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Recognizing melanoma *in situ* through dermoscopy: correlation with histopathology

Melanoma *in situ* (MIS) represents the earliest stage of melanoma, strictly confined to the epidermis. At this stage, it may closely resemble benign melanocytic lesions such as Clark's nevus, lentiginous junctional nevus, or solar lentigo. Because clinical appearance is often subtle, dermoscopy is essential for improving diagnostic accuracy by revealing early malignant clues, including asymmetry, gray dots or areas, and an atypical pigment network.

Objective — to analyze the dermoscopic and histopathologic characteristics of MIS and to emphasize the diagnostic relevance of gray structures as well as the value of dermoscopic-histopathologic correlation for early melanoma detection.

Materials and methods. Four patients (two women, two men, all over 45 years, Fitzpatrick skin types I—II) with small flat pigmented lesions (3—6 mm) located on the nose, lower leg, upper back, and back were examined. Each lesion underwent detailed clinical and dermoscopic evaluation using Kittler's analytic method. All lesions were then completely excised, and histopathologic assessment was performed to confirm the diagnosis and correlate microscopic findings with dermoscopic structures.

Results and discussion. All cases demonstrated dermoscopic asymmetry, multicomponent patterns, gray dots or clods, and an atypical pigment network. These features were consistent across the series. Histopathology confirmed an intraepidermal proliferation of atypical melanocytes without dermal invasion. Dermoscopic patterns showed clear correspondence with microscopic structures, supporting the reliability of these features in identifying MIS.

Conclusions. Recognition of gray structures, network atypia, and overall asymmetry plays a central role in detecting melanoma *in situ* at an early stage. Consistent correlation between dermoscopic findings and histopathology enhances diagnostic confidence and supports timely excision, helping prevent progression to invasive melanoma.

Key words

Melanoma *in situ*, dermoscopy, gray dots, histopathology, atypical pigment network, Kittler's analytic approach, early melanoma detection.

Melanoma *in situ* (MIS) represents the earliest stage of malignant melanoma, in which atypical melanocytes are confined to the epidermis. Early detection and complete excision at this stage ensure an excellent prognosis, as invasion into the dermis has not yet occurred. However, the diagnosis can be challenging because MIS often mimics benign melanocytic lesions such as Clark's nevus, lentiginous junctional nevus, or solar lentigo, both clinically and dermoscopically.

Dermoscopy plays a crucial role in distinguishing MIS from benign lesions by revealing subtle structural and color asymmetries, atypical pigment networks, and gray or white regression structures — key indicators of malignancy [2, 4]. Histopathologic confirmation remains the gold standard, enabling accurate classification and preventing diagnostic ambiguity, especially in borderline melanocytic lesions [1, 3].

In this series, we present several cases of MIS demonstrating diverse clinical and dermoscopic patterns, highlighting the diagnostic value of dermoscopic-histopathologic correlation and emphasizing the importance of early recognition to prevent progression to invasive melanoma.

Objective — to systematically analyze and illustrate the dermoscopic and histopathologic features of MIS using a series of representative clinical cases. Through careful examination of dermoscopic patterns — including asymmetry, multicomponent

structures, gray dots and clods, and regression features — and their correlation with corresponding histopathologic findings, this work seeks to enhance diagnostic accuracy and improve clinician awareness of early melanoma [2]. By showing clear clinical images and histology, this study highlights how small changes on the skin's surface can reveal important microscopic features that might be missed in routine exams.

An additional objective of the study is to identify and discuss diagnostic pitfalls in differentiating MIS from benign pigmented lesions such as Clark's nevi, lentiginous nevi, and solar lentigines, which often present with overlapping clinical and dermoscopic characteristics [2, 4]. These benign lesions can occasionally display irregular pigmentation or structural variation, leading to diagnostic uncertainty. By highlighting these potential sources of misdiagnosis, the study emphasizes the importance of careful dermoscopic evaluation, standardized analytic approaches (Kittler's method) and histopathologic confirmation. This approach reinforces the need for methodical assessment, especially when dealing with flat lesions on chronically sun-exposed skin, where photoaging changes may obscure early malignant features.

Furthermore, this work aims to underscore the clinical significance of early detection and the application of precise terminology in the management of pigmented lesions. Early and accurate identification of MIS not only facilitates timely surgical intervention but also significantly reduces the risk of progression to invasive melanoma, thereby improving patient outcomes. Clear communication of dermoscopic findings, consistent use of descriptive terminology, and correlation with histopathologic structures contribute to more reliable diagnosis and better clinical decision-making. Ultimately, this study seeks to provide a practical resource for clinicians and trainees, promoting a deeper understanding of the subtle dermoscopic and histopathologic relationships that are crucial for the early recognition and management of melanoma in situ.

Materials and methods

According to the requirements of the Helsinki Declaration of Human Rights and the Convention of the Council of Europe on Human Rights and Biomedicine, all participants provided written voluntary consent prior to inclusion in the study. This report describes four representative cases of melanoma in situ (MIS) diagnosed at the Department of Dermatology, Tbilisi State Medical University. The cohort consisted of two female and two male patients, all over 45 years of age, with Fitzpatrick skin phototypes I—II, placing them within a demographic particularly susceptible to sun-induced melanocytic lesions. These characteristics allowed for the selection of clinically relevant cases in which early melanocytic changes could be examined in detail.

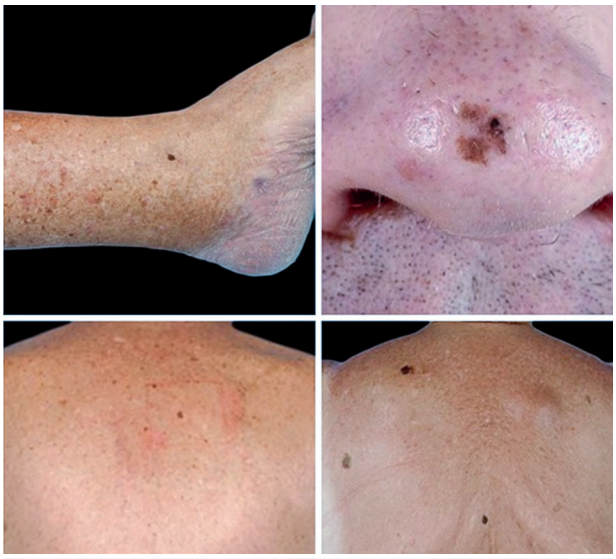

Fig. 1. **Clinical pictures of each lesion**

The lesions were situated on chronically or intermittently sun-exposed areas, including the nose, lower leg, upper back, and back, and measured between 3 mm and 6 mm in diameter (Fig. 1). Each patient underwent a comprehensive clinical examination, documenting lesion morphology, pigmentation, symmetry, border definition, and surface characteristics. Careful attention was directed toward subtle variations in color, architectural distortion, and emerging asymmetries, as these are often the earliest visual hallmarks of melanoma in situ and can be easily overlooked in routine evaluation.

Dermoscopy was performed using polarized light dermoscopy to ensure optimal visualization of subepidermal structures and pigment distribution (Fig. 2). Dermoscopic assessment followed Kittler's analytic approach, which emphasizes a structured evaluation of patterns, colors, and organizational features rather than relying solely on predefined algorithms. The analysis focused on key diagnostic indicators: asymmetry in structure and color, multicomponent patterns, atypical pigment networks, irregular dots and globules, and gray or white structureless areas suggestive of regression [2]. These findings were meticulously recorded and compared across the cases to identify reliable dermoscopic markers of early malignancy.

All lesions were subsequently excised with narrow but complete surgical margins under local anesthesia, ensuring both therapeutic removal and adequate tissue sampling for histopathologic analysis. Histopathologic evaluation concentrated on the distribution and morphology of atypical melanocytes, the

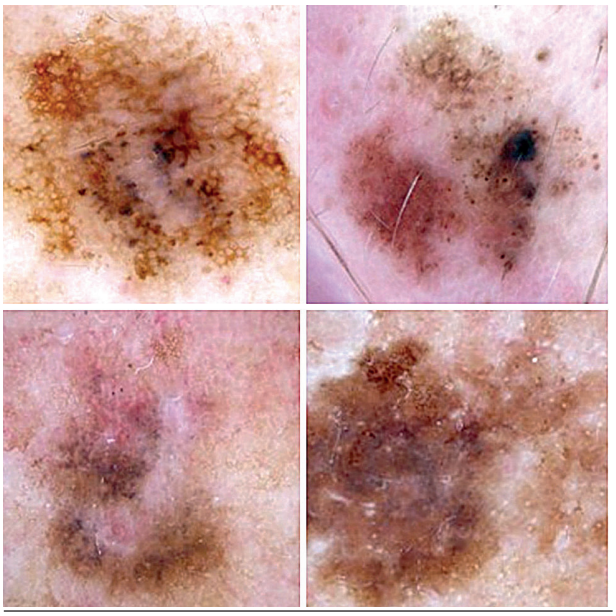

Fig. 2. **Dermatoscopic pictures of each lesion**

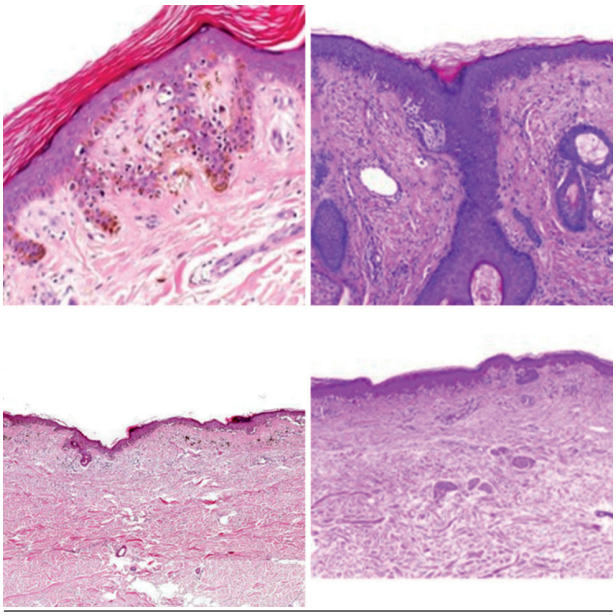

Fig. 3. **Histopathological pictures of each lesion**

degree of architectural disorder, the presence of cytologic atypia, and confirmation of the absence of dermal invasion. Special attention was given to correlating dermoscopic observations with microscopic findings, including the localization of melanin within melanocytes and melanophages, patterns of regression, and the configuration of rete ridges (Fig. 3).

Finally, dermoscopic-histopathologic correlation was performed for each case to validate diagnostic accuracy and to demonstrate the consistency of dermoscopic patterns in the early recognition of MIS. (see Fig. 2, 3). This integrated approach allowed for a nuanced characterization of the structural and chromatic variations that distinguish melanoma in situ from benign pigmented lesions such as Clark's nevi, lentiginous nevi, and solar lentigines. The findings offer both educational value for trainees and practical guidance for clinicians evaluating early melanocytic lesions in daily practice.

All participants provided written informed consent for the publication of their clinical data and images for educational and research purposes.

Results and discussion

Across all four cases included in our study, dermoscopic examination consistently demonstrated pronounced asymmetry in both structure and color, a hallmark feature suggestive of malignancy (Fig. 2). In addition, each lesion exhibited a multicomponent pattern, characterized by a heterogeneous combination of networks, dots, globules, and regression structures [2, 4]. According to Kittler's analytic approach, these findings represent strong and reliable indicators of early malignant transformation in melanocytic lesions, reinforcing the critical role of dermoscopy in the early detection of melanoma *in situ*.

Atypical pigment networks were present in all cases, showing irregular meshes and variable line thickness, often more at the periphery.

Gray structures (dots, clods, or areas) were a constant finding and served as a key diagnostic clue, corresponding histopathologically to melanophages in the papillary dermis. Color variegation was observed in all lesions, combining shades of light brown, dark brown, black, gray, blue-gray, and white [1, 2]. White structureless areas, when present, corresponded to fibrosis or regression microscopically. These shared features underscored the diagnostic reliability of gray and white structures in detecting melanoma in situ (see Fig. 2).

Histopathology (see Fig. 3) in all cases confirmed atypical melanocytic proliferation confined to the epidermis, with irregular nests and non-equidistant solitary melanocytes along the dermoepidermal junction, without dermal invasion.

Dermoscopic-histopathologic correlation revealed, that reticular lines corresponded to melanin in melanocytes and keratinocytes of the basal layer, small brown clods corresponded to small nests of melanocytes at the dermoepidermal junction and gray dots and clods correlated with collections of melanophages in the papillary dermis [2, 4].

The lesions on sun-exposed areas (nose, upper back, and lower leg) occurred on photodamaged skin, where benign lentigines and keratoses coexisted, making recognition more challenging. Nevertheless, gray dots and structural asymmetry were decisive in differentiating MIS from benign counterparts such as Clark's nevus or solar lentigo.

Overall, the findings emphasize that melanoma in situ, though subtle in appearance, displays consistent dermoscopic clues when analyzed systematically. Recognition of gray structures, asymmetry, and atypical networks allows for early excision and excellent prognosis [1—4].

Correlation between dermoscopic and histopathologic findings ensures diagnostic precision and reduces the risk of misclassifying early melanomas as severely dysplastic nevi.

Conclusions

Melanoma in situ remains a diagnostic challenge because its clinical and dermoscopic appearance frequently overlaps with that of benign melanocytic proliferations.

As demonstrated in this series, careful attention to hallmark dermoscopic clues particularly asymmetry in structure and color, the presence of a multicomponent pattern, an atypical or broadened pigment network, and the emergence of gray dots, clods, or structureless areas was essential in raising suspicion for early melanoma.

In classical dermatologic literature, gray pigmentation has long been emphasized as an early sign of melanocytic malignancy, reflecting melanin within the superficial dermis and often marking areas of incipient regression. Consistent with these descriptions, gray structures in our cases proved to be among the most dependable indicators prompting further evaluation.

Histopathologic examination confirmed that all lesions were confined to the epidermis, showing irregular nests and solitary atypical melanocytes distributed along the basal layer, with variable pagetoid spread. This pattern aligns with the histologic criteria outlined in standard literature, which describe MIS as an architectural disorder of melanocytes without infiltration of the dermis. The clear concordance between dermoscopic findings and microscopic features reinforces the well-established principle that dermoscopy, when interpreted analytically, can reveal architectural disturbances that are not yet clinically visible.

Importantly, these cases highlight the value of structured dermoscopic assessment such as Kittler's method, which encourages us to analyze global patterns before focusing on local criteria. This systematic approach reduces cognitive bias and allows subtle malignant features to emerge more clearly. The benefit is particularly evident in small lesions, where early melanoma may present with only delicate deviations from normal patterning.

Early detection of MIS is not merely an academic exercise; it has direct implications for prognosis. When identified at the in situ stage, melanoma is almost uniformly curable with simple surgical excision, preventing the transition to invasive disease and eliminating the risk of metastasis. Dermatoscopy literature teaches clinicians, that timely recognition of early melanoma is one of the most powerful interventions available in dermatologic practice, and the present cases underscore this principle.

Finally, incorporating dermoscopic-histopathologic correlation into routine clinical reasoning fosters more accurate diagnoses and deeper understanding of melanocytic pathology. Such integration strengthens clinical judgment, supports training for residents and practicing dermatologists and enhances patient care by ensuring that early melanomas are recognized and treated at the most curable stage.

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There is no conflict of interest.

Authors' participation: conceptualization, methodology, data collection, manuscript writing — I. Museridze; data analysis, literature review, critical revision of the manuscript — M. Davlasheridze. All authors reviewed and approved the final version of the manuscript.

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Розпізнавання меланоми *in situ* за допомогою дерматоскопії: кореляція з результатами гістопатологічного дослідження

Меланома *in situ* (MIS) є найпершою стадією меланоми, обмеженою епідермісом, і може клінічно імітувати доброякісні меланоцитарні утворення, такі як невус Кларка, лентигінозний юнкціональний невус або сонячне лентиго. Оскільки клінічна картина часто є нечіткою, дерматоскопія є необхідною для підвищення точності діагностики, оскільки дає змогу виявити ранні ознаки злоякісності, включаючи асиметрію, сірі крапки або ділянки та атипову пігментну мережу.

Мета роботи — проаналізувати дерматоскопічні та гістопатологічні характеристики меланоми in situ та підкреслити діагностичне значення сірих структур, а також цінність дерматоскопічно-гістопатологічної кореляції для раннього виявлення меланоми.

Матеріали та методи. Було обстежено чотирьох пацієнтів (дві жінки, два чоловіки, усі старші 45 років, фототип I—II) з плоскими пігментованими ураженнями (3—6 мм), розташованими на носі, нижній кінцівці, верхній частині спини та спині. Виконано клінічне та дерматоскопічне обстеження за аналітичним підходом Кіттлера. Потім усі ураження були повністю видалені, і було проведено гістопатологічне дослідження для підтвердження діагнозу та співвідношення мікроскопічних результатів з дерматоскопічними структурами.

Результати та обговорення. Усі ураження демонстрували асиметрію, багатокомпонентні структури, сірі крапки або клітини та атипову пігментну мережу при дерматоскопії. Ці особливості були однаковими у всіх випадках серії. Гістопатологія підтвердила внутрішньоепідермальну проліферацію атипових меланоцитів без інвазії в дерму. Дерматоскопічні патерни чітко відповідали мікроскопічним структурам, що підтверджує надійність цих ознак у діагностиці MIS.

Висновки. Розпізнавання сірих структур, асиметрії та багатокомпонентних патернів дає можливість своєчасно ідентифікувати меланому *in situ*. Стала кореляція дерматоскопії з гістопатологією забезпечує точний діагноз та сприяє своєчасному видаленню, запобігаючи прогресуванню до інвазивної меланоми.

Ключові слова: меланома *in situ*, дерматоскопія, сірі крапки, гістопатологія, атипова пігментна мережа, аналітичний підхід Кіттлера, рання діагностика меланоми.

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