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Anterior uveitis in patients with spondyloarthropathies in a single US academic center: a retrospective study

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Abstract

Uveitis may represent an opportunity to diagnose spondyloarthropathies (SpA) earlier and influence treatment decisions. We describe the percentage of acute anterior uveitis (AAU) in a diverse group of SpA patients seen at one academic setting and compare demographic and clinical characteristics according to the presence of uveitis. We conducted a retrospective study of patients with SpA and AAU (January 2016–June 2017). Patients were identified using ICD-10 and administrative claim codes, diagnoses were confirmed through chart review. Extracted data included demographics, laboratory, clinical data, treatment and Routine Assessment of Patient Index Data 3 (RAPID3) scores based on Multidimensional Health Assessment Questionnaire (MDHAQ). Baseline description and comparison between the two groups were performed. We included 190 patients, mostly men (59.5%), with a mean age of 45.9 years: 48% with ankylosing spondylitis (AS), 26% with psoriatic arthritis (PsA), 22% with undifferentiated SpA, and 4% with SpA associated with inflammatory bowel disease (IBD). Uveitis was identified in 17% of patients, ranging from 25% in AS to 4% in PsA. Time from symptom onset to SpA diagnosis was longer in patients with uveitis (10.9 versus 5.9 years, $p < 0.001$). A higher percentage of patients with uveitis were HLA-B27 positive (85% versus 67%, $p = 0.02$). The prevalence of uveitis in our population was 17%, slightly lower than previously reported in the literature. There was a diagnostic delay of about 7 years, significantly longer in patients with uveitis. New screening strategies in collaboration with ophthalmology may lead to earlier diagnosis and better outcomes.

Keywords Anterior uveitis · Spondyloarthropathies · Ankylosing spondylitis · HLA-B27 · Patient-reported outcomes · Diagnosis delay

Introduction

Acute anterior uveitis (AAU) is the most common extra-articular clinical feature in ankylosing spondylitis (AS) and is also common in other spondyloarthropathies (SpA) over the course of the disease [1], being significantly more frequent in patients who are HLA-B27 positive [2]. The estimated prevalence of AAU in SpA varies depending on the SpA type; in a recent systematic review that included 126 articles and 29,877 patients, it was reported as 37% in arthritis associated with inflammatory bowel disease (IBD), 33% in AS, 25% in psoriatic arthritis (PsA), and 13% in undifferentiated SpA [3]. The characteristics of uveitis may also vary according to the SpA type, being more commonly of sudden onset, unilateral and recurrent in AS and of insidious onset, bilateral and chronic in PsA and IBD [1].

The relationship between AAU and SpA is well recognized; however, about half of patients with clinically significant AAU may have an undiagnosed SpA: 41% according to a rheumatologist evaluation and 50% according to Assessment of SpondyloArthritis international Society (ASAS) criteria in a recent study [4].

The majority of SpA cases are diagnosed in rheumatology clinics on the basis of inflammatory low back pain or arthritis. However, since uveitis may be the initial symptom prompting patients to seek medical attention, early recognition of SpA in patients presenting with uveitis to an ophthalmology clinic may lead to earlier diagnosis of SpA and improve clinical outcomes. In addition, it has been previously shown that whereas only 20% of patients presenting

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with AAU had associated SpA at onset, 80% of patients with recurrent episodes of acute, unilateral, or alternating anterior uveitis will eventually develop SpA during the course of their disease [5].

There is compelling evidence that early referral of patients with chronic back pain or suspected SpA to appropriate rheumatological care results in decreased diagnostic delay and improved outcomes for such patients [6–9], and early diagnosis and treatment has become particularly important with the advent of effective therapy that has been shown to improve the quality of life and to reduce radiographic progression in patients with SpA [10–12].

We hypothesized that AAU may be recognized less frequently in a general University SpA clinical population than has been reported from SpA specialty centers, and, conversely, that systematic evaluation of all patients presenting with AAU may provide early identification of undiagnosed SpA patients. The presence of uveitis may also influence the treatment choices for patients with SpA. Thus, our aims were: (1) to determine the prevalence of AAU in a diverse group of patients with SpA seen at an academic institution; and (2) to compare the diagnostic delay, demographic, clinical characteristics and treatment in patients with and without associated uveitis.

Patients and methods

Study design and population

We conducted a retrospective study of all patients with SpA and/or acute anterior uveitis seen in our rheumatology clinic between January 2016 and June 2017. Patients were identified from two sources—administrative claim codes and our rheumatology repository using the following ICD-10 codes for SpA; ankylosing spondylitis (M45, M46.1, M46.8), unspecified inflammatory spondylopathy (M46.9), arthropathic psoriasis (L40.5), and enteropathic arthropathies, unspecified site (M07.60). To identify patients with uveitis, the following codes were used: unspecified acute and subacute iridocyclitis (H20.00-02), secondary noninfectious iridocyclitis (H20.04), chronic iridocyclitis (H20.1), unspecified iridocyclitis (H20.9), disorders of iris and ciliary body in diseases classified elsewhere (H22). We retrospectively reviewed each medical chart to confirm the diagnoses as well as the subgroup of SpA and associated AAU. The diagnosis of SpA was considered confirmed if the patient received the same ICD-10 codes for SpA in more than one face-to-face encounter with a rheumatologist, and the rheumatologist had documented in the chart that the patient had SpA. Patients with no clear diagnosis of SpA with or without associated AAU were excluded.

The following variables were extracted from the electronic health records (EHR): onset of arthritis or back pain symptoms, date of SpA diagnosis, family history of SpA, enthesitis, peripheral arthritis, imaging evidence of sacroiliitis, onset of the first episode of AAU, and number of flares. In addition, laboratory data including Erythrocyte Sedimentation Rate (ESR), C-reactive protein (CRP), and HLA-B27 were collected. According to our laboratory testing center, the cutoff point for ESR to be considered abnormal was >17 mm/h for men, and >27 mm/h for women, whereas for CRP, it was >8 mg/L.

Based on the extracted data, we calculated the diagnostic delay and disease duration of SpA. Diagnostic delay was defined from the onset of the first symptoms of arthritis and/or back pain to the diagnosis of SpA, and disease duration was defined from diagnosis of SpA to the date of included visit.

Current and previous treatment data including nonsteroidal anti-inflammatory drugs (NSAIDs), non-biologic and biologic disease-modifying antirheumatic drugs (DMARDs) were also collected from the EHR.

All patients in the rheumatology outpatient clinic in our institution complete a Multidimensional Health Assessment Questionnaire (MDHAQ) at every visit as part of the infrastructure of routine care. The MDHAQ is a 2-page questionnaire adapted from the standard health assessment questionnaire (HAQ) [13, 14]. It includes ten queries, eight from the original HAQ, and two advanced activities, each scored from 0 [("without any difficulty") to 3 ("unable to do")], higher scores reflecting poorer physical function. It also includes three 0–10 visual analogue scales (VAS) for pain, patient global estimate (PATGL), and fatigue, a listing of 60 symptoms, poor sleep quality (0–3.3), self-reported depression/feeling blue (0–3.3), anxiety (0–3.3), morning stiffness in minutes, and a self-reported painful joint count based on the rheumatoid arthritis disease activity index (RADAI) [15]. The RADAI self-reported painful joint count includes eight specific joint groups evaluated bilaterally: fingers, wrists, elbows, shoulders, hips, knees, ankles, and toes. Scoring ranges from 0 (none) to 3 (severe pain), with a total score of 48. For this specific study, we focused on the back and neck joint scores, which are also included in the RADAI. RADAI self-reported painful joint count has been shown to be informative not only in RA but also in other rheumatic diseases [16]. The MDHAQ also includes demographic data—date of birth, gender, self-reported ethnicity/race, work status, self-reported disability, and number of years of formal education.

RAPID3 (routine assessment of patient index data 3) is a composite index derived from the MDHAQ that includes 3 self-reported American College of Rheumatology (ACR) Core Data Set measures for RA: physical function, pain, and PATGL [17, 18]. Each of these individual measures is

scored from 0 to 10, for a total of 0–30. RAPID3 has been previously shown to be useful in patients with axial spondyloarthropathies and comparable to disease-specific indices such as the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) and Ankylosing Spondylitis Disease Activity Score (ASDAS) not only in cross-sectional but also longitudinal studies showing similar responsiveness [19].

Statistical analysis

For the purpose of this study, the last available visit in our database was analyzed. We described the population using frequencies and mean and standard deviation, or median and interquartile range depending on the distribution of the variables. The prevalence of uveitis in each SpA subgroup, as well as according to sex, age group, and self-reported ethnicity/race group was estimated. Comparison between uveitis and non-uveitis groups was performed using Student *t* test, Mann–Whitney test or Chi square test. p values < 0.05 were considered statistically significant. Normality in distribution was tested by graphical and numerical methods. A histogram plot and Skewness/Kurtosis tests were computed for each variable. All analyses were carried out in STATA 12.0® for Mac (StataCorp LP, College Station, TX).

Ethics and institutional review board approval

This study was conducted in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 1983. The study was reviewed and approved by the Institutional Review Board at Rush University Medical Center, and it received a waiver for patient consent for a retrospective use of data (Rush Rheumatic Diseases Patient-Reported Outcomes Studies: 14090502-IRB02-AM03, exemption granted on 4/12/2015, amendment approved on 11/24/2017).

Results

A total of 313 patients were identified with pre-specified ICD-10 codes for SpA and/or uveitis, including 107 patients from our rheumatology repository and 206 patients using the administrative claim codes (Fig. 1). After excluding the duplicates ($n = 68$), 245 patients were selected for chart review, of whom 16 were excluded for not having a confirmed diagnosis of SpA, and 39 patients were further excluded because they had uveitis but no SpA. In the group of excluded patients with uveitis but no confirmed SpA, 14 patients had non-specific arthralgia (36%), 9 patients had idiopathic AAU (23%), 4 patients had Behcet's disease (10%), 4 patients had undifferentiated connective tissue disease (10%), 3 patients had rheumatoid arthritis/juvenile idiopathic arthritis (8%), 2 patients had Cogan's syndrome (5%), and 3 patients with other diagnosis including sarcoidosis, granulomatosis with polyangiitis, and relapsing polychondritis (3%).

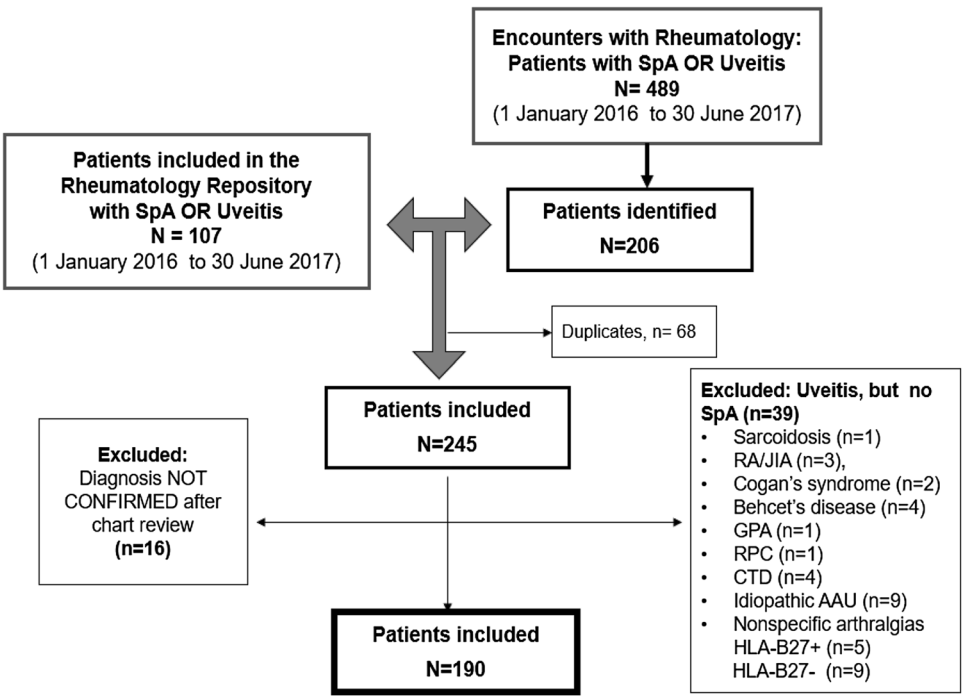

Fig. 1 Patient selection flowchart. *SpA* spondyloarthropathy, *RA/JIA* rheumatoid arthritis/juvenile inflammatory arthritis, *GPA* granulomatosis with polyangiitis, *RPC* relapsing polychondritis, *CTD* connective tissue disease, *AAU* acute anterior uveitis, *HLA* human leukocyte antigen

Proportion of uveitis by SpA subgroup

A total of 190 patients with SpA were included in the final analysis: 48% with ankylosing spondylitis (AS), 26% with psoriatic arthritis (PsA), 22% with undifferentiated SpA and 4% with SpA associated with inflammatory bowel disease (IBD). Overall, the proportion of uveitis was 17% in our SpA population and differed according to the subtype of SpA: 57% in IBD-associated SpA, 25% in AS, 9.5% in undifferentiated SpA, and 4% in PsA-associated SpA ($p = 0.001$, Table 1). There were no significant differences in the proportion of uveitis according to gender, age group, or ethnicity/race in all patients with SpA (Fig. 2).

Patient's demographics and disease characteristics

Mean (SD) age of patients was 45.9 (14.8) years, and 59.5% of patients were male. There were no significant differences in age, sex, educational level, and self-reported ethnicity/

Table 1 Spondyloarthropathy (SpA) patients' demographics, clinical characteristics, and treatment according to the presence of associated uveitis

	All $N = 190$	Non-uveitis $n = 157$ (83%)	Uveitis $n = 33$ (17%)	p value
Age, years, mean (SD)	45.9 (14.8)	45.6 (15.1)	47.3 (13.3)	0.56
Male, *n* (%)	113 (59.5%)	93 (59.2%)	20 (60.6%)	0.88
Self-reported race/ethnicity, *n* (%)				
White	105 (55%)	87 (55%)	18 (54%)	0.68
Black	32 (17%)	28 (18%)	4 (12%)	
Hispanics	24 (13%)	19 (12%)	5 (15%)	
Others	29 (15%)	23 (15%)	6 (19%)	
Education, years, mean (SD)	14.7 (3.5)	14.9 (3.6)	14.0 (2.7)	0.34
Diagnostic delay for SpA, years, median (IQR)	7.0 (3.3, 12.3)	5.9 (3.0, 11.6)	10.9 (8.3, 15.7)	**< 0.001**
Disease duration for SpA, years, median (IQR)	5.6 (1,6, 9.9)	5.3 (1.6, 9.3)	8.3 (5.3, 12.6)	**0.01**
Family history of SpA, *n* (%)	24 (12.6%)	17 (10.8%)	7 (21.2%)	0.10
Enthesitis, *n* (%)	21 (11.1%)	19 (12.1%)	2 (6.1%)	0.48
Peripheral arthritis, *n* (%)	123 (64.7%)	103 (65.6%)	20 (60.6%)	0.57
Imaging evidence of sacroiliitis, *n* (%)	123 (64.7%)	97 (61.8%)	26 (78.8%)	0.08
SpA subgroup				
AS, *n* (%)	92 (48%)	69 (75%)	23 (25.0%)	**< 0.001**
PsA-associated, *n* (%)	49 (26%)	47 (96%)	2 (4.1%)	
Undifferentiated, *n* (%)	42 (22%)	38 (90%)	4 (9.5%)	
IBD-associated, *n* (%)	7 (4%)	3 (43%)	4 (57.1%)	
Laboratory test				
HLA-B27 positivity, *n* (%)	75 (67%)	52 (61%)	23 (85%)	**0.02**
Elevated CRP (> 8 mg/L), *n* (%)	61 (32.1%)	49 (31.2%)	12 (36.4%)	0.65
Elevated ESR (M/F > 17/27 mm/h), *n* (%)	86 (45.3%)	67 (42.7%)	19 (57.6%)	0.12
Current treatment				
NSAIDs, *n* (%)	188 (98.9%)	156 (99.4%)	32 (96.9%)	0.67
Non-biologic DMARDs, *n* (%)				
Methotrexate	27 (14.2%)	24 (15.3%)	3 (9.1%)	0.26
Sulfasalazine	7 (3.7%)	6 (3.8%)	1 (3%)	
Combination	6 (3.1%)	5 (3.2%)	1 (3%)	
Others (HCQ, leflunomide, AZA)	10 (5.3%)	8 (5.1%)	2 (6.1%)	
Adalimumab, *n* (%)	50 (26.3%)	37 (23.6%)	13 (39.4%)	0.06
Etanercept, *n* (%)	33 (17.4%)	29 (18.5%)	4 (12.1%)	0.38
Infliximab, *n* (%)	24 (12.6%)	20 (12.7%)	4 (12.1%)	0.92
Other biologic DMARDs, *n* (%)	21 (11%)	16 (10.2%)	5 (15.2%)	0.41

Statistically significants are in bold

AS ankylosing spondylitis, *PsA* psoriatic arthritis, *IBD* inflammatory bowel disease, *HLA* human leukocyte antigen, *CRP* C-reactive protein, *ESR* erythrocyte sedimentation rate, *NSAID* nonsteroidal anti-inflammatory drug, *DMARD* disease-modifying antirheumatic drug, *HCQ* hydroxychloroquine, *AZA* azathioprine

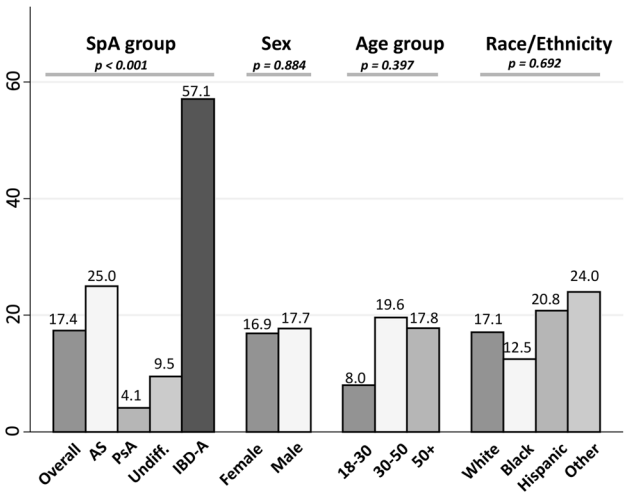

Fig. 2 Prevalence of Uveitis (% of patients) by spondyloarthropathy (SpA) clinical subset, sex, age and race–ethnicity groups. *AS* ankylosing spondylitis, *PsA* Psoriatic arthritis, *Undiff.* undifferentiated, *IBD-A* inflammatory bowel disease-associated

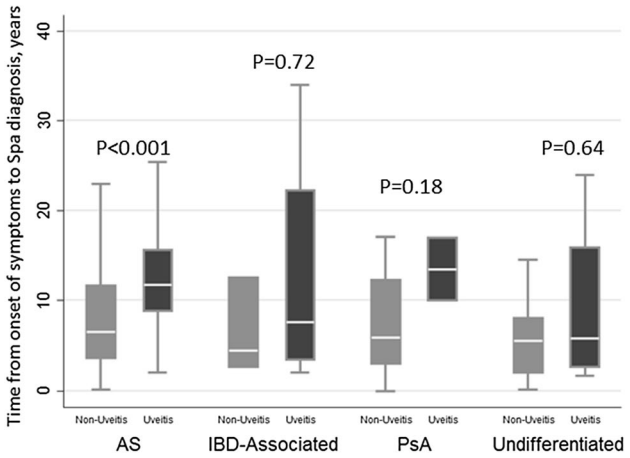

Fig. 3 Median (IQR) diagnostic delay by spondyloarthropathy (SpA) clinical subset. *AS* ankylosing spondylitis, *IBD* inflammatory bowel disease, *PsA* psoriatic arthritis

race in the two groups according to the presence of uveitis (Table 1).

Median (IQR) diagnostic delay in years was significantly higher in SpA patients with uveitis compared to SpA patients without uveitis, 10.9 (8.3, 15.7) versus 5.9 (3.0, 11.6), respectively ($p < 0.001$), and accordingly, disease duration in the uveitis group was significantly longer than in the non-uveitis group (Table 1). It was not possible to determine if uveitis preceded or followed the diagnosis of SpA in the majority of patients because data regarding the onset of uveitis was missing in a large percentage of patients. It was only available in 17 (51%) of 33 patients with uveitis, of whom only 9 had also documented onset of SpA symptoms.

A similar trend with a longer diagnostic delay in the uveitis group was observed in patients in each SpA clinical subgroup: median (IQR) diagnostic delay in years in patients with AS with uveitis versus without uveitis was 11.8 (8.9, 15.7) versus 6.5 (3.7, 11.7); it was 13.5 (10.0, 17.0) versus 5.9 (3.0, 12.3) in patients with PsA with versus without uveitis; 6.0 (2.7, 15.9) versus 5.5 (2.0, 8.1) in patients with undifferentiated SpA with versus without uveitis, and 7.6 (3.4, 22.4) versus 4.5 (2.6, 12.6) in patients with IBD-associated SpA with versus without uveitis. However, these differences reached statistical significance only for the AS group ($p < 0.001$) (Fig. 3).

Imaging, laboratory tests and treatment according to the presence of uveitis

Imaging evidence of sacroiliitis (including X-rays, CT scans, and MRIs) was found in 64.7% of all patients, and there were no significant differences according to the presence of uveitis (78.8% in uveitis versus 61.8% in non-uveitis group, $p = 0.08$), as shown in Table 1. Overall, 67% of patients were HLA-B27 positive, the antigen was more often detected in patients with associated uveitis compared to patients without uveitis (85% versus 61%, $p = 0.02$). In total, 32.1% of patients had elevated CRP and there was no significant difference according to the presence of uveitis (36.4% in uveitis versus 31.2% in non-uveitis group, $p = 0.65$). Similarly, ESR was elevated in 57.6% of patients with uveitis and 42.7% of patients without uveitis, $p = 0.12$.

The majority of patients received NSAIDs (98.9%) with no differences according to the uveitis status. No statistically significant differences were observed in non-biologic DMARD use between the two groups with methotrexate being the most commonly prescribed agent. Adalimumab was the most commonly prescribed biologic in all patients, followed by etanercept. Although the patients with uveitis were less likely to receive treatment with etanercept, the difference was not statistically significant (12.1% in uveitis versus 18.5% in non-uveitis group, $p = 0.38$) (Table 1).

MDHAQ self-reported questionnaire scores

Median (IQR) RAPID3 score was 7.9 (2.3, 14.6) corresponding to moderate disease activity, and there were no differences according to the presence of uveitis, 5.8 (3.3, 12.9) in uveitis versus 8.1 (2.1, 14.6) in non-uveitis group, ($p = 0.73$). Median (IQR) for MDHAQ function, pain and patient global assessment was also similar between the two groups. There was no statistically significant difference in the total self-reported painful joint count for all joints, and for the back and neck joints in particular, and 42% of all patients reported morning stiffness of more than 30 min with no differences between the two groups (Table 2). Psychological parameters

Table 2 Comparisons of mean multidimensional health assessment questionnaire/routine assessment of patient index data 3 (MDHAQ/RAPID3) scores according to presence of uveitis

	All $N=190$	Non-uveitis $N=157$ (83%)	Uveitis $N=33$ (17%)	p value
RAPID3 (0–30), median (IQR)	7.9 (2.3, 14.6)	8.1 (2.1, 14.6)	5.8 (3.3, 12.9)	0.73
MDHAQ—function (0–10), median (IQR)	1.8 (0.3, 3)	1.8 (0.3, 3)	0.9 (0, 2.7)	0.29
MDHAQ—pain (0–10), median (IQR)	4 (1.5, 7)	4 (1.5, 7)	3 (1.5, 7)	0.44
MDHAQ—PATGL (0–10), median (IQR)	3.25 (1.5, 6)	3.5 (1.5, 6)	3 (1, 6)	0.93
RADAI self-reported joint count				
Total RADAI (0–48), median (IQR)	5 (2, 9)	6 (2, 10)	4 (1, 8)	0.21
RADAI—back (0–3), median (IQR)	1 (0, 2)	1 (0, 2)	1 (0, 2)	0.89
RADAI—neck (0–3), median (IQR)	1 (0, 2)	1 (0, 2)	1 (0, 2)	0.56
MDHAQ—fatigue (0–10), median (IQR)	3.5 (1, 6.5)	4 (0.5, 6.5)	2.5 (1, 6)	0.78
MS > 30 min, *n* (%)	38 (42%)	30 (39%)	8 (53%)	0.32
MDHAQ—distress symptoms				
Depression (0–3.3), median (IQR)	0 (0, 1.1)	0 (0, 1.1)	0 (0, 1.1)	0.38
Anxiety (0–3.3), median (IQR)	0 (0, 1.1)	0 (0, 1.1)	0 (0, 1.1)	0.49
Poor sleep quality (0–3.3), median (IQR)	1.1 (0, 1.1)	1.1 (0, 1.1)	1.1 (1, 2.2)	0.21
Disability, *n* (%)	21 (11)	15 (9)	6 (18)	0.15
Full time working, *n* (%)	74 (39%)	60 (38%)	14 (42%)	0.65
Exercise frequency, *n* (%)				
Do not exercise regularly	49 (34%)	44 (38%)	5 (18%)	0.15
Regularly (> 1 time/week)	70 (49%)	53 (45%)	17 (63%)	
Disability or handicap	25 (17%)	20 (17%	5 (19%)	

PATGL patient global assessment, *RADAI, RA*, rheumatoid arthritis disease activity index, *MS* morning stiffness

measured by self-reported fatigue, depression, anxiety, and poor sleep quality scales on MDHAQ showed no significant differences in the two groups although the patients in uveitis group tended to have worse scores. There was no difference between the two groups for patient-reported disability and working status (Table 2). About half of the patients reported exercising regularly (> 1 time/week), which was similar in the two groups ($p=0.30$).

Discussion

We found a lower proportion of anterior uveitis in our diverse SpA population than expected based on the literature review. There was a diagnostic delay of 7 years for SpA which was significantly longer in patients with uveitis although we could not determine the chronology of uveitis onset in most patients.

The proportion of uveitis in our SpA population was 17% which is substantially lower than the previously reported prevalence of 33% obtained from a systematic literature review [3]. Possible explanations for this finding include underdiagnosis of uveitis in our center, a decline in AAU among SpA patients, or that our patients are fundamentally different from the previously described cohorts and not representative of the whole population of SpA patients. The first scenario is possible since not all patients were evaluated by an ophthalmologist, though they have not reported any symptoms to their rheumatologists. The second may be true as well, especially if treatment with modern therapeutics can substantively alter the disease course of SpA. Similarly, the third explanation may be true, as our SpA patients represent a general referral population, and may have less complex disease than those referred to quaternary SpA specialty centers. There were significant differences in uveitis prevalence by underlying SpA type with the highest prevalence of AAU in IBD-associated SpA and the lowest in PsA, which is similar to the previously cited systematic review.

The average age at the time of diagnosis was 45 years and the majority were male; this is concordant with a prior study by Rojas-Vargas et al. [20]. There was a delay in diagnosis of SpA of 7 years in our patients, and the delay was significantly longer in patients with uveitis, with a similar tendency across the SpA subgroups. Although this delay appears to be shorter than that reported by Deodhar et al. in the U.S. [12], it is longer than the delay observed in other sites including the Danish national registry where the authors suggested that the decreasing delay may be the reflection of an increasing awareness of the importance of early diagnosis [9]. Delayed diagnosis can result in worse disease outcomes, including loss of spinal range of motion, functional impairment impacting work disability, income

and healthcare expenditures [21]. Moreover, early diagnosis is important because effective therapeutic strategies are available, including patient education, physical therapy, NSAIDs and biologic DMARDs. Of note, anti-TNF therapy has been shown to be especially effective in achieving remission in patients with short duration of symptoms [22, 23]. The explanation for the prolonged diagnostic delay in the uveitis group is unclear, and, moreover, our data did not allow us to clarify whether or not the uveitis flare preceded the onset of SpA in the majority of patients. A limitation of our study is that the majority of patients with AAU were not seen in our ophthalmology department, so details regarding their uveitis diagnosis are limited. Among the patients seen by an ophthalmologist at our institution, only one was documented to have onset of AAU prior to SpA. It is possible that patients with SpA who develop uveitis could have intrinsic characteristics that contribute to longer delay to diagnosis.

Since uveitis is one of the most common initial extra-articular manifestations of SpA [1], it represents a unique opportunity to identify SpA patients earlier. Uveitis is one of the Assessment of SpondyloArthritis international Society (ASAS) classification criteria for patients with axial as well peripheral manifestations only. In the axial SpA group, uveitis is included in both "clinical" and "imaging arms" [24]. An evidence-based algorithm called the Dublin Uveitis Evaluation Tool (DUET) has been recently proposed to guide ophthalmologists in referral of appropriate AAU patients to rheumatology. It has been shown to have an excellent sensitivity (96%) and specificity (97%) [25]. This is an area where effective collaboration between ophthalmology and rheumatology may improve patient outcomes.

We found no differences in patients' baseline characteristics in the two groups, except for higher prevalence of HLA-B27 antigen in the uveitis group which is in concordance with the previous reports [1, 2, 4, 26].

In our series there was no difference in the choice of a specific anti-TNF agent based on the presence of uveitis. Previous reports have found that in contrast to anti-TNF antibody therapy, soluble TNF receptor treatment was ineffective at reducing uveitis flares [27]. Thus, the presence of uveitis in SpA patients can influence the choice of therapy, and similarly, earlier recognition of SpA in patients with uveitis affects the treatment choice for these patients.

Our study has several limitations. First, it is a retrospective chart review, and there were missing data since not all patients fully completed the MDHAQ. We selected patients based on ICD codes and, as a result, some patients could have been missed. Second, the details of the uveitis diagnosis and, the records of complete ophthalmological examination were not available for a large number of patients who were seen by ophthalmologists outside of our institution. Third, we were unable to estimate the temporal relationship between the first occurrence of uveitis and the onset of back pain/arthritis symptoms because of the missing data in over half of included patients. We hypothesize that uveitis onset could be missing because it occurred long before the rheumatology evaluation and the majority of patients could not recall the date. Fourth, this study was conducted in one academic clinical setting, and needs to be replicated in other clinical centers, both academic and community based.

An important strength of our study is that it presents data from a real-life clinical setting, and the included patients were from routine care, which enhances the generalizability of our results. Another strength is that our SpA population represents a diverse group of patients.

In conclusion, the prevalence of uveitis in our population was lower than expected based on reports in the literature. We also found significant differences in uveitis prevalence by underlying disease. There was a significant delay in diagnosis of SpA, which was longer in the uveitis group. New screening strategies in collaboration with ophthalmology may lead to an earlier diagnosis, more selective therapies and better patient outcomes.

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Compliance with ethical standards

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