Understanding back pain

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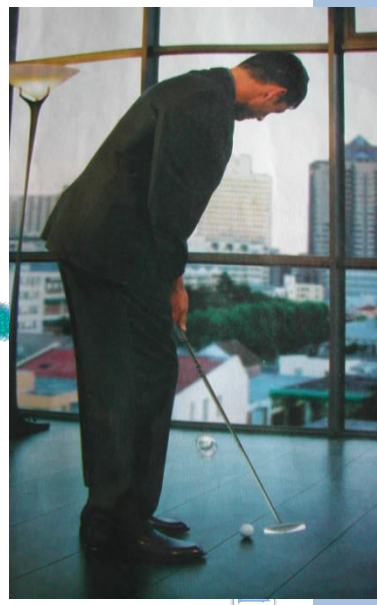
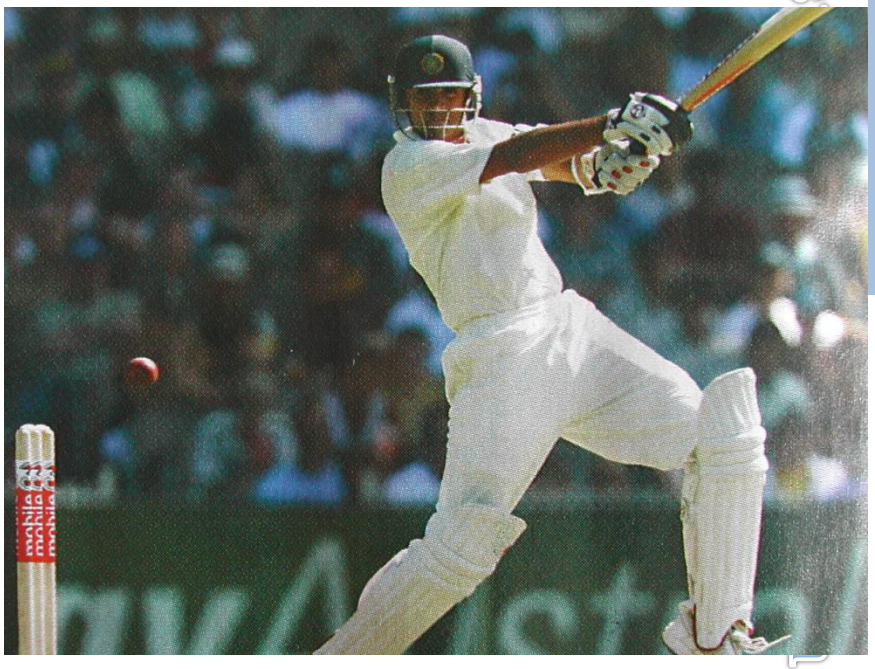



FAIR PLAY: Vajpayee kicks off
the National Football League



An overview

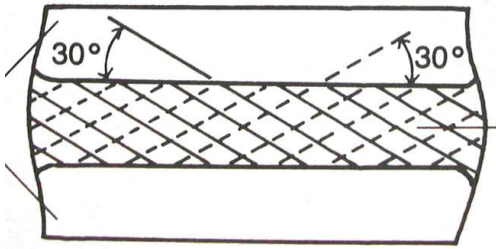
- Back pain generators
- Common pathologies causing back pain
- Bio-mechanical considerations
- Principles of investigation
- Principles of treatment

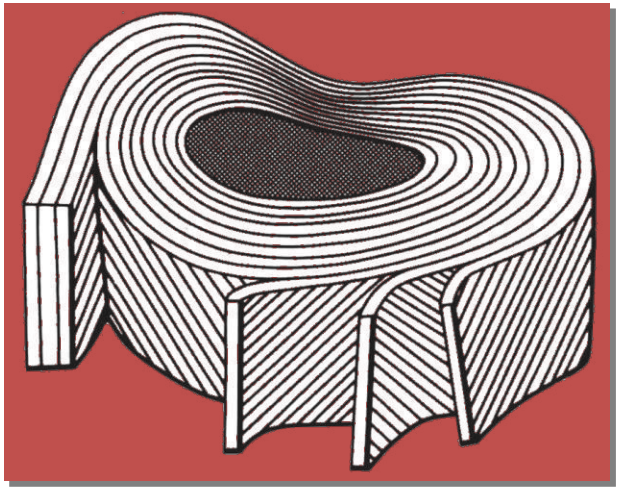
Functions of the disc

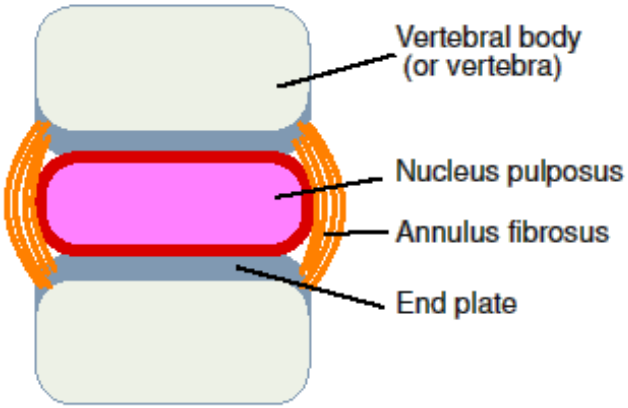
Load transmision

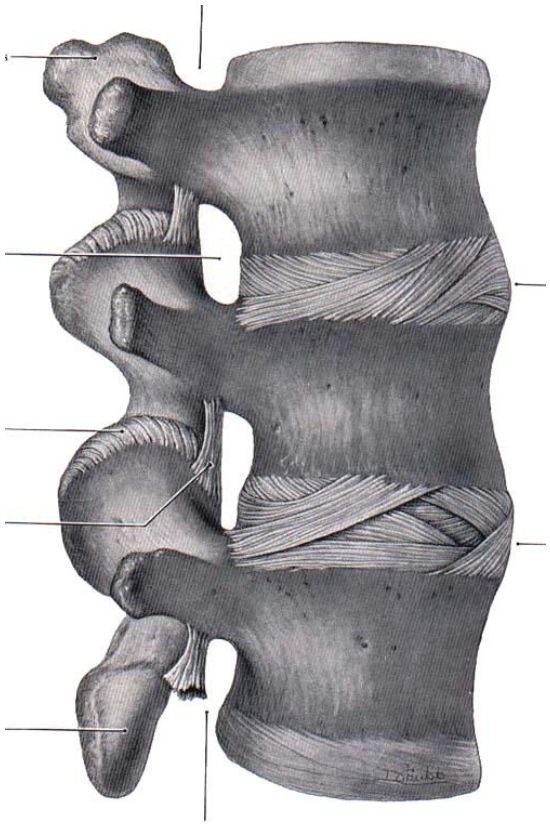
Motion

Inter-vertebral disc





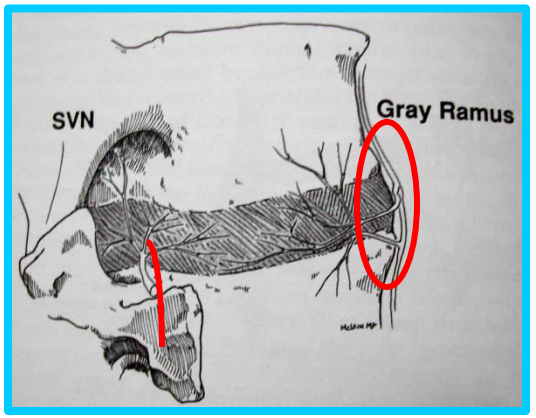


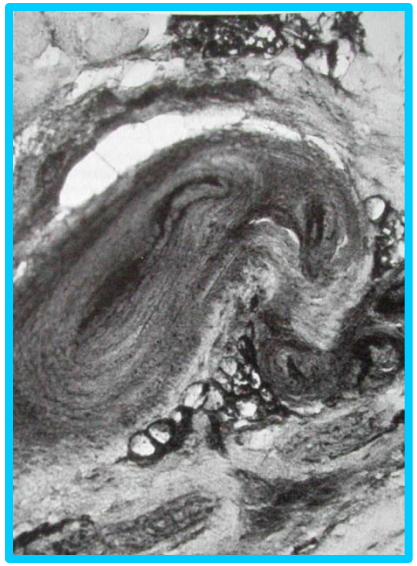


Understanding back pain

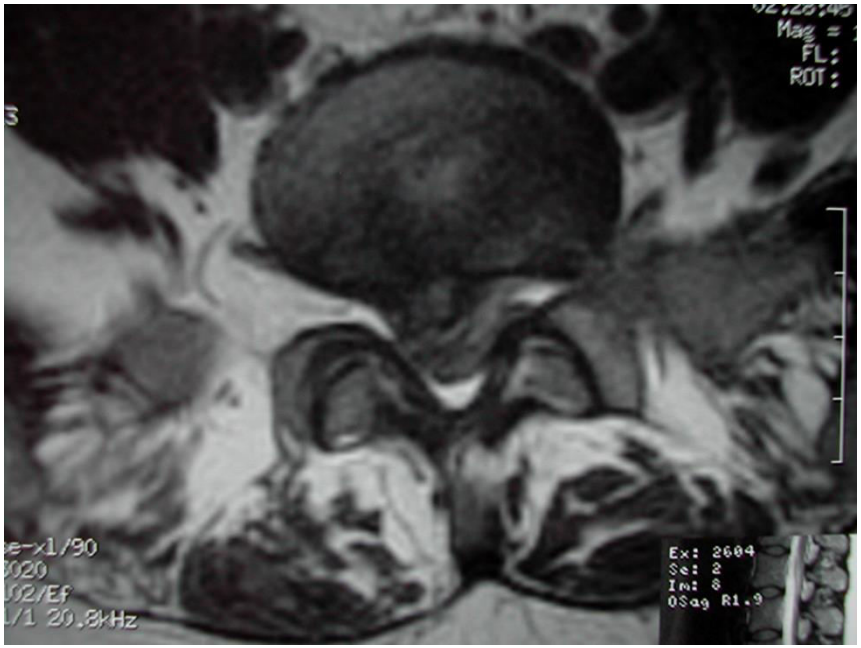
Disc innervation

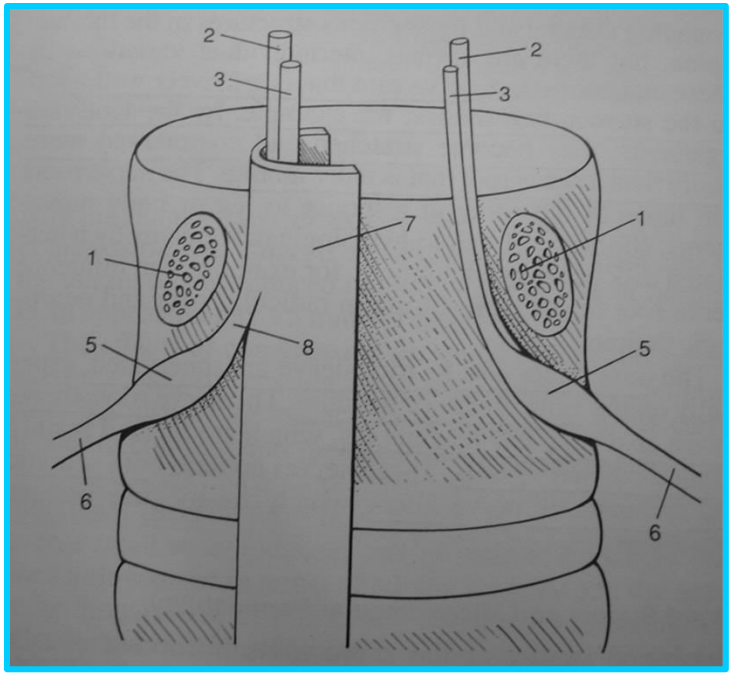
- **Anterior:**
  - Grey ramus
  - Ant + lat annulus, periosteum
- **Posterior:**
  - SVN re-enters canal
  - Post ann, PLL, dura, root sheath
- **Types of pain receptors:**
  - Nociceptors Aδ, C
  - Encapsulated mechanoceptors
  - Vibration sensitive





Back pain and leg pain





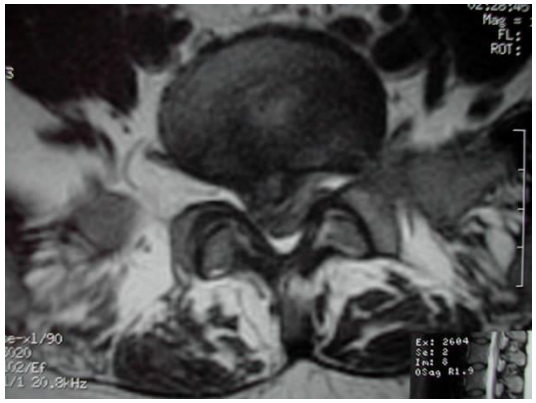
Understanding back pain

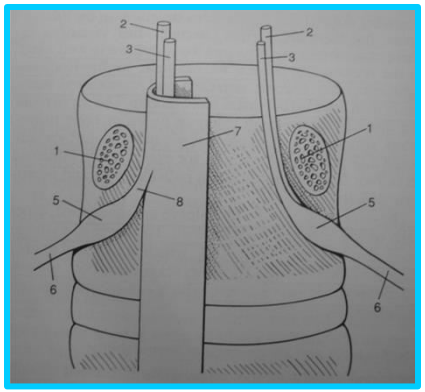
Mechanisms for sciatica

- **Mechanical effects on roots:**
  compression, stretching, distortion

- **Chemical effects:**
  Inflammation, congestion

- **Peri-radicular edema, fibrosis, demyelination**





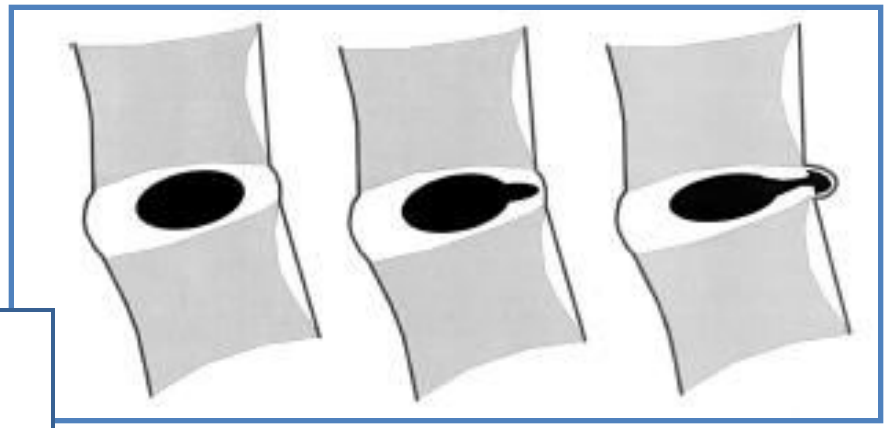
Common pathologies

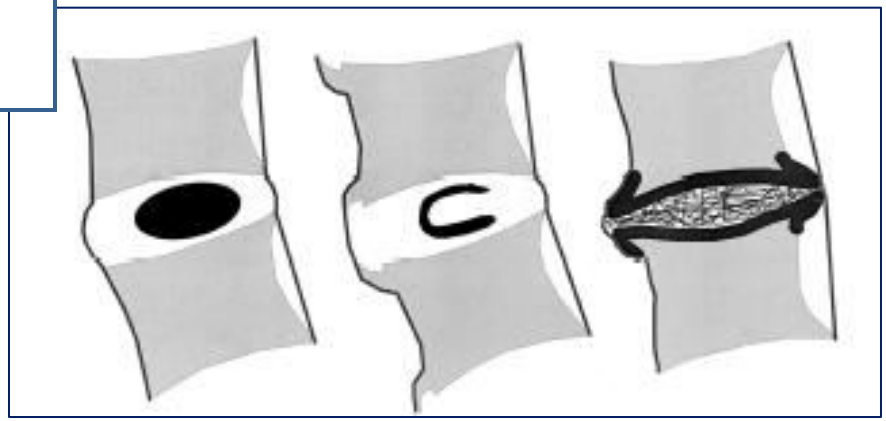
- Degenerative disc disease
- Lumbar canal stenosis
- Spondylolysis; Spondylolisthesis
- Myofascitis; osteoporosis
- Tumours; trauma and infections

Degenerative disc disease

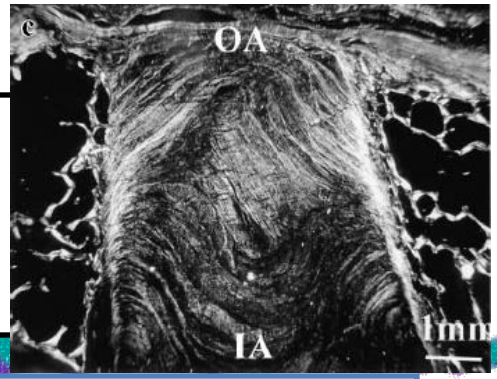
Spectrum of disc pathology

- **Disc prolapse**
- **Disc degeneration**

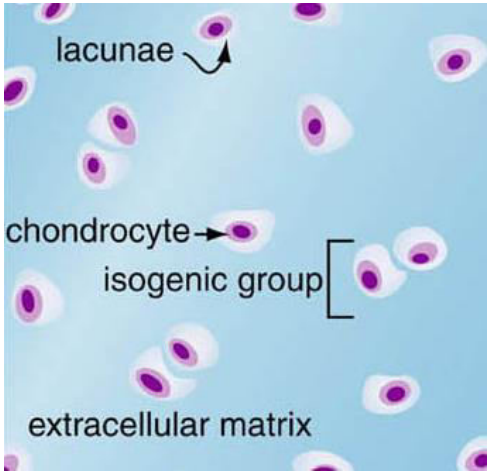


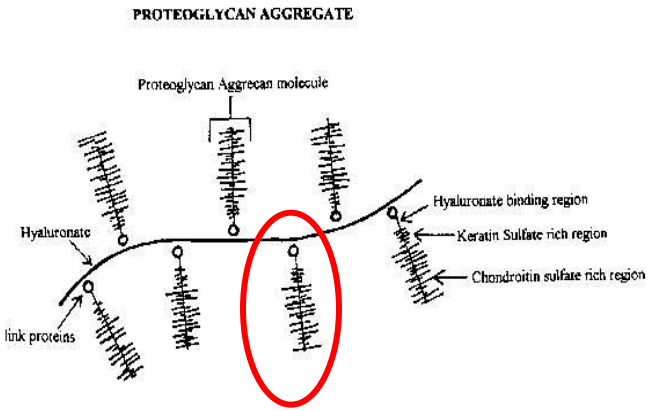


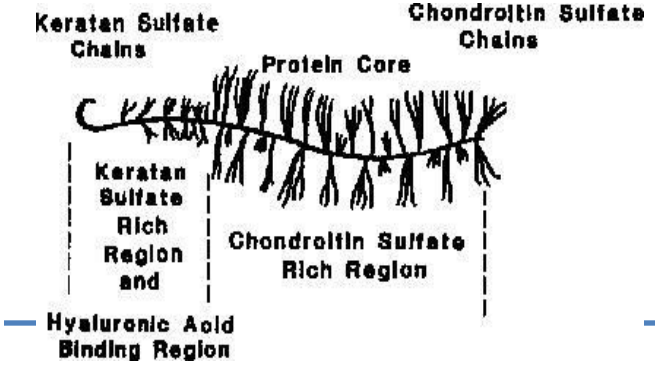
Disc histology

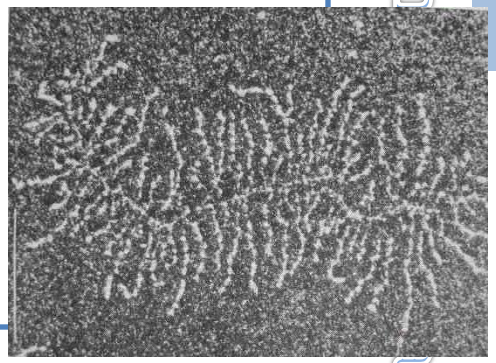


- **Collagen**
- **Proteoglycans**
- **Cells**



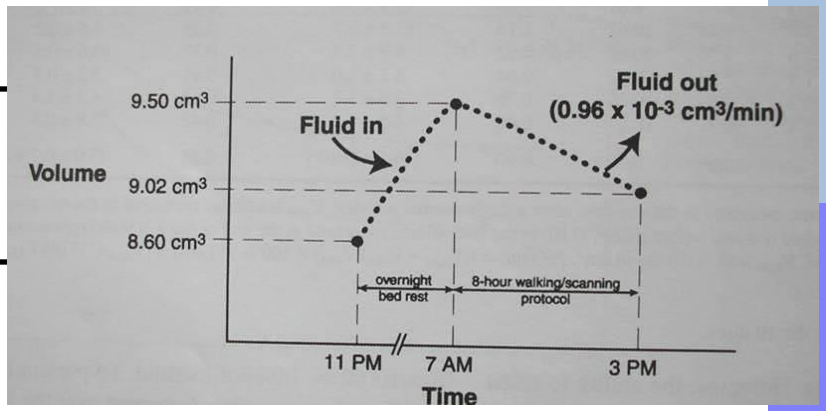


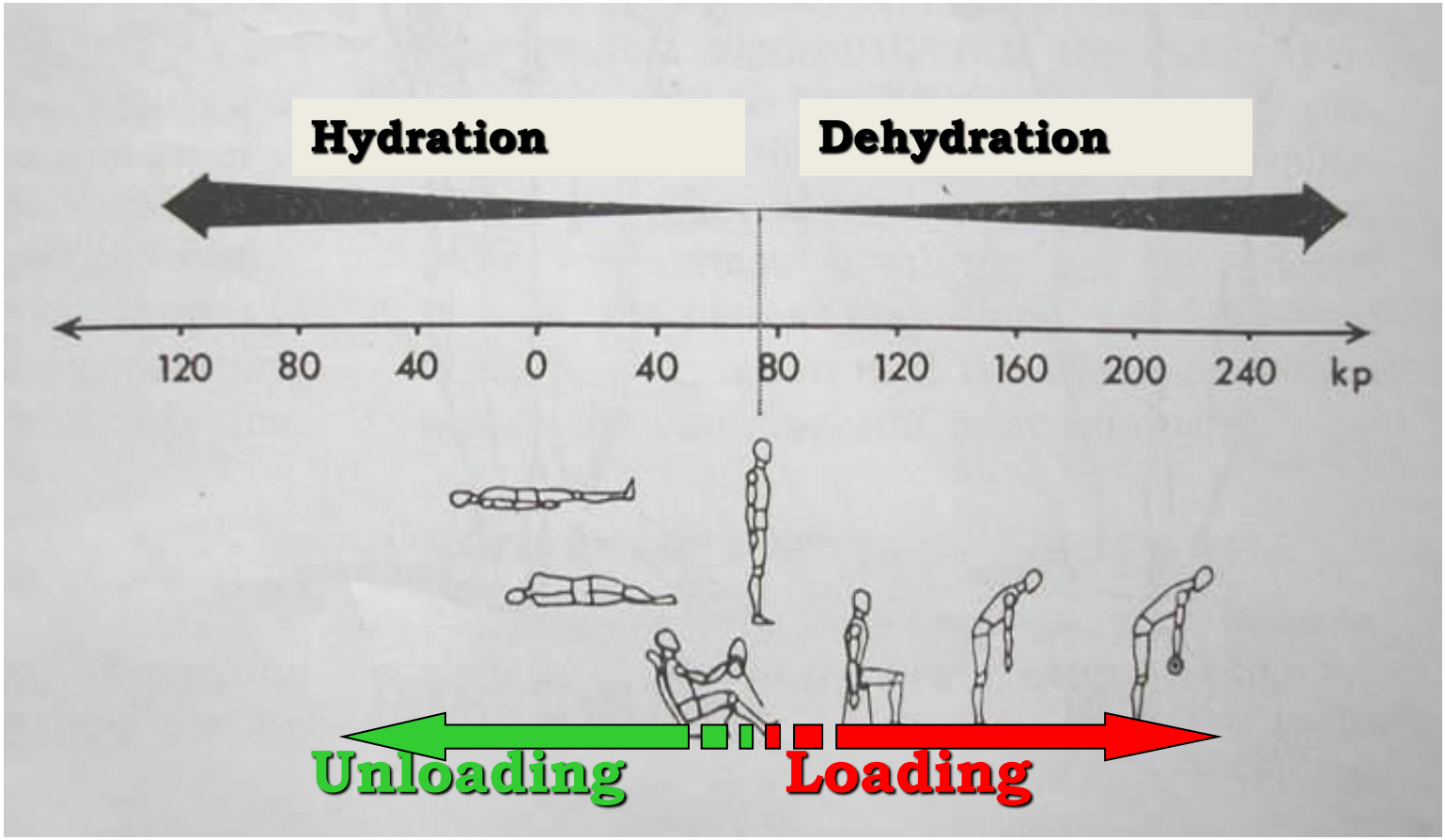




Understandin

Hydration cycle



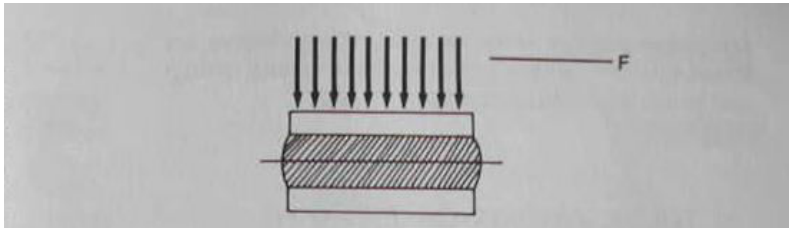


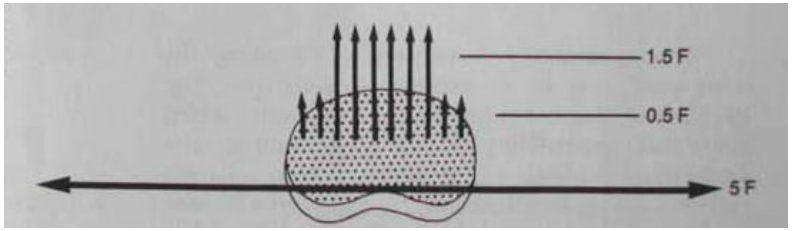
Understanding back pain

Biology reflects mechanics

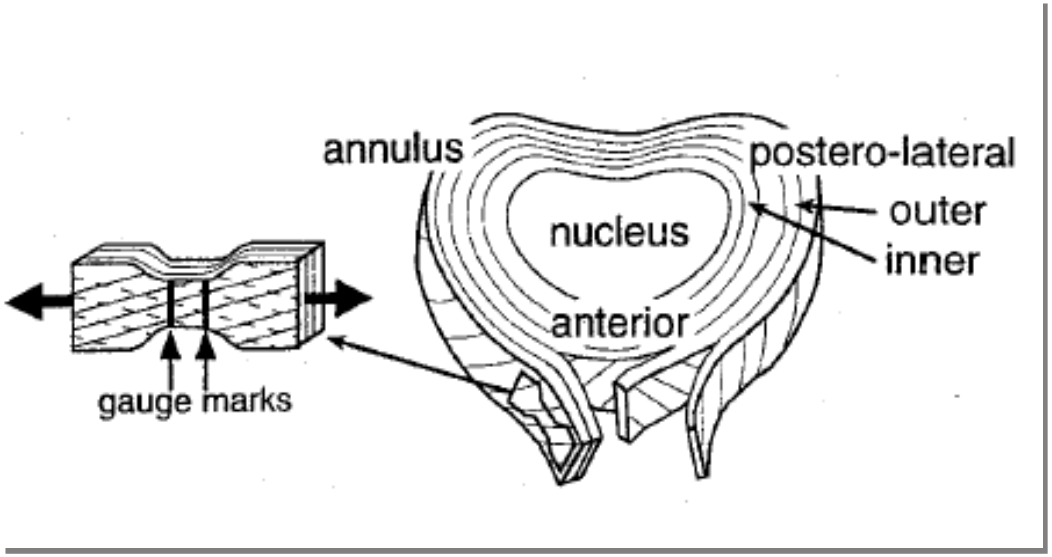
- **Nucleus Pulposus:**
  - **Water (70 – 80 %)**
  - **Shock absorber fluid filled bag**

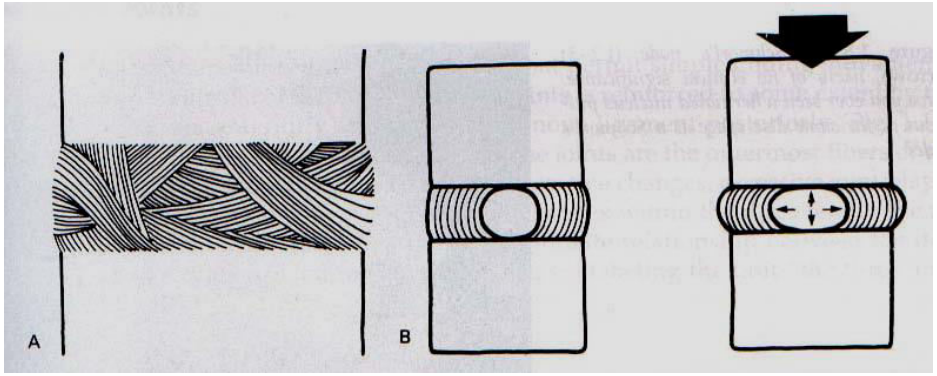
- **Annulus Fibrosus:**
  - **Well ordered collagen sheets**
  - **Load bearing (inflated tyre)**



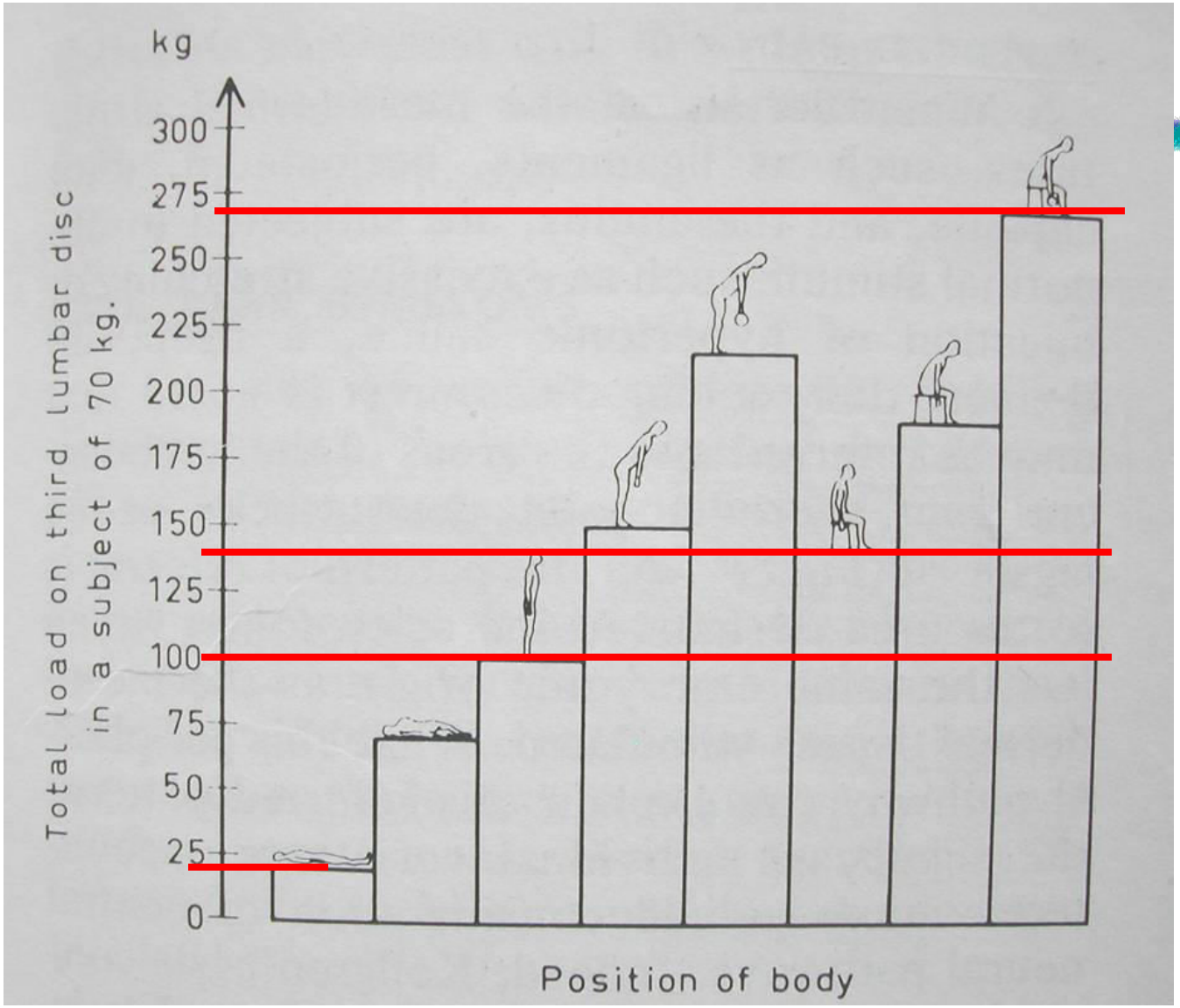


Hoop force dissipation system





Loads through a normal L3 disc



The beginning of the degeneration

- 2nd decade in men
- 3rd decade in women
- 40 yr: 80 % men
  65 % women

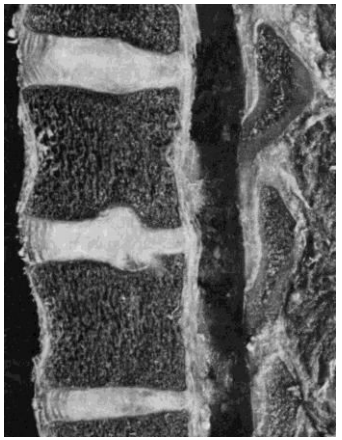
Why does the disc degenerate?

- Exaggeration of normal ageing
- Pathological loading
- Static loading more damaging !
- End plate damage is the trigger

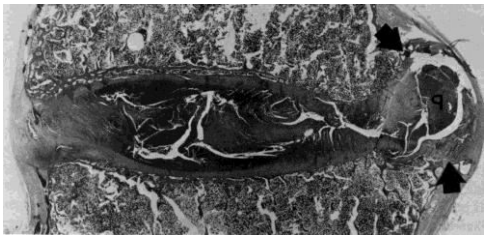
The degenerated disc

- **Mechanical**

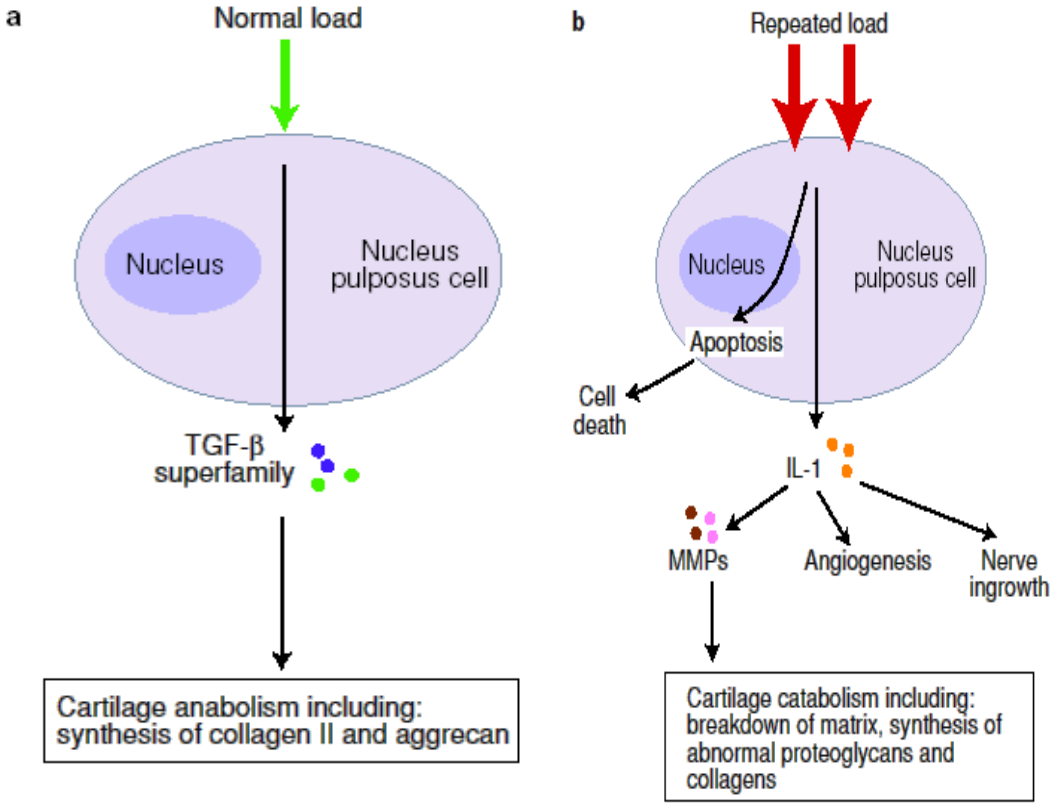
- **Biologic:**
  - **Largest avascular structure**
  - **Limited capacity for repair**



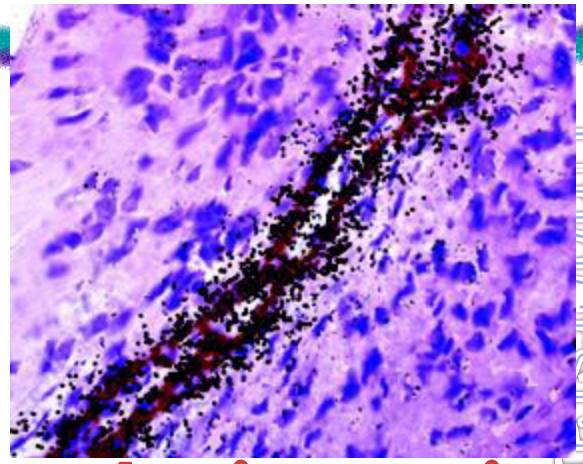
- **Bio-chemical**



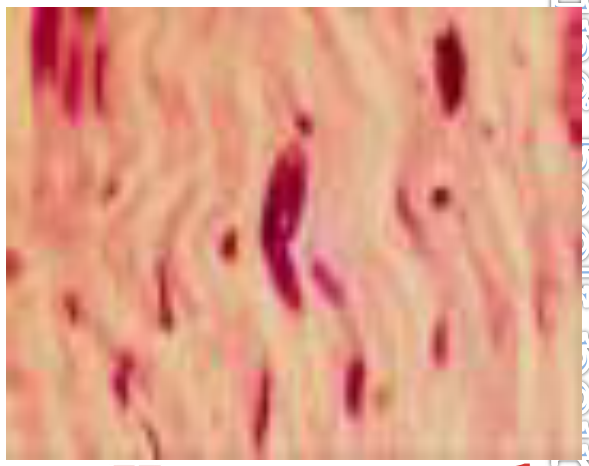
Effect of abnormal loads on cell metabolism



Cytokines

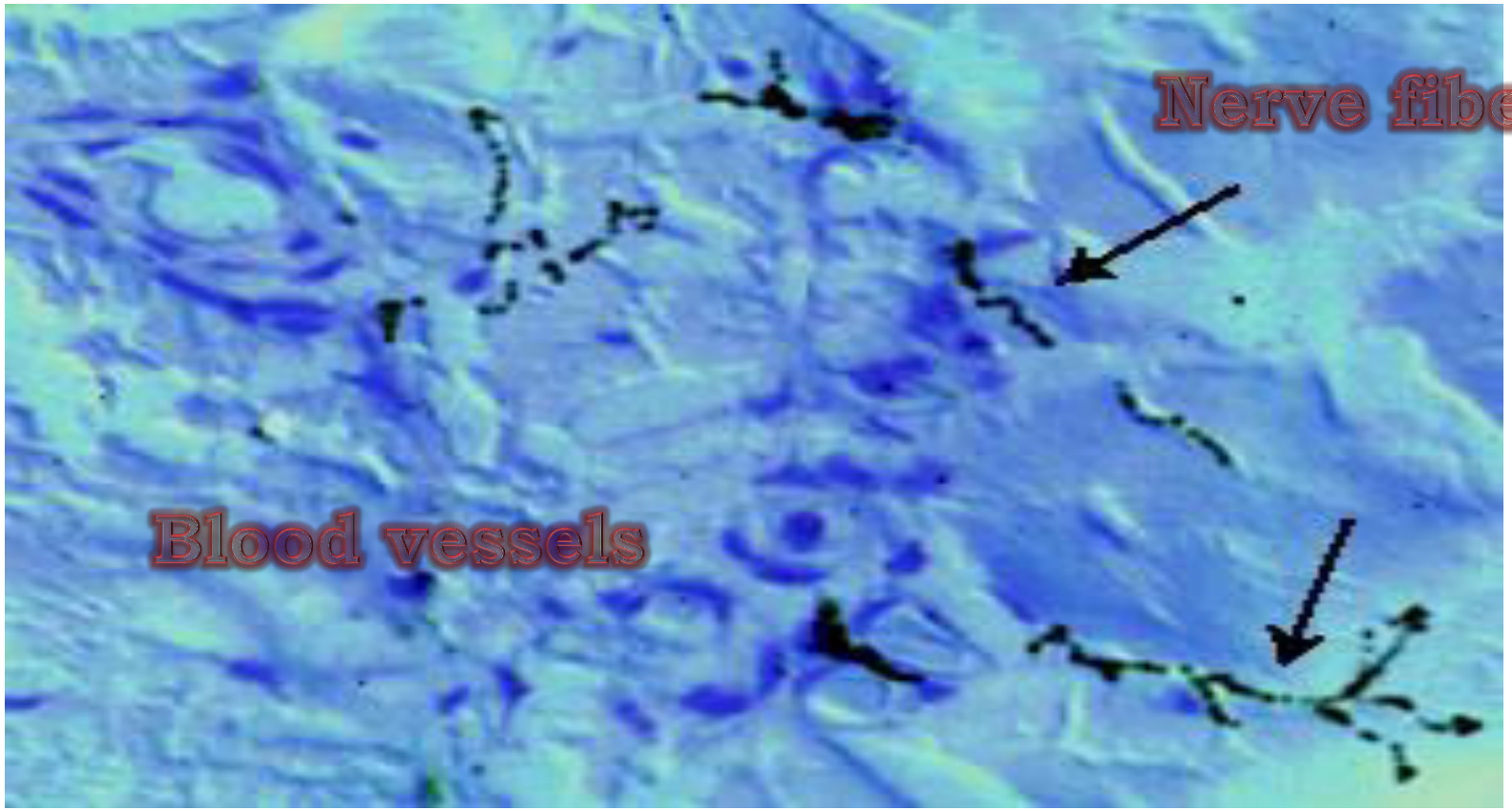


Angiogenesis



Nerve growth

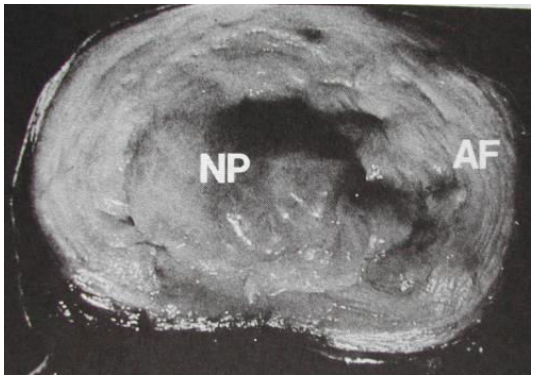
Cellular changes in degenerate discs

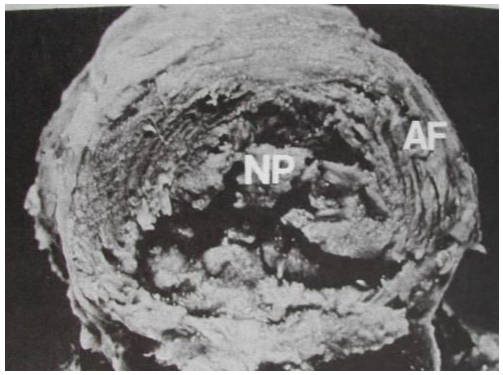


Biochemical changes

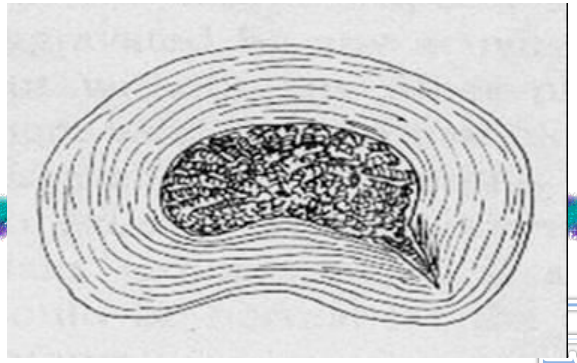
- **Proteoglycans:**
  - **Chondroitin sulphate synthesis is slower**
  - **↑ Keratan sulphate; ↓ size of the core**
  - **Loss of aggrecan**

- **Loss of water**

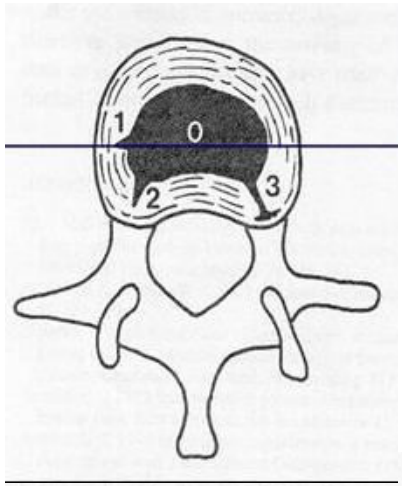


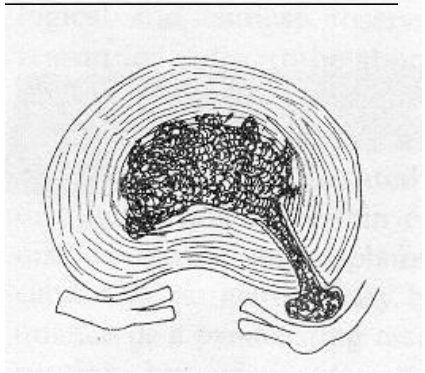


Internal disc disruption



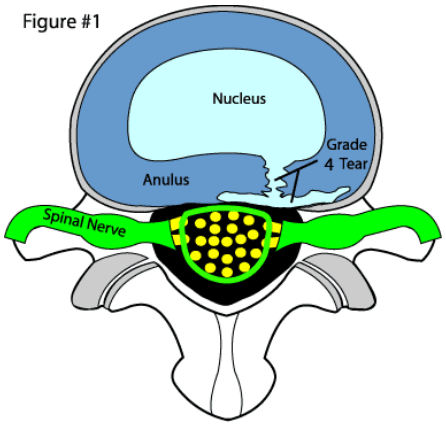
- ↓ nuclear hydrostatic pressure
- Buckling annular lamellae
- ↑ mobility; shear stress
- Fissures; de-lamination



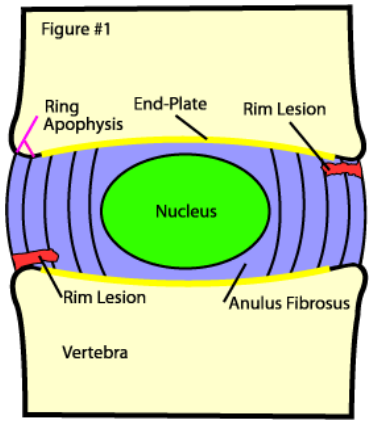


Annular tears

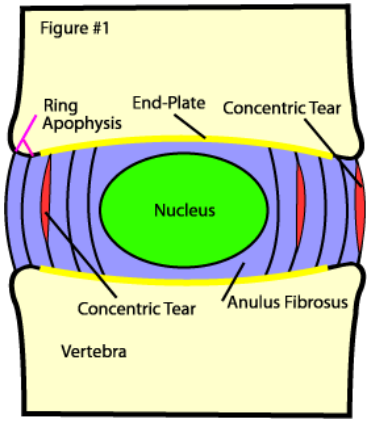
Radial tears



Rim tears

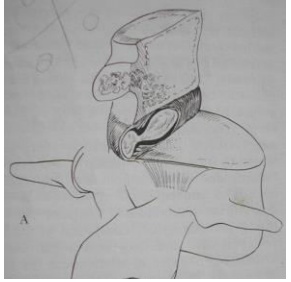


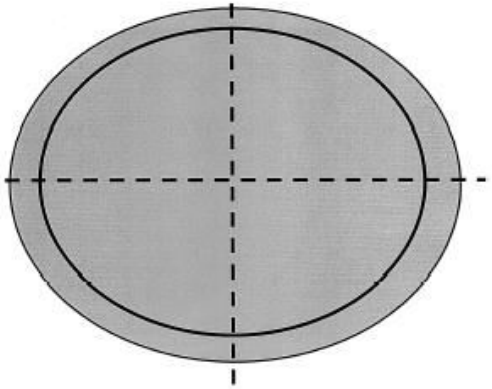
Concentric tears



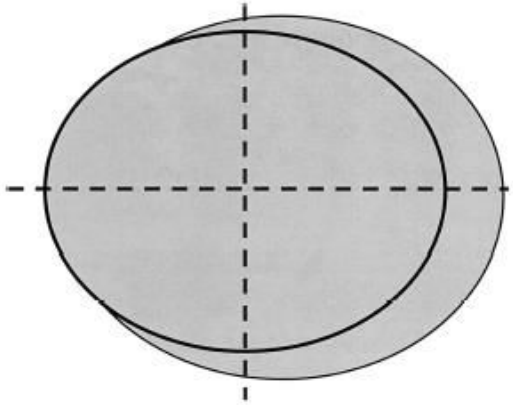
Understanding back pain

Disc bulges

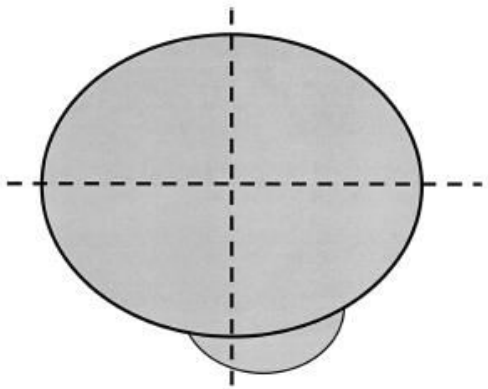




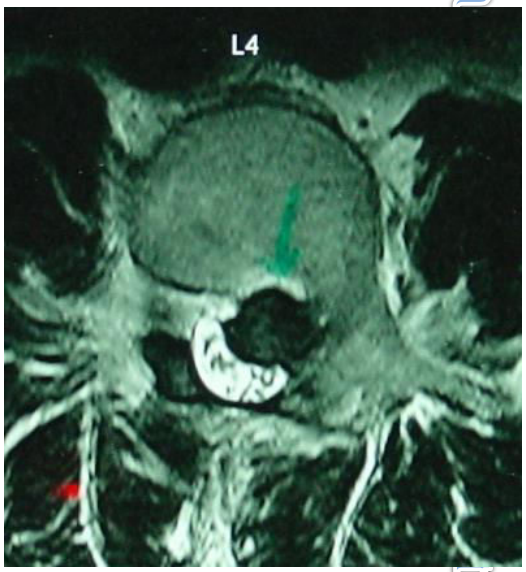
"Symmetrical Bulging Disc"



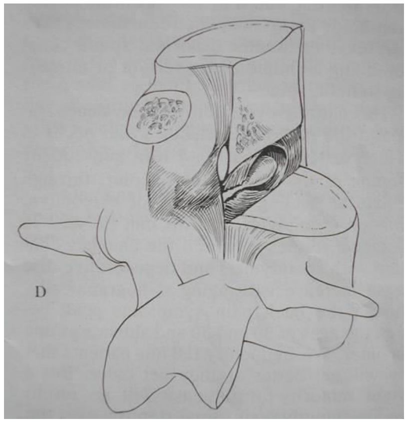
"Asymmetrical Bulging Disc"

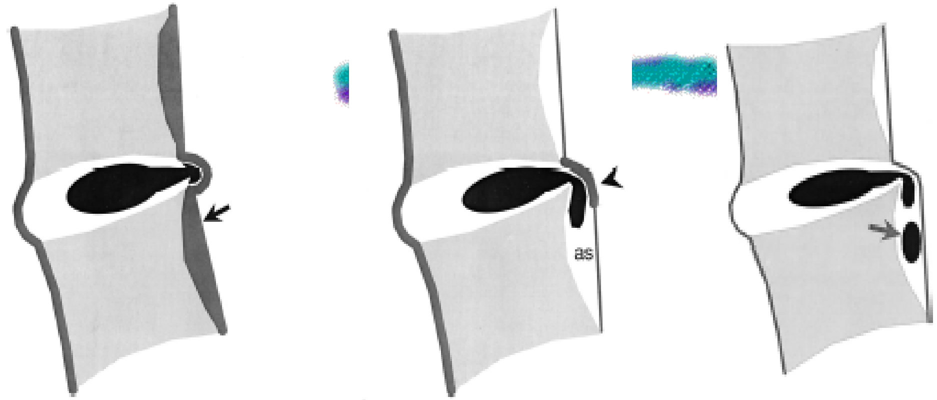


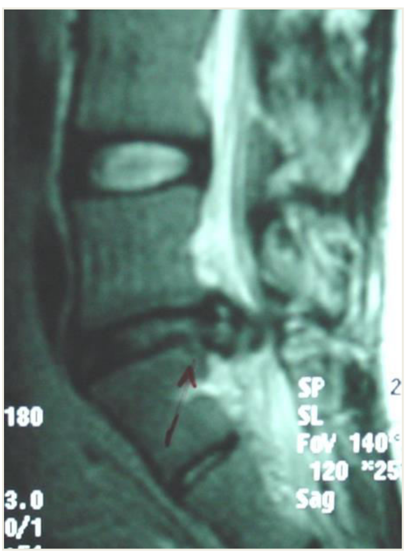
Focal Herniation

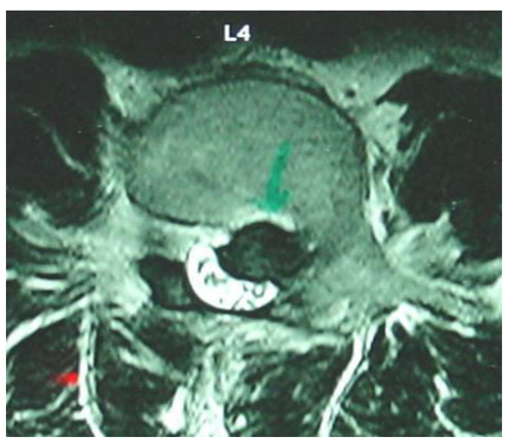


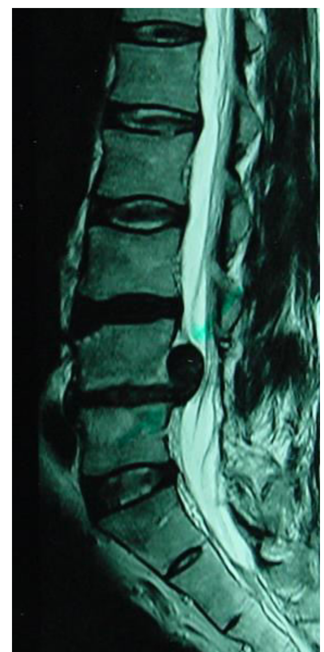
The prolapsed disc

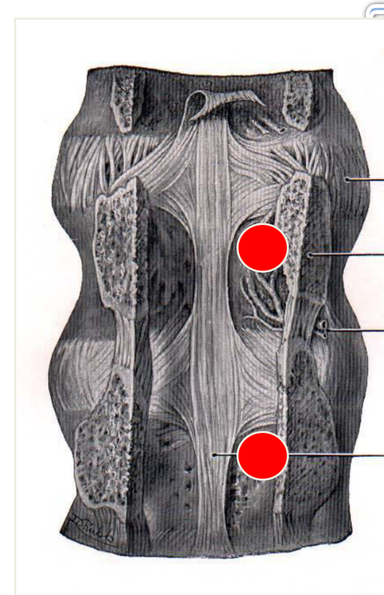




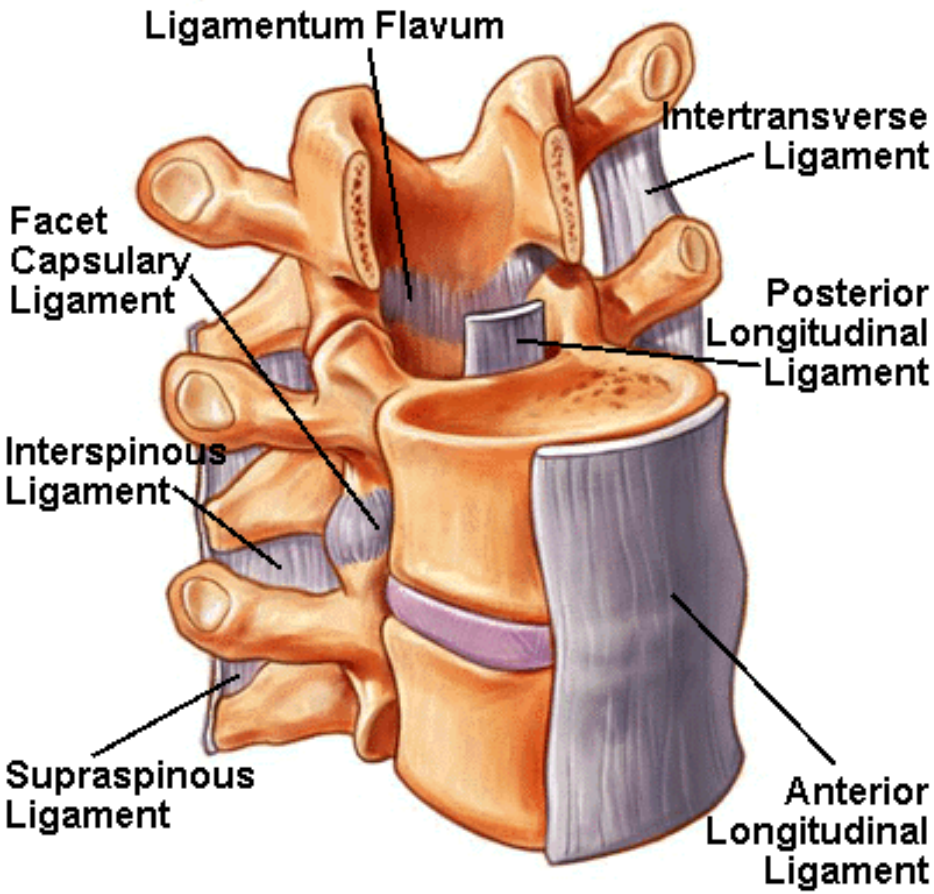






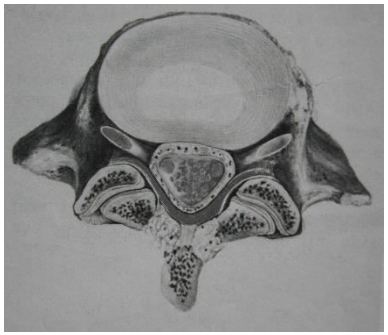


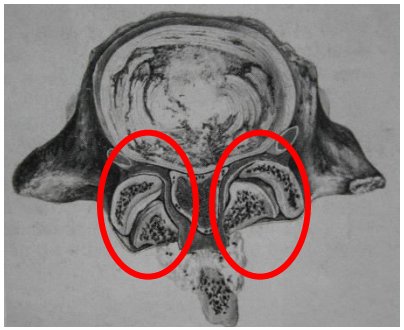
Motion segment

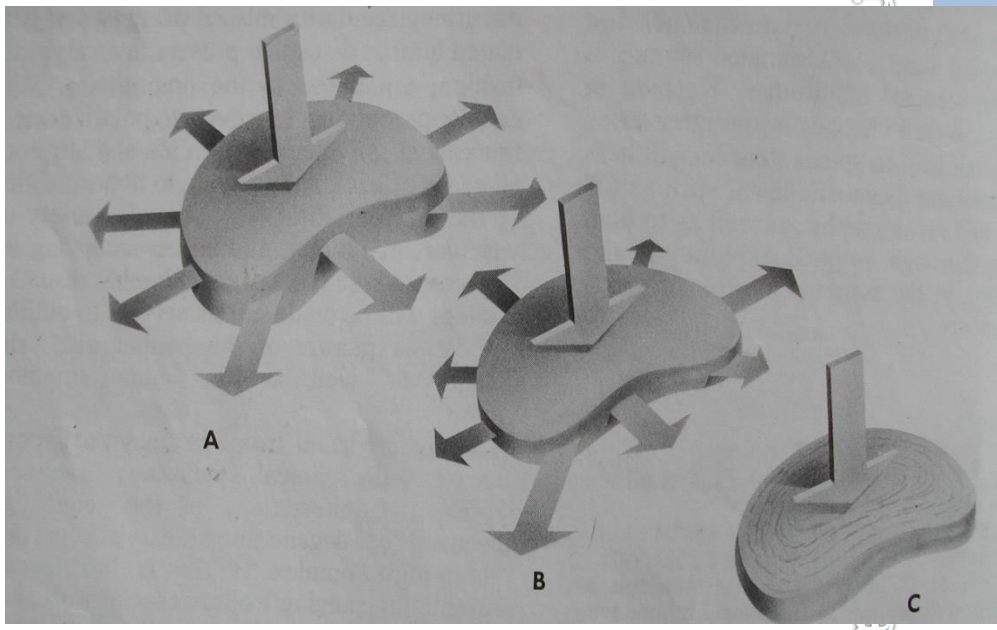


Effect on the motion segment

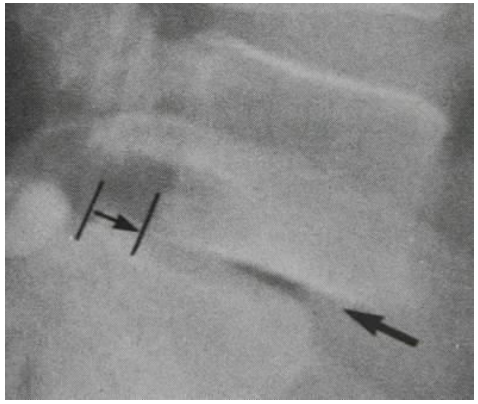
- ↓ nuclear hydrostatic pressure
- ↑ load on facets

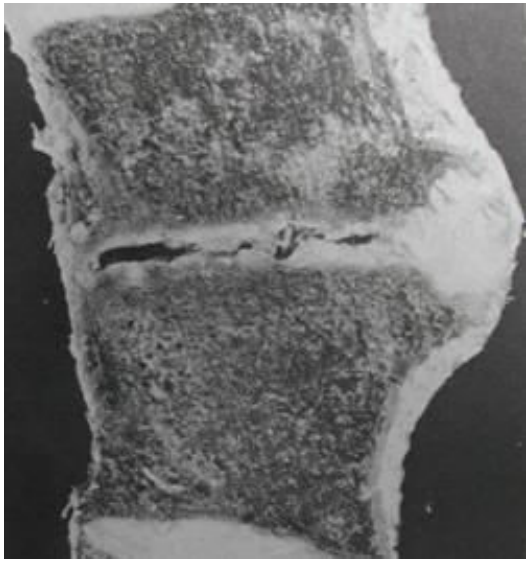




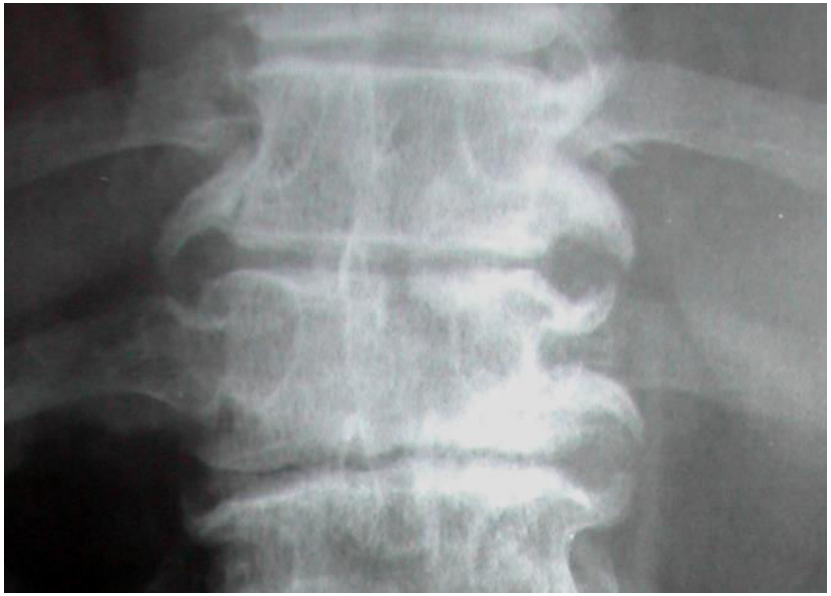


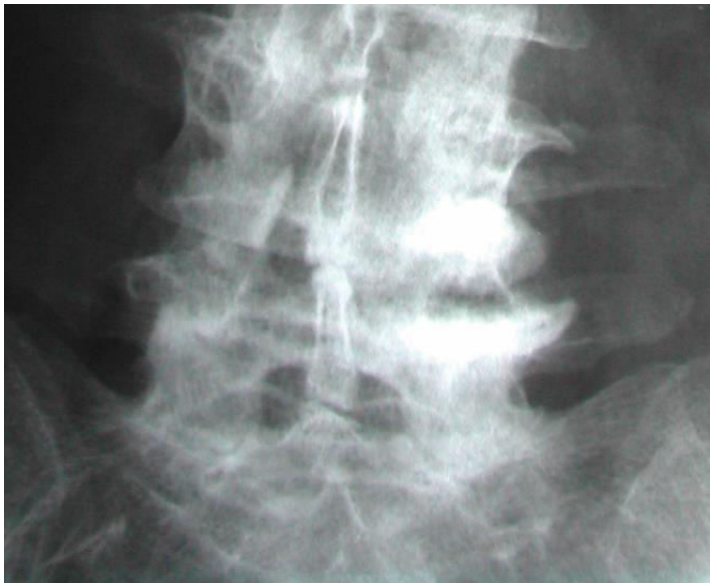
Loss of disc height





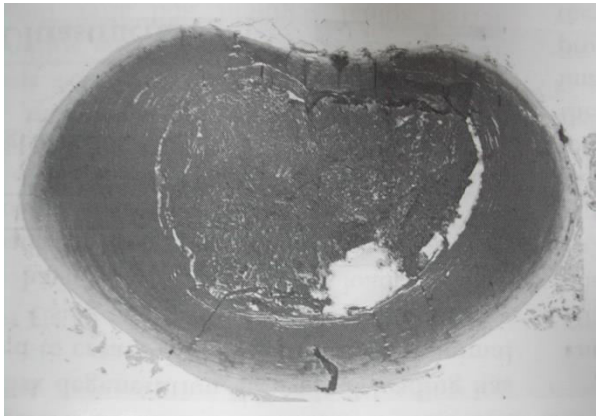
Spondylophytes

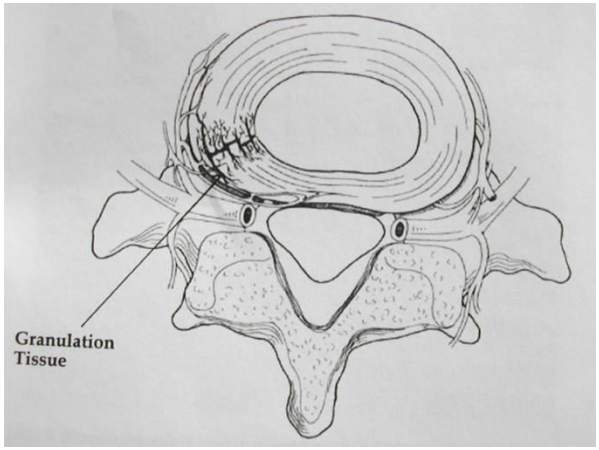




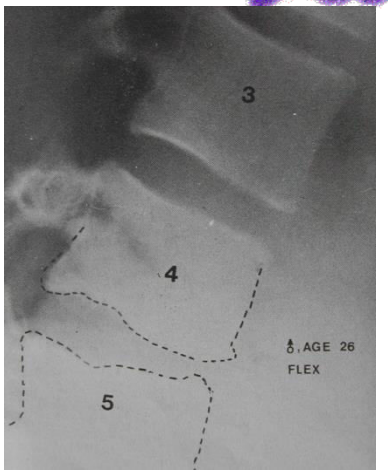
Degenerative cascade

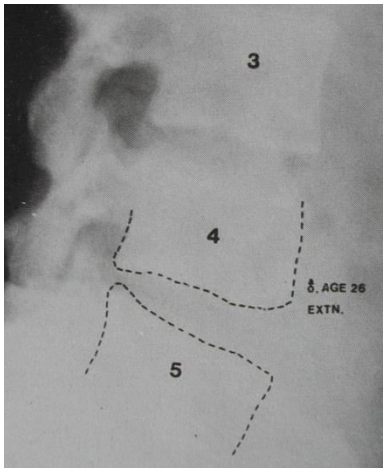
Dysfunction





Instability

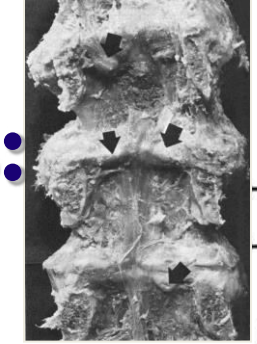


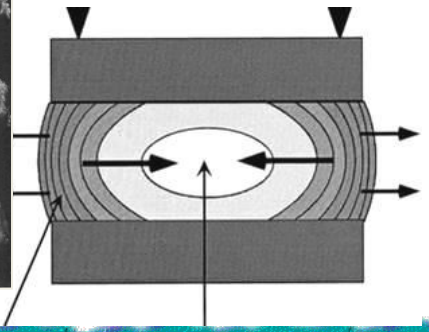


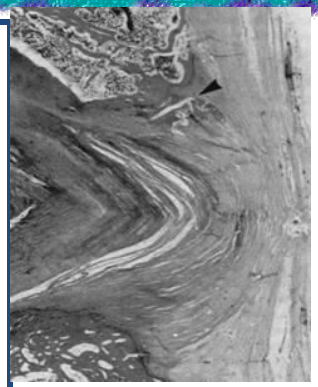
Re-stabilization

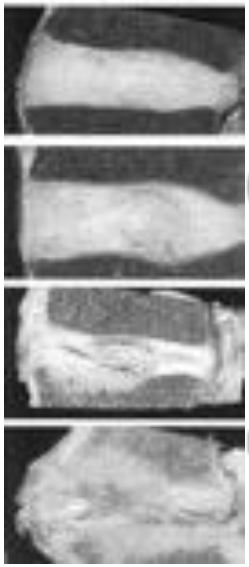
Understanding back pain

Degenerative changes:
summary

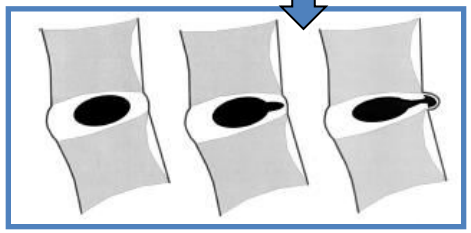




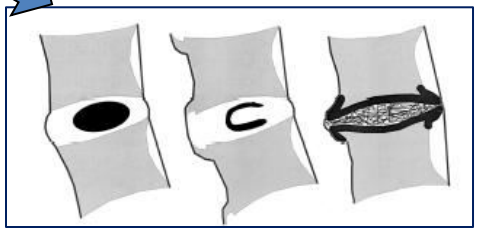




- Lack of nutrition to the disc
- Denaturation of proteins
- Irregular dissipation of forces by nucleus causing annular tears
- Loss of disc height



Disc prolapse

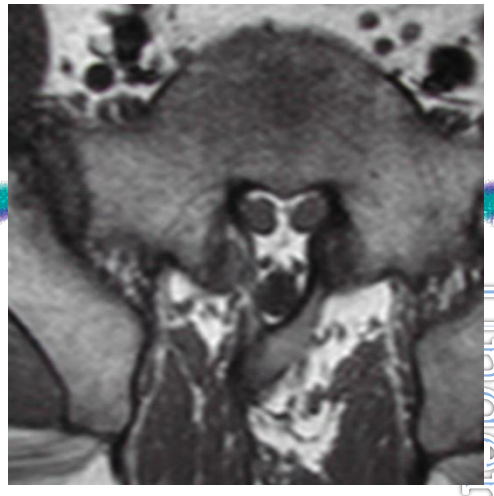


Disc degeneration

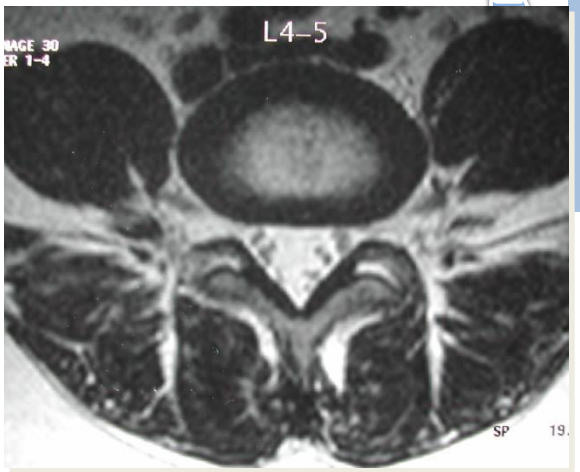
Lumbar canal stenosis

Lumbar canal stenosis

- **Primary:**
  - congenital / developmental
  - achondroplasia
- **Secondary:**
  - degenerative
  - synovial cysts
- **Combined:**
  - secondary factors + a narrow canal



Trefoil canal



Normal

Degenerative lumbar canal stenosis

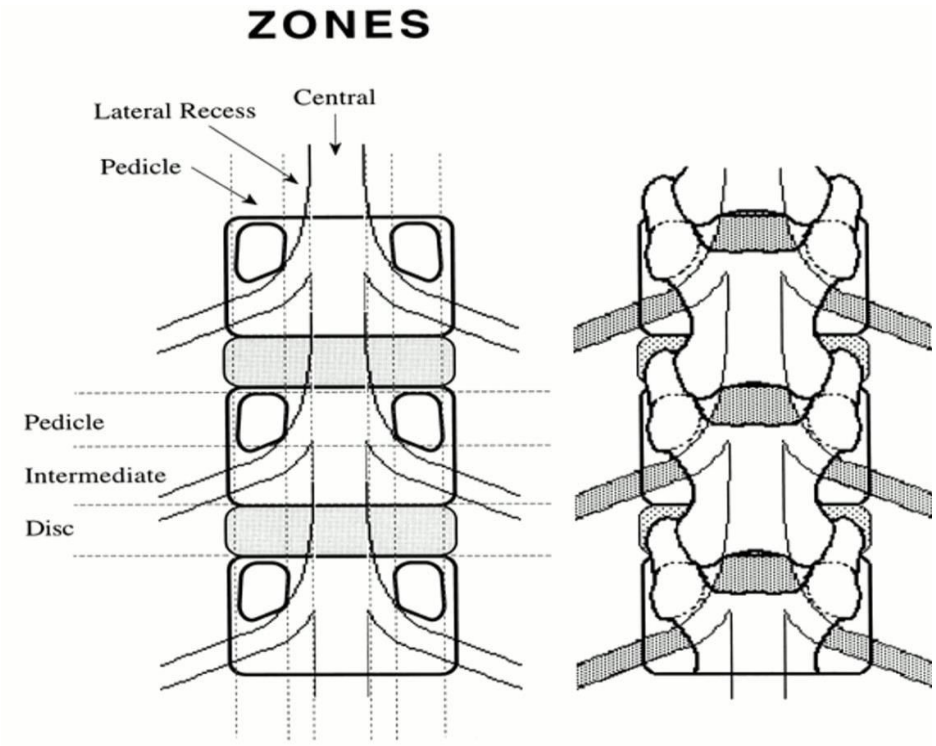
- Commonest
- 5-7 decades; M=F
- Clinical patterns:
  - Back pain
  - Claudication
  - Multi-level involvement

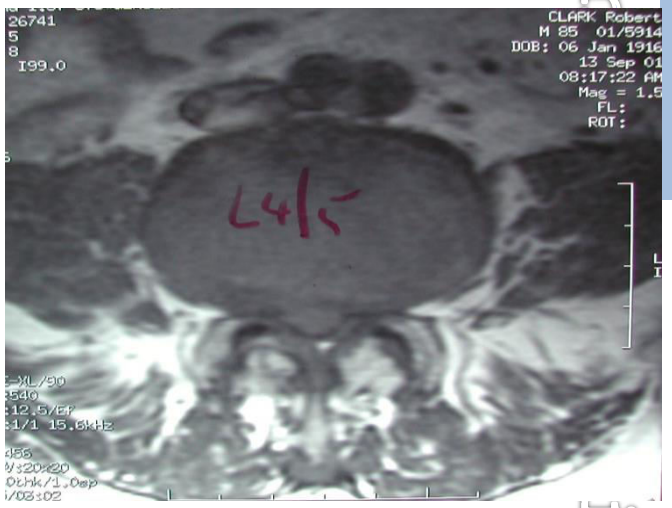
Degenerative lumbar canal stenosis

Location:

- Central canal
- Lateral (neural formamen)

Lateral



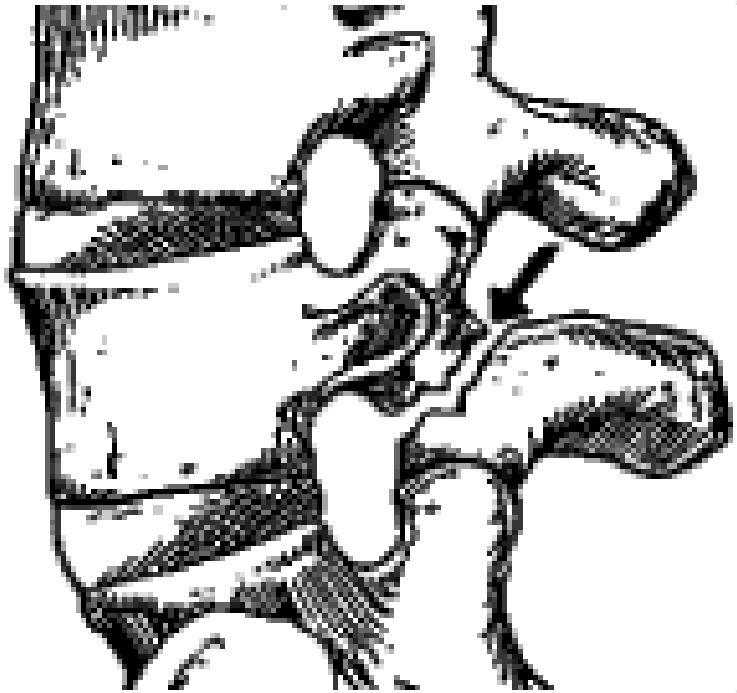


Central

Spondylolysis

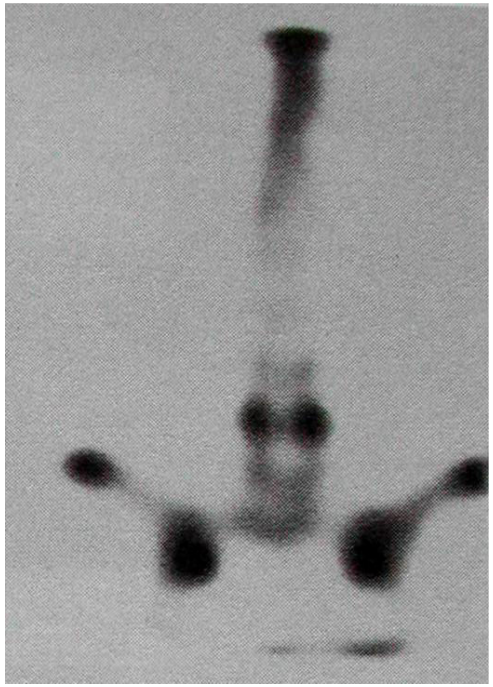
Spondylolysis

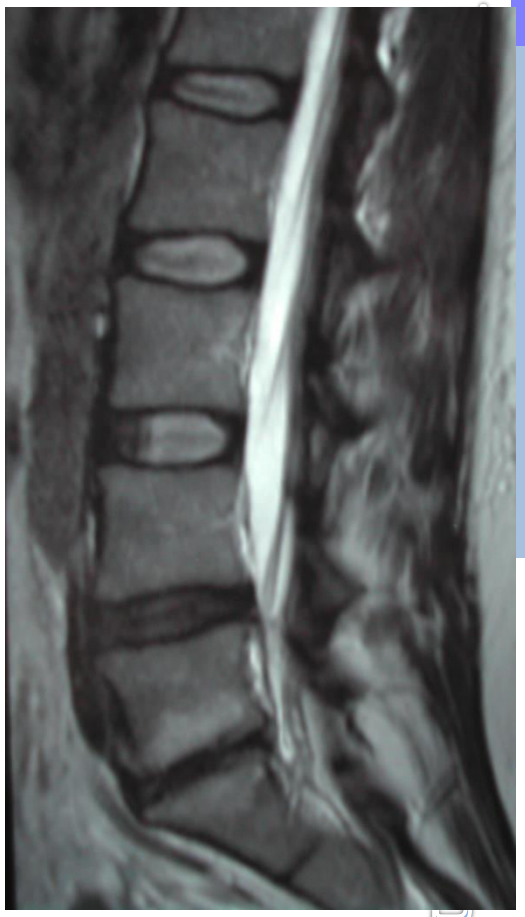
Break in the pars inter-articularis



Spondylolysis

- Pain localisation
  - Pars defects
  - Disc degeneration
- Disc above the level





Spondylolisthesis

Spondylolisthesis

Nonanatomic alignment of one verterbra on another

Spondylos: ***vertebra***

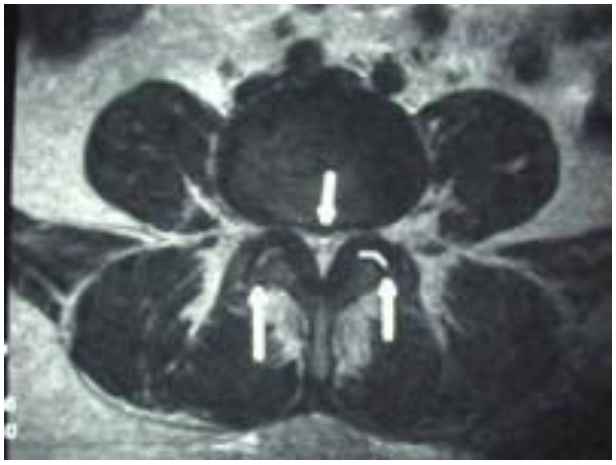
olithesis: ***slip or slide down an incline***

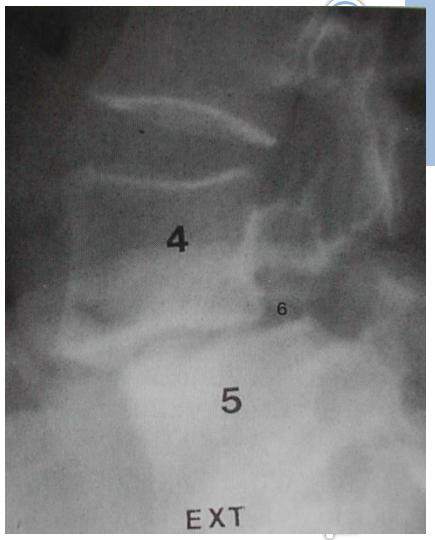
Spondylolisthesis:

common types

Isthmic

Degenerative

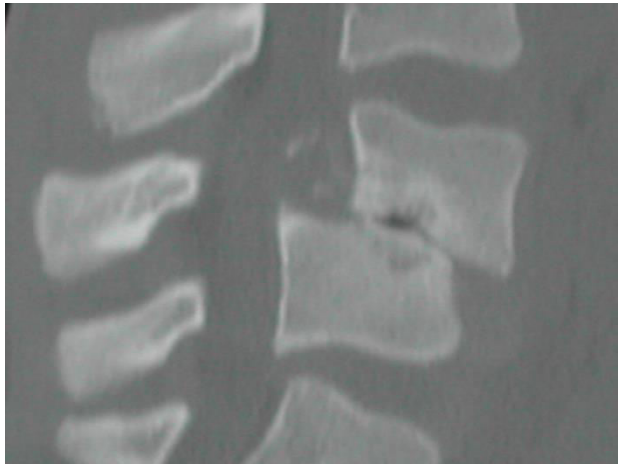




Spondylolisthesis:
uncommon types

Traumatic

Congenital



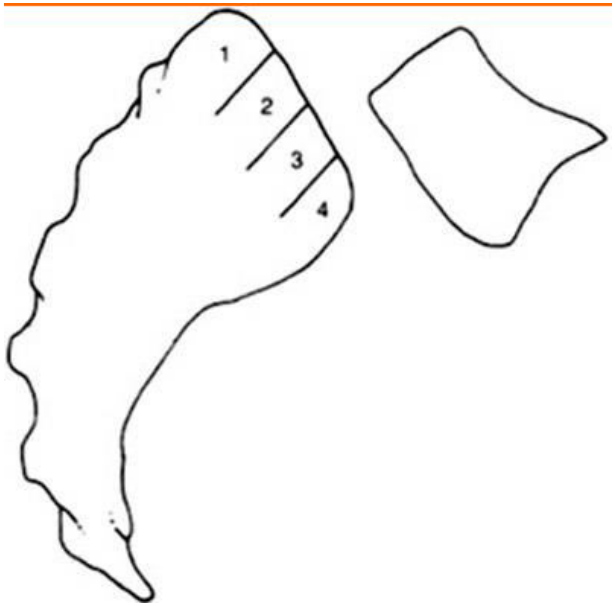
Neuropathic

Understanding back pain

Spondylolisthesis

Low grade

2x in M

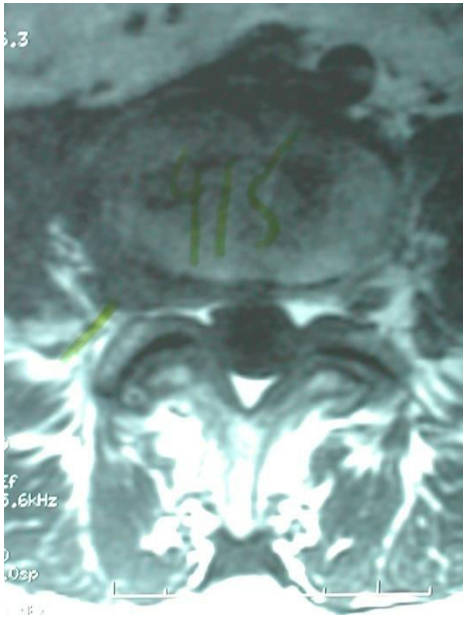


High grade

4x in F

Spondylolisthesis

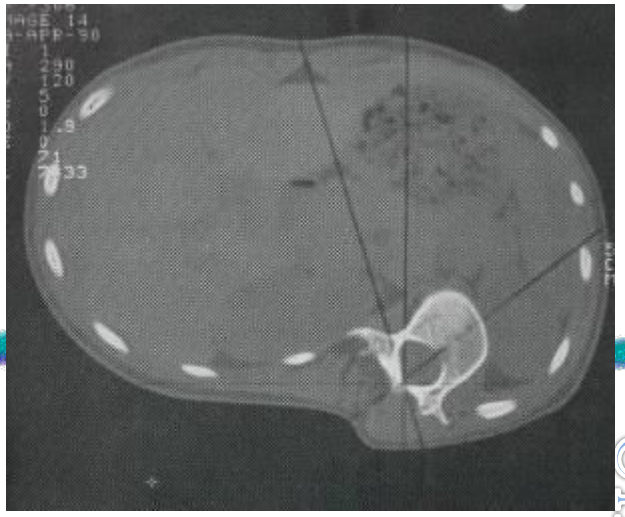
- **Back pain**
- **Radicular symptoms**

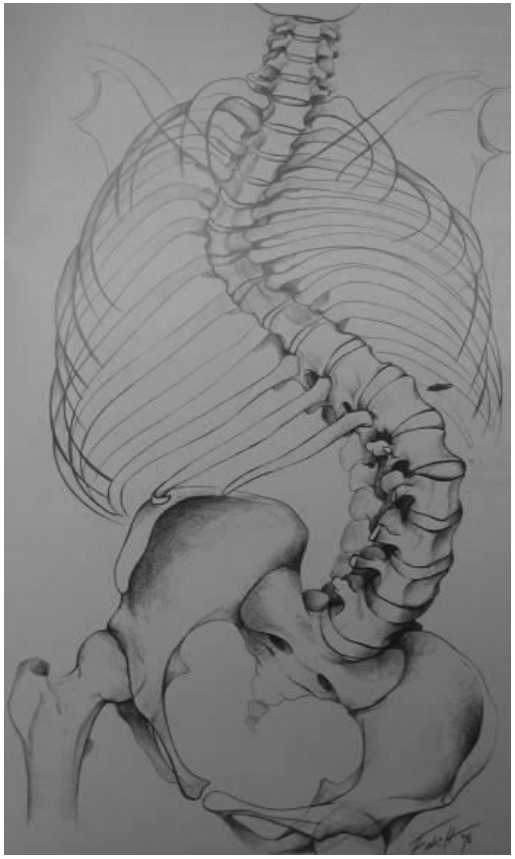


Spinal deformities

Spinal deformities:
Neuro-muscular scoliosis

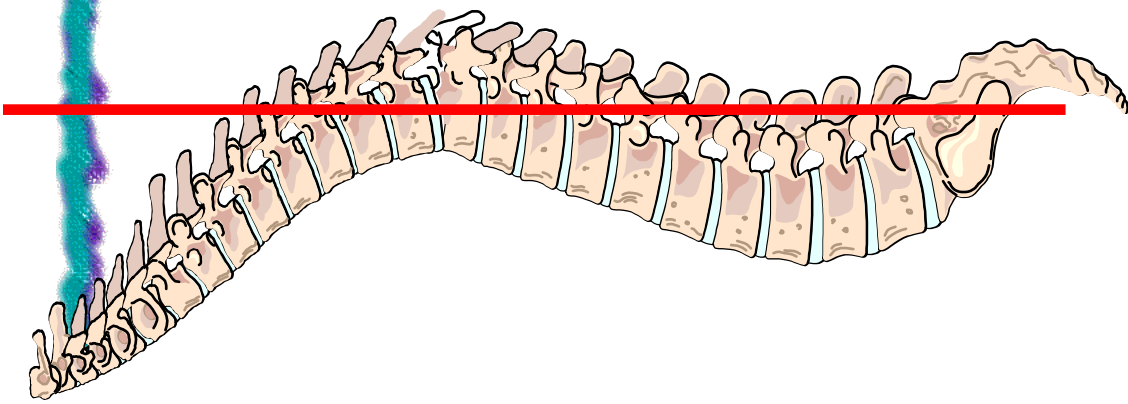
Spinal deformities:
Idiopathic scoliosis

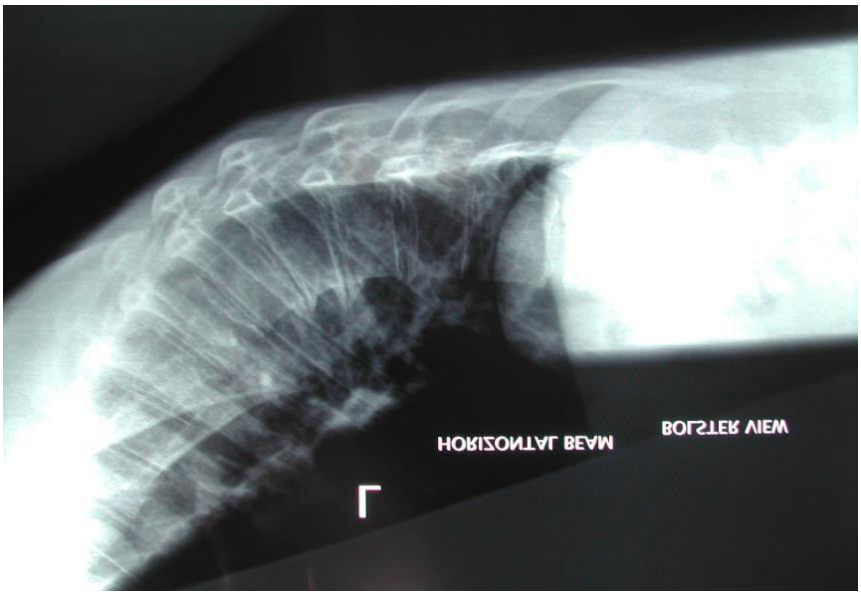




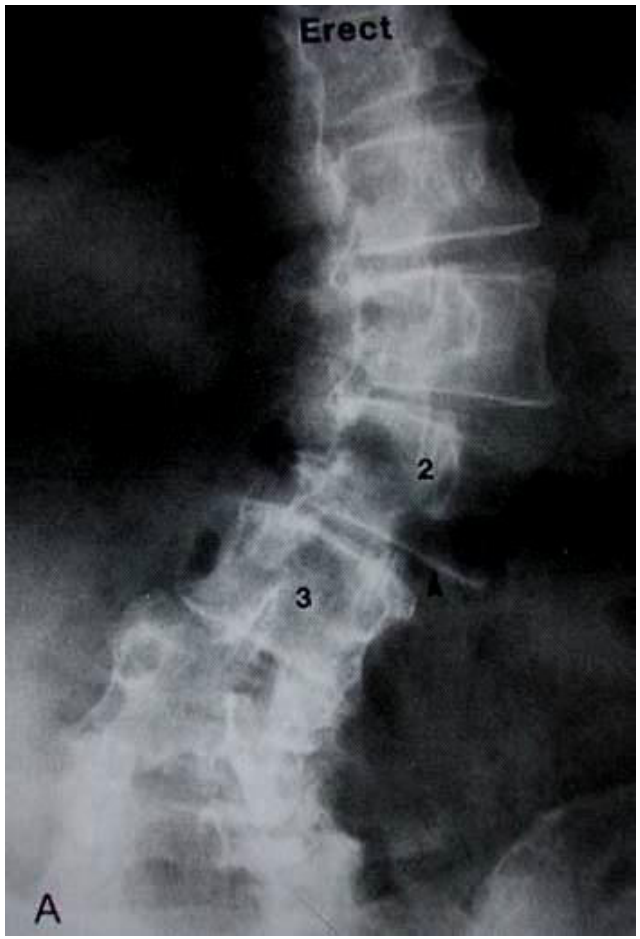
Understanding back pain

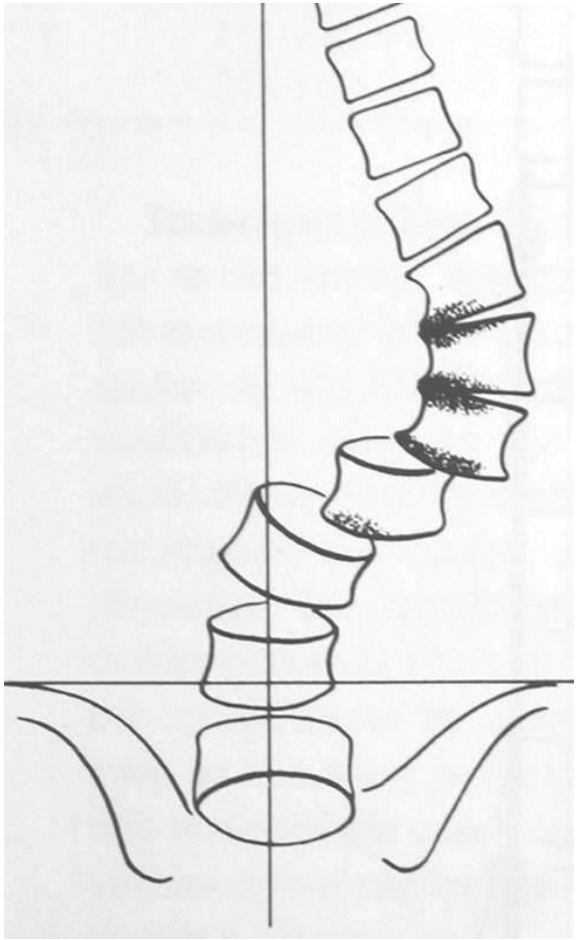
Spinal deformities:
Kyphosis





Spinal deformities:
Degenerative scoliosis





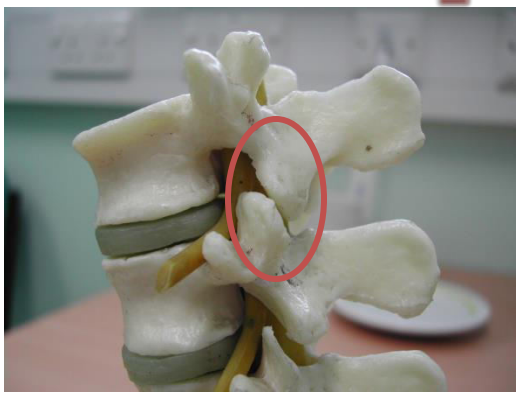
Lumbar: Clinical presentations

- **Axial back pain**
  - Discogenic
  - Spondylolysis
  - Instability
- **Leg pain**
  - Nerve root compression
  - Traction on the nerve root
  - Inflammatory sciatica
  - Referred from facets; SI joints
  - Hip; knee disease

Patho-physiology of back pain

Altered loading

Facet arthropathy



Disc degeneration

Postural effects

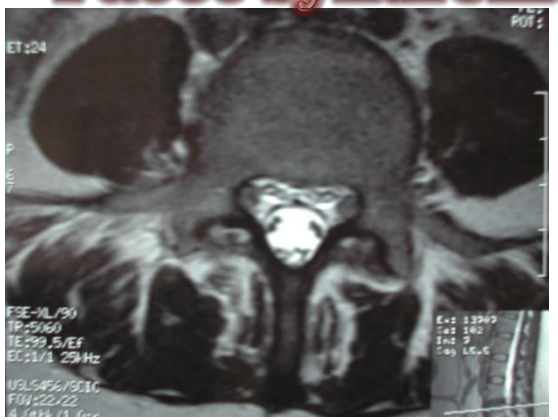
Understanding back pain

Patho-physiology of leg pain (sciatica)

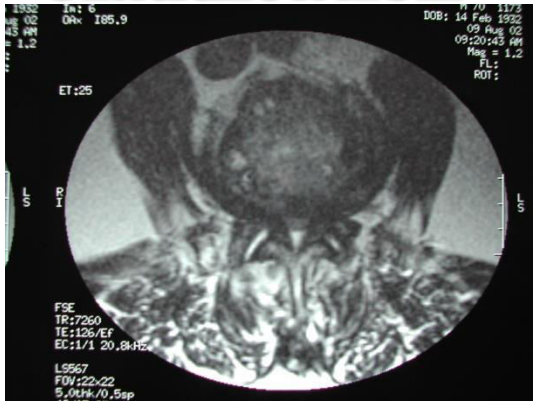
Mechanical nerve root compression

Nerve root inflammation

Facet syndrome



Claudication



Understanding back pain

Anatomic location of the pathology

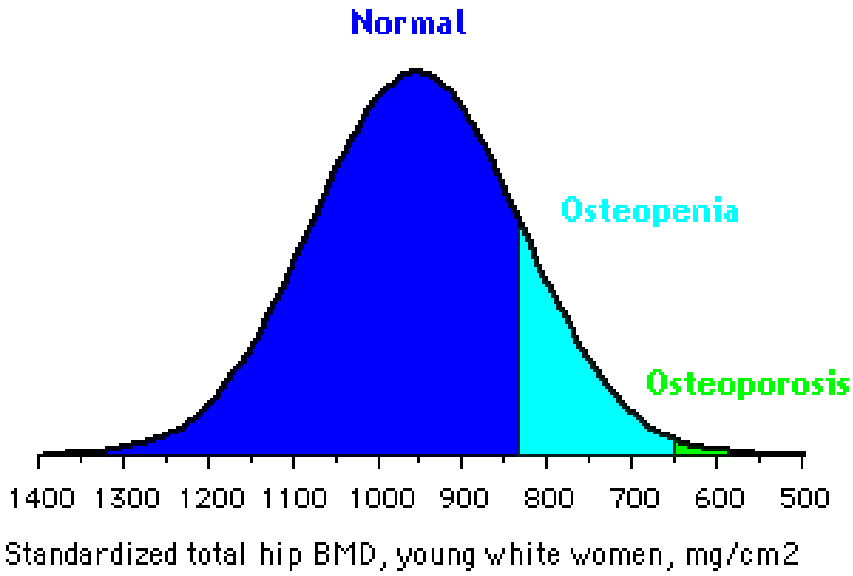
Disc

Facets

Pars defects

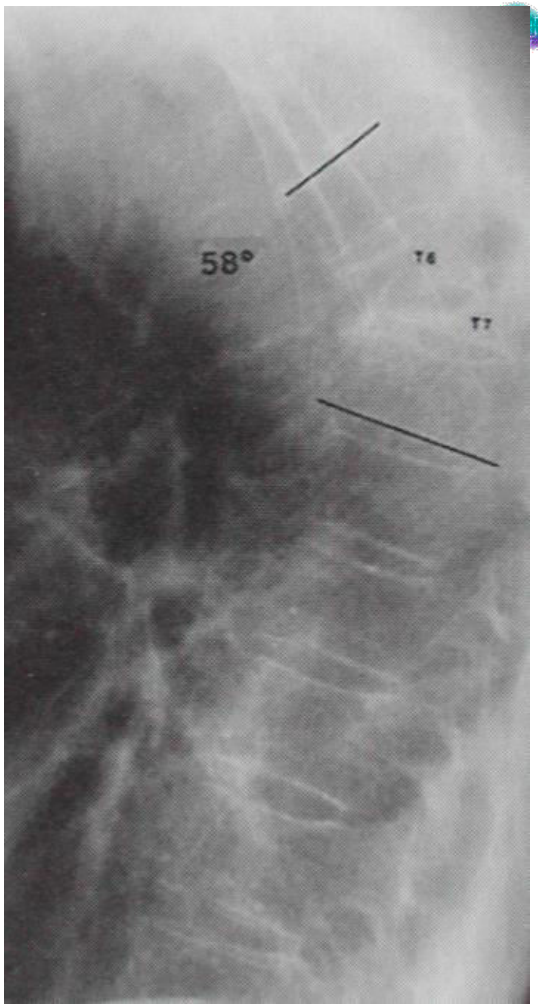
Trauma

Osteoporosis



Understanding back pain

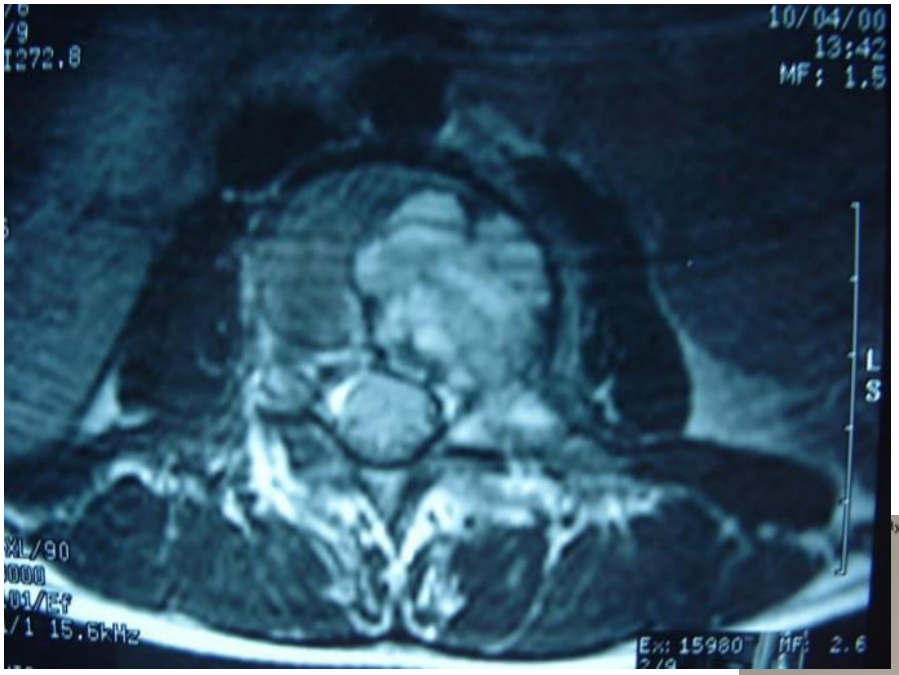
Tumours & Infection



Understanding back pain

Clinical Presentation: Pain

- Mechanical vertebral pain
- Radicular pain
- Expansion pain (tumour or abscess)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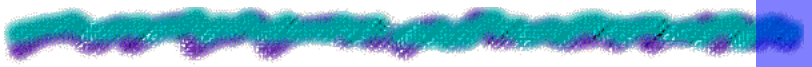

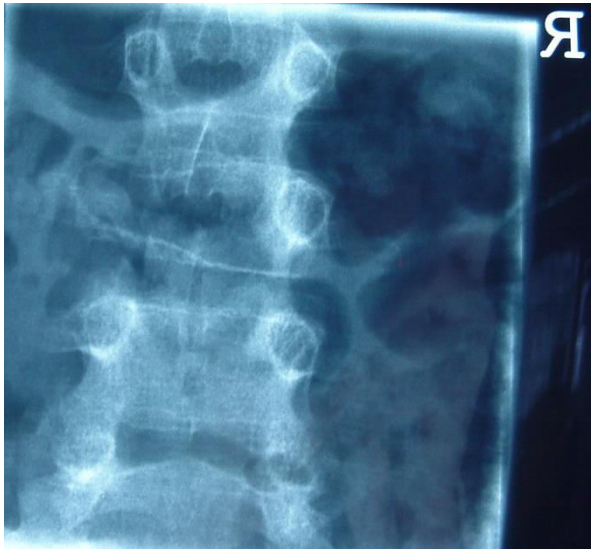
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Nuclear Medicine, QMC
06-Nov-2001

Winking owl sign

Laboratory studies

- CBC + ESR
- Haematocrit; platelets
- BUN; Sr Creatinine
- Sr Parathromone
- Thyroid function
- Sr Ca^{2+}; Phos; Alk Phosphatse
- Ur Ca^{2+}; Phos
- Sr Immunoelectrophoresis
- PSA; Acid Phoshatase
- Ur Vanilyl mandelic acid

History

- Neurology:
  - Differentiate from lethargy
  - Document progression

- Red flags:
  - Persistent axial; radicular pain
  - Known primary malignancy
  - > 50 years
  - Symptoms for > 1 month; non-responsive to medical treatment

Examination

- Palpate the entire column:
  - Tenderness
  - Masses
  - Deformities
- Examine:
  - Breast
  - Thyroid
  - Abdomen
  - Regional nodes
- Neurology:
  - UL; LL
  - Motor
  - Sensory (incl post column)
  - Reflexes (sup & deep)
- Rectal examination
  - Masses
  - Prostate
  - Perianal tone & sensation

Other red flags……

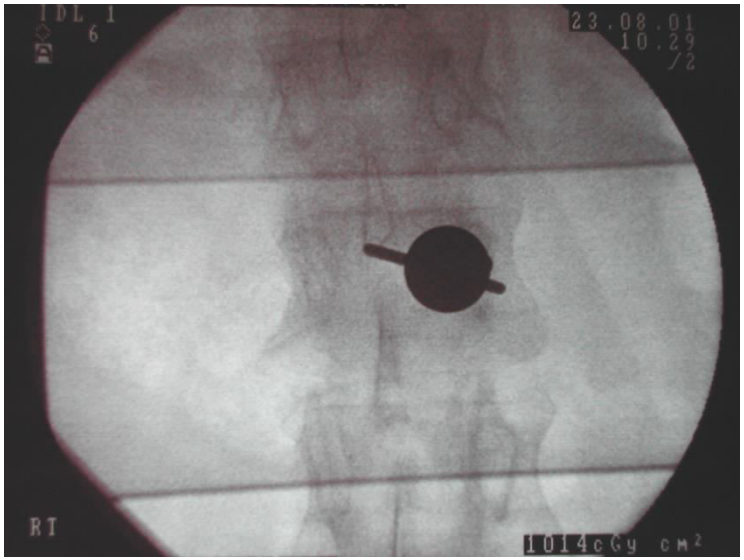
- Unintentional weight loss
- Anorexia; Fatigue
- **Smokers:** cough; haemoptysis; dyspnea
- **GI:** PR bleed; changed bowel patterns; constipation; incontinence
- **GU:** Haemauria; changed urinary patterns; hesistancy; frequency
- **Breast:** size; feel; family history

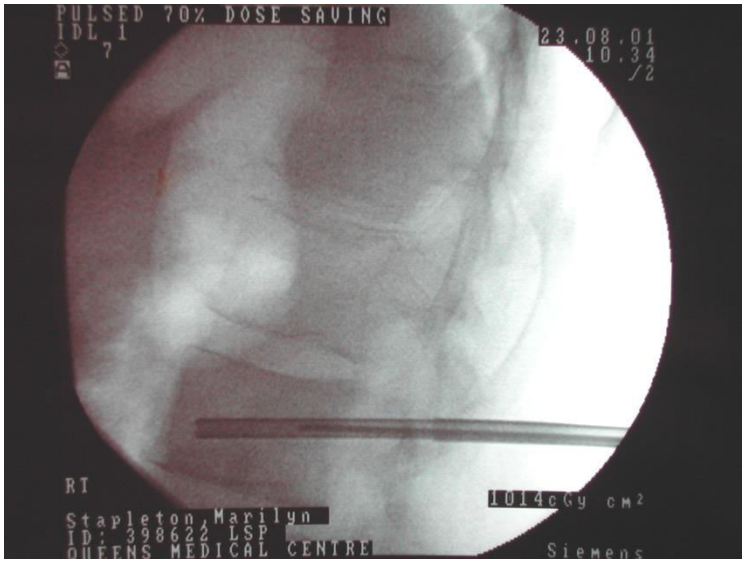
Basis for diagnosis: age

- 10y – 30y:
  - ABC; Ewings; GCT; Histiocytosis X;
  - O'blastoma; O'chondroma; Osteoid osteoma
- 30y – 50y:
  - C' sarcoma; Chordoma
  - Hodgkins
- 50y + :
  - Mets; Myeloma

Management of Spinal infections & tumours:

Immediate referral to spinal service



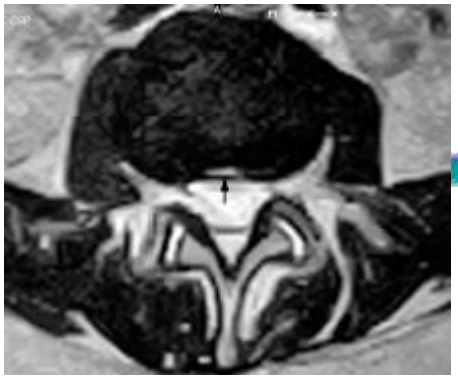


Principles of management of degenerative conditions

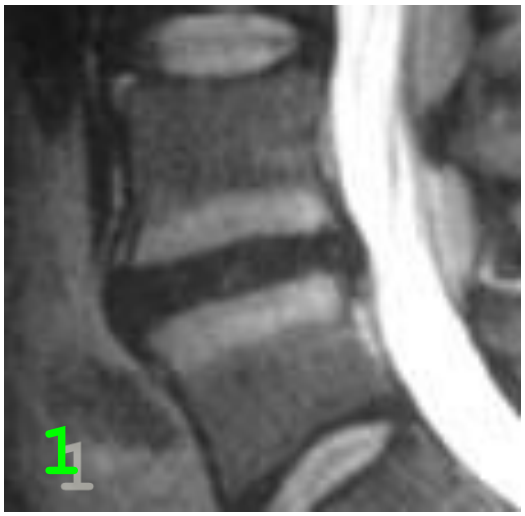
MRI changes in tumours & infection

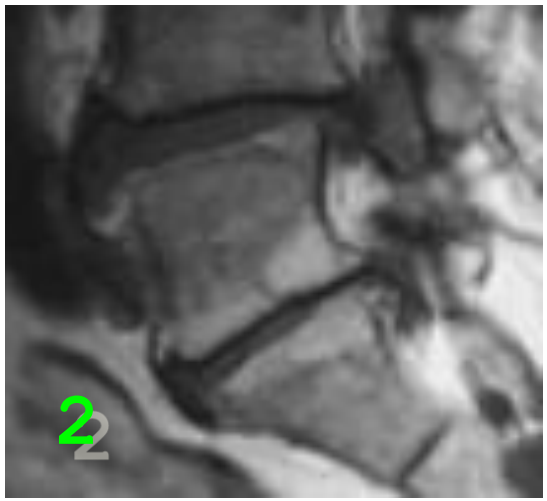
- Anatomic definition
- Cord status; marrow changes
- Epidural compression

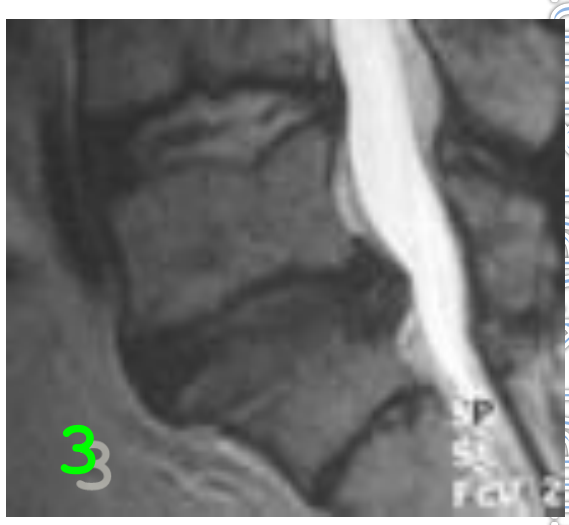
Degenerative changes on MRI



- High intensity zone
- Modic end plate changes
- ‘Black disc’ disease (T2 weighted scans)







Clinical pathway

Fusion

Spine arthroplasty &

Non fusion alternatives

Injections:

•Facet blocks

•Root blocks

Decompressions

Discectomy

Physiotherapy

Medications

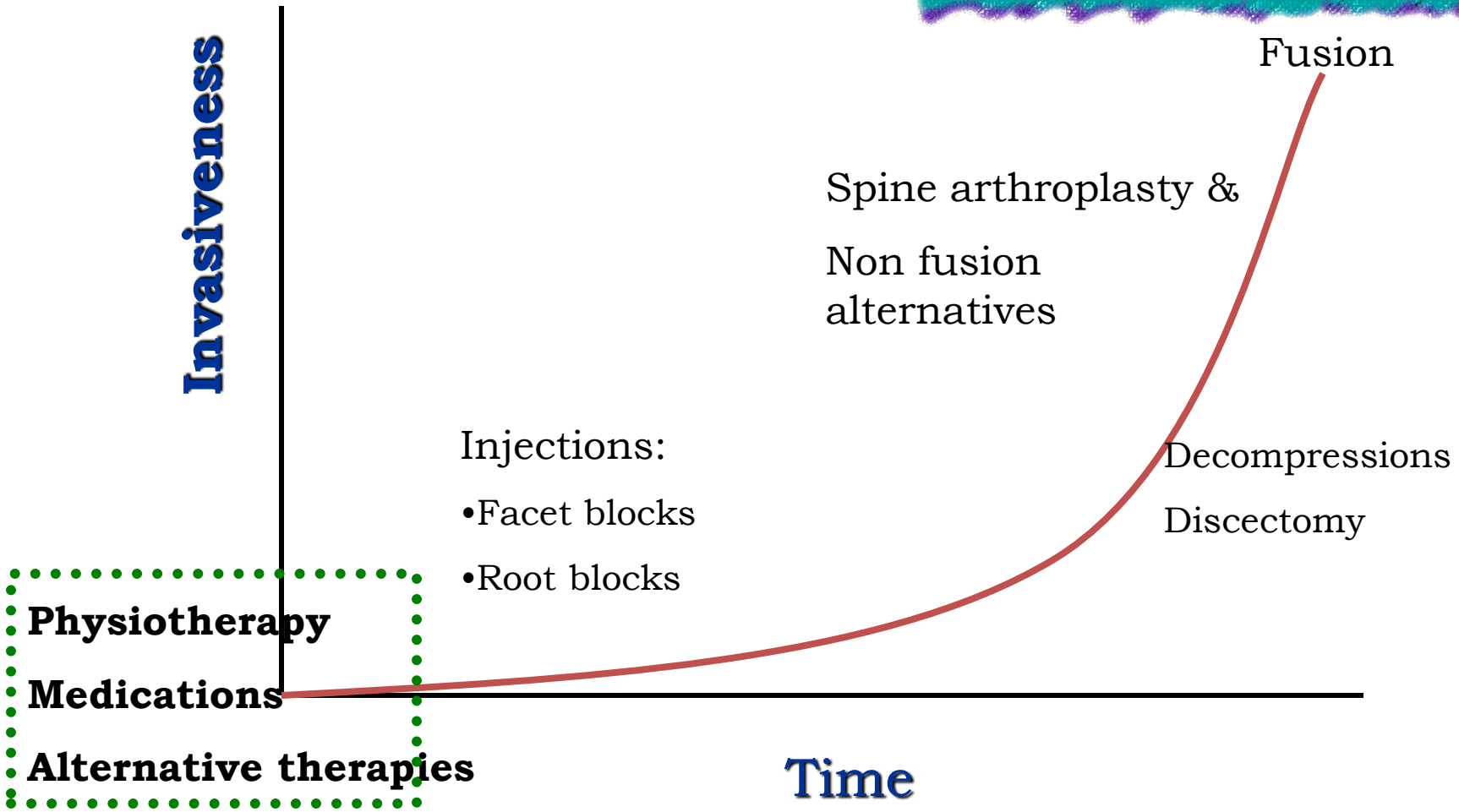
Alternative therapies

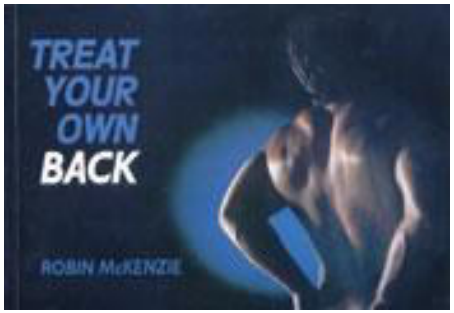
Invasiveness

Time

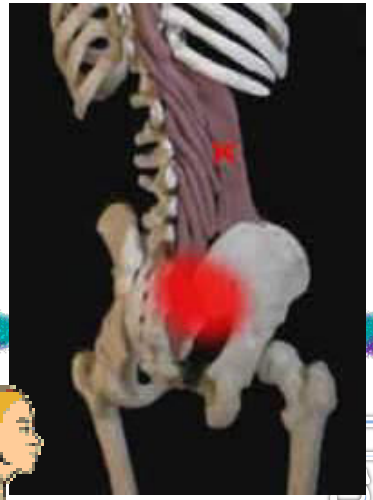
Understanding back pain

Clinical pathway: phase I
conservative measures

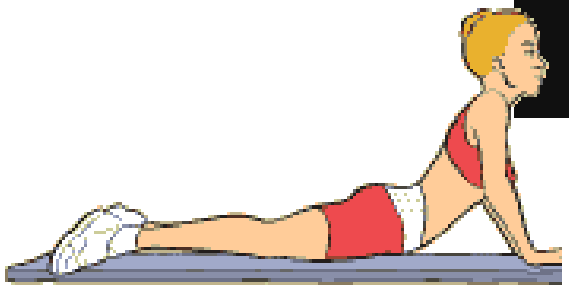


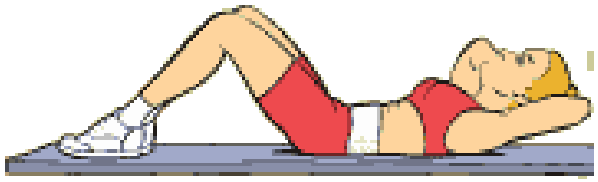


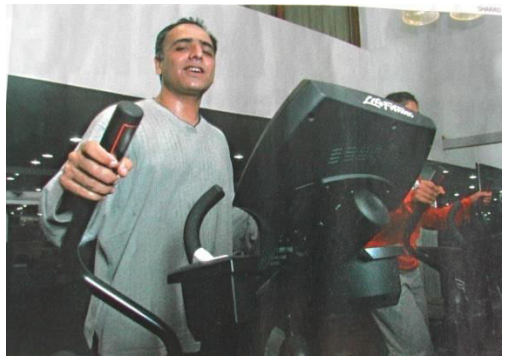
Physiotherapy



- **Acute pain (< 6 weeks)**
- **McKenzie execises**
- **Extension exercises**
- **Flexion exercises**
- **Aerobics**



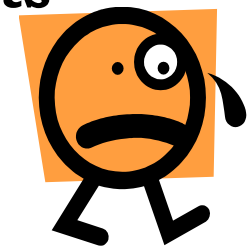


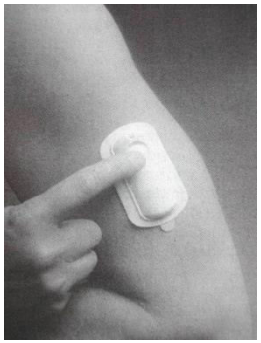


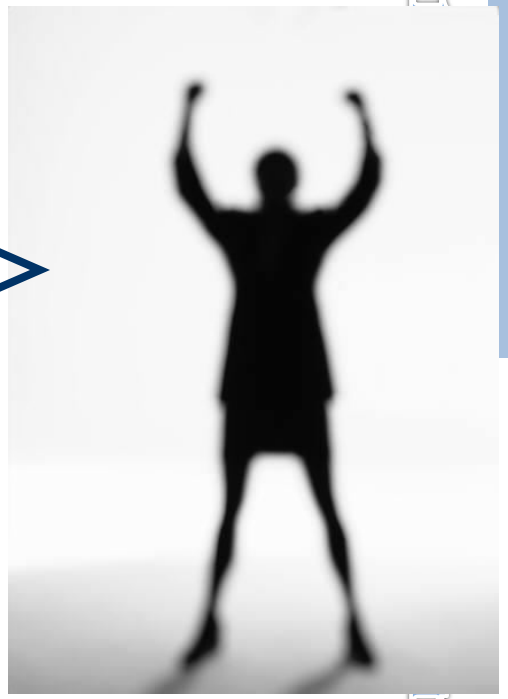
Understanding back pain

Medications

- **NSAID's**
- **Analgesics: opioids**
- **Muscle relaxants**
- **Gabapentin**
- **Anti-depresants**
- **Topical applications**

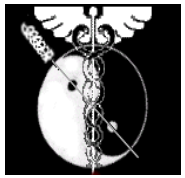






Alternative therapies

Acupunture



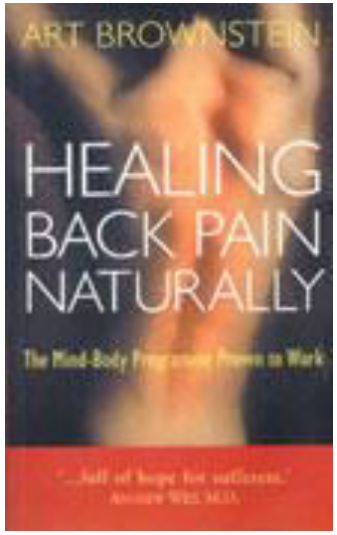
Chiropractic

Massage therapy

Aromatherapy

Magnetotherapy

Naturopathy



Vibration therapy

Understanding back pain

Summary of management of acute back pain:

Evidence of Improved Clinical Outcomes

- **Advice to stay active and continue usual activities**
- **Paracetamol**
- **NSAIDs**

Summary of management of acute back pain:

Evidence of no improvement in clinical outcomes

- **Bed rest for more than 2 days**
- **TENS (transcutaneous electrical nerve stimulation)**
- **Traction**
- **Specific back exercises**
- **Education pamphlets about low back symptoms**

Summary of management of acute back pain:

Evidence of potential harm

- **Use of narcotics or diazepam (>2 weeks)**
- **Bed rest with traction**
- **Manipulation under general anaesthesia**
- **Plaster jacket**

Summary of management of acute back pain:

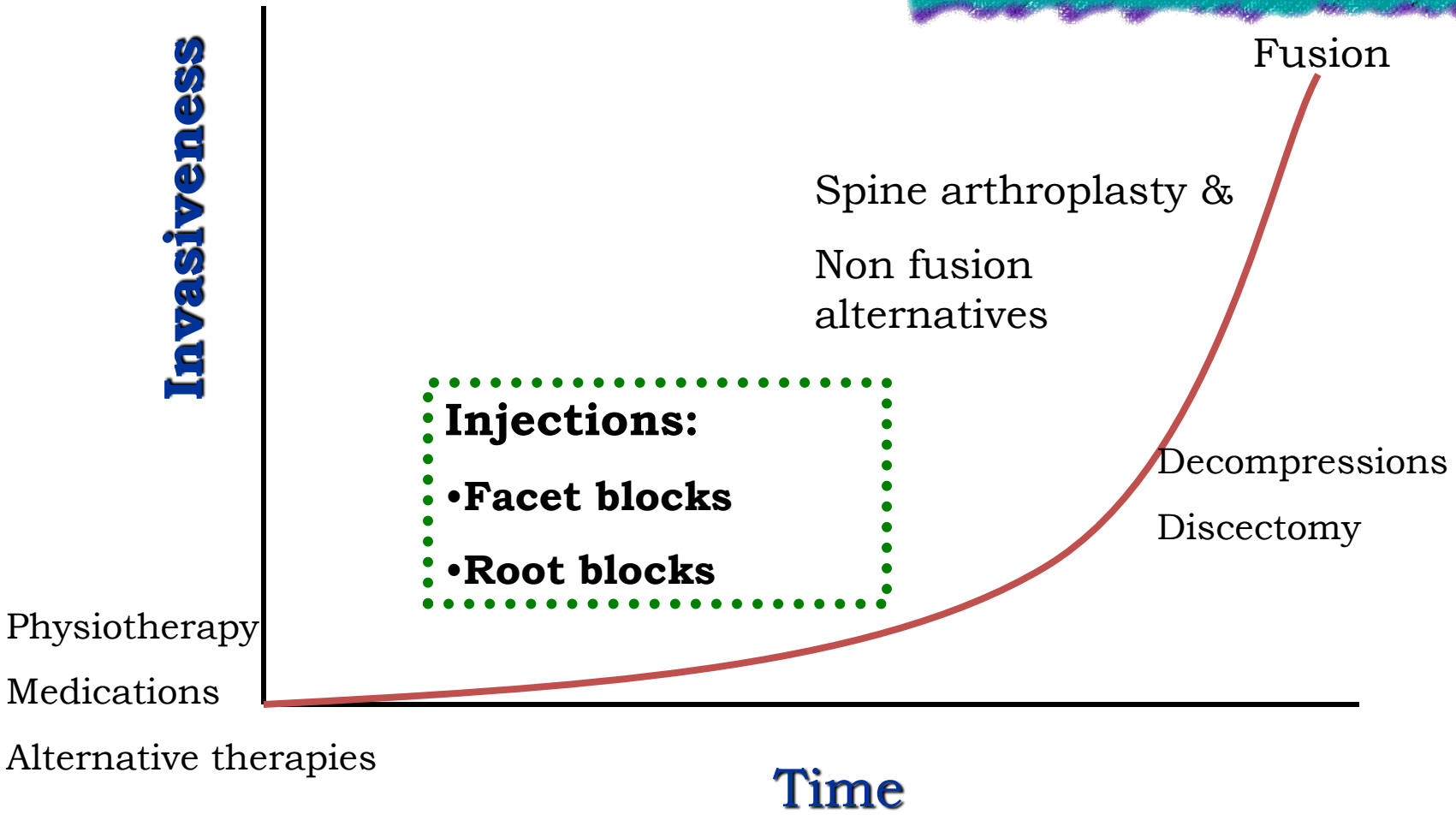
Insufficient research evidence for any improvement in clinical outcomes

- **Conditioning exercises for the trunk muscles**
- **Physical agents and passive modalities**
  (includes ice, heat, short wave diathermy, massage, ultra sound)

- **Workplace back schools**
- **Acupuncture**
- **Shoe lifts**
- **Corsets**
- **Biofeedback**

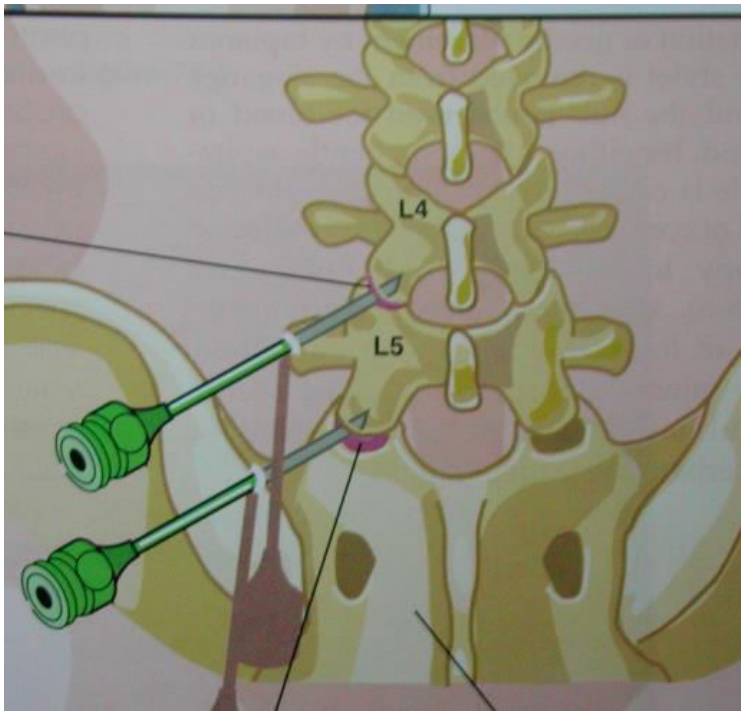
Clinical pathway: phase II

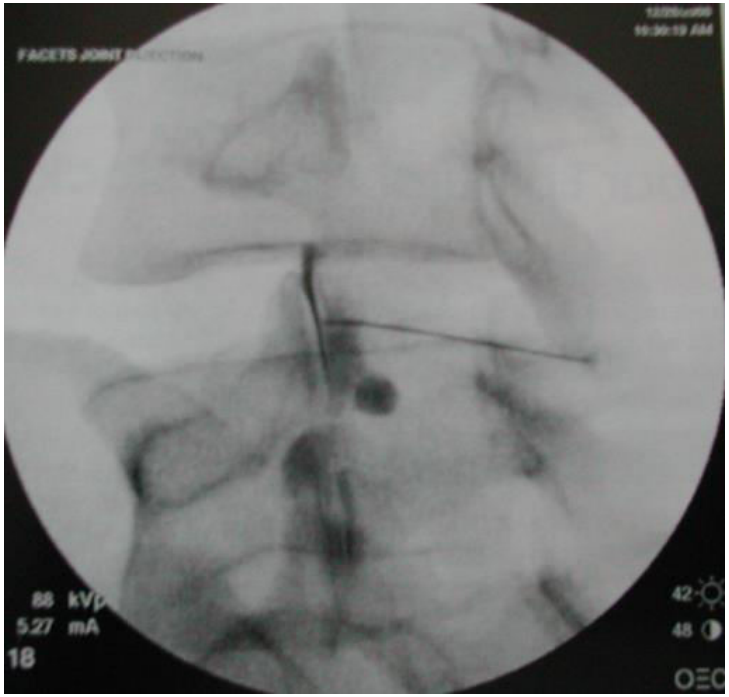
injections



Understanding back pain

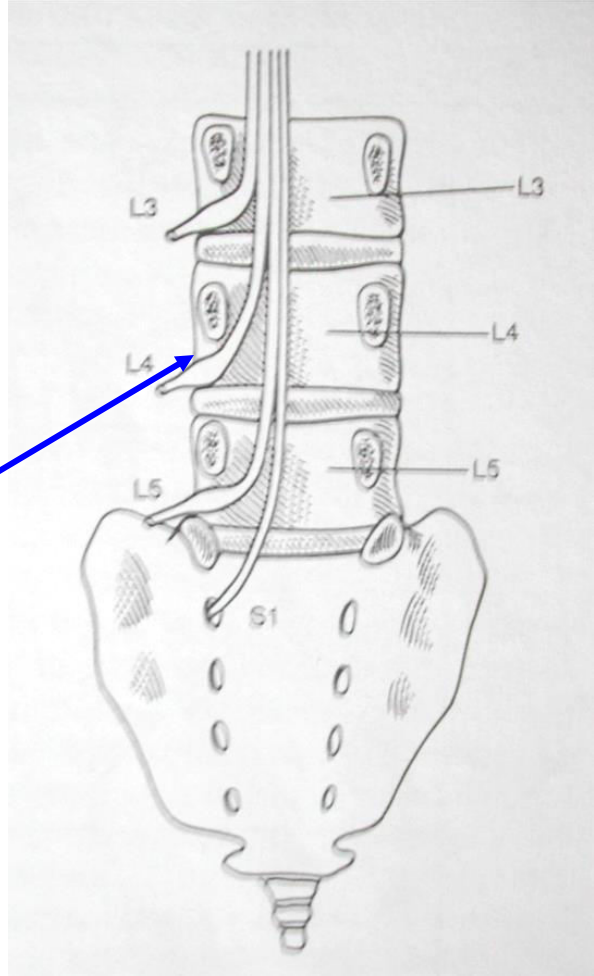
Facet joint injections

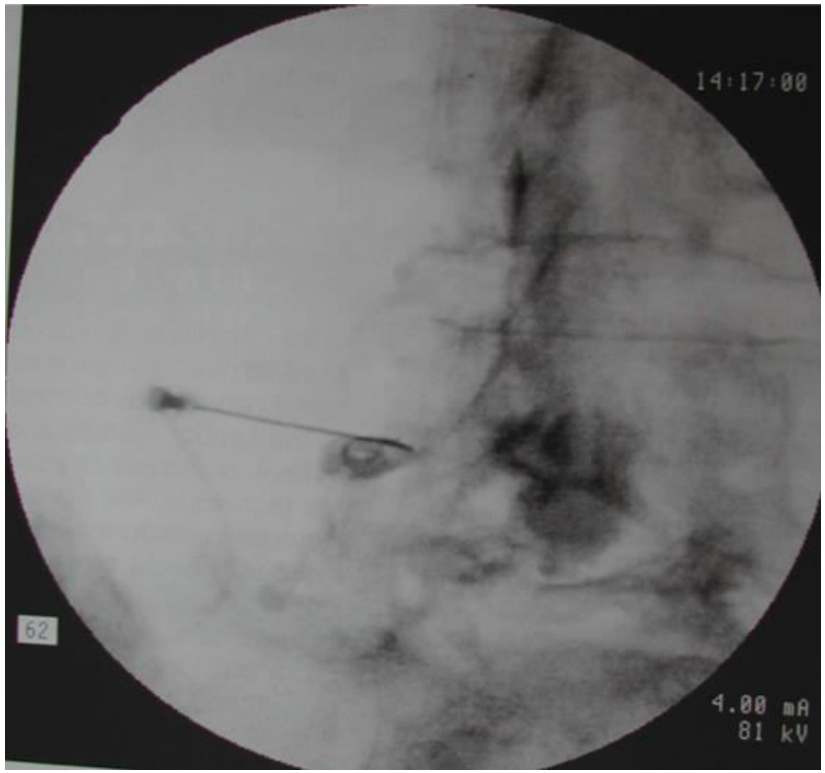




Understanding back pain

Nerve root block

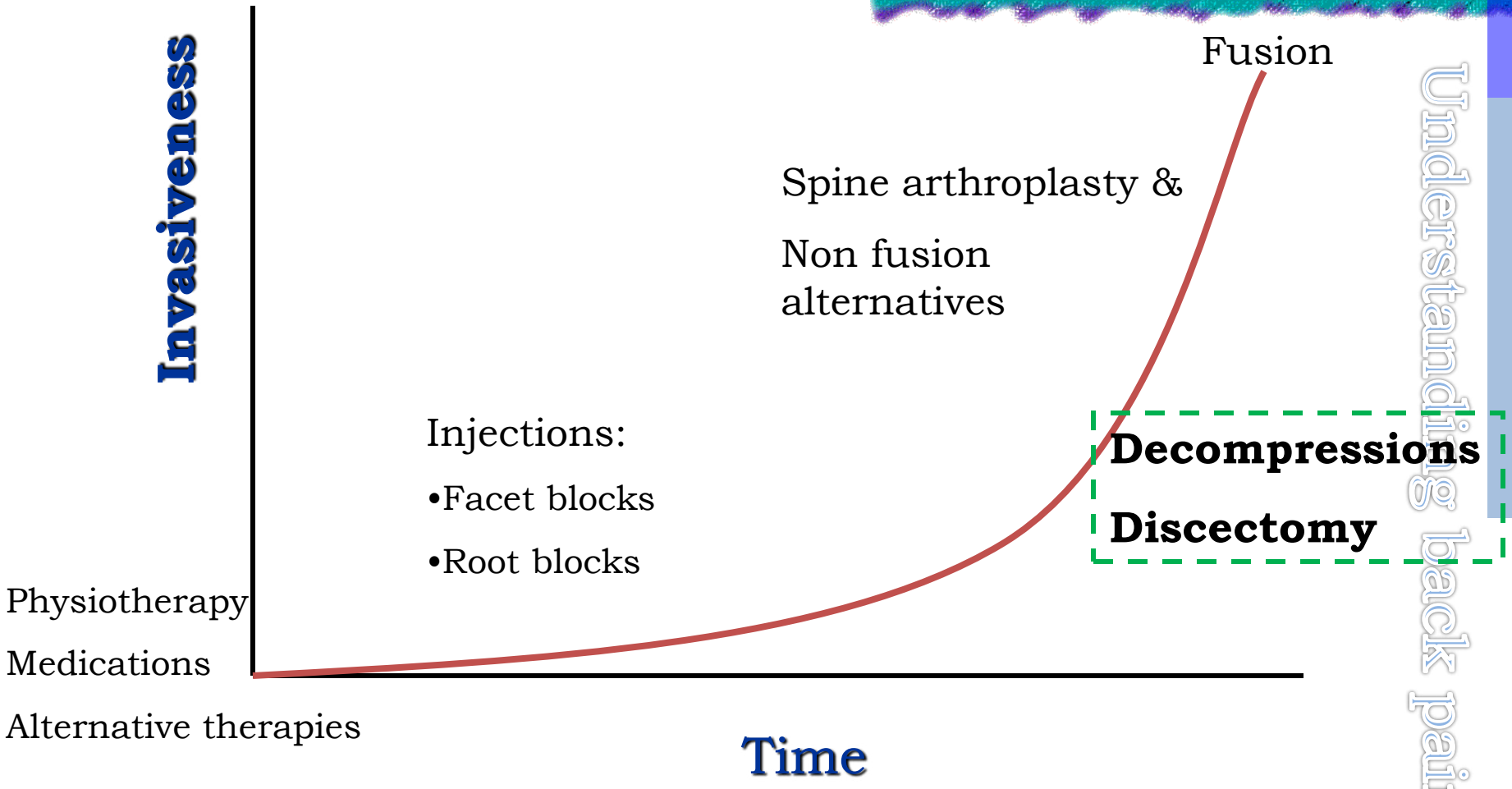




Understanding back pain

Clinical pathway: phase III

Decompressive surgery

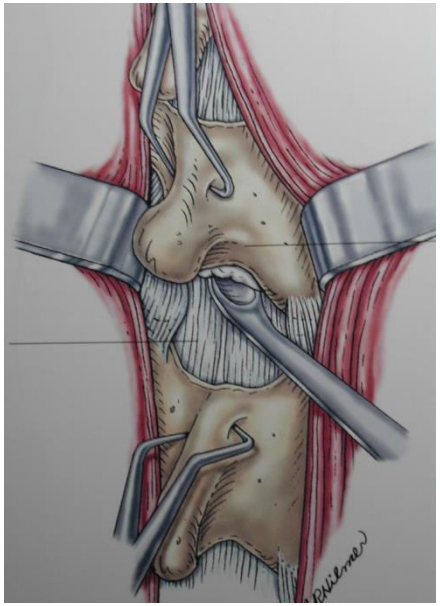


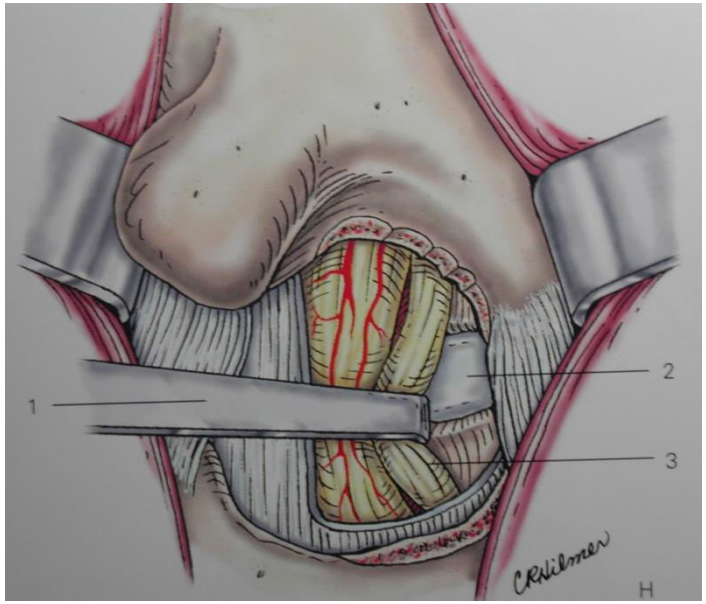
Understanding back pain

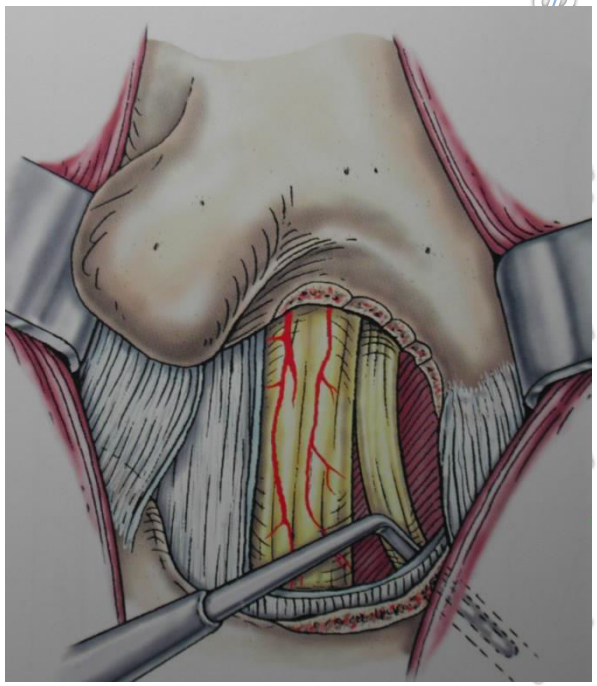
Degenerate lumbar spine:
Treatment principles: decompression

- **Assess the direction of compression**
- **Decomress = deroof**

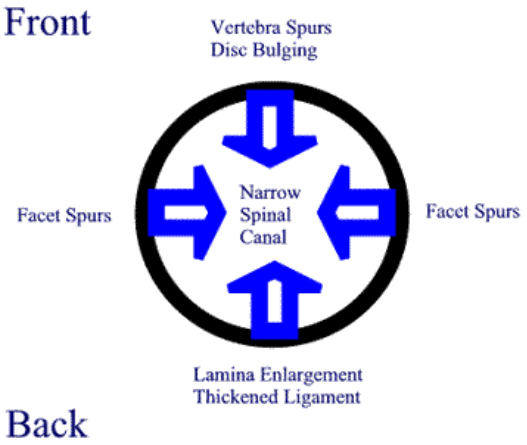
laminectomy or laminotomy



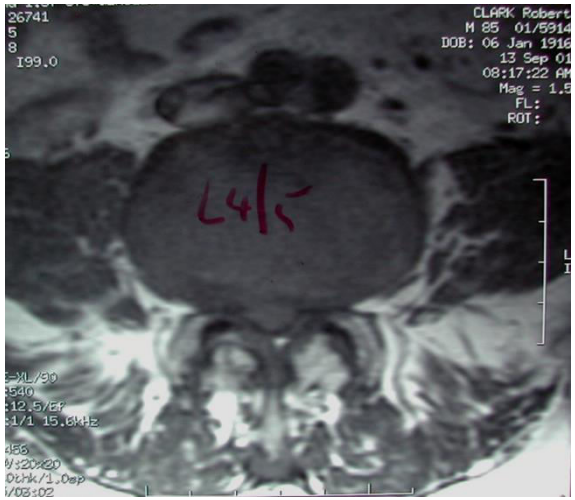


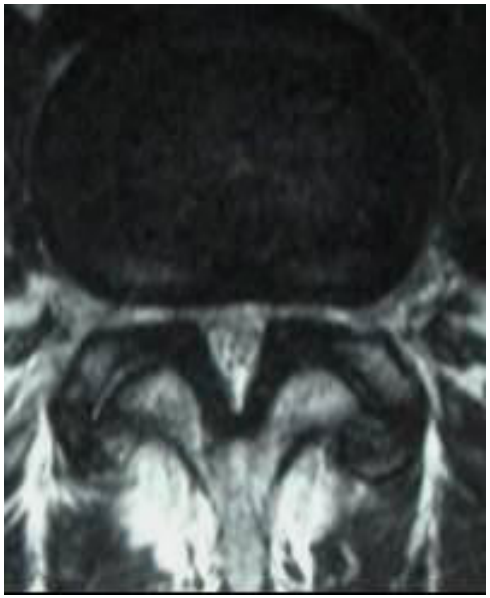


Degenerate lumbar spine:
Treatment principles: decompression



- **Discectomy**
- **Laminectomy**
- **Laminotomy**





back pain

Clinical pathway: phase IV

non-fusion surgery

Fusion

Spine arthroplasty &

Non fusion alternatives

Injections:

•Facet blocks

•Root blocks

Decompressions

Discectomy

Physiotherapy

Medications

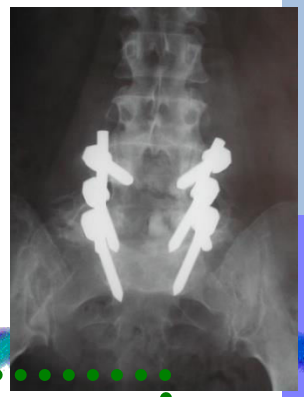
Alternative therapies

Invasiveness

Time

Understanding back pain

Clinical pathway: phase IV fusion



Fusion

Invasiveness

Spine arthroplasty &

Non fusion alternatives

Injections:

•Facet blocks

•Root blocks

Decompressions

Discectomy

Physiotherapy

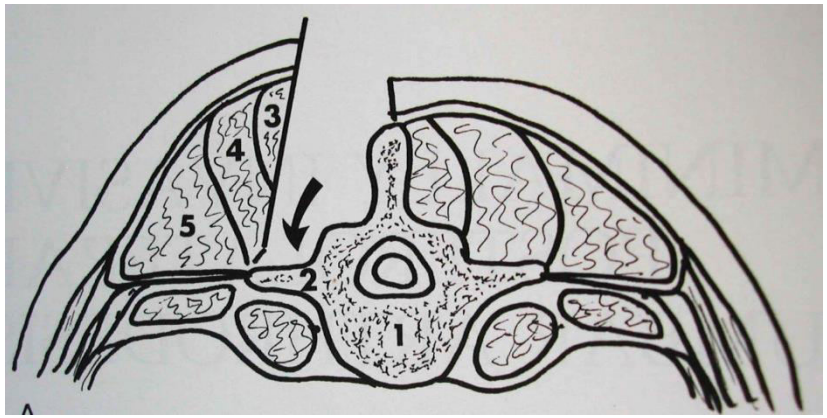
Medications

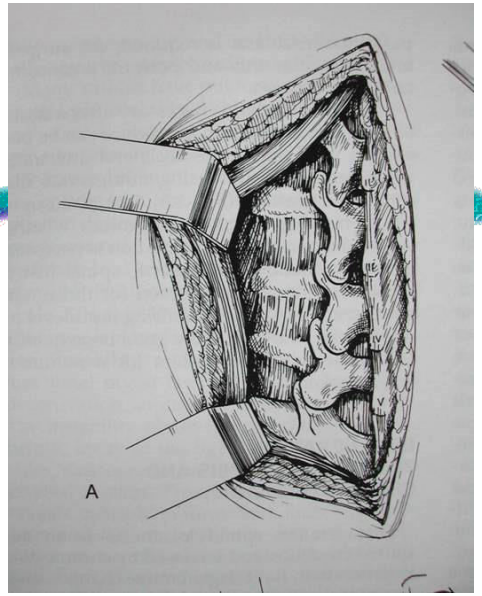
Alternative therapies

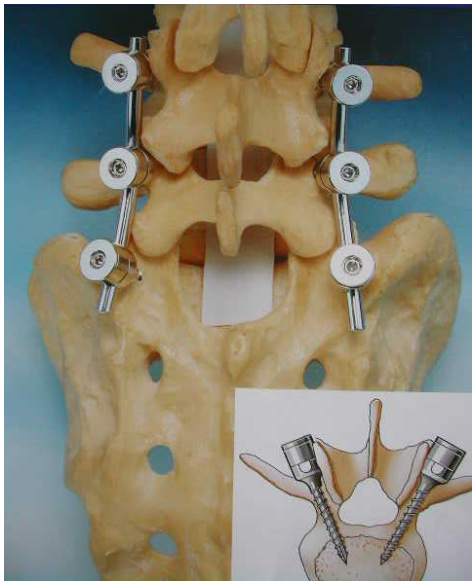
Time

Understanding back pain

Postero-lateral fusion

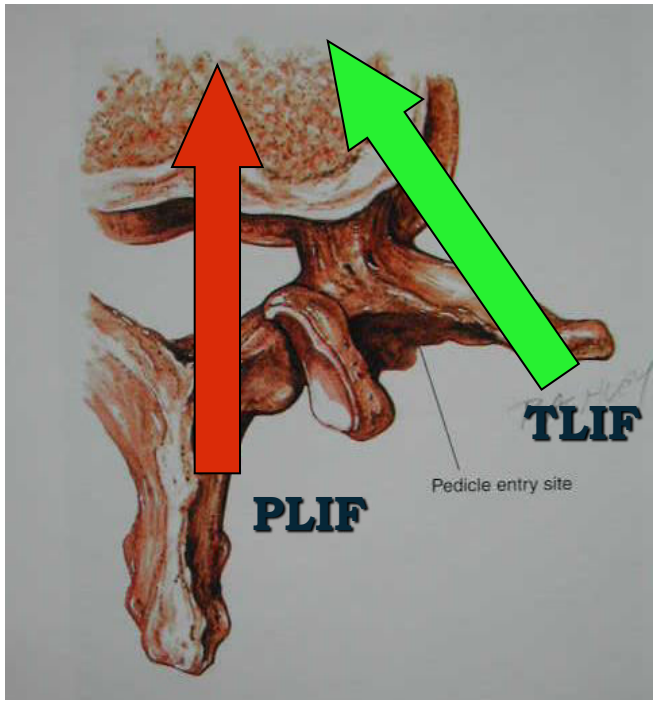


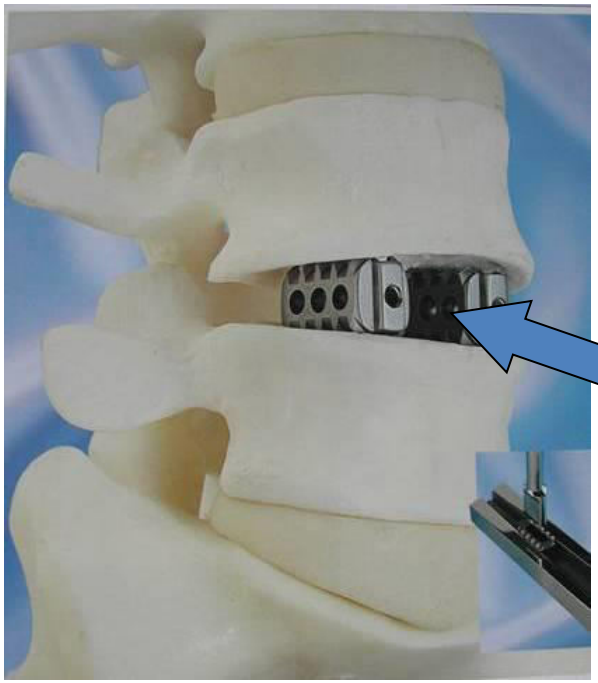




Inter-body fusions

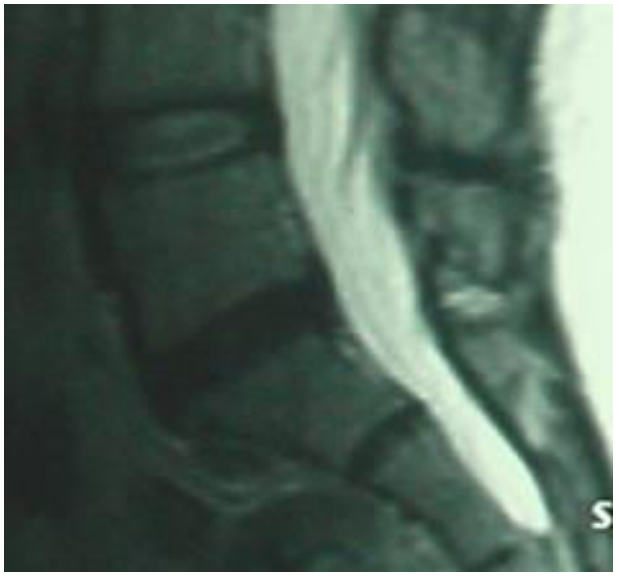
- PLIF (Posterior lumbar inter-body Fusion)
- TLIF (Trans-foraminal inter-body fusion)
- ALIF (Anterior lumbar inter-body fusion)





Fate of the ‘untreated’ disc prolapse

70 % settle down



Lumbar canal stenosis:
non-op options

- Good outcome in majority
- Physical therapy
- Judicious activity modification
- Medications
- Steroid injections

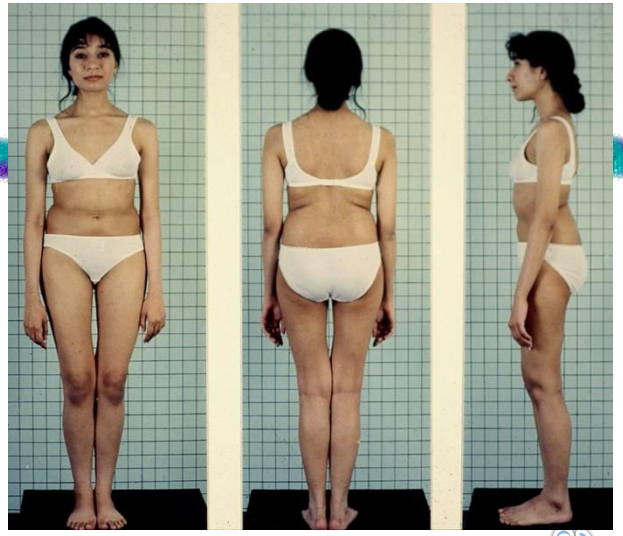
Spondylolisthesis:
Indications for surgery

Persistent severe back ± leg pain

Failed non-operative programme

Neurologic deficits

Spondylolisthesis:
Indications for surgery



- **Progression:**
  - Children / Adolescent over 50 %
  - Documented progression 25 -50 %
- **Cosmesis:**
  - Sagittal imbalance
  - Standing, walking difficulties

Take home messages……

- Think of anatomy and then pathology
- Think of the likely pain generators
- Biology and mechanics are inter-related
- Link symptoms to a likely pathology
- Tumours and infections !!


Back pain ....
.....not too hot to handle !