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Does dermatoscopy facilitate the detection and diagnosis of vascular skin lesions? A case–control study

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Abstract

Background During dermatoscope-guided surgical procedures, we noticed that vasculature was easily identified. This study investigated the use of dermatoscopy in detecting and diagnosing vascular skin lesions.

Methods We retrieved records of patients with vascular skin lesions who underwent dermatoscopy over a 3 month period, in two outpatient clinics affiliated with a university teaching hospital. Our controls were similar patients where dermatoscopy was not performed.

Results Our new findings are: 1, clinical and dermatoscopic examinations diagnosed significantly more patients with vascular skin lesions than clinical examinations alone (risk ratio: 1.36; 95% confidence interval: 1.10–1.67); 2, the detection rate increase was significant for cherry angiomas ($p < 0.001$), telangiectasias ($p < 0.01$) and spider angiomas ($p < 0.01$); 3, qualitatively, dermatoscopy revealed characteristic configurations, hues and colour saturations of the vascular skin lesions; and 4, the first reported dermatoscopic images of focal essential telangiectasia and petechial angioma.

Conclusion In our setting, clinical and dermatoscopic examinations significantly facilitated detecting and diagnosing vascular skin lesions, compared to clinical examination alone.

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Introduction

The efficacy of dermatoscopy (also known as dermoscopy) to enhance the diagnosis of vascular skin lesions is well reported and reviewed.[1–8] While performing dermatoscope-guided surgical procedures[9–11] we were alerted to the ease of identifying the vascular lesions and the vasculatures of lesions that were not primarily vascular diseases.

However, to our best knowledge, a systematic and quantitative study to evaluate the efficacy of dermatoscopy in vascular skin lesions has not been reported. Such a report would provide evidence for or against the efficacies of these applications.

We therefore report a retrospective case–control study aiming to evaluate the impact of dermatoscopy in detecting and diagnosing vascular skin lesions.

Methods

Our setting was two outpatient clinics affiliated with a university teaching hospital served by one physician with training and qualifications in dermatology. The patients made appointments directly with the physician. We have been utilising dermatoscopes since 2002, and have reported several novel applications of such.[12–15] On 1 January 2017, a physician (AC) commenced applying dermatoscopy, wherever clinically relevant and the circumstance allowed, to patients consulting us for skin problems. We had no intention for future academic endeavours at that time.

Our dermatoscope was a cross-polarised one, with an option to switch to the non-polarising mode. Liquid medium was unnecessary and could not be applied. The dermatoscope was shaped and functioned like a camera lens, and could be mounted on a digital single-lens reflex camera. The

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Figure 1 Cherry haemangioma, also known as cherry angioma or Campbell De Morgan spot. (a) Clinical view of a hemispherical, red lesion. (b) View under dermoscopy without cross-polarisation. A milky-red surface is seen, which blurs the underlying view of dilated blood vessels. (c) View under dermoscopy with cross-polarisation. Homogenous and dilated red blood vessels are clearly seen. These are tightly packed, leaving no space in between the vessels. (Magnification: 20× when the dermatoscopic images were cropped)

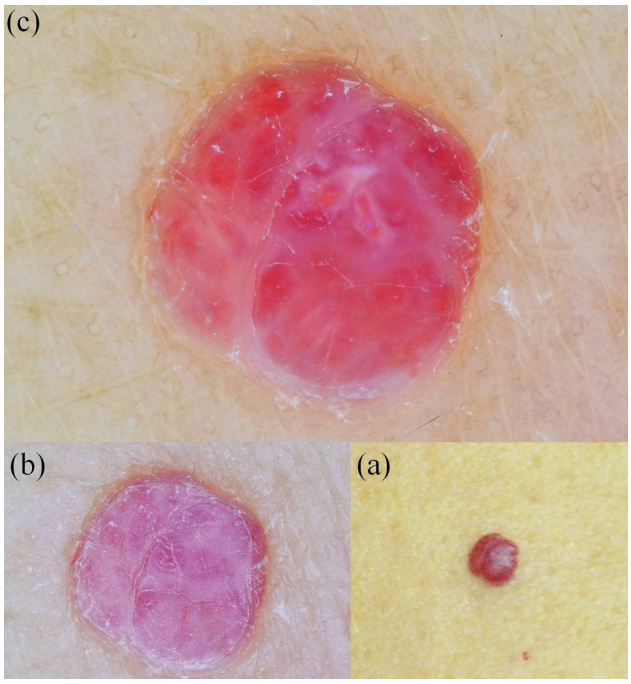
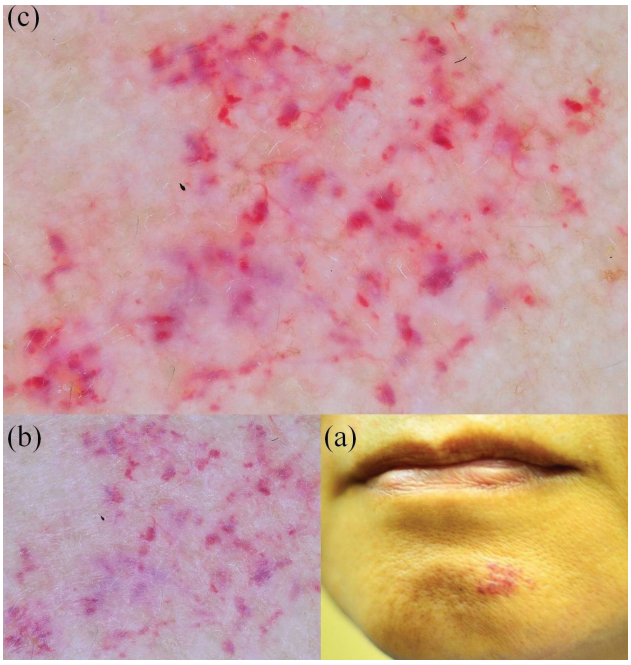


Figure 2 A resolving cherry angioma. (a) Clinical photography showing erythematous dotted lesions with redundant skin at the centre of the chin. Clinical diagnosis without history and dermoscopy could be difficult. (b) View under dermoscopy without cross-polarisation. Comma-like and dotted vessels are seen, with ample space in between the vessels. However, image quality and resolution are low owing to the overlying epidermal features. (c) View under dermoscopy with cross-polarisation. The comma-like and dotted vessels are clearly seen. These vessels appear to be 'jumping'. Diagnosis becomes straightforward. (Magnification: 10×)



dermatoscope switched itself between polarising and non-polarising modes alternately each time the shutter was released. Toggling between these two modes facilitated the differentiation of colour and depth of certain types of skin lesions.

We searched both written and electronic patient records for all patients who had consulted us over a 3-month period (1 January 2017–31 March 2017; 90 days). This was our study period. We used keywords related to vascular skin lesions, and hand searched all written records. The lesions had to be primarily vascular in nature. We excluded patients with vascular signs in dermoscopy but the lesions were not primarily vascular in nature.

We also retrieved reports of all patients with these lesions diagnosed in two periods (1 January 2015–31 March 2015; 1 January 2016–31 March 2016; 181 days) with dermatoscopy not performed. These were our control periods. We selected the same months for the study and control periods to minimise confounding variables, such as weather changes. We chose two control periods to lower the risk of type II errors.

For quantitative analyses, we adopted Poisson means test (PMT) to investigate the number of patients in different time periods. Where calculable, we used Fisher exact probability Test to analyse distribution data. We obtained informed consent from all patients or parents/legal guardians for patients <18 years of age before performing dermatoscopy and taking clinical photographs.

For qualitative analyses, we mainly described our observations according to the systems established by Zalaudek et al.,[16] Grazzini et al.,[1] Ayhan et al.[3] and Togawa.[7] Even though not all of these systems were specifically established for skin vascular lesions, the terminology used would be readily understandable to clinicians using dermatoscopes. In Figures 1–8 lesions are shown in (a) clinical photographs, (b) dermatoscopy images without cross-polarisation and (c) dermatoscopy images with cross-polarisation.

Results

Quantitative analyses

A total of 1,326 patients consulted us for skin problems during the study period, while 1,280 and 1,375 patients consulted us for such problems during the first and second control periods, respectively. PMT revealed insignificant differences ($p = 0.91$ for overall analysis).

The proportion of patients with vascular skin lesions within the total number of patients consulting us for skin problems was significantly higher in the study period than in the first control period [risk ratio (RR): 1.35; 95% confidence interval (CI): 1.05–1.73], the second control period (RR: 1.36; 95% CI: 1.06–1.74) and the two control periods combined (RR: 1.36; 95% CI: 1.10–1.67).

The most common lesions were cherry haemangioma, lesions related to venous stasis, telangiectasia, spider angioma and other haemangiomas (Table 1). We diagnosed significantly more patients (36 patients) with cherry haemangiomas during the study period than in the first control period (12 patients; PMT: $p < 0.001$), the second control period (18 patients; $p = 0.02$) and the two control periods combined (30 patients; $p < 0.001$). We also diagnosed significantly more patients with telangiectasia ($p < 0.01$) and spider angioma ($p < 0.01$) in the study period than in the control periods.

The findings were insignificant for venous stasis, all other haemangiomas (Table 1) and port-wine stain. However, the low numbers of patients with these lesions could have caused type II errors.

Qualitative analyses

A cherry haemangioma is depicted in Figure 1. Epiluminescence dermatoscopy (Figure 1c) reveals a clear image of enlarged and entangled blood vessels. The dilated vessels are regular in size for most parts. These changes are less lucidly seen clinically (Figure 1a) and under dermatoscopy without cross-polarisation (Figure 1b).

According to the system established by Ayhan et al.,[3] the morphology would be red globules, with the arrangement being irregular and homogenous. According to the systems by Zalaudek et al.[16] and Togawa,[7] the morphology would simply be haemangioma.

Figure 2 depicts a resolving cherry haemangioma. Without a history or past photographs diagnosis can be difficult. Under cross-polarised dermatoscopy (Figure 2c) the diagnosis becomes straightforward. The morphology would be dotted,[1,3,7,16] with the architecture being irregular non-homogenous.[3]

For venous insufficiencies, we present Figure 3 from a patient with stasis venous dilatation. The flashing erythema and the sharp margination indicate an acute inflammation (Figure 3a). Dermatoscopy with cross-polarisation (Figure 3c) produces a much clearer view of irregularly dilated vessels in an erythematous background. The morphology is dotted. Vessel arrangements are irregular non-homogenous. Although the advancing margin seems to be serpiginous, the architecture of the vascular lesions is not.

Figure 4 depicts acquired focal essential telangiectasia. The dominance of dilated blood vessels in an erratic configuration with sharp turns and knits is more readily perceived under cross-polarised dermatoscopy. The morphology is polymorphic or tortuous. The vessel arrangement is reticular or branched.

Figure 5 depicts a patient with spider naevi. The blanchable lesion was on her face, with no other similar lesion in the drainage area of the superior vena cava. The number of appendages seems to be small on clinical examination and the colour saturation is low (Figure 5a). Under epiluminescence

Figure 3 Venous stasis. Dotted lesions are seen, with larger dots in the centres of the lesions and smaller ones at the periphery.[3] In the clinical photograph (a), active inflammation with a distinct margin is seen. (b) Dermoscopy without cross-polarisation delivers a blurred view of dilated blood vessels. The number of vessels cannot be counted. Dermatoscopy with polarised light (c) produces a much clearer view of irregularly dilated blood vessels in an erythematous background. Dilated venules are seen out of focus. (Magnification: 10×)

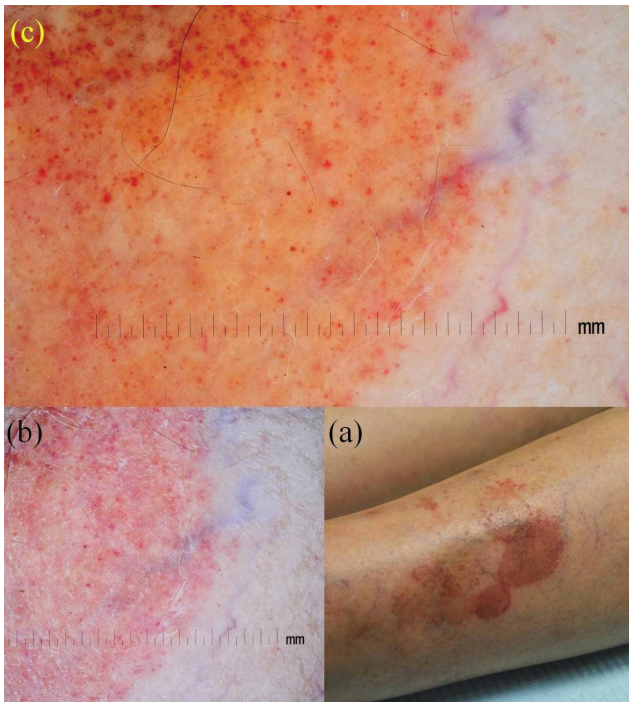


Figure 4 Acquired focal essential telangiectasia. Diagnosis based on the clinical photograph (a) is possible but indefinite. In the dermatoscopic view without polarised light (b), the skin creases impede the view of the architecture underneath. Epiluminescence dermatoscopy (c) reveals dilated and brittle vessels with angulations and turns. (Magnification: 20×)

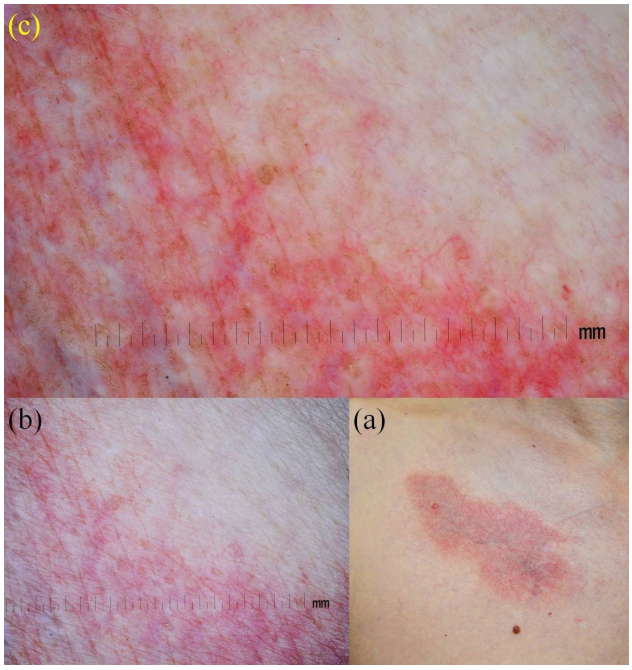


Figure 5 Spider angioma, also known as naevus araneus. Based on the clinical photograph (a) only, the diagnosis might be in doubt owing to inadequate number of appendages. Dermoscopy without cross-polarisation (b) delivers a blurred view of dilated blood vessels. Under epiluminescence dermatoscopy (c), more than eight appendages are unveiled, substantiating the diagnosis. (Magnification: 20×)

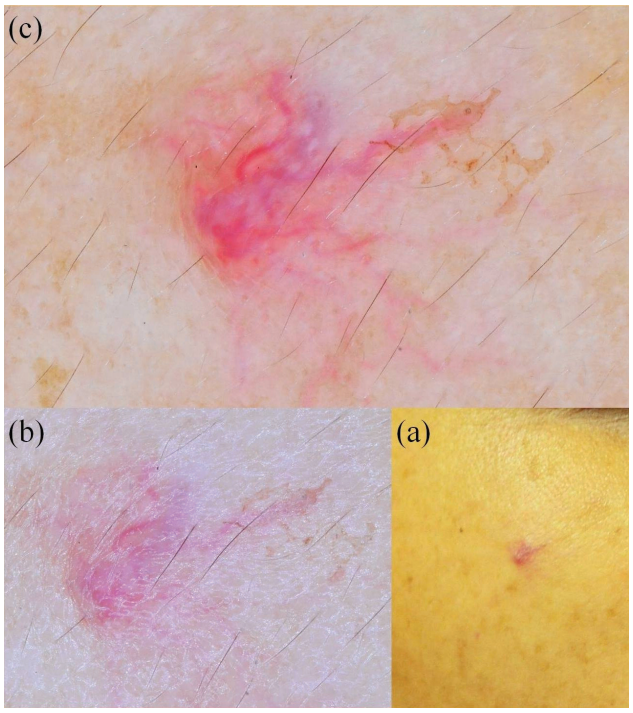
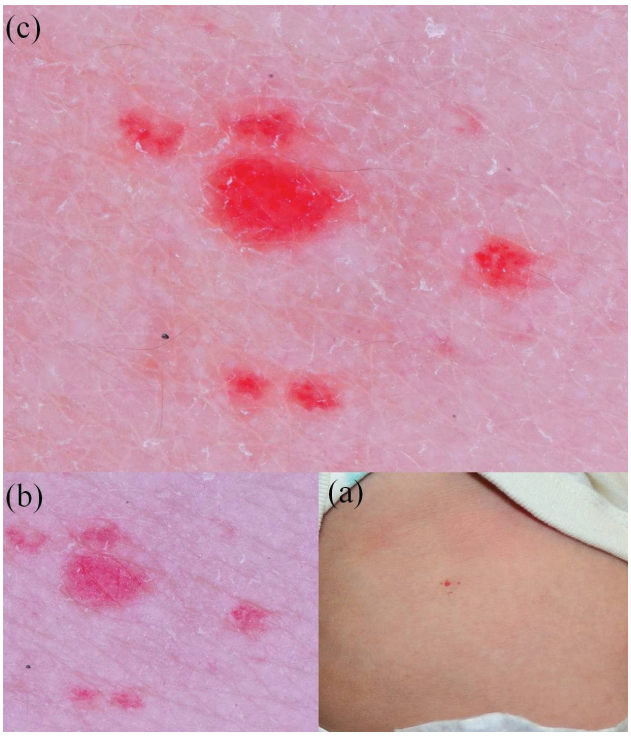


Figure 6 Congenital infantile haemangioma. The clinical photograph (a) is adequate for diagnosis. Details on deeper parts are seen in (b) and (c). (Magnification: 10×)



dermatoscopy (Figure 5c), around eight appendages appear with high colour saturation. The morphology is arborising. The arrangement is irregular arborising[3] or branched.[7,16] Dermatoscopy strongly substantiates the diagnosis.

Congenital infantile haemangiomata are easily diagnosed. However, the lesions can be very small (Figure 6). The morphology is red globules[3] or simply haemangioma.[7,16] The architecture is irregular but still homogenous. This highlights the ability of dermatoscopy to detect small lesions. Dermatoscopy also facilitates sequential monitoring of size and morphology of the lesions.

Figure 7 shows a congenital chain of petechial angioma. The configuration of individual sub-lesions is more readily appreciated under cross-polarised dermatoscopy (Figure 7c). The characteristic hue is seen. The morphology is dotted, with the architecture being irregular homogenous. To the best of our knowledge, this is the first documented application of dermatoscopy to petechial angioma.

Finally, port-wine stain is demonstrated in Figure 8. Clinical examination (Figure 8a) and dermatoscopy without cross-polarisation (Figure 8b) reveal that the entire lesion is erythematous, with no definite way to judge the origin of the colouration. Under cross-polarised dermatoscopy (Figure 8c), the morphology is mainly dotted, with some commas. The arrangement is irregular homogenous for most parts of the lesion. It is clear that the erythema is due to the enhanced vasculature and the characteristic hue of the vascular lesions.

Discussion

Fairly comprehensive systems[1,3,7,16] have been established to facilitate the application of dermatoscopy to vascular skin lesions or vascular components of other skin lesions. We have previously reported several dermatoscope-guided surgical procedures, including dermatoscope-guided lesional biopsy to diagnose EMA+ CK7+ CK20+ extramammary Paget's disease[9] and to diagnose CD68+ and S100- juvenile xanthogranuloma.[10] We have also reported dermatoscope-guided suturing.[11] During these procedures, we noticed that the vasculature was particularly easily identified under cross-polarisation. This held true even when there was active bleeding in the surgical field.

However, we failed to locate any quantitative study for a spectrum of skin vascular diseases. We therefore conducted this retrospective study. We found that despite no significant increase in the number of patients consulting us for skin problems during the study period compared to the control periods, we diagnosed significantly more patients with vascular lesions during the study period than the control periods. Moreover, we diagnosed significantly more cherry haemangiomas, telangiectasias and spider angiomas in the study period.

For the qualitative arm, we examined dermatoscopic and clinical images for the commonest conditions, and found

that clinical and dermatoscopic images delivered much more information than clinical images alone. For cutaneous lesions and rashes related to venous insufficiency, the areas involved were usually large, therefore, partially disabling the advantage of dermatoscopy to detect small lesions. The numbers of patients with other vascular skin lesions were small, exposing us to type II errors.

Diagnosing a resolving cherry haemangioma without a history and previous photographs can be difficult. The clinical photograph in Figure 2a shows redundant skin, a tell-tale sign. Under cross-polarisation (Figure 2c), the irregularly enlarged vessels in lobes and filaments are lucidly seen, rendering a reliable diagnosis of haemangioma possible.

Dermatoscopic findings in venous stasis have been reported.[17] The uniqueness of the lesion (Figure 3) is ongoing active inflammation, which must be treated before compression or other interventions.

Dermatoscopy might facilitate the diagnoses of systemic sclerosis[18] and generalised essential telangiectasia.[19] However, to the best of our best knowledge, Figure 4 represents the first documented application of dermatoscopy to diagnose focal essential telangiectasia.

Video dermatoscopy and Doppler ultrasound might identify spider naevi.[20] However, in epiluminescence mode of the dermatoscope (Figure 5c) the three-dimensional configuration is easily comprehensible.

Two dermatoscopic types of infantile haemangioma have been reported: superficial with linear dilated vessels and thickened with deep involvements.[21] Figure 6 shows superficial involvement only.

Dermatoscopy is known to facilitate the diagnosis of port-wine stain.[22,23] To the best of our knowledge, Figure 7 represents the first documentation of applying dermatoscopy to diagnose petechial angioma.

We are uncertain of the underlying mechanisms for dermatoscopy diagnosing vascular cutaneous lesions. We postulate three mechanisms: adjustable magnifications, epiluminescence and the high quality of images captured.

In low magnifications, dermatoscopy detects aberrations in colour and singularities. Vascular skin lesions display characteristic hues and rich colour saturations. Epiluminescence further enhances the visualisation of sub-surface lesions. Subsequently, in higher magnifications, dots, commas, hairpins, conglomerates and other morphologies will be easily visualised and analysed.

Image quality is related to technological advances in image capturing, storage and retrieval. Vascular structures display vivid colours, and become direct beneficiaries for these technological advances.

Figure 7 Petechial angioma. Making a diagnosis based on the clinical appearance (a) is insecure. The dermatoscopic view without polarised light (b) yields numerous monomorphous petechiae. The epiluminescence view (c) clearly shows hundreds of petechiae arranged into a conglomerated lesion. (Magnification: 10×)

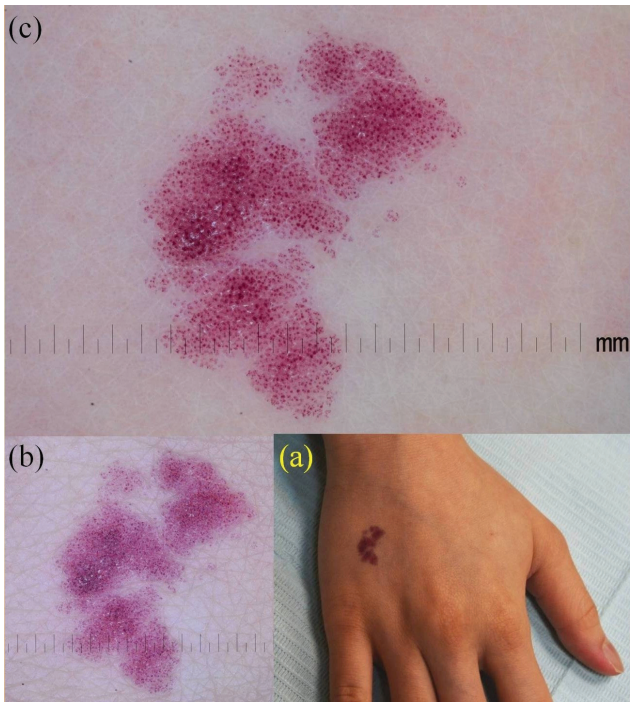


Figure 8 Port-wine stain, also known as naevus flammeus (a). Dermoscopy without cross-polarisation (b) depicts a blurred image of dilated capillaries owing to overlying skin creases obscuring the view. Under epiluminescence dermatoscopy (c), the morphology of numerous irregularly dilated capillaries in the shape of droplets is seen, substantiating the diagnosis. (Magnification: 20×)

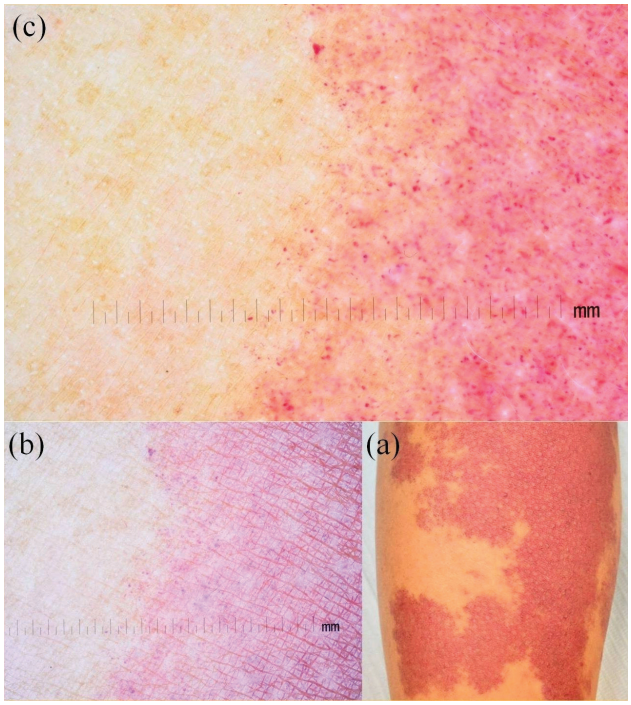


Table 1 Number of patients with vascular skin lesions diagnosed during the study and two control periods

	Study period dermoscopy performed (90 days)	First control period dermoscopy not performed (90 days)	Second control period dermoscopy not performed (91 days)	Combined analyses study period (90 days) and both control periods (181 days)
Total number of patients with vascular skin lesions				
	134	96 (RR: 1.35; 95% CI: 1.05– 1.73; p = 0.01)*	102 (RR: 1.36; 95% CI: 1.06–1.74; p < 0.05)*	198 (RR: 1.36; 95% CI: 1.10– 1.67; p < 0.01)*
Number of patients with individual vascular skin lesions				
Cherry haemangioma	36†	12 (p < 0.001)*,#	18 (p = 0.02)*	30 (p < 0.001)*
Venous stasis and complications	32	45 (p = 0.17)	48 (p = 0.10)	93 (p = 0.08)
Telangiectasia (all types)	29	13 (p = 0.02)*	11 (p < 0.01)*	24 (p < 0.01)*
Spider angioma	22	8 (p = 0.02)*	10 (p < 0.05)*	18 (p < 0.01)*
All other haemangiomas	7	5 (p = 0.77)	5 (p = 0.76)	10 (p = 0.64)
Port-wine stain	7	2 (p = 0.18)	5 (p = 0.76)	7 (p = 0.29)
Other solitary masses with primarily vascular changes	3	1 (p = 0.63)	1 (p = 0.62)	2 (p = 0.42)
Vasculitis with cutaneous manifestations	1	2 (p = 1.00)	0 (p = 1.00)	2 (p = 1.00)

*Statistical significance.
†Number of patients (one patient could have multiple lesions).
#Poisson means test compared to the study period.
CI: confidence interval; RR: risk ratio

One limitation of this study was that it was a retrospective study. However, the physician was not looking for vascular cutaneous lesions on patients during the study and the control periods. He also had no intention of future academic pursuits when examining the study and control patients. Therefore, the comparisons should be valid and fair.

If we performed a prospective study, the physician would be looking for vascular lesions more enthusiastically, leading to a systemic bias when comparing prospective data from the study period to retrospective data from the control periods. We therefore believe, given our settings and resources, that the methodology of our study is valid, albeit with limitations.

The most important limitation of our study is the collection of data and images from two clinics only; therefore, the study is not generalisable to other clinical settings and other parts of the world. Further studies in multiple centres internationally would be optimal.

Conclusion

We conclude that, in our setting, dermatoscopy significantly facilitated the detection and diagnoses of vascular skin lesions, particularly for cherry angioma, telangiectasia and spider angioma. Dermatoscopy revealed characteristic configurations, hues and colour saturations for these lesions, which could be part of the underlying mechanisms for the efficacy of dermatoscopy in cutaneous vascular lesions. We also reported the novel applications of dermatoscopy to diagnose focal essential telangiectasia and petechial angioma.

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