Imaging of axial SpA in Clinical Practice

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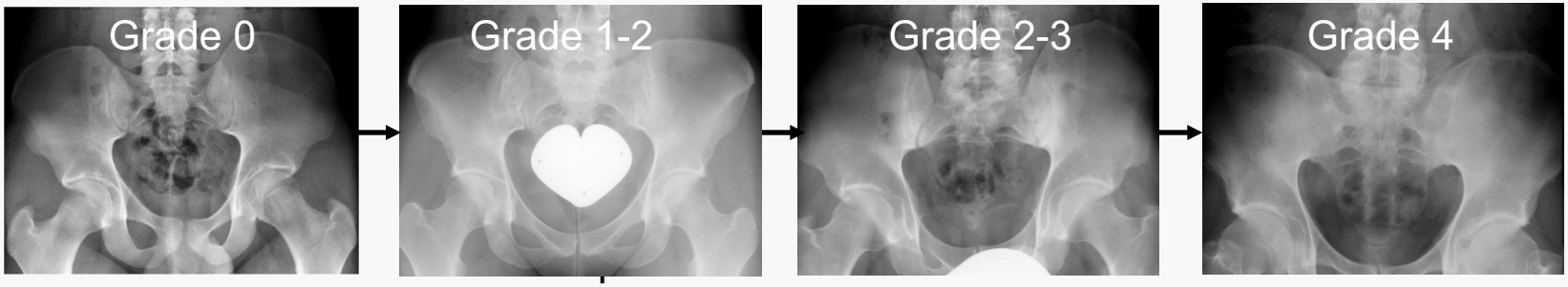
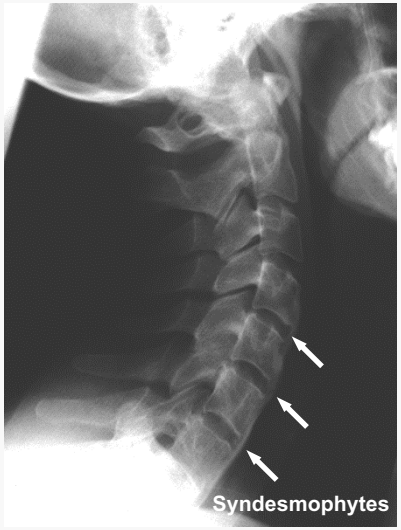
Continuum of Axial Spondyloarthritis

Sacroiliac joints



Spine



Non-radiographic stage (non-radiographic axial SpA)

Radiographic stage (ankylosing spondylitis)

Clinical symptoms, no structural changes on x-ray

Structural changes in the sacroiliac joints

Structural changes in the spine (syndesmophytes)

Time (Years)

Poddubnyy D, et al. Rheum Dis Clin North Am 2012;38:387-403.

ASAS Classification Criteria for Axial Spondyloarthritis (SpA)

In patients with ≥3 months back pain and age at onset <45 years

Sacroiliitis on imaging*

plus

≥1 SpA feature

OR

HLA-B27

plus

≥2 other SpA features

***Sacroiliitis on imaging**

- **active (acute) inflammation on MRI highly suggestive of sacroiliitis associated with SpA**
- **definite radiographic sacroiliitis according to the modified New York criteria**

SpA features:

- inflammatory back pain
- arthritis
- enthesitis (heel)
- uveitis
- dactylitis
- psoriasis
- Crohn's/colitis
- good response to NSAIDs
- family history for SpA
- HLA-B27
- elevated CRP

n=649 patients with back pain;

Overall
Sensitivity: 82.9%, Specificity: 84.4%
Imaging arm alone
Sensitivity: 66.2%, Specificity: 97.3%
Clinical arm alone
Sensitivity: 56.6%, Specificity: 83.3%

Rudwaleit M et al. Ann Rheum Dis 2009;68:777-783 (with permission)

Imaging tools relevant for diagnosing and monitoring of axial SpA

Preferred	Special situations	Not recommended for routine use
X-rays	CT	US
MRI		Scintigraphy
		PET

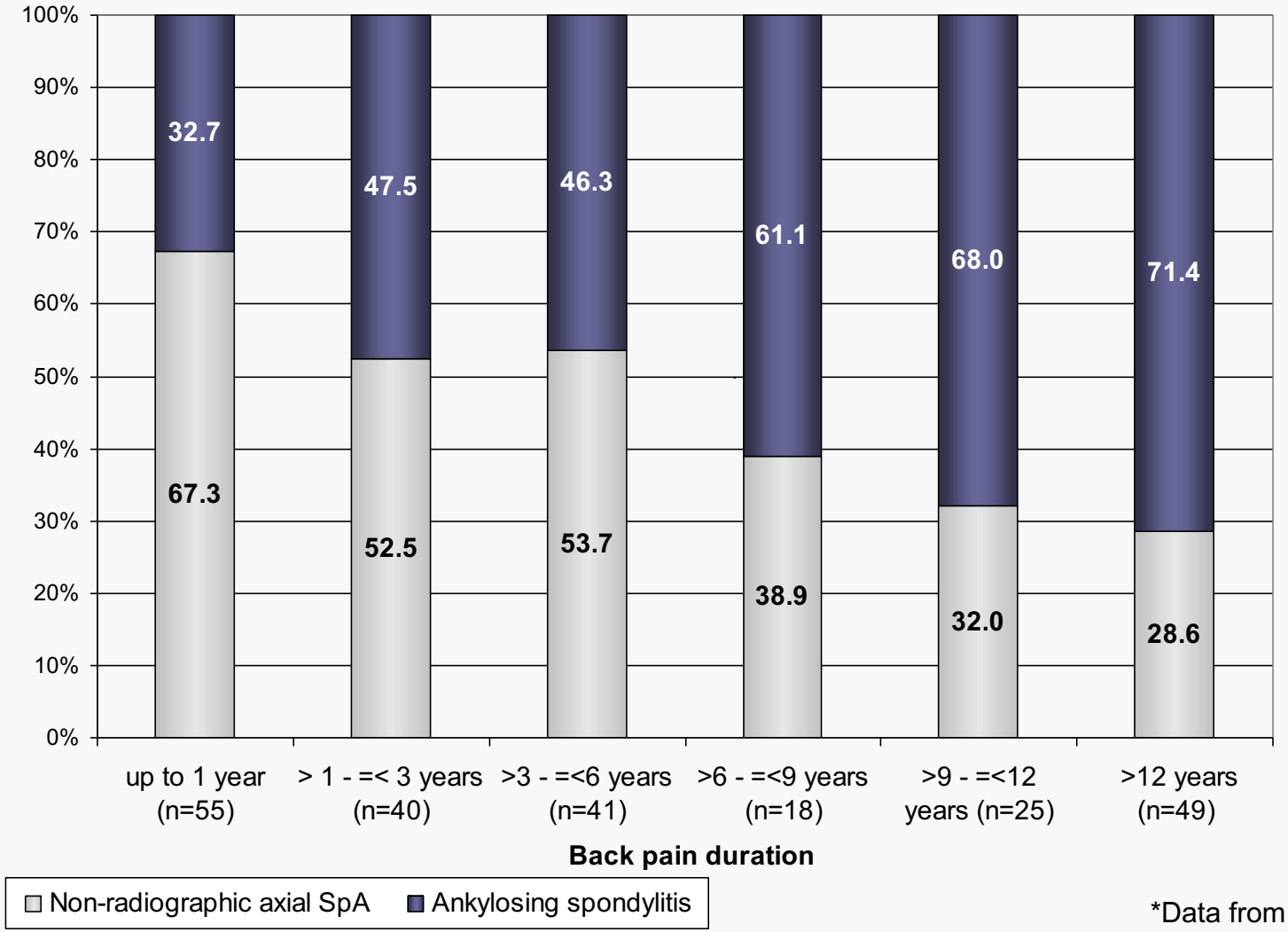
EULAR Imaging Recommendations for Spondyloarthritis

Diagnosing axial SpA

- In general, conventional radiography of the SI joints is recommended as the first imaging method to diagnose sacroiliitis as part of axial SpA. In certain cases, such as young patients and those with short symptom duration, MRI of the SI joints is an alternative first imaging method.

Mandl P, et al. Ann Rheum Dis 2015;74:1327-39.

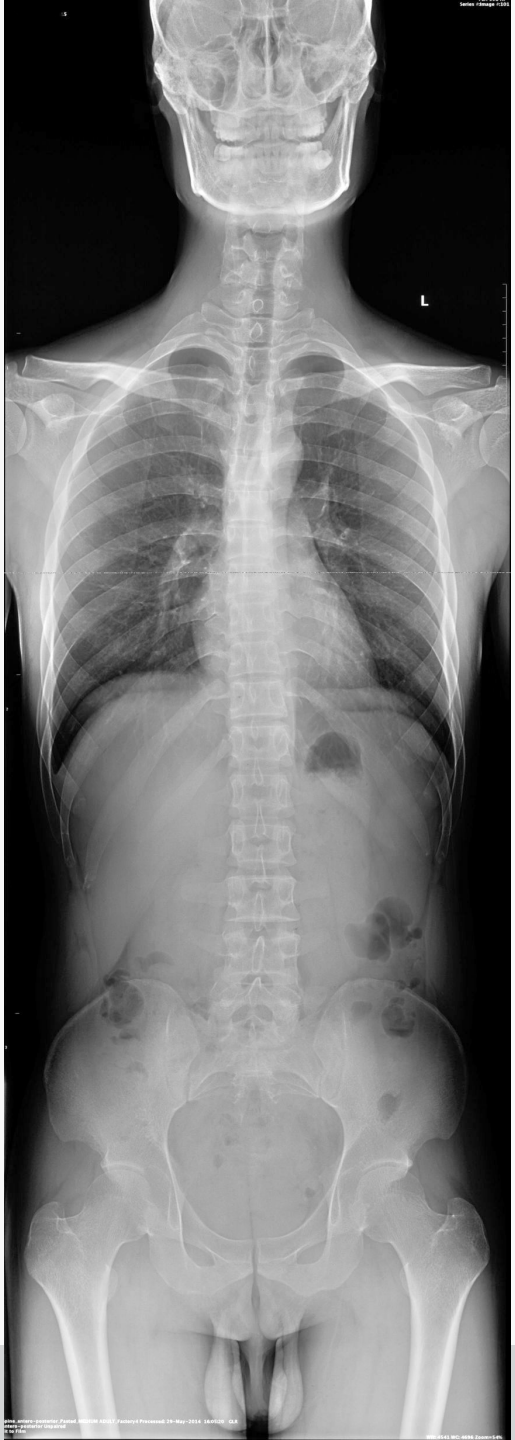
Proportions of non-radiographic and radiographic forms in relation to symptom duration in patients with definite axial SpA



*Data from the Berlin Early Spondyloarthritis Clinic

Poddubnyy D et al. Ann Rheum Dis 2012;71:1998-2001.

X-rays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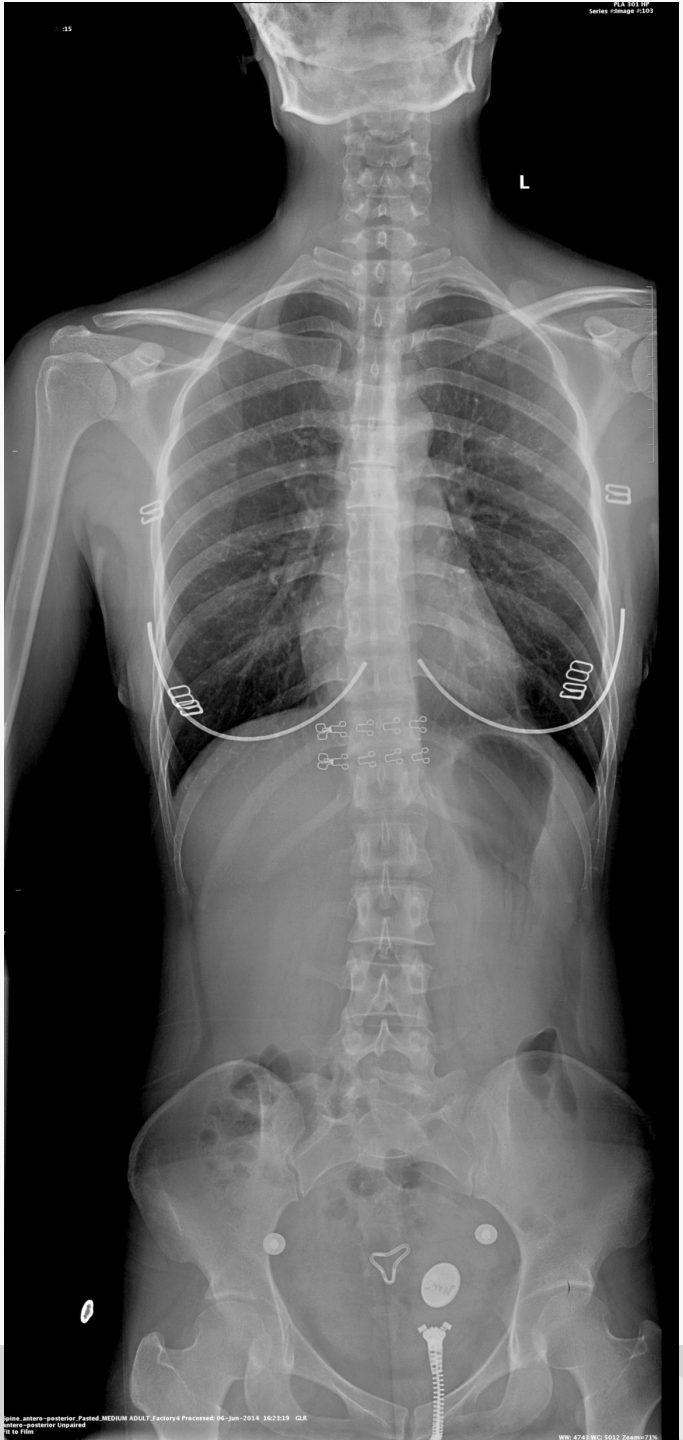
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Grading of Radiographic Sacroiliitis (1966)

- **Grade 0** normal
- **Grade 1** suspicious changes
- **Grade 2** minimal abnormality – small localized areas with erosion or sclerosis, without alteration in the joint width
- **Grade 3** unequivocal abnormality – moderate or advanced sacroiliitis with one or more of: erosions, evidence of sclerosis, widening, narrowing, or partial ankylosis
- **Grade 4** severe abnormality – total ankylosis

Bennett PH, Burch TA: Amsterdam.Excerpta Medica Foundation International Congress Series 148, 1966:456-457

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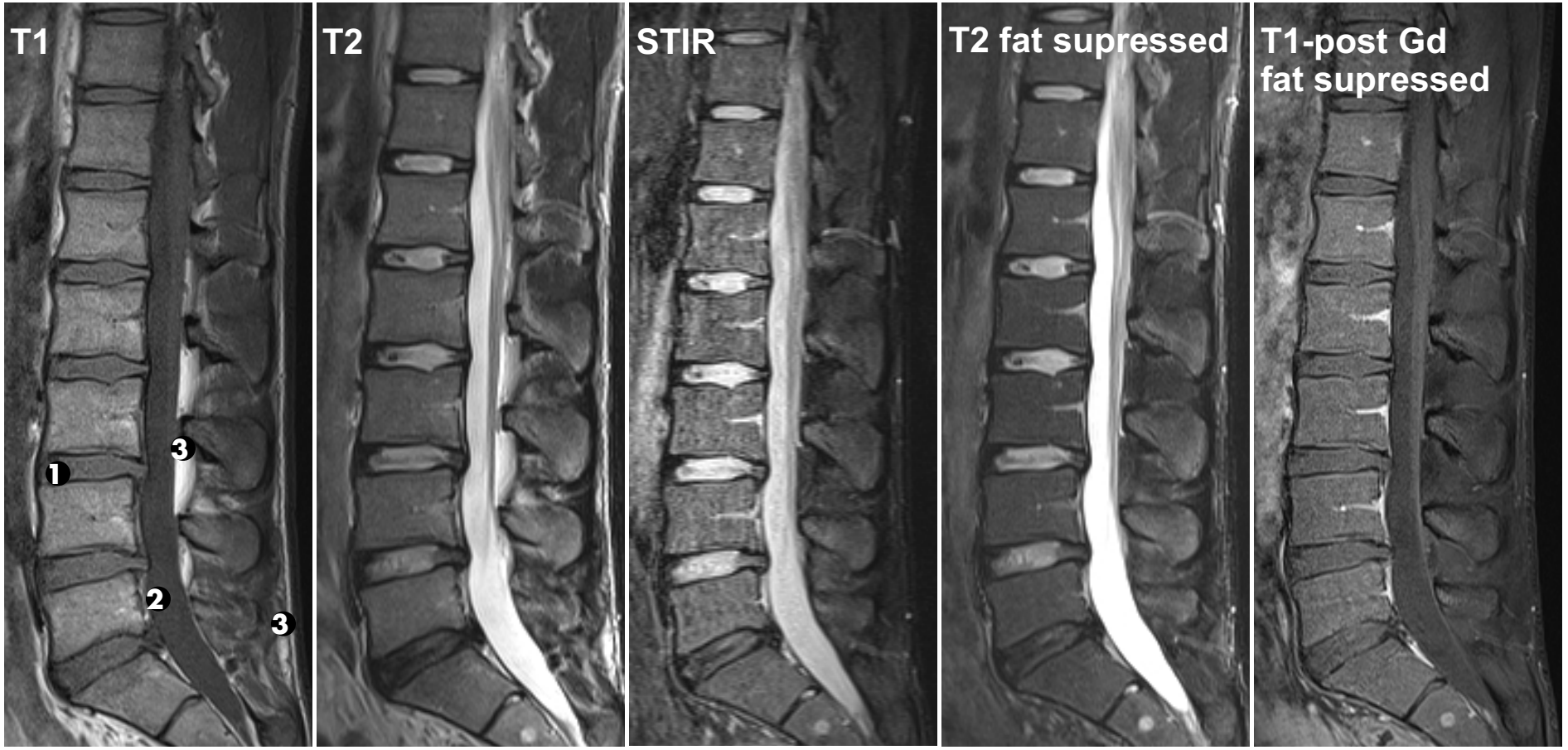
MRI-Sequences Used for SpA



L5/S1 level: degenerated disc, otherwise normal

Anatomical areas relevant for orientation:
❶ intervertebral disc, ❷ spinal fluid, ❸ fat tissue

How to Recognize MRI Sequences?

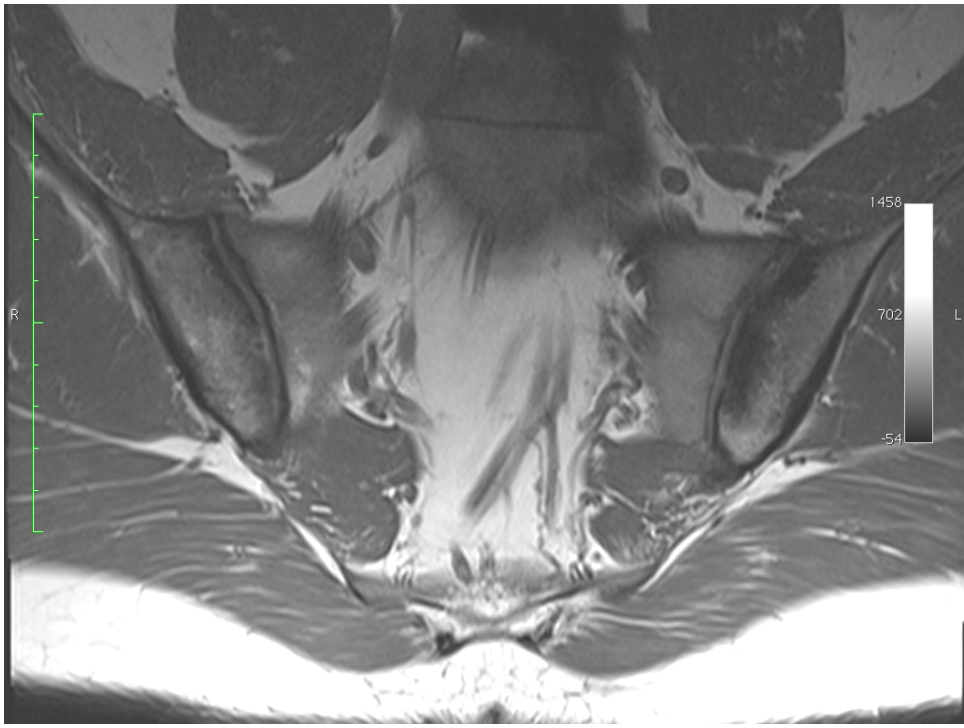
MRI-Sequence	Water	Fat tissue
T1-weighted		
T2-weighted (weighted FS)		
STIR		

MRI Sequences, which are Relevant for the Diagnosis of Axial SpA

STIR

Recognition of active inflammation:
- Osteitis / Bone Marrow Edema

T1-weighted



Recognition of post-inflammatory changes:
- Erosions
- Sclerosis
- Ankylosis
- Fatty lesions / fatty degeneration

Additional MRI sequence that might be useful in the differential diagnosis

Box 1 Definition of a positive MRI (active sacroiliitis) for the classification of axial spondyloarthritis (SpA) according to the Assessment in SpondyloArthritis International Society (ASAS) axial SpA criteria

Inflammation of the sacroiliac joints highly suggestive of SpA is required for the fulfilment of the imaging criterion 'active sacroiliitis on MRI' according to the ASAS classification criteria for axial SpA.

The requirements are listed below and guidelines for the application of the definition are provided in box 2.

REQUIRED MRI evidence of bone marrow inflammation must be present and the features required for the definition of active sacroiliitis on MRI are:

1. Bone marrow oedema (BMO) on a T2-weighted sequence sensitive for free water (such as short tau inversion recovery (STIR) or T2FS) or bone marrow contrast enhancement on a T1-weighted sequence (such as T1FS post-Gd).
2. Inflammation must be clearly present and located in a typical anatomical area (subchondral bone).
3. MRI appearance must be highly suggestive of SpA.

NOT REQUIRED Other findings related to sacroiliitis may be observed on MRI but are not required to fulfil the imaging criterion 'active sacroiliitis on MRI':

- The sole presence of other inflammatory lesions such as synovitis, enthesitis or capsulitis without concomitant BMO is not sufficient for the definition of 'active sacroiliitis on MRI'.
- In the absence of MRI signs of BMO, the presence of structural lesions such as fat metaplasia, sclerosis, erosion or ankylosis does not meet the definition of 'active sacroiliitis on MRI'.

Box 2 Guidelines for the application of the definition of a positive MRI (active sacroiliitis) for the classification of axial spondyloarthritis (SpA)

MRI interpretation:

- Bone marrow oedema (BMO) representing an inflammatory lesion that meets the above criterion will usually be easily seen on at least two consecutive slices of an MRI scan. Detection of inflammation on a single slice may be sufficient for the criterion 'highly suggestive of SpA' if there is more than one inflammatory lesion present. However, it is rare for an MRI scan of the sacroiliac joints with definite evidence of active sacroiliitis to demonstrate lesions on only a single image, and caution should be exercised in the interpretation of small lesions.
- It is essential that the reader of the MRI scan simultaneously review sequences designed to identify inflammation and sequences that focus on depiction of structural damage.
- If an inflammatory bone marrow lesion appears to be present but it is hard to determine whether the lesion meets the criterion 'highly suggestive of SpA', then the decision may be influenced by the presence of concomitant structural damage, especially erosion, and/or other signs of inflammation, which in themselves do not suffice to meet the criterion.

Context:

- Evaluation of an MRI scan should be performed objectively. However, MRI findings are non-specific and the determination of the importance of the observations should never be made in isolation of the clinical context as demographic, clinical and laboratory information may outweigh the importance of the MRI findings.
- The definition and guidelines are primarily for the classification of patients with SpA and will not be suitable for use in some clinical situations.

Lambert R, et al. Ann Rheum Dis 2016 Nov;75(11):1958-1963.

Patient 1, male, 27 years

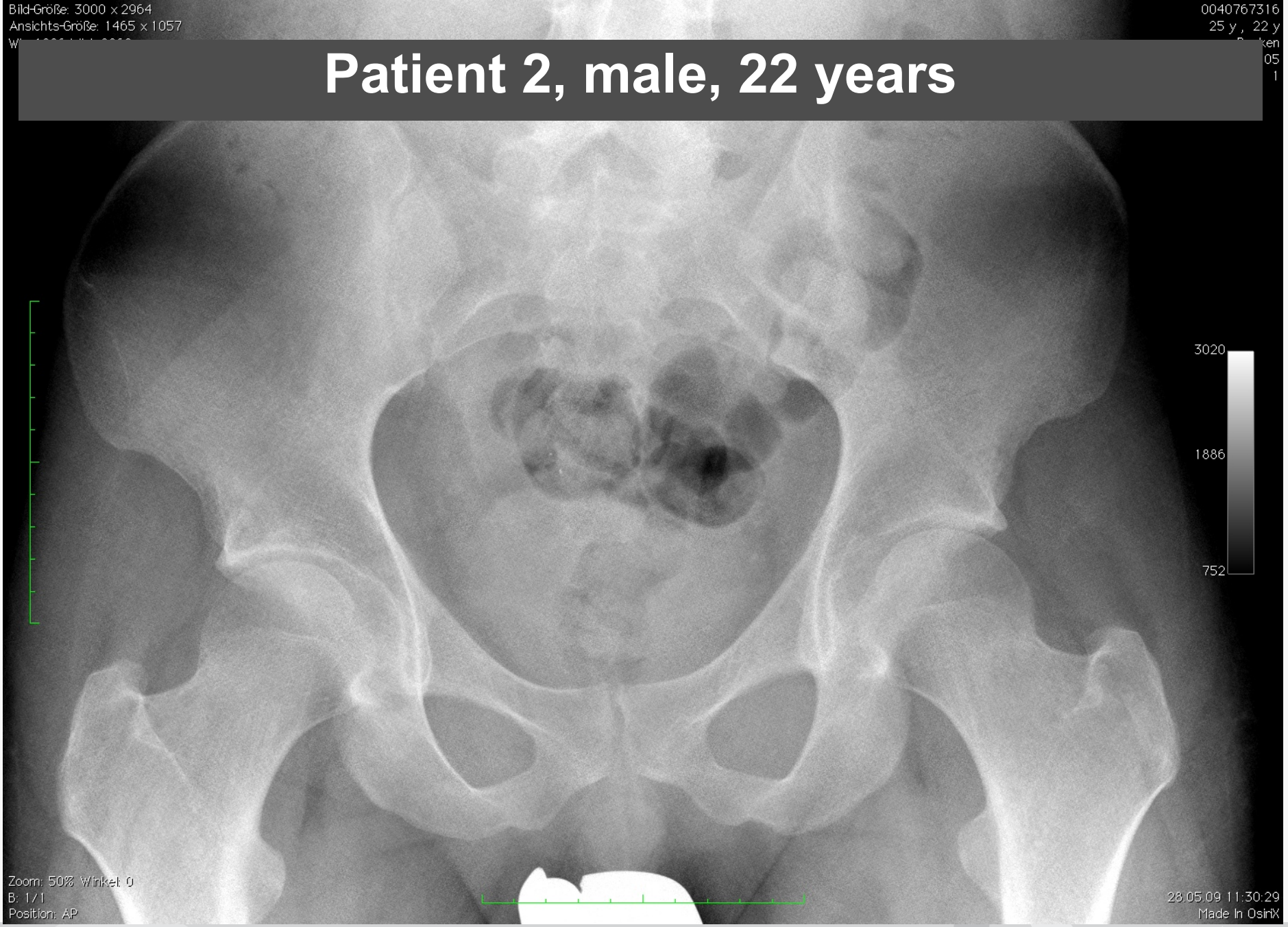
- Low back pain for about 3 years
- Pain at night, buttock pain, but no clear morning stiffness, no clear improvement with exercises
- No peripheral manifestations
- No extra-articular manifestations, no family history of SpA
- HLA-B27 positive
- CRP 6.0 mg/l (N <5)

STIR

T1

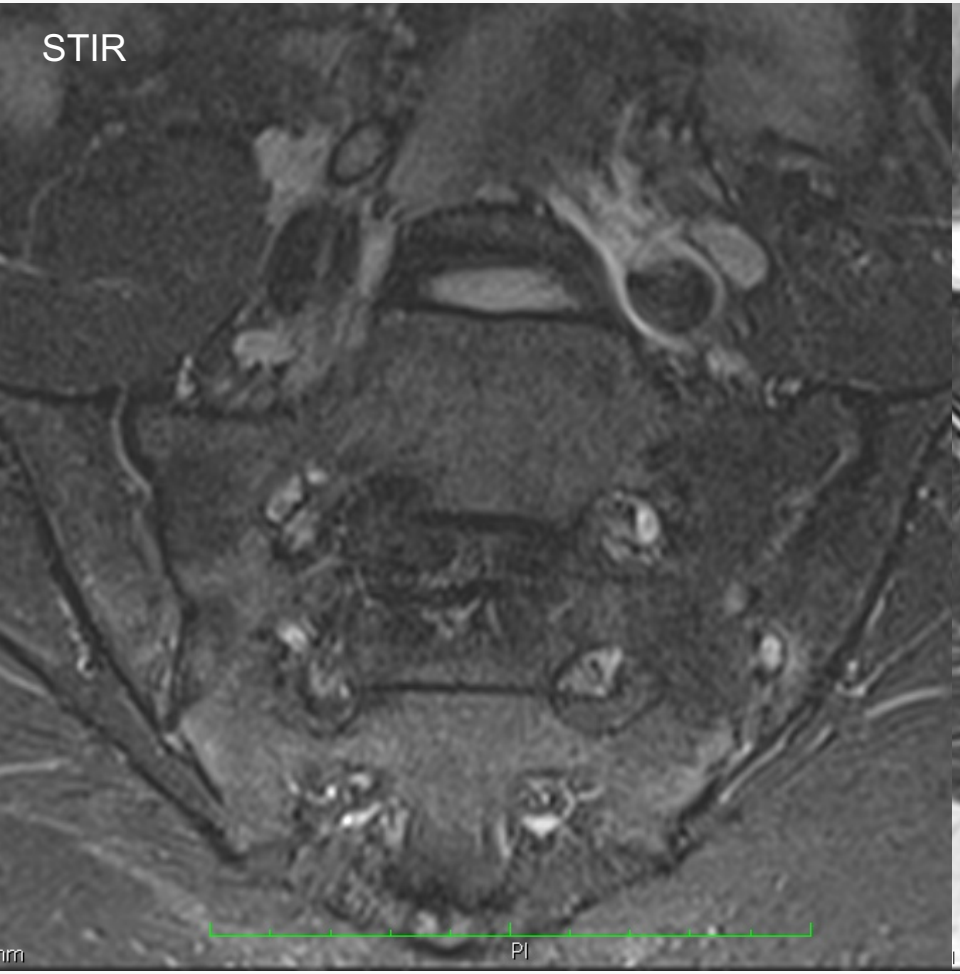
Patient 2, male, 22 years

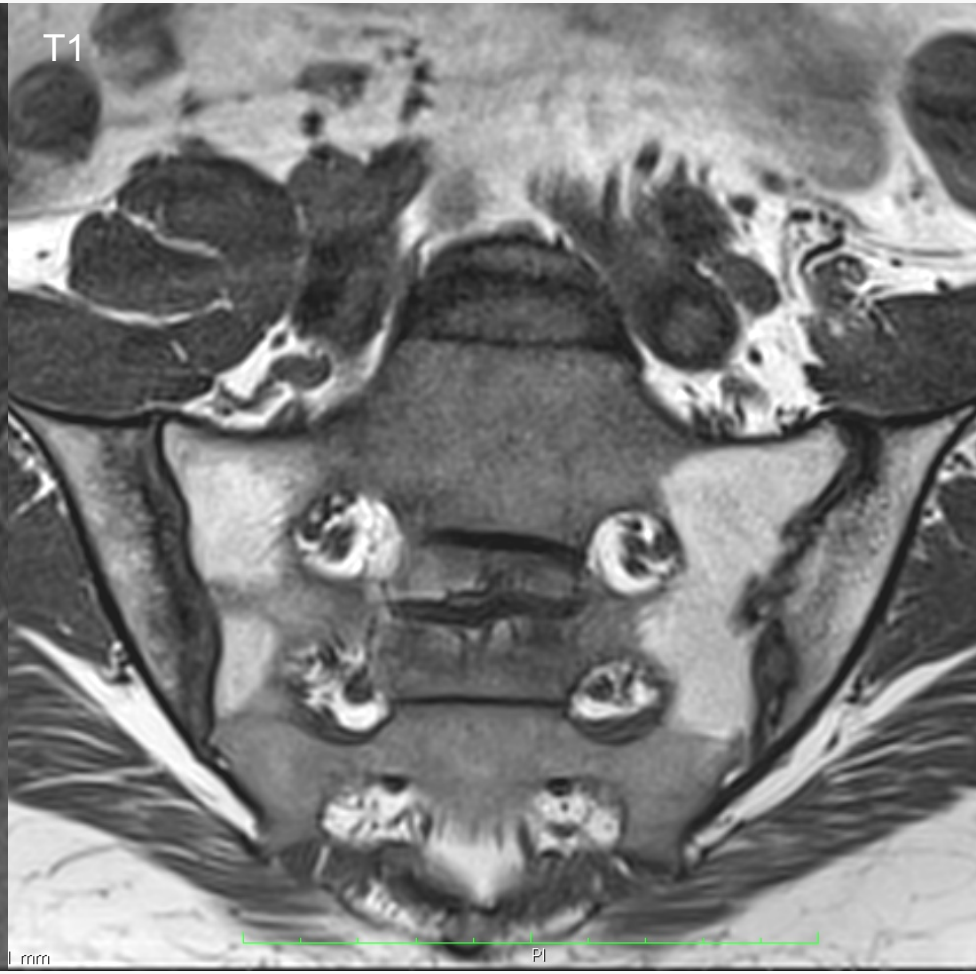
- Inflammatory back pain for about 2 years
- No peripheral manifestations
- No extra-articular manifestations, no family history
- HLA-B27 positive
- CRP 0.6 mg/l (N <5)
- Under NSAIDs (prescribed by an orthopedist about 4 weeks prior to the current presentation) almost no back pain anymore



Patient 2, male, 22 years

Patient 2, male, 22 years





MRI of the Spine

Typical Sites of Active Inflammation and Chronic Changes of the Spine in Spondyloarthritis on MRI

Location	Description
Spondylitis (involvement of vertebral bodies)	Typically located within bone marrow at one or more of the four corners of vertebral bodies. If located at the corners: spondylitis anterior (= Romanus lesion) or spondylitis posterior
Spondylodisciitis (involvement of intervertebral discs)	Located within bone marrow at cortical plate adjacent to intervertebral disc (Andersson lesion)
Arthritis of zygoapophyseal joints (facet joint arthritis)	Any facet joint from C2 to S1 may be involved. Usually associated with bone marrow edema within spinal pedicles (posterior of spinal canal)
Arthritis of costovertebral (CV) joints	Any CV joints from Th1 to Th12 may be involved. Associated with bone marrow edema near CV joints, extending to pedicles, posterior aspect of vertebral bodies (lateral of spinal canal) and neighbouring rib.
Enthesitis of spinal ligaments	Possibly affected entheses: supraspinal ligaments, interspinal ligaments, ligamenta flava
Syndesmophytes/ Ankylosis	Bridging (at the corners of the vertebral bodies) or fusion (new bone formation within the intervertebral disks) occurs in long-standing disease.

ASAS handbook, Ann Rheum Dis 2009; 68 (Suppl II) (with permission)

ASAS

Definition of the positive MRI of the spine

Descriptions of spinal MRI lesions and definition of a positive MRI of the spine in axial spondyloarthritis: a consensual approach by the ASAS/OMERACT MRI study group

Kay-Geert A Hermann, Xenofon Baraliakos, Désirée MFM van der Heijde, et al.

Ann Rheum Dis 2012 71: 1278-1288 originally published online May 14, 2012

- Based on expert consensus and taking the literature review into consideration, a positive spinal MRI for inflammation was defined as the **presence of anterior/posterior spondylitis in ≥3 sites**.

- Evidence of fatty deposition at several vertebral corners was found to be suggestive of axial SpA, especially in younger adults.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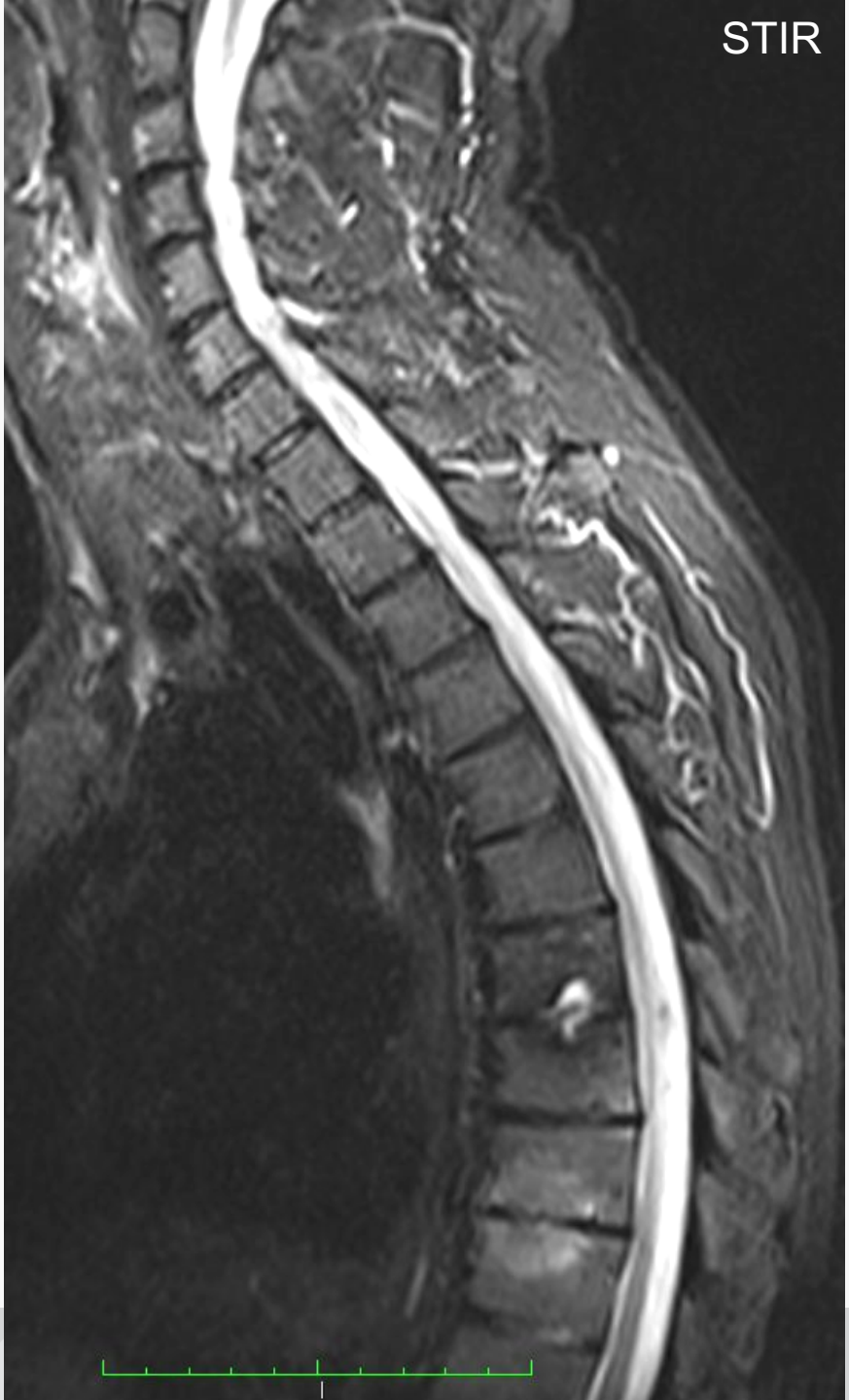
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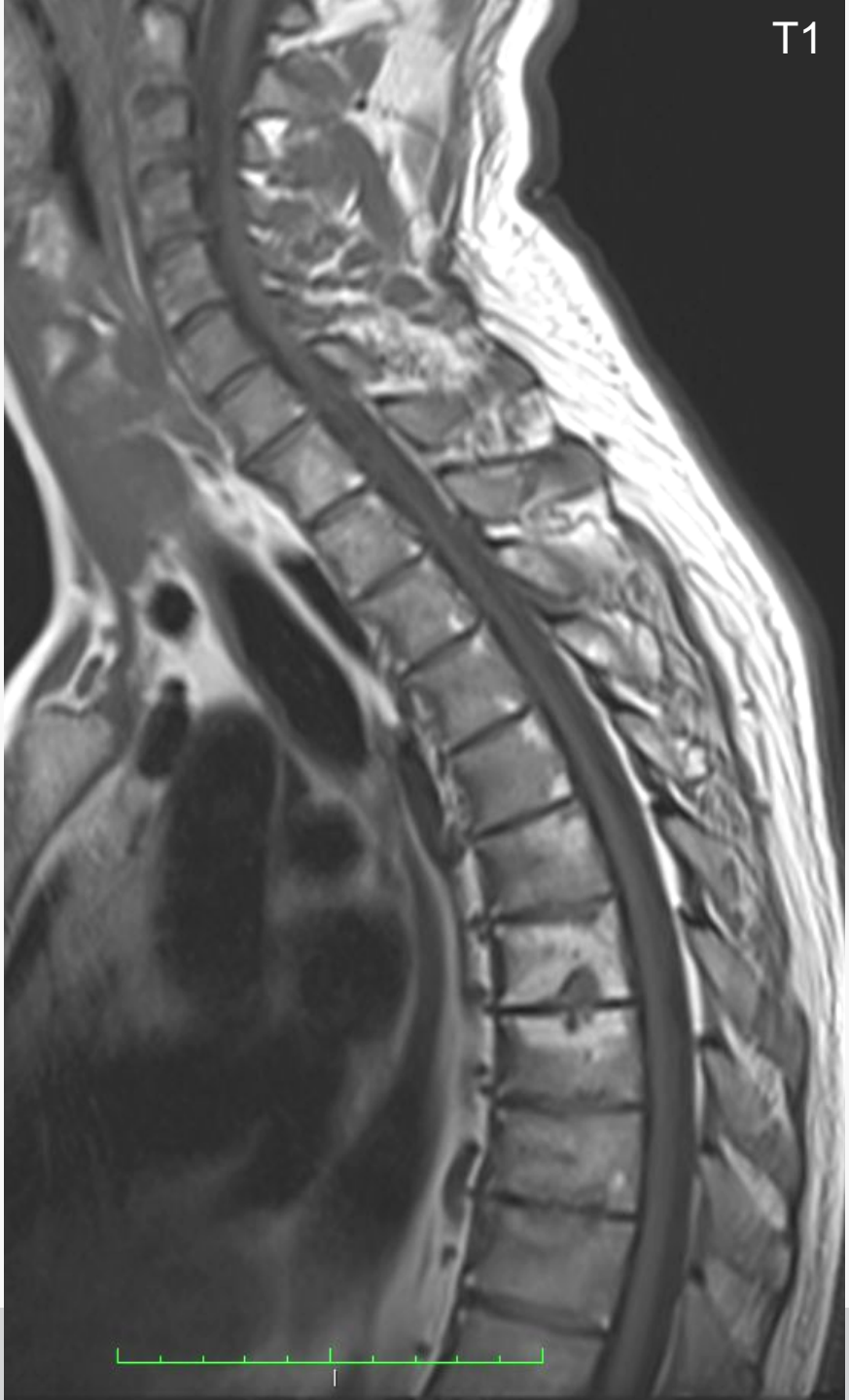
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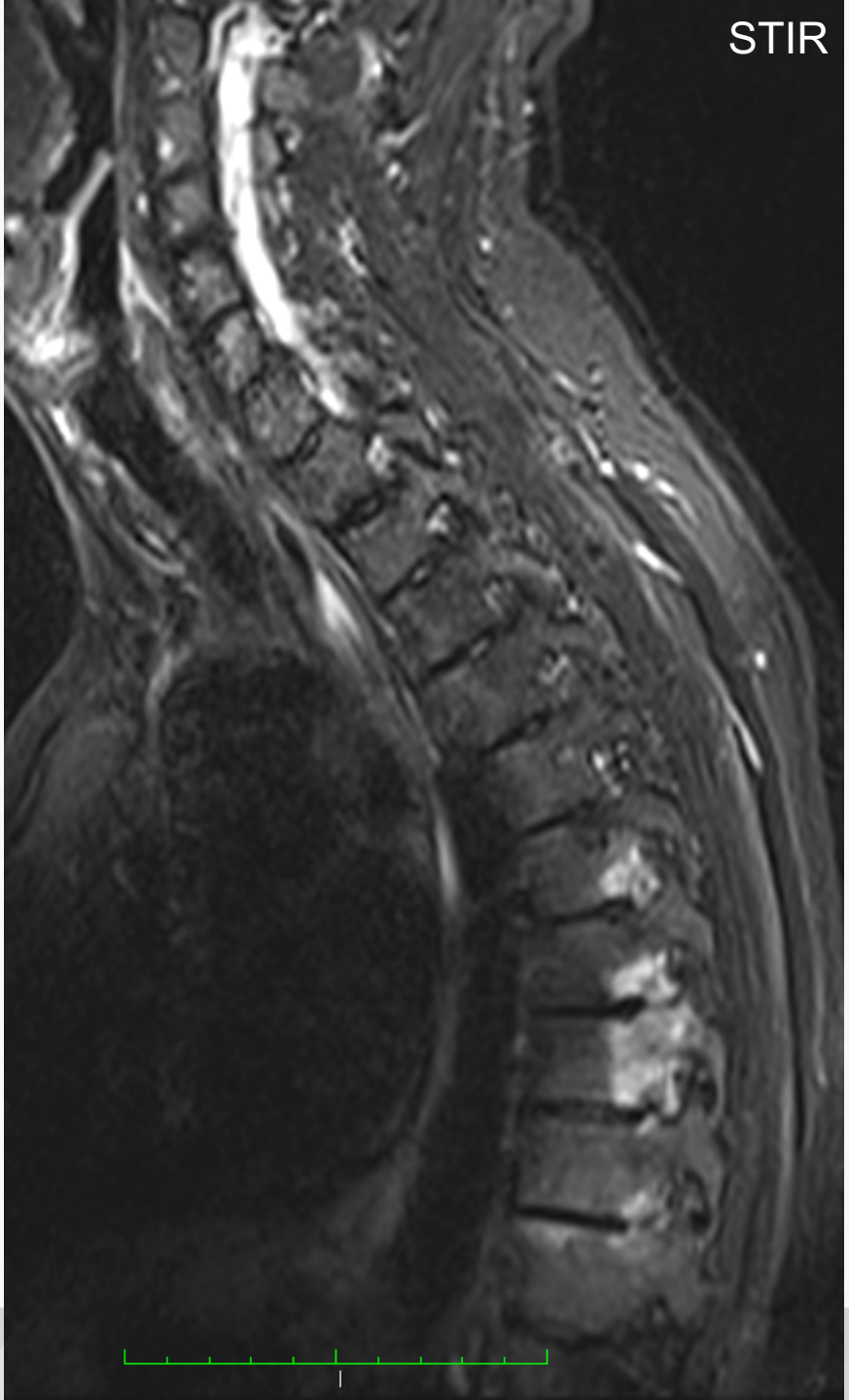
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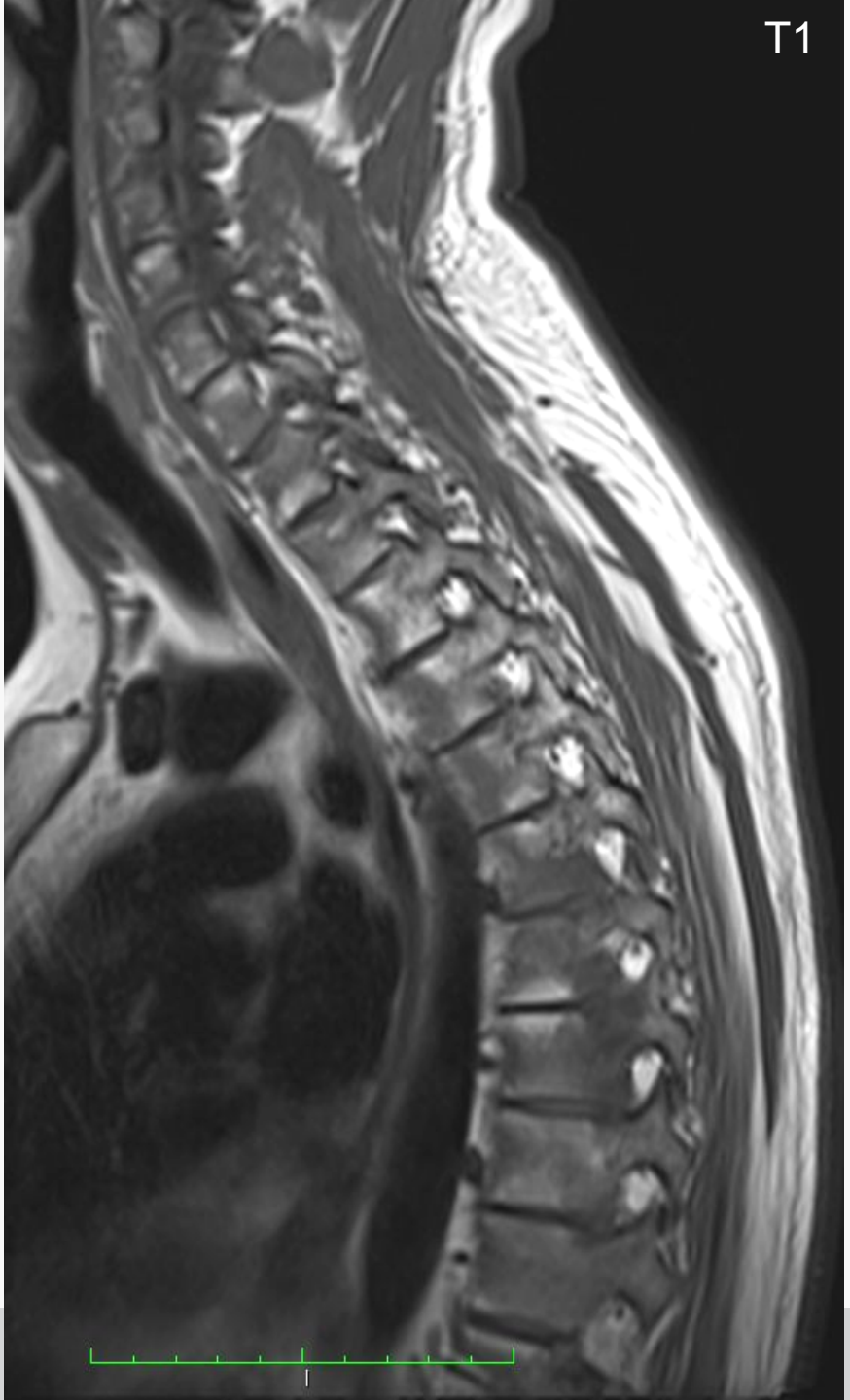
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EULAR recommendations for the use of imaging in the diagnosis and management of spondyloarthritis in clinical practice

Axial SpA: monitoring activity

- MRI of the SI joints and/or the spine may be used to assess and monitor disease activity in axial SpA, providing additional information on top of clinical and biochemical assessments. The decision on when to repeat MRI depends on the clinical circumstances. In general, STIR sequences are sufficient to detect inflammation and the use of contrast medium is not needed.

Mandl P, et al. Ann Rheum Dis 2015;74:1327-39.

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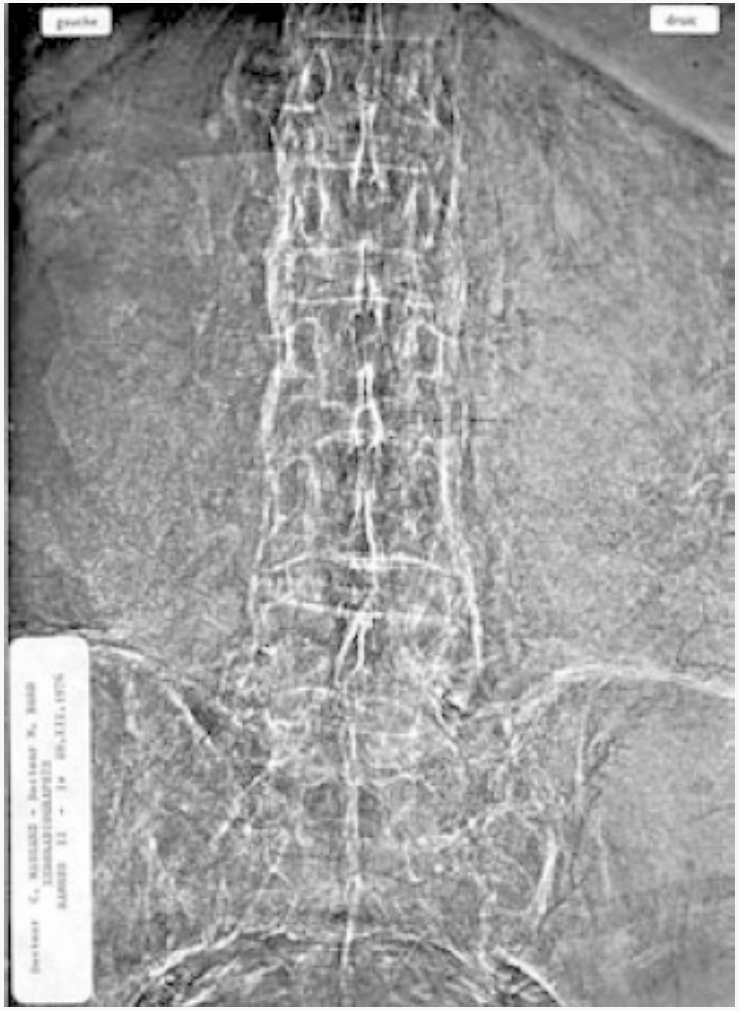
- If the diagnosis of axial SpA cannot be established based on clinical features and conventional radiography, and axial SpA is still suspected, MRI of the SI joints is recommended. On MRI, both active inflammatory lesions (primarily bone marrow oedema (BME)) and structural lesions (such as bone erosion, new bone formation, sclerosis and fat infiltration) should be considered. MRI of the spine is not generally recommended to diagnose axial SpA.

Mandl P, et al. Ann Rheum Dis 2015;74:1327-39.

Ramses II (Ramses the Great)

Balout L, et al. La momie de Ramse` s II. Recherche sur les Civilisations, Paris 1985.
Feldtkeller E, et al. Rheumatol Int 2003;23:1-5.

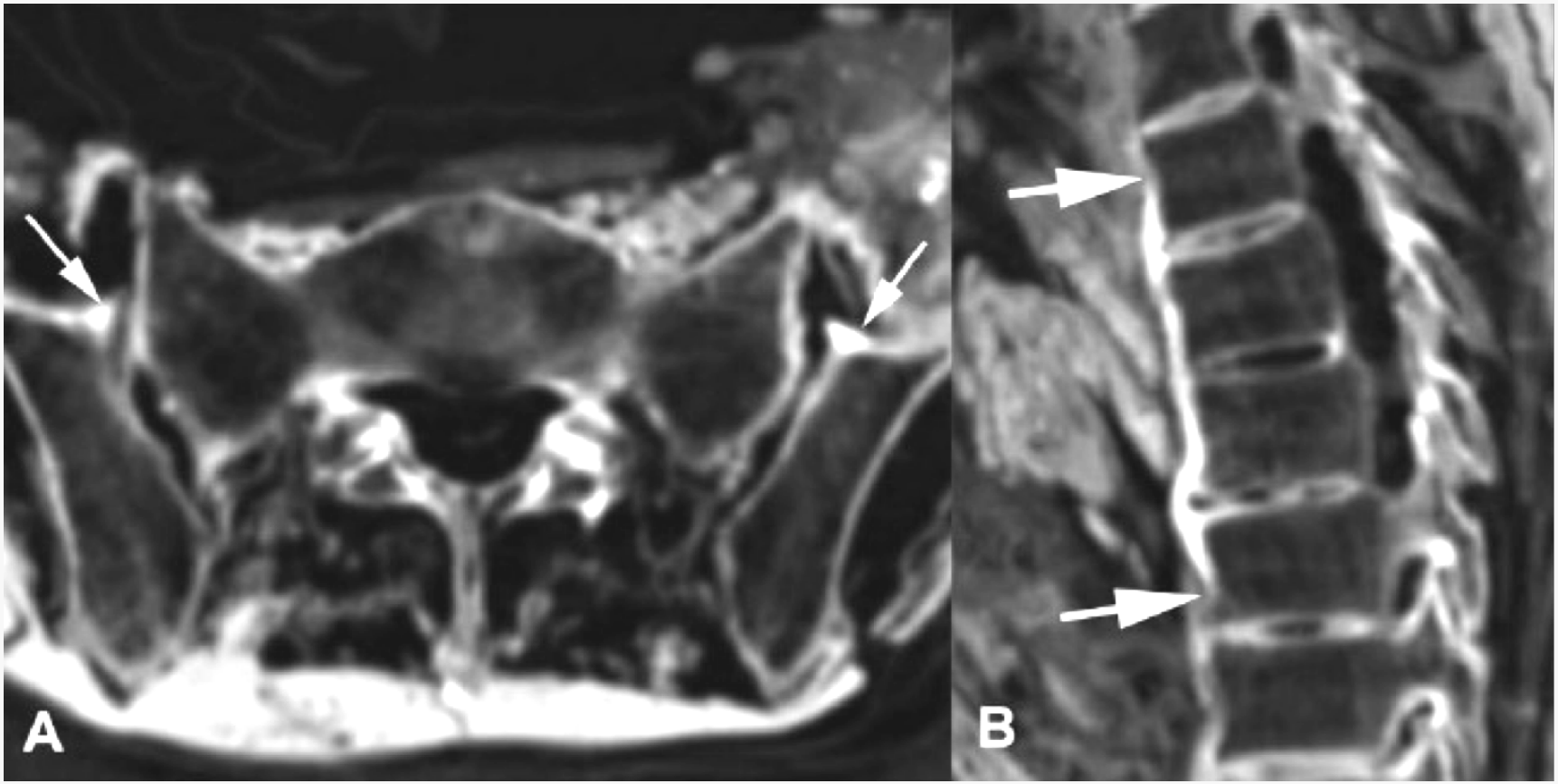
Case „Ramses the Great“



Ankylosing Spondylitis

Massare C. Bruxelles Med 1979;59:163-70.
Chhem RK, et al. Can Assoc Radiol J 2004;55:211-7.

Case „Ramses the Great“



DISH

Saleem SN, et al. Arthritis Rheumatol 2014;66:3311-6.


A 54 years old female patient with back pain for 10 years


Low-Dose CT
A 48 years old male patient with back pain for 8 years

Most important differential diagnoses for axial SpA

- Mechanical stress / Degenerative diseases :
- Degenerative disc disease, spondylosis, osteoarthritis of the SIJ
- DISH
- Mechanical stress (Sport)
- Osteitis condensans (Hyperostosis triangularis) ilii
- Lumbosacral transition anomalies

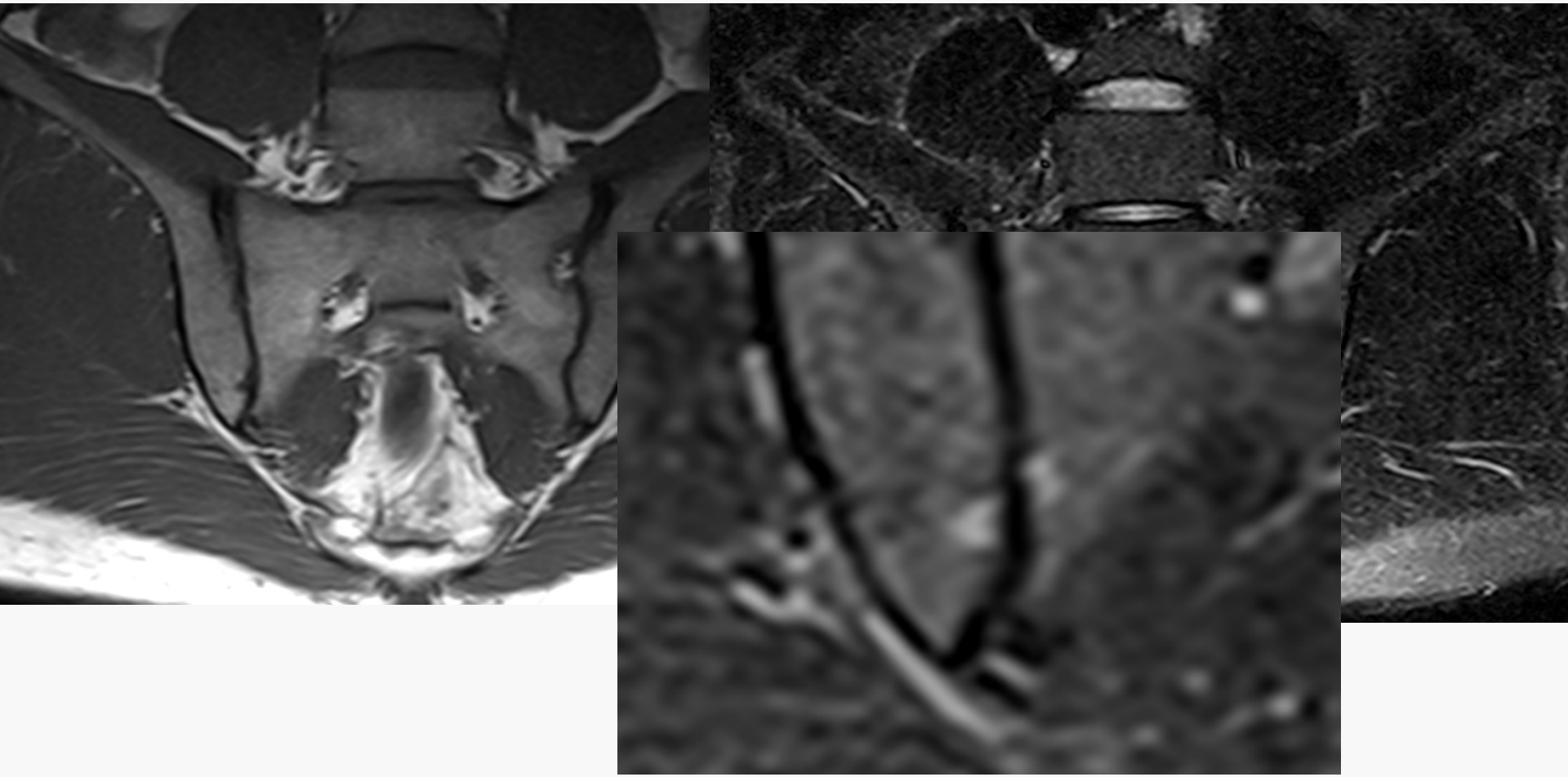
- Infection

- Fracture

- Tumor

Degenerative Changes

Mechanical Stress



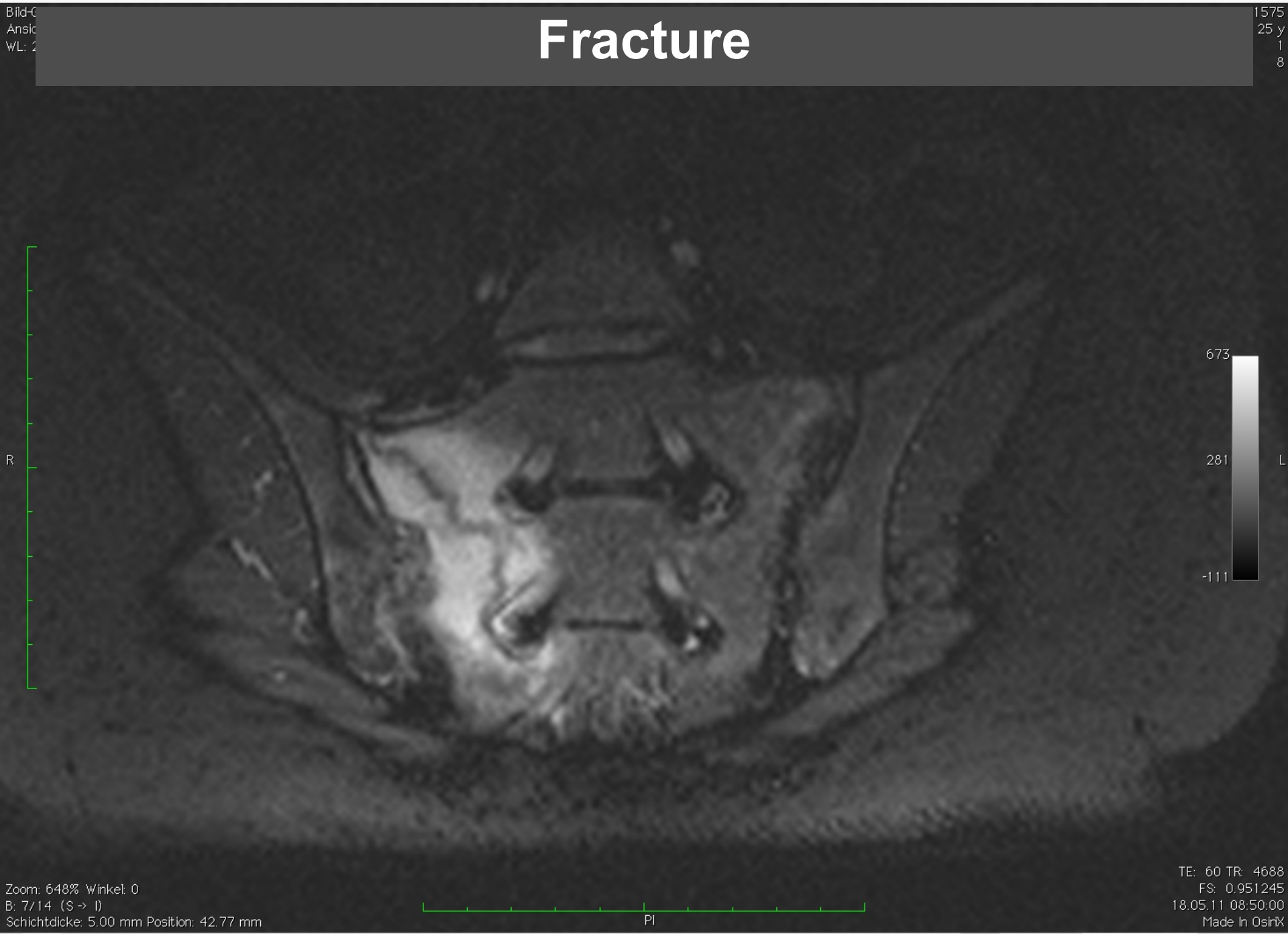
Osteitis Condensans Ilii

Aug 2010

Transition Anomaly

Infectious Sacroiliitis

Fracture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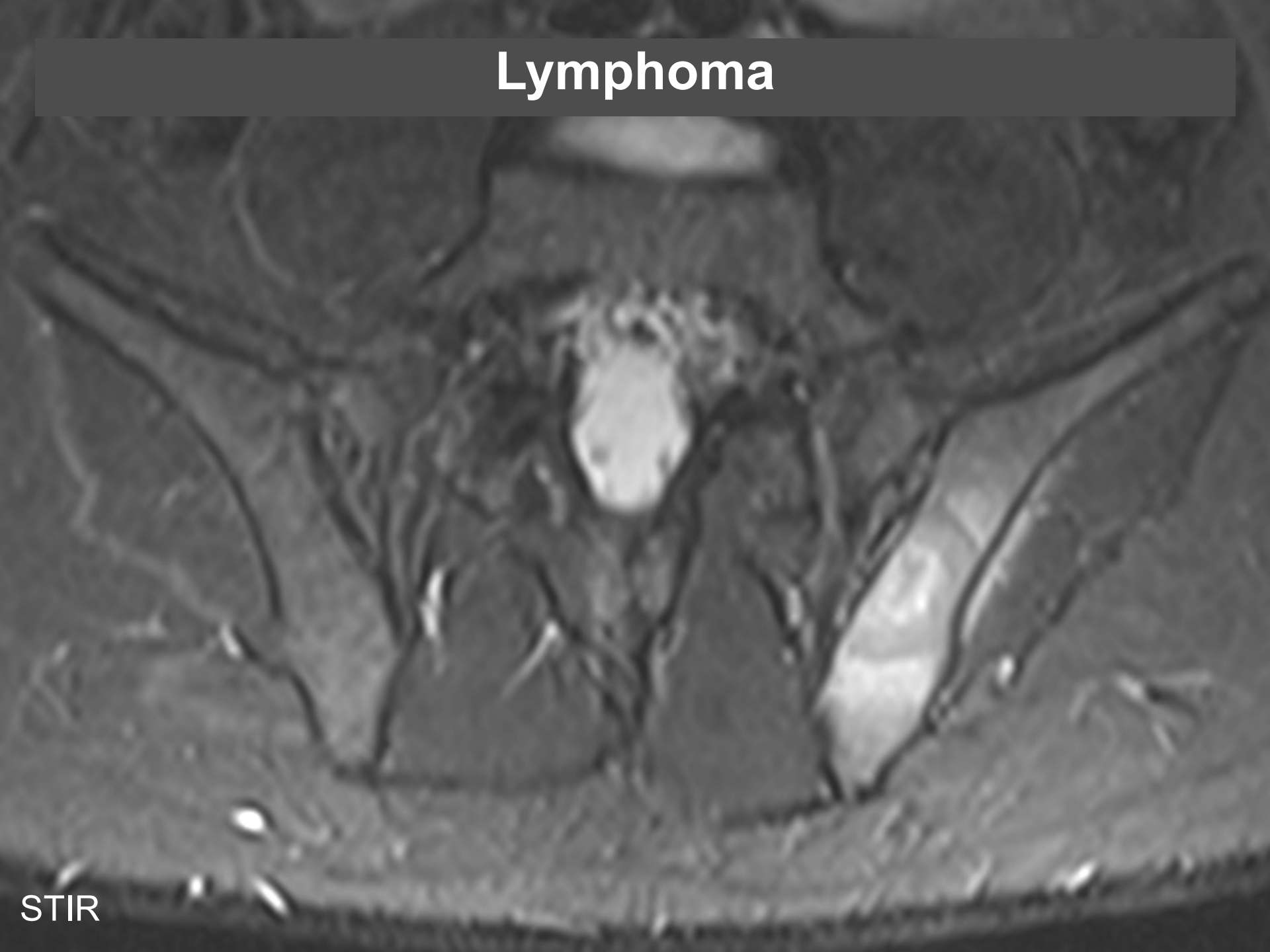
Lymphoma



Thank you for your attention!