Spinal canal stenosis

from anatomy to ⇨ treatment

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the European Union

Materials

RadiAnt DICOM VIEWER

Questions? Problems!

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Anatomy of the spinal canal - What do we need it for?

Neurology

- examination of cerebrospinal fluid (SCF)

Anesthesiology

- regional anesthesia

Orthopaedic/Neurosurgery

- any intervention at this region

To pass exams

Spinal canal anatomy - boundaries

Anterior

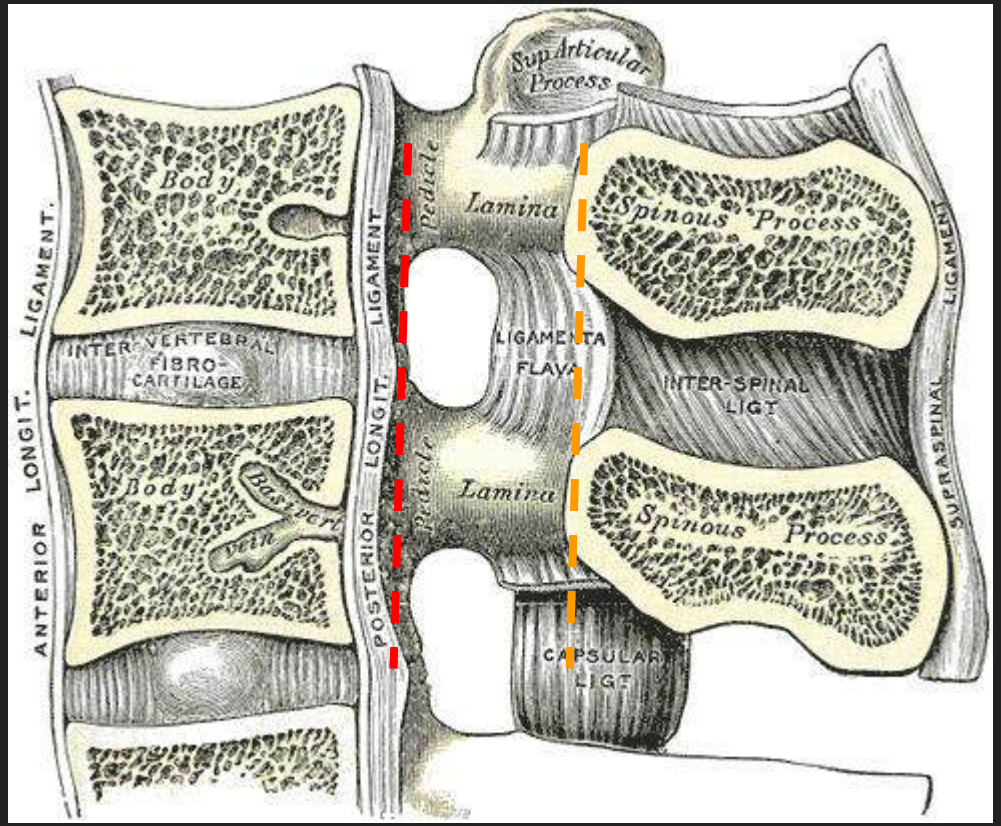
- **vertebral bodies and disc covered with posterior longitudinal ligament**

Posterior

- **lamina**
- **yellow ligament**

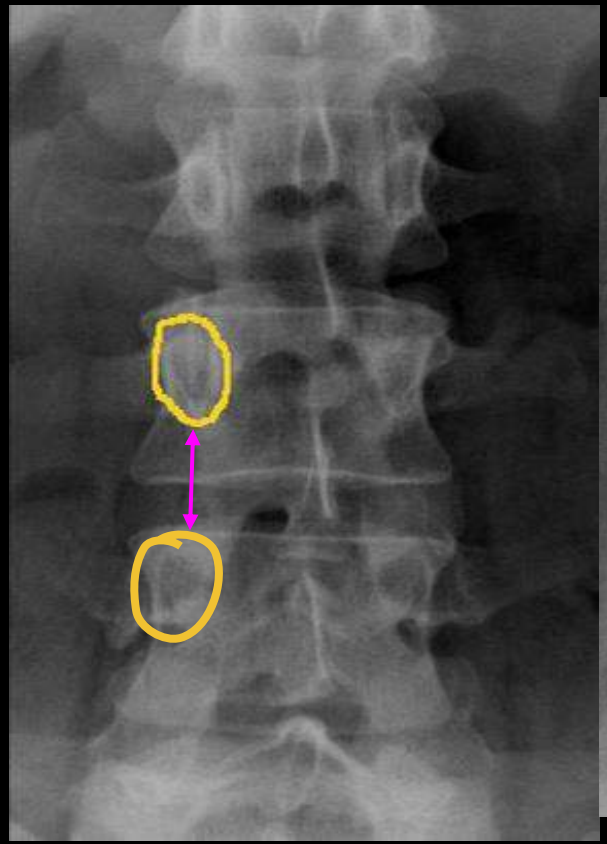
Lateral

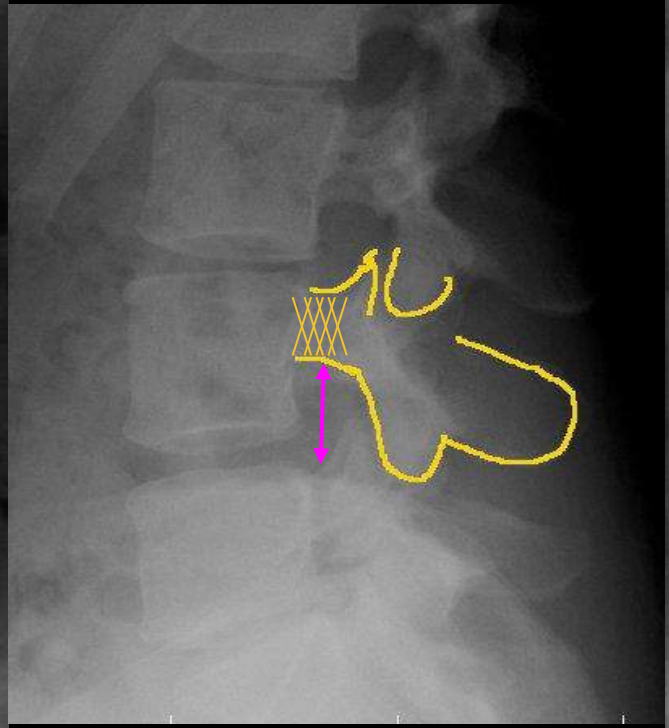
- pedicles with intervertebral foramina (root canals)

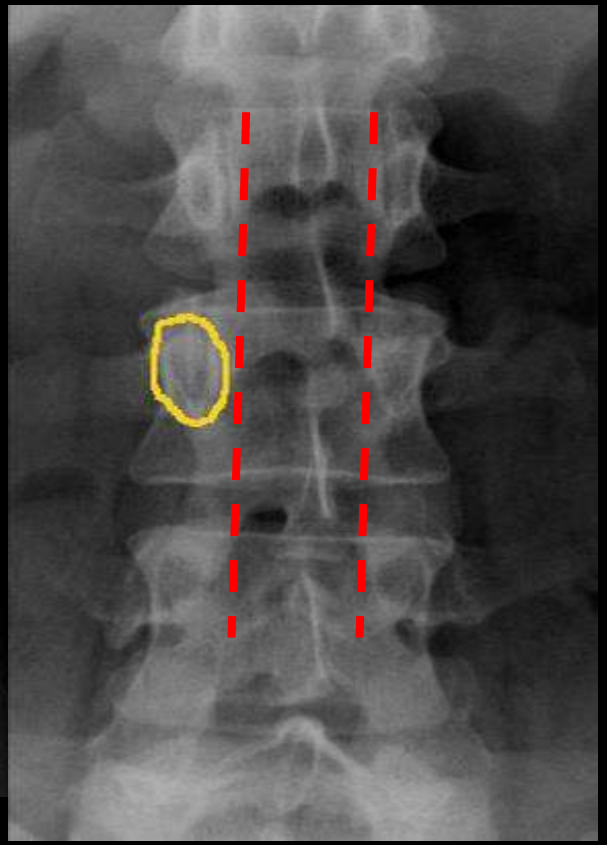


https://www.ncbi.nlm.nih.gov/books/NBK557616/

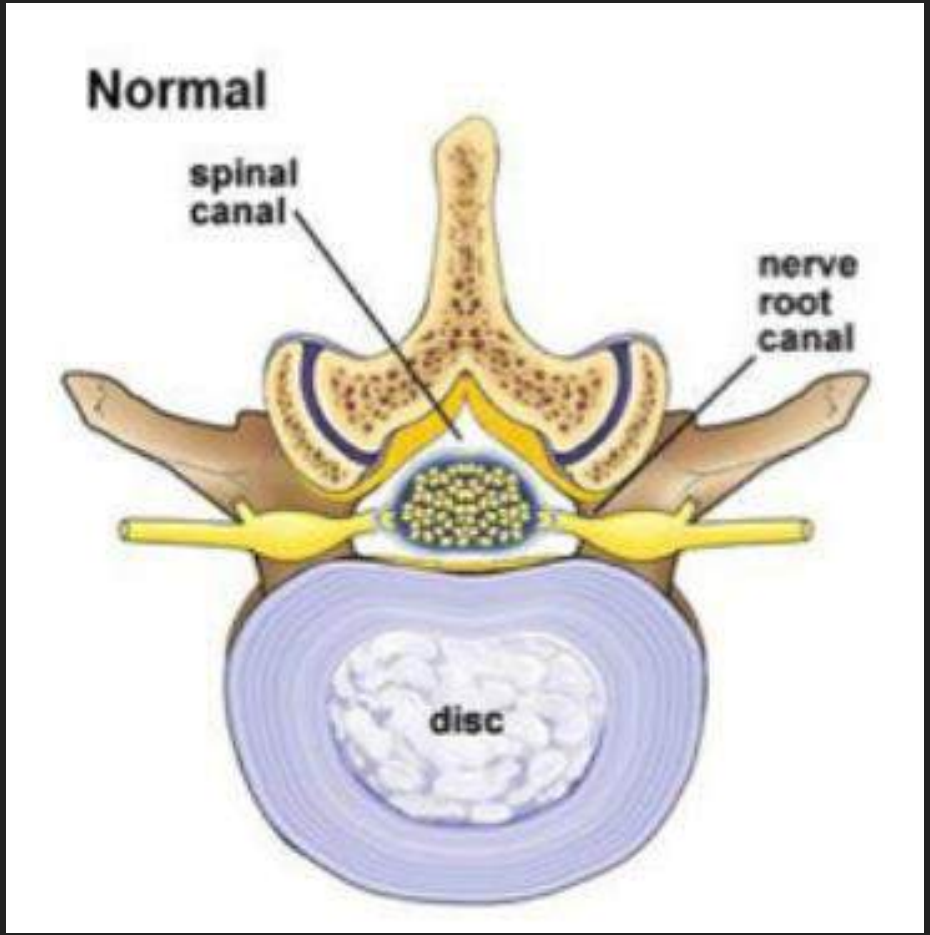
Pedicle & foramen - lateral marigin







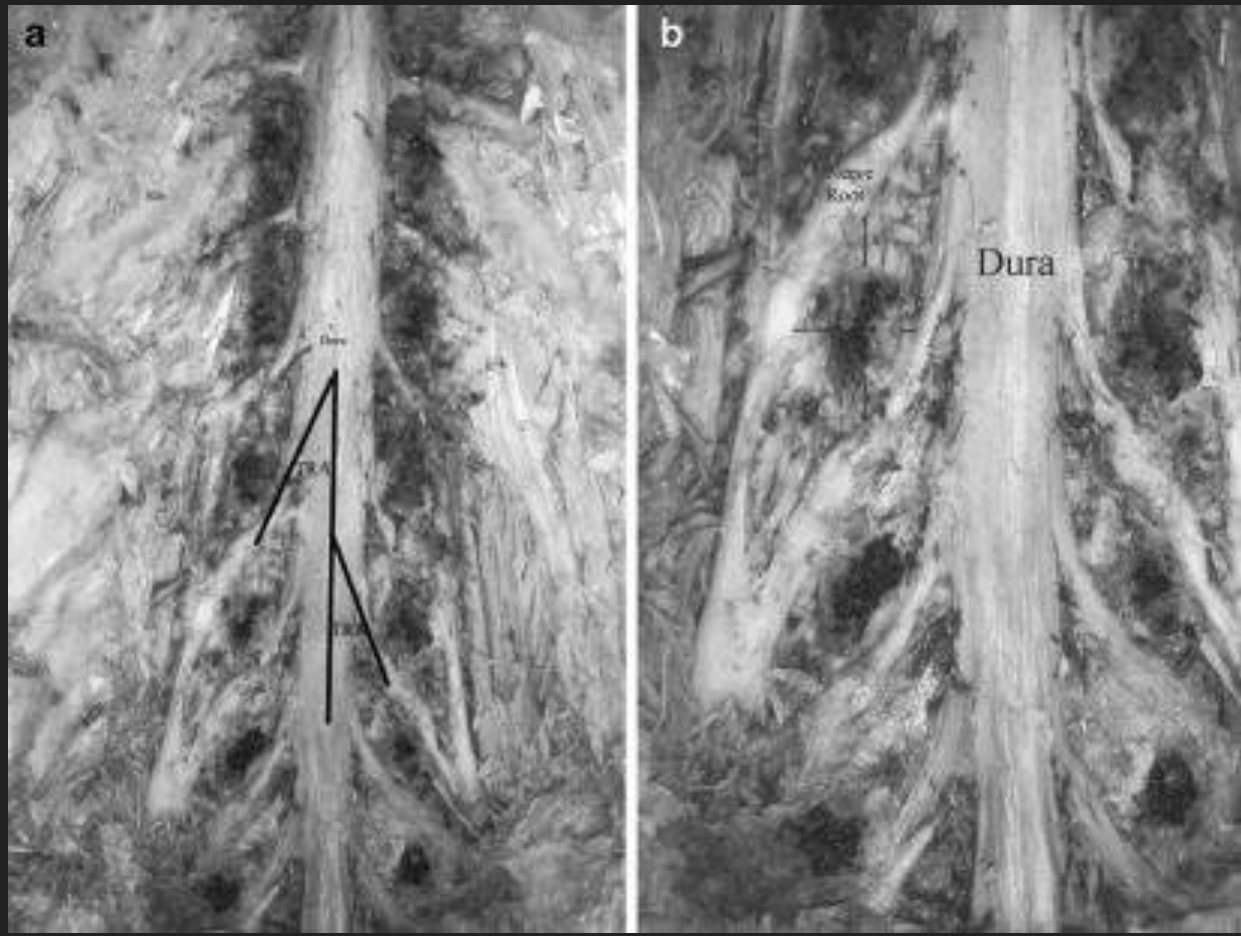
Transverse view



Spinal canal content

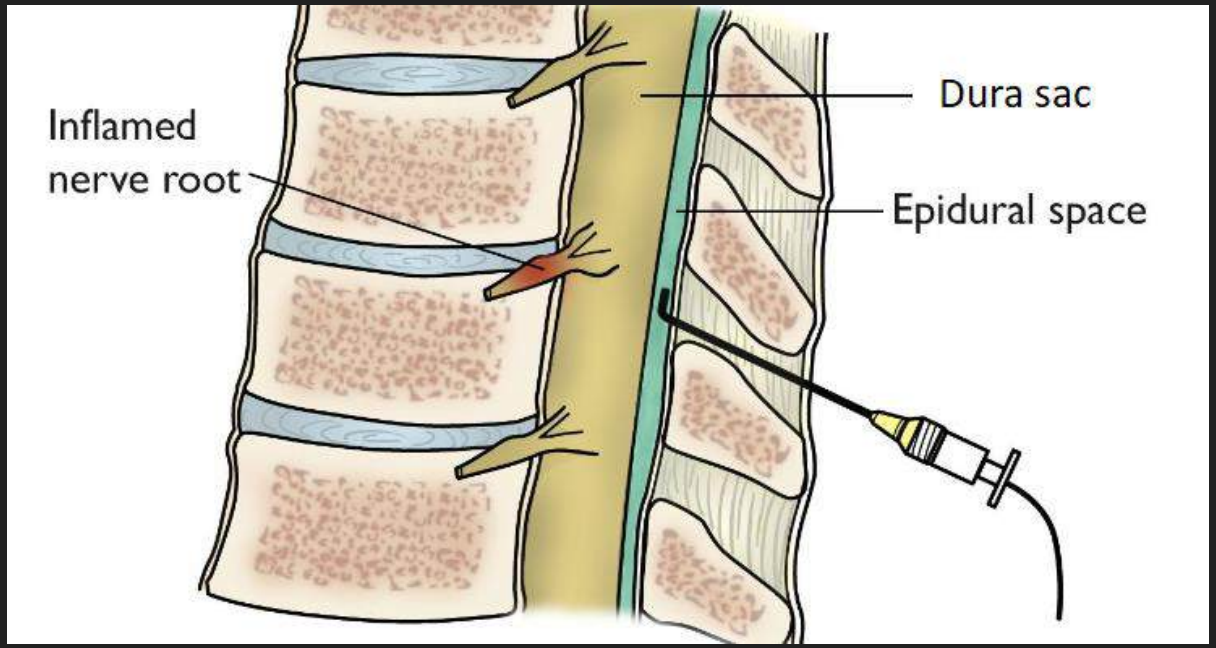
Dura sac with exiting nerve roots

- all neural structures are within the dura sac
- they bath in the cerebrospinal fluid



Interventional procedures

Epidural

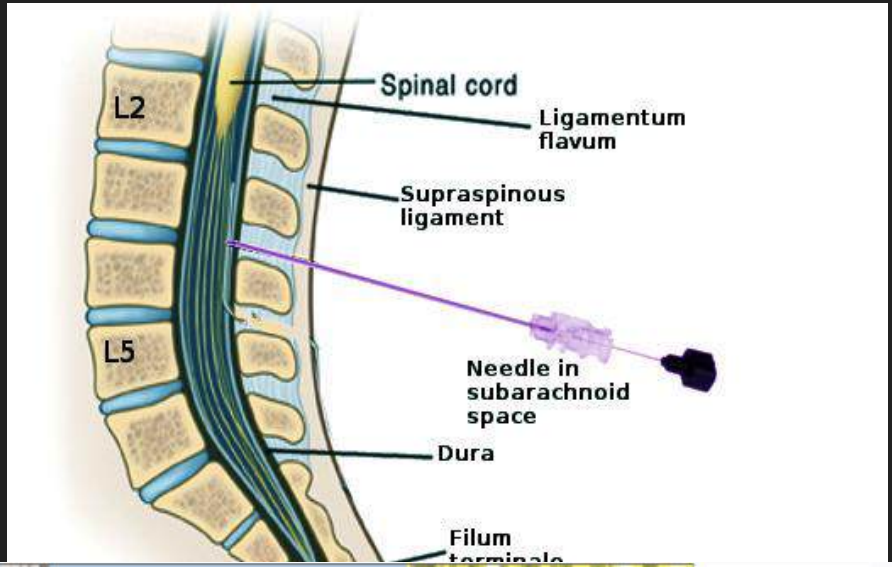


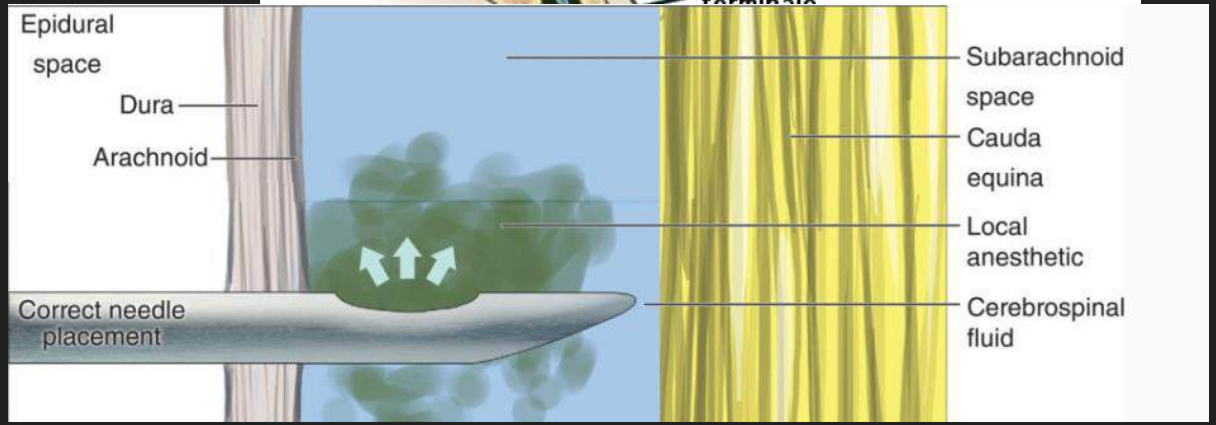
https://orthoinfo.aaos.org/en/treatment/spinal-injections/

Interventional procedures

Subarachnoid

Intradural



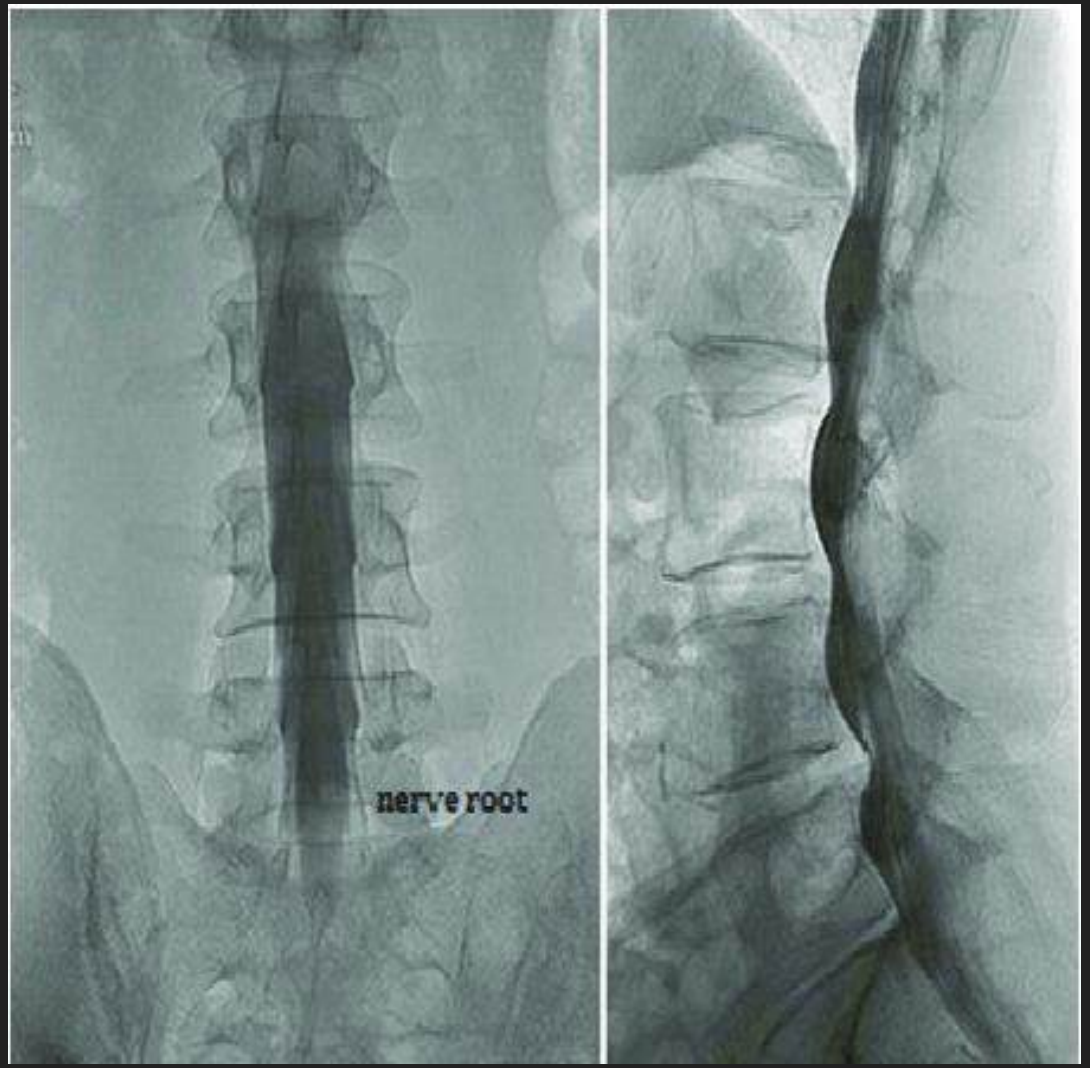


https://www.nysora.com/topics/complications/mechanisms-management-failed-spinal-anesthesia/

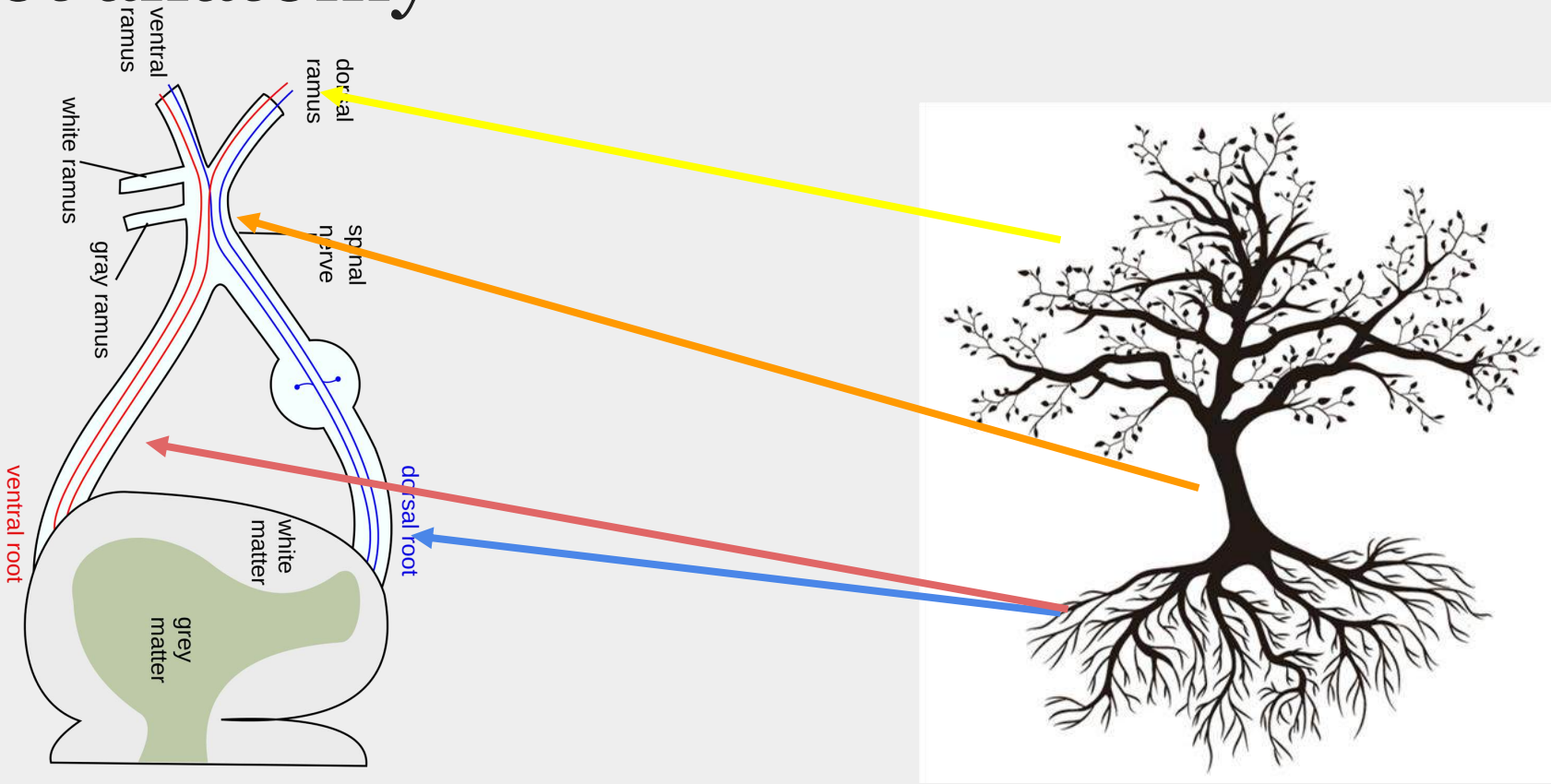
Subarachnoid space

myelography

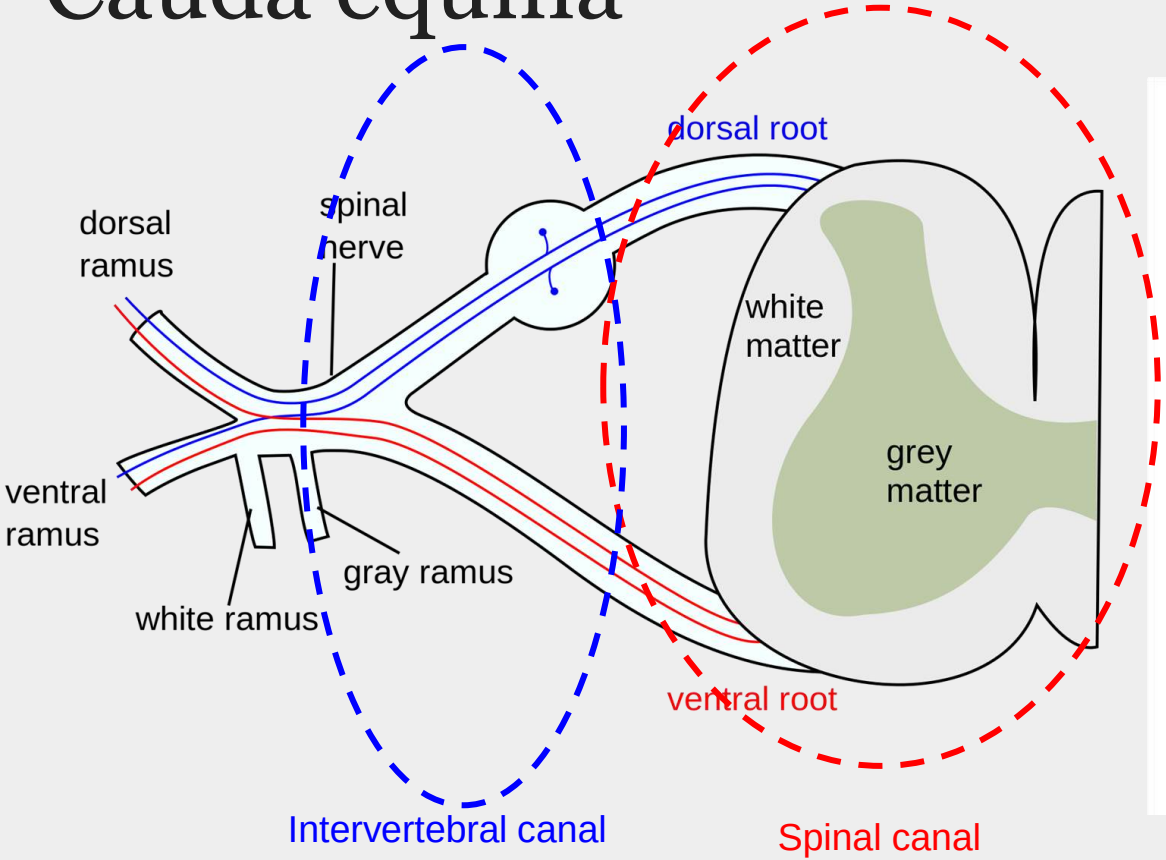
https://www.researchgate.net/publication/327238213_Is_ultrasound_guided_spine_injection_safe



Root anatomy



Cauda equina



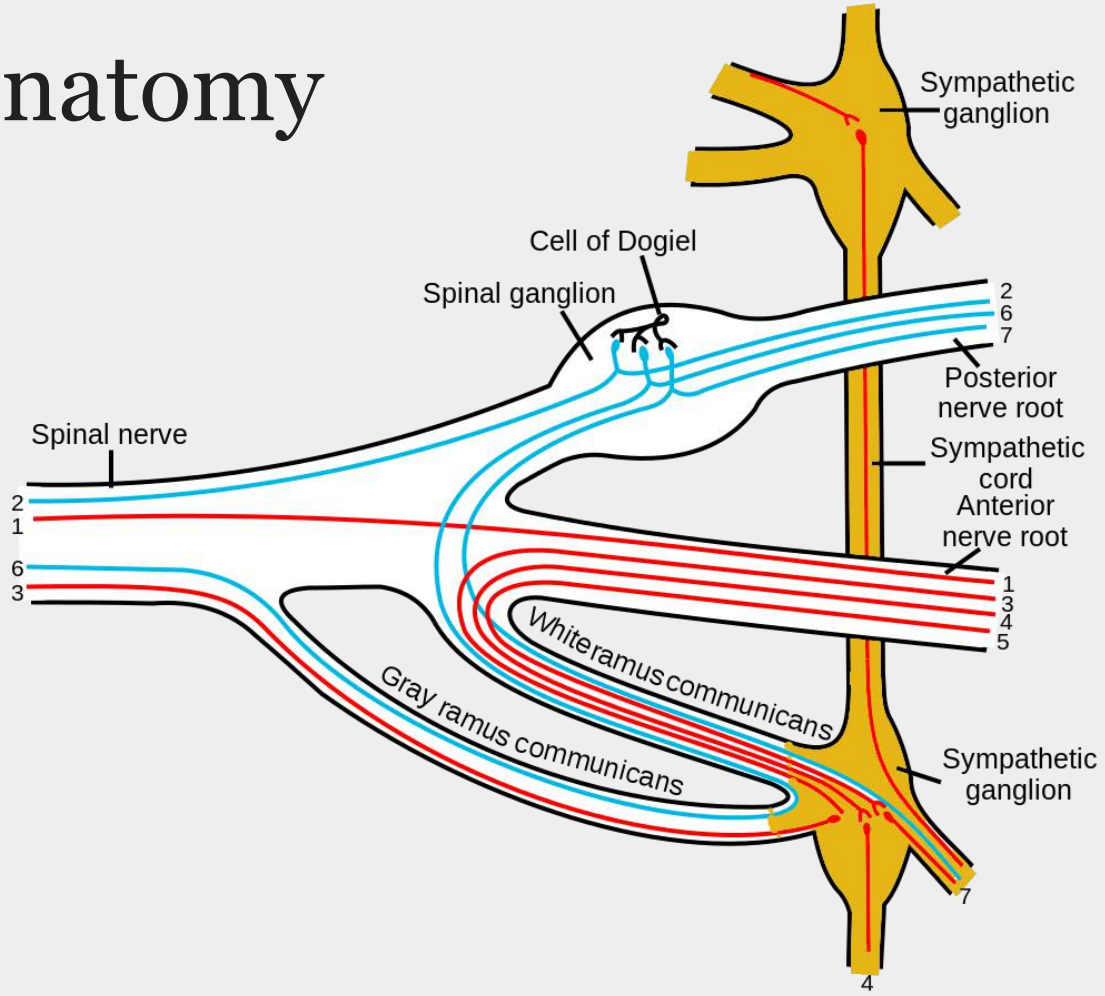
Spinal nerve anatomy

Branches

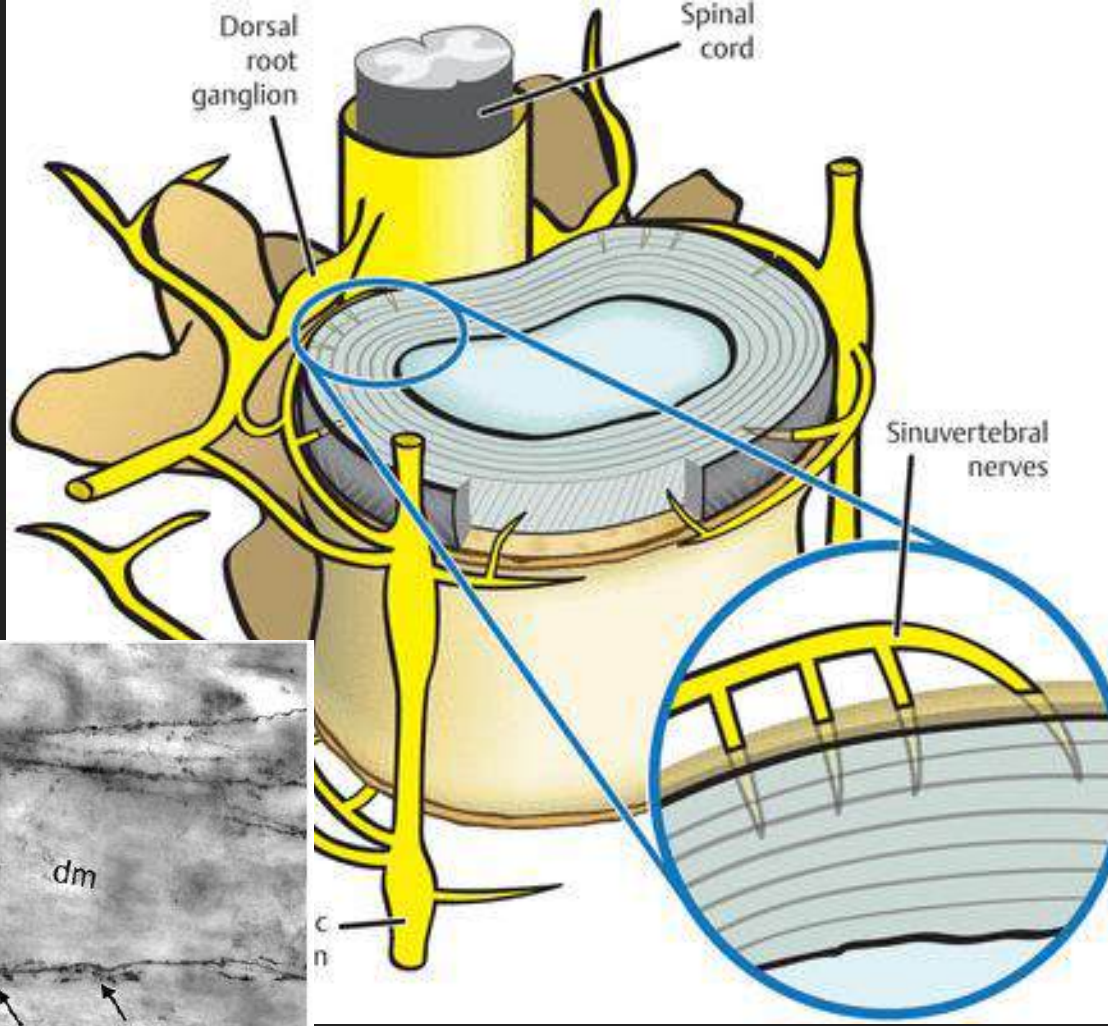
- ventral - anterior
- dorsal - posterior
- gray communicans
- sinoverterbral

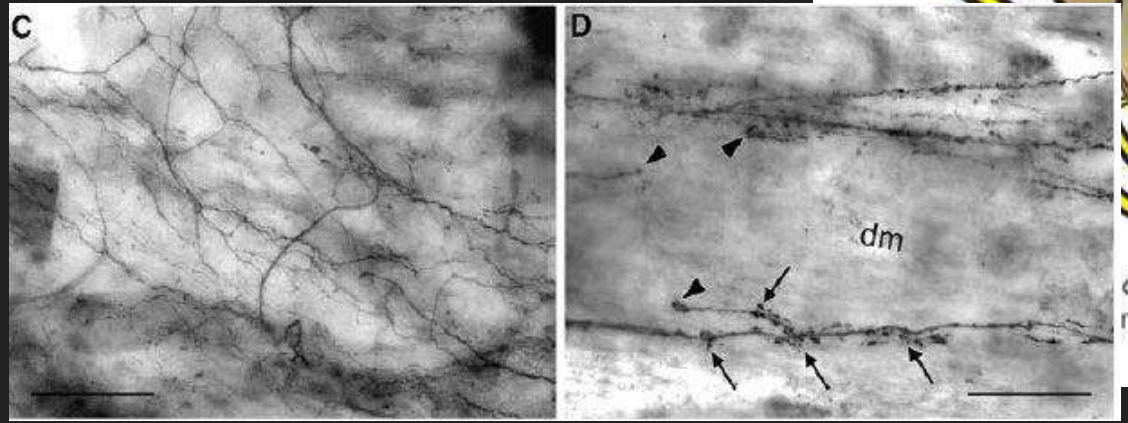
Types of nerves

- sensory
- motor
- autonomic



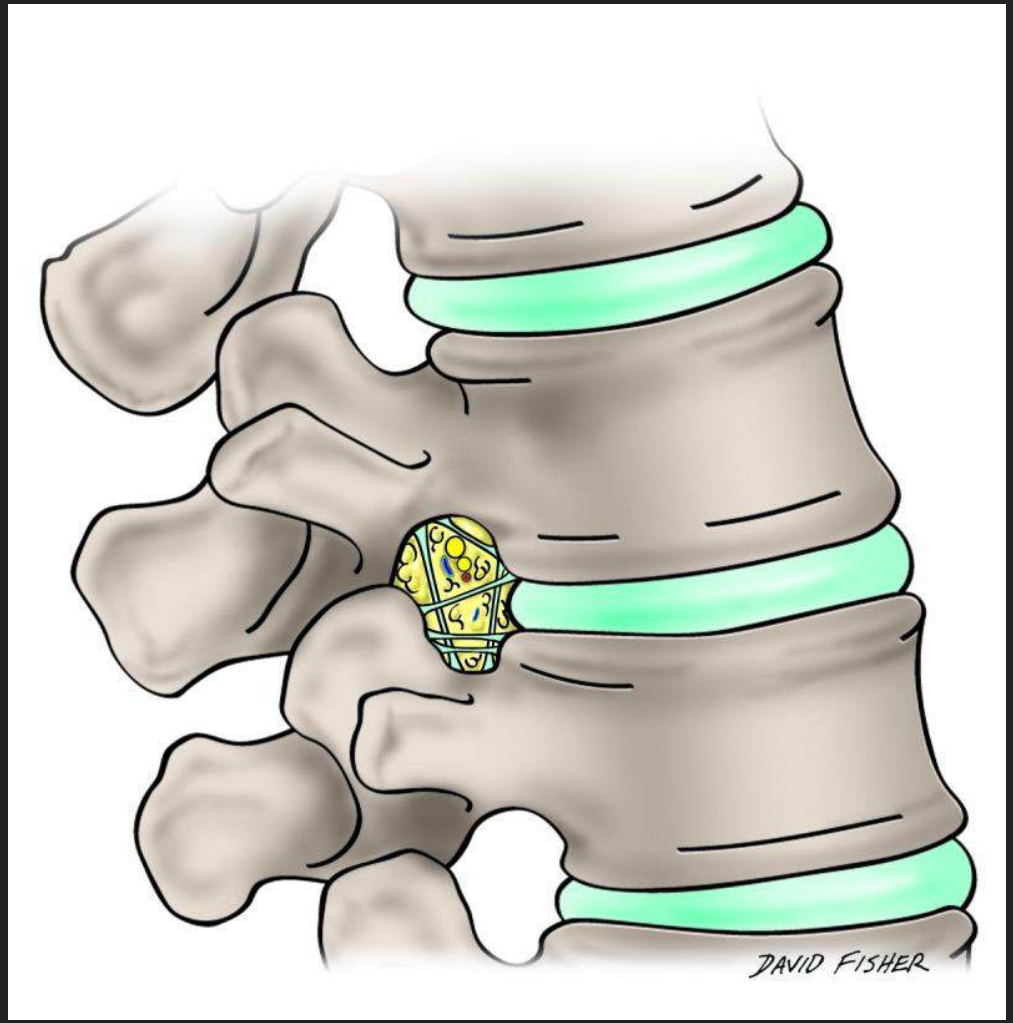
Branches


Dorsal
root
ganglion
Spinal
cord
Sinuvertebral
nerves
c
n

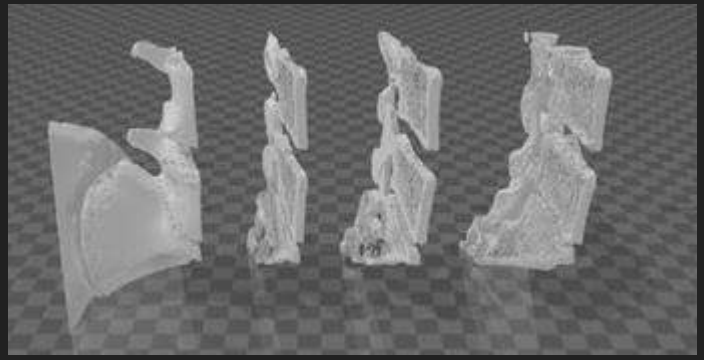

C
D
dm

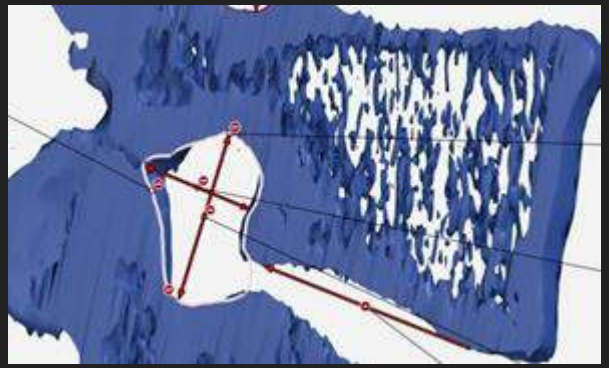
Intervertebral foramina

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6706257/

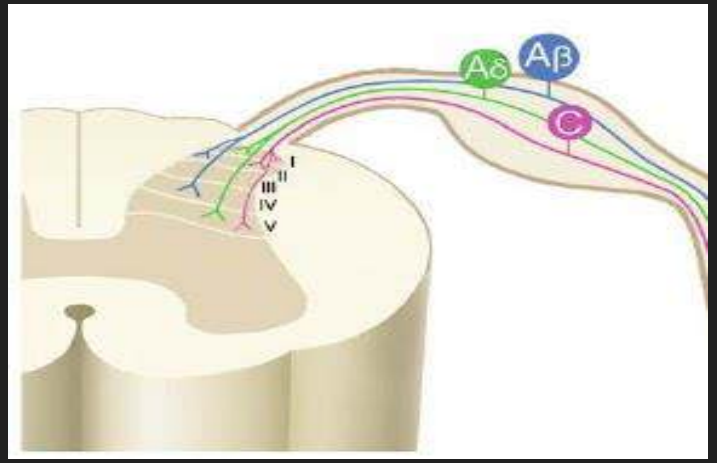


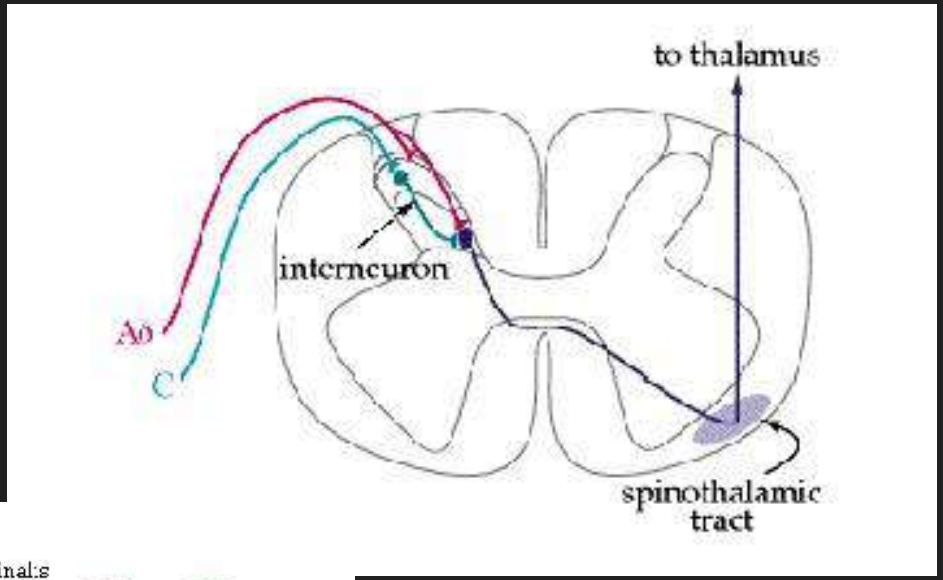
Intervertebral canal

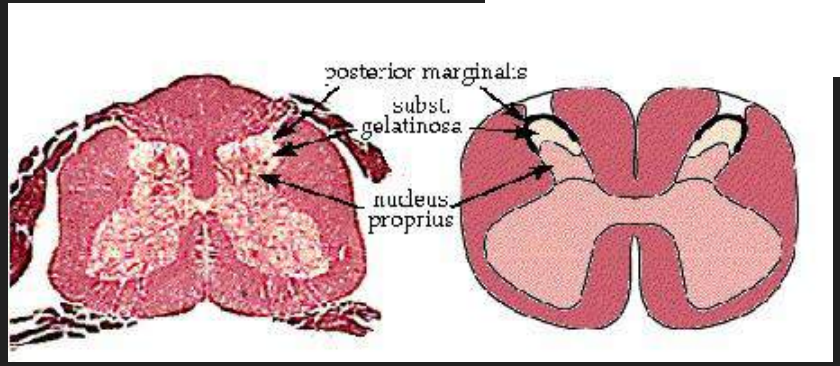




DRG - dorsal root ganglion - intervertebral canal



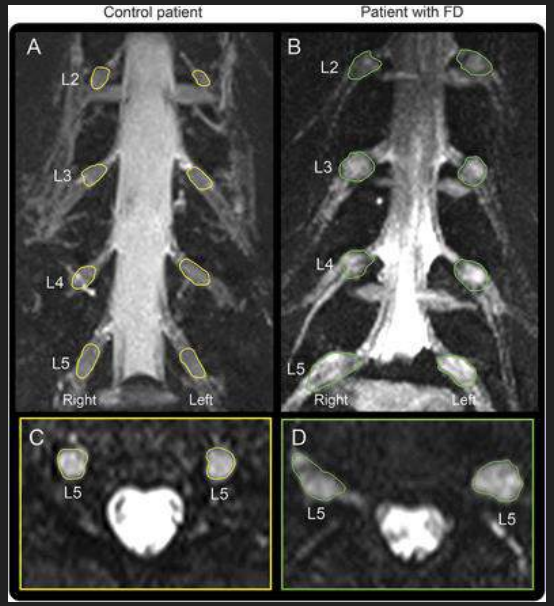




DRG

Concentration of the sensory nerves cells

in the intervertebral/root canals/foramina

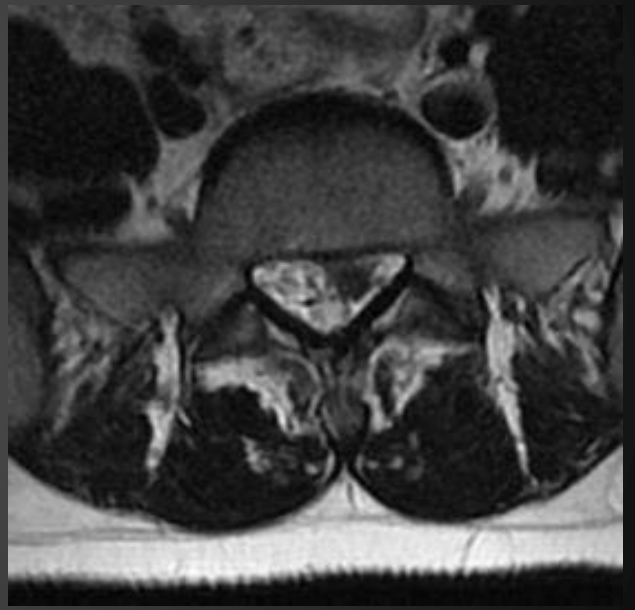


http://www.ajnr.org/content/27/10/2098

https://n.neurology.org/content/89/12/1274.figures-only

Spinal stenosis

Degenerative disc disease



T2 weighted mri

Types of DDD

1. NP dysfunction
    a. dehydration of the disc - "black disc" T2

2. AF dysfunction

    disc protrusion / extrusion

Soft tissue problems

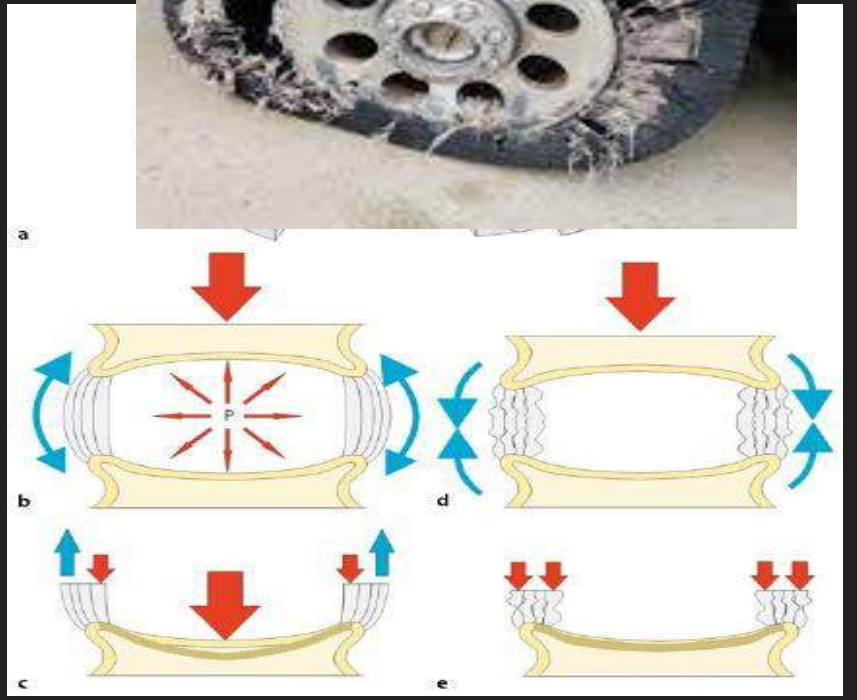
Consequences of DDD

Two types of degeneration process

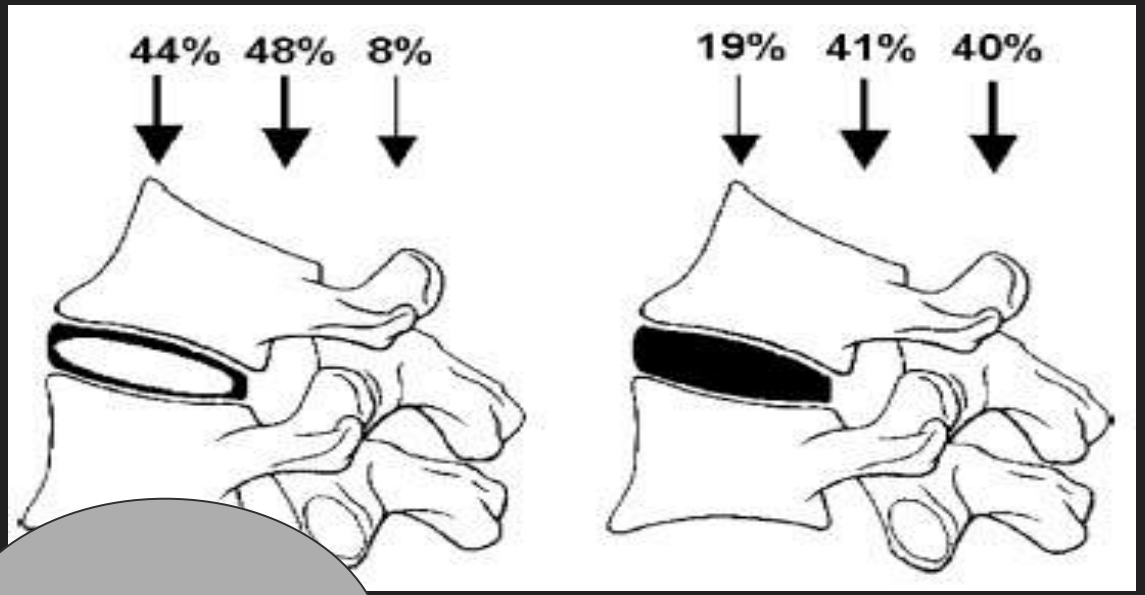
- dehydration of the disc
- disc prolapse

Effect

- decrease of the intervertebral height
- loss shock absorption ability
- local instability



Consequences of DDD



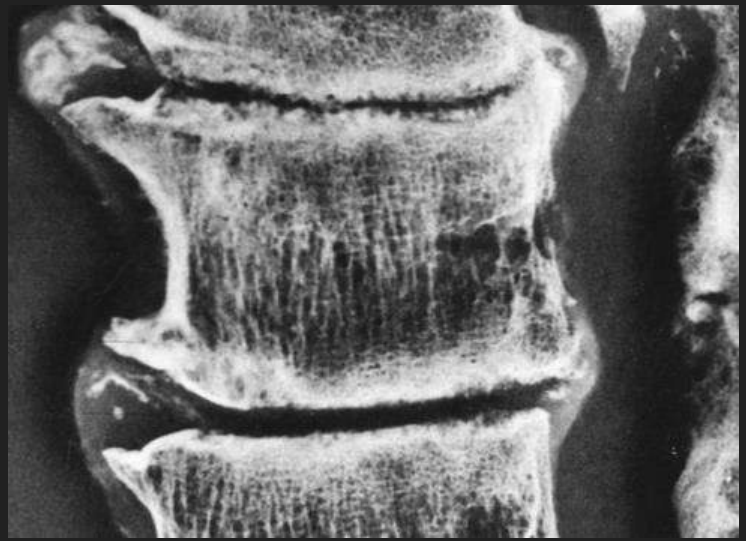
Soft tissue problems

Bone pathology

Bone pathology

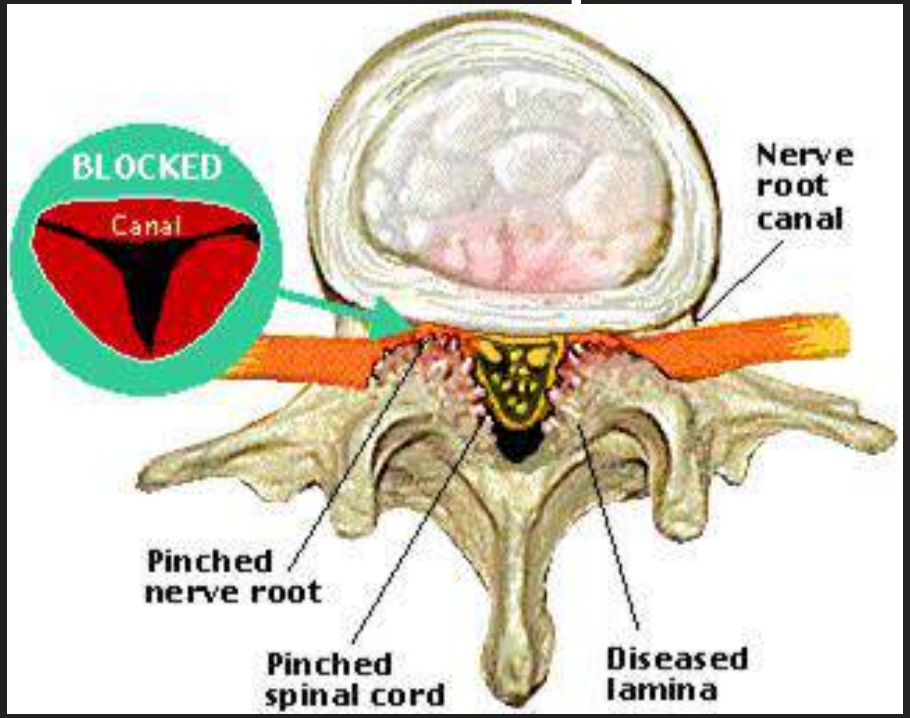
Facet joints degeneration - spondyloarthrosis

Bony spurs formation - spondylosis



Bone pathology

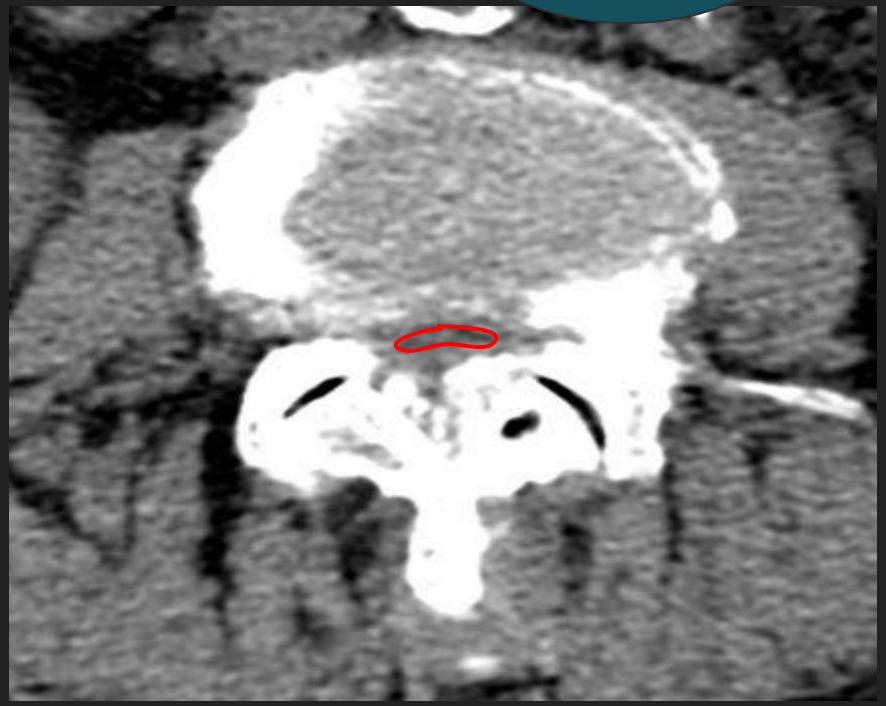
Spinal stenosis



Bone pathology

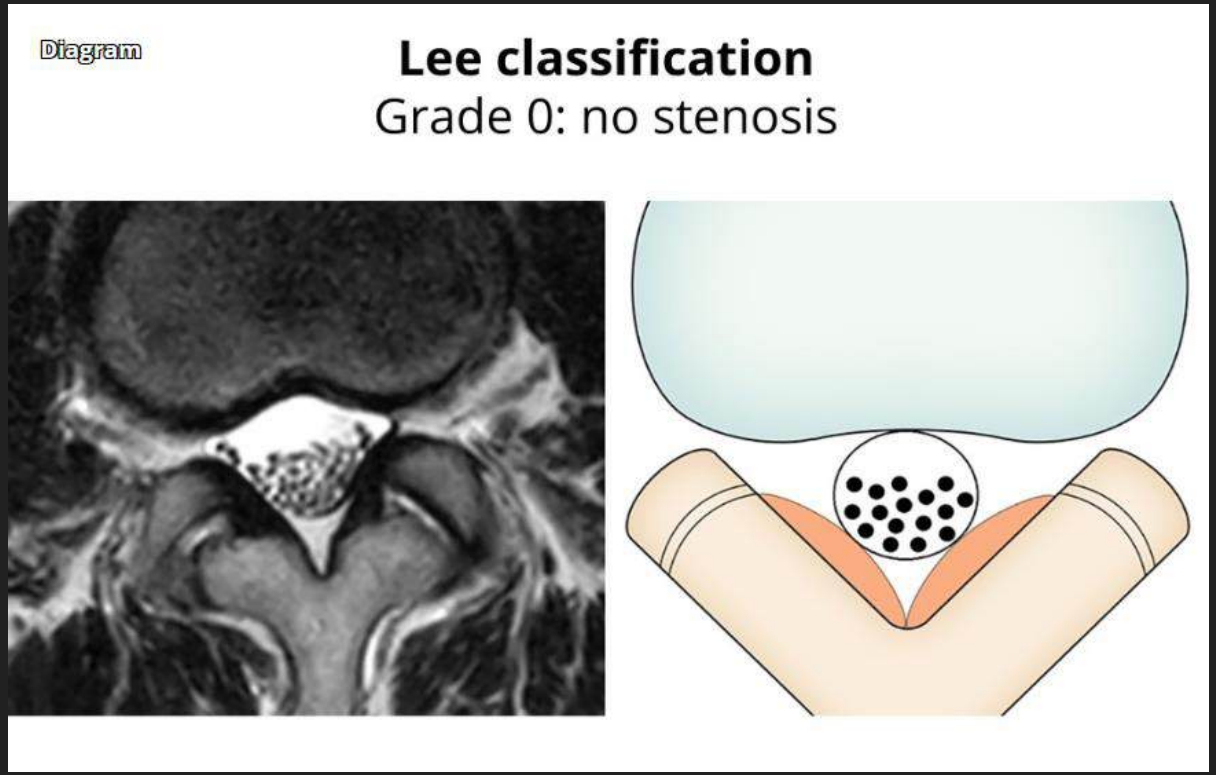
Spinal stenosis

Bone pathology



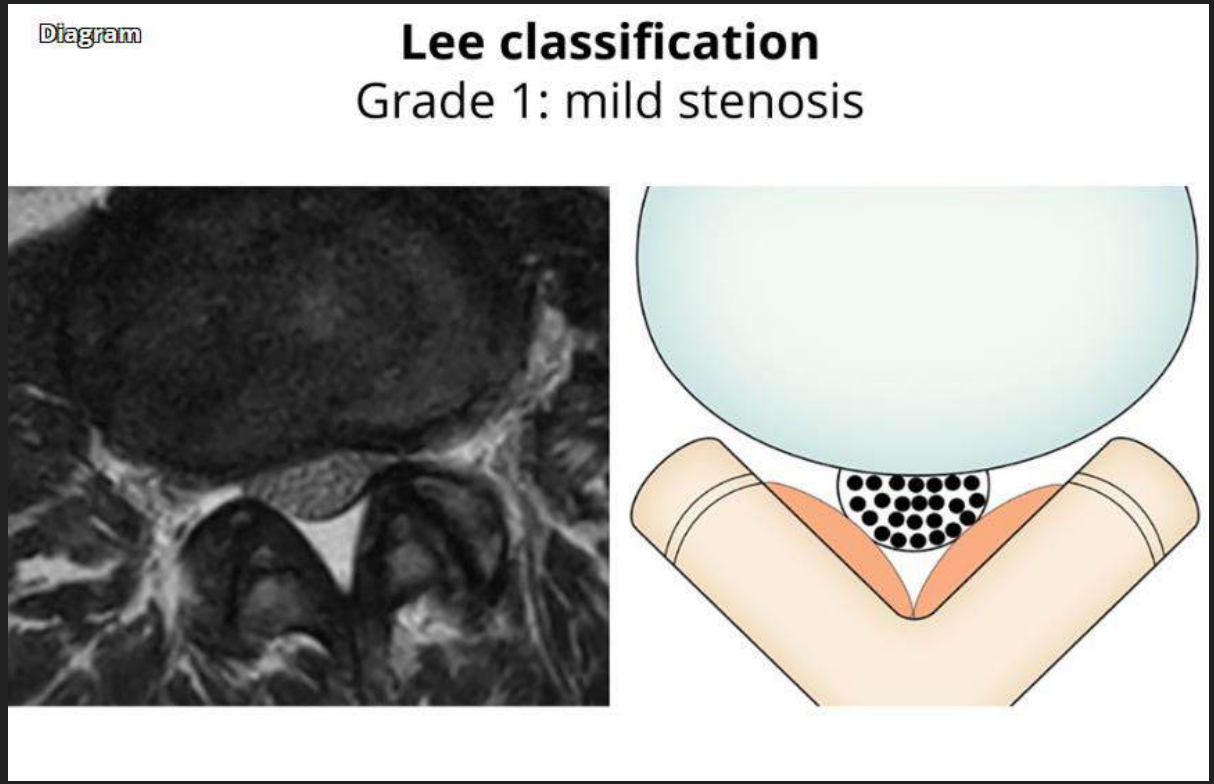
Classification

- grade 0 (no stenosis): the anterior CSF space is not obliterated

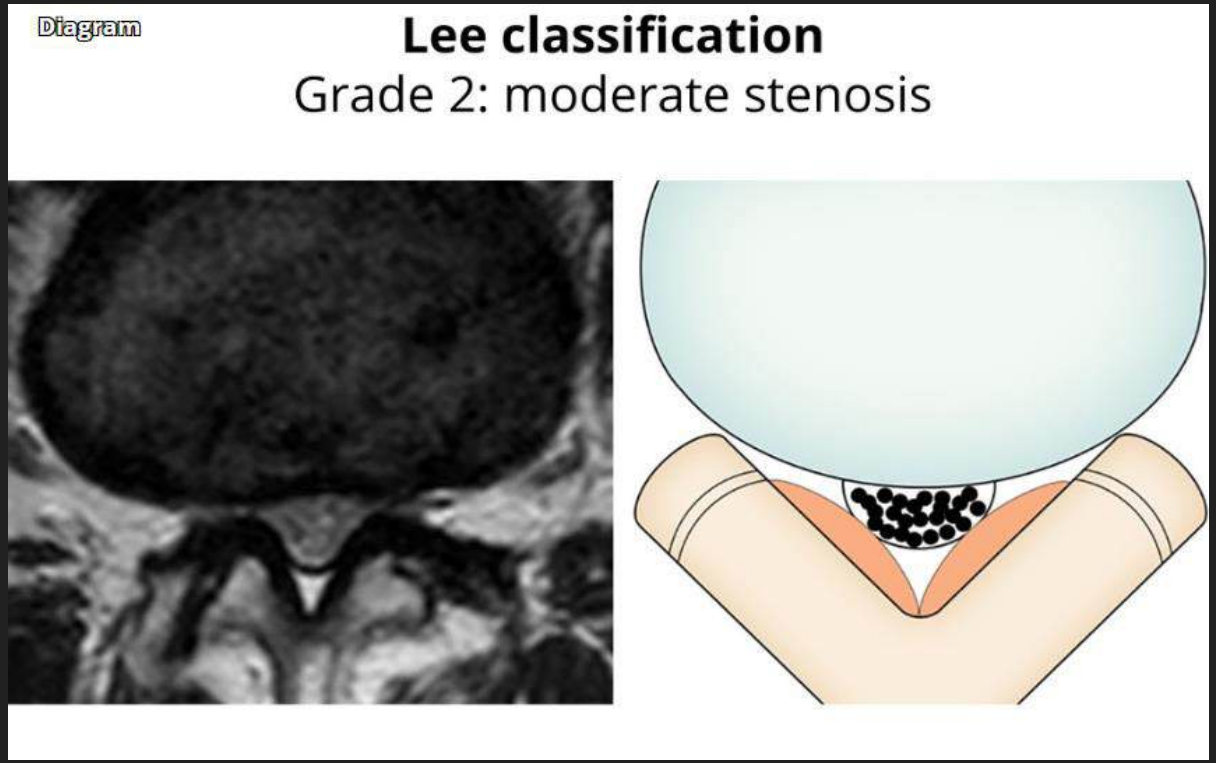


https://radiopaedia.org/articles/lumbar-spinal-stenosis-grading

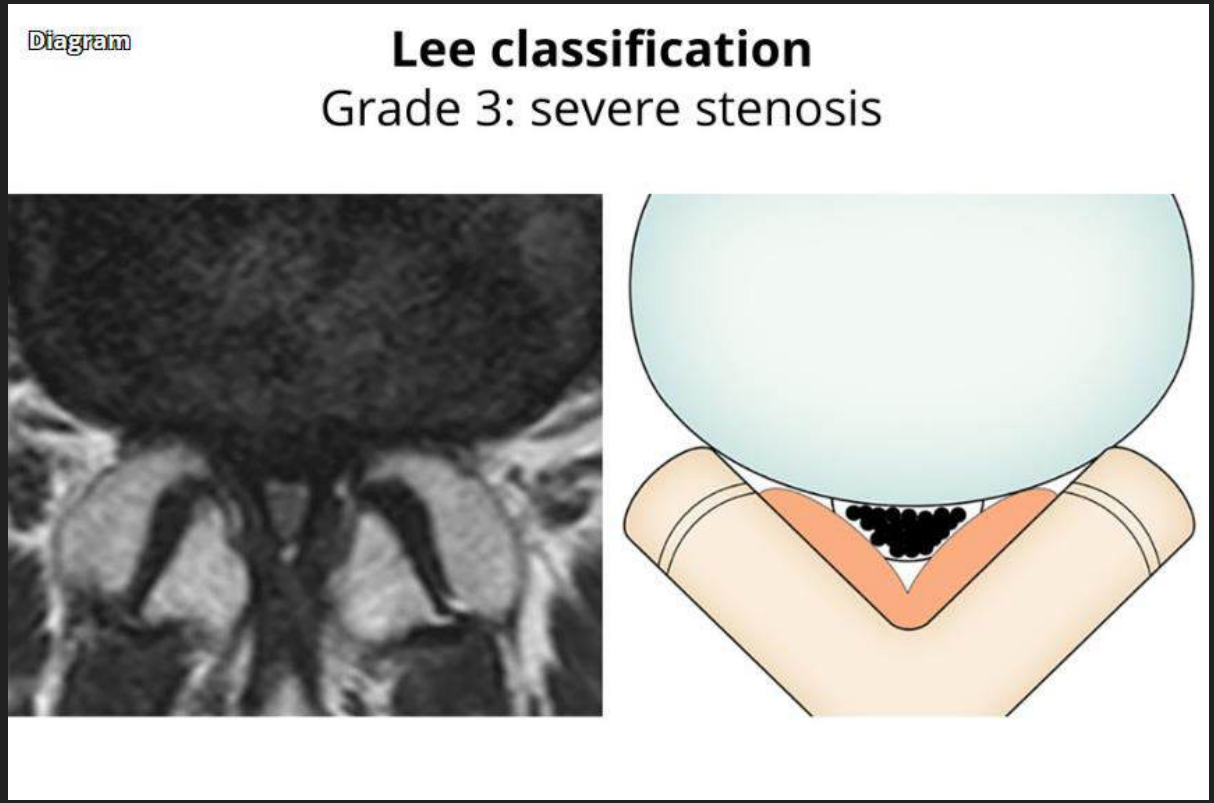
- grade 1 (mild stenosis): the anterior CSF space is mildly obliterated but all cauda equina can be clearly separated from each other



- grade 2 (moderate stenosis): the anterior CSF space is moderately obliterated and some of the cauda equina are aggregated (impossible to visually separate)



- grade 3 (severe stenosis): the anterior CSF space is severely obliterated so as to show marked compression of the dural sac and the cauda equina appears as one bundle (none can be visually separated from each other)



Measurements

central:

- <10 mm AP diameter on axial CT/MRI
- cross-sectional area <100 mm2

Radiopaedia

https://www.researchgate.net/publication/319456905_Evaluation_of_canal_stenosis_of_herniated_lumbar_disc_and_its_correlation_to_anterior-posterior_diameter_with_magnetic_resonance_imaging_morphometry

Table 5: AP diameter of spinal canal at L_5-S_1 level in males

Age group	Control	Case
0-20	17	11
21-30	15.27	11.22
31-40	14.33	11.2
41-50	15.14	10.5
51-70	14.25	11.83

AP: Antero-posterior

Table 6: AP diameter of spinal canal at L_5-S_1 level in females

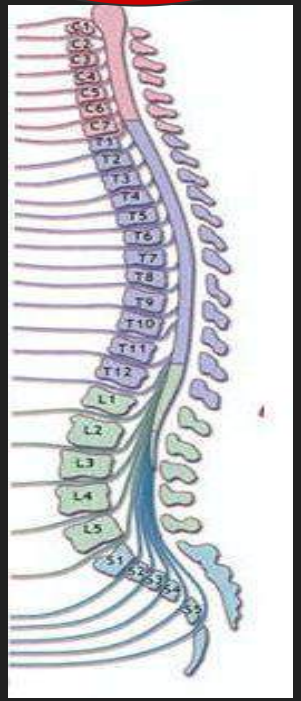
Age group	Control	Case
0-20	16.5	11.5
21-30	15.14	10.66
31-40	14.7	11.25
41-50	14.77	12.75
51-70	14	6

AP: Antero-posterior

Spinal stenosis – non selective compression

Nerve pathology - neuropathy

- Myelopathy - down to L1
  - Pathologic reflexes
  - Paresis / plegia
- Cauda equina syndrome
  - Neurological claudication
  - Back pain
  - Urinary and bowel dysfunction

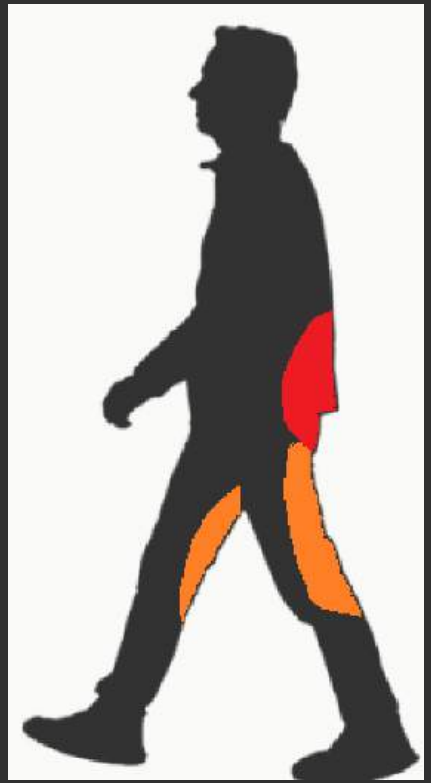


Vascular claudication

Neurological claudication

Vascular claudication

Neurological claudication



Neurological claudication = Lumbar stenosis

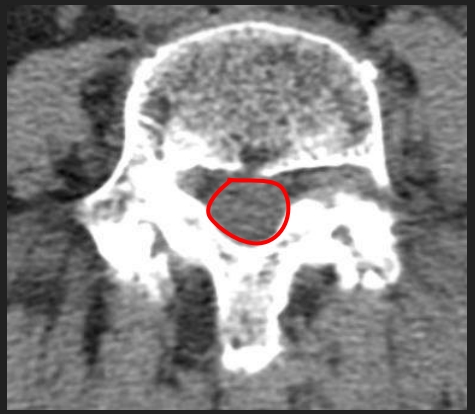
- The symptoms are often induced by walking, standing, or hip extension
- Variable distance to induce symptoms
- Relieved by squatting, sitting

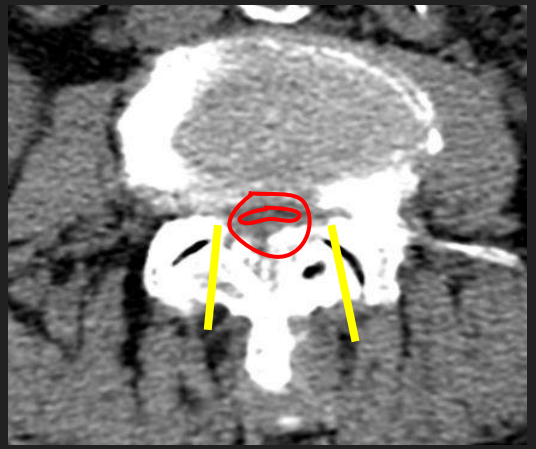
Treatment options

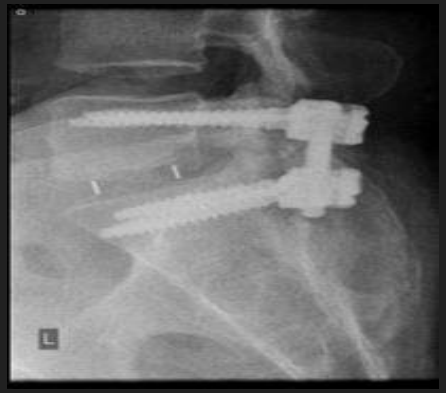
Decompression

- Endoscopic
- Microscopy

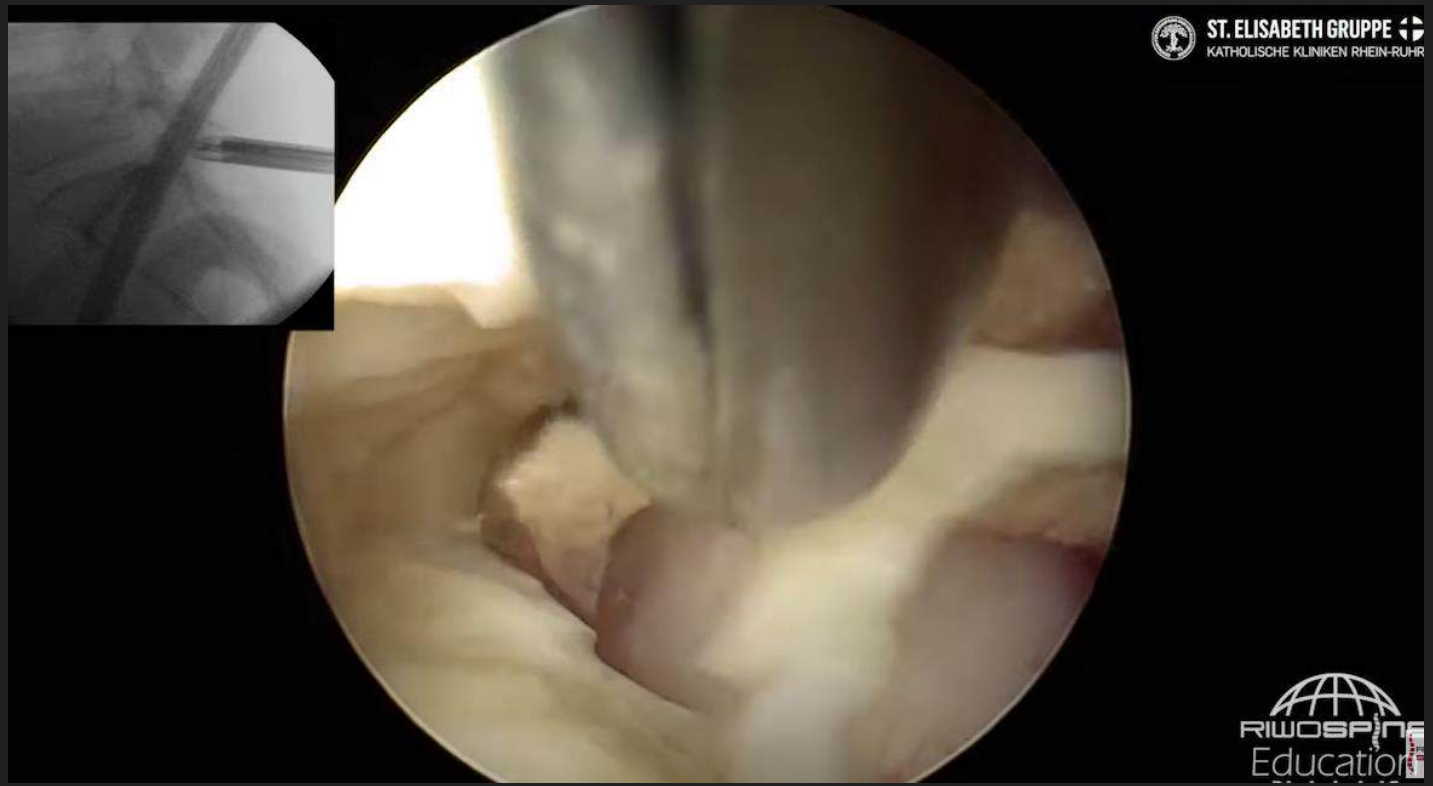
Fusion







Monoportal spine endoscopy

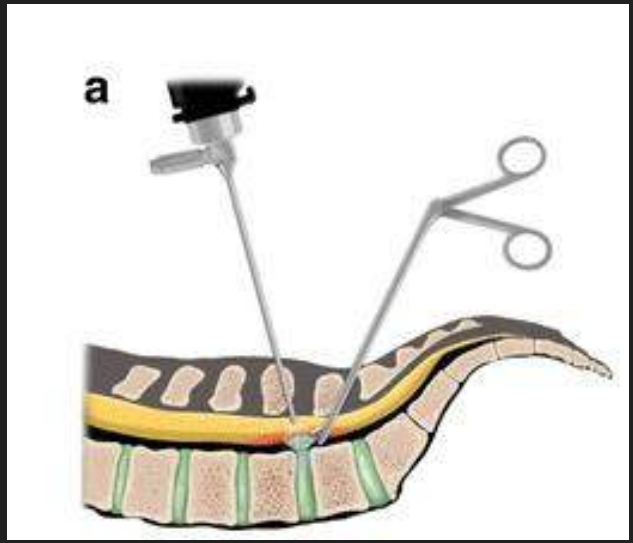


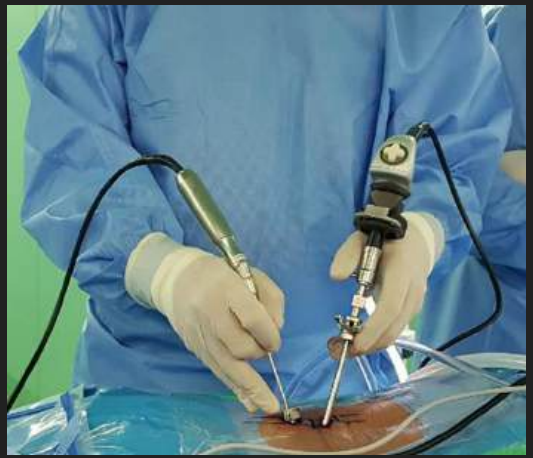
Unilateral Biportal Endoscopy

Two channels

- optic
- working

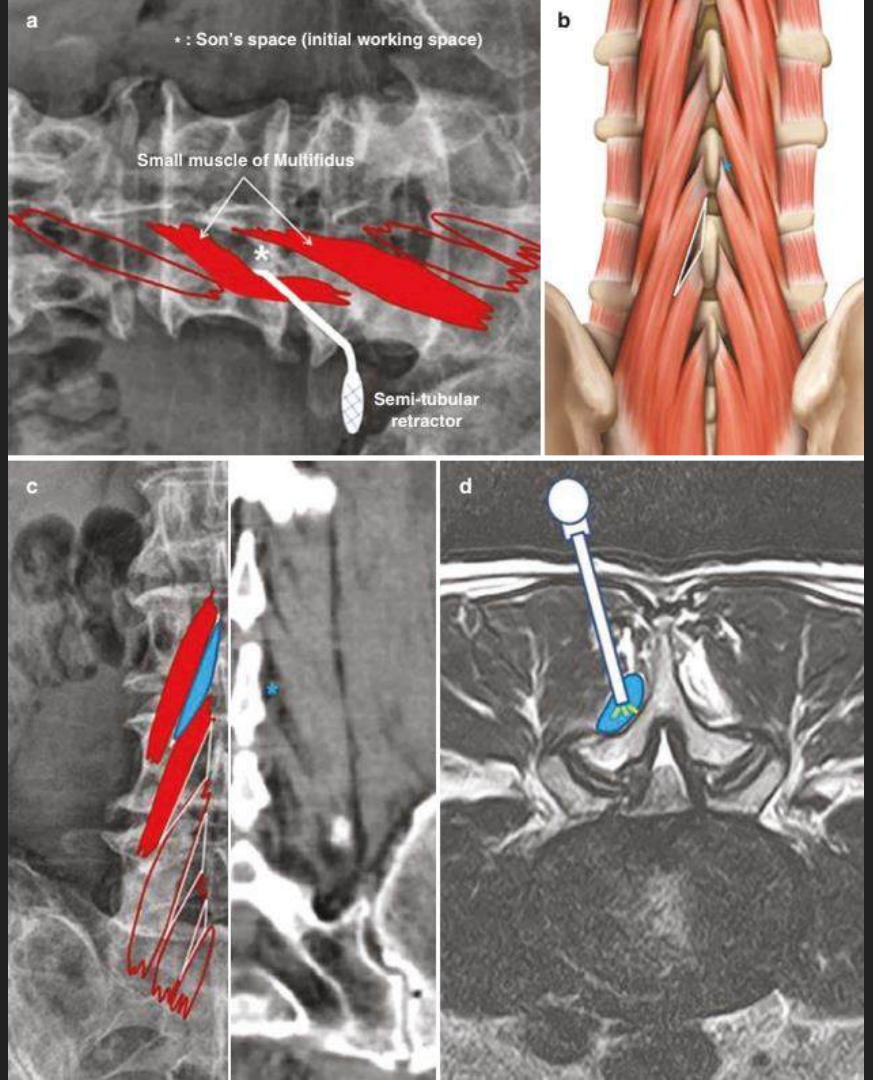
Like in arthroscopy

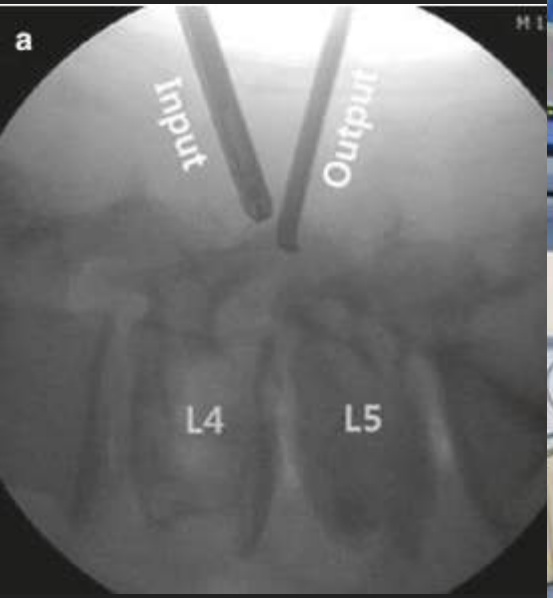




https://josr-online.biomedcentral.com/articles/10.1186/s13018-018-0725-1

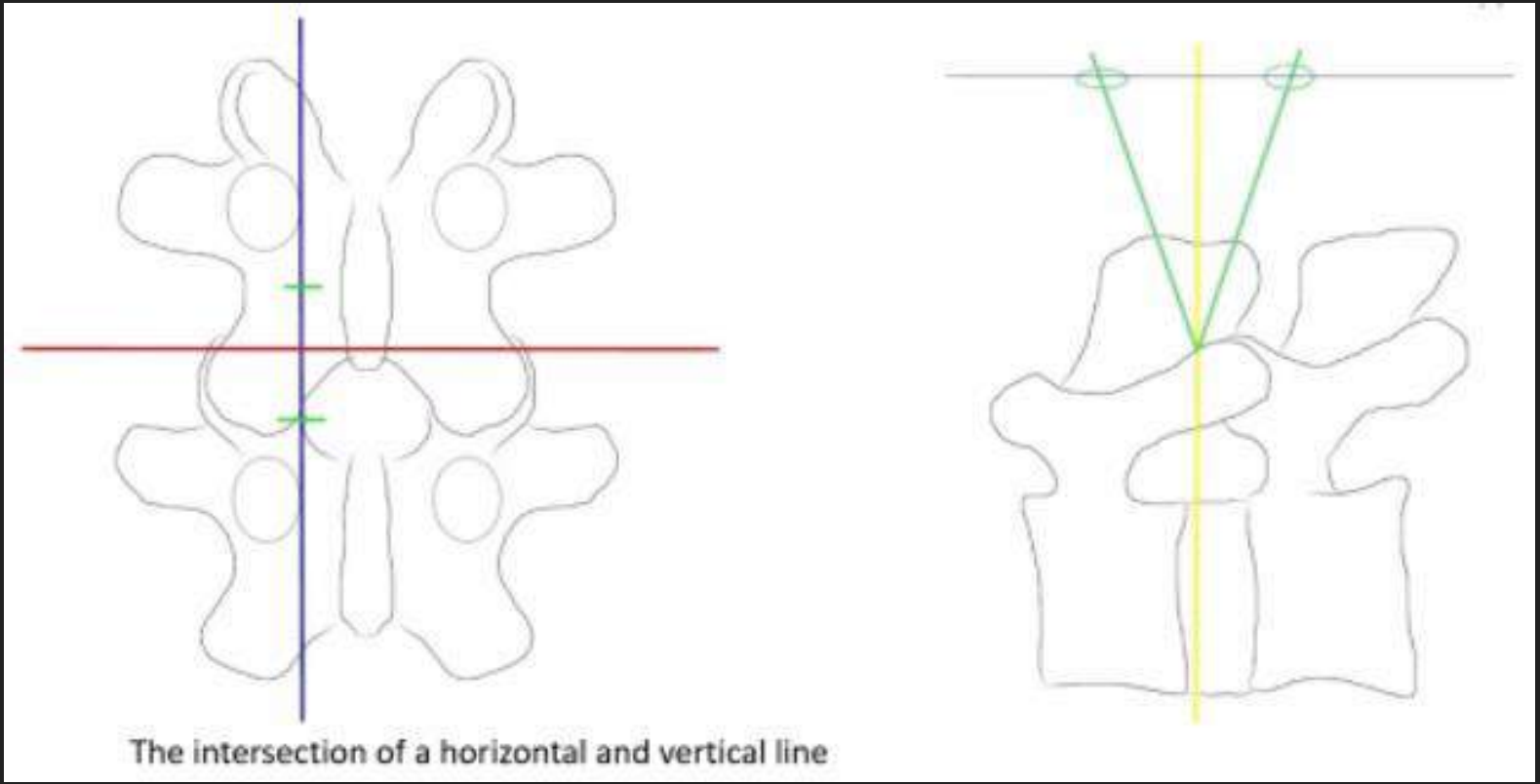
Working space - UBE



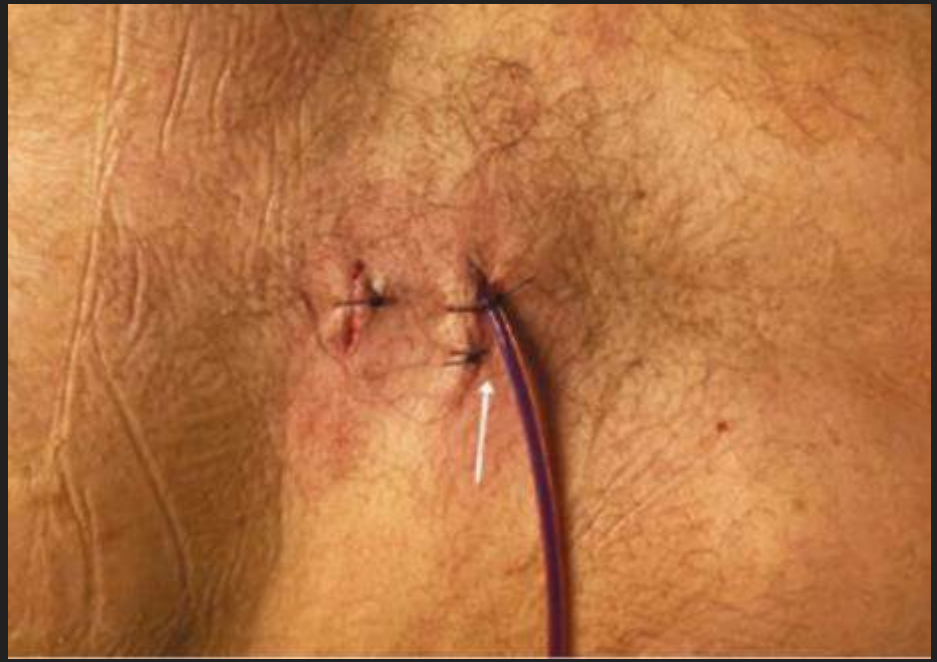

a
Input
Output
L4
L5


instrument
scope
assist
semi-tubular
retractor
Cranial

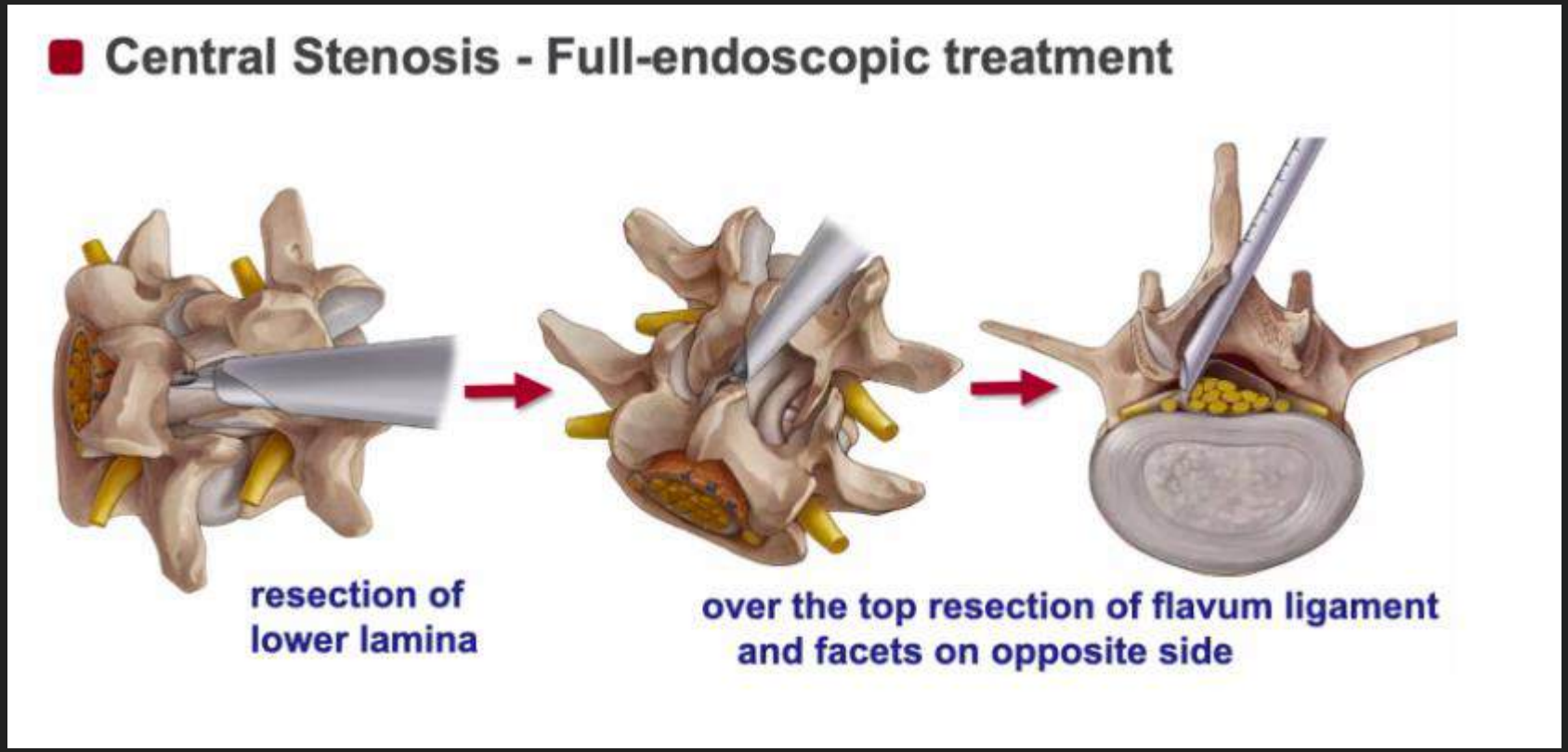
Approach



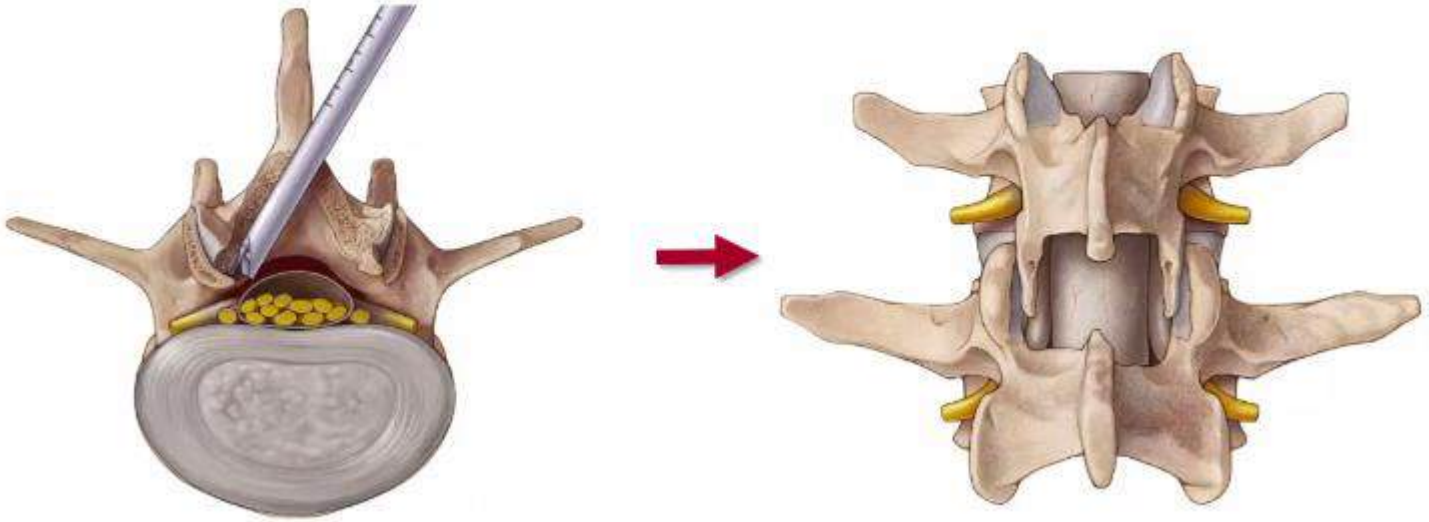
The intersection of a horizontal and vertical line



Treatment possibilities



Central Stenosis - Full-endoscopic treatment



Decompression