THE EVALUATION OF DERMATOSCOPIC STRUCTURES OF PRIMARY CUTANEOUS MELANOMAS ACCORDING TO TUMOUR THICKNESS: A RETROSPECTIVE STUDY

Vyhodnotenie dermatoskopických štruktúr primárnych kožných melanómov podľa hrúbky nádoru: retrospektívna štúdia

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Abstract
Introduction. Dermatoscopy as a non-invasive examination method enables early diagnosis of melanoma. Preoperative identification of melanoma thickness based on standard dermatoscopic criteria could be useful in planning surgical treatment.
Material and methodology. In this retrospective study of 92 primary cutaneous melanomas, dermatoscopic findings archived with the DermoGenius ultra digital dermatoscope were evaluated. The study is aimed at identifying standard dermatoscopic structures and colors in melanomas in situ (n = 26; 28%), melanomas with thickness of < 0.8 mm (n = 29; 32%), i.e. thin melanomas (n = 55; 60%), in the group of melanomas with thickness of 0.8–1.5 mm (n = 14; 15%) and melanomas with thickness of > 1.5 mm (n = 23; 25%), i.e. thick melanomas (n = 37; 40%). We also evaluated the total dermatoscopic score (TDS) according to the ABCD dermatoscopic algorithm, and the score according to the seven-point checklist in relation to the thickness of the melanomas.
Results. The group of thick melanomas was presented with a significantly higher frequency ($p < 0.05$) of the number of colors in the lesion of five or more (OR 3.1; 95% CI, 1.3–7.54), blue colour (OR 2, 4; 95% CI, 1.01–5.64), hairpin vessels (OR 6.2; 95% CI, 1.21–31.7), blue-white veil (OR 3.01; 95% CI , 1.27–7.16), centrally located areas without other dermatoscopic structures (OR 2.6; 95% CI, 0.99–7.1) polymorphous vessels (OR 2.4; 95% CI, 1.03 – 5.7) and ulceration (SN 22%, SP 100%, PPV 100%, OR cannot be determined). In the group of thick melanomas, we observed the TDS > 6.8 (OR 4.8; 95% CI, 1.18–19.44) and score ≥ 5 according to the seven-point checklist (OR 3.5; 95% CI, 1.36 – 8.99) significantly more often. A group of thin melanomas was associated with peripheral brown structureless areas (OR 4; 95% CI, 1.23–13.1).
Conclusion. Some standard dermatoscopic structures, colour and the evaluation of the mentioned dermatoscopic algorithms can be helpful in differentiating between thick and thin melanomas. However, the prediction of tumor thickness according to these dermatoscopic criteria is not unequivocal (tab. 3, fig. 2, lit. 18). Text in PDF www.lekarsky.herba.sk.
KEY WORDS: dermatoscopy, dermatoscopic structures, melanomas, tumor thickness.
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Abstrakt
Úvod: Dermatoskopia ako neinvazívna vyšetrovacia metóda umožňuje včasnú diagnostiku melanómu. Predoperačná identifikácia hrúbky melanómu na základe štandardných dermatoskopických kritérií by mohla byť užitočná v plánovaní chirurgickej liečby.
Súbor a metódy: V retrospektívnej štúdii 92 primárnych kožných melanómov boli vyhodnotené dermatoskopické nálezy archivované digitálnym dermatoskopom DermoGenius ultra. Práca je zameraná na identifikovanie štandardných dermatoskopických štruktúr a farieb pri melanómoch in situ (n = 26; 28 %), melanómoch s hrúbkou < 0,8 mm (n = 29; 32 %) tzn. tenké melanómy (n = 55; 60 %) a v skupine melanómov s hrúbkou 0,8 – 1,5 mm (n = 14; 15 %) a melanómov s hrúbkou > 1,5 mm (n = 23; 25 %), t. j. hrubé melanómy (n = 37; 40 %). Vyhodnotili sme aj celkové dermatoskopické skóre (TDS) podľa ABCD dermatoskopického algoritmu a skóre podľa sedembodového zoznamu vo vzťahu k hrúbke melanómov.
Výsledky: Skupina hrubých melanómov bola prezentovaná so signifikantne vyššou frekvenciou ($p < 0,05$) počtom farieb v ložisku päť alebo viac (OR 3,1; 95 % CI, 1,3 – 7,54), modrou farbou (OR 2,4; 95 % CI, 1,01 – 5,64), cievkami typu vlásenky (OR 6,2; 95 % CI, 1,21 – 31,7), modro-bielym závojom (OR 3,01; 95 % CI, 1,27 – 7,16), centrálne lokalizovanými plôškami bez iných dermatoskopických štruktúr (OR 2,6; 95 % CI, 0,99 – 7,1) polymorfnými cievkami (OR 2,4; 95 % CI, 1,03 – 5,7) a ulceráciou (SN 22 %, SP 100 %, PPV 100 %, OR nemožno stanoviť). V skupine hrubých melanómov sme signifikantne častejšie zaznamenali TDS > 6,8 (OR 4,8; 95 % CI, 1,18 – 19,44) a skóre ≥ 5 podľa sedembodového kontrolného zoznamu (OR 3,5; 95 % CI, 1,36 – 8,99). Skupina tenkých melanómov bola spojená s periférnymi hnedými bezštruktúrnymi plôškami (OR 4; 95 % CI, 1,23 – 13,1).
Záver: Niektoré štandardné dermatoskopické štruktúry, farby a vyhodnotenie uvedených dermatoskopických algoritmov môže byť nápomocné v odlíšení hrubých a tenkých melanómov, predikcia hrúbky nádoru podľa týchto dermatoskopických kritérií nie je však jednoznačná (tab. 3, obr. 2, lit. 18). Text v PDF www.lekarsky.herba.sk.
KĽÚČOVÉ SLOVÁ: dermatoskopia, dermatoskopické štruktúry, melanómy, hrúbka nádoru.
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Introduction

Malignant melanoma is one of the most malignant tumours of the skin and mucosa with a tendency to form early metastases. Although systemic treatment of metastatic disease is currently available, early diagnostics and surgical treatment remain crucial. Dermatoscopy is a non-invasive examination that enables more accurate diagnosis of melanoma than a clinical examination (1, 2). The extent of surgical treatment depends mainly on melanoma thickness in milimeters according to histophatological examination i.e. Breslow thickness. In accordance with current knowledge, an excisional biopsy with a narrow margin (1 – 3 mm) is recommended when melanoma is suspected. Histopathological confirmation of diagnosis should be followed by excision with a safety margin to prevent local recurrences. For the correct classification and subsequent therapeutic procedure, an examination of the sentinel lymph node is recommended in patients with the tumour thickness ≥ 0.8 mm (3). The association of selected dermatoscopic criteria with melanoma thickness has been the subject of several studies (4, 5, 6). In the recent years the dermatoscopic nomenclature has evolved and standard dermatoscopic criteria have been identified (7). These could be helpful in differentiating thick melanomas (Breslow thickness ≥ 0.8 mm) from thin ones (Breslow thickness < 0.8 mm). With an adequate preoperative prediction of tumour thickness, surgical treatment could be performed in a single procedure.

Methods

This work retrospectively evaluates the dermatoscopic findings of 92 primary cutaneous melanomas. Our patients were successively examined clinically, using a hand-held dermatoscope DermLite carbon 3GEN in the outpatient Dermatovenerology Center of the Faculty Hospital in Žilina from January 1, 2016, to December 31, 2020. After signing the informed consent, dermatoscopic findings were recorded with a digital dermatoscope DermoGenius ultra. Cases without a histopathological examination, cases in which it was not possible to determine melanoma thickness by histopathological examination, and cases with suboptimal quality of dermatoscopic records were excluded from the observation. We recorded clinical and histopathological data such as sex, the patient's age at the time of diagnosis, localisation of the lesion, diameter in mm, type of the lesion according to palpability: macula, papule, nodulus and Breslow thickness.

These dermatoscopic colours were evaluated: dark brown, light brown, blue, gray, red, white, black, as well as the dermatoscopic structures: 1) pigment network: typical, atypical, 2) streaks: regular and irregular radial streaming, regular and irregular pseudopods, 3) negative pigment network, 4) dots and globules: typical, atypical, 5) cobblestones, 6) structureless areas: located centrally, peripherally and also peripheral brown structureless areas, 7) blotch: regular, irregular, 8) blue-white structures: blue-white veil and manifestations of regression: white scar-like areas and peppering, i.e. numerous blue-gray dots that resemble ground black pepper, 9) vascular structures: comma, dotted, linear irregular vessels (linear irregular straight, linear irregular serpentine and corkscrew vessels), milky red areas, hairpin vessels, glomerular vessels, arborizing vessels, polymorphous vessels, i.e. the combination of two or more different vascular structures in a single lesion, 10) dermatoscopic ulceration, 11) comedo-like openings, 12) milia-like cysts, 13) hair, 14) exophytic papillary structures (8, 9). We evaluated and recorded the TDS according to the ABCD rule of dermatoscopy and the score according to the seven-point checklist. The TDS is a dermatoscopic algorithm that quantifies the symmetric or asymmetric distribution of contours, colours and structures within the lesion, the border sharpness, the number of colours in the lesion and the presence of five dermatoscopic structures: dots, globules, structureless areas, network and streaks. If the calculated score is less than 4.75, the lesion is considered benign, a score > 5.45 indicates malignancy. A score of 4.75 – 5.45 is associated with suspicious lesions (10). The seven-point score determines a combination of dermatoscopic criteria, important for distinquishing between melanomas and benign melanocytic lesions. Two points are counted for the main criterion, one point for the minor one. The points obtained are summed, with a score of 3 indicating melanoma, a score of less than 3 indicating a nevus (11). These dermatoscopic algorithms could be also useful in differentiating between thin and thick melanomas.

All tumours were surgical removed and the histopathological examination was carried out at the Department of Pathology of the Faculty Hospital in Žilina and the University Hospital in Martin.

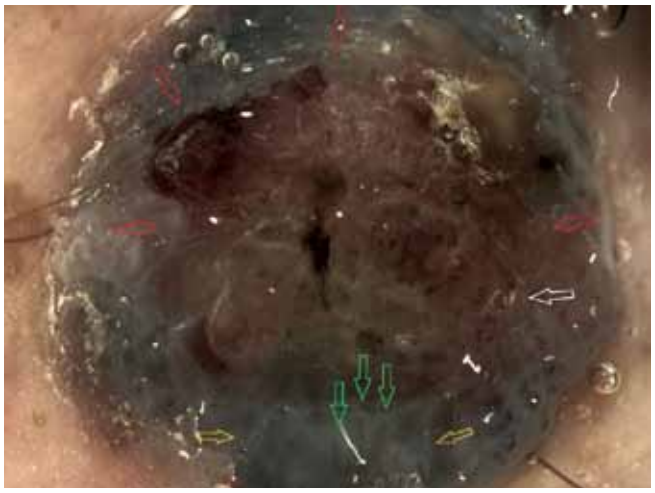
The obtained data were processed by statistical analytical methods. Quantitative variables are expressed using medians and interquartile ranges (IQR), categorical variables by absolute and relative frequency. The differences between melanoma groups were evaluated by Kruskal–Wallis test, Pearson's chi-square test, Fisher's test, and two-sample t-test. The p-value was considered statistically significant if it was lower than 0.05. The statistical analyses were performed in R software. We calculated sensitivity (SN), specificity (SP) positive predictive value (PPV), negative predictive value (NPV), positive likehood ratio (PLR) and negative likehood ratio (NLR).

Results

In our work, we analyzed 92 primary cutaneous melanomas. According to the tumour thickness, there were four groups: melanomas in situ (n = 26; 28 %), in which the tumour cells are located in the epidermis above basal membrane, melanomas with a Breslow thickness < 0.8 mm (n = 29; 32 %), 0.8 – 1.5 mm (n = 14; 15 %) and > 1.5 mm (n = 23; 25 %). We evaluated the frequency of 14 standard dermatoscopic structures, their subgroups, their regularity or irregulari-

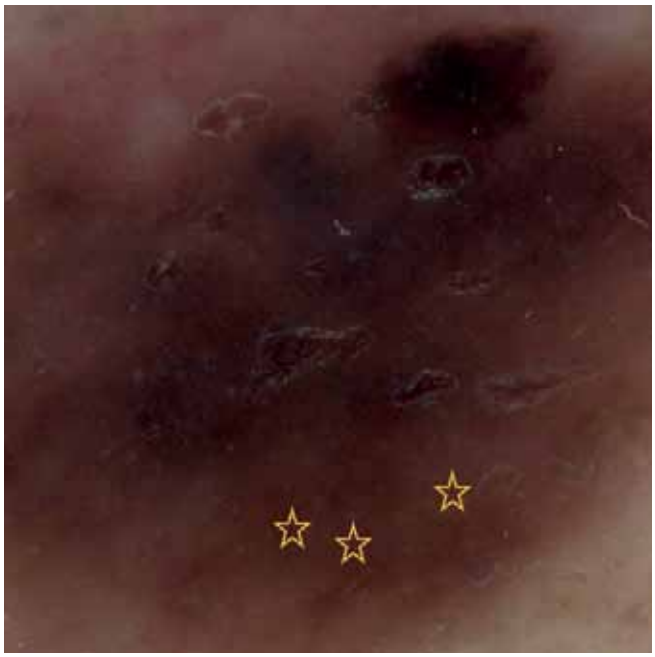
ty as stated in the work methodology. Table 1 reports only those dermatoscopic criteria and colours whose frequency was significantly different between melanoma subgroups. All melanomas were then divided into two groups: thin melanomas, as a group of melanomas with Breslow thickness < 0.8 mm, including in situ manifestations and a group of thick melanomas with the thickness ≥ 0.8 mm. According to the latest guidelines, it is recommended to examine the sentinel lymph node in melanomas with the tumour thickness ≥ 0.8 mm (3). By comparing the groups of thin and thick melanomas, the frequency of the following dermatoscopic parameters was statistically significantly different: the presence of ulceration, hairpin vessels, blue-white veil, polymorphous vessels, centrally located structureless areas, five or more colours in a single lesion and blue colour occurred more often in the group of thick melanomas (Fig. 1).

Figure 1. Thick melanoma (Breslow 4.3 mm, Clark IV)**, five colours in the lesion, blue-white veil** (yellow arrow)**, polymorphous vessels: hairpin vessels** (green arrow)**, linear irregular vessels** (white arrow) **ulceration** (red arrow)**.**



On the contrary, we found a significantly higher frequency of peripheral brown structureless areas in the set of thin melanomas (Fig. 2). Central structureless areas showed the highest sensitivity (81 %), but low specificity (38 %) for the group of melanomas with the thickness ≥ 0.8 mm, while in the case of blue colour, number of colours in the lesion ≥ 5, blue-white veil and polymorphous vessels we recorded sensitivity only in the range from 65 % to 54 %, the other dermatoscopic structures were presented with sensitivity lower than 30 %. The most specific dermatoscopic features for thick melanomas were ulceration (100 %) and hairpin vessels (96 %). Ulceration had the highest PPV (100 %) for thick melanomas. All the other dermatoscopic criteria had PPV less than 80 % for this group of melanomas. The NPV was lower than 80 % for all the dermatoscopic criteria. Structureless areas centrally localized were presented by the highest NPV (75 %). If there are no centrally localized structureless areas in the lesion, there is 75 % probability that it is not a thick melanoma. We recorded the highest PLR for hairpin vessels (5.2), which means that the probability of occurrence of hairpin vessels is approximately five times higher in thick melanomas than in thin ones. We recorded the smallest NLR for centrally localized structureless areas. The absence of central structureless areas in the lesion is 0.5 times more likely in thick melanomas than in thin ones. In other words, thin melanomas are two times (1/0.5) more likely than thick melanomas not to have centrally located structureless areas (Tab. 2).

Figure 2. Thin melanoma (Breslow 0.7 mm, Clark III)**, peripheral brown structureless areas** (asterix).



As the melanoma thickness increased, so did the TDS values, as well as the seven-point score (Tab. 1). The median value of the TDS was significantly higher in the group of thick melanomas. The score of TDS > 6.8 is an optimal cut-off point to differentiate thick melanomas from thin ones (12). The diagnostic test TDS > 6.8 in the identification of melanomas with the thickness ≥ 0.8 mm showed great specificity (95 %), but low sensitivity (22 %) in our melanoma group. The seven-point score was also significantly different between the set of thin and thick melanomas. We consider the score of 5 to be the threshold value in the identification thin melanomas from thick ones. Values ≥ 5 were determined in 29 out of 37 thick melanomas, but also in 28 thin melanomas out of their total number of 55. The diagnostic performance of values ≥ 5 for the group of thick melanomas showed higher sensitivity (78 %) than in the case of TDS > 6.8, but only 49 % specificity. In the group of thin melanomas, we observed an association only with peripheral brown structureless areas. These dermatoscopic structures showed only low sensitivity (33 %) for thin melanomas, but high specificity (89 %) as well as high PPV (82 %) (Tab. 2).

Table 1. Melanomas according to the tumour thickness, frequency of dermatoscopic structures, colours, values of dermatoscopic algorithms.

Dermatoscopic criterion	Melanoma in situ n = 26[1]	Invasive melanoma			p[2]
		< 0.8 mm n = 29[1]	0.8 – 1.50 mm n = 14[1]	> 1.50 mm n = 23[1]	
Number of colours					0.005
1	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
2	2 (7.7%)	1 (3,4%)	0 (0%)	0 (0%)	
3	12 (46%)	5 (17%)	4 (29%)	3 (13%)	
4	8 (31%)	12 (41%)	6 (43%)	4 (17%)	
5	4 (15%)	9 (31%)	1 (7%)	12 (52%)	
6	0 (0%)	2 (6.9%)	3 (21%)	4 (17%)	
Colours ≥ 5	4 (15%)	11 (38%)	4 (28%)	16 (70%)	0.001
Lighth brown	26 (100%)	29 (100%)	14 (100%)	20 (87%)	0.018
Blue	6 (23%)	18 (62%)	6 (43%)	18 (78%)	<0.001
Centrally localized structureless areas	13 (50%)	21 (72%)	10 (71%)	20 (87%)	0.044
Peripheral brown structureless areas	10 (38%)	8 (28%)	4 (29%)	0 (0%)	0.004
Blotch	11 (42%)	27 (93%)	9 (64%)	12 (52%)	<0.001
Irregular blotch	9 (35%)	26 (90%)	9 (64%)	12 (52%)	<0.001
Blue-white veil	4 (15%)	14 (48%)	8 (57%)	14 (61%)	0.006
Linear irregular vessels	5 (19%)	14 (48%)	3 (21%)	17 (74%)	<0.001
Hairpin vessels	0 (0%)	2 (6.9%)	1 (7.1%)	6 (26%)	0.019
Polymorphous vessels	6 (23%)	12 (41%)	4 (29%)	16 (70%)	0.007
Ulceration	0 (0%)	0 (0%)	1 (7.1%)	7 (30%)	<0.001
Totaly dermatoscopy score-TDS	5.65 (5.60, 6.10)	6.15 (6.05, 6.70)	6.15 (6.10, 6.45)	6.60 (6.10, 7.20)	<0.001
Seven-point score	4.00 (3.25, 5.00)	5.00 (4.00, 6.00)	5.00 (5.00, 5.75)	6.00 (4.50, 6.50)	0.004

[1] n (%); Median (IQR), [2] Pearsons Chi-squared test; Kruskal–Wallis rank sum test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

Table 2. Thick and thin melanomas, the statistical analysis of dermatoscopic criteria, colours, values of dermatoscopic algorithms.

Dermatoscopic criterion	SN (%)	SP (%)	PPV (%)	NPV (%)	PLR	NLR	OR (CI 95%)	p[1]
Thick melanomas ≥ 0.8 mm								
Colours ≥ 5	54	73	57	70	1.98	0.63	3.1 (1.30–7.54)	0.008
Blue	65	56	50	70	1.49	0.62	2.4 (1.01–5.64)	0.039
Blue-white veil	59	67	55	71	1.82	0.60	3.01 (1.27–7.16)	0.009
Polymorphous vessels	54	67	53	69	1.65	0.68	2.4 (1.03–5.7)	0.039
Hairpin vessels	19	96	78	64	5.20	0.84	6.2 (1.21–31.7)	0.027
Ulceration	22	100	100	65	NA	0.78	NA	0.001
Centrally localized structureless areas	81	38	47	75	1.31	0.50	2.6 (0.99–7.1)	0.035
Totaly dermatoscopis score – TDS > 6.8 mm	22	95	73	64	3.97	0.83	4.8 (1.18–19.44)	0.018
Seven point score ≥ 5	78	49	51	77	1.54	0.44	3.5 (1.36–8.99)	0.004
Thin melanomas < 0.8 mm								
Peripheral brown structureless areas	33	89	82	47	3.03	0.75	4 (1.23–13.1)	0.007

Sensitivity (SN), specificity (SP) positive predictive value (PPV), negative predictive value (NPV), positive likehood ratio (PLR), negative likehood ratio (NLR), odds ratio (OR), confidence interval (CI), [1]asymptotic two-sample t-test, Kruskal–Wallis rank sum test, testing was conducted at significance level of $\alpha = 0.05$

The clinical and epidemiological data are summarized in Table 3. The type of lesions according to palpation, diameter and localisation of the lesion showed statistically significant differences between the melanoma subgroups. In situ melanomas were most often macules (n = 16; 62 %), groups of invasive melanomas with the thickness < 0.8 mm and 0.8 – 1.50 mm were mostly represented by papules (n = 18; 62 %), (n = 11; 79 %), while nodular lesions made up a majority of melanomas with the thickness > 1.5 mm (n = 17; 74 %). The group of thin melanomas consisted only of macules and papules. More than half of thick melanomas were nodular (n = 20; 54 %). The melanoma thickness in our cohort did not increase in direct proportion to their

size. While the largest lesions were recorded in the group of melanomas with the thickness > 1.5 mm, the smallest lesions occurred in the group with the thickness of 0.8 – 1.5 mm. After a more detailed examination of the tumour localisation, we did not find significant differences between the group of thin and thick melanomas. There were no significant differences either in age at diagnosis or in the sex distribution among the groups. The youngest patient was 22, the oldest 93 years old. All patients were Caucasian.

Discussion

Dermatoscopy, in addition to improving the diagnostics of skin manifestations, could also be useful in the distinction of thin and thick melanomas. Several dermatologists have dealt with the prediction of melanoma thickness based on dermatoscopic findings.

As early as 1997, in a study of 72 melanomas, Argenziano reported a significant association of pigment network with melanoma thickness ≤ 0.75 mm, while melanomas with the thickness > 0.75 mm were associated with blue-white areas and vascular pattern (4). In a set of 84 melanomas, Stante registered a statistically significant association of irregular pigment network with the melanoma thickness ≤ 0.75 mm. On the other hand, he observed an association of radial streaming, atypical vascular pattern and blue-white areas with the group of melanomas with the thickness > 0.75 mm (5). Carli documented an increase of TDS values from melanomas in situ to melanomas with Breslow thickness of 0.75 – 1.5 mm. In a set of 84 cutaneous melanomas, in a preoperative detection of melanomas with the tumour thickness of more than 0.75 mm, the TDS value > 6.8 showed 80 % sensitivity and 84 % specificity (12). In our melanoma cohort, the TDS score increased in direct proportion to melanoma thickness, from melanomas in situ to melanomas > 1.5 mm thick. We did not perform as well with a TDS score > 6.8 for melanomas ≥ 0.8 mm as Carli did for melanomas > 0.75 mm. This may be due to the difference in the established threshold thickness for the group of thin and thick melanomas, the subjectivity of dermoscopic scoring, especially regarding the sharpness of the border, and the colour evaluation of the lesion. In the available literature, we did not find evaluation of the seven-point score in relation to melanoma thickness. Lallas in 2018 analyzed dermoscopic findings in a set of 325 in situ melanomas and 102 invasive melanomas with a Breslow thickness < 0.75 mm. While a multicomponent global pattern, blue-white veil were indicators of invasive melanoma, extensive regression was the only indicator of melanoma in situ (13). In 2021, Rodríguez-Lomba published the results of a study in which he analyzed updated dermatoscopic structures in a large set of 245 primary cutaneous melanomas in relation to melanoma thickness, taking into account a cut-off value of 0.8 mm between T1a and T1b melanomas. He found a significant association of melanomas with Breslow thickness < 0.8 mm with atypical pigment network, regression structures and hypopigmented areas (SN: 51.3 %, 45.3 %, 15.3 %), (SP: 65.2 %, 74.7 %, 93.7 %). On the other hand, in melanomas with the thickness ≥ 0.8 mm, significantly more frequent occurrence of red-pink (SN 51.6 %, SP 81.3 %), blue-gray (SN 46.7 %, SP 81.1 %), white colour (SN 43.2 %, SP 80.7 %) was noted. From dermatoscopic structures shiny white streaks (SN 54.7 %, SP 70.7 %), blue-white veil (SN 57.9 %, SP 86.0 %), irregular vessels (SN 43.2 %, SP 83.3 %), blue-black pigmentation (SN 18.9 %, SP 94.7 %), milky red areas (SN 35.8 %, SP 89.3 %), pseudolacunae (SN 24.2 %,

Table 3. Melanomas according to the tumour thickness, clinical and epidemiological data.

Clinical and epidemiological data	Melanoma in situ n = 26[1]	Invasive melanoma			p[2]
		< 0.8 mm n = 29[1]	0.8–1.50 mm n = 14[1]	> 1.50 mm n = 23[1]	
Age (y)	63 (58, 73)	67 (48, 74)	64 (54, 68)	66 (54, 76)	0.7
Sex distribution					0.3
Male	14 (54%)	14 (48%)	11 (79%)	12 (52%)	
Female	12 (46%)	15 (52%)	3 (21%)	11 (48%)	
Tumour type					<0.001
	Makula 16 (62%) Papula 10 (38%) Nodulus 0 (0%)	Makula 11 (38%) Papula 18 (62%) Nodulus 0 (0%)	Makula 0 (0%) Papula 11 (79%) Nodulus 3 (21%)	Makula 1 (4.3%) Papula 5 (22%) Nodulus 17 (74%)	
Diameter (mm)	12 (9.25, 16)	12 (9, 18)	11 (8, 13.75)	17 (11.5, 20)	0.016
Localisation					0.005
Back of trunk	11 (42%)	14 (48%)	3 (21%)	7 (30%)	
Front side of trunk	7 (27%)	1 (3.4%)	3 (21%)	3 (13%)	
Head	6 (23%)	0 (0%)	0 (0%)	4 (17%)	
Upper limbs	2 (7.7%)	8 (28%)	5 (36%)	5 (22%)	
Lower limbs	0 (0%)	5 (17%)	3 (21%)	3 (13%)	
Acral parts of the limbs	0 (0%)	1 (3.4%)	0 (0%)	1 (4.3%)	

[1] n (%); Median (IQR), [2] Pearson's Chi-squared test; Kruskal–Wallis rank sum test; Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

SP 98.0 %), ulceration (SN 36.8 %, SP 96.7 %) and rainbow pattern (SN 26.3 %, SP 95.3 %) were significantly associated with the thickness of melanomas ≥ 0.8 mm (14). To distinguish thick melanomas from thin ones, we defined a threshold value of 0.8 mm as Rodrigues did. In contrast to Rodríguez-Lomba, who found a significantly more frequent occurrence of blue-gray, red-pink and white colour in melanomas with the thickness ≥ 0.8 mm, we recorded a significant association of thick melanomas with blue colour (SN 65 %, SP 56 %). In the subset of thick melanomas, we observed a significantly more frequent blue-white veil (SN 59 %, SP 67 %), ulceration (SN 22 %, SP 100 %) with comparable sensitivity and specificity to Rodrígues-Lomba. While the authors of that study identified irregular vessels and milky-red areas as structures significantly associated with thick melanomas, in our study this group of melanomas was characterized by polymorphous vessels (SN 54 %, SP 67 %) and hairpin vessels (SN 19 %, SP 96 %). Our observation did not show significant differences in the representation of milky red areas between the monitored groups of melanomas. We did not record shiny white streaks, because we evaluated dermatoscopic images archived in a digital dermatoscope without the possibility of polarization. Since the rainbow pattern can also be captured only by polarized dermatoscopy, it was not evaluated in our set of pigmented lesions. The rainbow pattern is a dermatoscopic image, composed of several colours, which resembles a rainbow. It is considered higly specific for Kaposi's sarcoma (15). However, in addition to Kaposi's sarcoma, it has also rarely been reported in pyogenic granuloma, dermatofibroma, angioma, blue nevus, basal cell carcinoma, and melanoma (16). We observed only peripheral brown structureless areas in thin melanomas (SN 33 %, SP 89 %) significantly more often. Likewise, Annesi observed a significant association of peripheral brown structureless areas with thin melanomas (17). In our study, we did not record significant differences in the representation of atypical pigment network and regression structures between thin and thick melanomas. It is important to take into account the fact that mainly superficially spreading melanomas can have different thicknesses within a single lesion. In their clinical picture, it is possible to see a macular part on the periphery with a centrally located palpable part. Therefore, superficial melanomas with an invasive growth phase can present with a combination of dermatoscopic structures of thin and thick melanomas.

The retrospective nature of the work, a limited set of patients, implementation only within a single institution are the limitations of the study. Dermatoscopy is a largely subjective examination method. A single dermoscopist evaluated the dermatoscopic finding in our set of melanomas.

Conclusions

Although some dermatoscopic structures, colours and scoring of dermatoscopic algorithms are helpful in differentiating thin melanomas from thick ones, the correct prediction of tumour thickness according to dermatoscopic criteria is not unequivocal. In our study, thick melanomas tend to have the following dermatoscopic structures and colours: five or more colours in the lesion, blue colour, hairpin vessels, blue-white veil, centrally located structureless areas, polymorphous vessels and ulceration. Conversely, peripheral brown structureless areas were highly specific for thin melanomas. In the class of thick melanomas, the seven-point score of ≥ 5 was determined significantly more often and the TDS values > 6.8 were highly specific for thick melanomas. The calculation scores according to the ABCD rule of dermatoscopy and the seven-point checklist should become a part of the dermatoscopic examination of suspicious lesions before intended surgical intervention. The combination of clinical, dermatoscopic and other examination methods, for example high-frequency sonography, with already published favorable correlation between sonographically and histologically determined melanoma thickness (18), should play an important role in evaluating thickness of suspicious lesions before surgical treatment.*

Compliance with Ethics Requirements: The authors declare no conflict of interest regarding this article. The authors declare, that all the procedures and experiments of this research respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008 (5), as well as the national law.

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