Intervention
In Australia 80% of all newly diagnosed cancers are skin.

• 3 main types:
  - Melanoma
  - Basal Cell Carcinoma (BCC)
  - Squamous Cell Carcinoma (SCC)

BCC & SCC are the most common skin cancers with 434,000 patients treated annually.

• Treatment modalities:
  - Radiation Therapy (RT)
  - Topical Chemotherapy
  - Surgery

Intensity-Modulated Radiation Therapy (IMRT) when compared to conformal techniques can reduce toxicity to surrounding tissues without compromising target coverage through concave dose distributions.

Case Study
A 71 year old female presented with Hyperkeratosis & painful superficial skin cancers on both lower limbs (Figure 1). The lesions were classical BCC and ulcerated SCC.

• History:
  - Bowen’s disease
  - Multiple superficial skin cancers
  - Surgeries & skin grafts
  - Topical Chemotherapy

• Treatment:
  - Surgery;
    - Considered ineffective
    - Result in extensive skin grafting
  - Topical Chemotherapy;
    - Patient declined (previous severe reaction)
  - Superficial RT;
    - High risk of chronic non-healing ulcers
  - IMRT;
    - Effectively treat planning target volume (PTV)
    - Optimised dose to normal tissue structures
Method

- **Prescription, Stabilisation & Volumes (Figures 2-4):**
  - 60Gy in 2Gy daily fractions
  - Feet first in Vacfix®. Legs abducted & treated separately.
  - PTV excluded posterior aspect of limbs to reduce the risk of gross oedema.
  - **IMRT PTV:** 2 mm SUP/INF expansion of the PTV
  - **Normal Tissue:** Leg cropped from IMRT PTV by 5 mm
  - Area to receive ~ <D50%

- **Planning:**
  - Eclipse version 10 treatment planning system
  - Anisotropic Analytical Calculation Algorithm (AAA)
  - 6 fields per limb avoiding the contralateral limb (Figure 2)
  - 1.0 cm bolus over anterior surface of each limb
  - Planned according to ICRU guidelines (+7%, -5%)
  - 3-Dimensional Conformal Radiotherapy (3DCRT) plan created for retrospective comparison with IMRT.

- **Daily Isocentre Verification:**
  - kV/kV orthogonal paired images – anterior obliques
  - Online zero-action threshold

- **Skin Toxicity:**
  - Measured against the National Cancer Institute: Common Terminology Criteria for Adverse Events (NCI: CTAE v3)\(^6\)
    - G0 = Normal
    - G1 = Faint Erythema/Dry Desquamation
    - G2 = Patchy Moist Desquamation
    - G3 = Moist Desquamation
    - G4 = Skin Necrosis or Ulceration

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\(^6\) National Cancer Institute: Common Terminology Criteria for Adverse Events (CTAE) v3.

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*Figure 2: Field arrangement and PTVs.*

*Figure 3: Stabilization and Tattoos.*

*Figure 4: IMRT Structures.*
Results

• IMRT Dosimetry (Figures 5-9):
  - ICRU Guidelines achieved (57Gy - 64.2Gy)
    - Left Leg  \( D_{98\%} = 57Gy \) & \( D_{2\%} = 63Gy \)
    - Right Leg \( D_{98\%} = 56Gy \) & \( D_{2\%} = 64Gy \)
  - Homogenous and conformal dosimetry achieved
  - Dose to posterior aspect of each limb minimised
    - Normal Tissue mean dose 34Gy (L) & 33Gy (R)

• 3DCRT Dosimetry:
  - PTV coverage compromised (Figures 5-7)
    - Left Leg \( D_{98\%} = 56Gy \) & \( D_{2\%} = 63Gy \)
    - Right Leg \( D_{98\%} = 57Gy \) & \( D_{2\%} = 63Gy \)
  - Posterior aspect of each limb irradiated (Figures 8 & 9)
    - Normal Tissue mean dose 49Gy (L) & 58Gy (R)

• Side Effects:
  - Pain present prior to & throughout RT.
    - Managed with pain relief
      - Oxycontin bi-daily & Endone as required
  - Skin reached G3 (Moist Desquamation) at week 4.
    - Hospitalised for management.
    - Received at least Bi-Daily silicon based dressings
Discussion

The results demonstrated that the 3DCRT plans were not capable of achieving the equivalent level or better homogeneity and PTV coverage when compared with IMRT.

Figures 10-15 demonstrate the progression of skin toxicities. At week 4, skin reaction reached a peak of G3 (Moist Desquamation) due to the radical treatment and bolus providing 100% dose to the skin (Figures 12 & 13). The healing process was affected by the patient’s co-morbidities of diffuse atheromatous and poor circulation. The patient was admitted to hospital during week 4 for continual skin care and pain management.

The patient’s 6 week post RT follow up showed complete resolution of skin toxicity (G0) (Figure 14). A small cancerous nodule remained on her left leg (within the treatment area) that will be surgically excised at later date.
**Conclusion**

This case study presented a complex radiotherapy approach for treating skin cancer encompassing the limbs. For this patient IMRT was the most advantageous option and resulted in favourable dosimetric results. Furthermore, the skin reaction reached G3 (Moist Desquamation) as a result of the radical treatment, co-morbidities and use of bolus. The skin had resolved by the 6 week post-RT follow up (*Figures 16 - 18*) and treatment was well tolerated.

This case study has demonstrated the feasibility and effectiveness of IMRT for skin cancers of the limbs for patients with similar history and background.

**References**


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