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Case Report

Can Extensive Tattoos Make Melanoma Detection More Difficult? Case Report

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Abstract: Male patient, 42 years old, skin type I, smoker. He had a lesion on his back for several years, with reports of a nodule appearing on it 6 months ago. The examination revealed a 1.2 cm nodular erythematous violaceous lesion over the right lumbar region of an extensive tattooed area. Dermatoscopy revealed a heterogeneous lesion with flat and nodular components, presenting multiple colors. At the base, there was a brownish, asymmetrical pigmented lesion with an atypical network, inverted network, punctiform vessels, and bright white lines. Over this area, there was an erythematous nodular component with polymorphic vessels and bright white lines, forming a multicomponent pattern. An excisional biopsy with a 2 mm margin was performed, identifying nodular melanoma, Breslow 3 mm.

Keywords: Nodular Melanoma; Diagnosis; Skin cancer; Dermatoscopy.

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1. Introduction

Melanomas that arise in tattoos are rare, and early diagnosis can be particularly challenging due to their often-normal clinical appearance on clinical and dermatoscopic examination [1, 2], as well as the camouflaging effect that large tattoos can have on self-inspection by the patient. This article reports a case of melanoma in tattooed skin and explores the role of tattoos as a potential factor in delayed diagnosis and worse prognosis for patients, especially when dealing with the "nodular" histological subtype, which exhibits a pattern of rapid and vertical growth.

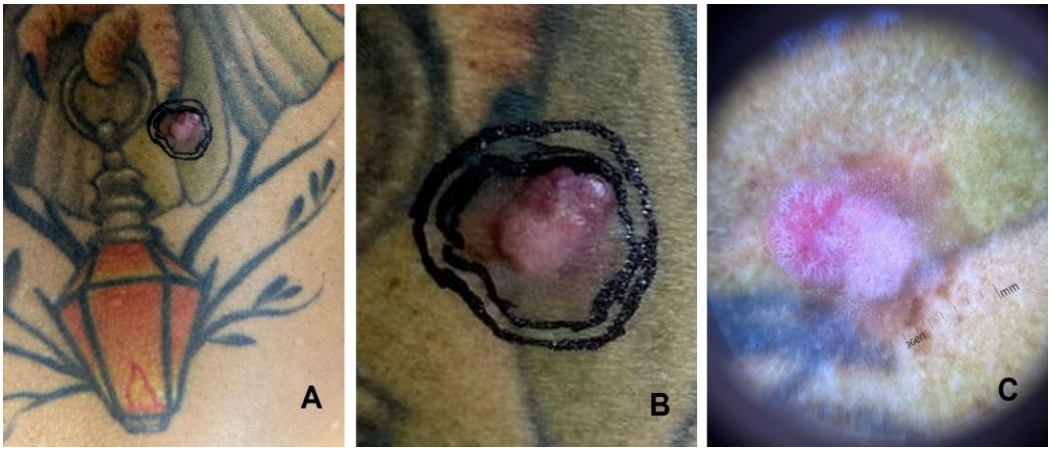
2. Case Report

Male patient, 42 years old, skin type I, smoker, and no family history of melanoma. He presented to the dermatologist complaining of a lesion in the right lumbar region for several years under an extensive tattoo, with reports of a nodule appearing in the same region 6 months ago. The patient reported a long-standing lesion at the site; however, the clinical history remained inconclusive as to whether the diagnosis was delayed due to the tattoo's interference or if the morphological progression to a nodular pattern was the primary driver for seeking specialized care. It is hypothesized that the tattoo hindered self-examination, potentially contributing to the clinical delay in seeking medical assistance. At the time the tattoo was done, there were no pre-existing lesions.

On physical dermatological examination, he presented with an erythematous-violaceous, nodular lesion measuring 1.2 cm in diameter, located in the right lumbar region, beneath the tattooed area (Figure 1A and 1B). Dermatoscopy revealed a heterogeneous lesion with flat and nodular components, exhibiting multiple colors. At the base, there was a brownish, asymmetrical pigmented lesion with an atypical network, an

inverted network, punctiform vessels, and bright white lines. Over this area, there was an erythematous nodular component with polymorphic vessels and bright white lines, forming a multicomponent pattern (Figure 1C).

Figure 1. Clinical (A, B) and dermoscopic (C) image of the nodular melanoma. (1A, 1B) Erythematous-violaceous nodular lesion, measuring 1.2 cm in diameter, located in the right lumbar region, over an extensive tattooed area. (1C) A heterogeneous lesion is observed, consisting of a flat and nodular component, exhibiting multiple colors. At the base, there is a brownish, asymmetrical pigmented lesion with an atypical network, an inverted network, punctiform vessels, and bright white lines. Over this area, there is an erythematous nodular component with polymorphic vessels and bright white lines, forming a multicomponent pattern.



An excisional biopsy with a 2 mm margin was performed, which revealed the following histopathology: nodular melanoma, in the vertical growth phase, with a Breslow thickness of 3.0 mm, and a Clark level III, characterized by a mitotic rate of 2 mitoses/mm². There was no evidence of ulcer formation or satellite nodules. The final staging was pT3a, according to the eighth edition of the AJCC staging system. Histopathology shows an expansive dermal nodule with an epidermal "collar" (Figure 2A) composed of nests of epithelioid cells and fascicles of spindle cells separated by thin fibrotic bands (Figure 2B and 2C), in addition to a brisk inflammatory infiltrate in the dermis, of the lichenoid type (Figure 2D). The superficial nests are confluent in a very irregular shape, without a clear circumscription of the overlying epidermis. The dermal melanocytes have a "spitzoid" morphology, with fusiform (E) and epithelioid (F) cells, both with eosinophilic cytoplasm.

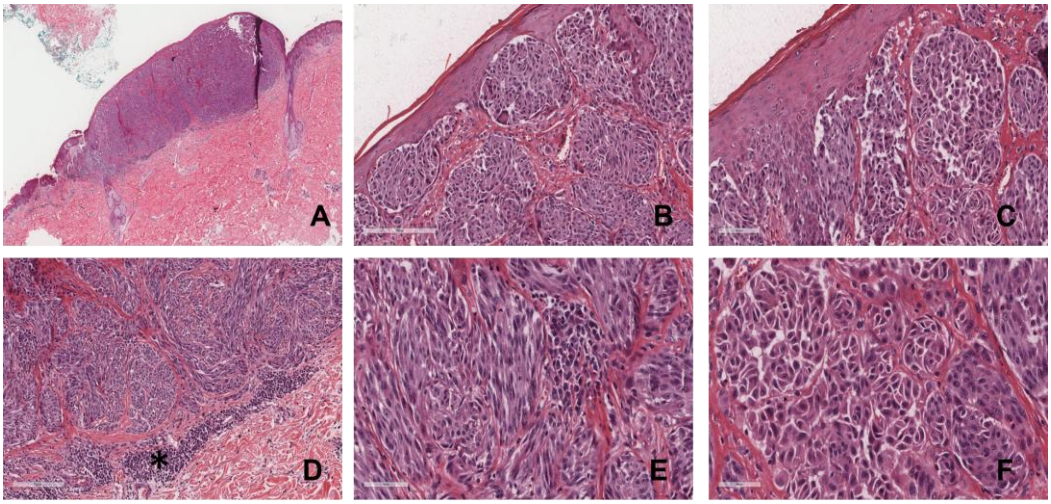
Histopathological analysis confirmed the diagnosis of nodular melanoma (NM). The patient was subsequently referred to a cancer referral center for wide local excision and sentinel lymph node biopsy. Surgical margins were clear; however, immunohistochemistry identified micrometastasis in one of four lymph nodes, without extracapsular extension. Following these interventions, the patient remains under outpatient surveillance for systemic staging and evaluation for adjuvant therapy.

3. Discussion

Melanoma can develop in tattoos, and clinical recognition can be more difficult because of surrounding tattooed areas that can mimic melanin pigment. Several factors have been proposed in the pathogenesis of malignant tumors in tattooed skin, including local trauma caused by ink injection; the inflammatory response triggered by the ink; the composition of the ink and its metabolites; and its photoreactive properties [1]. A recent systlike inic review [1] identified 45 cases of melanoma that arose in a tattoo, most of them in men (40/45) with a mean age of 45.7 years and with lesions located on the arm, followed

by the back (like our case). Although there is still controversy about the carcinogenic potential of tattoo pigments, several substances used in tattoo inks have been classified by the International Agency for Research on Cancer (IARC) as 'carcinogenic', 'probably' or 'possibly carcinogenic' to humans [2].

Figure 2. Histopathological images of the lesion: (A) Overview of a well-demarcated tumor with exophytic growth; (B) and (C) Confluent nests of melanocytic cells; (D) Dermis shows the presence of fibroplasia and chronic inflammatory cells (*), with lymphocytes and plasma cells; (E) and (F) Spindle and epithelioid-shaped patterns of neoplastic cells. H&E, hematoxylin-eosin stain.



Since Nodular Melanoma (NM), the most frequently reported subtype arising within tattoos, often evades the classic ABCD criteria (Asymmetry, Border, Color, Diameter), the EFG rule (Elevation, Firmness, and progressive Growth) should be utilized for assessment [6]. Extensive, dark tattoos (especially black and blue inks) exert a camouflaging effect, hindering visualization of classic melanocytic patterns, such as the pigment network. In this patient's case, although the lesion was situated beneath an extensive tattoo, its borders remained clearly distinguishable from the exogenous pigment, thereby not compromising the assessment of established dermoscopic criteria for suspicious or malignant pigmented lesions.

Specific characteristics of dermatoscopy in NM include peripheral black dots or globules, homogeneous blue pigmentation, asymmetric pseudopods, a bluish-white veil, ≥4 total colors, homogeneous black color (spot), and polymorphic/atypical blood vessels [3,5], which hinder the early diagnosis of melanoma in the dermis. Given its vertical growth pattern, many of the classic dermatoscopic structures are not visible in NM [3,4]. According to Lallas et al. [3], three dermatoscopic criteria (blue-black color, atypical vascular pattern, and milky pink/red coloration) were associated with NM, and the detection of any of these criteria in a nodular lesion (as identified in our case) justifies immediate excision.

Clinically, NM can present as a papule or nodule, with variable pigmentation, ranging from very dark variants to hypomelanotic and amelanotic variants. The most affected sites are the head, neck, and back in men (like what was observed in our case) and the legs in women [4]. The lesion often has a symmetrical shape, smooth surface, and well-circumscribed, small lateral diameter, clinically simulating other skin lesions, which can make clinical diagnosis difficult. The differential diagnosis of NM presents a significant clinical challenge, as its clinical manifestation mimics a broad spectrum of benign and malignant lesions [5,6]. Primary clinical simulators include basal cell carcinoma, pyogenic granuloma, dermatofibroma, seborrheic keratosis, neuro- fibroma, viral warts, and various benign nevi, such as Spitz and blue nevi [4–7]. In its amelanotic

variants, NM may be further confounded with anaplastic squamous cell carcinoma, atypical fibroxanthoma, or sarcomas [7].

Given its rapid vertical growth and frequently symmetrical morphology, the classic ABCD criteria often lack sensitivity; thus, the application of the EFG criteria (Elevation, Firmness, and progressive Growth) is essential to guide clinical suspicion [4–6]. Dermoscopy remains a cornerstone for identifying key features such as the blue-white veil, polymorphic vessels (e.g., hairpin or corkscrew), and peripheral black dots. At the same time reflectance confocal microscopy aids in differentiating melanocytic structures from exogenous pigments [1,4]. In hypopigmented NM, the possible visualization of pigment remnants may indicate the correct diagnosis. Purely amelanotic NM does not show dermatoscopic pigmentation and is characterized by a red/pink color and a vascular pattern that may consist of dotted, staple-shaped, linear, irregular, or highly convoluted (corkscrew-shaped) vessels [3,7].

According to WHO criteria, NM is, by definition, tumorigenic, i.e., it does not show an evident radial growth phase. These tumors, therefore, do not show intraepidermal melanocytic proliferation beyond three epidermal ridges on both sides of the tumor mass, as observed in our case. Microscopically, this could mean: 1) the presence of invasive melanoma without associated in situ melanoma; or 2) invasive melanoma associated with in situ melanoma of limited horizontal extension in the epidermis and/or follicles. Histologically, the tumor may be of high cellular density, containing two or more distinct pleomorphic cell types, as in our case. Atypical cells are usually epithelioid with vesicular nuclei and abundant, irregularly outlined cytoplasm, and, less frequently, have a spindle cell phenotype (as evidenced in our case) [6, 8].

Mitosis and single-cell necrosis are abundant, and the lesion may be ulcerated. NMs frequently exhibit a peripheral epidermal collar. This microscopic feature reflects the expansive force of the tumor's vertical growth phase and serves as a critical diagnostic clue for pathologists in identifying this specific subtype [6, 8]. Cytological maturation occurs in most cases, but “pseudomaturation” may occur. According to Gronbeck & Kerr [6], lichenoid inflammation serves as histopathological evidence of immune activation against the tumor. It is a component of what is classified in the literature as Tumor-Infiltrating Lymphocytes (TILs), which are characterized as 'brisk' when they infiltrate the entire tumor base or diffusely permeate the lesion. In the infiltrate, plasma cells may be prominent.

NM is recognized by the WHO as “an invasive and tumorigenic component” of the dermis, often with overlapping junctional melanoma cells, usually in nests. The most common additional histopathological features include atypical, immature neoplastic dermal melanocytes with numerous dermal melanocytic mitoses, an exophytic growth pattern that may produce an epidermal collar, and overlying ulceration, cell necrosis, associated lichenoid inflammation, and tumor-infiltrating plasma cells. NM may have a small diameter but a substantial Breslow depth at diagnosis [6, 8]. Consistent with the findings in our case, the Breslow depth is in line with what has been reported in the literature for nodular melanomas in tattoos (median 2.86 mm) than the thickness trends for melanoma in the general population (median 0.77 mm) [8].

4. Conclusion

Healthcare professionals must recognize tattoos as potential barriers to the early diagnosis of cutaneous neoplasms. Although the literature has raised concerns about the carcinogenic potential of tattoo pigments, there is currently no robust evidence establishing a direct causal link to cutaneous carcinogenesis. Large tattoos, such as the one presented in this case, further reinforce the camouflaging effect, making it difficult to assess the “ABCDE” criteria and potentially leading to delayed diagnosis. Within the scope of primary care, thorough physical examinations should include areas that are difficult for patients to self-examine, such as the back, particularly in male patients. The

incorporation of dermoscopy into the evaluation of tattooed skin is recommended, along with encouraging assisted self-examination in individuals with extensive tattoos.

Implementing educational initiatives targeting both patients and tattoo artists is essential, emphasizing the contraindication of tattooing over pre-existing melanocytic nevi, which should be surrounded by a pigment-free safety margin. Tattooing over nevi may obscure critical morphological changes, resulting in delayed diagnosis and poorer prognosis. Non-medical professionals should be advised to avoid tattooing over existing lesions and to maintain a clear margin around them to enable proper longitudinal clinical monitoring. Furthermore, extensive and dark tattoos should be discouraged in individuals with a personal or family history of melanoma, as they can significantly hinder early detection. Finally, further studies are needed to better characterize the genetic and molecular profiles of melanomas, as well as toxicological investigations to clarify the long-term biological safety of tattoo ink components and their potential role in carcinogenesis.

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Conflicts of Interest: All other authors declare no conflicts of interest.

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