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Cutting it close: Five-year retrospective review of melanoma guideline adherence in Northern British Columbia

Primary cutaneous melanoma is a potentially life-threatening disease treated primarily by surgical excision. Adherence to expert consensus guidelines likely helps physicians optimize patient outcomes.

ABSTRACT

Background: Specialist dermatologic care is generally challenging to access in Northern British Columbia. We aimed to quantify guideline adherence rates in the Northern Health Region for both biopsies of suspected melanoma and wide local excisions of confirmed melanoma.

Methods: We performed a retrospective review of melanoma-related histopathology reports from 2016 to 2020. Guideline adherence was

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CUTTING IT CLOSE: FIVE-YEAR RETROSPECTIVE REVIEW OF MELANOMA GUIDELINE ADHERENCE IN NORTHERN BRITISH COLUMBIA

Specialist dermatologic care is generally challenging to access in Northern British Columbia. We performed a retrospective review of melanoma-related histopathology reports from 2016 to 2020.

1034 specimens were identified. 621 biopsies and 265 re-excisions were evaluated.

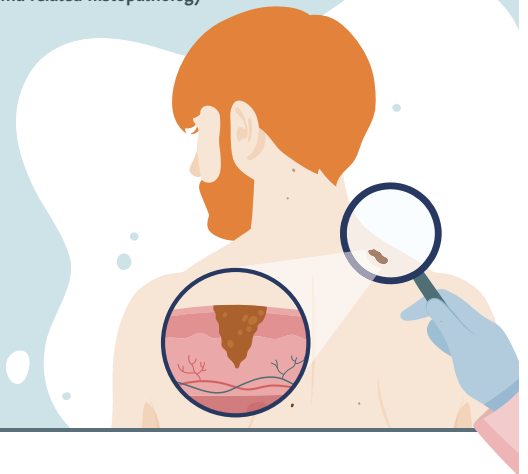
Guideline adherence rates were:

44.3% initial biopsies | 53.6% wide local excisions

Elliptical biopsies were 10 times as likely to follow recommendations as punch biopsies (95% CI, 5.36-18.7; $P < .001$).

Note: Guideline adherence was defined as an initial complete excision biopsy followed by a re-excision achieving minimum margins according to the Breslow depth.

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defined as an initial complete excision biopsy followed by a re-excision achieving minimum margins according to the Breslow depth.

Results: Of 1034 specimens identified, we evaluated 621 biopsies and 265 re-excisions. Guideline adherence rates were 44.3% for initial biopsies and 53.6% for wide local excisions. Elliptical biopsies were 10 times as likely to

follow recommendations than punch biopsies (95% CI, 5.36-18.7; $P < .001$).

Conclusions: Multiple deviations from published standards were identified in the clinical management and pathology reports. A melanoma database and standardized reporting are needed to fully evaluate current practices in Northern British Columbia.

Introduction

Primary cutaneous melanoma is a potentially life-threatening disease treated primarily by surgical excision. Guidelines recommending complete excisional biopsies with clinical margins have been published by the American, Australian, and British dermatological associations.¹⁻³ The initial biopsy is vital for staging melanomas via the Breslow depth and ulceration status, which determine the re-excision margins. See **Table 1** for stage-specific wide local excision margins.

While BC Cancer does not provide specific guidelines for the initial excision, the American Academy of Dermatology recommends a narrow excisional/complete biopsy with 1–3 mm margins that encompasses the entire breadth of the lesion and is of sufficient depth to prevent transection at the base.¹ This can be accomplished by elliptical excision, punch excision around the entire lesion, or deep shave/saucerization to a depth below the lesion. A clinical example is shown in **Figure 1**.

If a suspected melanoma is only partially excised, the thickest part of the melanoma may be missed, which risks underestimating the Breslow depth [**Figure 2**]. According to clinical practice guidelines, incisional biopsies should be performed only in sensitive or cosmetically important areas.^{1,2,4,5} However, the margins of the subsequent wide local excision should follow current guidelines, regardless of location, unless the risks of underexcising are clearly discussed with the patient [**Figure 3**].

Incisional biopsy of a melanoma alone does not appear to directly affect the local recurrence or overall survival of melanoma patients.⁶ However, a 2014 study found a significant proportion of Breslow depth values upstaged at the subsequent wide local excision when the initial biopsy was incisional.⁷ Incisional biopsies often underestimate the Breslow depth, potentially leading to subsequent wide local excision margins that are too narrow for the true tumor stage. Additionally, incisional sampling prevents assessment of vital histopathologic features in the differentiation of melanoma from

TABLE 1. BC Cancer melanoma staging and recommended re-excision margins.

T staging	Definition	Recommended re-excision margins
Tis	Melanoma in situ	0.5–1 cm
T1	T1a Breslow depth up to 0.8 mm; no ulceration	1 cm
	T1b Breslow depth 0.8–1.0 mm regardless of ulceration OR Breslow depth up to 0.8 mm with ulceration	
T2	T2a Breslow depth 1.01–2.0 mm; no ulceration	1–2 cm
	T2b Breslow depth 1.01–2.0 mm with ulceration	
T3	T3a Breslow depth 2.01–4.0 mm; no ulceration	2 cm
	T3b Breslow depth 2.01–4.0 mm with ulceration	
T4	T4a Breslow depth over 4.0 mm; no ulceration	2 cm
	T4b Breslow depth over 4.0 mm with ulceration	



FIGURE 1. Clinical example of an elliptical biopsy with 1–3 mm clinical margins. Both pigmented and erythematous portions of the lesion were excised in their entirety. Patient consent was received for publication.

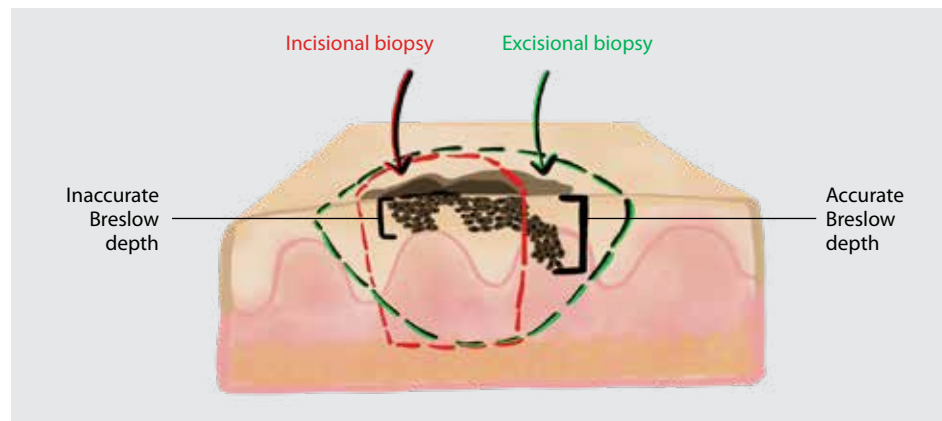


FIGURE 2. Schematic representation of an incisional biopsy (red) versus an excisional biopsy (green). Incisional biopsies may miss the deepest portion of a melanoma, leading to an inaccurate Breslow depth. In this example, the incisional biopsy would have rendered a diagnosis of melanoma in situ, whereas the lesion is truly an invasive melanoma. Consequently, only 5 mm margins would be re-excised if diagnosed as a melanoma in situ, rather than the guideline minimum 1 cm margin for invasive melanoma. Subclinical melanoma cells may be left behind and pose a recurrence risk.

nevus, including breadth, symmetry, and, to some extent, circumscription. Thus, a partial excision may miss the diagnosis of melanoma altogether; this rate has been measured at 23% for punch biopsies.⁸ Taken together, adherence to expert consensus guidelines likely helps physicians optimize patient outcomes.

British Columbia's Northern Health Region primarily serves rural and remote populations. Practitioners in Northern BC have historically had challenges accessing specialist care. Given this, we raised the question of whether this impacted guideline adherence in the region for melanoma biopsy and re-excision. To our knowledge, there has never been an audit of melanoma surgeries within the Northern Health Region. This study aimed to quantify guideline adherence rates for both initial biopsies of suspected melanomas and final melanoma re-excisions within the region.

Materials and methods

We conducted a retrospective chart review of histopathology reports for all melanoma-related cases in the Northern Health Region from 2016 to 2020. Ethics approval was granted by the Northern Health Research Review Committee. All histopathology reports containing the word "melanoma" were identified. Ordering physician and patient demographic data were removed. Each patient and physician was given a unique identifying number. Operational variables were pilot tested with 2016 data; one author abstracted the final data. Lesions were not selected based on histopathologic diagnosis; thus, biopsies of both benign and malignant lesions were included. For re-excisions, all primary cutaneous invasive melanoma and melanoma in situ were included. Relevant patient history was extracted from the requisition when available. Peripheral and deep histologic margin distance was recorded as the nearest approach to either invasive or in situ melanoma. The face, scalp, ears, hands, feet, nipples, and anogenital areas were defined as sensitive locations. Exclusion criteria included

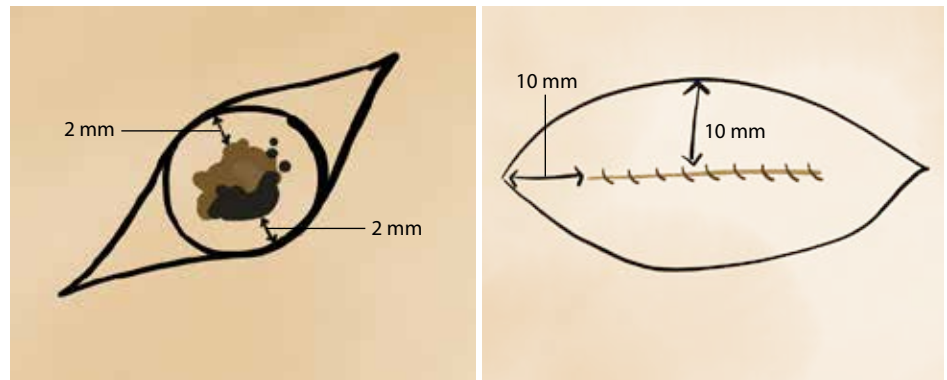


FIGURE 3. Guideline recommendations for melanoma biopsy (left) and re-excision (right).

Biopsy of the skin remains the first step in diagnosing and treating a cutaneous melanoma. Each confirmed melanoma undergoes two incisions: the initial biopsy to diagnose and the second as a wide local re-excision down to the fascia, with margins based on the biopsy's Breslow depth.

irrelevance to melanoma, conjunctival and ungual specimens, and atypical specimens such as amputations.

Adherence to management guidelines was compared with the recommendations available on the BC Cancer website.⁹ For biopsies, adherence to guidelines was defined as achieving complete excision (determined by gross margins) and inclusion of at least the superficial dermis. In cases where clinical margins were unavailable, a minimum biopsy width of 6 mm was set, given that the majority of melanomas have a diameter greater than 6 mm.^{10,11} In cases where gross margins were unknown, they were inferred from the histologic margins or substituted by the stated clinical margins in the requisition. Due to an incomplete data set, these uncertain data were included separately in select analyses as either likely adherent or likely nonadherent.

Re-excision gross margins were counterchecked with prior biopsy Breslow depth to assess adherence to respective minimum excisional margins [Table 1]. If gross margins were unavailable, they were approximated by halving the maximum width of the specimen. Gross measurements were allotted error margins of 21% for length and 12% for width to adjust for sample shrinkage.¹² When margins were equal to or extremely near the guideline standard (e.g., < 0.1 mm margins or 2.0 cm re-excision margins), they were categorized as borderline and

separated in the analyses.

Initial data were inspected using univariate analyses, including contingency tables and descriptive statistics. The mean and standard deviation were used to summarize continuous data. Categorical data were analyzed with the chi-square test, and continuous variables with the Student's *t* test. A two-tailed *P* value of $\leq .05$ was considered statistically significant.

Results

Of the 1034 specimens identified during the study period, 31 were excluded, including 18 irrelevant cases and 13 other specimens, such as frozen sections and subungual biopsies. We collected 18 core needle biopsies, 13 lymphadenectomies, 56 sentinel lymph node biopsies, 17 subcutaneous masses, and 15 internal metastasis specimens. Overall, 886 cutaneous specimens formed the data set, composed of 621 biopsies of pigmented lesions (any pathologic diagnosis) and 265 re-excisions (pathology-confirmed melanoma, invasive and in situ).

Cutaneous biopsies

In 46 (7.4%) skin biopsies, the biopsy technique (e.g., punch) was not mentioned in the pathology requisition. After excluding these and two from unknown anatomic locations, data from the remaining 573 cases were analyzed [Table 2]. The primary techniques employed for biopsies were elliptical

(61.6%), punch (30.9%), and shave (3.3%). Nontraditional formats were used in 4.2% of biopsies, including saucerization, wedge, narrow incisional fusiform, multiple punch biopsies within the same lesion, and placing multiple lesions in the same formalin container. On 16 instances, a second biopsy was taken as an intermediate step between an incisional biopsy and wide local excision.

Minimal clinical history was provided in most pathology requisitions and rarely mentioned the suspected diagnosis or whether the biopsy was incisional or excisional, which can inform tissue sectioning technique. Anatomic locations were not provided for two surgical specimens and four sentinel lymph node biopsies.

Incisional biopsies were slightly more frequent in sensitive anatomical areas. Excisional biopsies were taken with a 2.47 mm clinical margin on average (SD 2.45 mm, $n = 118$). Of all biopsies, 5.3% (14/265) were too shallow and had positive deep margins. Excluding these, the mean Breslow depth of incisional biopsies (1.68 mm) was lower than that of excisional biopsies (2.08 mm) but did not reach statistical significance.

Excluding those in cosmetically sensitive areas, 44.3% (159/359) of initial biopsies adhered to guidelines [Figure 4]. Elliptical biopsies were 10 times as likely to follow guidelines as punch biopsies (odds ratio 10.0; 95% CI, 5.36-18.7; $P < .001$). Reasons for not meeting guidelines were nonexclusive and distributed as follows: inadequate width (212), partial excision (83), shallow depth (6), multiple samples per lesion or container (14), and other technical errors (3), such as a nonperpendicular angle.

The occurrence rates of five important prognostic factors (ulceration, mitotic rate, satellitosis, lymphovascular invasion, and neurotropism) in biopsies positive for invasive melanoma are in Table 3. Ulceration status was not reported in 19.91% of melanoma biopsy reports. Approximately half (116/226) of invasive melanoma biopsy reports reported all five prognostic factors.

In 5.9% of biopsies, the Breslow value could not be determined due to melanoma extending to the deep margin.

TABLE 2. Descriptive data for biopsies of suspected primary cutaneous melanoma.

Variable	Percentage (n/total count)
Biopsy technique	
Unknown	7.4% (46/619)
Elliptical	61.6% (353/573)
Punch	30.9% (177/573)
Shave	3.3% (19/573)
Other	4.2% (24/573)
Location	
Unknown	0.33% (2/605)
Sensitive area	23.7% (143/603)
Nonsensitive area	76.3% (460/603)
Diagnosis	
Benign	42.8% (259/605)
Melanoma in situ	16.4% (99/605)
Nonmelanoma skin neoplasms	1.65% (10/605)
No diagnosis reached	1.82% (11/605)
Melanoma (all subtypes)	37.4% (226/605)
Superficial spreading	49.6% (112/226)
Nodular	12.8% (29/226)
Lentigo maligna melanoma	4.42% (10/226)
Other	16.4% (37/226)
Unspecified	16.8% (38/226)

Variable	Size (standard deviation, range, n)
Biopsy size (all anatomic locations)	
Punch diameter	4.35 mm (1.46 mm, 2.0–10 mm, 169)
Elliptical length	16.7 mm (11.94 mm, 2.2–150 mm, 318)
Elliptical width	9.9 mm (9.39 mm, 1.0–110 mm, 271)
Breslow depth	
Average Breslow depth (nonmetastatic biopsies)	1.85 mm (2.26 mm, 0.08–12.0 mm, 175)
Breslow depth not available (deep margin positive)	Percentage (n/total count) 5.9% (11/187)
Breslow depth not reported	1.6% (3/187)

Biopsies diagnosed as benign and malignant were both included. Frequencies are reported in percentages, and means are provided along with standard deviation, count (n), and data range from smallest to greatest values.

TABLE 3. Frequency and percentage of positive prognostic factors of 226 invasive melanoma biopsies.

Prognostic factor	Ulceration	Mitotic rate	Satellitosis	Lymphovascular invasion	Neurotropism
Percentage	19.9%	28.1%	3.3%	5.3%	5.2%
Positive count	36/181	50/178	6/140	10/188	8/153
Reporting rate	80.1%	78.8%	61.9%	83.2%	67.7%

The denominator provides the count of the number of times each was reported. More than 1 mitotic figure per mm² was assessed as positive. Those reported as high power fields were excluded.

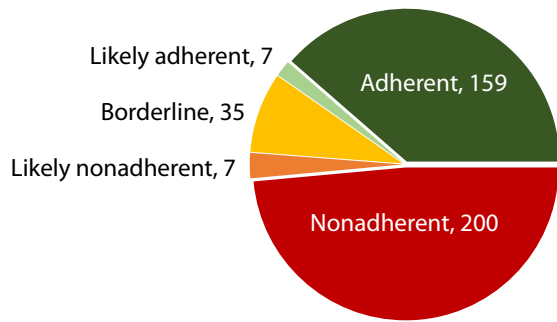


FIGURE 4. Adherence to excisional margin guidelines in initial cutaneous biopsies of suspected melanoma ($n = 412$).

Biopsies diagnosed as benign and malignant were both included. Biopsies taken in sensitive body locations were excluded. Meeting guidelines was defined as achieving negative gross margins or, if unknown, a minimum width of 6 mm. Uncertain data (likely adherent or likely nonadherent) were inferred from clinical margins on the pathology requisition or histologic margins. Borderline specimens had melanoma located less than 0.1 mm from the clinical margins or a width of exactly 6.0 mm.

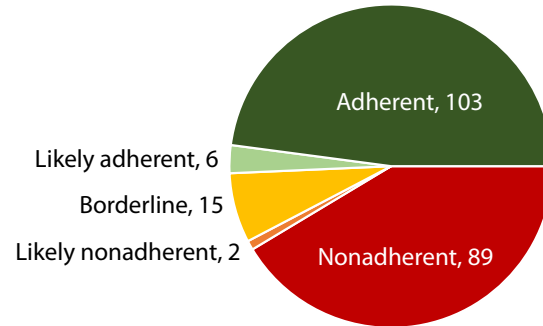


FIGURE 5. Adherence to excisional margin guidelines for wide local excisions of primary cutaneous invasive melanoma and melanoma in situ, across all anatomic locations ($n = 215$).

Guidelines were based on corresponding Breslow depth of the prior tumor biopsy (in situ = 5 mm; < 2 mm = 1 cm; > 2 mm = 2 cm). Uncertain data (likely adherent or likely nonadherent) were inferred from clinical margins on the pathology requisition or histologic margins. Borderline specimens had margin widths at the exact margin cutoff (e.g., 5.0 mm).

Nonmetastatic melanomas biopsied with negative deep margins had a mean Breslow depth of 1.85 mm (SD 2.26 mm, range 0.08–12.0 mm, $n = 175$).

Wide local excisions

There were 265 wide local excisions, including 28 repeat attempts (third surgery following a biopsy and re-excision with inadequate margins). There were 27.1% fewer re-excisions than expected, since all positive biopsies should theoretically prompt a re-excision. The disproportionate number of re-excisions suggests that not all biopsy-proven melanomas were followed up with a wide local excision. However, there is a possibility that some of these patients died or traveled out of the area for their re-excisions.

Of wide local excisions with available measurements, 53.6% (103/192) adhered to guidelines [Figure 5]. Re-excision guideline adherence decreased to 41.0% (16/39) in sensitive body locations. Deviations from published guidelines were primarily in the way of inadequate surgical margins. However, in three instances, providers aimed only to re-excise a specimen with a 5 mm total width, rather than re-excising 5 mm of healthy tissue on both sides of

the scar. Residual tumor was present in 30.5% (81/265) of all re-excisions. Four re-excisions had positive gross margins, and 6.3% (16/253) presented with positive histologic margins.

Discussion

This 5-year melanoma retrospective review

Overall, less than half of surgical excision specimens followed BC Cancer recommendations.

in the Northern Health Region in British Columbia identified multiple areas where melanoma guidelines were not adhered to. Across anatomic sites, approximately one-third of biopsies for suspected melanoma were incisional. Even excluding those in cosmetically sensitive areas, only 44.3% of initial biopsies adhered to guidelines. For wide local excisions, guideline adherence was slightly higher, at 53.6%.

Overall, less than half of surgical excision specimens followed BC Cancer recommendations. Adherence rates were lower

than those in other countries, which ranged from 88% to 96.8%.^{13,14} Rural populations with a low geographical density of dermatologists have previously been found to have a greater proportion of melanomas with Breslow depths greater than 2 mm.¹⁵ Another study showed that melanoma guidelines were less likely to be followed in rural areas than urban areas.¹⁶

Significant barriers exist to the uptake of melanoma guidelines. Smaller biopsies may be more comfortable for physicians who do not regularly perform surgical procedures. Time constraints, remuneration, and cosmesis may also play a role. Some argue that strict guidelines pose barriers to biopsy for physicians, resulting in delayed or fewer diagnostic biopsies. There is also no evidence that incisional biopsies adversely affect patient outcomes, if one assumes that incisional biopsies do not miss some melanomas altogether.⁸ Given current evidence and the potential consequences of incompletely excising melanomas, we recommend that physicians continue to strive to meet BC Cancer guidelines. Melanoma guidelines were developed through expert consensus and interpretation of available evidence to standardize the clinical management of melanoma and improve quality of

Clinical takeaways

- Punch biopsies should encompass the entire lesion, unless in a sensitive anatomic location. In this study, elliptical biopsies were 10 times as likely to follow recommendations as punch biopsies.
- Measure re-excision margins from the perimeter of the biopsy scar. If re-excising 5 mm margins, the total width of the specimen should be a minimum of 10 mm.
- In cosmetically sensitive areas or with a large lesion, an incisional biopsy may be clinically indicated. Sampling with a scalpel or punch biopsy within the most atypical part of the lesion is appropriate.
- Include the following elements in a pathology requisition:
 - Site, description, and size of lesion.
 - Excisional or incisional intent.
 - Type of biopsy (e.g., ellipse, punch, shave).

Key terms

Breslow depth: Maximum tumor thickness, measured from the top of the granular layer of the epidermis (or the base of an ulcer) to the deepest point of tumor involvement.

Invasive melanoma: Melanoma present in the dermis or deeper.

Melanoma in situ: Melanoma confined to the epidermis.

Melanoma staging: Based on tumor thickness (T), lymph node involvement (N), and presence of distant metastases (M). See **Table 1** for tumor staging details and corresponding re-excision margins.

Sentinel lymph node biopsy: Identification and excision of the first lymph node(s) the primary melanoma tumor is most likely to spread to. This procedure is considered for stage T1b and recommended for stage T2a and higher.¹ A positive sentinel lymph node biopsy leads to consideration for lymphadenectomy and adjuvant therapy.

care. Whether adherence to recommended margins plays a major factor in long-term survival is controversial and the subject of other studies.

When submitting a sample, providing more complete clinical information can be helpful for the pathologist. Stating the lesion's clinical size, the biopsy intent, and the area sampled is important. The excisional versus incisional status of the biopsy can impact tissue preparation and aid pathologists in the diagnostic process. If an incisional biopsy is clinically indicated due to a large lesion or a cosmetically sensitive location, sampling with a scalpel or punch biopsy in the most atypical part of the lesion is appropriate.

Future directions

Further surgical training may lead practitioners to feel more confident to follow excision guidelines. We encourage practitioners to review the most current guidelines before melanoma-related procedures. We recommend that most wide local excisions be referred to practitioners who are comfortable undertaking surgical re-excisions and regularly do so. To ensure high standards of melanoma care, interest is increasing in determining and monitoring the quality of

interventions. A prospective study is needed to better assess clinical melanoma management in the Northern Health Region. Standardizing melanoma reports and creating a melanoma data registry are needed to fully evaluate current practices. Promoting standardization and quality assurance of surgical procedures is likely to improve

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patient outcomes.¹⁷ Pathology reports can help emphasize guidelines—for instance, by explicitly stating when clinical history was missing, that a biopsy was incisional, or next steps in management (e.g., “Although the biopsy margins are negative for melanoma, a 10 mm re-excision +/- sentinel lymph node biopsy is indicated”). These study results can inform targeted educational initiatives in the region.

Limitations

This study had significant limitations. Data were coded by a single nonblinded author.

Since pathology requisitions rarely included clinical differential diagnoses, some biopsies of nonmelanocytic lesions without suspicion for melanoma may have been included and inappropriately held to melanoma biopsy standards. Some biopsies occurred outside of the Northern Health Region or the study time frame; thus, re-excision target margins could not be verified. These factors resulted in a largely incomplete data set. Margin clearance and prognostic factors were more frequently reported in aggressive melanomas, skewing the data toward advanced disease. Last, shave biopsies and small punches are inaccurate representations of tumor distance from margins due to specimens stretching during slide preparation.

Conclusions

In this study, guidelines for melanoma-related biopsies and wide local excisions in Northern British Columbia were often not adhered to. Whether guidelines impact long-term patient outcomes is controversial, but considering the stakes of missing a melanoma, striving for guideline-based care for melanoma patients remains important. Changes can be made in multiple dimensions—from biopsy to pathology report to subsequent re-excision—and these results

can be used to inform physician education in the future. A prospective study should be undertaken to better document guideline adherence rates and the effect on patient outcomes.

Competing interests

None declared.

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Data availability statement

The data that support the findings of this study are available upon request from the corresponding author, C.S. The data are not publicly available, as they contain details that could compromise patient privacy.

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