



Features Associated With Quality of Life Impairment in Hidradenitis Suppurativa Patients

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Background: Hidradenitis suppurativa (HS) is a chronic inflammatory skin disease with an adverse impact on patients' quality of life (QoL).

Objectives: To quantify QoL impairment in patients in Germany suffering from HS and to identify the parameters associated with QoL impairment.

Methods: A non-interventional, cross-sectional, mono-centric study with 500 HS patients. QoL data (measured using the Dermatology Life Quality Index; DLQI) and demographic, anamnestic, clinical, and blood parameters were collected. All patients were examined by dermatologists that documented the skin alterations. QoL data from 462 HS patients were available and evaluated.

Results: The mean (\pm standard deviation) DLQI score of HS patients was 13.18 ± 7.99 . Approximately 40% and 20% of HS patients declared very large and extremely large QoL impairment, respectively. The degree of QoL disturbance correlated with the severity of skin alterations, blood leucocyte count and, in particular, with anogenital localization and the presence of nodules and fistulas. Furthermore, QoL impairment was associated with specific comorbidities, such as adiposity and back pain, but not with HS family history. QoL impairment was not influenced by whether or not the patients had undergone resection surgery or antibiotic treatment but was more severe in HS patients that had undergone abscess lancing compared to patients without such treatment in the past.

Limitations: It was a mono-centric study and most data were obtained from self-administered patient questionnaires. The association of QoL with type of treatment was analyzed for abscess lancing, resection surgery, and antibiotic treatment. Further therapeutic modalities recommended in the guidelines were not investigated.

Conclusion: A profound impairment in QoL was present in patients with HS, and this was higher than that observed in other studied dermatoses. The degree of impairment correlated with the extent of cutaneous and some extra-cutaneous alterations. Surgical

and conventional medicamentous therapies of HS were not associated with long-lasting reduction of QoL impairment. Our data support the implementation of patient-reported outcome measures for the assessment of therapy responses.

Keywords: skin disease, quality of life, dermatology life quality index, obesity, spondyloarthritis, metabolic syndrome, family history

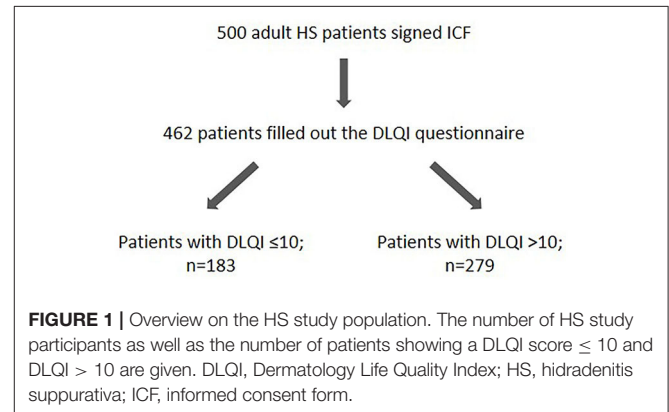
INTRODUCTION

Hidradenitis suppurativa (HS; also known as acne inversa) is a chronically relapsing inflammatory disease with characteristic alterations in skinfolds (1). HS is estimated to affect around 1% of the general population (2–4), with a common onset in the second and third decade of life (5). The axillary, inguinal, and gluteal areas are most commonly affected. Furthermore, the inner thighs, perineal area, and sub- and infra-mammary skin may be involved (1). HS leads to painful cutaneous lesions with malodorous discharge and causes irreversible destruction of normal skin structure. The clinical manifestation varies and includes recurring inflammatory nodules, abscesses, draining fistulas, and scars (1).

Despite the burden caused by HS alterations, the pathogenetic mechanisms underlying the skin inflammation are still obscure (6). The current model implies that initially, hyperplasia of the follicular epithelium leads to stasis, dilatation, and formation of subcutaneous nodules and propagation of bacteria (6, 7). Later in the process, a rupture of the pilosebaceous unit causes deep dermal abscess formation with purulent exudate. At molecular and cellular level, HS skin lesions are characterized by infiltration of immune cells and strong expression of numerous pro-inflammatory cytokines (8–12). The inflammation leads to the destruction of cutaneous architecture and the development of deep sinus tracts and scarring of the affected skin (6, 13). Furthermore, several inflammatory mediators reach the blood and may contribute to comorbid disorders (14, 15). In fact, HS is frequently associated with both spondyloarthritis and metabolic alterations, which increases the risk of cardiovascular diseases and reduces life expectancy (16–19).

The associated pain, the large amount of purulent secretion, malodor, and disfigurement caused by HS have a profound impact on affected patients, mainly resulting in isolation and fear due to stigmatization in work and personal life (20–25). In 2001, a study by Von der Werth *et al.* with 114 participants indicated that HS causes a reduction in quality of life (QoL) of greater extent than that shown for other skin diseases (20). Additionally, a study with 54 patients by Matusiak *et al.* confirmed these observations and showed that the clinical stage and number of involved areas are relevant factors related to QoL impairment (22). As the awareness and care of patients with HS has changed in recent years, our goal was to characterize the QoL of patients in a large cohort and extend the knowledge regarding parameters associated with a poor QoL.

Abbreviations: BMI, body mass index; DLQI, Dermatology Life Quality Index; HS, hidradenitis suppurativa; QoL, quality of life.



MATERIALS AND METHODS

Patients

A non-interventional, cross-sectional, mono-centric study with 500 patients suffering from HS was conducted. The patients: (i) visited the Department of Dermatology, Venereology, and Allergology, University Hospital Charité, Berlin, Germany, from February 2012 to November 2017, (ii) provided written informed consent, and (iii) fulfilled the following inclusion criteria: at least 18 years of age and diagnosis of HS. The diagnosis of HS was made by an experienced dermatologist on the basis of clinical presentation according to the diagnostic criteria (26). QoL data from 462 patients (278 women, 184 men) were available, evaluated, and are presented in this manuscript (Figure 1). Missing data were not replaced for analysis. The number of patients that gave information about specific parameters is indicated in the figure legends.

The study was conducted according to the principles expressed in the Declaration of Helsinki. The written informed consent was obtained from all participants and the study was approved by the clinical institutional review board of Charité University Hospital, Berlin.

Patients' Characteristics

The QoL was analyzed using the Dermatology Life Quality Index (DLQI; see below). Demographic characteristics, family history, details of the course of HS (e.g., age at onset), clinical data (e.g., blood pressure), details of affected regions, and blood cell counts were also collected. The body mass index (BMI) of each patient was calculated as the weight (kg)/height (m)². Disease severity was assessed using Hurley's 3-stage scale and the Sartorius score. Higher scores indicate greater severity of disease. The most

TABLE 1 | Demographic and clinical characteristics of the study cohort ($n = 462$).

	HS patients
Age in years	
(Mean \pm SD)	38.8 \pm 10.9
(Range)	18.0–78.4
Sex	
Females (%)	60.2
Males (%)	39.8
BMI	
(Mean \pm SD)	28.9 \pm 5.9
(Range)	17.2–52.6
Smoking habits	
Smoker (%)	66.5
Ex-smoker (%)	18.7
Never smoker (%)	14.8
Disease duration, years	
(Mean \pm SD)	13.4 \pm 9.8
(Range)	0.1–52.9
Sartorius score	
(Mean \pm SD)	49.2 \pm 34.7
(Range)	0–216
Hurley score	
(Mean \pm SD)	1.64 \pm 0.89
(Range)	0–3
Family history of HS	
Positive (%)	33.8
Negative (%)	66.2

BMI, body mass index; HS, hidradenitis suppurativa; SD, standard deviation.

important demographic and clinical characteristics are included in **Table 1**.

Dermatology Life Quality Index

DLQI is a self-administered questionnaire that was developed to assess QoL of patients suffering from skin diseases. The questionnaire consists of 10 questions covering six various aspects of life: symptoms and feelings, daily activities, leisure, job and school, personal relationships, and treatment of the disease. Each question is scored from 0 to 3, and the sum of the individual values provides the total score used for evaluation: 0 to 1 = no effect on patient's life, 2–5 = small effect, 6–10 = moderate effect, 11–20 = very large effect, and 21–30 = extremely large effect.

Statistical Analysis

Statistical calculations were performed using SPSS software (IBM, Ehningen, Germany). Continuous variables were described as means \pm standard deviation (SD) or standard error of the mean (SEM). The Mann-Whitey-*U*-test (two-tailed) was used to compare means. Discontinuous variables were described using percentages of each modality and were analyzed using the Chi-square test. Correlation analyses were performed by means of Spearman's rank correlation test. Statistical significance was achieved if $P < 0.05$ (* $P < 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$).

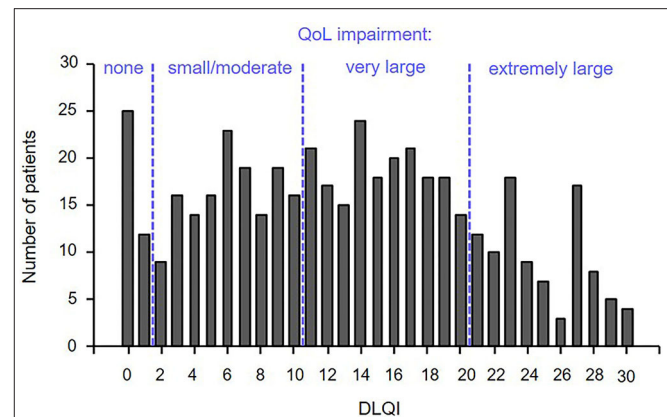


FIGURE 2 | More than half of the patients with HS showed a severe QoL impairment. QoL was assessed by means of the DLQI questionnaire in 462 patients with HS. The numbers of patients scoring a certain DLQI value is indicated. DLQI category: 0–1 = no effect on patient's life, 2–10 = small / moderate effect, 11–20 = very large effect, and 21–30 = extremely large effect. DLQI, Dermatology Life Quality Index; QoL, quality of life.

RESULTS

QoL Impairment

HS is a very complex disease that has a relevant genetic component and involves a physical as well as a psychological level of suffering with a significant mutual influence. To gain a deeper insight into these interactions, we first investigated the impact of HS on the QoL in a German patient cohort comprised of 500 HS patients (**Figure 1**).

The detected mean (\pm SEM) DLQI score of all evaluated HS patients ($n = 462$) was 13.18 (± 0.37), indicating that HS has a profound effect on the lives of patients. A very large (DLQI >10 and ≤ 20) impairment in QoL was noted in 40.3% of patients, whereas 20.1% of patients had an extremely large (DLQI > 20) impairment (**Figure 2**). Highest disturbances in patients' QoL were noted in the context of symptoms and feelings (**Table 2**). In fact, questions focusing on the presence of symptoms like pain, soreness, stinging, or itching (1.56 ± 0.04) and embarrassment or restrictions in self-consciousness (1.57 ± 0.05) achieved the highest score value, indicating the largest impairment.

QoL Impairment Correlates With Severity of HS

Next, we aimed to determine whether there is an association between the clinical manifestation of the disease and QoL. As assumed, the extent of impairment of QoL positively correlated with disease severity, as assessed by the Sartorius score ($r_s = 0.307$; $P = 0.000$) and the Hurley score ($r_s = 0.273$; $P = 0.000$; **Table 3**). Accordingly, we found a significant difference in disease severity between patients with small/moderate (DLQI ≤ 10) vs. very/extremely large (DLQI > 10) QoL impairment (**Figure 3A**). In more detailed analyses, we included information about the potential involvement of right and left axillary, inguinal, and gluteal areas as well as pilonidal sinus. These analyses revealed that DLQI was significantly associated with

TABLE 2 | Mean scores for each DLQI question.

	DLQI question	Mean \pm SEM
1	How itchy, sore, painful or stinging has your skin condition been?	1.56 \pm 0.04
2	How embarrassed or self-conscious have you been because of your skin?	1.57 \pm 0.05
3	How much has your skin interfered with you going shopping or looking after your home or garden?	1.28 \pm 0.05
4	How much has your skin influenced the clothes you wear?	1.53 \pm 0.05
5	How much has your skin affected your social or leisure activities?	1.21 \pm 0.05
6	How much has your skin made it difficult for you to do any sport?	1.38 \pm 0.06
7	Has your skin prevented you from working or studying?	1.22 \pm 0.06
8	How much has your skin created problems with your partner or any of your close friends or relatives?	0.90 \pm 0.05
9	How much has your skin caused any sexual difficulties?	1.29 \pm 0.06
10	How much of a problem has the treatment for your skin been?	1.26 \pm 0.05

DLQI, Dermatology Life Quality Index; SEM, standard error of the mean.

TABLE 3 | Correlations between DLQI and selected clinical data.

	Correlation with DLQI
Sartorius score	0.307 (0.000)
Hurley score	0.273 (0.000)
Number of involved regions	0.253 (0.000)
Blood leukocyte count	0.274 (0.000)
Age at onset (years)	-0.007 (0.888)
Age (years)	0.044 (0.345)
BMI	0.167 (0.000)
Waist circumference	0.158 (0.002)

BMI, body mass index; DLQI, Dermatology Life Quality Index.

The data were tested for correlation using the Spearman's rank correlation analysis. For each field, the Spearman's rank correlation coefficients (and *P*-values) are indicated. Significant *P*-values (*P* < 0.050) are in boldface.

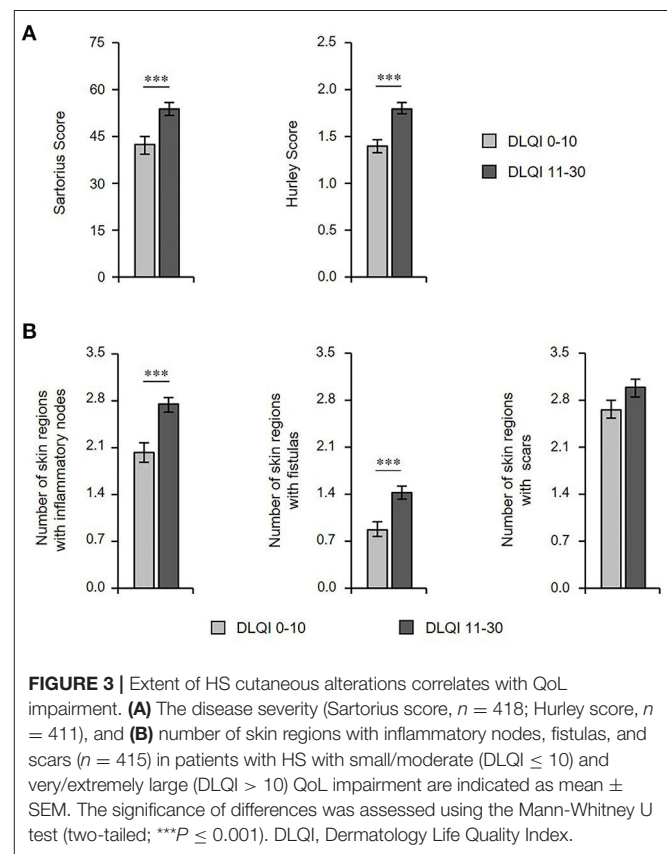
the number of affected body regions ($r_s = 0.253$; $P = 0.000$; **Table 3**). Furthermore, there was also a significant difference in the number of these regions containing nodules or fistulas (but not scars) between patients with small/moderate vs. large QoL impairment (**Figure 3B**).

Localization of Lesions Influences QoL Impairment

We further examined whether there were any differences in the QoL impairment in relation to body sites of clinical manifestation. Interestingly, patients with more profound reduction in QoL had significantly more frequent HS skin alterations at inguinal and gluteal sites (**Figure 4**). Conversely, no significant differences for axillary site or pilonidal sinus involvement were determined between patients with small/moderate (DLQI ≤ 10) vs. very/extremely large (DLQI > 10) QoL impairment (**Figure 4**).

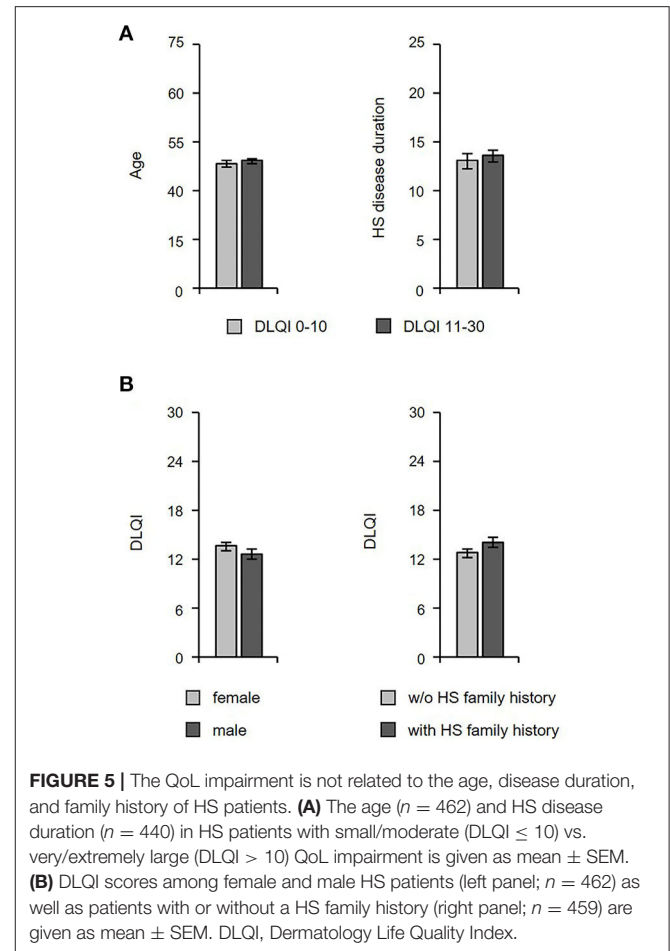
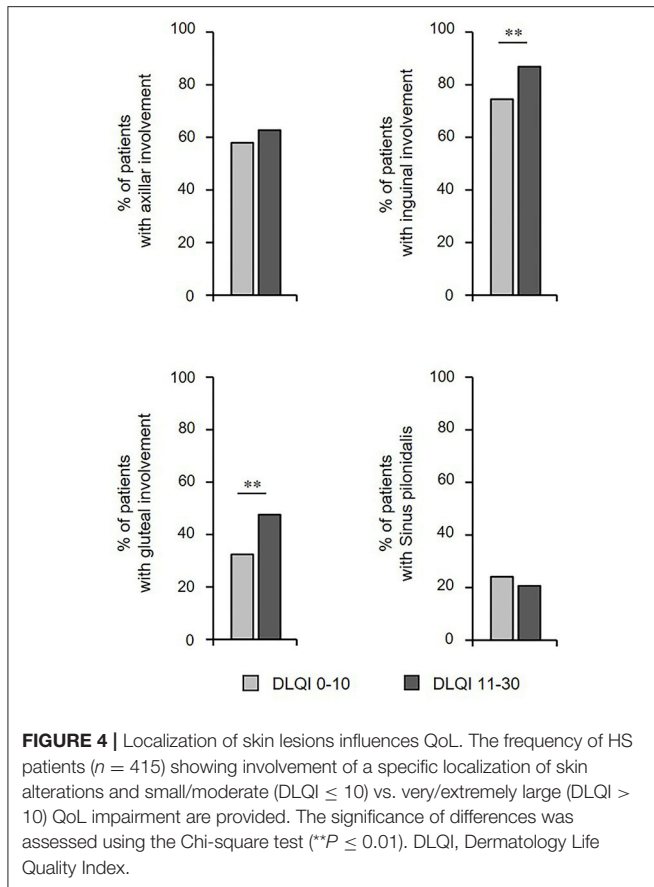
Impairment of QoL and HS Comorbidities

In the second part of our study, we investigated whether there are further characteristics of HS patients that are associated with a QoL impairment. The patients' age and HS disease duration seem to have no actual impact on QoL, as no difference in



these parameters between patients with small/moderate (DLQI ≤ 10) vs. very/extremely large (DLQI > 10) QoL impairment was detected (**Figure 5A**). Moreover, there were no differences in DLQI scores between patients with vs. those without positive family history for HS or between female and male HS patients (**Figure 5B**).

However, our analyses revealed a significant association between QoL and BMI ($r_s = 0.167$; $P = 0.000$), as well as between QoL and waist circumference ($r_s = 0.158$; $P = 0.002$; **Table 3**). We found a larger waist circumference (for women



95.2 ± 2.0 vs. 101.2 ± 1.4 ; $P = 0.023$ / for men 100.3 ± 1.6 vs. 105.8 ± 2.2 ; $P = 0.066$) and a higher BMI (**Figure 6A**) in patients with very/extremely large vs. small/moderate QoL impairment. Accordingly, a significant difference in DLQI score between patients with BMI <25 and BMI ≥ 30 (11.61 ± 0.71 vs. 14.98 ± 0.62 ; $P = 0.000$) was detected. Furthermore, we discovered that HS patients with very frequent/permanent back pain had larger QoL impairment (**Figure 6B**). On the other side, the frequency of patients with very frequent/permanent back pain was significantly higher among patients with very/extremely large compared to those with small/moderate QoL impairment (**Figure 6C**). Interestingly, when considering the location of back pain, the patients with very/extremely large QoL impairment suffered more frequently from lower back pain (**Figure 6D**).

DLQI and Treatment

We were also interested in determining whether the prescribed therapeutic regimen had any implications on QoL. Surprisingly, there were no significant differences in terms of the proportion of patients that had previously undergone abscess lancing, resection surgery, or antibiotic treatment between patients with small/moderate vs. very/extremely large QoL impairment (**Figure 7A**). Accordingly, there were no significant differences in DLQI scores between patients who had vs. those who had not undergone resection surgery and between patients who have been

prescribed antibiotic treatment vs. those who were left without those treatments (**Figure 7B**). Interestingly, our analyses even showed that the QoL impairment was even larger in the group undergone abscess lancing in the past (**Figure 7B**).

DISCUSSION

Hidradenitis suppurativa is a common chronic disease affecting the intertriginous skin areas. Previously, the Jemec group and the Szepletowski group indicated that HS has a negative impact on QoL (20, 22). Our results, based on a larger number of patients, suggest that now, 10–20 years later, HS still leads to a profound impairment in the QoL of individuals afflicted with the disease. In fact, HS has a large or extremely large negative effect on QoL in $\sim 60\%$ of patients. Importantly, patients with HS have a significantly lower QoL compared to patients with other chronic skin diseases (**Table 4**), including alopecia areata (27, 28), acne vulgaris (29, 30), vitiligo (31, 32), atopic eczema (33, 34), psoriasis vulgaris (35, 36), and non-melanoma skin cancer (37, 38).

Jemec *et al.* noted that the highest proportion of physical disability resulted from the soreness and pain induced by HS (20). In fact, the presence of pain but not odor seems to be a crucial contributor to QoL impairment (39, 40), and pain

severity correlated significantly with DLQI (41, 42). Moreover, embarrassment and diminished self-consciousness led to a considerable extent of QoL impairment in our patient cohort. Furthermore, the restriction in the choice of clothing due to skin inflammation appears to be another relevant problem. That, in turn might have a negative impact on self-realization and thereby self-consciousness.

Jemec *et al.* and Matusiak *et al.* also determined that QoL impairment clearly correlates with the severity of skin alterations including the number of lesions (20, 22), a fact that was confirmed by further studies (43–45) and was also observed in our study involving a large patient cohort. In this context, a very recently published study showed a positive correlation of QoL impairment with IHS4 (42). Moreover, we also found that anogenital localization of HS skin alterations has a substantial negative impact on QoL, an observation that was very recently published by Jørgensen *et al.* (45). This localization may have a profound effect not only on the psychological comfort of patients with HS, but also on common aspects of physical impairment (e.g., profound pain, malodorous secretion, and limited mobility). Our detailed analyses of the association between QoL impairment and disease severity revealed that

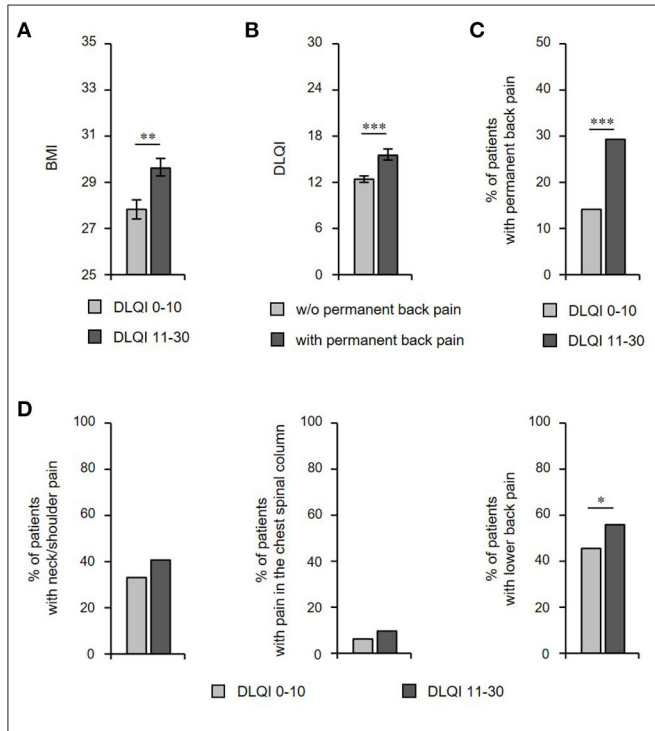


FIGURE 6 | Impairment of QoL is associated with HS comorbidities. **(A)** BMI ($n = 437$) in HS patients with small/moderate ($DLQI \leq 10$) vs. very/extremely large ($DLQI > 10$) QoL impairment is given as mean \pm SEM. The significance of differences was assessed using the Mann-Whitney U test (two-tailed; $**P \leq 0.01$). **(B)** DLQI scores of HS patients with or without very frequent/permanent back pain are presented as mean \pm SEM ($n = 462$). The significance of differences was assessed using the Mann-Whitney U test ($***P < 0.001$). **(C)** The frequency of HS patients ($n = 462$) with very frequent/permanent back pain in patients with small/moderate ($DLQI \leq 10$) vs. very/extremely large ($DLQI > 10$) QoL impairment is provided. The significance of differences was assessed using the Chi-square test ($***P \leq 0.001$). **(D)** The frequency of HS patients ($n = 462$) showing pain of neck/shoulder (left), chest spinal column (middle), and lower back (right) among patients with small/moderate ($DLQI \leq 10$) vs. very/extremely large ($DLQI > 10$) QoL impairment is provided. The significance of differences was assessed using the Chi-square test ($*P < 0.05$). BMI, body mass index; DLQI, Dermatology Life Quality Index.

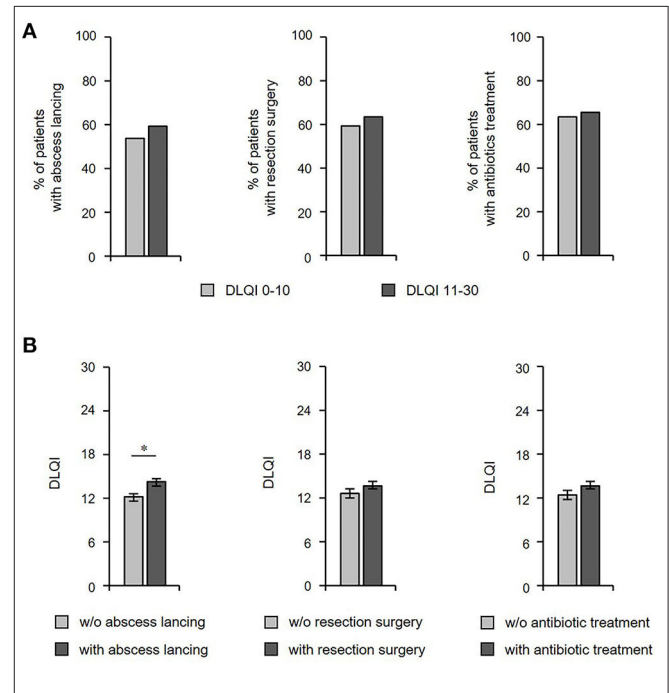


FIGURE 7 | DLQI scores are not associated with current type of treatment. **(A)** The frequency of HS patients ($n = 435$) who had received therapeutic abscess lancing (left), resection surgery (middle) and antibiotic treatment (right) in patients with small/moderate ($DLQI \leq 10$) vs. very/extremely large ($DLQI > 10$) QoL impairment is provided. **(B)** DLQI scores of patients with HS who have or have not undergone the respective therapeutic regimen are indicated using mean \pm SEM ($n = 435$). The significance of differences was assessed using the Mann-Whitney U test ($*P < 0.05$). DLQI, Dermatology Life Quality Index.

TABLE 4 | DLQI scores reported for different skin disorders.

Disease	HS	Alopecia areata	Acne vulgaris	Vitiligo	Atopic eczema	Psoriasis vulgaris	NMSC
DLQI score (mean \pm SD)	13.18 \pm 7.99	6.3 \pm 6.3	5.1 \pm 4.2	4.3 \pm 4.9	6.6 \pm 5.4	6.9 \pm 6.3	2.4 \pm 2.7
		7.9 \pm 7.6	8.2 \pm 4.8	5.2 \pm 5.4	8.3 \pm 5.9	10.8 \pm 7.1	4.1 \pm 4.3
References	Current study	(27, 28)	(29, 30)	(31, 32)	(33, 34)	(35, 36)	(37, 38)

DLQI, Dermatology Life Quality Index; HS, hidradenitis suppurativa; NMSC, non-melanoma skin cancer; SD, standard deviation.

nodules or fistulas, but not scars, have a large negative impact on QoL.

Our study indicates that there is an association between QoL impairment and HS comorbidities. In fact, we did not only detect a positive correlation between DLQI score and BMI as well as waist circumference, but we also found a higher BMI in patients with a large QoL impairment. Furthermore, we detected a significant difference with regards to back pain between patients with small/moderate vs. large QoL reduction. These results were related to lower back pain, in particular. It should be noted that there was no association between QoL impairment and patients' age or a positive family history for HS.

Interestingly, there were no differences between patients with small/moderate vs. large QoL impairment with regards to classical therapeutic procedures (resection surgery, antibiotic treatment) in our study. These data suggest that classical treatment options for HS do not lead to a long-lasting improvement in the patient's QoL. This highlights the necessity of a consequent implementation of the recently approved HS therapy, which is anti-TNF- α antibody. In fact, adalimumab and its biosimilars are approved for the treatment of moderate to severe HS and adalimumab has been shown to improve QoL in clinical studies as well as in clinical practice (46). Moreover, further research in HS is needed to develop new treatments that provide more effective relief for patients with this distressing, extremely debilitating disease. In this context, we firmly believe that offering psychological guidance to these patients may help improve acceptance of the skin condition and ameliorate therapeutic results.

In summary, our study revealed that HS causes profound impairment in patients' QoL. The degree of this impairment correlated with the severity of skin alterations, in particular, with the number of affected regions, anogenital localization, and the presence of nodules and fistulas. Furthermore, QoL reduction was associated with elevated BMI and back pain. In view of the extent of QoL impairment in patients with

HS, we recommend implementing the DLQI instrument when deciding on the appropriate treatment strategy and in assessing the therapeutic response.

DATA AVAILABILITY STATEMENT

The main data are presented within tables and figures of the article. Further data will be made available upon request according to the legal possibilities by the corresponding author.

ETHICS STATEMENT

The study was conducted according to the principles expressed in the Declaration of Helsinki. The study was approved by the clinical institutional review board (Ethikkommission) of Charité University Hospital, Berlin, Germany. Written informed consent was obtained from all participants.

AUTHOR CONTRIBUTIONS

SS-B: design of the study, conceptual idea of the manuscript, data collection and analysis, and drafting of the manuscript. AT: data collection and analysis and drafting of the manuscript. SB, JH-M, and BF: conceptual idea of the manuscript and revision of the manuscript. KW: contribution to data curation, revision of the manuscript, and editing of manuscript. KW: visualization of the results and revision of the manuscript. RS: conceptual idea of the manuscript, statistical analysis, and revision of the manuscript. All authors contributed to the article and approved the submitted version.

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