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ORIGINAL RESEARCH

Dermoscopic Features of Erosive Pustular Dermatosis of the Scalp: A Comparative Multicentric Retrospective Study in Bald and Hairy Patients

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Background: Erosive pustular dermatosis of the scalp (EPDS) is a rare inflammatory disorder primarily affecting elderly individuals with bald or hairy scalps. It is often misdiagnosed due to clinical overlap with other scalp conditions. Dermoscopy is an invaluable diagnostic tool for hair and scalp disorders, but its utility in EPDS remains underexplored. This study aims to identify dermoscopic features of EPDS and compare them with differential diagnoses to improve non-invasive recognition.

Materials and Methods: A retrospective multicentric study was conducted across three Italian dermatological centers. Two cohorts, bald and hairy patients with histologically confirmed EPDS, were compared with controls diagnosed with conditions mimicking EPDS. Dermoscopic images at 10× magnification were analyzed by two independent evaluators using standardized criteria. Comparative analyses of dermoscopic features and interobserver agreement were performed, with statistical significance set at $p<0.01$.

Results: A total of 116 patients [53 bald patients (28 with EPDS and 25 controls) and 63 hairy patients (32 with EPDS and 31 controls)] were included in the study. Among EPDS bald patients, linear-curved vessels (unspecific distribution) (78.6%), orange structureless areas (diffuse) (46.4%), and yellow scales/crusts (focal) were the main findings, whereas focal yellow scales/crusts (84.4%) and the "peripheral horizontal hair" sign (84.4%) turned out to be the most common features in EPDS hairy patients. Comparative analysis revealed linear-curved vessels ($p<0.001$), orange structureless areas (diffuse) ($p<0.001$) and non-follicular pustules ($p=0.005$) to be distinctive features of EPDS in bald patients, while yellow scales/crusts (focal), non-follicular pustules and "peripheral horizontal hair" sign (horizontally arranged hair whose proximal part of the shaft is seen through a thinned epidermis at the edge of alopecic areas) were related ($p<0.001$) to EPDS in hairy patients. Interobserver agreement was excellent (Kappa=0.81–0.83).

Conclusion: Dermoscopy provides valuable diagnostic clues for EPDS, distinguishing it from other scalp disorders.

Keywords: alopecias, dermoscopy, diagnosis, differential diagnosis, hair disorders

Introduction

Erosive pustular dermatosis of the scalp (EPDS) is an uncommon inflammatory disorder affecting the scalp and typified by patches of hair loss along with erosions, thick yellow or yellow-brown crusts, superficial ulcers, and pustules. It progresses over months or years, eventually resulting in skin atrophy and scarring alopecia. Elderly individuals with a bald, sun-damaged scalp represent the most common involved population, yet instances affecting hairy subjects may also be seen.[1] EPDS can be difficult to diagnose, particularly in its early stages when the clinical presentation overlaps with other scalp disorders, such as scalp infections, bullous diseases, and cicatricial alopecias.[1] In this regard, dermoscopy has been proven to be a valuable diagnostic tool in assisting the recognition of various hair and scalp disorders by

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revealing specific clues, thus decreasing the number of cases needing biopsy.[2] However, data on dermoscopic features of EPDS is limited.[3,4]

The aim of the present retrospective observational multicentric study was to compare the dermoscopic findings of EPDS in bald and hairy patients with those of the main differential diagnoses in order to improve the non-invasive recognition of such a condition.

Materials and Methods

This was a multicentric observational retrospective analysis involving three dermatological centers from Italy (Udine, Bologna and Trieste). The study population consisted of two cohorts, ie, consecutive bald (I) and hairy (II) patients diagnosed with EPDS according to histological assessment; controls were also considered by selecting subjects (bald and hairy) with hair disorders for which EPDS was included into the clinical differential diagnosis. We included only cases where high-quality dermoscopic images of the affected area were available, specifically the region from which the biopsy sample was taken or the most clinically representative lesion. Images were captured at 10× magnification under polarized light in a dry setting, with the possible additional use of a fluid interface based on the physician's evaluation.

Histologically confirmed diagnosis of Erosive Pustular Dermatosis of the Scalp (EPDS) was needed for the enrollment. To ensure that treatment-related changes did not influence the findings, they must not have undergone systemic or topical treatment for scalp conditions in the three months preceding the dermoscopic evaluation. Additionally, complete clinical and demographic data, including age, sex, and medical history, had to be accessible. Only patients from one of the three participating dermatology centers—Udine, Bologna, or Trieste—who met all these criteria were included. Patients were excluded from the study if histopathological confirmation of EPDS was unavailable or if the dermoscopic images were of insufficient quality due to low resolution, poor focus, or non-standardized lighting conditions that could interfere with interpretation. Those who had used systemic or topical therapies, such as corticosteroids or immunosuppressants, within three months before the dermoscopic assessment were also excluded, as these treatments could alter the appearance of the skin and hair. Moreover, patients with coexisting scalp diseases, including autoimmune disorders like discoid lupus erythematosus or lichen planopilaris, as well as chronic infections affecting the scalp, were not considered eligible. Lastly, insufficient clinical data or incomplete patient records resulted in exclusion from the study.

Dermoscopic images were randomly evaluated by two independent experienced investigators (E.E. and N.P.), who assessed dermoscopic findings according to the International Dermoscopy Society criteria for non-neoplastic dermatoses[5] integrated with parameters proposed by Rudnicka et al for follicular findings.[6] Each feature was recorded and analyzed based on its prevalence in both EPDS and control groups. Comparative analyses were also performed separately for bald and hairy patient groups to assess any differences in dermoscopic features with controls. Interobserver agreement for EPDS cohorts was evaluated through Cohen's kappa coefficient, whereas Fisher's exact test with p-value set at 0.01 was used for comparative analyses. All statistical calculations were performed using Microsoft Excel, ensuring systematic data handling and accurate computation of values. Total duration of data collection was 6 months (January-June 2024).

Results

A total of 116 patients [53 bald patients (28 with EPDS and 25 controls) and 63 hairy patients (32 with EPDS and 31 controls)] were included in the study; mean age was 68 and 57 years for bald and hairy EPDS cases and 61 and 59 years for corresponding controls, respectively. In the control groups we included: 16 squamous cell carcinomas, six pemphigus vulgaris and three cicatricial pemphigoid (bald patients); 14 folliculitis decalvans, 11 discoid lupus erythematosus, five lichen planopilaris and two pityriasis amiantacea (hairy patients). For all instances, hand-held dermatoscope Dermlite DL5 (San Juan Capistrano, CA, United States) coupled with a high resolution camera or smartphone was employed.

Considering bald patients (Figure 1 and Table 1), the main dermoscopic features (prevalence greater than one-third) of EPDS turned out to be linear-curved vessels (unspecific distribution) (78.6%), orange structureless areas (diffuse) (46.4%), and yellow scales/crusts (focal) (39.3%); other relevant findings included white structureless areas (focal) (32.1%), non-follicular pustules (28.6%), and dotted, linear and linear with branches vessels (28.6–32.1%). Moving to hairy patients with EPDS (Figure 2 and Table 2), yellow scales/crusts (focal) and horizontally arranged hairs with the proximal part of the shaft being visible through a thinned epidermis at the edge of alopecic areas ("peripheral horizontal

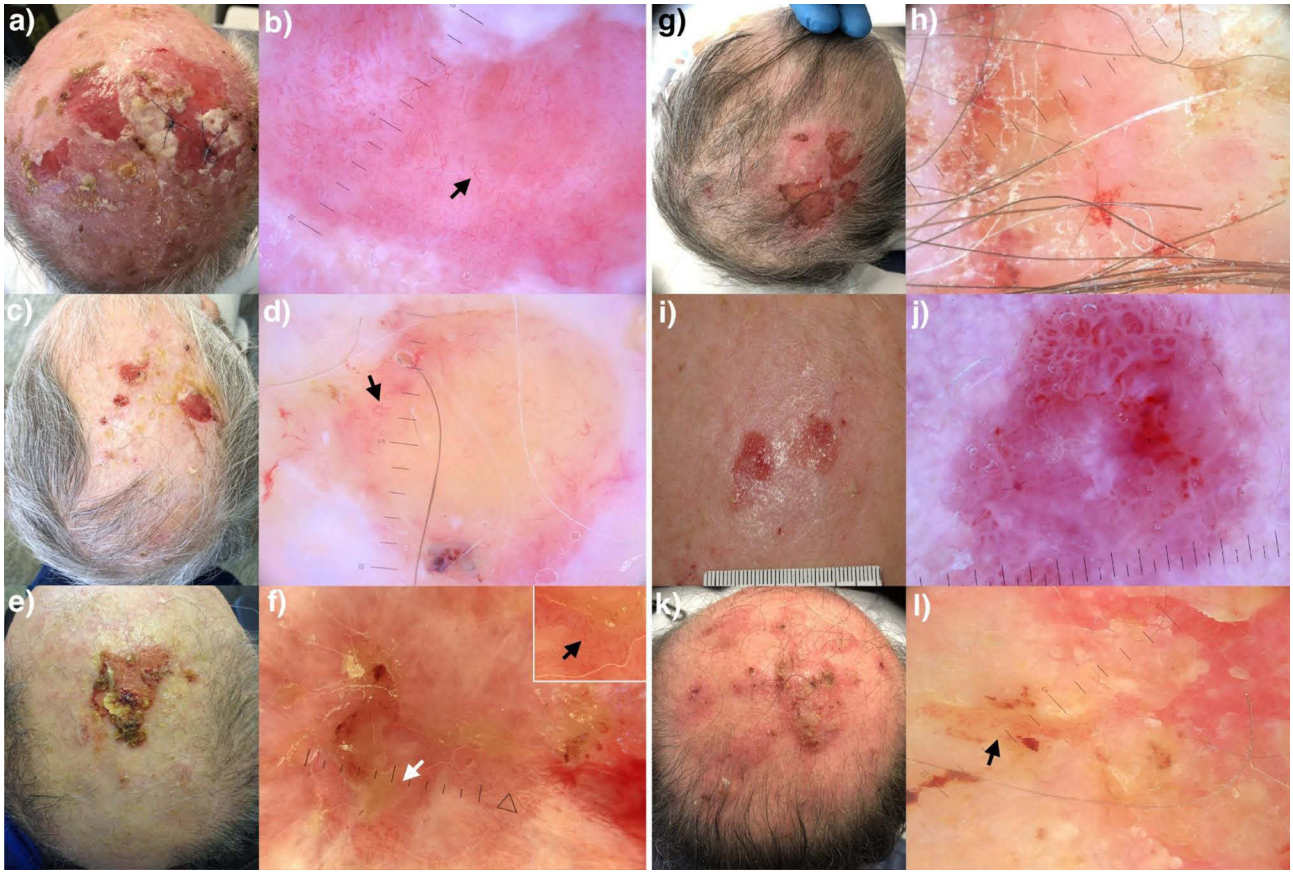

Figure 1 Clinical and dermoscopic features of erosive pustular dermatosis of the scalp in three bald patients (**a, c** and **e**) compared to three controls (**g, i** and **k**). (**a**) Extensive erosions, erythema and yellow-white scales/crusts are visible on clinical assessment; (**b**) Dermoscopy displays diffuse focused linear-curved (black arrow) and branched vessels. (**c**) Clinical examination shows erosions with erythema and prominent yellow crusts; (**d**) In-focus linear and linear-curved vessels (black arrow) surrounding an Orange structureless areas are visible on dermoscopic examination. (**e**) Clinically, one major erosion with pustules and sero-hematic crusts are evident on the vertex region of the scalp; (**f**) Dermoscopy shows linear-curved vessels (black arrow) and non-follicular pustules (white arrow). (**g**) Cicatricial pemphigoid: clinical image; (**h**) Dermoscopic evaluation shows white scales, sero-crusts and linear/dotted vessels. (**i**) Squamous cell carcinoma of the vertex: clinical image; (**j**) Dermoscopy displays dotted and linear-curved vessels along with perivascular white halos, ulcerations and structureless white areas. (**k**) Pemphigus of the scalp: clinical image; (**l**) Dermoscopic features include linear erosions (black arrow), white-yellow scales and sparse dotted vessels.

hair" sign) were the main dermoscopic features (both with a prevalence of 84.4%). Further common findings included linear vessels and linear vessels with branches (unspecific distribution) (56.3% and 40.6%, respectively), white structureless areas (focal) (53.1%), non-follicular pustules (40.6%), broken hairs (40.6%), and black dots (34.4%).

Table 1 Dermoscopic Findings of Included Instances of Erosive Pustular Dermatosis of the Scalp (EPDS) and Controls in Bald Patients, Along With Results of the Comparative Analysis

Dermoscopic Finding*	**EPDS (n = 28) (prevalence)**	**Controls (n = 25)** (prevalence)**	***P*-value*****
1. Vessels			
Linear-curved vessels (unspecific distribution)	22 (78.6%)	4 (16.0%)	**<0.001**
Dotted vessels (unspecific distribution)	8 (28.6%)	5 (20.0%)	0.536
Dotted vessels (cluster distribution)	3 (10.7%)	11 (44.0%)	0.011

(*Continued*)

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Table 1 (Continued).

Dermoscopic Finding*	EPDS (n = 28) (prevalence)	Controls (n = 25)** (prevalence)	*P*-value***
Linear vessels (unspecific distribution)	9 (32.1%)	10 (40.0%)	0.580
Linear vessels with branches (unspecific distribution)	8 (28.6%)	9 (36.0%)	0.769
2. Scales/crusts			
White scales (focal)	2 (7.1%)	6 (24.0%)	0.129
Yellow scales/crusts (focal)	11 (39.3%)	10 (40.0%)	1.000
Yellow scales/crusts (perifollicular)	2 (7.1%)	3 (12.0%)	0.658
3. Follicular findings			
Black dots	3 (10.7%)	4 (16.0%)	0.695
Broken hairs	4 (14.3%)	4 (16.0%)	1.000
4. Other structures			
Orange structureless areas (focal)	8 (28.6%)	1 (4.0%)	0.026
Orange structureless areas (diffuse)	13 (46.4%)	0 (0.0%)	**<0.001**
White structureless areas (focal)	9 (32.1%)	5 (20.0%)	0.365
Purple (haemorrhagic) structureless areas (focal)	3 (10.7%)	6 (24.0%)	0.276
White lines	4 (14.3%)	5 (20.0%)	0.720
Purple (haemorrhagic) dots	2 (7.1%)	4 (16.0%)	0.404
5. Clues			
Linear erosions	0 (0.0%)	6 (24.0%)	0.024
Non-follicular pustules	8 (28.6%)	0 (0.0%)	**0.005**

Notes: *Analysis performed according to the International Dermoscopy Society criteria for non-neoplastic dermatoses (Errichetti E, et al. *Br J Dermatol* 2020;182:454–67) integrated with parameters proposed by Rudnicka L, et al (Atlas of Trichoscopy: Dermoscopy in Hair and Scalp Diseases; Springer 2012) for follicular findings; **16 squamous cell carcinomas, six pemphigus vulgaris and three cicatricial pemphigoid; ***$p<0.01$ deemed as statistically significant. Values in bold indicate findings with statistical significance.

Turning to the comparative analyses, we found the following findings to be statistically more common in EPDS compared to controls in bald patients (Table 1): linear-curved vessels ($p<0.001$), orange structureless areas (diffuse) ($p<0.001$), and non-follicular pustules ($p=0.005$). Notably, this last feature was more frequent in EPDS affecting hairy patients compared to controls ($p<0.001$), along with yellow scales/crusts (focal), and "peripheral horizontal hair" sign ($p<0.001$ for both of them). On the other hand, perifollicular white scales ($p=0.003$) and follicular plugs ($p<0.001$) were more common in the control group. For further analytical details see Table 2.

In terms of inter-observer concordance about dermoscopic findings in EPDS, we found significant agreement between evaluators, with Kappa values being 0.81 and 0.83 for bald and hairy cohorts, respectively.

Discussion

Our study underlines that dermoscopy may be of help in assisting the recognition of EPDS in both bald and hairy patients. In particular, the diagnostic clues in the former population included linear-curved vessels, orange structureless areas (diffuse), and non-follicular pustules. The first two features were already reported as common findings in bald

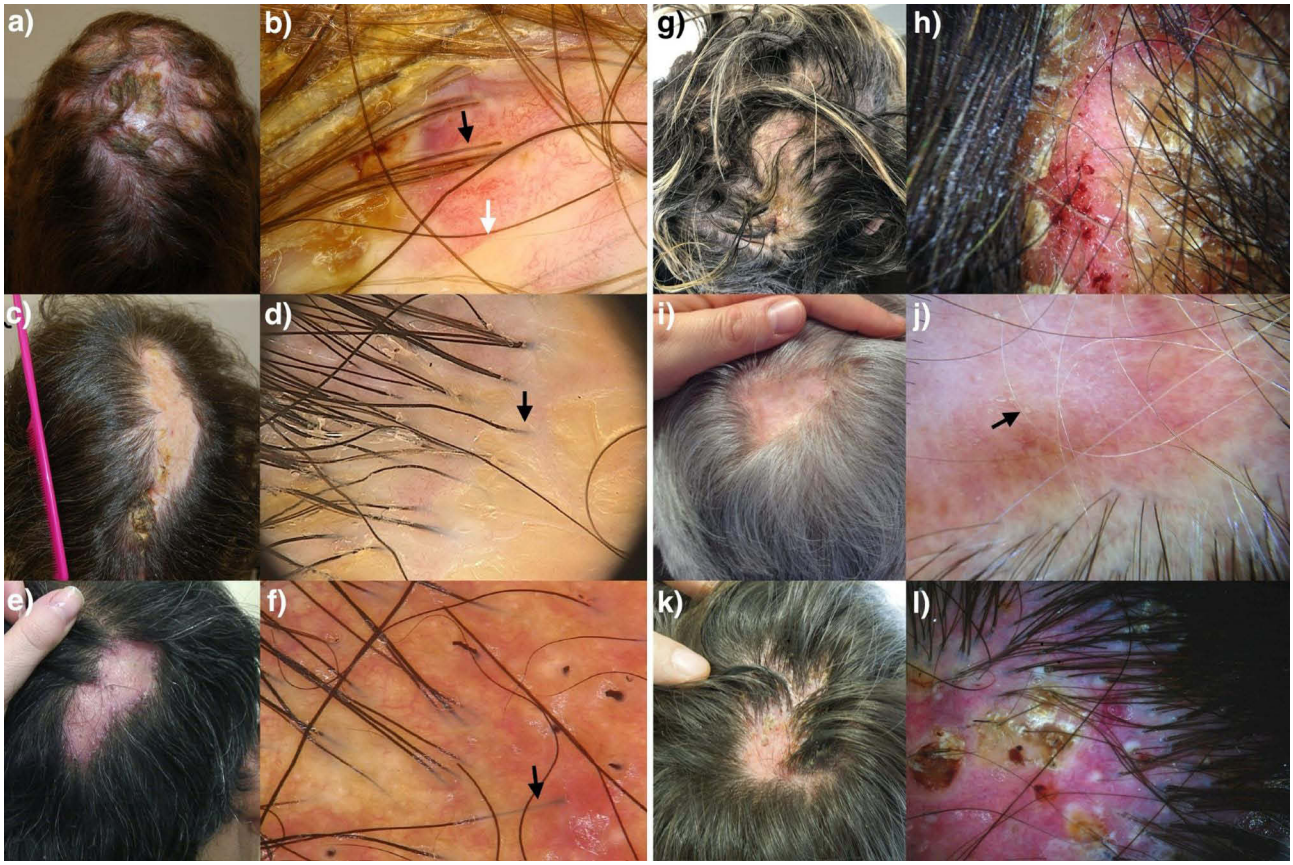

Figure 2 Clinical and dermoscopic features of erosive pustular dermatosis of the scalp in three hairy patients (**a, c** and **e**) compared to three controls (**g, i** and **k**). (**a**) Erythema with extensive crusting and erosion with alopecia in affected areas on clinical examination; (**b**) Dermoscopy displays "peripheral horizontal hair" sign (visible hair shafts through the thinned epidermis) (black arrow), yellow scales/crusts, non-follicular pustules (white arrow) and linear-curved/branched vessels. (**c**) Clinically, crusting and erosion are present with initial sclero-atrophy; (**d**) Dermoscopy shows white/yellow scales, dilated vessel and "peripheral horizontal hair" sign (black arrow). (**e**) Clinical image with alopecia patches; (**f**) "Peripheral horizontal hair" sign (black arrow) along with linear-curved/branched vessels on an erythematous background are evident on dermoscopic examination. (**g**) Pityriasis amiantacea: clinical image shows thick adherent asbestos-like scales encasing hair shafts with underlying scalp erythema; (**h**) Dermoscopic features include thick yellowish-white scales, enveloping hair shafts, and focal scalp erythema. (**i**) Discoid lupus erythematosus of the scalp: clinical picture; (**j**) trichoscopy reveals white scarring areas, lack of hair, and peripheral brownish pigmentation. (**k**) Folliculitis decalvans: yellow crusting and patches of alopecia of the vertex on clinical assessment; (**l**) Dermoscopy shows tufted hairs, perifollicular pustules, yellowish perifollicular scaling and a prominent erythematous background with polymorphic vessels.

patients with EPDS histologically typified by lymphoplasmacellular infiltrate in a small case-series published by some of the authors of this study.[4] Interestingly, orange structureless areas were thought to be related to either a compact cellular infiltrate in the dermis ("mass effect") or dermal hemosiderin deposits.[5,7] Of note, similarly to Zoon's balanitis, the

Table 2 Dermoscopic Findings of Included Instances of Erosive Pustular Dermatosis of the Scalp (EPDS) and Controls in Hairy Patients, Along With Results of the Comparative Analysis

Dermoscopic Finding*	**EPDS (n = 32) (prevalence)**	**Controls (n = 31)** (prevalence)**	***P*-value*****
1. Vessels			
Linear-curved vessels (unspecific distribution)	7 (21.9%)	11 (35.5%)	0.274
Dotted vessels (unspecific distribution)	6 (18.8%)	5 (16.1%)	1.000
Linear vessels (unspecific distribution)	13 (40.6%)	16 (51.6%)	0.453
Linear vessels with branches (unspecific distribution)	18 (56.3%)	25 (80.6%)	0.058

(*Continued*)

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Table 2 (Continued).

Dermoscopic Finding*	EPDS (n = 32) (prevalence)	Controls (n = 31)** (prevalence)	*P*-value***
2. Scales/crusts			
White scales (focal)	5 (15.6%)	11 (35.5%)	0.088
White scales (perifollicular)	4 (12.5%)	15 (48.4%)	**0.003**
Yellow scales/crusts (focal)	27 (84.4%)	11 (35.5%)	**<0.001**
Yellow scales/crusts (perifollicular)	5 (15.6%)	12 (38.7%)	0.050
3. Follicular findings			
Follicular plugs	0 (0.0%)	12 (38.7%)	**<0.001**
Black dots	11 (34.4%)	5 (16.1%)	0.148
Broken hairs	13 (40.6%)	6 (19.3%)	0.099
Perifollicular pustules	4 (12.5%)	10 (32.3%)	0.075
4. Other structures			
Orange structureless areas (focal)	4 (12.5%)	0 (0.0%)	0.113
Orange structureless areas (diffuse)	0 (0.0%)	0 (0.0%)	1.000
White structureless areas (focal)	17 (53.1%)	21 (67.7%)	0.306
Purple (haemorrhagic) structureless areas (focal)	6 (18.8%)	4 (12.9%)	0.732
White structureless areas (diffuse)	11 (34.4%)	7 (22.6%)	0.405
White lines	5 (15.6%)	6 (19.3%)	0.750
Purple (haemorrhagic) dots	5 (15.6%)	3 (9.7%)	0.708
5. Clues			
Non-follicular pustules	13 (40.6%)	0 (0.0%)	**<0.001**
"Peripheral horizontal hair" sign****	27 (84.4%)	3 (9.7%)	**<0.001**

Notes: *Analysis performed according to the International Dermoscopy Society criteria for non-neoplastic dermatoses (Errichetti E, et al. *Br J Dermatol* 2020;182:454–67) integrated with parameters proposed by Rudnicka L, et al (Atlas of Trichoscopy: Dermoscopy in Hair and Scalp Diseases; Springer 2012) for follicular findings; **14 folliculitis decalvans, 11 discoid lupus erythematosus, five lichen planopilaris and two pityriasis amiantacea; ***$p<0.01$ deemed as statistically significant; ****Horizontally arranged hair whose proximal part of the shaft is seen through a thinned epidermis at the edge of alopecic areas. Values in bold indicate findings with statistical significance.

presence of linear-curved vessels has been described as a possible dermoscopic clue of lymphoplasmacellular EPDS in bald population, in line with our results.[4] This association is explained by the histological background as EPDS is characterized by atrophic epidermis, thus allowing the visualization of enlarged dermal vessels.[3,7] Importantly, in our study we did not perform a dermoscopic-pathological correlation analysis, thereby preventing us to establish a possible correlation between the aforementioned dermoscopic findings and the type of cellular infiltrate.

More recently, Gupta et al described a rare case of Erlotinib-induced EPDS, highlighting trichoscopic findings that further expand the spectrum of EPDS presentations.[8] While our study focuses on spontaneous EPDS cases, the inclusion of drug-induced variants in future analyses may provide a broader understanding of its dermoscopic variations and pathophysiological mechanisms. These insights emphasize the need for further prospective studies, particularly integrating trichoscopy with histopathological correlation, to refine diagnostic accuracy and guide clinical management.

Another relevant feature emerging from our study was the association between non-follicular pustules resulting from the neutrophilic infiltration of the epidermis/upper dermis and EPDS in both bald and hairy patients. Besides such a dermoscopic clue, other typical findings of EPDS found in our hairy population included non-follicular focal yellow scales/crusts due to the drying of pustules as well as the presence of horizontally arranged hairs with proximal part of the shaft being visible through a thinned epidermis at the edge of alopecic areas ("peripheral horizontal hair" sign). According to our comparative analysis, the latter clue is indicative of EPDS in hairy patients as it was not seen in the main differential diagnoses. This is consistent with a case-series including 20 instances reported by some of the authors of the present analysis that found bulbs of the hair follicles visible through the thinned skin to be one of the most common dermoscopic findings of EPDS in hairy subjects.[3] From a dermoscopic-pathological correlation point of view, it is possible that "peripheral horizontal hair" sign is due to the remarkable dermal fibrosis typical of EPDS that may give rise to displacement of the hair roots towards the atrophic skin surface at the periphery of the alopecic patches.[3,7] Notably, unlike our analysis, perifollicular yellow crusts turned out to be the most frequent scaling/crusting pattern in the previous study.[3] Additionally, we also observed non-follicular pustules to be another distinctive feature of EPDS, while they were not reported in the prior analysis. It is likely that such differences might be due to the selection of lesions in different stages of development.

Limitations

The main limitations of the study include (I) the retrospective design, which is prone to recall and observation biases, that were addressed by involving evaluators who did not contribute to the sample collection; (II) the lack of dermoscopic-pathological correlation analysis; and (III) the potential variability introduced by having multiple investigators collecting the images at different centers, yet the use of the same dermoscopic device reduced the relevance of such a bias. Therefore, future studies addressing such points are needed to confirm our preliminary data.

Conclusions

This study highlights the diagnostic value of dermoscopy in EPDS, providing distinctive dermoscopic features that help differentiate EPDS from other scalp conditions. In bald patients, the most characteristic findings included linear-curved vessels, diffuse orange structureless areas, and non-follicular pustules. In hairy patients, EPDS was associated with focal yellow scales/crusts, non-follicular pustules, and the "peripheral horizontal hair" sign. The identification of these dermoscopic clues may assist dermatologists in reducing diagnostic uncertainty and potentially decreasing the need for invasive biopsies in suspected cases of EPDS.

Data Sharing Statement

All the data of the study is included in the present manuscript.

Compliance with Ethics Guidelines

The patients in this manuscript provided informed consent for the publication of case details, and institutional approval was not required, as the study was based on data retrospectively collected in a routine clinical setting, consistently with AIFA (Italian Medicines Agency) regulation (AIFA Determination, March 20, 2008). This study complies with the Declaration of Helsinki and no ethical approval was required as it results from clinical routinary activity. Accessed data for the study complied with relevant data protection and privacy regulations.

Consent to Publication Form

Consent to publication form has been signed by the patients included in this study.

Author Contributions

All authors made a significant contribution to the work reported (ie, conception, study design, execution, acquisition of data, analysis, and interpretation); took part in drafting, revising, or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work. Michela Starace and Enzo Errichetti are qualified as last author.

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Disclosure

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