



Profound Sexual Dysfunction Among Patients with Hidradenitis Suppurativa: A Cross-sectional Study

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Received: May 5, 2024 / Accepted: May 24, 2024 / Published online: June 13, 2024
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ABSTRACT

Introduction: Sexual health, a critical aspect of overall well-being, is often compromised in individuals with chronic disorders. Hidradenitis suppurativa (HS) is a chronic inflammatory skin condition that mainly affects intertriginous areas, potentially impacting sexual health as a

result of its specific symptoms and psychosocial burden.

Methods: This cross-sectional study utilized data from the EpiCAi project, focusing on 199 patients with HS. Participants completed digital questionnaires assessing sexual health via sex-specific instruments: the Female Sexual Function Index (FSFI) for women and the International Index of Erectile Function (IIEF) for men,

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alongside different psychosocial scales. The disease severity was assessed using the Hurley stage and the Lesion Identification Scheme for Acne Inversa (LISAI).

Results: The majority of the participants reported impaired sexual health, with significant clinical sexual dysfunctions noted in 71.8% of women (FSFI score < 26) and erectile dysfunction in 63.8% of men. Sexual dysfunction was associated with several factors, including age, and marital status. Psychosocial factors, notably depression and quality of life, showed strong correlations with sexual health outcomes. Notably, women over 40 and those treated with biologics reported more severe dysfunction, while among men, employment status significantly influenced sexual health.

Conclusions: HS profoundly affects the sexual health of both male and female patients, with significant impacts on their quality of life and psychological well-being. The findings underscore the necessity for healthcare providers to address sexual health proactively in the management of HS, considering both physical symptoms and psychosocial impacts. This holistic approach is essential for improving patient outcomes and overall quality of life.

Trial Registration: German Register for Clinical Trials, identifier DRKS00025315.

Keywords: Hidradenitis suppurativa; Sexuality; Erectile dysfunction; Sexual dysfunction

Key Summary Points

Significant sexual dysfunction in patients with hidradenitis suppurativa (HS):

The study revealed high levels of sexual dysfunction among patients with HS, with 71.8% of women experiencing significant sexual dysfunction (FSFI score < 26) and 63.8% of men reporting erectile dysfunction.

Correlation with psychosocial factors:

Sexual dysfunction in patients with HS was strongly correlated with psychosocial factors such as depression, anxiety, and reduced quality of life, highlighting the intertwined nature of psychological health and sexual well-being in this patient group.

Impact of demographic and disease severity:

Age and marital status seemed to affect sexual health. Notably, older women and those treated with biologics reported more significant sexual dysfunction, while employment status significantly influenced sexual health in men.

Need for comprehensive care:

The results emphasize the importance of integrating sexual health into the overall care and management of HS, urging healthcare providers to adopt a more holistic approach to improve both mental and physical health outcomes for patients.

INTRODUCTION

According to the World Health Organization (WHO), sexual health encompasses a holistic state of physical, emotional, and social well-being, extending beyond the absence of disease or dysfunction. It involves a positive and respectful attitude towards sexuality and sexual relationships [1]. Additionally, it is fundamental to the overall health and well-being of individuals, couples, and families, as it supports the ability to have enjoyable and secure sexual experiences without the presence of coercion, discrimination, or violence [1]. While the definition was created for healthy adults, sexuality is also essential for a good quality of life (QoL) among people living with chronic disorders [2]. Yet, this specific population is much more prone to sexual dysfunctions and dissatisfaction with

sexual life [3]. A vast body of literature has been published on the harmful effects of numerous chronic diseases on sexual health, involving neurological, vascular, urologic, gynecologic, and hormonal disorders [2]. Similarly, it has been shown that chronic dermatoses, including psoriasis [4, 5], chronic urticaria [6], atopic dermatitis [7, 8], alopecia areata [9], and vitiligo [10], may affect patients' sexual health. In the majority of cases, sexual dysfunction has been strongly associated with a higher incidence of depression, anxiety, and suicidal ideation [11].

It has been stated that chronic disorders may affect sexuality in three significant ways: direct effect (e.g., affection of the anogenital area or hormonal disturbances), indirect (e.g., chronic pain, fatigue, stiffness), or iatrogenic (e.g., mutilating surgeries, inhibited sexual functioning, mental fluctuations) [12]. The sexual health of patients with hidradenitis suppurativa (HS) may be prone to be affected in all three aspects. HS is a chronic disease in which the inflammatory, highly painful suppurating lesions with foul smell affect primarily intertriginous areas (including anogenital area) [13].

In light of the aforementioned reasons, we decided to perform a cross-sectional study on a group of 199 patients with HS to determine the influence of this disease on patients' sexual lives.

METHODS

The data for this project comes from the EpiCAi (Epidemiology and Care in Acne inversa) project, a health services research initiative conducted by an international group of specialists led by the Department of Dermatology at the University Medical Center Mainz in collaboration with LENICURA GmbH. The project's objective is to merge routine care data from a substantial cohort of patients with (HS) alongside data collected through digital questionnaires. Participation was extended to patients with HS who consented to their data from LAight® therapy sessions—a physical treatment modality in Germany available in outpatient settings [14, 15]—to be recorded using LENICURA's software platform. Recruitment for the additional

questionnaires was conducted via mailed invitations to addresses provided by patients for research purposes, and additional promotional flyers at LAight® therapy locations. The project was also featured on its dedicated website (www.epicai.de). Upon accessing their LENICURA software accounts, patients were prompted to complete various questionnaires initially and at 3 and 6 months follow-ups. Although completing all questionnaires was not obligatory, once initiated, a questionnaire would automatically close after 7 days, preserving the latest entered data. The research primarily explores aspects of sexuality among patients, utilizing specific validated outcomes from the EpiCAi questionnaires [16].

From December 3, 2021 to June 3, 2022, the study engaged 3513 patients, with 277 consenting to participate. The study's protocols were performed according to the Declaration of Helsinki, received ethical approval from the Rhineland-Palatinate ethics committee, and registered with the German Register for Clinical Trials under the identifier DRKS00025315.

Data Specification

Disease Severity

A physician with expertise in HS assessed each patient's Hurley stage [17]. Simultaneously, patients self-assessed all their lesions using the Lesion Identification Scheme for Acne Inversa (LISAI) system. Studies have shown that the LISAI system enables patients to accurately identify their lesions in a manner consistent with physician evaluations [18].

Sexual Health

The sexual health of the studied group was assessed with sex-specific questionnaires: the Female Sexual Function Index (FSFI) for women and the International Index of Erectile Function (IIEF) for men.

FSFI is a brief, multidimensional, self-report instrument measuring female sexual function in the previous 4 weeks [19]. It consists of 19 questions, each ranked on a 6-point scale (from 0 to 5), divided into six domains: desire

(questions 1, 2), arousal (questions 3–6), lubrication (questions 7–10), orgasm (questions 11–13), satisfaction (questions 14–16), and pain (questions 17–19) [19]. The added score from each domain is then multiplied by its factor, resulting in scores of 0 to 6 points for every domain. The higher the results for each domain, the better the patient's sexual functioning. Then, the domain scores are added up to a maximum of 36 points. A final score lower than 26 points indicates the presence of significant clinical sexual dysfunctions [19]. In this study, a validated German version of FSFI was used [20].

IIEF is a 15-item, self-administered questionnaire for the assessment of erectile dysfunction in the previous 4 weeks, introduced in 1997 [21]. It is composed of ten questions ranked on a scale from 0 to 5 points and five questions ranked on a scale from 1 to 5 points, with a total score ranging from 5 to 75 points. The questionnaire is divided into five domains: erectile function (EF) (questions 1–5 and 15), orgasmic function (OF) (questions 9 and 10), sexual desire (SD) (questions 11 and 12), intercourse satisfaction (IS) (questions 6–8), and overall satisfaction (OS) (questions 13 and 14). The score of each domain is also counted separately, and the lower the results, the bigger the dysfunction [21]. Moreover, erectile dysfunction (ED) is diagnosed when the score of EF domain is lower than 26 points. The severity of ED may be divided into four subcategories according to the EF domain score: mild (22–25 points), mild to moderate (17–21 points), moderate (11–16 points), and severe (6–10 points) [22].

Sexual health was also evaluated with the use of a sex-non-specific questionnaire, the 10-item Relation and Sexuality Scale (RSS) [23]. This questionnaire has a 2-week recall and consists of 10 items evaluating emotional closeness, affection, sexual desire, arousal, orgasm, and frequency of sexual intercourse. The ten items are divided into three domains: sexual function (SFU), sexual frequency (SFR), and sexual fear (SF). This questionnaire was previously used on this group of patients, and the paper has been published [24]. In this manuscript, the RSS questionnaire and its domains were solely used for correlation purposes.

Psychosocial Evaluation

In order to fully understand the complex interaction between sexual health and patients' well-being, a robust psychosocial evaluation of each patient was performed. For the quality of life (QoL) impairment, the Dermatology Life Quality Index (DLQI) [25, 26] was used. Stigmatization was measured using the 6-item stigmatization scale (6ISS) [27]. The incidence and severity of depression and anxiety were assessed with the use of the Hospital Anxiety and Depression Scale (HADS) [28]. For the self-esteem assessment, the Rosenberg Self-Esteem Scale was used [29]. Moreover, all previously diagnosed psychiatric comorbidities were included.

Statistical Analysis

The statistical analyses were conducted using Python 3.9 in conjunction with the Pandas library for robust data manipulation and analysis. The data underwent an initial evaluation to determine its distribution, which was either normal or non-normal. For subgroups of exogenous variables, key statistical measures such as median, mean, interquartile range, and standard deviation were computed and visualized using violin plots. Depending on whether the data distribution was normal, the analysis of quantitative variables was performed using either the Student's *t* test or the Mann–Whitney *U* test. Associations between continuous variables were examined using Spearman's correlation methods. For qualitative data, the chi-square test was utilized. Group differences involving more than two groups were analyzed using the Kruskal–Wallis test. The study also looked at bivariate correlations between the FSFI and IIEF scores and other scales, including RSS, DLQI, HADS-A, HADS-D, and 6ISS. A two-sided *p* value of less than 5% was considered significant.

RESULTS

Group Characteristics

The study involved 199 individuals, 152 women (76.4%) and 47 men (23.6%), with an average

age of 40.6 ± 10.3 years. The studied population generally fell into the obese category, with an average body mass index (BMI) of 30.8 ± 6.81 kg/m². Around 59% of the respondents were in a relationship or married.

The average age when patients were first diagnosed with HS was 33.8 ± 10.6 years. The first doctor's visit was at 25.0 ± 10.0 years, and the average age at the onset of the first lesion was at 22.2 ± 9.21 years. This data points to an average delay of 2.8 years before seeking medical advice and an 11.6-year delay in receiving a proper diagnosis of HS. Most of the patients were categorized as Hurley stage 2 (61.8%), then Hurley stages 3 (22.1%) and 1 (16.1%). There were no observed differences in the severity of HS between genders. The majority of patients had multiple affected areas (91.8%), with groins being the most commonly affected region (79.8%).

Inflammatory nodules were present in 91.1% of patients and abscesses in 93.3%, while approximately three-quarters reported having inflammatory tunnels (76.7%). Statistically significant differences were noted in the mean number of inflammatory nodules (4.3 ± 5.4 for women and 5.7 ± 4.2 for men, $p = 0.002$) and abscesses (2.4 ± 2.9 for women and 3.2 ± 2.9 for men, $p = 0.001$) between genders. The average pain level, measured on the numeric rating scale (NRS), was $5.1 (\pm 2.7)$, indicating moderate pain levels. A significant proportion of patients (65.3%) had undergone an average of 3.4 surgeries (± 3.2), but only 18.8% had been treated with biologic therapies. The detailed demographics of the group were published previously [24].

Sexual Health

A total of 138 women (90.7%) filled out the FSFI questionnaire, out of which 110 patients (79.7%) reported having intercourse in the previous 4 weeks. The average group score was 20.1 ± 10.9 points, indicating the presence of significant clinical sexual dysfunctions. Almost three-quarters of female patients (71.8%, 79 people) scored below 26 points. In this group, the mean FSFI total score was 12.5 ± 8.2 points

(detailed scoring of FSFI presented in Table 1). Women over 40 scored lower in the FSFI total score (16.5 ± 11.6 vs. 22.9 ± 9.5 points, $p = 0.001$) and all subdomains ($p < 0.05$). Relationship status significantly influenced sexual dysfunction ($p = 0.003$), with married women reporting the lowest FSFI total score, as well as arousal, lubrication, satisfaction, and pain ($p < 0.05$). There were no statistically significant differences in desire and orgasm domains between different relationship statuses, yet married women had lower scores in both domains. The occupational status and monthly income did not influence women's sexual function. Similarly, no significant differences were found between different BMI categories. Regarding the disease-related factors, time after diagnosis, HS severity according to the Hurley staging system, as well as previous surgeries did not influence sexual function in women. Nevertheless, patients with a history of at least one prior biologic therapy scored significantly lower in FSFI total score, as well as in arousal, orgasm, satisfaction, and pain domains ($p < 0.05$). Moreover, anogenital affectation was the sole area that decreased sexual function significantly in the FSFI total score and almost all domains but the desire domain (Table 1 and Fig. 1). A negative, strong, significant correlation was found between the FSFI total score and almost all domains with RSS total score and all its domains (Table 2). The psychosocial assessment revealed negative, moderate, significant correlations between the FSFI satisfaction domain and 6ISS and HADS Depression score; similar correlations were visible between the FSFI orgasm domain and Self-Esteem questionnaire and pain. Moreover, significant negative correlations were reported between the DLQI total score and the FSFI total, satisfaction, and pain domains (Table 2).

All male patients filled out the IIEEF questionnaire and scored, on average, 39.9 ± 23.5 points (out of 75 points). Erectile dysfunction was found in the majority of patients (30 patients, 63.8%). Almost three-quarters of them (21 patients, 70%) had severe erectile dysfunction (detailed data in Table 3). The EF scores were significantly lower in men aged 40 and older ($p = 0.035$). Regarding the sociodemographic variables, married men had significantly lower scores

Table 1 Statistically significant associations between patients' characteristics and at least one domain of FSFI

Characteristic (mean ± SD)	FSFI total	Desire	Arousal	Lubrication	Orgasm	Satisfaction	Pain
Score; <i>n</i> = 138, points	20.1 ± 10.9	3.1 ± 1.2	3.4 ± 2.2	3.8 ± 2.5	3.4 ± 2.4	3.3 ± 1.9	3.1 ± 2.5
Age; <i>n</i> = 138							
≤ 40 years	22.9 ± 9.5	3.5 ± 1.2	4.0 ± 2.0	4.4 ± 2.2	3.9 ± 2.1	3.6 ± 1.8	3.6 ± 2.4
> 40 years	16.5 ± 11.6	2.5 ± 0.9	2.7 ± 2.2	3.1 ± 2.6	2.9 ± 2.5	2.8 ± 2.0	2.5 ± 2.6
<i>p</i>	0.001*	< 0.001*	< 0.001*	0.003*	0.039*	0.032*	0.028*
Relationship; <i>n</i> = 124							
Married	14.6 ± 10.7	2.9 ± 1.2	2.5 ± 2.2	2.8 ± 2.6	2.6 ± 2.6	2.2 ± 1.7	1.6 ± 2.3
In relationship	20.8 ± 10.5	3.2 ± 1.3	3.5 ± 2.1	4.0 ± 2.4	3.3 ± 2.2	3.6 ± 1.7	3.2 ± 2.4
Not in relationship	22.5 ± 11.0	3.0 ± 1.1	3.9 ± 2.1	4.2 ± 2.4	3.8 ± 2.4	3.6 ± 2.0	3.9 ± 2.4
<i>p</i>	0.003*	0.586	0.009*	0.015*	0.077	< 0.001*	< 0.001*
HADS Depression; <i>n</i> = 122							
HADS-D < 8	21.9 ± 11.1	3.2 ± 1.2	3.7 ± 2.2	4.1 ± 2.4	3.7 ± 2.4	3.7 ± 2.0	3.5 ± 2.5
HADS-D ≥ 8	16.7 ± 10.7	2.8 ± 1.1	2.8 ± 2.1	3.3 ± 2.6	2.9 ± 2.4	2.5 ± 1.5	2.5 ± 2.5
<i>p</i>	0.003*	0.093	0.011*	0.097	0.042*	< 0.001*	0.060
Biologics; <i>n</i> = 102							
No biologics	21.4 ± 11.1	3.1 ± 1.1	3.6 ± 2.2	4.1 ± 2.4	3.7 ± 2.4	3.5 ± 2.0	3.4 ± 2.5
At least one prior therapy	14.1 ± 10.4	2.7 ± 1.2	2.4 ± 2.2	2.8 ± 2.7	2.3 ± 2.4	2.3 ± 1.5	1.6 ± 2.1
<i>p</i>	0.009*	0.192	0.048*	0.054	0.017*	0.026*	0.005*
Anogenital lesions, <i>n</i> = 126							
Not affected	25.6 ± 10.6	3.4 ± 1.1	4.3 ± 2.1	4.7 ± 2.2	4.5 ± 2.1	4.3 ± 1.8	4.3 ± 2.2
Affected	18.7 ± 10.9	2.9 ± 1.2	3.2 ± 2.1	3.6 ± 2.5	3.1 ± 2.4	3.0 ± 1.9	2.8 ± 2.5
<i>p</i>	0.002*	0.057	0.016*	0.007*	0.007*	0.002*	0.012*

FSFI Female Sexual Function Index, *n* number of participants, *SD* standard deviation, *BMI* body mass index

*Statistically significant

for IIEF total score and EF domain ($p < 0.05$) (Fig. 2). In contrast to the women population, the occupational status significantly influenced the total score of the IIEF. Not employed patients scored significantly lower than actively working patients (28.7 ± 23.0 and 44.7 ± 19.6 points, respectively; $p = 0.043$). Almost no disease-related factors had a significant influence on the sexual function of male patients, only diagnosed depression. Moreover, the depression related to HS significantly decreased IIEF total score and

EF, IS, and OS domains. Regarding the cutoff points of the HADS score for depression, male patients with more than 8 points had significantly lower SD ($p = 0.010$) (Table 4). Moreover, the localization of skin lesions did not influence male sexual function. Significant, negative correlations between IIEF with its domains and RSS with its domains were observed. The self-esteem scale correlated negatively with IS and OS domains, while HADS depression correlated

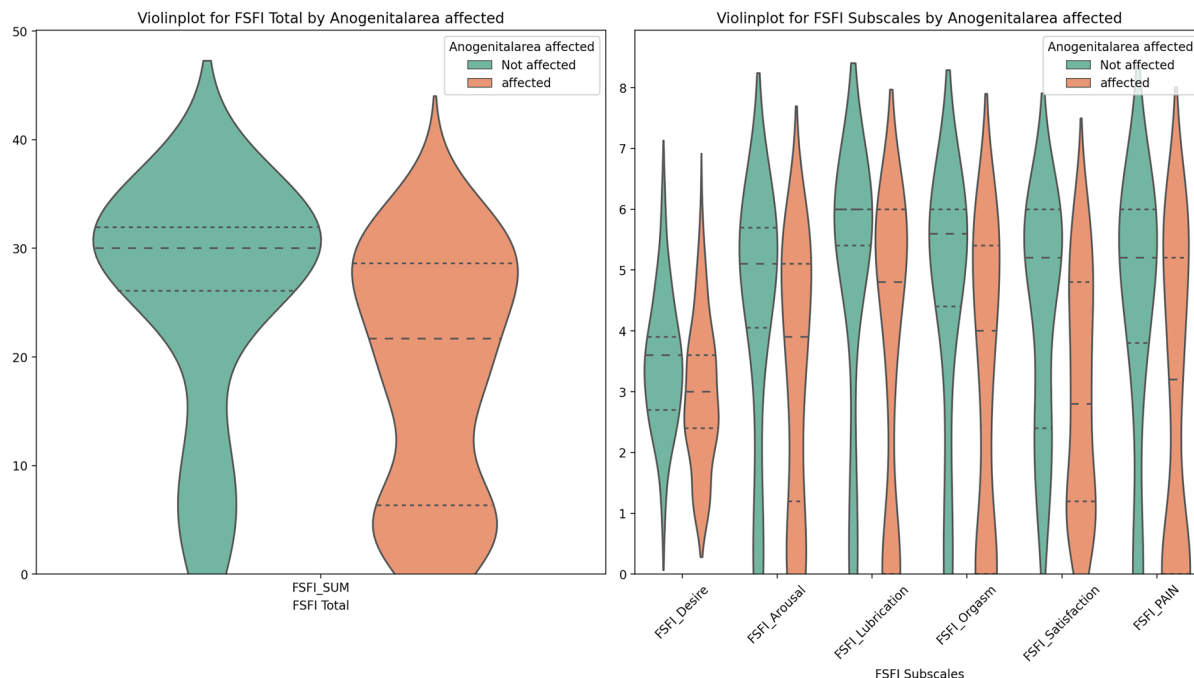


Fig. 1 Violin plots representing differences in female sexual function depending on the genital area affection

negatively with IIEF total score, EF, and SD domains (Table 4).

DISCUSSION

HS is a chronic, inflammatory, recurrent skin disorder characterized by the creation of inflammatory, deep-seated nodules, abscesses, inflammatory tunnels, and vast scarring [13]. The skin-lesion-associated pain of high severity, continuous purulent discharge of foul smell which stains cloths, as well as movement restriction caused by vast scarring and pain are commonly associated with this disorder [13, 30]. On the basis of multiple studies, it has been shown that HS is associated with a significant decrease in patients' QoL [31]. Patients often suffer from depression and anxiety [32], workplace challenges, stigma, and suicidal ideation [33]. Moreover, they are often not satisfied with social and private life [34] and their patient–doctor relationship [35]. The disease influences not only patients but also their partners and families [36, 37]. The special clinical picture of HS seems to

affect all areas of patients' lives, significantly impairing most of them [33]. Similar observations have been made for the sexual function of patients and their partners [38]. Several research papers have been published on the topic, most using different questionnaires and methodologies. Currently, there are only three articles with a methodology like ours that have been published between the years 2012 and 2018 [39–41]. The results of our study are similar to the previously published, yet the severity of sexual dysfunction in our studied population is higher. In the previous papers, the authors mentioned that the mean sexual function scores assessed with FSFI and IIEF of the HS population varied between 20 and 22.1 points for women and between 42 and 49.7 for men [39–41]. Interestingly, according to the cutoff points of FSFI, sexual dysfunction for female patients was significantly higher in our group in comparison to the previously published (71.8% vs. 62%, respectively) [40]. Intriguingly, according to the results of our study, the influence of HS on female sexual satisfaction seems higher than that of endometriosis [42] and psoriasis [43, 44] and similar to breast cancer [45, 46], vulvar

Table 2 Spearman correlation coefficients of FSFI total and FSFI domains among female patients

	Total	Desire	Arousal	Lubrication	Orgasm	Satisfaction	Pain
RSS total (<i>n</i> = 138)	−0.539 (<i><</i> 0.001)*	−0.281 (<i><</i> 0.001)*	−0.424 (<i><</i> 0.001)*	−0.426 (<i><</i> 0.001)*	−0.364 (<i><</i> 0.001)*	−0.572 (<i><</i> 0.001)*	−0.483 (<i><</i> 0.001)*
RSS function (<i>n</i> = 138)	−0.450 (<i><</i> 0.001)*	−0.359 (<i><</i> 0.001)*	−0.377 (<i><</i> 0.001)*	−0.348 (<i><</i> 0.001)*	−0.371 (<i><</i> 0.001)*	−0.405 (<i><</i> 0.001)*	−0.340 (<i><</i> 0.001)*
RSS frequency (<i>n</i> = 138)	−0.378 (<i><</i> 0.001)*	−0.156 (0.067)	−0.290 (0.001)*	−0.253 (0.003)*	−0.175 (0.040)*	−0.490 (<i><</i> 0.001)*	−0.360 (<i><</i> 0.001)*
RSS fear (<i>n</i> = 138)	−0.476 (<i><</i> 0.001)*	−0.147 (0.085)	−0.356 (<i><</i> 0.001)*	−0.401 (<i><</i> 0.001)*	−0.326 (<i><</i> 0.001)*	−0.521 (<i><</i> 0.001)*	−0.499 (<i><</i> 0.001)*
6ISS total (<i>n</i> = 136)	−0.146 (0.090)	0.020 (0.815)	−0.096 (0.269)	−0.058 (0.501)	−0.112 (0.193)	−0.219 (0.010)*	−0.111 (0.199)
Self esteem total (<i>n</i> = 135)	−0.115 (0.186)	−0.017 (0.849)	−0.121 (0.161)	−0.088 (0.310)	−0.183 (0.034)*	−0.054 (0.538)	−0.127 (0.141)
IHS4 (<i>n</i> = 85)	−0.126 (0.252)	−0.051 (0.646)	−0.093 (0.399)	−0.130 (0.235)	−0.101 (0.357)	−0.090 (0.413)	−0.141 (0.197)
DLQI (<i>n</i> = 122)	−0.188 (0.038)*	−0.039 (0.668)	−0.147 (0.105)	−0.063 (0.492)	−0.177 (0.051)	−0.183 (0.043)*	−0.238 (0.008)*
HADS- Anxiety (<i>n</i> = 122)	0.070 (0.445)	0.091 (0.321)	0.059 (0.521)	0.131 (0.149)	0.083 (0.365)	0.048 (0.597)	0.042 (0.649)
HADS- Depression (<i>n</i> = 122)	−0.196 (0.031)	−0.119 (0.194)	−0.190 (0.036)	−0.064 (0.482)	−0.101 (0.267)	−0.226 (0.013)*	−0.166 (0.067)
Pain NRS (<i>n</i> = 124)	−0.157 (0.082)	−0.076 (0.404)	−0.156 (0.085)	−0.126 (0.163)	−0.196 (0.029)*	−0.109 (0.228)	−0.144 (0.110)

p values are shown in parenthesis

N number of participants, *FSFI* Female Sexual Function Index, *RSS* Relation and Sexuality Scale, *6ISS* 6 Item Stigmatization Scale, *IHS4* International Hidradenitis Suppurativa Severity Score, *DLQI* Dermatology Life Quality Index, *HADS* Hospital Anxiety and Depression Scale, *NRS* Numeric Rating Scale

*Statistically significant

lichen sclerosis [47], and lichen planus [48]. The similar affectation of sexual functions of the previously mentioned gynecological and dermatological diseases predominantly affecting the anogenital location stand in agreement with the result of our study. In our population, the anogenital skin lesions were the sole independent

factor for the higher sexual dysfunction among female patients. Moreover, age played an important role in the development of sexual dysfunction in female subjects. Patients over 40 scored significantly lower on the FSFI total score and all domains. This is not extraordinary, as during the perimenopausal and postmenopausal periods,

Table 3 Statistically significant associations between patients’ characteristics and at least one domain of IIEF

Characteristic (mean ± SD)	IIEF-15 total	Erectile dys- function	Orgasmic dysfunction	Sexual desire	Intercourse satisfaction	Overall sat- isfaction
Score; <i>n</i> = 47, points	39.9 ± 23.5	3.2 ± 1.9	6.3 ± 4.3	6.6 ± 2.4	5.6 ± 5.4	4.8 ± 2.7
Age; <i>n</i> = 47						
≤ 40 years	46.9 ± 22.3	2.6 ± 1.8	7.1 ± 4.0	7.2 ± 2.3	7.0 ± 5.5	5.3 ± 2.6
> 40 years	32.6 ± 23.0	3.8 ± 1.7	5.5 ± 4.4	5.9 ± 2.5	4.0 ± 4.9	4.3 ± 2.8
<i>p</i>	0.058	0.035*	0.360	0.067	0.085	0.191
Relationship; <i>n</i> = 38						
Married	30.5 ± 21.7	3.9 ± 1.8	5.5 ± 4.4	6.4 ± 2.5	3.3 ± 5.4	3.7 ± 2.4
In relationship	53.2 ± 19.2	1.9 ± 1.6	7.9 ± 4.0	7.3 ± 1.0	7.5 ± 4.1	5.9 ± 2.6
Not in relationship	43.0 ± 18.5	3.2 ± 1.7	7.0 ± 3.8	6.8 ± 1.9	6.2 ± 4.5	5.4 ± 2.0
<i>p</i>	0.040*	0.030*	0.419*	0.592	0.119	0.072
Occupational status; <i>n</i> = 38						
Not employed	28.7 ± 23.0	4.0 ± 1.7	4.5 ± 4.6	6.3 ± 2.7	3.1 ± 4.6	3.6 ± 2.0
Employed	44.7 ± 19.6	2.9 ± 1.8	7.4 ± 3.7	6.9 ± 1.6	6.0 ± 4.9	5.4 ± 2.5
<i>p</i>	0.043*	0.077	0.157	0.530	0.182	0.062
Depression diagnosed; <i>n</i> = 36						
No diagnosis	48.9 ± 21.2	2.5 ± 1.7	7.5 ± 3.8	7.3 ± 1.6	7.5 ± 4.9	5.8 ± 2.6
Depression diagnosed	31.8 ± 18.9	3.9 ± 1.8	6.3 ± 4.0	6.1 ± 2.3	2.8 ± 4.0	3.9 ± 1.8
<i>p</i>	0.021*	0.053	0.513	0.111	0.007*	0.039*
Depression related to HS; <i>n</i> = 36						
No diagnosis or not related to HS	47.8 ± 21.3	2.6 ± 1.7	7.3 ± 3.9	7.0 ± 1.8	7.4 ± 4.9	5.8 ± 2.5
Depression diagnosed	29.3 ± 17.8	4.1 ± 1.8	6.3 ± 3.8	6.6 ± 2.4	1.7 ± 3.1	3.3 ± 1.7
<i>p</i>	0.028*	0.045*	0.635	0.701	0.005*	0.012*

IIEF-15 International Index of Erectile Dysfunction, *n* number of participants, *SD* standard deviation, *HS* hidradenitis suppuraitva

*Statistically significant

important changes in gynecological physiology, like low levels of estrogen and testosterone, loss of libido, and multiple vaginal symptoms, including dryness, pain, or vaginal discharge, influence sexual functions [49]. Moreover, the accumulated scarring due to the long duration of the disease may have permanent sequelae on sexual health. Interestingly, married women experienced more severe sexual dysfunction in

comparison to those in a relationship and those without a partner. This may be explained by the influence HS has on the patient’s families and partners. This was first shown by Włodarek et al. [37] in their study on 50 partners of patients with HS. The authors showed that the QoL of patients’ families is significantly decreased and that the disease severity is correlated with the severity of its impairment [37]. In another study

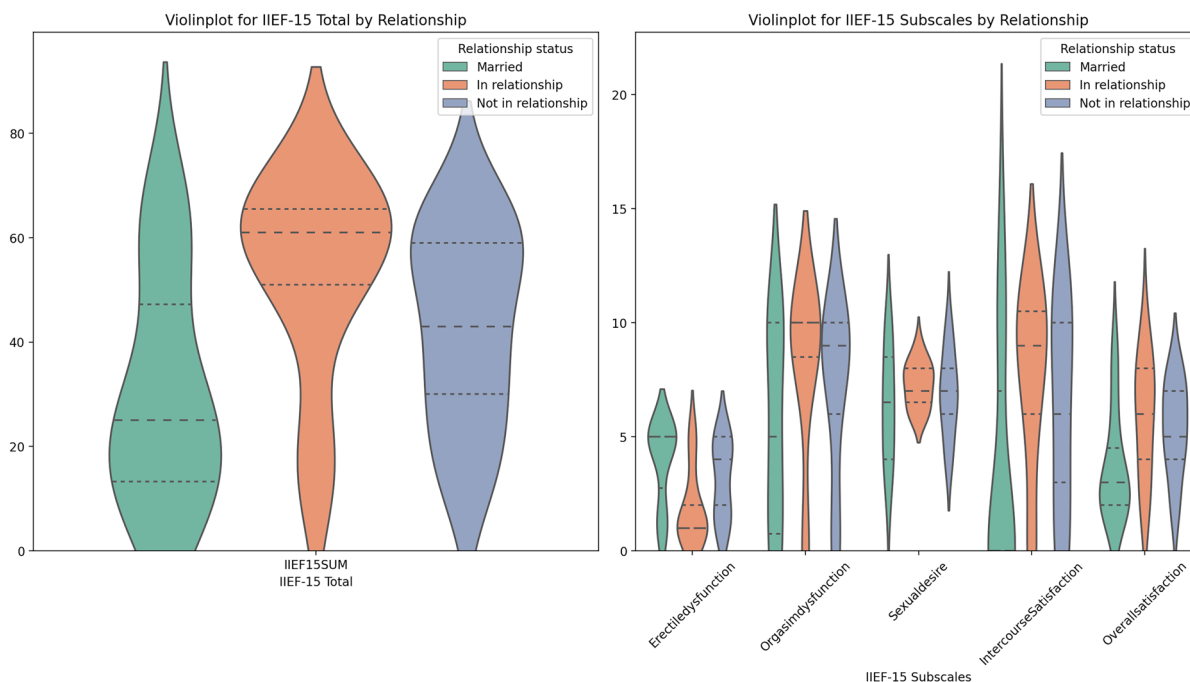


Fig. 2 Violin plots representing differences in male sexual function depending on the relationship status

by Cuenca-Barrales et al. [36], the authors confirmed the decreased QoL of patients' partners yet did not find sexual dysfunction among them. Moreover, the authors did not find any factors influencing female sexual function in patients' partners [36]. One may hypothesize that married patients have higher sexual dysfunction due to the imposed burden on their partners.

Higher sexual dysfunction in patients who achieved cutoff points for depression, according to HADS, is an expected finding. We believe that multilayer influences between HS, sexual function, and depression may result in further aggravation of each one of the disorders. We also observed that female patients treated with biologics have more severe sexual dysfunction. This could be explained by the disease severity indications of starting biological treatment in patients with HS, yet we did not find such an association in our cohort. Interestingly, in this period of time, biologic treatment for HS was not broadly available. Patients had to undergo additional effort to consult an expert in HS who would also prescribe adalimumab. Those who were willing to make that effort most likely had a more substantial desperation for disease

reduction, which might also stem from a diminished sexual function.

We made similar observations for ED in male patients. Male patients from our cohort reported ED more frequently than it was previously published (63.8% vs. 52%, respectively) [40]. Interestingly, the severity of the ED was only mentioned in the study by Janse et al. [40] and was lower than in our cohort. ED is a common phenomenon in patients over 40 years old, yet in this particular group (over 40 years old), the prevalence is estimated at 17–40% [50, 51]. This indicates that patients with HS have a substantially higher chance of developing ED in comparison to their healthy peers. Moreover, severe ED in our studied group was found much more frequently than it was reported for healthy individuals (70% vs. 5.7%) [51]. Interestingly, the prevalence of ED in patients with HS is similar to that of patients with chronic liver disease [52], chronic kidney disease (stages 3–5) [53], celiac disease [54], and diabetes [55]. All of the aforementioned diseases influence erectile function on multiple levels, including a decrease in blood flow, systemic inflammation, and penile nerve damage [52–55]. This

Table 4 Spearman correlation coefficients of IIEF-15 total and IIEF-15 domains among male patients

	IIEF-15 total	Erectile function	Orgasmic dysfunction	Sexual desire	Intercourse satisfaction	Overall satisfaction
RSS total (<i>n</i> = 45)	−0.655 (<i><</i> 0.001)*	0.521 (<i><</i> 0.001)*	−0.433 (0.003)*	−0.451 (0.002)*	−0.564 (<i><</i> 0.001)*	−0.734 (<i><</i> 0.001)*
RSS function (<i>n</i> = 45)	−0.398 (0.007)*	0.291 (0.052)	−0.355 (0.017)*	−0.243 (0.107)	−0.357 (0.016)*	−0.419 (0.004)*
RSS frequency (<i>n</i> = 45)	−0.486 (0.001)*	0.436 (0.003)*	−0.256 (0.090)	−0.202 (0.184)	−0.424 (0.004)*	−0.694 (<i><</i> 0.001)*
RSS fear (<i>n</i> = 45)	−0.617 (<i><</i> 0.001)*	0.497 (0.001)*	−0.370 (0.012)*	−0.504 (<i><</i> 0.001)*	−0.556 (<i><</i> 0.001)*	−0.606 (<i><</i> 0.001)*
GISS total (<i>n</i> = 45)	−0.082 (0.592)	0.090 (0.555)	0.039 (0.799)	−0.021 (0.892)	0.029 (0.848)	−0.098 (0.520)
Self esteem total (<i>n</i> = 45)	−0.282 (0.060)	0.189 (0.214)	−0.213 (0.159)	−0.278 (0.065)	−0.352 (0.018)*	−0.301 (0.044)*
IHS4 (<i>n</i> = 32)	−0.129 (0.483)	0.264 (0.144)	−0.037 (0.842)	−0.136 (0.457)	−0.008 (0.966)	−0.187 (0.306)
DLQI (<i>n</i> = 43)	−0.061 (0.700)	0.103 (0.511)	−0.047 (0.766)	−0.111 (0.477)	0.060 (0.703)	−0.012 (0.939)
HADS-Anxiety (<i>n</i> = 43)	−0.260 (0.092)	0.220 (0.156)	−0.021 (0.894)	−0.307 (0.045)*	−0.151 (0.335)	−0.292 (0.057)
HADS-Depression (<i>n</i> = 43)	−0.379 (0.012)*	0.331 (0.030)*	−0.208 (0.181)	−0.471 (0.001)*	−0.230 (0.139)	−0.231 (0.137)
Pain NRS (<i>n</i> = 43)	−0.053 (0.735)	0.139 (0.374)	0.033 (0.836)	−0.159 (0.309)	−0.007 (0.967)	0.064 (0.685)

p values are shown in parenthesis

N number of participants, *IIEF* International Index of Erectile Function, *RSS* Relation and Sexuality Scale, *GISS* 6 Item Stigmatization Scale, *IHS4* International Hidradenitis Suppurativa Severity Score, *DLQI* Dermatology Life Quality Index, *HADS* Hospital Anxiety and Depression Scale, *NRS* Numeric Rating Scale

*Statistically significant

indicates that the influence of HS on erectile dysfunction may be much more complex than only psychological. It was previously published that patients with HS have a much higher probability of developing life-threatening cardiovascular disorders than healthy controls [24]. It was predominantly attributed to the comorbidities that include obesity, smoking, and type 2 diabetes, yet HS was reported to be an independent factor for cardiovascular risk [24]. The dyslipidemia, abnormal adipokine production,

and increased inflammatory markers may accelerate the pathogenetic effect on endothelial cells, which contributes both to ED and cardiovascular disorders [56, 57]. Similarly to the female cohort, male patients with depression suffered more profound sexual dysfunction. It was even more pronounced in those who had their depression diagnosed as a result of HS. Among male subjects, no location or previous treatment influenced sexual function. Remarkably, subjects who were not employed scored

significantly lower in IIEF-15 than employed patients. It was previously reported that employment status might have a detrimental effect on a man's sex life and was previously described as a "form of castration and rejection by wife and friends" [58]. Although, in the last decades, the attitude toward the employment environment has changed, some patients may still be affected by those beliefs.

Given its cross-sectional design and possible non-response bias, our study has several limitations. As the completion of the EpiCAi questionnaires was optional, it is possible that patients who experienced significant sexual health problems chose not to disclose their issues. Similarly, those without sexual health concerns might have opted out of the sexual questionnaires, perhaps because they felt it was less relevant compared to other issues. Given the intimate nature of the self-administered survey, social desirability effects cannot be ruled out. Secondly, LAight® therapy is a treatment paid for out-of-pocket, potentially resulting in a selection bias towards patients who can afford it. However, the therapy is relatively inexpensive, costing approximately 100 EUR per session, making it accessible to most patients in outpatient clinics in Germany. Lastly, our studied group was composed of mostly women patients (76.4%). Therefore, the male patient cohort is relatively small, which may impede the generalization of the result to the male HS population.

CONCLUSIONS

Sexual life is commonly overlooked in patients suffering from inflammatory skin disorders. This may be attributed to cultural settings, ethical dilemmas, shame, or underappreciation of sexual life as a meaningful QoL determinant. The results of our study indicate the enormous impairment of the sexual function of male and female patients suffering from HS. Treating physicians should understand that sexual well-being, which is crucial for both mental and physical health, can be significantly affected by certain diseases, even in the absence of genital

lesions. This awareness is essential for the comprehensive care of their patients.

ACKNOWLEDGEMENTS

We thank the participants of the study

Author Contributions. Piotr K. Krajewski, Alexandra Strobel, Michael Schultheis, Petra Staubach, Stephan Grabbe, Katharina Hennig, Lukasz Matusiak, Esther von Stebut, Simone Garcovich, Hans Bayer, Marcus Heise, Uwe Kirschner, Georgios Nikolakis and Jacek C. Szepietowski assisted in the concept and design, drafting, editing and revisions of this manuscript.

Funding. This work was supported in part by the Biomolecular Analyses for Tailored Medicine in AcneiNversa (BATMAN) project, funded by ERA PerMed. No funding or sponsorship was received for this study or publication of this article.

Data Availability. The data presented in this study are available on a reasonable request from the corresponding author.

Declarations

Conflict of Interest. Michael Schultheis: Grants or contracts from any entity: LENICURA GmbH—auditor activity on the implementation of the contract "AOK-Priomed Acne inversa" | Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events: UCB, Pfizer, AbbVie—honoraria for lectures | Support for attending meetings and/or travel: UCB, AbbVie, Pfizer, Almirall Novartis – funding of travel, congress, and hotel fees; Advisory Boards: UCB and Novartis. Stephan Grabbe: Grants or contracts from any entity: Novartis, Pierre Fabre | Consulting fees: AbbVie, BMS, MSD, Genzyme, Klinge Pharma, Sun Pharma, Kyowa-Kirin, Novartis, Pierre Fabre | Participation on a Data Safety Monitoring Board or Advisory Board: Alcedis | Leadership or

fiduciary role in other board, society, committee or advocacy group, paid or unpaid unrelated to current work presented here: DeCOG, German dermatological cooperative oncology group—unrelated to current work presented here. Petra Staubach: Grants or contracts from any entity: Novartis; Allmirall | Consulting fees: AbbVie, Allergika, Almirall-Hermal, Amgen, Beiersdorf, Biocryst, BMS, Boehringer-Ingelheim, Celgene, CSL-Behring, Eli Lilly, Falk, Galderma, Hexal, Janssen, Klinge, Klosterfrau, LEO-Pharma, LETI-Pharma, L'Oreal, Novartis, Octapharma, Pfizer, Pflüger, Pharming, Regeneron, Shire, Takeda, Sanofi-Genzyme, UCB Pharma | Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid unrelated to current work presented here: Society of dermopharmazie, UNEV. Alexandra Strobel: Nothing to declare. Marcus Heise: Nothing to declare. Katharina Hennig: CEO and stakeholder of LENICURA GmbH. Georgios Nikolakis: Consulting fees—Dessau Medical Center received a consulting fee from Mölnlycke Health Care GmbH, for which I served as a consulting physician | Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events: Speaker for the EADV HS Course 28–30.11.2022, Porto, Portugal | Support for attending meetings and/or travel: Elli Lilly Scholarship for attending EADV 2021 | Participation in a data protection monitoring board or advisory board—Dessau Medical Center received a consulting fee from Mölnlycke Health Care GmbH, for which I served as a consulting physician, travel grants from Abbvie. Uwe Kirschner: Consulting Fees: Novartis | Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events: Novartis | Participation on a data protection monitoring board or advisory board: Novartis, EsmAiL, EpiCAi | Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid: Deutsche Gesellschaft für Wundheilung und Wundbehandlung. Jacek C Szepietowski: Advisory Board/Consultant for AbbVie, Leo Pharma, Novartis, Pfizer, Sanofi-Genzyme, Trevi, UCB and Vifor; Speaker for AbbVie, Almirall, Janssen-Cilag, Eli Lilly, Leo Pharma, Novartis, Pfizer, Sanofi-Genzyme; Investigator for for AbbVie, Almirall,

Amgen, AnaptysBio, BMS, Boehringer Ingelheim, Celtrion, Galderma, Galapagos, Helm AG, Kliniksa, Incyte, InfraRX, Janssen-Cilag, Leo Pharma, Medimmune, Menlo Therapeutics, Merck, Novartis, Pfizer, Regeneron, UCB, Teva, Trevi. Jacek C. Szepietowski is an Editorial Board member of *Dermatology and Therapy*. Jacek C. Szepietowski was not involved in the selection of peer reviewers for the manuscript nor any of the subsequent editorial decisions.. Lukasz Matusiak: Advisory Board/Consultant for AbbVie, Novartis; Speaker for AbbVie, Aristo, Leo Pharma, Medac; Investigator for for AbbVie, Almirall, Amgen, AnaptysBio, BMS, Boehringer Ingelheim, Celtion, Galderma, Galapagos, Helm AG, Kliniksa, Incyte, InfraRX, Janssen-Cilag, Leo Pharma, Medimmune, Menlo Therapeutics, Merck, Novartis, Pfizer, Regeneron, UCB, Teva, Trevi. Piotr Krajewski: Nothing to declare. Esther von Stebut: Consulting fees: Janssen, Novartis | Payment or honoraria for lectures, presentations, speakers bureaus, manuscript writing or educational events: Janssen, Novartis, Infectopharm, Leo | Leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid: Deutsche Dermatologische Gesellschaft, Deutsche Forschungsgemeinschaft, Mediziner Fakultätentag). Hans Bayer, Simone Garcovich: No conflict of interest to this manuscript.

Ethical Approval. The study was conducted following the Declaration of Helsinki and was approved by the Ethics Committee Rhineland-Palatinate ethics committee, and was registered with the German Register for Clinical Trials under the identifier DRKS00025315.

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