



# Risk factors for positive or equivocal margins after wide local excision of 1345 cutaneous melanomas

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**Background:** Positive or equivocal margins after wide local excision (WLE) complicate surgical management of cutaneous melanoma.

**Objective:** To identify the frequency of and risk factors for positive or equivocal margins after WLE of cutaneous melanoma.

**Methods:** Retrospective, single-center, cross-sectional study of 1345 consecutive melanomas treated with WLE.

**Results:** The overall frequency of positive or equivocal margins was 4.2% (56/1345), ranging from 2.2% to 22.6%, depending on the size of the surgical margins, patient characteristics, biopsy history, and the clinicopathology of the melanoma. In descending order, independent risk factors associated with the greatest odds for positive or equivocal margins after multivariate analysis were noncompliance with recommended surgical margins (odds ratio [OR] 5.57,  $P = .002$ ); anatomic location on the head, neck, hands, feet, genitals, or pretibial leg (OR 5.07,  $P < .001$ ); histologic regression (OR 2.78,  $P = .007$ ); in situ melanoma (OR 2.27,  $P = .011$ ); multiple biopsies at the tumor site before WLE (OR 1.92 [per biopsy],  $P = .004$ ); and increasing age (OR 1.049 [per year],  $P < .001$ ).

**Limitations:** This was a single-site, retrospective observational study.

**Conclusions:** Clinicopathologic factors, especially location in cosmetically or functionally sensitive areas and noncompliance with recommended surgical margins, identified melanomas at increased risk for positive or equivocal margins after WLE. (J Am Acad Dermatol 2017;77:333-40.)

**Key words:** counseling; delayed reconstruction; equivocal margins; immediate reconstruction; incomplete excision; local recurrence melanoma; positive margins; wide local excision.

The standard treatment for primary melanoma of the skin is wide local excision with margins including uninvolved skin.<sup>1</sup> When melanomas are excised with inadequate margins, local recurrences develop at a high rate within the surgical scar.<sup>1,2</sup> Locally recurrent melanomas might have a more advanced stage and a worse prognosis

#### Abbreviations used:

AUC: appropriate use criteria  
CI: confidence interval  
LM: lentigo maligna  
OR: odds ratio  
WLE: wide local excision

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compared with the initial primary melanomas.<sup>3-5</sup> To avoid local recurrence and tumor progression, most melanomas with positive margins undergo additional excisions.<sup>1,5,6</sup> After excisions and reconstruction, subsequent microscopic assessment of the margins and reconstruction often are more complex.<sup>7</sup> Moreover, incomplete tumor removal might provoke patient anxiety. Patients place highest priority on complete skin cancer removal,<sup>8,9</sup> and the fear of recurrence ranks among melanoma patients' greatest concerns and sources of distress.<sup>10,11</sup>

This cross-sectional study reviews a large cohort of melanomas to assess risk factors for positive or equivocal margins after conventional wide local excision. Identifying risk factors for positive or equivocal surgical margins might help to improve surgical management of melanoma. Melanomas at low risk for positive margins might be expected to have successful outcomes after conventional wide local excision and immediate reconstruction. By contrast, melanomas at high risk for positive margins might benefit from microscopic analysis of the margins with techniques such as Mohs micrographic surgery with frozen-section melanocytic immunostains<sup>12</sup> or exhaustive margin control with formalin-fixed paraffin-embedded sections before reconstruction.<sup>13,14</sup>

## METHODS

### Experimental design

This retrospective cross-sectional study was approved by the institutional review board at the Hospital of the University of Pennsylvania. Inclusion criteria were age  $\geq 18$  years, biopsy-proven melanoma whose diagnostic biopsy and excision specimens were interpreted by a board-certified dermatopathologist at the University of Pennsylvania between January 1, 2008, and December 31, 2013. All biopsy-proven primary melanomas included in the study were treated by a University of Pennsylvania Health System provider with conventional WLE, which was defined as excision of melanoma with a documented margin of clinically normal skin and immediate reconstruction, followed by microscopic assessment of the margin via

formalin-fixed paraffin-embedded breadloaf tissue sections. Cases were included only when the WLE was done after the preoperative biopsy confirmed the pathologic diagnosis of melanoma. Excisions done for diagnosis, rather than treatment, did not qualify as a WLE. Eligible cases were identified via a search of the Dermatopathology Database for "melanoma" and "lentigo maligna" (LM), which resulted in the identification of 7657 pathology reports containing either term in the line diagnosis. Review of the medical record identified 1345 melanomas that met inclusion criteria for this study. Each melanoma included in the study accounted for 2 reports: 1 pathology report for the diagnostic biopsy and 1 report for the wide local excision. In addition, some melanomas had multiple preoperative biopsies and some pathology reports were from re-excisions for positive or equivocal margins. Most of the remaining cases were

excluded because either the diagnostic biopsy or the WLE specimen was interpreted by a physician outside of the University of Pennsylvania health system. If patients had  $>1$  melanoma, all eligible melanomas were included. An a priori study size calculation was not performed to determine the desired sample size.

### Data collection

Study data were collected and managed using REDCap electronic data capture tools hosted at the University of Pennsylvania. After verifying that a melanoma met the inclusion criteria, clinical notes and pathology reports from the diagnostic biopsies and WLE for each patient were reviewed. The following data were recorded from the clinical notes and pathology reports: biopsy method, anatomic location, patient age at biopsy, patient history of melanoma, previous attempts at definitive treatment of the lesion, size of the surgical margin, and histopathologic characteristics of the melanoma (presence or absence of residual melanoma in the excision specimen, invasive versus in situ disease, Breslow depth, mitotic rate, ulceration, regression, LM subtype versus other subtypes). If multiple scouting biopsies had been performed before the WLE, the number of scouting biopsies was recorded, and the tumor was

## CAPSULE SUMMARY

- Criteria to predict risk for positive margins after conventional wide local excision are uncertain.
- Melanomas have a 5-fold increased risk for positive margins if they are excised with narrower than recommended surgical margins or located on the head, neck, hands, feet, genitals, or pretibial leg.
- Melanomas at high risk for positive margins might benefit from surgical techniques with more exhaustive microscopic margin assessment before reconstruction.

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