

Epidemiology of melanoma in Nikšić, Montenegro's largest municipality

Ana Popović^{1,2}✉, Milica Đurović Bojić^{1,2}, Miloš Bojić³, Tanja Pješčić⁴, Milena Ražnatović Đurović^{1,2}

¹Clinic of Dermatology and Venereology, Clinical Center of Montenegro, Podgorica, Montenegro. ²Faculty of Medicine, University of Montenegro, Podgorica, Montenegro. ³Department of Plastic Surgery, Clinical Center of Montenegro, Podgorica, Montenegro. ⁴Primary Health Care Nikšić, Nikšić, Montenegro.

Abstract

Introduction: Melanoma can affect individuals of all ages, and its incidence is increasing among younger populations. Dermoscopy units are highly effective in reducing the number of benign lesions excised in high-risk patients. The aim of this study was to determine the occurrence of melanoma following dermoscopic examinations, the reasons for patient visits, the presence of social inequalities, and the characteristics of confirmed melanoma, including size and localization.

Methods: We conducted a retrospective descriptive study of patients examined at the Dermoscopy Unit of the Department of Dermatology at Nikšić General Hospital in Nikšić, Montenegro, from 2017 to 2022 using manual dermoscopy examination.

Results: The study comprised 125 patients (74 male and 51 female). The main reasons for dermoscopic examinations were a personal history of atypical nevi and the presence of more than 100 melanocytic nevi. The mean thickness of melanoma in patients younger than 45 years was 0.96 mm, in patients 46 to 65 years old it was 1.08 mm, and in patients over 66 it was 1.38 mm. A statistically significant difference in melanoma localization was observed between sexes: in male patients melanoma occurred significantly more often on the trunk, whereas in female patients it was more frequent on the lower legs.

Conclusions: Dermoscopy enhances diagnostic accuracy for skin lesions, benefiting both dermatologists and primary care providers. Effective melanoma prevention strategies include practicing sun protection, performing monthly self-examinations for new or changing moles and birthmarks, and attending regular medical checkups.

Keywords: dermoscopy, melanoma, incidence, localization, epidemiology

Received: 23 December 2024 | Returned for modification: 17 January 2025 | Accepted: 16 February 2025

Introduction

The rising incidence and associated mortality of melanoma have become a well-recognized public health concern (1). Despite advances in technology, pharmaceuticals, and overall medical development, the severity of melanoma remains a significant challenge due to its rapid progression when diagnosed late (2). The most effective way to combat this complex disease is through prevention or early detection. This is closely linked to the population's medical knowledge, making public awareness a crucial responsibility of public health institutions (3).

Tracking risk factors and developing new methods for early melanoma detection are of critical importance (4). Although certain racial phenotypes contribute to an increased risk of skin cancer, factors such as immunosuppression and a history of melanoma pose an even greater risk (5). Identifying and monitoring precursor lesions, particularly atypical nevi, is essential for early intervention (6). Genetic mutations associated with an increased risk of melanoma include *CDKN2A*, *CDK4*, *BAP1*, *TERT*, *MITF*, *MC1R*, and *POT1* (7).

Ultraviolet (UV) radiation is the leading environmental factor contributing to melanoma development, with meta-analyses highlighting the relative risks associated with various forms of UV exposure (8, 9). Although the 5-year survival rate for melanoma in Europe has been increasing, notable disparities remain, with survival rates surpassing 90% in Nordic and Western countries but being significantly lower in eastern Europe (10).

Since the 1980s, early melanoma detection through naked-eye examination using the ABCDE criteria (asymmetry, border irregu-

larity, color variability, diameter ≥ 6 mm, and evolution or recent change) has increased by 65% (11). However, this method remains imperfect and requires additional diagnostic techniques for more precise evaluation.

Melanoma can affect individuals of all ages, with incidence rates rising among younger populations. Therefore, promoting preventive measures is essential, with dermoscopy playing a particularly vital role in early melanoma detection (12–14). Dermoscopy units have proven highly effective in reducing unnecessary excisions of benign lesions in high-risk patients. Research suggests that dermoscopy is a cost-effective tool for melanoma detection and should be routinely utilized by specialists as well as family physicians (15). Regular dermoscopic evaluations, along with routine skin checkups, should be a standard practice for both general physicians (GPs) and dermatologists to aid in the prevention and early detection of melanoma (16).

Encouragingly, recent findings indicate an increasing trend in dermatologic checkups performed by GPs. A study by Fee et al. highlighted that—although both GPs that use dermoscopy and those that do not acknowledge its value in improving primary care skin assessments—inadequate training in dermoscopic techniques remains a major barrier. This gap could be addressed through future educational campaigns (17).

To the best of our knowledge, no similar study has been conducted in Montenegro. The aim of this study was to assess the occurrence of melanoma following dermoscopic examinations, the reasons for patient visits, the presence of social inequalities, and the characteristics of confirmed melanomas, including their size and localization.

✉ Corresponding author: dermatologyana@gmail.com

Methods

This retrospective descriptive study was conducted among patients examined at the Dermoscopy Unit of the Department of Dermatology at Nikšić General Hospital in Nikšić, Montenegro, from 2017 to 2022. The study included patients that underwent dermoscopic examination and subsequently proceeded with a biopsy based on the findings.

During dermoscopic evaluation, patients were positioned comfortably to allow optimal access to the area of interest. The skin was cleaned prior to examination to ensure accurate lesion visualization, with any interfering substances, such as creams or oils, removed. For specific anatomical locations, such as the scalp or nail bed, necessary adjustments were made, including parting the hair or ensuring clear views of the subungual region.

A dermatoscope was used to examine skin lesions in either contact or non-contact mode. In contact dermoscopy, a transparent gel was applied to the skin surface to minimize light reflection and enhance visualization of subsurface structures, followed by direct placement of the dermatoscope onto the lesion.

The variables analyzed for each patient included demographic data (sex, age, and Fitzpatrick skin phototype), reasons for referral (including multiple factors), and melanoma characteristics.

Institutional board approval (no. 10683) was obtained from Nikšić General Hospital for this study.

Statistical analysis was performed using IBM SPSS software version 26.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to assess the mean, standard deviation (*SD*), and range (minimum and maximum) of the variables. Categorical variables were expressed as frequencies and percentages. For comparisons, various statistical tests were applied, including ANOVA, the Wilcoxon signed-rank test, and Pearson's correlation coefficient. A significance level of $p < 0.05$ was set for all analyses.

Results

An estimated 600 patients underwent dermoscopic examination at Nikšić General Hospital between 2017 and 2022. Of these, 125 patients with suspected lesions were referred to the Department of Surgery for biopsy. Histopathological evaluation confirmed primary melanoma in 75 patients, and 10 patients with a previous diagnosis of primary melanoma were found to have developed a new primary melanoma.

Our study included 74 male and 51 female patients. Their demographic characteristics, including distribution by sex, skin phototype, and age range, are presented in Table 1.

The reasons for referral to the dermoscopy department were varied, as shown in Figure 1. The most common reasons included

a personal history of atypical naevi (29.4%), the presence of more than 100 melanocytic naevi (27.1%), a family history of melanoma (14.8%), a personal history of melanoma (11.8%), and the presence of congenital melanocytic naevi (5.9%). The majority of patients (43.5%) independently noticed suspicious lesions and sought dermatologic evaluation, and 30.6% were referred by healthcare professionals, including general practitioners and specialists.

Among patients with a negative histopathological evaluation for melanoma, none were immunosuppressed. However, in the group with confirmed melanoma, six patients were immunosuppressed: two had undergone organ transplantation, one was HIV-positive, and three had a history of non-skin-related malignancies.

Melanoma-confirmed lesions

We analyzed 85 lesions confirmed as melanoma. The mean thickness of melanoma in patients under age 45 was 0.96 mm (*SD* = 0.48), in patients 46 to 65 years old it was 1.08 mm (*SD* = 0.95), and in patients over 66 it was 1.38 mm (*SD* = 1.11). The

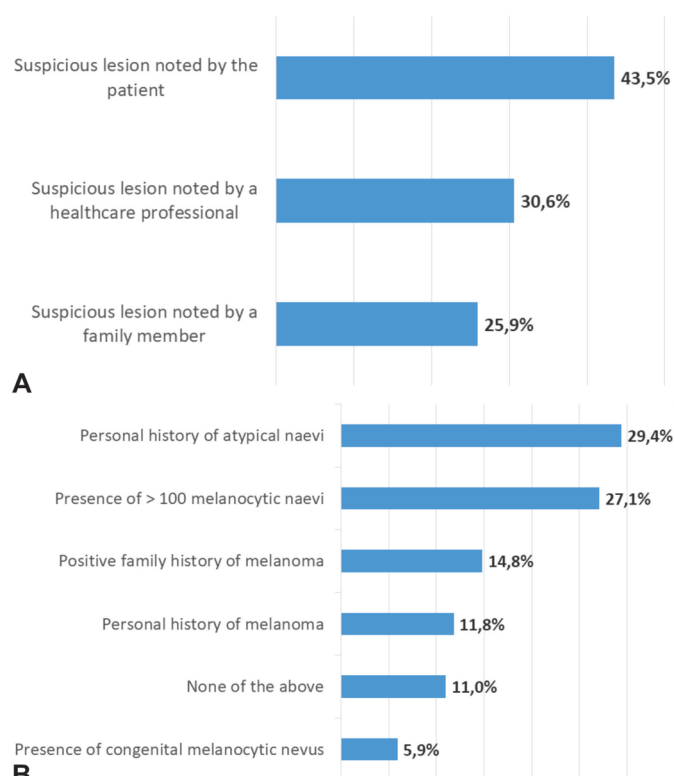


Figure 1 | a) Reasons for referral to the dermoscopy unit, categorized by three variables: suspicious lesion detected by the patient, a healthcare professional, or a family member. b) Reasons for referral to the dermoscopy unit, categorized by five additional variables.

Table 1 | Demographic characteristics of patients in the study with data on patients during follow-up by sex, skin phototype, and age.

	Total	Melanoma confirmed at follow-up		p-value
		Yes	No	
Sex, n (%)				
Male	74 (59.2)	45 (60.8)	29 (39.2)	0.03*
Female	51 (40.8)	40 (78.4)	11 (21.6)	
Fitzpatrick type, n (%)				
II	79 (63.2)	57 (72.2)	22 (27.8)	0.14
III	46 (36.8)	28 (60.0)	18 (40.0)	
Age (years), n (%)				
20–45	31 (24.8)	15 (48.4)	16 (51.6)	0.01*
46–65	51 (40.8)	35 (68.8)	16 (31.4)	
> 66	43 (34.4)	35 (81.4)	8 (18.6)	

* $p < 0.05$ is considered statistically significant.

mean thickness of melanoma by age group and sex is presented in Tables 2 and 3.

Table 2 | Mean Breslow thickness by age, men.

Age (years)	Patients, <i>n</i>	Thickness, mm			SD
		Min.	Max.	Mean	
20–45	4	0.3	2.0	1.07	0.69
46–65	15	0.3	4.0	1.54	1.20
> 66	26	0.3	4.0	1.63	1.26

SD = standard deviation.

Table 3 | Table 3. Mean thickness by age, women.

Age (years)	Patients, <i>n</i>	Thickness, mm			SD
		Min.	Max.	Mean	
20–45	10	0.5	2.0	0.91	0.41
46–65	18	0.3	2.0	0.71	0.42
> 66	12	0.6	1.0	0.81	0.18

SD = standard deviation.

Localization of melanoma

The chi-squared test of independence revealed a statistically significant difference in melanoma localization based on sex. Melanoma was significantly more likely to occur on the trunk in male patients, whereas in female patients it was more commonly found on the lower legs. Figure 2 presents the data on sex disparities in melanoma localization.

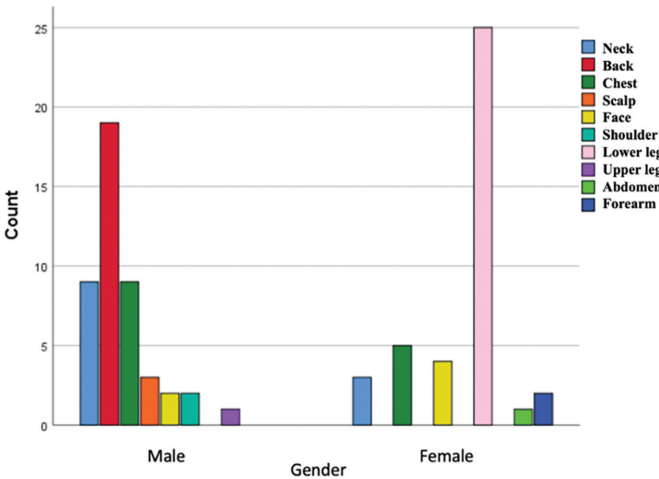


Figure 2 | Presentation of melanoma localization by sex; x-axis = sex, y-axis = number of lesions.

Discussion

The diagnosis of pigmented skin lesions can be challenging, even for experienced professionals, due to the wide variability in clinical presentation. As a result, further investigations are often required. These methods can be classified into invasive (biopsy) and non-invasive techniques. Dermoscopy, also known as epiluminescence microscopy, is the most effective non-invasive technique for evaluating and distinguishing suspicious melanocytic lesions, atypical lesions, and melanomas (18). However, a definitive diagnosis can only be confirmed through histopathology.

The primary reasons individuals seek mole checks include changes in existing moles or the appearance of new pigmentation or growth on the skin. In addition, a personal history of melanoma or a positive family history are also common reasons for seeking checkups (19). Our results align with this because the most frequent reason for seeking evaluation was a skin lesion noticed by the patients themselves, followed by those identified by

healthcare professionals.

Regarding the reasons for referral to the dermoscopy unit, the most common reason was a personal history of atypical moles, which was somewhat unexpected. In contrast, García Piqueras et al. reported that the most common reason in their study was a personal history of melanoma (16). In our series, a personal history of melanoma ranked fourth as a reason for referral. The second most common reason was the presence of a large number of nevi on the skin, which aligns with expectations because individuals with numerous moles are often more knowledgeable about pigmented skin lesions and are generally more proactive about preventive measures. In addition, some patients did not fall into any of the aforementioned categories and visited the dermoscopy unit either by chance or without a specific risk factor.

Seventy-five percent of our participants were over 45 years old, with melanoma progression occurring more frequently in younger patients. This may be attributed to individuals with lower socio-economic status and those living in rural areas, who often have a reduced perception of melanoma risk, have limited knowledge about the disease and its prevention, and typically present with more advanced melanomas (20). Our study further reaffirms that age is a significant risk factor for developing melanoma because data show that the incidence of invasive melanoma increases with advancing age. However, it is important to note that the occurrence of cutaneous melanoma is also rising rapidly among young adults, particularly women (21). This trend highlights the need for continued vigilance and monitoring of this high-risk group. Notably, the municipality where this study was conducted primarily consists of an older population.

Melanomas can develop anywhere on the body, although they are most commonly found in sun-exposed areas such as the face, back, and legs. However, a smaller proportion of melanomas can also arise in less exposed regions, including the feet, palms, and nail beds (22). The increasing incidence of melanoma in younger populations is largely attributed to more active, “careless” lifestyles, with significantly higher exposure to ultraviolet radiation. Furthermore, individuals with occupational sun exposure, such as road workers, construction workers, and those in similar professions, are at an elevated risk (23).

Regarding melanoma localization, our study aligns with established patterns. In men, melanomas are most frequently found on the back and other areas of the trunk (from the shoulders to the hips), as well as the head and neck. In women, the most common sites are the lower legs (24). Literature also suggests that the incidence of melanoma varies by sex, with higher rates in older males and younger females (25). In our study, melanoma was found to occur significantly more often in males.

Furthermore, our findings indicate that, across all age groups, melanomas tend to be thicker in men than in women. This suggests that male patients may present with more advanced or aggressive tumors at the time of diagnosis. Most studies on this topic have been conducted in North America and Europe, limiting the generalizability of these findings to other regions (26).

The economic burden of skin cancer has been rising in recent years, with melanoma contributing significantly to healthcare costs in Europe (27). Continued public health efforts to implement evidence-based sun-safety interventions will be essential in reducing both the incidence of skin cancer and the financial strain associated with its treatment (28).

Conclusions

Referral to the dermoscopy unit in our study was most commonly due to a personal history of atypical moles or the patient's own detection of suspicious lesions. This descriptive study highlights the ongoing need to improve awareness of early melanoma detection and the importance of regular skin examinations. Despite advances, significant efforts are still required to enhance prevention and education initiatives.

The most effective strategies for reducing melanoma risk in-

clude practicing sun protection, performing monthly self-examinations to detect new or changing moles, and scheduling regular medical checkups. Alongside dermoscopic evaluations, these measures are key non-invasive approaches to melanoma prevention. Dermoscopy significantly enhances diagnostic accuracy for both dermatologists and primary care providers. Montenegro actively participates in the Euromelanoma campaign, and the findings of this study could contribute to shaping future public health strategies within the campaign.

References

1. Waseh S, Lee JB. Advances in melanoma: epidemiology, diagnosis, and prognosis. *Front Med*. 2023;10:1268479.
2. Abernethy A, Adams L, Barrett M, Bechtel C, Brennan P, Butte A, et al. The promise of digital health: then, now, and the future. *NAM Perspect*. 2022;2022:10.31478/202206e.
3. Becevic M, Smith E, Golzy M, Bysani R, Rosenfeld A, Mutrux ER, et al. Melanoma extension for community healthcare outcomes: a feasibility study of melanoma screening implementation in primary care settings. *Cureus*. 2021;13:e15322.
4. Garrison ZR, Hall CM, Fey RM, Clister T, Khan N, Nichols R, et al. Advances in early detection of melanoma and the future of at-home testing. *Life (Basel)*. 2023;13:974.
5. Shao K, Feng H. Racial and ethnic healthcare disparities in skin cancer in the United States: a review of existing inequities, contributing factors, and potential solutions. *J Clin Aesthet Dermatol*. 2022;15:16–22.
6. Goldstein AM, Tucker MA. Dysplastic nevi and melanoma. *Cancer Epidemiol Biomarkers Prev*. 2013;22:528–32.
7. Toussi A, Mans N, Welborn J, Kiuru M. Germline mutations predisposing to melanoma. *J Cutan Pathol*. 2020;47:606–16.
8. Sample A, He YY. Mechanisms and prevention of UV-induced melanoma. *Photodermatol Photoimmunol Photomed*. 2018;34:13–24.
9. Sun X, Zhang N, Yin C, Zhu B, Li X. Ultraviolet radiation and melanomagenesis: from mechanism to immunotherapy. *Front Oncol*. 2020;10:951.
10. Forsea AM. Melanoma epidemiology and early detection in Europe: diversity and disparities. *Dermatol Pract Concept*. 2020;10:e2020033.
11. Petrie T, Samatham R, Witkowski AM, Esteva A, Leachman SA. Melanoma early detection: big data, bigger picture. *J Invest Dermatol*. 2019;139:25–30.
12. Jitian Mihulecea CR, Iancu GM, Leventer M, Rotaru M. The many roles of dermoscopy in melanoma detection. *Life (Basel)*. 2023;13:477.
13. Inić Z. Melanom kože – dijagnostika i terapija. *Sanamed*. 2010;5:87–93. Serbian.
14. Endres L, Uivarosan D, Mirela Țiț D, Pop O, Bungău S, Buhaș C. Demographic and pathologic characteristics of malignant melanoma in west part of Romania. *Iran J Public Health*. 2018;47:606–7.
15. Herschorn A. Dermoscopy for melanoma detection in family practice. *Can Fam Physician*. 2012;58:740–5, e372–8.
16. García Piqueras P, Ruiz Rivero J, Izquierdo Del Monte MG, Avilés-Izquierdo JA. Reasons for referral and epidemiological characteristics of patients seen at a dedicated dermoscopy unit in a Spanish tertiary care hospital. *Actas Dermosifiliogr*. 2022;113:961–5.
17. Fee JA, McGrady FP, Rosendahl C, Hart ND. Dermoscopy use in primary care: a scoping review. *Dermatol Pract Concept*. 2019;9:98–104.
18. Sgouros D, Apalla Z, Ioannides D, Katoulis A, Rigopoulos D, Sotiriou E, et al. Dermoscopy of common inflammatory disorders. *Dermatol Clin*. 2018;26:359–68.
19. Cortez JL, Vasquez J, Wei ML. The impact of demographics, socioeconomic, and health care access on melanoma outcomes. *J Am Acad Dermatol*. 2021;84:1677–83.
20. Thompson JF, Williams GJ. The effect of age on melanoma incidence and prognosis. *Aging*. 2023;15:7857–9.
21. Reed KB, Brewer JD, Lohse CM, Bringe KE, Pruitt CN, Gibson LE. Increasing incidence of melanoma among young adults: an epidemiological study in Olmsted County, Minnesota. *Mayo Clin Proc*. 2012;87:328–34.
22. Stanienda-Sokół K, Salwowska N, Sławińska M, Wicherska-Pawłowska K, Lorenc A, Wcisło-Dziadecka D, et al. Primary locations of malignant melanoma lesions depending on patients' gender and age. *Asian Pac J Cancer Prev*. 2017;18:3081–6.
23. Waters TR, Dick RB. Evidence of health risks associated with prolonged standing at work and intervention effectiveness. *Rehabil Nurs*. 2015;40:148–65.
24. Erturk K, Tas F. Effect of biology on the outcome of female melanoma patients. *Mol Clin Oncol*. 2017;7:1093–100.
25. Morgese F, Sampaiolesi C, Torniai M, Conti A, Ranallo N, Giacchetti A, et al. Gender differences and outcomes in melanoma patients. *Oncol Ther*. 2020;8:103–14.
26. D'Ecclesiis O, Caini S, Martinoli C, Raimondi S, Gaiaachi C, Tosti G, et al. Gender-dependent specificities in cutaneous melanoma predisposition, risk factors, somatic mutations, prognostic and predictive factors: a systematic review. *Int J Environ Res Public Health*. 2021;18:7945.
27. Krensel M, Schäfer I, Augustin M. Cost-of-illness of melanoma in Europe—a modelling approach. *J Eur Acad Dermatol Venereol*. 2019;33:34–45.
28. Kao SZ, Ekwueme DU, Holman DM, Rim SH, Thomas CC, Saraiya M. Economic burden of skin cancer treatment in the USA: an analysis of the Medical Expenditure Panel Survey Data, 2012–2018. *Cancer Causes Control*. 2023;34:205–12.