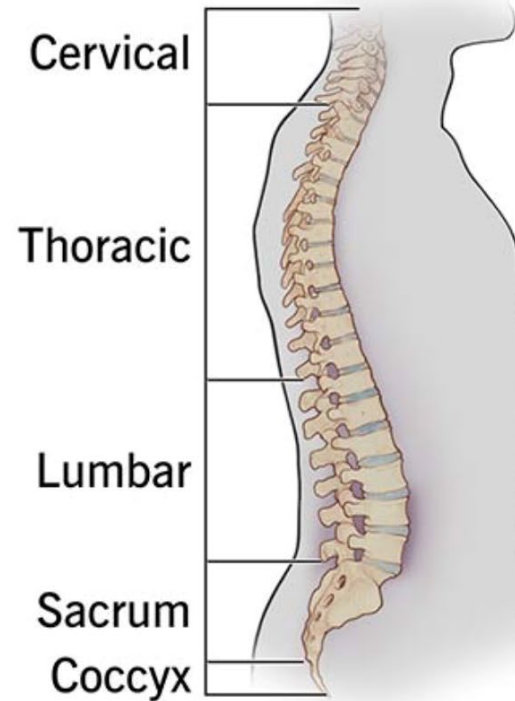


Spine Anatomy

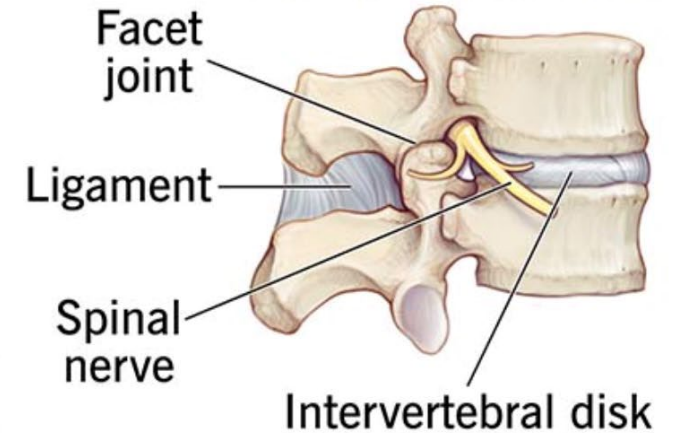
- Vertebrae
- Discs
- Ligaments
- Joints
- Muscles

Spine (backbone)

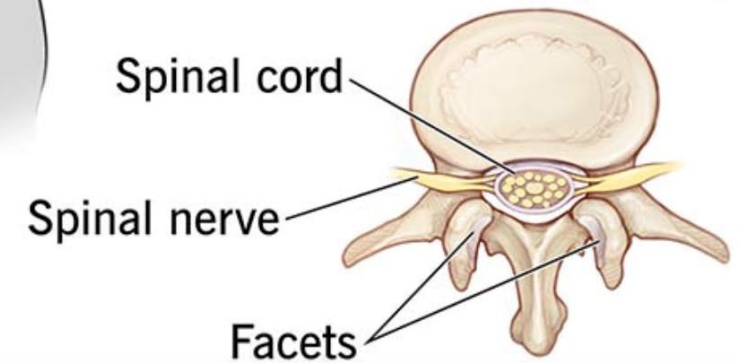
Parts of the spine

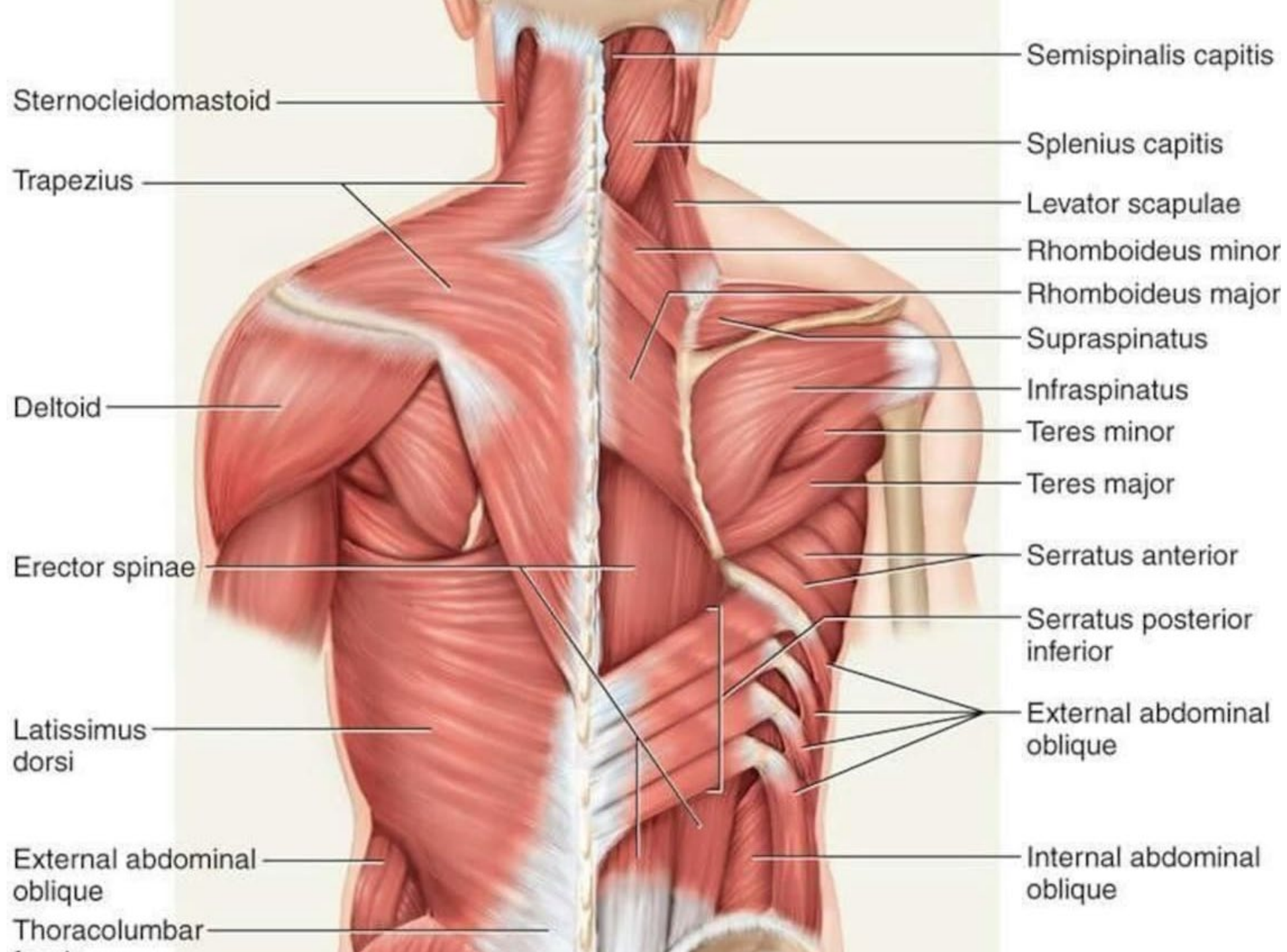


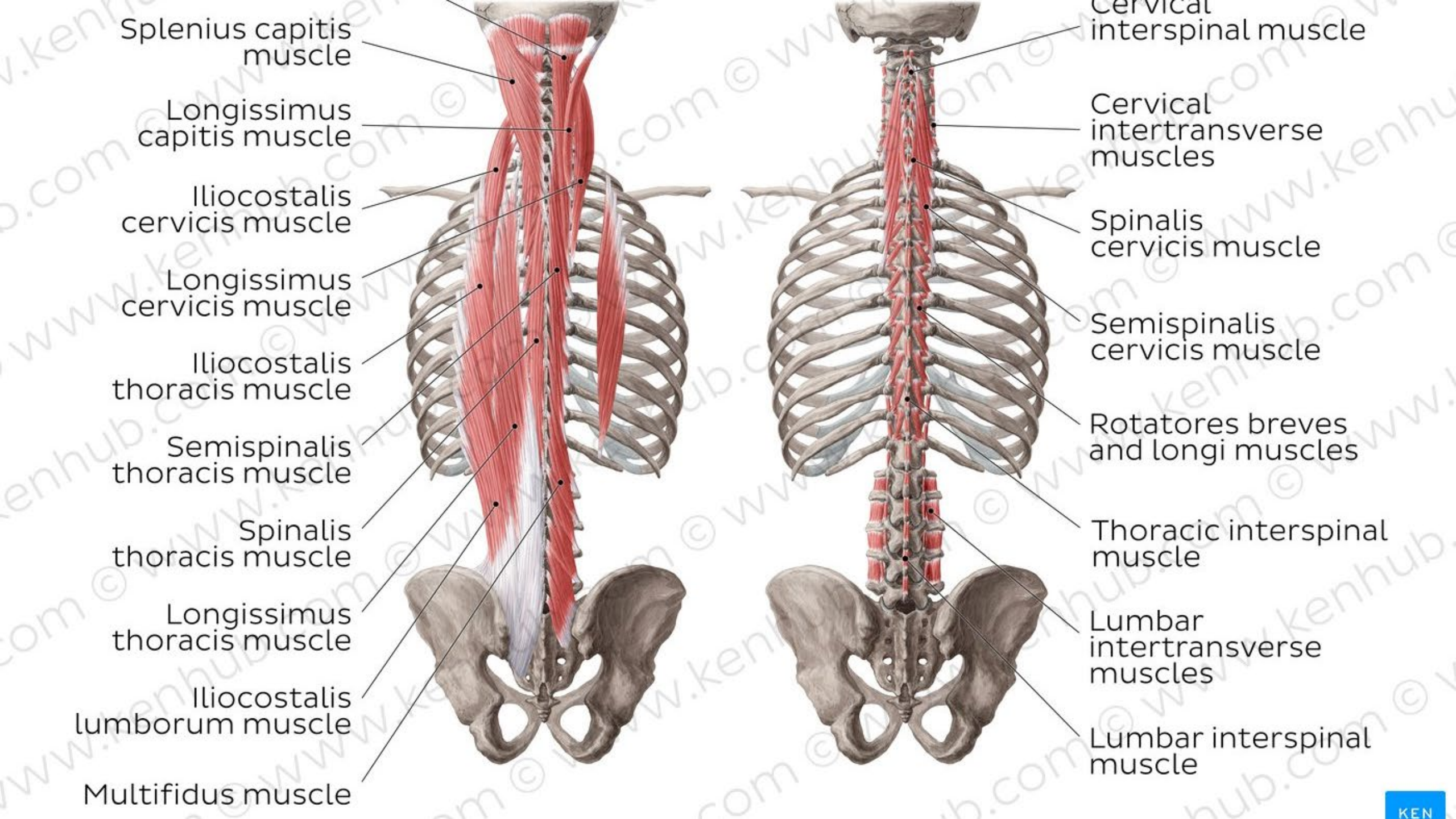
Vertebrae (side view)



Vertebra (top view)







Splenius capitis muscle

Longissimus capitis muscle

Iliocostalis cervicis muscle

Longissimus cervicis muscle

Iliocostalis thoracis muscle

Semispinalis thoracis muscle

Spinalis thoracis muscle

Longissimus thoracis muscle

Iliocostalis lumborum muscle

Multifidus muscle

Cervical interspinal muscle

Cervical intertransverse muscles

Spinalis cervicis muscle

Semispinalis cervicis muscle

Rotatores breves and longi muscles

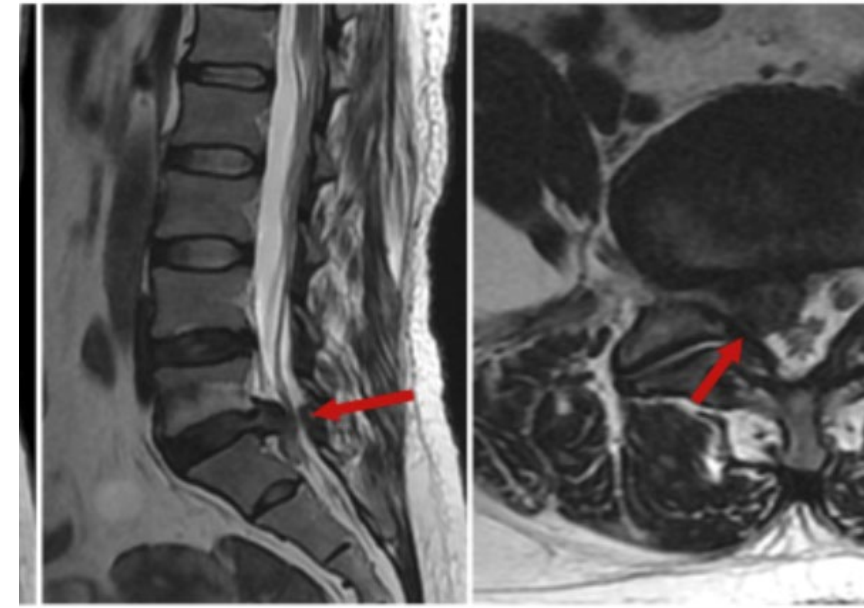
Thoracic interspinal muscle

Lumbar intertransverse muscles

Lumbar interspinal muscle

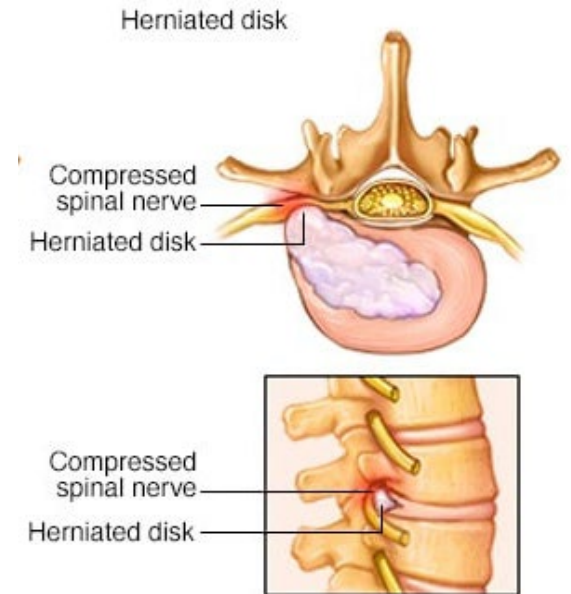
When is Spine Surgery Needed?

- In general, two goals of any spine surgery:
 - 1) Decompress nerves or spinal cord
 - 2) Stabilize bones



When is Spine Surgery Needed?

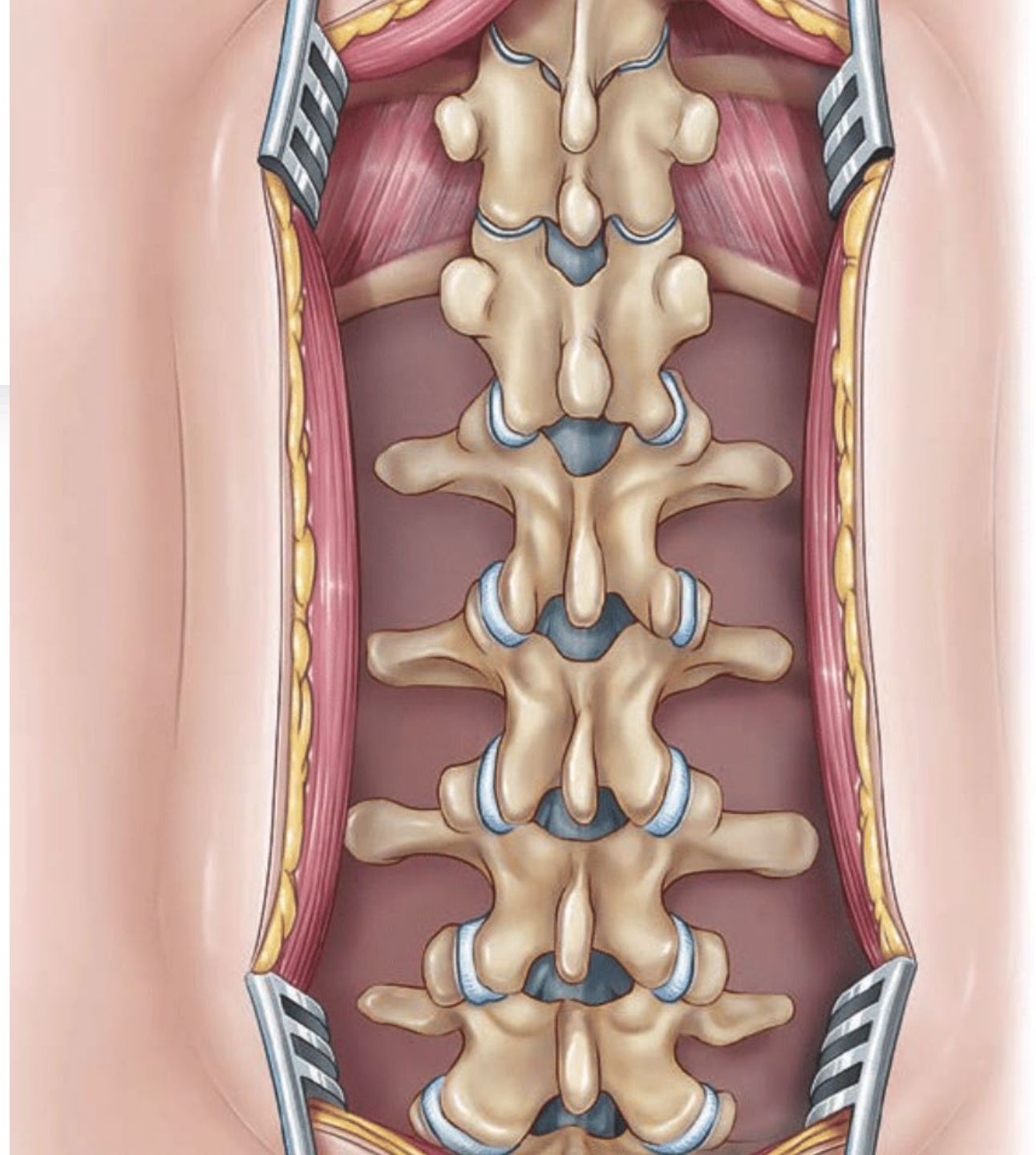
- Scope of spine surgery is very wide



RIGHTS RESERVED.

Traditional Spine Surgery

- Midline incision
- Strip muscle off bone for exposure
- Muscle held back with retractors
- Muscle sewn back at end of procedure



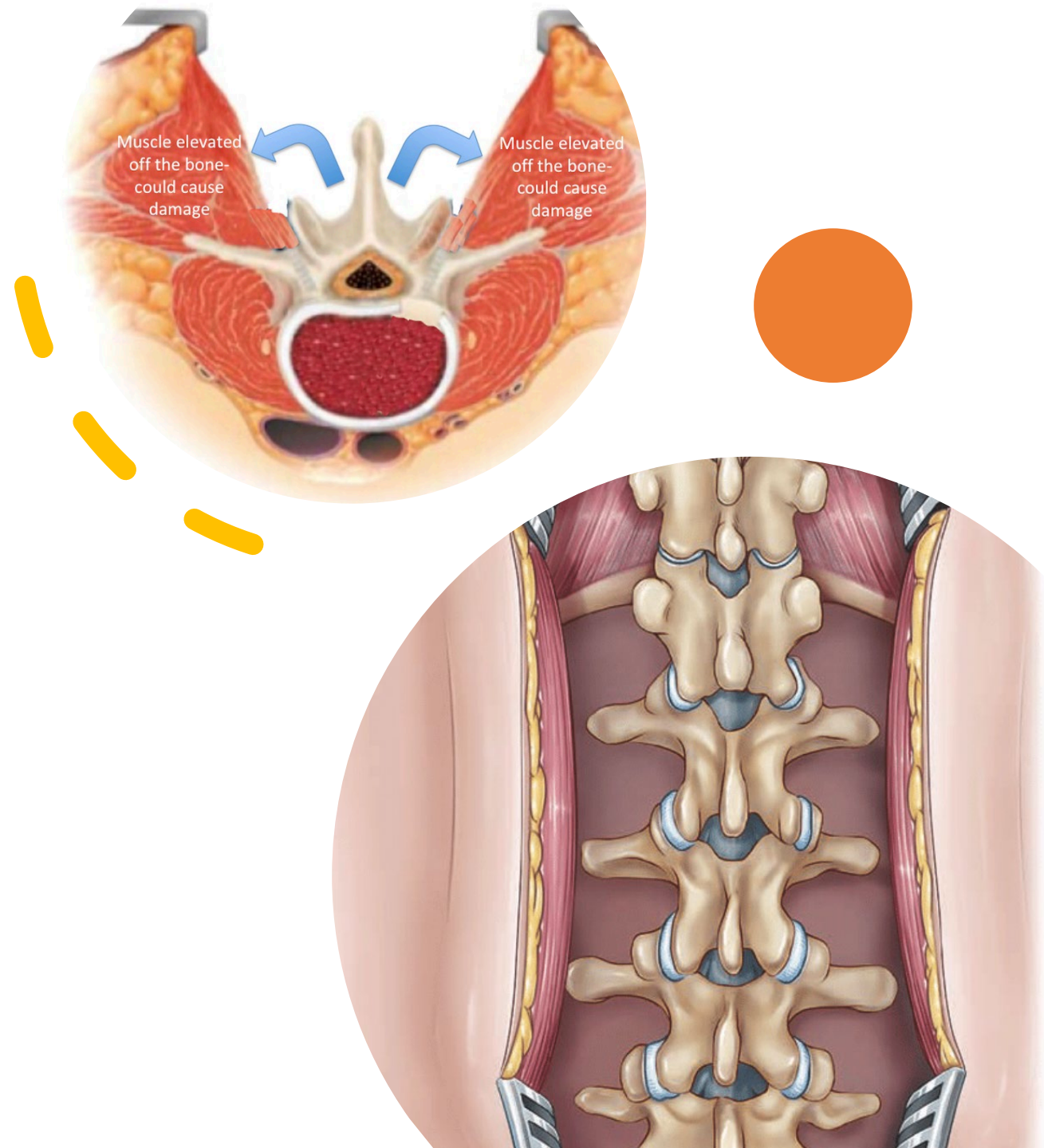
Traditional Spine Surgery

- **Advantages:**

- Direct visualization of anatomy
- Allows for extensive bone work--> possibly better fusion, easier correction of major deformities
- Familiar midline approach
- Potentially less operating time

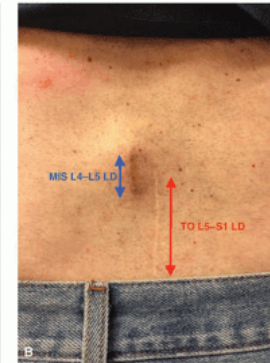
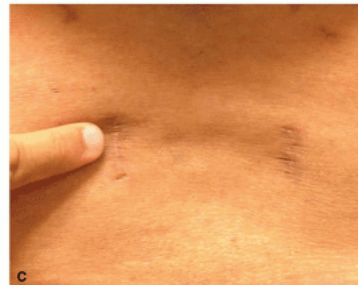
- **Disadvantages:**

- Disruption of muscular attachments and some support ligaments
- Muscle atrophy
- Higher blood loss
- Likelihood of longer hospital stay, need for surgical drains



"Minimally Invasive" Spine Surgery

- Paramedian incisions
- Dilators used to go thru muscle, leaving it attached to bone
- Tube retractors used for visualization of bone/neural elements
- Muscle fibers come back together when tube is removed



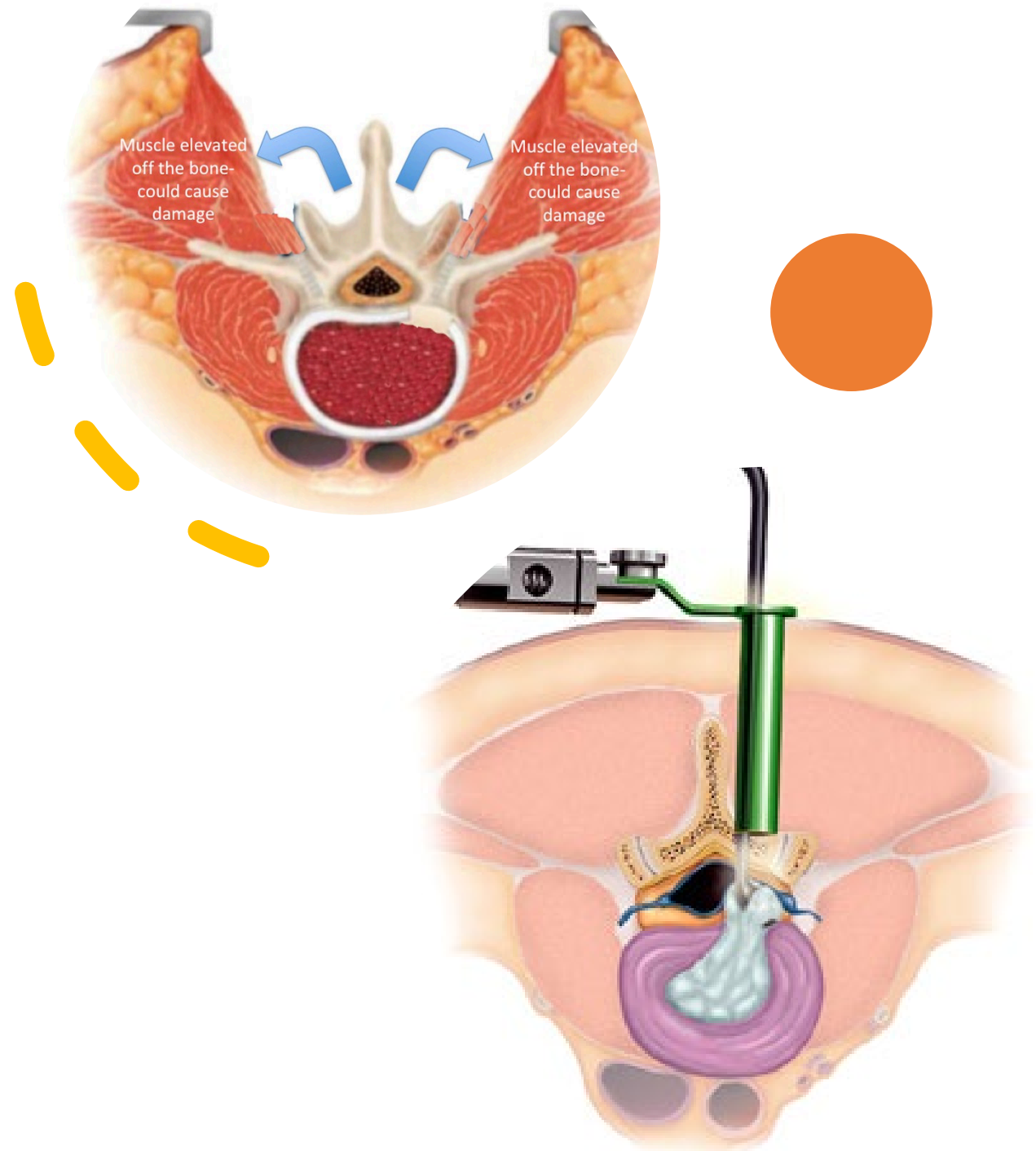
"Minimally Invasive" Spine Surgery

- **Advantages:**

- Smaller incisions
- No muscle stripping, less atrophy, potential for less postop pain
- Less dead space created
- Lower blood loss
- Potentially shorter stays/same day d/c

- **Disadvantages:**

- Learning curve
- Requires more use of xray, or navigation equipment
- Limited visualization- need to be precisely on target
- Limited ability to deal with "big" problems i.e scoliosis, trauma, cancer, infection



History of MIS

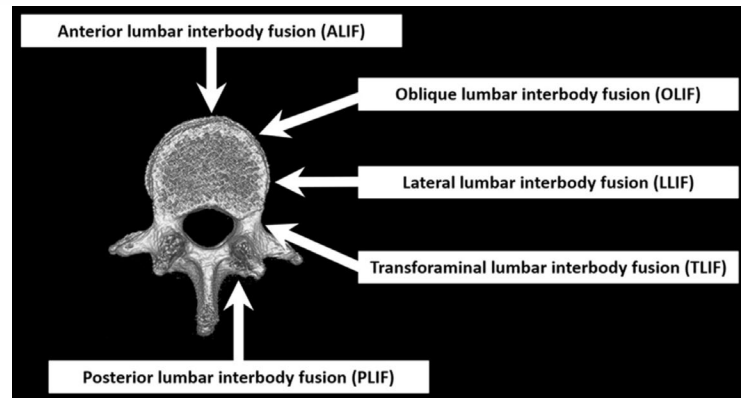
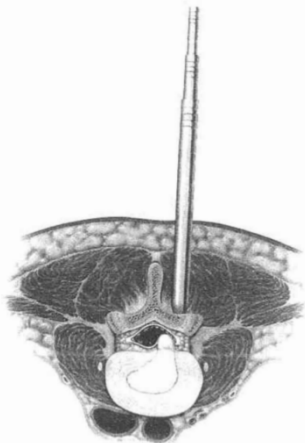
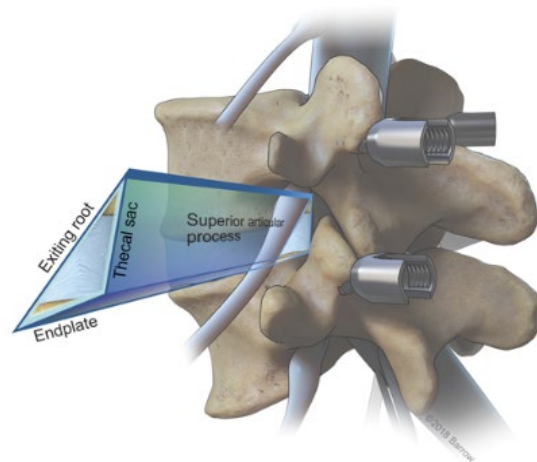
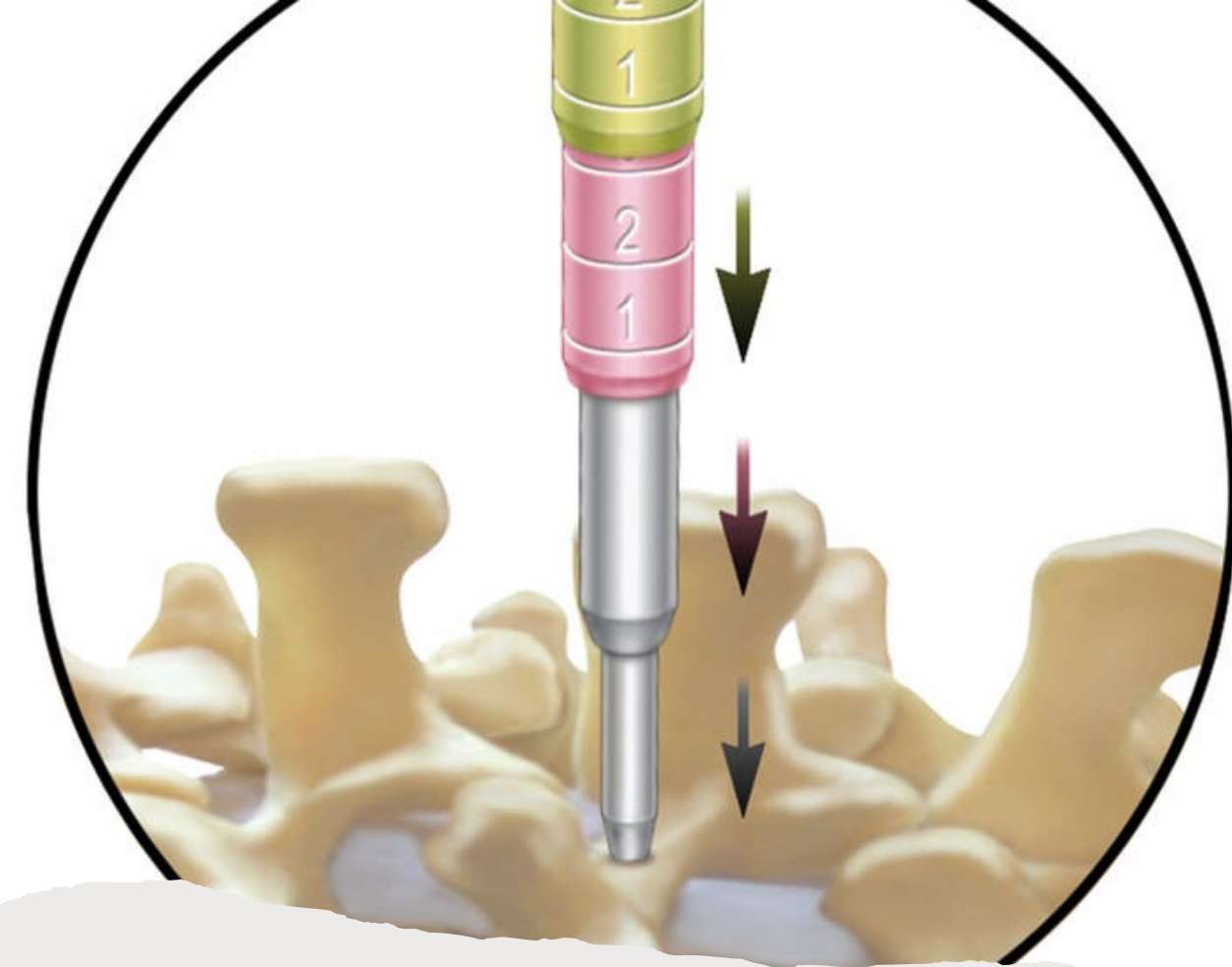
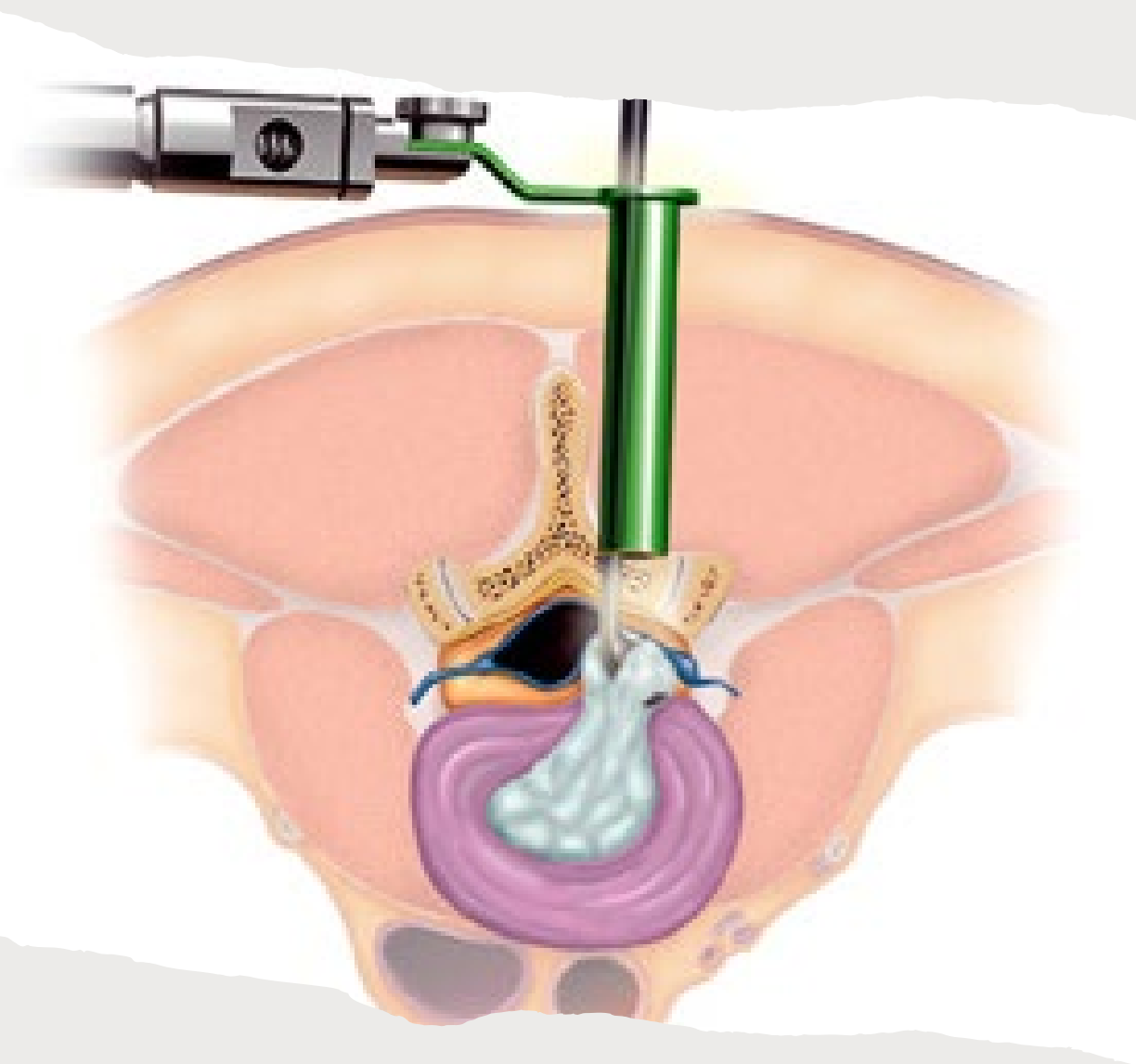


FIG. 3. Axial view illustrating sequential soft tissue dilation.



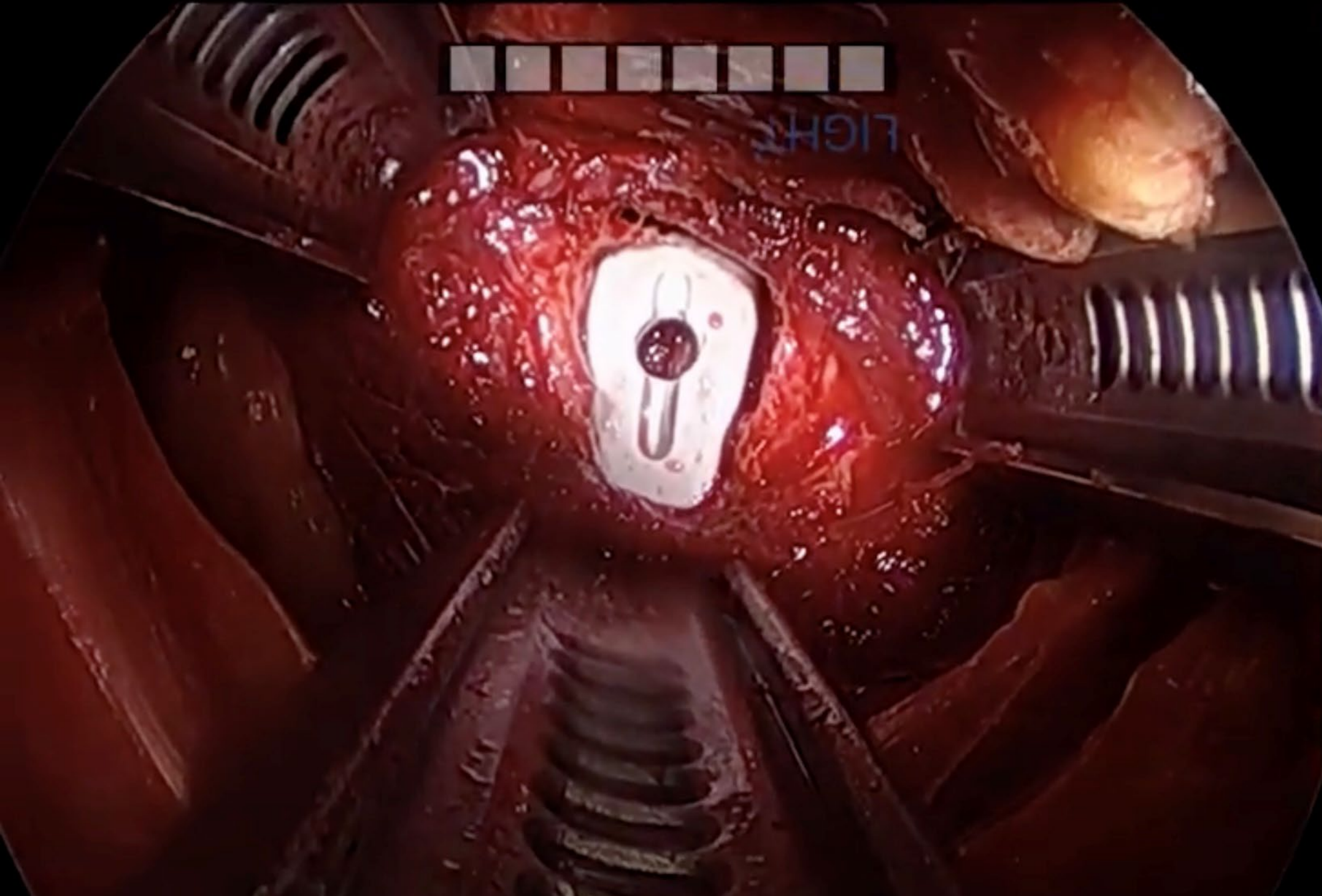
- Kambin described a keyhole "triangle" to access disc 1973
- Foley et al patented tubular retractor in 1997.
- Percutaneous screws patented 2001.
- Lateral transpsoas approach 2001
- MIS spine fusion first described 2003.



How does it work?

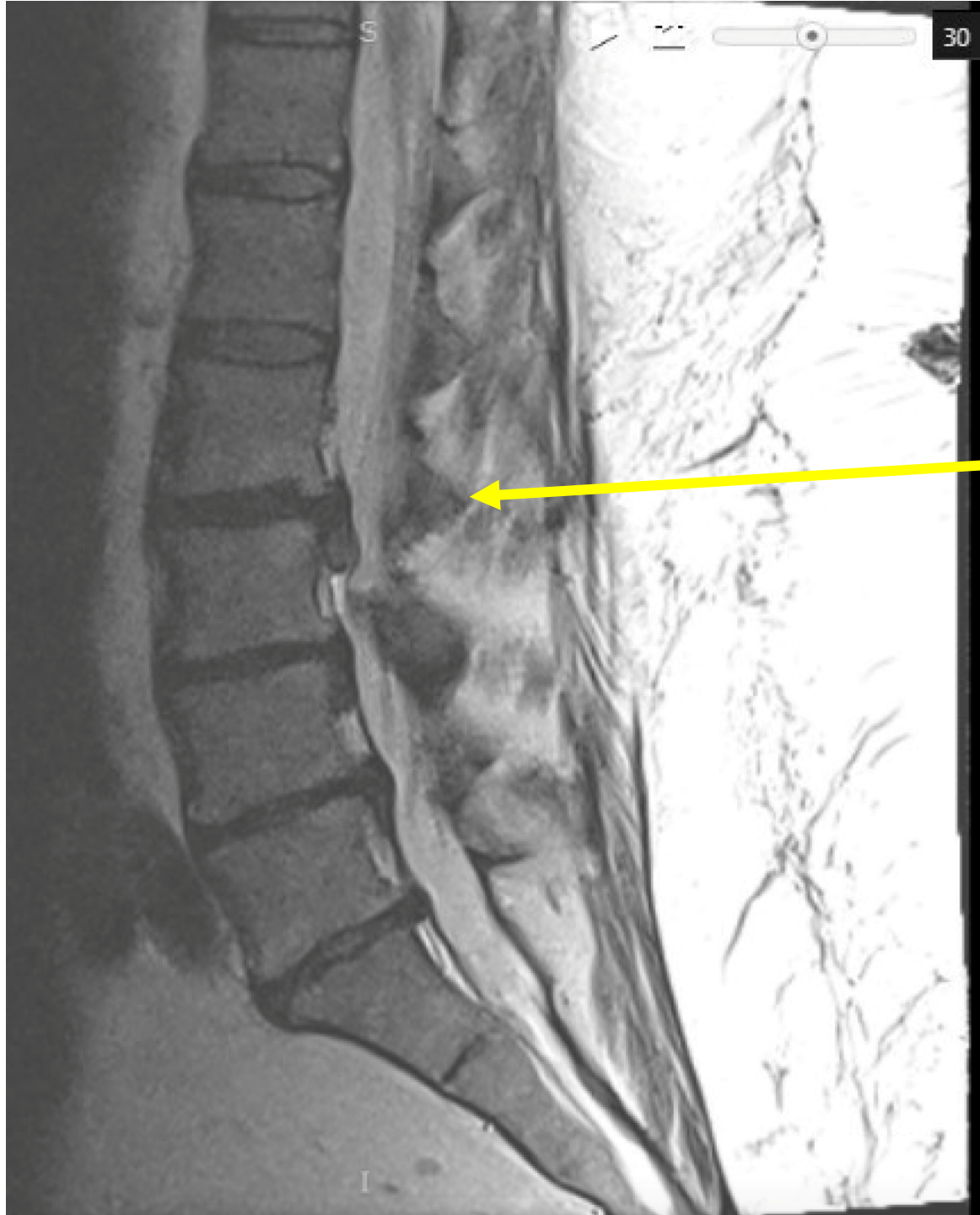
Serial dilation with enlarging metal tubes splits muscles rather than strips them off bone

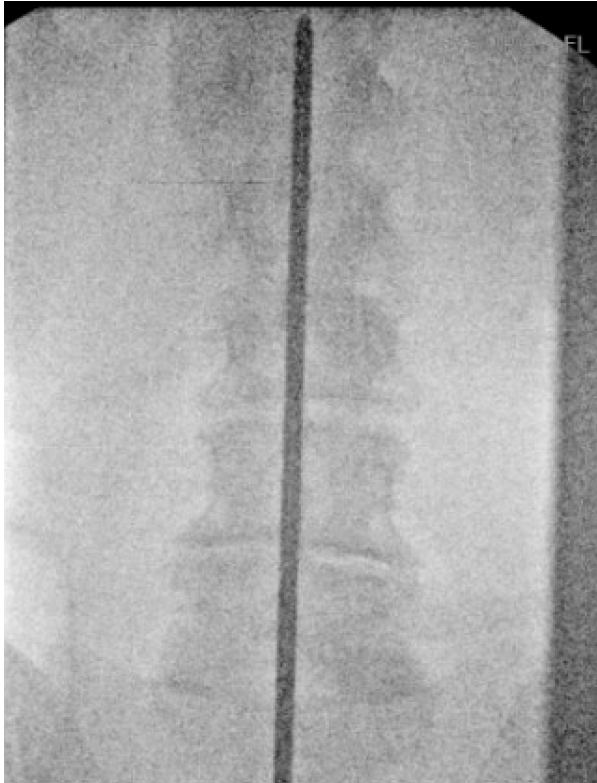




Case Example- Case #1

- 52 yo obese female presents with one month of numbness and weakness in LLE, inability to lift the leg, leaving her wheelchair bound and unable to perform ADLs
- PMH: DM2 with A1C 10.4
- Exam:
 - BMI 51.6, weight 310 pounds
 - LLE inability to flex hip against gravity
 - Cannot bear her own weight
 - Numbness throughout LLE thigh

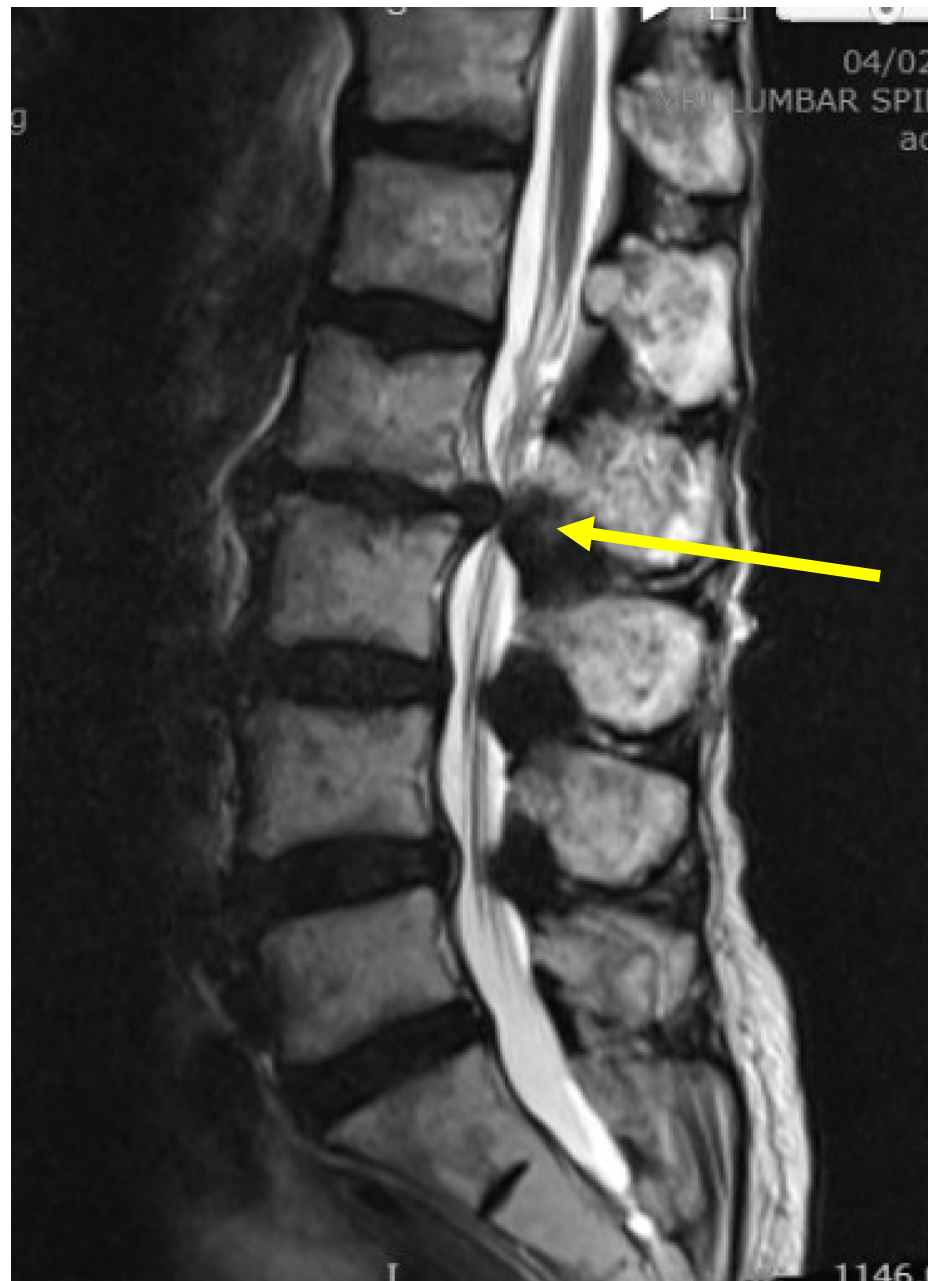
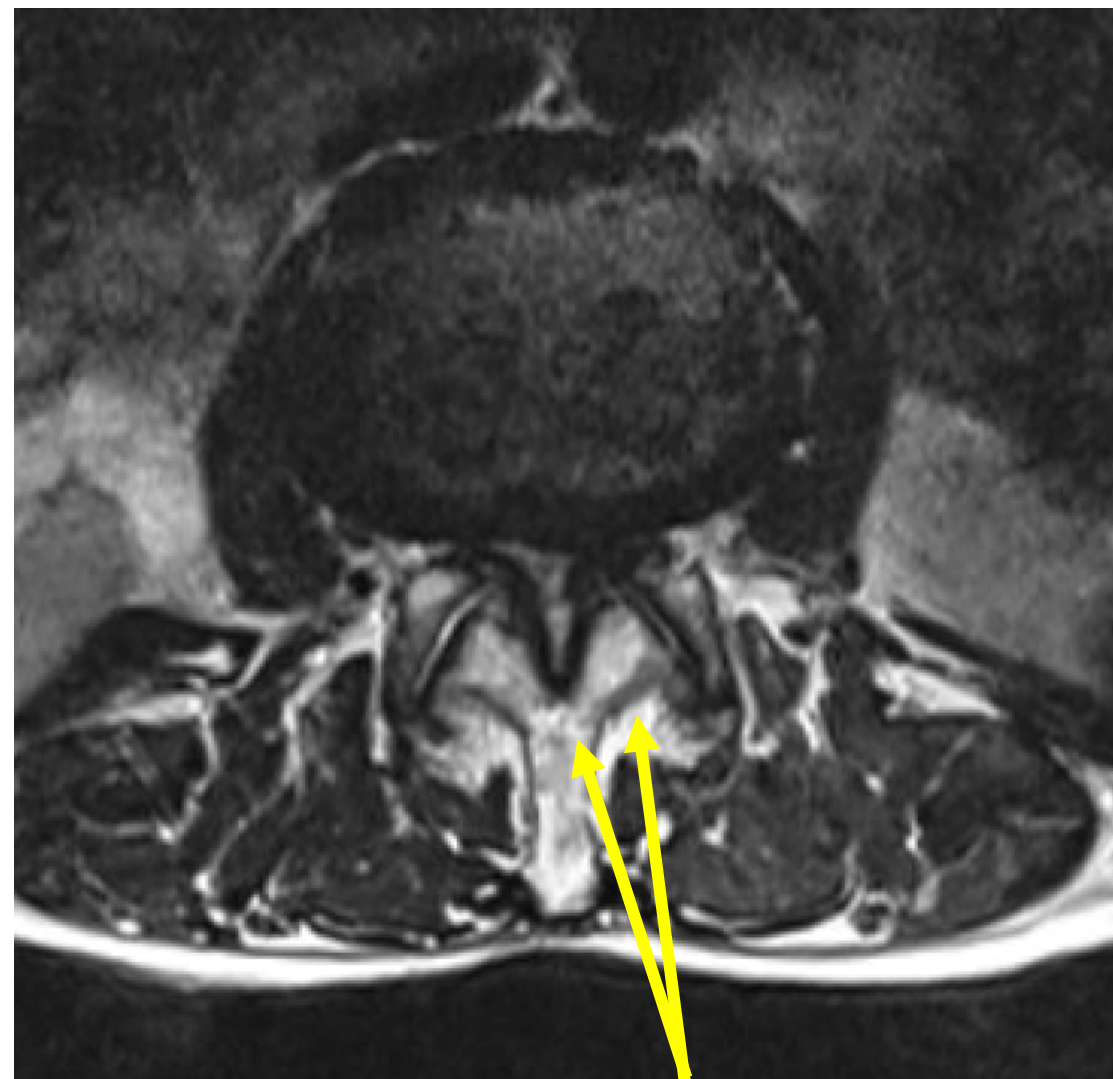


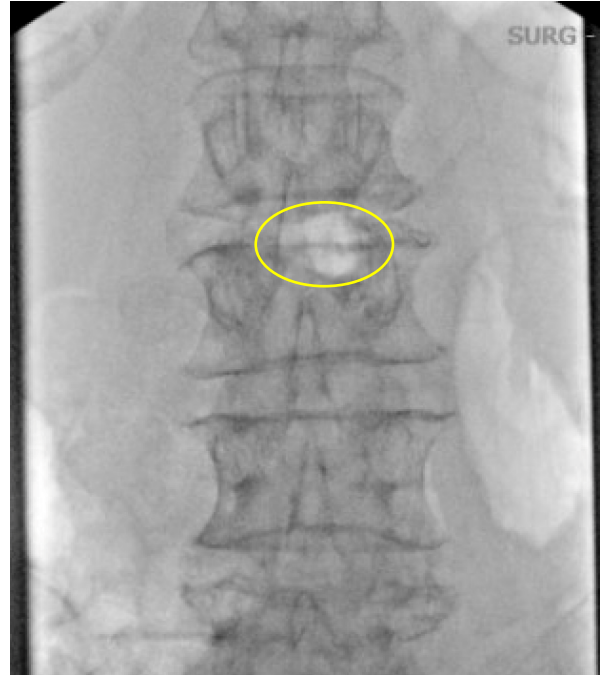


Two weeks post op, able to walk independently, strength in left hip flexion improved but not normal

Case Example- Case #2

- 86 yo active female presents with several months shooting pains down both legs, left much worse than right. Endorses numbness and weakness in left thigh, sensation of leg "giving out"
- Pain occurs whenever she stands, thus limiting her ability to walk, garden, or teach. Relieves when sitting down.
- PMH: osteoarthritis, HLD, back issues
- Exam: Full motor strength, subjective tingling anterior left thigh



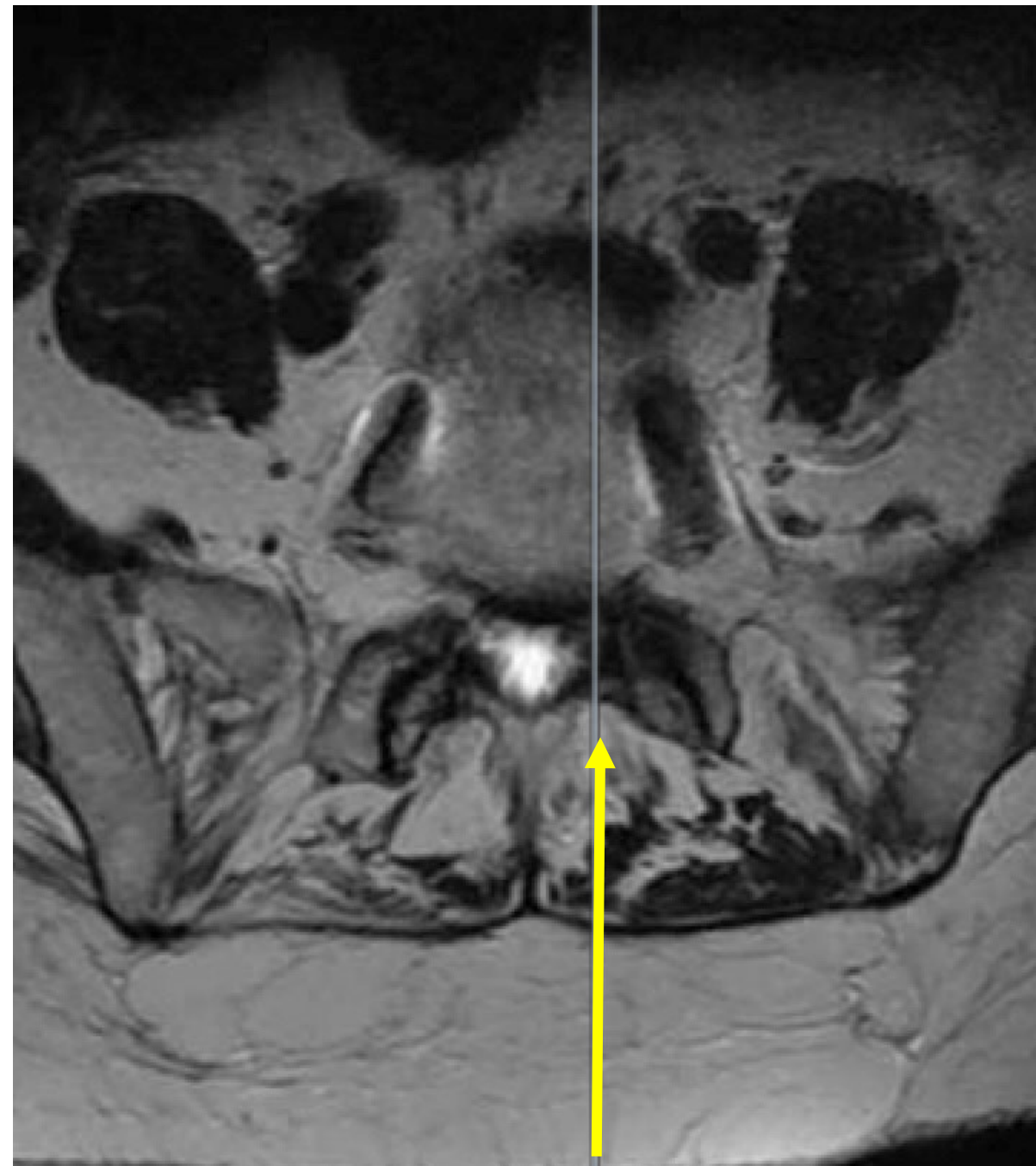


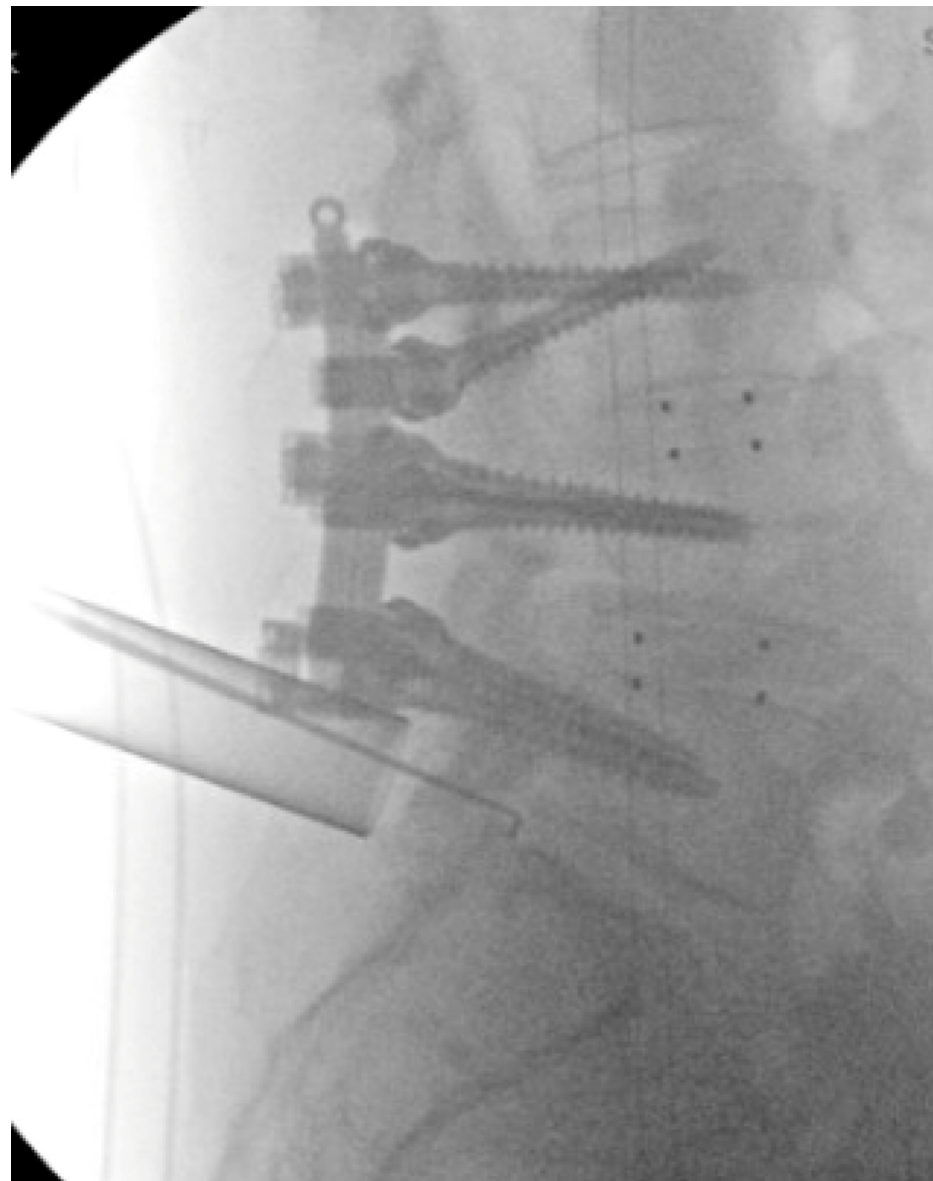
Two weeks post op, all left leg pain resolved, some right leg pain remains. Never took narcotics.

Case Example- Case #3

- 63 yo female presents with 8 months shooting pain down back of LLE after a fall at work. Has chronic back pain, but LLE pain is the biggest issue.
- Pain is constant, especially bothers her while sitting at desk at work.
- PMH: former smoker, fibromyalgia, HTN, COPD
- Exam: Full motor strength, absent left Achilles reflex.



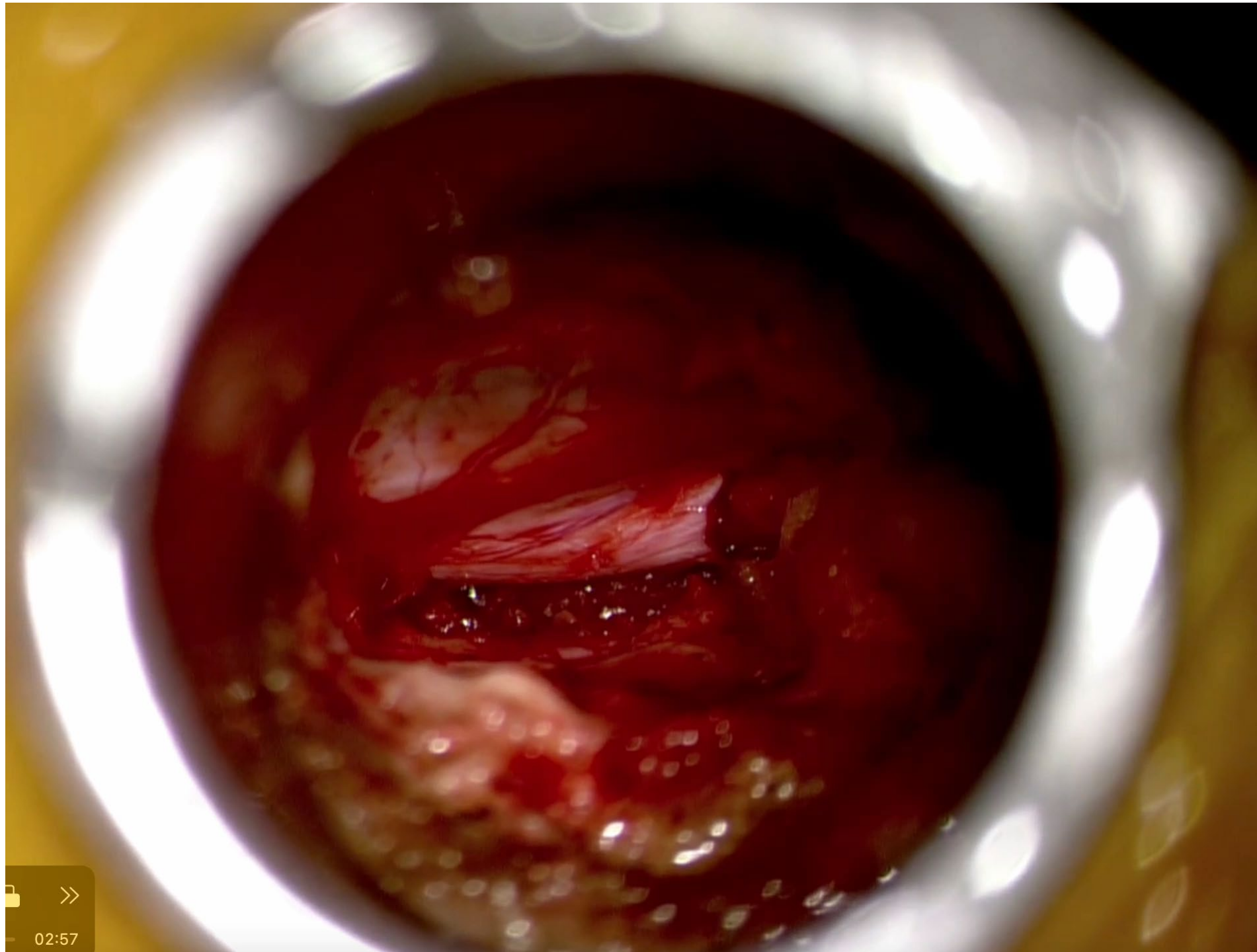




Patient now 5 months post op, with total resolution of LLE pain. Chronic back pain is stable.



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Future of MIS

- Future is the past? Kambin's triangle from the 1970's has gained recent popularity
- Cameras have improved and technique has been refined

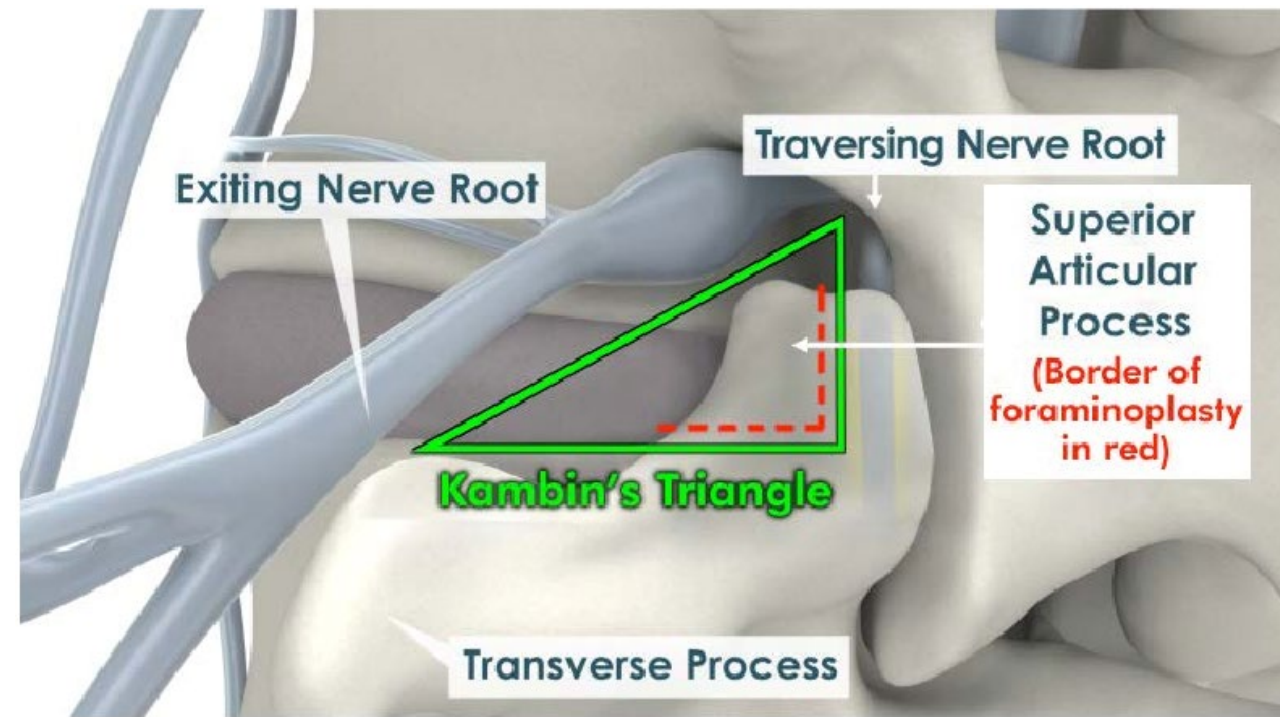
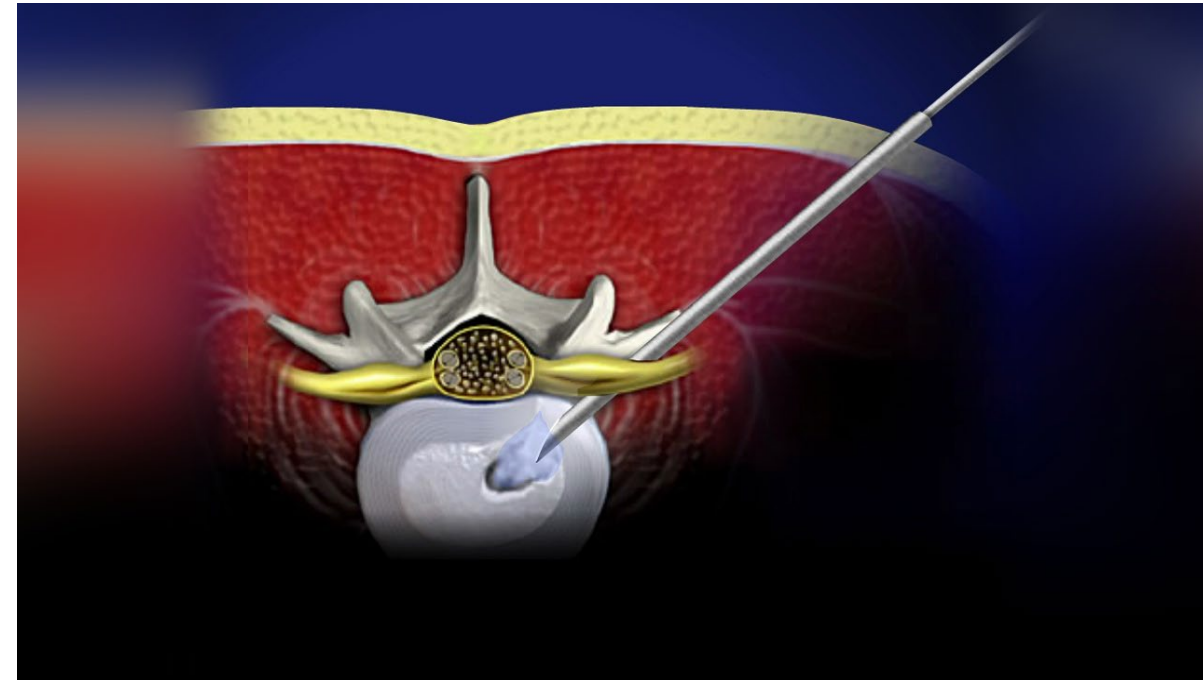
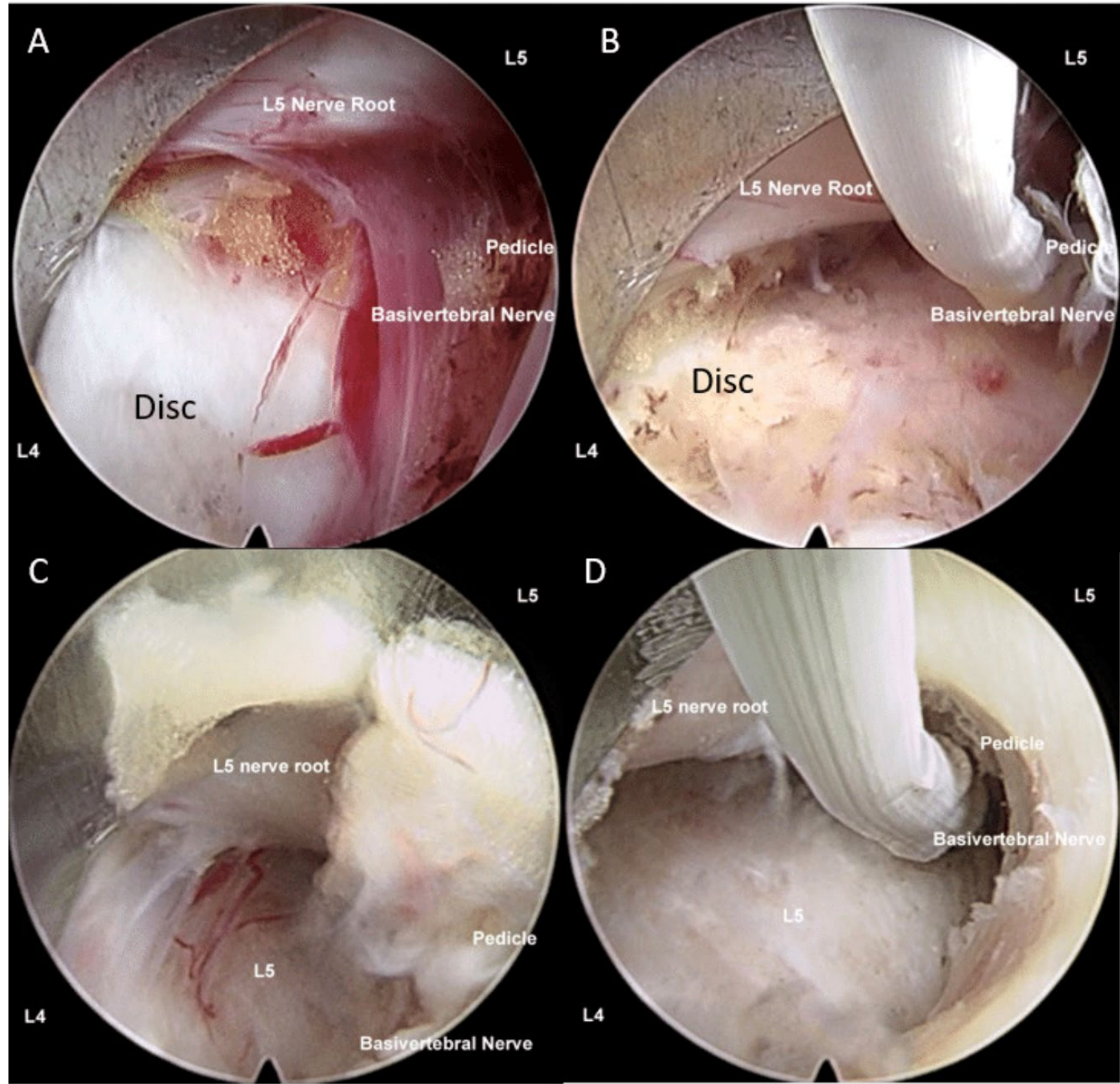


Figure 5 Schematic diagram showing Exiting nerve root, transverse process



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Questions?

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