East of England Radiotherapy Network:

Skin Protocol V3.0

Contents

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EofE RTN Skin Protocol V3
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1.0 Indications and patient population

This protocol covers treatment in the following situations:

a. Squamous cell and basal cell carcinoma

b. Squamous cell carcinoma regional lymph node disease

c. Malignant melanoma

d. Merkel cell carcinoma

e. Kaposi's sarcoma

Cutaneous lymphoma – see Lymphoma protocol.

Angiosarcoma of the skin – see Sarcoma protocol.

Benign skin lesions not included in the scope of this document.

1.1 Curative treatment eligibility

1.1.a Inclusion criteria

- Histological confirmation of malignancy.
- Confocal microscopic or clinical diagnosis without histology is acceptable only with skin MDT agreement.
- Radiotherapy is preferred to surgery:
    - Lesions where surgery would result in poorer cosmetic or functional outcome.
    - Patients in whom surgery is difficult due to frailty, comorbidity, anti-coagulants, pacemakers etc; and where there is less risk of late radiation effects.

1.1.b Exclusion criteria

- Surgery is preferred in:
    - Younger patients
    - Lesions on mobile skin amenable to conventional excision
    - Upper eyelid
    - Advanced lesions involving bone / cartilage / tendons / joints.
    - Sites of poor vascularity e.g. the back and distal extremities.
    - Sites of burn, previous radiotherapy or overlap with previous fields.
    - Immunosuppressed, Gorlin's and Ataxia Telangiectasia.

1.1.c Pre-Radiotherapy investigations for curative patients

- Clinical photography of skin lesion.
- Patients for adjuvant radiotherapy of skin grafts / flap must have pre-operative photo available.
- Biopsy or confocal microscopy to confirm diagnosis.
- Large cutaneous lesions may require imaging with CT or MRI for depth assessment.
- CT staging for patient with regional lymph node disease.
- Operative histology for adjuvant lymph node radiotherapy.
- Adjuvant neck lymph node radiotherapy would require dental and nutritional assessment, as per the Head and Neck radiotherapy protocol.

2.0 Localisation

Localisation	Notes	
Patient position	Determined by the clinician / radiographer at planning.	Depending on treatment site and modality
Arm/ leg/ head/ thorax position	Determined by the clinician / radiographer at planning.	Depending on treatment site and modality
Immobilisation and supports	Custom lead mask, shielding and bolus may be required depending on site and technique.	
	Individual immobilisation may be required for skin cancers on limbs.	
Organ pre-requisites	As per protocols for adjuvant/curative lymph node radiotherapy to parotid/neck, axilla and inguinal/ pelvis	
Contrast	Required for lymph node radiotherapy	
CT acquisition	Slice thickness: as per departmental protocol	A CT scan may be required to assess depth – the patient should be scanned in a suitable position with the area of interest marked with wire.
	Scanning limits	Site dependent
	Scanning limits	Site dependent

3.0 Dose prescription & chemotherapy

Intent	Dose (Gy/#)	#/ week	Chemo/ comments
Squamous cell carcinoma and basal cell carcinoma – definitive or adjuvant treatment of the primary site	18-20Gy / 1#	1	Small tumours where cosmesis is unimportant
	32.5-35Gy / 5#	5	Usually small tumours <4 cm
	32Gy / 4#	1	Usually in elderly patients with small field size <4cm
	45Gy / 10#	3-5	Over 2-3 weeks, field size 4-6 cm diameter
	40.5Gy / 9#	3	Standard fractionation (BCC), field size 4-6 cm diameter
	50Gy / 15#	5	Field size 4-6 cm diameter, NOT in areas of poor radiation tolerance
	50 - 55Gy / 20#	5	Field size <6 cm diameter in areas of poor radiation tolerance 50Gy post-op
	60Gy / 30#	5	Field size >6 cm diameter in areas of poor radiation tolerance
	21Gy/ 3#	1	For SCC cutaneous and H&N
Squamous cell carcinoma and regional lymph nodes	50-60Gy / 25-30#	5	For adjuvant radiotherapy to lymph node regions considered at high risk of relapse after therapeutic lymphadenectomy
	65Gy / 30#	5	Where there are high risk pathological features in the head and neck region
Malignant melanoma	48Gy / 20#	5	Adjuvant radiotherapy to lymph node regions
	50-60Gy / 25-30#	5	

Intent	Dose (Gy/#)	#/ week	Chemo/ comments
Merkel cell carcinoma	60-66Gy / 30-33#	5	Definitive radiotherapy to the primary site and / or draining lymph node region
	50 – 55Gy / 20-25#	5	Adjuvant radiotherapy
	40-45Gy / 15#	5	
	50-60Gy / 25-30#	5	Adjuvant radiotherapy
Kaposi's sarcoma	20-30Gy / 10-15#	5	Large areas, soles of feet, mucosa
	16Gy / 4#	5	Other lesions
	8Gy / 1#	1	Single or small lesions <4cm

3.1 Dose prescription

- This depends on the site of the lesion, whether adjuvant or definitive, the need for good cosmetic result, travelling distance and age of the patient, and the sensitivity of surrounding tissues.
- Cosmesis improves somewhat with increasing fractionation.
- The doses above are commonly uses schedules and encompass the RCR fractionation guidelines (2022).

4.0 Target volumes

- Use standard nomenclature as per AAPM 263
- https://www.aapm.org/pubs/reports/RPT_263.pdf
- Target volumes should match agreed naming conventions unless there are operational reasons for use of other naming. PTV ProKnow nomenclature should be used for NHSE ProKnow Collections and Scorecard Templates for upload.

4.1 Curative / Adjuvant radiotherapy margins – Skin lesions

- **Superficial x-rays:**
    - GTV (tumour) or CTV (tumour bed/scar) to PTV margin.
    - Nodular BCCs - a 5-10mm margin is required.
    - Infiltrative / morphoeic BCCs – consider a 10-15mm margin.
    - SCCs - use a 10-15 mm margin.
    - Skin graft / tumour bed + 10mm margin to PTV – use pre-op photo for definition.
    - Depth required will depend on tumour thickness.
    - For superficial energies, CTV /PTV are considered equivalent.

- **Electrons:**
    - Margins as above .
    - Then add 5-10mm to create a FIELD MARGIN for electron penumbra according to local departmental protocol.
    - There is in-bowing of electron isodoses at depth.
    - Complex cases should be discussed with physics team.

4.2 Merkel cell carcinoma (MCC) curative / adjuvant radiotherapy

- **Primary Skin lesions**
    - To primary tumour if technically inoperable or patient frail.
    - Radiotherapy should be delivered to the primary disease site on the skin with a margin of normal skin around it.

- CTV includes the clinically apparent tumour (i.e. the GTV) or the site of the primary tumour if an excision biopsy has been performed, plus a 3cm lateral margin of normal skin.
- If the tumour is close to critical structures, then smaller margins can be used, e.g. 1-2 cm.
- The CTV depth of treatment should be down to the underlying aponeurosis of the muscle or periosteum of bone i.e. down to the underlying fascial plane as seen on the planning CT or felt with clinical palpation. In most cases it is expected this will be at least 10mm.

- **MCC - Adjuvant (post-operative) radiotherapy to the Primary Tumour site:**
  - If postoperative (adjuvant RT) is given, the doses recommended are as follows:
    - Clear microscopic surgical margins - 50Gy in 20 fractions in 4 weeks.
    - Involved positive resection margins - 55Gy in 20 fractions or 40Gy in 15 fractions in 3 weeks.

- **MCC - Regional nodal irradiation**
  - If regional nodal irradiation is given, the doses recommended are as follows:
    - Prophylactic (no lymph node dissection) - 50Gy in 25 fractions over 33 days.
    - Positive nodes 60Gy/30F or equivalent, or 50Gy/ 25F with 6Gy/ 3F boost to nodes.

4.3 Adjuvant skin radiotherapy - Lymph node basin

4.3.1 Axilla protocol

- **Pre-treatment processes:**
  - Immobilisation: Breast board technique with arms above head
  - Planning CT: IV contrast, wire the scar.
  - Pre-op imaging should be available with planning: consider fusion to aid volume definition.
  - Volume definition: Recommended CTV to encompass ipsilateral Axillary nodes level I, II, III, supraclavicular fossa in continuity.

PTV = CTV +10mm

Bolus over the scar in a 2cm width strip, 1cm depth (only to be applied at planning and treatment – not required at scanning: only required for melanoma)

RTOG atlas (White et al) can be used to aid volume:

Axilla Level I – Below (lateral to) pectoralis minor muscle (yellow)

Axilla Level II - Deep to pectoralis minor muscle (pink)

Axilla Level III - Deep to pectoralis minor muscle (blue)

Supraclavicular fossa (teal)

Superiorly: below the cricoid cartilage

Inferiorly: inferior edge of clavicle head

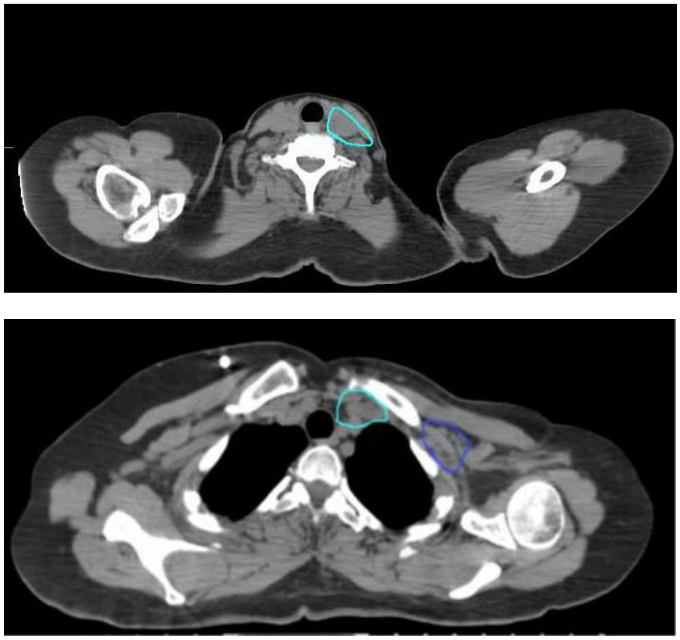
Anteriorly: sternocleidomastoid muscle (SCM)

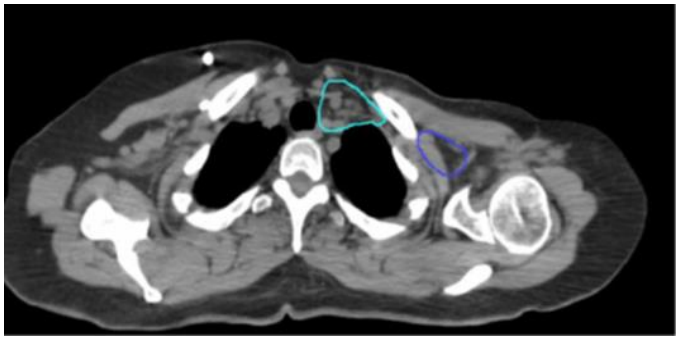
Posteriorly: scalene muscle

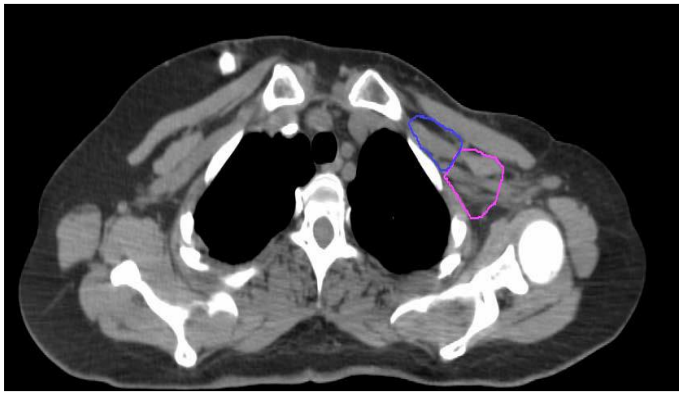
Laterally: SCM/junction 1st rib-clavicle

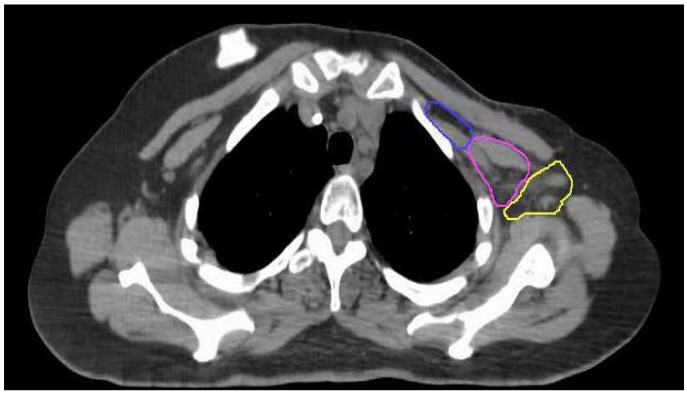
Medially: lateral edge of vertebrae

Figure from RTOG Atlas (White et al):









- Organs at risk and dose constraints:
  - Spinal cord – objective <40Gy, Constraint <44GY
  - Lungs – combined, V20 <15GY

- Treatment Processes
- Dose Prescription 48Gy in 20 #s over 4 weeks or 50Gy in 25 #s over 5 weeks
- Dose Homogeneity 95% to 107% of prescribed
- Energy 6MV

- Technique IMRT
- Prescription Point Median
- Verification Daily volumetric scan

4.3.2 Inguinal / Pelvis node protocol

Patients may have had metastases in inguinal and obturator/external iliac nodes. Volume definition is flexible to take into account the preoperative and operative findings (e.g. presence of very large nodes/extensive extracapsular spread). For women who wish to have a pregnancy, consider oophoropexy and outline uterus, cervix and vagina. For men, consider sperm banking.

- Pre-treatment processes:
- Immobilisation: Supine position, legs apart but comfortable. Genitals moved to contralateral side in reproducible position. Immobilisation is decided at CT on a patient specific basis: may need vacbag for IMRT.
- Localisation: CT plan, IV contrast, wire the scar. Pre-op imaging should be available with planning: consider fusion to aid volume definition.
- Volume definition: CTV should include the surgical bed and scar, superficial / deep femoral and inguinal nodal basins, elective nodes are the next echelon-external iliac chain up to L5/S1. Please note that internal iliac nodes do **not** need to be treated.
- PTV = CTV +10mm
- Bolus over the scar in a 2cm width strip, 1cm depth (only to be applied at planning and treatment – not required at scanning, only required for melanoma)

Summary of the guidelines for delineating nodal regions

- Common iliac 7 mm margin around vessels.
  Extend posterior and lateral borders to psoas and vertebral body.
- External iliac 7 mm margin around vessels.
  Extend anterior border by a further 10 mm anterolaterally along the iliopsoas muscle to include the lateral external iliac nodes.
- Internal iliac Not treated.
- Obturator Join external and internal iliac regions with 17 mm wide strip along the pelvic side wall.

- Inguinal nodes The volumes must cover superficial and deep inguinal lymph nodes of the femoral triangle and visible lymph nodes outside these boundaries.

- Superiorly: extend to the upper edge of the superior pubic rami
- Inferiorly: lower edge of ischial tuberosities
- Anteriorly: skin
- Posteriorly: pectineus, adductor long and iliopsoas muscle
- Laterally: medial edge of sartorius or iliopsoas muscle

Organs at Risk (OAR) and dose constraints

- Genitalia - V20Gy <50%
- Small Bowel - V35Gy < 150cc, V30Gy < 200cc
- Femoral Head - V44Gy < 5%
- Vagina and Uterus (in premenopausal women) ≤ 10Gy

- **Treatment Processes**
- Dose Prescription - 48Gy in 20 #s over 4 weeks or 50Gy in 25 #s over 5 weeks Consider 5Gy/3# boost if residual nodal disease.
- Dose Homogeneity 95% to 107% of prescribed
- Energy 6MV
- Technique IMRT
- Prescription Point Median
- Verification Daily Volumetric scan

4.4 Palliative radiotherapy

As per Palliative radiotherapy protocol.

5.0 Organs at risk and constraints

- For skin cancers in the head and neck region, the head and neck limitations for organs at risk will be applied.
- For nodal radiotherapy at other sites, other relevant dose constraints will be used – see section 4.3.

6.0 Planning process/ technique – Skin lesions

- Histology, clinical photograph, relevant imaging and new patient letter should be available at planning. If patient has been discussed at MDT, the outcome should be available.
- Informed consent should be obtained using the RCR skin radiotherapy form.
- Standard skin application technique is used if the patient is undergoing treatment using electrons or superficial energies.
- Mark-up: ensure patient is comfortably positioned under a bright light; use a fine-tipped skin marker pen to delineate the GTV, then add a margin for PTV (see section 4).
- Consult departmental depth dose charts and discuss with physics team for complex cases.

- **Superficial x-rays** – generally used for:
    - Superficial lesions with treatment depth < 1cm.
    - Where electrons are not indicated.
    - Avoid on ears and areas overlying bone but can be used on the nose for clinically suitable tumours.
- **Electrons** – generally used for:
    - Large areas over scalp, ears, other sites on body.
    - Minimum field size 4 cm.
    - Avoid near eyes and around complex air spaces.
- **Photons -** For deeper primary tumours or lymph node radiotherapy, photons may be used with IMRT or 3D conformal plans.

7.0 Peer Review/ Contour QA

- Peer review should occur for all adjuvant lymph node radiotherapy and a proportion of direct skin mark-ups. Consider inter-departmental video-linked peer review of skin mark-ups if necessary.
- A description of the planning process and of the peer review, including changes made, should be saved in the patient record.
- The peer review process and outcomes should be audited.

8.0 Target verification

Modality	Frequency	Match point	Additional information
kV planar/ MV planar/ CBCT	**Daily CBCT**		**Radical photon plans**

9.0 Side effects

All patients undergoing skin radiotherapy should complete the standardised consent form available on the Royal College of Radiologists' website.

National radiotherapy consent forms | The Royal College of Radiologists (rcr.ac.uk)

9.1 Possible early or short-term side effects	
Expected (50- 100%)	**Management (if appropriate)**
Mild tiredness	
Skin irritation, flaking, peeling, scaling, dryness, colour changes in treatment area	Topical application of water-soluble emollient or patient's own moisturising cream (providing it is Sodium Lauryl Sulphate free). 1% hydrocortisone topical application.
Skin may scab over several times	
Skin breakdown in the treatment area	
Hair thinning or loss in radiotherapy area	
Common (10- 50%)	**Management (if appropriate)**
Soreness	Non-prescription painkillers
Less common (Less than 10%)	**Management (if appropriate)**
Infection in treated area	Antibiotics
Site Treated	**Other specific risks**
Nose	Soreness, dryness, crusting or bleeding
Lip and cheek	Swelling or pain
Eyelids	Soreness around the eye

9.2 Possible late or long-term side effects	
Expected (50- 100%)	**Management (if appropriate)**
Permanent skin texture changes in the treatment area	
Skin colour changes in the treatment area	

9.2 Possible late or long-term side effects	
Permanent hair loss in and around the treatment area	
Common (10- 50%)	**Management (if appropriate)**
Telangiectasia	
Increased sensitivity of the treated skin to the sun and changes in temperature	
Less common (Less than 10%)	**Management (if appropriate)**
Chronic non-healing ulcer	Dressings. May require surgery.
Rare (Less than 1%)	**Management (if appropriate)**
Permanent damage to the cartilage or bone in the treated area	
A different cancer in the treatment area	
Site treated	**Other specific risks**
Nose	Runny nose or nose dryness
Eyes	Dry eye or watery eye Ectropion Cataracts – may require surgery
Skin grafts	Increased risk of skin graft failure

10.0 References

- Radiotherapy dose fractionation, Fourth edition | The Royal College of Radiologists (rcr.ac.uk)
- National radiotherapy consent forms | The Royal College of Radiologists (rcr.ac.uk)

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12.0 Amendment History

A record of changes in this document

Date	Updated version number	Previous version number	Page Number/ Section (updated version)	Details
01.05.24	V1.0			New Document
04.04.24	V2.0	V1.0	Section 3	21Gy/3# added Duplicate prescription removed
			Section 4.1	Correction on CTV/PTV
			Section 10	RCR reference updated Link to consent form updated

Date	Updated version number	Previous version number	Page Number/ Section (updated version)	Details
24.03.25	V3.0	V2.0	Section 3	Dose table updated to ensure clarity for merkel cell carcinoma. 'Target size' updated to 'field size'.
			Section 4	Target Volume section updated
			Section 11	Membership updated