ONLINE FIRST

This is a provisional PDF only.

Nowotwory
Journal of Oncology

ISSN: 0029-540X

e-ISSN: 2300-2115

Discrepancies in dermatoscopy — pathology correlation of pigmented skin lesions

Authors: Magdalena Misiak-Gałązka, Małgorzata Lenarcik, Adam Gałązka

DOI: 10.5603/njo.100759

Article type: Review paper

Submitted: 2024-05-19

How to cite:

Misiak-Gałązka M, Lenarcik M, Gałązka A. Discrepancies in dermatoscopy — pathology correlation of pigmented skin lesions. NOWOTWORY J Oncol 2024; 74 (Ahead of print).

Accepted: 2024-10-04

Published online: 2024-12-06

Review article

Tumor pathology

Discrepancies in dermatoscopy — pathology correlation of pigmented skin lesions

Magdalena Misiak-Gałązka[1, 2 https://orcid.org/0000-0001-7638-9719], Małgorzata Lenarcik[1, 3 https://orcid.org/0000-0001-7332-467X], Adam Gałązka[4 https://orcid.org/0000-0002-2576-781X]

[1]Department of Pathomorphology, Maria Sklodowska-Curie National Research Institute of Oncology, Warsaw, Poland

[2]Maria Sklodowska-Curie Medical Academy in Warsaw, Warsaw, Poland. Evimed Medical Centre Ltd.

[3]Department of Gastroenterology, Hepatology and Clinical Oncology, Centre of Postgraduate Medical Education, Warsaw, Poland

[4]Head and Neck Cancer Department, Maria Sklodowska-Curie National Research Institute of Oncology, Warsaw, Poland

Abstract

Various dermatoscopic algorithms are used to diagnose skin lesions. There are specific dermatoscopic structures that suggest malignancy. Despite constant progress in dermatoscopy, the method has its limitations. There is a group of pigmented lesions that we cannot name in dermatoscopy, or even determine whether they are benign or malignant. Many benign lesions are excised. The article aims to explain the factors that may cause the discrepancies between dermatoscopic and histopathologic diagnoses of pigmented skin lesions. The reasons for the discrepancies are complex. Different structures are evaluated in dermatoscopy (pigment distribution) and histopathology (architecture and morphology of melanocytes). Every single dermatoscopic structure can be seen both in benign and malignant lesions. Some early melanomas lack specific dermatoscopic criteria. Finally, there is no consensus among pathologists regarding the final diagnosis in the group of melanocytic lesions. Despite its limitations, dermatoscopy significantly increased melanoma detection, especially in the early stages.

Keywords: dermatoscopy, pathology, correlation, melanoma

Introduction

Dermatoscopy is a noninvasive technique for diagnosing skin lesions. One of the applications is the diagnosis of pigmented skin lesions (PSL) and differentiation between melanoma and nevus. The meta-analysis of Vestergard et al. [1] showed that the relative diagnostic odds ratio for melanoma, for dermatoscopy *vs.* the naked eye examination, was 9.0 [95% confidence

interval (CI) 1.5–54.6; p = 0.03] and 15.6 (95% CI 2.9–83.7; p = 0.016), (depending on studies included in the analysis). Moreover, the sensitivity for dermatoscopy was estimated as 0.9 (95% CI 0.8–0.95) — higher than the naked eye examination [0.71 (95% CI 0.59–0.82)] [1]. In the same study, the specificity of dermatoscopy was evaluated as 0.9 (95% CI 0.57–0.98) [1].

Over the decades, the approach to clinical, dermatoscopic, and pathological diagnosis of melanoma has evolved towards earlier recognition of cancer [2]. Medical training focused on "*how not to miss melanoma*", which led to increased awareness, detection, and treatment of melanocytic tumors. The threshold for diagnosing melanoma has been lowered. Failure to recognize melanoma may have serious consequences for patients and doctors. The decision to excise the lesion is based mainly on dermatoscopy examination.

This narrative review aims to clarify the discrepancies between dermatoscopic and histopathologic diagnoses of PSL on non-facial non-acral skin. These discrepancies may explain, at least in part, why so many benign lesions are removed.

Basic rules of dermatoscopy of pigmented skin lesions

Dermatoscopic criteria for PSL evolved over decades, which reflects the process of understanding the method and the need for simple algorithms that can be easily used in everyday practice. Different algorithms help to diagnose pigmented skin lesions, such as the ABCD rule, the 3-point checklist, the 7-point checklist, color, architecture, symmetry, and homogeneity (CASH), and chaos and clues [3]. One of the most widespread methods is an algorithmic system based on pattern analysis developed by Kittler et al. [4]. In short, the method uses basic elements (lines, dots, clods, circles, pseudopods) and colors to describe a lesion. The same elements form basic patterns (for example, reticular pattern, parallel pattern, pattern of dots). Colors depend on the type and distribution of pigment. The main pigment is melanin, followed by hemoglobin and keratin. Apart from patterns and colors, there are also clues to malignancy and specific diagnosis.

To sum up, patterns + colors + clues = diagnosis. The lesions could present many patterns and colors, distributed symmetrically or asymmetrically. Chaos is the asymmetry of structures, border abruptness, or colors [4]. The basic melanoma model includes more than one pattern or/and more than one color distributed asymmetrically with at least one clue to malignancy [5].

Discrepancies between dermatoscopic and histopathologic examination

The main difference between dermatoscopy and patomorphology of PSL is that dermatoscopy evaluates mainly the distribution and color of pigment (melanin), whereas histopathological examination is based on the architecture and cytomorphology of melanocytes. In dermatoscopy, structures are two-dimensional on a horizontal plane, and we cannot see the deeper parts of the lesion. With dermatoscopy, we can examine the whole lesion, compare it with the patient's other lesions, and follow it up. Histopathological examination remains the gold standard. We can assess the whole depth of the lesion and the cell morphology on vertical sections, but only about 2% of the lesion is examined [6]. It is crucial to understand that not every melanocytic lesion is pigmented, such as amelanotic melanomas and a group of dermal nevi. In such cases no pigment can be found in dermatoscopy, and other structures are evaluated (mainly the pattern of vessels). On the other hand, not every PSL has a melanocytic origin.

Melanin

The process of melanin synthesis is called melanogenesis. Melanocytes, localized in the basal layer of the epidermis, produce melanin in melanosomes. They contact up to 40 keratinocytes to form epidermal-melanin units. Melanin-loaded melanosomes concentrate at melanocytic dendrites and are transferred to keratinocytes. In keratinocytes, melanin forms caps upon the nuclei to protect against ultraviolet radiation (UV) radiation. Then, via a process called autophagy, the melanin is degraded upon keratinocyte terminal differentiation [7–9].

The accumulation of melanin is higher in the basal layer of the epidermis but can be in the upper layers, including the stratum corneum. Melanin granules could be found in the dermis, as well. They could fall from the epidermis or be released by melanocytes. Some melanin is phagocyted by macrophages called melanophages. To sum up, we can find melanin granules in 1) melanocytes, 2) keratinocytes, 3) macrophages (melanophages), or 4) lie free in the epidermis or dermis. Figure 1 shows irregular melanin deposits on different levels of the epidermis and the dermis. Figure 2 shows dermatoscopy and histopathology of lentigo simplex (A, B) and the melanocytic nevus with melanin deposits in stratum corneum (C, D).

Nonmelanocytic lesions classified as nevus or melanoma

Reticular lines are probably the most common pattern of melanocytic lesions. The formation of reticular lines comes from the skin structure. The dermo-epidermal junction is not a flat line but is wavy to form rete ridges and dermal papillae. In nonmelanocytic lesions in rete ridges, pigmented keratinocytes are grouped and look darker in dermatoscopy than keratinocytes over dermal papillae. In melanocytic lesions, the formation of reticular lines is

more complex. When melanocytes are not pigmented, the reticular lines are created like in nonmelanocytic lesions (only by melanin in keratinocytes). When melanocytes are pigmented, reticular lines can be formed by nests of melanocytes in rete ridges with or without pigmentation of keratinocytes [4]. Among nonmelanocytic lesions that can present with reticular lines are solar lentigo, seborrheic keratosis, and dermatofibroma. Figure 3 shows the pigment network in melanocytic (nevi, lentigo simplex) and nonmelanocytic lesions (dermatofibroma).

Figure 2 shows dermatoscopy and histopathology of lentigo simplex (A, B) and the melanocytic nevus with melanin deposits in stratum corneum (C, D).

Many nonmelanocytic lesions have pigmented variants and may mimic melanocytic lesions. Among them are benign and malignant epidermal and appendageal tumors [such as basal cell carcinoma (BCC), actinic keratosis (AK), squamous cell carcinoma (SCC), melanoacanthoma, poroma, lichen planus-like keratosis (LPLK)], cutaneous metastases of malignancy, exogenous pigmentation. In these lesions, pigmented structures such as lines, globules, dots, structureless areas, and circles can be found. The topic is extensive, and the discussion of the dermatoscopy pathology correlations in each pigmented lesion goes beyond the scope of the article.

Melanoma vs. nevus

In dermatoscopy, we cannot see where melanin is deposited (melanocytes, keratinocytes, melanophages, extracellularly) but we can see colors. Colors (black, dark brown, light brown, gray, blue) correspond to the layer in the epidermis or dermis of pigment (melanin) deposition (Tab. I) [4].

According to the chaos and clues method introduced by Rosendahl et al., there are nine clues to malignancy: 1) eccentric structureless area, 2) peripheral black dots or clods, 3) thick reticular lines, 4) grey or blue structures, 5) segmental radial lines or pseudopods, 6) white lines, 7) polymorphous vessels, 8) angulated lines, 9) parallel lines on the ridges (acral) [5, 10]. The algorithm helps a clinician select lesions that should be excised or biopsied. We do not discuss parallel lines on the ridges as we focus on non-facial non-acral lesions.

Eccentric structureless area

The meaning of an eccentric structureless area is defined by its color. When it's black, dark brown, light brown, grey, or blue, it represents melanin deposits on different levels in the epidermis and dermis. Irregular deposits of melanin may correlate with the proliferation of malignant melanocytes. Moreover, grey and white colors may represent areas of regression

when lymphocytes attack neoplastic melanocytes and induce fibrosis. Red areas may correspond to increased blood flow in the lesion. Lallas found that irregular areas (blotches) were present in 41% of invasive melanomas, 18% of melanoma in situ (MIS), as well as in 14% of excised nevi, and 5% of non-excised nevi [11].

Peripheral black dots or clods

Peripheral clods are clues to the growth of the lesion, which is a frequent event in adolescence, but suggests malignancy in adult patients.

One of the vital histopathologic criteria of melanoma is pagetoid spread of atypical melanocytes. That means that atypical melanocytes go up to superficial layers of the epidermis. Figure 4 shows melanocytes in A) melanoma, B) normal skin, and C) blue nevus. If melanocytes contain melanin deposits, we can see dark brown or black globules and clods. However, similar structures (dark brown or black) could be observed in irritated nevi, when melanin deposits lie free in the horny layer. Lallas et al. [11] found irregular dots or globules in 69% of invasive melanomas, 50% of MIS, 54% of excised nevi, and 54% of non-excised nevi. They also found that not only peripheral dots and clods but also irregular small black or dark brown areas in the central parts of a lesion (irregular hyperpigmented areas and blotches) were indicators of MIS [11].

Thick reticular lines

As mentioned above, reticular lines in nevi are formed by pigmented nests of melanocytes in rete ridges or by pigmented keratinocytes. In such cases, reticular lines are thin, and lines are narrower than holes. On the opposite in thick reticular lines, holes are small, and lines are broader. This pattern is developed when pigmented nests of melanocytes are in a horizontal position and go beyond the rete ridges. In melanoma, this may correspond to the confluence of intraepidermal nests or confluent proliferation of neoplastic melanocytes along the basal layer of the epidermis. In nevi, a large amount of melanin deposited in the upper layers of the epidermis creates thick lines. In metaphoric language thick reticular lines are part of an atypical network. In the study by Lallas et al. [11], an atypical network was present in 66% of invasive melanomas, 85% of MIS, 83% of excised nevi, and 55% of non-excised nevi.

Grey and blue structures

Grey and blue structures are observed in melanomas, pigmented basal and squamous cell carcinomas, as well as in common and blue nevi. Grey and blue structures include lines,

clods, dots, circles, and structureless areas. A grey color corresponds to melanin deposition in the papillary dermis, whereas a blue color correlates with melanin in the reticular dermis (deep dermis). In histopathological examination, pigment is in melanocytes, macrophages, or both. Figure 5 shows melanin deposits in the reticular dermis. Grey circles correspond to melanin around the hair infundibula, and are more common in the face, but can be found in any part of the body. Lallas et al. [12] found blue structures in benign (blue nevi, angiomas, seborrheic keratoses) and malignant tumors (melanomas, BCC). It was shown that blue clods or irregular structures, combination of blue color and gray or linear vessels are clues to malignancy. Braun et al. [12] found multiple blue-grey dots (granularity) in 26,5% of benign lesions and in 93,5% of melanomas. In the prospective part of the study, 3773 lesions were examined. They found 41 (1%) lesions with blue-grey granularity (11 melanomas, 12 high-grade dysplastic nevi, eight congenital nevi, four low-grade dysplastic nevi, and three lichen planus-like keratosis) [12].

In metaphoric language, blue and white structureless areas are called a blue-white veil. In a study by Lallas et al. [11], a blue-white veil was present in 24% of invasive melanomas, 10% of MIS, 16% of excised nevi, and 4% of non-excised nevi. Blue-grey regression was present in 66% of invasive melanomas, 80% of MIS, 80% of excised nevi, and 49% of non-excised nevi [11].

Recently, peripheral hyperpigmented microcircles were proposed as a novel dermatoscopic clue to non-facial non-acral melanoma [13].

Segmental radial lines or pseudopods

Irregular radial lines or pseudopods in melanoma correspond to the extension of the intraepidermal nests beyond the dermal component, and are signs of radial growth of the lesion. Symmetrical radial lines or pseudopods are also observed in Spitz nevi: benign neoplasms with specific genetic alterations and a distinctive histological presentation. Moreover, radial lines are found in pBCC and pSCC. Lallas et al. [11] showed irregular lines (streaks) in 26% of invasive melanomas, 28% of MIS, 28% of excised nevi, and 7% of non-excised nevi.

White lines

White lines are whiter than normal skin and correlate to increased collagen and stromal alteration. Some white lines can only be seen in polarised light, they are shiny and oriented perpendicularly. They are detected in both malignant and benign lesions, such as melanomas, basal cell carcinomas, nevi, seborrhoeic keratoses, dermatofibromas, and others.

It was shown that the presence of white lines increases the risk of malignancy and risk of invasive melanomas *vs.* in situ melanomas by a factor of 10 [14].

Polymorphous vessels

In polymorphous vessels (also called atypical vessels), more than one pattern is seen (including lines, dots, and clods). In histopathology, they reflect increased vessel formation/dilatation due to uncontrolled tumor growth. Polymorphous vessels, especially with dotted type, suggest melanoma diagnosis. Lallas et al. [11] showed that atypical vessels were present in 35% of invasive melanomas, and 30% of MIS, but also in 34% of excised nevi and 10% of non- excised nevi. Polymorphous vessels can be found also in BCC (1.8–8.6%) [15, 16] and SCC (8.9%) [17] .

Angulated lines

Angulated lines are lines that connect at different angles forming polygons. Histopathology of extrafacial lentigo maligna can show lines of atypical melanocytes with melanophages below neoplastic cells, with no relation to hair follicles (in contrast to facial lentigo maligna) [18]. Jaimes et al. [19] found angulated lines in 44% of melanomas. They are more common on chronic sun-damaged skin. Lallas et al. found angulated lines in 20% of invasive melanomas, 11% of melanomas in situ, 5% of excised nevi, and 2% of non-excised nevi [11, 12].

As presented above, the clues for malignancy can be seen not only in melanoma or skin cancers but also in nevi and non-melanocytic tumors. However, regardless of which diagnostic algorithm you choose to diagnose skin lesions, the diagnostic value is comparable. Carrera et al. [3] analyzed the diagnostic accuracy of six simplified algorithms (the 7-point checklist, CASH, Menzies method, the ABCD rule, the 3-point checklist, and chaos and clues). Their sensitivity varied between 69 and 95%, and their specificity was 25 to 59%. The diagnostic accuracy was estimated as modest variable agreement between doctors was demonstrated for various dermatoscopic criteria [3].

Hemoglobin and keratin

In certain situations, hemoglobin and keratin may mimic melanin deposits and suggest a diagnosis of a melanocytic lesion. On dermatoscopy, hemoglobin is usually red or purple, but thrombosed blood produces a dark red or black color. The best example is subungal hematoma imitating acral melanoma. Keratin comes from the stratum corneum and is white or

yellow, but when mixed with melanin, it turns orange or light brown. For this reason, many seborrheic keratoses are misdiagnosed as nevi or melanomas [4].

Micromelanomas and featureless melanomas

"Micro-melanoma", "small diameter melanoma", and "mini-melanoma" are names for melanoma with a diameter less than 5 or 3 mm [20–22]. Some small melanomas cannot be diagnosed by dermoscopy during the first examination [20–26]. However, as Słowińska et al. [22] showed, the 7-point checklist and TADA dermoscopic algorithms can help in the majority of cases. Spitzoid patterns were the most common in this group of MM, followed by multicomponent asymmetric patterns [22]. In addition, Ferrara et al. [27] underlined that the diagnostic value of dermoscopy over clinical examination is higher in small lesions. The difficulty with micro-melanomas is that although they are small in diameter, they can already be invasive. In one study, only 44 of the 103 mini-melanomas (≤ 5 mm) were melanomas in situ [21]. In another study, 206 suspicious pigmented skin lesions with a diameter ≤ 3 mm were evaluated. Among them, 23 cases were diagnosed as melanomas: 4 MIS and 19 invasive melanomas with Breslow thickness of 0.2 to 1.08 mm [20]. The small diameter of a lesion does not exclude the possibility of melanoma diagnosis. In light of these data, it is hard to agree with Welch et al. [28] that lesions with a diameter below 6 mm should not be examined and excised.

"Featureless melanoma" is melanoma that cannot be diagnosed on first examination, and only digital dermatoscopy monitoring (DDM) and side-by-side comparison of dermatoscopic pictures allow correct diagnosis [29, 23]. Słowińska et al. [22] showed that among 50 micro-melanomas (< 5 mm) staged pTis and pT1a, 40% did not present with specific melanoma criteria. Babino et al. [29] compared melanomas (diagnosed on first examination or with digital dermoscopy monitoring) and benign lesions. They showed that approximately 60% of melanomas detected on DDM did not present with specific melanoma criteria, and were found only based on a comparison of dermatoscopic images taken at specific time intervals. On follow-up visits, when melanomas showed melanoma-specific criteria, irregular hyperpigmentation was the most frequent one [29]. Kittler et al. [23] evaluated 499 lesions that were qualified for digital dermatoscopy monitoring and then excised on follow-up visits (after 1.5 to over 8-month intervals). Among these lesions, 91 (18%) were melanomas and 408 melanocytic nevi. The study confirmed that the evaluation of changes during monitoring can improve melanoma detection. On the other hand, 408 melanocytic nevi presented with changes in DDM were removed as well. Kittler et al. [23] found no significant differences between melanoma and nevi in terms of dermatoscopic

changes with short-term follow-up (1.5–4.5 months). With longer follow-up (over 8 months), 62% of melanomas showed asymmetrical enlargement in comparison to 20% of nevi ($p < 0.001$). Among the independent predictors of malignancy after a follow-up longer than 4.5 months were broadening of pigment network, focal increase in pigmentation, and increase in black dots. Kittler et al. [23] also suggested excising the lesion (when the lesion grows irregularly or presents with regression elements, or changes in color (new color), pigmentation, and structure.

Another vital issue is that histopathologic diagnoses of a melanocytic lesion are not always definitive. The study by Hosler et al. [30] showed that 24% of melanocytic lesions received equivocal diagnoses after independent, blinded evaluation by dermatopathologists. In terms of dermatoscopy pathology correlation, it was shown that difficult lesions with regression structures in dermatoscopy were also difficult in histopathological examination.

Conclusions

The reasons for the discrepancies between dermatoscopy and histopathology of PSL are complex. First of all, we evaluate different structures in dermatoscopy (pigment distribution) and histopathology (architecture and morphology of melanocytes). Next, dermatoscopic algorithms have limited accuracy with varied interobserver agreements. Every single dermoscopic structure can be seen both in benign and malignant lesions [11, 12, 19]. Nevi may present with melanoma-specific clues and change over time to suggest malignancy. On the other hand, we must be aware of the lack of specific dermoscopic criteria in a selected group of melanomas, including featureless and micro-melanomas. Finally, there is discordance among pathologists in terms of final diagnoses in a group of melanocytic lesions. Difficult dermoscopic lesions may be confusing for pathologists as well.

Knowing discrepancies in dermatoscopy pathology correlation is crucial for understanding the method and its limitations. We must be aware that there is a group of pigmented lesions we cannot name in dermatoscopy, or even say whether the lesion is benign or malignant. Despite its limitations, dermatoscopy has significantly increased melanoma detection, especially in the early stages.

Article information and declarations

Authors contributions

Magdalena Misiak-Gałązka — conceptualization, investigation, supervision, visualization, writing — original draft preparation, writing — review & editing.
Małgorzata Lenarcik — writing — review & editing.

Adam Gałązka — visualization, writing — review & editing.

Funding

None.

Acknowledgments

None.

Conflicts of interest

The author declare no conflict of interest.

Supplementary material

None.

Magdalena Misiak-Gałązka

Department of Pathomorphology

Maria Sklodowska-Curie National Research Institute of Oncology

Roentgena 5 St.

02–781 Warsaw, Poland

e-mail: magdamisiak@o2.pl

Received: 19 May 2024

Accepted: 4 Oct 2024

Early publication: 6 Dec 2024

References

1. Vestergaard ME, Macaskill P, Holt PE, et al. Dermoscopy compared with naked eye examination for the diagnosis of primary melanoma: a meta-analysis of studies performed in a clinical setting. Br J Dermatol. 2008; 159(3): 669–676, doi: 10.1111/j.1365-2133.2008.08713.x, indexed in Pubmed: 18616769.
2. Kittler H. Evolution of the Clinical, Dermoscopic and Pathologic Diagnosis of Melanoma. Dermatol Pract Concept. 2021; 11(Suppl 1): e2021163S, doi: 10.5826/dpc.11S1a163S, indexed in Pubmed: 34447612.
3. Carrera C, Marchetti MA, Dusza SW, et al. Validity and Reliability of Dermoscopic Criteria Used to Differentiate Nevi From Melanoma: A Web-Based International Dermoscopy Society Study. JAMA Dermatol. 2016; 152(7): 798–806, doi: 10.1001/jamadermatol.2016.0624, indexed in Pubmed: 27074267.
4. Kittler HRC, Cameron A, Tschandl P. Dermatoscopy. An algorithmic method based on pattern analysis. I ed. Via Medica, Gdańsk 2012.
5. Rosendahl C, Cameron A, McColl I, et al. Dermatoscopy in routine practice - 'chaos and clues'. Aust Fam Physician. 2012; 41(7): 482–487, indexed in Pubmed: 22762066.
6. Braun R, Kerl K. Differences between histologic and dermoscopic criteria. https://dermoscopedia.org/Differences_between_histologic_and_dermoscopic_criteria.

7. Bento-Lopes L, Cabaço LC, Charneca J, et al. Melanin's Journey from Melanocytes to Keratinocytes: Uncovering the Molecular Mechanisms of Melanin Transfer and Processing. Int J Mol Sci. 2023; 24(14), doi: 10.3390/ijms241411289, indexed in Pubmed: 37511054.
8. Maranduca MA, Branisteanu D, Serban DN, et al. Synthesis and physiological implications of melanic pigments. Oncol Lett. 2019; 17(5): 4183–4187, doi: 10.3892/ol.2019.10071, indexed in Pubmed: 30944614.
9. Moreiras H, Seabra MC, Barral DC. Melanin Transfer in the Epidermis: The Pursuit of Skin Pigmentation Control Mechanisms. Int J Mol Sci. 2021; 22(9), doi: 10.3390/ijms22094466, indexed in Pubmed: 33923362.
10. Kittler HRC, Cameron A. Primary Diagnostic Algorithms: Pattern Analysis Revised. In: Marghoob AA, Braun R, Jaimes N, et al. ed. Atlas of Dermoscopy, Third Edition. CRC Press 2023.
11. Lallas A, Longo C, Manfredini M, et al. Accuracy of Dermoscopic Criteria for the Diagnosis of Melanoma In Situ. JAMA Dermatol. 2018; 154(4): 414–419, doi: 10.1001/jamadermatol.2017.6447, indexed in Pubmed: 29466542.
12. Braun RP, Gaide O, Oliviero M, et al. The significance of multiple blue-grey dots (granularity) for the dermoscopic diagnosis of melanoma. Br J Dermatol. 2007; 157(5): 907–913, doi: 10.1111/j.1365-2133.2007.08145.x, indexed in Pubmed: 17725673.
13. Pietkiewicz P, Giedziun P, Idziak J, et al. Diagnostic Accuracy of Hyperpigmented Microcircles in Dermatoscopy of Non-Facial Non-Acral Melanomas: A Pilot Retrospective Study using a Public Image Database. Dermatology. 2023; 239(6): 976–987, doi: 10.1159/000533820, indexed in Pubmed: 37666232.
14. Shitara D, Ishioka P, Alonso-Pinedo Y, et al. Shiny white streaks: a sign of malignancy at dermoscopy of pigmented skin lesions. Acta Derm Venereol. 2014; 94(2): 132–137, doi: 10.2340/00015555-1683, indexed in Pubmed: 24002051.
15. Micantonio T, Gulia A, Altobelli E, et al. Vascular patterns in basal cell carcinoma. J Eur Acad Dermatol Venereol. 2011; 25(3): 358–361, doi: 10.1111/j.1468-3083.2010.03734.x, indexed in Pubmed: 20561131.
16. Suppa M, Micantonio T, Di Stefani A, et al. Dermoscopic variability of basal cell carcinoma according to clinical type and anatomic location. J Eur Acad Dermatol Venereol. 2015; 29(9): 1732–1741, doi: 10.1111/jdv.12980, indexed in Pubmed: 25627865.
17. Inskip M, Cameron A, Akay BN, et al. Dermatoscopic features of pigmented intraepidermal carcinoma on the head and neck. J Dtsch Dermatol Ges. 2020; 18(9): 969–976, doi: 10.1111/ddg.14220, indexed in Pubmed: 32841518.
18. Vanden Daelen A, Ferreira I, Marot L, et al. A Digital Dermoscopy Follow-up Illustration and a Histopathologic Correlation for Angulated Lines in Extrafacial Lentigo Maligna. JAMA Dermatol. 2016; 152(2): 200–203, doi: 10.1001/jamadermatol.2015.4132, indexed in Pubmed: 26651094.
19. Jaimes N, Marghoob AA, Rabinovitz H, et al. Clinical and dermoscopic characteristics of melanomas on nonfacial chronically sun-damaged skin. J Am Acad Dermatol. 2015; 72(6): 1027–1035, doi: 10.1016/j.jaad.2015.02.1117, indexed in Pubmed: 25824275.
20. Bono A, Tolomio E, Trincone S, et al. Micro-melanoma detection: a clinical study on 206 consecutive cases of pigmented skin lesions with a diameter < or = 3 mm. Br J Dermatol. 2006; 155(3): 570–573, doi: 10.1111/j.1365-2133.2006.07396.x, indexed in Pubmed: 16911283.
21. Nazzaro G, Maronese CA, Casazza G, et al. Dermoscopic predictors of melanoma in small diameter melanocytic lesions (mini-melanoma): a retrospective multicentric study of 269 cases. Int J Dermatol. 2023; 62(8): 1040–1049, doi: 10.1111/ijd.16710, indexed in Pubmed: 37208996.

22. Slowinska M, Kaminska-Winciorek G, Kowalska-Oledzka E, et al. Dermoscopy of Small Diameter Melanomas with the Diagnostic Feasibility of Selected Algorithms-A Clinical Retrospective Multicenter Study. Cancers (Basel). 2021; 13(23), doi: 10.3390/cancers13236095, indexed in Pubmed: 34885203.
23. Kittler H, Guitera P, Riedl E, et al. Identification of clinically featureless incipient melanoma using sequential dermoscopy imaging. Arch Dermatol. 2006; 142(9): 1113–1119, doi: 10.1001/archderm.142.9.1113, indexed in Pubmed: 16982998.
24. Menzies SW, Ingvar C, Crotty KA, et al. Frequency and morphologic characteristics of invasive melanomas lacking specific surface microscopic features. Arch Dermatol. 1996; 132(10): 1178–1182, indexed in Pubmed: 8859028.
25. Pehamberger H, Binder M, Steiner A, et al. In vivo epiluminescence microscopy: improvement of early diagnosis of melanoma. J Invest Dermatol. 1993; 100(3): 356S–362S, doi: 10.1111/1523-1747.ep12470285, indexed in Pubmed: 8440924.
26. Kamińska-Winciorek G, Pilśniak A. The role of dermoscopy in dermato-oncological diagnostics – new trends and perspectives. Nowotwory. Journal of Oncology. 2021; 71(2): 103–110, doi: 10.5603/njo.a2021.0013.
27. Ferrara G, Argenziano G, Soyer HP, et al. Dermoscopic and histopathologic diagnosis of equivocal melanocytic skin lesions: an interdisciplinary study on 107 cases. Cancer. 2002; 95(5): 1094–1100, doi: 10.1002/cncr.10768, indexed in Pubmed: 12209696.
28. Adamson AS, Mazer BL, Welch HG, et al. The Rapid Rise in Cutaneous Melanoma Diagnoses. N Engl J Med. 2021; 384(1): 72–79, doi: 10.1056/NEJMsb2019760, indexed in Pubmed: 33406334.
29. Babino G, Lallas A, Agozzino M, et al. Melanoma diagnosed on digital dermoscopy monitoring: A side-by-side image comparison is needed to improve early detection. J Am Acad Dermatol. 2021; 85(3): 619–625, doi: 10.1016/j.jaad.2020.07.013, indexed in Pubmed: 32652193.
30. Hosler GA, Goldberg MS, Estrada SI, et al. Diagnostic discordance among histopathological reviewers of melanocytic lesions. J Cutan Pathol. 2024; 51(8): 624–633, doi: 10.1111/cup.14635, indexed in Pubmed: 38725224.

Table 1. Colors in dermoscopy correspond to melanin deposits at different levels of the epidermis and dermis. Adapted from Kittler et al. [4]

Color in dermoscopy	**Melanin deposits**
Black	Horny layer
Dark brown	Epidermis, big deposits
Light brown	Epidermis, small deposits
Grey	Papillary dermis
Blue	Reticular dermis

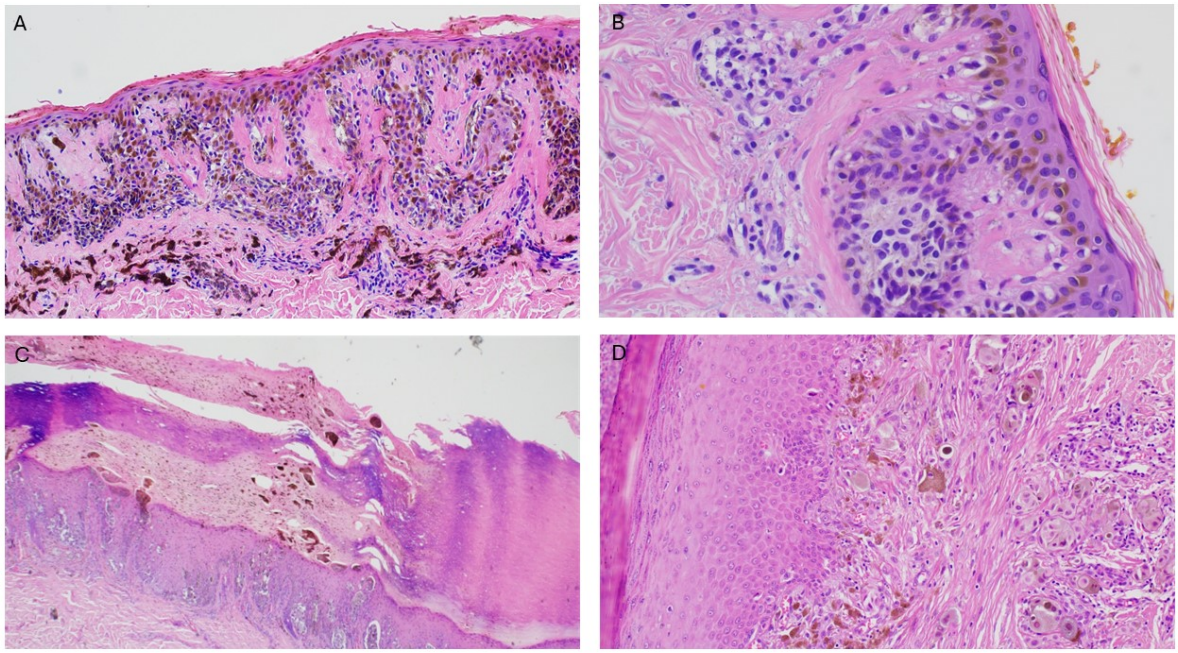

Figure 1. Irregular melanin deposits on different levels of the epidermis and the dermis; **A.** Lentiginous nevus; **B.** Junctional nevus; **C, D.** Superficial spreading melanoma

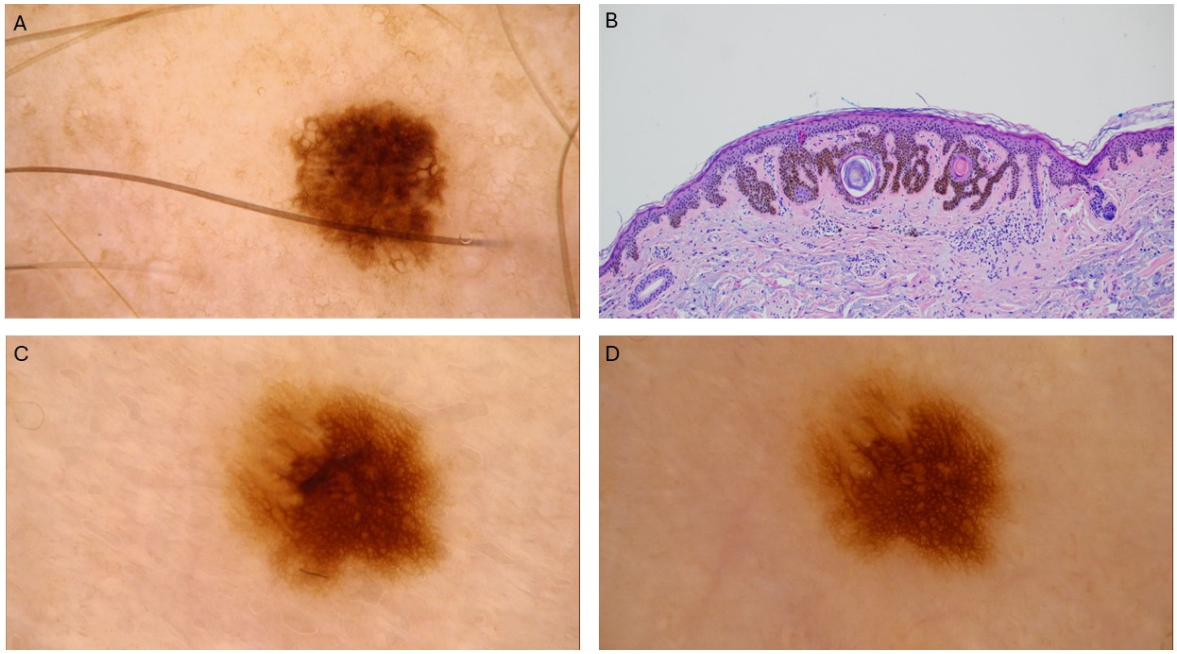

Figure 2. A. Lentigo simplex with irregular pigmentation. The lesion was misdiagnosed as atypical nevus and excised; **B.** Histopathology of lentigo simplex. Hyperpigmentation of basal layer of keratinocytes without proliferation of melanocytes; **C, D.** Melanin deposits in stratum corneum. The melanocytic nevus **A.** before and **B**. after removing the horny layer of the epidermis

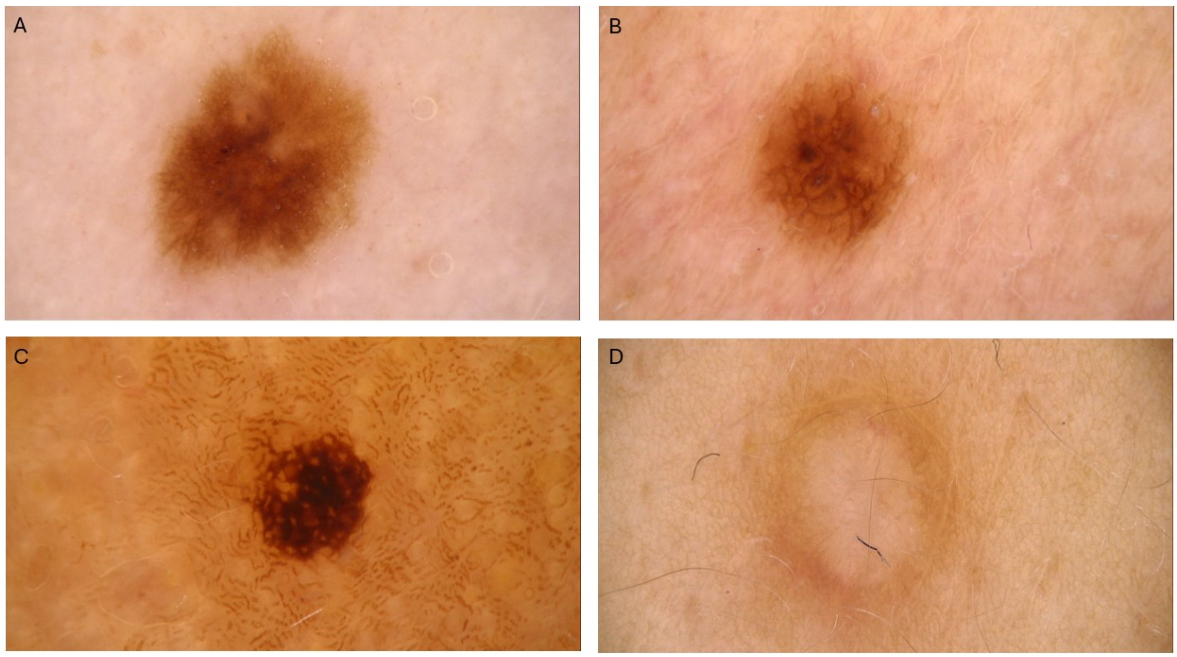

Figure 3. Pigment network; **A, B.** Melanocytic nevi; **C.** Lentigo simplex; **D.** Dermatofibroma

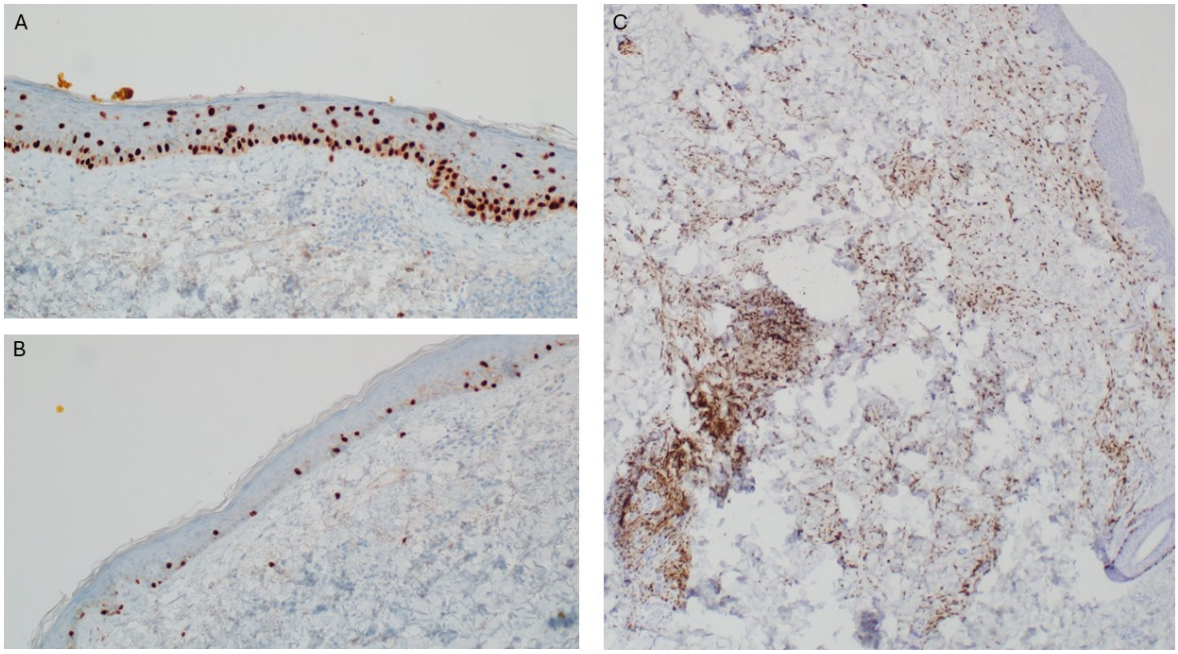

Figure 4. SOX-10 nuclear staining highlighting melanocytes; **A.** Melanoma with pagetoid spread of atypical melanocytes; **B.** Normal skin adjacent to melanoma with melanocytes only in the basal layer of epidermis; **C.** Blue nevus with melanocytes in the reticular dermis.

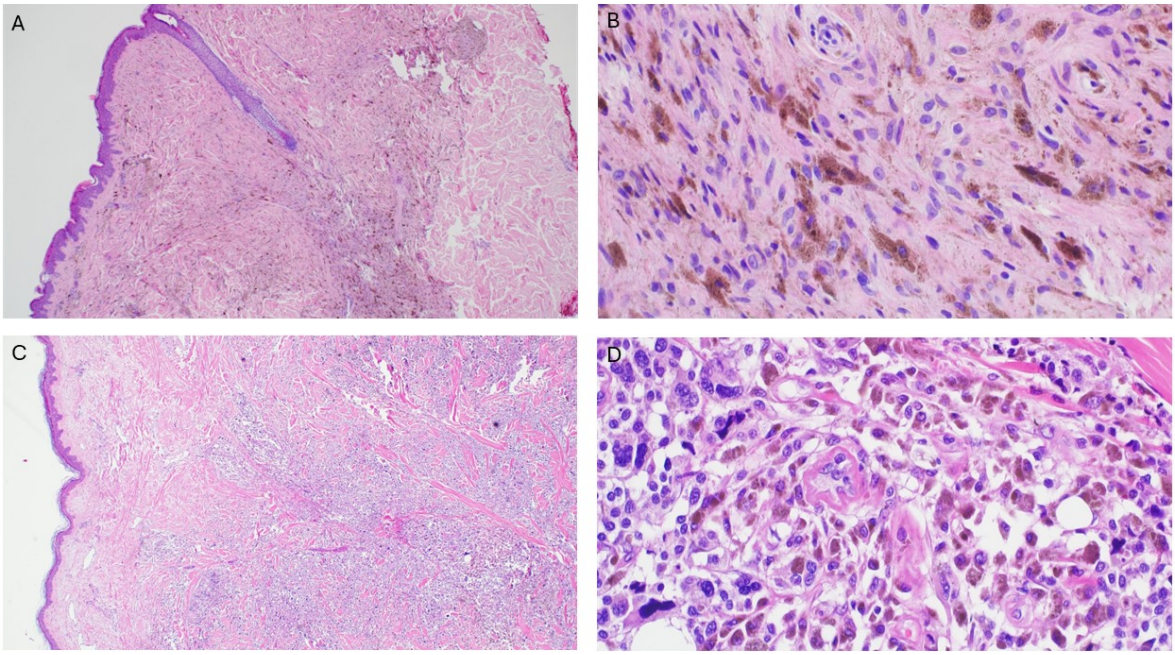

Figure 5. Melanin deposits in the reticular dermis. The pigment is in melanocytes or macrophages; **A, B.** Blue nevus; **C, D.** Melanoma metastasis. Compare the morphology of melanocytes in blue nevus (regular spindle cells with regular nuclei) and melanoma metastasis (atypical cells of various sizes with hyperchromatic nuclei)