Patients benefit from modern radiation technology

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Patients with tumors and other life-threatening conditions are benefiting from the steady evolution of radiosurgery and radiotherapy, treatments that are often described as "incisionless surgery" or "surgery without the knife."

Both radiosurgery and radiotherapy involve destroying a tumor or diseased tissue by bombarding it with targeted beams of radiation. Radiosurgery uses high doses of radiation in a single or small number of treatments, while radiotherapy uses lower doses of radiation given in as many as 30 to 35 treatments. Radiation works by damaging the DNA inside cells and making them unable to divide and reproduce, therefore causing them to die.

"Radiosurgery and radiotherapy are among the most valuable tools we have in health care," says John Breneman, MD, Charles M. Barrett Professor of Radiation Oncology at the University of Cincinnati (UC) College of Medicine and Co-Director of Precision Radiotherapy Center in West Chester.

"These treatments are a blend of surgical and radiation oncology techniques. We use some of the same navigation tools of surgery, which allow us to precisely locate the lesion, or tumor. But instead of using a knife, we ablate our targets with a machine—a linear accelerator—that delivers X-ray beams. In short, we use the best of both worlds."

The experience, Breneman says, is reminiscent of getting an X-ray.

"There is no discomfort and no bleeding. Treatments typically last less than an hour, and patients almost always go home the same day."

Precision Radiotherapy Center, which opened in 2003, is a partnership of UC Health Radiation Oncology and the Mayfield Clinic. The center works closely with the UC Cancer Institute, the UC Health Barrett Center and the UC Brain Tumor Center. Also serving as co-director is Ronald Warnick, MD, professor of neurosurgery and radiation oncology and chairman and president of the Mayfield Clinic.

Radiation oncologists collaborate with a multi-disciplinary team of specialists—surgeons, medical oncologists, radiation physicists and dosimetrists—to treat a number of conditions at Precision Radiotherapy Center, including tumors in the brain, head and neck, breast, lung, liver, pancreas, prostate and rectum. In addition, a number of benign conditions, such as facial pain disorders (trigeminal neuralgia), and cerebrovascular malformations (arteriovenous malformations and cavernomas), can be successfully treated with these techniques.

William Barrett, MD, chairman of the radiation oncology department at UC, notes that the interest in radiosurgery as a definitive treatment for stage 1 and 2 lung cancers continues to increase and is being used more and more. "Stereotactic radiation for liver metastasis from colon (and possibly from some other) cancers has potential as well and may be used more in the future," Barrett says.

The good news for patients, Breneman says, is that radiation therapy has evolved significantly over time, "allowing us to zero in ever more precisely on lesions while not injuring sensitive surrounding structures."

Safety is a priority, and protocols at Precision Radiotherapy Center call for daily checks of the equipment's accuracy. Radiosurgery research by Breneman and UC's radiation oncology team has focused on accuracy and safety.

The benefits of this modern radiation technology include the ability to target 1) especially large cancers; 2) tumors that cannot be easily reached through conventional surgery; 3) tumors that are in or near sensitive areas, such as the brainstem, spinal cord or facial nerves; and 4) tumors that have already been subjected to maximal conventional radiation or surgery. Radiation oncologists can also use radiation to simultaneously treat multiple tumors, as in the case of metastases that have spread from their original source to other parts of the body.

Prior to treatment, brain or body scans are performed to determine the tumor's location, volume, shape and proximity to critical structures. This information is transferred into the treatment planning computer system, and the treatment team then determines the appropriate radiation dose, the number and angle of treatment beams, and the shape of the beams so that they exactly match the tumor.

During planning scans and treatment, patients must be placed in the same position each time on the treatment table. Patients with tumors outside the head are fitted for and immobilized in vacuum body molds.

Patients with tumors inside the head benefit from one of the most important developments in recent years: the replacement of the invasive head frame previously used for brain radiosurgery with a non-invasive plastic mask. In 2009 Breneman and his colleagues at Precision Radiotherapy Center and the UC Brain Tumor Center published their research findings that radiosurgery of metastatic brain tumors could be safely and effectively performed without immobilizing a patient's head with an invasive head frame.

Until a few years ago, the standard of care for radiosurgery had required the fixation of a rigid, invasive stereotactic head frame to the skull in order to immobilize the patient and provide a frame of reference for targeting the radiosurgery. Bolted to the skull with surgically implanted pins, the head frame was often associated with discomfort, anxiety and increased recovery time.

Today, the rigid head frame has been eliminated from all radiosurgery and radiotherapy treatments involving brain lesions at Precision Radiotherapy Center. Patients are routinely immobilized in a fabricated, noninvasive mask that is custom fit to patient's head.

Another important development involves "gating technology," which allows radiation to be targeted to parts of the body, such as the lungs and abdomen, which move when the patient breathes in and out.

Provided by University of Cincinnati

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