Clinical and Histological Margins in Melanoma Surgery
A Discussion Document

Please read this document in conjunction with
https://www.skincancer.org.nz/clinical-resources/nz-melanoma-clinical-guidelines

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- Clinical and Histological Margins in Melanoma Surgery – Evidence Supplement
- Melanoma Excision Margins – Quick Reference (for day-to-day use)
- A podcast (a shorter adapted audio version of this document)
- Tissue Shrinkage and how it effects Melanoma Excision Margins

Goals

- Improve basic understanding of melanoma margins
- Clarify areas of the guidelines that are ambiguous or not consistent with current practice
- Explain what is meant by “clear histological margins” (which has yet to be defined), by reverse engineering from clinical margins and reference to pertinent research

What Are Margins?

Margins are defined as the amount of noncancerous tissue excised around a melanoma to ensure complete tumour removal and minimise recurrence.

1. Clinical Radial Margin: Distance from the surgical scar or edge of residual tumour (assessed clinically or dermatoscopically). May overestimate (e.g., due to surrounding photo-damage)

or underestimate (e.g., due to subclinical tumour extension). The reason that international recommendations for wide clinical margins do not explicitly account for the primary histological margin already achieved in the diagnostic biopsy is that the supporting studies were conducted based on this approach. However, in practical surgical settings, the histological margin already achieved is often considered, especially in anatomical locations where it has significant clinical relevance.

2. Clinical Deep Margin: Excision down to, but not including, the deep fascia, unless the fascia is involved by tumour (for both MIS and invasive melanoma). Where the subcutis is unusually deep, it is acceptable practice to excise only to a depth equal to the recommended radial margin, rather than continuing down to fascia. Routine fascial excision is not otherwise required: retrospective studies found no outcome benefit from excising the fascia, even in melanomas thicker than 1mm (1) or 2mm (2). The rationale for excising through the full depth of the dermis and subcutis even in MIS (which by definition is restricted to the epidermis) is that malignant cells can spread down hair follicles whilst remaining in situ; follicular involvement has been reported in up to 82% of MIS specimens generally (3), and in 95.8% of specimens in a lentigo-maligna-specific study, with atypical melanocytes extending a mean of 0.45mm into the follicle (range 0.1-1.1mm) (4).

3. Histological Margins: Distance from the tumour edge to the excision margin, measured microscopically on sampled sections. Typically 10-30% smaller than clinical margins due to tissue shrinkage post-excision and processing, though the best-controlled studies measuring margin width specifically report shrinkage nearer 12-15% (5,6). Histological margins may be imprecise due to tumour irregularity and sampling limitations.

Why do we want a Clinical Margin?

Excision beyond the visible tumour removes subclinical disease, increasing the likelihood of clear histological margins and reducing local recurrence (LR).

Why do we want a Histological Margin?

Routine histology (bread-loafing) examines circa 1-3% of margins. Irregular tumour borders may be missed, necessitating a safety margin to improve the chances of actual clear histological margins.

Current Australasian Guidelines for Melanoma Excision

Initial Biopsy: Clinical radial margin

Radial Margin: 2 mm

Wide Local Excision (WLE): Clinical radial margins

- Melanoma in situ (MIS): 5–10 mm
- Breslow ≤ 1 mm: 10 mm
- Breslow 1.1–2.0 mm: 10–20 mm
- Breslow >2.0 mm: 20 mm

If the prescribed margins are likely to result in functional or cosmetic consequences Mohs surgery, mapping biopsies or sequential excisions should be undertaken to ensure the least amount of tissue is removed to achieve clear histological margins

Clinical radial margins for MIS

5 mm clinical margins may be sufficient if all of the following criteria are met

- Well-circumscribed lesions
- Small lesions, < 1 cm in diameter
- Non-chronically sun-exposed skin (trunk, proximal extremities)
- Absence of histological evidence of chronic sun damage/solar elastosis on biopsy (i.e., not LM)

10 mm clinical margins should be considered for

- Areas of sufficient skin laxity where larger margins can be achieved without untoward consequence
- Ill-defined lesions
- Lesions >1 cm in diameter
- Chronically sun-exposed skin, such as the head and neck and distal extremities
- Diagnosis of LM on dermatopathology review of biopsy
- Acral lesions

10-15 mm clinical margins should be considered in

- Very large lesions >3 cm in diameter

Clinical considerations in radial margin selection for Lentigo Maligna on the head or neck

Lentigo maligna frequently has varying degrees of subclinical disease and frequently requires >10 mm clinical margins to achieve adequate histological margins. Associated photodamaged skin complicates clinical and histological margin assessment. For this reason, lesions in anatomically challenging areas, preliminary border mapping, and serial excisions are useful techniques when Mohs micrographic surgery isn't available. When available, Mohs or slow Mohs will maximise the chance of clear margins and minimise tissue loss. Histologic clearance should be confirmed prior to undertaking complex reconstruction. Consideration should be given to

field treatment with imiquimod for 3 months post excision when the lesion is very large and lentiginous with poorly demarcated histological features.

Non-Surgical Alternatives

Smaller margins, nonsurgical treatment (Imiquimod, radiotherapy) or active surveillance are sometimes resorted to in elderly/fragile patients or where a large excision would be unacceptable cosmetically or functionally. No randomised trials support these nonsurgical approaches. Imiquimod has the most data: the largest systematic review (347 tumours) reported 76% histologic and 78% clinical clearance, with recurrence rates of 0-21% depending on follow-up length (7); radiotherapy data is more limited: the largest systematic review found local recurrence rates ranging from 0-31% across 14 retrospective series with no prospective trials (8), and one comparative series reported a notably higher recurrence rate with radiotherapy than with surgery (29% vs 4.2%) (9).

Clinical considerations in radial margin selection for invasive melanoma

There is a paucity of evidence supporting margins above 1cm for thicker Melanomas (>2mm). Although Melmart II (10) aims to quantify this, we await the report. Existing non-randomised evidence specific to the 1cm-v-2cm comparison is so far consistent with no difference: several retrospective cohorts and a 2025 meta-analysis found no significant difference in local recurrence or survival between 1cm and 2cm margins (16,17,18,19), although one large population-based cohort found a survival benefit for margins >1.1cm in thin melanoma and worse survival with margins <1.6cm in thick melanoma (20), so this question remains unresolved.

Clinical considerations in rare subtypes of melanoma

Desmoplastic melanoma (DM) is a histologic subtype of melanoma that tends to be locally aggressive with a higher propensity for local recurrence, especially when perineural invasion is present. Pure DM (≥90% desmoplastic component) has a lower risk of distant metastasis than conventional melanoma; mixed DM behaves more like conventional melanoma, with a similar or higher metastatic risk (11). Mucosal, Spitzoid and Acral melanomas are often more aggressive subtypes that require careful consideration of management strategies, including clinical margins, sentinel lymph node biopsy considerations, and adjuvant therapies.

Survival Predictors

Melanoma subtype, Breslow depth, ulceration, and mitotic rate strongly predict survival. The effect of margin width on survival is genuinely contested: most trials comparing 2 cm against even wider margins (e.g., 4 cm) show no additional survival benefit from the wider excision (12), although one UK trial found a disease-specific survival advantage for a 3 cm over a 1 cm margin

in thicker melanomas (13). These two trials are not directly comparable (2cm v 4cm versus 1cm v 3cm), so their results are not strictly contradictory. The ongoing MelMarT-II trial (1cm v 2cm) is testing this directly, with contemporary staging, to confirm whether 1cm is genuinely inferior to 2cm itself and not just to 3cm. Across most studies, wider margins are more consistently associated with reduced local recurrence than with improved overall survival.

What is a "clear histological margin?"

Guidelines consider treatment adequate when "clear histological margins" are achieved, but what measured margins will most likely achieve "clear histological margins" lacks a universal definition. By reverse engineering from the guideline's minimum clinical margins (5 mm for MIS, 10 mm for invasive Breslow ≤1.0 mm) and a conservative 40% shrinkage assumption (actual shrinkage is invariably less than this (5,6)), the resulting histological margins are estimated to be approximately 3 mm and 6 mm respectively. Because this combines the lowest recommended clinical margin with a worst-case shrinkage figure, it represents a floor rather than a typical value: at more realistic shrinkage (10-30%) or when wider clinical margins are used, the achieved histological margin will usually be greater. In addition, Moura, Homer, and McKirdy 2020 (14), whose cohort was 89% lentigo maligna (80% pure and 9% mixed), demonstrated in their study that a greater than 3mm histological margin for MIS is associated with 3% LR rate compared to a 13% LR for histological margins of ≤ 3mm. Pathological margins greater than 3 mm may therefore reasonably be considered adequate 97% of the time. Because lentigo maligna's subclinical extension is notoriously hard to predict clinically, a wider planned clinical margin is often needed to reliably achieve this histological clearance in the first place. It is important to note that whilst wide excisions only control local recurrence, if an MIS does recur it may be in the form of invasive disease.

The Wise or Wide (WoW) Trial

The WoW trial is currently testing whether omitting further wide excision is safe when a diagnostic excision of a thin invasive melanoma (Breslow ≤1.0 mm, pT1) has already achieved a histologically verified margin of ≥1.5 mm, excluding lentiginous (lentigo maligna, acral lentiginous) and desmoplastic subtypes from enrolment. As an ongoing trial, its results are not yet available and it carries no weight in the recommendations above (15).

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