Imaging of Axial Spa MRI of the Spine and SIJ

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Learning Objectives

1. To learn standardised MRI
2. To understand the MRI specific findings that aid diagnosis
3. To learn a structured approach to MRI of Spine and SIJ reporting

FOCUS on Axial SpA imaging
Axial SpA IMAGING METHODS

• X-Ray
• CT
• MRI

Inflammatory and Structural
Axial SpA – Goals of MRI

1. Evidence of SpA on MRI?
   - YES: Activity of the disease
   - NO: Other diagnosis?

2. Quality of the images

3. Standardized protocols

4. Relevant reporting by the radiologist
MR Imaging of the Spine and Sacroiliac Joints for Spondyloarthritis: Influence on Clinical Diagnostic Confidence and Patient Management⁠¹

Conclusion: MR imaging of the spine and sacroiliac joints significantly influences the diagnostic confidence of rheumatologists regarding clinical features and overall diagnoses of axial spondyloarthritis, and consequently significantly affects treatment plans.

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Overall, 50% of patients had a change in treatment regarding biologic agents after MRI.
ASAS classification criteria for axial SpA
(in patients with back pain ≥3 months and age at onset < 45 years)

** SpA features:
- Inflammatory back pain
- Arthritis
- Enthesitis (heel)
- Uveitis
- Dactylytis
- Psoriasis
- Crohn's disease/ulcerative colitis
- Good response to NSAIDs
- Family history for SpA
- HLA-B27
- Elevated CRP

*Sacroiliitis on imaging:
- Active (acute) inflammation on MRI highly suggestive of sacroiliitis associated with SpA
- Definite radiographic sacroiliitis according to mod. New York criteria

** Note: Elevated CRP is considered a SpA feature in the context of chronic back pain

Sensitivity 82.9%, specificity 84.4%; n = 649 patients with chronic back pain and age at onset < 45 years.
Imaging arm (sacroiliitis) alone has a sensitivity of 66.2% and a specificity of 97.3%.
MRI in Axial SpA

1. Sacro-iliac Joints
2. Spine

- MRI protocol « How I do it »
- Typical lesions
- Standardized reporting
SIJ

- Complex anatomy
- Cartilage
- Ligaments
SIJ MRI – FOV, Planes and Sequences

FOV tailored for SIJ: 24 to 28 cm
Coronal Oblique +/- Axial
SIJ MRI PROTOCOL – Key Points

- FOV 24-28 cm
- Coronal Oblique (3-4 mm)
- Axial useful
- T1w
- STIRw or FatSat T2w
- GADO optional but not required
Semi Coronal STIR and T1
SIJ MRI: normal STIR

- F29
- STIR
SIJ MRI: normal T1

- F29
- T1
GADOLINIUM

GADO not required for SIJ MRI (STIR or FS T2)
SIJ MRI: normal axial

- H48
- T1
MRI of SI joints in Early SpA
Where are the lesions?

- Semicoronal + Semiaxial Slices
- Ventral and Dorsal margins of the cartilaginous portion
- Good analysis of ligamentous portion
- SpA lesions Cartilage >> Ligamentous

Puhakkaa et al.
Acta Radiologica 2003
MRI of SI joints in Axial SpA
Early Stage of Disease

- Inflammatory lesions
- Iliac and caudal involvement ++
- Bone marrow edema
- Synovitis
- Capsulitis
- Enthesitis of interosseous ligaments
SIJ BME in SpA
MRI of SI joints in Axial SpA
Early Stage of Disease

- Inflammatory lesions
- Bone marrow edema
- Synovitis
- Capsulitis
- Enthesitis of interosseous ligaments
Validation of the ASAS criteria and definition of a positive MRI of the sacroiliac joint in an inception cohort of axial spondyloarthritis followed up for 8 years

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Conclusion  Both arms of the ASAS criteria have good diagnostic utility in early SpA, although they are of limited value for the prediction of radiographic progression. This may be due to the definition of a positive MRI for sacroiliitis that lacks specificity at baseline.
CT for SIJ STRUCTURAL LESIONS

CT useful in difficult cases
MRI of SI joints
Chronic stage of disease

- Structural lesions +++
- Erosions
- Sclerosis
- Ankylosis
- Fat
M 42

T1-w

Fat

Erosions

Sclerosis

Ankylosis
M 42

STIR-w

Edema
Bone
Ligaments
Assessment of Structural Lesions in Sacroiliac Joints Enhances Diagnostic Utility of Magnetic Resonance Imaging in Early Spondylarthritis

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Objective. To compare the diagnostic utility of T1-weighted and STIR magnetic resonance imaging (MRI) sequences in early spondylarthritis (SpA) using a standardized approach to the evaluation of sacroiliac (SI) joints, and to test whether systematic calibration of readers directed at recognition of abnormalities on T1-weighted MRI would enhance diagnostic utility.

Methods. Six readers independently assessed T1-weighted and STIR MRI scans of the SI joints from 187 subjects: 75 ankylosing spondylitis (AS) and 27 preradiographic inflammatory back pain (IBP) patients, and 26 mechanical back pain and 59 healthy volunteer controls ages ≤45 years. The exercise was repeated 6 months later on a random selection of 30 AS patients and 34 controls after calibration directed at lesions visible on T1-weighted MRI. Specific MRI lesions were recorded according to standardized definitions. In addition to deciding on the presence/absence of SpA, readers were asked which MRI sequence and which type of lesion was the primary basis for their diagnostic conclusion.

Results. Structural lesions were detected in 98% of AS patients and 64% of IBP patients. A diagnosis of SpA was based on T1-weighted or combined T1-weighted/STIR sequences in 82% of AS patients and 41% of IBP patients. Calibration enhanced the diagnostic utility of MRI in the majority of readers, especially those considered less experienced; the mean positive and negative likelihood ratios (of 6 readers) were 14.5 and 0.08 precalibration, respectively, and 22.2 and 0.02 postcalibration, respectively.

Conclusion. Recognition of structural lesions on T1-weighted MRI contributes significantly to its diagnostic utility in early SpA. Rheumatologist training directed at detection of lesions visible on T1-weighted MRI enhances diagnostic utility.
Bilateral extensive BME
Bilateral extensive structural lesions
Bilateral extensive structural lesions
ANKYLOSIS
SIJ MRI
F42 Diagnosis?
- SIJ degenerative changes
- Bilateral iliac Sclerosis
- No erosions
The Validity of the New York Radiological Grading Criteria in Diagnosing Sacroiliitis by Computed Tomography

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- CT
- 1304 patients
- Normal SIJ width = 2 mm
- Cysts 3.5%
- THI 3.7%
- Accessory 16.6%

Fig. 13. Degenerative and bridging osteophytes, and subchondral cysts, in 2608 joints.
Spinal MRI Protocol in Axial SpA

- Minimum: Lower Thoracic and Lumbar Spine
- Optimum: Full spine MR imaging
- Sagittal - Axial
- T1 and STIR or FS T2
- Gado usually not required
- Duration: 20 to 30 minutes
SPINAL MRI in SpA

- Different locations
- Different lesion patterns

- Bone
- Disc space
- Ligaments

Disco Vertebral Unit
ACTIVE LESIONS

• STIR (and T1)
  – Vertebral Corners
  – Endplates
  – Disc
Ax SpA: Costo-vertebral inflammation
Ax SpA: Posterior interspinous inflammatory changes
STRUCTURAL LESIONS

- Multiple Levels
- Lower Thoracic +++

- FATTY changes
  - T1w
  - Triangular
  - Bands
AS – Anterior inflammation (Romanus) – Initial MRI
AS – Anterior inflammation (Romanus) – Follow-up
H49 – Multiple Romanus + Posterior Lesions
Evaluation of the Diagnostic Utility of Spinal Magnetic Resonance Imaging in Axial Spondylarthritis

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• Specific lesions of SPA?
Spinal MRI and Diagnosis of Ax SPA

*Bennett et al. AR 2009*

- Full Spine MRI (T1 – STIR) – 185 patients
- Corners – Endplates – Posterior
- Scoring
- Diagnosis on MRI (without clinical data)
- Final Diagnosis: SPA (64) – DDD (45) – Metas (45) – Other (20) – Normals (11)
- Concordance 72%
Specific lesions of SPA

- Multiple Romanus ≥ 3 [LR 12.4] in patients aged ≤ 50 y
- Posterior inflammatory lesions [LR 14.5]

- Lesions of Vertebral Endplates in patients aged ≥ 50 y: frequent and non specific
Value of Spinal MRI: Where are we now? Weber et al. ARD 2014

EXTENDED REPORT

Does spinal MRI add incremental diagnostic value to MRI of the sacroiliac joints alone in patients with non-radiographic axial spondyloarthritis?

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Conclusions Combined spine and SIJ MRI added little incremental value compared with SIJ MRI alone for diagnosing patients with nr-axSpA and enhancing confidence in this diagnosis.
MRI in non-radiographic axial SpA
Patients and Controls
Spine MRI evaluated separately and also combined with SIJ MRI
Vertebral corners lesion were the main drivers towards misclassification of controls
Caution is warranted
MRI Spine - SpA DIFFERENTIALS

- Degenerative changes +++
- SAPHO
- DISH
- (Infection)
- (Tumoral)
F54
Back Pain
Modic 1
L5-S1
F58 – Chronic Degenerative Changes
H54 - SAPHO
F45 DISH

No SIJ Erosions
CONCLUSION

1. MRI of the SIJ +++
2. MRI of the Spine (caution)
Standardized protocols
Reporting
- Typical of Axial SpA
- Suggestive but…
- No evidence