Clinico-pathological Features of Patients with Melanoma and Positive Sentinel Lymph Node Biopsy: A Single Institution Experience

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ABSTRACT Sentinel lymph node biopsy (SLNB) is an established method for the assessment of tumor aggressiveness in patients with primary cutaneous melanoma (PCM). To improve the criteria for the selection of SLNB candidates, the aim of our study was to determine clinico-pathohistological parameters that can serve as predictors of metastatic progression. We retrospectively evaluated all available clinico-pathohistological parameters in 844 patients with PCM diagnosed between January 1, 2005 and December 31, 2010. SLNB was conducted in 484 (57.3%) patients, 122 (14.5%) of whom had a positive node. The association between predictors and SLNB outcomes (positive SLNB and metastatic development) was tested using logistic regression analysis. The main predictors of positive SLNB were Breslow thickness (adjusted odds ratio (AOR)=1.22; 95% confidence interval (CI)=1.11-1.33), Clark levels (AOR=1.78; 95% CI=1.31-2.40), ulceration (AOR=3.1; 95% CI=1.65-5.81), microsatellitosis, gender, and tumor localization. The predictors of metastatic spread were Breslow thickness (AOR=1,69; 95% CI=1.51-1.89), Clark level (AOR=3.59; 95% CI=2.79-4.62), nodular type of melanoma (AOR=8.21; 95% CI=1.70-39.53), ulceration, mitotic rate, microsatellitosis, gender, and tumor localization. It seems that these parameters should be taken into consideration when selecting patients for SLNB since tumor thickness is not a sufficient predictor of SLNB outcome, particularly in case of very thin lesions.

KEY WORDS: primary cutaneous melanoma (PCM); sentinel lymph node biopsy (SLNB); metastases

INTRODUCTION

In many countries, including Croatia, primary cutaneous melanoma (PCM) has an increasing mortality rate, and an even more rapidly increasing incidence rate, the latter probably attributable to improved diagnostics of thin minimally invasive melanoma (1-5). An established method for assessing the presence of nodal metastases, with a low risk of postoperative complications, is sentinel lymph node biopsy (SLNB) (6,7,8). However, in about 80% of the cases, sentinel biopsy yields a negative result, which suggests a need for better candidate selection criteria to decrease the number of unnecessary sentinel biopsies (9).

Tumor thickness is a generally accepted reliable prognostic parameter but it has been shown that very thin lesions behave differently from thick lesions (10). This is why other pathohistological and clinical parameters have to be used in the selection of candidates for SLNB, particularly in the case of thin PCM

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(11,12). Recent research on novel melanoma molecular markers has obtained promising results, but we should continue searching for easier and simpler ways to screen the candidates for SLNB and follow up those with higher metastatic potential (12,13). This research is an extension of our study performed on melanoma patients between 2005 and 2007, with a significant enlargement of our database from 492 to 844 melanoma patients, during the period 2005-2010 (14). The main objective of this study was to determine whether routinely collected clinico-pathohistological data can be reliable predictors of SLNB and metastatic potential in primary cutaneous melanoma.

PATIENTS AND METHODS

The study was conducted at the Referent Center for Malignant Melanoma of the Republic of Croatia over a six-year period, from January 1, 2005 to December 31, 2010 and included 844 patients with primary cutaneous melanoma (PCM). This is an extension of our previous study conducted on 492 melanoma patients hospitalized between 2005 and 2007, who were followed up for 3-6 years (14). Pathohistological analysis of the primary excised tumor and sentinel node were performed at the "Ljudevit Jurak" Department of Pathology at the "Sestre Milosrdnice" University Hospital. In this study we correlated SLNB outcome and metastatic development with age, gender, localization, tumor type and thickness, Clark level, and other pathohistological parameters of the primary excised tumor: ulceration, regression, mitotic rate, lymphovascular invasion, lymphocytic infiltrate, and presence of microsatellitoses (Table 1).

There were 844 patients diagnosed with PCM, 386 (45.73%) men and 458 (54.26%) women. The mean patient age was 54 years (min 7; max 90). As many as 52.1% patients had tumors on the trunk, usually on the back (38.9%), and 61.6% of them had superficial spreading melanoma (SSM). There was an equal number of patients with Clark 2, 3, and 4 levels (about a third of patients with each). A similar distribution was found for Breslow thickness I, II, and III (about a third of the patients each), covering the majority (83.5%) of our patients. The main selection criterion for sentinel biopsy was tumor thickness ≥1mm, but some SLNB were also performed on the basis of clinical judgment.

Breslow tumor thickness is stratified into stages from I to IV and expressed in mm and T1-T4 degrees according to TNM classification (15). Thin tumors were analyzed separately and divided into subgroups: <0.5; 0.5-0.75; 0.76-1.0; 1.01-1.25; and 1.26-1.5 mm. Mitotic rate (number of mitoses per mm^2) was divided into four subgroups: no mitoses, one mitosis per mm^2, two to five per mm^2, and more than five mitoses per mm^2. Lymphocytic infiltration was classified as follows: no lymphocytic infiltration, scarce infiltration, moderately dense infiltration, and dense infiltration.

The study complied with the Helsinki Declaration, and ethical approval was obtained from the ethics committees of the University of Zagreb, Zagreb School of Medicine, and "Sestre Milosrdnice" University Hospital, Zagreb, Croatia.

Statistical analysis

Numerical variables were tested for normality of distribution using the Kolmogorov-Smirnov test. For ordinal and numerical variables that did not show normal distribution, nonparametric tests were used (Mann-Whitney or Kruskal-Wallis), while for nominal categorical variables chi-square and Fisher's exact test were used. The association between sentinel and metastatic outcome and independent variables was tested using univariate logistic regression, and multiple logistic regression was used to control for the confounding effects of age and gender. The level of statistical significance was set at $\alpha=0.05$. STATA/IC software version 11.02 was used (StataCorp LP, College Station, TX, USA).

RESULTS

SLNB was performed in 484 (63%) patients, 22 (16%) of whom had a positive node. There were 205 patients (29.5%) who developed a recurrence and 39 patients (4.6%) who developed metastatic disease despite a negative sentinel biopsy.

Half of our patients (426 patients or 50.47 %) had thin tumors, with thickness less than 1.5 mm, and 184 patients (43%) from this group underwent sentinel biopsy.

In the group of thin tumors, sentinel biopsy was positive in 22 patients (12%), and 30 patients (7.65%) developed metastatic disease. The group of thinnest tumors (<0.5 mm) had the highest proportion of positive nodes (33.3%) among all tested groups, while the group of the thickest tumors (1.26-1.5 mm) had the highest proportion of patients with metastatic development (23%). As much as 50% of positive nodes were found in tumors less than 1 mm. The two thickest stratified groups covered as much as 36% of all metastatic outcomes. (Table 2).

Seven patients had lymphovascular invasion and only four regressions, which was insufficient to include these parameters into statistical analysis.

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Table 1. Clinical and pathohistological features (N=844)

		N	% (valid)
Gender (N=844)	men	386	45.7
	women	458	54.3
Localization (N=844)	head and neck	68	8.1
	trunk front	111	13.2
	trunk back and gluteal	327	38.9
	arm and shoulder	130	15.5
	leg and hip	176	20.9
	earlobe, subungual, and fingers	16	1.9
	eye	3	0.4
	unknown primary site	10	1.2
Type (N=599)	MIS*	20	3.3
	SSM*	369	61.6
	NM*	150	25.0
	LMM*	32	5.3
	ALM*	19	3.2
	melanoma nevoides	8	1.3
	desmoplastic melanoma	1	0.2
Clark classification (N=751)	1	27	3.6
	2	238	31.7
	3	237	31.6
	4	220	29.3
	5	29	3.9
Breslow classification (N=763)	I	220	28.8
	II	206	27.0
	III	211	27.7
	IV	126	16.5
T stage according to TNM classification (N=401)	T1a	70	17.5
	T1b	134	33.4
	T2a	90	22.4
	T2b	27	6.7
	T3a	9	2.2
	T3b	13	3.2
	T4a	18	4.5
	T4b	40	10.0
Thin tumors (mm) (N=426)	<0,5	116	27.2
	0,5-0,75	104	24.4
	0,76-1	111	26.1
	1,01-1,25	58	13.6
	1,26-1,5	37	8.7
Sentinel biopsy (N=764)	not done	280	36.6
	negative	362	47.4
	positive	122	16.0
Metastases (N=694)	negative	489	70.5
	positive	205	29.5
Ulceration (N=408)	no	322	78.9
	yes	86	21.1
Lymphatic capillary infiltration (N=398)	no	391	98.2
	yes	7	1.8
Regression (N=398)	no	394	99.0
	yes	4	1.0
Number of mitoses (N=418)	no mitoses	81	19.4
	1	127	30.4
	2-5	147	35.2
	more than 5	63	15.1
Lymphocytic infiltration (N=412)	none	16	3.9
	scarce	70	17.0
	moderately dense	156	37.9
	dense	170	41.3
Microsatellitosis (N=408)	no	383	93.9
	yes	25	6.1

*MIS – melanoma in situ; SSM – superficial spreading melanoma; NM – nodular melanoma; LMM – lentigo maligna melanoma; ALM – acrolentiginous melanoma

Table 2. Thin tumors (<1.5 mm)

		sentinel lymph node biopsy			
		neg	pos	pos %	Total
Thin tm (mm)	<0.5	10	5	33.33	15
	0.5-0.75	15	3	16.67	18
	0.76-1	60	7	10.45	67
	1.01-1.25	44	4	8.33	48
	1.26-1.5	33	3	8.33	36
Total		162	22		184
		metastases			
		neg	pos	pos %	Total
Thin tumors (mm)	<0.5	105	5	4.55	110
	0.5-0.75	99	5	4.81	104
	0.76-1	97	8	7.62	105
	1.01-1.25	41	6	12.77	47
	1.26-1.5	20	6	23.08	26
Total		362	30		392

		sentinel lymph node biopsy		Total
		neg	pos	
Metastases	neg	134	0	134
	pos	6	22	28
Total		140	22	250

Sentinel biopsy outcome

Sentinel biopsy was performed in 484 (57.34%) patients, 122 (14.45%) of whom had a positive SLNB, of which significantly more men than women (P=0.028), with men having a 1.61 times higher risk for a positive sentinel biopsy outcome (women vs. men odds ratio (OR)=0.62; 95% confidence interval (CI)=0.41-0.94). There was no significant difference according to age. Significantly more patients with nodular and nevoid melanoma had positive SLNB (P<0.001), but logistic regression analysis did not confirm this finding. Patients with tumors on the trunk had the highest risk for positive SLNB – the front trunk (adjusted OR (AOR)=5.6; 95% CI=1.53-20.55) and the back trunk including the gluteal region (AOR=4.43; 95% CI=1.29-15.27). Higher risk of sentinel lymph node positivity was also associated with higher Clark levels of invasion (AOR=1.78; 95% CI=1.13-2.4) and Breslow tumor thickness (AOR=1.22; 95% CI=1.11-1.33).

When we stratified thin tumors into five groups, increase in tumor thickness did not lead to an increase in the risk of positive sentinel biopsy: 0.5-0.75 mm (AOR=0.46; 95% CI=0.09-2.45); 0.76-1.00 mm (AOR=0.23; 95% CI=0.06-0.88); 1.01-1.25 mm (AOR=0.17; 95% CI=0.04-0.75); 1.26-1.50 mm (AOR=0.18; 95% CI=0.04-0.91) (Table 3).

Regarding other pathohistological parameters, a significant association with SLNB positivity was found for the presence of ulceration (P<0.001), higher mitotic rate (P=0.018), microsatellitosis (P<0.031), and the presence of lymphocytic infiltration (P=0.037), but not for the presence of lymphocapillary invasion (P=0.575). Logistic regression analysis confirmed that ulceration was a strong predictor of positive sentinel biopsy outcome (AOR=3.1; 95% CI=1.65-5.81), as well as the presence of microsatellitoses (AOR=2.86; 95% CI=1.1-7.41), indicating a three times greater probability of a positive sentinel biopsy outcome.

Since only routine staining (hematoxylin and eosin (HE) stain) was performed in our pathohistological laboratory, too few lymphocapillary invasions (N=7) were detected to be included into statistical analysis. Only four of these patients experienced recurrence and none had undergone SLNB. The results of logistic regression analysis for positive SLNB outcome are summarized in Table 3.

Outcome of metastatic development

At the end of study period, 205 patients (24.28%) experienced some type of disease progression (positive local or distant lymph nodes, presence of cutaneous or distant visceral metastases). Men had an almost two times higher probability of developing metastatic disease than women (P<0.001) (OR=0.51;

Table 3. Logistic regression analysis for positive outcome of sentinel lymph node biopsy

Feature	OR	95%CI	AOR***	95%CI
Gender (women vs. men)	0.62*	0.41-0.94	NA	NA
Age (years)	1.01	0.996-1.02	NA	NA
Localization – head and neck	1	NA	1	NA
Localization – trunk front	5.17*	1.42-19.82	5.6*	1.53-20.55
Localization – trunk back and gluteal	4.02*	1.17-13.74	4.43*	1.29-15.27
Localization – arm and shoulder	2.13	0.56-8.07	2.43	0.64-9.32
Localization – leg and hip	2.73	0.77-9.69	3.16	0.87-11.47
Localization – earlobe, subungual. and fingers	2.41	0.34-17.04	2.36	0.33-16.82
Localization – eye	NA**	NA**	NA**	NA**
Localization – unknown primary site	NA**	NA**	NA**	NA**
Type- MIS**	1	NA	1	NA
Type - SSM**	0.47	0.04-5.35	0.49	0.04-5.57
Type - NM**	1.41	0.12-15.91	1.42	0.12-16.11
Type - LMM**	0.44	0.03-7.67	NA**	NA**
Type - ALM**	2	0.09-44.35	0.46	0.03-8.04
Type - melanoma nevoides	NA**	NA**	NA**	NA**
Type – desmoplastic melanoma	NA**	NA**	NA**	NA**
Clark classification	1.87*	1.39-2.51	1.78*	1.31-2.40
Breslow thickness (mm)	1.24*	1.14-1.35	1.22*	1.11-1.33
Breslow classification I	1	NA	1	NA
Breslow classification II	0.32*	0.12-0.84	0.33*	0.12-0.87
Breslow classification III	1.18	0.50-2.8	1.16	0.49-2.77
Breslow classification IV	2.40	0.99-5.84	2.24	0.91-5.14
Thin tumors – <0.5 mm	1	NA	1	NA
Thin tumors – 0.5-0.75 mm	0.40	0.08-2.06	0.46	0.09-2.45
Thin tumors – 0.76-1 mm	0.23*	0.06-0.88	0.23*	0.06-0.88
Thin tumors – 1.01-1.25 mm	0.18*	0.04-0.80	0.17*	0.04-0.75
Thin tumors – 1.26-1,5 mm	0.18*	0.04-0.90	0.18*	0.04-0.91
TNM- T1a	1	NA	1	NA
TNM- T1b	0.41	0.10-1.72	0.43	0.10-1.82
TNM- T2a	0.45	0.12-1.69	0.45	0.12-1.67
TNM- T2b	0.63	0.14-2.85	0.61	0.13-2.81
TNM- T3a	0.83	0.12-6.01	0.87	0.12-6.40
TNM- T3b	1.79	0.35-9.13	1.86	0.36-9.58
TNM- T4a	1.88	0.39-9.01	1.92	0.40-9.34
TNM- T4b	3.21	0.83-12.44	3.17	0.80-12.57
Number of mitoses - 0	1	NA	1	NA
Number of mitoses - 1	0.33	0.08-1.28	0.33	0.08-1.29
Number of mitoses - 2-5	1.08	0.36-3.24	1.06	0.35-3.18
Number of mitoses - >5	1.55	0.48-5.03	1.42	0.43-4.68
Ulceration (yes vs. no)	3.27*	1.75-6.08	3.10*	1.65-5.81
Lymphocytic infiltration – none	1	NA	1	NA
Lymphocytic infiltration – scarce	4.67	0.53-41.22	4.14	0.46-37.06
Lymphocytic infiltration – moderately dense	2.22	0.26-19.17	2.19	0.25-19.00
Lymphocytic infiltration – dense	1.62	0.19-13.97	1.56	0.18-13.54
Microsatellitosis (yes vs. no)	2.84*	1.11-7.26	2.86*	1.10-7.41

*statistically significant result at the level α=0.05

**perfectly predicts the outcome

***OR standardized for age and gender

****MIS – melanoma in situ; SSM – superficial spreading melanoma; NM – nodular melanoma; LMM – lentigo maligna melanoma; ALM – acrolentiginous melanoma

95% CI=0.37-0.71). Nodular melanoma showed the greatest aggressiveness (AOR=8.21; 95% CI=1.70-39.53), with metastatic development observed in 62.6% of cases, followed by nevoid melanoma at 50% and ALM at 41.7% of cases (P<0.001). A significant association was found between the localization of the primary tumor (P<0.001) and development of metastatic disease – 66.7% of acral localization cases

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Table 4. Logistic regression analysis for metastatic spread of melanoma

Feature	OR	95%CI	AOR***	95%CI
Gender (women vs. men)	0.51*	0.37-0.71	NA	NA
Age (years)	1.01	0.99-1.02	NA	NA
Localization- head and neck	1	NA	1	NA
Localization – trunk front	3.17*	1.34-7.52	3.29*	1.36-7.91
Localization – trunk back and gluteal	2.29*	1.03-5.08	2.46*	1.10-5.53
Localization – arm and shoulder	1.15	0.46-2.86	1.36	0.54-3.42
Localization – leg and hip	2.67*	1.17-6.10	3.56*	1.52-8.35
Localization–earlobe,subungual. and fingers	11*	2.27-56.27	10.71*	2.18-52.68
Localization – eye	NA**	NA**	NA**	NA**
Localization – unknown primary site	NA**	NA**	NA**	NA**
Type – MIS* **	1	NA	1	NA
Type – SSM* **	1.08	0.23-5.060	1.11	0.23-5.24
Type – NM* **	8.37*	1.75-40.20	8.21*	1.7-39.53
Type – LMM* **	NA**	NA**	NA**	NA**
Type – ALM* **	3.57	0.53-23.95	3.77	0.56-25.51
Type - melanoma nevoides	NA**	NA**	NA**	NA**
Type – desmoplastic melanoma	NA**	NA**	NA**	NA**
Clark classification	3.66*	2.86-4.71	3.59*	2.79-4.62
Breslow thickness (mm)	1.71*	1.53-1.91	1.69*	1.51-1.89
Breslow classification I	1	NA	1	NA
Breslow classification II	2.58*	1.18-5.67	2.59*	1.17-5.70
Breslow classification III	17.2*	8.46-35	16.80*	8.25-34.25
Breslow classification IV	45.72*	21.15-95.86	43.54*	20.08-94.40
Thin tumors – <0,5mm	1	NA	1	NA
Thin tumors – 0.5-0.75mm	1.06	0.30-3.78	0.99	0.28-3.62
Thin tumors – 0.76-1mm	1.73	0.55-5.48	1.63	0.50-5.27
Thin tumors – 1.01-1.25mm	3.07	0.89-10.62	2.99	0.86-10.36
Thin tumors – 1.26-1.5mm	6.30*	1.75-22.64	6.05*	1.64-22.32
TNM – T1a	1	NA	1	NA
TNM – T1b	0.74	0.20-2.71	0.78	0.21-2.90
TNM – T2a	5.54*	1.78-17.18	5.55*	1.78-17.27
TNM – T2b	11.27*	2.89-43.96	11.60*	2.96-45.46
TNM – T3a	15.50*	2.33-102.90	14.15*	2.08-96.33
TNM – T3b	108.50*	10.59-1111.25	115.18*	11.07-1198.43
TNM – T4a	34.88	7.39-164.68	34.45*	7.25-163.58
TNM – T4b	42.63*	11.67-155.63	40.19*	10.82-149.22
Number of mitoses – 0	1	NA	1	NA
Number of mitoses – 1	0.43	0.14-1.28	0.46	0.15-1.38
Number of mitoses – 2-5	4.64*	2.03-10.60	4.86*	2.11-11.19
Number of mitoses – >5	17.87*	6.87-46.47	16.94*	6.43-44.58
Ulceration (yes vs. no)	8.69*	4.78-15.80	8.54*	4.64-15.71
Lymphocytic infiltration – none	1	NA	1	NA
Lymphocytic infiltration – scarce	1.69	0.46-6.13	1.47	0.39-5.45
Lymphocytic infiltration – moderately dense	0.63	0.18-2.17	0.55	0.15-1.94
Lymphocytic infiltration – dense	0.45	0.13-1.59	0.42	0.16-1.47
Microsatellitosis (yes vs. no)	8.02*	3.15-20.43	8.60*	3.34-22.15

*statistically significant result at the level α=0.05

**OR standardized for age and gender

***MIS – melanoma in situ; SSM – superficial spreading melanoma; NM – nodular melanoma; LMM – lentigo maligna melanoma; ALM – acrolentiginous melanoma

metastasized, followed by 36.6% of front trunk localization cases, 32.7% of leg and hip localization cases, and 29.4% of back trunk and gluteal localization cases. Patients with primary tumor localization on the trunk and leg had a three times higher probability of developing metastatic disease: trunk front (AOR=3.29; 95% CI=1.36-7.91); trunk back and gluteal region (AOR=2.46; 95% CI=1.10-5.53); leg (AOR=3.56; 95% CI=1.52-8.35); and patients with acral tumor localization (earlobe, subungual, fingers) had an almost 11 times higher probability (AOR=10.71; 95% CI=2.18-52.68) than patients with tumor localization on the head and neck. Higher Clark levels of invasion increased the risk of developing metastatic disease almost four times (AOR=3.59; 95% CI=2.79-4.62). As many as 84.2% of patients with

Clark level V developed metastatic disease. Increased thickness was associated with greater metastatic development (AOR=1.69; 95% CI=1.51-1.89). Among thin tumors (up to 1.5 mm), significantly more tumors from the subgroup 1.26-1.5mm developed metastases (AOR=6.05; 95% CI=1.64-22.32).

The presence of microsatellitosis increased the risk of metastatic development (AOR= 2.86; 95% CI=1.10-7.41), as well as the presence of ulceration, which increased the risk for almost 8.5 times (AOR= 2.86; 95% CI=1.10-7.41). Increased risk was also found for mitotic rate in the group of tumors with 2-5 mitoses/mm2 (AOR=4.86; 95% CI=2.11-11.19) and more than 5 mitoses/mm2 (AOR=16.94; 95% CI=6.43-44.58) compared with the group of tumors with no mitoses.

Out of the 284 sentinel negative patients, 39 developed a remote visceral metastasis, suggesting a procedural error or passing over the lymph node. Lymphocapillary invasion (*P*=0.221) and recurrence (*P*=0.275) showed no significant correlation with metastatic development. Although expected, the association with age was not found. The results of logistic regression analysis are summarized in Table 4.

DISCUSSION

Different clinico-pathological parameters have been shown to have prognostic value for SLNB positivity (16,17). For example, the American Joint Committee on Cancer (AJCC) included mitotic rate and ulceration among prognostic factors, which affected staging and classification of thin tumors (18). Therefore, there is a need for uniform criteria for SLNB across different health institutions.

Since thick tumors (>4 mm) showed a high incidence of positive lymph nodes (30-40%), we believe that SLNB should be conducted even in patients with thick tumors who have clinically negative lymph nodes (19). However, most primary cutaneous melanomas are thin tumors (0.51-1.00 mm thickness). These tumors are usually associated with a low risk of disease progression and mortality, but still about 10% of them result in recurrence and death (10). Our study confirmed that thin lesions showed a tendency towards aggressive behavior – as much as 12% of patients with a thin lesion had a positive sentinel node and 7.65% of patients with such lesions developed metastases. Such results indicate that thickness alone, particularly within the group of tumors thinner than 1.5 mm, is not a reliable prognostic factor and that other pathohistological and clinical parameters need to be taken into account, such as male gender, nodular melanoma, localization (particularly trunk and acral), higher Clark levels, ulceration, and the presence of mitoses in primary tumors as well as occurrence of microsatellitoses.

It has still not been determined whether SLNB is useful in thin melanoma cases (20,21). If we take into account the cost of this procedure and risk of possible complications, it is clear that selection criteria for SLNB should be improved. Tumor thickness was not found to reliably predict tumor aggressiveness, particularly in thin tumors (under 1.5 mm).

The main limitation of our study was the lack of routine SLNB in tumors thinner than 1 mm in our institution; in such cases SLNB was conducted on the basis of clinical judgment. Therefore, we did not have a representative sample in this category. Still, the occurrence of metastases among stratified thin tumors was significantly higher in the group of the thickest tumors (1.26-1.50 mm).

Some studies report that lymphocapillary invasion and tumor regression predicted a positive sentinel biopsy outcome and the occurrence of metastases, but we were not able to confirm such finding due to small sample size.

CONCLUSION

Although recent molecular studies have shown promising results in the field, clinical and pathohistological data remain the most cost-effective and simple way to assess the risk of metastatic occurrence in patients with melanoma.

The contradictory results obtained within the group of thin tumors indicate that thickness might not be a reliable predictive parameter. Thus, our study showed that when deciding whether to conduct SLNB we should consider other pathohistological factors in addition to tumor thickness and level of invasion. These factors are the presence of mitosis, ulceration, microsatellitosis, male gender, trunk and acral localization, and nodular type of melanoma. We also recommend introduction of additional immunohistochemical methods into routine work to be able to more efficiently assess the predictive value of all parameters. There is also a need for further prospective studies on this topic, especially those focusing on thin tumors.

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