Degenerative Spinal Disorders

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Neurosurgery

Surgical treatment of diseases of central and peripheral nervous system

- Surgery of nerves (brain, spine, peripheral nerves)
- Surgery of their supporting structures (skull, spinal column)
- Surgery of their blood vessels

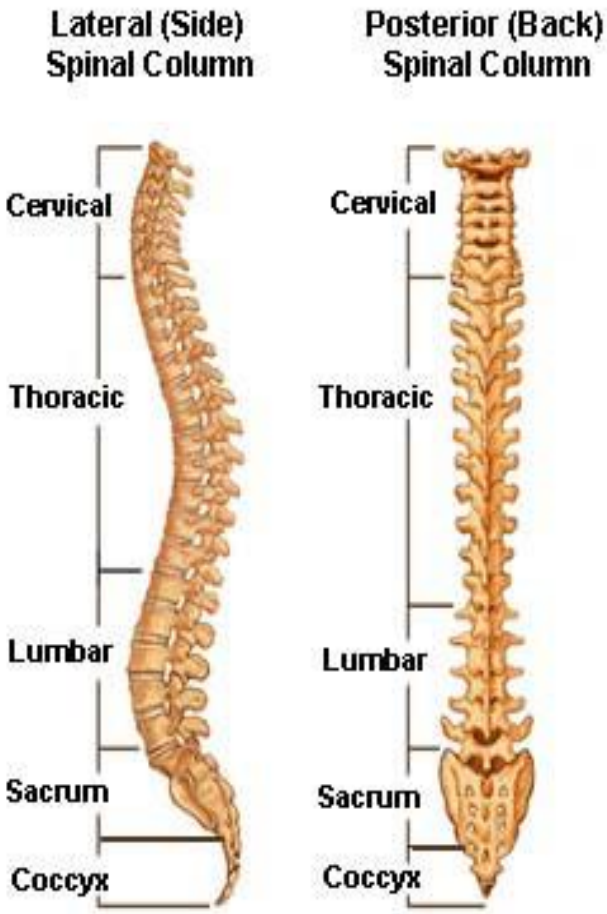
Spine surgery (neurosurgery or orthopedic surgery)

- Decompression
- Stabilisation

Anatomical Classification of the Spine

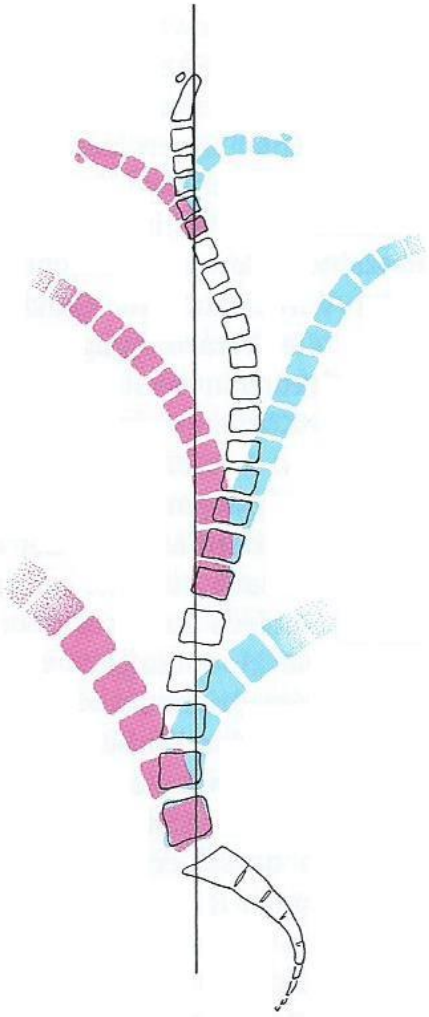
- Craniocervical (occipitocervical) junction: C0-C2
- Subaxial cervical spine: C3-C7 (Th1)
- Thoracic and thoracolumbal spine: Th2-L2
- Lumbal and lumbosacral spine: (L1-)L3-S

- Cervicothoracic junction
- Thoracolumbal junction



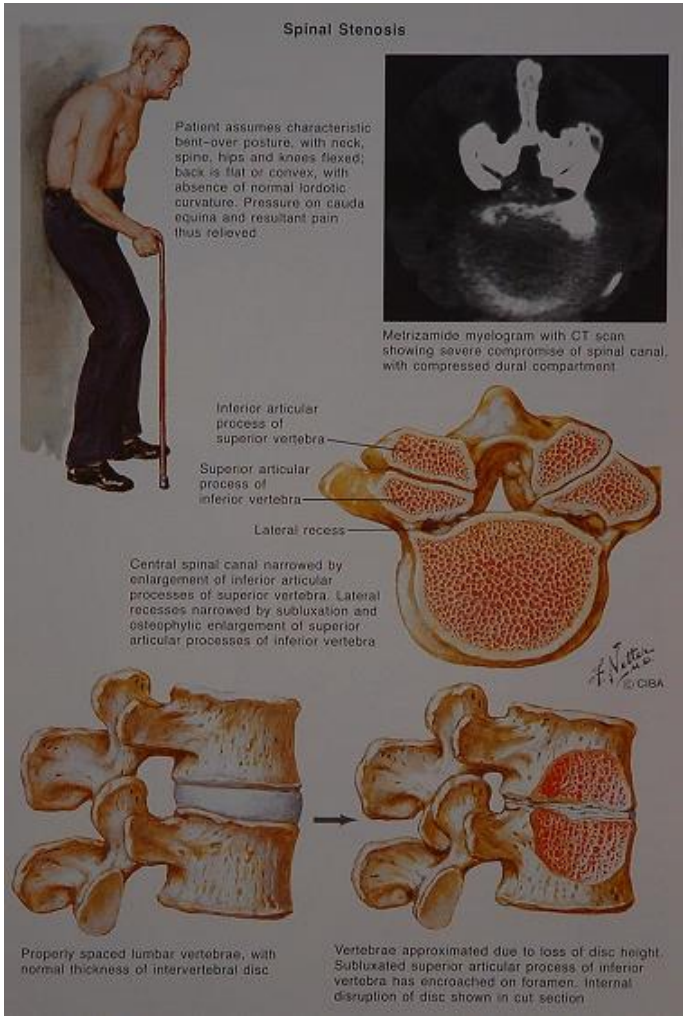
Pathological Classification of Spinal Disorders

- Traumatic injuries
- Tumors
- **Degenerative spinal disorders**
- Inflammatory disorders
- Infection (pyogen)
- Developmental anomalies



Major Topics

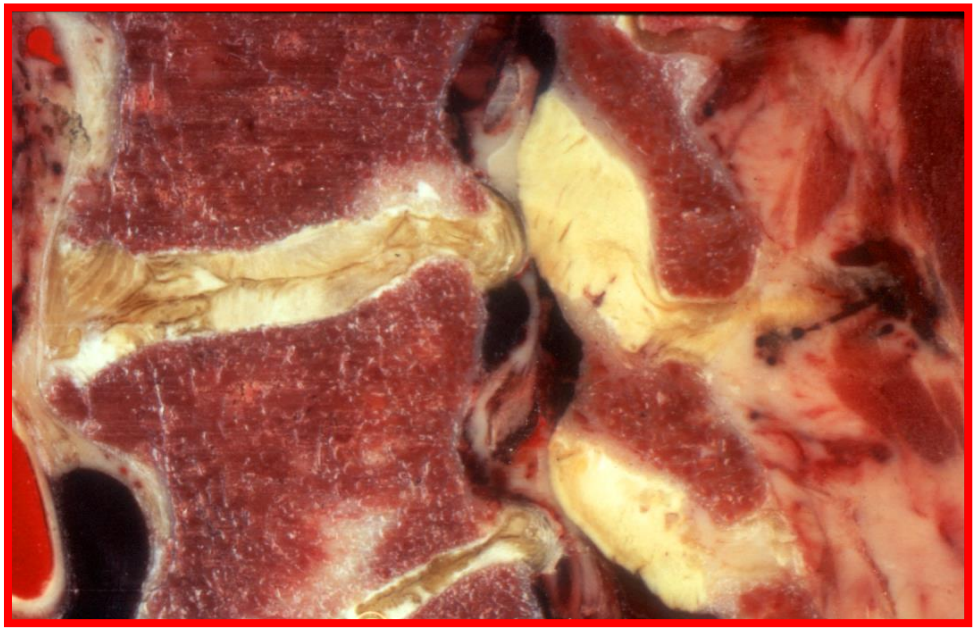
- Basic principles
- Radiology
- Degenerative lumbal spine
- Degenerative cervical spine
- Degenerative thoracic spine
- Craniocervical instability (rheumatoid arthritis, ankylosing spondylitis)
- Osteoporosis



Definition and Pathomechanism

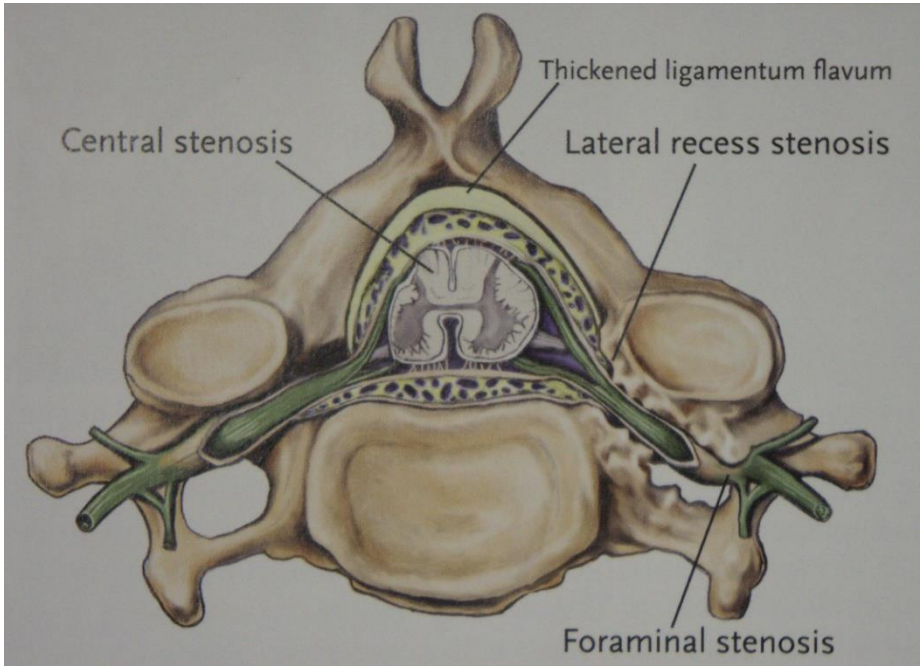
- Anatomic adaptation to the continous wear and tear of the involved structures (disc, ligaments, joints)
- Leading to:
  - thickening and calcification of the ligaments (spondylosis)
  - weakening and bulging of intervertebral disc (disc herniation)

- Causing
  - nerve compression (radiculopathy or myelopathy)
  - axial pain



Compression

- Three types of stenosis:
1. Central stenosis
2. Lateral recess stenosis
3. Foraminal stenosis

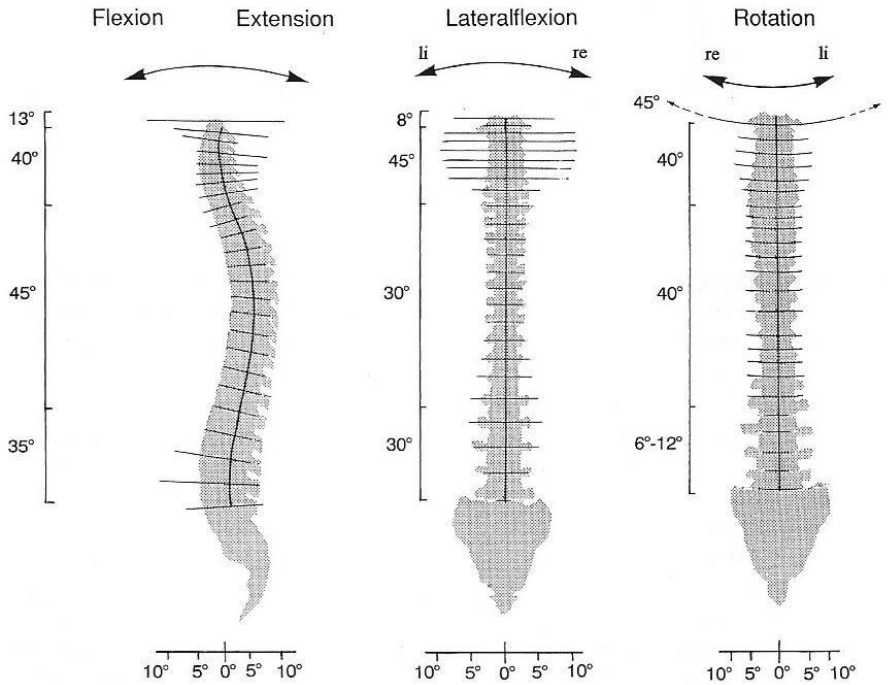


- Compressing
-nerve roots (radiculopathy)
-spinal cord (myelopathy)
- Acute or chronic

<u>Aim of surgery:</u>
-to prevent further neural damage (clinical progression)
-to provide optimal conditions for regeneration (neurological improvement)

Instability

- Biomechanical: pathological movement caused by physiological load
- Clinically this leads to axial pain and stenosis



<u>Aim of surgery:</u>

-to provide optimal conditions for conservative treatment by decompression and stabilisation

Instability: Spondylolisthesis and spondylolysis

Table 48.1 Myerding grading for spondylolisthesis

Grade	Percent slip
I	0–25
II	25–50
III	50–75
IV	75–100

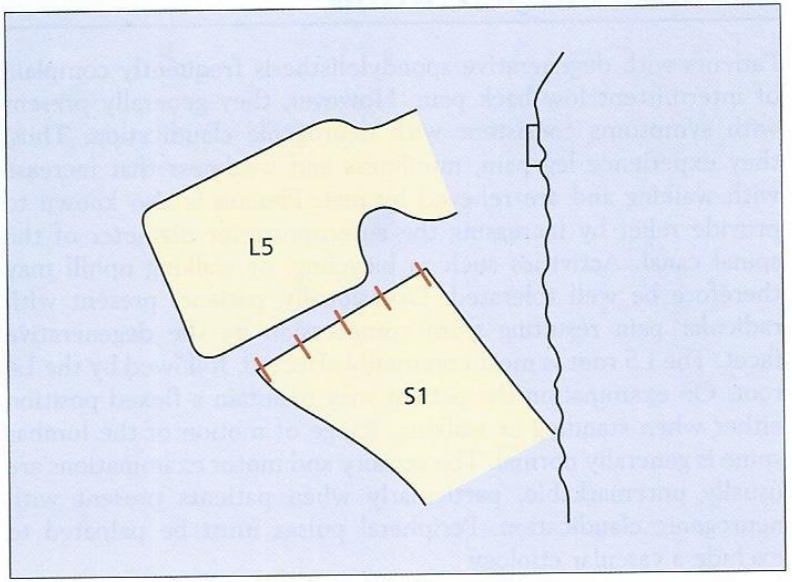
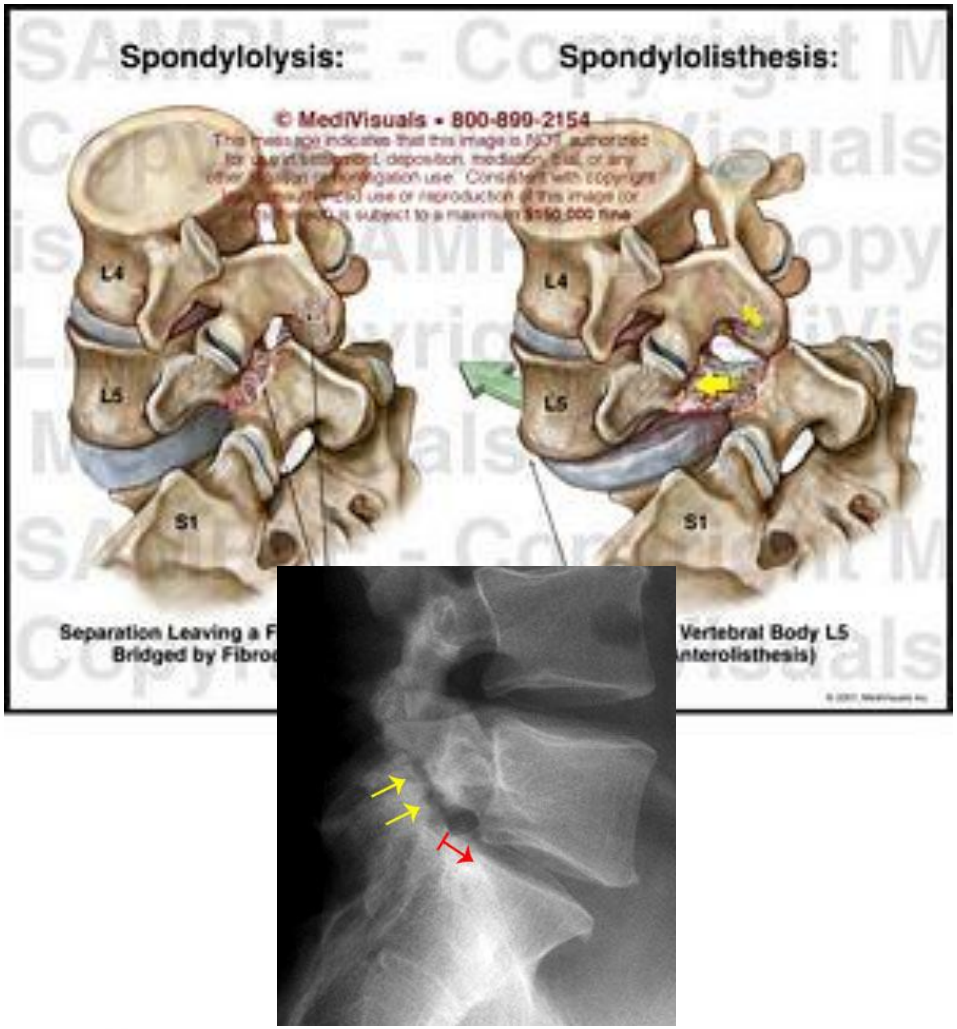


Figure 48.1 Myerding grading scheme for spondylolisthesis.



Principles of Treatment

- Multimodality management involving neurologist, rheumatologist, pain specialist, spine surgeon, physiotherapist, psychologist, functional neurosurgeon
- All deal only with the consequences of degenerative disorders, non of them are curative

- Aim of spine surgery is decompression and stabilisation
- Minor decompression may be insufficient
- Major decompression may lead to instability

- Conservative treatment includes medication, physiotherapy, physicotherapy, balneotherapy
- Semi-conservative: radicular and facet infiltration, epidurolysis (pain specialists)
- Functional neurosurgery: spinal cord stimulation, morphine pump

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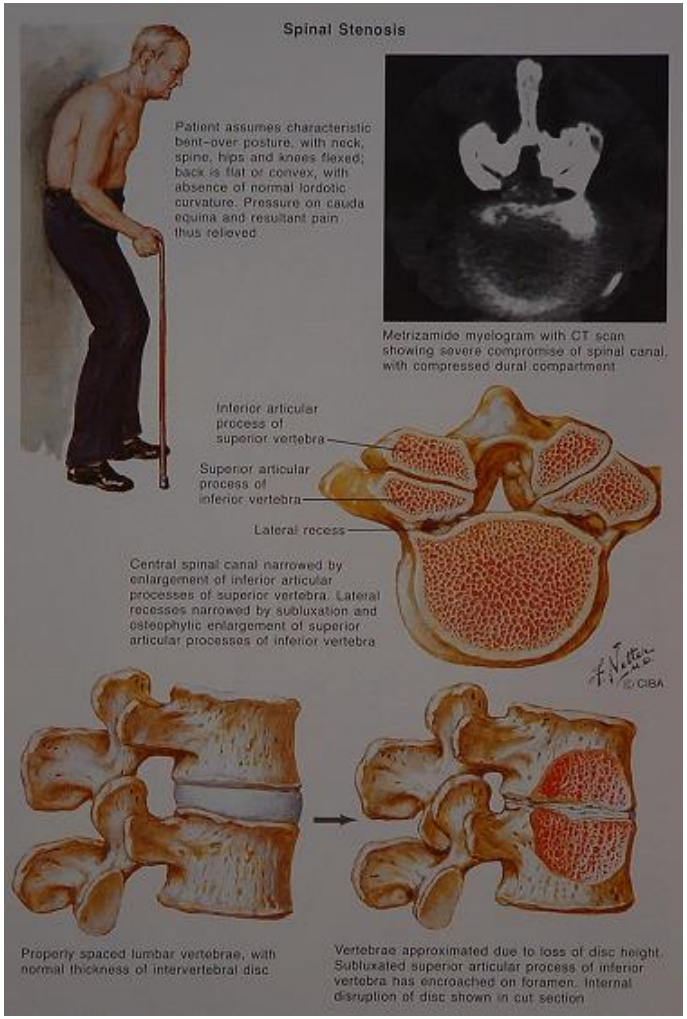
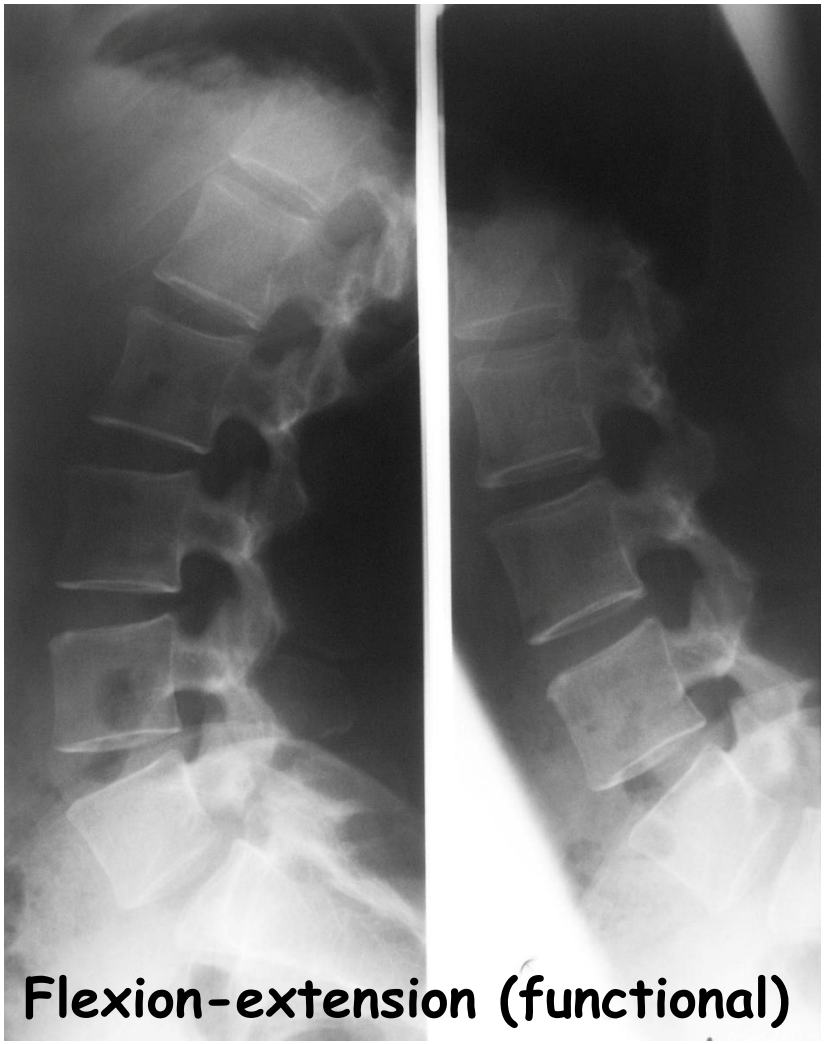


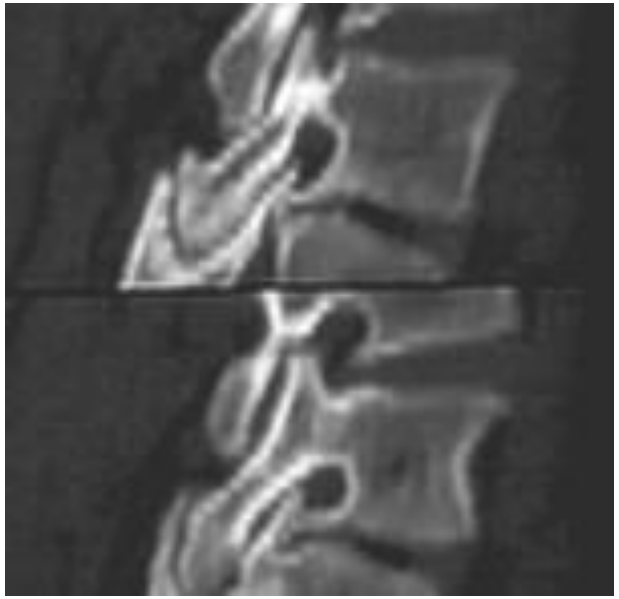
Radiological Diagnosis – X-ray

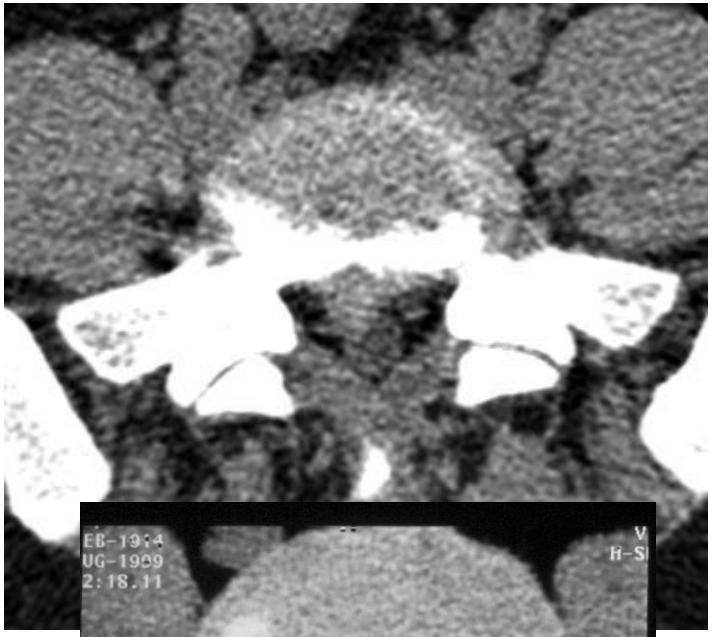
Lateral Antero-posterior



Flexion-extension (functional)

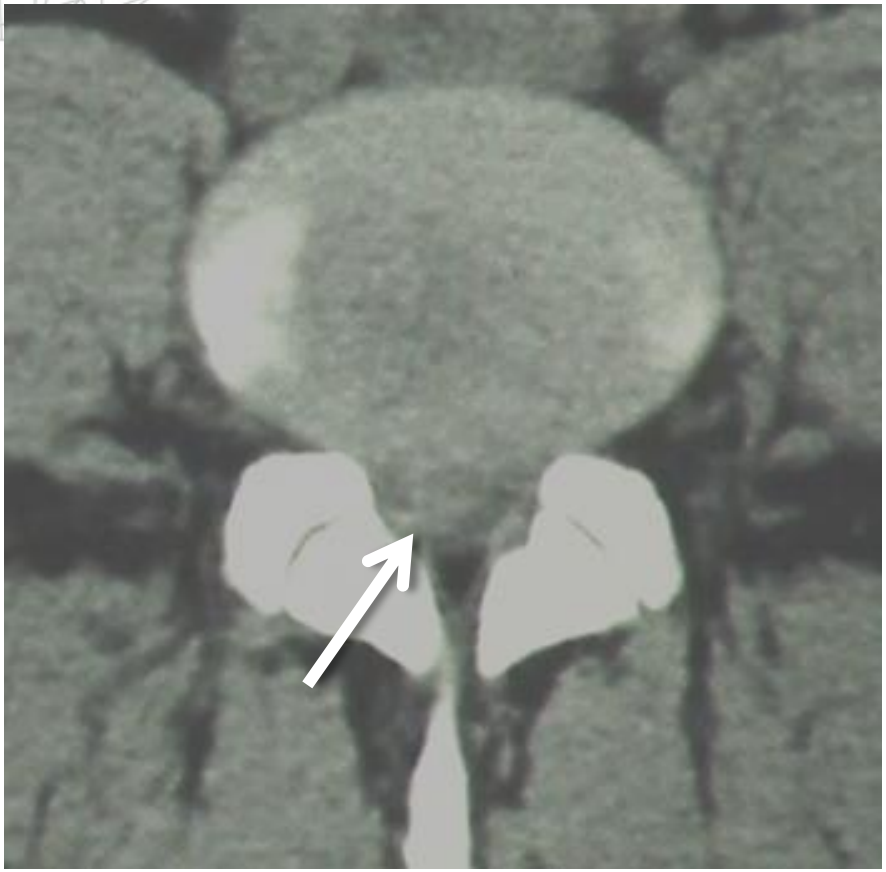
Radiological Diagnosis – CT

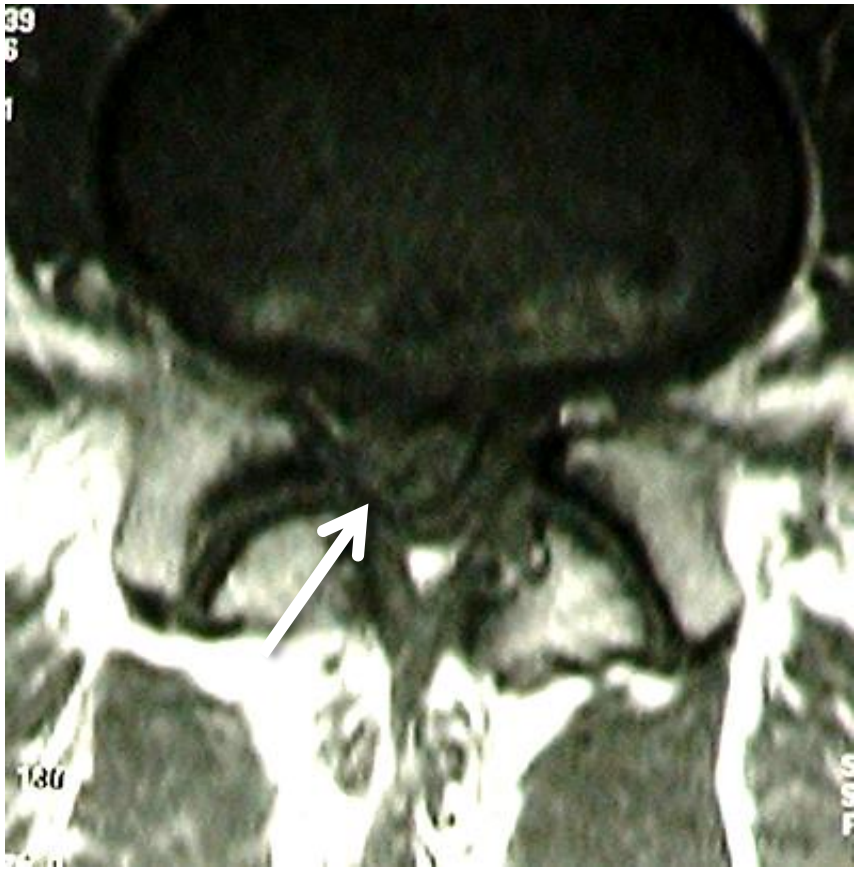




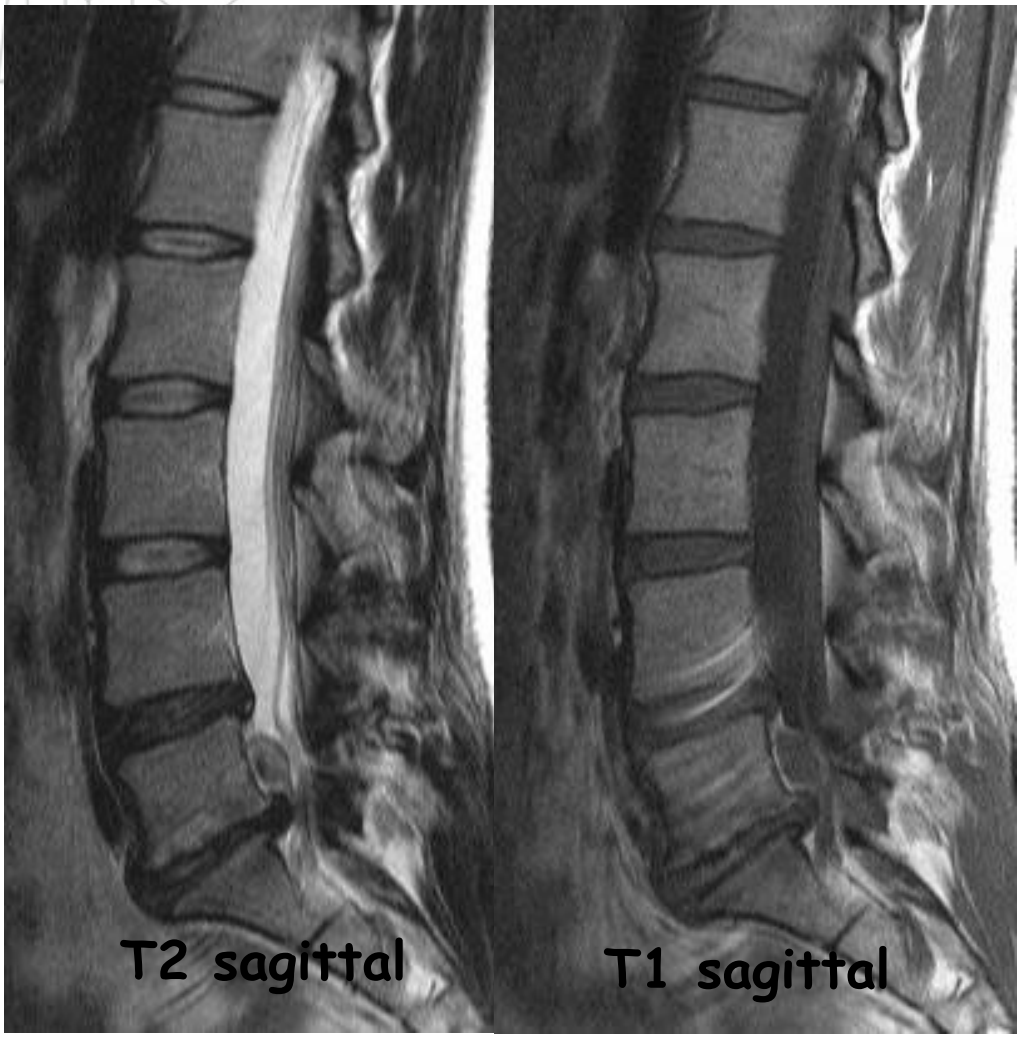
- Ideal for bony structures
- May be sufficient for soft tissues (HD: sensitivity 80-95%, specificity 68-88%)

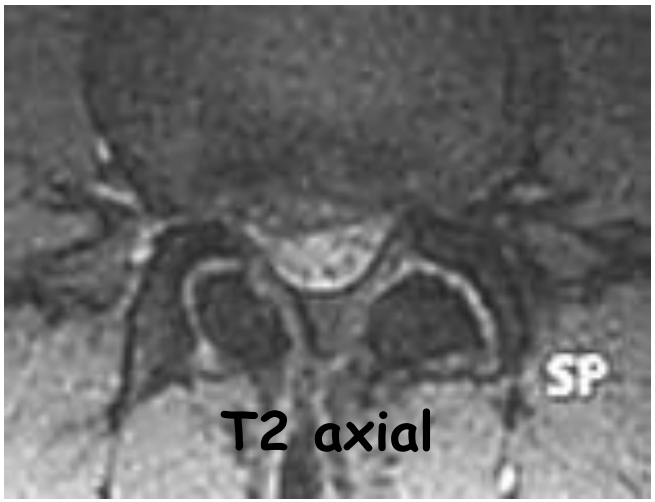
Limitations of CT

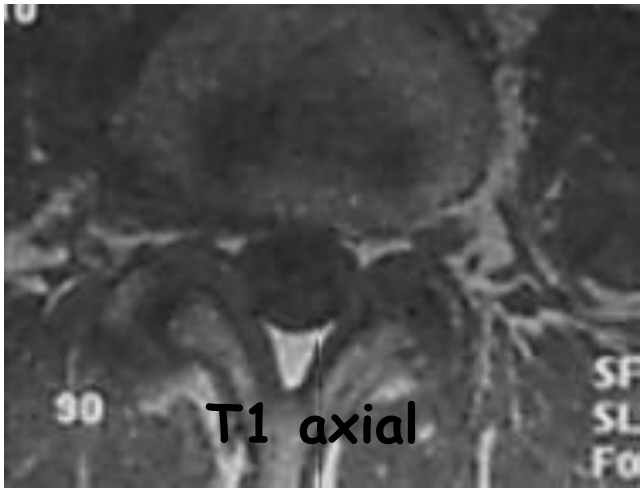




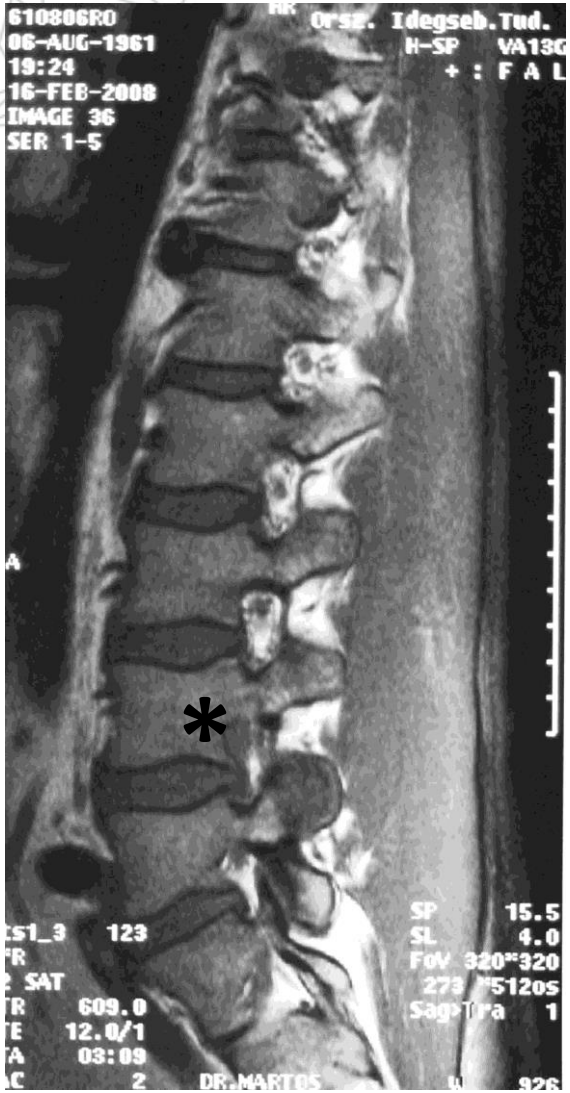
Radiological Diagnosis – MRI







Radiological Diagnosis – MRI



Importance of parasagittal slices! (Foramina)

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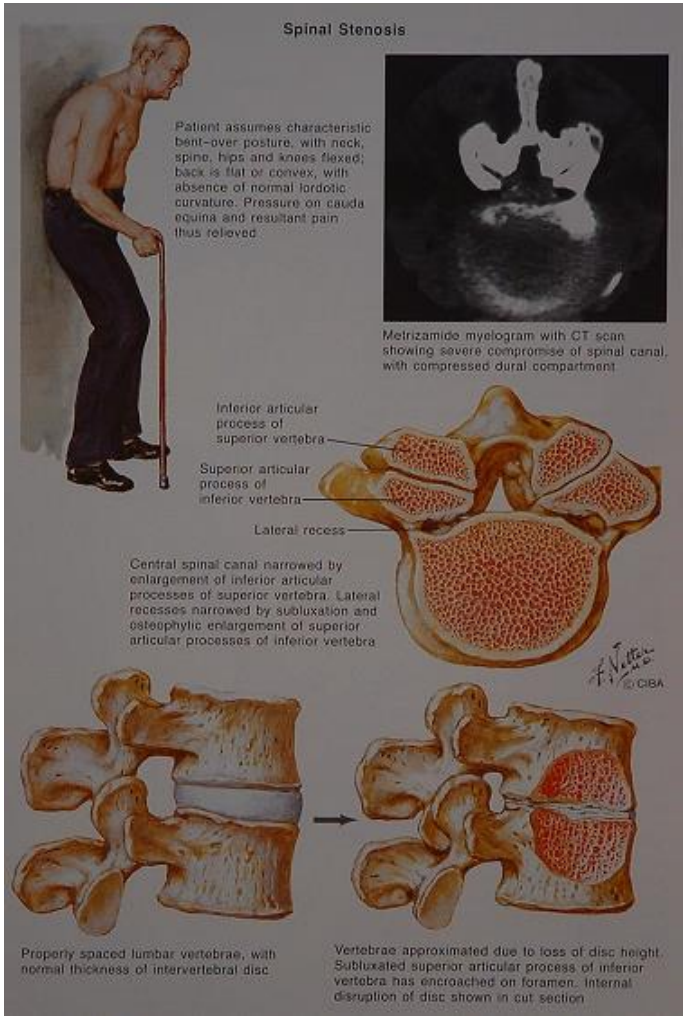
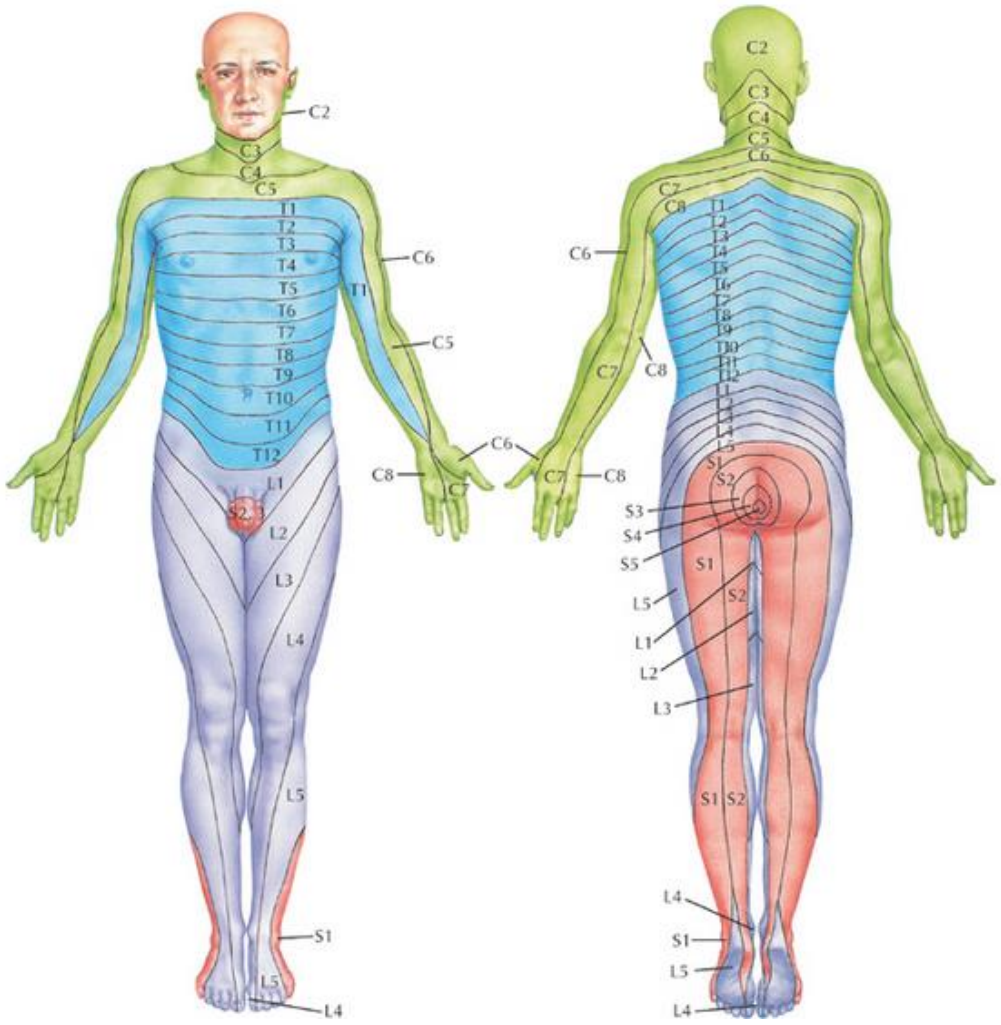


Low Back Pain (LBP) and Radiculopathy

- LBP is the second most common reason for people to seek medical attention, 15% of sick leave from work, most common cause of disability <45 yrs
- Lifetime prevalence 60-90%, annual incidence 5%
- 1% will have radicular symptoms, 1-3% have disc herniation
- 85% no specific diagnosis, 90% improves without specific treatment within 1 month
- Imaging and further studies are not helpful during the first 4 weeks, except "red flags"
- Bed rest beyond 4 days is not necessary, pain relief is best achieved by nonprescription pain meds and/or spinal manipulation

Radicular Symptoms – Lumbal Spine

- L2,3: iliopsoas – hip flexion
- L3,4: quadriceps – knee extension
- L4,5: tibialis anterior – ankle dorsiflexion
- L5: extnesor hallucis longus – great toe extnesion
- S1: gastrocnemius – ankle plantarflexion
- S2-4: sphincters



"Red Flags"

1. Cancer/infection
   Age >50 or <20, history of cancer, unexplained weight loss,immunosuppression, UTI, IV drug abuse, fever or chills, back pain not improved with rest
2. Fracture
   history of significant trauma, prolonged use of steroids, age >70
3. Cauda equina syndrome or severe neurological compromise
   acute onset of urinary retention or overflow incontinence, fecal incontinence or loss of anal tone, saddle anesthesia, global or progressive weakness of muscles

- **These need further investigation!!!**

Lumbar Disc Herniation Indications for Surgery

1. Emergency Surgery
   * cauda equina syndrome (24-48hrs)
   * acute development of motor deficit (24-72hrs)

   * may be indicated if pain remains intolerable in spite of adequate pain medication
2. Relative indication

A. *70% of radicular pain caused by lumbar disc herniation is improved within 4 weeks without surgery
   * 85% within 6 weeks
   *thus, 5-8 weeks of waiting is advocated before surgery

B. * paresis of unknown duration is doubtful indication for surgery

Surgery vs. Conservative Evidence?

1. Maine Lumbal Spine Study

Long-Term Outcomes of Surgical and Nonsurgical Management of Sciatica Secondary to a Lumbar Disc Herniation: 10 Year Results from the Maine Lumbar Spine Study. Spine. 30(8):927-935, 2005.

- 507 patients (183 surgical, 217 non-surgical)
- Prospective comparison with 10-year follow-up

- No long-term difference in terms of working ability
- After surgery: better radicular pain release, better functional outcome, greater satisfaction

2. Cochrane Library

Surgery for Lumbar Disc Prolapse The Cochrane Database of Systematic Reviews 2005 Issue 3

- Quicker improvement of pain with surgery
- Long term benefit is not clear

Surgery for Lumbal Disc Herniation

1. Discectomy
   - microdiscectomy
   - endoscopic discectomy
   - percutaneous laser discectomy
2. Discectomy+fusion (see later)
   - in case of instability
   - after 2nd recurrence

Microdiscectomy

Adantages of Minimally Invasive Approaches

*Main goal is decompression of neural structures

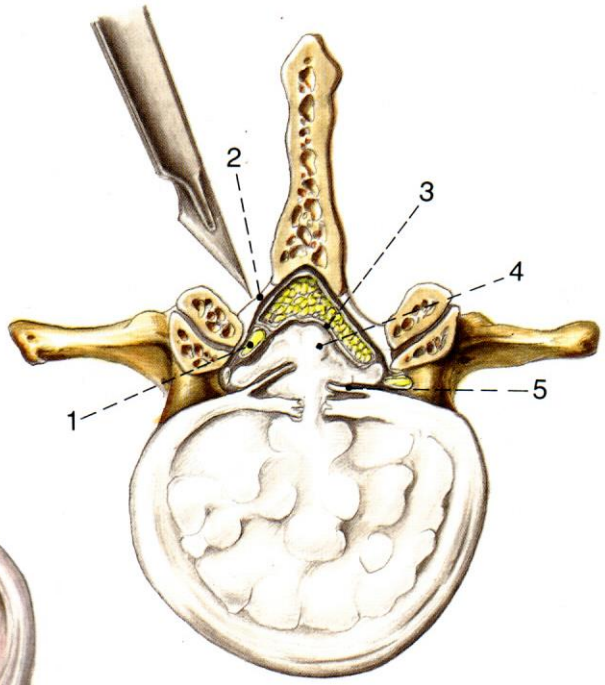
*Without sacrificing spinal stability

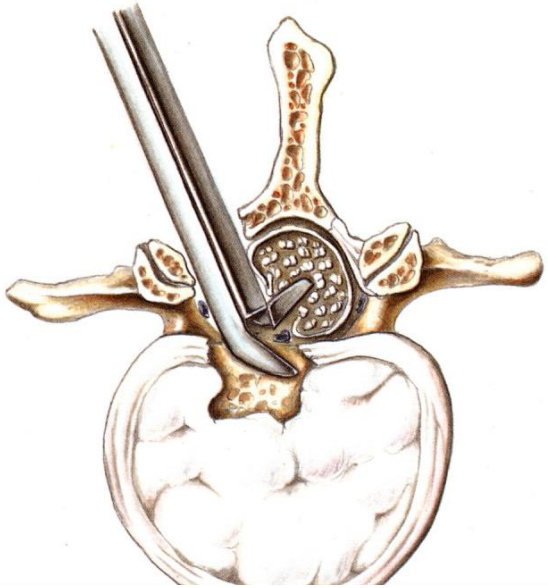
*Shorter hospital stay, earlier mobilization

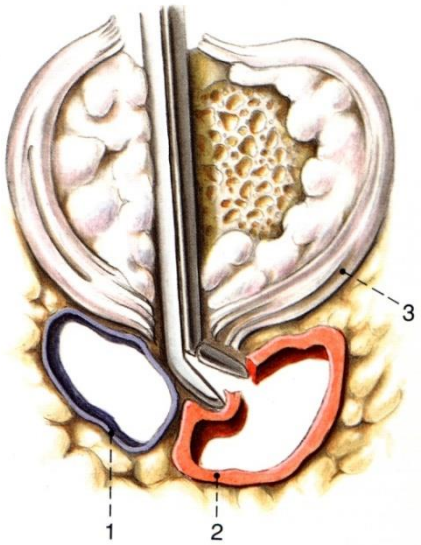
*Decrease blood loss & pain & septic complication etc…

Complications

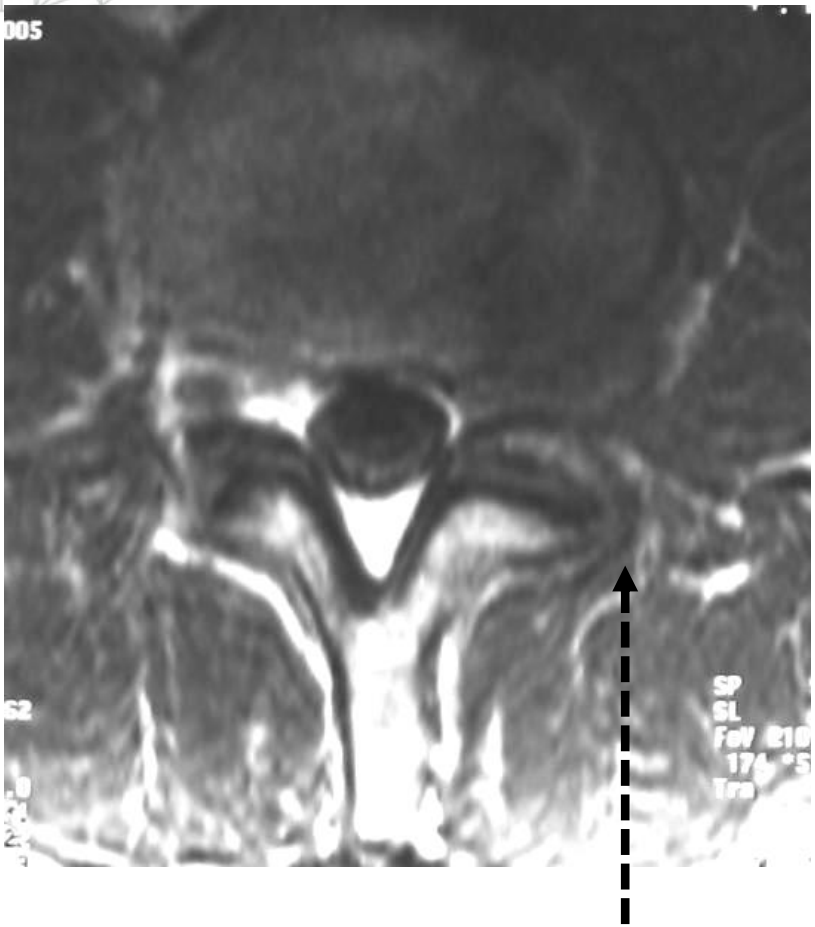
- Recurrence (2-20%)
- Failure of improvement
- CSF leak
- Nerve damage
- Life threatening bleed
- Wound infection

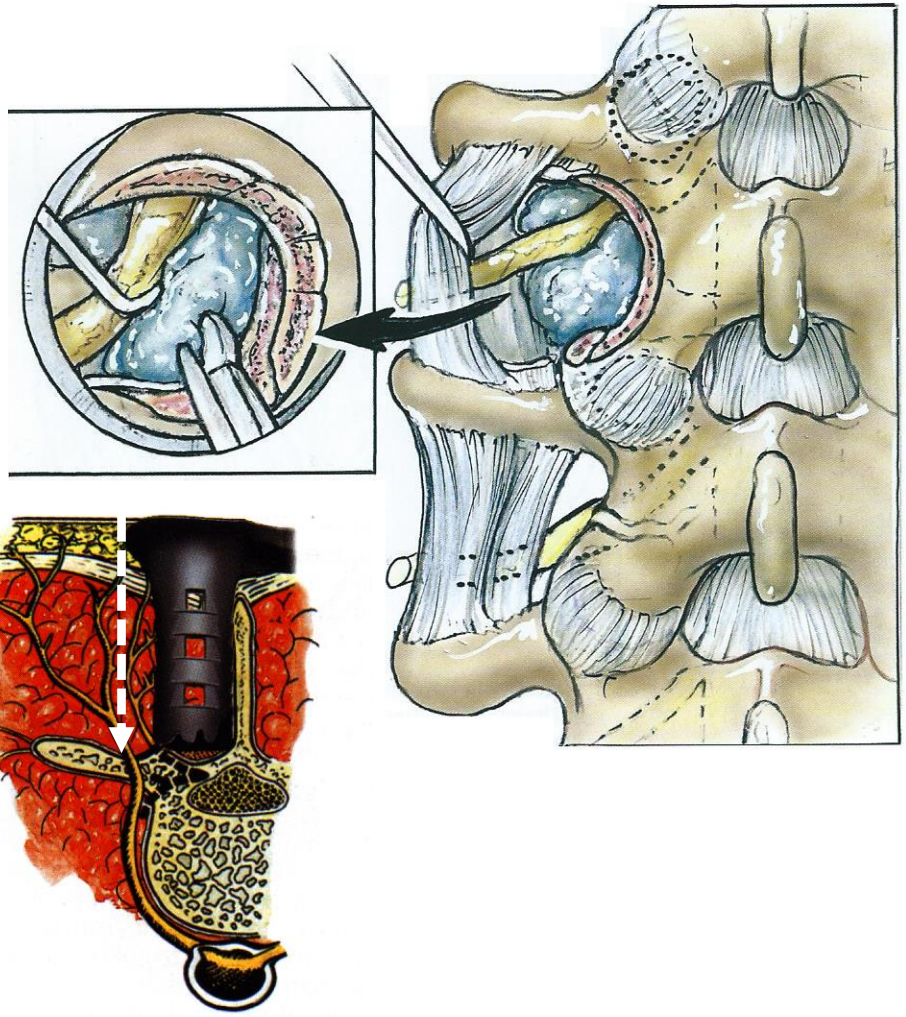






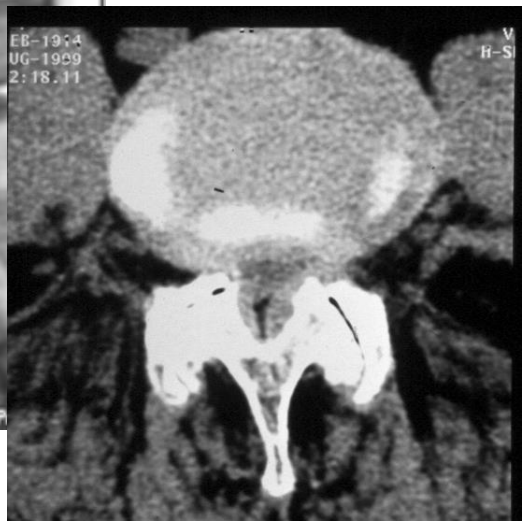
Far Lateral Approach
Extraforaminal Disc Herniation



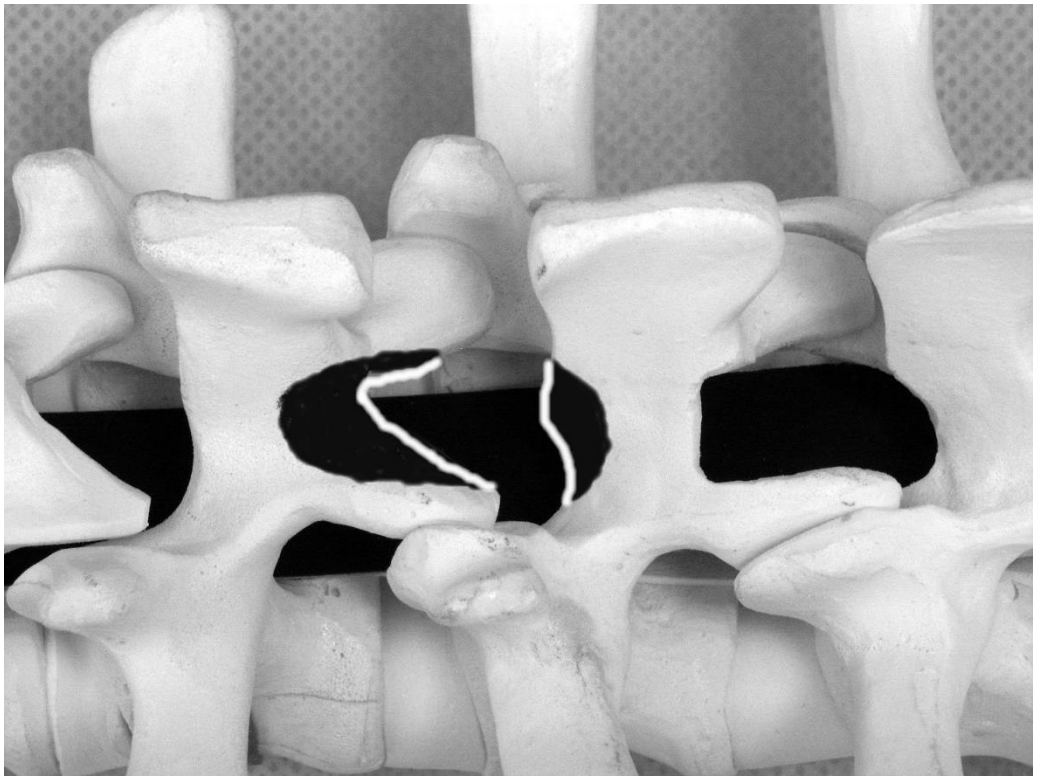


Spinal Canal Stenosis (Lumbal)

- reduction in canal size below a critical value
  - congenital
  - acquired
  - acquired superimposed on congenital
- facet hypertrophy
- lig. flavum hypertrophy
- protruding disc
- spondylolisthesis



Unilateral Laminoctomy with Bilateral Decompression ("Over the Top")



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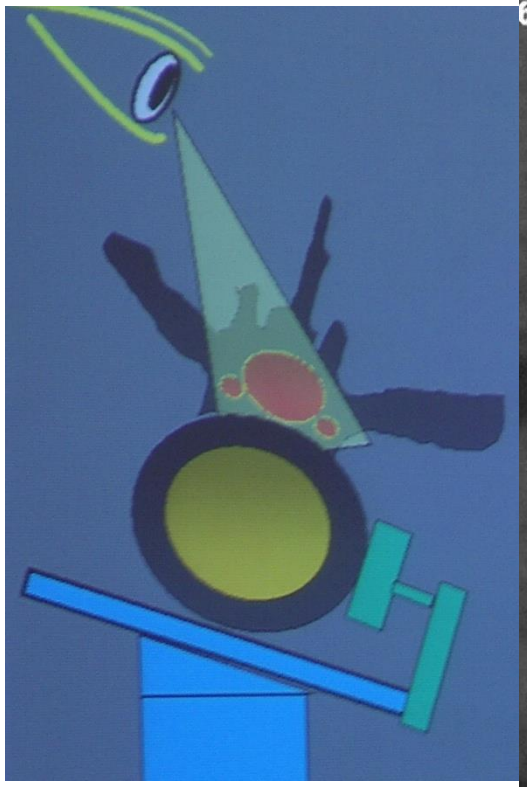
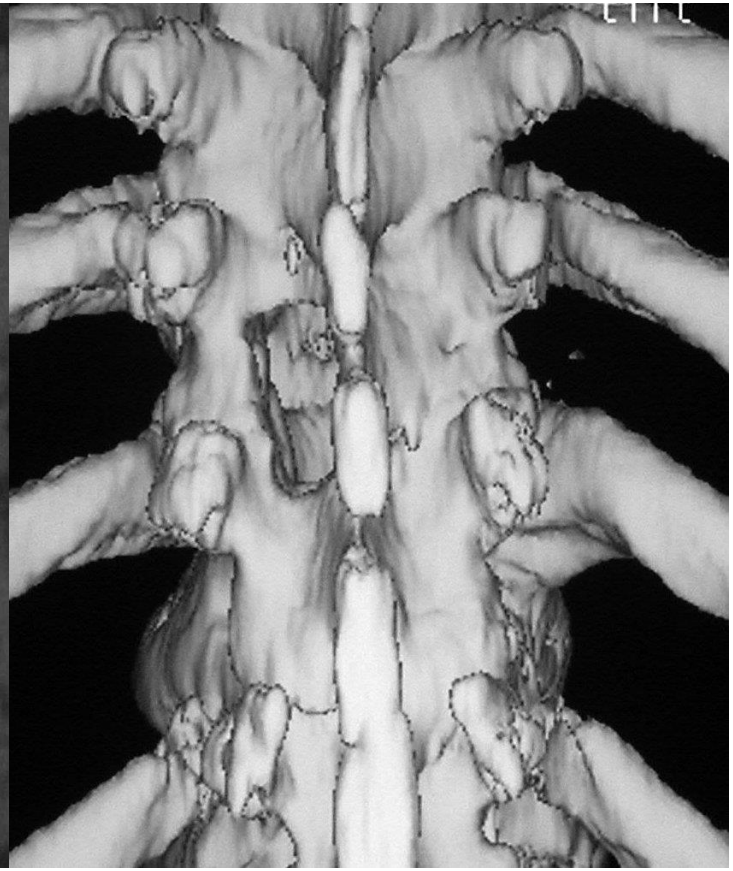
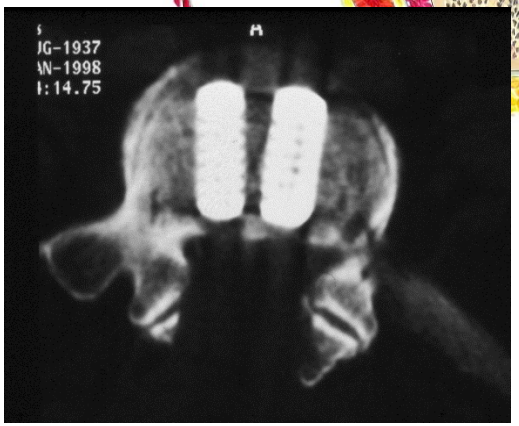
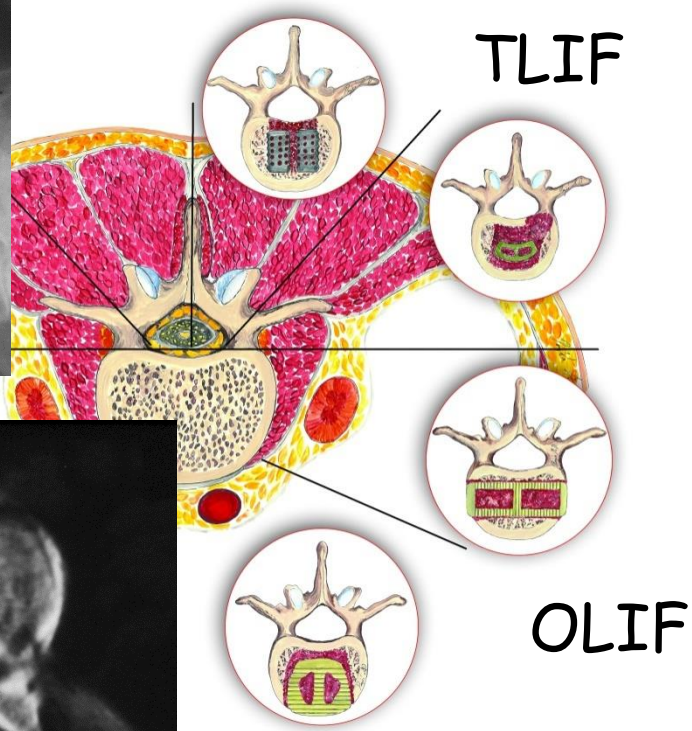




Instability – Fusion Cage

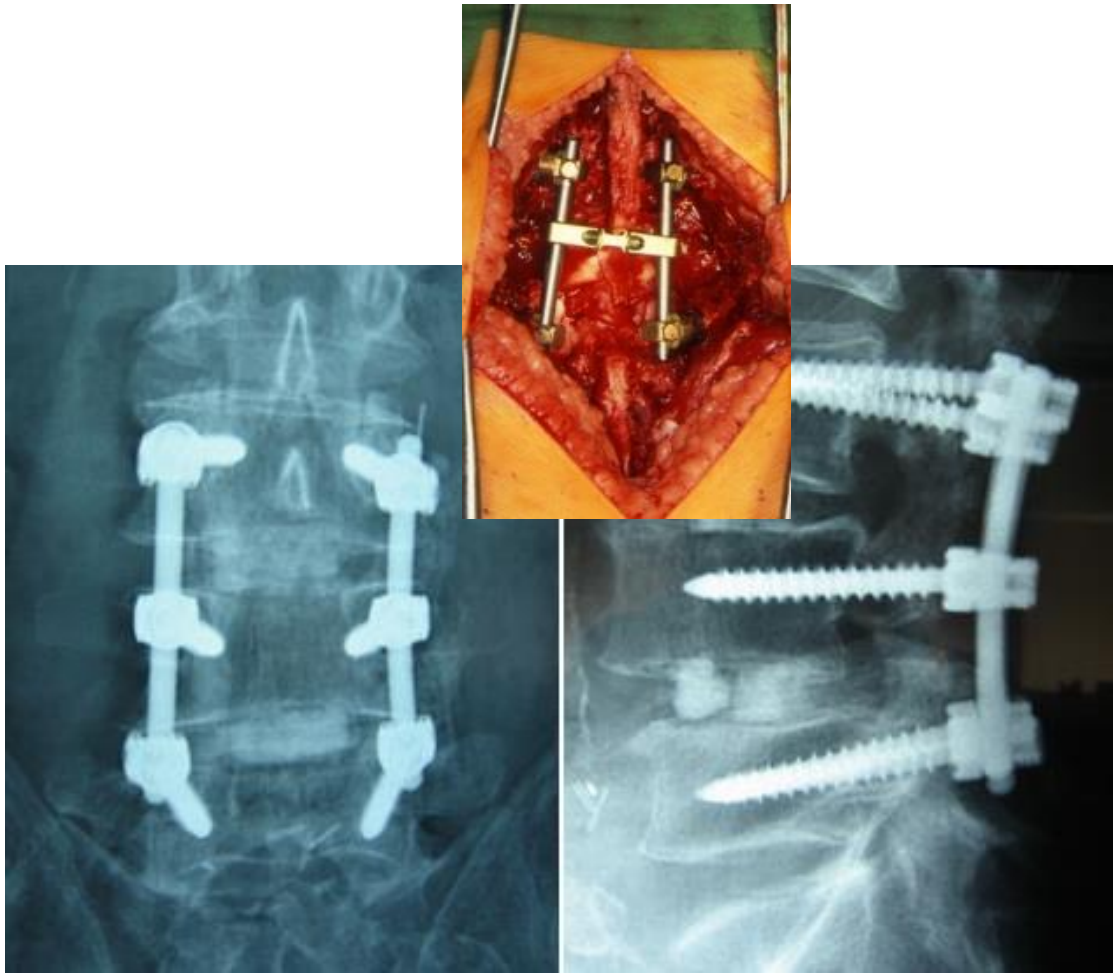
- Restitution of distance between vertebral bodies
- Alone and/or transpedicular srews
- Instant and long-standing stability





Instability – Transpedicular Screws (Rigid Fixation)

- Makes maximal decompression possible
- Prevents all types of instability
- Ablative (adjacent level syndrome)



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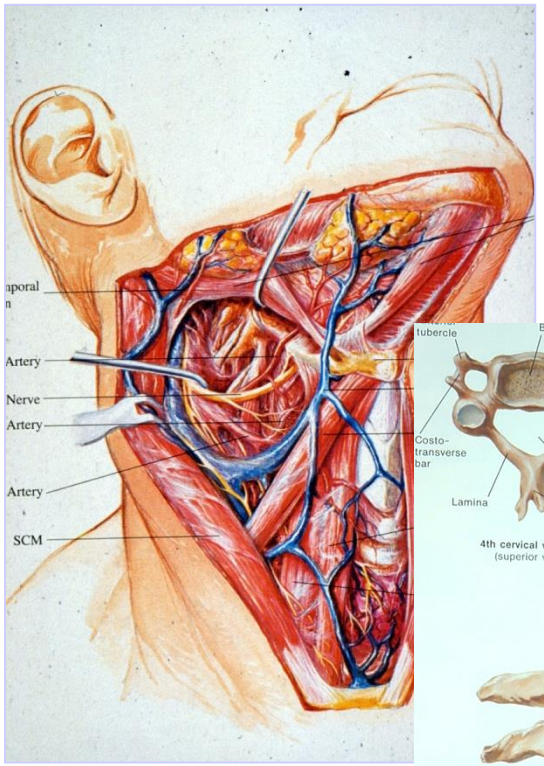
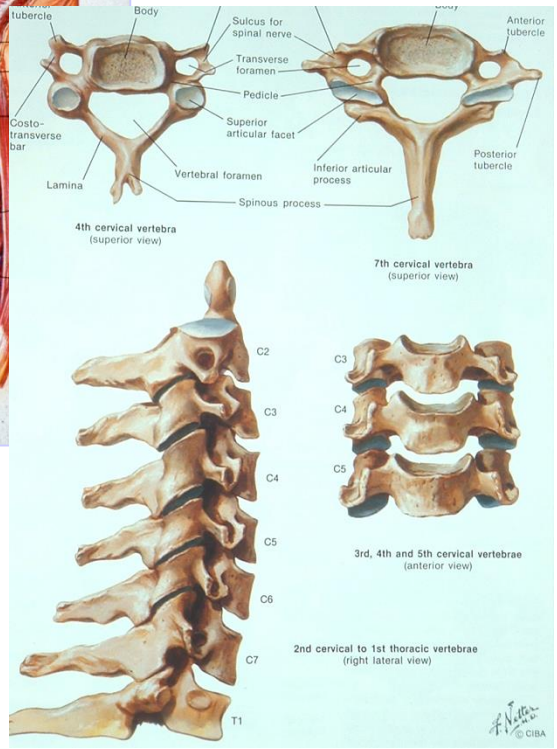


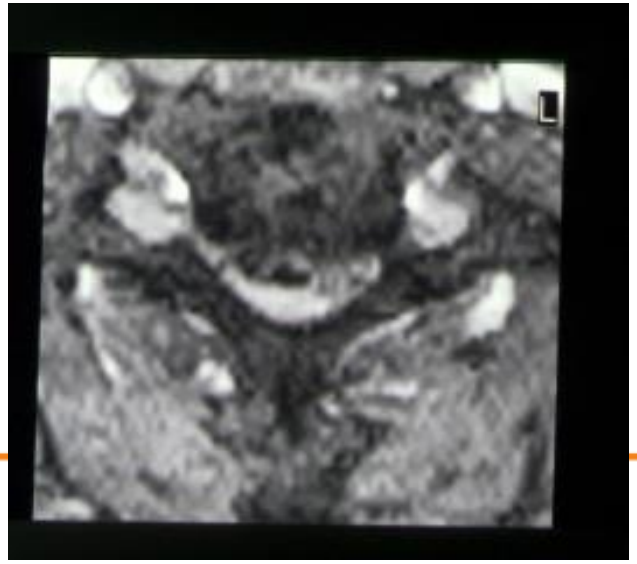


Degenerative Cervical Spine

- Myelopathy or radiculopathy
- Disc herniation, OPLL, Spondylosis

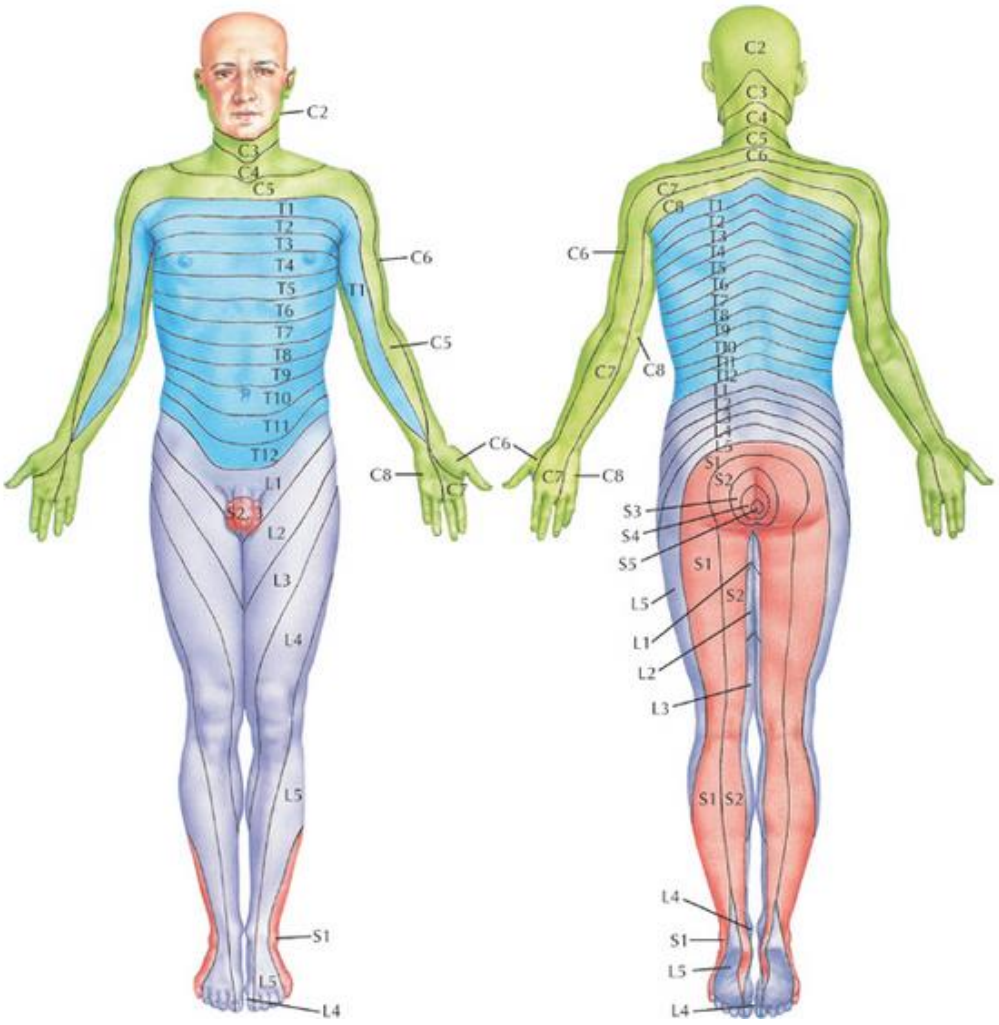
Aim of Surgery

- Decompression
- Stabilization
- Physiological curveture rewconstruction
- Minimal affection of movement

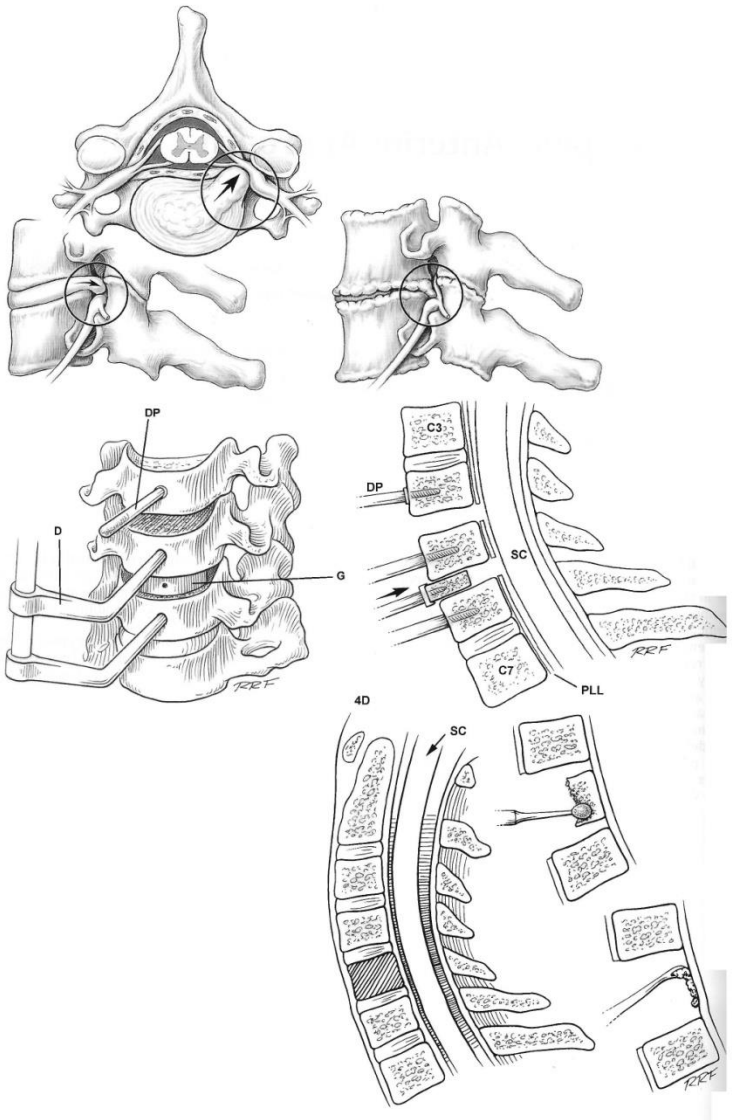


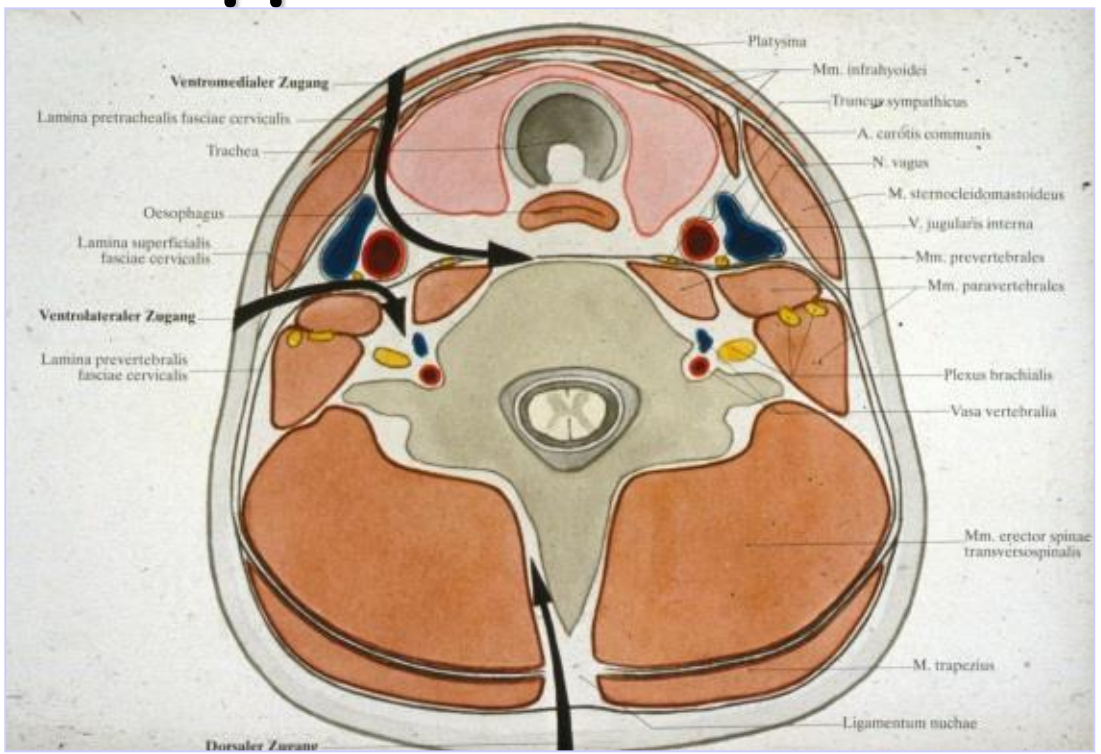
Radicular Symptoms – Cervical Spine

- C4: diaphragm
- C5: deltoid – arm abduction
- C6: biceps, extensor carpi radialis – elbow flexion, wrist extension
- C7: triceps – elbow extension
- C7-8: extensor digitorum – finger extension
- C8-Th1: flexor digitorum profundus – grasp



Anterior Approach

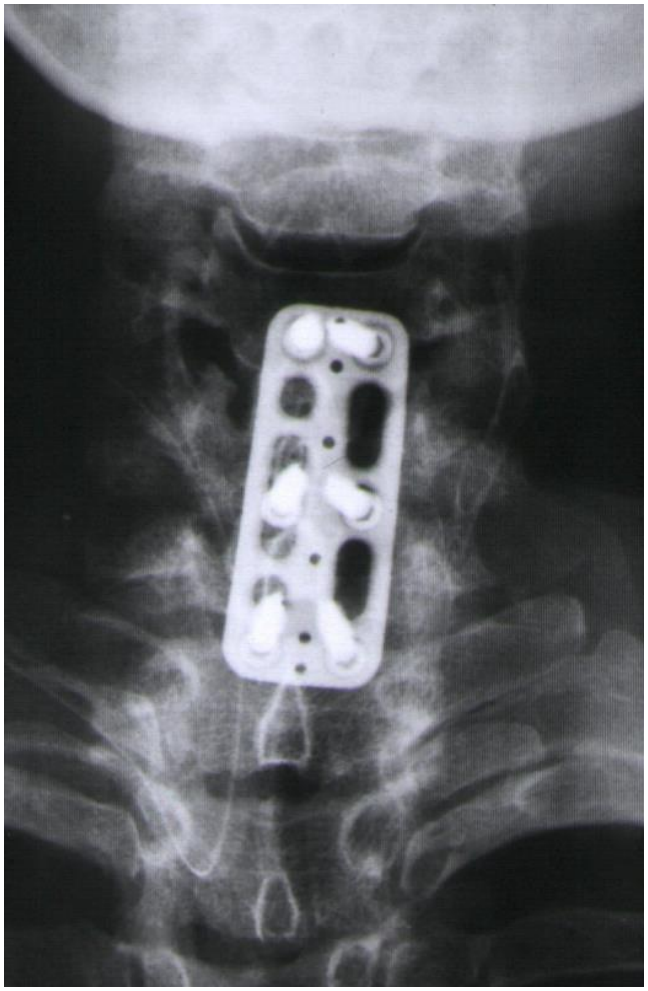




- Anterior cervical discectomy and fusion (ACDF) or prosthesis (TCDR)
- Corpectomy

Anterior Cervical Discectomy and Fusion

Anterior Cervical Discectomy and Fusion

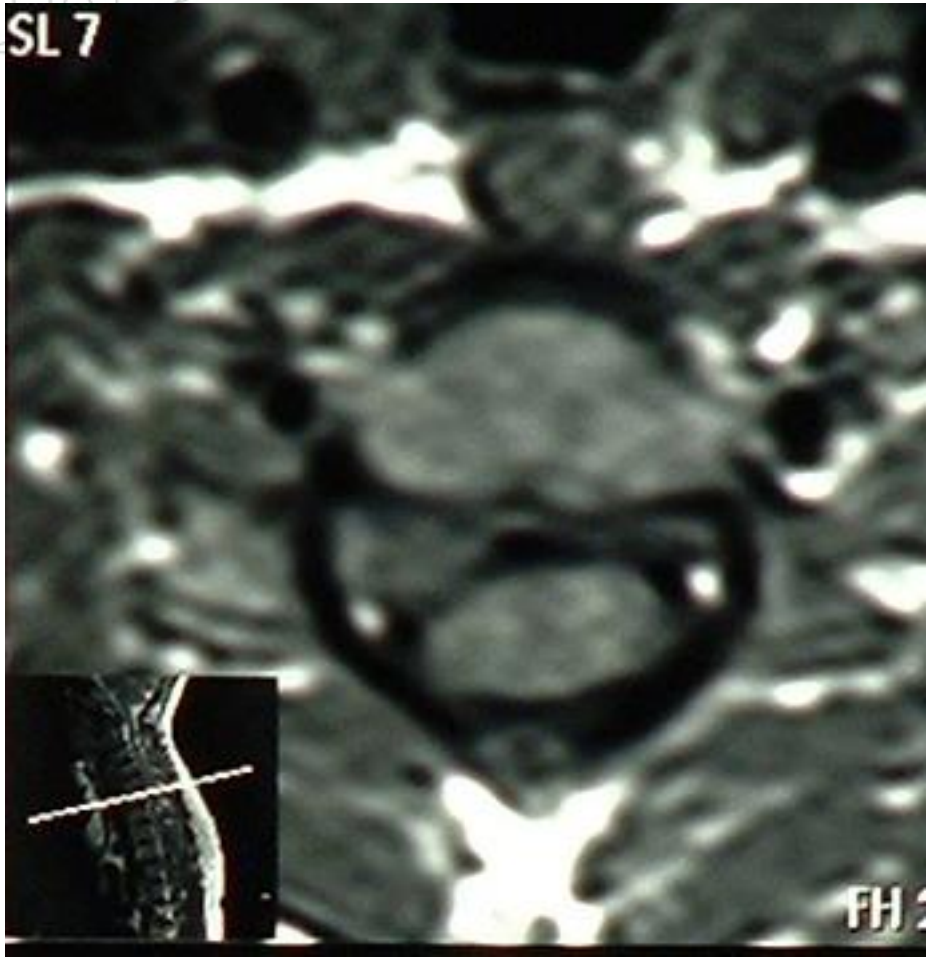


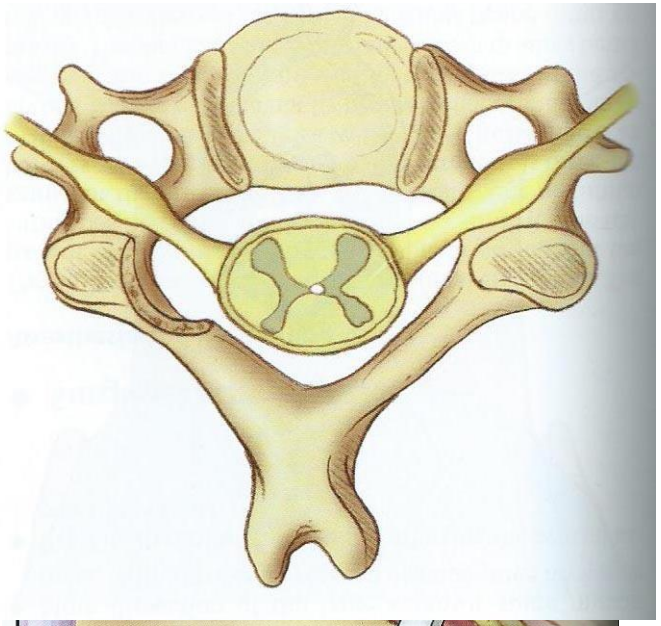
Total Cervical Disc Replacement (Prosthesis)

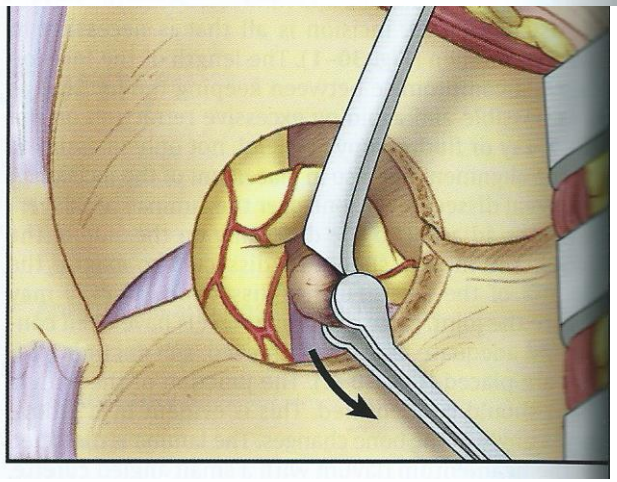
- Lafuente&Casey, 2003: 19% of the patients underwent ACDF requered second operation due to adjacent disc disease (100 cases, 1-15 yrs follow-up)
- Aim is to preserve motion function
- Contraindications:
  - kyphosis
  - facet joint arthrosis
  - immobility
  - ligamentous injury, subluxation
  - osteoporosis
  - inflammation
  - low compliance

Total Cervical Disc Replacement (Prosthesis)

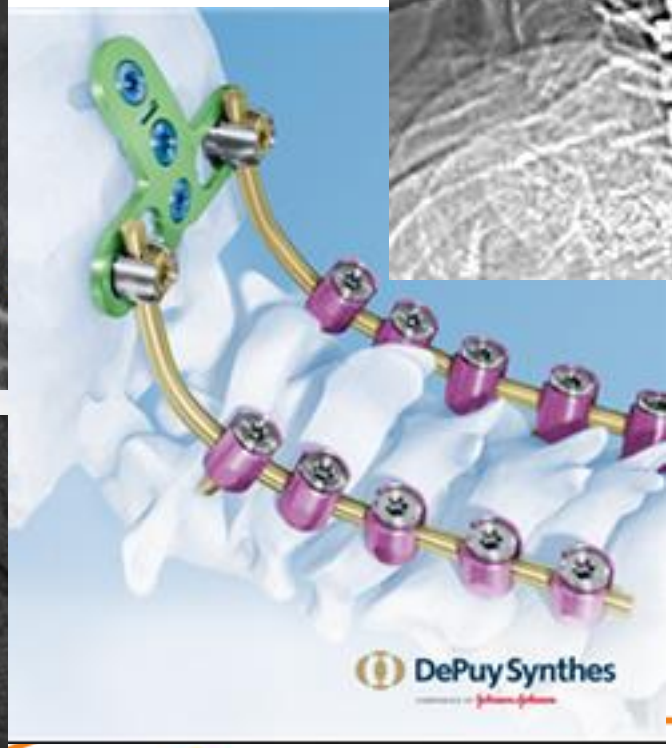
Posterior Approach (Foraminotomy)

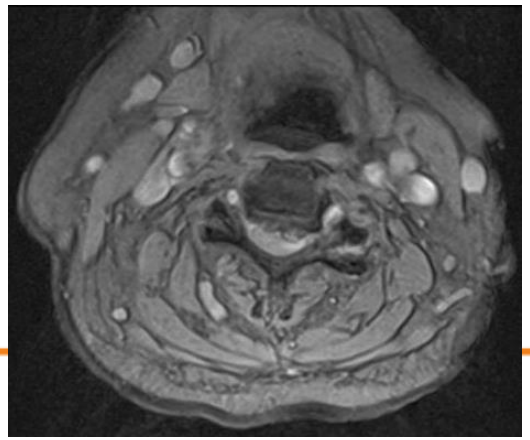


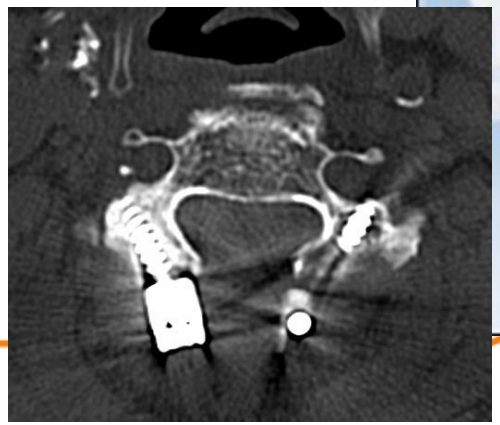




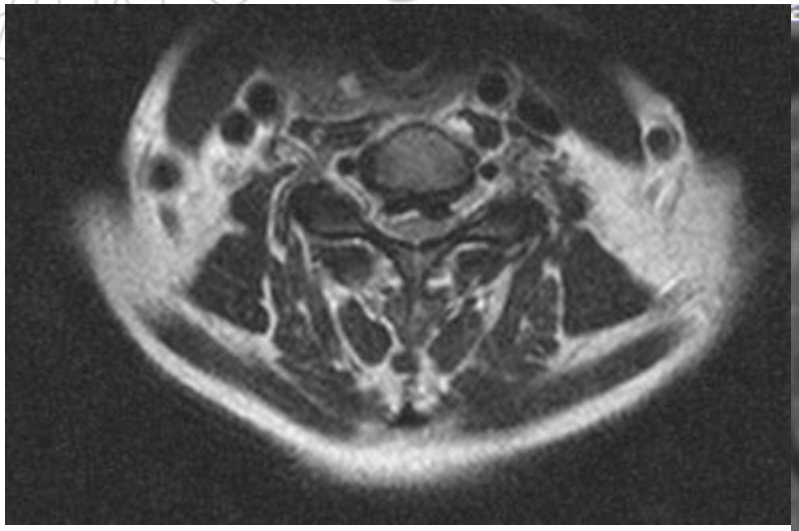
Posterior Approach (Laminectomy+Fixation)

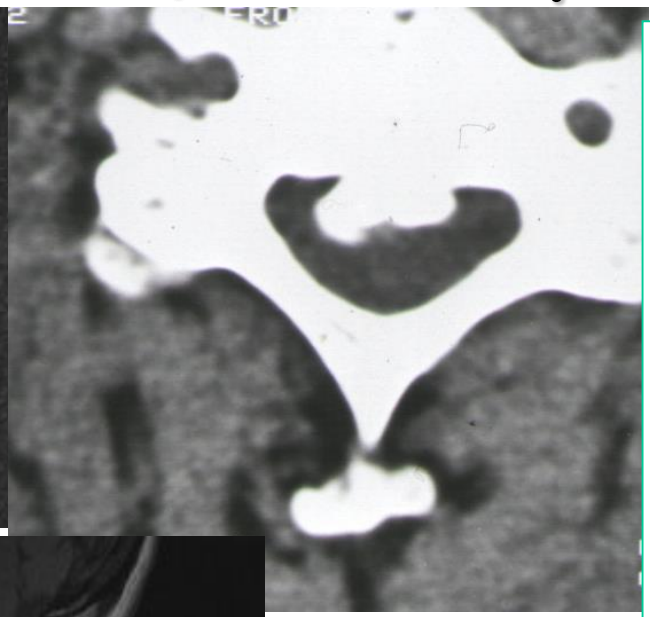






Ossification of Posterior Longitudinal Ligament (OPLL): Laminoplasty





Major Topics

- Basic principles
- Radiology
- Degenerative lumbal spine
- Degenerative cervical spine
- Degenerative thoracic spine
- Craniocervical instability (rheumatoid arthritis, ankylosing spondylitis)
- Osteoporosis

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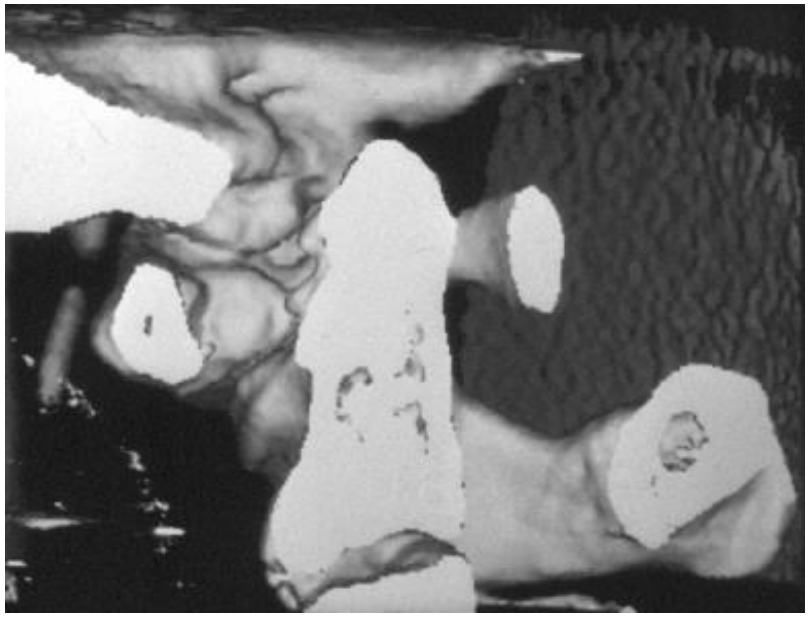
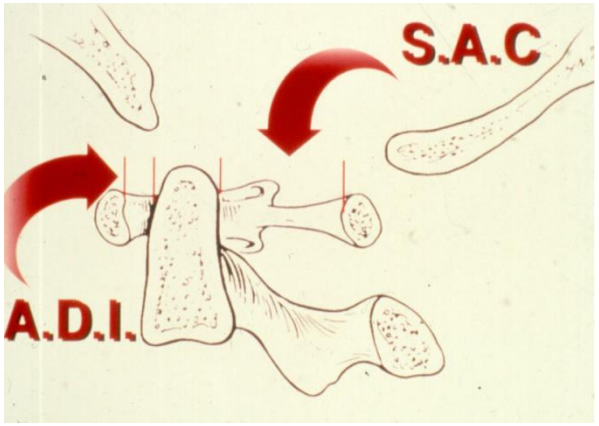
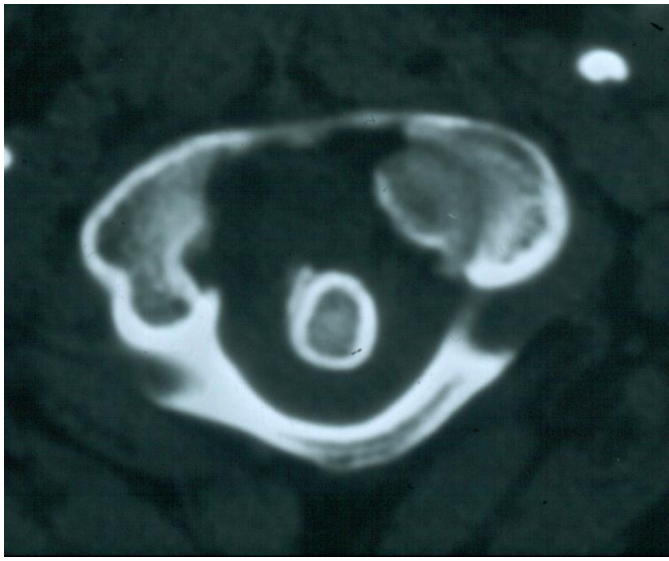


Rheumatoid Arthritis

- Prevalence: 0.8%
- Spine is affected in 5-80%
- Neurologic symptoms in 15%

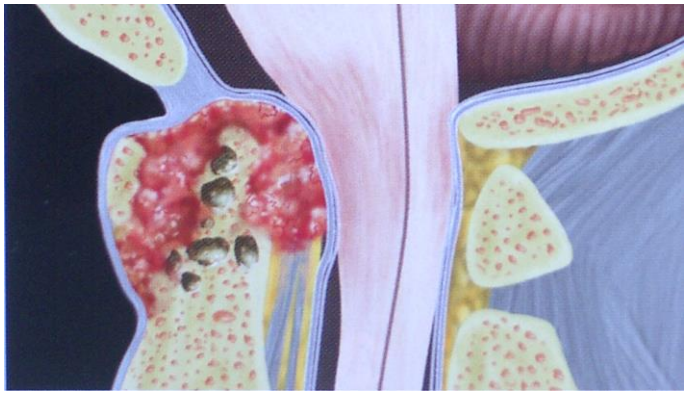


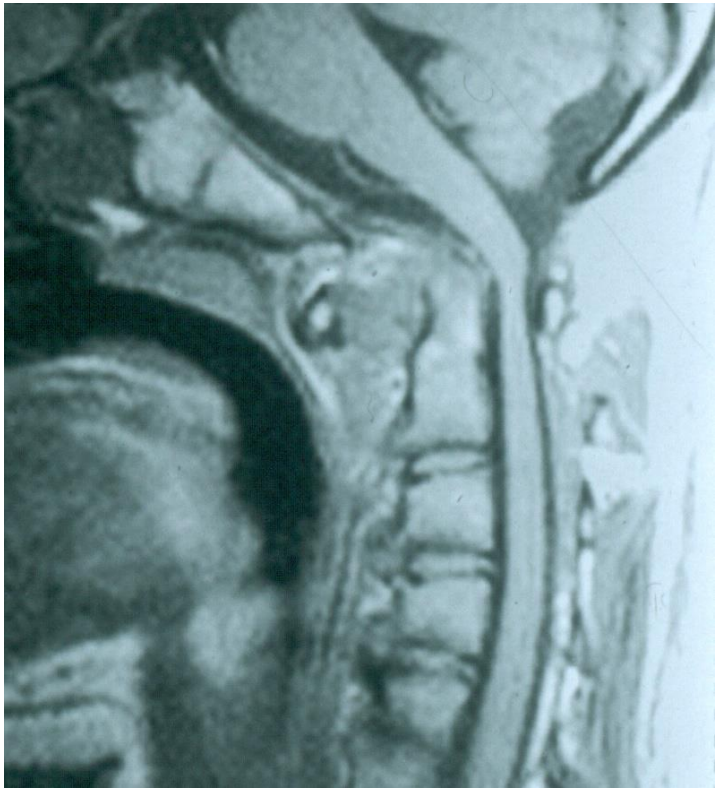
- Atlanto-axial synovitis
  - Elongation and rupture of ligaments
  - Instability
  - Pannus
  - Vertical translocation
  - Myelopathy



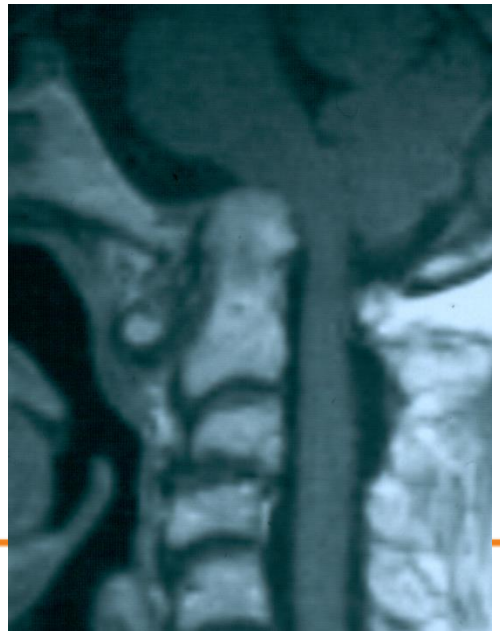
Rheumatoid Arthritis

- Pannus



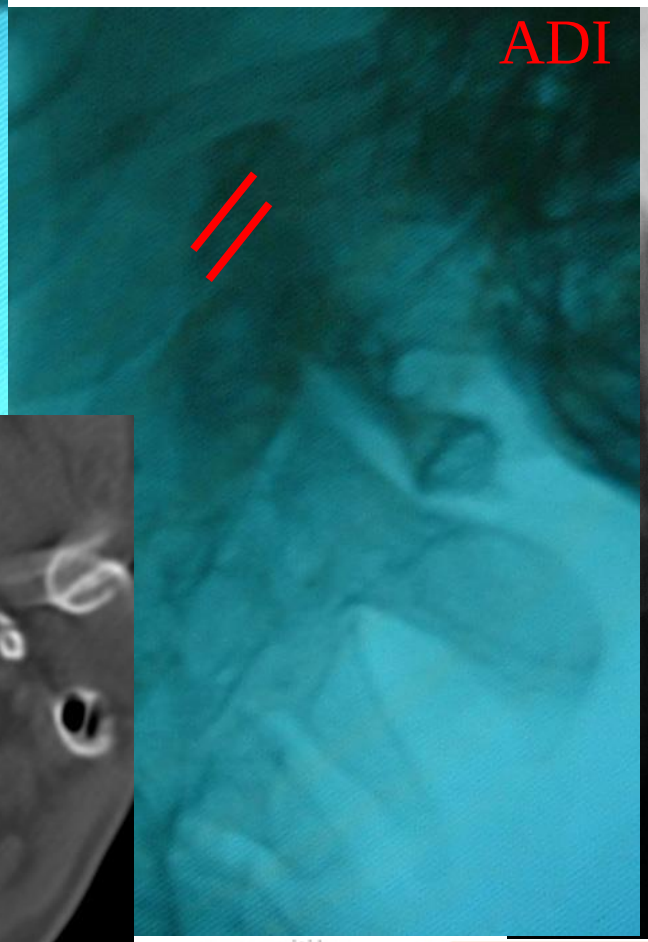


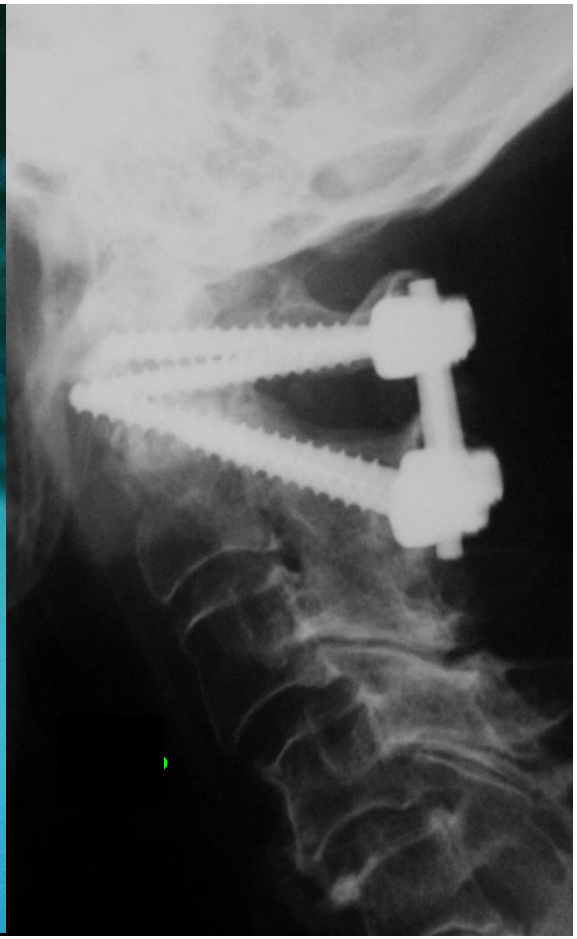
- Vertical translocation

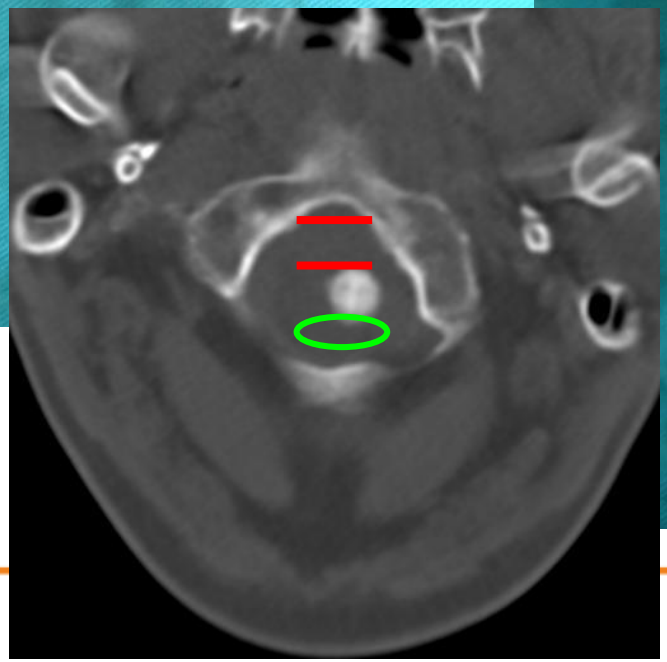


Rheumatoid Arthritis – Surgical Options 1.

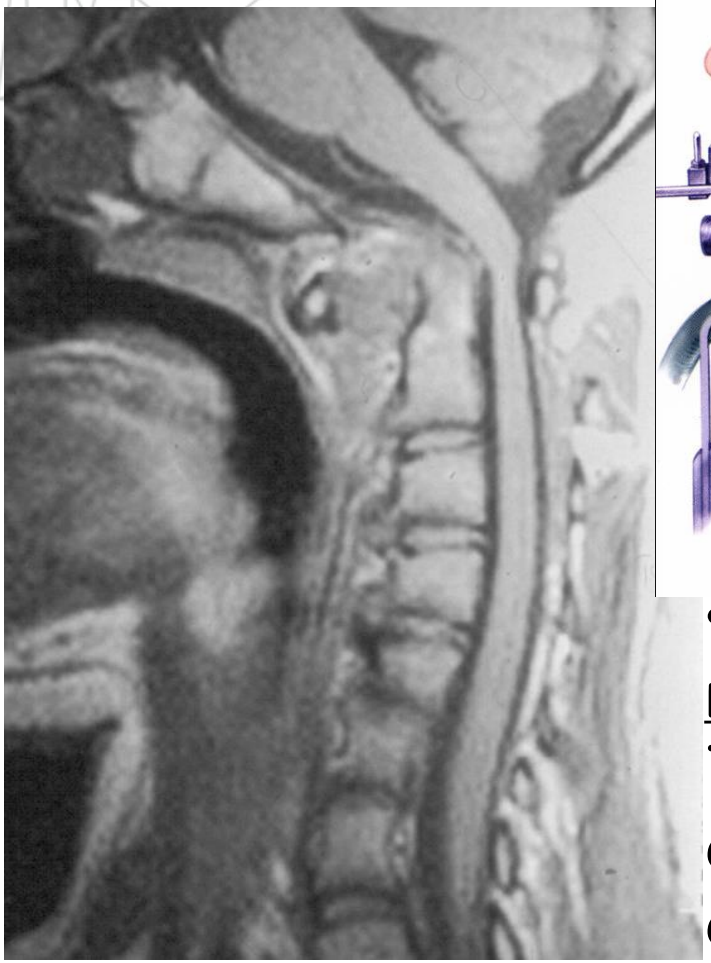
- Reponable: dorsal fixation
(Goel-Harms C1-2 lateral mass screw)

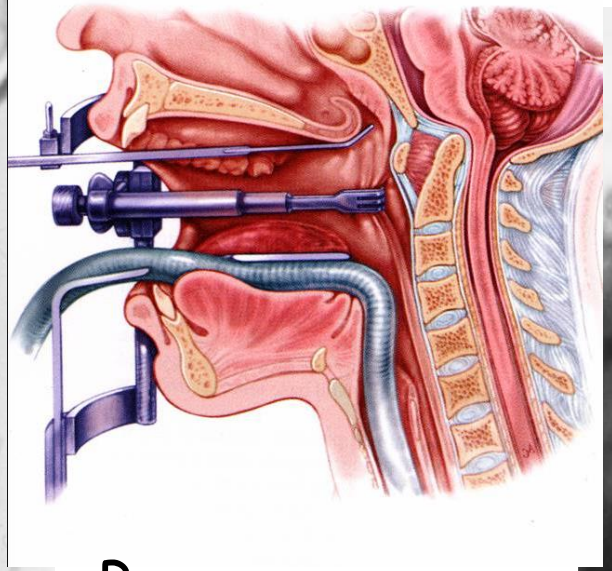






Rheumatoid Arthritis – Surgical Options 2.





- <u>Pannus+non-reponable:</u> Transoral decompression + dorsal fixation

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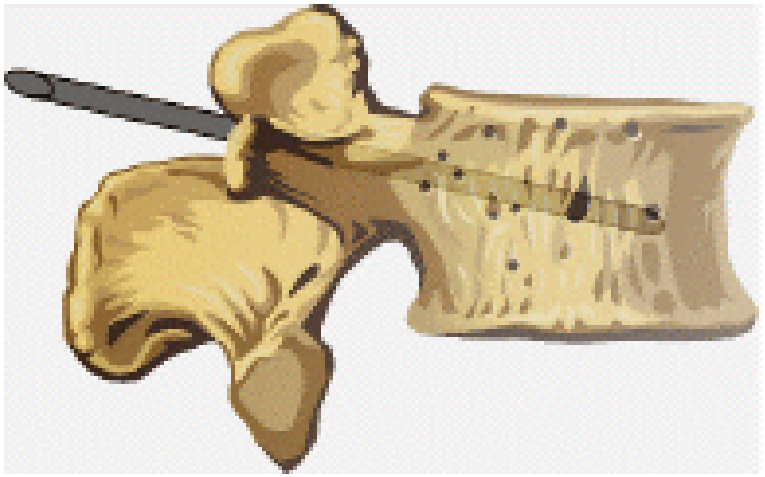
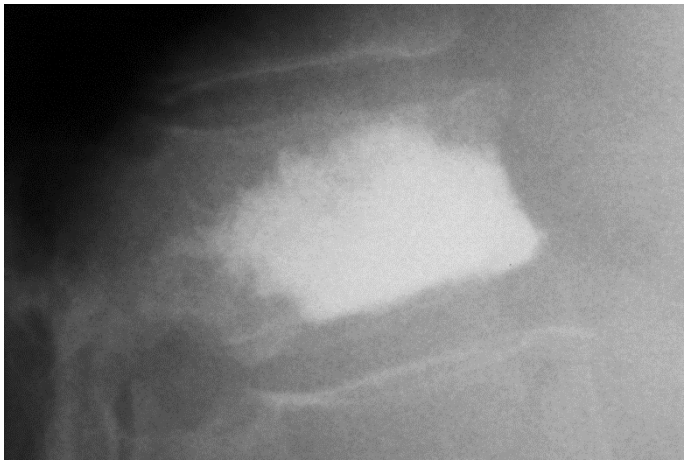
Osteoporosis – Compression Fracture

- Prevalence: demonstrated in 26% of females >50 years
- Incidence: 700,000/y in USA, 30,000/y in Hungary

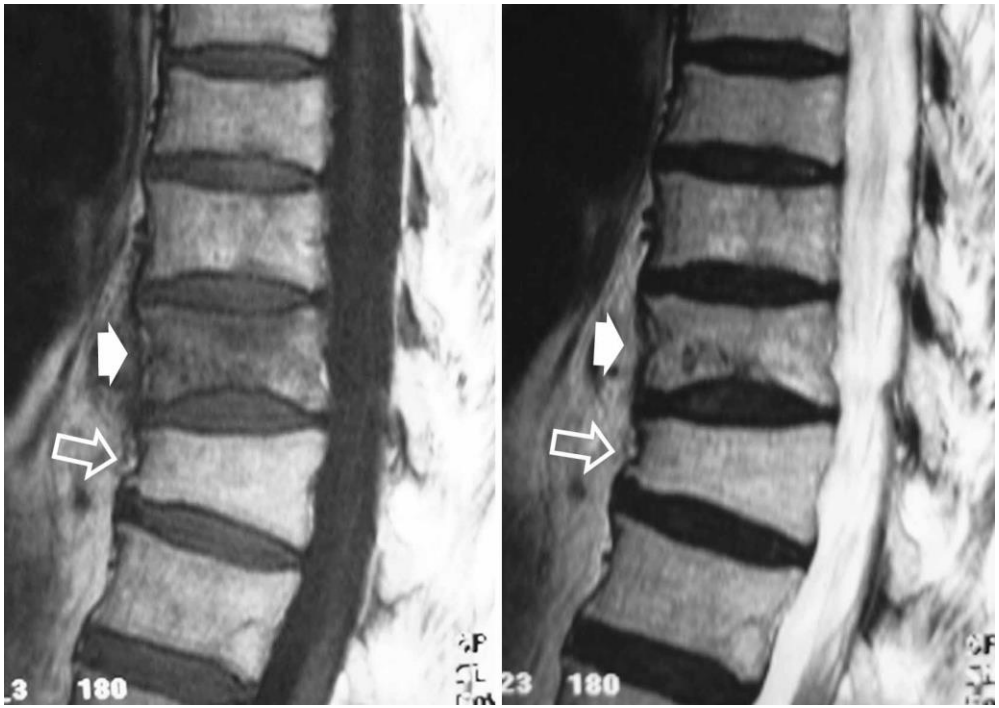
- Treatment:
  - conservative: bed rest, analgetics, rehabilitation
  - percutaneous vertebroplasty (PVP)
  - surgery is rarely indicated (only if neurological deficit or instability)





Osteoporosis – Compression Fracture

- PVP
  - 90% pain release
  - 1-3% complication rate



Thank You for Attention