

Understanding radiation dermatitis

Most patients who get radiation experience dermatitis—yet we know little about how to prevent or treat it.

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According to the National Cancer Institute, an estimated 1.6 million new cases of cancer will have been diagnosed in the United States in 2015. During the course of their disease, most cancer patients receive radiation therapy.

Delivering high energy in the form of waves or particles, radiation therapy alters the DNA of cancer cells, causing their death. Radiation can be administered either externally or internally (through materials placed into the body). It's given in fraction doses, with the total recommended dose divided into daily amounts. Treatment, including the total dose, is determined on an individual basis.

Although improvements have been made in delivery of radiation therapy, approximately 95% of patients who receive it experience a skin reaction. What's more, radiation therapy commonly is given concurrently with chemotherapy or targeted therapy to improve survival, which increases the toxicity risk.

Physiologic effects

Radiation can injure rapidly dividing cells both directly and indirectly by damaging structures and chemicals within the cell. External beam radiation (the most common form of radiation therapy) commonly affects rapidly dividing cells of the epidermis, sebaceous glands, and hair follicles. The initial radiation dose begins



to destroy the skin's basal layer, causing the remaining cells to shed more quickly. Basal cells in the resting phase of mitosis are stimulated into proliferating more quickly and the balance of normal cell production is disrupted. An inflammatory response arises, with histamine production, capillary dilation, edema, and increased vascularity.

Patients may experience both early and late effects of radiation therapy, as well as skin pigmentation changes from melanin migration to the superficial skin layers. Hair growth within the radiation field is interrupted as hair follicles enter a resting phase, with complete hair loss occurring at doses above 55 Gy.

Doses of 30 Gy permanently damage the sweat and sebaceous glands, causing such symptoms as dry skin and pruritus. (See *Risk factors*.)

Risk factors

Various patient- and treatment-related factors influence whether a patient will develop radiation dermatitis and how severe it might be.

Patient-related factors include older age, poor nutritional status, smoking, overlapping skinfolds, poor skin integrity before radiation therapy, obesity, concurrent chemotherapy (such as with cetuximab), chronic sun exposure, genetic factors, and certain underlying comorbidities (including diabetes and renal failure).

Treatment-related factors include treatment field location; larger treatment volume, field, or total dose; larger fraction size; type of energy used (for instance, X-ray, gamma rays, electrons, protons, or neutrons); and therapy duration. Radiation to the head, neck, breast, chest wall, perineum, or vulva are more likely to cause radiation dermatitis.

Assessment

Signs and symptoms of radiation dermatitis include pain, discomfort, pruritus, burning, and general irritation. In some patients, these problems may restrict movement of an affected limb, impeding activities of daily living (ADLs) and lead to loss of independence and self-care ability. Some patients have difficulty wearing clothing on the affected area.

Clinicians can use various grading scales to define the skin reactions of radiation dermatitis. These scales include:

- National Cancer Institute (NCI) Common Toxicity Criteria for Adverse Events (CTCAE)
- Radiation Therapy Oncology Group/European Organization for Research and Treatment of Cancer toxicity criteria

Generally, topical corticosteroids can ease itching.

- Radiation-induced Skin Reaction Assessment Scale
- Skindex-16 scale.

In the United States, the CTCAE scale is most commonly used in clinical trials. It defines acute skin reactions to radiation as those occurring within the first 90 days after therapy. The scale encompasses five grades of reactions.

- *Grade 1*: faint erythema or dry desquamation. Arising within the first 2 to 4 weeks of treatment, these reactions cause skin redness and warmth and a rashlike appearance. The patient may complain that the skin feels tight or sensitive.
- *Grade 2*: moderate to brisk erythema; patchy, moist desquamation usually confined to skinfolds or creases. Moderate edema, dryness, pruritus, and flaking of skin layers (dry desquamation) also may occur.
- *Grade 3*: moist desquamation in areas other than creases and skinfolds. Bleeding may arise from minor trauma, such as abrasion.
- *Grade 4*: life-threatening consequences, such as full-thickness skin ulcers, necrosis, and spontaneous bleeding
- *Grade 5*: death.

Prevention

Although many products have been tested, prevention of radiation dermatitis remains elusive. In 2010, Gosselin et al. tested Aquaphor®, Biafine®, RadiaCare®, and a placebo of sterile water mist. In the study (n=208), none of these skin care products made a statistically significant difference in minimizing the incidence of grade 2 to 4 skin reactions, compared to placebo. A recent pilot study by Fenton-Kerimian (n=30) also reported no statistically significant difference in the effects of calendula cream, RadiaPlex®, and mometasone plus Aquaphor®.

Wong et al. (2013) developed an inter-

Recommended interventions for radiation dermatitis

The list below comes from the Oncology Nursing Society's "Putting Evidence into Practice (PEP)" resources. PEP teams include nurse scientists, advanced practice nurses, and staff nurses, who summarize and synthesize available evidence in an effort to determine which interventions are effective or ineffective in preventing or treating radiation dermatitis. The agents and approaches fall into four categories, shown below.

Recommended for practice

- Intensity-modulated radiation therapy
- Skin hygiene and care
- Use of non-aluminum containing deodorants

Likely to be effective

- Calendula
- Silver sulfadiazine

Effectiveness not established

- Allantoin emulsion

- Anionic Polar Phospholipid (APP) cream
- Aquaphor®
- ATP cream
- Bepanthen® topical cream
- Chamomile cream and almond ointment
- Corticosteroids (topical)
- Dermatitis control protocol
- Dietary supplements
- Epithelial growth factor
- Glutathione and anthocyanin (Ray Gel™)
- GM-CSF impregnated gauze
- Henna ointment
- Herbal medicine
- Honey-impregnated gauze
- Hyaluronic acid/sodium hyaluronate
- Hydrocolloid and hydrogel dressings
- Hydrophillic foam dressing
- LED light
- Lipiderm™
- MASO65D (Xclair®)
- No Sting Barrier (Cavilon™ No Sting Barrier Film)
- Oil in water emulsion
- Plant extract cream (Capilen®)
- Platelet gel
- Polymeric dressings
- Silver leaf dressings
- Sodium sucrose octasulfate (Na SOS)
- Sucralfate
- Theta cream
- Turmeric cream
- Urea and hyaluronic acid (topical)
- Urea-based topical treatment
- Vitamin C
- Wheatgrass
- WOBE-MUGOS®
- Zinc, zinc supplements

Not recommended for practice

- Aloe vera
- Trolamine (Biafine®)

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national clinical practice guideline for prevention and treatment of acute and late radiation reactions. It recommends prophylactic topical steroids, such as mometasone, to reduce discomfort from radiation dermatitis. It gives all other agents, including sucralfate, hyaluronic acid, and silver sulfadiazine cream, only a weak or insufficient evidence recommendation. The panel strongly recommends against use of trolamine (Biafine®) and aloe vera. Similarly, Chan et al. (2014) found no strong evidence for any products in preventing or treating radiation dermatitis.

General skin care during radiation therapy also has been investigated as a

way to prevent radiation dermatitis. Some experts recommend washing the skin with a pH-balanced soap, wearing loose-fitting clothing, avoiding scratching or rubbing the skin, and avoiding sun exposure on the treatment area.

Treatment

Like prevention, treatment of radiation dermatitis poses a challenge. For many therapeutic agents, effectiveness hasn't been established. (See *Recommended interventions for radiation dermatitis*.) Generally, though, principles of moist wound therapy apply. For grade 1 skin reactions, apply bland emollients to keep the skin moisturized and follow standard

hygiene principles.

Both Chan et al. and Wong et al. found insufficient evidence to support recommending for or against any specific treatment. Generally, topical corticosteroids can ease itching. If the patient develops signs or symptoms of infection, cultures should be obtained from the affected area and antibiotics prescribed based on culture results.

No specific dressing is better than any other; each case should be evaluated individually. Dressing choices include hydrocolloid, hydrogel, hydrofiber, alginates, and polyurethane and silicone foam dressings.

Late skin effects of radiation therapy include chronic ulceration, telangiectasia, and fibrosis. Chronic ulcers should be evaluated for biofilm and subclinical infection and treated according to moist wound principles. These wounds may require debridement or hyperbaric oxygen therapy. Telangiectasia may improve with vascular laser therapy. Chronic fibrosis is hard to treat; refer the patient to a dermatologist with experience treating this complex problem.

Take a cautious approach

Caring for patients undergoing radiation therapy calls for special attention to topical skin care. Yet high-quality studies haven't shown that specific agents prevent radiation dermatitis, and the literature on treating the condition fails to identify which skin care treatments are most effective. As more and more products reach the marketplace, clinicians need to be cautious about blanket recommendations until these agents have undergone further testing to determine their effectiveness. ■

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