Associations of Lumbar Scoliosis with Presentation of Suspected Early Axial Spondyloarthritis

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Original article

Running head: Scoliosis and Presentation of Early Axial Spondyloarthritis

Associations of Lumbar Scoliosis with Presentation of Suspected Early Axial Spondyloarthritis

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ABSTRACT (235 words)

Objective: Scoliosis may impact the mechanical loading and cause secondary changes of the sacroiliac joints and lumbar spine. Our goal was to look how lumbar scoliosis modify the clinical and imaging-study in patients with recent-onset inflammatory back pain (IBP) suggesting axial spondyloarthritis (axSpA).

Methods: Baseline weight-bearing lumbar-spine radiographs obtained in the DESIR cohort of patients aged 18-50 years and having IBP for at least 3 months but less than 3 years suggesting axSpA were studied. After training on scoliosis detection based on Cobb's angle>10° plus Nash-Moe grade≥1, readers blinded to patient data measured spine lumbar scoliosis, sacral horizontal angle, lumbosacral angle and total lordotic angle on the radiograph of the lumbar and scored sacroiliitis on the radiograph of the pelvis. Baseline MRIs T1 and STIR of the lumbar spine and sacroiliac joints were evaluated for respectively degenerative changes and signs of axSpA.

Results: Of the 360 patients (50.8% females) 88.7% had lumbar pain and 69.3% met ASAS criteria for axSpA. Mean Cobb's angle was 3.2°±5.0° and 28 (7.7%) patients had lumbar scoliosis. No statistical differences were observed for radiographic sacroiliitis, MRI sacroiliitis, modified Stoke Ankylosing Spondylitis Spinal Score, Pfirmmann score, high-intensity zone, protrusion, extrusion, MODIC score between patients with and without scoliosis. In both groups, degenerative changes by MRI were rare and predominated at L4-L5 and L5-S1.

Conclusion: In patients with early IBP suggesting axSpA, lumbar scoliosis was not associated with inflammatory or degenerative changes.

Key words: Ankylosing spondylitis. Axial spondyloarthritis. Lumbar scoliosis. Lumbar lordosis. Sacral slope. Degenerative disease.

Significance and Innovations

- A normal to low prevalence of 7.7 % lumbar scoliosis and lordosis is found in patients between 18-50 years who had early IBP in the DESIR cohort. (7.7 % of patients with early IBP suggesting axSpA have lumbar scoliosis)

- Lumbar scoliosis is not associated with changes in clinical or imaging-study findings in this context.

- lumbar scoliosis is not associated with secondary changes to mechanical loading as sclerosis or BME of the sacroiliac joints.

- Lumbar scoliosis has no impact on the MR diagnosis of sacroiliitis on radiographs and MR SI joints.

INTRODUCTION

Back pain has a lifetime prevalence of 70% in the general population (1,2). In most patients, back pain is a nonspecific symptom that is related to mechanical factors whose exact cause is identified in fewer than half the cases (3).

Scoliosis (4) is a three-dimensional spinal deformity that can cause back pain. The main diagnosis criterion is a coronal curvature with a Cobb's angle greater than 10° on the anteroposterior radiograph. In addition, the assessment of pedicle position according to the Nash-Moe technique shows vertebral rotation (Nash-Moe grade >1) (1,5,6). The prevalence of scoliosis has been estimated at 1%-3%. Idiopathic scoliosis accounts for about 80% of all structural coronal deformities, with a prevalence of 1%-2% among schoolchildren up to age 15. In adults, the prevalence of idiopathic scoliosis has been reported to increase with age from 8% starting at 25 years to 68% between 60 and 80 years, due in part to the development of degenerative spinal lesions (1) (2,8–14). Scoliosis causes multifactorial low back pain, whose typically mechanical pattern may be combined with an inflammatory component, for instance in the event of vertebral endplate edema (3,7). The pain may be chronic or recurrent. Scoliosis also restricts spinal mobility.

Degenerative disease of the spine on radiographs has a high prevalence in the general population with back pain (121 to 274, 44%) and clinical correlation with MR imaging findings is low (15). These include dehydration of discs and loss of disc height, a high-intensity zone (HIZ) in the posterior annulus of the disk, disk herniation, Modic type vertebral endplate changes, facet-joint osteoarthritis, interspinous bursitis (rare and not scored by us), degenerative spondylolisthesis (3). The presence of scoliosis accelerates the development of degenerative changes of the spine. In addition the change the mechanical loading may cause secondary changes in the SI joints as reactive sclerosis or bone marrow edema.

In axial spondyloarthritis (axSpA), back pain is a key manifestation. Thus, inflammatory back pain (IBP) in younger patients predominantly suggests axSpA. The early diagnosis of axSpA is challenging and relies on a convergence of evidence from the medical history, physical examination, laboratory tests, and imaging studies (16–19). Degenerative changes are common in the general population and in axSpA. Thus, in the SPACE cohort, 90% of patients classified as having possible or definite axSpA also had degenerative changes by MRI, which predominated at the lumbar spine (15). However, the prevalence of lumbar scoliosis in patients with axSpA has not been reported. Furthermore, no data exist on whether scoliosis is associated with differences in the clinical and/or imaging-study presentation of axSpA.

Our objective here was to evaluate whether lumbar scoliosis was associated with differences in clinical manifestations, imaging-study findings, and/or the degree of axSpA diagnosis certainty in the DESIR cohort of patients with recent-onset IBP and suspected axSpA.

PATIENTS AND METHODS

The DESIR cohort

DESIR (DEvenir des Spondyloarthropathies Indifférenciées Récentes) is a French prospective, multicenter, cohort established between October 2007 and April 2010. Adults aged 18 to 50 years were included if they had inflammatory pain in the thoracic spine, lumbar spine, and/or buttock(s) meeting Calin and/or Berlin criteria (16), of more than 3 months' but less than 3 years' duration, leading to a determination by the local investigator that the probability of axSpA was at least 5 on a 0-10 numerical rating scale (0, not suggestive at all; 10, highly suggestive). The baseline characteristics of the patients are described in detail elsewhere (20,21).

The DESIR cohort study complied with good clinical practice guidelines, was registered on Clinical Trials.gov (NCT0164 8907), and was approved by the appropriate ethics committee (CPP Ile-de-France III, submission number P070302). Before study inclusion, each patient gave written informed consent and permission to publish any individual anonymized data. A detailed description of the study protocol is available online at http://www.lacohortedesir.fr/desir-in-english/. The research project was approved by the DESIR scientific committee. For this study, the database was locked in 2014. Standing, weight-bearing, antero-posterior radiographs of the lumbar spine were used.

Assessment of imaging studies

Evaluation of scoliosis. We used Cobb's angle (1,5,6) to quantify spinal curvature in the frontal plane and the Nash-Moe grade to assess vertebral rotation. Cobb's angle is subtended by the line along the superior endplate of the vertebra at the top of the curve and a line along the inferior endplate of the vertebra at the bottom of the curve. The Nash-Moe grade based on pedicle shadow position reflects the degree of rotation of the vertebra at the apex of the

curve; the grade can range from 0 (no rotation) to 4 (major rotation) (5,6).Two rheumatology fellows (MVH and GCA) received training from a spine specialist then evaluated the baseline anteroposterior lumbar-spine radiograph (in DICOM format) of each patient for evidence of scoliosis (**Figure 1**), on two separate occasions separated by at least 2 days. Patients with a Cobb's angle ≥10° and a Nash-Moe grade ≥1 were classified as having scoliosis and other patients as being free of scoliosis (1,5,6). Disagreements between the two readers (scoliosis yes/no) were resolved by having the spine specialist (TM) repeat the measurements.

Evaluation of degenerative disease. As part of the DESIR cohort data collection process, the baseline lumbar-spine radiograph and MRI scan of each patient had been previously assessed for degenerative changes by two readers blinded to all patient data (15). Radiographic degenerative changes were recorded as present/absent at L3-L4, L4-L5, and L5-S1, as they are the most affected by degenerative changes. The MRI scans were also assessed for disk degeneration, Modic changes, Pfirrmann grade, canal stenosis, disk herniation/extrusion, HIZ, facet-joint osteoarthritis, spondylolisthesis, and Schmorl's nodes at L3-L4, L4-L5, and L5-S1. For this study, Pfirrmann grades I and II were considered normal and grades III, IV, or V as indicating degenerative disease; disagreements between the two readers were resolved by a third reader.

Angle measurements. For another DESIR cohort study, two readers used the baseline lateral lumbar-spine radiographs to measure sacral slope (SS) as the angle formed by the line along the upper endplate of S1 and the horizontal plane (22) and total lordotic angle (TLA) formed by the lines drawn along the upper endplates of L1 and S1(22–24). Lumbosacral angle (LSA) formed by two lines drawn along the lower L5 endplate and upper S1 endplate, respectively; sacral horizontal angle (SHA) between the horizontal line and the line along the

upper S1 endplate; and the total lordotic angle (TLA) between the lines along the upper L1 and S1 endplates. The values were used for the present study.

Imaging abnormalities suggesting axSpA. We also compared the right or left curved scoliosis to the right and left sacroiliac joints joint for grade of sclerosis on radiograph and bone marrow edema on sacroiliac MRI. As part of the DESIR cohort data collection process, baseline radiographs of the spine and pelvis were used to assess New-York modified criteria for sacroiliitis (25), the modified Stoke Ankylosing Spondylitis Spinal Score (mSASSS score) (26), and the Bath Ankylosing Spondylitis Radiology Index (BASRI) (27); baseline MRI scans were evaluated for evidence of sacroiliitis (28) and determination of the sacroiliac and spinal SPondyloARthritis Research Consortium of Canada MRI inflammation (SPARCC) score (29–30). Ranges of the scoring systems are included in the tables showing the results.

Statistical analysis

Intraobserver repeatability and interobserver reproducibility of the diagnosis of scoliosis were estimated by computing the kappa coefficients, which were interpreted according to Landis and Koch (0.61-0.80, substantial agreement; and 0.81-1, near perfect agreement). Patients with and without scoliosis were compared regarding the clinical presentation (demographics, pain pattern, spinal mobility, and other features), the prevalence of degenerative disease (presence or absence) visible radiographically and by MRI, and the degree of confidence in a diagnosis of axSpA. All data were evaluated at baseline. Associations between these variables and scoliosis were sought by univariate analysis using the chi-square test (or Fisher's exact test when appropriate) or the Mann-Whitney test. We also verified that Cobb'angle was not correlated to either mSASSS or grade of sacroiliitis on X-rays using the Spearman's coefficient.

With Bonferroni's correction, P values <0.001 were required to indicate significant differences. Statistical analyses were performed using SPSS 23.0 software (IBM, Armonk, NY).

RESULTS

Study group

From the DESIR cohort, 362 patients with available standing, weight-bearing, anteroposterior lumbar-spine radiographs were included in the study. Mean Cobb's angle was 3.2°±5.0, with a maximum of 32°. Of the 362 patients, 28 (7.7%) had scoliosis. The Nash-Moe grade was I or II in all patients. No patient had severe scoliosis. In the overall patient population, the intraobserver kappa coefficient was 1, indicating perfect agreement, and the interobserver kappa coefficient was 0.7, indicating substantial agreement.

The baseline characteristics of the 362 patients were similar to those of the entire cohort (supplementary table 1): mean age was 33.2±8.4 and 50.8% of patients were female; 88.7% of patients had low back pain and 72.7% had buttock pain. The ASAS classification criteria for axSpA were met by 69.3% of patients at baseline (**Table 1**). No patient had spondylolysis and very few patients had spondylolisthesis, Modic changes, canal stenosis, or facet-joint osteoarthritis.

Associations of scoliosis with clinical presentation and confidence in a diagnosis of *axSpA*

Table 2 compared the clinical characteristics in the groups with and without scoliosis. No statistically significant differences were found for demographic data, site or features of the pain, or motion range of the lumbar spine. Neither range of motion of the lumbar spine nor the degree of confidence in a diagnosis of axSpA differed between the two groups.

Associations of scoliosis with imaging-study abnormalities

Table 3 reports the results of tests for associations linking scoliosis to SS and TLA values measured on radiographs and to MRI signs of degenerative disease. Overall, MRI abnormalities were extremely uncommon, with no significant between-group differences; for each abnormality, the numbers were too small for statistical analyses. Except for Schmorl's nodes, the MRI abnormalities predominated at L4-L5 and L5-S1.

TLA was non-significantly greater in the group with scoliosis (58.9° vs. 52.4°, *P*=0.009). SS was non-significantly greater in the group with scoliosis (42.2° vs. 39.0, *P*=0.03).

Scoliosis was not associated with abnormalities suggesting axSpA by radiography (New York criteria, mSASSS score, BASRI score and SPARCC score) or MRI (ASAS criteria and SPARCC score) (**Table 4**). The Cobb'angle was not correlated to either mSASSS (r -0.28, p0.61) or grade of sacroiliitis on X-rays (left: r=0.60, p0.26; right: r=0.01, p0.78).

DISCUSSION

In this study, lumbar scoliosis was not significantly associated with the clinical or imaging-study features of patients with early IBP. Thus, patients with and without scoliosis did not differ regarding nocturnal pain, morning stiffness according to the Berlin criteria, chronicity of the symptoms, and confidence in a diagnosis of axSpA. Moreover, the proportion of patients meeting ASAS criteria was the same in the two groups, indicating that lumbar scoliosis did not increase the risk of mistakenly diagnosing axSpA in this population

of patients in whom the local investigators rated the likelihood of axSpA at 5 or more on a 10-pont scale (32).

Lumbar scoliosis might be expected to diminish the range of forward bending. In a study of adolescent idiopathic scoliosis, forward bending was restricted in proportion to the amount of curvature and rotation (10). Furthermore, an association has been reported between scoliosis and spinal degenerative disease. However, the modified Schober's test and finger-floor distance were similar in our groups with and without scoliosis. This finding may be ascribable to the characteristics of our patients, who were young, with little evidence of degenerative disease, and whose lumbar scoliosis was usually mild (23).

Sagittal lumbosacral balance as assessed on radiographs did not differ between the groups with and without scoliosis. In patients with scoliosis, total lordosis and SS were non-significantly greater than in patients without scoliosis. In both groups, the TLA and SS values were within the normal ranges. Few studies have addressed sagittal lumbosacral balance in patients with scoliosis (31,32). In 160 patients with adolescent idiopathic scoliosis (34), lumbar lordosis was non-significantly greater in the group with lumbar curves. Some studies suggest that greater lordosis may not be associated with the progression of scoliosis (33,34).

Data on potential associations of lumbar lordosis with degenerative changes and low back pain are conflicting. In a study of 112 females aged 40-72 years, the angle of lordosis was not significantly different in the groups with and without radiographic degenerative disease of the lumbar spine (23). The TLA may be associated with spondylolysis and spondylolisthesis but not with other manifestations of spinal degenerative disease (24).

MRI abnormalities were rare in both groups, suggesting that lumbar scoliosis may not be associated with an increased risk of spinal degenerative disease in adults with early IBP who are younger than 50 years of age. Nevertheless, scoliosis was associated with

degenerative disease in many studies, with some parameters correlating with low back pain. Thus, Modic changes were more common or more marked in patients with scoliosis (13,14) and predominated at the curve apex concavity (9,11). Severe facet-joint degeneration was associated with painful lumbar scoliosis (2,8,10,11). One study found that Schmorl's nodes were associated with pain in pediatric patients with scoliosis who had Schmorl's nodes (9). Other degenerative lesions such as foraminal stenosis and spondylolisthesis may correlate with symptoms in patients with lumbar scoliosis (11). In our study, degenerative changes at the lumbar spine were found in similar proportions of patients with and without lumbar scoliosis. This finding may be ascribable to the relatively young age of the patients and to the mild nature of most of the cases of lumbar scoliosis. Alternatively, any deleterious effects of lumbar scoliosis may have been counterbalanced by an increase in lumbar lordosis. In a study of patients who had two MRI scans of the lumbar spine at a 4-year interval, lordosis was more marked in patients with no degenerative disease progression (14). Scoliosis was not associated with progression. In the SPACE cohort of patients aged 16 to 45 years and presenting with chronic back pain, the prevalence of degenerative changes was 89% by MRI and 44% by radiography, with no difference across the groups with and without axSpA; the prevalence of each type of degenerative change was far lower, although HIZ were seen at the lumbar spine in 62.4% of patients (19). The main strength of this study is the collection of a vast array of data in a large population. In addition, most of the imaging study assessments were done by experienced radiologists. Among the weaknesses is the focus on lumbar scoliosis. We did not obtain standing AP radiograph of the full-spine to quantify spinal curvature in a uniform and comparable method, as recommended by the American Scoliosis Research Society. Patients with low back pain may also have thoracic spinal pain with or without thoracic or thoracolumbar scoliosis. Thoracolumbar scoliosis can be missed and no information is available on S-shaped curve of the spine. Furthermore,

Cobb's angle, although the current reference standard for assessing scoliosis, measures a 2D curve, whereas scoliosis is a 3D deformity (5). However, we also assessed the Nash-Moe grade to evaluate vertebral rotation. Nevertheless, measurement error have been found to result in 2° to 7° differences in Cobb's angle values and the Nash-Moe grade can be properly assessed only on a true frontal view. The number of patients with scoliosis is low and the difference of number between the group with and without scoliosis might have decreased the statistical power of the study. Nevertheless, Cobb'angle was not correlated to either mSASSS or grade of sacroiliitis on X-rays.

In conclusion, in a large prospective cohort of patients with early IBP, lumbar scoliosis is infrequently seen and not associated with secondary changes to mechanical loading, sclerosis or bone marrow edema of the sacroiliac joints. Therefore there is no impact on the classification criteria for axSpA. Furthermore, lumbar spine degenerative changes were not more common in the patients with versus without lumbar scoliosis. These results were obtained in patients aged 18-50 years who had early IBP. It would be of interest to assess longitudinal data with AP full spine radiographs from the DESIR cohort with the aim of determining whether lumbar scoliosis is associated with the outcomes of axSpA.

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Figure 1. Cobb's angle measurement on an anteroposterior radiograph of the lumbar spine

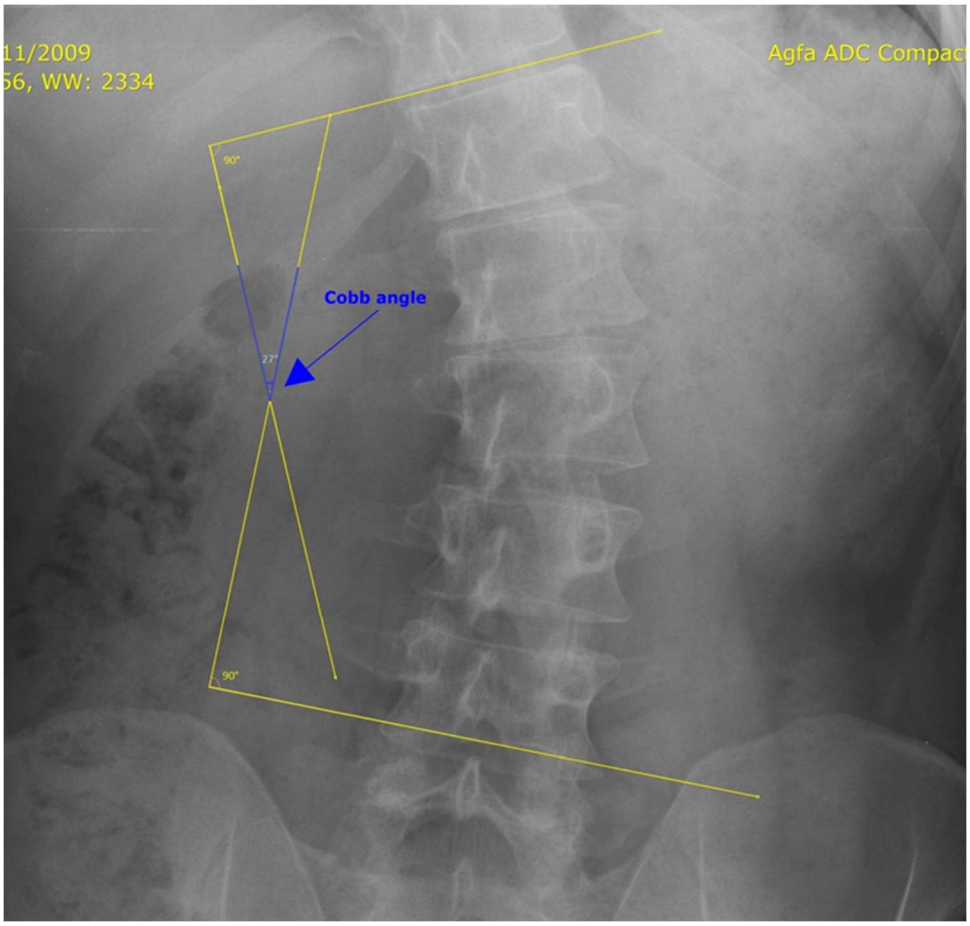

Table 1. Main patient characteristics at baseline (n=362)

Age (years), mean±SD	33.2 ± 8.4
Males, n (%)	178 (49.2%)
BMI (m/kg²), mean±SD	24.1±4.3
Low-back pain,[a] n (%)	321 (88.7%)
Buttock pain,[a] n (%)	263 (72.7%)
Morning stiffness (Berlin criteria), n/N (%)	329 (90.9%)
Nocturnal pain (Berlin criteria), n/N (%)	319 (88.1%)
Modified Schober test (10+Xcm), mean±SD	3.7 ± 1.1
Finger-floor distance (cm), mean±SD	13.0 ± 12.9
HLA B27 positivity, n (%) (n=674)	224 (61.9%)
ASAS criteria, n (%) (n:669)	251 (69.3%)
Confidence in a diagnosis of SpA at baseline,[b] mean±SD	7.4 ± 2.1
Sacral slope, °, mean±SD	39.3 ± 9.2
Lumbosacral angle, °, mean±SD	14.6 ± 4.6
TLA, °, mean±SD	53.0 ± 13.1
Lumbar scoliosis, n (%)	28 (7.7%)

[a] inclusion criterion

[b] assessed on a 1-10 scale by the investigator at each study center

BMI, body mass index; HLA, human leukocyte antigen; ASAS, Assessment of SpondyloArthritis international Society; SpA, spondyloarthritis; TLA, total lordotic angle

Table 2. Associations of scoliosis with the clinical presentation and confidence in a diagnosis of axSpAat baseline; ASAS criteria and confidence in a diagnosis of spondyloarthritis are also reported after 2 years

Characteristics	**No scoliosis N=327**	**Scoliosis N=28**	***P* value***
Age (years), mean±SD	33.2 ± 8.4	31.9 ± 7.5	0.49
Males, n (%) (N=327)	163 (49.8)	12 (42.9)	0.48
Weight (kg), mean±SD	70.3 ± 13.4	67.0 ± 15.6	0.23
Height (cm), mean±SD	170.2 ± 9.3	168.6 ± 10.3	0.46
BMI (m/kg²), mean±SD	24.1 ± 4.3	24.3 ± 3.4	0.41
Low back pain, n (%)(N=327)	289 (88.4)	26 (92.9)	0.47
Buttock pain, n (%)(N=327)	241 (73.7)	18 (62.3)	0.28
Morning stiffness (Berlin criteria), n (%)(N=327)	301 (92.0)	22 (78.6)	0.02
Nocturnal pain (Berlin criteria), n (%)	287 (87.8)	26 (92.9)	0.42
Modified Schober test (10+Xcm), mean±SD	3.7 ± 1.1	3.5 ± 1.0	0.18
Finger-floor distance (cm), mean±SD	12.9 ± 12.8	15.6 ± 14.2	0.23
HLA B27 positivity, n (%)	202 (61.8)	19 (67.8)	0.52
ASAS criteria met at baseline, n (%)	226/325 (69.5)	22 (78.6)	0.32
Confidence in a diagnosis of SpA at baseline, mean±SD [a]	7.3 ± 2.1	8.0 ± 2.1	0.06

[a]inclusion criterion

[b]assessed on a 1-10 scale by the investigator at each study center

BMI, body mass index; HLA, human leukocyte antigen; ASAS, Assessment of SpondyloArthritis international Society; SpA, spondyloarthritis

Table 3. Associations of scoliosis with radiographic sagittal balance and MRI signs of degenerative disease at baseline

Characteristics at baseline	**No scoliosis (n= 306)**	**Scoliosis (n= 27)**	***P* value***
Pfirrmann L3-L4 ≥3, n (%)	14 (4.6)	2 (7.4)	0.51
Pfirrmann L4-L5 ≥3, n (%)	46 (15.0)	2 (7.4)	0.28
Pfirrmann L5-S1 ≥3, n (%)	75 (24.5)	6 (22.2)	0.79
HIZ L3-L4, n (%)	5 (1.6)	0 (0.0)	0.5
HIZ L4-L5, n (%)	45 (12.5)	0 (0.0)	0.32
HIZ L5-S1, n (%)	62 (20.3)	3 (11.1)	0.25
Protrusion L3-L4, n/ (%)	6 (2.0)	0 (0.0)	1.00
Protrusion L4-L5, n (%)	21 (6.9)	0 (0.0)	0.39
Protrusion L5-S1, n (%)	39 (12.7)	1 (3.7)	0.22
Extrusion L3-L4, n (%)	2 (0.6)	0 (0.0)	1.00
Extrusion L4-L5, n (%)	18 (5.9)	2 (7.4)	0.67
Extrusion L5-S1, n (%)	26 (8.5)	3 (11.1)	0.72
Modic L3-L4, n (%) - 1 - 2 - 3	 2 (0.6) 1 (0.3) 0 (0.0)	 0 (0.0) 1 (3.7) 0 (0.0)	0.09
Modic L4-L5, n (%) - 1 - 2 - 3	 4 (1.3) 4 (1.3) 0 (0.0)	 0 (0.0) 0 (0.0) 0 (0.0)	0.70
Modic L5-S1, n (%) - 1 - 2 - 3	 7 (2.3) 3 (1.0) 0 (0.0)	 1 (3.7) 1 (3.7) 0 (0.0)	0.41
Sacral horizontal angle, °, mean±SD	39.0 ± 9.2	42.2 ± 8.9	0.09
Lumbosacral angle, °, mean±SD	14.6 ± 4.6	14.0 ± 4.6	0.45
Lumbar lordosis, °, mean±SD	52.4 ± 13.2	58.9 ± 11.4	0.009

HIZ, high-intensity zone; SD, standard deviation

Table 4. Associations of scoliosis and radiographic and/or MRI signs suggesting axSpAat baseline

	No scoliosis (n=362)	Scoliosis (n= 28)	*P* value
Sacroiliac joints			
New York criteria, radiographs	61/327 (18.6%)	8/28 (28.6%)	0.20
ASAS criteria, MRI, mean±SD	102/322 (31.7%)	12/28 (42.8%)	0.23
SPARCC score, MRI, mean±SD (n=640)	3.8±8.0	4.4±7.1	0.20
Spine			
mSASSS score, radiographs, mean±SD (n=640)	0.4±1.7	1.2±3.5	0.48
SPARCC score, MRI, mean±SD (n=651)	5.0±9.3	6.4±8.9	0.06
BASRI , radiographs mean±SD (n=651)	0.2±0.7	0.5±1.2	0.65

SPARCC, SPondyloArthritis Research Consortium of Canada score; mSASSS, modified Stoke Ankylosing Spondylitis Spinal Score; BASRI, Bath Ankylosing Spondylitis Radiology Index

Supplementary table 1: Description of patients of this study and the whole DESIR cohort

Characteristics	Patients in our study (n=362)	Patients from the DESIR cohort (n=708)
Age (years), mean±SD	33.2 ± 8.4	33.8 ± 8.6
Males, n (%)	178 (49.2%)	327 (46.2%)
BMI (m/kg²), mean±SD	24.1±4.3	24.0 ± 4.6
Low-back pain,[a] n (%)	321 (88.7%)	(67.1%)
Buttock pain,[a] n (%)	263 (72.7%)	(39.6%)
Morning stiffness (Berlin criteria), n/N (%)	329 (90.9%)	623 (88.0%)
Nocturnal pain (Berlin criteria), n/N (%)	319 (88.1%)	630 (89.0%)
Modified Schober test (10+Xcm), mean±SD	3.7 ± 1.1	3.7 ± 1.3
Finger-floor distance (cm), mean±SD	13.0 ± 12.9	13.2 ± 13.0
HLA B27 positivity, n (%) (n=674)	224 (61.9%)	(57.3%)
ASAS criteria, n (%) (n:669)	251 (69.3%)	447 (63.1%)
Confidence in a diagnosis of SpA at baseline,[b] mean±SD	7.4 ± 2.1	6.8 ± 2.6