Invitation

Who:

- students of the fifth or sixth year of the Faculty of Medicine,
- students of doctoral studies at the Faculty of Medicine,
- residents of orthopedics or neurosurgery,
- PUMS affiliation is required.

Where: Brno, at the Faculty of Medicine of the Masaryk University

When: August 2022

How: send us CV and cover letter

Bonus: 2 ECTS points

Number of training places - **4** (each year, 3 tour).

Visualizing the spine

Department of Adult Spine Orthopedics
Poznan University of Medical Science

Łukasz Kubaszewski - 2022

Co-funded by
the European Union

Plato's cave

DICOM viewer app

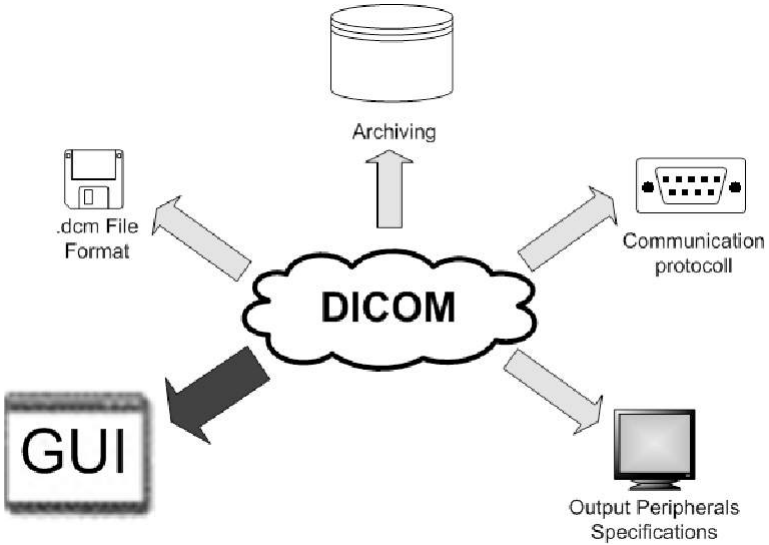
DICOM image properties

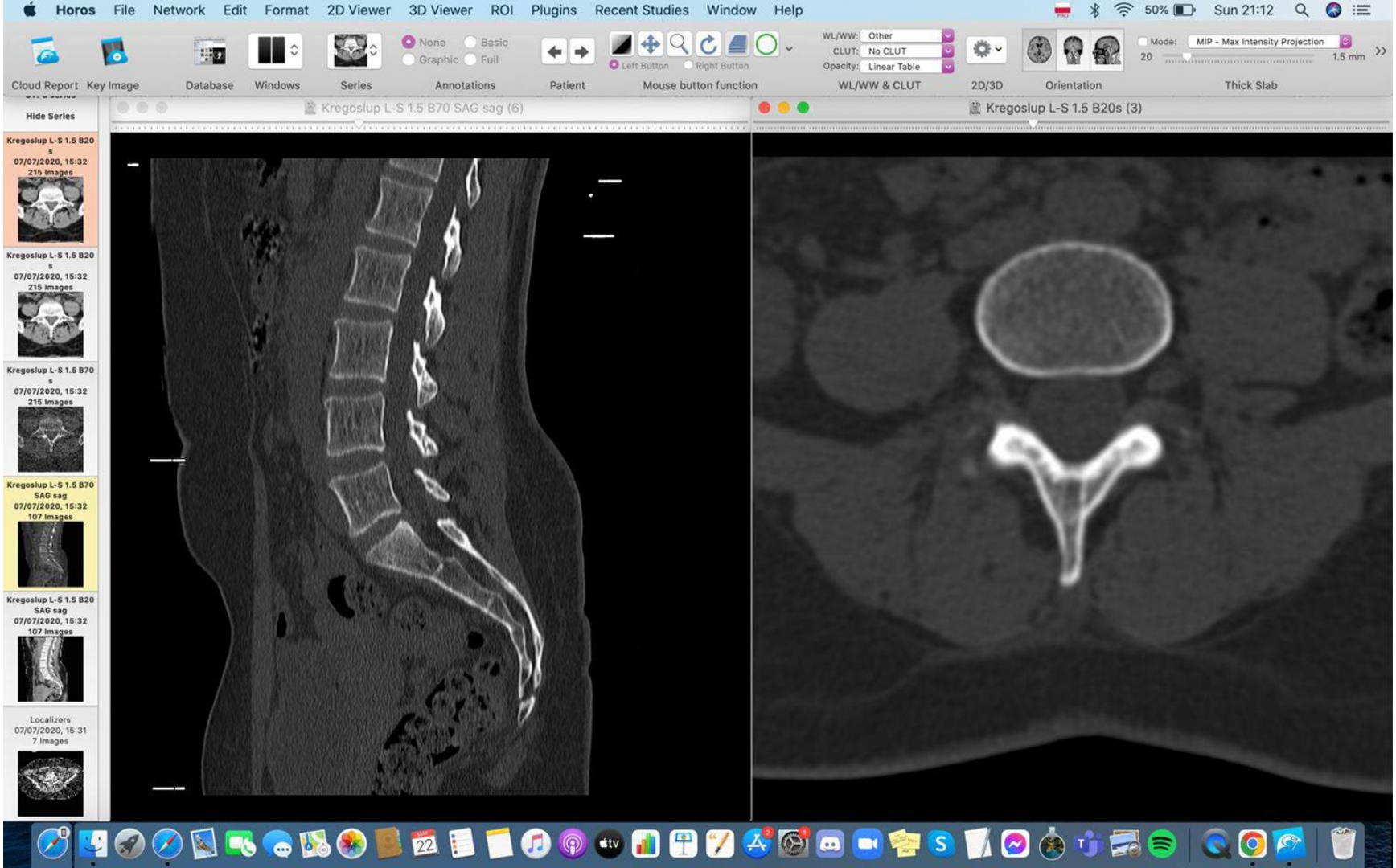
Large

Adjustable

Size	Type
588 KB	DICOM File (RA64)
124 KB	JPG File

Digital
Imaging and
Communications in
Medicine




Horos File Network Edit Format 2D Viewer 3D Viewer ROI Plugins Recent Studies Window Help
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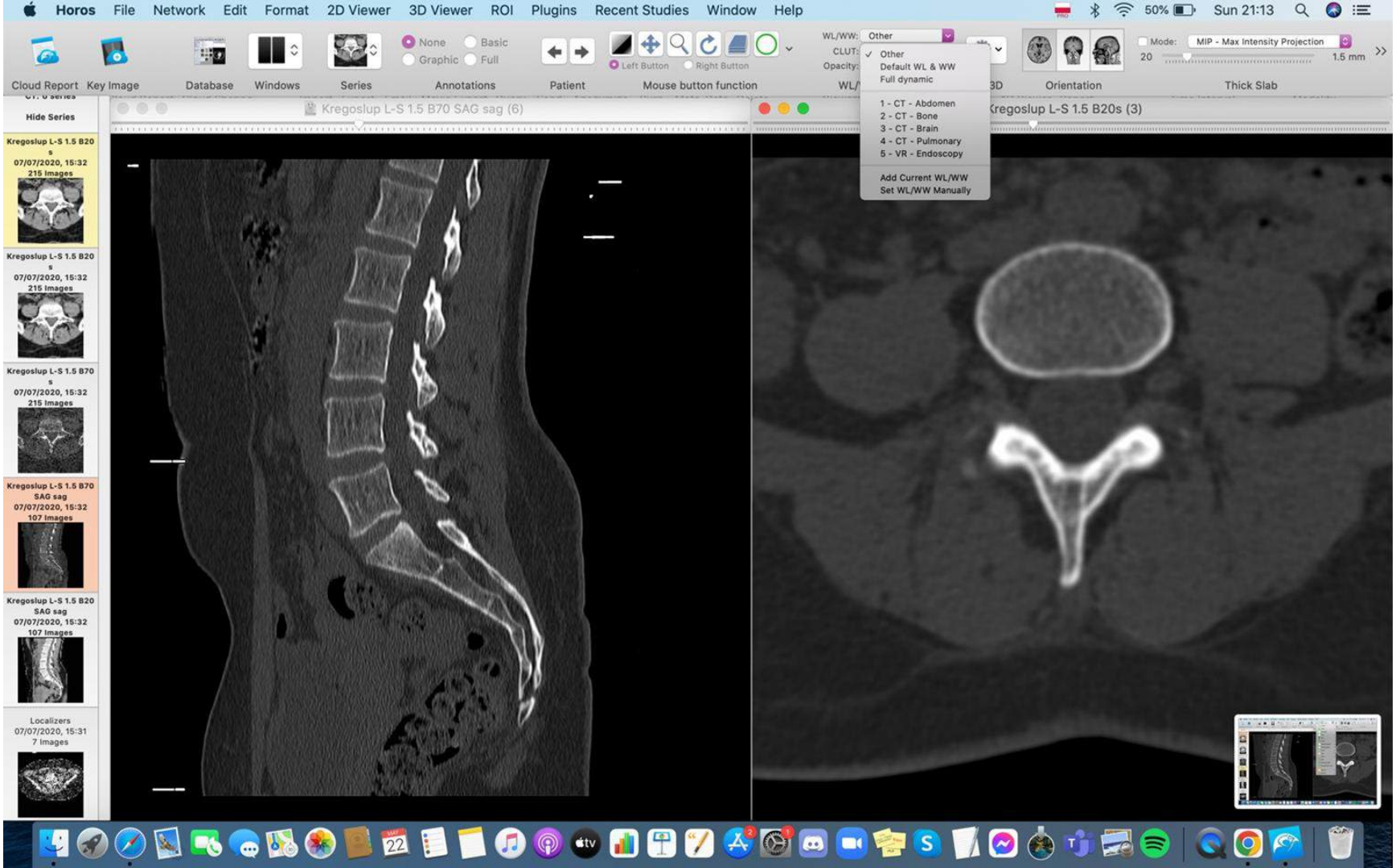
Cloud Report
Key Image
Database
Windows
Series
None Basic Graphic Full
Annotations
Patient
Left Button Right Button
Mouse button function
WL/WW: Other
CLUT: No CLUT
Opacity: Linear Table
WL/WW & CLUT
2D/3D
Orientation
Mode: MIP - Max Intensity Projection
20 1.5 mm
Thick Slab
Hide Series
Kregoslup L-S 1.5 B20 s 07/07/2020, 15:32 215 Images
Kregoslup L-S 1.5 B20 s 07/07/2020, 15:32 215 Images
Kregoslup L-S 1.5 B70 s 07/07/2020, 15:32 215 Images
Kregoslup L-S 1.5 B70 SAG sag 07/07/2020, 15:32 107 Images
Kregoslup L-S 1.5 B20 SAG sag 07/07/2020, 15:32 107 Images
Localizers 07/07/2020, 15:31 7 Images
Kregoslup L-S 1.5 B70 SAG sag (6)
Kregoslup L-S 1.5 B20s (3)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None
Basic
Graphic
Full
Annotations
Patient
Left Button
Right Button
Mouse button function
WL/WW: Other
CLUT:
Opacity:
Other
Default WL & WW
Full dynamic
1 - CT - Abdomen
2 - CT - Bone
3 - CT - Brain
4 - CT - Pulmonary
5 - VR - Endoscopy
Add Current WL/WW
Set WL/WW Manually
Orientation
Mode:
MIP - Max Intensity Projection
20
1.5 mm
Thick Slab
Hide Series
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Kregoslup L-S 1.5 B70s
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215 images
Kregoslup L-S 1.5 B70 SAG sag
07/07/2020, 15:32
107 images
Kregoslup L-S 1.5 B20 SAG sag
07/07/2020, 15:32
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Localizers
07/07/2020, 15:31
7 images
Kregoslup L-S 1.5 B70 SAG sag (6)
Kregoslup L-S 1.5 B20s (3)

Security measures

Those DICOM data are fully anonymized,

The are for your personal use,

Although the are anonymized please do not:

- share it
- “smear it” around internet

They contain bits of one’s “individual mark”

Types of the bones

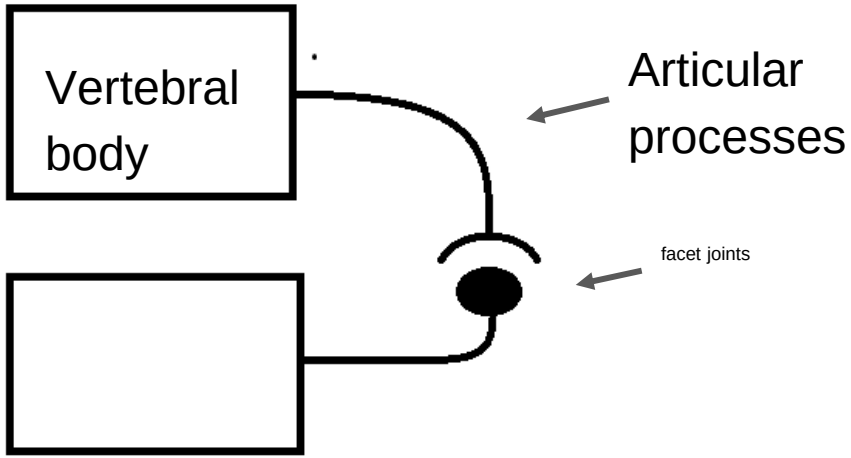
Long bone – length is more the 2x width.

Short bone – the opposite to the above.

Flat bone – has a surface

Irregular bone – it’s complicated - **vertebrae**

Elements of the vertebra



Pedicles

Lamina

Spinous process

Transverse processes

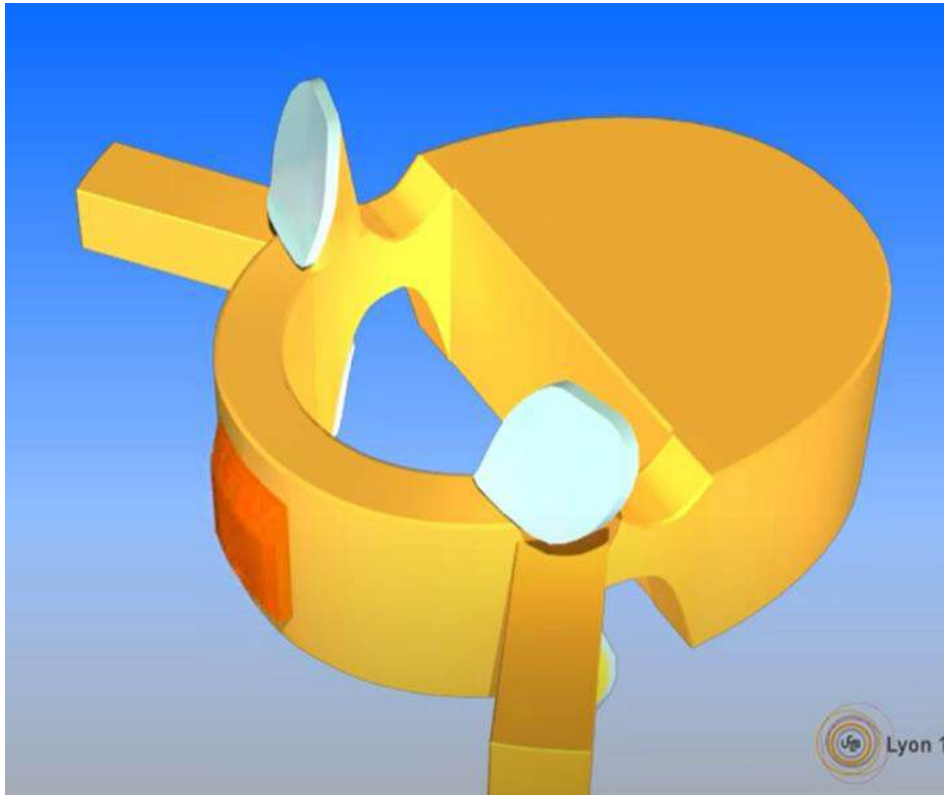
Contact Points
- loads transmission

Connecting elements

Spinal canal cover

Muscle attachments

Simplified view of the vertebra



Types of studies

X-ray

CT

MRI

Computer tomography - bony structures

Vertebral body

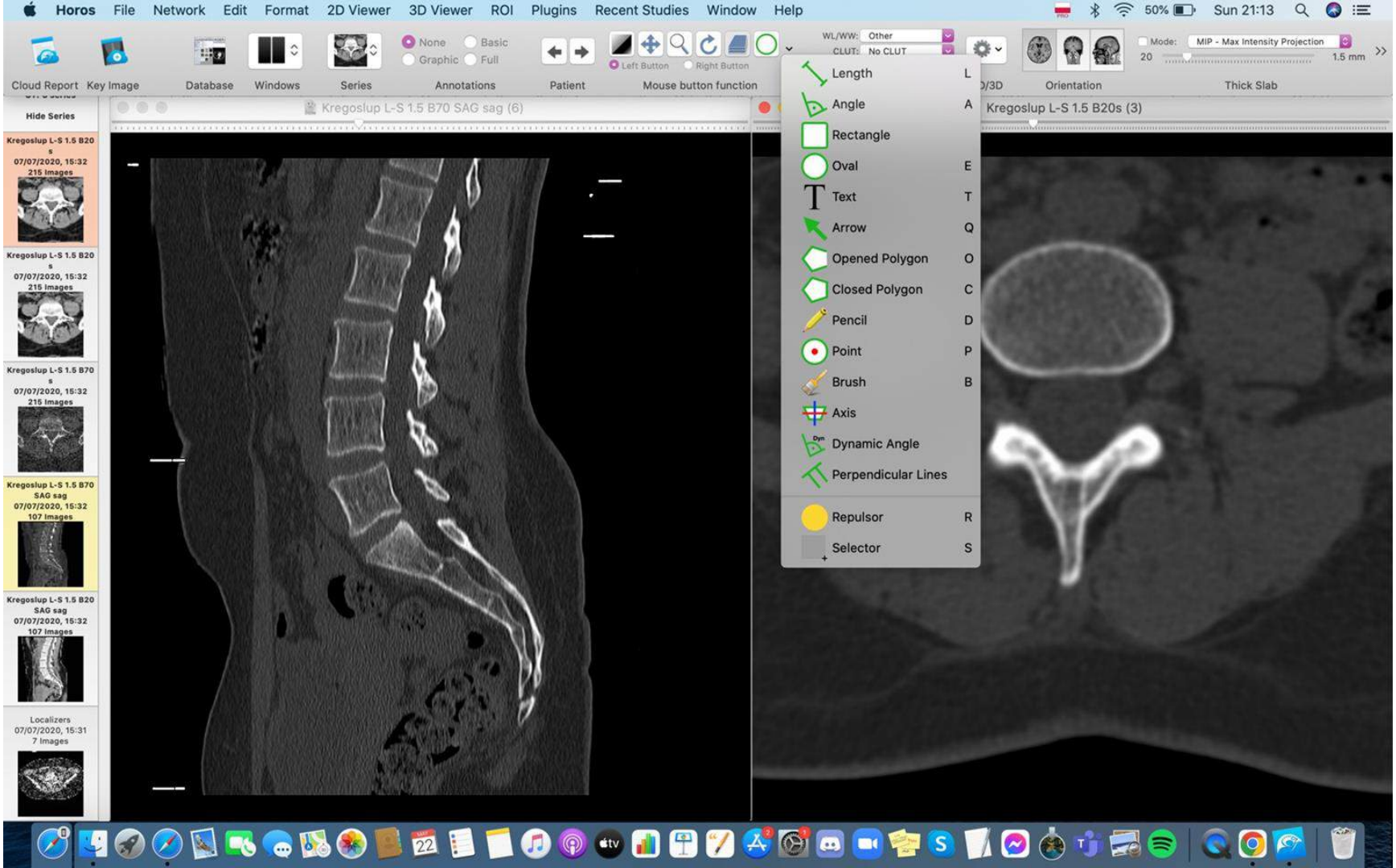
Pedicles

Lamina

Facets

Spinal process

Transverse process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Kregoslup L-S 1.5 B20s (3)
Length L
Angle A
Rectangle
Oval E
Text T
Arrow Q
Opened Polygon O
Closed Polygon C
Pencil D
Point P
Brush B
Axis
Dynamic Angle
Perpendicular Lines
Repulsor R
Selector S

Vertebral body volume

Review | Published: 16 September 2015

Anthropometric approach to lumbar vertebral body volumes

Alexandre Caula, Gautier Metmer & Eric Havet

Surgical and Radiologic Anatomy **38**, 303–308 (2016) | Cite this article

Vertebral body volume increased gradually from T1 to L4 with the exception of L5, which measured to be smaller than L4.

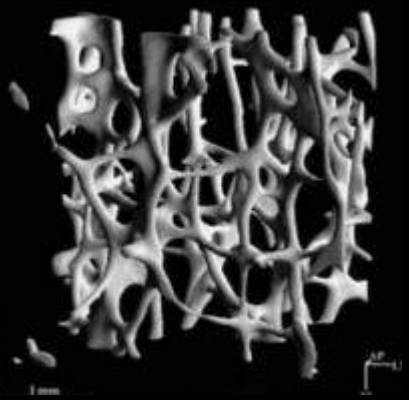
- mean lumbar vertebrae volume was **35 cm^3**
  - Range 19.7 to 61.5 cm^3.
  - Men had larger volume vertebral bodies only in the lumbar spine compared with women.

How much bone is in the bone ?

BoneVolume / TotalVolume

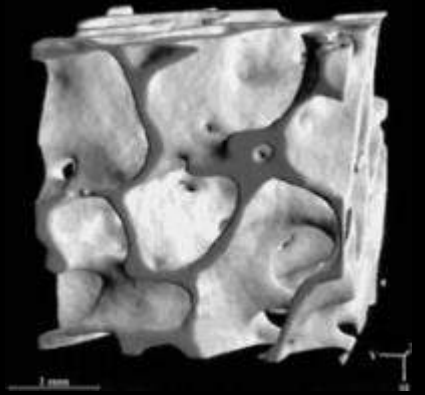
Lumbar spine

22,6%



Femoral head

48,1%

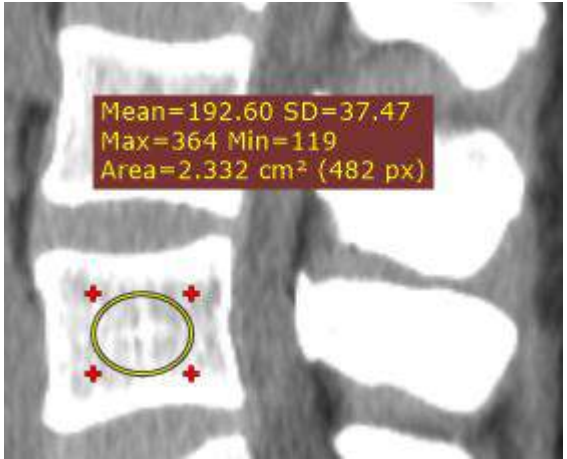


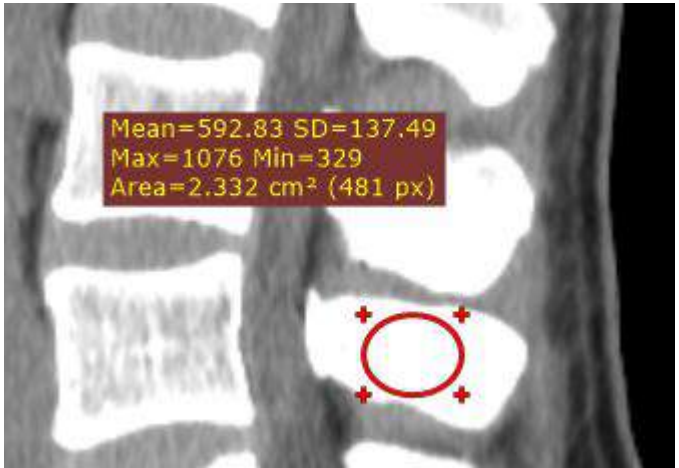
Hildebrand T, Laib A, Müller R, Dequeker J, Rüegsegger P. Direct three-dimensional morphometric analysis of human cancellous bone: microstructural data from spine, femur, iliac crest, and calcaneus. J Bone Miner Res. 1999 Jul;14(7):1167-74.

Bone density - Hounsfield scale

	cancelous	cortical
Peripheral skeleton	+300 to +400	+500 to +1900
Spine	195.7 ± 55.5	
Spine osteoporosis	97.9 ± 58.8	

Water = freezing point





X-ray

Vertebral body

Pedicles

Lamina

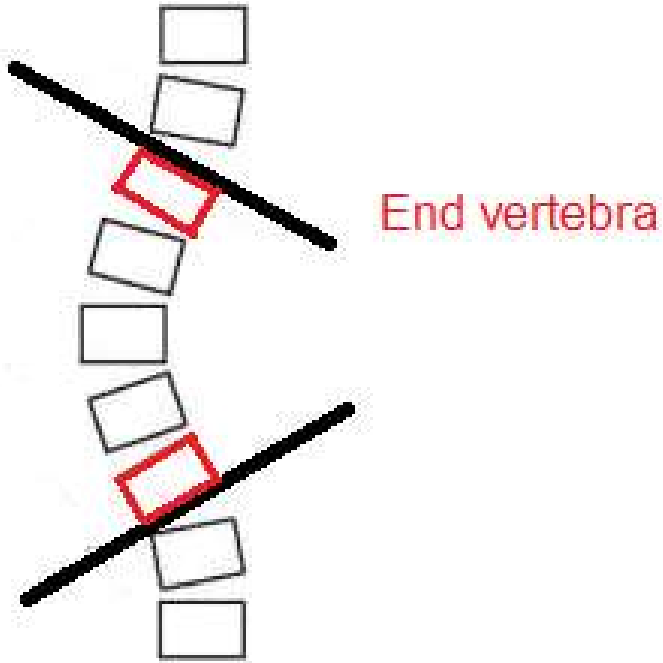
Facets

Spinal process

Configuration

Reaction to the loads

Measuring the scoliosis



MRI

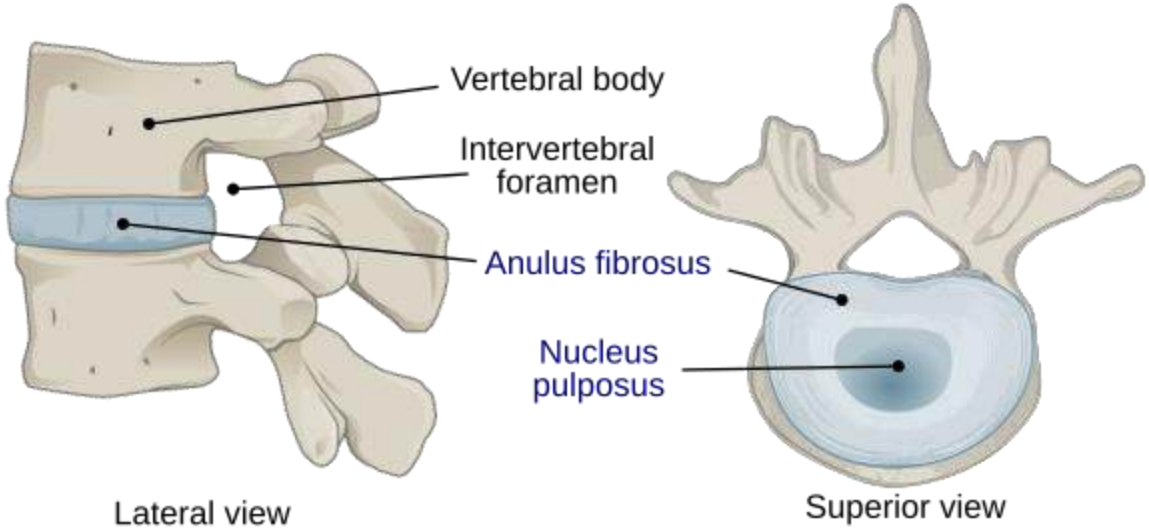
Soft tissue

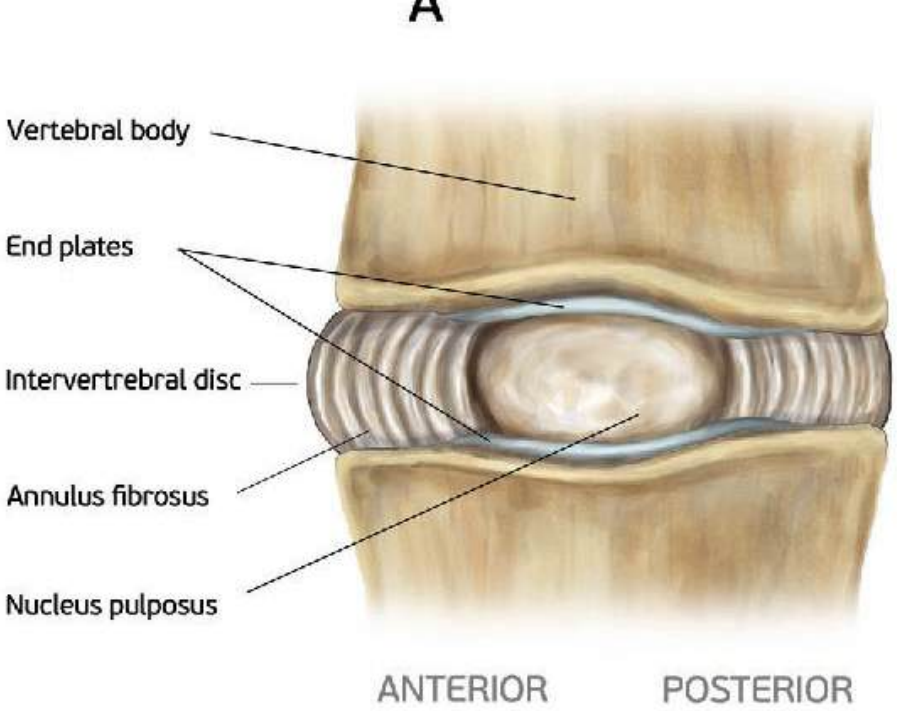
Weighted images T1 and T2 (more about)

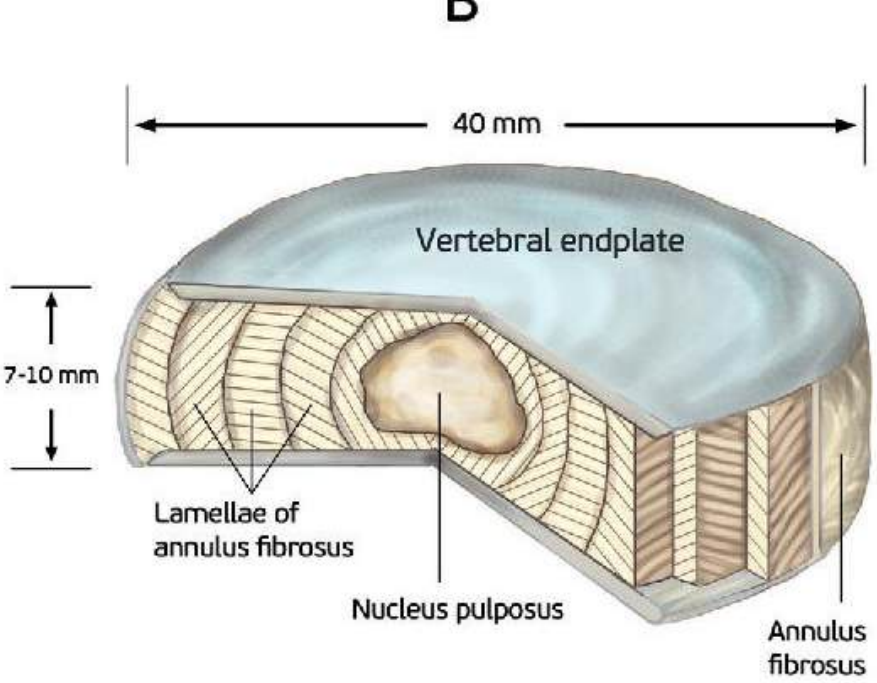
Degeneration changes - T

Tissue	T1-Weighted	T2-Weighted
CSF	Dark	Bright
Muscle	Gray	Dark Gray
Spinal Cord	Gray	Light Gray
Fat (subcutaneous tissue)	Bright	Light
Disk (if intact and hydrated)	Gray	Bright
Air (pharynx)	Very Dark	Very Dark
Inflammation (edema, infarction, demyelination)	Dark	Bright

Intervertebral disc




A
Vertebral body
End plates
Intervertrebral disc
Annulus fibrosus
Nucleus pulposus
ANTERIOR
POSTERIOR

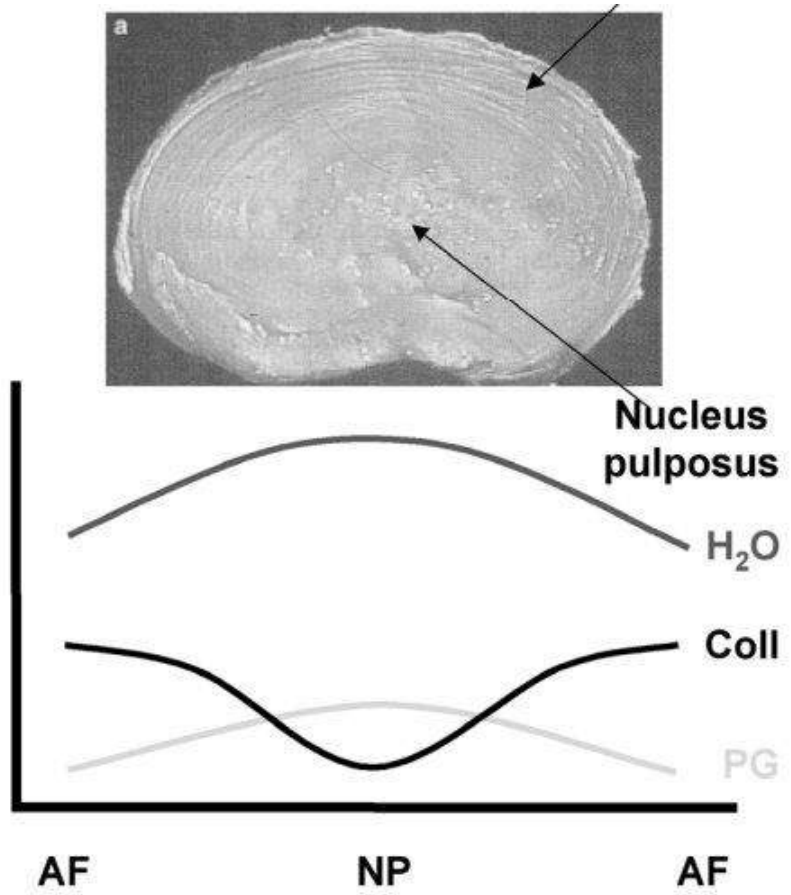

B
40 mm
Vertebral endplate
7-10 mm
Lamellae of annulus fibrosus
Nucleus pulposus
Annulus fibrosus

IVD components

1. H_20
2. collagen
3. PGY- proteoglycans

AF

NP



Disc degeneration scenarios

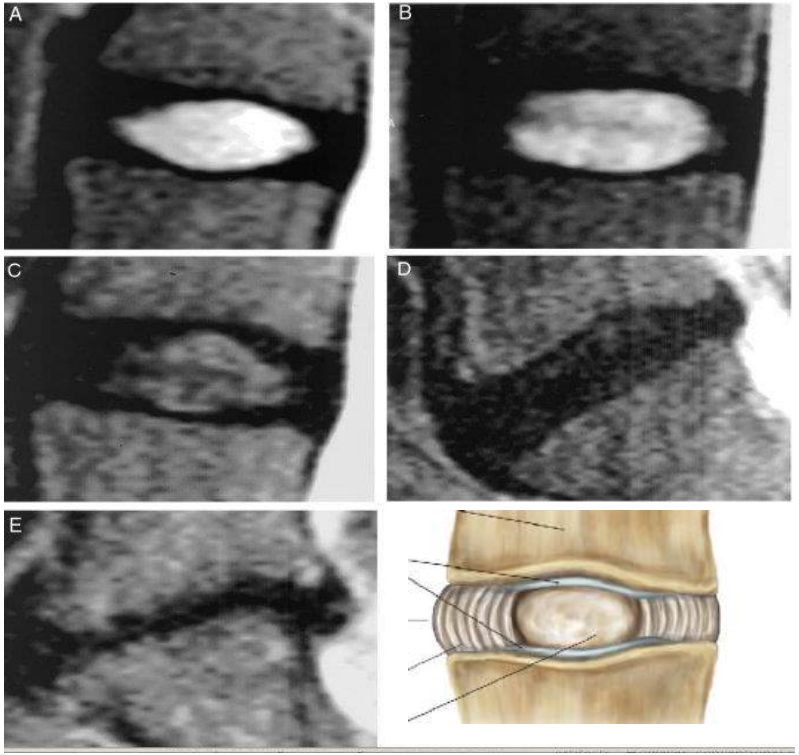
Dehydration

Loss of the water

Annulus fibrosus failure

MRI - Pfirrmann classification H_2O content

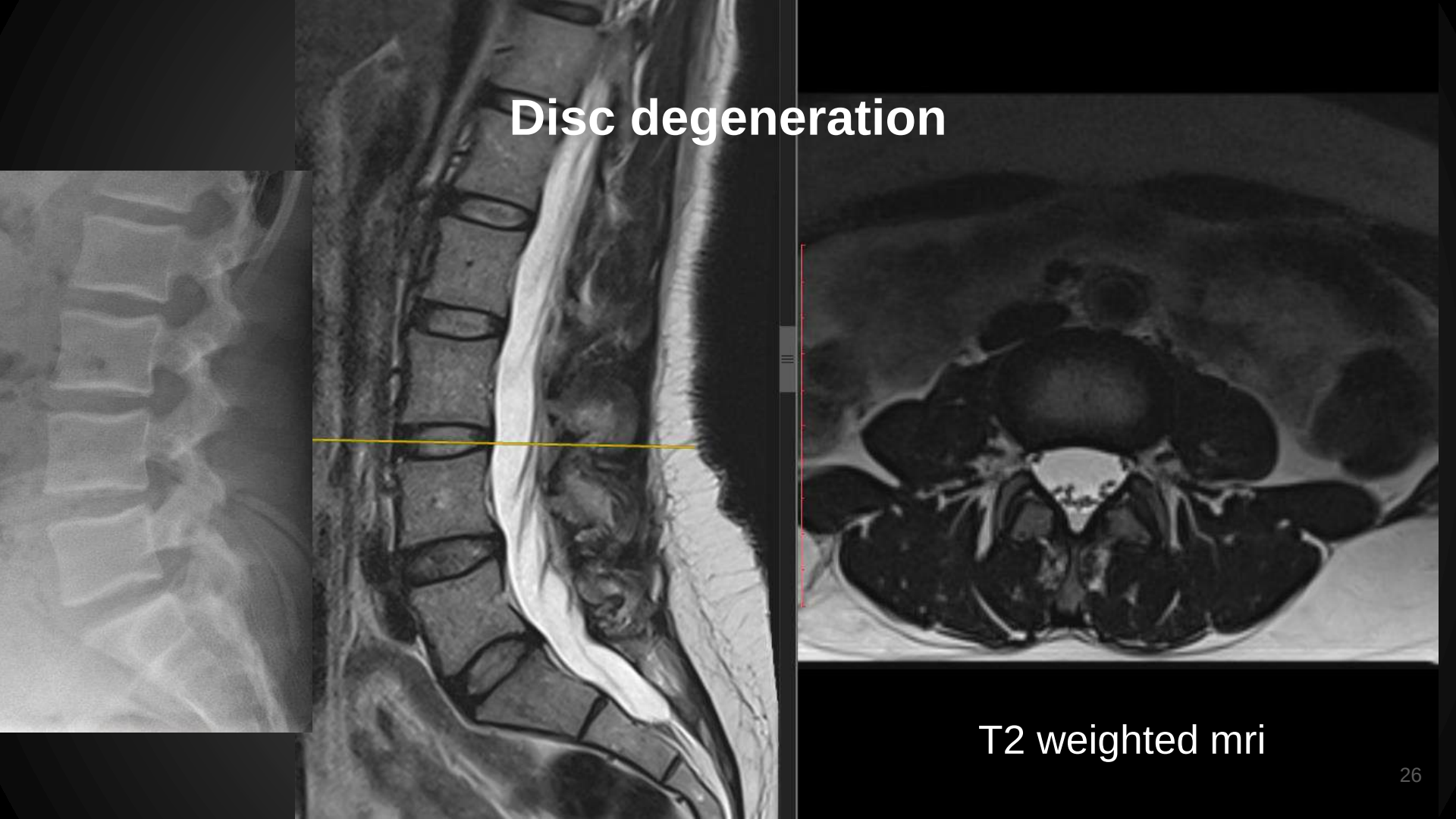
Dehydration - scenario #1



Grade	Structure	Distinction of nucleus and annulus	Signal Intensity	Height of intervertebral disc
I	Homogenous, bright white	Clear	Hyperintense, isointense to cerebrospinal fluid	Normal
II	Inhomogenous with or without horizontal bands	Clear	Hyperintense, isointense to cerebrospinal fluid	Normal
III	Inhomogenous, grey	Unclear	Intermediate	Normal to slightly decreased
IV	Inhomogenous, grey to black	Lost	Intermediate to hypointense	Normal to moderately decreased
V	Inhomogenous, black	Lost	Hypointense	Collapsed disc space

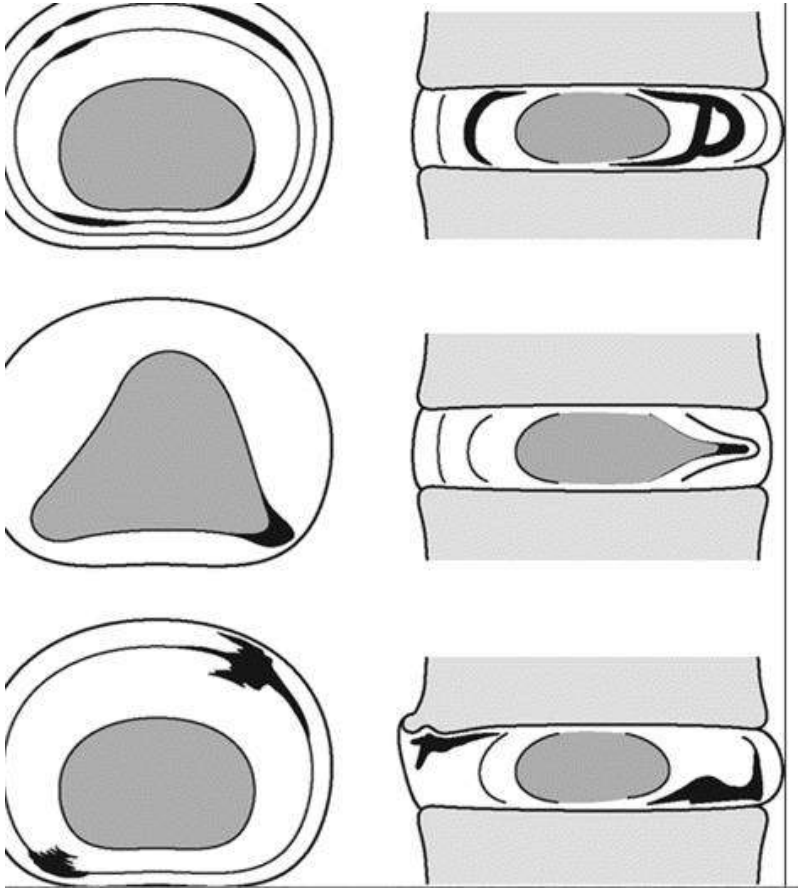
*Adapted from Pfirrmann et al. (2001) (8)

Disc degeneration



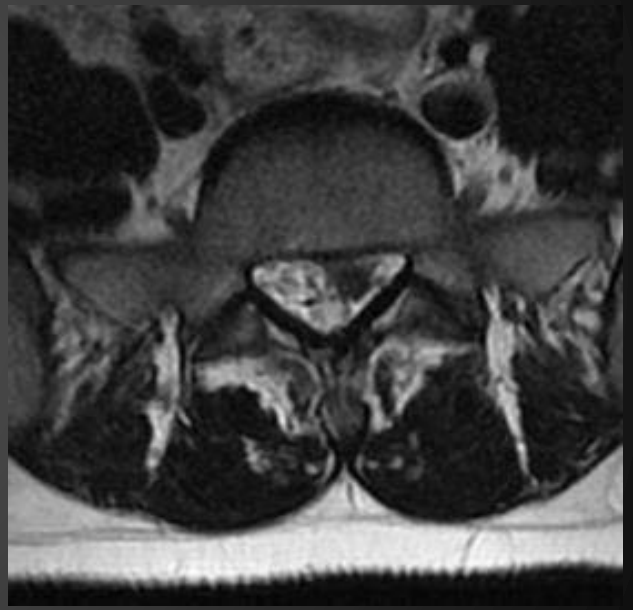
T2 weighted mri

Degeneration of the AF - scenario #2



Soft tissue problems

Disc degeneration



T2 weighted mri

Online resources

Our website

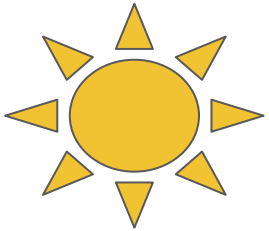
https://human.biodigital.com/explore

https://3dmdb.com/en/3d-models/dicom/

https://www.dicomlibrary.com/

http://www.osirix-viewer.com/resources/dicom-image-library/

if you find anything interesting add as the comment to the slide



What next?

Spine is a puzzle.

We will be solving the puzzle of degenerative spine.

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- students of doctoral studies at the Faculty of Medicine,
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- PUMS is required.

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When: August 2022

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