

Surgical margins required for basal cell carcinomas treated with Mohs micrographic surgery according to tumor features



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Background: Basal cell carcinomas (BCCs) with high-risk features are preferably treated by Mohs micrographic surgery. Studies have shown clinicopathologic characteristics that may predict more stages required for clearance. However, few studies have correlated such factors with the number of millimeters removed per stage.

Objective: To determine margins necessary for BCC clearance according to tumor features, especially for tumors less than 6 mm, and to suggest initial margins for Mohs micrographic surgery and margins for wide local excision.

Methods: Retrospective analysis of 295 consecutive Mohs micrographic surgeries for primary BCCs. Variables analyzed included patient age, sex, immunostatus, lesion size, location, histologic subtype, borders, stage number, and millimeters excised per stage.

Results: BCCs less than 6 mm had a clearance rate of 96% with 3-mm margins. In adjusted multivariable analysis, superficial, micronodular, infiltrative, and morpheaform subtypes were associated with larger margins, whereas clinically well-defined tumors were associated with smaller margins.

Limitations: Because of the limited sample of certain subtypes, a 3-mm margin is better suited for nodular tumors.

Conclusion: These data help guide initial Mohs micrographic surgery and wide local excision margins required for tumor clearance according to tumor features. Nodular BCCs less than 6 mm may be cleared with 3-mm margins instead of the current 4-mm margin recommendation. (*J Am Acad Dermatol* 2020;83:493-500.)

Key words: basal cell carcinoma; dermoscopy; Mohs micrographic surgery; surgical margins.

INTRODUCTION

Basal cell carcinomas (BCCs) located on high-risk areas are preferably treated by Mohs micrographic surgery.¹ Previous studies have shown that tumor and patient characteristics may predict a higher number of stages necessary to achieve clear

margins.^{2,3} However, few have directly measured millimeters removed in each stage.⁴

Studies have recommended margins for wide local excision when Mohs micrographic surgery is not available.^{5,6} According to the National Comprehensive Cancer Network, the recommended

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lateral margin for BCCs less than 2 cm with no high-risk features is 4 mm, regardless of whether its size is 19 or 4 mm.¹ To our knowledge, however, only 1 study directly evaluated margins for BCCs less than 6 mm with Mohs micrographic surgery.⁷

The aim of the study was to determine lateral margins required for BCC clearance according to tumor features, especially for tumors less than 6 mm, and furthermore to suggest initial margins for Mohs micrographic surgery and margins for wide local excision.

METHODS

This was a retrospective study of BCCs treated with Mohs micrographic surgery from August 2017 to November 2019. Inclusion criteria were biopsy-proven primary BCC on the head. Exclusion criteria were recurrent and incompletely excised tumors. All patients were treated at a Mohs micrographic surgery unit by the same dermatologist. This study was approved by the local institutional review board.

Data were collected prospectively after each surgery. This included age, sex, Fitzpatrick skin phototype, tumor location, size, border definition as rendered by the surgeon (ill defined versus well defined), histologic subtype, immunosuppression, perineural invasion, surgical margins in millimeters excised in each stage, subunits affected, and number of stages.

Tumor location was divided according to the National Comprehensive Cancer Network into high, moderate, and low risk.¹ Dimensions were measured on the largest diameter and perpendicular to it. Tumors were divided in group sizes (group 1, <6 mm; group 2, 6-10 mm; group 3, 11-19 mm; and group 4, >19 mm). Histologically, BCCs were classified into nonaggressive (superficial and nodular) and aggressive (micronodular, infiltrative, morpheaform, and metatypical). If more than 1 subtype was present, tumor was classified according to the most aggressive one. To reduce the subjective bias of classification, the Mohs micrographic surgery histologic slides were considered for tumor classification. The author (F.B.C.) routinely performs debulking analysis on frozen sections. If tumor was not observed on the slides (debulking and margins), the Mohs surgeon reviewed the preoperative biopsy (20 cases). On every stage, tumor size and millimeters

removed were written on a paper used to transfer tissue to the laboratory.

Preoperatively, tumor borders were marked according to clinical and dermoscopic alterations because visual assessment has been shown to have limited accuracy.⁸ Tumor was marked with a dotted line and first-stage margins with a continuous line.

Margin measurement started on the inner edge of the dotted line and finished on the outer edge of the continuous line. For 1-mm margins, only the continuous line was drawn. Margins were delineated before local anesthesia and without overstretching the skin. In patients with a significant amount of wrinkled skin, stretching was performed enough to flatten the skin. All tumors were measured and marked by a single surgeon with the same brand of surgical marking

pen and ruler. For each case, the surgeon determined the first-stage margin according to tumor characteristics and location, varying from 1 to 4 mm (90% started with up to 2 mm). For example, a small, clinically well-defined BCC on the nasal ala was initially excised with a 1-mm margin, whereas an ill-defined BCC on the cheek typically was excised with a 2-mm one. The only case that started with a 4-mm margin was a 25 × 25-mm morpheaform tumor involving the inner canthus and cheek subunits, performed under general anesthesia. For removal, tumors were debulked with a razor blade (saucerization); then margins were excised at a 45-degree angle. In 35 cases, debulking was not performed to avoid removal of epidermis beyond delineated margins. In these cases, the specimen block was thoroughly sectioned. If additional stages were required, marking and measurement were done before additional lidocaine infiltration. Subsequent stages were undertaken until complete tumor removal.

Statistical analysis

Data were analyzed with SPSS (version 25; IBM Corp., Armonk, NY) and R (version 3.6.2; R Foundation for Statistical Computing, Vienna, Austria). Mann-Whitney and Kruskal-Wallis tests were performed to compare the number of stages and total margins with other variables, followed by post hoc analysis for multiple comparisons. A logistic regression model was adjusted to predict margins

CAPSULE SUMMARY

- Excisional margins for basal cell carcinoma have been suggested. Mohs micrographic surgery has been shown to be tissue sparing in treatment of basal cell carcinoma, but few studies have correlated margins required for clearance to tumor characteristics.
- Nodular basal cell carcinomas less than 6 mm may be cleared with 3-mm margins instead of the 4-mm recommendation.

Abbreviation used:

BCC: basal cell carcinoma

required for tumor clearance and to list predictors most associated with margin increase. For that, the stepwise algorithm was used, implemented by MASS (version 0.5.2; R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

Included were 295 BCCs from 239 patients (137 women, 102 men) with a mean age of 64 years (range 29-92 years). The most frequently involved subunit was the nose (N = 132) (Fig 1). The most common histologic subtype was nodular (N = 159), followed by infiltrative (N = 78), superficial (N = 28), micronodular (N = 18), metatypical (N = 6), and morpheiform (N = 6). When divided into superficial, nodular, or aggressive as performed on the appropriate use criteria on Mohs micrographic surgery, average required margins were 3.1, 2.0, and 2.9 mm, respectively ($P < .001$). Regarding number of stages, the average was 1.8, 1.2, and 1.6, respectively ($P < .001$). For the whole cohort, it was 1.38 (range 1-8).

On average, BCCs measured 9.2×7.1 mm (range 3×2 to 33×30 mm). Table I correlates tumor size and margins required for clearance. Two additional size classifications (appropriate use criteria on Mohs micrographic surgery and the National Comprehensive Cancer Network) are compared. Group 1 (BCCs < 6 mm) had a 96% clearance rate with up to 3-mm margins; 45 were on the nose and 50 of 76 were nodular BCCs. To achieve clearance in 95% of BCCs between 6 and 19 mm, 4-mm lateral margins were required for well-defined tumors, 5-mm ones for ill-defined and nonaggressive tumors, and 7-mm ones for ill-defined and aggressive tumors.

Preoperative size was a significant predictor of larger margins and number of stages in a univariate analysis ($P < .001$) (Table II). Table III shows which specific group sizes had a statistically significant difference. Group 1 BCCs required smaller margins for clearance compared with all other groups ($P < .001$). However, for number of stages, only groups 1 and 4 had a statistically significant difference. Table IV shows which specific histologic subtypes had a statistically significant difference for clearance margins and number of stages.

Among 7% (N = 21) of BCCs that required more than 4-mm margins, all had at least 2 high-risk features (all filled location/size criteria; 19 were ill

defined and 14 were aggressive).^{1,9} Considering these 3 high-risk features according to the National Comprehensive Cancer Network, BCCs that needed greater than 4 mm for clearance had an average of 2.7 versus 1.8 high-risk features compared with BCCs cleared with less than or equal to 4 mm ($P < .001$). However, location or size criteria were not associated with larger margins or more stages ($P = .60$ and $.78$, respectively). In a univariate analysis of location (risk area), moderate versus high risk, there was a statistically significant difference regarding number of stages ($P = .001$), but not margins ($P = .86$).

The first-stage margins were 1 mm in 49 cases (16.7%), 1.5 mm in 74 (25%), 2 mm in 141 (47.7%), 2.5 mm in 21 (7.1%), 3 mm in 9 (3%), and 4 mm in 1 case (0.3%). Two hundred sixty-four cases (90%) started with up to 2-mm margins and had 77.6% (N = 205) clearance on the first stage. The reasons to start with greater than 2-mm margins (N = 31) were tumors with some of the following features: location on less sensitive cosmetic areas, larger tumor size (mean 17×14 mm vs 8×6 mm for initial margins of up to 2 mm), ill-defined borders, subclinical dermoscopic features of tumor at periphery, and aggressive subtypes. Among the 49 cases started with 1-mm margins, 30 (61%) were cleared on the first stage. These tumors were all less than 10 mm, mainly located on high-risk areas (N = 44), nonaggressive (N = 41), and well defined (N = 30). When this group of 1-mm initial margins was divided by size, group 1 tumors had 73% clearance rate (22/30), whereas group 2 had 42% (8/19).

Factors more related to larger margins in univariate analysis were included in a logistic regression analysis (Table V).

DISCUSSION

The clinical relevance of this study is 3-fold. Correlating clinicopathologic preoperative features with postoperative surgical margins may guide initial margins in Mohs micrographic surgery. The results serve as a guide for wide local excision margins when Mohs micrographic surgery is not available. Furthermore, nodular BCCs less than 6 mm may be cleared with 3-mm margins. In the present tumor cohort, certain features such as size, subtypes, and ill-defined borders directly correlated with larger lateral margins for complete tumor removal.

Few studies evaluated margins required for complete BCC removal using Mohs micrographic surgery. Methodology of measurement and inclusion criteria among these studies varied considerably.^{4,7,10-12} In a key study of primary well-defined BCCs, 4-mm margins achieved 98% clearance rate for tumors less than 2 cm (N = 106). In the present study,

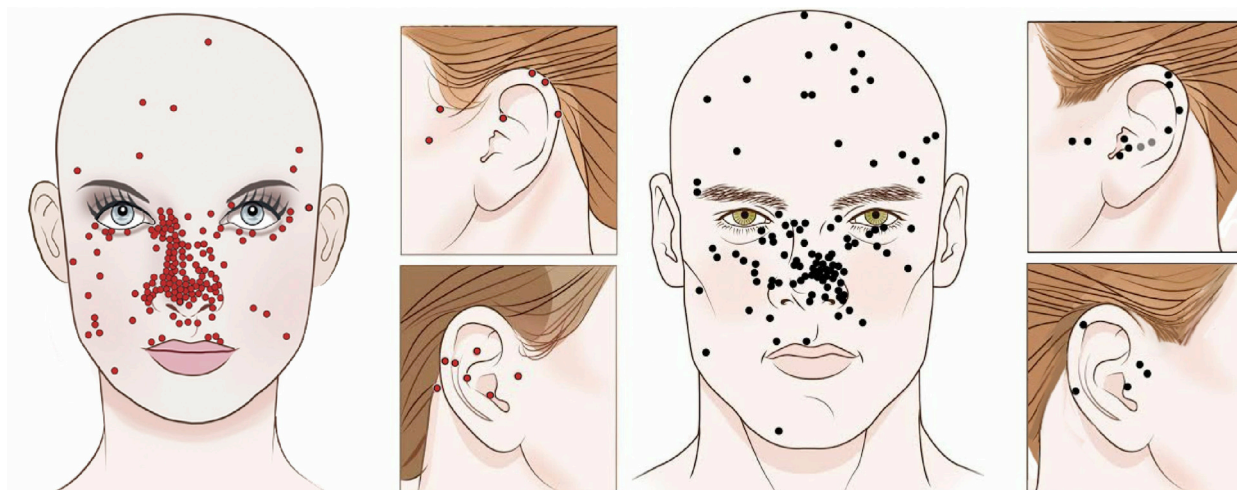


Fig 1. Tumor locations in women and men. There were 244 tumors located in high-risk areas and 51 in moderate-risk ones. Gray circles in the left ear of the man represent retroauricular tumors.

Table I. Tumor size and margins required for clearance

	Lateral margins (mm), %							
	1	2	3	4	5	6	7	>7
Current study								
G1 (n = 76)	28.9	89.5	96.1	97.4	98.7	98.7	100.0	100.0
G2 (n = 133)	6.8	69.9	83.5	93.2	94.7	97.0	97.7	100.0
G3 (n = 72)	0.0	62.5	79.2	93.1	97.2	98.6	100.0	100.0
G4 (n = 14)	0.0	14.3	50.0	71.4	92.9	92.9	92.9	100.0
MAUC								
G1 (n = 76)	28.9	89.5	96.1	97.4	98.7	98.7	100.0	100.0
G2 (n = 133)	6.8	69.9	83.5	93.2	94.7	97.0	97.7	100.0
G3 (n = 76)	0.0	61.8	77.6	90.8	97.4	98.7	100.0	100.0
G4 (n = 10)	0.0	0.0	50.0	80.0	90.0	90.0	90.0	100.0
NCCN								
G1 (n = 76)	28.9	89.5	96.1	97.4	98.7	98.7	100.0	100.0
G2 (n = 97)	9.3	72.2	83.5	91.8	92.8	95.9	96.9	100.0
G3 (n = 108)	0.0	63.0	80.6	94.4	98.1	99.1	100.0	100.0
G4 (n = 14)	0.0	14.3	50.0	71.4	92.9	92.9	92.9	100.0

G, Group; MAUC, Mohs appropriate use criteria; NCCN, National Cancer Comprehensive Network.

Current study, basal cell carcinoma (BCC) sizes: G1, < 6 mm; G2, 6–10 mm; G3, between 11–19 mm; and G4, > 19 mm. MAUC: G1, BCC < 6 mm; G2, 6–10 mm; G3, between 11–20 mm; and G4, > 20 mm. NCCN: G1, < 6 mm; G2, 6–9 mm; G3, between 10–19 mm; and G4, > 19 mm. Subtypes of G1 tumors: 12 superficial, 50 nodular, 4 micronodular, 9 infiltrative, 0 morpheiform, and 1 metatypical. Location of G1 tumors: nose (45), cheek (10), eyelid (8), upper cutaneous lip (8), apical triangle (1), forehead (1), inner canthus (1), philtrum (1), and temple (1).

a separate analysis with the same tumor features (N = 142) had a 99% clearance rate with 4-mm margins. We performed an additional analysis with BCCs less than 6 mm (N = 76), not evaluated in the

aforementioned article because of the limited cases (N = 7).⁴ We found that this subgroup had a 96% clearance rate with 3-mm lateral margins.

A recent study with 306 small aggressive BCCs on the face (<6 mm on high-risk area and <10 mm on moderate-risk area) evaluated margins required for tumor clearance.⁷ Among 274 cases with BCCs less than 6 mm, 94.9% were cleared with 3-mm margins, a finding similar to that of the present study (96%). A possible reason for the slightly higher clearance in our study was the inclusion of nonaggressive tumors in the cohort.

Although a 1-mm lateral margin difference does not seem clinically significant, each millimeter visibly influences the size of the defect because the area of a circle is calculated by $3.14 \times r^2$. For example, an additional 1-mm margin (4 mm instead of 3 mm) for a 4 × 4-mm BCC increases the defect area by 44% (5- versus 6-mm radius). In practice, a 1- to 2-mm difference in defects of the nose, shifted in any direction, can widely change reconstructive options. This finding also reiterates those of previous studies on the tissue-sparing properties of Mohs micrographic surgery.^{13,14} In the current study, a 1-mm margin was mainly used for less than 10 mm nonaggressive and well-defined tumors located on cosmetically sensitive areas, with a first-stage clearance rate of 61% (30/49), reinforcing that if Mohs micrographic surgery is available, it is indicated in such cases because of sparing properties in addition to its high cure rate.

A study of 495 nonmelanoma skin cancers (385 BCCs) suggested margins of 4.75 and 8 mm to achieve 95% clearance for low- and high-risk BCCs, respectively.¹⁰ Although tumors were excised with

Table II. Correlation of tumor and patient features with lateral margins required for clearance, and number of stages

Tumor and patient features	No. (%)	Margin (mm)	P value	Stages	P value
Current study					
G1	76 (25.8)	1.8 (±0.9)	<.001	1.3 (±0.7)	.02
G2	133 (45.1)	2.6 (±2.2)		1.5 (±0.9)	
G3	72 (24.4)	2.6 (±1.1)		1.3 (±0.5)	
G4	14 (4.7)	3.7 (±1.8)		1.7 (±0.7)	.02
MAUC					
G1	76 (25.8)	1.8 (±0.9)	<.001	1.3 (±0.7)	
G2	133 (45.1)	2.6 (±2.2)		1.5 (±0.9)	
G3	76 (25.8)	2.6 (±1.1)		1.3 (±0.5)	
G4	10 (3.4)	3.8 (±2)		1.8 (±0.8)	
NCCN					
G1	76 (25.8)	1.8 (±0.9)	<.001	1.3 (±0.7)	.012
G2	97 (32.9)	2.6 (±2.5)		1.5 (±1.1)	
G3	108 (36.6)	2.5 (±1)		1.3 (±0.5)	
G4	14 (4.7)	3.7 (±1.8)		1.7 (±0.7)	
Location/size					
High risk	283 (95.9)	2.4 (±1.8)	.60	1.4 (±0.8)	.78
Low risk	12 (4.1)	2.2 (±0.4)		1.3 (±0.5)	
Aggressive histology					
Yes	112 (38)	2.8 (±2.1)	<.001	1.5 (±0.9)	.002
No	183 (62)	2.2 (±1.4)		1.3 (±0.7)	
Border definition					
Ill	153 (51.9)	2.9 (±2.2)	<.001	1.6 (±1)	<.001
Well	142 (48.1)	1.9 (±0.7)		1.1 (±0.3)	
Immunosuppressed					
Yes	4 (1.4)	2.8 (±0.5)	.11	1 (±0)	.34
No	291 (98.6)	2.4 (±1.7)		1.4 (±0.8)	
BCC subtype					
Single	204 (69.2)	2.1 (±1.5)	<.001	1.3 (±0.7)	<.001
Mixed	91 (30.8)	3 (±2.1)		1.7 (±0.8)	
Most aggressive subtype					
S	28 (9.5)	3.1 (±2.8)	<.001	1.8 (±1.3)	<.001
N	159 (53.9)	2 (±0.8)		1.2 (±0.4)	
MN	18 (6.1)	3.9 (±4.2)		2 (±1.7)	
I	78 (26.4)	2.7 (±1.4)		1.4 (±0.6)	
MO	6 (2)	4 (±1.4)		2.5 (±0.5)	
MT	6 (2)	2.2 (±0.8)		1.2 (±0.4)	
Risk area					
M	51 (17.3)	2.1 (±0.8)	.86	1.1 (±0.4)	<.001
H	244 (82.7)	2.5 (±1.9)		1.4 (±0.8)	

Data with ± represent standard deviation.

Because of the small number of tumors with perineural invasion (n = 1), statistical analysis was not possible with this variable.

BCC, Basal cell carcinoma; G, group; H, high; I, infiltrative; M, moderate; MAUC, Mohs appropriate use criteria; MN, micronodular; MO, morpheaform; MT, metatypical; N, nodular; NCCN, National Comprehensive Cancer Network; S, superficial.

Mohs micrographic surgery, margins were estimated according to tumor and defect size. This probably overestimated the margins because wounds tend to expand after full-thickness incision.⁴ The inclusion of recurrent tumors may also have contributed to overall larger margins.^{2,15,16}

A meta-analysis suggested 3-mm margins for nonmorpheaform BCCs less than 2 cm, but data were based on bread loaf (vertical sections) analysis,

which limits their validity.¹⁷ Bread loaf sections evaluate approximately 1% of the peripheral margins and may miss tumor extension at nonvisualized surgical margins.^{18,19}

An important study demonstrated that narrow margins (1-3 mm) were inadequate for the elliptic excision of primary, well-demarcated nodular BCCs less than 1 cm on the face, given the 20% probability of encountering surgical margins positive for BCCs.²⁰

Table III. Post hoc analysis of tumor size and margins required for clearance and tumor size and number of stages

	Current study				MAUC				NCCN			
	G1	G2	G3	G4	G1	G2	G3	G4	G1	G2	G3	G4
Margin												
G1	—	<.001	<.001	<.001	—	<.001	<.001	<.001	—	<.001	<.001	<.001
G2		—	.24	.002		—	.14	.004		—	.044	.001
G3			—	.08			—	.10			—	.05
G4				—				—				—
Stage												
G1	—	.29	1.00	.016	—	.29	.79	.025	—	.16	1.000	.016
G2		—	1.00	.21		—	1.00	.22		—	1.000	.37
G3			—	.15			—	.19			—	.10
G4				—				—				—

Current study: group 1, basal cell carcinoma (BCC) less than 6 mm; group 2, 6 mm less than or equal to BCC less than or equal to 10 mm; group 3, 11 mm less than or equal to BCC less than or equal to 19 mm; and group 4, BCC greater than 19 mm. MAUC: group 1, BCC less than 6 mm; group 2, 6 mm less than or equal to BCC less than or equal to 10 mm; group 3, 11 mm less than or equal to BCC less than or equal to 20 mm; and group 4, BCC greater than 20 mm. NCCN: group 1, BCC less than 6 mm; group 2, 6 mm less than or equal to BCC less than or equal to 9 mm; group 3, 10 mm less than or equal to BCC less than or equal to 19 mm; and group 4, BCC greater than 19 mm.

G, Group; MAUC, Mohs appropriate use criteria; NCCN, National Comprehensive Cancer Network; —, intersection of the same group (eg, G1 and G1).

Table IV. Post hoc analysis of histologic subtypes and margins required for clearance, and histologic subtypes and stages

	S	N	MN	I	MO	MT
Margin						
S	—	.07	1.00	1.00	.64	1.00
N		—	.20	<.001	.005	1.00
MN			—	1.00	.96	1.00
I				—	.49	1.00
MO					—	.77
MT						—
Stages						
S	—	.05	1.00	1.00	.027	1.00
N		.05	.026	.041	<.001	1.00
MN			—	1.00	.14	1.00
I				—	.003	1.00
MO					—	.007
MT						—

I, Infiltrative; MN, micronodular; MO, morpheaform; MT, metatypical; N, nodular; S, superficial; —, intersection of the same group (eg, S and S).

However, it did not evaluate the number of millimeters necessary to achieve clearance; rather, it evaluated whether the margin determined by the surgeon (1, 2, or 3 mm) was enough for tumor clearance if treated with simple excision instead of Mohs micrographic surgery. Although a direct comparison is not possible because of different methodology and objectives, our study with Mohs micrographic surgery full-margin assessment demonstrated that in a subgroup of BCCs (<6 mm), 3-mm margins were sufficient to completely remove the tumor in 96% of

Table V. Multivariate analysis of the most significant features of larger-clearance lateral margins (in millimeters)

Tumor characteristics	z Statistic	P	OR (95% CI)
Superficial	2.485	.013	9.77 (1.7–75.9)
Micronodular	3.071	.002	18.2 (3–148)
Infiltrative	2.007	.045	5.15 (1.2–35.4)
Morpheaform	3.297	.001	47 (5.2–608)
Well-defined borders	–2.475	.013	0.073 (0.004–0.386)

For this analysis, tumors were dichotomized in 2 groups according to required clearance margins (≤ 4 mm or > 4 mm). The odds ratio for each predictor in the final model was calculated and the confidence interval for this measure was also estimated, considering 5% significance.

OR, Odds ratio; CI, confidence interval.

cases. In the aforementioned study, only 24 of 134 cases had excision with 3-mm margins, which makes it impossible to know the clearance rate if all tumors were initially excised with 3-mm instead of 1- or 2-mm margins.

Location on high-risk areas was associated with a higher number of stages, as previously reported.^{2,3} However, total margin required for tumor clearance was not statistically significant. This may indicate that, because of functional and cosmetic importance, initial margins on high-risk areas may have been smaller, leading to more stages but not necessarily a larger overall clearance margin.

Aggressive subtypes such as micronodular, infiltrative, and morpheaform are well-known factors for higher number of stages and larger clearance

margins, similar to the findings in the present study.²¹ Despite that superficial BCCs have margin recommendation similar to that for nodular ones, this study showed that superficial BCCs had more subclinical extension, leading to larger margins and more stages, as previously reported.²¹⁻²³ Superficial tumors located on the face may be harder to demarcate because of photodamaged skin.

LIMITATIONS

There are limitations to this study. First, tumor shrinkage caused by preoperative biopsy may have led to an underestimation of the real tumor size, but this is inherent in studies with Mohs micrographic surgery because a preoperative biopsy is often performed. It may be safe to assume that some of these tumors were actually larger than 5 mm, reinforcing our findings that a subgroup may be cleared with a smaller margin. To address this limitation, biopsy scars were carefully included in the initial measurement.

In 20 cases (7%), the subtype classification was based on preoperative biopsy slides instead of Mohs micrographic surgery histologic slides. On the other hand, the fact that all the slides were read by the same individual reduces the likelihood of subjective classification bias of BCC subtypes, which is possible when pathology reports by multiple investigators are considered.

Initial Mohs micrographic surgery margins were not the same for all cases. Because of limited sample size, more specific recommendations for every histologic subtype and location were not possible.

One limitation of suggesting 3-mm margins for nodular BCCs less than 6 mm when Mohs micrographic surgery is not available is that the recommendation will be based on the preoperative biopsy, which may not represent all subtypes present on the tumor.^{21,24-30}

Last, the primary surgeon does not use curettage to help assess the tumor extension.³¹ Instead, the author (F.B.C.) uses dermoscopy and uses saucerization for debulking.

In conclusion, the main factors related to larger clearance margins were superficial, micronodular, infiltrative, and morpheaform subtypes, whereas clinically well-defined borders were the main factor related to smaller margins. Regarding margin recommendation for Mohs micrographic surgery, a 1-mm initial margin seems reasonable for well-defined BCCs that are nonaggressive, less than 6 mm, and on cosmetically sensitive areas. For other tumors, initial margins of 2 mm achieve a higher cure rate on the first stage. Excision recommendations of 4-mm

margins may be divided into 3 mm for nodular tumors less than 6 mm in apparent size; and for tumors between 6 and 19 mm, 4 mm for well-defined ones, 5 mm for ill-defined and nonaggressive ones, and 7 mm for ill-defined and aggressive ones. Recommendations for tumors greater than 19 mm were not possible because of small sample size. A larger prospective study comparing these margins for each tumor size and risk factor would be beneficial.

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