MRI

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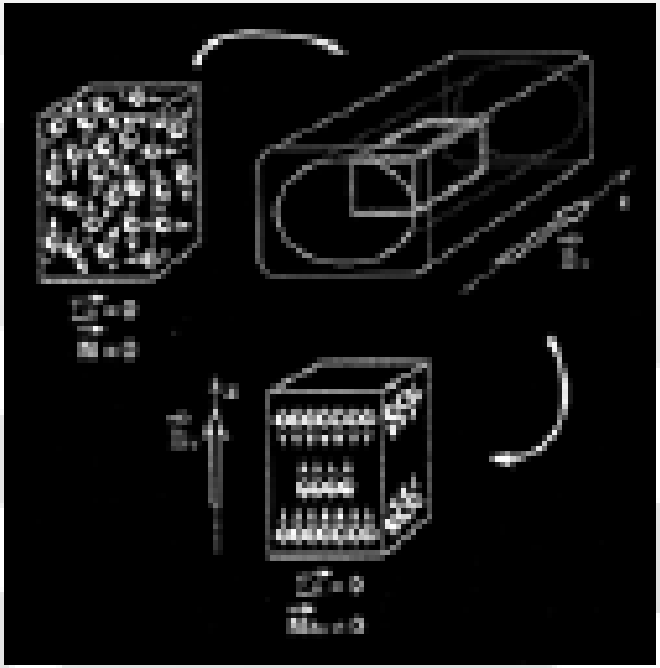
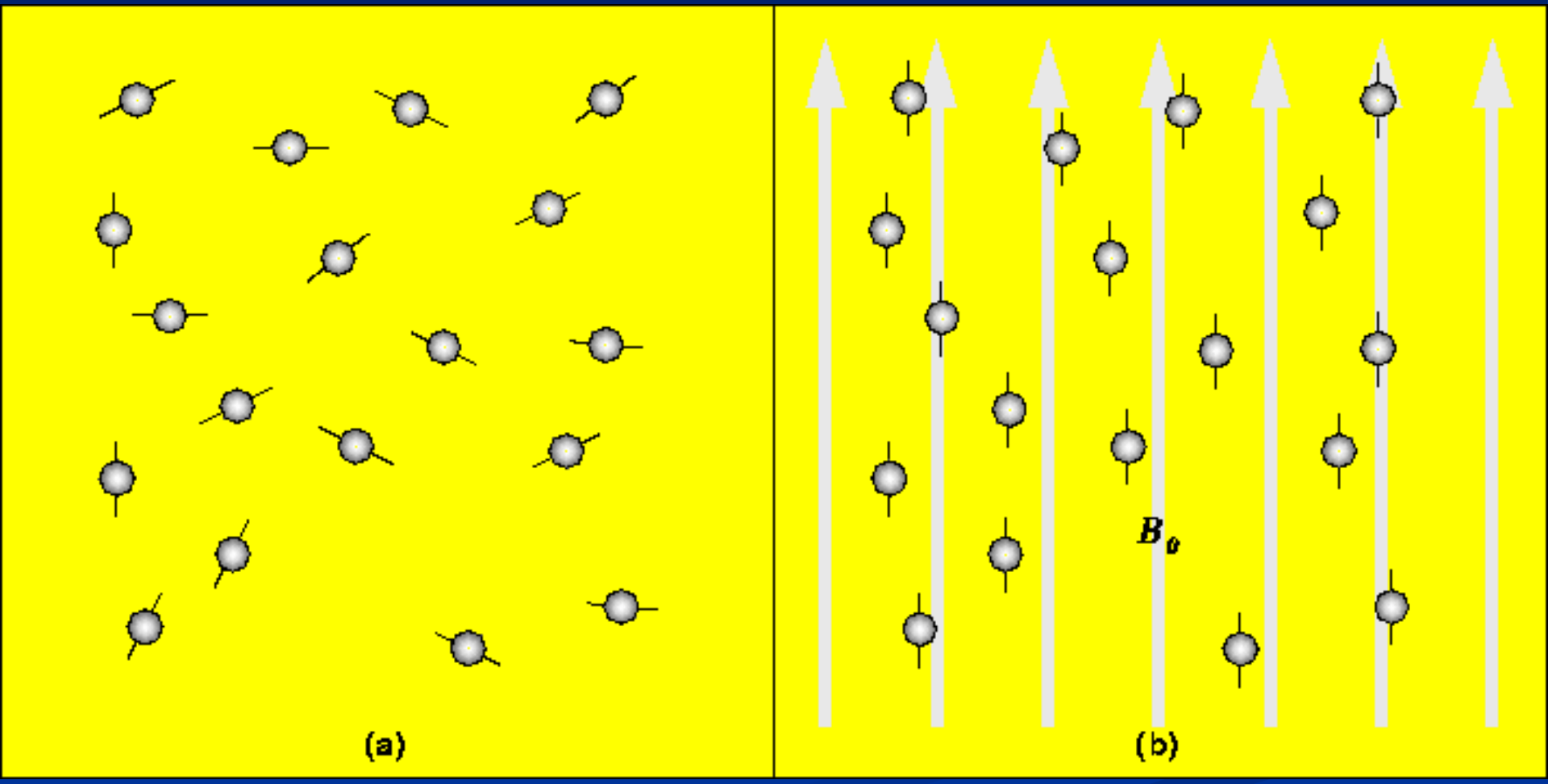
Magnetic Resonance Imaging

MRI: Absorption and emission of radiofrequency energy by hydrogen nuclei placed in a strong magnetic field B_0



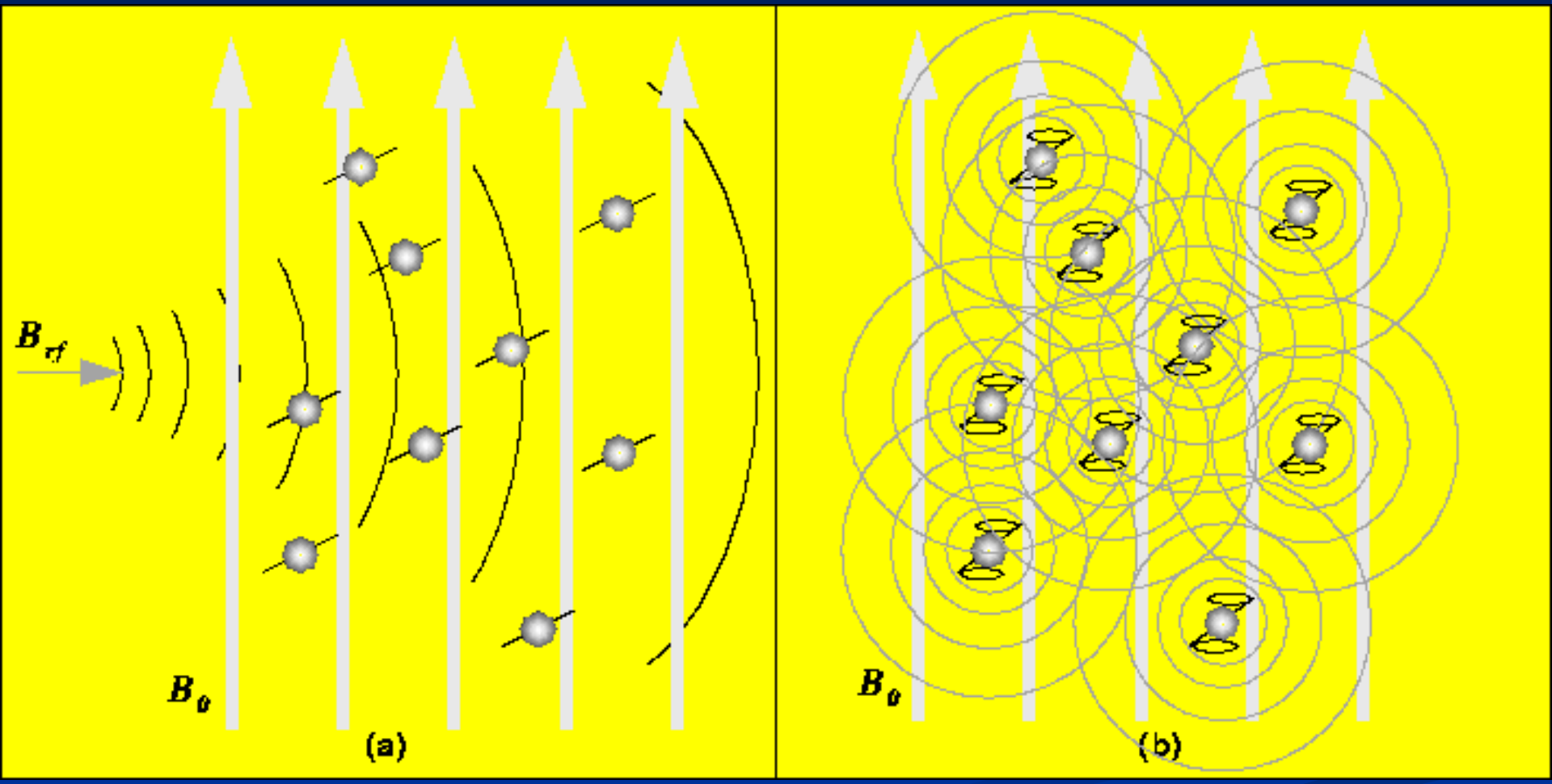
Without B_0: Random orientation of nuclei spin angular momentum u
With B_0: ***Magnetization*** phenomenon

Hydrogen nuclei of the body



No magnetic field

Align in magnetic field



RF pulse applied

Relaxation of nuclei

Permanent magnet

Magnetic field originates from permanently ferromagnetic materials

No need for additional electrical power or cooling

Disadvantages –

- Low field strengths of 0.4 T.
- Cost of magnet and supporting structures
- Varying changes in the magnetic field

Electromagnet

- Coils of wire wound on an iron core. Magnetised as current flows through.
- Superconducting magnets - partially built from superconducting materials
- No resistence at absolute zero temp.
- High magnetic field

Contraindications for MRI

- Cerebral aneurysmal clips
- Metallic foreign bodies in eye
- Pacemaker
- Metallic implant in the area being scanned

Open MRI

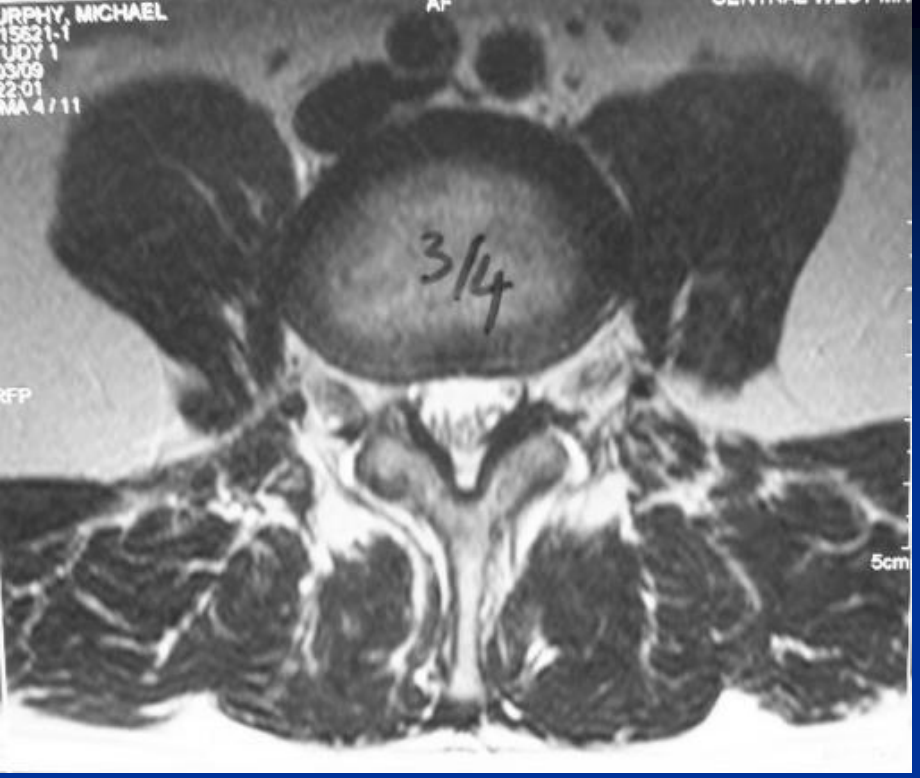
Open MRI

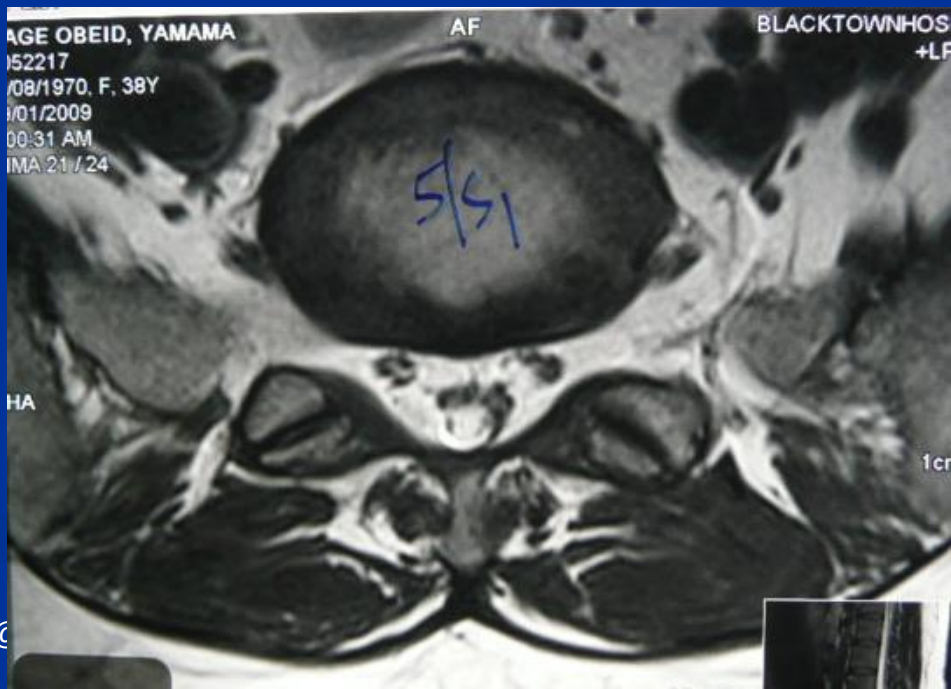
Open MRI

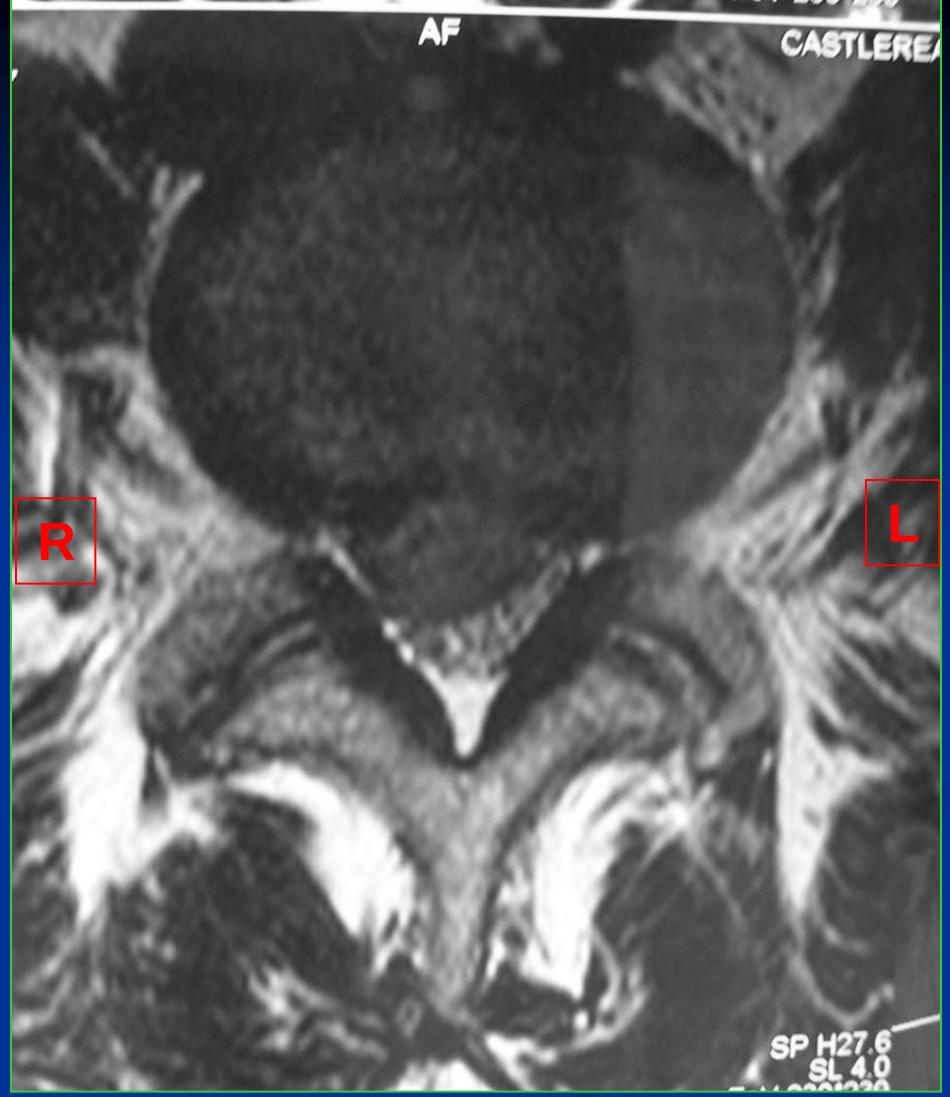
T1 image

T2 image

	Fat	Fluid
T1 images	Bright	Dark (hypointense)
T2 images	Less bright	Bright (hyperintense)

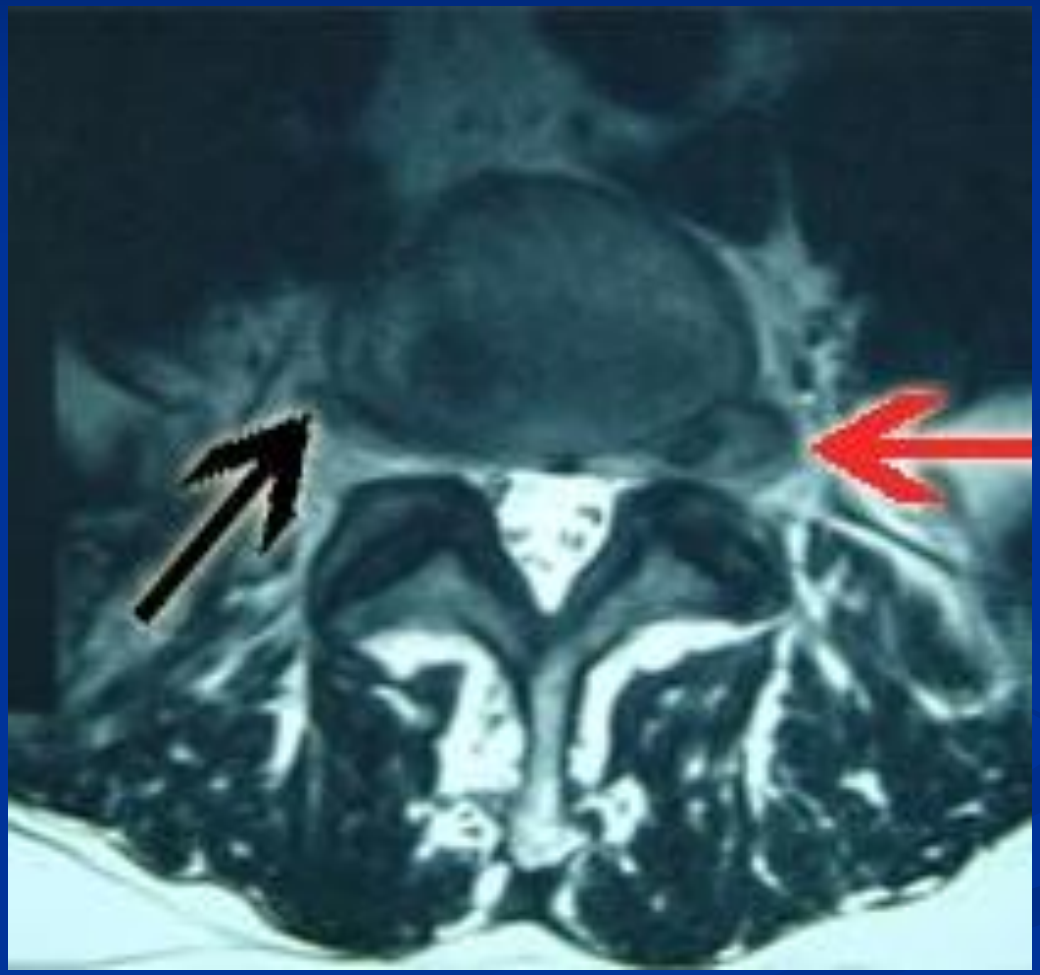

AF
3/4
5cm

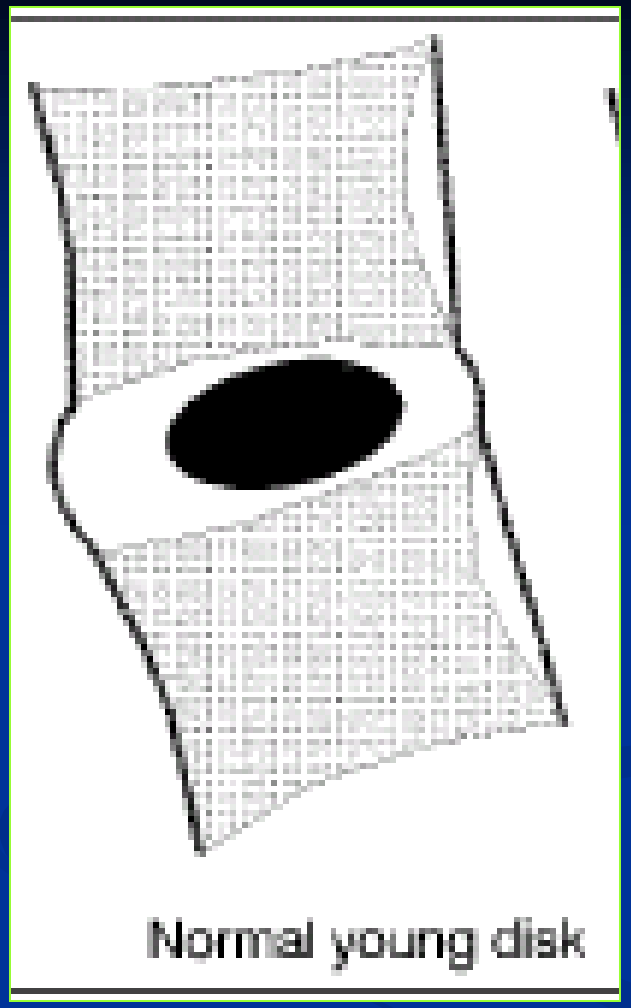

AF
5/S1



Disc herniation

Far lateral disc herniation

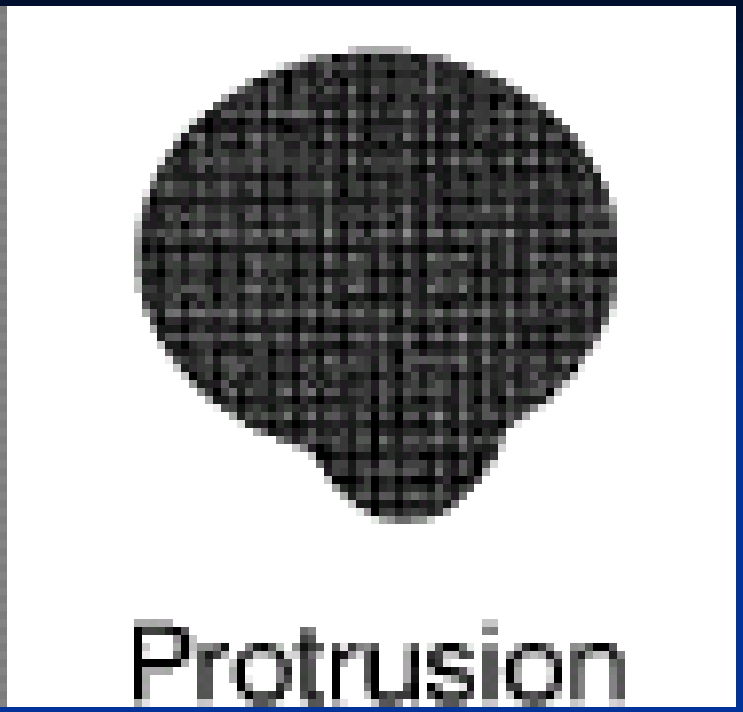


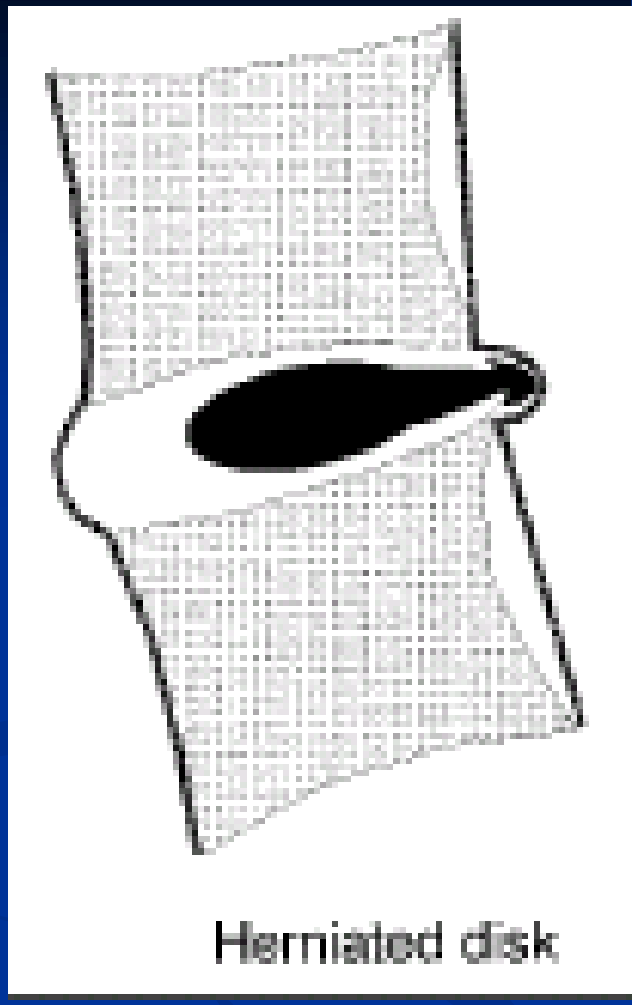


Absence of disc extension beyond the interspace

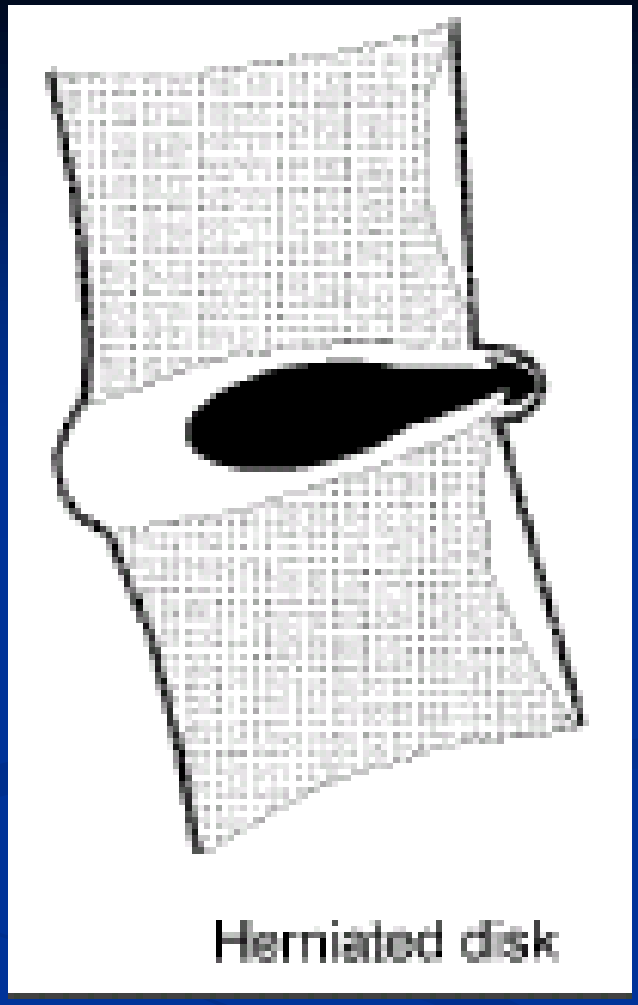
Disc bulge

- circumferential symmetrical extension beyond the interspace





- Focal, symmetric disc extension beyond the interspace
- Base is broader than any other diameter of the protrusion
- Remains within the outermost fibres of the annulus fibrosus



- **Focal, asymmetric disc extension beyond the interspace**
- **Base is narrower than the diameter of the protrusion**
- **Penetrates annulus fibrosus but contained by posterior ligament**

Disc Sequestration

The extruded disc is not in continuity with the rest of the disc.

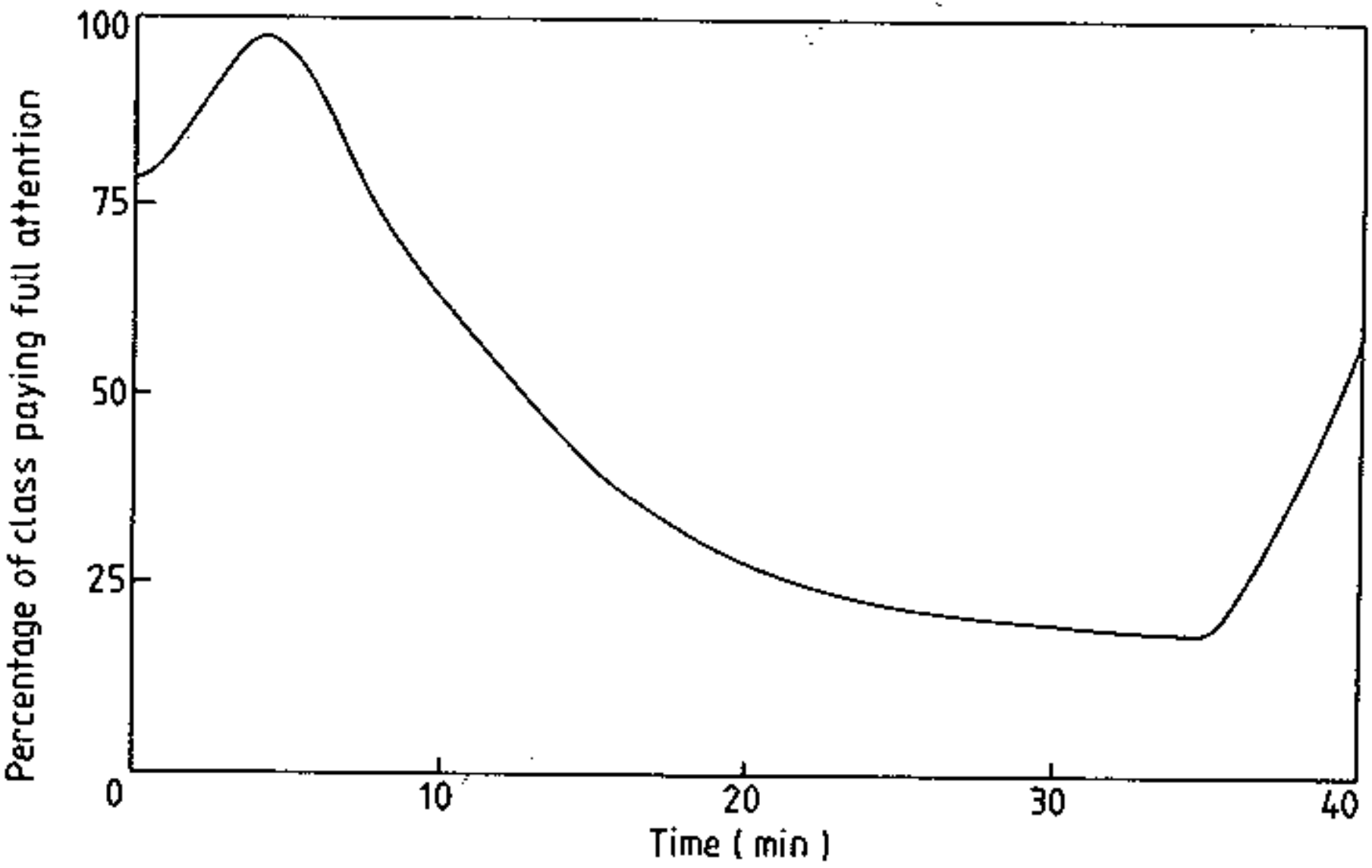
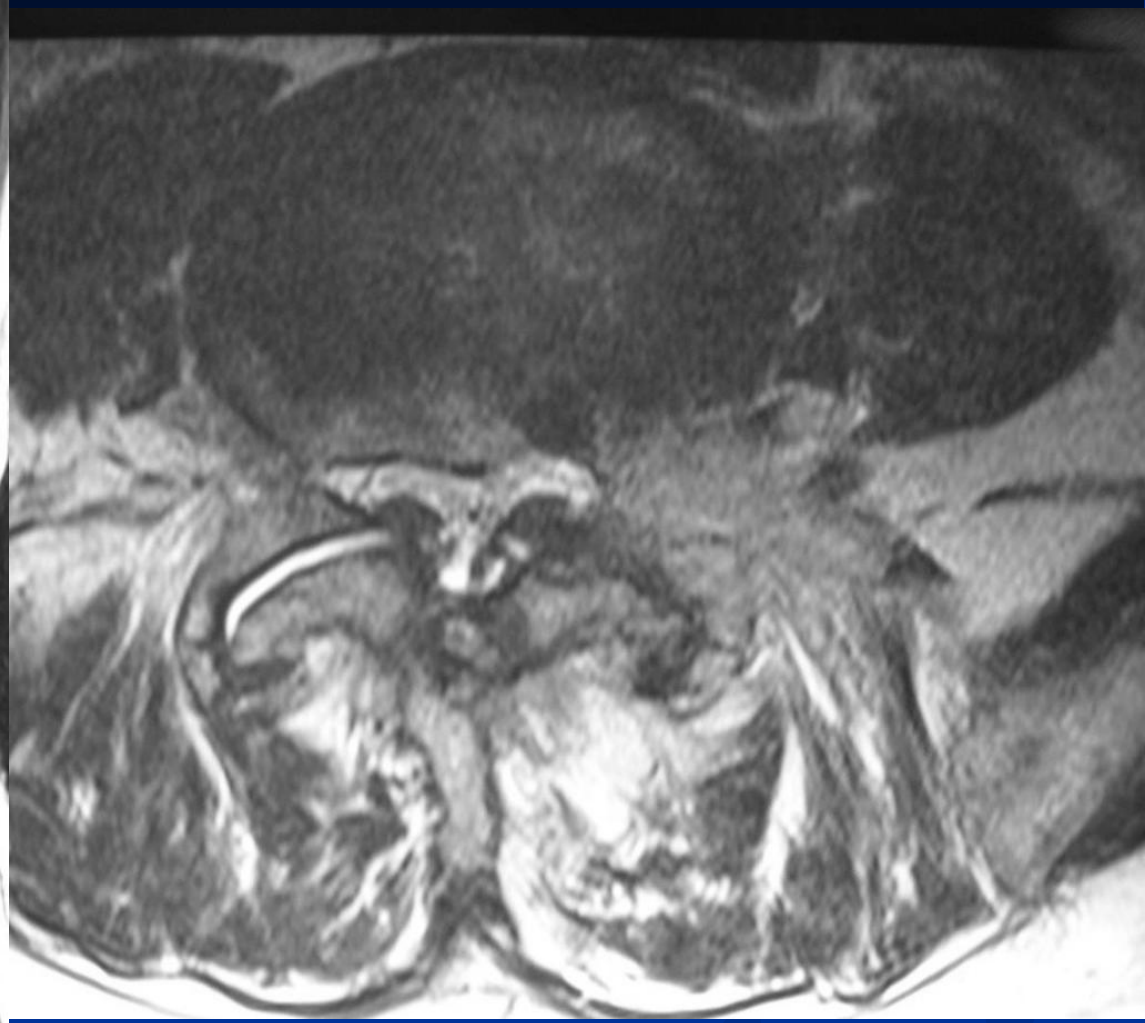
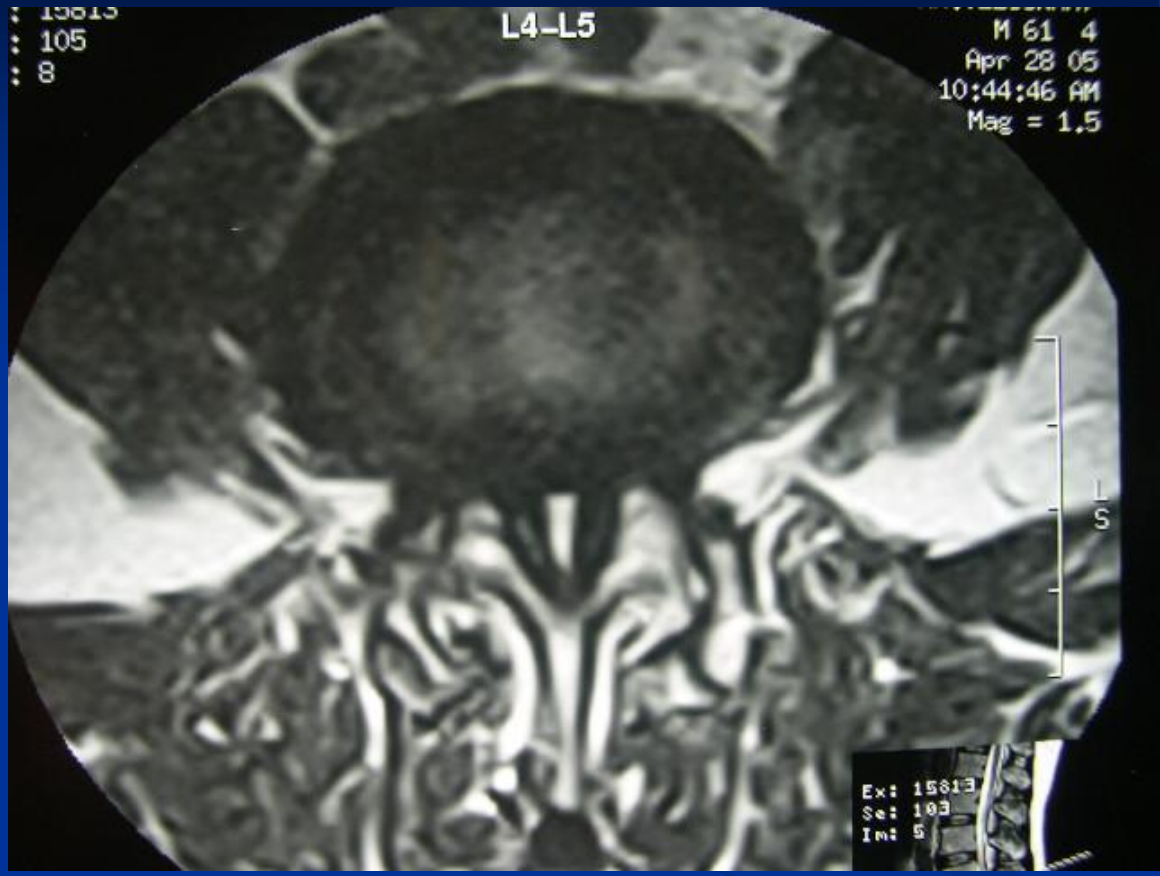


Figure 1 The attention curve.[3]

Lumbar canal stenosis

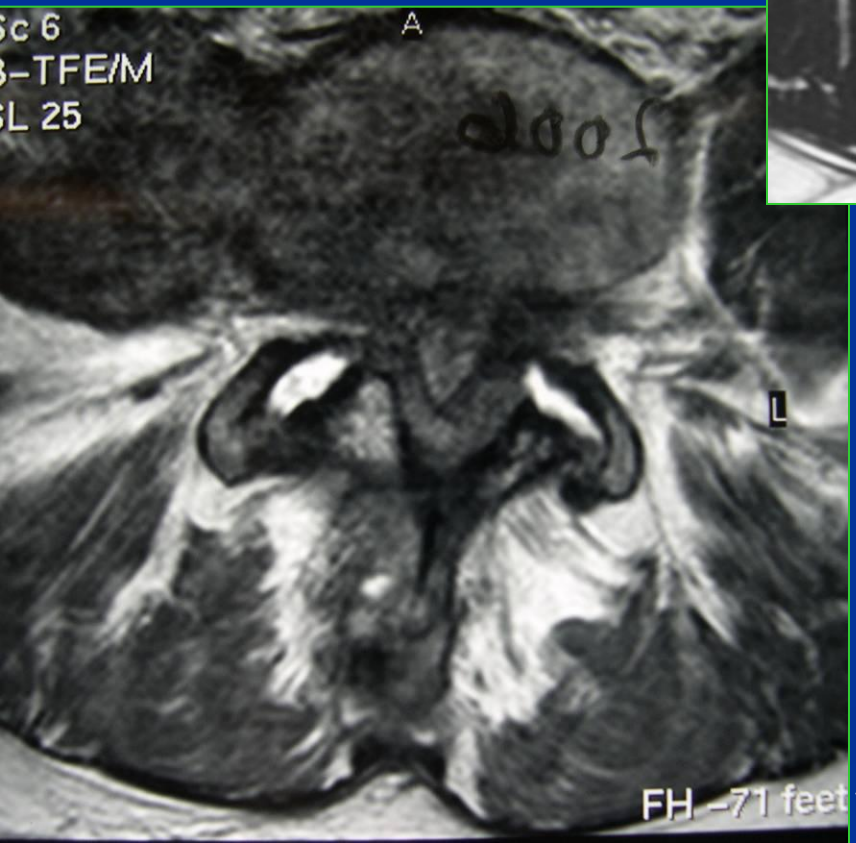


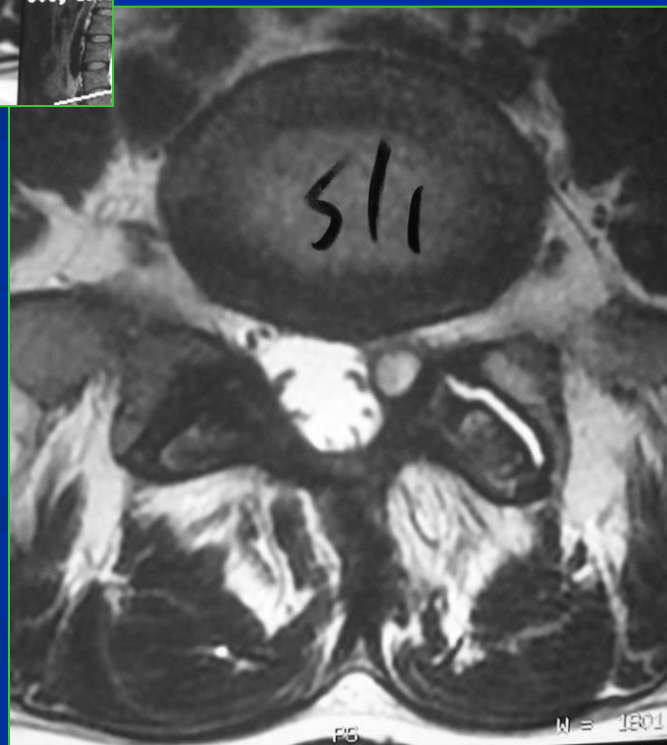
L4-L5 canal stenosis



Multi-level canal stenosis

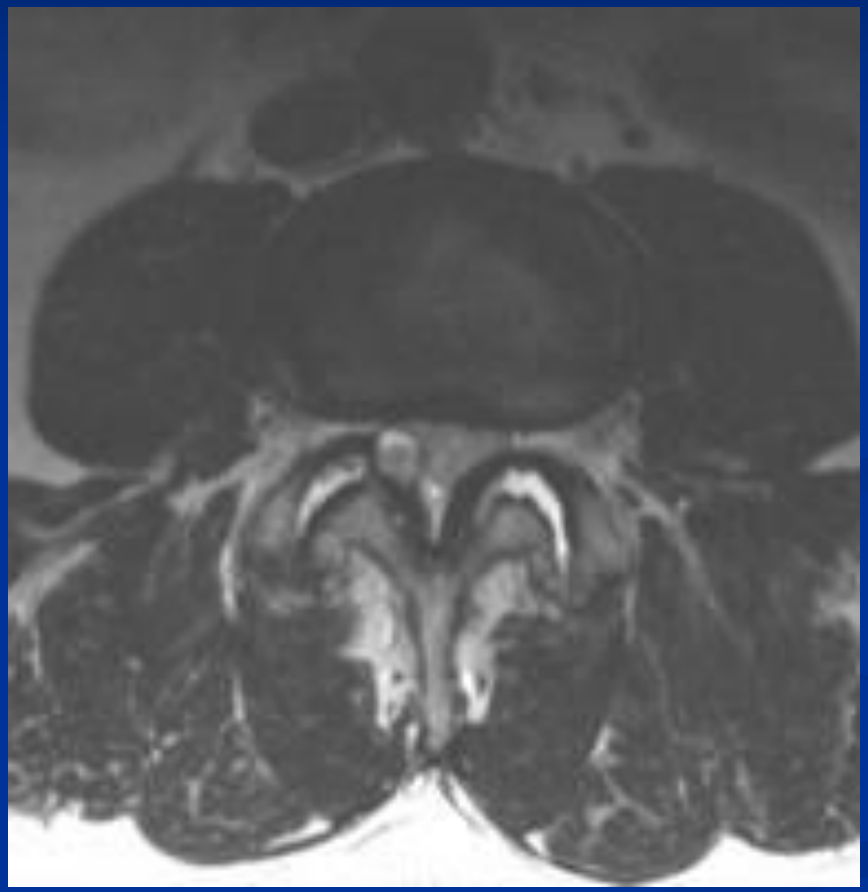
Facet joint

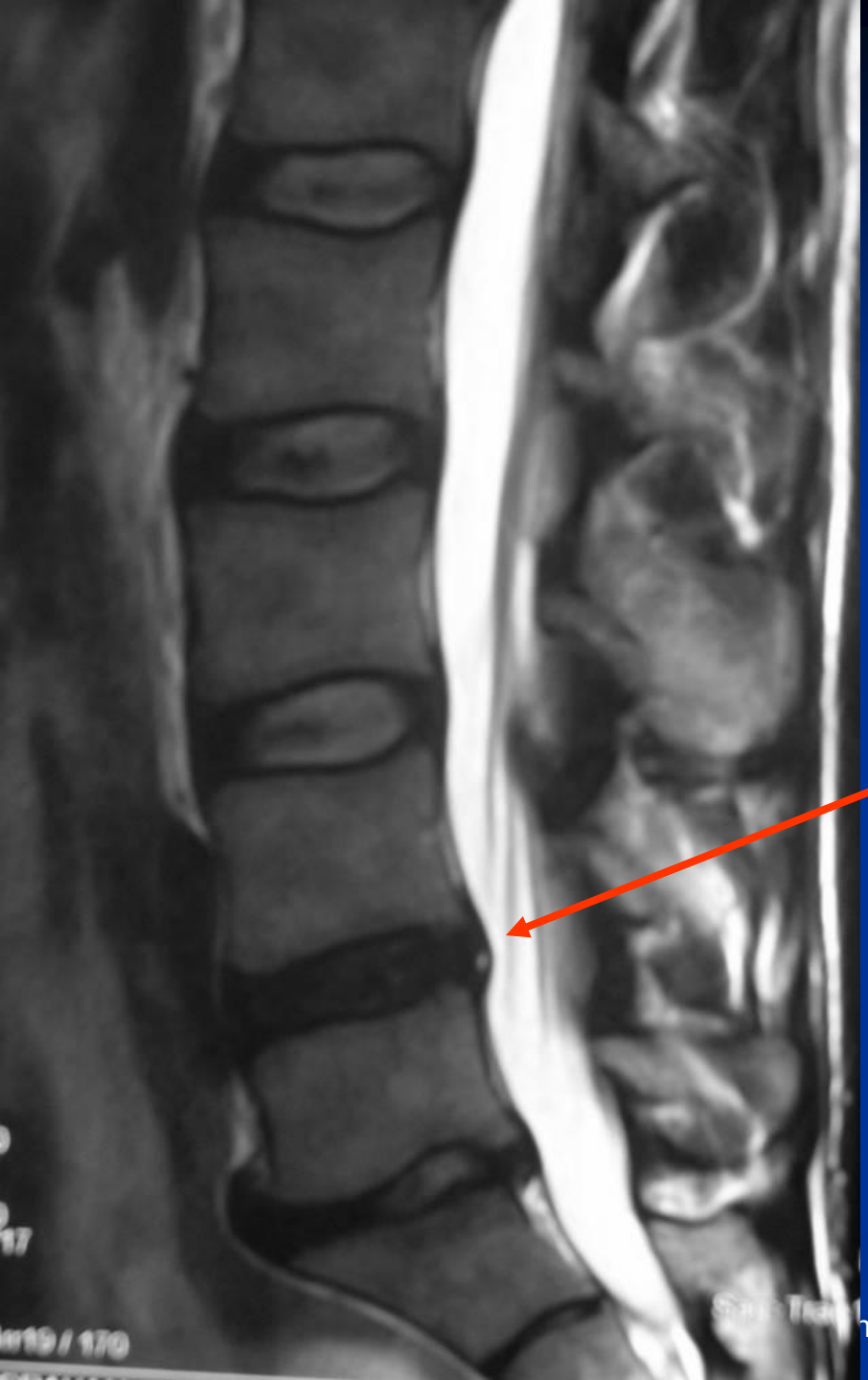




School @ Bangalore

Facet cyst





Disc Degeneration

High intensity zone
HIZ

High intensity zone - HIZ

Sensitivity and specificity of HIZs was 27% and 87%

Lei et al J Spinal Disord Tech. 2008

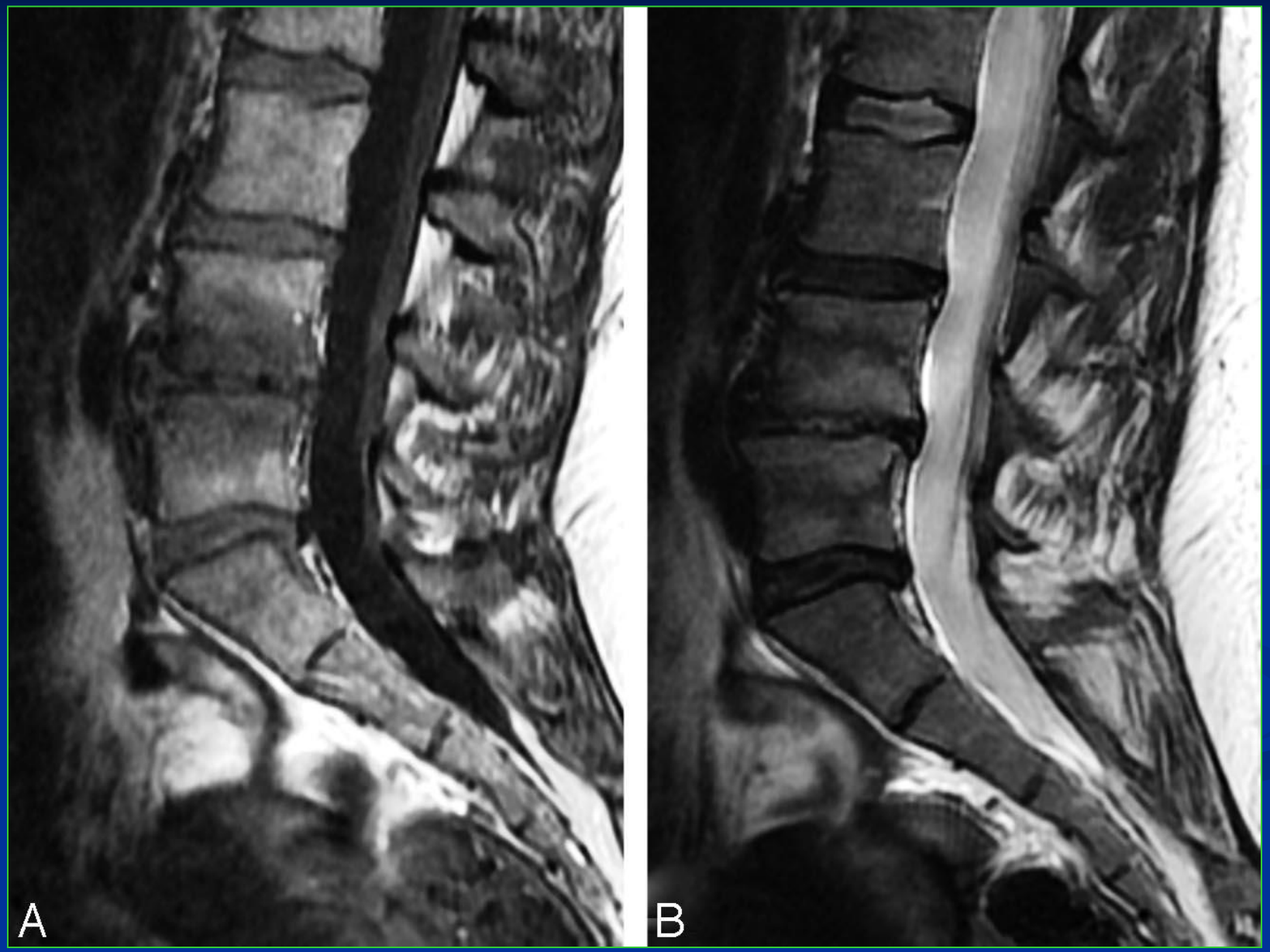
HIZ a reliable marker of painful outer annular disruption in patients with LBP

Peng et al Eur Spine J 2006

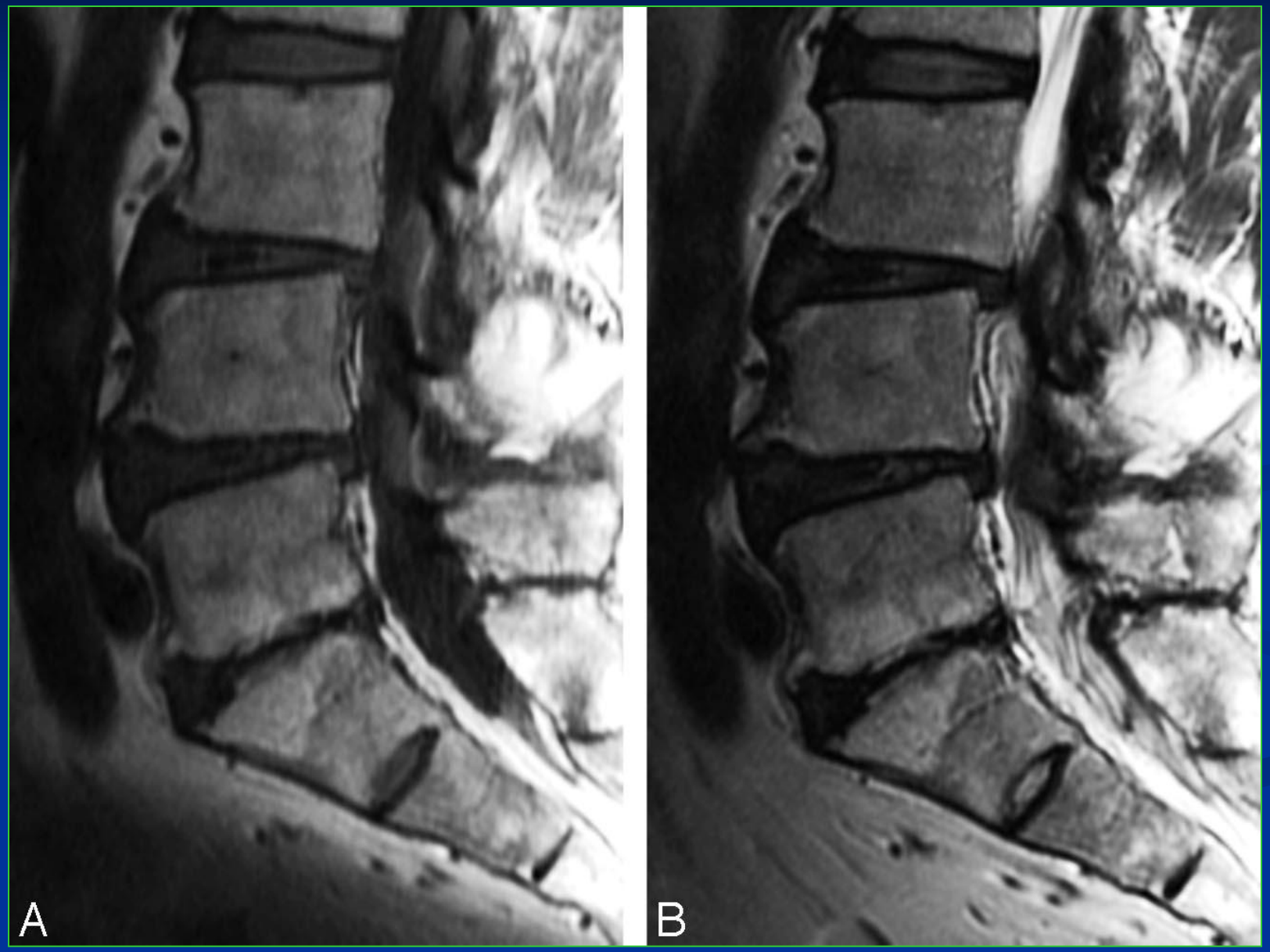
MODIC CHANGES

	T1	T2	significance
TYPE 1	↓	↑	edema
TYPE II	↑	→ (or slight ↑)	fatty degeneration
TYPE III	↓	↓	bony sclerosis

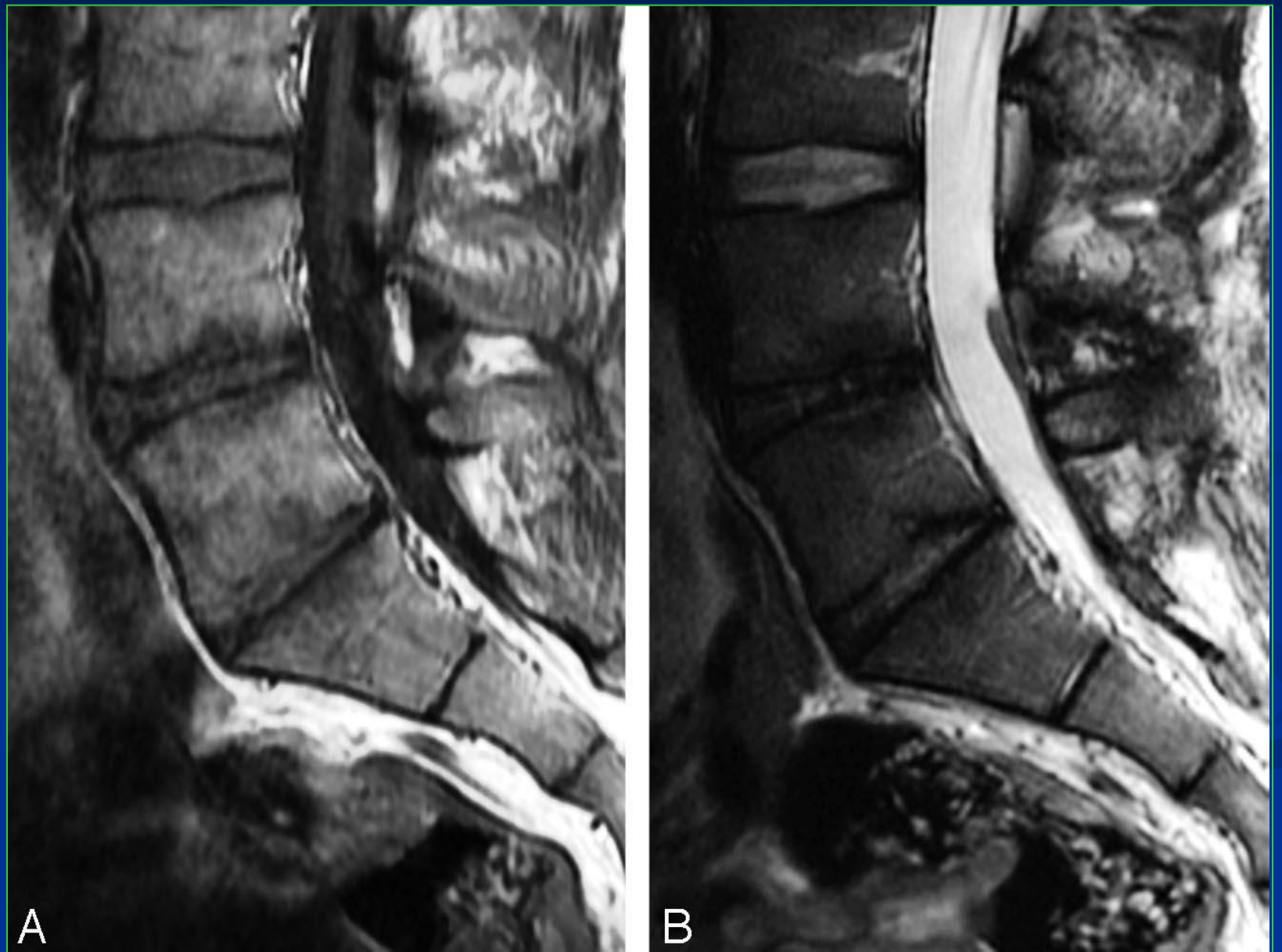
Type I



Type II



Type III



Significance of Modic changes

- 22% to 50% Modic changes in DDD

- 73% with Type I change and 11% with Type II, had significant low back pain.

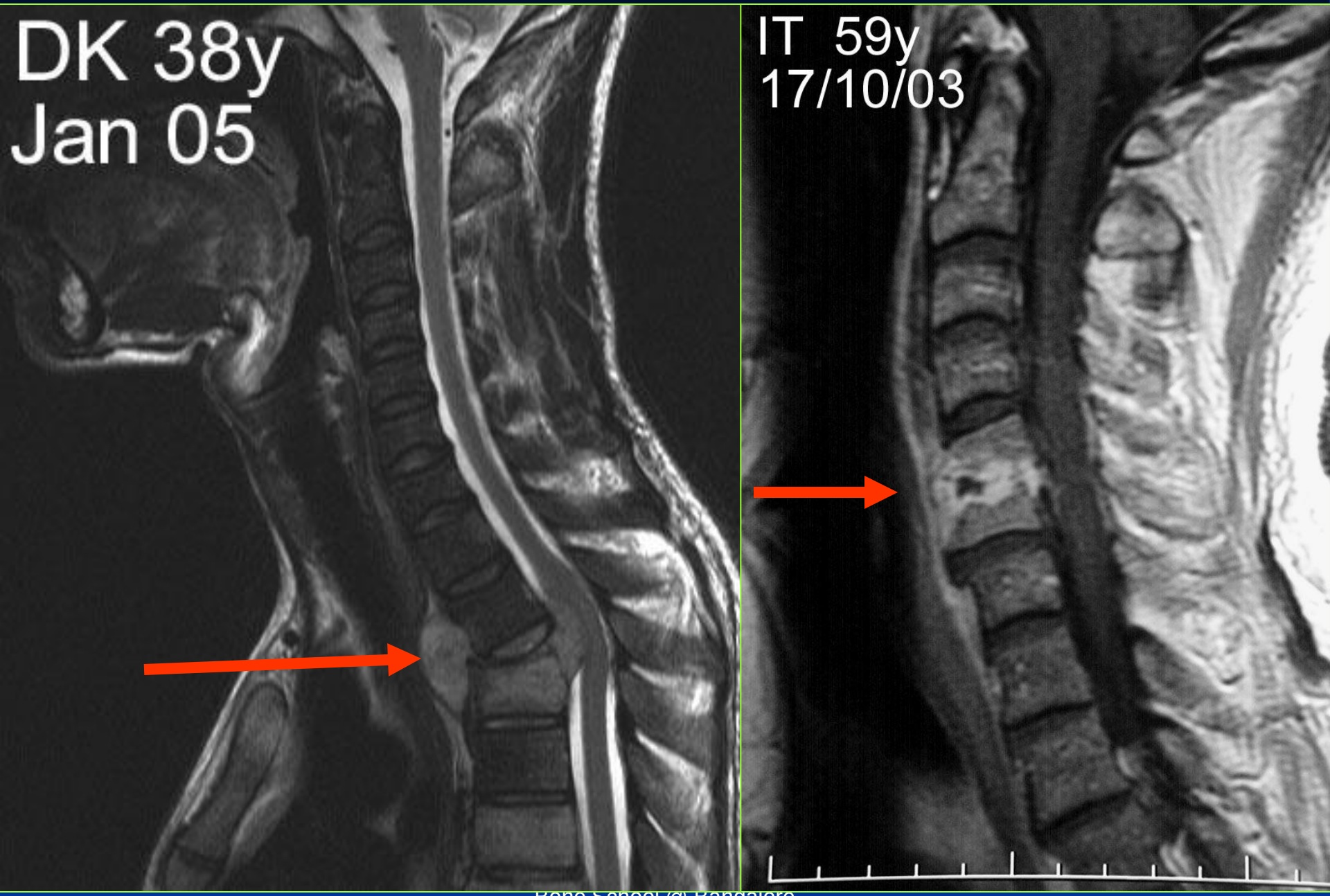
  Toyone et al JBJS 1994

- Conversions occur

  Kuisma et al Spine 2006

Variant 2: Trauma, steroids, osteoporosis, over 70.

Radiologic Exam Procedure	Appropriateness Rating	
Plain Lumbar X-Rays	8	
Plain MRI	5	
MRI + Gadolinium	4	
Isotope Bone Scan	4	
CT	4	
Myelogram	2	
Myelogram /CT	2	


DK 38y
Jan 05
IT 59y
17/10/03

- High signal intensity in fractured vertebra
- Fresh fracture

- 50 year old lady
- Metastatic tumor in T10 vertebra (from thyroid)
- Early paraparesis

END