Australasian Journal of Dermatology

Australasian Journal of Dermatology (2021) ••, ••–•• doi: 10.1111/ajd.13781

ORIGINAL RESEARCH

Dermoscopy of inflamed seborrheic keratosis: A great mimic of malignancy

Marcial Álvarez-Salafranca MD[1] | Ignacio Gómez-Martín MD, PhD[2] | José Bañuls MD, PhD[3] | Patricia Serrano MD[4] | Carolina Medina MD[5] | Alex Llambrich MD, PhD[6] | Ángel Pizarro MD, PhD[7] | Mariano Ara MD, PhD[1] | Pedro Zaballos MD, PhD[2]

[1]Department of Dermatology, Hospital Clínico Universitario Lozano Blesa, Zaragoza, Spain, [2]Department of Dermatology, Hospital de Sant Pau i Santa Tecla, Tarragona, Spain, [3]Department of Dermatology, Hospital General Universitario de Alicante, ISABIAL, Alicante, Spain, [4]Department of Dermatology, Consorci Sanitari del Maresme, Barcelona, Spain, [5]Department of Dermatology, Hospital Universitario de Gran Canaria 'Doctor Negrín', Gran Canaria, Spain, [6]Department of Dermatology, Hospital de son Llatzer, Palma de Mallorca, Spain, and [7]Department of Dermatology, Clínica Dermatológica Internacional, Madrid, Spain

ABSTRACT

Background: Clinical and dermoscopic recognition of seborrheic keratoses (SKs) is often straightforward, and biopsy might not be required. However, inflamed SKs (iSKs) can pose a diagnostic challenge. Dermoscopic features of iSKs have not yet been evaluated to date.

Objectives: To assess the diagnostic ability of a group of dermatologists to diagnose iSKs by dermoscopy. To evaluate the dermoscopic findings of a long series of inflamed seborrheic keratoses.

Methods: Clinical and dermoscopic images of 100 difficult-to-diagnose skin tumours, including 29 iSKs, were presented to 33 clinicians (24 dermatologists and 9 dermatology residents), who were blinded to the diagnosis. The dermoscopic features of a series of 219 iSKs were retrospectively analysed.

Results: iSKs were correctly identified in a 37.6% of cases. Classic dermoscopic criteria were present in only 47% of iSKs. The most frequent dermoscopic feature in iSKs was the presence of vascularization (91.3%), but only a 44.5% showed predominance of hairpin vessels. A bluish hue was observed in 18.3% of lesions. Seven dermoscopic patterns were identified, based on the dermoscopic similarity to other tumours: seborrheic keratosis-like (28.8%); squamous cell carcinoma-like (25.6%); melanoma-like (17.8%); keratoacanthoma-like (6.8%); basal cell carcinoma-like (5.9%); verruca vulgaris-like (5.9%); nevus-like (2.3%).

Conclusions: The diagnosis of iSKs can be challenging even with dermoscopy. They may behave as authentic mimics of other cutaneous tumours, including squamous cell carcinoma or melanoma. For this reason, histopathological examination should be mandatory in these cases.

Key words: dermoscopy, dermatoscopy, seborrheic keratosis, malignant melanoma, squamous cell carcinoma, basal cell carcinoma.

Correspondence: Dr Marcial Álvarez-Salafranca, Department of Dermatology, Hospital Clínico Universitario 'Lozano Blesa', Avenida San Juan Bosco n°15, CP 50009, Zaragoza, Spain. Email: malvarezs@salud.aragon.es

Conflict of interest: None declared.

Financial disclosure: None reported.

Funding/Support: None.

Ethics: The study protocol was approved by the Local Research Ethics Committee (Comité de Ética de la Investigación de la Comunidad Autónoma de Aragón: CEICA) with the version 2.0 of the protocol.

Submitted 19 August 2021; revised 17 November 2021; accepted 12 December 2021.

© 2021 Australasian College of Dermatologists.

Abbreviations:

SK	seborrheic keratosis
SCC	squamous cell carcinoma
MM	melanoma
KA	keratoacanthoma
BCC	basal cell carcinoma
VV	verruca vulgaris
iSKs	Inflamed seborrheic keratosis

INTRODUCTION

Seborrheic keratoses (SKs) are common benign epidermal neoplasms.[1,2] Their clinical and dermoscopic recognition is often easy, and histopathologic examination is usually not required. The classic dermatoscopic features of SKs are well established (comedo-like openings, milia-like cysts, fissures/ridges, fingerprint-like structures and sharp demarcation with or without moth-eaten borders).[3,4] However, SKs may occasionally lack these criteria or present dermoscopic features that mimic other benign and malignant skin tumors.[5,6] Histopathological variants of SKs are often difficult to diagnose confidently because of the presence of overlapping dermoscopic features with malignant skin tumours or due to a global atypical dermoscopic pattern. These include clonal, hyperkeratotic, reticulated, irritated or regressing SKs among others.[7] Inflamed seborrheic keratosis (iSKs) is defined as any kind of SKs, in whose histopathological study there is a conspicuous inflammatory infiltrate in the underlying dermis, composed mainly of lymphocytes and histiocytes.[8]

Dermoscopic features of iSKs have not been thoroughly evaluated to date and data available are based on small reports.[9] The first objective of the present study is to assess the diagnostic accuracy of a group of dermatologists in identifying inflamed seborrheic keratosis by dermoscopy. Subsequently, the dermoscopic features of a long series of iSKs are described for the first time, highlighting their ability to simulate other skin tumours.

METHODS

The present study is composed of two distinct parts. The first part consisted of a survey, which was focussed in assessing the diagnostic ability of dermatologists in diagnosing iSKs by dermoscopy. The second one was a retrospective, descriptive and multicentric study based on a large series of iSKs.

First part of the study

A slideshow-based questionnaire with clinical and dermoscopic images of 100 biopsy-proven, difficult-to-diagnose skin tumours was presented to 33 clinicians (24 dermatologists and 9 dermatology residents), with different level of experience in dermoscopy (6 months to >10 years). The survey included 29 randomly selected inflamed SK of our series and other 71 skin lesions from our database. Each slide corresponded to a clinical and dermoscopic image of a single lesion and was accompanied by brief information regarding sex, age and anatomical location. The image set consisted of 29 iSKs, 15 malignant melanomas (MM), 10 melanocytic nevi, 8 dermatofibromas, 8 non-inflamed SKs, 6 basal cell carcinomas (BCC), 4 Bowen´s diseases, 3 lichen planus-like keratoses, 3 clear cell acanthomas, 3 sebaceous hyperplasias, 2 collision tumours, 2 pilomatricomas, 2 spitzoid tumours, 1 squamous cell carcinoma (SCC), 1 keratoacanthoma (KA), 1 blue nevus, 1 glomic tumour and 1 inverted follicular keratosis. Participants, who were blinded for the objective of the study, were asked to give a diagnosis.

Second part of the study

Dermoscopic images of iSKs were retrospectively collected from the image database of 6 dermatology departments in Spain during the period between 2014 and 2020. Clinical and dermatoscopic images of 219 histopathologically proven iSKs were separately evaluated by 2 independent investigators with at least 5 years of experience in dermoscopy (MAS and IGM). Both dermoscopists were asked to score iSKs for the presence of predefined dermoscopic structures (available in Table 1) related to 7 different dermoscopic patterns: SK-like, MM-like, SCC-like, KA-like, BCC-like, nevus-like and verruca vulgaris (VV)-like patterns. This categorisation was built based on the most frequent misdiagnoses of the first part of the study, including relevant lesions from a practical point of view and excluding less frequent lesions or anecdotal responses. If discrepancies between both observers, a third investigator (PZ) was responsible for solving them. All pigmented lesions were recorded using DermLite Foto equipment (3Gen, LLC, Dana Point, CA, USA), at 10-fold magnification.

Statistical analysis

For the first part of the study, categorical variables were summarised in both absolute and porcentual terms. Differences between categorical variables were assessed by the chi-squared test. A P value <0.05 was considered statically significant. In the second part, descriptive statistics were used and frequencies were calculated. All analyses were performed using IBM SPSS version 25.0 (IBM, Armonk, NY).

RESULTS

First part of the study

Thirty-three participants were included in the study (24 dermatologists and 9 dermatology residents). Considering both groups together, the sensitivity for the diagnosis iSKs was 37.6%, while it was 56.8% in the case of other skin tumours ($P < 0.001$). Considering both groups separately, dermatologists were able to correctly diagnose 40.6% of iSKs and 56.9% of other skin tumours ($P < 0.001$), while this percentages were 29.7% and 56.6%, respectively, in the group of dermatology residents ($P < 0.001$). Differences in sensitivity between experienced dermatologists and dermatology residents were statistically significant for iSKs ($P = 0.003$).

Second part of the study

Regarding the clinical features of the 219 iSKs included, 135 lesions were exophytic (61.6%), 73 were slightly palpable ('plaque-type') (33.3%), and only 11 (5%) were flat.

© 2021 Australasian College of Dermatologists.

Table 1 Dermoscopic features of the different patterns of inflamed seborrheic keratosis

Pattern n (%)	Ulceration/ Erosions/ Haemorrhage n (%)	Classic dermoscopic criteria of SK	Pigmented structures	Blue structures	White structures	Vascularization
SK- like pattern 63 (28.8)	26 (41.3)	Milia-like cysts: 24 (38.1) Comedo-like openings: 30 (47.6) Fissures/ ridges: 9 (14.3)	Blue-grey granules: 22 (34.9) Pigment network :1 (1.6) Pseudonetwork: 5 (7.9) Pigmented dots/globules: 8 (12.7) Hyperpigmented structureless areas: 17 (27) Streaks/ pseudopods: 0 (0)	Blue-grey globules/ ovoid nests: 1(1.6) Bluish hue: 17 (27)	Negative network: 1 (1.6) Shiny white structures: 20 (31.7) Rosettes: 3 (4.8)	Present: 56 (88.9) Predominant distribution: widespread: 34 (54) Predominant type: hairpin 35 (55.6) White halo: 24 (54)
SCC-like pattern 56 (25.6)	40 (71.4)	Milia-like cysts: 8 (14.3) Comedo-like openings: 13 (23.2) Fissures/ ridges: 7 (12.5)	Blue-grey granules: 10 (17,9) Pigment network: 1 (1.8) Pseudonetwork: 1 (1.8) Pigmented dots/globules: 3 (5.4) Hyperpigmented structureless areas: 6 (10.7) Streaks/ pseudopods: 0 (0)	Blue-grey globules/ ovoid nests: 2 (3.6) Bluish hue: 5 (8.9)	Negative network: 1 (1.8) Shiny white structures: 13 (23.2) Rosettes: 4 (7.1)	Present: 54 (96.4) Predominant distribution: widespread: 33 (58.9) Predominant type: glomerular 18 (32.1) White halo: 26 (46.4)
MM-like pattern 39 (17.8)	18 (46.2)	Milia-like cysts: 15 (38.5) Comedo-like openings: 13 (33.3) Fissures/ ridges: 4 (10.3)	Blue-grey granules: 21 (53.8) Pigment network: 5 (12.8) Pseudonetwork: 6 (15.4) Pigmented dots/globules: 15 (38.5) Hyperpigmented structureless areas: 24 (61.5) Streaks/ pseudopods: 5 (12.8)	Blue-grey globules/ ovoid nests: 6 (15.4) Bluish hue: 12 (30.8)	Negative network: 4 (10.3) Shiny white structures: 20 (51.3) Rosettes: 2 (5.1)	Present: 30 (76.9) Predominant distribution: widespread: 15 (38.5) Predominant types: hairpin 10 (25.6) // atypical/linear irregular 9 (23.1) White halo: 13 (33.3)
KA-like pattern 15 (6.8)	9 (60)	Milia-like cysts: 0 (0) Comedo-like openings: 0 (0) Fissures/ ridges: 0 (0)	Blue-grey granules: 0 (0) Pigment network: 0 (0) Pseudonetwork: 0 (0) Pigmented dots/globules: 0 (0) Hyperpigmented structureless areas: 4 (26.7) Streaks/ pseudopods: 0 (0)	Blue-grey globules/ ovoid nests: 0 (0) Bluish hue: 2 (13.3)	Negative network: 0 (0) Shiny white structures: 4 (26.7) Rosettes: 0 (0)	Present: 15 (100) Predominant distribution: radial: 12 (80) Predominant types: hairpin 11 (73.3) // NS 2 (13.3) White halo: 10 (66.7)
BCC-like pattern 13 (5.9)	9 (69.2)	Milia-like cysts: 4 (30.8) Comedo-like openings: 4 (30.8) Fissures/ ridges: 1 (7.7)	Blue-grey granules: 4 (30.8) Pigment network: 0 (0) Pseudonetwork: 0 (0) Pigmented dots/globules: 2 (15.4) Hyperpigmented structureless areas: 1 (7.7) Streaks/ pseudopods: 0 (0)	Blue-grey globules/ ovoid nests: 6 (46.2) Bluish hue: 0 (0)	Negative network: 0 (0) Shiny white structures: 9 (69.2) Rosettes: 1 (7.7)	Present: 13 (100) Predominant distribution: widespread: 7 (53.8) Predominant types: arborizing telangiectasia 6 (46.2) // hairpin 6 (46.2) White halo: 4 (30.8)
VV-like pattern 13 (5.9)	9 (69.2)	Milia-like cysts: 0 (0) Comedo-like openings: 0 (0) Fissures/ ridges: 3 (23.1)	Blue-grey granules: 3 (23.1) Pigment network: 0 (0) Pseudonetwork: 0 (0) Pigmented dots/globules: 0 (0) Hyperpigmented structureless areas: 2 (15.4) Streaks/ pseudopods: 0 (0)	Blue-grey globules/ ovoid nests: 0 (0) Bluish hue: 0 (0)	Negative network: 0 (0) Shiny white structures: 2 (15.4) Rosettes: 0 (0)	Present: 12 (92.3) Predominant distribution: widespread: 7 (53.8) Predominant types: hairpin 5 (38.5) // Glomerular 3 (23.1) White halo: 8 (61.5)

© 2021 Australasian College of Dermatologists.

Table 1 *Continued*

Pattern n (%)	Ulceration/ Erosions/ Haemorrhage n (%)	Classic dermoscopic criteria of SK	Pigmented structures	Blue structures	White structures	Vascularization
Nevus-like pattern 5 (2.3)	2 (40)	Milia-like cysts: 1 (20) Comedo-like openings: 2 (40) Fissures/ ridges: 1 (20)	Blue-grey granules: 2 (40) Pigment network: 4 (80) Pseudonetwork: 2 (40) Pigmented dots/globules: 0 (0) Hyperpigmented structureless areas: 1 (20) Streaks/ pseudopods: 1 (20)	Blue-grey globules/ ovoid nests: 0 (0) Bluish hue: 0 (0)	Negative network: 0 (0) Shiny white structures: 1 (20) Rosettes: 0 (0)	Present: 5 (100) Predominant distribution: widespread: 3 (60) Predominant types: hairpin 3 (60). White halo: 1 (20)

SK, seborrheic keratosis; SCC, squamous cell carcinoma; MM, melanoma; KA, keratoacanthoma; BCC, basal cell carcinoma; VV, verruca vulgaris.

On dermoscopic examination, 47% (103/219) showed asymmetry of colour, while 44.3% (97/219) showed asymmetry of structures. Clinical or dermoscopic ulceration, including the presence of erosions or bleeding, was present in 54.3% (119/219; Fig. 1), while hyperkeratosis was present in 64.4% (141/219).

Regarding SK-related dermoscopic features, 64 lesions showed comedo-like openings (29.2%), 54 (24.7%) showed milia-like cysts and 25 (11.9%) showed fissures/ ridges or fat fingers. Interestingly, 53% (116/219) of the lesions did not show any of these three most common classical dermoscopic criteria associated with the diagnosis of seborrheic keratosis. The presence of blue-grey granules was found in 66 lesions (30.1%). A bluish homogeneous background ('bluish hue') was observed in 40 iSKs (18.3%).

Regarding vascular structures, the vast majority of iSKs (91.3%; 200/219) showed dermoscopic vascularization. Among them, classical hairpin vessels were predominant in only 44.5% of cases (89/200), with a lower percentage of other vessel types. A whitish halo around vessels was present in 101/200 lesions (50.5%).

iSKS were classified into 7 patterns, as follows: (i) SK-like (28,8%; 63/219) (Fig. 2): The majority of them presented at least one classic criteria of SK (66.7%; 42/63). Hairpin vessels were the predominant type of vascularization (55.6%; 35/63); (ii) SCC-like (25.6%; 56/219) (Fig. 3): this group included those lesions resembling invasive SCC or in situ SCC (Bowen disease). This were mostly hypopigmented hyperkeratotic lesions (66.1%; 37/56) with some degree of erosion or ulceration (71.4%; 40/56). Glomerular (32.1%; 18/56) and hairpin vessels (30.4%; 17/56) were predominant; (iii) MM-like (17.8%; 39/219) (Fig. 4): mostly asymmetric lesions showing a multicomponent pattern. Relevant structures in this group were the presence of pigmented dots/ globules (38.5%; 15/39), pigmented pseudonetwork (15.4%; 6/39) or pigmented network (12.8%; 5/39). Strikingly, 51.3% of lesions showed shiny white structures (SWS) (20/39). Blue-grey granules were present in 53.8% (21/39). Vascularization was highly variable in this group; (iv) KA-like (6.8%; 15/219) (Fig. 5): a distinctive pattern characterised by symmetry and sharp demarcation. All lesions were exophytic and hyperkeratotic (100%; 15/15) and showed a radial arrangement of vessels (80%; 12/15), most of them hairpin-shaped (73.3%; 11/15). (v) BCC-like (5.9%; 13/219; Fig. 5): iSKs belonging to this group were mainly characterised by some degree of erosion/ ulceration and SWS (69.2%; 9/13). Blue structures (i.e. blue globules/ovoid nests) were also frequent (46.2%; 6/13). Regarding vascularization, arborizing telangiectasia and hairpin vessels were the predominant types (46.2% each; 6/13); (vi) Verruca vulgaris-like (VV-like) (5.9%; 13/219): these are hypopigmented lesions with a polylobulated or verrucous surface. In addition, they were characterised by the presence of hyperkeratosis (69.2%; 9/13) and hairpin (38.5%; 5/13) or glomerular vessels (23.1%; 3/13); and (vii) Nevus-like (2.3%; 5/219): mostly symmetric, round-shaped and small-sized lesions. Pigmented network was present in 80% of the lesions (80%; 4/5).

© 2021 Australasian College of Dermatologists.

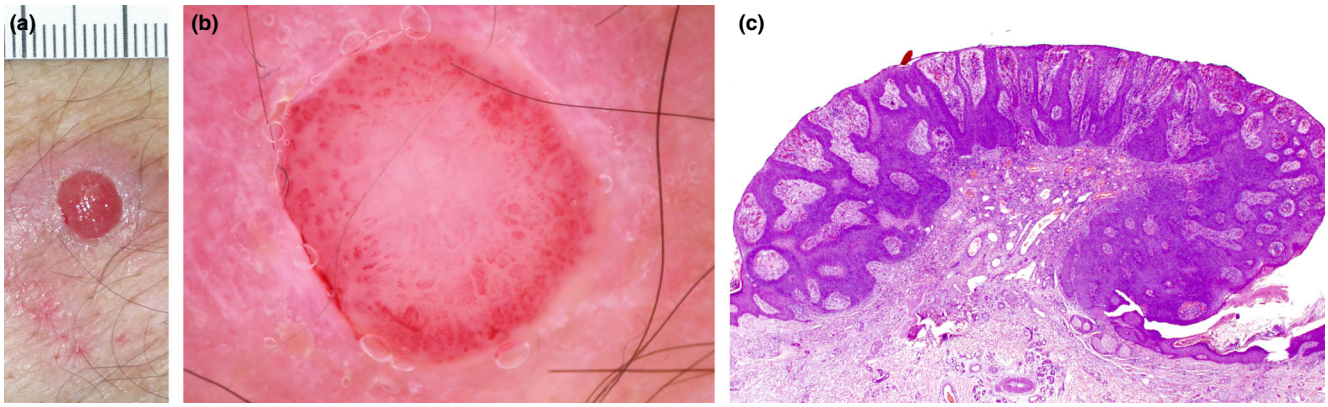

Figure 1 (a) Erythematous ulcerated tumour measuring 6 mm in diameter. (b) Dermoscopy revealed an atypical vascular pattern composed by glomerular and atypical hairpin vessels, in absence of criteria of SK (DermLite Foto; 3Gen, LLC, Dana Point, CA, USA Original magnification ×10). (c) Histopathologic examination showed an acanthotic proliferation of typical keratinocytes along with a heavy inflammatory infiltrate and dilated blood vessels in the underlying superficial dermis.

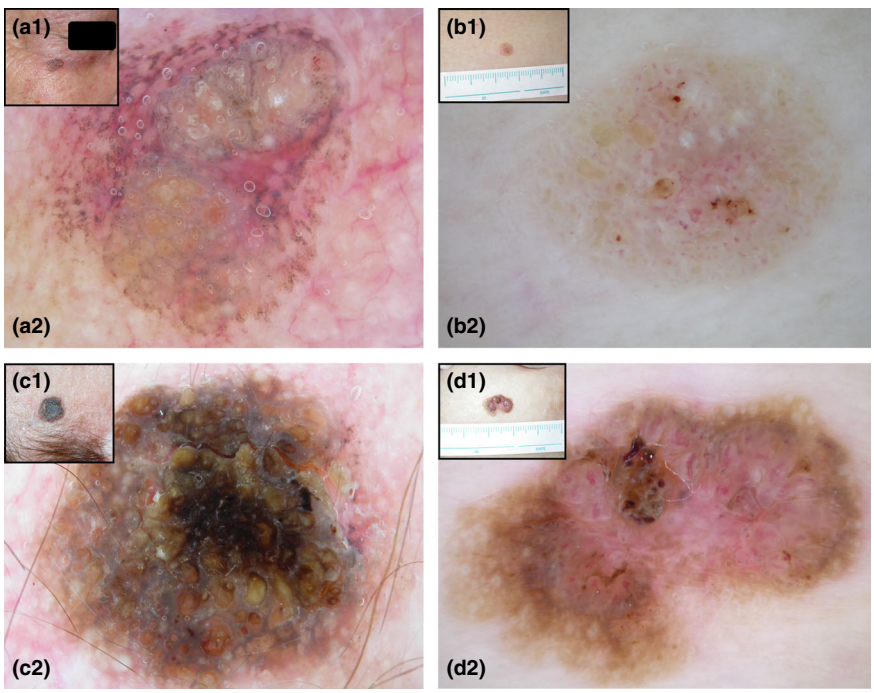

Figure 2 SK-like iSKs. (a1) Pigmented skin papule located on the right cheek; (a2) Dermoscopy of the lesion showed diffuse erythema and blue-grey granules, but also comedo-like openings and milia-like cysts. (b1) Hypopigmented lesion located on the trunk. (b2) Dermoscopic examination showed some crusts and hairpin vessels surrounded by a whitish halo, along with comedo-like openings and milia-like cysts. (c1) Brownish hyperkeratotic lesion on the temple. (c2) In the dermoscopic view, we can see keratin, comedo-like openings, milia-like cysts and blue-grey granules. (d1) Asymmetric pigmented lesion located on the trunk. (d2) Although the lesion was clinically atypical, dermoscopy showed hairpin vessels surrounded by a whitish halo, milia-like cysts and fissures/ ridges, in absence of criteria of melanocytic lesion (DermLite Foto; 3Gen, LLC, Dana Point, CA, USA Original magnification ×10).

The remaining 15 lesions were classified as 'other pattern', as they did not fit into any of these predefined groups. Dermoscopic structures detected in each pattern are summarised in Table 1. Overall, 123 lesions (56.2%) were considered to mimic malignant tumours (SCC, MM, BCC or KA).

DISCUSSION

The usefulness of dermoscopy for the diagnosis of SKs is well established, and its recognition is usually straightforward. Braun and colleagues evaluated the dermoscopic features of 203 pigmented SKs and observed that comedo-

© 2021 Australasian College of Dermatologists.

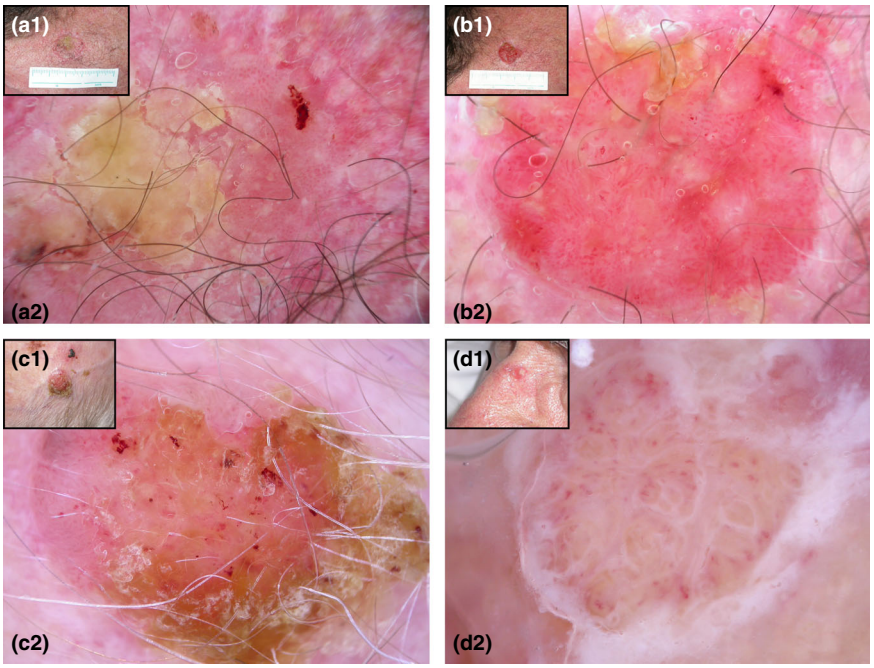

Figure 3 SCC-like iSKs. (a1) Hyperkeratotic erythematous lesion on the neck. (a2) Dermoscopy revealed yellowish keratin, haemorrhagic crusts and clustered glomerular and dotted vessels. (b1) Erosive erythematous tumour located on the neck. (b2) Dermoscopically, the lesion was characterised by hairpin vessels surrounded by a whitish halo, glomerular vessels and yellowish keratin, along with some haemorrhagic crusts. (c1) Erythematous hyperkeratotic tumour on the temple. (c2) Dermoscopy showed a polymorphous atypical vascularization along with yellowish keratin and haemorrhage. (d1) Ulcerated erythematous papule on the nose. (d2) In the dermoscopic view, we can see predominantly glomerular and dotted vessels, along with yellowish globules and white lines (DermLite Foto; 3Gen, LLC, Dana Point, CA, USA Original magnification ×10).

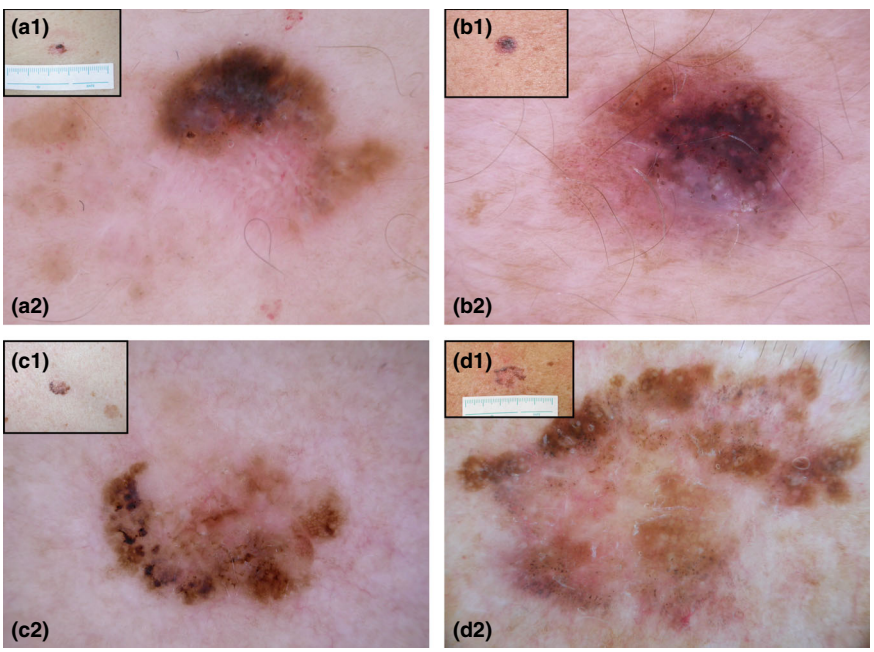

Figure 4 MM-like iSKs. (a1) Asymmetrically pigmented lesion on the trunk. (a2) Dermoscopy revealed hyperpigmented structureless areas, radial streaks, blue-grey granules and SWS. (b1) Irregularly pigmented lesion located on the trunk. (b2) Dermoscopically, the lesion was characterised by brown globules, atypical pigmented network, blue-grey areas and hyperpigmented structureless areas. (c1) Irregularly pigmented skin lesion on the trunk. (c2) Dermoscopic examination showed an atypical pigment network, blue-grey granules and hyperpigmented structureless areas. (d1) Multicoloured skin lesion on the trunk. (d2) Using dermoscopy, the lesion showed hyperpigmented structureless areas, blue-grey granules and an atypical vascularization, along with some milia-like cysts (DermLite Foto; 3Gen, LLC, Dana Point, CA, USA Original magnification ×10).

© 2021 Australasian College of Dermatologists.

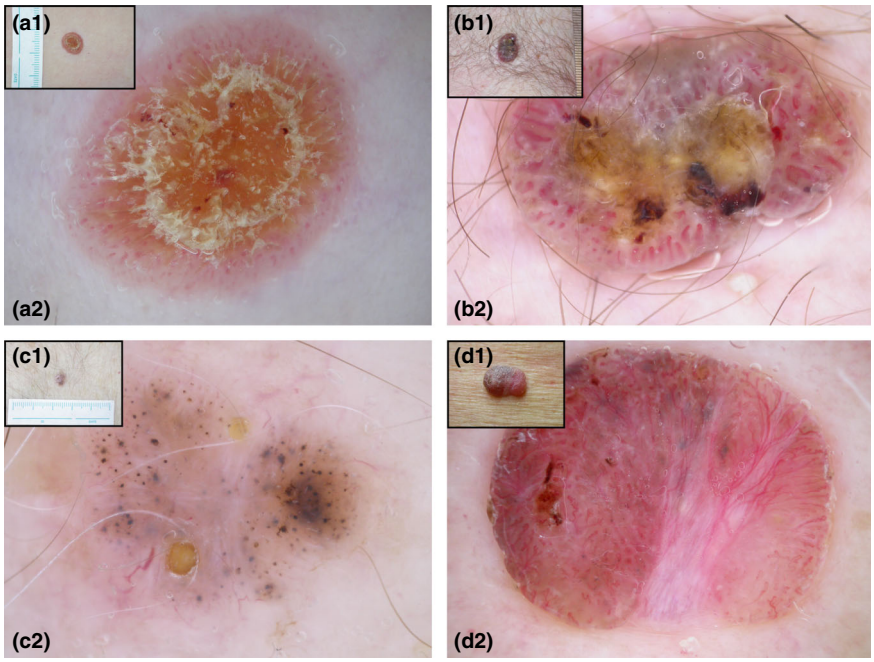

Figure 5 KA-like (a, b) and BCC-like iSKs (c, d). (a1) Yellowish-erythematous crateriform lesion with sharp demarcation. (a2) Dermoscopic examination revealed hairpin and glomerular vessels with a peripheral distribution, surrounding central keratotic area. (b1) Erythematous-violaceous exophytic tumour with sharp borders and keratotic centre. (b2) Dermoscopically, the lesion was characterised by peripheral hairpin vessels surrounded by a whitish halo, along with a yellowish central keratotic mass. (c1) Partially pigmented skin lesion with a shiny surface. (c2) Dermoscopy showed multiple blue-grey globules and dots, along with arborizing telangiectasia and two comedo-like openings. (d1) Exophytic erythematous and bluish lesion. (d2) In the dermoscopic view, we can see multiple blue-grey globules, multiple erosions, hairpin vessels and also arborizing vessels (DermLite Foto; 3Gen, LLC, Dana Point, CA, USA Original magnification ×10).

like openings were present in 71%, milia-like cysts in 67% and brain-like appearance in 61%.[3] The dermoscopic two-step algorithm establish the diagnosis of SK in the presence of multiple milia-like cysts, comedo-like openings, brain-like appearance and fingerprint-like structures in absence of criteria of melanocytic lesion.[10,11] Lin and colleagues reported a sensitivity and specificity for this method of 79.1% and 78.3%, respectively.[4] These authors described an optimised algorithm, which includes the lack of blue-grey or blue-white colours in addition to sharp demarcation, mica-like structure and yellowish colour, reporting a sensitivity of 95.7% and a specificity of 78.3%.[4] In our series of iSKs, we describe a 'SK-like pattern' in those lesions that, although atypical, could be confidently diagnosed by experienced dermoscopists based on these SK-related dermoscopic features. The majority of these lesions showed at least one of the three most prevalent dermoscopic criteria reported by Braun and colleagues.[3] Interestingly, we detected a bluish homogeneous background ('bluish hue') in almost 20% of the iSKs in our series. This is in conflict with the diagnostic algorithm proposed by Lin and colleagues.[4] Based on our results, the absence of blue-grey or blue-white colour should not be used when an inflamed SK is in the differential diagnosis.

The first part of our study reveals that conspicuous inflammation can significantly decrease the usefulness of dermoscopy for the diagnosis of SKs. Even though the ability of diagnosing iSKs improves in experienced dermatologists, it remains below 50% in any case. Despite being the most frequent epidermal tumour, our study shows that clinical-dermoscopic examination may not be enough in some cases and histopathologic examination should be performed. In order to highlight these challenging presentations, we classified these atypical lesions according their dermatoscopic similarity to predefined skin tumours. This classification allowed us to include more than 94% of the lesions in one of these predefined patterns. Squillace and colleagues and Mazzeo and colleagues have already used this similarity to describe atypical SKs, regardless of inflammation.[6,12] In our study, we have observed that 56.2% of iSKs were suspicious of malignancy, which represents a high percentage in comparison to the study of Braun and colleagues, in which only 10% from 203 pigmented SKs had a doubtful diagnosis and required histopathological examination.[3]

The 'SCC-like' pattern represented the 25.6% of our series. Our findings in SCC-like iSKs, which are mainly characterised by hyperkeratosis (66.4%), erosions/ulceration (71.4%) and glomerular (32.1%) or hairpin vessels (30.4%), are in line with well-known dermoscopic patterns in SCC and/or non-pigmented Bowen's disease.[13,14] SCC is also the main differential diagnosis in hyperkeratotic and irritated SKs. Dermoscopic predictors of SCC versus irritated SKs are dotted vessels, branched linear vessels, white structureless areas or white circles surrounding follicles, as recently reported by Papageorgiou and colleagues.[15] A distinctive pattern mainly characterised by sharp demarcation, central keratin and peripheral hairpin vessels in a

© 2021 Australasian College of Dermatologists.

radial arrangement was detected in almost 7% of lesions in our series ('KA-pattern'). These findings are analogous to those reported by Rosendahl and colleagues and Zalaudek and colleagues in their series of 43 and 24 KA, respectively.[13,16] Both clinical and histopathological KA-like features have been previously reported in different variants of SKs.[17] Regarding dermoscopy, this so-called 'KA-pattern' was also described as an atypical pattern in the study conducted by Squillace and colleagues, without specifying whether there was inflammation or not.[6]

A 'MM-like' pattern was found in 17.8% of iSKs in our series. Asymmetry of colours and structures were present in 74.4% and 76.9% of lesions in this group, respectively. These findings have been classically associated with malignancy, although its prevalence in SK has not been evaluated to date.[18,19] In our study, hyperpigmented structureless areas were present in 61.5%, pigmented dots/globules in 38.5%, pigmented network in 12.8% and streaks/pseudopods in 12.8%. In their series of atypical SKs, Squillace and colleagues described an analogous multicomponent pattern characterised by irregular dots/globules, atypical pigment network and diffuse hyper/hypopigmentation.[6] Furthermore, we also found other suspicious structures such as SWS in 51.3%, and negative network in 10.3%. SWS, which are a clue of malignancy in melanocytic neoplasms, are visible only under polarised light dermoscopy and, as recently reported, they can reflect hyperkeratosis or dermal fibrosis.[20,21] Although negative network may rarely be present in Spitz nevi or dermatofibromas, these structures are highly specific of MM.[22] Blue-grey granules were present in more than half of 'MM-like' iSKs of our series (53.8%). Considering that this dermoscopic finding may be seen in both regressing SK with lichenoid inflammation and MM,[23] any cutaneous tumour with this feature and without unequivocal benign criteria, should be biopsied to rule out MM.[24] On the other hand, Carrera and colleagues evaluated 134 MM that resemble SKs, concluding that the presence of blue-white veil, streaks/pseudopods and pigment network are the most helpful structures in order to correctly identify these lesions. However, in their series, comedo-like openings were observed in 30.6%, scale and hyperkeratosis in 33.6%, milia-like cysts in 22.4% and fissure and ridges in 11.2%.[25] This fact reveals that MM and SK may show overlapping dermoscopic features. Therefore, even in the presence of classic dermoscopic findings of SK, biopsy should be mandatory in this doubtful or atypical lesions to exclude SK-like MM.

We classified iSKs as having a 'BCC-like' pattern in 5.9% of our series, mainly because of the detection of erosions/ulceration (69.2%), blue-grey ovoid nests/globules (46.2%) and/or arborizing telangiectasia (46.2%). These three dermoscopic structures are positive features for the diagnosis of BCC in the model created by Menzies and colleagues.[26] Moreover, SWS were observed in the 69.2% of 'BCC-like' iSKs in our series. These structures have been reported in 46% of a series of 287 BCC by Navarrete-Dechent and colleagues.[27] Due to the presence of bluish globular-like structures, previous studies specifically reported that clonal SKs can mimic BCC.[28] Apart from this specific histopathologic variant, the ability of SKs to mimic BCC has been only anecdotally reported.[29]

Regarding vascular structures, the vast majority (91.3%) of the iSKs in our series showed vessels on dermoscopy. Overall, 40.6% of lesions in our series showed hairpin vessels as the predominant type. Braun and colleagues reported the presence of hairpin vessels in 63% of SKs in their series of pigmented SKs,[3] whereas in the study conducted by Mazzeo and colleagues, only 8.3% of atypical SKs showed these vascular structures.[12] Even though they are a common finding in SKs, these kind of dermoscopic vascularization is not specific and represents a clue for the group of keratinising tumours, specifically when a white halo surrounding vessels is present.[30] A white halo surrounding vessels was found in just over half of vascularized lesions in our series. In addition, they often appeared elongated, irregular in size, twisted, helical or double-stranded, resulting in a marked vascular polymorphism. It should be taken into account that atypical hairpin vessels may also be seen in non-keratinising malignant tumours such as MM.[25] Interestingly, more than half of vascularized iSKs didn't show a predominance of hairpin vessels. Specifically, glomerular and dotted vessels were predominant in 12.8% and 8.7% of lesions, respectively. As previously reported, this finding correlates with a bowenoid or SCC-like appearance.[6,13] An atypical polymorphous vascular pattern was detected in 11.4% of lesions, highlighting the ability of iSKs to mimic malignant cutaneous neoplasms.[31] In some iSKs of our series, vascularization was the most relevant dermoscopic finding. In this sense, erythematous or hypopigmented lesions with a filiform or polilobulated surface and diffusely distributed vessels were classified into a 'VV-like pattern' (5.9%).

The present study has several limitations. In the first part of the study, we assessed diagnostic accuracy through an artificial scenario, which may not be representative of diagnoses made during live patient examinations. The second part of the study was conducted retrospectively and descriptively. A comparative analysis of the different patterns of iSKs with the different tumours they mimic was not performed. SKs with histopathological inflammation were collected, whereas the different histologic variants of SKs were not considered. The histopathologic diagnosis of iSK was based on the official pathology diagnosis from the corresponding centre; a second pathologist did not confirm the diagnoses.

In conclusion, this study highlights the challenge of diagnosing iSKs. Although iSKs may show some of the well-known dermoscopic criteria of SK, they often present with striking dermoscopic findings such as atypical vessels, shiny white structures, pigment network, blue colour or ulceration. Therefore, iSKs may behave as true mimickers of other cutaneous tumours, with SCC and MM being the main differential diagnosis. In this sense, we have observed seven repetitive patterns according to this ability to simulate other cutaneous neoplasms. Even though dermoscopy remains a key tool for the diagnosis of skin tumours, it has some limitations. For these reasons, in case

© 2021 Australasian College of Dermatologists.

of significant overlap between SK features and malignancy-associated criteria, histopathologic examination is still mandatory.

REFERENCES

1. Hafner C, Vogt T. Seborrheic keratosis. *J. Dtsch. Dermatol. Ges.* 2008; **6**: 664–77.
2. Braun RP, Ludwig S, Marghoob AA. Differential diagnosis of seborrheic keratosis: clinical and dermoscopic features. *J. Drugs. Dermatol.* 2017; **16**: 835–42.
3. Braun RP, Rabinovitz HS, Krischer J *et al*. Dermoscopy of pigmented seborrheic keratosis: a morphological study. *Arch. Dermatol.* 2002; **138**: 1556–60.
4. Lin J, Han S, Cui L *et al*. Evaluation of dermoscopic algorithm for seborrhoeic keratosis: a prospective study in 412 patients. *J. Eur. Acad. Dermatol. Venereol.* 2014; **2**: 957–62.
5. Nwabudike LC, Tebeica T, Tatu AL. Nodular, ulcerated seborrhoeic keratosis. *Clin. Exp. Dermatol.* 2020; **45**: 602–4.
6. Squillace L, Cappello M, Longo C *et al*. Unusual dermoscopic patterns of seborrheic keratosis. *Dermatology* 2016; **232**: 198–202.
7. Minagawa A. Dermoscopy-pathology relationship in seborrheic keratosis. *J. Dermatol.* 2017; **44**: 518–24.
8. Abreu-Velez AM, Klein AD 3rd, Howard MS. Overexpression of linker for activated T cells, cyclooxygenase-2, CD1a, CD68 and myeloid/histiocyte antigen in an inflamed seborrheic keratosis. *N. Am. J. Med. Sci.* 2011; **3**: 161–3.
9. Mansur AT, Yildiz S. A diagnostic challenge: inflamed and pigmented seborrheic keratosis. Clinical, dermoscopic, and histopathological correlation. *Dermatol. Online. J.* 2019; **25**: 13030/qt0w56m5hq. PMID: 30982311.
10. Soyer HP, Argenziano G, Chimenti S *et al*. Consensus Net Meeting on Dermoscopy. Milan, Italy: EDRA Medical Publishing, 2001.
11. Argenziano G, Soyer HP, Chimenti S *et al*. Dermoscopy of pigmented skin lesions: results of a consensus meeting via the Internet. *J. Am. Acad. Dermatol.* 2003; **48**: 679–93.
12. Mazzeo M, Manfreda V, Diluvio L *et al*. Dermoscopic analysis of 72 'atypical' seborrheic keratoses. *Actas Dermosifiliogr* 2019; **110**: 366–71.
13. Zalaudek I, Giacomel J, Schmid K *et al*. Dermatoscopy of facial actinic keratosis, intraepidermal carcinoma, and invasive squamous cell carcinoma: a progression model. *J. Am. Acad. Dermatol.* 2012; **66**: 589–97.
14. Zalaudek I, Argenziano G, Leinweber B *et al*. Dermoscopy of Bowen's disease. *Br. J. Dermatol.* 2004; **150**: 1112–6.
15. Papageorgiou C, Spyridis I, Manoli SM *et al*. Accuracy of dermoscopic criteria for the differential diagnosis between irritated seborrheic keratosis and squamous cell carcinoma. *J. Am. Acad. Dermatol.* 2020 Feb 14; **85**: 1143–50.
16. Rosendahl C, Cameron A, Argenziano G *et al*. Dermoscopy of squamous cell carcinoma and keratoacanthoma. *Arch. Dermatol.* 2012; **148**: 1386–92.
17. Laimer M, Kraus L, Zelger B. Verrucous seborrheic keratosis with keratoacanthoma-like features, a pitfall in differential diagnosis. *J. Dtsch. Dermatol. Ges.* 2015; **13**: 911–3.
18. Lorentzen HF, Weismann K, Larsen FG. Structural asymmetry as a dermatoscopic indicator of malignant melanoma–a latent class analysis of sensitivity and classification errors. *Melanoma. Res.* 2001; **11**: 495–501.
19. Weber P, Tschandl P, Sinz C *et al*. Dermatoscopy of neoplastic skin lesions: recent advances, updates, and revisions. *Curr. Treat. Options. Oncol.* 2018; **19**: 56.
20. Liebman TN, Rabinovitz HS, Dusza SW *et al*. White shiny structures: dermoscopic features revealed under polarized light. *J. Eur. Acad. Dermatol. Venereol.* 2012; **26**: 1493–7.
21. Bañuls J, Francés L, Niveiro M *et al*. Heterogeneity in the linear shiny white structures in melanomas seen with polarized light according to histopathological association: cross-sectional observational study in 118 cutaneous melanomas. *J. Dermatol.* 2020; **47**: 1058–62.
22. Pizzichetta MA, Talamini R, Marghoob AA *et al*. Negative pigment network: an additional dermoscopic feature for the diagnosis of melanoma. *J. Am. Acad. Dermatol.* 2013; **68**: 552–9.
23. Yélamos O, Braun RP, Liopyris K *et al*. Dermoscopy and dermatopathology correlates of cutaneous neoplasms. *J. Am. Acad. Dermatol.* 2019; **80**: 341–63.
24. Zaballos P, Blazquez S, Puig S *et al*. Dermoscopic pattern of intermediate stage in seborrhoeic keratosis regressing to lichenoid keratosis: report of 24 cases. *Br. J. Dermatol.* 2007; **157**: 266–72.
25. Carrera C, Segura S, Aguilera P *et al*. Dermoscopic clues for diagnosing melanomas that resemble seborrheic keratosis. *JAMA. Dermatol.* 2017; **153**: 544–51.
26. Menzies SW, Westerhoff K, Rabinovitz H *et al*. Surface microscopy of pigmented basal cell carcinoma. *Arch. Dermatol.* 2000; **136**: 1012–6.
27. Navarrete-Dechent C, Bajaj S, Marchetti MA *et al*. Association of shiny white blotches and strands with nonpigmented basal cell carcinoma: evaluation of an additional dermoscopic diagnostic criterion. *JAMA. Dermatol.* 2016; **152**: 546–52.
28. Longo C, Zalaudek I, Moscarella E *et al*. Clonal seborrheic keratosis: dermoscopic and confocal microscopy characterization. *J. Eur. Acad. Dermatol. Venereol.* 2014; **28**: 1397–400.
29. Gao YY, An XJ, Yang J *et al*. Seborrheic keratosis mimicking basal cell carcinoma under dermoscopy: a case report. *Chin. Med. J. (engl)* 2020; **133**: 2139–40.
30. Togawa Y. Review of vasculature visualized on dermoscopy. *J. Dermatol.* 2017; **44**: 525–32.
31. Deinlein T, Eber E, Fink-Puches R *et al*. Polymorphic vessels-think about seborrheic keratosis. *Dermatol. Pract. Concept.* 2020; **10**: e2020090.

© 2021 Australasian College of Dermatologists.