



Guidelines for the excision of cutaneous squamous cell cancers in the United Kingdom: The best cut is the deepest

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Summary Surgical excision remains the gold standard for the management of cutaneous squamous cell cancers (SCC) and national guidelines for operative radial margins predict 95% oncological clearance with a margin of 4 mm for low-risk and 6 mm for high-risk tumours.

We retrospectively analysed all cutaneous SCC excisions performed across 4 regional Plastic surgical units in England over a consecutive 24-month period and collected data on tumour characteristics, operative and histological margins and completeness of excision.

We identified 633 eligible SCC excisions of which 265 (42%) were over 2 cm in diameter with 37 recurrent tumours (5.8%). The mean radial operative margin was 6.5 mm across all tumours and 8.4 mm for tumours greater than 2 cm. The mean histological tumour diameter was 21 mm. The overall incomplete excision rate was 7.6% (7.9% for tumours >2 cm). Ninety-four percent (45/48) of incomplete excisions involved the deep margin and only 3 out of 633 excisions (0.47%) were incomplete at a radial margin only. No differences were observed in tumour size or excision margin between incompletely and completely excised tumours. Incomplete excisions were most common on the ear, nose and cheek.

In summary our analysis demonstrates that despite adherence to recommended surgical margins for cutaneous SCCs the incomplete excision rate remains higher than expected. We believe that this is because most incomplete excisions are incomplete at the deep margin and question the utility of performing increasingly wide excisions, and, the generalisability of the evidence upon which recommendations for radial margins are based.

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Introduction

Surgical excision remains the mainstay of treatment for the management of cutaneous squamous cell cancer (SCC) as it permits comprehensive histological examination of the tumour. Current guidelines¹ for the surgical excision of SCCs recommend a 4 mm radial margin for low risk SCCs (<2 cm diameter with a well defined edge) and 6 mm for higher risk tumours (>2 cm diameter, poorly defined edge, high-risk anatomical site and tumours extending subcutaneously). Whilst these margins predict 95% oncological clearance no specific guidance is given for the management of the deep margin. The recommendations for radial margins are based upon a histological analysis of a series of 141 patients with primary SCCs undergoing Moh's micrographic surgery.² Sections of tissue were excised from these primary tumours at 1–2 mm intervals and analysis showed that at 4 mm 95% of the tumours under 2 cm had been completely excised and at 6 mm 95% of tumours over 2 cm were completely excised. Of note, only 20% of patients had tumours over 2 cm in size.

Whilst incomplete excision of cutaneous SCCs necessitates further treatment (either surgical or non-surgical) secondary treatment modalities may be made more difficult as a result of a primary incomplete excision. Incomplete excision rates for cutaneous SCC vary considerably in the reported literature (5–17%)^{3–11} and patient cohorts in whom these rates are reported are heterogeneous with regards to tumour size, primary versus recurrent lesions and the inclusion/exclusion of *in situ* disease. Therefore, direct comparisons in oncological outcomes between treatment modalities and practitioner groups may be confounded by patient selection. Plastic Surgeons involved in the management of skin cancers tend to be referred larger and more challenging lesions that are beyond the remit of non-specialist practitioners. Achieving oncological clearance in these patients often requires resection of anatomically challenging areas (nose, ear, peri-orbital) and subsequent reconstruction in an elderly cohort of patients. The aim of this paper was two-fold: primarily we aim to quantify the incomplete excision rate for cutaneous SCCs in a representative cohort of patients referred for Plastic Surgical excision in a multidisciplinary team setting. Secondly, we aim to critically appraise the current recommendations for radial excision margins in cutaneous SCC in light of our findings and ask whether they accurately reflect the pattern of tumour growth and surgical treatment.

Methods

We performed a retrospective analysis of patients who underwent surgical excision across 4 regional Plastic Surgery centres (Stoke Mandeville Hospital, Aylesbury (SMH), John Radcliffe Hospital, Oxford (JRH), Salisbury District Hospital, Wessex (SDH) and Queen Alexandra Hospital, Portsmouth (QAH)) over a 24-month period from 1st January 2009 to 31st December 2010. Patients were identified from the histopathology database held at each regional centre and case-note review was performed for included cases. We included all primary and recurrent tumours and excluded the following: patients undergoing

diagnostic biopsies, patients undergoing non-excisional therapies, aerodigestive tract SCCs, carcinoma-*in-situ* and in transit metastases. We also collected correlative demographic and histological data from these tumour excisions, which included data on histological excision margins and tumour features. A consensus meeting was held to discuss all incomplete excisions to ensure standardization of data collection and to discuss complex cases.

Statistical analysis was performed using SPSS (IBM UK, Middlesex) with univariate analyses using independent samples *t*-test ($\alpha = 0.05$).

Results

We identified 633 cutaneous squamous cell cancers that had been excised over a 24-month period across all 4 regional Plastic Surgery centres. Seventy one percent of patients having a cutaneous SCC excised were male and the median age was 80 years (range: 27–108) (Table 1).

Two hundred and sixty five (42%) of all tumours excised measured over 2 cm in histological diameter and 368 were under 2 cm.

Clinical features and operative margins

Sixty percent of all tumours were located on the head and neck (Figure 1a) with the next most common anatomical sites being: upper limb (17%), lower limb (13%) and 4.5% on the trunk and abdomen.

Thirty-seven out of 633 tumours (5.8%) were recurrent lesions and of these 25 (68%) had been treated with further therapeutic modalities after their primary excision: re-excision (32%), >1 re-excision (10%), curettage/shave (12%), cryotherapy (5%), radiotherapy (1%) and multiple treatment modalities (4%) (Figure 1b).

The mean histological diameter of tumours was 21 mm (range: 1–200 mm). One hundred and forty five (23%) of tumours were found to be ulcerated on examination and 15 patients (2.4%) presented with regional lymphadenopathy at initial consultation.

The mean operative radial margin documented for all tumour sizes was 6.5 mm (range: 1–50 mm) and 8.4 mm (range: 2–25 mm) for tumours greater than 2 cm in diameter. The documentation rate for operative margins in our series was 75%.

Histological features and margins

The mean histological diameter was 21 mm (range: 1–200 mm) and mean tumour thickness was 4.9 mm (range: 0.5–27 mm). Ninety one tumours out of 633 were poorly differentiated (14%) and 123 tumours (19%) showed extension to Clarke's level V. Fifty-two (8.2%) tumours demonstrated perineural invasion on histological analysis.

The mean histological radial margin of excision was 5.1 mm (range: 0.1–21 mm) across all tumour sizes and 5.9 mm (range: 0.1–15 mm) for tumours greater than 2 cm in diameter. The mean histological deep margin of excision was 3.9 mm (range: 0.05–21 mm).

Table 1 Table of demographic, clinical, operative, histological and completeness of excision characteristics (values represent means and figures in parentheses represent ranges unless otherwise stated).

<i>Patient demographics</i>	
Age	80 y (27–108 y)
Female	184 (29%)
Male	449 (71%)
<i>Clinical tumour characteristics</i>	
Tumour diameter	15 mm (range: 0.5–150 mm)
Diameter >2 cm	265 (42%)
Diameter <2 cm	368 (58%)
Recurrent tumour	37 (5.8%)
Ulceration	145 (23%)
Regional lymphadenopathy	15 (2.4%)
<i>Operative margins</i>	
All tumours	6.5 mm (range: 1–50 mm)
Tumour >2 cm	8.4 mm (range: 2–25 mm)
<i>Histological features</i>	
Tumour diameter	21 mm (range: 1–220 mm)
Tumour thickness	4.9 mm (range: 0.5–27 mm)
Well differentiated	205 (32%)
Moderately differentiated	316 (50%)
Poorly differentiated	91 (14%)
Clarke's level IV	225 (36%)
Clarke's level V	123 (19%)
Perineural invasion	52 (8.2%)
<i>Histological margins</i>	
Radial margin	
All tumours	5.1 mm (range: 0.1–21 mm)
Tumours >2 cm	5.9 mm (range: 0.1–15 mm)
Deep margin	3.9 mm (range: 0.05–21 mm)
<i>Incomplete excision rates</i>	
All tumours	48 (7.6%)
Tumour <2 cm	27/368 (7.3%)
Tumours >2 cm	21/265 (7.9%)
Primary tumours	39/596 (6.5%)
Recurrent tumours	9/37 (24%)

Incomplete excisions

Forty-eight out of 633 SCCs (7.6%) were incompletely excised of which 6 (12%) were recurrent and 42 (88%) were primary tumours. The incomplete excision rate for tumours under 2 cm was 7.3% (27/368) and 7.9% (21/265) for tumours over 2 cm in diameter. Forty-two of 596 primary SCCs (7.0%) were incompletely excised and the incomplete excision rate for recurrent tumours was 16% (6/37).

No significant differences were observed in histological diameter between complete (mean diameter: 21.1 mm

(range: 0.5–200 mm)) and incomplete (mean diameter: 21.6 mm (range: 0.4–80 mm)) excisions (Figure 2a). No significant differences were observed in the histological radial margin of excision between complete (mean margin: 5.1 mm (range: 0.1–21 mm)) and incomplete (mean margin: 5.5 mm (range: 0.1–17 mm)) excisions (Figure 2b) in tumours that were incomplete only at the deep margin.

Three of 48 incomplete excisions (8%) were incomplete at the radial margin only, 33 tumours (68%) were incomplete at the deep margin only and 12 (24%) were incomplete at both radial and deep margins. Ninety-four percent of incomplete excisions involved the deep margin (45/48) and the incomplete excision rate for the radial tumour margin was 2.4% (15/633). Only 3 of 633 tumours were incomplete at a radial margin only (0.47%). Incomplete excisions were most common in the ear, nose and cheek.

Discussion

Surgical excision remains the mainstay of management for cutaneous malignancies as it allows formal histological analysis of the excised tumour. Whilst evidence for the association between incomplete excision and disease recurrence in SCC is lacking few would argue against a one-stage curative excision as the gold standard management. In our analysis the overall incomplete excision rate for Plastic Surgical excisions of cutaneous SCCs, primary and recurrent, was 8%. This figure is higher than would be predicted (5%) despite adherence to the British Association of Dermatologist's guidelines for radial excision margins. Interestingly, our analysis shows that 92% of incomplete SCC excisions are incomplete at the deep margin and despite an overall incomplete excision rate at the radial margin of 2.5%.

The principles of oncological excision are radial excision with an appropriate operative radial margin that begins at the visible edge of the tumour, and excision through a deep plane that is macroscopically clear of tumour involvement. The judgement of where a tumour ends and when a deep plane is 'clean' can be complicated by local anatomy and common examples of this include the ear, nose and cheek where excisions are more likely to be incomplete in an attempt to preserve underlying vital anatomical structures (cartilage, facial nerve). In such circumstances, a more conservative surgical approach followed by adjuvant radiotherapy may be a reasonable alternative. From our own data, the commonest sites of incomplete excision were: ear (12/48), scalp (8/48), nose (10/48), forehead (8/48), upper limb (6/48) and cheek (4/48). Previous studies reporting incomplete SCC excisions¹² have also commented on the propensity for incomplete excision in these anatomically complex areas but have advocated the use of wider excisional margins. The British Association of Dermatology guidelines¹ for cutaneous SCC excision recommend a radial excision margin of 4 mm for low-risk SCCs (<2 cm with well defined margins) and 6 mm for high-risk tumours (>2 cm, high risk site, poorly differentiated or exhibiting clinical subcutaneous extension). Adherence to these guidelines predicts 95% oncological tumour clearance (level 2c evidence). These recommendations are based upon a single study of 141 patients that underwent Moh's micrographic surgery for cutaneous SCCs.² By taking 1–2 mm thick sections

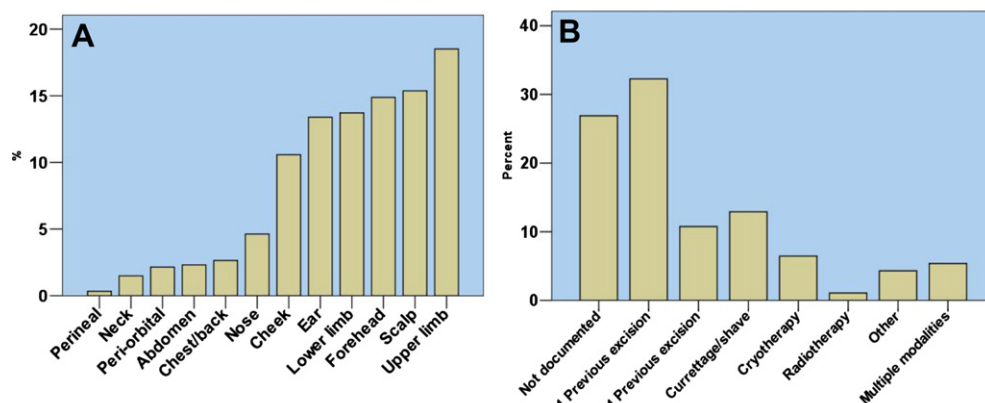


Figure 1 (A) Anatomical location of SCCs demonstrating that 60% of all lesions were located in head and neck; (B) Previous treatment(s) given to recurrent SCCs prior to being seen in the Plastic surgery clinic.

of tissue for histological analysis they showed that, in their cohort, 95% clearance was achieved for tumours under 2 cm with a radial excision margin of 4 mm, and for tumours over 2 cm (or that were poorly differentiated or showed subcutaneous extension) a 6 mm radial margin was required. Of note, their patient cohort consisted of only primary tumours with 20% of tumours being greater than 2 cm in diameter. The current guidelines¹ do not offer any recommendations on the management of the deep margin at the time of excision but rather advocate that a wider radial margin equates to a greater probability of tumour clearance. In this study, despite taking radial margins greater than, or equal to, those recommended (histological radial margins: 5.1 mm (all tumour sizes) and 5.9 mm (tumours >2 cm)) we observed higher than expected incomplete excision rates: 7% for primary SCCs, 7.9% for tumours >2 cm and 16% for recurrent tumours. Interestingly, 94% of our incomplete excisions were incomplete at the deep margin (either alone or in conjunction with an involved radial margin) and the radial incomplete excision rate in our series was 0.47% (3/633). Moreover, incompletely excised recurrent tumours (all situated on the

ear, nose or scalp) were found to be incomplete at a deep margin with 2 tumours being incomplete at both deep and radial margins. In summary, the current guidelines for cutaneous SCC excisions do not offer any guidance on the management of the deep margin and we would propose that wider radial margins do not equate to better oncological clearance for cutaneous SCCs. Furthermore, we would recommend that in anatomically challenging areas, such as the ear and nose, and when dealing with recurrent tumours, the index of suspicion for microscopic residual disease at the deep margin must be high and clinical inspection alone may be insufficient to assess tumour clearance.

Longitudinal studies of SCC excision¹² have shown that whilst both tumour diameter and tumour thickness are independent risk factors for metastatic spread only the latter is an independent risk factor for local tumour recurrence on multivariate analysis (hazard ratio: 6.03 (2.71–13.43); $p < 0.0001$). The risk of local recurrence and metastatic spread increases significantly with tumour thicknesses over 6 mm, which represents 26% (164) of the patients in our cohort. Furthermore, 128 tumours (20.2%) had a diameter over 2 cm and were greater

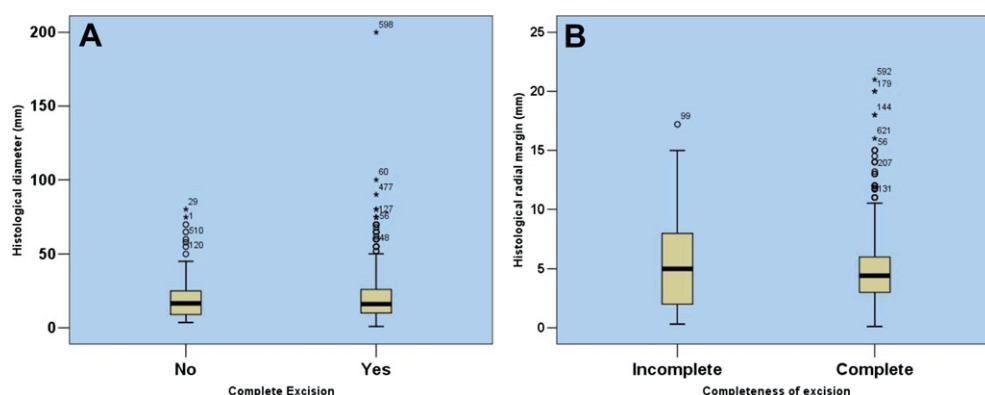


Figure 2 (A) Box and whisker plot of histological diameter in complete and incomplete SCC excisions. No significant difference was observed in tumour diameter between completely and incompletely excised tumours (mean diameter: 21.1 mm (complete) and 21.6 mm (incomplete)); (B) Box and whisker plot comparing histological radial margins in complete SCC excisions with incomplete excisions that were incomplete only at a deep margin. No significant difference was observed in the radial excision margin between completely and incompletely excised tumours (mean histological margin: 5.1 mm (complete) and 5.5 mm (incomplete)).

than 6 mm in thickness. Therefore, we would argue that the SCCs encountered in our practice represent a group at higher risk of metastatic spread. Additionally, given that tumour thickness is an independent predictor of both local recurrence and metastasis, current management of the radial margin appears adequate and efforts to improve oncological outcomes should address management at the deep margin.

Previously reported incomplete excision rates for cutaneous SCCs range from 5% to 17%.^{3,5–12} However, heterogeneity amongst the different study populations makes direct comparison difficult as some studies do not include data on surgical or histological margins, chose to include *in situ* disease into their cohorts or reported on only primary tumours or tumours under 2 cm in diameter.

In summary, the spectrum of cutaneous SCCs presented in this paper accurately reflects the SCC caseload encountered by Plastic surgeons (working in an MDT setting) in the UK and we would argue that the tumours that we treat fall into a higher-risk group for metastatic spread and local recurrence than those referred to other practitioner groups. Our study highlights the role of active, specialist Plastic surgical input in dealing with the oncological sequelae of incomplete excision and the impact of this on improving outcomes for this difficult sub-group of patients. Our series, which reflects one of the largest and most inclusive series of SCC excisions, demonstrates that residual disease is located at the deep margin and we would question the utility of performing increasingly wider radial excisions as we believe radial clearance is not consistently proportionate to oncological clearance. Better deep clearance may be achieved by excising an extra deep fascial plane of tissue (even in the presence of a macroscopically clear deep plane) or performing frozen sections intra-operatively. Whilst definitive recommendations on the optimal management of the deep margin are beyond the scope of this analysis, we feel a consensus view is required to ensure a consistent and coherent cutaneous oncology service.

Ethical approval

Not required.

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Conflict of interest

None declared.

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