## Title

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# Physical and Psychosocial Comorbidities of Pediatric Hidradenitis Suppurativa: A Retrospective Analysis

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## Abstract

**Background/Objectives:** Hidradenitis suppurativa (HS) is under-studied in the pediatric population. Adult HS patients are known to have a high comorbidity burden. We aim to describe physical and psychosocial comorbidities in a cohort of pediatric HS patients.

**Methods:** A retrospective chart review of pediatric HS patients at a single academic institution was conducted. **Data on** patient demographics, disease characteristics, and physical and psychosocial comorbidities in pediatric patients with HS were collected and analyzed.

**Results:** 73 pediatric patients were included in this study, 81% female. Mean (SD) age of HS disease onset was 12.6 (2.9) years. Comorbid conditions were reported in 68 of 73 (93%) patients. Significantly increased rates of several comorbidities were seen in our cohort as compared to the general U.S. pediatric population. Metabolic and endocrine abnormalities were prevalent, with 52% (22/42) patients with obesity and 10% (6/59) with polycystic ovary syndrome. The most common cutaneous comorbidity was acne vulgaris, seen in 37% (27/73) of patients. Over one quarter (21/73, 29%) of patients had either an anxiety or depression disorder. Almost one-fifth (14/73, 19%) of our cohort had a diagnosis of asthma and other reactive airway diseases. Only one-third (24/73, 33%) of patients had documentation regarding impact of HS on their daily

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Conflicts of Interest: JLH has served as an advisor for Novartis. VYS is on the Board of the Directors for the Hidradenitis Suppurativa Foundation, and has served as an advisor, investigator and/or speaker for Sanofi Genzyme, Regeneron, AbbVie, Burt's Bees, Dermira, Eli Lilly, Novartis, Pfizer, Galderma, Leo Pharma, SUN Pharma, Menlo Therapeutics, GpSkin, and Skin Actives Scientific. MH is an investigator for Amgen. There was no financial transaction for the preparation of this manuscript. JS, EC, and TG report no conflicts of interest.

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life. Overall, comorbidities largely did not significantly differ based on race, gender, or disease severity.

**Conclusions:** Pediatric patients with HS face a high comorbidity burden, especially with psychiatric conditions. Early identification, including routine mental health screening, and management of comorbidities is warranted in the pediatric HS population.

### Keywords

hidradenitis suppurativa; pediatric dermatology; comorbidities; quality of life; psychiatric; inflammatory disorders

## Introduction:

Hidradenitis suppurativa (HS) has a profound negative effect on patients' quality of life (QoL) in all age groups.[1] Adults with HS are known to have a high burden of comorbid conditions;[2,3] however, data on pediatric HS comorbidities is limited. In this retrospective chart review study, we aim to characterize the physical and psychosocial comorbidities of pediatric HS.

## Materials and Methods:

An electronic health record (EHR) search was conducted in April 2020 of all patients within the University of California Los Angeles (UCLA) health system using International Classification of Diseases (ICD)-9 (705.83) and ICD-10 (L73.2) codes for HS and an age limit of 25 years, which resulted in 286 unique patients. Patients were included if they were younger than 18 years old at time of HS diagnosis and had either an HS diagnosis by a dermatologist, or by a non-dermatologist with physical exam findings of typical lesions in intertriginous areas, and were seen for HS, which resulted in 73 patients.

Data on demographics, HS disease characteristics, and comorbidities were collected via retrospective chart review for patients up until age 18. If Hurley stage was not documented in the EHR, a board-certified dermatologist (JLH) assigned a Hurley stage based on the documented physical exam.

The study data were summarized using frequencies and percentages for categorical or ordinal data, and means, standard deviations and ranges for continuous numerical data. Comorbidity associations with gender, race, and pre-teen vs post-teen onset were evaluated using Chi-square tests, and with body mass index (BMI) using the t-test. HS cohort comorbidity percentages were compared to corresponding general U.S. pediatric population percentages using the Chi-square Goodness of Fit (GOF) tests. P-values $\leq 0.05$ were considered statistically significant. All analyses were performed using IBM SPSS V27 (Armonk, NY).

## Results:

A total of 73 patients (59 female and 14 male) were included in this study (Table 1). About a third (36%, 19/53) were White, 28% (15/53) Hispanic, 19% (10/53) Black, and 6% (3/53)

Asian. Over half of the patients (44/73, 60%) were Hurley stage 1, 38% (28/73) stage 2, and 1% (1/73) stage 3. Mean age of symptom onset was 12.6 years (SD 2.9, range 6-17). There was no significant difference in prevalence of comorbidities based on pediatric (0-12 years old) v adolescent (13-17 years old) HS onset or based on family history of HS. Pediatric HS patients had a significantly increased rate of several comorbidities when compared to rates reported in the general U.S. pediatric population (Table 2).

Comorbid conditions were reported in 93% (68/73) of patients. The most common comorbidities included obesity (22/42, 52%), acne vulgaris (27/73, 37%), acanthosis nigricans (17/73, 23%), and anxiety (16/73, 22%). Besides obesity, other metabolic and endocrine comorbidities were also prevalent; 16% (12/73) had hypercholesterolemia, and 10% (7/73) had pre-diabetes or diabetes. Irregular menses and polycystic ovary syndrome (PCOS) were noted in 26% (15/58) and 10% (6/59) of female patients, respectively. Almost one-fifth of our cohort had a diagnosis of asthma and other reactive airway diseases (19%). Two patients (3%) had Down syndrome.

Male patients were significantly more likely than female patients to have comorbid hypercholesterolemia (43% v 10%, p=0.003), prediabetes (21% v 3%, p=0.016), and hypothyroidism (7% v 0%, p=0.039). When compared to White patients, non-White patients were significantly more likely to have acanthosis nigricans (35% v 5%, p=0.015). Female patients with increased BMI trended toward having increased risk of PCOS (p=0.094) and hirsutism (p=0.053) when compared to those with lower BMI. Patients with increased HS severity (Hurley 2/3) had significantly increased risk of comorbid pilonidal cyst (10% v 0%, p=0.029) when compared to patients with mild HS (Hurley 1). Patients with mild HS (Hurley 1) were more likely than those with more severe HS (Hurley 2-3) to have hypercholesterolemia (25% vs 3%, p=0.015).

Psychiatric comorbidities were common in HS pediatric patients, especially among female patients. Nearly one-third (23/73, 32%) of patients were diagnosed with a psychiatric condition. Female patients were more likely to be diagnosed with anxiety (25% v 7%, p=0.14) and depression (22% v 7%, p=0.20), though statistical significance was not reached. There were 5 (7%) patients, all female, who reported suicidal ideation. For information on all reported comorbidities, see Supplemental Table 1.

One third (24/73, 33%) of patients had documentation regarding the impact of HS on daily activities, most (22/24, 92%) documented by dermatologists. Over half (13/24, 54%) of these patients, all female, expressed concerns about their ability to shave. Decreased participation in sports was also common, reported by 10/24 (42%) patients, of whom 4 had a comorbid psychiatric condition.

## Discussion:

Our pediatric cohort with HS had a high prevalence of comorbidities, including metabolic and endocrine comorbidities such as obesity and PCOS, cutaneous comorbidities such as acne, asthma and other reactive airway disorders, and psychiatric comorbidities such as anxiety and depression. Several of these comorbidities occurred at significantly different

rates than the general pediatric population. This suggests that pediatric HS patients have associated comorbidities that necessitate standardized screening. HS was also found to have a profound social impact on HS patients.

Similar to a recent multicenter pediatric cohort study,[4] we found a high prevalence of acne vulgaris, but acne conglobata was uncommon. There was a high prevalence of acanthosis nigricans and metabolic comorbidities, supporting findings of previous studies.[4-7] Importantly, BMI was not associated with rate of metabolic disorders, suggesting that metabolic screening may be indicated regardless of whether a patient is obese. Our study found a higher rate of PCOS than previously reported in two previous multicenter studies (10% v 5%[4] and 3.8%[6]). There were two cases (3%) of precocious puberty, comparable to a previous multicenter study (3.6%),[6] and significantly higher than the rate in the general population.[8] We suggest baseline screening for pediatric HS patients to include height and weight measurement, blood pressure measurement, fasting lipid panel, glycated hemoglobin, and screening for precocious puberty and PCOS. Dermatologists should be aware of these metabolic comorbidities and consider either screening patients in their own practice or referring to primary care or another appropriate specialty for screening.

The significantly increased rate of asthma and other reactive airway disorders and the increased rate of atopic dermatitis in our cohort is notable. A recent study found a positive bidirectional association between HS and AD.[9] There may be a common pathophysiologic pathway explaining atopy in HS patients, possibly related to Th17 axis skew, microbiome dysbiosis, or sex hormones. Investigation of the underlying mechanisms driving co-occurrence of atopic diseases in patients with HS is needed. The prevalence of anxiety and depression has been described in previous pediatric HS cohorts by Riis et al. (anxiety, 1.4%),[6] Liy-Wong et al. (anxiety/depression disorder, 3%),[4] and Tiri et al. (depression 8.5%, anxiety 5.9%).[10] Our study found a much higher proportion of patients with anxiety or depression disorder (21/73, 29%) than previously reported. This reflects the urgent need for all physicians who care for pediatric HS patients to perform mental health screening, and this may be done by the patient's dermatologist, primary care provider, or other HS healthcare provider. Overall, our data suggest that regardless of a pediatric patient's gender, racial background, or HS disease severity, comorbidity screening is important.

Finally, HS has significant impacts on QoL in children,[1] however, only one-third of patients had any medical documentation about the effect of HS on their everyday life. Further studies are needed to investigate the unique challenges that pediatric HS patients face. Limitations of this study include that it was retrospective in nature and performed at a single academic medical center, limiting generalizability.

In conclusion, pediatric HS patients may present with high rates of medical and psychosocial comorbidities. Our study highlights the need for prospective, large-scale studies to investigate potentially understudied or under-reported pediatric HS comorbidities and development of consensus screening guidelines in this specific patient population.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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**Table 1.**

Patient Demographics

| **Demographics (N=73)** | **n (%)** |
|---|---|
| Gender (n=73) | |
| Female | 59 (81%) |
| Male | 14 (19%) |
| Race/Ethnicity (n=53) | |
| White | 19 (36%) |
| Hispanic | 15 (28%) |
| Black | 10 (19%) |
| Asian | 3 (6%) |
| Bi-racial | 2 (4%) |
| Other | 4 (8%) |
| Age at symptom onset, y (mean +/− SD, range) (n=64) | 12.6 +/− 2.9, 6-17 |
| Pre-teen (age 0-12 y) onset | 31 (43%) |
| Age at diagnosis, y (mean +/− SD, range) (n=68) | 14.3 +/− 2.6, 7-17 |
| Age at presentation, y (mean +/− SD, range) (n=73) * | 14.5 +/− 2.5, 7-17 |
| Age of menarche (mean +/− SD, range) (n=28) | 11.1 +/− 1.2, 9-13 |
| Pre-menstrual flares (n=26) | |
| Yes | 9 (35%) |
| No | 17 (65%) |
| Family history of HS (n=29) | |
| Yes | 14 (48%) |
| No | 15 (52%) |
| BMI (mean +/− SD, range) (n=47) * | 28.6 +/− 7.4, 15.7-48.5 |
| BMI percentile (mean +/− SD, range) (n=42) * | 81.8 +/− 22.8, 20.5-99.5 |
| Smoking status (n=73) * | |
| Current smoker | 1 (1%) |
| Never smoker | 51 (70%) |
| Unknown | 21 (29%) |
| Recreational drug use (n=73) | |
| Marijuana | 4 (6%) |
| Cocaine | 1 (1%) |
| None | 10 (14%) |
| Unknown | 58 (79%) |

Abbreviations: HS, Hidradenitis suppurativa; BMI, Body mass index

* At time of first hidradenitis suppurativa-related visit at our institution

**Table 2.**

Comorbidities of Pediatric Hidradenitis Suppurativa Patient Cohort

| Affected System | Comorbidity | Patient Cohort (n=73) | US Peds Population | p-value | Female (n=59) | Male (n=14) | PMID reference[&] |
|---|---|---|---|---|---|---|---|
| Articular | Arthralgias | 6 (8%) | | | 4 (7%) | - | |
| Cutaneous | Acne vulgaris | 27 (37%) | 85% | <0.001* | 21 (36%) | 6 (43%) | 23210645 |
| | Acanthosis nigricans | 17 (23%) | 8.3% | <0.001* | 14 (24%) | 3 (21%) | 20616290 |
| | Atopic dermatitis | 13 (18%) | 12.7% | 0.190 | 12 (20%) | 1 (7%) | 23773154 |
| | Seborrheic dermatitis | 7 (10%) | 2-5% | 0.005* | 7 (12%) | - | McInerny et al.[1] |
| | Pilonidal cyst | 3 (4%) | 0.12% | <0.001* | 2 (3%) | 1 (7%) | 33080769 |
| | Psoriasis | 2 (3%) | 0.13% | <0.001* | 2 (3%) | - | 29462227 |
| | Dissecting cellulitis of the scalp | 1 (1%) | | | 1 (2%) | - | |
| | Acne conglobata | 1 (1%) | | | 1 (2%) | - | |
| Genetic | Down syndrome | 2 (3%) | 0.10% | <0.001* | 2 (3%) | - | 19948627 |
| Hematologic | Anemia | 7 (10%) | | | 7 (12%) | - | |
| Endocrine | Irregular periods | - | 7.5%^ | <0.001* | 15 (26%)@ | - | 23756098 |
| | PCOS | - | 0.56-1.14%^ | <0.001* | 6 (10%) | - | 23756098 |
| | Hirsutism | - | 0.3%^ | <0.001* | 5 (9%) | - | 23756098 |
| | Precocious puberty | 2 (3%) | 0.01-0.05% | <0.001* | 2 (3%) | - | Muir et Al[2] |
| | Hyperthyroidism | 1 (1%) | | | 1 (2%) | - | |
| | Hypothyroidism | 1 (1%) | | | - | 1 (7%) | |
| | Elevated serum testosterone | - | 0.2%^ | 0.010* | 1 (2%) | - | 23756098 |
| Metabolic | Obesity# | 22 (52%) | 18.5% | 0.010* | | | 29155689 |
| | Hypercholesterolemia | 12 (16%) | 22.9%-23.9% | 0.160 | 6 (10%) | 6 (43%) | 20602343 |
| | Pre-diabetes | 5 (7%) | 18% | 0.013* | 2 (3%) | 3 (21%) | 31790544 |
| | Diabetes | 2 (3%) | 0.25% | <0.001* | 2 (3%) | - | National Diabetes Statistic report[3] |
| | Hypertension | 3 (4%) | 3.5% | 0.777 | 2 (3%) | 1 (7%) | 28827377 |
| Neuropsychiatric | Anxiety | 16 (22%) | 7.1% | <0.001* | 15 (25%) | 1 (7%) | 30322701 |
| | Depression | 14 (19%) | 3.2% | <0.001* | 13 (22%) | 1 (7%) | 30322701 |
| | ADHD | 6 (8%) | 8.4% | 0.956 | 5 (9%) | 1 (7%) | 29363986 |
| | Suicidal ideation | 5 (7%) | 17.0% | 0.021* | 5 (9%) | - | Youth Risk Behavior Surveillance[4] |
| | Substance use disorder | 2 (3%) | 11.4% | 0.020* | 2 (3%) | - | 20855043 |
| | Autism | 2 (3%) | 2.47% | 0.882 | 2 (3%) | - | 29297068 |
| | Bipolar affective disorder | 1 (1%) | 2.9% | 0.436 | 1 (2%) | - | 20855043 |

| Affected System | Comorbidity | Patient Cohort (n=73) | US Peds Population | p-value | Female (n=59) | Male (n=14) | PMID reference[&] |
|---|---|---|---|---|---|---|---|
| Pulmonary | Asthma and other reactive airway disorders | 14 (19%) | 8.4% | <0.001[*] | 11 (19%) | 3 (21%) | National Center for Health Statistics[5] |

Abbreviations: PCOS, Polycystic ovary syndrome; ADHD, Attention-deficit hyperactivity disorder

[&] PMID reference for general US pediatric population comorbidity rate

[@] Out of n=58 because one female patient had not yet reached menarche

[^] Prevalence in adolescent female population

[#] Defined as >95$^{th}$ percentile, calculated out of n=42 from available data

[*] Statistically significant, p≤0.05

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