RADIATION DERMATITIS AND WOUND CARE
IN THE BREAST CANCER PATIENT

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Radiation dermatitis is a common side effect in the breast cancer patient receiving radiation therapy. This reaction causes increased pain and ultimately decreased quality of life. The purpose of this article is to introduce the reader to products that are currently being used or have been used in clinical studies for radiation therapy and wound care. The goal is to determine which products decrease pain and promote healing in breast cancer patients with radiation dermatitis. Ultimately, nurse practitioners will be able to use this as a guide in understanding and treating breast cancer patients who present with radiation dermatitis.
INTRODUCTION

Breast cancer can affect any woman, despite race, age or ethnic background. According to the American Cancer Society (2005), out of an estimated 662,870 women who develop cancer, 32% will be diagnosed with breast cancer. Many women with early stage breast cancer are candidates for breast conservation therapy, which combines conservative surgery with radiation (Fisher et al., 2002). In more advanced breast cancer requiring mastectomy, adjuvant radiation therapy has been shown to improve overall survival (Ragaz et al., 1997). In 2001, 67,391 (44%) women that were diagnosed with breast cancer were treated with radiation (American College of Surgeons, 2001). Despite technological advances in the way radiation is delivered to patients, it is estimated “in some series, that 90% of patients treated with radiotherapy for breast cancer will develop a degree of radiation-induced dermatitis (Porock & Kristjanson, 1999).

The purpose of this article is to introduce products that are currently being used or have been used in clinical studies throughout the country. The goal is to determine which products decrease pain and promote healing in breast cancer patients undergoing radiation therapy experiencing radiation dermatitis. Currently the literature is devoid of clinical standards of care for the treatment of radiation dermatitis.

Radiation Therapy

Radiation therapy is defined as, “the use of high energy x-rays or particles to treat disease” (Bruner, Haas, & Gosselin-Acomb, 2005, p.12). Radiation is delivered through medial and lateral tangential x-ray beams for the duration of six to seven weeks of daily treatments. A tangential beam minimizes the volume of normal lung and cardiac tissue that is irradiated (Harper, Franklin, Jenrette, & Aguero, 2004, p 989). The intracellular
target is cancer cell DNA (Harper et al., 2004, p 989). The goal is to damage the defective DNA (cancer) and cause cellular death to rapidly growing cancer cells. One must remember that skin cells also grow rapidly and are affected by radiation therapy. There should be a balance between eradicating the cancer and minimizing damage to the skin, also known as radiation skin necrosis.

Radiation and Skin

In order to understand the pathophysiology of radiation damage to the normal skin, it is important to review how the skin normally regenerates itself. The skin is made up of two layers; the epidermis and dermis. As superficial cells are shed through normal desquamation, new cells are formed in the basal layer of the epidermis and these cells continually replace those that are lost. The dermis, which contains blood vessels, sweat glands, nerves and hair follicles, provides the supportive structure required for the epidermis to regenerate. (Figure 1 – Skin layers). The normal process of renewing the epidermis takes approximately four weeks (Wells & MacBride, 2003, p. 135).

Ionizing radiation damages the mitotic ability of stem cells within the basal layer. This prevents the process of repopulation and thus weakening the integrity of the skin. Repeated radiation impairs cell division within the basal layer, so the degree to which a skin reaction develops is dependent on the survival of actively proliferating basal cells in the epidermis. Moist desquamation occurs when stem cells in the basal layer are eradicated. This inhibits repopulation in time to replace the damaged tissue. (Giean et al., 2001, pg. 75-81).

Radiation causes a skin reaction after an accumulated dose is given to the tumor and the surrounding tissue. These reactions are measurable by four different grades.
According to Bruner et al. (2005) definitions of the grades are as follows: Grade I is faint/dull erythema, Grade 2 is bright erythema and dry desquamation (dry, flaky skin), Grade 3 is moist desquamation (blistering/sloughing of skin) and Grade 4 is ulceration and skin necrosis (Bruner et al., p. 50). Radiation dose and skin reactions typically increase over time. The more radiation the tissue receives, the higher the incidence of skin irritation, which is why a patient who receives radiation therapy postoperatively will need to wait at least four weeks before treatments begin (Radiation Therapy, 2004). The irradiated area is generally completely re-epithelialized in several weeks (Sitton, 1992).

Skin Care

Development and severity of radiation dermatitis is dependent on many factors. One factor is quality of skin care from the onset of radiation therapy. Skin care should be discussed before the patient begins radiation treatments. The nurse instructs the patient to gently clean the irradiated skin with a mild soap, rinse with water, and moisturize daily. Patients are instructed not to apply any creams to the skin being irradiated four hours before radiation and not to use topical agents that contain metals. Both of these contraindications can potentiate the dose of radiation at the skin level causing a “bolus” effect (Porock, Nikoletti, & Kristjanson, 1999).

Most cancer centers follow the same guidelines for skin care prior to the patient receiving radiation dermatitis. Yet, once a patient develops radiation dermatitis, which includes symptoms of moist desquamation and pain, there are many different products that are used. Some products prescribed or recommended are Silvadene, hydrocortisone cream, hydrocolloid dressings (Duoderm), and moisture vapor permeable dressings (Tegaderm) (Bruner et al., 2004, p 51).
The main focus of treatment for moist desquamation includes minimizing trauma and discomfort to the area (friction), promoting healing, and preventing infection. Skin care also prevents the patient from having to delay or terminate radiation treatments before the full dose is administered (Sitton, 2002), thus risking the chance of complete eradication of the cancer.

Conceptual Framework

The purpose of this manuscript is to determine if one of three proposed skin care products would promote healing and decrease pain in the breast cancer patient receiving radiation therapy. Rae Noble-Adams' conceptual framework tries to describe how to accurately measure skin reactions. Noble-Adams (1999) believed that "accurate assessment of both the subjective symptoms and observable signs of these reactions is a prerequisite in enabling an understanding of the phenomenon and planning appropriate care" (p. 1140). Noble-Adams proposed that physical presentation of radiation reaction and the patient's symptoms, together affect the patient's activities-of-daily living (Figure 2 – Noble-Adams Conceptual Framework). This model does not tell us how to measure outcomes with interventions. In the proposed framework, the practitioner can use Noble-Adams skin assessment tool to monitor the condition of the skin.

Goals of Treatment

One goal of research in oncology is to measure both response to treatment and quality of life. Response to treatment is defined as what type of symptoms occurred and whether the patient received the intended (palliative or curative) dose. Quality of life is an aspect of an outcome that is directly perceived by the individual. It addresses areas of life affected by each individual's perception.
In order to accomplish this, one must also look at the impact that each of these components have on the completion of treatment. Response to treatment, pain, and quality of life can be measured many different scales. Pain is measured on a numeric pain rating scale zero to ten, with zero being no pain and ten the worst pain. The Symptom Distress Scale (SDS), created by Ruth McCorkle, measures quality of life. This scale is a “cancer-specific tool for assessing cancer-related symptoms” (McCorkle, 1999). Completion of treatment is defined as completing the prescribed dose of radiation in order to have the maximum outcome, whether it is palliative or curative. The outcome for the use of skin care products impacts one aspect of this. The framework outlines the effect radiation therapy has on one’s treatment adherence. These reactions then cause symptoms, pain in particular, which is measured on a one to ten scale. Skin reactions to treatment and pain can affect the patient’s quality of life, which can also affect treatment adherence (Figure 3 – Conceptual Framework). This framework will guide this project because it helps the practitioner understand how radiation therapy affects the skin and the impact of radiation on quality of life and treatment adherence.

Literature Review

Using Medline, Ovid and Proquest, the key search terms for the literature review include radiation dermatitis, breast cancer, radiation therapy, and wound healing. Mixed benefits to the skin exist when different products are used both preventatively and post-radiation. The overall consensus was that treatment for skin reactions are based mostly on physician/institutional preference, which further supports the need for research and the development of standards of care. According to Dunne-Daly (1995), “more research is
needed to support the use of many nursing measures used in skin care and wound management in radiation oncology” (p. 148).

According to the treatment standards for wound care, it has been shown that keeping a wound moist enhances the healing process and allows for faster closure of wounds (Hess, 2005). When a wound is left dry the cells will dehydrate and eventually die. Varghese, Balin, Carter, & Caldwell (1986) stated “wound dressings are beneficial for wound healing, because they preserve a moist environment that enhances re-epithelialization, allow enzymes in the wound fluid to lyse necrotic tissue, and permit inflammatory cells to phagocytose necrotic debris and bacteria” (p.53). Dressings not only encourage wound healing, they also provide protection to the skin against further skin breakdown due to friction and decrease risk of infection.

Dunne-Daly (1995) states that breast cancer patients are at higher risk for skin breakdown due to the anatomical position of the structures (breast tissue) being treated with radiation. Wells (2003) also found that large breasted women may have more skin reaction because “they require a greater radiation dose to the skin and because their potential to heal may be compromised by reduced vascularity in adipose tissue” (p. 142-143). Skin folds are at increased risk for breakdown due to friction and moisture. Women who wear a bra also increase their chances of skin breakdown, Dunne-Daly, (1995) which is why patients are instructed not to wear a bra once skin reaction occurs.

Szumacher et al. (2001) conducted a Phase II study with 60 breast cancer patients that underwent lumpectomy and were then treated with radiation and chemotherapy. This study’s purpose was to determine if Biafine cream used prophylactically would decrease the amount of radiation induced skin toxicity. Results showed that 35 patients
(83%) had Grade 2 radiation dermatitis, but none of the participants had delays or interruptions in treatment due to skin toxicity. This study found that “47% of the patients studied complained of quite a bit of pain or soreness in the affected breast areas” (p. 84). Szumacher et al. said, “despite the common occurrence of radiation-induced skin toxicity, there have been very few trials that have formally evaluated the usefulness of topical therapy for this common problem” (p. 84). This study assessed pain and skin reaction, but failed to include quality of life. One can assume using the conceptual framework that quality of life must have been at least “fair” because there was no delay in treatment. However, 47% of patients did experience pain.

Heggie et al., (2002) conducted a Phase III study that involved 225 breast cancer patients receiving radiation after lumpectomy or partial mastectomy. The aim of the study was to determine if topical aloe vera was effective in reducing the radiation skin side effects of itching, erythema, pain and skin breakdown compared with aqueous cream (p. 442). The study also had a second arm that assessed other variables and their influence on radiation skin reactions including breast size, smoking habit, and postsurgical lymphocele drainage. This study found that itching was higher in the aloe vera arm, 26% aloe vera patients and 17% aqueous cream patients had grade 2 or more pain, as well as lymphocele drainage patients using aloe had more pain than aqueous arm (40% vs. 20%). In summary, aloe was found to be less effective than aqueous cream in reducing skin reaction and pain, thus aloe vera is not validated using the conceptual framework. Evaluating this article using the conceptual framework, pain was increased with aloe (26% vs 17%) and therefore may increase the probability of decreased quality of life and adherence to treatment.
Following moist wound healing principles, creating a moist wound environment, as well as keeping down bacterial cell growth, will increase wound healing. Many products in wound care have been tested and support this theory, yet the lack of standardization in radiation oncology and treatment of radiation dermatitis continues to be a problem.

Products

As noted earlier in this manuscript, there are several products that are used in radiation oncology to treat radiation dermatitis. Some of these include aloe vera, Silvadene cream, hydrocortisone cream, Biafine (Medix Pharmaceuticals, INC., Largo, FL), transparent hydrocolloids and hydrogel dressings (Bruner, 2004, p. 51 and Wickline, 2004, p. 237). Wickline discovered that, “the current evidence is unable to provide clinicians with guidelines to manage acute radiation dermatitis” p. 237. Therefore I have chosen three products to evaluate in the treatment of radiation dermatitis; RadiaCare Gel, which is used in different treatment centers across the US, Xenaderm and Humatrix.

**RadiaCare Gel**

The first product reviewed is RadiaCare Gel, produced by Carrington Laboratories. As stated in the product insert, this gel is indicated to “condition the skin before radiation therapy and to manage skin reactions after radiation therapy.” RadiaDres Gel Sheet dressing may also be used to manage radiation-induced dermatitis (Smith, 2000).

An unpublished clinical study conducted by Carrington Labs, used 40 patients to determine the effectiveness of topical application of the gel on pain for the patient undergoing external beam radiation. The sample included women who received daily
radiation doses between 50 and 70 Gray (prescription for curative therapy for breast cancer) Janjan & Weissman, 1998). The nurse who supplied the patient with RadiaCare Gel completed basic skin assessment. The treatment protocol specified that all irradiated areas should have RadiaCare gel massaged into the treatment field one or more times per day. On return visits to the radiation center, the nurse administered a survey to determine how effective the use of the product was in relieving the patient’s skin pain. The findings showed that 93% of the patients stated better pain relief with RadiaCare Gel. Patients also found the product better or much better than similar products that were not mentioned but had been used in the past to treat their skin pain. Since this study was not blinded or double-blinded it lacks validity.

This study assessed only one aspect of the conceptual framework; pain. Therefore we can assume there was some type of reaction to cause the pain, and by using the RadiaCare gel, this alleviated symptoms enough that there was no interference with treatment adherence. It is unknown what the impact was on quality of life, but again assumption would lead the reader to believe this was minimal or improved with RadiaCare gel as well.

**Xenaderm**

Xenaderm, manufactured by Healthpoint, is another product used in the United States. As stated on the package insert, “this product is indicated to promote healing and the treatment of decubitus ulcers, varicose ulcers, dehiscent wounds. It can relieve pain and promote healing” (*PDR drug information*, 2005).

Healthpoint published a supplement in the March 2003 issue of the journal, “Wounds.” Four studies were conducted by independent testing facilities. One study
used 10 subjects that applied Xenaderm topically to evaluate the effect on local blood flow at the site of application at one hour and 3 hours after application. This was compared to the opposite arm without product for the control. Results showed that Xenaderm significantly increased blood flow in the treated area in 3 hours ($p < 0.01$). *(Xenaderm ointment clinical studies, n.d.)*

Another study involved 16 subjects in order to evaluate transepidermal water loss. Exposure to Xenaderm did not interfere with healing of experimentally traumatized skin. It was concluded that Xenaderm may even have a positive effect as a protective barrier *(Xenaderm ointment clinical studies, n.d.)*.

A randomized study was done on wound healing using 19 subjects (6 men, 13 women). An epidermal lesion was made using a laser on bilateral forearms. Subjects were to treat wounds twice daily using Xenaderm on one arm and saline to the other. Subjects returned on Days 2, 4, 6, 8, and 10 to be evaluated for erythema, scabbing and reepithelialization (wound healing marker). The study concluded that erythema was significantly less using Xenaderm compared to saline on Day 2 ($p < 0.05$). Reepithelialization with Xenaderm was significantly greater at every observed day ($p < 0.05$) than saline, with Xenaderm treated lesions being “virtually healed” by Day 10 *(Xenaderm ointment clinical studies, n.d.)*. Lastly, scabbing results were also less in the Xenaderm arm than the saline arm, again with a $p$ value of $<0.05$. *(Xenaderm ointment clinical studies, n.d.)*

In another study, 212 healthy men and women underwent a repeated-insult patch test over six weeks in order to test the potential of Xenaderm to irritate the skin or induce allergic contact dermatitis. This study went through three phases: conduction, rest and
challenge. The induction phase entailed each participant having 9 applications of the product. Investigators evaluated the test sites 3 different times. After the ninth application, participants received no treatment for 10 to 15 days, followed by identical patch applications to skin adjacent to previously tested skin. This challenge patch was removed after 24 hours and was examined by investigators 24, and 48 hours post patch removal. Results showed that Xenaderm showed no potential for skin irritation or contact sensitization (Xenaderm ointment clinical studies, n.d.).

A case study that was published examined a 69-year-old female who had a modified radical mastectomy followed by radiation therapy (Xenaderm ointment clinical studies, n.d.). She developed multiple blisters, moist and dry desquamation, and erythema on her left chest and back in the area of radiation. Her pain was rated a 10/10 and she was unable to eat, drink or sleep. Before using Xenaderm, she used Domboro soaks. Xenaderm was initiated using two daily applications. After the initial application, the patient reported a decrease in pain from 10/10 to 5/10. Six days later, her wounds were 50% epithelialized and her pain level had decreased to 2/10. Wounds were completely healed within 27 days. Healthpoint drug representative, Patrick Humphrey, reported that more clinical trials are currently underway (Xenaderm ointment clinical studies, n.d.).

After reviewing the studies on Xenaderm, radiation therapy and its effects were addressed in a case study with one patient. Using the framework to evaluate this product, the reader appreciates the radiation reaction obtained, the amount of pain the patient experienced, and how this affected quality of life (which was significant). It can be assumed that Xenaderm was used post-completion of radiation since the affected area
healed; in that the patient obviously had increased pain that affected her quality of life, but may not have affected treatment adherence.

**Humatrix**

Humatrix, created by CareTech Laboratories, is a Microclysmic gel that exhibits endothermic and biometric properties which cools traumatized tissue and aids in the homeostasis of healing. The product insert states, “provides the ultimate moisturization for burns, autograft procedures, radiation irritation, glycolic acid peel irritation, mechanical injuries, laser treatment and chronic wound therapy” *(Humatrix® Microclysmic Gel, n.d.)*. The properties of this product have several unique benefits. First, the time release of water molecules provides the traumatized tissue with a consistent level of moisture to promote tissue regeneration. Secondly, Humatrix provides a protein template to assist the biological regeneration of fibroblasts necessary for wound healing. Thirdly, the cooling process lowers the surface temperature 8 to 12 degrees within three minutes, preventing further tissue damage caused by dehydration of cells. Humatrix is a bacteriostatic, (stops the growth of bacteria) protein enriched formulation designed to maintain a moist environment that promotes and accelerates cellular regeneration by replicating the natural fibro-connective template and promotes fibroblast activity, the precursor of collagen formulation. It is non-toxic and contains no metals, which would be suitable with radiation treatments *(Humatrix® Microclysmic Gel, n.d.)*.

The company is researching the effects of this product with dermal abrasion, and the microbiologist of CareTech Laboratories reports impressive results with use of the product before and after the abrasion. However, this product currently has no research data to prove that Humatrix is safe for the breast cancer patient receiving radiation.
therapy and how well it controls pain or expedites the wound healing process. The reader can assume that it would also decrease pain caused by skin reactions, thus maintaining quality of life and treatment adherence.

Product Summary

In summary, only RadiaCare gel is indicated for radiation dermatitis. It follows wound healing principles by keeping the wound moist and decreases pain. The other two products may have benefits in treating radiation dermatitis, but there are no clinical trials. The benefits of Humatrix, is that it can decrease the temperature of the affected skin (radiation induced erythema) and literally feed the exposed tissue protein topically, as well as keeps the wound moist. Another benefit is that it has a bacteriocidal component, thus reducing the risk of infection. Xenaderm takes a different perspective, in that it increases the blood flow to the area while having bactericidal and debriding properties, which follows all the principles of wound healing. There is definitely much promise in these products, but to claim that one is better than another is impossible without further research that use randomized controlled designs.

DISCUSSION

The purpose of this project was to give the reader a general overview of radiation therapy in relation to the breast cancer patient, as well as, introduce products that may decrease pain and promote healing in breast cancer patients with radiation dermatitis. The products that were reviewed have been shown to follow moist wound healing principles and based on this may be of benefit in radiation oncology.

Cancer symptoms and quality of life issues are the main priority to oncology nurse practitioners and nurses. The main role of the radiation oncology team is to assess
patient’s symptoms, manage symptoms incurred, and provide in-depth patient education. Communication is at the forefront for intervening with these expected, but uncomfortable effects of radiation therapy.

Strengths

The redundant theme from the literature review proved that this article was needed to address the lack of scientific data to support how clinicians currently treat radiation dermatitis. Over and over in the research, it has shown that radiation skin reactions are a direct side effect of radiation. The conceptual framework of this paper will be a foundation for future research. This paper also recommends the bridging of wound care with radiation oncology. In utilizing wound care principles and standards of care in wound management; the field of radiation oncology can increase the quality of care in the patient with radiation dermatitis.

Limitations

Questions that still remain are ones that include how we currently address this symptom in our practice. With standards of care at the core of medicine, there is a lack of standardized treatment for radiation dermatitis. The data collected in this article is promising for the person experiencing radiation dermatitis, yet it does not give clinically proven evidence that one product is superior to another. Rigorous research studies that use randomized, controlled, double blind designs are needed to compare the effectiveness of various products.

Role of the Nurse Practitioner

Radiation therapy is a common treatment for breast cancer. Even more common are the side effects directly caused by radiation. The nurse practitioner must prepare the
breast cancer patient, through education, the expected side effects of treatment and interventions for these skin reactions. The nurse practitioner must also assess how these reactions are effecting the patients’ perceived quality of life so that the provider may intervene with the appropriate plan of care. As practitioners, we must be advocates for our patients and explore new products to alleviate the discomfort caused by radiation therapy. Currently, scientific data is needed to strengthen our perceived clinical data.

Conclusion and Further Implications

In summary, the products that have been reviewed show much promise for the field of radiation oncology and for improving the overall quality of life in breast cancer survivors. The field of Radiation Oncology should adapt proven principles of the wound healing industry and bridge the management for radiation dermatitis, which ultimately would decrease associated pain and increase quality of life.

Future studies need to establish standards-of-care for skin reactions in the radiation oncology patient. Research should continue to evaluate new skin care products specifically indicated for the radiation oncology patient experiencing radiation dermatitis. Rigorous research studies that use randomized, controlled, double-blind designs are needed to compare the effectiveness of various products. Clinicians can minimize the extent of radiation dermatitis by decreasing discomfort and pain, and ultimately improving the quality of life of breast cancer survivors.
References


Porock, D. & Kristjanson, L. (1999). Skin reactions during radiotherapy for breast...


Figure 1 – Skin Layers

- Epidermis
- Dermis
- Fatty Tissue
- Nerve
- Follicle
- Oil Gland
- Sweat Gland
Figure 2 - Noble-Adams Conceptual Framework (permission to use)
Figure 3 - Conceptual Framework

**Skin Reaction**
- Erythema
- Itching/Dry Desquamation
- Moist Desquamation/weeping
- Necrosis

**Radiation Therapy**

**Quality of Life**
Measured by Symptom Distress Scale

**Pain**
Measured by Numeric Pain Scale (0-10)

**Treatment Adherence**
Completing full dose of prescribed radiation without a delay or termination in treatment