Letters to the Editors

Difficulties for the detection of positive signs of sacroiliitis in spondyloarthritides by magnetic resonance imaging (MRI) in everyday clinical practice. Results from an audit circle (audit and re-audit)

Sirs

All the existing evidence supports the importance of early detection of sacroiliitis by magnetic resonance imaging (MRI) in order to reach an early diagnosis of spondyloarthritis (SpA) (1). In clinical practice however, the MRIs are often reported as negative for findings despite clinical evidence. The aim of the study presented here (registered as Audit) was to establish whether there was an agreement between the clinical suspicion and the MRI findings and to assess whether the difficulty in identifying sacroiliitis early was technical, interpretational or perhaps due to lack of inter-specialty communication.

All patients referred to MRI of the sacroiliac (SI) joints and/or the lumbar spine for diagnostic purposes, during a one-year-period were reviewed. Patients' MRIs requested upon treating physician's suspicion of a SpA diagnosis and had inflammatory back pain (IBP) according to the Calin (2) or/and the Berlin criteria (3). From those predominantly reported as having negative MRI, 20 patients were selected for review which was carried out on 2 different occasions (time points) in February and November 2008. MRI of 11 patients were selected to be reviewed blindly by an external experienced radiologist (AGJ) during the 1st audit. Nine patients' MRI were selected to be reviewed likewise blindly during the 2nd audit.

The MR examinations were performed with a 1.5 T MR scanner. The technique varied for the 11 patients included in the first audit. The MRI sequences used in 8 of 9 patients were: axial T1, and semi-coronal T1 and short Tau Inversion Recovery (STIR). Straight coronal T1 and STIR, and axial T1 and T2 were performed in one patient, and 2 patients had only lumbar spine views.

The technique was standardized in the 9 patients included in the second audit to include visualization of the SI joints in both a semi-coronal orientation along the long axis of the sacral bone and a perpendicular semi-axial slice orientation and encompassed in all patients the following sequences: semi-coronal T1-weighted spin echo images (repetition time (TR)/echo time (TE): 720/12ms; field of view (FOV)/matrix: 240mm/384x256; slice thickness/gap: 4/1mm), semi-axial T1 (TR/TE: 560/9; FOV/matrix: 200-240mm/384x224; slice thickness/gap: 6/1mm), semi-coronal STIR (TR/TE/inversion time (TI): 3340/50/150ms; FOV/matrix: 240mm/256x224; slice thickness/gap: 4/1mm) and semi-axial STIR (TR/TE/TI: 5220/48/150ms; FOV/matrix: 200-240mm/320x224; slice thickness/gap: 6/1mm). Semi-coronal T1Fat Suppress (FS) with TR/TE: 500/12; FOV/matrix: 240mm/284x256, slice thickness/gap: 4/1mm was performed in selective patients.

The MRI readings at the site of the initial assessments were performed by several consultant radiologists, none of whom had special training in musculoskeletal radiology.

From a total of 107 patients who had MRI of SI joints and/or of the lumbar spine for diagnostic purposes only 33 (30.8%) MR examinations were reported positive suggesting a 70% divergence in the diagnosis according to the clinician's opinion and the radiological evidence, respectively. T1, STIR and T2 sequences were predominantly used and only 18 of the 107 (16.8%) examinations included Gadolinium (Gd) enhanced MR sequences. Summary of the data of all patients whose MRI was reviewed on either the first or the second circle of the audit is shown in Table I, including data obtained through a validated questionnaire administered to patients with clinical suspicion of SpA when they attended the out patients' clinic.

In the 1st audit patients (M:F=5:6) had a mean age of 45.9 (SD±9.9), disease duration of 11 years (SD±12) and a delay in diagnosis of 10.5 years (SD±12.3). The clinical conditions of those patients were AS (n=1), PsA (n=7), Crohn's disease (n=1) and USpA (n=2). All patients had normal (negative) reported MRI by a local radiologist. External reviewer reported 4 positive MRI for sacroiliitis, 4 equivocal, 1 with problematic slice orientation. The SI joints could not be assessed in the 2 patients with only lumbar spine views. Technical suggestions given by external evaluator following initial audit were: 1) change slice orientation; 2) increase matrix resolution to 512; 3) for screening purpose use semi-axial STIR, and semi-coronal T1 and T1FS sequences; 4) T1FS should always be used to diagnose potential erosions. The radiology department performed the recommended changes and reporting substantially improved. However, a number of cases with IBP were still reported normal hence the 2nd audit was carried out.

During 2nd audit, the MRI of the SI joints of another 9 patients were re-evaluated [(M/F=2/7). They had a mean age of 50 years (±13.9), disease duration of 9.5 (±6.6) and delay in diagnosis of 5.5 years (±6.9). Clinical diagnoses were AS (n=2), PsA (n=2), USpA (n=4) and ulcerative colitis (n=1). Local reports were positive for sacroiliitis in 2 patients' MRI and normal (negative) in 7 of them. Upon review by the same external radiologist the positive MRI for sacroiliitis in 2 patients were confirmed, in addition to another one previously reported normal. Three more MRI were reported to show slight sacroiliitis (1 bilateral and 2 on the left side) upon review. Two further MRI were reported to show narrow SI joints but a definite diagnosis of sacroiliitis could not be established. One of these patients was later diagnosed with pustulotic arthro-osteitis.

The technical comments during audit 2 were: 1) one MRI had "poor image quality" and 2) the thickness of 4 mm per slice for coronal views was considered adequate, while the thickness of 6 mm for axial slices was considered inadequate as small areas of inflammation may be missed as reported before (4).

Summary of technical recommendations: High matrix resolution is needed, *e.g.* 512 for adequate visualisation. For screening semi-axial STIR and semi-coronal T1 and T1FS sequences are advised. Semi-coronal T1-weighted sequence with regards to erosions and fatty marrow deposition; semi-axial STIR to detect activity. Additional semi-coronal T1FS (or gradient echo sequence) may be needed with regards to minor erosion, which is not always visible on T1-weighted images, in addition to joint space alterations. Semi-coronal and semi-axial T1FS after gadolinium, which detect increased blood flow in the bone marrow and joint space, is only needed to assess the presence of minor vascularised changes (5). MR visualisation of SI joints is not easy to obtain due to the complex joint anatomy necessitating a need for special technique including a) the slice orientation, b) the sequence used and c) the image matrix (6). More specifically, 1) The anatomical structures in the sacroiliac region are not always adequately visualised on coronal images, in particular the posterior sacroiliac ligaments; 2) there can be ligaments attached deeply in the iliac bone at the border between the cartilaginous and ligamentous portions surrounded by vessels which on coronal

Table I. Demographics and disease characteristics of the 20 patients included in the audit and re-audit process.

Demographics	Mean ± SD	Clinical data	Mean ± SD
Age at examination, years	47.9 ± 11.8	BASDAI score	6.3 ± 1.5
Age at diagnosis, years	41 ± 8.7	BASFI	5.2 ± 2.3
Disease duration, years	10.3 ± 9.7	Sleep disturbances	4.94 ± 3.3
Delay in diagnosis, years	8.3 ± 10.3	Night pain	4.7 ± 3.3
Gender (M:F)	7:13	ESR (mmHg)	21.3 ± 26.1
AS:PsA:USpA:UC:Crohn's*	3:9:6:1:1	CRP (mmol/L)**	10.1 ± 13.9

SD: Standard deviation. *AS: Ankylosing spondylitis; PsA: Psoriatic arthritis; USpA: Undifferentiated spondyloarthritis; UC: Ulcerative colitis; Crohn's disease. **Normal limit: <5 mmol/L.

slices may simulate erosions; 3) the area of the ligament attached in the iliac bone can display non-specific oedema or increased blood flow (enhancement) due to strain and may be mistaken for erosions. The diagnosis by MRI has been identified as being problematic before (7), suggesting that training may improve the quality of assessment (8) and indeed such training sessions are acknowledged (9) as well as the needed for collaboration between the rheumatologists and the radiologists (10) perhaps due to lack of specific protocols, which suggests that the inter-speciality communication has room for improvement.

Finally, the diagnostic value of MRI depends on disease duration. Thus, for suspected inflammatory back pain for less than 3 months the advice/suggestion is to "await course"; for between 3–12 months with classic symptoms the advice is to request primarily MRI; for between 3–12 months with less typical symptoms radiography is advisable to exclude or confirm other diseases and if radiography is inconclusive to perform MRI or CT. For symptoms of more than 12 months duration primary radiography is recommended and only if the radiography is negative to request MRI or CT. In addition, MRI is indicated in young individuals with hip arthritis or imaging confirmed inflammatory changes at tendon attachments (enthesopathy).

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