

LETTER – RESEARCH

Risk factors and surgical outcomes in periocular basal cell carcinoma treated with Mohs micrographic surgery



Dear Editor,

Periocular basal cell carcinoma (BCC) represents a therapeutic challenge due to its invasive behavior and proximity to critical anatomical structures. Few studies have evaluated its predictors of aggressiveness and recurrence treated with Mohs micrographic surgery (MMS).

A retrospective cohort study was conducted at a Brazilian multidisciplinary center by a single surgeon (maintaining the same surgical technique standard). Patients with periocular BCC treated with MMS between 2008 and 2018 were included.

Data were collected on sex, age, tumor location, aggressive histological subtype (micronodular, sclerosing, infiltrative, and metatypical/basosquamous) or non-aggressive (superficial, nodular), tumor diameter (> 10 mm or ≤ 10 mm), prior Mohs surgery recurrence (PMSR), MMS stages, type of reconstruction, follow-up, and postoperative recurrence. Cases with perineural invasion (two) and prior radiotherapy (none) were excluded because they are already established high-risk factors, for homogenization of the statistical sample, and because there were few cases. In cases with mixed subtypes, the most aggressive was considered. Reconstructions were classified based on non-standardized criteria as minor (primary closure, small flaps, canthotomy-cantholysis), moderate (Tenzel flap), and significant (Hughes or Mustardé flaps), according to the size of the defect and structures involved (up to 25%–30%, 30% to 60%, and above 60% of the eyelid margin, respectively). For cases without involvement of the eyelid margin, those requiring the Mustardé flap were considered significant, while the others were considered minor.

The statistical analysis included descriptive statistics, the Shapiro-Wilk test, the Wilcoxon test, Fisher's exact test, and the Kruskal-Wallis test ($p < 0.05$). Logistic regression models were used, with variable selection based on the calculation of Akaike's information criterion.

One hundred and eight patients were included, 57.1% female, mean age 66.3 years (± 15.1 ; 27–91 years). The

lower eyelid was the most affected site (55.5%) and medial canthus (29.7%), consistent with other literature studies on MMS in this location (51%).¹ Aggressive subtypes were present in 66.1%. Tumors with a diameter > 10 mm were observed in 49.1%, and 8% presented with PMSR. Recurrence after MMS occurred in 3.8% ($n = 4$), with a follow-up of 64.8 months (± 31.6), similar to previous studies with recurrence of 3%–3.3% in similar cohorts.^{2,3} The mean tumor area was 96 mm² and the mean final area was 398 mm². Reconstructions were minor (62%), moderate (13%), and significant (25%).

More stages of MMS were associated with PMSR (2.9 ± 1.5) vs. primary BCC (2.0 ± 1.1 ; $p = 0.002$), diameter > 10 mm (2.6 ± 1.4) vs. < 10 mm (1.9 ± 1.1 ; $p = 0.007$), and aggressive histology (2.4 ± 1.1) vs. non-aggressive (2.0 ± 1.5 ; $p = 0.005$).

Table 1, through univariate logistic regression, exemplifies that tumors > 10 mm were strongly associated with aggressive histology (OR = 7.33; $p < 0.001$) and larger defect area (OR = 1.008; $p < 0.001$). Tumors with PMSR showed a greater number of stages (OR = 1.72; $p = 0.002$), a larger defect area (OR = 1.008; $p = 0.001$), and more significant reconstructions (OR = 2.73; $p = 0.039$). Tumors with aggressive histology exhibited a greater chance of complex reconstructions (OR = 4.53; $p = 0.006$).

Table 2 using the multivariate model indicated that PMSR was associated with a larger defect area (OR = 1.002; $p = 0.001$) and significant reconstruction (OR = 3.77; $p = 0.0177$), as well as previous studies that demonstrated that lesions previously inadequately treated by conventional surgery tend to exhibit increased/more aggressive subclinical growth and behavior when recurring locally.^{4,5} Tumors > 10 mm were associated with PMSR (OR = 8.02; $p = 0.0148$), aggressive subtype (OR = 8.41; $p = 0.0021$) and larger defect area (OR = 1.006; $p = 0.0017$). Aggressive histology was associated with a diameter > 10 mm (OR = 6.92; $p < 0.001$).

The anatomical distribution and cure rate (3.8%) after MMS are aligned with the literature, as in Shi et al. 4.2% ($n = 167$), with the lower eyelid and medial canthus being the most frequent sites.^{1–3,6–8} The initial descriptive analysis revealed associations between a higher number of MMS stages and tumors with aggressive histology, diameter > 10 mm, and PMSR, as described in previous studies.^{4,9}

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Table 1 Univariate logistic regression model of variables associated with the main surgical outcomes in periocular basal cell carcinoma. Pre-operative Mohs surgical recurrence (PMSR), Odds ratio (OR).

Outcome	Variable	p-value	Odds ratio (OR)	Confidence Interval
Diameter > 10 mm	PMSR	<0.001	5.875	2.413-15.635
	Stages	0.008	1.575	1.142-2.256
	Defect area	<0.001	1.008	1.005-1.012
	Aggressive histology	<0.001	7.333	3.093-18.848
	Moderate reconstruction	0.829	0.876	0.246-2.832
	Significant reconstruction	<0.001	6.938	2.494-22.807
PMSR	Diameter >10 mm	<0.001	5.875	2.413-15.635
	Stages	0.002	1.721	1.236-2.485
	Defect area	0.001	1.008	1.005-1.012
	Aggressive histology	0.158	1.873	0.8-4.623
	Moderate reconstruction	0.154	2.391	0.697-7.945
	Significant reconstruction	0.039	2.732	1.05-7.169
Aggressive histology	Diameter > 10 mm	<0.001	7.333	3.093-18.848
	Stages	0.072	1.364	0.988-1.954
	Defect area	0.066	1.001	1-1.002
	PMSR	0.158	1.873	0.8-4.623
	Moderate reconstruction	0.056	3.778	1.067-17.817
	Significant reconstruction	0.06	4.533	1.636-14.815

Table 2 Multivariate logistic regression for outcomes of diameter > 10 mm, prior Mohs micrographic surgery recurrence (PMSR), and aggressive histological subtype. Odds ratio (OR).

Outcome	Variable	Odds Ratio (OR)	Confidence Interval	p-value
Diameter > 10 mm	Defect area	1.006	1.003–1.010	0.0017
	PMSR	8.023	1.688–52.422	0.0148
	Aggressive histology	8.412	2.316–36.826	0.0021
PMSR	Defect area	1.002	1.001–1.004	0.0007
	Significant reconstruction	3.765	1.256–11.510	0.0177
Aggressive histology	Diameter > 10 mm	6.922	2.724–19.070	<0.001
	Moderate reconstruction	4.944	1.271–24.944	0.0305

The univariate analysis reinforced that larger tumors, aggressive histology, or those with PMSR exhibit a greater chance of subclinical growth and complex reconstructions.

The multivariate analysis confirmed these findings; however, it showed that tumors with PMSR and tumors > 10 mm were almost seven times more likely to have aggressive histology. Although modest, the differences in the area of the final defect were statistically significant, highlighting the impact of these tumor characteristics on surgical extent. The findings suggest that larger tumors with aggressive histology require wider excisions.

Significant reconstructions were associated with PMSR (OR = 3.76), suggesting that recurrent tumors require more complex approaches. However, reconstructive complexity may reflect tumor biology/behavior (size, histological subtype), without being an independent predictor. As shown above, BCCs with PMSR tend to be aggressive subtypes and have a diameter > 10 mm.

The association between size, PMSR, and tumor aggressiveness reaffirms MMS as the preferred technique in these cases, given the higher chance of subclinical growth.^{4,5,9} Margin control is crucial, especially where conventional surgery is still common and access to MMS is limited, reducing the risks of invasive tumors.^{2,3}

The study limitations include its retrospective and single-center design, which may limit its findings. Larger studies may validate these associations and support individualized surgical planning.

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Research data availability

The entire dataset supporting the results of this study was published in this article.

Conflicts of interest



None declared.

Editor

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References

1. Shi K, Wang L, Srivastava D, Nijhawan RI. Mohs micrographic surgery for periocular skin cancer: a single-institution experience. *Arch Dermatol Res*. 2023;315:1181–6.
2. Weesie F, Naus NC, Vasilic D, Hollestein LM, van den Bos RR, Wakkee M. Recurrence of periocular basal cell carcinoma and squamous cell carcinoma after mohs micrographic surgery: a retrospective cohort study. *Br J Dermatol*. 2019;180:1176–82.
3. O'Halloran L, Smith H, Vinciullo C. Periocular mohs micrographic surgery in western Australia 2009–2012: a single centre retrospective review and proposal for practice benchmarks. *Australas J Dermatol*. 2017;58:106–10.
4. Fatigato G, Capitani S, Milani D, Grassilli S, Alameen AAM, Candiani M, et al. Risk factors associated with relapse of eyelid basal cell carcinoma: results from a retrospective study of 142 patients. *Eur J Dermatol*. 2017;27:363–8.
5. Moul DK, Chern PL, Shumaker PR, Zelac DE, Greenway HT. Mohs micrographic surgery for eyelid and periorbital skin cancer. *Int Ophthalmol Clin*. 2009;49:111–27.
6. Sines DT, Polomsky M, Dutton JJ. Predicting the surgical margin of resection in periocular cutaneous neoplasms and the significance of reconstruction following mohs micrographic surgery. *Ophthalmic Plast Reconstr Surg*. 2016;32:284–91.
7. Sin CW, Barua A, Cook A. Recurrence rates of periocular basal cell carcinoma following Mohs micrographic surgery: a retrospective study. *Int J Dermatol*. 2016;55:1044–7.
8. Peirano D, Vargas S, Hidalgo L, Donoso F, Abusleme E, Sanhueza F, et al. Management of periocular keratinocyte carcinomas with mohs micrographic surgery and predictors of complex reconstruction: a retrospective study. *An Bras Dermatol*. 2024;99:202–9.
9. van Kester MS, Goeman JJ, Genders RE. Tissue-sparing properties of mohs micrographic surgery for infiltrative basal cell carcinoma. *J Am Acad Dermatol*. 2019;80:1700–3.

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