Managing acute skin reactions to radiotherapy treatment


Summary
Promoting tissue viability and caring for skin damaged as a result of radiotherapy are critical to the quality of care patients receive. However, few nurses recognise fully the effect of radiotherapy on tissue viability and wound healing. This article considers the causes and types of skin damage resulting from radiotherapy treatment that nurses may encounter, and how this damage can be graded. Based on the extent of skin reaction to radiotherapy, management options are explored, illustrated by a case study. A guide to product selection, derived from the authors' experience, is presented.

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These professional concerns provided the impetus for a collaborative initiative by the authors – a nursing lecturer and a specialist Macmillan radiographer – with the overall aim of highlighting the issues related to wound care and tissue viability for radiotherapy patients.

This article considers the causes and types of skin damage resulting from radiotherapy treatment and grading of this damage. The gap in nursing knowledge related to promoting tissue viability when caring for radiotherapy patients will be explored, and then underpinned by best practice with the aim of optimising future care. The challenges sometimes experienced by clinicians caring for this group of patients will be illustrated by a case study, culminating in an evidence-based tool to guide practice. Late reactions to skin radiation resulting in necrosis and ulceration may occasionally occur, but are beyond the scope of this article.

Radiotherapy and tissue damage
Radiotherapy is known to cause skin damage and complex skin changes can occur in the short, intermediate or long term following treatment. The use of radical treatments that are associated with dose escalation and the evolution of more advanced techniques, such as intensity-modulated radiotherapy, mean many patients will have a skin reaction. An estimated 87% of patients can expect a moderate to severe skin reaction (Robson and Cooper 2009), with about 10-15% of patients progressing to moist desquamation (Hornsby et al 2005).

The College of Radiographers (2001) produced a summary of intervention for acute radiotherapy-induced skin reactions in cancer patients. This acknowledged inconsistencies in the UK with regard to skin care and management. It supported the practice of giving patients verbal and written information about skin reactions and self-care strategies. The College of Radiographers (2001) provided recommendations for reducing trauma and irritants to the irradiated skin. This

MANAGING ACUTE SKIN reactions to radiotherapy treatment is essential in radiotherapy centres, hospital wards and the community to provide optimum patient care. Radiotherapy is an established cancer treatment and is given to more than 50% of cancer patients (Naylor and Mallett 2001). Sub-optimal care is not an option, yet many therapy radiographers do not have specific expertise in wound care and few nurses recognise fully the effect of radiotherapy on tissue viability and wound healing. There are centres of excellence, and best practice guidelines have been developed by some organisations, but in many acute hospitals and primary care settings therapy radiographers and nurses practise independently in relation to tissue viability and wound care. Traditional practices and care based on personal preference are common, despite increased emphasis on evidence-based practice.

NURSING STANDARD
included protecting against sun exposure and reduction of mechanical irritants such as friction, shaving, rubbing and avoiding the use of adhesive tape in the treatment area. In 2004 a best practice statement was produced by NHS Quality Improvement Scotland (NHS QIS) to offer guidance on good practice, consistency and promotion of a cohesive approach to the care of radiotherapy patients (Glean et al 2001, Hornsby et al 2005).

Short-term tissue damage resulting from radiotherapy may include erythema, dry desquamation, moist desquamation and necrosis. The acute phase of skin damage during radiotherapy will depend on a number of extrinsic (treatment related) factors such as the dose – skin reactions increase with dose, fractionation – the number and interval of radiotherapy treatments, energy and type of radiation beam, and certain chemotherapy agents (Bomford and Kunkler 2003). In addition, intrinsic (patient related) factors such as skin folds in treatment areas, high body mass index (BMI), malnourishment, smoking and wound infection also affect tissue damage (Kedge 2009).

There are a number of skin assessment tools to help with the grading of radiotherapy reactions. The most commonly known, and that which has been adopted by the College of Radiographers, is the radiation therapy oncology group (RTOG) scale (Glean et al 2001). This scale is recorded weekly by the therapy radiographers when treating or reviewing patients. An RTOG grade or score of 0 would show no visible change in the skin in the treatment area and an RTOG grade or score of 1 would indicate faint erythema.

**Erythema**

The term ‘erythema’ is Greek for ‘redness’. The skin looks pink or reddened with slight inflammation. This is a characteristic acute radiotherapy reaction on the skin and represents a normal physiological response to radiation therapy (NHS QIS 2004). The area may feel hot and patients report itching and discomfort.

The erythema itself can vary from a faint or dull erythema (RTOG grade 1) (Figure 1) to a tender or bright erythema (RTOG grade 2a) (Figure 2). Patients often refer to this as ‘sunburn’.

**Dry desquamation**

This condition describes dry, scaling, flaking skin or superficial flaking. Patients may report sensations of itching and burning in the area. Radiological damage affects regeneration of the skin. In an attempt to replace damaged cells, the skin compensates by increasing mitotic activity, but the cells produced tend to be immature and easily traumatised; if new cells reproduce faster than the old cells can shed, the skin becomes scaly and thickened (RTOG 2a) (NHS QIS 2004) (Figure 3). Care of the skin is recommended to prevent skin breakdown and relieve burning and itching sensations (O’Regan 2008).

**Moist desquamation**

This occurs if dead epidermal cells shed before new cells have replaced them (NHS QIS 2004). When radiation-associated damage is severe enough, the inflamed epidermis blisters and sloughs, leading to a painful area of epidermis; this is often accompanied by exudate production. The moist desquamation can vary from patchy (RTOG grade 2b) (Figure 4) to confluent moist desquamation (RTOG grade 3) (Figure 5).

It is important to recognise that irradiated skin will be altered, and these fibrotic changes result in the area being permanently prone to
nursing homes completed the survey. The 43 responses from healthcare assistants, midwives, podiatrists and nursing students were not included in the results because the target group was registered nurses.

Findings and best practice recommendations

Question 1
In the context of advice for washing or cleansing the skin, the use of aqueous cream or a soap substitute was advocated by 14 of the 150 nurses (9%), non-perfumed soap and water was suggested by 13 nurses (9%), no soap was advocated by five nurses (3%), with washing not being mentioned by 118 nurses (79%) (Figure 6a).

The need for a moisturiser was advocated by 111 nurses. Twelve nurses (11%) advocated Cavilon cream or Cavilon film, 30 nurses (27%) suggested the use of aqueous cream, 15 respondents (14%) promoted the use of 50% white soft paraffin and 50% liquid paraffin or Vaseline, and 54 nurses (49%) advocated the use of E45, Diprobase, Epaderm and Doublebase. Five nurses suggested not using moisturiser (Figure 6b). A total of 34 nurses acknowledged they did not know what to recommend.

Tissue damage in this scenario is comparable with dry desquamation. Best practice suggestions include gentle cleansing with warm water and

Identifying the issues

Recognising a potential knowledge deficit in tissue viability when caring for radiotherapy patients, one of the authors was led to question whether nurses in her locality shared this gap in knowledge. University-led wound care study days in Suffolk and south Norfolk were used as an opportunity to carry out an informal, anonymous written survey of nursing knowledge so that the results could underpin future education if this proved to be needed. Permission for the educational survey was granted by the university concerned, with confirmation that ethical approval was not necessary. Before lectures began on each of three identical wound care study days in March 2009, registered nurse delegates were invited to respond to four written questions (Box 1).

Survey results
A total of 150 registered nurses practising in hospital, the community and

BOX 1

Survey questions

Question 1
During a course of radiotherapy treatment, for example to the breast area, a patient seeks your advice as dry flaky skin has developed over the area being treated. What skin care advice and/or moisturiser would you recommend?

Question 2
A patient finished radiotherapy treatment for cancer to the breast seven days ago. The skin is red and inflamed, particularly in the fold under the breast (the skin is not broken). What topical agent and/or wound management product would you choose?

Question 3
A week later you see the same patient again. The area of skin that received radiotherapy treatment now appears similar to an eczema-type reaction. The surface layer of the skin is broken in many places. There is exudate seeping through these breaks, and the area is sore and painful. What wound management product(s) would you choose to apply?

Question 4
In the same way that skin damage as a result of pressure can be graded, tissue damage caused by radiotherapy treatment can be graded. Are you aware of this grading system? If yes, what is this grading system or what are the stages?
Aqueous cream or a similar low-cost non-perfumed proprietary brand of moisturiser is advocated in radiotherapy literature (NHS QIS 2004). Aqueous cream was designed as an emollient soap substitute (wash-off product). However, it is often mistakenly used as a leave-on emollient. If used in this way it can precipitate irritant reactions (Cork and Danby 2009). Although there are mixed opinions on the use of E45 cream in the literature, this is an effective, readily available moisturiser.

Some radiotherapy literature advises avoidance of Vaseline and petroleum jelly products on the basis that these moisturisers are not easily absorbed (British Colombia Cancer Agency 2006). However, the main issue is that petroleum jelly products are greasy and difficult to remove – care needs to be taken not to build up a layer of cream or moisturiser, which can act as a bolus and may therefore increase the dose of radiotherapy to the skin beyond an appropriate therapeutic level. Patients should also be reminded that petroleum products are flammable.

Respondents in the survey did not differentiate between Cavilon cream and Cavilon film. Cavilon film is a non-sting barrier film rather than a moisturiser, but can be used to delay the onset of skin reactions during radiotherapy (Graham et al. 2004). Doublebase gel contains liquid paraffin and isopropyl myristate, both of which have moisturising properties. However, this product is only available on prescription.

**Question 2** This question looked at what topical agent and/or wound management product should be recommended for a patient who finished radiotherapy treatment for cancer to the breast seven days ago and has red and inflamed skin, particularly in the fold under the breast. Of the 150 respondents, 82 nurses (55%) advocated the use of a moisturiser with or without gauze, or a low adherent product (for example, NA Ultra) under the breast; 31 nurses (21%) did not know what to recommend or would seek advice, 19 respondents (13%) suggested the use of a wound management product, ten nurses (7%) advocated an antifungal cream and eight nurses (5%) recommended the use of a topical corticosteroid cream or ointment (Figure 7).

Tissue damage in this scenario is comparable with erythema. Best practice recommendations provide some evidence to support the use of a mild topical steroid cream, for example hydrocortisone 1% or less, to reduce irritation and/or itching, but not as routine (NHS QIS 2004, British Colombia Cancer Agency 2006). The inflammatory response results from radiotherapy treatment and the use of an anti-fungal cream is probably not therefore justified. However, fungal infections of moist skin creases are common, particularly in obese individuals. Treatment would need to be based on an informed assessment. A simple wound contact layer, for example Atrauman, to separate skin surfaces under the breast, is appropriate and a sheet hydrogel can be soothing in this situation (Gollins et al. 2008, Harmer 2008), for example ActiFormCool (Bradbury et al. 2008).

**Question 3** This question looked at what wound management product(s) should be applied to the same patient in question 2 who presents a week later with an eczema-type reaction in the area that received radiotherapy. The surface layer of the skin is broken in many places. There is exudate seeping through these breaks, and the area is sore and painful.

A range of wound management products were selected by 80 nurses (53%). A total of 55 nurses (37%) did not know what products to apply or would seek advice, while 11 nurses (7%) advised using steroid cream with a dressing product, and four nurses (3%) suggested the use of a steroid cream without a dressing product (Figure 8).
Tissue damage in this scenario is comparable with moist desquamation. As the skin is broken and painful, and exudate is present, a wound management product is appropriate, but the choice made should reflect evidence-based practice. Appropriate dressings include products from the soft silicone range to aid retention and enable the passage of exudate away from the wound surface to an absorbent layer, for example the Mepilex range. NHS QIS (2004) highlighted that dressings with adhesive borders may cause epidermal stripping and pain, and stated specifically that any dressing that sticks to the wound bed and requires soaking to remove is the wrong dressing. A key component of soft silicone products is minimal skin stripping and pain on removal, even on very fragile tissues damaged by radiotherapy (Wound Academy Expert Forum 2007). In the authors’ experience soft silicone products are gentle to remove, do not adhere to the wound bed and patients report that they are soothing on application and during wear.

Generally, topical steroids should be avoided if skin is broken. In addition, steroids can cause atrophy of dermal collagen, which can thin the skin (Mendelsohn et al 2002), and increase susceptibility to infection by suppressing the normal physiological response to an increasing microbial load. The enhanced risk of infection in this patient group may justify the use of a topical antimicrobial product, but caution is needed with metallic-based compounds, for example silver sulfadiazine, which can be absorbed into the skin and cause a bolus effect if radiotherapy is ongoing (Harper et al 2004). In addition, removing silver sulfadiazine from radiotherapy-damaged skin can be traumatic (D’Haese et al 2005).

Antimicrobial products that may have a place in the management of radiotherapy-damaged skin include silver incorporated into a soft silicone-based product, for example Mepilex Ag, and *Leptospermum* (manuka) honey dressings, for example Actilite. However, honey, and to a lesser extent silver products, can exacerbate wound-related pain (Hollinworth 2005). Only three nurses in the survey mentioned using analgesia; however, pain control needs to be a key component of patient care. All practitioners should be mindful that skin damaged as a result of radiotherapy treatment is frequently painful and psychologically distressing.

**Question 4**

This question looked at whether nurses were aware of grading systems and the relative stages of tissue damage as a result of radiotherapy treatment.

A total of 130 nurses (87%) acknowledged they were not aware of a grading system for tissue damage caused by radiotherapy treatment. The remaining 20 nurses (13%) stated they were aware of a grading system, but of these five nurses gave no further details, and 15 nurses described radiotherapy tissue damage using the same tool commonly used to grade pressure ulcer damage (Figure 9).

It is a professional requirement to use evidenced-based practice (Nursing and Midwifery Council 2008), and in the same way that pressure ulcer grading tools cannot be used to grade leg...
Ulcers, only appropriately validated tools should be used to assess radiotherapy-induced tissue damage. Grading of tissue damage as a result of radiotherapy treatment can be useful to guide treatment, and the RTOG scale has been used to frame the practical tool presented at the end of this article. A case study to illustrate the complexity of promoting tissue viability for this group of patients is now described.

**Case study**

A 70-year-old female presented with a rapidly advancing left neck node cancer (a secondary cancer from an unknown primary). Her medical history included a small laryngeal cancer treated by laser therapy; however, it would be unusual for this to metastasise. The neck lesion was advanced at presentation and the diagnostic magnetic resonance imaging scan suggested involvement of the main carotid artery. The patient was deemed inoperable by the head and neck multidisciplinary team. She underwent induction chemotherapy (chemotherapy alone) followed by concurrent chemoradiation (chemotherapy and radiotherapy given in conjunction with each other). The radiotherapy was ‘multi-phased’ starting with a larger volume and reducing to a high-dose smaller volume. The radiotherapy is given over 32 treatments – Monday to Friday for six and a half weeks. This allows for escalation of the dose to achieve a radical treatment, although it does mean that the treated skin is ‘pushed to the limit’ of tolerance.

RTOG grade 1 erythema was noted at the eleventh treatment, progressing to RTOG grade 2a by the nineteenth treatment, and this tissue damage continued to develop to RTOG grade 3 despite the treatment being stopped for one week to allow some skin healing and recovery. Most radiotherapy side effects peak about seven to ten days from when the treatment has finished, and therefore patients need to follow specific skin care for some weeks after completion of radiotherapy.

The patient was admitted to the oncology ward at the twenty-fifth treatment episode and had bolus feeding initiated using a radiologically-inserted gastrostomy tube because she was losing weight, needed psychological support and side-effect management including pain relief. Analgesia included morphine sulphate tablets (slow release morphine sulphate 20mg twice a day; this was increased to 40mg twice a day for the last five days of treatment, and then 60mg until two weeks after the end of radiotherapy). She also had 5mg oramorph oral or liquid morphine up to four times a day for breakthrough pain, and lidocaine and hydrocortisone mucilage mouthwash and approved products for oral mucositis (inflammation of the oral mucosa).

Figure 10 shows moist desquamation to the left parotid gland area (RTOG grade 3) and Figure 11 shows the area after one week of rest from radiotherapy treatment (but still RTOG grade 3).

Some radiotherapy treatment areas are difficult to dress. A bandage was used to keep the soft silicone dressing in place rather than adhesive tape, which can cause further trauma to the skin on removal. Mepilex Lite and
Meplex Border have been used by the authors and found to be easy to apply and remove; they stay in place and improve patient comfort in a range of wound care situations. MacBridge et al (2008) supported this approach to wound management.

Bernier et al (2008) advised that RTOG grades 2 and 3 reactions can be managed by an integrated team and that skin reactions should be assessed weekly. All radiotherapy departments should record and manage radiotherapy skin toxicity consistently for effective comparison. Digital photographic documentation is a requirement for many randomised controlled trials and this should be extended to all patients receiving radiotherapy and scoring RTOG grades 2b or 3 to capture data on radiotherapy skin damage. The aim is to help future patients, and such illustrations could be incorporated into patient information – although patient permission would be a key consideration. Table 1 provides a guide to product selection based on the extent of tissue damage and clinical experience.

The product list in Table 1 is not exhaustive. The key principle for dressing choice here is to select a wound contact layer, which will not exacerbate tissue trauma by causing skin stripping on removal, and is comfortable when in position. The growing range of products based on soft silicone are proven to minimise pain and tissue damage. It is beyond the remit of this article to discuss the options.

For curative radiotherapy treatments great care is taken to ensure an even ‘homogenous’ dose distribution is obtained throughout the treatment area. It is usual practice to remove all the dressings to avoid the potential build up dose effect that leaving products in place may have. While this is not ideal for maintaining optimum wound temperature and promoting wound healing, further research is needed to evaluate and draw subsequent conclusions about irradiating through dressings. However, most tissue damage becomes evident during the later stages of radiotherapy treatment. Therefore, further consideration could be given to leaving the product in place and the radiotherapy dose recalculated on an individual patient basis. For patients with fungating lesions, it is accepted practice to irradiate with the dressing in place, but the presence of the dressing on the wound is taken into account during the initial radiotherapy planning stage.

### Table 1

<table>
<thead>
<tr>
<th>RTOG grade</th>
<th>Tissue type</th>
<th>Suggested products</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No change to skin.</td>
<td>Consider Cavilon barrier film to delay onset for skin areas at risk in the treatment field. Moisturise with, for example, E45 cream, aqueous cream, or Diprobase cream.</td>
</tr>
<tr>
<td>1</td>
<td>Follicular, dull or faint erythema. Erythema: pink.</td>
<td>Use aqueous cream, but consider potential for allergic reaction. Moisturise with E45 cream or Diprobase cream.</td>
</tr>
<tr>
<td>2a</td>
<td>Tender or bright erythema with or without dry desquamation. Erythema: bright/deep. Dry desquamation: flaking, scaling, itching.</td>
<td>Consider 98% pure aloe vera gel in combination with a moisturiser (Dudek et al 2000). Use soft silicone foam (Mepilex) or sheet hydrogel (ActiFormCool) if the patient is uncomfortable. If there is pruritus, 1% hydrocortisone cream may be applied sparingly for a few days.</td>
</tr>
<tr>
<td>2b</td>
<td>Patchy moist desquamation, with or without moderate oedema. Moist desquamation: up to 3cm patch.</td>
<td>Use hydrogels, soft silicone foam (Mepilex) if the patient is uncomfortable. Consider Leptospermum dressings. Provide adequate analgesia.</td>
</tr>
<tr>
<td>3</td>
<td>Widespread confluent moist desquamation, pitting oedema.</td>
<td>Use hydrogels, soft silicone foam (Mepilex) or silver sulfadiazine cream (Mepilex Ag) if post treatment. Consider Leptospermum dressings. Provide adequate analgesia.</td>
</tr>
<tr>
<td>4</td>
<td>Necrosis – rarely seen. Little radiotherapy-based evidence relating to necrosis.</td>
<td>Management would be considered on an individual basis according to the tissue type and extent of tissue damage. It is beyond the remit of this article to discuss the options.</td>
</tr>
</tbody>
</table>

(Adapted from Gleen et al 2001)

### Conclusion

Patients with cancer are in a vulnerable position because they may experience symptoms secondary to cancer that can be detrimental to effective wound healing, such as nausea, fatigue and malnutrition. This is compounded by emotional stress and often difficult, distressing treatments. Patients should be educated in personal hygiene and skin preservation from the outset of radiotherapy. Healthcare professionals should be skilled in communicating with patients and family members to ensure understanding and development of trust. Wound management
should be holistic and encompass the patient’s physical and emotional needs so that the whole person is cared for and not just the area of tissue damaged by radiotherapy.

Nurses need further education in promoting tissue viability when caring for radiotherapy patients, as evidenced by the survey reported in this article. It is also important to apply up-to-date evidence-based guidelines to share good practice, and to improve documentation, because this will enhance the quality of patient care.

More randomised controlled trials that focus on tissue viability within radiotherapy wound management will give greater confidence to all professionals caring for radiotherapy patients.

References


