

Diagnostic Accuracy of Dermoscopy for Spitzoid Tumours in Adults

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Spitzoid tumours (ST) represent a diagnostic challenge and the accuracy of dermoscopy in these cases remains unclear. This retrospective study evaluated dermoscopic images collected from 2011 to 2016. Two dermatologists, blinded to clinical/histopathological data, identified lesions with spitzoid dermoscopic patterns, using histopathology as the gold standard. Of 4,337 dermoscopic images, 240 (5.5%) showed spitzoid dermoscopic patterns (221 patients; median age 40; 57.9% female). Histopathology revealed 23% (55/240) ST, 62% (149/240) non-spitzoid melanocytic lesions and 15% (36/240) non-melanocytic lesions. Overall, 25.4% (61/240) were malignant, mainly melanoma/melanoma metastases (50/240). Across excised tumours, 1.5% (67/4,337) were ST. Sensitivity and specificity were 82.1% (95% CI 70.8–90.4%) and 95.7% (95% CI 95–96.3%), with an AUC of 0.88 (95% CI 0.84–0.93). Positive predictive value was 22.9% (95% CI 17.8–28.8%), and negative predictive value was 99.7% (95% CI 99.5–99.9%). Starburst pattern was more frequent in ST ($p=0.007$). Linear vessels (OR 5.12; 95% CI 2.08–13.1) and glomerular vessels (OR 3.03; 95% CI 1.37–6.69) correlated with malignancy. Dermoscopy demonstrated high diagnostic accuracy and negative predictive value. However, low positive predictive value highlights limited specificity in adults; since 1 in 4 lesions with a spitzoid dermoscopic pattern was malignant, any spitzoid lesion in adults warrants high clinical suspicion.

Key words: dermoscopy; melanoma; sensitivity and specificity; spitz nevus; spitzoid-looking.

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Spitzoid melanocytic tumours present a diagnostic challenge for both dermatologists and pathologists due to overlapping features between benign and malignant lesions (1, 2). This diagnostic uncertainty

SIGNIFICANCE

Spitzoid tumours are rare and can resemble melanoma, as well as common benign lesions seen in daily practice, such as warts or pyogenic granulomas. This overlap often leads to uncertainty for both patients and clinicians. In this study, we evaluated how well dermoscopy identifies these uncommon lesions in routine practice. Among 4,337 excised tumours, only a small fraction showed a spitzoid dermoscopic pattern; however, 1 in 4 lesions was malignant. Dermoscopy showed high accuracy, helping distinguish true spitzoid tumours and features linked to malignancy. These findings highlight the importance of careful examination of lesions with spitzoid dermoscopic patterns in adults.

can affect patient management, potentially leading to unnecessary treatments or, more seriously, a failure to recognize melanoma (3, 4).

Molecular classification of melanocytic tumours by the World Health Organization (WHO) defines Spitz tumours as a spectrum ranging from benign (Spitz nevus) to malignant (Spitz melanoma), including intermediate lesions (melanocytoma/atypical Spitz tumours). A proportion of these tumours can show HRAS mutations or kinase fusions (such as ALK, ROS1, NTRK1, NTRK3, MET, RET, BRAF and MAP3K8) (5, 6). The term “spitzoid” is applied to lesions that display the classic histopathological features described by Sophie Spitz, even in cases lacking molecular analysis confirming a spitzoid lineage (7, 8).

Clinical suspicion of spitzoid melanocytic tumours is difficult due to their rarity and their variable morphology (9, 10). They are predominantly seen in children and young adults, and their clinical similarity to other skin tumours leads to multiple differential diagnoses, such as pyogenic granuloma, congenital, acquired and dysplastic nevus or melanoma (2, 11). Dermoscopy has significantly improved the recognition of spitzoid tumours by identifying characteristic structures and patterns, but the diagnostic accuracy of this technique has not been well established in clinical practice (12–14).

Although current guidelines recommend excision of lesions with spitzoid dermoscopic patterns in patients aged ≥ 12 years to rule out melanoma (14,

15), individualized management remains controversial, highlighting the need for further research to improve clinical diagnosis and treatment strategies aligned with precision medicine.

Our study aimed to evaluate the diagnostic accuracy of dermoscopy in the detection of spitzoid melanocytic tumours in a real-world referral centre setting; to characterize the clinical and dermoscopic features of all lesions with spitzoid dermoscopic patterns; and to identify dermoscopic features associated with spitzoid histopathology and malignancy.

MATERIALS AND METHODS

We conducted a retrospective study using the database of dermoscopic images collected between 1 January 2011 and 31 December 2016, at a tertiary Spanish hospital. Only excised lesions with histopathological confirmation were included. All dermoscopic images were evaluated using a structured, multi-phase consensus approach. In the first phase, a trained dermatologist (NV) with 5 years of experience evaluated all eligible images case-by-case under standardized viewing conditions to perform the primary screening for spitzoid dermoscopic patterns. In the second phase, NV and a senior dermatologist (CC) with over 20 years of experience reviewed the selected cases together to achieve a joint consensus classification. Both evaluators remained strictly blinded to clinical and histopathological information during this process. In case of disagreement, a third senior expert (SP) reviewed the images. Crucially, SP performed this adjudication completely independently and remained blinded to the previous opinions of NV and CC, providing a blinded tie-breaking evaluation to reach the final classification. Dermoscopic images of insufficient quality and lesions lacking histopathological confirmation were excluded.

Spitzoid dermoscopic criteria were defined according to available literature (16, 17). Global patterns were classified into 7 groups: vascular (dotted vessels regularly distributed in flat lesions; glomerular, linear or hairpin vessels in raised lesions), starburst (central homogeneous area and streaks or pseudopods symmetrically distributed at the periphery), globular (brown to black globules of variable size, distributed throughout the lesion or at the periphery in multiple rows), reticular (thick, intensely pigmented, superficial black network), homogeneous (diffuse dark brown, black or bluish pigmentation in the absence of other dermoscopic structures), atypical or multicomponent (the combination of at least 2 different patterns) and nonspecific (not assignable to any of these global patterns but with local spitzoid dermoscopic features) (Fig. S1). Local dermoscopic features such as black network, negative network, shiny white

lines, pseudopods, streaks, blotch, globules, regression, blue-white veil, blue-black pigmentation and vascularity were also evaluated.

Additionally, all histopathological reports containing the terms 'Reed', 'Spitz' or 'spitzoid' during the study period were retrieved from the pathologic archive and reviewed for correlation.

For each included lesion, the following data were recorded: patient age, sex, personal and/or family history of melanoma, Fitzpatrick skin type, anatomical location, lesion size, colour and histopathological diagnosis.

To enhance the diagnostic accuracy analysis, lesions were classified based on the concordance between dermoscopic impression and histopathological diagnosis. True positives were lesions showing a spitzoid dermoscopic pattern and diagnosed histopathologically as a Spitz/Reed/spitzoid nevus, atypical Spitz/spitzoid tumour or Spitz/spitzoid melanoma. False positives displayed a spitzoid dermoscopic pattern but had a different histopathological diagnosis. False negatives were those not presenting a spitzoid dermoscopic pattern but were histopathologically diagnosed as spitzoid tumour. True negatives showed no spitzoid dermoscopic pattern and were histopathologically diagnosed as non-spitzoid.

Statistical analysis

Demographic, clinical and dermoscopic variables were analysed. Categorical variables were summarized as absolute frequencies and percentages; continuous variables as mean and standard deviation (SD) or median and interquartile range (IQR), depending on their distribution. The dataset was stratified primarily into spitzoid versus non-spitzoid histopathology and secondarily into benign versus malignant tumours in general. Group comparisons were performed using Pearson's Chi-squared or Fisher's exact test for categorical variables and the Wilcoxon rank-sum test for continuous variables. Univariate logistic regression models were applied to calculate crude and adjusted odds ratios (OR) with 95% confidence intervals (95% CI). The diagnostic accuracy of dermoscopy for spitzoid melanocytic tumours was assessed through sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and the area under the curve (AUC) of the Receiver Operating Characteristic (ROC) curve with a 95% CI, using histopathology as the reference standard. The ROC curve was plotted to illustrate test performance. All statistical analyses were performed using the computing environment R version 4.5.1 (2025-06-13) and RStudio (version 2024.12.0.467). A 2-sided p -value <0.05 was considered statistically significant. Given the exploratory and descriptive nature of this study, no

statistical adjustments for multiple comparisons (e.g., the Bonferroni correction) were applied. Consequently, *p*-values are reported as unadjusted and should be interpreted as hypothesis-generating.

The study was approved by the Clinical Research Ethics Committee of the Clínic Hospital of Barcelona (reference # HCB/2022/0373).

RESULTS

Fig. 1 shows a detailed flowchart of the selection and classification process of cases. A total of 5,499 dermoscopic images were retrieved from the database spanning 2011 to 2016. Among these, 129 cases (2.3%) were excluded due to low-quality, as well as 1,033 cases (18.7%) since they lacked histopathological confirmation. Among the remaining 4,337 dermoscopic images, 240 cases (5.5%) were classified dermoscopically as spitzoid lesions, and 55 cases (1.2% of the total) were confirmed as melanocytic spitzoid tumours by histopathology. Conversely, histopathological assessment of the 4,337 cases revealed 67 spitzoid melanocytic tumours (1.5%) and 4,270 other melanocytic and non-melanocytic diagnoses. A total of

12 lesions (0.3% of the total) classified dermoscopically as non-spitzoid were diagnosed as spitzoid tumours by histopathology (false negatives).

Demographic characteristics of patients with dermoscopically spitzoid lesions

Table I summarizes the demographic, clinical and dermoscopic characteristics of lesions with spitzoid dermoscopic patterns. A total of 240 dermoscopically spitzoid lesions from 221 patients were analysed. The median age of patients was 40 years (IQR, 22 years), with 57.9% females. Patients with spitzoid tumours confirmed by histopathology had a median age of 29 years (IQR, 20), compared to 45 years (IQR, 22.5 years) in cases of non-spitzoid tumours ($p<0.001$), with similar proportion of females between groups (67.9% vs 54.8%; $p=0.091$). A personal history of melanoma was more frequent in patients with non-spitzoid tumours (38.5% vs 14%; $p=0.001$) and family history of melanoma showed a similar trend (26.5% vs 14%; $p=0.044$). Conversely, patients with dermoscopically spitzoid malignant tumours had a median age of 50 years (IQR, 28.5 years) compared to 38 years (IQR, 20 years)

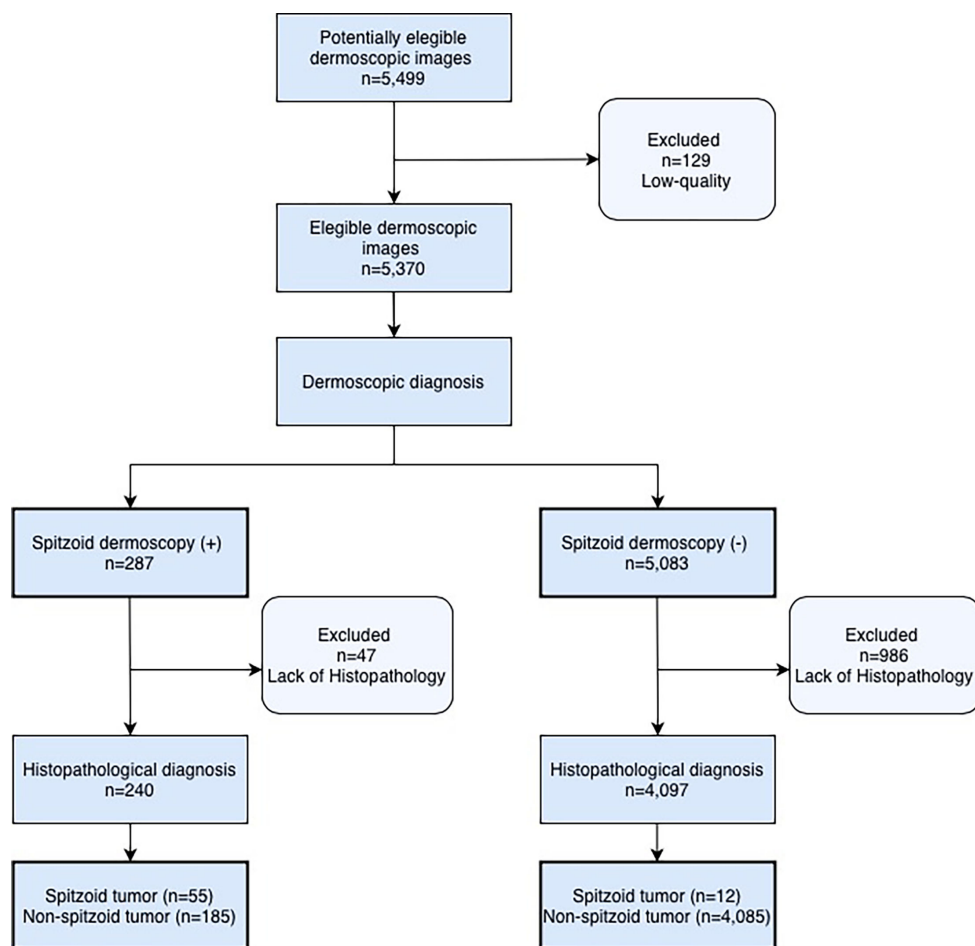


Fig. 1. Flowchart of selection and classification process of cases.

Table I. Demographic, clinical and dermoscopic characteristics of lesions with spitzoid dermoscopic patterns

	Overall	Spitzoid histology	Non-Spitzoid histology	P value ¹	Malignant	Benign	P value ¹
Patients demographics (n=221)							
Age, years, median (Q1, Q3)	40 (31, 53)	29 (18, 38)	45 (35,57.5)	<0.001*	50 (42, 70.5)	38 (28, 48)	<0.001*
Sex, n (%)							
Male	93 (42.1%)	17 (32.1%)	76 (45.2%)	0.091	26 (46.4%)	67 (40.6%)	0.45
Female	128 (57.9%)	36 (67.9%)	92 (54.8%)		30 (53.6%)	98 (59.4%)	
Fitzpatrick skin type, n (%)							
I	16 (8.8%)	4 (9.5%)	12 (8.6%)	0.42	5 (10.2%)	11 (8.3%)	0.79
II	70 (38.7%)	13 (31%)	57 (41%)		21 (42.9%)	49 (37.1%)	
III	93 (51.4%)	24 (57.1%)	69 (49.6%)		23 (46.9)	70 (53%)	
IV	2 (1.1%)	1 (2.4%)	1 (0.7%)		0 (0%)	2 (1.5%)	
Missing	40	11	29		7	33	
Personal history of melanoma, n (%)							
No	139 (67.5%)	43 (86%)	96 (61.5%)	0.001*	30 (53.6%)	109 (72.7%)	0.009
Yes	67 (32.5%)	7 (14%)	60 (38.5%)		26 (46.4%)	41 (27.3%)	
Missing	15	3	12		0	15	
Family history of melanoma, n (%)							
No	151 (76.6%)	43 (86%)	108 (73.5%)	0.070*	38 (74.5%)	113 (77.4%)	0.67
Yes	46 (23.4%)	7 (14%)	39 (26.5%)		13 (25.5%)	33 (22.6%)	
Missing	24	3	21		5	19	
Clinical and dermoscopic characteristics of lesions (n=240)							
Size, mm, median (Q1,Q3)	5 (4, 6)	5 (3, 6)	5 (4, 6)	0.80	5 (4, 6)	5 (4, 6)	0.84
Missing	35	4	31		14	21	
Anatomical location, n (%)							
Trunk	109 (45.4%)	20 (36.4%)	89 (48.1%)	0.39	21 (33.4%)	88 (49.2%)	0.16
Legs	75 (31.3%)	20 (36.4%)	55 (29.7%)		25 (41%)	50 (27.9%)	
Arms	20 (8.4%)	6 (10.9%)	14 (7.6%)		7 (11.5%)	13 (7.3%)	
Head/neck	18 (7.5%)	6 (10.9%)	12 (6.5%)		5 (8.2%)	13 (7.3%)	
Acral	18 (7.5%)	3 (5.5%)	15 (8.1%)		3(3.9%)	15 (8.4%)	
Colour, n (%)							
Brown	125 (52.1%)	22 (40%)	103 (55.7%)	<0.001*	28 (45.9%)	97 (54.2%)	0.037
Black	58 (24.2%)	27 (49.1%)	31 (16.8%)		11 (18%)	47 (26.3%)	
Pink	55 (22.9%)	6 (10.9%)	49 (26.5%)		22 (36.1%)	33 (18.4%)	
Blue	2 (0.8%)	0 (0%)	2 (1.1%)		0 (0%)	2 (1.1%)	
Symmetry, n (%)							
No	167 (69.6%)	31 (56.4%)	136 (73.5%)	0.015*	45 (73.8%)	122 (68.2%)	0.52
Yes	73 (30.4%)	24 (43.6%)	49 (26.5%)		16 (26.2%)	57 (31.8%)	
Global dermoscopic pattern, n (%)							
Starburst	78 (32.5%)	23 (41.8%)	55 (29.7%)	0.007*	16 (26.2%)	62 (34.6%)	0.10
Globular	62 (25.8%)	10 (18.2%)	52 (28.1%)		14 (23%)	48 (26.8%)	
Vascular	49 (20.4%)	4 (7.3%)	45 (24.3%)		20 (32.8%)	29 (16.2%)	
Reticular	24 (10%)	9 (16.4%)	15 (8.1%)		5 (8.2%)	19 (10.6%)	
Other	27(11.3%)	9 (16.4%)	18 (9.7%)		6 (9.8%)	21 (11.7%)	

¹Wilcoxon rank sum test; Pearson's Chi-squared test; Fisher's exact test.

in cases of benign lesions ($p<0.001$), and a personal history of melanoma was more frequent in patients with malignant tumours (46.4% vs 27.3%, $p=0.009$).

Clinical and dermoscopic characteristics of lesions with spitzoid dermoscopic patterns

Among the 240 dermoscopically spitzoid lesions, the most common anatomical location was the trunk (45.4%), followed by the lower extremities (31.3%) and upper extremities (8.3%), with no significant differences between histologically spitzoid and non-spitzoid tumours or benign and malignant tumours.

Overall, the most common dermoscopic patterns were starburst (32.5%), globular (25.8%) and vascular (20.4%). The starburst and reticular patterns were significantly more frequent in histologically spitzoid tumours compared with non-spitzoid tumours (41.8% vs 29.7% and 16.4% vs 8.1%; $p=0.007$). No significant

difference was found in dermoscopic patterns between benign and malignant tumours ($p=0.10$). Black colour was significantly more frequent in spitzoid tumours compared with non-spitzoid tumours (49.1% vs 16.8%; $p<0.001$), as was symmetry (43.6% vs 26.5%; $p=0.015$). Pink was a significantly more evident colour in malignant tumours than in benign lesions (36.1% vs 18.4%; $p=0.037$), whereas symmetry showed no significant difference ($p=0.41$).

Local dermoscopic features were evaluated by univariable analysis, which showed that blue-black pigmentation (OR 4.48; 95% CI, 2.31–8.75), blotch (OR 3.12; 95% CI, 1.65–5.92) and streaks (OR 3.02; 95% CI, 1.60–5.72) were strongly associated with spitzoid histopathology, whereas linear vessels (OR 5.12; 95% CI, 2.08–13.1), glomerular vessels (OR 3.03; 95% CI, 1.37–6.69), milky-red areas (OR 2.84; 95% CI, 1.40–5.74) and shiny white lines (OR 2.59; 95% CI, 1.22–5.45) were associated with malignancy (**Table II**).

Table II. Association of dermoscopic features with definite spitzoid histopathology and malignant diagnosis

	Univariate analysis			
	Spitzoid vs Non-spitzoid OR (95% CI)	p-value	Malignant vs benign OR (95% CI)	p-value
Blue-black	4.48 (2.31–8.75)	<0.001*	0.60 (0.27–1.24)	0.19
Blotch	3.12 (1.65–5.92)	<0.001*	0.87 (0.43–1.66)	0.67
Streaks	3.02 1.60–5.72	<0.001*	0.84 (0.42–1.61)	0.61
Pseudopods	1.55 (0.80–2.94)	0.18	0.64 (0.31–1.26)	0.21
Black network	2.20 (0.91–5.06)	0.069	0.33 (0.08–1.00)	0.082
Negative network	0.39 (0.14–0.92)	0.045*	1.04 (0.50–2.08)	0.92
Dots	0.59 (0.21–1.39)	0.26	1.67 (0.77–3.47)	0.18
Globules	0.78 (0.42–1.42)	0.41	1.05 (0.58–1.88)	0.87
Regression	0.88 (0.31–2.16)	0.79	0.30 (0.07–0.90)	0.057
Blue-white veil	1.21 (0.42–3.09)	0.70	1.65 (0.63–4.02)	0.28
Ulceration	0.29 (0.02–1.56)	0.24	2.19 (0.63–7.15)	0.19
Dotted vessels	0.45 (0.18–1.02)	0.072	1.79 (0.91–3.45)	0.088
Linear vessels	0.31 (0.05–1.11)	0.12	5.12 (2.08–13.1)	<0.001*
Glomerular vessels	0.21 (0.03–0.74)	0.038	3.03 (1.37–6.69)	0.006*
Milky-red areas	0.78 (0.32–1.74)	0.57	2.84 (1.40–5.74)	0.004*
Shiny white lines	0.66 (0.24–1.58)	0.38	2.59 (1.22–5.45)	0.012*

Histopathological correlation of lesions with spitzoid dermoscopic patterns

Of the 240 dermoscopically spitzoid lesions, only 55 (23%) were confirmed as melanocytic spitzoid tumours by histopathology, including Spitz nevus (27/240, 11.3%), spitzoid nevus (19/240, 7.9%), atypical Spitz nevus (5/240, 2.1%) and spitzoid melanoma (4/240, 1.7%); 149 (62%) were diagnosed as common nevi (62/240, 25.8%), atypical nevi (41/240, 17.1%), conventional melanoma (37/240, 15.4%) and melanoma metastases (9/240, 3.8%). Also found were 36 (15%) non-melanocytic lesions including seborrheic keratosis (9/240, 3.8%), dermatofibromas (8/240, 3.3%) and non-melanoma skin cancer (NMSC) (11/240, 4.5%). Overall, 25.4% (61/240) of spitzoid lesions on dermoscopy were histologically diagnosed as malignant tumour (Fig. 2).

Sensitivity and specificity of dermoscopy

Dermoscopy showed a sensitivity of 82.1% (95% CI: 70.8%–90.4%) and a specificity of 95.7% (95% CI: 95%–96.3%) in detecting spitzoid melanocytic tumours. The PPV was 22.9% (95% CI: 17.8%–28.8%), and NPV 99.7% (95% CI: 99.5%–99.9%) (Table III). The AUC was 0.88 (95% CI: 0.84–0.93), indicating very good diagnostic accuracy (Fig. S2).

DISCUSSION

The present study demonstrates that dermoscopy is highly effective in detecting spitzoid melanocytic tumours, with a sensitivity of 82.1% and a specificity of 95.7%. These results are particularly relevant considering that previous clinicopathological studies have reported that only 20% of Spitz nevi were

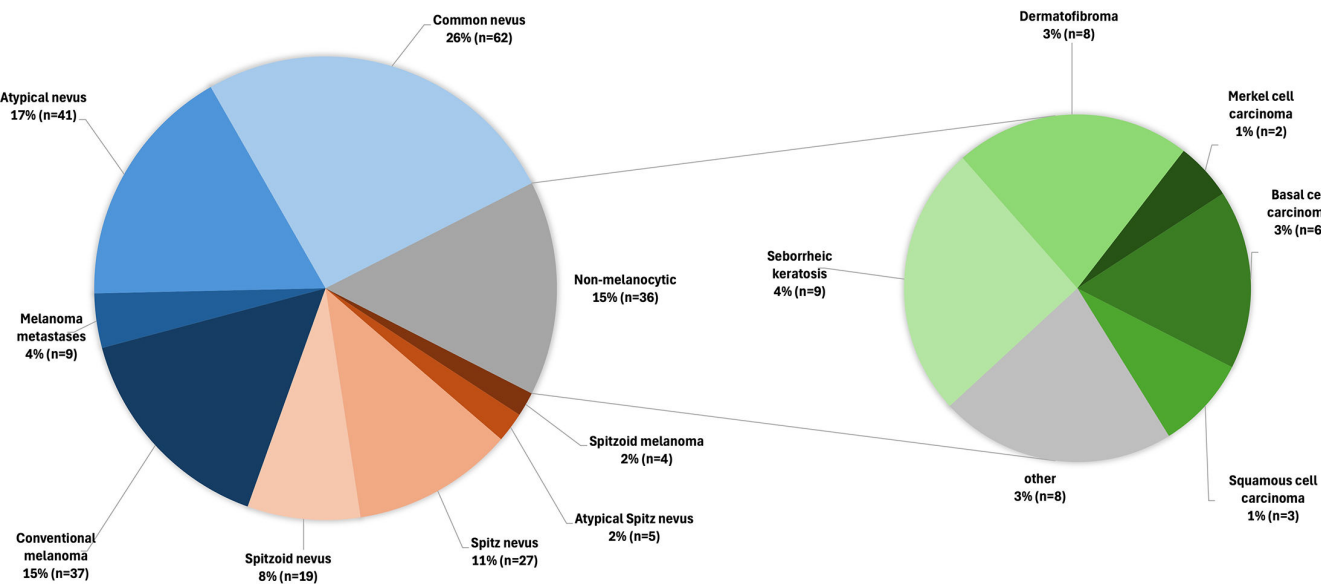


Fig. 2. Distribution of histopathological diagnoses among lesions with spitzoid dermoscopic patterns (N=240). Pie charts show the absolute number of cases. "Other" include inflammatory lesions (n=2), eccrine poroma (n=1), clear cell acanthoma (n=1), actinic keratosis (n=1), dermal vascular proliferation (n=1), acroangiodermatitis (n=1) and fibroepithelial polyp (n=1).

Table III. Cross tabulation of Dermoscopy results compared to Histopathology

Dermoscopy	Histopathology		
	Spitzoid	Non-Spitzoid	Total
Spitzoid	55	185	240
Non-Spitzoid	12	4,085	4,097
Total	67	4,270	4,337

Sensitivity 82.1 % (95% confidence interval: 70.8%–90.4%)
 Specificity 95.7 % (95% confidence interval: 95%–96.3%)
 Positive predictive value 22.9 % (95% confidence interval: 17.8%–28.8%)
 Negative predictive value 99.7 % (95% confidence interval: 99.5%–99.9%)

clinically suspected, suggesting a significant risk of underdiagnosis (18, 19). These findings support the usefulness of dermoscopy both in improving the clinical recognition of these tumours and in reliably ruling them out in clinical practice. Although the PPV was low (22.9%), reflecting that only about one-quarter of dermoscopically spitzoid lesions in adults are true spitzoid tumours on histopathology, this finding carries substantial clinical weight. Since 25.4% (1 in 4) of these dermoscopically spitzoid lesions turned out to be malignant, a spitzoid dermoscopic pattern in adult patients cannot be safely monitored and should promptly lead to an excision or biopsy, reinforcing that the very high NPV (99.7%) highlights dermoscopy as a robust tool for excluding spitzoid melanocytic tumours when features are completely absent.

Our results confirm that spitzoid melanocytic tumours are infrequent, representing only 1% of all excised lesions as previously reported (9, 10). These tumours were found to appear at younger ages and were associated with a lower frequency of personal or family melanoma history compared to non-spitzoid melanocytic tumours, suggesting a distinctive molecular mechanism, as defined by the current WHO classification (5, 6). Tumours driven by gene fusions have been reported to occur more frequently in younger individuals, whereas tumours initiated by mutations tend to arise later in life, probably due to the progressive accumulation of somatic mutations over time (8, 20). In addition, the majority of spitzoid melanocytic tumours in our series were benign, and this is consistent with previous studies reporting that a low proportion of these tumours belong to an intermediate or malignant category (21–23).

In our cohort, approximately 1 in 4 lesions with spitzoid dermoscopic patterns was malignant, mainly melanoma, although NMSC were also observed. This is consistent with prior evidence showing a substantial morphological overlap between Spitz nevi and melanoma (24, 25). A retrospective study reported that the risk of a spitzoid lesion being melanoma rises markedly with age, from 2% between 12 and 20 years to 50% or higher in those over 50 years (26). Given that most of our cohort consisted of adults, maintaining

a high index of suspicion is essential when evaluating spitzoid lesions in this population.

The starburst pattern was the most frequent in spitzoid tumours, aligning with established evidence (13, 17, 23). The black reticular pattern, although uncommon overall, appeared more often in spitzoid tumours and may provide limited supportive value, but should be interpreted in the clinical context (13, 27).

Vascular structures such as linear and glomerular vessels, in addition to shiny white lines, were strongly associated with malignancy, consistent with reports in atypical Spitz tumour, melanoma and NMSC (28–30). These findings support the excision of spitzoid lesions with atypical vascular structures on dermoscopy.

This study offers a novel contribution by quantifying the prevalence of spitzoid dermoscopic patterns and evaluating their clinical relevance in a real-world setting. Notably, several non-melanocytic tumours (15% of dermoscopically spitzoid lesions) can mimic spitzoid dermoscopic patterns, including irritated, clonal or regressive seborrheic keratosis (SK) (31, 32); haemosiderotic or aneurysmal dermatofibromas (33); certain basal cell carcinomas with a predominant vascular pattern, mainly on limbs (34–36); and other malignant tumours with atypical vascular patterns (37, 38) (**Fig. 3**). The false-negative cases lacked spitzoid features but showed atypical characteristics or changes during follow-up, raising concern and warranting excision.

Limitations of this study include its retrospective design; therefore, incomplete data in the medical records could have been left unaddressed. Although pediatric dermatologists refer challenging pediatric cases to our unit, most patients in this study were adults evaluated at a melanoma referral centre, which may have increased the observed prevalence of malignancy among spitzoid lesions. These factors limit the interpretation and generalizability of these results to the pediatric population and to primary care or general dermatology settings. Since only biopsied or excised lesions were included, this study may not include all spitzoid tumours seen at our institution. Conversely, histopathological diagnoses of tumours with “Spitzoid features” may not exhibit the current Spitz molecular profile and could be subject to reclassification if molecular testing were performed systematically (39). Additionally, our dermoscopic evaluation relied on a sequential screening and joint consensus-based approach rather than independent duplicate readings. This paradigm involved dermatologists with different levels of experience; while this workflow was optimized to guarantee consensus and reduce interobserver variability, initial individual screening metrics were not independently archived, precluding the calculation of formal interobserver agreement statistics. This limits the appraisal of individual test reproducibility

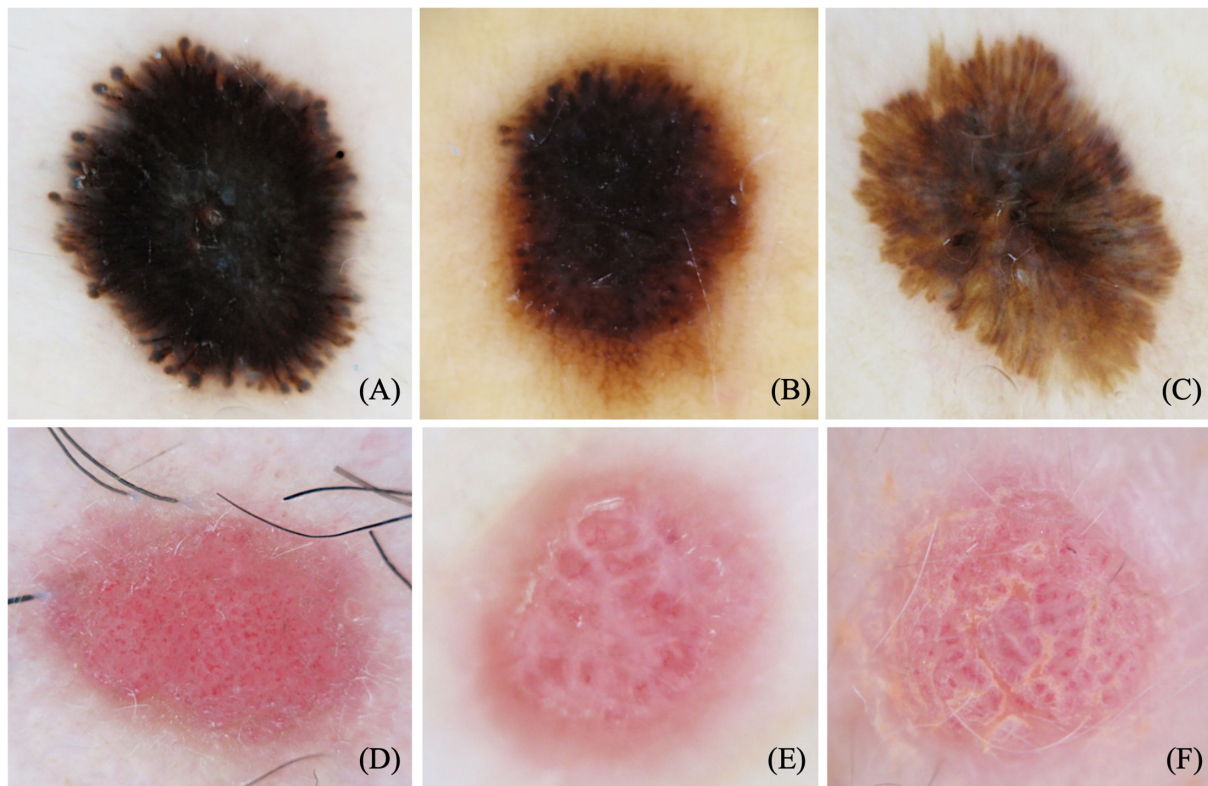


Fig. 3. Dermoscopic images of spitzoid lesions showing a starburst pattern (A–C): (A) Reed nevus; (B) Melanoma; (C) Seborrheic keratosis; and vascular pattern (D–F): (D) Spitz nevus; (E) Melanoma metastases; (F) Seborrheic keratosis.

outside a consensus panel environment. However, since diagnostic accuracy for challenging lesions like spitzoid tumours is heavily influenced by evaluator experience, the involvement of a third senior expert blinded to prior opinions for discordant cases likely maximized the reliability of our final dataset. Finally, due to the multiple statistical comparisons performed in evaluating various dermoscopic features, there is an increased risk of Type I errors (false positives); therefore, borderline significant *p*-values should be interpreted with caution and validated in future larger cohorts.

Further research is needed to correlate dermoscopic features with emerging molecular classifications of Spitz tumours. Integrating molecular techniques, artificial intelligence and emerging *in vivo* technologies, such as reflectance confocal microscopy and line-field confocal optical coherence tomography, could potentially enhance diagnostic accuracy and provide further insight into the biological behaviour of these tumours.

Dermoscopy improves the detection of spitzoid melanocytic tumours, offering high sensitivity, specificity and NPV. In a referral centre, few excised lesions may show spitzoid features on dermoscopy and, interestingly, only a small proportion will be true spitzoid tumours. Notably, a significant percentage of dermoscopically spitzoid lesions will be malignant, primarily melanoma, while nonmelanocytic lesions

may also display spitzoid features. Starburst pattern is the most frequent among true spitzoid tumours, and blue-black pigmentation, blotch and streaks are highly suggestive of spitzoid histopathology, while atypical vessels raise suspicion of malignancy.

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