Principles of Radiation Therapy

What Hospitalists Need to Know

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KEYWORDS

• Radiation therapy • Radiation toxicity • Hospital medicine • Management

HOSPITAL MEDICINE CLINICS CHECKLIST

1. Radiation therapy is often used in cancer therapy. Ionizing energy leads to cell death. Each cancer type and normal tissue has different radiosensitivities. The goal of radiation oncologists is to maximize malignant cell damage while preserving healthy tissue.
2. As more hospitalists provide direct care of hospitalized patients with cancer, knowledge of some common radiation therapy applications in oncology will be useful to help diagnose and treat complications of cancer therapy in an appropriate manner.
3. Typical side effects of radiotherapy include fatigue, nausea, dermatitis, and mucositis. Most patients undergoing radiation therapy are not hospitalized. However, when admission is required, it is usually secondary to complications from dermatitis, mucositis, dehydration, profound deconditioning, bleeding, or delirium.
4. Most patients undergoing brain radiation should also receive corticosteroids to help mitigate expected side effects.
5. Palliative care consultation could be considered if symptoms do not improve in an expected manner. Thoughtful consideration to determine whether symptoms are related to treatment side effects versus cancer progression is important and challenging.

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BACKGROUND

Why do hospitalists caring for patients with cancer need to understand radiation oncology principles?

In 2012, there were almost 14 million patients with cancer in the United States.[1] Radiation therapy (RT) is frequently used for curative, adjuvant, neoadjuvant, therapeutic, and palliative intent. In 2004, more than 1 million patients made 23.4 million RT treatment visits to hospitals or freestanding RT centers in the United States.[2] As general hospitalists care for more oncology patients, they will also see more patients who undergo RT and therefore it will be beneficial to understand RT principles.

What is RT?

RT uses ionizing radiation to control or kill cancer cells. Ionizing radiation kills cells by damaging DNA directly or through the free radicals it creates.[3] The damage is primarily manifested by the loss of reproductive capacity, which is the main characteristic of tumor cells. This damage may appear immediately and continue to occur after several cell divisions before metabolic death. The effectiveness of radiation on tumors depends on the cells' proliferation rate. Cancer with very slow rates of growth, commonly seen in prostate carcinoma, may persist for years.[3] **Table 1** lists radiation doses given in common procedures.

How is RT given?

Most patients receive external beam RT from a linear accelerator, similar to how a computed tomography test is done. Radiation is usually delivered through photons, which are electromagnetic energy such as visible light or X-rays. Another way to deliver radiation is using protons, which in theory limits healthy tissue damage. Equipment availability, cost, and lack of established guidelines currently limit use of this type of RT.

Besides external beam, radiation can also be administered by implanting radioactive seeds in the tumor, as is done in prostate cancer. Another method is direct injection, such as radioactive iodine for thyroid cancer or the use of samarium or strontium for painful bone metastasis.

Table 1
Radiation dose comparison for common procedures

Procedure	Approximate Radiation Dose (Gy)
Chest radiograph (1 view)	0.00002
Natural radiation in 1 y	0.003
Computed tomography of abdomen	0.008
Single-dose bone metastasis	8
Lymphoma	30
Lung cancer	60
Prostate cancer	70

Data from Refs.[3,24,70,71]