SUMMARY OF SCIENTIFIC BREAKTHROUGHS
FROM THE 2019 ASTRO ANNUAL MEETING

THE ROLE OF RADIATION THERAPY IN CANCER CARE

ASTRO

TARGETING CANCER CARE

Introduction

Hearing a cancer diagnosis is scary. Overwhelming. Confusing. Many questions flood your mind when you learn you or a loved one have cancer. And trying to learn and understand all the treatment options can be daunting to say the least. At the American Society for Radiation Oncology (ASTRO), our mission is to advance the practice of radiation therapy by promoting excellence in patient care, which includes promoting radiation oncology research and disseminating results to both our members and patients.

For more than 100 years, doctors have been using radiation therapy, also known as radiotherapy, to treat patients diagnosed with cancer. Radiation therapy is often combined with other treatment options, like chemotherapy or surgery, or used as a stand-alone treatment. Radiation therapy is an effective option for many people faced with a cancer diagnosis. In fact, nearly two-thirds of all cancer patients are treated with radiation during their illness.

Radiation therapy targets cancer cells and damages the DNA of the cell. The radiation destroys the ability of the cancer cells to reproduce and repair, causing the cells to die. Once these cancer cells die, the body naturally eliminates them. Normal cells that surround the cancer cells are affected by the radiation treatment as well, but the normal, healthy cells can repair themselves far better than the cancer cells. Advances in radiation therapy have allowed doctors to better target the cancer to reduce the risk of side effects from radiation. Despite the name, radiation therapy does not cause a patient to become radioactive. Radiation therapy treatments allow most patients to continue with their typical daily activities. Side effects vary based on the location and type of cancer, and many patients continue to work or go to school while undergoing treatments.

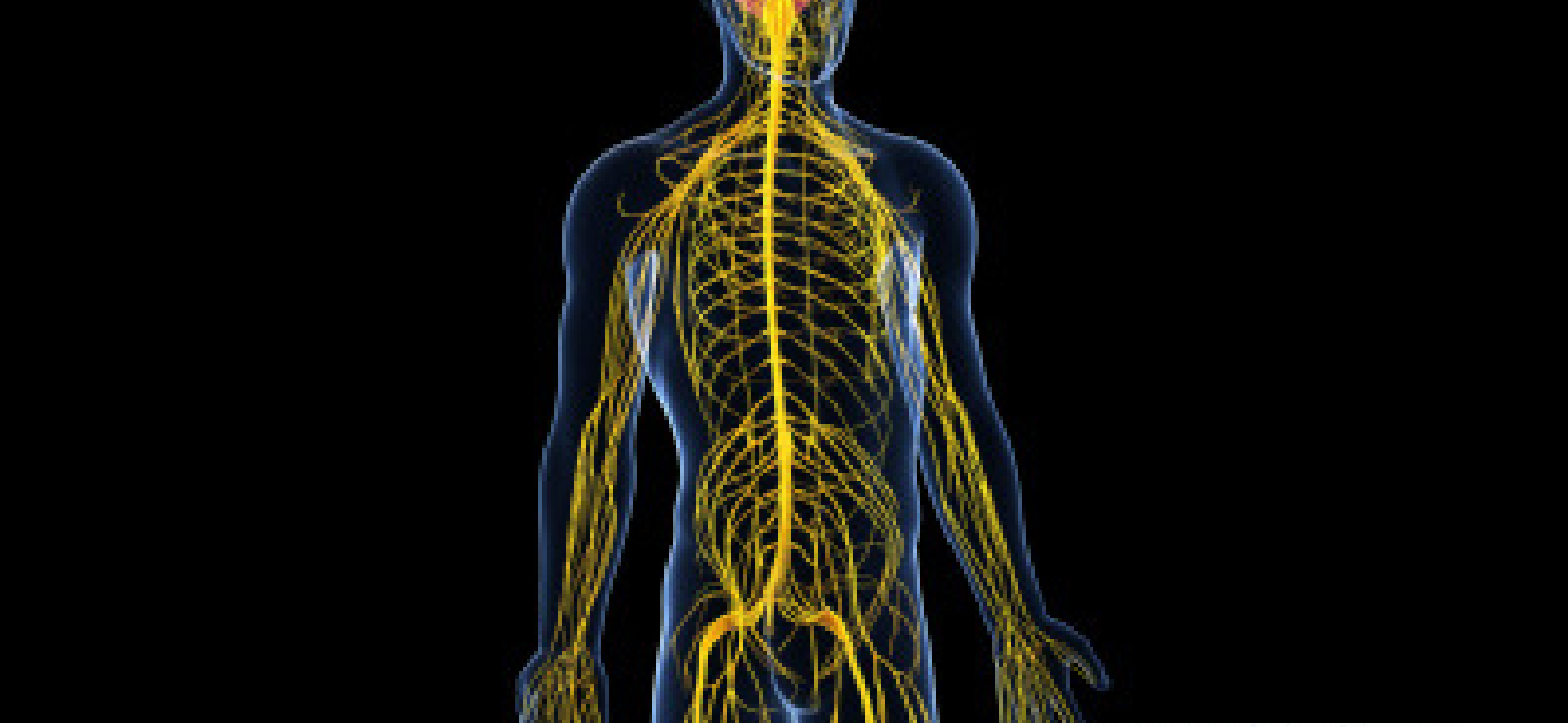
With radiation therapy, research often focuses on this question: What is the right dose of radiation for each patient? Sometimes more intense therapy is needed, and in others, is it possible to reduce the amount and intensity of treatments while still achieving excellent outcomes for patients? How do radiation oncologists find the right balance between reducing treatment doses to improve patients' quality of life while making sure that the reduced treatment remains powerful enough to stop the cancer from spreading?

The answer is research, where scientists and physicians work together to discover new cancer treatments. Today, radiation oncologists are actively researching safe and effective radiation treatments, including more personalized approaches and studies of lower doses for a variety of cancers.

In an effort to disseminate the latest science related to radiation therapy, ASTRO prepared this pamphlet, which highlights some of the top research presented at our 2019 Annual Meeting.

We encourage you to review all of your treatment options, including radiation therapy, with your primary care physician before determining which option or combination of options is best for you and your lifestyle.

Theodore L. DeWeese, MD, FASTRO
Chair, ASTRO Board of Directors



CNS – Central Nervous System

Cancers of the central nervous system include brain and spinal cord cancers. As with other types of cancer, treatment options vary based on the type of tumor, size, specific location and grade, meaning how aggressive the tumor looks.

Avoiding the hippocampus during whole-brain radiation therapy preserves patients' mental functions

When cancerous tumors spread to the brain with many lesions, the seriousness of the situation often requires radiation oncologists to treat the tumors with whole-brain radiation therapy (WBRT) to treat not only the tumors that are seen, but also hidden cancer not yet seen on imaging. This therapy targets the entire brain and helps to limit neurological regression and delay onset of new brain metastases. Unfortunately, WBRT can cause troublesome side effects like fatigue, hair loss and cognitive (knowing, perceiving, reasoning) problems, including short-term memory loss.

A new study has found that it is possible to modify WBRT to reduce the risk of cognitive side effects and improve overall neurologic function. The key to success, says Vinai Gondi, MD, the study's co-lead author, lies in carefully directing the radiation to avoid the hippocampus, the part of the brain believed to be responsible for creating and storing memories.

In this randomized study, 500 patients with brain metastases from a variety of cancer, received radiation therapy plus memantine, a memory-enhancing drug. Half of the patients received conventional WBRT in which no attempt was made to avoid the brain's hippocampus. The other half of the patients received intensity-modulated radiation therapy (IMRT) that allowed the radiation oncologist to avoid radiating the hippocampus.

The researchers hypothesized that avoiding the hippocampus would result in more patients maintaining their cognitive health and performance than using conventional WBRT. They tested patients' cognitive health and performance by having them fill out standardized questionnaires at two, four, six and 12 months after completing radiation therapy.

The results showed that the patients in the hippocampus-avoidance group had more patients able to maintain mental skills to manage daily life at four months, and learning and memory at six months. What's more, patients in this group were better able to preserve all learning and memory abilities for the entire study duration. In addition, patients in the hippocampus-avoidance group reported better overall neurologic function, including less fatigue, less burden of neurologic symptoms and better ability to remember things. Toxicity and overall survival outcomes were similar in both groups, meaning that there was no clinical downside to protecting the hippocampus from radiation.

These findings led Dr. Gondi, who is the director of Research and Education at the Northwestern Medicine Chicago Proton Center and co-director of the Brain Tumor Center at Northwestern Medicine Cancer Center Warrenville, to conclude that IMRT with hippocampal avoidance should become the standard of care for patients with diffuse brain metastasis who are eligible for WBRT and expected to live at least four months. This conclusion has been supported by the updated National Comprehensive Cancer Network guidelines for brain metastases.

Fighting high-risk neuroblastoma: More radiation is not better

Neuroblastoma is a cancerous tumor that begins in nerve tissue of infants and young children. Neuroblastoma accounts for about 6% of all childhood cancers. There are about 800 new cases diagnosed each year in the U.S., 90% of them in children younger than age five.

High-risk neuroblastoma is defined using a combination of risk factors including age, stage, pathology and other biologic features. These patients with high-risk neuroblastoma typically receive combination treatment that includes chemotherapy, surgery, stem cell transplants and radiation. Even so, they often develop tumors that may occur in other organs or lymph nodes, and the five-year survival rate for high-risk neuroblastoma is only 40% to 50% according to the American Society of Clinical Oncology.

Some studies have suggested that increasing the radiation dose — called "boost" radiation — might prevent a local recurrence. A team from the Children's Oncology Group decided to see whether that finding held up. Their study enrolled 323 patients between November 2007 and February 2012. They gave 133 patients who had residual tumor after surgery "boost" radiation therapy for a total dose of 36 Gy (a measure of how much radiation is absorbed by tissue). Patients on a previous Children's Oncology Group trial who had residual tumor after surgery received radiation therapy totaling 21.6 Gy. The researchers compared the two groups using several measures of treatment effectiveness, including five-year cumulative incidence of local progression and overall survival.

None of the measures showed any significant differences between the two groups, said lead author Kevin Liu, MD, DPhil, of the Harvard Radiation Oncology Program. His group therefore recommends that all high-risk neuroblastoma patients should receive only the standard radiation dose.

External beam radiation therapy outperformed stereotactic body radiotherapy in spinal tumor pain control

When tumors spread to the spine from organs like the lungs, breasts or prostate, radiation therapy is the treatment of choice to shrink the tumors, ease pain and improve patients' quality of life. But which type of radiation therapy leads to the best results?

Samuel Ryu, MD, chair of the Radiation Oncology Department at Stony Brook University Hospital in Stony Brook, New York, expected that stereotactic body radiotherapy (SBRT) would improve pain control more than conventional external beam radiation therapy (EBRT). That's because SBRT delivers higher doses of radiation to tumor tissue compared to conventional EBRT while sparing healthy tissue. With EBRT, healthy tissues receive radiation as the beams pass through to reach the tumor, which means the doses must be lower to limit this potentially harmful exposure.

"Previous experience with spine radiosurgery has shown much improved tumor and pain control in patients," Dr. Ryu said. "Therefore, the next step was to perform a randomized study to compare how effective radiosurgery and conventional radiation were at controlling pain caused by spine metastasis." To the surprise of Dr. Ryu and his colleagues, EBRT outperformed SBRT in a head-to-head pain-control comparison involving some 300 patients. The average pain score in both groups was around six out of 10 before receiving radiation therapy. At three months following radiation, patients in the SBRT group reported an average improvement of three points on the pain scale. At the same time, patients in the EBRT group reported an average pain scale improvement of nearly four points.

While EBRT had better-than-expected pain control, the question remains: Is the standard external beam radiation dose sufficient to control the tumor? Dr. Ryu stated, "The long-term effects on pain and tumor control should be the ultimate goal, and we are still waiting to learn from those results which form of radiotherapy is more effective."