Received: 9 March 2023 | Accepted: 9 July 2023

DOI: 10.1111/ddg.15202

ORIGINAL ARTICLE

Diagnostic delay, comorbid hidradenitis suppurativa and the prognostic value of bacterial culture in folliculitis decalvans: A cohort study

Anna Lyakhovitsky[1] | **Oz Segal**[1] | **Eran Galili**[1] | **Curtis T Thompson**[2,3] | **Ido Tzanani**[1] | **Alon Scope**[1,4] | **Sharon Baum**[1] | **Aviv Barzilai**[1,5]

[1]Department of Dermatology, Sheba Medical Center, Tel-Hashomer, Ramat-Gan, Israel

[2]CTA Pathology, Portland, USA

[3]Departments of Dermatology and Pathology, Oregon Health Sciences University, Portland, USA

[4]Kittner Skin Cancer Screening and Research Institute, Sheba Medical Center, Tel-Hashomer, Ramat-Gan, Israel

[5]Institute of Pathology, Sheba Medical Center, Tel-Hashomer, Ramat-Gan, Israel

Correspondence
Anna Lyakhovitsky, MD, Dermatology Department, Sheba Medical Center, Tel-HaShomer, Derech Sheba 2, 52621 Ramat-Gan, Israel.
Email: anna.lyakhovitsky@sheba.health.gov.il

[1,4,5] Affiliated with the Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

Summary

Background: Folliculitis decalvans (FD) is a type of primary neutrophilic cicatricial alopecia often leading to irreversible hair loss. Data on its epidemiology, clinical features, outcomes, and prognostic factors are limited.

Objective: To evaluate a cohort of patients with FD and identify characteristics of severe disease and prognostic factors which impede remission.

Patients and Methods: This retrospective cohort study included 192 patients diagnosed with FD and followed for at least six months at a tertiary center between 2010 and 2020.

Results: There was a diagnostic delay averaging 22.2 (± 29.7) months. Comorbid follicular occlusion disorders were common. Bacterial cultures were positive in 45.6% of the cases, with *Staphylococcus (S.) aureus* being the most common pathogen. Severe disease was associated with comorbid hidradenitis suppurativa and a positive bacterial culture, particularly *S. aureus*. 50.7% of patients experienced complete remission: 32% within the first six months of treatment and 18.7% later during follow-up. Relapses were frequent. Negative prognostic factors for achieving remission included younger age and a positive bacterial culture.

Conclusions: There is a need for the education of dermatologists to reduce the diagnostic delay. Screening FD patients for comorbid hidradenitis suppurativa and obtaining bacterial cultures is important for treatment planning.

INTRODUCTION

Folliculitis decalvans (FD) is a type of neutrophilic primary cicatricial alopecia (PCA) that accounts for 2.8%–45% of PCAs, depending on ethnicity and geographic region.[1–5] Commonly, young to middle-aged adults are affected, with an evident male predominance.[1,5–8] Clinical manifestations of FD include erythematous papules, pustules with crusting, hair tufts, skin induration, and centrifugally advancing scarring alopecia.[9–17] The most commonly affected area is the vertex, but other scalp areas and, in rare cases, extra-scalp hair-bearing regions may be involved.[5,11,14,15,18] Folliculitis decalvans often causes pain, burning, or itching and runs a chronic relapsing course.[5,9,10,13] A definitive diagnosis relies on clinical findings and confirmation by biopsy in inconclusive cases.[6,9,10,12,13]

Although the exact pathogenesis of FD is unknown, a bacterial infection with an exaggerated host immune response is hypothesized to play a primary role.[10,12] *Staphylococcus (S.) aureus* is the most common pathogen isolated from the skin of FD patients; however, in some cases, other pathogens or no bacterial pathogens are isolated.[19–25] The persistence of an unbalanced subepidermal microbiota acting as a reservoir has been proposed to underlie

disease chronicity.[22,23] Mechanical factors leading to follicular occlusion may also represent potential pathogenic mechanisms,[10] but this remains unproven. Familial cases suggest a possible genetic background. However, most cases are sporadic.[10,12,13]

Folliculitis decalvans is resistant to therapy, posing a therapeutic challenge. A combination of topical and oral antibiotics is the most common first-line therapy.[5,7,10,12,18,26] Corticosteroids (local application or intralesional injections) and calcineurin inhibitors are additional options for topical treatment. Tetracyclines, clindamycin, rifampicin, fusidic acid, and trimethoprim-sulfamethoxazole are the most commonly reported oral antibiotics. Other systemic agents used include retinoids, dapsone, steroids, and steroid-sparing immunosuppressive agents.[5,7,10,12,18,26–28] Recently, positive outcomes with infliximab, adalimumab, and Janus kinase inhibitors have been reported.[29–32] Non-pharmacologic modalities include surgery, Nd:YAG laser, photodynamic therapy, and radiation.[7,12,33]

Unfortunately, there is still no accepted clinical disease severity scale. Current data on disease epidemiology and outcomes is scarce. Several previous studies used small patient cohorts and produced inconsistent results.[5,12,33] The primary goals of this study were to assess FD epidemiology, describe severe disease characteristics, and identify significant prognostic factors.

MATERIALS AND METHODS

Patients and data collection

In this retrospective cohort study, medical records of patients diagnosed with FD with follow-up at the Hair Disease Clinic of the Department of Dermatology at the Haim Sheba Medical Center between January 2010 and December 2021 were evaluated. Patients with complete data and at least six months of follow-up after FD diagnosis were included. The diagnosis was based on clinical and trichoscopic findings and, if necessary, was supported by histopathology. Data on epidemiological, clinical characteristics, treatments, outcomes, and relapses were gathered from patient charts. Epidemiological data included sex, age at the first visit and at the disease onset, comorbid diseases, and family history of FD. Clinical parameters assessed included affected areas, number of alopecic patches, clinical signs of inflammation, and symptoms. The areas of scalp involvement were classified as vertex, mid-scalp, occipital, temporal, frontal, parietal, and diffuse. Among the trichoscopic features examined were pustules, perifollicular erythema, crusting, tufts, perifollicular scaling, absent follicular ostia, starburst pattern, elongated capillary loops, coiled vessels, and interfollicular thickened skin. Pain, burning, and itching were among the symptoms evaluated. Disease severity was determined by the size of the largest alopecic patch and classified as mild (Grade I, < 2 cm), moderate (Grade II, 2–4.99 cm), or severe (Grade III, >5 cm).[5] Laboratory evaluation included bacterial culture and histopathology. The following disease outcomes were evaluated: *(1)* The disease state 6 months after treatment initiation (classified as complete remission [CR] without treatment, CR while on treatment, partial remission [PR], and no-response [NR]); *(2)* achievement of CR later during follow-up; and *(3)* relapses. Complete remission was defined as the absence of active inflammatory lesions, alopecic patch extension, and symptoms. Partial remission was defined as a reduction in inflammatory lesions and symptoms. No-response was defined as no change or an increase in inflammatory lesions or symptoms. Relapse was defined as the appearance of new inflammatory lesions and/or an increase in the alopecic area in a patient who had previously achieved CR. This study was conducted following the principles of the Declaration of Helsinki and was approved by the Local Ethical Committee (SMC-7592-20).

Statistical analysis

Numbers and percentages were used for categorical variables. Continuous variables were represented by the mean and standard deviation (SD). Categorical variables were compared using the chi-square test, and continuous variables between groups were compared using the Student's t-test. To identify the prognostic factors for achieving CR after six months of therapy, a univariate logistic regression models and a multivariate logistic regression model were created. All statistical tests were two-sided, with statistical significance defined by a p value ≤ 0.05. Statistical analysis was performed using SPSS software (IBM SPSS Statistics, IBM Corp., vx28, 2022, Armonk, NY, USA).

RESULTS

Epidemiological characteristics

Between January 2010 and December 2020, 274 people were diagnosed with FD and followed. Eighty-two patients were excluded (6 for misdiagnosis, 42 for short follow-up, and 34 for incomplete data); the remaining 192 patients were included, with 176 men (91.7%) and 16 women (8.3%), and a male to female ratio of 11 : 1. The disease onset age ranged widely, though most patients developed the disease before the age of 40. There was a significant diagnostic delay, with an average of 22.2 ($\pm$ 29.7) months between FD onset and diagnosis. Table 1 displays the patients' epidemiological data.

Clinical and laboratory characteristics

Clinical characteristics, including trichoscopy and bacterial culture results upon presentation are shown in Table 2. Nine of the 47 patients who had positive bacterial cultures

TABLE 1 Epidemiological characteristics of patients with folliculitis decalvans.

Variable	Men (n = 176)	Women (n = 16)	Total (n = 192)
Age at onset, years, mean (SD)	28.0 (12.4)	33.4 (10.4)	28.5 (12.3)
Time to diagnosis, months, mean (SD)	21.6 (29.3)	27.8 (34.6)	22.2 (29.7)
Age subgroup, n (%)			
10–20 y	67 (38.1%)	2 (12.5%)	69 (35.9%)
21–30 y	54 (30.7%)	5 (31.3%)	59 (30.7%)
31–40 y	29 (16.5%)	7 (43.8%)	36 (18.8%)
41–50 y	16 (9.1%)	1 (6.3%)	17 (8.9%)
51–60 y	4 (2.3%)	0	4 (2.1%)
61–70 y	5 (2.8%)	1 (6.3%)	6 (3.1%)
71–80 y	1(0.6%)	0	1 (0.5%)
Comorbidity, n (%)			
Dermatological			
Atopic dermatitis	7 (4%)	0	7 (3.6%)
Psoriasis	2 (1.1%)	2 (12.5%)	4 (2.2%)
Lichen planus	1 (0.6%)	0	1 (0.5%)
Alopecia areata	2 (1.1%)	0	2 (1%)
Cystic acne	63 (35.8%)	7 (43.8%)	70 (36.5%)
Hidradenitis suppurativa	15 (8.5%)	2 (12.5%)	17 (8.8%)
Pilonidal sinus	17 (9.7%)	0	8 (4.2%)
Metabolic	34 (19.3%)	1 (6.3%)	35 (18.2%)
Obesity	40 (22.7%)	5 (31.2%)	45 (23.4%)
Cardiovascular	3 (1.7%)	0	3 (1.6%)
Pulmonary	7 (4%)	0	7 (3.6%)
Gastrointestinal	3 (1.7%)	1 (6.3%)	4 (2.2%)
Renal/urologic	2 (1.1%)	0	2 (1%)
Thyroid disorders	2 (1.1%)	2 (12.5%)	4 (2.2%)
Neurological	7 (4%)	1 (6.3%)	8 (4.2%)
Psychiatric	9 (5.1%)	0	9 (4.7%)
Malignancy	3 (1.7%)	0	3 (1.6%)
Other atopic conditions	8 (4.5%)	1 (6.3%)	9 (4.7%)
Comorbidity-free	58 (33%)	6 (37.5%)	64 (33.3%)
Smoking	37 (21%)	3 (18.7%)	40 (20.8%)
Family history offolliculitis decalvans	5 (2.8%)	0	5 (2.6%)
Follow-up duration, months, mean (SD)	35.2 (28.2)	51.5 (36.4)	36.5 (38.2)

Abbr.: y, years, SD, standard deviation

Non-dermatological comorbidities included: metabolic: metabolic syndrome or its components; cardiovascular: ischemic heart disease (n = 1), hypertrophic cardiomyopathy (n = 1); pulmonary: asthma (n = 7); gastrointestinal: inflammatory bowel disease (n = 2), gastroesophageal reflux (n = 1), irritable bowel syndrome (n = 1); renal/urological: nephrolithiasis (n = 1), benign prostatic hypertrophy (n = 1); thyroid disorders: hypothyroidism (n = 4); neurological: migraine (n = 2), essential tremor (n = 2), Parkinson's disease (n = 1), epilepsy (n = 1), Tourette syndrome (n = 1), cerebrovascular accident (n = 1); psychiatric: depression (n = 4), posttraumatic stress disorder (n = 2), obsessive-compulsive disorder (n = 1), schizophrenia (n = 1), attentive deficit hyperactivity disorder (n = 1); malignancies: non-melanoma skin cancer (n = 2), testicular cancer (n = 1); other atopic conditions: allergic rhinitis (n = 4), house dust mite sensitivity (n = 4).

TABLE 2 Clinical characteristics and bacterial cultures in patients with folliculitis decalvans.

Variable	n (%)
Severity	
Mild	34 (17.7%)
Moderate	81 (42.2%)
Severe	77 (40.1%)
Number of scalp areas involved	
Single	58 (30.2%)
Several	80 (41.7%)
Entire scalp (diffuse)	54 (28.1%)
Distribution	
Vertex	99 (51.6%)
Occipital	68 (35.4%)
Mid-scalp	30 (15.6%)
Parietal	28 (14.5%)
Temporal	11 (5.7%)
Frontal	5 (2.6%)
Number of patches within involved area	
Single	43 (22.4%)
Multiple	149 (77.6%)
Symptoms	
Pain	132 (68.8%)
Itch	59 (30.7%)
Burning	12 (6.3%)
No symptoms	23 (12%)
Trichoscopy	
Perifollicular erythema	188 (98%)
Lack of follicular ostia	174 (91%)
Pustules	133(70%)
Crusting	129 (67%)
Tufts	113 (59%)
Tubular scaling	112 (58%)
Thickened skin (keloid-like)	48 (25%)
Coiled vessels/ elongated capillary loops	25 (13%)
Starburst pattern	15 (8%)
Bacterial cultures (n = 103)	
Positive	47 (45.6%)
Gram-positive cocci *	28 (59.6%)
Gram-negative rods**	9 (19.1%)
Gram-positive rods***	6 (12.8%)
Mixed growth	4 (8.5%)

*Gram-positive cocci included: *S. aureus* (n = 19), *Staphylococcus epidermidis* (n = 6), *Staphylococcus capitis* (n = 2) and *Streptococcus pyogenes* (n = 1).

**Gram-negative rods included: *Pseudomonas aeruginosa* (n = 3), *Klebsiella* (n = 2), *Proteus mirabilis* (n = 1), *Enterobacter* (n = 1), *Acinetobacter* (n = 1), and *Citrobacter* (n = 1).

***Gram-positive rods included *Cutibacterium acne* (n = 6).

at presentation were in remission after six months. In 32 of the remaining 38 patients, cultures were repeated, and nine were positive. A skin biopsy was performed in 86 (44.7%) patients. Histopathological findings revealed varying degrees of perifollicular inflammation, ranging from neutrophilic predominance in a few cases to a mixed infiltrate of neutrophils, lymphocytes, and plasma cells in the majority of cases. There was also granulomatous inflammation with foreign body giant cells, loss of sebaceous glands, and fibrosis.

Characteristics of severe disease

Table 3 presents the data. Patients with severe disease did not differ in age or gender from those with mild or moderate disease. Among the comorbid diseases, hidradenitis suppurativa (HS) was significantly more prevalent in cases of severe FD ($p < 0.001$). Obesity and smoking had no correlation with disease severity. Clinical features included more frequently occurring diffuse scalp involvement ($p = 0.03$), multiple active patches ($p = 0.02$), and pain ($p < 0.001$). All trichoscopic signs of inflammation, except for perifollicular erythema and scaling, were more prevalent in severe FD. A higher frequency of positive bacterial cultures was found ($p = 0.008$). When each pathogen was evaluated separately, *S. aureus* was the only pathogen with a significant association with severity ($p = 0.03$). No correlation was found between histological findings and severity.

Treatment within the first 6 months of diagnosis

Most patients (180, 93.8%) received both systemic and topical treatment, and 12 (6.2%) received only topical treatment. All patients received topical therapy, which included either antibiotics, corticosteroids, or their combination, and 21% of patients received intralesional corticosteroid injections. The most common first-line systemic treatments were antibiotics, with 130 (67.7%) patients receiving tetracyclines, 29 (15%) receiving clindamycin (in 25 combined with rifampicin); 11 (5.7%) receiving trimethoprim with sulfamethoxazole; and 47 (24.5%) receiving other antibiotics such as macrolides, cephalosporins, quinolones, and fusidic acid. Other systemic therapies included isotretinoin administered to 48 (25%) and corticosteroids administered to eight (4.2%) of the patients. Steroid-sparing immunosuppressive medications were not administered to any patient within the first 6 months. Dapsone, hydroxychloroquine, methotrexate, and different steroid-sparing agents were administered to a number of patients after six months of follow-up, but not as first-line therapy.

TABLE 3 Comparison of epidemiological, clinical, and laboratory characteristics between severe and mild to moderate folliculitis decalvans using a univariate logistic regression.

Variable	Mild to moderate disease (n = 115)	Severe disease (n = 77)	p value
Mean age at onset, years, mean (SD)	29.4 (13.3)	27.1 (10.6)	0.20
Male sex (n, %)	105 (91.3)	71 (92.2)	0.82
Comorbidities, n (%)			
Metabolic syndrome	21 (18.3)	14 (18.2)	0.98
Cystic acne	37 (32.1)	33 (42.8)	0.13
Pilonidal sinus	5 (4.3)	3 (3.9)	0.87
Hidradenitis suppurativa	3 (2.6)	14 (18.2)	< 0.001
Atopic conditions	11 (9.6)	12 (5.6)	0.20
Areas of involvement, n (%)			
Frontal	4 (3.5)	1 (1.3)	0.35
Vertex	64 (55.7)	35 (45.5)	0.16
Mid-scalp	14 (12.1)	16 (20.8)	0.10
Occipital	40 (34.8)	28 (36.4)	0.82
Parietal	13 (11.3)	15 (19.5)	0.11
Temporal	4 (3.5)	7 (9.1)	0.10
Number of scalp areas involved			
Single	47 (40.9)	11 (14.2)	< 0.001
Multiple	42 (36.5)	38 (49.4)	.14
Entire scalp (diffuse)	26 (22.6)	28 (36.4)	< 0.05
Number of active patches, n (%)			
Single	32 (27.8)	11 (14.3)	< 0.05
Multiple	83 (72.2)	66 (85.7)	< 0.05
Symptoms, n (%)			
Pain	65 (56.5)	67 (87.0)	< 0.001
Itch	37 (32.2)	22 (28.6)	0.59
Burning	8 (7.0)	4 (7.0)	0.70
Asymptomatic	19 (16.5)	4 (5.2)	< 0.01
Trichoscopy, n (%)			
Pustules	74 (64.3)	64 (83.1)	< 0.01
Perifollicular erythema	111 (96.5)	77 (100.0)	.98
Tufts	58 (50.7)	55 (71.4)	< .01
Perifollicular scaling	70 (60.9)	42 (54.5)	0.38
Lack of follicular ostia	99 (86.1)	75 (97.4)	< 0.01
Starburst pattern	1 (0.9)	14 (18.2)	< 0.001
Elongated capillary loops	9 (7.8)	16 (20.8)	< 0.01
Crusting	68 (59.1)	61 (79.2)	< 0.01
Keloid-like areas	18 (15.7)	30 (39.0)	< 0.001

(Continues)

TABLE 3 (Continued)

Variable	Mild to moderate disease (n = 115)	Severe disease (n = 77)	p value
Positive bacterial culture, n (%)	17 (32.6)	30 (58.8)	< 0.01
Staphylococcus aureus	7 (6.1)	12 (15.6)	< 0.05

Abbr.: CI, confidence interval; SD, standard deviation
Statistically significant p values are highlighted in bold.

Remission rate within six months from diagnosis

Complete remissions were achieved in 61 (32%) patients. Of these, 15 (25%) were off therapy, while 46 (75%) were still receiving therapy. Sixty-five (34%) patients had PR, and 66 (34%) patients were NR.

Remissions after more than six months of follow-up and relapses

After six months, 36 additional patients achieved a CR, bringing the overall CR rate to 50.7%. Of these, 60 patients were still receiving therapy, and 37 had terminated their treatment. An additional nine patients (4.7%) achieved a PR. There were 21 (10.9%) NRs. Relapses occurred in 58 (59.8%) of patients who achieved CR, in 24 patients after the treatment was stopped, and in 34 while still receiving treatment.

Negative predictive factors for achieving CR in 6 months

Table 4 compares patients who achieved CR to those who did not, using data from univariate logistic regression models. Complete remission was negatively associated with a younger age of disease onset, severe disease at presentation, multiple areas of involvement, multiple patches of activity, pain, pustules, tufts, crusting, positive bacterial culture, and first-line isotretinoin treatment. Obesity and smoking had no correlation with remission rates.

According to a multivariate logistic regression that included demographic, clinically significant characteristics, and bacterial culture results, the only negative predictors of CR were a younger age of onset and positive bacterial cultures (Table 5).

DISCUSSION

This large retrospective study of 192 patients with FD has three significant findings important for patient care. These are: *(1)* There is a marked diagnostic delay; *(2)* HS is a negative comorbid factor; and *(3)* positive bacterial cultures are associated with more severe disease. For the diagnostic delay, the average delay in diagnosis was nearly 2 years. Because FD causes irreversible alopecia, it is crucial to reduce this delay in order to improve patient outcomes. Potential factors contributing to a delay in diagnosis include a patient-dependent time lag between symptom onset and initial consultation, and a physician-dependent time lag resulting from a lack of medical knowledge about the disease. Thus, there may be delayed referral to a specialist. Both factors should be addressed with better education of general dermatologists on the diagnosis and treatment of FD and encouragement of early referral to hair expert clinicians.

Most patients in our cohort were males, as observed in previous studies, though our study identified an even more significant male predominance.[5,18,19,26,28,34,35] The age of disease onset ranged broadly, involving adolescents and the elderly, but most patients were under 40 years of age. The increase in male pattern hair loss (MPHL) with age, which favors the vertex and mid-scalp, may explain the decline in FD incidence. Thus, smaller, miniaturizing hair follicles in MPHL may be less susceptible to developing FD. There was also a slight trend towards an older age of onset in women, as reported previously,[5,26] but the difference was not significant.

The second most important finding of this study is that patients with HS have significantly worse disease severity. Prior studies have reported an association between FD and HS, but the relationship to disease severity has not been previously evaluated.[36–38] Though other follicular occlusion triad disorders were found, HS was the most significantly associated finding with FD disease severity. The results indicate that screening for follicular occlusion disorders should be performed in FD patients and that in cases of comorbid HS, a more aggressive treatment approach should be considered.[39]

Other comorbid diseases, such as metabolic syndrome or its components, atopy, and others, occurred at comparable rates to the general population of similar ages.[40–43] Similar to previous studies, no link to immunodeficiency disorders was discovered, and the majority of cases were sporadic.[5,18,26] There were fewer comorbidity-free individuals in our cohort than previously reported (33% vs 65% and 74%, respectively).[5,18]

The third significant finding of this study is that severe FD is associated with a higher rate of positive bacterial cultures, particularly *S. aureus*. Gram-positive cocci were found in 60% of positive cultures, with *S. aureus*, in line with previous reports, being the most frequently isolated pathogen. Since *S. aureus* is commonly isolated from the skin, a positive culture does not necessarily indicate its causative role, but it does imply a contributing role in the escalation of inflammation. This finding emphasizes the importance of obtaining bacterial cultures and eradicating the pathogen with antibiotics. Of note, our study found positive bacterial cultures in one-half of the cases, a percentage that is less

TABLE 4 Comparison between patients with folliculitis decalvans who achieved complete remission within six months to those who did not, using a univariate logistic regression.

Variable	Complete remission		OR (CI 95%)	p value
	Yes (n = 61)	No (n = 131)		
Average age at onset, years, mean (SD)	31.6 (15.1)	27.0 (10.5)	1.03 (1.00–1.05)	< 0.01
Average time for diagnosis, months, mean (SD)	17.3 (23.9)	24.4 (31.9)	0.99 (0.97–1.00)	0.12
Male gender, n (%)	54 (88.5)	122 (93.1)	0.56 (0.20–1.60)	0.28
Severity, n (%)				
Mild	21 (34.4)	13 (9.9)	4.76 (2.18–10.38)	< 0.001
Moderate	32 (52.5)	49 (37.4)	1.84 (0.99–3.41)	< 0.05
Severe	8 (13.1)	69 (52.7	0.13 (0.06–0.30)	< 0.001
Comorbidities, n (%)				
Metabolic syndrome	14 (23.0)	21 (16.0)	1.56 (0.73–3.32)	0.24
Cystic acne	24 (39.3)	46 (35.1)	1.19 (0.64–2.24)	0.57
Pilonidal sinus	7 (5.3)	1 (1.6)	0.29 (0.36–2.45)	0.23
Hidradenitis suppurativa	4 (6.6)	13 (9.9)	0.63 (0.19–2.04)	0.44
Atopy	6 (9.8)	17 (13.0)	0.73 (0.27–1.95)	0.53
Area of involvement, n (%)				
Frontal	2 (3.3)	3 (23)	1.44 (0.23–8.88)	0.68
Vertex	32 (57.4)	67 (55.7)	1.05 (0.57–1.94)	0.86
Mid–scalp	6 (9.8)	24 (18.3)	0.48 (0.19–1.26)	0.13
Occipital	19 (31.1)	49 (37.4)	0.75 (0.39–1.44)	0.39
Parietal	7 (11.5)	21 (16.0)	0.67 (0.27–1.69)	0.40
Temporal	0	11 (8.4)	0	< 0.05
Number of scalp areas involved, n (%)				
Single	26 (42.6)	32 (24.4)	2.35 (1.24–4.48)	< 0.01
Several	18 (29.5)	62 (47.3)	0.51 (0,27–0.99)	< 0.05
Diffuse (entire scalp)	17 (27.9)	37 (28.2)	0.98 (0.49–1.93)	0.95
Number of patches, n (%)				
Single	19 (31.1)	24 (18.3)	2.01 (1.00–4.06)	< 0.05
Multiple	42 (68.9)	107 (81.7)	0.49 (0.24–0.99)	< 0.05
Symptoms, n (%)				
Pain	35 (57.4)	97 (74.0)	0.47 (0.24–0.89)	< 0.05
Itch	17 (27.9)	42 (32.1)	0.81 (0.42–1.59)	0.55
Burning	3 (4.9)	9 (6.9)	0.70 (0.18–2.68)	0.60
Asymptomatic	13 (21.3)	10 (7.6)	3.27 (1.34–7.97)	< 0.01
Trichoscopy, n (%)				
Pustules	36 (59.0)	102 (77.9)	0.40 (0.21–0.78)	< 0.01
Perifollicular erythema	59 (96.7)	129 (98.5)	0.45 (0.06–3.32)	0.42
Tufts	28 (45.9)	85 (64.9)	0.45 (0.24–0.85)	< 0.01
Perifollicular scaling	36 (59.0)	76 (58.0)	1.04 (0.56–1.93)	0.89
Lack of follicular ostia	53 (86.9)	121 (92.4)	0.54 (0.20–1.46)	0.22
Starburst pattern	2 (3.3)	13 (9.9)	0.30 (0.06–1.40)	0.11
Elongated capillary loops	9 (14.8)	16 (12.2)	1.24 (0.51–2.99)	0.62
Crusting	35 (57.4)	94 (71.8)	0.53 (0.28–0.99)	< .05
Keloid-like areas	11 (18.0)	37 (28.2)	0.55 (0.26–1.19)	.12

(Continues)

TABLE 4 (Continued)

Variable	Complete remission		OR (CI 95%)	p value
	Yes (n = 61)	No (n = 131)		
Bacterial cultures, n (%)	*28 (45.9)*	*75 (57.2)*		
Positive culture	9 (32.1)	38 (29.0)	0.42 (0.19–0.94)	< 0.05
Staphylococcus. aureus	4 (6.6)	15 (30.7)	0.75 (0.28–2.02)	0.57
Treatments, n (%)				
Intralesional corticosteroids	10 (16.4)	30 (22.9)	0.66 (0.29–1.45)	0.30
Tetracyclines	40 (65.6)	90 (68.7)	0.86 (0.45–1.65)	0.66
Clindamycin/rifampicin	4 (6.6)	21 (16.0)	0.36 (0.12–1.12)	0.06
Trimethoprim-Sulfamethoxazole	4 (6.6)	7 (5.3)	1.24 (0.35–4.41)	0.73
Isotretinoin/acitretin	6 (9.8)	42 (32.1)	0.23 (0.09–0.58)	< 0.001
Systemic steroids	2 (3.3)	6 (4.6)	0.70 (0.13–3.60)	0.67

Abbr.: CI, confidence interval; OR, odds ratio; SD, standard deviation
Statistically significant p values are highlighted in bold.

TABLE 5 Multivariable logistic regression predicting complete remission six months after treatment initiation in patients with folliculitis decalvans.

Variable	OR (95% CI)	p value
Female gender	1.434 (0.453–4.537)	0.54
Age at disease onset	1.026 (1.000–1.053)	< 0.05
Disease duration until diagnosis	0.988 (0.973–1.003)	0.10
Multiple patches	0.529 (0.240–1.168)	0.12
Tufts	0.480 (0.218–1.060)	0.07
Pustules	1.063 (0.511–2.210)	0.87
Perifollicular scales	0.759 (0.343–1.678)	0.49
Positive bacterial culture	0.413 (0.174–0.981)	< 0.05

Abbr.: OR, odds ratio, CI, confidence interval
Statistically significant p values are highlighted in bold.

than has been reported in other studies.[5,18] This could be due to the patient population at the tertiary center, where some patients have received antibiotics prior to referral.

In 40% of our cases, other gram-positive cocci, gram-negative rods, or gram-positive *Cutibacterium acne* rods were isolated. Gram-negative rods were previously reported in FD patients from tertiary care facilities. These results have been linked to referral bias brought on by past antibiotic usage and ongoing inflammation, which compromises the epidermal barrier and affects the skin microbiota.[21–24] Based on these assumptions, this subset of patients can be expected to have more severe or recalcitrant disease. However, neither the severity nor the remission rate was associated with gram-negative rods in our cohort. Our analysis of the indicators of severe disease enabled us to identify various clinical signs, as well as positive bacterial cultures and *S. aureus* cultures. Our study did not find a connection between severity and younger age, in contrast to prior published findings.[5,18]

Overall, the CR rate was around 50%, with one-third of patients achieving CR within 6 months and the remaining 20% achieving CR later in the follow-up. Most patients needed ongoing treatment to maintain remission, and the majority of those who achieved CR relapsed. This emphasizes the chronic relapsing nature of FD, the limited efficacy of current treatments, and the requirement for long-term therapy. Our results demonstrate that retinoids as first-line treatment were associated with a lower rate of remissions when compared to antibiotics.

While univariate logistic regression found that several clinical characteristics, positive bacterial culture, and isotretinoin treatment were all negative predictors of achieving CR, the multivariate regression model found that the only negative predictors were younger age at onset and a positive bacterial culture. This should be investigated further in large-cohort multicenter studies.

Among the study's strengths are the longitudinal design with a long follow-up period in the largest-size cohort published to date, and the FD diagnoses made by experienced dermatologists and confirmed by trichoscopy and histology when needed. However, our study has several limitations. The first is its retrospective design. Since FD is an uncommon condition, obtaining a sizeable sample for a prospective design is challenging. Second, the current study is based on patients from a single tertiary center. Thus, our cohort represents our geographic location, may contain a higher proportion of severe cases, and is influenced by our center's therapeutic approaches. Furthermore, for future prospective studies, a consensus of hair specialists on a clinical severity scale of FD would be prudent.

CONCLUSIONS

Our study has demonstrated that there is a significant delay in FD diagnosis, highlighting the need for improving general dermatologist education in FD diagnosis and treatment. In addition to clinical signs and symptoms of

inflammation, comorbid HS, positive bacterial cultures, and *S. aureus* cultures were identified as indicators of severe disease. Younger age and positive bacterial cultures were also discovered to be negative predictors of CR. Our findings emphasize the importance of obtaining a bacterial culture and thereafter attempting to eradicate the pathogen. Further research and the development of novel therapies with evaluation in multicenter prospective studies will be necessary to improve the management of this challenging disorder.

ACKNOWLEDGEMENT

The authors thank Zvi Segal, MD, for his insightful contribution to the statistical analysis of the results. We also thank all the participants in this study.

CONFLICT OF INTEREST

None.

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How to cite this article: Lyakhovitsky A, Segal O, Galili E, et al. Diagnostic delay, comorbid hidradenitis suppurativa and the prognostic value of bacterial culture in folliculitis decalvans: A cohort study. *JDDG: Journal der Deutschen Dermatologischen Gesellschaft*. 2023;21:1469–1477. https://doi.org/10.1111/ddg.15202