

Clinical Protocol for Radiotherapy for Keloid Scarring

UK

1. Introduction and Purpose

This document guides the GCUK recommended radiotherapy protocol for the treatment of keloid scarring

2. Terms and Definitions

2.1. Definition

Keloid scars are common benign dermal fibro-proliferative growths and represent abnormal healing responses to injury. They result in raised scars that may be red or hyper-pigmented. They are often cosmetically disfiguring but can also cause itching and pain. In contrast to hypertrophic scars, they extend outside the confines of the original wound and do not spontaneously regress.

Scars can be scored as to their likelihood of being keloid scars as apposed to mature or hypertrophic scars via the Japan Scar Workshop scale, considering factors such as ethnicity, size, elevation and symptoms [1].

They may occur in response to relatively minor trauma, such as ear piercing, and particularly occur on the upper chest, shoulders and earlobes. They are more common in dark-skinned patients, but also occur at a lower rate in patients with light skin. They are most common between the ages of 10 – 30 years, but also occur at a lower rate outside of this age range.

2.2. Management options

Management of keloids scars often involves multiple therapies [1]. In principle, treatment should start with the least invasive options first, for instance steroid plasters, make-up and preventative strategies. If this is not effective, then further treatment often includes combinations of the following:

1. Intra-lesional corticosteroid injection (generally Triamcinolone): These are often used as a primary treatment to flatten scars and can also be used adjuvantly after surgery to prevent recurrence.
2. Surgical excision: While other treatments can reduce the height of the scar, surgery is the only treatment that can reduce the width of the lesion. When surgery is used as the sole modality, the recurrence rate is high, for instance Lawrence et al. reported a recurrence rate of 70% [2]. Also, surgery can

result in a keloid scar that is larger than the original lesion. It is therefore generally used only as part of multi-modal therapy, for instance with post-excision intra-lesional steroid injections or with radiotherapy.

3. Radiotherapy: most studies support radiotherapy within 24-72h of surgery, either using superficial xrays or electrons. The evidence of radiotherapy as monotherapy is even less and limited to one retrospective study only [11].

2.3. Post-operative radiotherapy

Most studies of radiotherapy for the treatment of keloids are retrospective case series of the combination of surgery and postoperative radiotherapy. Recurrence rates vary widely, but representative figures are 7% at 2 years, 16% at 5 years, and 27% at 10 years [3-6]. The radiation is generally delivered with superficial/orthovoltage X-rays or with electrons within 24 - 72 hours of surgery, although several studies and guidelines do not support the need for early postoperative treatment [1,6].

These studies represent an evidence base supporting the effectiveness of radiotherapy when given postoperatively. Most studies are retrospective and/or have small numbers, insufficient follow-up, unclear outcomes, and detail the treatment of heterogeneous groups of patients including those with heterotrophic scars. However overall, they seem to compare favourably with historical recurrence rates of 45 - 100% after excision alone.

There are several trials comparing radiotherapy with other treatments, although both suffer from low patient numbers:

1. Emad et al. performed a prospective non-randomised comparison in 26 patients with 76 keloids of (i) excision with radiotherapy within 48 hours using 12Gy in 3 fractions with 120kV radiotherapy versus (ii) cryotherapy with post-treatment intralesional triamcinolone injection. After one year of follow-up, 18.2% of the patients in the radiotherapy group had recurrence, compared with 28.1% in the cryotherapy group [7].
2. Sclafani et al. randomised 31 patients after excision of earlobe keloids to steroid injections or to radiotherapy. They found that at "a minimum of 12 months" after radiotherapy 12.5% recurred, compared with 33% after steroid injections [8].
3. Biljard et al. randomised 26 patients to primary cryotherapy alone vs. excision with adjuvant treatment (steroids or brachytherapy) and found that cryotherapy was inferior to excision + brachytherapy in resistant keloids [9].
4. Khalid et al. randomised 60 patients with ear keloids having excision to either 5FU and steroid injections or to radiotherapy early post-operative radiotherapy. They found less recurrence in the 5FU+steroid arm, but there were several issues with the study, including short follow-up, low radiotherapy dose, and that the radiotherapy arm did much worse than expected [10].

2.4. Primary radiotherapy

There is weak evidence for radiotherapy as monotherapy, for instance Malaker et al [11] performed a retrospective analysis of 86 keloids treated in 64 patients and found that 97% showed significant regression at 18 months after the treatment.

3. Patient selection/Inclusion criteria

3.1. Post-operative

Radiotherapy is often given within 24-72h hours of keloid excision in order to prevent regrowth, and this would necessitate careful advance co-ordination of the date of surgery and the date of the radiotherapy in order to achieve this. The skin and benign MDT should be the forum whereby decisions about surgery and radiotherapy together with associated timelines should take place.

However, there is evidence to show that early radiotherapy is not more effective than later radiotherapy [6], in particular that it is reasonable to wait up to 72 hours or even longer after surgery without increase in recurrence rate. While it is generally advisable to treat with radiotherapy within 24 hours, there are circumstances where it is reasonable to wait longer, for instance up to 72 hours if it is not possible to coordinate the surgery and radiotherapy dates; or longer than 72 hours if there is worry about wound healing where primary wound closure is not achieved.

3.2. Primary treatment

Radiotherapy is given as monotherapy in order to shrink the keloid scar and/or reduce symptoms (e.g. pain and itching). This option should only be offered in exceptional circumstances (eg no surgical capacity, patient declines surgery, surgeon deems lesion inoperable) and should always be supported by a skin and benign MDT decision. Patients should be consented that the evidence of success for radiotherapy monotherapy is poor.

3.3. Repeat radiotherapy

Consideration should be given to surgery for recurrent lesions whether patients have had previous radiotherapy or not. If radiotherapy was previously given, then it may be repeated after surgery as per section 3.1. There is poor evidence for repeat radiotherapy as monotherapy and it should only be considered in the context of a clinical trial.

4. Radiotherapy Dataset

Essential:

1. Radiotherapy Referral (paper or electronic) detailing site and laterality.

2. For electrons - Electron Prescription and Planning form (PHY-TEM-002) completed by oncologist detailing site and laterality
3. Agreement to treat
4. Clinical photography of lesion showing site and laterality
5. Skin and Benign MDT discussion
6. Referral letter from referring specialist to Oncologist where available.
7. Clinic annotation from consultant stating site and laterality.

5. Scheduling of Patients

For post-operative patients, every effort will be made to treat on the same day at the mark-up. For patients treated with radiotherapy monotherapy, a next day treatment is available. Cases may start on any weekday.

6. Patient Positioning and Localisation

Patient positioning, immobilisation, shielding and bolus requirements will vary depending upon the area being treated.

Therefore, only appropriately trained Therapy Radiographers and physics staff should be present during the mark-up and treatment sessions.

7. Target Volumes

7.1. Post-operative

CTV = surgical scar

PTV = surgical scar + $\geq 5\text{mm}$ [1]

Field = an appropriate margin added for electrons (no margin for kV)

7.2. Monotherapy

GTV = keloid scar

CTV = GTV + $\geq 5\text{mm}$

PTV = CTV

Field = PTV + appropriate margin added for electrons (no margin for kV)

7.3. Organs at Risk

Every effort should be made to shield out areas at risk for radiation-induced carcinoma, for instance breasts, thyroid, although this will not always be possible.

8. Prescription Dose (options)

Indication	Dose	Reference number
Post-operative: Single Fraction	10Gy in 1 fraction	[5]Ragoowansi
Post-operative: Risk adapted fractionated approach	Areas of low recurrence risk (earlobes): 10Gy/ 2#/ 5Gy per fraction over 2 days 8Gy/ 1 # over 1 day	[1 and 13]
	Areas of high recurrence risk (anterior chest wall, scapula, suprapubic): 20Gy/ 4#/ 5Gy per fraction over 4 days 18Gy/ 3#/ 6Gy per fraction over 3 days	
	Any other area: 15Gy/ 3#/ 5Gy per fraction over 3 days 15Gy/2#/ 7.5Gy per fraction over 2 days	
Primary Radiotherapy	16Gy/ 4 # over 9 months (one fraction given every 3 months)	[12 and 14]
	37.5Gy/ 5 # over 5 weeks (one fraction given every week)	[11]
Recurrent	single fraction after surgery as above	[12]

9. Pre-treatment Verification/Checks

- Treatment verification is to be undertaken usually 1 day prior to treatment where pathway allows.

10. Treatment Delivery

- Radiotherapy Treatment Policy (RT-POL-014)
- Radiotherapy Assessments Policy (RT-POL-300)
- Radiotherapy Chat Check assessment work instruction (RT-WI-406)
- Radiotherapy weekly patient assessment work instruction (RT-WI-407)
- Patient Identification Procedures for Radiotherapy (RT-SOP-003)

11. Surveillance

- Follow up appointments – at 2 - 3 months post-radiotherapy by treating radiation oncologist

12. References

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Revision History

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1.0	September 2020	Clinical Oncologist Richard Shaffer Skin and Benign Specialist radiographer: Rory Walford	New Document
1.1	October 2020	Penny Kechagioglou, GenesisCare Chief Medical Officer	Revision of radiotherapy monotherapy indications, radiotherapy dataset and prescription doses
1.2	November 2020	Skin and Benign Specialist radiographer: Rory Walford	Dose and fractionation of 15Gy in 2#s added to protocol