Accuracy of dermoscopic and reflectance confocal microscopic criteria for diagnosis of psoriasis

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To the Editor: Psoriasis is a chronic inflammatory disease that is usually diagnosed on the basis of typical clinical features. However, ambiguous cases can exist at times and are sometimes mistaken for other erythematosquamous diseases. Although histopathologic diagnosis remains the gold standard in such cases, it is frequently bypassed to avoid damage to the lesion areas and reduce discomfort for patients. Because a biopsy cannot provide real-time monitoring, non-invasive techniques that are cost-effective, such as dermoscopy and reflectance confocal microscopy (RCM), have increasingly been used in clinical practice during the past few years.

Dermoscopy allows magnified observation of the entire skin surface, which greatly improves the diagnostic accuracy of a wide variety of dermatoses. Lately, dermoscopy has gained an increasingly important role because it can identify particular vascular patterns in psoriatic lesions that are not visible to the naked eye. RCM visualizes the superficial region of the skin up to a depth of 250 μm, and provides images of cell and tissue structures in real time. Meanwhile, psoriasis has distinct histological characteristics, including parakeratosis, absent or diminished granular layer, acanthosis, and regular elongation of dermal papillae. Trafficking of inflammatory cells among corneocytes (Munro microabscesses) and through the epidermis (Kogoj micropustules) can sometimes be observed within the lesions, and is highly specific for psoriasis. Inflammatory infiltration and tortuous dilated capillaries can also be seen in the papillary epidermis. These features can be detected by *in vivo* RCM without the need for biopsy samples.

The present study was approved by the Research Ethics Committee of China-Japan Friendship Hospital and conformed to the principles of the *Declaration of Helsinki*. All participants provided written informed consent after receiving a complete description of the procedures. We retrospectively included consecutive equivocal lesions involving clinical differential diagnoses with psoriasis at China-Japan Friendship Hospital from 2017–2018, with available clinical data, dermoscopic findings, RCM images, and histopathologic diagnosis. We included lesions presenting as erythema with inconspicuous scale, usually negative for the Auspitz sign. We excluded lesions on the scalp, nail, and genital areas. Moreover, patients who had received systemic or topical treatments within the last 6 months and 1 month, respectively, according to their electronic medical records were excluded.

Dermoscopy and RCM examinations were performed with a Medicam 800 HD (FotoFinder Systems GmbH, Birbach, Germany) or VivaScope 1500 (Lucid Inc., Rochester, NY, USA). Keratolytic agents were applied to better detect the deeper portions of the lesions by removing the impact of the stratum corneum. Images were collected by a single expert who did not participate in the image evaluation process. The dermoscopic variables included background color, vascular type and arrangement, scale color, and scale distribution. Several RCM images at different depths (epidermis, dermal-epidermal junction [DEJ], dermis) were collected for all lesions evaluated.

Two experienced experts, who were blinded to the histopathological diagnoses and clinical pictures, separately evaluated the dermoscopic and RCM images to reach a diagnosis. The investigators were asked to suggest the most likely diagnosis, if the diagnosis was uncertain, and to point out individual dermoscopic or RCM criteria as being present or absent.

Access this article online

Quick Response Code:

Website: www.cmj.org

DOI: 10.1097/CM9.0000000000001198

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Chinese Medical Journal 2020;133(24)
Received: 13-05-2020 **Edited by:** Li-Shao Guo

Table 1: Dermoscopic and RCM characteristics of psoriasis compared to non-psoriasis (dermatitis and pityriasis rosea), *n* (%)

Variables	Psoriasis ($n = 61$)	Dermatitis ($n = 37$)	Pityriasis rosea ($n = 23$)	*P* values
Dermoscopic variables				
Background color				
Light red/light pink	40 (65.6)	7 (18.9)	5 (21.7)	<0.001
Dark red/dark pink	16 (26.2)	18 (48.6)	2 (8.7)	0.003
Yellowish	5 (8.2)	12 (32.4)	16 (69.6)	<0.001
Vessel morphology				
Dotted/globular	61 (100)	36 (97.3)	21 (91.3)	0.066
Hairpin-like	28 (45.9)	1 (2.7)	0	<0.001
Circle	25 (41)	0	0	<0.001
Linear	0	0	0	
Dotted/globular + linear	6 (9.8)	11 (29.7)	2 (8.7)	0.019
Vessel arrangement				
Regular/diffuse	52 (85.2)	7 (18.9)	6 (26.1)	<0.001
Patchy/clustered	4 (6.6)	29 (78.4)	15 (65.2)	<0.001
In rings	5 (8.2)	0	1 (4.3)	0.268
Peripheral, central	0	1 (2.7)	1 (4.3)	0.244
Scale color				
White	58 (95.1)	13 (35.1)	23 (100.0)	<0.001
Yellow	0	11 (29.7)	0	<0.001
White + yellow	3 (4.9)	13 (35.1)	0	<0.001
Scale distribution				
Diffuse	25 (41.0)	8 (21.6)	4 (17.4)	0.041
Patchy/clustered	31 (50.8)	26 (74.3)	1 (4.3)	<0.001
Peripheral	5 (8.2)	1 (2.7)	15 (65.2)	<0.001
Central	0	2 (5.4)	3 (13.0)	0.013
RCM variables				
Epidermis				
Hyperkeratosis	43 (70.5)	34 (91.9)	6 (26.1)	<0.001
Parakeratosis	54 (88.5)	16 (43.2)	16 (69.6)	<0.001
Neutrophils in the stratum corneum	43 (70.5)	0	0	<0.001
Absent/decreased granular layer	52 (85.2)	2 (5.4)	14 (60.9)	<0.001
Acanthosis	56 (91.8)	32 (86.5)	17 (73.9)	0.106
Spongiosis	41 (67.2)	35 (94.6)	19 (82.6)	0.005
Up-migrated dermal papillae	54 (88.5)	20 (54.1)	13 (56.5)	<0.001
Dermal-epidermal junction				
Disappearance of the papillary rings	20 (32.8)	7 (18.9)	1 (4.3)	0.017
Dermis				
Enlarged dermal papillae	52 (85.2)	26 (74.3)	19 (82.6)	0.407
Dilated vessels	58 (95.1)	34 (91.9)	21 (91.3)	0.697
Dermal inflammatory cell infiltration	48 (78.4)	29 (78.4)	17 (73.9)	0.889

RCM: Reflectance confocal microscopy.

The performance of dermoscopy or RCM was assessed by calculating the concordance of each non-invasive technique with the histopathological diagnosis. Pearson χ^2 test or Fisher exact test was performed to compare the dermoscopic or RCM features of psoriasis and non-psoriasis patients. The level of statistical significance was set at $P < 0.05$. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of specific criteria were also evaluated. Sensitivity was calculated as true positive value (TP)/(TP + false negative value (FN)), specificity as true negative value (TN)/(TN + false positive value (FP)), PPV as TP/(TP+FP), and NPV as TN/(FN+TN). All statistical analyses were performed with SPSS 25.0 software (IBM Corp., Armonk, NY, USA).

A total of 121 patients (79 males and 42 females) with 121 lesions were included in the study. We evaluated lesions in 61 psoriasis patients (mean age: 33.2 ± 12.5 years) and 60 non-psoriasis patients, including 37 dermatitis patients (mean age: 42.6 ± 15.6 years) and 23 pityriasis rosea patients (mean age: 22.4 ± 5.4 years).

Descriptive results of the dermoscopic analyses are shown in Table 1. The majority of the psoriatic lesions were characterized by light red/pink background (65.6%, $P < 0.001$), dotted vessels (100%, $P = 0.066$) with regular distribution (85.2%, $P < 0.001$), and white scales (95.1%, $P < 0.001$) [Supplementary Figure 1, http://links.lww.com/CM9/A375]. The combination of these four characteristics had diagnostic specificity and PPV of 100%. Hairpin-like vessels (45.9%, $P < 0.001$) and circular vessels (41%, $P < 0.001$) were exclusively detected in psoriatic lesions, with diagnostic specificity of 98.3% and 100% and PPV of 96.6% and 100%, respectively [Supplementary Table 1,

http://links.lww.com/CM9/A375]. Dermatitis was characterized by patchy/clustered distribution of vessels (78.4%) and scales (74.3%) [Supplementary Figure 1, http://links.lww.com/CM9/A375]. White scales were common features in both psoriatic lesions (95.1%) and pityriasis rosea (100%), while peripheral scale distribution was mainly found in pityriasis rosea (65.2%, $P < 0.001$) with yellowish background (69.6%, $P < 0.001$) [Supplementary Figure 1, http://links.lww.com/CM9/A375].

The findings of the RCM analyses at different depths (epidermis, DEJ, dermis) are shown in Supplementary Table 2, http://links.lww.com/CM9/A375. Parakeratosis (88.5%, $P < 0.001$), neutrophils in the stratum corneum (70.5%, $P < 0.001$), and absent/decreased granular layer (70.5%, $P < 0.001$) combined with up-migrated dermal papillae (88.5%, $P < 0.001$) were typical characteristics in psoriasis patients compared with non-psoriasis patients [Supplementary Figure 2, http://links.lww.com/CM9/A375]. The combination of hyperkeratosis, acanthosis, parakeratosis, absent granular layer, and up-migrated dermal papillae had high diagnostic specificity and PPV of 98.3% and 97.7%, respectively. Among these features, neutrophils in the stratum corneum, corresponding to Munro microabscesses on histopathological examination, were exclusively detected in psoriasis with diagnostic specificity and PPV of 100% [Supplementary Table 2, http://links.lww.com/CM9/A375], and thus highly suggestive of correct diagnosis. Disappearance of the papillary rings at the DEJ level was observed in 20 of 61 psoriasis patients (32.8%, $P = 0.017$). Enlarged dermal papillae, dilated vessels, and dermal inflammatory cell infiltration were detected in 85.2%, 95.1%, and 78.4% of psoriatic lesions, respectively, and showed no significant differences compared with dermatitis and pityriasis rosea [Supplementary Figure 2, http://links.lww.com/CM9/A375].

In the present study, the typical dermoscopic manifestation of psoriasis was a combination of light red/pink background and dotted vessels in regular distribution with white scales. Hairpin vessels and circular vessels, reflecting capillary loops parallel to the skin surface, were highly predictive of psoriasis, allowing a high PPV for diagnosis. Dotted vascular pattern, observed as capillary bushes (glomerular vessels) at a higher magnification on dermoscopy, is a characteristic criterion for the diagnosis of psoriasis and was notably seen with regular distribution in our psoriatic patients. The mean diameter of the bushy capillaries may be correlated with the severity of psoriasis, known as the Psoriasis Area Severity Index (PASI).[1] Meanwhile, dermoscopy can reveal impending steroid-induced atrophy by detection of linear vessels and contribute to monitoring of topical steroid therapies in chronic psoriasis.[2] Furthermore, dermoscopic evaluation can provide a sensitive and efficient quantification for psoriasis severity.[3] In contrast, yellow background, patchy distribution of vessels, and yellow scales sharply decreased the possibility for diagnosis of psoriasis.

RCM examination successfully identified typical RCM features of parakeratosis, absent/decreased granular layer, acanthosis, up-migrated dermal papillae, enlarged dermal papillae, and dilated vessels in the upper dermis. Neutrophils in the stratum corneum (Munro microabscesses) were detected in most of our cases, and were highly specific for the diagnosis of psoriasis. We found partly disappeared papillary rings at the DEJ level in the psoriatic lesions. This sign may arise through suppression of growth and pigment production in melanocytes induced by interleukin-17 and tumor necrosis factor associated with psoriasis.[4] RCM may be more sensitive for visualization of capillaries than histology, and can provide clues for determining the inflammation severity in these diseases. Furthermore, unstable psoriatic plaques were reported to frequently show increased inflammatory cells in the epidermis and dermis including Munro and Kogoj microabscesses, a larger diameter of dermal papillae and a higher capillary flow within more tortuous capillaries.[5]

In conclusion, we have elucidated the typical characteristics of psoriasis under dermoscopy and RCM examinations by evaluating different features in psoriasis compared with other inflammatory skin diseases. Our findings suggest that both dermoscopy and RCM are valuable diagnostic tools for psoriasis. These two *in vivo* techniques could be applied for more generalized use in inflammatory dermatoses because they are able to monitor the natural course of lesions and evaluate the efficacy of therapies. Further studies should concentrate on the applications of these non-invasive techniques for a wider range of skin diseases in clinical practice.

Funding

This work was supported by grants from the Fundamental Research Funds for the Central Universities (No. 3332019163), Beijing Municipal Science and Technology Commission Medicine Collaborative Science and Technology Innovation Research Project (No. Z191100007719001).

Conflicts of interest

None.

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How to cite this article: Wang ZY, Shen CB, Fei WM, Shen X, Li CX, Jing Y, Cui Y. Accuracy of dermoscopic and reflectance confocal microscopic criteria for diagnosis of psoriasis. Chin Med J 2020;133:3010–3012. doi: 10.1097/CM9.0000000000001198