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# Image-Guided Radiation Therapy: A New Paradigm in Cancer Care

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At its most basic level, the goal of radiation therapy is to cause permanent injury to the DNA of cancer cells, which, in turn, causes the cells to die. And when higher doses of radiation are used, it is more likely that cancer cells will be killed. However, high doses of radiation have the potential to also damage nearby healthy tissues.

In the past, when tumors grew near areas such as the spine, using radiation was not possible because the risk of damaging the spinal cord was too great. Doctors are now able to use IGRT to safely deliver very high doses of radiation to places previously considered impossible to treat. IGRT accomplishes this by combining two technologies — image-guided verification and highly conformal radiation treatment.

At the beginning of an IGRT session, the treatment team performs a CT scan and other x-rays to verify the exact location of the tumor in the patient's body. The scanner rotates 360 degrees around the patient, providing a 3-D view of the tumor. Imaging the tumor immediately before the delivery of radiotherapy and throughout treatment reduces the margin of healthy tissue exposed to radiation to as little as two millimeters, sometimes even less. The radiation “conforms” to the precise outlines of the tumor, allowing doctors to deliver higher doses.

As Dr. Yamada explains, “What makes it all possible is being able to fuse together the ability to give very conformal radiation — in other words, radiation that very precisely follows the 3-dimensional shape of the tumor — with our ability to deliver that radiation with submillimeter accuracy.”

The delivery of IGRT requires a team of experts working together and using their expertise to devise the optimal approach for each patient.

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## Using IGRT to Treat Spine Tumors

While IGRT is used to treat many types of cancer, it is one of the most common treatments for tumors that begin in the spine as well as for metastatic [spine tumors](#) (tumors that spread to the spine from another part of the body). According to Dr. Yamada, more than 3,000 patients have been treated with spine radiotherapy at treatment centers worldwide, and 90 percent of these patients have experienced long-term control of their tumors — meaning that their tumors do not come back.

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Josh Yamada, MD

“IGRT is used to treat spine tumors by focusing multiple beams of radiation that converge on the tumor,” says Dr. Yamada. “We have the capability to sculpt that radiation so that it conforms very tightly to the target.” Once the location is determined, high doses of radiation are delivered directly to the tumor, while potential damage to surrounding normal tissues is avoided. This means fewer side effects, less toxicity, and fewer complications of treatment for patients.

IGRT can be used as the sole curative treatment; or it can be used in combination with chemotherapy, surgery, or both. When used as a combination treatment, radiation therapy is often used first to shrink a tumor to make surgical removal possible. IGRT is also useful in the treatment of tumors that have not responded well to conventional radiation therapy.

Another advantage of IGRT is that fewer treatment sessions are necessary for the patient because the doses of radiation are so high. Treatments that used to take more than seven weeks to administer using conventional delivery methods can now be given in one afternoon. This is especially important for patients who are traveling a distance to receive treatment.

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## Using IGRT for Symptom Relief

In some instances, the goal of treatment is not to cure the patient’s cancer but to improve his or her quality of life by relieving symptoms — this is known as a palliative treatment. For example, patients with a metastatic spine tumor often have significant back pain, but surgery is not an option for a variety of reasons. Dr. Yamada explains that for these patients IGRT can be used as a noninvasive treatment approach to alleviate those symptoms and prevent them from getting worse.

“Tumors cause pain and loss of function — these are all dramatic, negative impacts upon quality of life,” he says. “If any type of therapy can get rid of a tumor, you’re going to get rid of the patient’s symptoms, and his or her quality of life will improve.”

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## IGRT Going Forward

Despite the many advantages of image-guided radiation, it is important to remember that there is still an important role for conventional radiation therapy. Dr. Yamada notes, “IGRT isn’t always beneficial or even desirable for all situations. This is something that patients need to discuss with their physicians.”

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