

# Predictors of Lidocaine Volume Used During Mohs Micrographic Surgery

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## PRACTICE POINTS

- Larger lesion size, melanoma diagnosis, and multiple surgical sites are associated with higher lidocaine volume requirements during Mohs micrographic surgery.
- Melanomas required more than twice the average lidocaine volume compared with basal cell carcinomas and squamous cell carcinomas.
- Flap and graft repairs require substantially more lidocaine than primary closures, while secondary-intention healing uses the least, making reconstruction type an important predictor of total anesthetic needs.

To the Editor:

Mohs micrographic surgery (MMS) is performed in stages and often requires repeated administration of a local anesthetic, most commonly lidocaine. While generally safe, lidocaine administration carries the potential for cumulative toxicity, particularly in patients who have large or multiple lesions or medical comorbidities or who require extensive repair. Current safety guidelines suggest upper limits of 7 mg/kg (or 500 mg) of lidocaine with epinephrine and 4.5 mg/kg (or 300 mg) without epinephrine for adults.<sup>1</sup> However, concerns have been raised about the relevance of these thresholds to MMS, in which anesthetic administration may be prolonged, cumulative, and influenced by surgical complexity.<sup>2-5</sup> While clinical experience often guides anesthetic planning, limited data exist identifying predictors of lidocaine use during MMS.

We performed an institutional review board–approved retrospective chart review of 149 patients who underwent 170 MMS procedures at a single academic dermatologic surgery center between July 2022 and June 2023. The aim of our study was to identify clinical and surgical predictors of lidocaine volume used during MMS. All procedures

were performed by board-certified dermatologic surgeons (including A.J.). All patients received 1% lidocaine with epinephrine as the primary anesthetic agent. We collected patient demographic variables (age, sex, race, weight), procedural characteristics (anatomic site, number of Mohs stages, skin cancer type, number of surgical sites treated in one day, preoperative and postoperative lesion size, surgeon, repair type), comorbid conditions (hypertension, diabetes), and time from diagnosis to surgery. Data were extracted from the institutional REDCap system. We used *t* tests and analysis of variance for categorical variables and linear regression for continuous predictors, with statistical significance set at  $P < .05$ .

Baseline characteristics of the study patients are outlined in Table 1. The mean (SD) age was 74.2 (9.4) years, and most patients (98.7% [147/149]) were White. The mean (SD) weight was 83.1 (19.1) kg. Most lesions were either basal cell carcinoma (BCC) (50.6%) or squamous cell carcinoma (SCC) (44.1%), with 5.3% of lesions representing melanoma. The mean (SD) total lidocaine volume administered was 11.8 (8.3) mL. The majority (123/149 [72.4%]) of cases required one Mohs stage, but a subset required multiple stages, with a maximum of 5.

Several procedural and patient factors were significantly associated with the volume of lidocaine used. As expected, lesion size strongly influenced lidocaine volume. Both preoperative and postoperative lesion sizes were highly significant linear predictors ( $R^2 = 0.28$  and  $0.41$ , respectively;  $P < .001$ ), and postoperative lesion size demonstrated the strongest correlation of all tested variables. Patient weight was also significantly associated with lidocaine use ( $R^2 = .03$ ,  $P = .0202$ ), though the proportion of explained variance was modest. The operating surgeon also was significantly associated with lidocaine use ( $P = .006$ ), suggesting potential variation in anesthetic technique or threshold for reinfiltration. The number of surgical sites treated in a single session also was significantly associated with greater lidocaine volume ( $P < .001$ ).

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The authors have no relevant financial disclosures to report.

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Cutis. 2026 May;117(5):162-164. doi:10.12788/cutis.1391

Skin cancer type was a notable categorical predictor. Melanomas required substantially more lidocaine than BCCs or SCCs, with a mean (SD) volume of 25.6 (12.1) mL compared with 10.8 (6.0) mL for BCC and 11.4 (8.8) mL for SCC ( $P<.001$ ). This difference may reflect disparities in surgical margin requirements, tumor depth, or intraoperative technique. While lesion location and number of stages were not statistically significant overall, mean lidocaine volumes trended higher in lesions on the trunk (18.2 mL) and in procedures requiring 3 or more stages (up to 22.0 mL for a single 4-stage case), though small sample sizes limited the ability to detect statistically significant differences in these subgroups. Detailed comparisons are presented in Table 2.

Wound repair type also was significantly associated with lidocaine volume requirements. Primary closures required a mean (SD) volume of 12.3 (5.0) mL, whereas flap repairs required 19.3 (10.0) mL and graft repairs required 17.5 (8.2) mL. Secondary-intention healing used the lowest lidocaine volumes (mean [SD], 4.9 [2.0] mL). Differences across repair types were statistically significant (analysis of variance,  $P<.001$ ). These findings indicate that more complex reconstructions, such as flaps and grafts, are associated with higher anesthetic needs when compared with primary closures or secondary-intention healing.

Several other predictors, including age, time from diagnosis to surgery, and comorbid conditions such as hypertension or diabetes, were not significantly associated with anesthetic volume in our cohort. Time from diagnosis to surgery ranged widely but did not correlate with lesion size or lidocaine use, possibly due to scheduling variability or biopsy technique.

These findings offer practical implications for clinical planning. While most MMS cases fall well within safe limits for lidocaine administration, some patients—particularly those with melanoma, large lesions, or multiple surgical sites—may approach thresholds at which further monitoring or dose tracking becomes relevant. Anticipating higher anesthetic requirements may help surgical teams plan procedure length, anesthesia restocking, or sequencing of multisite cases. Our analysis also showed that the type of wound repair meaningfully influences anesthetic use, with flap and graft repairs requiring substantially higher lidocaine volumes than primary closures and secondary-intention healing. Considering both tumor characteristics and the planned reconstruction may therefore improve the accuracy of anesthetic forecasting during preoperative planning.

We also observed surgeon-level variation in lidocaine volume despite standardized tumor types and case complexity. This suggests a role for individual technique (eg, depth of field block, number of reinfiltrations) and highlights the need for ongoing education around anesthetic optimization.

Our study was limited by its retrospective design, single-institution setting, and demographically

homogeneous population. With 98.8% of patients identifying as White, generalizability to skin of color populations may be limited. In addition, lidocaine metabolism may vary across patient factors not captured here (eg, hepatic or renal function). Finally, although lidocaine volume was the outcome of interest, we did not measure patient-reported pain control, which may further clarify anesthetic adequacy. Nonetheless, our analysis demonstrated that routinely available clinical and procedural data can predict lidocaine volume requirements with reasonable reliability. Although no patient in our cohort approached the maximum recommended lidocaine dose, understanding these predictors may help anticipate scenarios nearing maximum dosing thresholds. In future studies, integrating weight-based thresholds (eg, mL/kg received) or serum lidocaine levels may improve safety monitoring and validate toxicity thresholds in complex cases.

In conclusion, we identified several key factors that predict lidocaine volume during MMS, including lesion size, melanoma diagnosis, number of surgical sites, patient weight, planned reconstruction type, and the operating surgeon. Among these factors, melanoma cases required more than twice the volume of lidocaine compared to BCC and SCC cases, and flap and graft repairs demonstrated the highest anesthetic requirements among closure types. Taken together, these findings reinforce the need for advanced anesthetic planning in aggressive, anatomically complex, or reconstruction-intensive cases and may support more informed intraoperative decision-making.

**TABLE 1. Baseline Characteristics of Patients Undergoing Mohs Micrographic Surgery**

Characteristic	Total (N=170) <sup>a</sup>
Mean (SD) age, y	74.2 (9.4)
Mean (SD) weight, kg	83.1 (19.1)
Female sex, n (%)	46 (27.1)
White race, n (%)	168 (98.8)
Mean (SD) total volume of 1% lidocaine with epinephrine, mL	11.8 (8.3)
Skin cancer diagnosis, n (%)	
Basal cell carcinoma	86 (50.6)
Squamous cell carcinoma	75 (44.1)
Melanoma	9 (5.3)

<sup>a</sup>Totals reflect the number of lesions treated with Mohs micrographic surgery. Sum of percentages may not equal 100% due to rounding.

**TABLE 2. Predictors of Lidocaine Volume Used During Mohs Micrographic Surgery**

Variable	Mean (SD) volume of lidocaine required, mL	Effect summary	P value	95% CI	No. of cases
Repair type					
Primary closure	12.3 (5.0)	NA	<.001	NA	68
Flap repair	19.3 (10.0)	Flap repair required more lidocaine on average than primary closure	NA	NA	37
Graft repair	17.5 (8.2)	Graft repair required more lidocaine on average than primary closure	NA	NA	12
Secondary intention	4.9 (2.0)	Secondary intention repair required the least amount of lidocaine on average	NA	NA	40
No. of MMS stages					
1	10.8 (8.14)	NA	NA	NA	123
2	14.3 (8.79)	NA	NA	NA	38
3	15.0 (6.27)	NA	NA	NA	7
4	22.0 (5.29)	NA	NA	NA	1
5	15.0 (7.41)	NA	0.12	NA	1
Skin cancer type					
BCC	10.8 (6.00)	NA	NA	NA	86
SCC	11.4 (8.78)	NA	NA	NA	75
Melanoma	25.6 (12.1)	Melanoma cases required more lidocaine than BCC or SCC	<.001	NA	9
Surgeon	NA	NA	.006	NA	170
No. of surgical sites (1 vs ≥2)	NA	NA	<.001	NA	170
Weight, kg	NA	R <sup>2</sup> =0.03	.0202	(0.01-0.14)	170
Preoperative lesion size, cm <sup>2</sup>	NA	R <sup>2</sup> =0.28	<.001	(1.35-2.23)	170
Postoperative lesion size, cm <sup>2</sup>	NA	R <sup>2</sup> =0.41	<.001	(0.84-1.72)	170

Abbreviations: BCC, basal cell carcinoma; NA, not applicable; SCC, squamous cell carcinoma.

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