**ORIGINAL ARTICLE**

# Dermoscopic Findings and the Clinicopathologic Correlation of Pigmented Purpuric Dermatosis: A Retrospective Review of 60 Cases

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**Background:** Pigmented purpuric dermatosis (PPD) is known as a chronic recurrent eruption which usually presents with petechiae and pigmented macules on the lower extremities. Dermoscopy is a noninvasive diagnostic tool in identifying pigmented and vascular lesions, which can also be beneficial in the evaluation of PPD. **Objective:** We aimed to analyze the common dermoscopic characteristics of PPD, and correlate those findings with the histopathologic features. Additionally, dermoscopic and pathological findings in this study population were compared with other similar studies from the literature review. **Methods:** A retrospective analysis was performed using data of 60 patients who were diagnosed as PPD by skin biopsy and had dermoscopic examination. The pathologic analysis was performed by categorizing the pattern into lichenoid, perivascular, interface, and spongiotic subtype, and the dermoscopic assessment was performed by the three authors independently. **Results:** In dermoscopy, 96.7% of the patients showed red globules and dots, followed by brownish patch, coppery-red pigmentation, and annular comma-like vessels. The pathologic pattern analysis revealed statistically significant association of lichenoid pattern with coppery red pigmentation, perivascular pattern with annular/comma-like vessels, and spongiosis pattern with reticular pigmented network and linear vessels. The interrater similarity test showed total kappa value of 0.811 which referred to "very good". **Conclusion:** In this study, the prevalence of dermoscopic features in Asian PPD patients was identified, which was similar with previous studies. The dermoscopic-pathologic correlation was found in four dermoscopic features. We suggest that dermoscopic examination is helpful in clinical diagnosis and pathological prediction of PPD. **(Ann Dermatol 33(3) 214~221, 2021)**

**-Keywords-**
Dermoscopy, Pathology, clinical, Pigmentation disorders, Pigmented purpuric dermatosis, Skin diseases, vascular

## INTRODUCTION

Pigmented purpuric dermatoses (PPD) is a group of dermatoses presenting petechiae, pigmentation and occasional telangiectasia. It is usually found on the patient's lower limbs and characteristically shows a benign prognosis, yet the lesions tend to relapse having wax-and-wane features. It is noted that PPD is subdivided into five categories; progressive pigmentary dermatosis (Schamberg disease), Purpura annularis telangiectodes (Majocchi purpura), pigmented purpuric lichenoid dermatosis of Gourgerot and Blum, eczematid like purpura of Doucas and Kapetanakis, and lichen aureus[1,2]. Depending on the results of a physical examination and noted symptoms of the lesion, whether it has lichenoid papules, annular plaques, pinpoint petechiae, red brown macules or scales, the subtypes are able to be determined clinically[1-3]. Despite the clinical difference, they share the common histopathologic features of a su-

perficial lymphocytic infiltration, erythrocyte extravasation and hemosiderin deposition.

To begin with, dermoscopy is a noninvasive technique to improve the incidence of diagnostic accuracy in identifying pigmented or vascular lesions in patients. With the polarized and non-polarized images that render the corneal layer of skin translucent and magnify the lesions, we can visualize the specific morphological features through the use of dermoscopy[4,5]. Notably, it is widely used as assistive diagnosic tool in PPD, and Ozkaya et al.[4] first reported the prevalence of specific dermoscopic findings in 32 patients diagnosed as PPD. There have been a few studies about dermoscopic examination of PPD patients, or dermoscopic-pathologic correlation of PPD. Herein, we investigated the common dermoscopic characteristics of PPD in an Asian population, and assessed the correlation of those findings with the histopathologic features and patterns of PPD.

## MATERIALS AND METHODS

### Study population

This study included patients who were diagnosed as PPD in Korea University Medical Center (Anam, Guro, and Ansan Hospital) between January 2013 and December 2019. Among total 95 clinically diagnosed PPD patients, we first excluded six patients who did not receive skin biopsy. Also, according to the histologic criteria of PPD—superficial lymphocytic infiltration, erythrocyte extravasation, and hemosiderin deposition—seven patients who were pathologically confirmed as other diseases such as leukocytoclastic vasculitis or nummular eczema[1-3]. Patients who did not have clear dermoscopic image records were also excluded, and finally 60 patients met the criteria, and underwent the pathologic and dermoscopic evaluation. The flowchart of study following the inclusion and exclusion criteria is described in Supplementary Fig. 1.

### Clinical data

Here, the clinical details were obtained from the patient's medical records including age, sex, clinical presentation, distribution, clinical subtypes and concomitant diseases such as hypertension, diabetes, or autoimmune disease.

### Dermoscopic examination

The dermosopic images of each lesion were taken using a dermoscopy (DermLite FotoII pro; 3Gen Inc., San Juan Capistrano, CA, USA and Derma 9500S-GR; Derma Medical Inc., Yokohama, Japan) adopted on a digital camera (Canon EOS 750D, Canon G15; Canon, Tokyo, Japan). The images were reviewed by the three authors indepen-

dently. According to a review of articles of dermoscopic examination of PPD, the reviewers assessed both polarized and nonpolarized images, and checked the key features of each patient (Supplementary Table 1).

### Pathological analysis

The glass slides were reviewed by the three authors together. The pathological features were categorized into four types—spongiotic, interface, lichenoid, and perivascular pattern—according to the main inflammation. In this context, the definition of each pattern was based on the previous review of Huang et al.[6] about pathological spectrum of PPD; spongiotic pattern, spongiosis without the inflammation of other patterns; interface pattern, basal vacuolization and dyskeratotic keratinocytes but no band-like infiltration in upper dermis; lichenoid pattern, dense band-like lymphocyte infiltration in papillary dermis; and perivascular pattern, limited perivascular infiltration without any of other inflammations.

### Statistical analysis

The demographic data, clinical subtypes, dermoscopic and pathologic features were estimated as descriptive statistics. Additionally, the inter-rater agreement and reliability analysis were calculated using a Fleiss kappa analysis. The relationship of the dermosopic and pathologic features was analyzed with the use of a chi-squared test and Cochran–Armitage trend test. This Cochran–Armitage Trend test, assessing the trends in binomial proportions across the levels of a single variable, was conducted to evaluate the positive tendency in two axis—the dermoscopic features and corresponding pathologic patterns. We performed a statistical analysis using IBM SPSS statistics ver. 25.0 (IBM Corp., Armonk, NY, USA) and R 3.6.2 (R Foundation for Statistical Computing, Vienna, Austria).

### Ethical approval

The procedures of clinical photograph, dermoscopic examination and skin biopsy had been performed after informed consent of the patients, and were conducted in accordance with the Helsinki Declaration. This study was approved by the Institutional Review Boards (IRB) in Korea University Ansan Hospital (IRB no. 2020AS0194). We received the patient's consent form about publishing all photographic materials.

## RESULTS

### Clinical and demographic data

A total of 60 patients were involved in this study. Notably, 28 (46.7%) of the patients were female, and 32 (53.3%) of

them were male. The ages of the patients ranged between 16 and 90 years (mean±standard deviation [SD], 53.55± 19.37 years). In this study, 86.7% of the patients had bilateral distribution, and lower extremities were most commonly involved. Almost half of the patients (48.3%) had underlying diseases such as hypertension, diabetes mellitus, hyperlipidemia, or cerebral infarction. None of the patients had concomitant rheumatoid or autoimmune disease, nor had the onset of PPD after the initiation of the disease or medication (Supplementary Table 2).

Forty (66.7%) of the patients had Schamberg disease, 9 had Majocchi purpura, 6 had lichen aureus, 4 had pigmented purpuric lichenoid dermatosis of Gougerot and Blum, and one had eczematid-like purpura (Supplementary Table 2, Fig. 1).

## Dermoscopic and histopathological features

In what follows, a dermoscopic examination revealed coppery red pigmentation, red globules and dots, red patch, brown dots, brownish patch, lentigine-like reticular pigmented network, linear vessels and annular/comma-like vessels (Fig. 2, 3). Here, it was noted that the most com-
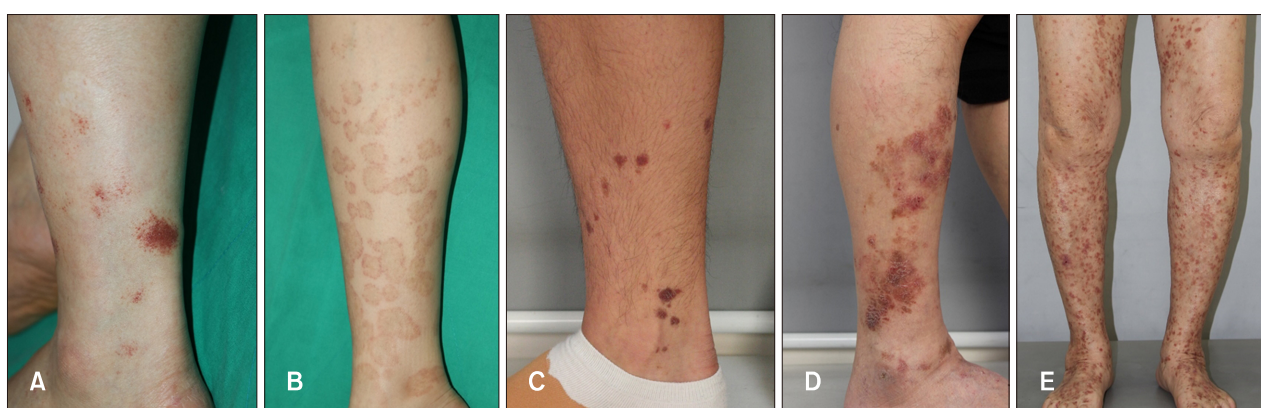


**Fig. 1.** Clinical presentation and subtypes of pigmented purpuric dermatosis (PPD). The most commonly observed clinical subtype of PPD was Schamberg disease (A), showing cayenne-pepper like pigmentation. (B) Majocchi purpura has peripheral light erythematous-brown patches with peripheral extension. (C) Lichen aureus shows multiple lichenoid papules. (D) PPD of Gougerot−Blum shows lichenoid papules and plaques of erythematous-brown pigmentation. In patients with eczematid-like purpura of Doucas-Kapetanakis (E), pruritic eczematous patches are observed.
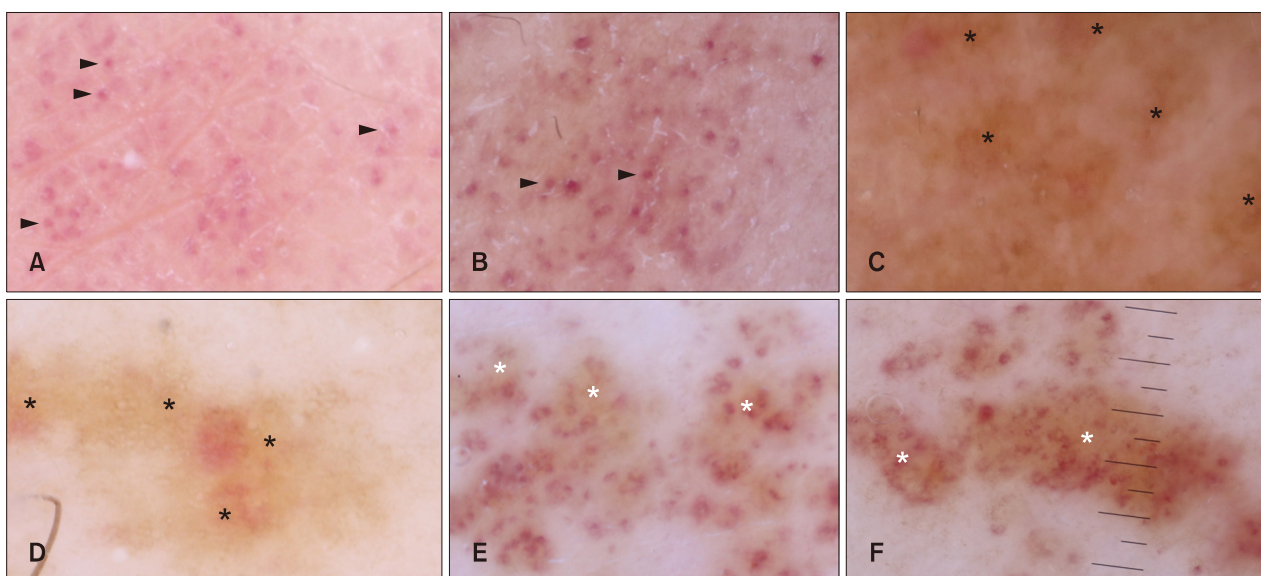


**Fig. 2.** Three most common dermoscopic features of pigmented purpuric dermatosis. Red globules and dots (black arrowheads) were most prevalently observed as (A) and (B). Brownish patches (black asterisks) were seen as (C) and (D). Coppery red pigmentation (white asterisks) revealed as bright orange-brown colored patches in the polarized images as such in (E) and (F).
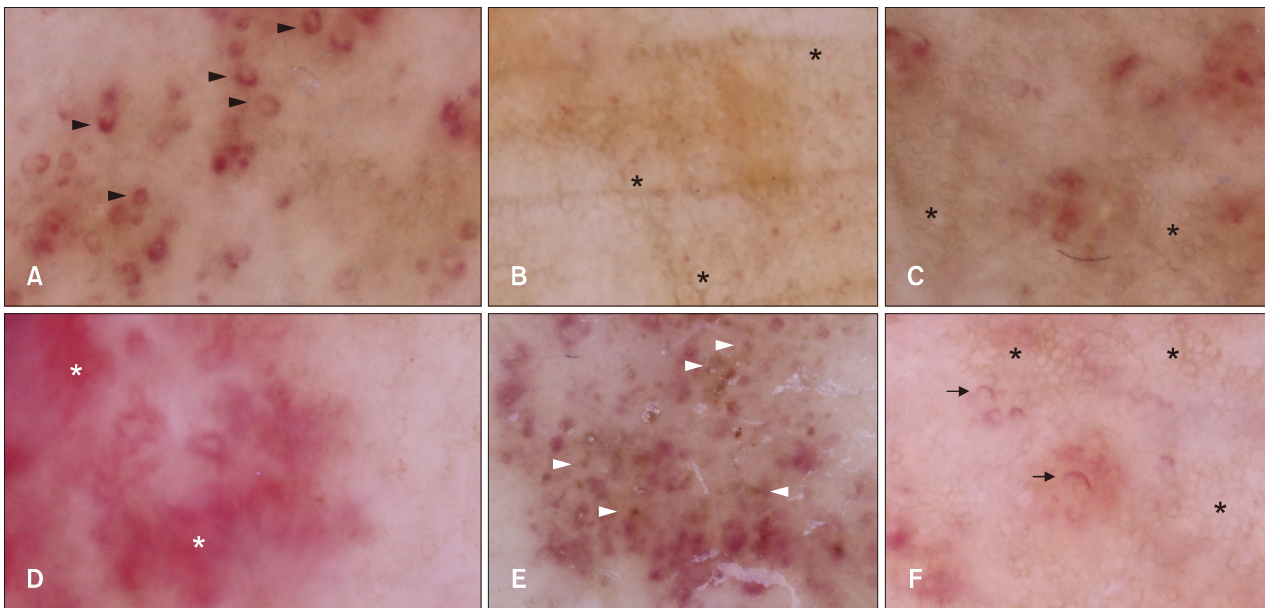
**Fig. 3.** Other main dermoscopic features of pigmented purpuric dermatosis. Annular vessels and comma-like vessels (black arrowheads) were observed as (A), and some linear vessels (black arrows) were also seen as (F). Distinguished from brownish patch or coppery red pigmentation, there were reticular brownish networks (black asterisks) as such in (B), (C), and (F), resembling the dermoscopic image of solar lentigines. Red patches (white asterisks) and brown dots (white arrowheads) were also noted as (D) and (E).

mon feature were red globules and dots (96.7%), followed by brownish patch (68.3%), coppery red pigmentation (66.7%), annular/comma-like vessels (51.7%) and reticular pigmented network (51.7%) (Table 1).

Each of the dermoscopic images were examined by three reviewers independently, and a Fleiss kappa analysis were performed to assess inter-rater similarity. Hence, the total kappa value was 0.811, which is interpreted as 'very good', and kappa value of each dermoscopic features are between the range of 0.663~0.821, which means 'good' to 'very good' reliability. Notably, reviewer 1 and 3 had identical results of red dots and globules, and for that reason the kappa value calculation was not possible to achieve at that time (Table 1).

Upon review, the pathologic analysis showed 24 (40.0%) patients of lichenoid pattern, 19 (31.7%) perivascular, 9 (15.0%) interface and 8 (13.3%) spongiosis pattern (Fig. 4). The incidence of the erythrocyte extravasation and epidermal change were the most commonly observed histologic findings (Supplementary Table 3).

### Dermoscopic-pathologic correlation

The prevalence of dermoscopic findings were categorized according to the pathological pattern (Table 2). We perfomed chi-squared test in each pairs of the dermoscopic feature and the pathologic pattern, and found four statistically significant correlation. Coppery red pigmentation and annular comma-like vessels were associated with lichen-

**Table 1.** Main dermoscopic features in pigmented purpuric dermatosis and Fleiss kappa analysis to assess interrater similarity

| Dermoscopic features | Percentage (%) | Interrater similarity kappa |
|---|---|---|
| Red globules/dots | 58 (96.7) | - |
| Brownish patches | 41 (68.3) | 0.663 |
| Coppery red pigmentation | 40 (66.7) | 0.688 |
| Annular and comma-like vessels | 31 (51.7) | 0.821 |
| Lentigine-like reticular pigmented network | 31 (51.7) | 0.699 |
| Red patches | 28 (46.7) | 0.800 |
| Brown dots | 8 (13.3) | 0.691 |
| Linear vessels | 7 (11.7) | 0.677 |
| Total | 60 (100) | 0.811 |

The most common finding was red globules and dots, followed by brownish patches, coppery red pigmentation, annular comma-like vessels and reticular pigmented network. The interrater similarity kappa value was ranged from 0.663 to 0.821, which means 'good'~'very good', and total kappa value was calculated as 0.811 which shows very good reliability of dermoscopic examination. For 'red globules and dots', it was impossible to calculate the kappa value because two of the three evaluators showed identical results.

oid and perivascular pattern respectively ($p = 0.025$ and $p = 0.008$). Spongiosis pattern was related with lentigine-like reticular pigmented network and linear vessels ($p = 0.003$ and $p = 0.015$, respectively). Additional Cochran–Armit-
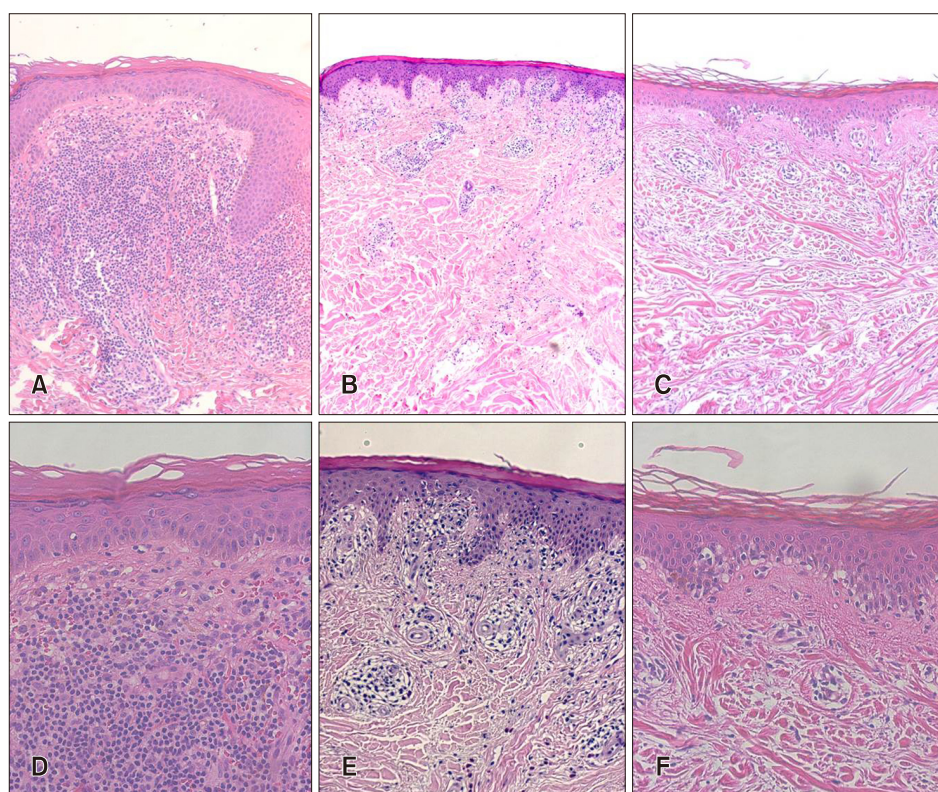
**Fig. 4.** Histopathologic images of the lichenoid, perivascular, and interface pattern patients. (A, D) In lichenoid pattern, there were dense band like lichenoid infiltration of lymphocytes in the upper dermis. Epidermal change of focal hyperkeratosis, erythrocyte extravasation, lymphocyte exocytosis and hemosiderin deposition was identified. (B, E) Perivascular pattern showed focal vacuolization in the basal layer, erythrocyte extravasation, lymphocyte exocytosis. Perivascular lymphocyte infiltration in the papillary dermis was also identified. (C, F) There was significant basal layer vacuolization with focal basal/dermal pigmentation and dyskeratotic keratinocytes in interface pattern patient. H&E, ×40 (A~C); ×200 (D~F) magnification images.

**Table 2.** Dermoscopic features according to the pathologic pattern

| Dermoscopic feature | Pathologic pattern | | | | | | | | Total (n=60) |
|---|---|---|---|---|---|---|---|---|---|
| | Lichenoid | | Perivascular | | Interface | | Spongiosis | | |
| | n=24 | $\chi^2$ test (p) | n=19 | $\chi^2$ test (p) | n=9 | $\chi^2$ test (p) | n=8 | $\chi^2$ test (p) | |
| Red globules/dots | 22 | 0.078 | 19 | 0.328 | 9 | 0.546 | 8 | 0.573 | 58 |
| Brownish patches | 16 | 0.821 | 13 | 0.992 | 5 | 0.371 | 7 | 0.211 | 41 |
| Coppery red pigmentation | 20 | 0.025* | 10 | 0.116 | 7 | 0.443 | 3 | 0.061 | 40 |
| Annular and comma-like vessels | 15 | 0.170 | 5 | 0.008* | 6 | 0.329 | 5 | 0.510 | 31 |
| Lentigine-like reticular pigmented network | 12 | 0.833 | 7 | 0.118 | 4 | 0.638 | 8 | 0.003* | 31 |
| Red patches | 13 | 0.342 | 9 | 0.941 | 3 | 0.385 | 3 | 0.577 | 28 |
| Brown dots | 4 | 0.535 | 3 | 0.703 | 0 | 0.202 | 1 | 0.941 | 8 |
| Linear vessels | 2 | 0.511 | 1 | 0.293 | 1 | 0.955 | 3 | 0.015* | 7 |

Values are presented as number only. The prevalence of dermoscopic features according to each pathological patterns are described in the table. The $\chi^2$ test was performed in each pairs of the dermoscopic feature and the pathologic pattern, in order to figure out the association of two variables. Statistically significant association was identified in coppery red pigmentation and lichenoid pattern, annular/comma-like vessels and perivascular pattern respectively. Also, reticular pigmented network and linear vessels were related with spongiosis pattern. *The association with statistical significance ($p<0.05$) are indicated in the table with asterisk.

age trend test also showed statistical significance with $p$-value below 0.05 in all pairs.

## DISCUSSION

Generally speaking, PPD is characterized as a chronic relapsing cutaneous disorder with petechiae, pigmented macules and patches. It is more frequent in male patients, while Majocchi purpura is more commonly seen in females[1-3]. Consistently, it is noted that in this study, the results supported that it had 53.5% male patients with female predominance only in Majocchi disease (8/9, 88.9%).

The mean age in the subjects of the study was 53.5 years old (SD = 19.37 years), and most of the cases were presented on the subject's lower extremities. The etiology of PPD is still much unknown, but venous hypertension, gravitational dependency, exercise, capillary fragility, alcohol ingestion, and focal infection were reported as highly likely to be potential causal or aggravating factors in PPD[7-10]. Some drugs had been suspected to occur with PPD, such as acetaminophen, aspirin, adalin, glipizide and hydralazine[11-22]. In fact, 48.3% of the subjects in this study had concomitant disease such as hypertension, diabetes mellitus, hyperlipidemia and cerebral infarction, but none of them reported that their medication was changed or started at the onset of the symptom.

We performed a literature review through the PubMed directory resource regarding the dermoscopic findings and pathologic review of PPD. Through this lens, Ozkaya et al.[4] investigated the prevalence of specific dermoscopic findings in 32 patients diagnosed as PPD. In that case, the coppery red pigmentation was most frequently seen (97%), followed by red globules and dots, brown dots, and a reticular network. Another study of 25 PPD patients by Metin and Elmas[23] also identified a common dermoscopic feature; red globules and dots (100%), coppery brown background (72%), light brown background and reticular brown lines. Finally, a case-series study of PPD patients reported by Çakmak et al.[24] listed dermoscopic findings of 18 patients; with characteristic brownish diffuse coloration of background, round red dots, globules and patches, linear vessels, and twisted red loops.

Based on these well-documented studies, the main eight dermoscopic features were listed up in the present study (Supplementary Table 1). The prevalence of each finding in the previous articles were similar with our study. Most commonly found findings were red globules and dots, brownish patches and coppery red pigmentation. Coppery red pigmentation was able to discriminate from brownish patches in that it showed bright orange-brown color when polarized (Fig. 2). Notably, annular/comma-like vessels were more frequently seen in our study population (51.7%), compared with other studies which described that as twisted red loops, red circles and serpentine vessels[4,5,23-25]. We suggest that it was much easier to discriminate such vascular features from the diffuse red and brown patches in this study, attributing to high resolution image and polarization. The lentigine-like reticular pigmented network were also observed in the half of the PPD patients, usually in company with red and brownish patches. Brownish dots and linear vessels were noted in some patients (Fig. 3).

The Huang et al.[6] study had reviewed pathologic features of 107 PPD cases and categorized them into five patho-logic patterns - lichenoid, perivascular, interface, spongiosis and granulomatous pattern. Since they assessed the clinic-pathologic correlation of PPD, we adopted the same classification of the pathologic patterns. However, none of the patients in our study showed the presence of granuloma in the filtration so that we categorized the patients into four patterns[6,26]. The lichenoid pattern were most commonly seen with a dense band-like lichenoid lymphocyte infiltration in the upper dermis (Fig. 4). The perivascular pattern consisted about one third of the patients, and showed perivascular lymphocyte infiltration with or without focal vacuolization in the basal layer (Fig. 4). Compared with other two patterns, the interface and spongiosis pattern were less common, showing basal vacuolization with dyskeratotic keratinocytes and spongiosis respectively without other inflammation or band like infiltrations (Fig. 4). The detailed pathologic findings showed consistent results of prevalent epidermal change, erythrocyte extravasation and basal/subpeidermal vacuoles (Supplementary Table 3).

Some dermoscopic features were shown to have statistically significant associations with the pathological patterns. Also, all of those associations showed positive trend in Cochrane−Armitage trend test ($p < 0.05$), which referred that the presence of dermosopic finding was related with corresponding pathologic pattern. Coppery red pigmentation was correlated with lichenoid pattern and annular/comma-like vessels was correlated with perivascular pattern. Reticular pigmented network and linear vessels had statistical association with spongiosis pattern. We suggest that capillaritis accompanying dense lymphocytic infiltration, which is lichenoid pattern, resulted in prominent erythrocyte and hemosiderin deposition in upper dermis, thus identified as orange brown color[4,27]. Yet, to our knowledge, the dermoscopic interpretation of benign lesions regarding to the pathologic findings had not been much studied. Further research is still necessary to fully explain other statistical association between dermoscopic and pathologic features. Additionally, this study has novelty in that the inter-rater similarity appeared to be 'very good', proposing that the dermosopic examination in PPD would be reliable and reproducible diagnostic method.

As a limitation of this study, first, the study subjects were limited to an Asian population demographic. Compared to previous studies, a larger population was enrolled, but there may be bias in this statistical analysis due to the small group size in some uncommon pathologic patterns or clinical subtypes. Secondly, all patients had hematoxylin-eosin stain as a standard, but there was a lack of interpretation due to the lack of special staining to clearly see hemosiderin deposition or dermal fibrosis. Finally, it was

retrospective study and the progress was not documented objectively and regularly. Further study of correlating the dermoscopic findings with the treatment outcome and prognosis would be necessary to compensate the shortcomings of this study.

In conclusion, this study described and analyzed the dermoscopic features of PPD in an Asian population, and assessed an identified pathologic pattern with detailed findings. In this scheme, red globules and dots, brownish patch, coppery red pigmentation were commonly observed, and annular/comma-like vessels were more likely to be seen in our study group. Additionally, the dermoscopic examination appeared to have reproducibility and consistency among the clinicians, based on high inter-rater similarity. Also, some statistical association of the pathologic pattern and dermoscopic findings were identified. Coppery red pigmentation and annular comma-like vessels were related to lichenoid and perivascular pattern respectively, and spongiosis pattern showed correlation with linear vessels and reticular pigmented network. We suggest that the dermoscopic examination is a diagnostic method to support the clinical suspect of PPD and assist in prognostication of the pathological patterns.

## ACKNOWLEDGMENT

## SUPPLEMENTARY MATERIALS

Supplementary data can be found via http://anndermatol.org/src/sm/ad-33-214-s001.pdf.

## CONFLICTS OF INTEREST

The authors have nothing to disclose.

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## DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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