

Types and Advanced Techniques in Breast Cancer Radiotherapy

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Description

Radiation therapy, a of modern cancer treatment, utilizes high-energy radiation to target and destroy cancerous cells. However, while this treatment can be life-saving, it is not without risks. One of the most concerning complications is acute radiation toxicity. This condition encompasses a range of symptoms and adverse effects that can occur shortly after exposure to high doses of radiation. Understanding acute radiation toxicity is vital for healthcare providers and patients alike to manage and mitigate its impacts effectively. Acute radiation toxicity refers to the immediate adverse effects that arise within days to weeks of exposure to ionizing radiation. Unlike chronic radiation toxicity, which develops months to years after exposure, acute toxicity is characterized by its rapid onset. The severity and specific symptoms depend on several factors, including the radiation dose, the area of the body exposed, and the patient's overall health and sensitivity to radiation. Radiation primarily affects rapidly dividing cells, which is why it is effective against cancer. However, this also means that healthy tissues with high cell turnover rates, such as the skin, gastrointestinal tract and bone marrow, are particularly susceptible to damage. When these tissues are exposed to radiation, they can exhibit a range of toxic effects, from mild to severe. The symptoms of acute radiation toxicity can vary widely depending on the area treated and the dose received. Here are some common manifestations. Radiation dermatitis is one of the most frequent side effects. It ranges from mild redness and dryness to severe blistering and ulceration. Patients might experience

Systemic symptoms

High doses of radiation can cause systemic symptoms such as fatigue a common and debilitating symptom. Fever indicative of an inflammatory response or infection. Hair loss especially in areas exposed to radiation. Oral and pharyngeal symptoms. In head and neck cancer treatments, radiation can lead to painful inflammation and ulceration of the mucous membranes. Dry mouth due to damage to salivary glands difficulty swallowing due to inflammation and fibrosis. The biological mechanisms underlying acute radiation toxicity are complex. Radiation damages cellular DNA, either directly or through the generation

of free radicals. This damage triggers a molecular events, leading to cell death or dysfunction. The body's attempt to repair this damage can also contribute to the symptoms experienced. Radiation exposure induces an inflammatory response, characterized by the release of cytokines and other inflammatory mediators. This can lead to tissue swelling, pain, and redness, contributing to symptoms such as dermatitis and mucositis. The death of rapidly dividing cells in tissues like the gastrointestinal tract and bone marrow disrupts normal function. For instance, the loss of epithelial cells in the intestines can impair nutrient absorption and barrier function, leading to diarrhea and increased infection risk.

Immune system suppression

Damage to bone marrow can suppress the immune system, making patients more susceptible to infections. This is particularly concerning as infections can exacerbate other symptoms and complicate treatment. Effective management of acute radiation toxicity involves a combination of preventive measures, symptomatic treatment and supportive care. Here are some strategies. Dividing the total radiation dose into smaller, daily doses can help minimize damage to healthy tissues. Techniques such as intensity-modulated radiation therapy (IMRT) and proton therapy allow for more precise targeting of tumors, sparing surrounding healthy tissue. Topical steroids, moisturizers and protective dressings can help manage radiation dermatitis. Avoiding irritants and gentle skin care are also recommended. Antiemetics can help control nausea and vomiting. Analgesics and anti-inflammatory medications can alleviate pain from mucositis and other inflammatory conditions. Ensuring adequate fluid and nutrient intake is vital, especially for patients experiencing gastrointestinal symptoms. May be necessary for patients with severe anemia or thrombocytopenia. Hematopoietic growth factors can stimulate bone marrow recovery, reducing the duration and severity of leukopenia and thrombocytopenia. Prophylactic antibiotics and stringent hygiene practices can help prevent infections in immunocompromised patients. Educating patients about the potential side effects of radiation therapy and how to manage them is vital. Psychological support and counseling can also help patients cope with the stress and anxiety associated with their treatment and symptoms.