MANAGEMENT OF SKIN TOXICITY IN THE PATIENT RECEIVING RADIATION THERAPY

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Introduction

Cancer has been one of the most prolific and challenging diseases of our time. Great strides have been made in the research and development of treatment regimes, and cancer survival is at its highest level in history. Many new pharmaceuticals have been developed in recent years including chemotherapy, monoclonal antibodies, and biological response modifiers, to name a few. These therapies have been developed and modified to provide optimum tumour kill and quality of patient life. The regimes change often with the addition of new agents, different methods of delivery, and varying combinations of existing therapeutic agents.

One of the constants in cancer treatment, however, has been radiation therapy. Since the first patient treatment in the late nineteenth century, the method of delivery has become more sophisticated with the streamlining of the treatment machines and the development of the linear accelerator, which creates the high energy x-rays required for radiation therapy, but the principles of treatment and some of the toxicities remain the same.

Brief Review Of Radiation Therapy

Radiation therapy is a local treatment involving the use of high energy x-rays, that is, ionizing radiation to destroy cancer cells. Ionizing radiation causes displacement of electrons from atoms and changes the molecular structure of cells, damaging the DNA so extensively that the cells lose the ability to divide and multiply. The toxic effects of radiation develop because of the damage that occurs to healthy cells in the treatment field. Healthy cells, however, recuperate from the toxic effects of radiation and return to normal functioning post treatment. The unit of measure of radiation is referred to as a “rad”. One hundred rads equal one grey, which is the term used when prescribing radiation therapy in practice .Most patients will receive from hundreds to thousands of rads, depending on the diagnosis and treatment regime prescribed, ranging from a single dose to thirty five days duration. As a comparison, the rad dose of a mammogram is 0.1 to 0.2.

Radiation therapy may be given as external beam or internally by introducing radioactive material directly into the tumour, a process referred to as brachytherapy. Radiation is used in the treatment of solid tumours of the prostate gland, head and neck, genitourinary system, brain, spinal cord, gastrointestinal system, breast, lung, bone, skin and soft tissue. It is also used in the treatment of leukemia and lymphoma. Radiation therapy may be used in the curative or palliative setting, to provide pain relief or to restore function to affected systems.

Toxicities of radiation therapy are a result of the damaging effects of the ionizing radiation that essentially causes a burn to the treatment area, extending from the epidermis to the internal tumour site. The specific toxicities, their extent, and duration are dependent on the site of treatment and the rad dose.

The purpose of this article is to specifically discuss the effects of ionizing radiation on the skin. All external beam radiation will cause a toxic skin reaction, and these reactions are often managed inappropriately by patients and caregivers post treatment, whose philosophy is usually to manage it as a "sunburn", rather than complex skin trauma.

Brief Description Of Skin Anatomy And Function

The skin is the human body's largest organ and can account for up to sixteen percent of body weight. It has multiple functions, including protection from environmental assaults such as ultraviolet rays or injury, regulation of temperature, regulation of metabolism, and provision of a physical barrier to infection. Alterations in skin integrity can pose significant threats to homeostasis if a large area is compromised for a period of time, including pain and infection.

The skin comprises two primary layers, that is the epidermis and the dermis. The epidermis is the outermost layer of the skin. Melanin, which is responsible for pigmentation, is dispersed throughout this layer. Keratinization, the maturation and migration of skin cells, begins in the epidermis, and produces hair, nails, and new skin cells. The epidermis is the barrier between the body and the external environment. The dermis is the second layer of the skin and is responsible for temperature regulation and the provision of nutrient rich blood to the epidermis. Fibroblasts in the dermis form collagen connective tissue, providing elasticity and support to the skin. The dermis contains hair follicles, nerve endings, and pressure receptors. It is the body's defense against infectious agents that penetrate the epidermis. These layers provide extremely important protective mechanisms that are responsible for systemic health and well being. Any interruption in this function can have serious detrimental effects to the whole organism.

Skin Toxicity Due To Radiation Therapy

The toxic effects of radiation therapy compromise the epidermal layer and can have a very negative impact on a patient both during and post treatment. There is currently no means available to protect the skin during external beam radiation, and nearly all patients will experience some changes in skin integrity during treatment. The manner in which these reactions are managed, however, can significantly improve patient comfort and reduce recovery time post treatment.

The toxic effects of ionizing radiation are often cumulative and patients rarely experience skin changes prior to a full week of treatment. The effects are more pronounced in areas where the epidermal layer is thinnest, and in creases or skin folds.

Erythema

The first noticeable skin reaction occurs approximately seven to fourteen days after the radiation therapy is initiated and is characterized as erythema. The skin within the treatment field becomes reddened and blanches under pressure. This is a result of inflammation caused by an increase in blood volume under the epidermis. The patient may experience mild tingling and a sensation of heat as a result of erythema. Usually, no intervention is required at this stage but a mild moisturizer such as aloe vera gel helps keep the skin supple and may decrease tenderness. As treatment progresses, and erythema worsens, patients may suffer itching and painful burning which in most facilities is managed with a mild topical steroid such as hydrocortisone one per

cent cream.

At this stage of the skin reaction, patients are instructed to avoid direct sunlight to the treatment area because ultraviolet rays can accelerate skin damage. The area of erythema should be washed gently with clear, tepid water to prevent trauma from friction or extreme temperatures. Scented, coloured, or alcohol-based lotions or creams are not recommended as these additives can aggravate the skin reaction. Loose clothing should be worn to avoid friction and heat and moisture accumulation at the treatment site to prevent further pain and itching.Tight clothing can also cause abrasions to skin that is sensitive due to radiation reaction. Many patients will not experience a reaction worse than erythema for the duration of treatment but skin tolerance to radiation is dose dependent and many more patients will progress to the next phase of skin toxicity.

Dry Desquamation

Dry desquamation is the second phase of radiation skin toxicity. It is characterized by dry, flaky skin that is usually itchy. Dry desquamation occurs when there is a loss of epidermal cells which break apart and are sloughed away after they are destroyed. A mild topical steroid is effective in managing this phase, and the skin care regime is maintained as with erythema. Again, many patients will not progress beyond this stage, depending on the radiation dose and treatment site.

Moist Desquamation

The most painful and difficult to manage phase of skin toxicity due to radiation therapy is moist desquamation. This phase is characterized by dermal cracks and fissures draining serosanguineous fluid. Moist desquamation usually occurs during the final one to two weeks of treatment, but like all other skin reactions can persist up to two weeks post radiation. The folds of the skin tend to be predisposed to moist desquamation because radiation dose is unevenly distributed in these areas and the moist, warm folds promote skin excoriation and bacterial and fungal growth.

Moist desquamation is a result of epidermal destruction and is a serious breach of skin integrity that can cause complications such as infection, pain, and limited function of the affected area in the case of the extremities. Topical steroids are not effective in this situation as they cause pain in open areas and can provide an environment conducive to bacterial growth.

Areas of moist desquamation must be kept as clean and dry as possible. Burosol, a topical antiseptic powder, is a very good cleanser when dissolved in sterile water and applied to affected areas as a soak. Burosol saturated sterile gauze pads are applied to open areas four times daily for fifteen minutes at a time to remove debris and provide a cooling, drying effect to the desquamated site without the trauma that can be caused by rubbing. Burosol solution may also be used as a sitz bath if the perineum is in the treatment field. Silver sulfadiazine, widely known as Flamazine, is an antifungal, antibacterial silver preparation frequently used in the management of second and third degree burns. Flamazine functions to promote healing and provide a barrier to infection. It is a very thick cream and is applied two or three times daily until the skin is once again intact. This preparation can only be used if the patient has no allergy to Sulfa. If a Sulfa allergy is present, Fusidic acid 2%, more commonly known as Fucidin cream, is a very effective antibacterial agent that is useful in the management of both primary and secondary skin infections, and is an acceptable alternative to Flamazine. Any prescription cream is provided at

the discretion of the Radiation Oncologist after careful assessment of each individual reaction.

Burosol solution is very effective in the removal of these creams when applied as a soak to prevent accumulation on the treatment area. Layers of cream can cause excessive uptake of radiation to the area causing even more skin damage. Patients are instructed to apply topical preparations after radiation therapy, rather than prior to it for this reason. Severe moist desquamation may necessitate the discontinuation of radiation therapy until the skin has healed. A significant infection to the compromised area may require oral antibiotics and radiation stoppage also, but this complication is relatively rare if the treatment area is kept clean and dry, and protective creams are utilized. A small percentage of patients may require analgesic therapy to reduce pain and inflammation when moist desquamation is extensive or affecting a particularly sensitive area such as the groin.

Conclusion

Even the most severe skin toxicity associated with radiation therapy will begin to improve one to two weeks after treatment is completed. Healing tends to be rapid but until the skin is once again intact, patients are instructed to follow the prescribed skin care regime. After healing is complete, a dark, permanent pigmentation may be present in the treatment field, due to the large production of melanin by the epidermis in response to the trauma of the ionizing radiation.

Skin toxicity is just one of the side effects associated with radiation therapy, but it can cause marked discomfort to the patient and has the potential to become serious enough to require treatment cessation. Therefore, it must be dealt with as promptly and thoroughly as any other radiation toxicity. The goals of proper skin care during radiation therapy are to prevent infection, decrease discomfort, and promote maximum healing. Proactive care is vital to recovery post radiation and both patients and caregivers must be well educated in this area if optimal healing is to occur.

A cancer diagnosis and the prospect of treatment and the management of toxicities is an enormous challenge for a patient to face, but proper education and preparation regarding these issues can empower patients and lessen the trauma of the experience.

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