Hidradenitis suppurativa

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HIGH PREVALENCE OF HIDRADENITIS SUPPURATIVA SYMPTOMS IN AXIAL SPONDYLOARTHRITIS PATIENTS: A POSSIBLE NEW EXTRA-ARTICULAR MANIFESTATION

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ABSTRACT

Background: Spondyloarthritis (SpA), a chronic inflammatory, rheumatic disease, and hidradenitis suppurativa (HS), a chronic, debilitating, inflammatory skin disease, share several clinical and pathophysiological features, such as the association with inflammatory bowel disease and elevated cytokine levels IL-17 and TNF-α. Recently, SpA was reported to be more prevalent (2.3–28.2%) in patients with HS than in the general population. Conversely, the prevalence of HS in SpA is not exactly known.

Objective: To determine the prevalence of HS in patients with axial SpA, a subtype of SpA primarily of the axial skeleton. Secondly, to identify patient characteristics associated with the presence of HS in axial SpA.

Methods: In this cross-sectional study, a self-screening questionnaire based on validated diagnostic HS questions was sent to all participating axial SpA patients from the Groningen Leeuwarden Axial Spondyloarthritis (GLAS) cohort fulfilling the ASAS axial SpA criteria. Self-reported HS symptoms were confirmed by previous medical diagnosis or verification by phone using highly specific validated questions.

Results: In total, 75.6% (449/592) questionnaires were eligible for analyses. Included patients had a mean age of 50 ± 13 years, 64% was male, mean symptom duration was 23 ± 13 years, and 79% was HLA-B27 positive. HS diagnosis could be confirmed in 41 patients, resulting in an estimated prevalence of 9.1%. In comparison to patients without a positive history of HS, these patients were more often female (54% vs. 35%, P = 0.02), showed higher axial SpA disease activity (mean BASDAI 4.5 vs. 3.6, p = 0.01 and ASDASCRP 2.6 vs. 2.2, P = 0.003) and worse quality of life (QoL) (median ASQoL 9.0 vs. 4.0, P < 0.001). Also, a history of heel enthesitis and dactylitis was more prevalent (34% vs. 19%, P = 0.03 and 15% vs. 6%, P = 0.05, respectively). Multivariable analysis showed that a higher score on ASDAS was independently associated with HS (OR: 1.639, 95% CI: 1.176–2.284).

Conclusion: In our cohort of axial SpA patients, HS is more prevalent than in the general population (9.1% versus 0.053–4.1%). HS is associated with female gender, lower QoL, and especially higher axial SpA disease activity.

INTRODUCTION

Axial spondyloarthritis (SpA) is a chronic rheumatic inflammatory disease of primarily the axial skeleton and is associated with several extra-articular manifestations (EAMs).[1,2] Uveitis is the most common EAM, followed by psoriasis and inflammatory bowel disease (IBD); pooled data showed prevalence rates of approximately 26%, 9% and 7%, respectively.[2] The presence of EAMs may help to diagnose axial SpA.[3] Furthermore, the presence of one or more EAMs may affect axial SpA treatment decisions and disease prognosis, quality of life (QoL), and other health-related outcomes and resource usages.[2] Interestingly, recently SpA was reported to be more common in patients with hidradenitis suppurativa (HS) than in the general population, with a prevalence rate between 2.3% and 28.2%.[4-6]

Hidradenitis suppurativa is a chronic, recurrent, often disfiguring and debilitating, inflammatory skin disease affecting the terminal hair follicles in the apocrine gland bearing inverse body regions.[7] There are no pathognomonic tests for diagnosing HS; diagnosis is made clinically and based on three primary criteria: 1. Presence of typical deep-seated painful nodules. Other frequently reported lesions are abscesses, sinus tracts, scarring, and open "tombstone" double ended comedones; 2. Involvement of HS in at least one of the predilection areas: axillae, genitofemoral area, buttocks, and inframammary area in women; and 3. Chronicity and recurrences (i.e., 2 recurrences in 6 months) of lesions (Figure 1).[8]

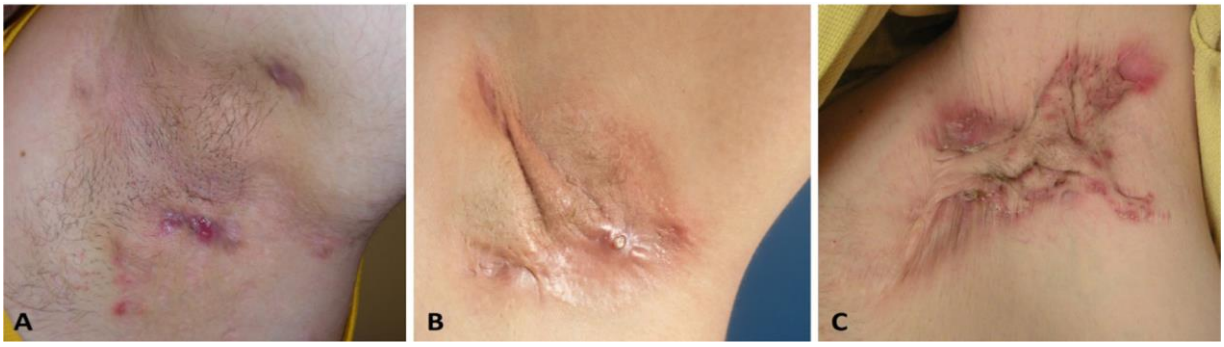

Figure 1. Hurley stages of hidradenitis suppurativa

Hidradenitis suppurativa in an axilla.

A. Hurley stage I: abscess formation, single or multiple, without sinus tracts and scarring.

B. Hurley stage II: recurrent abscesses with sinus tract formation and scarring, single or multiple, widely separated lesions.

C. Hurley stage III: diffuse or nearly diffuse involvement, with multiple interconnected sinus tracts and abscesses across the entire area.

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The reported prevalence of HS varies between 0.053% and 4.1%, and is overall estimated at 1%.[9-14] Hidradenitis suppurativa affects more females than males (3:1), usually initiates after puberty and the prevalence declines after 50 years of age.[10,14] Cigarette smoking and being overweight are important risk factors for both the development and severity of HS.[15-18] Due to its chronicity, the location of the affected body areas and symptoms such as pain, itch and foul smell of discharge of pus, the professional and private quality of life (QoL) of HS patients is significantly impaired.[19,20]

The cause and exact pathogenesis of HS are unclear. An increasing amount of literature postulates that an aberrant innate and adaptive immune response plays a key role in HS. Very interestingly, the tumor necrosis factor-alpha (TNF-α) pathway and interleukin (IL)-23/IL-17 axis seem to be involved in the pathogenesis of both axial SpA and HS.[1,21-24] Treatment overlap for HS and axial SpA also exists; a substantial part of the patients of both diseases respond to TNF-α inhibitors.[1,8] Moreover, similar to axial SpA, it is known that IBD, particularly Crohn's disease, occurs more frequently in HS and vice versa than in the general population, further strengthening the concept of (partially) shared pathogenesis.[1,2,25,26]

Although axial SpA and HS seem to share common denominators in the pathogenesis and treatment, the prevalence of HS in axial SpA is not exactly known. Therefore, the objective of this study was to determine the prevalence of HS in a large cohort of axial SpA patients and to identify patient characteristics associated with the presence of HS in axial SpA.

METHODS

Patients

All patients participating in the Groningen Leeuwarden Axial Spondyloartritis (GLAS) cohort, included before June 2016, were asked to participate in this study. The GLAS cohort is an on-going, longitudinal, prospective observational cohort study which started in 2004 by including all consecutive ankylosing spondylitis (AS) patients 18 years or older, fulfilling the modified New-York criteria and starting TNF-α inhibitors.[27] Since the development of the Assessment in Spondylo-Arthrits international Society (ASAS) axial SpA criteria in 2009, all consecutive axial SpA patients fulfilling these criteria, irrespective of treatment, are included.[28]

Patients are clinically evaluated according to a fixed protocol every six months. Patient characteristics included gender, age, symptom duration, HLA-B27 status, body mass index (BMI), and smoking history and status. During follow-up, the occurrence/episodes of peripheral SpA features (peripheral arthritis, heel enthesitis, dactylitis) and EAMs (uveitis, psoriasis, IBD) are recorded.

Furthermore, disease activity is assessed with Bath AS Disease Activity Index (BASDAI, range 0–10), AS Disease Activity Score ($ASDAS_{CRP}$), C reactive protein (CRP), and erythrocyte sedimentation rate (ESR). Also, health-related QoL was assessed with the Ankylosing Spondylitis Quality of Life questionnaire (ASQoL, range 0–18). Structural spinal damage was quantified by the modified Stoke Ankylosing Spondylitis Spine Score (mSASSS, range 0–72) at baseline.

HS questionnaire and verification of diagnosis

The applied diagnostic HS question "Do you repeatedly have outbreaks of painful abscesses or inflammations in the armpits, groin or buttocks or other body areas?" is based on previously validated questions with a sensitivity between 92% and 97% and specificity of 82–86%.[29] Patients could reply with "no" or "yes, in the past" or "currently". In addition, to enable patients to self-assess the presence of HS more accurately, prototypical colour pictures of HS lesions of the Hurley stages of the axilla and a brief informative description of HS were added, as suggested by Esmann *et al.* (Figure 1).[29] Patients were asked to fill in the questionnaire and return it by post using a stamped return envelope. After three weeks, a reminder was send to the non-respondents. Anonymously returns and largely incomplete answered questionnaires were excluded.

Two sources of verification of HS diagnoses were used. First, a medical record check was done in patients who indicated having a diagnosis of HS made by a physician. The diagnosis of HS was considered valid if it was made by a dermatologist. Secondly, verification by phone took place by an HS expert physician (AR), using a second validated diagnostic HS question "Have you had outbreaks of boils during the last six months, with a minimum of two boils?". This question yielded a sensitivity of 90% and specificity of 97% in previous research.[30] The history of recurrent boils was also questioned. In addition, in case of a positive answer, the involved body locations were asked. The diagnosis of HS was considered verified if the body locations of occurrence of the lesions were specific for HS.

Statistical analysis

First, the prevalence rate of a positive history of HS was calculated. Descriptive statistics were applied for all relevant variables; results were expressed as number of patients (%), mean ± standard deviation (SD) or median (interquartile range (IQR)) for categorical, normally distributed and non-normally distributed data, respectively. Group comparison for patients with and without HS was done using the independent-sample t-tests or Mann-Whitney U tests for continuous variables and chi square tests or Fisher exact tests for dichotomous variables. Univariable and multivariable logistic regression analysis with a backward likelihood ratio method were performed to investigate independent predictors for having a history of HS. The maximum number of independent variables allowed to be

included in the multivariable analysis was 10% of the number of patients diagnosed with HS in this study, as explained by a method by Peduzzi *et al.*[31] Data are presented as odds ratios (OR) with a 95% confidence interval (CI). P-values ≤ 0.05 were considered as statistically significant. Statistics were performed using IBM SPSS 23.0 software for Windows (SPSS, Chicago, IL, USA).

Ethical considerations

No formal informed consent is necessary for this type of questionnaire study in the Netherlands, verified at the local ethics committee of the University Medical Center Groningen (UMCG). The GLAS cohort was approved by the local ethics committees of the UMCG and the Medical Center Leeuwarden. All patients provided written informed consent according to the Declaration of Helsinki, in which they also gave written permission to be approached (non-committal) for future additional/new SpA related research.

RESULTS

Patients characteristics and questionnaires sent and returned

All 592 axial SpA patients currently participating in the GLAS cohort were sent a questionnaire, of which 471 questionnaires (79.6%) questionnaires were returned. Excluded were 22 (3.8%) questionnaires due to anonymously returns (n = 4) and missing data (n = 18), resulting in 449 (75.8%) questionnaires eligible for analysis. Baseline characteristics of the 449 included respondents showed a mean age of 50.1 ± 12.7 years, 63.7% were male, mean symptom duration was 23.0 ± 13.1 years and 78.5% was HLA-B27 positive. The mean scores of BASDAI and $ASDAS_{CRP}$, both assessed at the closest visit to the questionnaire response date, were 3.7 ± 2.2 and 2.2 ± 1.0, respectively (Table 1). The remaining 143 axial SpA patients not included in the analysis were significantly younger (43.3 ± 13.6 years, P < 0.001). The male–female ratio between included and excluded patients was similar.

Reported prevalence of HS in axial SpA

Of the in total 449 respondents, 50 (11.1%) had a positive self-screening diagnosis of HS, of whom three had a previously confirmed diagnosis made by a dermatologist. Verification of the diagnosis of HS took place by phone in the 47 remaining respondents, of which in 38 the diagnoses could be confirmed. Overall, the diagnosis of HS could be made in 41 of the 449 respondents, resulting in an estimated positive history of HS prevalence rate of 9.1% in the GLAS cohort. Assuming that all non-responders and patients from excluded questionnaires never had HS, the minimal HS prevalence rate would be 6.9% (41/592).

Table 1. Axial SpA patient characteristics with and without HS

Clinical values	Total axial SpA patients (*n* = 449)	Axial SpA patients with HS (*n* = 41)	Axial SpA patients without HS (*n* = 408)	Comparison of groups with HS vs. without HS, *P*-value
Age, *years*	50.1 ± 12.7	46.7 ± 12.7	50.5 ± 12.7	.07
Male gender	286 (63.7)	19 (46.3)	267 (65.4)	.02
Age of onset axial SpA, *years*	26.9 ± 10.5	28.3 ± 10.7	26.8 ± 10.5	.41
Symptom duration axial SpA, *years*	23.0 ± 13.1	19.3 ± 12.5	23.3 ± 13.1	.07
HLA-B27+	339 (78.5)	31 (81.6)	308 (78.2)	.69
BMI at baseline, *kg/m²*	26.7 ± 4.6	27.8 ± 4.8	26.6 ± 4.5	.12
BMI ≥ 25 kg/m²	277 (62.4)	31 (75.6)	251 (61.0)	.09
History of smoking	290 (67.4)	31 (77.5)	259 (66.4)	.16
History of peripheral arthritis	161 (38.5)	16 (41.0)	145 (38.3)	.86
History of enthesitis (heel)	90 (20.2)	14 (34.1)	76 (18.8)	.03
History of dactylitis	30 (6.7)	6 (14.6)	24 (5.9)	.05
History of EAMs[a]	209 (46.5)	19 (46.3)	190 (46.6)	.00
History of uveitis	143 (35.2)	10 (26.3)	133 (36.1)	.29
History of psoriasis	55 (14.0)	8 (21.6)	47 (13.2)	.21
History of IBD	50 (12.5)	4 (9.8)	46 (12.7)	.80
Crohn's disease	24 (5.3)	1 (2.4)	23 (5.6)	.71
Colitis ulcerosa	23 (5.0)	3 (7.3)	20 (4.9)	.46
History of TNF-α inhibitor use	252 (56.4)	21 (51.2)	231 (56.9)	.51
BASDAI at last visit, *range 0–10*	3.6 ± 2.2	4.5 ± 2.6	3.6 ± 2.2	.01
$ASDAS_{CRP}$ at last visit	2.2 ± 1.0	2.6 ± 1.1	2.2 ± 1.0	.003
CRP at last visit, *mg/l*	3 (2–6)	4 (2–9)	3 (2–6)	.14
ESR at last visit, *mm/hour*	9 (4–18)	13 (3–19)	9 (4–18)	.52
ASQoL at last visit, *range 0–18*	4.5 (1.0–9.0)	9.0 (5.0–11.9)	4.0 (1.0–9.0)	<.001
mSASSS at baseline, *range 0-72*	4.6 (1–15.5)[b]	2.0 (0.0–8.5)	5.0 (1.0–15.7)	.07

Values are presented as number of patients (%), mean ± standard deviation, or median (interquartile range).

Axial SpA, axial spondyloarthritis; HS, hidradenitis suppurativa; BMI, body mass index; EAMs, extra articular manifestations; IBD, inflammatory bowel disease; TNF-α, tumor necrosis factor-alpha; BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; ASDAS, Ankylosing Spondylitis Disease Activity Score; CRP, C-reactive protein; ESR, erytrocyte sedimentation rate; ASQoL, Ankylosing Spondylitis Quality of Life; mSASSS, modified Stoke Ankylosing Spondylitis Spine Score.

a. Uveitis, psoriasis and inflammatory bowel disease.
b. MSASSS at baseline is missing in 196 out of 449 (43.7%) respondents.

Comparison of axial SpA patients with HS versus without HS

The 41 axial SpA patients with HS were significantly more often female than the 408 patients without HS (53.7% vs. 34.6%, P = 0.02) (Table 1). A history of heel enthesitis and dactylitis were significantly more prevalent in axial SpA patients with HS, 34.1% vs. 18.8% (P = 0.03) and 14.7% vs. 5.9% (P = 0.05), respectively. Axial SpA patients with HS scored significantly worse on self-reported axial SpA-related disease activity (BASDAI) and QoL (ASQoL) measurements, 4.5 vs. 3.6 (P = 0.01) and 9.0 vs. 4.0 (P < 0.001), respectively. Also, the composite index of subjective and objective axial SpA-related disease activity ($ASDAS_{CRP}$) was higher in these patients (2.6 vs. 2.2 respectively, P = 0.003). Axial SpA patients with HS had a trend to higher BMI and a more often positive smoking history (27.8 vs. 26.6, P = 0.12 and 77.5% vs. 66.4%, P = 0.16, respectively). No other differences between these two groups were found for the other patient characteristics (Table 1).

Patients characteristics associated with HS in axial SpA

Univariable logistic regression resulted in six out of 20 tested parameters significantly associated HS in axial SpA, as also mentioned above (Table A.1, Appendix). HS was confirmed in 41 axial SpA patients, therefore a maximum of four parameters (10% of 41) were allowed as to use as independent variables in the multivariable logistic regression analysis. After careful consideration, the four most clinically relevant from these six significant parameters were selected, resulting in gender, history of heel enthesitis, history of dactylitis, and $ASDAS_{CRP}$. BASDAI was not selected since BASDAI and $ASDAS_{CRP}$ contain overlap in patient-reported disease activity and CRP is also included in the ASDAS, resulting in a more objective disease activity measure. ASQoL was not included, because QoL reflects disease outcome. Multivariable analysis showed that a higher $ASDAS_{CRP}$, indicating higher axial SpA disease activity, was the only independent predictor associated with HS (OR 1.639, 95% CI: 1.176–2.284, P = 0.004).

DISCUSSION

To our knowledge, this is the first study that investigated the prevalence of HS in the axial SpA population. In our cohort derived from daily clinical practice, we found a prevalence rate of 9.1% after thorough standardized verification of the HS diagnosis, and minimal 6.9% when correcting for non-response. This is at least 1.7 times more frequent than in the general population (0.053–4.1%).[9-14]

Interestingly, compared to the acknowledged EAMs in axial SpA, the prevalence rate of HS found in our study is more or less similar. The reported pooled prevalence of psoriasis and IBD in axial SpA is 9.3% and 6.8% respectively, compared to approximately 2% and 0.4% in the general population.[2,32,33]

This high prevalence of HS in axial SpA is not surprisingly; a link between HS and SpA has been described previously. Cross-sectional studies showed that SpA is more prevalent in HS than in the general population. A large multi-centre study reported a crude prevalence between 2.3% and 3.7% of combined axial and peripheral SpA in 640 HS patients defined by ASAS and the European Spondyloarthropathy Study Group criteria, respectively, which is higher than the prevalence of axial SpA in the general population of 0.32–1.4%.[1,4] Very recently, a smaller single-centre study reported a prevalence of SpA as high as 28.2% (11/39 HS patients), in which approximately 80% were defined as axial SpA and 20% peripheral SpA based on the ASAS criteria, compared to 2.6% (1/39) in the control group), resulting in a OR of 11 (95% CI: 4.1–83.3).[5] However, both studies report limitations such as the incompleteness of clinical and diagnostic examinations and selection bias.[4,6] Furthermore, another study in 46 HS patients found in 39.1% signs of active inflammation and 32.6% signs of chronic SpA changes at the sacroiliac joints in retrospectively evaluated pelvic magnetic resonance images (MRIs).[5] Noteworthy, the authors reported that 15.2% of these HS patients simultaneously presented clinical signs and symptoms of acute or chronic SpA.[5] The used diagnostic MRI criteria for sacroiliitis in this study were not exactly the same as defined by the ASAS-working group.[34-36] Further data suggesting (a partially) shared pathogenesis exists, comes from multiple case series, in which HS patients had presented with peripheral and/or axial SpA features.[37-39] A similar dysfunctional immune response is theorized to be involved in both axial SpA and HS, reflected by the elevated involved cytokines IL-1, IL-23, IL-17 and TNF-α, and the good response to TNF-α inhibitors in both conditions.[1,7,8,21,24] With this in mind, HS might fall under the concept of immune-mediated inflammatory diseases (IMID), in which a group of seemingly unrelated conditions are described that share common inflammatory pathways.[40] Axial SpA and also IBD, a comorbidity that is associated with both axial SpA and HS, have already been described as one of the IMID conditions.[40]

Group comparison analysis between SpA patients with HS and without HS in our study showed that HS is more prevalent in females than in males with axial SpA. This is not surprising, because HS occurs more frequently in females (ratio 3:1).[10] Therefore, the clinicians treating axial SpA patients should be aware of the possible co-occurrence of HS, particularly in females. However, this might be challenging due to the hidden nature of HS lesions (inverse body regions) and that HS symptoms, such as malodorous inflammations and affected intimate body locations, can cause HS patients to feel embarrassed about talking and showing their lesions.[41]

Furthermore, two major risk factors identified for disease severity in HS are tobacco smoking and overweight; most HS patients are overweight (45–80%) and active smokers (60–90%) or ex-smokers (5–15%).[15-18] Also in axial SpA, smoking and obesity were found to be associated with higher incidence of axial SpA and higher disease activity.[42-44] Although

it was a trend, also in our study a larger percentage of axial SpA patients with HS had a positive smoking history and obesity at baseline than patients without HS. The main possibility for not reaching statistical significance seems a lack of power. In all respondents (n = 449) both the percentage of smoking (68%) and obesity (62%) were already relatively high.

Further, other peripheral SpA features such as heel enthesitis and dactylitis were significantly more prevalent in axial SpA with HS than without HS symptoms. Interestingly, the occurrence of a positive history of heel enthesitis and dactylitis in HS patients was also reported previously.[4,45] It can be hypothesised that patients with (a history of) more SpA features have a more active aberrant immune system, making them more susceptible for having other (auto-)inflammatory diseases, such as HS. This remains to be investigated.

Another notable finding from our study is that axial SpA patients with HS scored significantly worse on the measurements BASDAI and $ASDAS_{CRP}$. Resulting from our multivariable analysis, a higher $ASDAS_{CRP}$, meaning a higher axial SpA disease activity, was independently associated with a positive history of HS. Furthermore, the outcome measure ASQoL was significantly higher in axial SpA patients with HS, indicating these patients experience a worse QoL. HS is a skin condition with one of the highest impact on QoL among other chronic skin conditions, including eczema and psoriasis.[46,47] Therefore, it is likely that having HS symptoms contributes to a higher (negative) impact on disease activity and QoL of axial SpA patients.

A strength of the present study is the high response rate to the questionnaire, nearly 80%. In total, 75.8% of the patients could be included in the final analysis, decreasing the nonresponse bias to a great extent. Nevertheless, both underestimation and overestimation of the HS prevalence is still possible, since a postal questionnaire does not result in the same validity as physical examination by a physician. We have tried to overcome this by using questions with very high diagnostic power. The HS question used in our patient-self-administered questionnaire was based on previously validated questions and showed a very high sensitivity of 92–97% and a specificity of 82–86%.[29] To yield an even higher diagnostic power, we added a brief description and prototypical photos of HS disease.[29] Subsequently, we thoroughly verified the positive self-reported HS symptoms through a detailed phone call that included another validated question with a high specificity (97%).[30] Due to recurrent nature of HS symptoms in which periods of remission are possible, we also asked patients by phone if they had a history of such HS symptoms. Therefore, recall bias is possible. However, in case there was any uncertainty if these symptoms belonged to the diagnosis of HS, we decided to classify these patients as HS negative. Another limitation from our study is that there were no longitudinal data,

because of the cross-sectional study design. A causal association between axial SpA characteristics and HS could therefore not be determined.

CONCLUSIONS

Despite these limitations, our results show meaningful information with respect to the association of two auto-inflammatory diseases: axial SpA and HS. The high prevalence and shared denominators in the pathogenesis and treatment may cautiously suggest that HS could be another EAM in (axial) SpA. Clinicians should be aware of undiagnosed HS symptoms, especially in female axial SpA patients with high disease activity and who experience poor QoL. Additionally, a history of peripheral SpA features such as heel enthesitis and dactylitis seem to be associated with the presence of HS. This awareness, in combination with possible shared treatment options, may benefit and improve disease understanding and treatment as well as QoL outcomes for both axial SpA and HS patients. Besides research exploring the possible shared pathophysiology, further studies are needed to prospectively determine the prevalence and incidence of HS in axial SpA patients diagnosed by a dermatologist by physical examination.

Acknowledgments

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APPENDIX

Table A.1. Univariable and multivariable logistic regression analysis of parameters associated with the presence of hidradenitis suppurativa in 449 patients with axial spondyloarthritis

Clinical values	Univariable logistic regression			Multivariable logistic regression		
	OR	95% CI	*P* value	OR	95% CI	*P* value
Age, *years*	0.977	0.952–1.002	.08			[a]
Female gender	2.193	1.148–4.187	.02			[b]
Age of onset axial SpA, *years*	1.013	0.982–1.045	.41			[a]
Symptom duration axial SpA, *years*	0.975	0.948–1.003	.08			[a]
HLA-B27+	1.237	0.526–2.906	.63			[a]
BMI at baseline, kg/m^2	1.053	0.986–1.125	.12			[a]
History of smoking	1.742	0.806–3.768	.16			[a]
History of peripheral arthritis	1.123	0.574–2.192	.74			[a]
History of heel enthesitis	2.238	1.120–4.471	.02			[b]
History of dactylitis	2.714	1.040–7.084	.04			[b]
History of uveitis	0.631	0.297–1.340	.23			[a]
History of psoriasis	1.814	0.782–4.204	.17			[a]
History of IBD	0.808	0.274–2.383	.70			[a]
History of TNF-α inhibitor use	0.795	0.418–1.513	.49			[a]
BASDAI at last visit	1.199	1.040–1.382	.01			[a]
$ASDAS_{CRP}$ at last visit	1.620	1.167–2.250	.004	1.639	1.176-2.284	.004
CRP at last visit, *mg/L*	1.017	0.989–1.047	.24			[a]
ESR at last visit, *mm/hour*	1.007	0.981–1.003	.62			[a]
ASQoL at last visit	1.128	1.055–1.205	<.001			[a]
mSASSS at baseline	0.976	0.940–1.013	.20			[a]

Values are presented as odds ratios (OR) with a 95% confidence interval (CI).

Axial SpA, axial spondyloarthritis; HS, hidradenitis suppurativa; BMI, body mass index; IBD, inflammatory bowel disease (Crohn's disease and colitis ulcerosa); TNF-α, tumor necrosis factor-alpha; BASDAI, Bath Ankylosing Spondylitis Disease Activity Index; ASDAS, Ankylosing Spondylitis Disease Activity Score; CRP, C-reactive protein; ESR, erytrocyte sedimentation rate; ASQoL, Ankylosing Spondylitis Quality of Life; mSASSS, modified Stoke Ankylosing Spondylitis Spine Score.

a. The variable was not tested in multivariable regression analysis based on the p-value in univariable regression analysis.
b. The variable was not selected during multivariable regression analysis.

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