Assessment and management of radiotherapy-induced skin reactions

KEY WORDS
- Cancer therapy
- Oncology
- Radiotherapy-induced skin reaction

A severe radiotherapy-induced skin reaction (RISR) can delay ongoing radiotherapy treatment. The reaction can also be painful and socially isolating for the patient. Several risk factors for RISR have been identified, enabling prophylactic intervention. However, if a skin reaction does occur, an appropriate assessment to guide management and prevent further skin breakdown is required. This article outlines the current guidelines for RISR assessment and management and presents two case studies.

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The aetiology of the radiotherapy-induced skin reaction (RISR) has been well documented (Hollinworth and Mann, 2010; Trueman and Taylor, 2014; Bostock and Bryan, 2016). In radiotherapy, external beam radiation is delivered in small doses (fractions) periodically over time. In theory, this allows healthy basal cells to recover between treatments. If skin damage occurs, this is cumulative, with symptoms of RISR usually showing 10–14 days after the start of treatment (Trueman, 2015).

- As more fractions are given, further skin damage occurs; new cells reproduce before old dead cells shed, leading to dry desquamation
- Where no new cells replace dead cells moist desquamation occurs; often called radiotherapy-induced moist desquamation
- The severity of skin reactions may increase between 7–10 days post treatment, corresponding with the time it takes for damaged basal cells to reach the outer epidermis (Trueman, 2013).

RISK FACTORS FOR RISR

A number of intrinsic and extrinsic factors are thought to increase the risk of RISR (Censabella et al, 2017). These include age, diabetes, obesity (excess fatty tissue can impede healing), skin infection (basal cells can be damaged by bacterial or fungal infection) and location of treatment (higher doses of radiation reach the skin folds) (Vuong et al, 2004; Gould et al, 2015). Chemical irritants such as deodorants, perfume and talcum powder can exacerbate a RISR (D'haese et al, 2005). In addition, high doses of radiation to large treatment fields increases the risk of skin damage (Harris et al, 2011)

RISR ASSESSMENT

The Radiation Therapy Oncology Group (RTOG) developed a skin assessment scale for RISR (Cox et al, 1995). The stages are outlined in *Table 1.*

According to the Princess Royal Radiotherapy Review Team, Trueman (2014), the overarching aims of RISR management are:

- Maintain the integrity and hydration of the skin.
- Reduce the potential for further exacerbation of RISR.
- Promote comfort and compliance.
- Reduce pain and protect from trauma.
- Prevent infection.

Recommended treatment rationale have also been made for each RTOG stage (Princess Royal Radiotherapy Review Team, Trueman, 2014):

- RTOG 0 – maintain the integrity and hydration of the skin.
- RTOG 1 – maintain the integrity and hydration of the skin; treat itchy skin; reduce pain, soreness and discomfort.
- RTOG 2a – as for RTOG 1.
- RTOG 2b – Promote comfort. Reduce risk of complications of further trauma and infection. Reduce pain, soreness and discomfort.
- RTOG 3 – Promote comfort, reduce risk of complications of further trauma and infection.

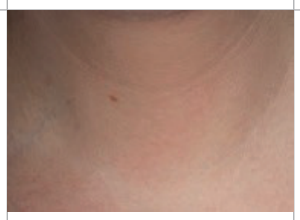
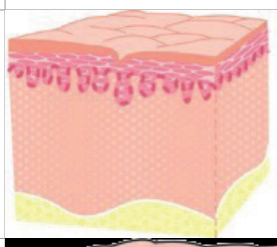
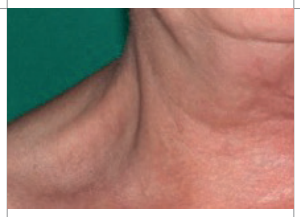
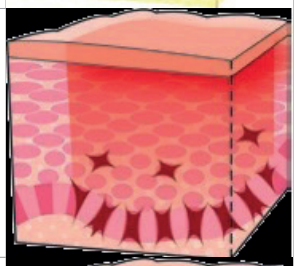
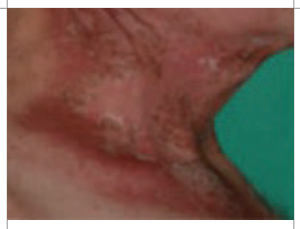
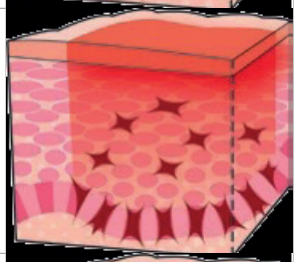
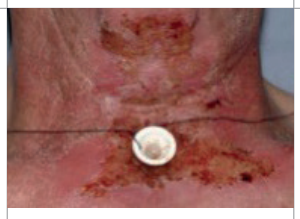
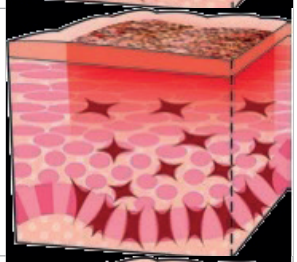
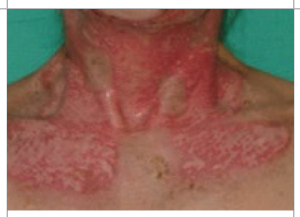
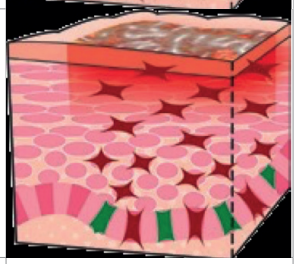
CASE STUDIES

The following case studies outline the presentation and treatment given to two patients who experienced a RISR and were subsequently referred to the tissue viability team. Their treatment is discussed in relation to current recommendations for RISR management.

Patient 1

Mr A's medical history included a chronic cough,

Table 1. RTOG Grading Tool (reproduced with permission from Trueman and the Princess Royal Radiotherapy Review Team, 2014).

Stage	Skin reaction	Assessment/observation	Effects of radiotherapy on skin cells
RTOG 0		No visible change to the skin.	
RTOG 1		Faint or dull erythema. Mild tightness of skin and itching may occur.	
RTOG 2a		Bright erythema/dry desquamation. Sore, itchy and tight skin.	
RTOG 2b		Patchy moist desquamation. Yellow/pale green exudate. Soreness and oedema.	
RTOG 3		Confluent moist desquamation. Yellow/pale green exudate. Soreness with oedema.	
RTOG 4		Ulceration, bleeding, necrosis (rarely seen).	

Epithelial cells in basal membrane damaged by radiation. Damaged cells from basal membrane migrating upwards. New epithelial cells generated in basal membrane.

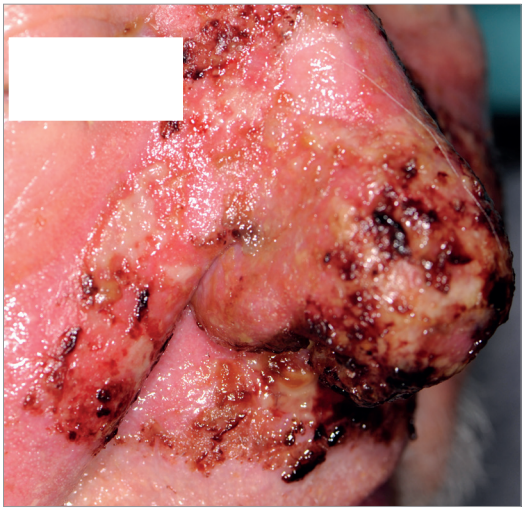


Figure 1. Mr A on initial presentation to the tissue viability team

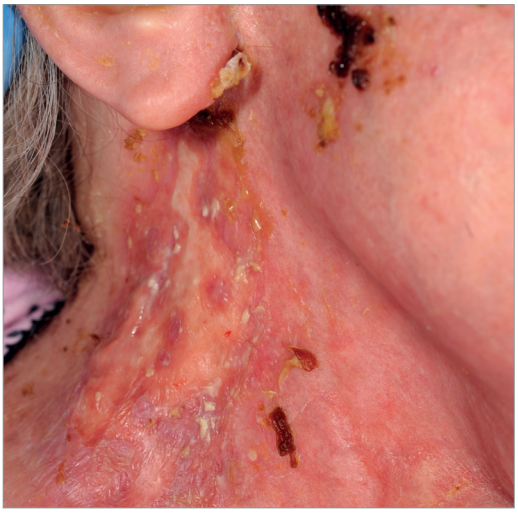


Figure 2. Mrs B's wound 10 days after use of honey-impregnated dressing

macular degeneration, asthma, and basal cell carcinoma. Radical radiotherapy had been given to treat a malignant neoplasm of his right columella (skin and cartilage between the nostrils) and right nasal vestibule; 55 gray in 20 fractions over 4 weeks (a gray is a unit of measurement of absorbed radiation dose in tissue; Morgan, 2014). He was referred to the tissue viability team by hospital-based nurses for management of a facial and nasal RISR (*Figure 1*), having completed his radiotherapy some 6 days earlier. The timeframe for the development of his RISR illustrates how RISRs can worsen after radiotherapy treatment, as radiation accumulates.

Mr A stated that his skin reaction (RTOG score 2b) was not painful, just 'sore'. Oral antibiotic therapy (flucloxacillin) had been prescribed whilst Mr A was an inpatient, as purulent exudate was evident. Mr A's CRP (a marker of the inflammatory process) was raised at 44.3 and his haemoglobin was 137 (indicating that he was not anaemic). Nevertheless, he had been referred to a dietitian as he was eating only small amounts of soft food.

Gauze soaked with Microdacyn® (Oculus Technologies), a super oxidised cleansing solution containing hypochlorous acid, was applied for 10 minutes three times daily to aid gentle removal of devitalised tissue and reduce the skin bioburden. Various absorbent dressings were applied to manage exudate, including PolyMem® (Aspen Medical Europe) and Mepilex® (Mölnlycke Health Care). These were subsequently removed, due to being uncomfortable and indiscreet – Mr A stated he must look like the "Phantom of the Opera!"

A skin protectant was then used (iLEX® ointment, iLEX Health Products), but soon discontinued as Mr. A experienced a 'stingy' sensation when it was applied. Of note, iLEX® contains zinc and thus could not have been used during Mr A's radiation treatment. Mr A found Diprobase® ointment (Bayer) to be 'soothing'; hence this was applied after skin cleansing.

In Mr A's case, treatment focused on skin care in order to manage pain and infection associated with his RISR.

Patient 2

Mrs B had received radiotherapy after a right radical parotidectomy and neck dissection for poorly differentiated carcinoma. She was referred by hospital-based nurses to the tissue viability team with a RISR (RTOG score 2b) on her neck 1 week after completion of radiotherapy (*Figure 2*). The timeframe of the deterioration of this significant RISR is congruent with the fact that the severity of a reaction may increase between 7–10 days after treatment has been completed (Trueman, 2015).

Mrs B's medical history included hip and knee osteoarthritis, hyperthyroidism, diverticular disease, oesophageal ulcer, hypertension and leg ulceration. Mrs B was taking small frequent soft meals and snacks, and she had been referred to the dietitian. Analgesia was delivered via a syringe

driver and initially Mrs B appeared withdrawn. Microdacyn was soaked in gauze and applied prior to dressing renewal (to reduce the bioburden of inflamed, broken skin and to induce a soothing, cooling effect). Intact skin was moisturised with Diprobase ointment in keeping with local and RTOG guidelines.

A honey-impregnated sheet, L-Mesitran® Hydro (Aspen Medical Europe), was advised by the tissue viability nurse as a primary antimicrobial dressing, as the wound was colonised with *Pseudomonas*. This honey-hydrogel sheet donates moisture to the wound bed, rehydrating dry, sloughy tissue and aiding gentle, autolytic debridement of slough. L-Mesitran Hydro partially disintegrates as it absorbs wound exudate and thus requires a secondary, absorbent dressing. Mepilex foam (feathered for conformability) was used and secured with a light retention bandage.

Mrs B was comfortable with this dressing regimen which required renewal on alternate days during her hospital stay. In addition to the positive RISR treatment outcomes (slough removal and granulation formation), Mrs B seemed less withdrawn during a subsequent tissue viability review, in which she discussed participating in art therapy.

Management of both cases

While Mr A and Mrs B were undergoing radiotherapy (on an inpatient basis) their skin was assessed prior to each treatment (and more frequently, as required) by nurses, radiographers and the medical team involved in their care. Skin care education was given by members of these professional teams at the outset of radiotherapy and as required during treatment.

Diprobase cream was used initially to prevent/manage skin redness. Subsequently, Diprobase ointment was applied when erythema became more severe. Such care, given according to local protocol, reflects RTOG guidelines – in particular, with respect to avoiding the use of aqueous cream and other products containing sodium lauryl sulphate (SLS; Society of Radiographers, 2014).

On discharge from hospital, Mr A's and Mrs B's GPs and community nursing teams were informed of their respective RISR management plans, thereby facilitating continuity of care until resolution of RISRs became evident.

DISCUSSION

Trueman (2015) recommends the use of a SLS-free moisturiser for prevention and management of RISR RTOG 0–2a. However, a survey undertaken by the Society of Radiographers (2014) found that RISR care in UK radiotherapy departments was variable and that aqueous cream containing SLS was still used prophylactically, or to alleviate erythema (81% and 65%, respectively) despite the adverse effects of SLS (Medicines and Healthcare products Regulatory Agency, 2016).

The aim of treatment for RTOG 0 is to promote skin hydration and maintain skin integrity (Bostock, 2016; Bostock and Bryan, 2016). Non-specific advice, such as follow local skin care guidelines, use unperfumed preparations and apply moisturiser, is frequently cited (Hollinworth and Mann, 2010; Glover and Harmer, 2014; Bostock, 2016; Bostock and Bryan, 2016). The following emollients are recommended: E45 (Forum Health Products), Diprobase cream, Cavilon™ durable barrier cream (3M) and Sorbaderm® non-sting barrier cream (Aspen Medical Europe), as suggested by several authors (Hollinworth and Mann, 2010; Laffin et al, 2015; Scott, 2015).

A build-up of cream or ointment can act as a bolus, thereby increasing the radiotherapy dose above a therapeutic level. Thus, emollients that are less easily absorbed, such as petroleum jelly, are not recommended (Hollinworth and Mann, 2010).

Villaquiran (2015) suggests that emollients be applied immediately after therapy (and not within 4 hours prior to treatment) in order to reduce the risk of deviation from the prescribed radiation dose.

Emollient therapy is important in reducing the incidence and severity of skin damage associated with radiotherapy (Society of Radiographers, 2014). Nevertheless, RISRs can occur despite the use of suitable emollients.

It must be acknowledged that no one topical application or wound dressing is deemed superior for RISRs. Nevertheless, if treatment choice is based on a sound rationale, RTOG skin reactions may be effectively managed, as outlined below.

RTOG 1

The recommended care of grade RTOG 1 RISRs primarily involves moisturising the skin (Society of Radiographers, 2014). However, as a prophylactic

measure, Hollinworth and Mann (2010) suggest that Cavilon barrier film may be applied to areas of skin most at risk in the treatment field. In the author's workplace, Cavilon barrier film is predominantly used on moist skin, such as the perianal area and between skin folds.

RTOG 2a

Application of an emollient is recommended to moisturise dry, flaky skin associated with RTOG 2a RISRs (Society of Radiographers, 2014). If pruritus is experienced, use of a mild topical steroid (hydrocortisone 1%) is recommended in conjunction with emollient therapy (Hollinworth and Mann, 2010; Glover and Harmer, 2014; Villaquiran, 2015; Bostock, 2016; Bostock and Bryan, 2016).

Dressing choices include absorbent and conformable ranges – PolyMem, Mepilex (foam and transfer), Mepitel® (non-adherent; Mölnlycke Health Care), Duoderm® (thin, flexible hydrocolloid; ConvaTec), Actiform Cool® (soothing, sheet hydrogel; L&R Medical UK) and Mepitac® (non-traumatic, non-sensitising tape; Mölnlycke Health Care), as outlined by several authors (Bradbury et al, 2008; Hollinworth and Mann, 2010; Scott, 2013, 2014; Morgan, 2014; Trueman and Taylor, 2014; Denyer et al, 2015; Bostock, 2016; Bostock and Bryan, 2016).

PolyMem dressings contain a surfactant and glycerine, both of which promote wound cleansing. The pain and discomfort related to a RISR may be relieved by glycerine, which also acts as a moisturising agent. This highly absorbent dressing may be adapted to fit a range of difficult-to-dress areas, such as the head, neck, breast, axilla, perineum and genitalia. Rahemtulla et al (2006) advocate the use of Actiform Cool sheets to facilitate a moist wound healing environment and relieve pain associated with RISRs.

Mepilex and Mepitel are silicone dressings with Safetac® technology. They adhere to intact skin, but not the wound bed, minimising pain on removal. Safetac also reduces the risk of skin stripping (Glover and Harmer, 2014). Both attributes are advantageous in the management of fragile skin associated with RISRs.

Bostock (2016) and Bostock and Bryan (2016) suggest that Duoderm spots or strips can stay in place for 3 to 5 days, depending on exudate levels. Hollinworth and Mann (2010) add that Duoderm should only be used if daily radiotherapy has been completed, so as to avoid skin stripping by repeated removal of hydrocolloid adhesives.

It is usual practice to remove dressings during radiotherapy in order to avoid a potential build-up of radiotherapy dose. However, in a fungating wound, dressings may be left in place during radiation treatment and this is taken into account when planning radiotherapy (Hollinworth and Mann, 2010; Trueman and Taylor, 2014).

RTOG 2b

Cavilon wipes are normally used to cleanse and moisturise skin after an incontinence episode. In the author's experience, these wipes have also been useful in the cleansing and moisturising of RTOG 2b skin reactions of the anal, rectal and vulval areas and axilla/mammary skin folds.

Absorbent dressings recommended to manage moist desquamation and associated exudate include Aquacel® Extra™ (ConvaTec) and Eclypse® (Advancis Medical; a superabsorbent), plus those mentioned above (Bostock, 2016; Bostock and Bryan, 2016).

Hollinworth and Mann (2010) suggest the use of honey-impregnated dressings (Actilite®, Advancis Medical), but caution that topical honey may be associated with the exacerbation of wound-related pain. Nevertheless, a honey hydrogel dressing (Medihoney® HCS, Derma Sciences Europe) has been shown to enable a reduction in wound related pain, significant autolytic debridement of slough and necrotic tissue, reduced exudate levels and enable atraumatic removal in the management of an ulcerated RISR (Porter and Rasmussen, 2016).

A combination of a hydrogel (Intrasite® Gel 8g, Smith & Nephew) and morphine (10mg) has been advocated for the management of wound-related pain (Bostock, 2016; Bostock and Bryan, 2016). In the author's workplace, morphine sulphate 10mg in 10ml Intrasite Gel pre-filled syringes are available as an unlicensed 'special' product, to manage pain from malignant and non-malignant ulceration for patients receiving palliative care. This product may only be prescribed by a patient's consultant in palliative medicine or a GP.

RTOG 3

Confluent moist desquamation associated with

this RTOG stage 3 of RISR is managed by any of the absorbent dressings mentioned previously. If wound infection is evident, an antimicrobial product may also be indicated (Hollinworth and Mann, 2010; Glover and Harmer, 2014). The benefits associated with honey as a topical antimicrobial have already been mentioned (Porter and Rasmussen, 2016).

Antimicrobial products impregnated with silver, such as Mepilex® Ag and silver sulfadiazine cream, may only be used post-radiotherapy treatment, as metal absorbed into the skin can cause a bolus radiation effect (Hollinworth and Mann, 2010).

RTOG 4

This severe reaction is rarely observed and treatment is tailored according to the extent of skin damage (Hollinworth and Mann, 2010). Thus, any of the aforementioned dressings, emollients and skin protectants may be indicated.

Odour associated with ulceration can be distressing. Odour-absorbing carbon dressings such as Clinisorb® (CliniMed) or Carboflex® (ConvaTec) may be helpful in management (Bostock, 2016; Bostock and Bryan, 2016).

CONCLUSION

Cancer treatment is challenging for patients. Side-effects such as RISR may be managed more easily if an appropriate explanation regarding their development, timespan and management is offered by the healthcare team. Educating patients and significant others is an essential aspect of radiotherapy.

Patients who present with a RISR may feel embarrassed about their appearance and anxious about a possible delay in therapy. They may also have significant pain related to their skin reaction. Offering emotional support and taking time to ascertain whether they have any concerns about their treatment is also an important part of patient-centred care.

Caring for patients with a RISR entails much more than simply choosing an appropriate cream or dressing to alleviate symptoms. It is important that healthcare practitioners are informed about treatment options for RISRs of various grades.

It is hoped that this review of evidence regarding the management of RISRs will guide practitioners with respect to making an holistic skin assessment and commencing appropriate, timely and effective care. WUK

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