

EXTENDED REPORT

Does the site of magnetic resonance imaging abnormalities match the site of recent-onset inflammatory back pain? The DESIR cohort

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ABSTRACT

Objectives To assess whether the site of axial pain (thoracic spine, lumbar spine or buttock(s)) was associated with the site of MRI lesions in patients with recent inflammatory back pain (IBP) suggesting spondyloarthritis.

Methods We conducted a cross-sectional study of baseline data in 708 patients with recent IBP from the DESIR cohort. Radiographs of the sacroiliac joints (SIJs) and MRI scans of the SIJs and thoracic and lumbar spine were obtained routinely. Associations between pain sites and sites of inflammatory and structural MRI changes were evaluated using separate multivariate logistic regressions.

Results Of the 648 patients with complete data, 61% had thoracic pain, 91.6% lumbar pain and 79.2% buttock pain. MRI inflammation was seen in 19%, 21% and 46% of patients at the thoracic, lumbar and SIJ sites, respectively. By multivariate analysis, pain was significantly associated with MRI inflammation only at the same site (adjusted OR (aOR)_{thoracic pain} 1.71; 95% CI 1.09 to 2.67; $p=0.02$; aOR_{lumbar pain} 2.53; 95% CI 1.03 to 6.20; $p=0.04$; aOR_{buttock pain} 2.86; 95% CI 1.84 to 4.46; $p<0.0001$). Pain site was not significantly associated with the site of structural MRI changes, except for buttock pain and SIJ structural MRI changes (aOR_{buttock pain} 1.89; 95% CI 1.22 to 2.90; $p=0.004$). The association between pain site and site of MRI inflammation persisted in the subgroups with normal or doubtful SIJ radiographs or with Assessment of SpondyloArthritis international Society criteria for axial spondyloarthritis.

Conclusions The site of pain (thoracic spine, lumbar spine or buttock(s)) is associated with MRI inflammation at the same site in patients with recent IBP.

INTRODUCTION

The diagnosis of early spondyloarthritis (SpA) is often difficult in everyday practice. A major challenge is that radiographic evidence of sacroiliac joint (SIJ) or spinal involvement, which has been considered the hallmark of SpA, may require years to develop or never appear at all.¹ MRI may visualise SIJ inflammation even in patients with normal radiographs.²⁻³ Consequently, the Assessment of SpondyloArthritis international Society (ASAS) recently included MRI inflammation of the SIJs among the classification criteria for axial SpA.⁴⁻⁵

Other studies found MRI evidence of spinal inflammation in patients whose SIJs were normal by MRI.⁶⁻⁷ Thus, it is unclear whether MRI of the SIJs, lumbar spine, or thoracic spine has the best diagnostic yield in patients with recent-onset inflammatory back pain (IBP).

To guide the choice of the site to be investigated by MRI, and to improve the interpretation of the images, it would be useful to know whether MRI changes are more likely to be found at sites of pain than at other sites. Our hypothesis was that pain at one site was associated with MRI inflammation at the same site. The aim of the study reported here was to assess the association between the site of axial pain and MRI changes in patients with recent-onset IBP.

METHODS

We used the baseline data from the patients included in the DESIR cohort (*DEvenir des Spondylarthropathies Indifférenciées Récentes*, outcomes in patients with recent-onset undifferentiated spondyloarthritis).

Study population

DESIR is a French prospective longitudinal cohort study of adults aged 18–50 years from 25 regional centres. As previously described,⁸ the DESIR-cohort patients had IBP in the buttock(s), lumbar spine, or thoracic spine fulfilling either the Calin⁹ or the Berlin¹⁰ criteria, for less than 3 years; presence of at least 4 out of 5 items from Calin criteria or at least 2 out of 4 items from Berlin criteria were required for inclusion in the cohort. A SpA probability score of at least 5/10 on a numerical rating scale (0, not suggestive at all; 10, highly suggestive) as determined by the local investigator was also required. Exclusion criteria were a definite diagnosis of spinal disease, a history of biological therapy, glucocorticoid therapy in a daily dosage greater than 10 mg prednisone in the past 4 weeks, and past or current disorders that might interfere with the validity of informed consent and/or prevent optimal patient adherence to study requirements (eg, alcoholism or psychological disorders). The last patient was recruited on 29 April 2010 and the database used for the present study was locked on 30 June 2010.

Of the 708 DESIR cohort patients, 60 had no available MRI scans ($n=54$) and/or radiographs ($n=27$), leaving 648 patients for our study.

Clinical and epidemiological research

The study was approved by our ethics committee and complied with Good Clinical Practices. Participants gave their written informed consent before study inclusion. Details on the study centres, cohort organisation, study protocol, and case-report form are available online in French at www.lacohortedesir.fr.

Collected data

Baseline clinical parameters were collected using a standardised questionnaire and physical examination. Patients were asked by a trained rheumatologist about past and current axial pain at each spinal level and at the SIJs (buttocks). Medication use was recorded in detail, with special attention to medications used because of the IBP (analgesics, non-steroidal anti-inflammatory drugs (NSAIDs) and disease-modifying antirheumatic drugs (DMARDs)). For each patient, we also computed the percentage of days with NSAID intake. Baseline laboratory test results were recorded, including the erythrocyte sedimentation rate, C-reactive protein (CRP) level and HLA-B27 antigen status.

To ensure the quality and standardisation of collected images, a written specific procedure was provided to each centre in the study protocol.⁸ Among available radiographs, we used only the anteroposterior pelvis radiographs for this study. Radiologists or rheumatologists at each study centre scored each SIJ as follows: 0, normal; 1, doubtful; 2, obviously abnormal; or 3, fused. Abnormal SIJ radiographs were defined as a score of 2 or 3 for at least one SIJ. This scoring method used for the local reading in DESIR is derived from the modified New York criteria for radiographic sacroiliitis changes with one modification: grade 2 and 3 of New York criteria were pooled together in one sole grade.¹¹ MRI scans of the SIJs, thoracic spine and lumbar spine were performed using the T1-weighted spin echo and short-tau inversion recovery sequences. For each of the two spinal levels and for the SIJs, local radiologists or rheumatologists separately assessed inflammation (bone oedema) and structural changes (erosions, sclerosis, and/or bone formation) concerning the vertebral body and SIJ, classifying the MRI scans for each of these two findings as normal, doubtful or abnormal.

For the present analysis, the main evaluation criterion was the presence of MRI inflammation at one or more of the three sites (SIJs, lumbar spine and thoracic spine). For each of the two spinal sites, presence of MRI inflammation was defined as doubtful or abnormal findings at one or more vertebral levels. For the SIJs, presence of MRI inflammation was defined as doubtful or abnormal findings in one or both SIJs. Thus a positive MRI for inflammation at one spinal level should comprise doubtful or definite oedema at one or more vertebral body, and a positive MRI for structural changes at one spinal level should comprise doubtful or definite erosions and/or sclerosis, and/or bone formation in one or more vertebral body. In the same way, a positive MRI for inflammation at the SIJs level should comprised doubtful or definite oedema in one or both SIJs, and a positive MRI for structural changes at the SIJs level should comprised doubtful or definite erosions and/or sclerosis, and/or bone formation in one or both SIJs.

Statistical analysis

Qualitative data are described as n (%) and quantitative data as mean (\pm SD) or median (IQR). CRP was log-transformed to allow comparisons between groups. The prevalence of MRI inflammation at each site with the 95% CI was evaluated using a normal distribution approximation.

First, baseline characteristics of patients with and without MRI inflammation at each site were compared using the t-test

or Wilcoxon-Mann-Whitney test for continuous variables, as appropriate, and the Pearson χ^2 test for categorical variables. To compare the prevalences of DMARD use according to MRI inflammation, we routinely adjusted the analysis based on a propensity score for DMARD use. The propensity score was the probability of group membership predicted based on logistic regression.

Second, associations between the pain site and the site of each MRI lesion type (inflammation and structural changes) were evaluated by estimating ORs and their 95% CIs, using a logistic regression model. The tested explanatory variables were clinical data (site of pain, Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), Bath Ankylosing Spondylitis Functional Index (BASFI), presence of enthesitis, number of swollen joints, extra articular features and body mass index), demographic data (age at disease onset and gender), biomarkers (HLA27 and CRP) and treatments (DMARDs and NSAIDs).

Variables associated with p values <0.15 by the univariate analysis were included in a multivariate logistic regression model. In the multivariate analysis, ORs were routinely adjusted for pain at other sites. We then repeated the analyses in the subgroup of greatest interest, that is, the subgroup whose SIJ radiographs were normal or doubtful. We also studied the subgroup fulfilling ASAS classification criteria for axial SpA.

We conducted two sensitivity analysis. In one of these analyses, we classified patients with doubtful MRI inflammation as having normal instead of abnormal MRI findings. In the other, we considered only current pain instead of current or past pain when evaluating the associations between pain site and MRI lesions (inflammation and structural changes separately).

All analyses were two-sided and p values <0.05 were considered statistically significant. STATA software V.11 (College Station, Texas, USA) was used for the statistical analyses.

RESULTS

Radiographic and MRI findings

The 648 patients with complete data had a mean age of 34 (± 9) years; 53% were women and 58.2% were HLA-B27-positive and 446 (68.8%) fulfilled ASAS criteria. The mean duration of axial symptoms was 1.6 (± 1) years. Past and/or current pain was located at the thoracic spine in 61% of patients, lumbar spine in 91% and buttock(s) in 79%. Past and/or current pain at more than one site was reported by 86% of patients. The 60 patients of the DESIR cohort who were not included because of missing imaging data did not differ significantly from the included patients regarding any of these characteristics (data not shown).

The SIJ radiographs were abnormal in 173 (26.7%; 95% CI 23.2% to 30.1%) patients. MRI scans showed structural changes at the thoracic spine in 61 (9%) patients, lumbar spine in 55 (8%) patients and SJI(s) in 225 (35%) patients. MRI showed at least one structural change in 274 (41%) patients. The prevalence of MRI inflammation differed between patients with versus without radiographic SIJ abnormalities. Figure 1 shows the distribution of MRI inflammatory lesions according to pain site and radiographic SIJ findings. MRI showed at least one inflammatory lesion in 357 (55%; 95% CI 51% to 59%) patients. MRI inflammation was found at the thoracic spine in 125 (19%; 95% CI 16% to 22%) patients, lumbar spine in 140 (21%; 95% CI 18% to 24%) patients, and SIJ(s) in 303 (46%; 95% CI 43% to 51%) patients. MRI inflammation was seen only at the thoracic spine in 12 (2%) patients, only at the

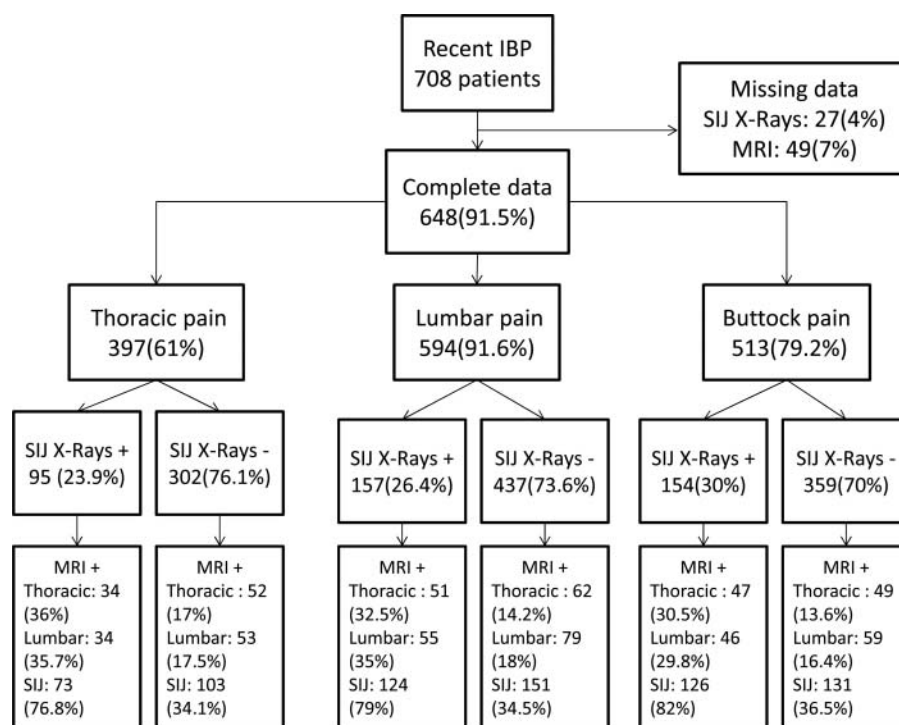


Figure 1 Distribution of MRI inflammatory lesions according to SIJ radiographic lesions and pain site: the DESIR cohort study. IBP, inflammatory back pain; SIJ, sacroiliac joints; +, abnormal findings; -, normal findings (see Material and Methods for definitions).

lumbar spine in 14 (2%) patients and only at the SIJ in 158 (25%) patients. Among patients with normal MRI and radiographic findings at the SIJ, 33 (5%) had MRI inflammation at the thoracic and/or lumbar spine. Of the 475 (475/648, 73%) patients with normal or doubtful SIJ radiographs, 208 (44%) had MRI inflammation at one or more sites; 70 (14.7%) had MRI inflammation at the thoracic spine, 82 (17.2%) at the lumbar spine, 163 (34.3%) at the SIJ(s); 88 (18%) had MRI inflammation only at the SIJ and 15% SIJ MRI inflammation and thoracic or lumbar MRI inflammation. In patients with abnormal SIJ radiographs, 70 (40%) had only SIJ MRI inflammation and 68 (39%) SIJ MRI inflammation and thoracic or lumbar MRI inflammation.

Table 1 compares the baseline characteristics of patients with and without MRI inflammation at each site. The group with MRI inflammation had higher proportions of men and of HLA-B27-positive patients, higher CRP levels, and a higher prevalence of radiographic SIJ changes, compared with the group without MRI inflammation. The patients with lumbar MRI inflammatory change were older than the other patients, whereas the patients with SIJ MRI lesions were younger than the other patients.

Factors associated with the site of MRI changes

MRI inflammation was not significantly associated with the use of NSAIDs or DMARDs. By univariate analysis (table 1), thoracic pain was associated with thoracic MRI inflammation ($p=0.06$), lumbar pain with lumbar MRI inflammation ($p=0.06$) and buttock pain with SIJ MRI inflammation ($p=0.0001$).

After full adjustment, past or current pain in the thoracic spine was associated with thoracic MRI inflammation (OR 1.71; 95% CI 1.09 to 2.67; $p=0.02$), past or current lumbar pain was associated with lumbar MRI inflammation (OR 2.53; 95% CI 1.03 to 6.20; $p=0.04$), and past or current

buttock pain was associated with SIJ MRI inflammation (OR 2.86 95% CI 1.84 to 4.46; $p=0.0001$). MRI inflammation at one site was not associated with past or current pain at any other site (table 2).

In the subgroup with normal or doubtful SIJ radiographs, the results were similar. After full adjustment, past or current thoracic pain was associated with thoracic MRI inflammation (OR 1.76; 95% CI 0.97 to 3.22; $p=0.06$), past or current lumbar pain with lumbar MRI inflammation (OR 3.19; 95% CI 0.92 to 11.12; $p=0.07$), and past or current buttock pain with SIJ MRI inflammation (OR 2.29; 95% CI 1.36 to 3.85; $p=0.002$). In patients with abnormal SIJ radiographs, similar associations were found but did not reach statistical significance. In the subgroup of patients fulfilling ASAS criteria for axial SpA with complete data ($n=446$), the results were unchanged (added table 4). Past or current thoracic pain remained significantly associated with MRI thoracic inflammation (adjusted OR (aOR)_{thoracic pain} 1.66; 95% CI 1.01 to 2.71; $p=0.04$), lumbar pain with MRI lumbar inflammation (aOR_{lumbar pain} 2.79; 95% CI 1.04 to 7.45; $p=0.04$), and buttock pain with MRI SIJ inflammation (aOR_{buttock pain} 3.42; 95% CI 2.00 to 5.85; $p=0.0001$).

The site of past or current pain site was associated neither with thoracic MRI structural lesions (aOR_{thoracic pain} 1.04; 95% CI 0.61 to 1.77; $p=0.89$; aOR_{lumbar pain} 1.05; 95% CI 0.40 to 2.74; $p=0.59$; and aOR_{buttock pain} 1.44; 95% CI 0.71 to 2.91; $p=0.18$) nor with lumbar MRI structural lesions (aOR_{thoracic pain} 0.79; 95% CI 0.46 to 1.37; $p=0.41$; aOR_{lumbar pain} 2.61; 95% CI 0.62 to 11; $p=0.19$; and aOR_{buttock pain} 1.25; 95% CI 0.61 to 2.54; $p=0.54$). SIJ MRI structural lesions were significantly associated with past or current buttock pain (aOR_{buttock pain} 1.89; 95% CI 1.22 to 2.90; $p=0.004$) but not with past or current thoracic or lumbar pain (aOR_{thoracic pain} 0.92; 95% CI 0.66 to 1.27; $p=0.61$; aOR_{lumbar pain} 0.9; 95% CI 0.51 to 1.61; $p=0.73$).

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Table 1 Characteristics of patients from DESIR cohort according to presence or not of MRI inflammatory lesions

	Inflammatory MRI				Sacroiliac					
	Overall N=648	Thoracic Abnormal n=125	Normal n=523	p*	Lumbar Abnormal n=140	Normal n=508	p*	Abnormal n=303	Normal n=345	p*
Gender (women)	338 (53)	39 (31.5)	299 (58.1)	<0.0001	55 (3.3)	286 (56.9)	<0.0001	132 (44.2)	209 (61)	<0.0001
Age (years)	33.8 (8.7)	34.4 (8.5)	33.6 (8.7)	0.35	35.4 (8.5)	33.4 (8.7)	0.01	32.5	35	0.0003
HLA B27 status	374 (58.2)	92 (74)	54.6 (282)	<0.0001	89 (63.5)	287 (5.7)	0.15	207 (68.1)	169 (49)	<0.0001
BMI (m/kg ²)	23.9 (4.6)	24.7 (6.9)	23.7 (3.8)	0.04	24.2 (6.5)	23.8 (3.9)	0.34	23.9	23.9	0.91
DMARD†	57 (8.8)	9 (7.1)	48 (9.3)	0.21	11 (7.6)	46 (9.1)	0.51	24 (7.7)	33 (9.7)	0.49
NSAID intake† (Y/N)	597 (92.8)	117 (93.6)	480 (92.7)	0.72	131 (93.6)	471 (9.7)	0.73	288 (95.1)	314 (91)	0.05
NSAID intake† (% of daily intake)	4.3 (14.7–78.3)	44.8 (17.4–71.4)	40.4 (15–78.8)	0.97	37.6 (14.6–71.3)	43.7 (15.7–79.8)	0.42	48.2 (19.1–80.5)	38 (13.3–76.4)	0.04
CRP	3.1 (1–7.1)	5 (1.6–13)	3 (1–6)	<0.0001	4 (1–10.5)	3 (1–6.1)	<0.0001	4 (1.5–9.6)	2.5 (1–5)	<0.0001
Thoracic pain	393 (61.5)	86 (68)	307 (59.7)	0.06	87 (63)	310 (61.3)	0.7	176 (58.7)	221 (64.2)	0.14
Lumbar pain	589 (91.7)	113 (90.4)	476 (92.1)	0.54	134 (95.7)	460 (90.7)	0.06	275 (91.1)	319 (9.5)	0.51
Buttock pain	513 (79.6)	96 (76.8)	412 (80.2)	0.4	105 (76.6)	408 (80.5)	0.32	257 (85.7)	256 (74.4)	0.0001

BMI, Body Mass Index; CRP, C-reactive protein; DMARD, Disease Modifying AntiRheumatic Drug; ; NSAID, Non-Steroidal Anti-inflammatory Drugs; SIJ, Sacro-Iliac Joints. Categorical variables were expressed as percentage (%), continuous variables as mean and SD except for CRP as median (25–75) interquartile space.

*Continuous variables were compared using student t-test or Wilcoxon-Mann-Whitney as appropriate, categorical variables using Pearson χ^2 test.

†Regarding treatments, comparisons were systematically adjusted for propensity score using logistic regression models.

Hs-CRP was log-transformed for statistical test.

Sensitivity analyses

Classifying patients who had doubtful MRI lesions with the patients who had normal MRI findings (instead of with those having abnormal MRI findings) did not change the results: the site of past or current pain site remained associated with MRI inflammation only at the same site (data not shown).

Using only the site of current pain instead of the site of past or current pain did not change the association with the site of MRI inflammation. Current thoracic pain remained significantly

associated with thoracic MRI inflammation (aOR 1.73; 95% CI 1.12 to 2.68; $p=0.01$) and buttock pain with MRI SIJ inflammation (aOR 2.17; 95% CI 1.45 to 3.26; $p=0.0001$). The association between current lumbar pain and lumbar MRI inflammation did not reach statistical significance (aOR 1.82; 95% CI 0.89 to 3.75; $p=0.10$). The association between past or current buttock pain and SIJ MRI structural lesions remained significant when only current pain was considered (aOR 1.67; 95% CI 1.10 to 2.53; $p=0.02$).

Table 2 Association between MRI inflammation and axial pain sites in the DESIR cohort (multivariate analysis)

	Inflammatory lesions by MRI					
	Thoracic (n=122)		Lumbar (n=137)		Sacroiliac (n=295)	
	OR (95% CI)*	p Value	OR (95% CI)*	p Value	OR (95% CI)*	p Value
Thoracic pain	1.71 (1.09–2.67)	0.02	1.15 (0.76–1.73)	0.5	0.85 (0.60–1.20)	0.37
Lumbar pain	1.06 (0.50–2.22)	0.87	2.53 (1.03–6.20)	0.04	1.00 (0.54–1.82)	0.99
Buttock pain	1.23 (0.73–2.07)	0.43	1.00 (0.62–1.63)	0.99	2.86 (1.84–4.46)	0.0001
Gender (male)	3.0 (1.91–4.72)	0.0001	1.97 (1.30–2.98)	0.001	2.0 (1.41–2.83)	0.0001
Age (+1 SD)	1.34 (1.07–1.67)	0.008	1.40 (1.14–1.72)	0.01	0.82 (0.69–0.98)	0.03
HLA-B27	2.47 (1.54–3.98)	0.0001	1.54 (1.01–2.36)	0.04	2.14 (1.51–3.03)	0.0001
LnCRP (+1SD)	1.34 (1.05–1.71)	0.01	1.21 (0.98–1.51)	0.07	1.16 (0.98–1.38)	0.09

CI, confidence interval; CRP, C-reactive protein.

Normal MRIs were defined as MRIs scored 0 and abnormal MRIs as MRIs scored 1 or 2.

*ORs estimated using logistic regression models.

Table 3 Association between MRI inflammation and axial pain sites in the DESIR cohort according to radiographic findings at the sacroiliac joints (SIJ) (multivariate analysis)

	Thoracic (n=70)		Lumbar (n=82)		Sacroiliac (n=163)	
	OR (95% CI)*	p Value	OR (95% CI)*	p Value	OR (95% CI)*	p Value
Normal SIJ radiographs (n=475): Inflammatory lesions at MRI						
Thoracic pain	1.76 (0.97–3.22)	0.06	1.21 (0.71–2.07)	0.47	0.98 (0.64–1.49)	0.92
Lumbar pain	1.02 (0.40–2.57)	0.97	3.19 (0.92–11.12)	0.07	1.32 (0.61–2.83)	0.48
Buttock pain	0.93 (0.50–1.73)	0.81	1.03 (0.56–1.90)	0.92	2.29 (1.36–3.85)	0.002
Gender (male)	2.06 (1.17–3.63)	0.01	1.93 (1.13–3.28)	0.02	1.97 (1.30–3.00)	0.001
Age (+1 SD)	1.41 (1.05–1.89)	0.02	1.71 (1.30–2.26)	0.0001	0.93 (0.75–1.14)	0.5
HLA-B27	2.58 (1.42–4.67)	0.002	1.38 (0.82–2.33)	0.22	1.91 (1.26–2.90)	0.002
lnCRP (+1SD)	1.24 (0.93–1.66)	0.13	1.10 (0.84–1.42)	0.48	1.06 (0.86–1.29)	0.58
Abnormal SIJ radiographs (n=173): inflammatory lesions at MRI						
	Thoracic (n=55)		Lumbar (n=58)		Sacroiliac (n=140)	
Thoracic pain	2.09 (0.97–4.47)	0.06	1.24 (0.62–2.52)	0.54	0.63 (0.26–1.58)	0.33
Lumbar pain	1.03 (0.28–3.84)	0.96	1.63 (0.42–6.34)	0.48	NA	NA
Buttock pain	1.44 (0.45–4.56)	0.54	0.37 (0.13–1.06)	0.06	1.74 (0.51–5.94)	0.38
Gender (male)	5.65 (2.36–13.5)	0.0001	1.57 (0.75–3.28)	0.23	0.91 (0.36–2.31)	0.85
Age (+1 SD)	1.54 (1.05–2.25)	0.03	1.19 (0.84–1.68)	0.33	0.74 (0.49–1.11)	0.15
HLA-B27	1.51 (0.62–3.66)	0.36	1.27 (0.56–2.88)	0.57	1.75 (0.69–4.46)	0.24
lnCRP (+1SD)	1.49 (0.92–2.40)	0.1	1.29 (0.84–1.98)	0.25	1.14 (0.72–1.81)	0.56

CI, confidence interval; CRP, C-reactive protein.

Radiographs of the SIJs were classified as abnormal if they showed inflammation or fusion and as normal otherwise.

Normal MRIs were defined as MRIs scored 0 and abnormal MRIs as MRIs scored 1 or 2.

*ORs estimated using logistic regression models.

DISCUSSION

In the DESIR cohort of patients with recent IBP, the site of pain was associated with the site of MRI inflammation. This association remained significant in patients with normal SIJ radiographs. Pain site was not associated with having MRI structural lesions at the thoracic or lumbar spine. However, the site of past or current pain was associated with MRI structural lesions at the SIJs.

In accordance with previous studies, we found that MRI could visualise axial inflammation in patients with normal radiographs, particularly at the SIJs. This greater sensitivity of MRI compared to radiography can decrease the time to diagnosis in patients with recent IBP. Thus, in the current study, MRI inflammation of the SIJ(s) was found in about 34% of the patients with normal SIJ radiographs. In keeping with our results, in a Dutch cohort 32% of the 68 patients with IBP for less than 2 years had MRI inflammation of the SIJ(s).¹² MRI

inflammation at the thoracic or lumbar spine was less common but was nevertheless the only imaging-study abnormality in 5% of our patients. Similarly, in a British cohort of 54 patients with recent-onset IBP, 23.5% of patients had MRI inflammation of the lumbar spine¹³; and in a study of semi-recent-onset ankylosing spondylitis or IBP, spinal inflammation by MRI was the only abnormality detected by radiographs and axial MRI in 5% of patients.¹⁴ These data highlight the potential utility of axial MRI in the early diagnosis of SpA.

Whatever the site of pain, MRI inflammation was most common at the SIJ(s). However, the significant association between the site of axial pain and the site of MRI inflammation supports the usefulness of spinal MRI when the thoracic and/or lumbar spine is the only or predominant site of pain. In addition, spinal MRI may be valuable in this situation to rule out differential diagnoses such as epidural tuberculosis or metastasis and lymphoma.

Table 4 Association between MRI inflammation and axial pain sites in patients fulfilling Assessment of SpondyloArthritis international Society criteria, the DESIR cohort (multivariate analysis)

	Inflammatory lesions by MRI					
	Thoracic (n=109)		Lumbar (n=111)		Sacroiliac (n=269)	
	OR*	p Value	OR*	p Value	OR*	p Value
Thoracic pain	1.66 (1.01–2.71)	0.04	1.21 (0.76–1.94)	0.42	0.77 (0.49–1.20)	0.25
Lumbar pain	1.09 (0.49–2.41)	0.83	2.79 (1.05–7.45)	0.04	0.82 (0.39–1.72)	0.60
Buttock pain	1.22 (0.68–2.20)	0.49	0.94 (0.53–1.65)	0.83	3.42 (2.00–5.85)	0.0001
Gender (male)	3.17 (1.91–5.24)	0.03	2.04 (1.26–3.29)	0.0003	2.34 (1.50–3.66)	0.0001
Age (+1 SD)	1.31 (1.03–1.67)	0.03	1.28 (1.01–1.62)	0.04	0.71 (0.57–0.90)	0.04
HLA-B27	1.19 (0.62–2.28)	0.58	0.75 (0.41–1.36)	0.35	0.2 (0.10–0.41)	0.0001
lnCRP (+1SD)	1.37 (1.05–1.80)	0.02	1.25 (0.97–1.62)	0.08	1.09 (0.88–1.36)	0.39

Normal MRIs were defined as MRIs scored 0 and abnormal MRIs as MRIs scored 1 or 2.

*ORs estimated using logistic regression models.

CRP, C-reactive protein.

The site of axial pain was significantly associated with the site of MRI inflammation in the overall study population, and in the subgroup of patients with normal SIJ radiographs, in which the diagnostic usefulness of MRI is greatest. The association between site of axial pain and site of MRI inflammation was not significant in the subgroup with abnormal SIJ radiographs, probably because of inadequate statistical power, as only 27% of patients had abnormal SIJ radiographs. This explanation is supported by the fact that, in patients with abnormal SIJ radiographs, the ORs were higher for the matching site than for the other sites, although they were not significant for lumbar or buttock pain. The greater probability of finding MRI inflammation at the site of pain indicates a need for obtaining details on the pain site from the patient and on paying particular attention to that site when reading the MRI scans.

Our findings indicate that, in patients with recent IBP and in patients meeting ASAS criteria for axial SpA, pain is related to concomitant MRI inflammation. Longitudinal studies have established that axial inflammation is the first step in the natural course of SpA, whereas structural changes develop later on, and that the inflammation is associated with pain.¹⁵ We found spinal MRI inflammation in similar proportions of patients in the thoracic segment (19%) and lumbar segment (21%). In previous studies, both the inflammatory and the structural changes predominated in the thoracic segment.^{16–18} However, the patients in these studies were not selected based on recent onset of the IBP. Consequently, whether thoracic spine inflammation is an early finding in axial SpA remains unclear.

Presence of the HLA-B27 antigen was recently reported to be associated with an increased prevalence of MRI inflammation in the spine or SIJ(s) among DESIR patients who had definite axial SpA.⁸ In our study of all DESIR patients having complete imaging data, we also found an association between HLA-B27 and MRI inflammation. Similarly, in the Dutch cohort of IBP patients with recent-onset IBP, HLA-B27 positivity was associated with MRI inflammation at any time during the 2-year follow-up.¹⁹ Thus, although the combination of normal SIJ radiographs and HLA-B27-negativity raises the greatest diagnostic challenges in patients with IBP, MRI is less likely to provide the diagnosis in this subgroup than in HLA-B27-positive patients.

Our study has several limitations. The cross-sectional design (baseline data from the DESIR cohort) precluded an evaluation of potential causal links between axial pain and MRI lesions. Since the site of IBP was self-reported, there may have been some degree of misclassification. Moreover, MRI inflammation may have been overestimated, as some of the isolated inflammatory lesions may have been classified as abnormal or grade 2, whereas studies have shown that a single focus of oedema lacks specificity for SpA.⁶ However, in our sensitivity analysis involving a change in the threshold used to define abnormalities, the results were similar to those in the main analysis. Conversely, some degree of underestimation of spinal inflammatory lesions may have occurred, because we considered only the foci of vertebral oedema, and not of the posterior and lateral elements: recent studies indicate that considering both oedema and fatty lesions or overall inflammatory lesions of the posterior elements may increase the diagnostic value of MRI.^{20–22} Finally, our subgroup analyses may have lacked sufficient power to detect significant differences. The local reading of the images, instead of a centralised one, may also be considered as a limitation of our study. However, in DESIR, the imaging

techniques were standardised and the centres involved had to fulfill predefined quality criteria in order to be able to participate in the study, namely regarding previous experience with multicentre, longitudinal epidemiological studies.⁸ In the same line, and despite the common guidelines which were provided for the reading, the images were interpreted by either local rheumatologists or radiologists who might give different evaluations of some lesions. Finally, the scoring method to adjudicate radiographic sacroiliitis was not strictly the New York criteria, as grade 2 and 3 were pooled together in one sole grade. It appeared more realistic and more robust for non specifically trained readers to pool frank anomalies of a SIJ in one grade.

However, our multicentre study also has several strengths. Our analyses were performed in more than 600 patients who were routinely investigated by MRI of the spine and SIJs. The MRI scans were assessed for both structural changes and inflammatory lesions, by trained radiologists or rheumatologists. Moreover, none of the patients had IBP for longer than 3 years, indicating that our patients were in the very early stages of the disease. Detailed interviews, physical examinations and laboratory tests were performed, allowing full adjustment for demographic characteristics, lifestyle, laboratory parameters, treatments and HLA-B27 status.

To our knowledge, this is the first study showing an association between the site of axial pain and the site of MRI inflammation. Consequently, additional studies are needed to further evaluate this association

Contributors All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be published. PC had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. FCP, SBG, MD, AS, PC: study conception and design. SF, PLC, VF, CP, BJ, PC: acquisition of data. MB, BC, MD, AS, CP, FCP, PC: analysis and interpretation of data.

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Does the site of magnetic resonance imaging abnormalities match the site of recent-onset inflammatory back pain? The DESIR cohort

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