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Use of Protoporphyrin IX Fluorescence to Determine Clinical Target Volume for Non-Melanotic Skin Cancers Treated with Primary Radiotherapy

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Background

Squamous cell (SCC) and basal cell (BCC) of the skin continue to be the most commonly diagnosed cancers worldwide.[1] Radiotherapy provides local control of 90% and 80% for small and large BCCs respectively.[2,3]

The challenge with radiotherapy lies in determining treatment volumes, especially for poorly defined tumors. Photodynamic therapy (PDT), which involves preferential uptake of a photo-sensitizer that also fluoresces, provides a unique method that may increase accuracy for tumor delineation.[4,5]

Two previous surgical series (Brandt, Tierney) demonstrated that protoporphyrin IX (PpIX) fluorescence strongly correlates with the surgical extent of disease.[4,6]

This study prospectively investigated PpIX fluorescence as a means of determining the clinical target volume (CTV) necessary to encompass disease for non-melanotic skin cancers.

Materials and Methods

33 biopsy proven SCCs or BCCs. 7 were controls (well demarcated), 26 were poorly demarcated (experimental group).

Gross lesion size recorded (GTV)

↓

ALA, MAL applied, left on 2 hours

↓

Lesion fluorescence recorded (CTV)
Compared to: 5mm expansion if well demarcated, or 10mm if poorly demarcated

↓

Lesion treated to PTV (CTV + 2-3mm), 50Gy in 20 fractions

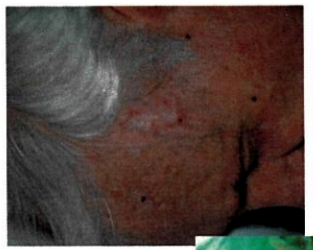


Figure 1: lesion under white light

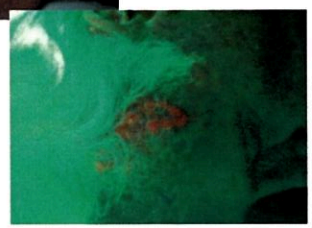


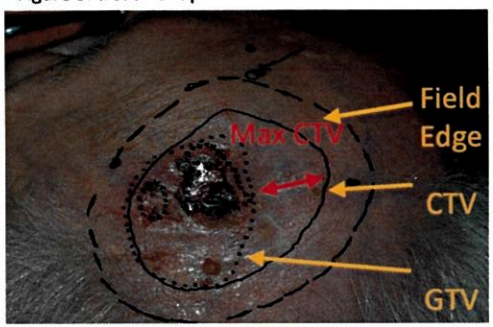
Figure 2: lesion after PpIX fluorescence

Results

Table 1: Average PpIX CTV margin

	Control	Study
Patients	7	26
Standard CTV	5mm	10mm
← →	p=0.50	p=0.01
Max PpIX CTV	9mm	14mm
	Nose	**Other**
Patients	17	16
PpIX CTV	14mm	14mm
	p=0.11	p=0.04
Multi-focal	94%	44%

Figure 3: treatment plan



Follow-up

Average follow-up was 14 months. 1 local recurrence, was excised Nov. 2012. Patient died 11 months post-excision. 1 distant recurrence – axillary metastases 1 month after completion. Died 7 months after therapy.

Conclusions

PpIX photo-delineation suggests that 10 mm margins may inadequately cover areas of subclinical disease in poorly demarcated skin tumors. Long follow-up may be necessary to determine if this increase in CTV is clinically significant. PpIX photo-delineation also demonstrated that most nasal lesions are multifocal and thus, treatment of the entire nose should be considered.

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