Factors associated with the decision of the rheumatologist to order sacroiliac joints magnetic resonance imaging (SI-MRI) or HLA-B27 testing in the diagnostic work-up of patients with spondyloarthritis in clinical practice

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Abstract

Objective

To evaluate the patients' characteristics associated with the clinical decision to request SI-MRI and/or HLA-B27 in patients with SpA in daily practice.

Methods

Patients referred to a rheumatology outpatient-clinic in a national referral-centre were selected. Patients with a clinical diagnosis of SpA according to the rheumatologist were included. SI-MRI and HLA-B27 was available for patients in whom the rheumatologists had ordered these tests. Characteristics associated with ordering SI-MRI or HLA-B27 were identified with univariable analyses. Variables with p-value <0.05 and >80% completeness were selected for further analysis. A multivariable logistic regression analysis was used to evaluate the determinants related with the decision to perform SI-MRI and/or HLA-B27 and odds ratios with 95% confidence intervals were calculated.

Results

In total, 581 patients with SpA were included in the cohort, 72% were men, mean age 34.6±12.1 and disease duration 7.3±9.7 years. Of these patients, 24% (n=137) had SI-MRI and 77% (n=441) had HLA-B27 tests ordered. Independently predictive factors for ordering a SI-MRI were the presence of IBP (OR=1.81), enthesitis (OR=1.57) and the number of initial-symptoms at presentation (OR=1.27 per additional symptom present). Independently predictive factors of HLA-B27 testing were the number of initial-symptoms (OR=1.45 per symptom) and uveitis (OR=3.19).

Conclusion

This study strongly suggests that rheumatologists use certain clinical clues to decide if they order expensive and scarce tests in the diagnostic work-up of SpA patients. These manifestations may increase the efficiency of these tests in clinical practice and suggest that clinical reasoning follows principles of Bayesian theory.

Key words

spondyloarthritis, magnetic resonance imaging, HLA-B27

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Introduction

Spondyloarthritis (SpA) comprises a heterogeneous group of related diseases that are genetically linked and share characteristic clinical features associated with the inflammation of sacroiliac joints and the presence of HLA-B27 (1). Clinically, SpA patients may present with axial and peripheral joint manifestations, entheseal involvement, and extra-articular features, such as uveitis and psoriasis (2). In addition to clinical findings, imaging [radiography and sacroiliac joint magnetic resonance imaging (SI-MRI)] (3) and laboratory data [HLA-B27 and C-reactive protein (CRP)] (4, 5) are important diagnostic tools in clinical practice.

In the last two decades, MRI has been increasingly used to assess patients with clinically suspected SpA (6). Currently, MRI has become an important tool in SpA and its introduction as a diagnostic test for SpA has been a major advance (7), mainly because active inflammatory lesions are visible on MRI long before definite lesions on conventional radiographs are detectable (8). It makes MRI the most sensitive imaging modality available for the detection of sacroiliitis.

Since the role of HLA-B27 as a marker of AS has first been reported in 1973, its potential role in the diagnosis, prognosis and management of SpA has been extensively investigated. HLA-B27 is known to be associated with earlier age at disease onset in ankylosing spondylitis (AS) (9), increased severity and persistence of SI-MRI- inflammation in patients with inflammatory back pain (IBP) (10) and with a higher likelihood of a positive SI-MRI in patients with early IBP (4). Additionally, HLA-B27 has been associated with anterior uveitis in SpA patients (11).

The relevance of MRI and HLA-B27 as central parameters in defining the spectrum of SpA is obvious for many reasons: First, these parameters have been included in the classification criteria: HLA-B27 in the Amor criteria (12) and both (SI-MRI/ HLA-B27) in the ASAS classification criteria. In the ASAS axial-SpA criteria (13), two "anchor criteria" were defined in combination with SpA features: the "imaging arm" requires the evidence of sacroiliitis by imaging and the "clinical arm" requires the presence of the HLA-B27 antigen. In peripheral-SpA (14), sacroiliitis on MRI and HLA-B27 were included as additional SpA features. Second, sacroiliitis by MRI and HLA-B27 positivity have been selected as feasible screening methods for axial-SpA (15), and have been included in the decision tree of the original and modified Berlin diagnostic algorithm advised to be used by rheumatologists in daily practice (16). Recently, these two tests were included in the list of parameters of the ASAS-endorsed recommendation for early referral of patients suspected of having axial-SpA by primary care physicians or non-rheumatologists (17). Moreover, in an international survey about referral, diagnosis and management in axial-SpA (18), rheumatologists reported that they belief strongly in imaging (MRI) and systematically request HLA-B27-typing when evaluating a patient in their daily practice. However, these tests are rather costly, and waiting time for MRI is long in many countries. Therefore, many recommend to pre-select patients for HLA-B27 testing and SI-MRI in order to increase diagnostic yield.

Knowledge about criteria to order MRI and/or HLA-B27 in patients suspected of SpA, is rather limited. Since imaging MRI and HLA-B27 are a fundamental part of the ASAS classification criteria, and are considered important elements in the early referral and diagnosis of patients, it is expected that the decision about whether or not to order one or both of these tests will become increasingly important. Therefore, the aim of the present study was to identify and evaluate the patient's characteristics associated with the clinical decision to ask SI-MRI and/or HLA-B27 in the diagnostic work-up of SpA in clinical practice.

Methods

Study design and data collection

A cohort of consecutive patients referred to a single-center rheumatology outpatient clinic in Colombia were included at the first visit to the clinic between January 2002 and June 2010. Detailed information of the cohort has

Table I. Comparison of demographic and SpA disease characteristics according to SI-MRI-ordered status (n=581).

Explanatory variables	SI-MRI ordered Yes n=137	SI-MRI ordered No n=444	*p*-value
Male gender, (%)	87 (63.5)	330 (74.3)	0.01
Age at assessment, (years)*	33.5 ± 11.8 (n=136)	34.9 ± 12.2 (n=329)	0.46
Age symptom onset (≤35 yrs) (%)*	115 (83.9) (n=133)	365 (82.2) (n=329)	0.64
Symptoms at presentation (%)*			
Arthritis	32 (23.4)	173 (38.9)	≤0.001
Enthesitis	8 (5.8)	24 (5.4)	
Back pain	43 (31.4)	180 (40.5)	
Butock pain	4 (2.9)	5 (1.1)	
Several symptoms	48 (35) (n=136)	58 (13.1) (n=335)	
Disease duration (≤5 years) (%)	52 (37.9) (n=131)	123 (27.7) (n=332)	0.02
Chronic back pain, (%)	123 (89.8)	316 (71.1)	≤0.001
IBP, (%)	88 (64.2)	170 (38.2)	≤0.001
Buttock pain, (%)	48 (35)	124 (27.9)	0.11
Arthritis, (%)	88 (64.2)	331 (74.5)	0.01
Enthesitis, (%)	97 (70.8)	235 (52.9)	≤0.001
Dactyilitis, (%)	21 (15.3)	63 (14.1)	0.74
Uveitis, (%)	10 (7.3)	25 (5.6)	0.47
Psoriasis, (%)	2 (1.5)	25 (5.6)	0.04
Infection history, (%)	36 (26.3)	174 (39.2)	0.006
BASFI (≥4) (%)*	103 (75.2) (n=127)	369 (83.1) (n=239)	0.03
BASDAI (≥4) (%)*	113 (82.4) (n=127)	370 (83.3) (n=239)	0.81
ASDAS CRP high (≥2.1) (%)*	111 (81) (n=80)	434 (97.7) (n=59)	≤0.001
ASDAS ESR high (≥2.1) (%)*	125 (91.2) (n=84)	412 (92.8) (n=162)	0.47
CRP (≥5mg/dl) (%)*	12 (8.8) (n=81)	143 (32.2) (n=97)	≤0.001
ESR (≥20 mm/hr) (%)*	86 (62.8) (n=84)	364 (81.9) (n=218)	≤0.001
Diagnostic subtype (%)			
Ankylosing spondylitis	44 (32.1)	125 (28.1)	0.001
Undifferentiated SpA	70 (51.1)	160 (36)	
Reactive arthritis	20 (14.6)	136 (30.6)	
Psoriatic arthritis	2 (1.5)	19 (4.3)	
IBD	1 (0.7)	4 (0.9)	
Number of SpA features	2.2 ± 1.1	1.9 ± 1.1	0.18
Number of criteria met	2.18 ± 0.8	2.05 ± 0.9	0.64

Values are mean ± SD for continuous variables or percentages for categorical variables, unless otherwise specified. *p*-values were calculated using *t*-test adjusted for unequal variances for comparison of continuous variables and Chi square test for categorical variables.
IBP: inflammatory back pain; CRP: C-reactive protein; ESR: erythrocyte sedimentation rate; IBD: SpA associated to inflammatory bowel disease; SI-MRI: sacroiliac joints magnetic resonance imaging; BASFI: Bath Ankylosing Spondylitis Functional Index; BASDAI: Bath Ankylosing Spondylitis Disease Activity Index; ASDAS: Ankylosing Spondylitis Disease Activity Score.
*Variables with missing data, n means the number of patients in which these variables are based.

been published previously (19). Patients with a clinical diagnosis of SpA by one of two rheumatologists considered experts in the field (RV, JL) were selected and included. Patient information was collected based on data from the clinical record. The institutional ethics committee approved this study, conducted under the principles of the Helsinki declaration. Patients signed informed consent to collect, file and use the data.

We collected data related to demographic and clinical parameters such as gender, age at assessment, age at symptoms onset, symptoms at presentation, disease duration and preceding infection. Furthermore, data on past (history) and present (current) SpA features were collected: chronic back pain, IBP, alternating buttock pain, asymmetric oligo-arthritis (predominantly in lower limbs), enthesitis (heel pain), dactylitis (sausage digit), uveitis (confirmed by an ophthalmologist), psoriasis and inflammatory bowel disease (IBD). The rheumatologists assessed the patients and provided the clinical diagnosis categorised by subtypes (AS, undifferentiated SpA, reactive arthritis, psoriatic arthritis and SpA associated to IBD). The number of classification criteria met, which was retrospectively assessed per patient (ESSG, Amor, and ASAS) and the number of SpA features, were included as explanatory variables. The patients' disease characteristics, including the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI), Bath Ankylosing Spondylitis Functional Index (BASFI), C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were assessed. The Ankylosing Spondylitis Disease Activity Score (ASDAS) was calculated per patient: ASDAS-ESR and ASDAS-CRP (20).

Outcome measurement

The outcome of interest in the current analyses was the request of SI-MRI or HLA-B27 by the rheumatologists. Information of this outcome was retrieved from the clinical file with a description of the test result as recorded in the medical chart. If information about SI-MRI or HLA-B27 was found, it was considered that this specific test had been requested by the rheumatologist (who decided to ask these test). Sacroiliitis on MRI was defined according to the local experienced musculoskeletal radiologist's interpretation of the presence of active inflammatory changes in the SI-joint (21). According to usual clinical practice, no central reading was done. The HLA-B27 test was performed locally in the laboratory of immunology.

Statistical analysis

Descriptive statistics were used to calculate mean (± SD) for continuous data and percentages for categorical data. Explanatory variables were "SI-MRI-ordered" (yes *vs*. no) and "HLA-B27-ordered" (yes *vs*. no).

Table II. Association of demographic and SpA disease characteristics that independently prompt to ordering SI-MRI. Results from a multivariable logistic regression model.

Explanatory variables	SI-MRI ordered	
	OR (95% CI)	*p*-value
Male gender (male *vs*. female)	0.79 (0.50-1.22)	0.28
Number of symptoms at presentation (per additional symptom)	1.27 (1.10-1.47)	**≤0.001**
Disease duration (per year)	0.90 (0.57-1.41)	0.66
Chronic back pain (yes *vs*. no)	1.57 (0.72-3.23)	0.26
Inflammatory back pain (yes *vs*. no)	1.81 (1.13-2.90)	**0.01**
Arthritis (yes *vs*. no)	0.85 (0.54-1.33)	0.48
Enthesitis (yes *vs*. no)	1.57 (1.00-2.49)	**0.04**
Uveitis (yes *vs*. no)	1.08 (0.48-2.41)	0.85
Psoriasis (yes *vs*. no)	0.25 (0.53-1.20)	0.08
Infection history (yes *vs*. no)	0.82 (0.49-1.37)	0.46
Diagnostic subtype	1.06 (0.78-1.43)	0.68

SI-MRI: sacroiliac joints magnetic resonance imaging.

Age at symptom onset, age at assessment, symptoms at presentation and disease duration had less than 20% of missing data. BASFI, BASDAI, ASDAS-CRP, ASDAS-ESR, CRP and ESR had more than 20% of missing data. All other explanatory variables had complete data. In case of missing data, imputation was performed by using the median or mode from the variable's distribution as appropriate, but only variables with complete data in at least 80% of the cohort were included in the multivariable analysis (see below).

Patient´s characteristics were examined per subgroups of SI-MRI ordered (yes *vs*. no) or HLA-B27 ordered (yes *vs*. no) and analysed by univariable analysis (either by chi-square or by *t*-test if appropriate) followed by logistic regression analysis. Variables with a *p*-value <0.05 in univariable analysis were entered in a (backward selection) multivariable analysis if data availability was at least 80%, with SI-MRI ordered or HLA-B27-ordered as dependent variables.

Based on the hypothesis that IBP will primarily lead to ordering SI-MRI in male patients and in those that have short disease duration, interactions of characteristics with gender (male/female) and with disease duration (short/long) respectively were tested. Potentially relevant interactions ($p \leq 0.1$) were found with age of symptoms onset and age of assessment. These interactions were weak, not considered clinically relevant and not reported.

In the logistic regression analysis, the following variables were excluded because of too much missing information (≥20% of the cohort): BASFI, BASDAI, CRP, ESR, ASDAS-CRP and ASDAS-ESR. In addition, IBD and age of symptom onset were excluded because of collinearity. Statistical analyses were performed with SPSS 20.0 and STATA 12.0.

Results

Patients' characteristics

In total, 581 patients with a clinical diagnosis of SpA were analysed. Most of them (72%) were males with a mean (SD) age of 34.6 (12.1) years, age at symptom onset of 28 (10.3) years and disease duration of 7.3 (9.7) years. Sixty percent of the cohort had less than 5 years of disease duration. Disease activity was rather high in the patients with axial SpA: BASDAI 5.4 (2.4), ASDAS-ESR 3.0 (0.9), and ASDAS-CRP 2.6 (0.8), and also in patients with peripheral SpA as assessed by the ASDAS-CRP (2.3 (0.9)). Information on SI-MRI and HLA-B27 was available in a varying proportions of the patients, ordered at the instigation of the rheumatologist: of all patients, 137 patients (24%) had SI-MRI and 441 patients (77%) had HLA-B27 testing performed.

Demographic and disease characteristics of patients in whom an SI-MRI was ordered

In univariable analysis, male gender, the number of symptoms at presentation, short disease duration, chronic back pain, IBP, enthesitis, no history of arthritis, no history of psoriasis, lower CRP, ESR and ASDAS-CRP were associated with a request for SI-MRI.

In multivariable analysis, factors remaining independently associated with ordering SI-MRI were IBP (OR=1.81, CI 95% [1.13–2.90], p=0.01), enthesitis (OR=1.57, CI 95% [1.00–2.49], p=0.04) and the number of symptoms at presentation (OR=1.27 per additional symptom, CI 95% [1.10–1.47], p<0.001). The results are shown in Tables I-II.

Demographic and disease characteristics of patients in whom HLA-B27 was ordered

In univariate analysis, the number of symptoms at presentation, the presence of IBP, uveitis, lower CRP, ESR and ASDAS-CRP were associated with a request for HLA-B27 testing.

In multivariable analysis, the single factor remaining independently associated with ordering HLA-B27 was the number of symptoms at presentation (OR=1.45 per additional symptom, CI 95% [1.24–1.71], p<0.001). Although uveitis was associated in the univariable analysis with a request for HLA-B27, it just missed statistical significance in multivariable analysis (OR=3.19, CI 95% [0.94–10.87], p=0.06). Results are presented in Tables III–IV.

Discussion

The results of this study confirm that rheumatologists working in clinical practice order additional tests such as SI-MRI and HLA-B27 cautiously (not in all patients), and base their diagnostic behaviour on clinical clues. Characteristics associated with the decision to order SI-MRI and/or HLA-B27 in clinical practice, were the presence of IBP, enthesitis, the number of symptoms at presentation and uveitis. Of note, gender, disease duration, the presence of peripheral arthritis and/or psoriasis did not independently determine the behaviour of rheumatologists to request SI-MRI and/or HLA-B27 testing.

Apparently certain clinical manifestations are important. 'Clinical clues' make intuitive sense since they may convey the highest probability on a

Table III. Comparison of demographic and SpA disease characteristics according to HLA-B27-ordered status (n=581).

Explanatory variables	HLA-B27 ordered Yes (n=441)	HLA-B27 ordered No (n=140)	*p*-value
Male gender, (%)	311 (70.5)	106 (75.7)	0.23
Age at assessment, (years)*	34.4 ± 12 (n=367)	35 ± 12.3 (n=98)	0.70
Age symptom onset (≤35 years) (%)*	361 (81.9) (n=364)	119 (85) (n=98)	0.39
Symptoms at presentation (%)*			
Arthritis	124 (28.1)	81 (57.9)	≤0.001
Enthesitis	25 (5.7)	7 (5)	
Back pain	191 (43.3)	32 (22.9)	
Buttock pain	8 (1.8)	1 (0.7)	
Several symptoms	87 (19.7) (n=373)	19 (13.5) (n=98)	
Disease duration (≤5 years) (%)*	132 (29.9) (n=344)	43 (30.7) (n=89)	0.86
Chronic back pain, (%)	341 (77.3)	98 (70)	0.07
IBP, (%)	207 (46.9)	51 (36.4)	0.02
Buttock pain, (%)	136 (30.8)	36 (25.7)	0.24
Arthritis, (%)	313 (70.9)	106 (75.7)	0.27
Enthesitis, (%)	255 (57.8)	77 (55)	0.55
Dactyilitis, (%)	61 (13.8)	23 (16.4)	0.44
Uveitis, (%)	32 (7.3)	3 (2.1)	0.02
Psoriasis, (%)	17 (3.9)	10 (7.1)	0.10
Infection history, (%)	153 (34.7)	57 (40.7)	0.19
BASFI (≥4) (%)*	353 (80) (n=291)	119 (85) (n=75)	0.19
BASDAI (≥4) (%)*	366 (82.9) (n=291)	117 (83.6) (n=75)	0.87
ASDAS CRP (high) (%)*	407 (92.3) (n=116)	138 (98.6) (n=23)	0.02
ASDAS ESR (high) (%)*	403 (91.4) (n=222)	134 (95.7) (n=36)	0.15
CRP (≥5 mg/dl) (%)*	43 (9.8) (n=142)	112 (80) (n=36)	≤0.001
ESR (≥20 mm/hr) (%)*	333 (75.5) (n=239)	117 (83.6) (n=63)	0.04
Diagnostic subtype (%)			
Ankylosing spondyltis	134 (30.4)	35 (25)	0.13
Undifferentiated SpA	179 (40.6)	51 (36.4)	
Reactive arthritis	108 (24.4)	44 (31.4)	
Psoriatic arthritis	12 (2.7)	9 (6.4)	
IBD	3 (0.7)	1 (0.7)	
Number of SpA features	2.1 ± 1.1	1.8 ± 1.1	0.36
Number of criteria met	2.1 ± 0.9	1.8 ± 1	0.23

Values are mean ± SD for continuous variables or percentages for categorical variables, unless otherwise specified. p-values were calculated using t-test adjusted for unequal variances for comparison of continuous variables and Chi square test for categorical variables.
IBP, inflammatory back pain, CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; IBD, SpA associated to Inflammatory Bowel Disease; MRI, magnetic resonance imaging; BASFI, Bath Ankylosing Spondylitis Functional Index; BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; ASDAS, Ankylosing Spondylitis Disease Activity Score.
*Variables with missing data, n means the number of patients in which these variables are based.

positive test result (either sacroiliitis on MRI or HLA-B27 positivity) and therefore increase efficiency, optimise usage and save costs. This is true especially for AS (22), a disease that has a reportedly strong association with HLA-B27 and is related to the presence of axial manifestations. In contrast, clinicians apparently know that patients presenting with non-inflammatory mechanical back pain, peripheral arthritis or psoriasis for example, may benefit more from other tests. Physicians do not ask for HLA-B27 (77%) or SI-MRI (only 24%) in all patients but when clinical symptoms are indicative but not confirmatory.

It is also interesting to look at which factors did not contribute. Apparently, clinicians do not base their behaviour (of asking SI-MRI or HLA-B27) on the conventional appreciation that AS is a disease of males. Gender was not a factor that determined a SI-MRI or HLA-B27 request. That is a promising finding in light of the fact that many still consider females with SpA underdiagnosed in spite of findings suggesting that as many females as males may suffer from axial SpA (23).

It is important to mention that this study has only addressed the performance of a test, and not the result of that test. A recent study from the ESPeranza Cohort (24) has assessed the utility of SpA features to anticipate the presence (not the request) of sacroiliitis on MRI or a positive result of a HLA-B27 test in patients with suspected axSpA. They found that IBP according to the ASAS definition plus alternating buttock pain or IBP according to Calin criteria plus awakening in the second half of the night predicted the presence of sacroiliitis on MRI. Our study assigned IBP as a determinant for ordering SI-MRI. Together, these studies confirm that the presence of IBP according to certain expert-criteria not only evokes an SI-MRI-request, but also that this behaviour is rational in that the likelihood of a positive result increases. In analogy, we have found uveitis being predictive of ordering HLA-B27, while in the ESPeranza Cohort uveitis appeared to be the factor related to a positive HLA-B27 (LR+ of 2.6). This finding is also in line with previous studies reporting that a positive HLA-B27 test in a patient presenting with uveitis plus SpA features may increase the likelihood of a diagnosis of SpA (25, 26).

Clinical clues that guide the request of a SI-MRI or HLA-B27 can be useful in clinical practice, because of costs and waiting time for SI-MRI. A practice based on inexpensive and widely available clues may be cost-and time-efficient, and their importance may increase over time.

This study has limitations. First, the design was retrospective. Other factors than those that have been measured could have influenced the likelihood to request a SI-MRI or a HLA-B27-test. Second the study may have suffered from missing data and from the nec-

Table IV. Association of demographic and SpA disease characteristics that independently prompt to ordering HLA-B27. Results from a multivariable logistic regression model.

Explanatory variables	HLA-B27 ordered OR (95% CI)	*p*-value
Male gender (male *vs*. female)	0.85 (0.53-1.36)	0.50
Number of symptoms at presentation (per additional symptom)	1.45 (1.24-1.71)	**≤0.001**
Disease duration (per year)	1.26 (0.77-2.04)	0.34
Chronic back pain (yes *vs*. no)	0.96 (0.53-1.73)	0.90
Inflammatory back pain (yes *vs*. no)	1.14 (0.70-1.85)	0.58
Arthritis (yes *vs*. no)	1.15 (0.70-1.89)	0.55
Enthesitis (yes *vs*. no)	0.89 (0.58-1.38)	0.62
Uveitis (yes *vs*. no)	3.19 (0.94-10.87)	0.06
Psoriasis (yes *vs*. no)	0.71 (0.27-1.83)	0.48
Infection history (yes *vs*. no)	11.01 (0.61-1.64)	0.96
Diagnostic subtype	0.85 (0.63-1.15)	0.30

essary exclusion of variables with too many missing data. There was, for instance, an indication that SI-MRI and/or HLA-B27 has been preferentially requested in patients with increased acute-phase reactants (CRP and/or ESR). A univariate comparison was highly statistically significant, but the variables were missing in too many patients and were excluded from multivariable analysis. The high level of missingness for CRP and ESR suggests in any case that decisions of requesting additional tests are certainly not only based on CRP/ESR. Third, the study only addresses one side of the entire spectrum: patients with a diagnosis of SpA. Patients in whom a diagnosis of SpA was not established, with or without a SI-MRI or a HLA-B27 test, were not taken into consideration. This study can therefore never be interpreted as a diagnostic experiment that tests the value of SI-MRI and HLA-B27. This study only gives insight into the circumstances in which SI-MRI or HLA-B27 are requested. It is very reasonable to assume that expensive and scarce diagnostics such as SI-MRI and HLA-B27 tests are only considered if they may help the clinician to increase the likelihood of a suspected clinical diagnosis, but not if the clinician considers the likelihood of SpA as sufficiently high. In that situation, he may rather refrain from asking expensive and time-consuming tests. These Bayesian principles form the basis of proper clinical reasoning. Finally, all patients of this study came from the same country and even the same centre, which importantly limits the external validity and the extrapolation of the findings to other countries and clinics. The results of this study should be interpreted in this context.

In conclusion, rheumatologists use certain clinical clues to decide if they order expensive and scarce tests in the diagnostic work-up of patients with SpA. These manifestations may increase the efficiency of these tests in clinical practice and suggest that clinical reasoning follows principles of Bayesian theory.

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