



SUMMARY OF SCIENTIFIC BREAKTHROUGHS FROM THE 2019 ASTRO ANNUAL MEETING

THE ROLE OF RADIATION THERAPY IN CANCER CARE

ASTRO
TARGETING CANCER CARE





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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?

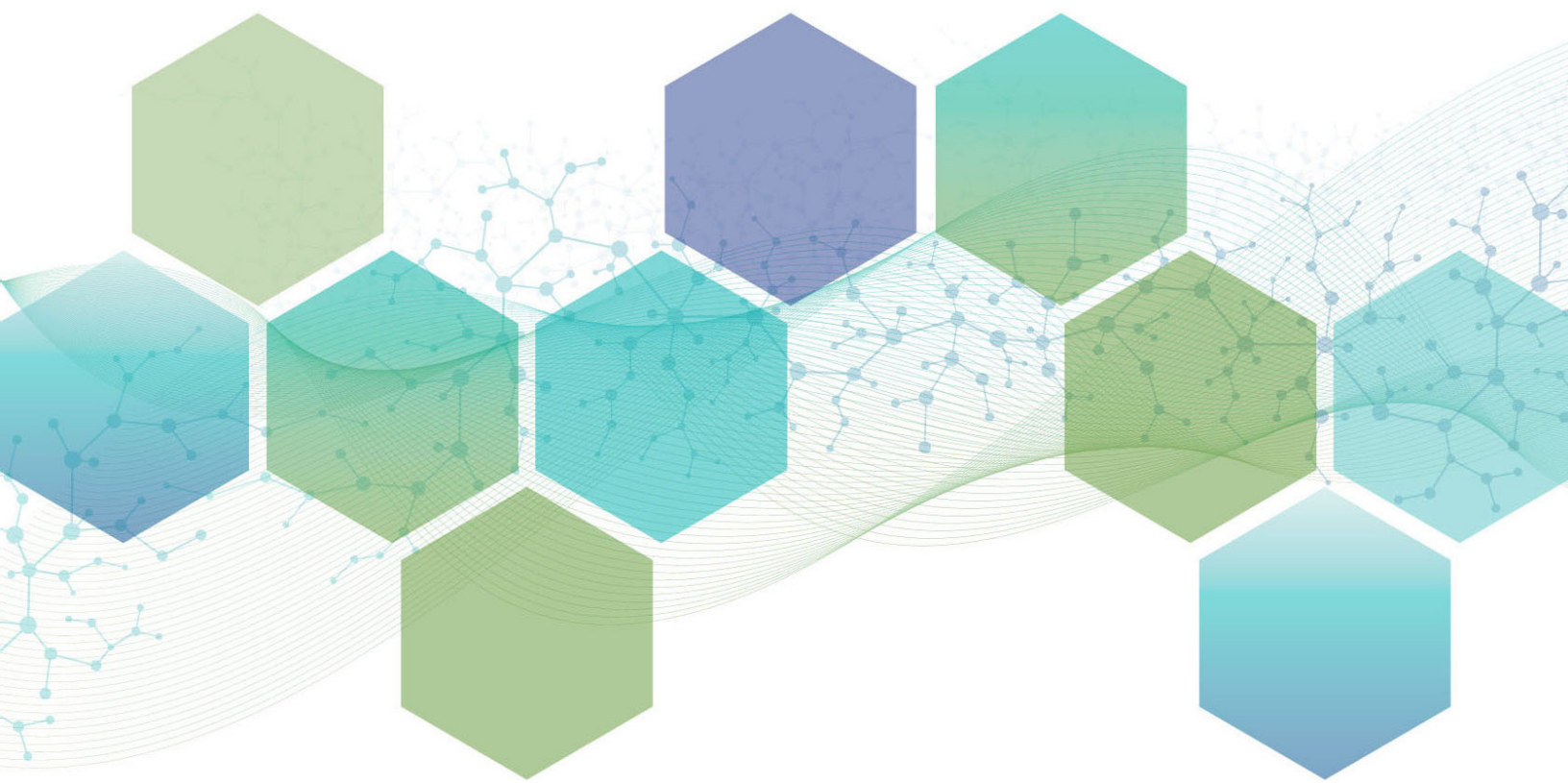
The answer is research, where scientists and physicians work together to discover new cancer treatments. Today, radiation oncologists are actively researching safe and effective radiation treatments, including more personalized approaches and studies of lower doses for a variety of cancers.

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.

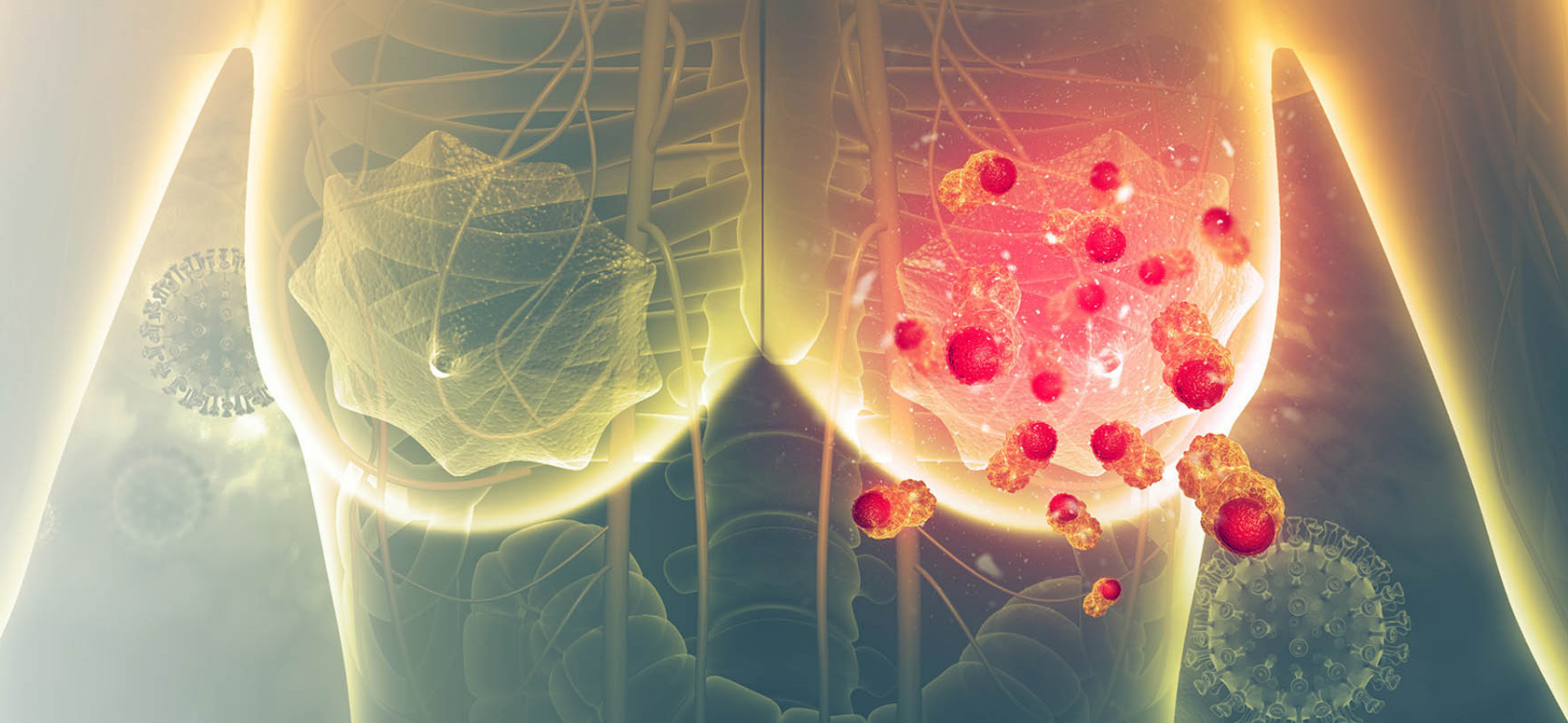


We encourage you to review all of your treatment options, including radiation therapy, with your primary care physician before determining which option or combination of options is best for you and your lifestyle.

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



Research by Disease Site



Breast

Breast cancer affects both men and women, and it is the most common type of cancer among women worldwide according to the World Cancer Research Fund. Breast cancer can often be cured, and about 83% of all patients with breast cancer live at least 10 years after their diagnosis. Radiation therapy is a common treatment following mastectomy or lumpectomy, as it reduces the risk of the tumor recurring and improves the likelihood of survival.

Choosing the right therapy after lumpectomy

Women diagnosed with early stages of breast cancer (stage II or earlier) often undergo the removal of the cancer, known as lumpectomy, aiming to keep as much of their breast as possible, followed by radiation therapy to lower the risk of the cancer returning. Radiation destroys cancer cells or pre-cancerous cells in the breast that have not yet been detected. There are two primary radiation therapy choices: whole breast irradiation or partial breast irradiation, which targets a smaller area beside the lumpectomy site. Studies have shown that the two treatments are about the same when it comes to preventing the cancer from coming back, with no significant differences in overall survival, the time patients live without the cancer coming back, or the time patients live without the cancer spreading to another site.

An advantage of partial breast irradiation is that it takes several days, compared with three or four weeks for whole breast treatments. One question remains: Is one treatment better than the other from a cosmetic point of view? It turns out that they're about the same, according to a study from The Ohio State University. The researchers measured cosmetic outcomes for 900 women, of whom 477 had received partial breast treatment and the rest had received whole breast treatment. They asked both the patients and their physicians to rate the cosmetic outcome of the treated breast, compared with the untreated one, as either excellent, good, fair or poor at three different times (right after treatment, 12 months after treatment and three years after treatment).

The researchers also had the outcomes assessed independently by two teams of three physicians each. They took digital photos of the women's breasts at each time point and had the physicians rate them, without knowing which treatment the women received, or which breast was treated.

"We found that whether the women received whole breast radiation or partial breast radiation, there was an equal cosmetic outcome from the patients' perspective," said Julia White, MD, FASTRO, a professor of radiation oncology at The Ohio State University Comprehensive Cancer Center and lead author on the study. The pattern held when the patient had also received chemotherapy. In addition, patients' satisfaction with their treatment and cosmetic outcome were the same for whole breast and partial breast radiation. Three years after completing radiation therapy, 81% and 86% of patients said they were "totally satisfied" with partial breast or whole breast radiation, respectively; 14% and 11% were "somewhat satisfied"; 2% and 3% were neither "satisfied nor dissatisfied"; 1% and 2% were "somewhat dissatisfied"; and less than 1% of patients in each group said they were "totally dissatisfied" with their treatment.

Treating physicians rated cosmetic outcomes from partial and whole breast radiation as equal at one year after treatment, though they considered outcomes from partial breast radiation worse at three years after treatment. Like the patients, the independent observers saw no significant differences.

Dr. White said the findings were important for women facing difficult choices after being diagnosed with breast cancer. "If a patient chooses breast conservation [lumpectomy with radiation therapy versus an alternative option of mastectomy, which is removal of the entire breast] for her treatment, she generally wants the breast to feel and look as normal as possible. We were relieved that the partial breast and whole breast radiation cosmetic outcomes were equal."

Type of axillary surgery is a better predictor of lymphedema for breast cancer patients

Breast cancer patients have lymph nodes removed (along with cancerous breast tissue) if their lymph nodes have cancer or they are at high risk of containing cancer. Lymphedema — fluid accumulation and swelling around the lymph node surgical site and extending to the arm — is a common, disfiguring and sometimes disabling side effect of treatment. There's no cure for it, though it can sometimes be controlled with measures such as compression bandages, exercises and massage.

Previous research shows that having more underarm lymph nodes removed increases lymphedema risk. Axillary lymph node dissection (ALND), a procedure that removes many lymph nodes, is associated with higher risk than sentinel lymph node biopsy (SLNB), which may remove only one or two lymph nodes. According to the National Cancer Institute, between 5% and 17% of women who have SLNB develop lymphedema, whereas between 20% and 53% of women who have ALND will develop lymphedema, and the risk increases with the number of nodes removed.

One question is whether having radiation in addition to surgery increases the risks of developing lymphedema. A long-term study recently completed at Massachusetts General Hospital in Boston suggests that the main driving risk for lymphedema is the axillary surgery. That's good news for patients who have been advised to have radiation treatments but are worried about side effects. Investigators found that "while regional lymph node radiation slightly increases the risk of lymphedema, the main driving lymphedema risk factor is the axillary surgery."



Between 2005 and 2018, 2,758 patients intending to have surgery for breast cancer were enrolled in a lymphedema screening trial. All participants received either SLNB or ALND (in addition to lumpectomy, mastectomy or mastectomy with reconstruction). The largest group, 1,354, received only SLNB and the smallest, 87, received only ALND. The other two groups received either SLNB plus regional lymph node radiation (RLNR — also referred to as RNI, regional nodal irradiation) or ALND and RLNR.

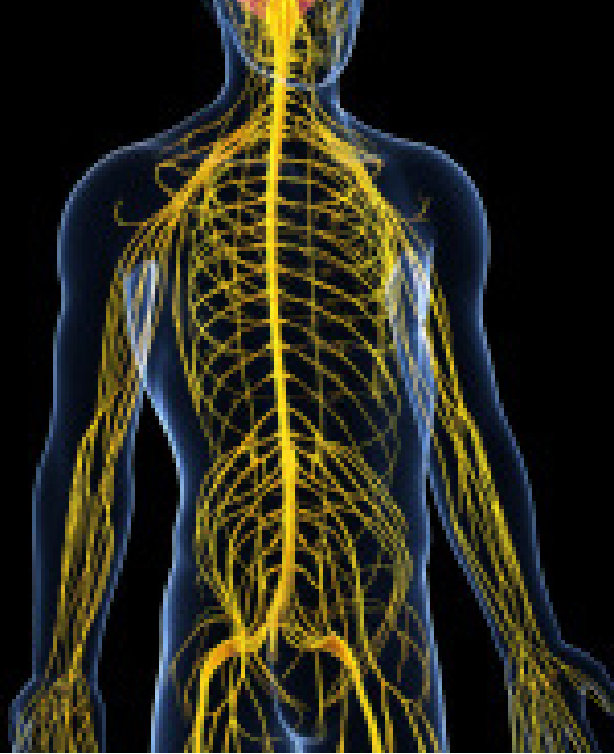
The study, lead authored by G.E. Naoum, MD, measured the level of lymphedema using perometry, a new non-invasive technique that uses infrared light to measure the width of the affected arm and the volume of fluid. Patients received a baseline measurement before surgery. Breast cancer-related lymphedema was defined as a 10% or greater relative arm-volume increase arising more than three months after surgery. The five-year risk of breast cancer-related lymphedema was lower in patients treated with SLNB and RLNR (11.2%), compared with either ALND with RLNR (36%) or ALND alone (28%). Skipping radiation reduced the risk only slightly for women having SLNB (8.5%).

Hypofractionation results in fewer side effects for breast cancer patients who have had reconstructive surgery

Much of the clinical research done by radiation oncologists is devoted to determining the right amount, type and frequency of radiation given to treat a cancer. It also focuses on minimizing side effects, maximizing the anti-cancer effect and creating a treatment plan that's reasonably convenient for the patient. One desirable goal is hypofractionation, or delivering the optimal amount of radiation over fewer sessions and a shorter time. Studies of hypofractionation focus on whether it can control cancer as well by giving more standard radiation, delivered more frequently over four to five weeks, and whether there is a difference in side effects, compared to standard longer course radiation therapy.

Previous studies have shown that hypofractionation works well for breast cancer patients who have had mastectomies, have not had breast reconstruction and have had surgery to remove cancerous lymph nodes. A recent study led by Christine Fisher, MD, MPH, out of the University of Colorado extended that promising news, showing that hypofractionation also works well for patients who have had some type of breast reconstruction using either an implant or their own tissue.

A year later, patients treated with hypofractionated radiation had fewer side effects: 26% of the patients studied had experienced some type of negative event from the treatment, compared with the 40% that's expected with the standard treatment plan. The most common negative event was lymphedema, or accumulation of fluid in the area surrounding the lymph node surgery, defined as an increase of 10% in arm measurement and experienced by 22% of the studied patients.



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."



Gynecological

Gynecologic cancers include malignancies of the female genital tract involving the vulva, vagina, cervix, uterus, fallopian tubes or ovaries. The American Cancer Society estimates that more than 113,000 women will be diagnosed with some form of gynecologic cancer in 2020.

Women with high-risk endometrial cancer live longer when chemotherapy is added to radiation therapy

When it comes to treating women with endometrial cancer, physicians usually start by performing surgery to remove as much of the cancer as possible. Typically, this includes a hysterectomy to remove the woman's uterus (the endometrium is the uterus's inner lining), fallopian tubes and ovaries. If the cancer is more advanced, nearby lymph nodes may also be removed.

But then what? A recommendation for additional treatment after surgery (called adjuvant treatment) to reduce the risk of the cancer coming back depends on the risk factors found in the cancer tissue, for example high grade, unfavorable histological type or advanced stage. Women with so-called high-risk endometrial cancer comprise about 15-20% of the endometrial cancer patients. These women typically receive chemotherapy and/or radiation therapy once they recover from surgery, with the exact therapy and dose depending on cancer stage and other factors. Radiation oncologists are eager to learn the results of high-quality trials that compare different treatments head-to-head.

One such study has found that women with high-risk endometrial cancer who received both chemotherapy and radiation therapy lived longer than those who received only radiation. This study, known as the PORTEC-3 clinical trial, included 660 women who were randomly assigned to receive both chemotherapy and radiation or radiation therapy alone. Among women in the combined therapy group, 81.4% were still alive after five years. In the radiation-only group, 76.1% were still alive after five years.

According to lead author, Stephanie M. de Boer, MD, Leiden University Medical Center, Leiden, Netherlands, women who had a cancer type known as serous endometrial cancer had worse outcomes. This was true regardless of which treatment they received. In the combined treatment group, 71.4% of patients with serous disease were alive after five years, while only slightly more than half of patients in the radiation-only group, 52.8%, survived that long. In addition, women with stage III endometrial cancer were also found to benefit more from chemotherapy than those with stage I-II disease.

Dr. de Boer and her colleagues also analyzed cancer recurrence trends among the participants. They found that 30% of the radiation-only patients developed cancer that came back but in different parts of the body, while only 22% of patients in the combined therapy group did. When patients' endometrial cancer did return, this was most often (80%) during the first two years after surgery.

Dr. de Boer emphasized that the findings apply mostly to patients who have advanced disease. "While women with stage III disease benefitted from receiving chemotherapy plus radiation, pelvic radiation therapy remains the standard of care among patients who have stage I-II disease, even with high-risk characteristics, as also found in the U.S. GOG-249 trial, which was published this year," she said.



Radiation oncologists can offer sexual health resources following cervical cancer treatment

Sexual health is often overlooked in the aftermath of a gynecologic cancer diagnosis and treatment, especially since many women who have finished treatment are just relieved to have survived. "Both the mental stress and dealing with side effects from radiation therapy and chemotherapy are known to reduce interest in sex," said Kathrin Kirchheiner, PhD, a clinical psychologist at the Medical University of Vienna in Austria. "But in many women, that desire comes back and is an important part of being alive and well." Dr. Kirchheiner and her colleagues run the longstanding EMBRACE clinical trial, which studies patients with locally advanced cervical cancer who were treated with external radiation therapy, chemotherapy and internal radiation therapy (brachytherapy). To date, more than 20 studies have been published using EMBRACE data.

In the newest one, Dr. Kirchheiner focuses specifically on EMBRACE patients' sexual health. As part of their follow-up care, more than 1,400 cervical cancer patients from 22 medical centers around the world completed questionnaires about their sexual activity and quality of life.

Participants completed their first questionnaires after receiving their cervical cancer diagnosis but before starting treatment. They also completed questionnaires during the first three years after treatment so that the researchers could learn about how treatment for cervical cancer affects women's ability to have and enjoy sex. "We already knew that radiotherapy causes changes in the vagina that can lead to sexual problems," Dr. Kirchheiner said. "However, the findings indicate that nearly 60% of the patients studied are sexually active after treatment. Sexual problems were found in around one-third of those patients."

Dr. Kirchheiner hopes that these study results will help improve patients' quality of life in the months and years following treatment. "There are very effective intervention strategies to either prevent vaginal side effects or to reduce existing symptoms," she said. "We need to talk about it more openly and implement sexual health programs as integral parts of cancer rehabilitation."

But don't feel you need to wait for your radiation oncologist to raise the subject. "My core message to patients is that your sexual life is not over after radiation therapy and chemotherapy, but you might need to adapt to changes in your vagina caused by radiation therapy," Dr. Kirchheiner said. "Talk to your radiation oncologist because help is available if you already experience sexual problems, such as vaginal dryness, the feeling of vaginal shortening or tightening or pain during intercourse."

Post-operative IMRT for endometrial and cervical cancers results in fewer GI and urinary side effects

In this study of women getting radiation after surgery for endometrial and cervical cancer, the authors wanted to find out if fewer gastrointestinal (GI) and urinary symptoms would occur if they used intensity-modulated radiation therapy (IMRT), a technique that adjusts the radiation beam to the shape of a tumor, allowing for the same effective doses of radiation to be delivered while minimizing exposure to surrounding healthy tissue, instead of standard 4-field radiation therapy for pelvic radiation.

Patients completed questionnaires at various times during and after radiation to report GI and urinary symptoms. A total of 279 patients took part.

The authors found that women who received IMRT had fewer GI symptoms at the end of radiation and one year after completing radiation compared to women who received standard 4-field radiation. There were no differences in GI symptoms between the two groups at three years after completing radiation.

Women who received IMRT also had fewer urinary symptoms at the end of radiation and at three years after completing radiation. The study also compared how effective treatment was in controlling cancer and found no difference between the two groups.

This study shows that IMRT to the pelvis after surgery results in fewer patient-reported GI and urinary symptoms compared to standard 4-field radiation. This reduction in symptoms happens both during radiation and afterward when effects still show up. As a result of this study, lead author Anamaria Yeung, MD, suggests that IMRT in this setting should become standard instead of 4-field pelvic radiation.



Head and Neck

The American Cancer Society estimates that, in the United States, approximately 3-5% of all cancers will be in the head and neck region. Treatment options vary based on the specific location of the cancer (e.g., base of neck, throat, tongue), but the two main treatment options are surgery or radiation therapy. Sometimes, chemotherapy and/or targeted systemic therapy is used in combination with radiation therapy.

Radiation de-escalation may be possible in some locally advanced head and neck cancers

Sue Yom, MD, PhD, MAS, of the University of California, San Francisco, recently examined two different de-escalation strategies, treatments which lower the dose of radiation, for patients with human papillomavirus (HPV)-positive head and neck cancer. "We tested two approaches to reduce the dose of radiation to a specific group of HPV-positive patients with very limited extent of cancer," she said.

Dr. Yom and her co-authors hypothesized that reduced-dose radiation therapy would prevent cancer relapse for at least two years in 85% or more of the participating patients. Some patients received radiation therapy only on a slightly compressed schedule, while others received radiation therapy in conjunction with the chemotherapy drug cisplatin.

After more than two years of follow-up, the researchers concluded that the combined radiation-chemotherapy regimen met the two-year progression-free survival goal, but the radiation-only regimen did not. "We designed the two trial arms [segments] hoping they would both be successful, but one was not," Dr. Yom said. "In light of this and other data showing negative outcomes from de-intensifying treatment, additional studies should be undertaken with caution. However, we are excited to move forward with our successful de-intensification arm in a new large-scale study attempting to develop a new de-intensified standard of care."

Proton beam therapy offers esophageal cancer patients reduced toxicities versus intensity-modulated radiation therapy

Esophageal cancer is a disease that often reduces a patient's quality-of-life. The esophagus is the hollow tube that connects your mouth with your stomach. When you swallow food or liquid, it travels through the esophagus to reach your stomach and begins the digestion of food process.

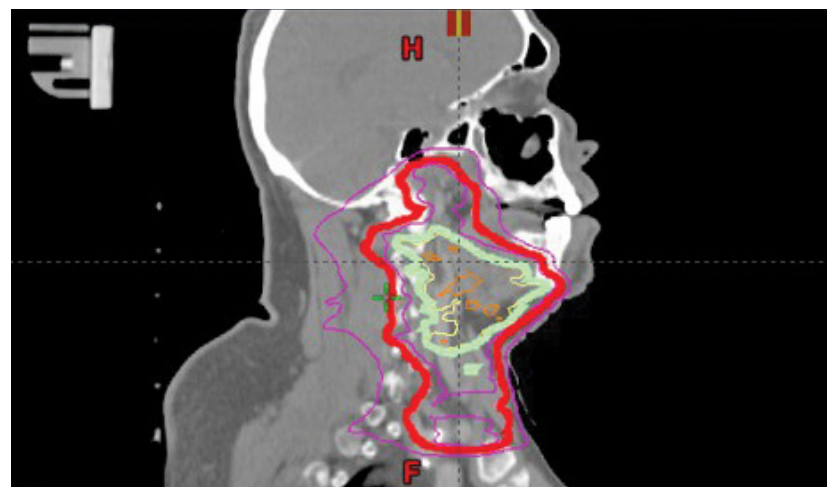
Tumors in the esophagus can make swallowing difficult or impossible, and the radiation treatment used to treat them can also cause side effects that make swallowing a challenge. When patients receive radiation therapy for esophageal cancer, in addition to treating the cancer, top priorities are preserving patients' ability to swallow and protecting the nearby heart and lungs from radiation damage.

A Phase II randomized study measured the severity of the side effects of radiation therapy associated with two different types of treatment. Specifically, the study compared the side effects of proton beam therapy (PBT) with those of intensity-modulated radiation therapy (IMRT).

The study, led by Steven H. Lin, MD, PhD, a radiation oncologist at MD Anderson Cancer Center in Houston, hypothesized that the greater precision of PBT could reduce esophageal cancer patients' total toxicity burden (TTB) without affecting their clinical outcomes, such as progression-free survival (PFS).

Lin, and his team assigned numeric values to 11 side effects that often occur within one year of starting radiation therapy. Severe side effects increased each patient's TTB score more than mild ones.

The investigators found that, at a median follow-up time of 52.9 weeks, patients in the IMRT group had worse side effects, with an average TTB score that was 2.3 times higher than those in the PBT group. About half the patients in each group had surgery as part of their overall therapy. For these patients, the average complications score after surgery was 7.6 times higher in the IMRT group than in the PBT group. Additional research is being conducted to determine whether PBT or IMRT helps patients live longer; these results will not be available for several years.



Hematologic – Lymphomas

Lymphomas affect the network of tiny vessels (even smaller than veins and arteries) and lymph nodes that extend throughout the body and are known as the lymphatic system. These lymphatic vessels carry a clear liquid called lymph from the extremities and organs back to the blood circulation and help fight infections and disease. Two common cancers in this area, often referred to as lymphoma, are Hodgkin's lymphoma and Non-Hodgkin's lymphoma.

Hodgkin's lymphoma: What's the best level of treatment?

Hodgkin's lymphoma (also known as Hodgkin's disease) is one of the most curable cancers today. Since all cancer treatments come with side effects, current research often focuses on creating treatment plans that minimize the amount of treatment without losing effectiveness. Recent research has suggested that Hodgkin's patients can skip radiation treatments if they have a good initial response to chemotherapy, but a new European study with more than a thousand patients contradicts that finding.

"Radiation therapy is still a key player in the management of Hodgkin's lymphoma," said principal investigator Hans Eich, MD, PhD, a radiation oncologist at University Hospital Muenster in Germany. He noted that radiation therapy was the only treatment for the disease several decades ago, but recent studies, including this one, indicate that a combination of chemotherapy and low-dose radiation achieves the highest level of tumor control with the least harmful effects.

Between November 2009 and December 2015, the German Hodgkin Study Group (GHSG) recruited 1,150 patients, ranging in age from 18 to 75, with newly diagnosed, early-stage favorable Hodgkin's lymphoma, from Germany, Switzerland, Austria and the Netherlands.

The patients all received chemotherapy, and positron emission tomography (PET) was used to evaluate how well they responded. They were then randomly assigned to one of two groups. Group one received a course of low-dose radiation therapy regardless of what the PET scan showed. Group two was divided into two arms based on their PET results. The patients whose PET scans showed a good response to chemotherapy received no further treatment aside from routine follow-up care, and the patients who responded less well received low-dose radiation.

The research team compared the chemotherapy-only group (300 patients) with the 328 patients in the chemo/radiation group who had similar PET results. They found that 93.4% of the patients receiving both chemotherapy and radiation were disease free after five years, compared with only 86.1% of the patients in the chemotherapy-only group. Dr. Eich said he was surprised at the size of the difference. Most often, the disease recurred at its original site, rather than showing up in other parts of the body.

"A limited, well defined, low-dose radiation therapy in conjunction with a limited chemotherapy offers the best chances for a cure in limited-stage Hodgkin's lymphoma," he said.





Lung

Lung cancer is the leading cause of cancer death among both men and women, according to the American Cancer Society. Each year, more people die of lung cancer than of colon, breast and prostate cancers combined.

Lung cancer is generally categorized as “small cell” and “non-small cell,” based on looking at the cancerous cells under a microscope. Small cell cancer is the less common and more aggressive of the two. It has often spread to other organs by the time it’s discovered and has an average five-year survival rate of only 6%. Non-small cell cancer, which accounts for 80% to 85% of diagnoses, has a better five-year survival rate of 60% if it’s caught while still localized. If the non-small cell cancer has spread to nearby regions, the rate drops to 23% five-year survival. Finding ways to improve those rates is a top priority for many lung cancer researchers.

New radiation treatment plans for lung cancer

Can some lung cancer patients improve their prognoses by receiving extra radiation treatments over a shorter time than usual, without suffering additional side effects from the treatment? A recent study is cautiously optimistic, though the researchers warn that the technique needs to be studied further and in combination with other treatments.

Conducted at UCLA, the study evaluated 28 patients on a prospective Phase II study with inoperable non-small cell lung cancer that was locally advanced and gave them an accelerated course of radiation and chemotherapy, further “boosted” by targeted radiation treatments using stereotactic ablative radiotherapy, or SABR.

The current standard of care for patients with locally advanced non-small cell lung cancer is chemotherapy at the same time as radiation therapy for six weeks, said lead author Percy Lee, MD, a radiation oncologist who specializes in SABR. “Outcomes for this treatment plan are suboptimal, with poor cancer control and long-term survival,” he said. The study sought to answer several questions: whether higher doses of radiation, over three weeks, would be more effective than the current standard; how much radiation patients could tolerate without harmful reactions; and whether an extra “boost” of SABR radiation would improve patients’ survival rates.

The three-week regimen appeared to be safe and effective for many of the patients, though Dr. Lee did note that two patients out of 28 treated had fatal complications from the treatment. The patients’ overall survival rates were 78% at one year and 52% at two years. He said the advantage of using SABR as part of the treatment was that it minimizes high doses of radiation to normal tissues, including the heart, spinal cord, esophagus and airways.

However, Dr. Lee said this work is only the beginning of finding ways to combine SABR with other kinds of treatment. “With advances in radiation therapy planning and delivery, along with advances in systemic therapy with immunotherapy, we are seeing more favorable results and achieving higher rates of durable disease control and cure,” he said. “We believe that this abbreviated and dose-intense plan for chemoradiotherapy should be studied in combination with immunotherapy to see if we can further enhance disease control, survival and quality of life in these patients.”

Radiation therapy may increase immunotherapy results in patients with advanced lung cancer

When cancer patients have a widespread, or systemic, response to a localized therapy (for example, after radiation to one site of cancer leads to all sites of cancer shrinking), this is called the abscopal effect. Radiation oncologists are trying to better understand the abscopal effect in hopes of being able to trigger this response in patients more consistently. In that way, more patients could have better-than-expected responses to treatment, eventually improving the standard of care.

Allison Campbell, MD, PhD, of Yale University, and colleagues recently conducted a Phase II trial to study the abscopal effect in patients with metastatic lung cancer. “Our clinical trial enrolled patients with metastatic lung cancer who had their disease progress while undergoing immunotherapy,” she said. “We gave them radiation to just one cancerous lesion in the hopes that this would stimulate an anti-tumor immune response throughout the whole body.”

The researchers enrolled 50 patients with metastatic lung cancer who had not yet received immunotherapy and treated them with the drug pembrolizumab. Of these 50 patients, disease progressed in 16. These patients, plus six others whose cancer had already progressed on immunotherapy, received high-dose stereotactic body radiation therapy (SBRT) to a single tumor each. The patients who received SBRT experienced an average of five months before their cancer progressed. And nearly half of the SBRT patients achieved stable disease after treatment.

The researchers also found that 10% of patients in the study had tumors shrink that were located outside the area that received radiation. What’s more, this response continued for more than a year in some patients. This study, in combination with other recently published Phase I/II trials, indicates that the combination of immunotherapy and radiation is safe. “There are hints that adding radiotherapy to immunotherapy might emerge as an important therapeutic option when immunotherapy stops working,” Dr. Campbell said.



Palliative Care

The goal of palliative care, also known as supportive care, is to improve the quality of life of people with serious illnesses, including cancer, by relieving or managing symptoms caused by the cancer itself or cancer treatments. Symptoms treated can include pain, shortness of breath, loss of appetite, fatigue and disruptions to normal sleep patterns. The idea behind palliative care is that by providing relief to some of these symptoms, a patient would then gain more strength and be able to carry on with normal daily activities or tolerate other medical treatments. Patients can receive palliative care at the same time as other cancer treatments.

Can a rapid access bone metastasis clinic reduce financial toxicity?

Each year, thousands of U.S. cancer patients learn that their cancer has metastasized, meaning it has spread to other parts of the body, including their bones. Almost any cancer can metastasize (or spread) to the bones, but cancers of the breast, lung and prostate — some of the most common in the U.S. — are the types of cancer most likely to spread to the bones.

Bone metastases are typically painful and often prevent patients from continuing to do the things they enjoy. Fortunately, palliative radiation therapy is an effective treatment for bone metastases. Radiation therapy can reduce the need for pain medication and improve patients' quality of life, so providing effective, affordable treatments for bone metastases is an important priority among radiation oncologists.

To meet this need, the University of Texas MD Anderson Cancer Center in Houston launched a rapid access bone metastases clinic (RABC). The goal is for patients to receive radiation oncology and orthopedic surgery consults within 48 hours of being referred. When possible, patients receive radiation simulation and one 8 Gy treatment on the same day. Typically, this referral, planning and palliative radiation treatment process can take up to several weeks and requires multiple doctor visits, all of which rack up out-of-pocket costs to patients.

So far, high patient satisfaction scores have indicated that the RABC is meeting its goal of quickly improving care for patients with bone metastases. But is the RABC cost effective for patients? Jose Alberto Maldonado, a first-year medical student at the University of Texas Medical Branch, and colleagues conducted a survey to compare how much patients paid out of pocket when receiving treatment in the RABC compared with patients who did not use the RABC. The survey also asked about travel distance and patient satisfaction. Maldonado and colleagues learned that the RABC at MD Anderson Cancer Center significantly decreased overall out-of-pocket costs for palliative radiation patients. They found that the average out-of-pocket expense for RABC patients was \$500 per treatment, versus \$3,500 for MD Anderson patients who didn't use the RABC. "For patients, having the option of being seen for a consult and treated all within one day can make palliative care much more affordable," he said.

One finding did surprise Maldonado: There was no difference in the average distance a patient traveled, whether they were treated in the RABC or received treatment elsewhere at MD Anderson. "One of our worries with this study was that patients might pick treatment based on how far they had to travel and how much time they could spend in Houston," he said. "However, our results proved otherwise, making our findings much stronger."

Currently, the MD Anderson team is studying how much time patients must spend at the hospital. They are also looking at how many patients need additional palliative radiation sessions at the RABC and hope to publish data on how effective the 8 Gy single-fraction treatment is compared to more traditional forms of treatment.

Looking ahead, Maldonado sees much room for growth in the RABC model of care. "Implementation of an RABC in local community centers can further decrease costs for patients receiving palliative radiation," he said. "It is our hope that these findings encourage other cancer centers to implement RABCs throughout the country and even across the world."

SABR treatment gives patients with metastatic cancer good quality of life despite increased side effects

When researchers study new cancer treatments, they evaluate how well patients tolerate the new treatment, and they also look at how the new treatment affects patients' quality of life. But patients' thoughts about their quality of life don't always match up with researchers' perceptions.

That's what happened when researchers performed a new analysis on previously published data. A team of researchers led by Robert A. Olson, MD, MSc, of the University of British Columbia, studied whether adding stereotactic ablative radiotherapy (SABR) to standard therapy, such as palliative chemotherapy, would improve quality of life for patients with metastatic cancer.

SABR, also known as stereotactic body radiotherapy (SBRT), is a high-dose, high-precision cancer therapy that delivers its full dose of radiation to tumors in a few — or even just one — treatment session. In theory, a higher dose could cause increased side effects and decreased quality of life.

That's not what happened, though. When patients completed a questionnaire on quality of life, those who had received SABR reported no worse quality of life than the patients who had received standard care, even though the SABR patients did develop more side effects from their treatment.

"We were surprised that SABR was not associated with a worse quality of life when compared to standard of care, because we previously showed that SABR does have a measurable increase in side effects," Dr. Olson said. "Combined with our previously reported findings that SABR was associated with longer survival, we believe that SABR should now be studied in larger randomized trials and could be considered a treatment approach in well-selected patients with a few sites of cancer spread."

Currently, the researchers are performing two larger follow-up Phase III trials to compare SABR's effectiveness with standard therapies. The SABR-COMET-3 trial examines how well SABR works in patients whose cancer has spread to one to three sites. The SABR-COMET-10 trial will report on using SABR in patients whose cancer has spread to four to 10 sites.



Prostate

Prostate cancer is the most common type of cancer diagnosed in men. The American Cancer Society estimates that one in every six men will develop prostate cancer over the course of their lifetime. Prostate cancer is often curable, with more than 98% of men living more than 10 years after diagnosis. Radiation and surgery are often both equally effective as treatment options.

Study finds weekly high-dose radiation treatment as effective but better tolerated compared to every other day treatments

Stereotactic ablative radiotherapy, or SABR (sometimes called stereotactic body radiation therapy, or SBRT), is increasingly popular for treating some kinds of cancers. SABR differs from conventional radiation in several ways. It delivers a focused beam with a high dose of radiation that pinpoints the tumor without damaging nearby tissues. It's typically used to treat smaller tumors in the earliest stages of cancer. While conventional radiation treatments are given every day for six weeks or more, SABR treatments can be completed in a much shorter time.

But questions remain about the best frequency of each SABR treatment. For prostate cancer patients, a team of researchers at several Canadian cancer centers studied two schedules of SABR treatment to compare both their effectiveness and the level of side effects associated with each.

The randomized study included 152 patients who received a total of five treatments. About half received the treatments every other day over 11 days, which is a typical course of therapy in many cancer centers. The other half received treatments about once a week over 29 days.

The every-other-day group had more side effects than the weekly group during treatment, but the side effects subsided after treatment, and both groups showed about the same long-term response. "I was happily surprised that the more intense short-term problems experienced by men getting SABR every other day did not linger," said principal investigator Andrew Loblaw, MD, MSc, of the Odette Cancer Centre at the University of Toronto.

At five years after treatment, there was no difference between the two groups in how well their cancer was controlled or in their experience of side effects. Dr. Loblaw says his group plans to combine its data with that of another study in Switzerland to see if the findings are consistent.

The choice of treatment schedule seems to come down to convenience, he adds. "In my experience, patients who have to travel a significant distance to the cancer center or who are working when they are going through treatment find the weekly treatment more convenient and easier to fit into their life."



Radiation may generate immune response as it fights tumors

Can some types of radiation treatment stimulate the immune system to help the body fight cancer? Results of a study, called the ORIOLE trial, spearheaded by Ryan Phillips, MD, PhD, of Johns Hopkins University, suggest that stereotactic ablative radiotherapy (SABR) can help keep prostate cancer from spreading, in addition to shrinking or destroying specific tumors. SABR is a type of external beam radiation therapy that uses a focused beam to deliver a high dose of radiation to a well-defined tumor. This type of treatment is generally best for very small tumors. SABR provides a high dose of radiation in shorter amounts of time and can be completed in one to five treatments.

The study followed 54 patients with oligometastatic prostate cancer — that is, their cancer had spread to one, two or three sites outside the prostate after treatment with surgery or radiation. They wanted to delay starting hormone-suppression therapy, often the next step in treating these types of cases. Previous research has shown SABR to be safe and effective for men with localized or non-metastatic prostate cancer, but patients with oligometastatic disease have been considered incurable.

The patients were randomly assigned to one of two groups: those who were observed but received no further treatment for six months and those who were treated with SABR to the metastatic sites outside of the prostate.

Patients treated with SABR were significantly less likely to experience increases in their levels of prostate-specific antigen (PSA), a marker for the presence of cancer, and they lived significantly longer without any detectable disease progression than patients who received no additional treatment. Just 19% of patients treated with SABR had their disease progress after six months, compared with 61% of those in the observation group. More than half of the patients in the SABR-treated group were still progression-free more than a year after treatment.

The research team also studied what happened to the patients' immune systems by measuring changes in the characteristics of their T cells, a type of white blood cell that is an essential part of the immune system. They found significant changes in the T cells of patients in the SABR group 90 days after treatment, but no change in the T cells of those in the observation group. This response suggests that radiation may spark the immune system to more aggressively fight the cancer.



Long-term hormone therapy may do more harm than good for prostate cancer patients with low PSA

Some men who receive long-term hormone therapy after surgery and radiation treatment for prostate cancer may increase their mortality risk from other causes and their risk of cardiac and neurological problems, enough to offset the cancer survival benefit of the therapy, according to a new study. If they have low levels of prostate-specific antigen (PSA), a protein produced by cells of the prostate gland, after surgery, they may be better off skipping the hormone therapy.

“What we showed for the first time is that a patient’s PSA level is a predictive biomarker,” said Daniel Spratt, MD, associate professor of radiation oncology at the University of Michigan Rogel Cancer Center. “We found that the lower the PSA, the more harm the patient experienced. The higher the PSA, the more likely the patient was to benefit from hormone therapy.”

The study re-examined data from an earlier study of 760 patients treated between 1998 and 2003 at more than 100 centers across North America whose cancer returned following surgical removal of their prostate. Half of them had received both radiation therapy and hormone therapy, and the other half had received just radiation. Overall, the group that received hormone therapy had better survival rates than the group that just received radiation, and that original study helped make hormone therapy an accepted part of prostate cancer treatment.

The new analysis was designed to determine whether a patient’s PSA level affected their response to treatment. Researchers divided each group based on their PSA levels after surgery, measured in nanograms per milliliter (ng/mL).

Those with PSA levels higher than 1.5 ng/mL had better survival rates with hormone therapy and radiation therapy than with radiation alone. However, hormone therapy gave no overall survival benefit to men with PSA levels lower than 1.5 ng/mL.

The researchers did further analysis on men with very low PSA levels — less than or equal to 0.6 ng/mL. They found that this group was twice as likely to die from causes other than cancer when hormone therapy was added, with the greatest risk of death for those with the lowest PSA levels (0.2-0.3 ng/mL). These patients were also three to four times more likely to experience a combination of severe heart and neurological problems.

Dr. Spratt called for rethinking treatment guidelines. “We went into this study expecting that men with low PSAs probably would derive minimal benefit from hormone therapy, but we were surprised at the magnitude of harm that these patients experienced,” said Dr. Spratt. “A lot of these side effects have been reported over the past few decades, but demonstrating this in a clinical trial to this extent has not been done before. There needs to be a real discussion about the fact that hormone therapy has not been shown to help these men live longer.”

Dr. Spratt and his colleagues are currently enrolling post-operative patients with prostate cancer in another study (BALANCE Trial, NRG GU006) that will delve deeper into who might benefit from hormone therapy and who might not, based on genetic testing of their tumors.



Prostate cancer patients get good news: evidence of a cure

Oncologists are understandably reluctant to tell their patients that they're cancer-free — even when post-treatment tests don't show any signs of cancer — if they don't know how likely it is that the cancer might return someday.

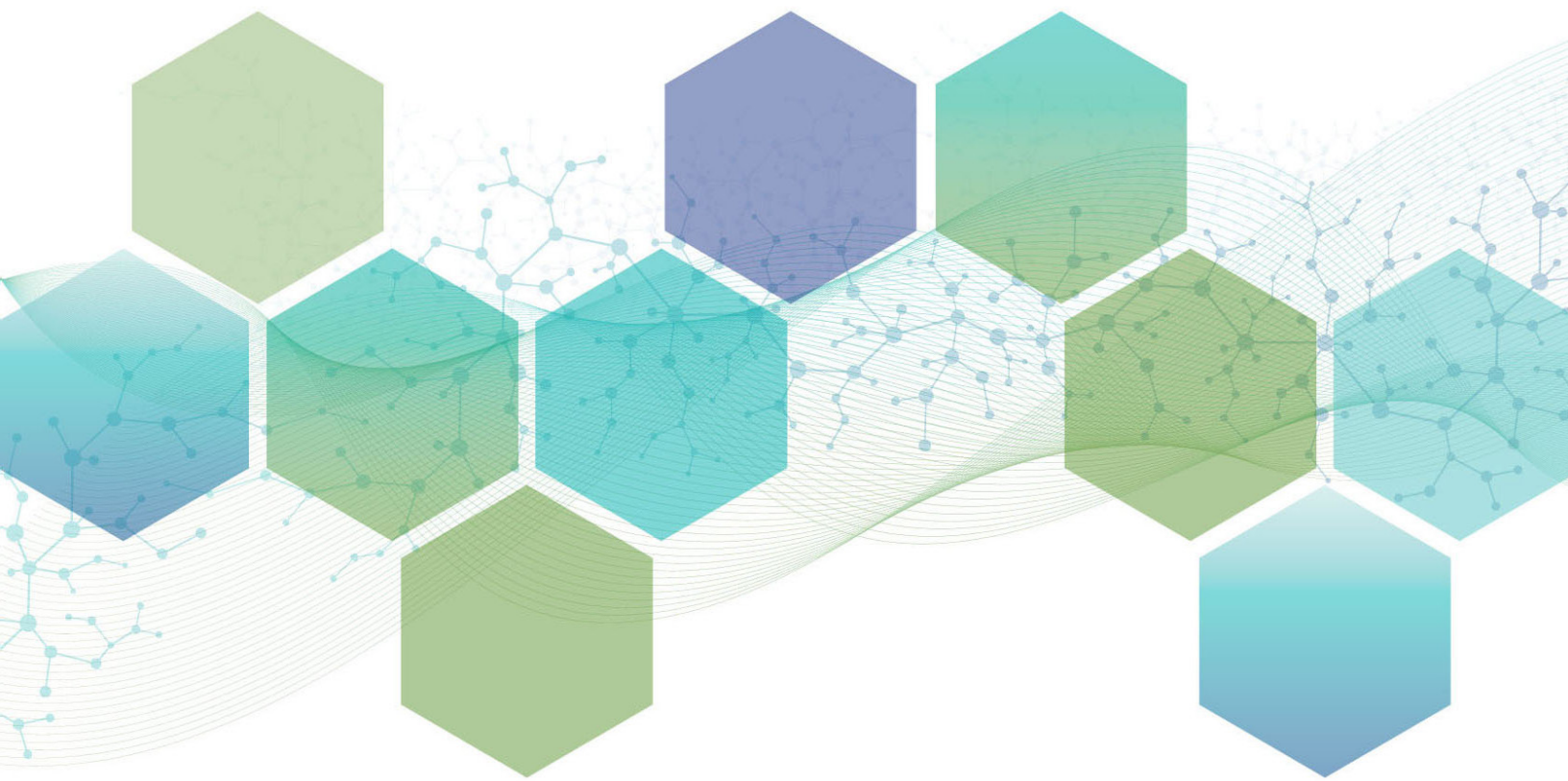
But researchers look for ways to confirm that patients can rest easy, and they have found one for the prostate cancer treated with brachytherapy, which is the insertion of radioactive implants directly into the tissue. A long-term study of almost 15,000 patients at seven institutions across the U.S., Canada and Ireland has shown that the results of a blood test four years after treatment can predict, with high levels of certainty, that patients will remain cancer free up to 15 years after treatment.

All the patients had localized prostate cancer and had been treated with low-dose-rate brachytherapy. Most of them had received only brachytherapy, although some had also received radiation through an external beam and/or androgen deprivation therapy, which starves the cancer of male hormones.

The study looked at the patients' test results for prostate-specific antigen (PSA), measured in nanograms per milliliter of blood (ng/ml). While there's no single "normal" PSA reading, the higher the level of PSA in a man's blood, the more likely it is that he has prostate cancer, particularly if the PSA level increases over time. After successful cancer treatment, very low levels of PSA are typical.

The study removed patients whose cancer had returned within four years after treatment and then measured the correlation between the patients' PSA levels at four years and their survival both 10 and 15 years later. "We wanted to see if we could discover a PSA level early in follow-up which would predict for cure at 10 to 15 years after brachytherapy," said Juanita Crook, MD, of the University of British Columbia, the lead author on the study. "We found that 80% of patients had reached a PSA level of 0.2 ng/ml or lower by four years after treatment, and this level was associated with a 99% chance of being free of prostate cancer at 10 years and 97% at 15 years."

The study team suggested that a PSA level of 0.2 ng/ml be adopted as the biochemical definition of a cure for low-dose brachytherapy patients with four years of follow-up. "This standard allows us to reassure patients early on that they are very likely cured, and it also means that they don't need as close follow-up in subsequent years," Dr. Crook said. "It was satisfying to establish this with such a large group of patients."



Glossary of Terms

Abscopal effect – A hypothesis in the treatment of metastatic cancer whereby shrinkage of untreated tumors occurs concurrently with shrinkage of tumors within the scope of the localized treatment.

Axillary lymph node dissection (ALND) – A surgery to remove lymph nodes from the underarm (armpit or axilla). Also called axillary dissection, axillary node dissection or axillary lymphadenectomy.

Brachytherapy – A radiation therapy treatment that involves the placement of radioactive sources in or just next to a tumor or tissue. Two main forms of brachytherapy are intracavitary treatment and interstitial treatment. With intracavitary treatment, the radioactive sources are put into a space near where the tumor is located, such as the cervix, the vagina or the windpipe. With interstitial treatment, the radioactive sources are put directly into the tissues, such as the prostate.

Clinical Trial – A research study conducted to test methods of screening, prevention, diagnosis or treatment of cancer. Clinical trials try to determine if a new approach is safe and potentially effective, often comparing more commonly used treatments with a new treatment that researchers think might be better. See Phase I, II, III, IV for further details.

DNA – The molecules inside cells that carry genetic information. Also known as deoxyribonucleic acid.

De-escalation – In cancer treatment, the reduction of exposure to treatment therapy and its negative effects. Treatment de-escalation is usually considered as a way to improve quality of life for the patient.

Distant recurrence – Cancer that comes back but in different areas of the body.

FASTRO – Fellow of the American Society for Radiation Oncology. This designation is awarded to members of ASTRO based on service to ASTRO and contributions to the field of radiation oncology.

Gy (gray) – A measure of radiation dose by how much radiation is absorbed by the tissues.

Hippocampus – A part of the brain structure located in the temporal lobe. This section of the brain is part of the system responsible for emotion, learning and memory.

Hormone-suppression therapy – Slows or stops the growth of hormone-sensitive tumors by blocking the body's ability to produce hormones or interfering with the effects of hormones on cancer cells.

Hypofractionation – Delivering the optimal amount of radiation over fewer sessions.

Immune system – Protects the body against disease; identifies and attacks foreign bodies including viruses, bacteria or parasites.

Immunotherapy – A treatment that uses the patient's own immune system to help fight the cancer. Treatment will either stimulate the immune system to attack cancer cells or provide the immune system with what it needs, such as antibodies, to fight the cancer cells.

Intensity-modulated radiation therapy (IMRT) – A technique that adjusts the radiation beam to the shape of a tumor, allowing for higher, more effective doses of radiation to be delivered while minimizing exposure to surrounding healthy tissue.

Lumpectomy – A surgery in which only the tumor and some surrounding tissue is removed from the breast. It is also known as breast-conserving surgery.

Lymph nodes – Small glands that filter a clear fluid called lymph through the lymphatic system.

Lymphedema – A long-term condition where excess fluid (lymph) collects in tissues causing swelling.

Lymphatic system – Part of the immune system, the lymphatic system is a network of tissues and organs that help rid the body of toxins, waste and other unwanted materials. The primary function of the lymphatic system is to transport lymph, a fluid containing infection-fighting white blood cells, throughout the body.

Lymphoma – A tumor found in the lymphatic system. The two main types of lymphomas are Hodgkin's and non-Hodgkin's lymphomas.

Mastectomy – Breast cancer surgery that removes the entire breast.

Metastases (Metastasis) – The spread of cancer from one part of the body to another.

Neuroblastoma – A cancerous tumor that begins in nerve tissue of infants and very young children, often younger than five years of age.

Oligometastatic – A type of metastasis in which cancer cells from the original tumor travel through the body and form a small number of new tumors in one or two other parts of the body.

Overall Survival (OS) – The length of time from either the date of diagnosis or the start of treatment that patients diagnosed with the disease are still alive. In a clinical trial, measuring the overall survival is one way to see how well a new treatment works.

Palliative – A type of care, also known as supportive care. The goal of this care is to improve the quality of life of cancer patients by relieving distressing symptoms such as pain, shortness of breath, loss of appetite, problems sleeping, fatigue and many more. Many cancer patients undergo palliative care while maintaining their other cancer treatments.

Perometry – A non-invasive technique that uses infrared light to measure limb circumference and volume of fluid and is more accurate than a simple limb circumference measurement. The measurement tool is called a perometer.

Phase I, II, III, IV – Clinical trials are broken down into four phases of study.

- **Phase I** often looks at combining radiation therapy with other treatments such as surgery or drugs to evaluate new ways to deliver radiation therapy.
- **Phase II** tries to establish if the new treatment determined in Phase I is effective in controlling the tumor.
- **Phase III** compares the new treatment against the current standard treatment. Patients are randomly assigned to one of two groups; one group receives the standard treatment, the other receives the new treatment and results are compared. If the new treatment results are better than standard treatment, researchers will reconsider the standard of care treatment.
- **Phase IV** is the final step in the process and tests to make sure the new treatment is safe and effective over a long period of time.

Progression-free survival (PFS) – The length of time during and after treatment that a patient lives with cancer, but the cancer does not get worse. In a clinical trial, measuring the progression-free survival is one way to see how well a new treatment works.

Proton beam radiation therapy – A type of radiation therapy that uses protons (tiny particles with a positive charge) to kill tumor cells. This type of treatment can reduce the amount of radiation damage to healthy tissue near a tumor by targeting the cancer cells more precisely.

Randomized study – A study in which the participants (patients) are divided at random into separate groups to compare different treatments.

Regional lymph node radiation (RLNR) – Radiation treatment to nearby lymph nodes, which is commonly used after mastectomy in women with node-positive breast cancer. Also termed regional nodal irradiation (see below).

Regional nodal irradiation (RNI) – Radiation treatment to nearby lymph nodes, which is commonly used after mastectomy in women with node-positive breast cancer. Also termed regional lymph node radiation (see above).

Sentinel lymph node biopsy (SLNB) – A biopsy that does minimal sampling of lymph nodes most likely to be involved with cancer.

Simulation (radiation simulation) – In cancer treatment, a process used to plan radiation therapy so that the target area is precisely located and marked.

Stage 1, 2, 3 cancers – The extent of a cancer in the body. Staging is usually based on the size of the tumor, whether lymph nodes contain cancer, and whether the cancer has spread from the original site to other parts of the body.

Stereotactic ablative radiotherapy (SABR) – A treatment that delivers one to five stereotactic radiation treatments to tumors within the body, excluding brain or spine. Also known as stereotactic body radiation therapy (SBRT).

Stereotactic body radiation therapy (SBRT) – A type of external radiation therapy that uses special equipment to position a patient and precisely deliver radiation to tumors in the body. The total dose of radiation is divided into smaller doses given over several days. Also called SABR, (see above).

Stereotactic radiosurgery (SRS) – A treatment that delivers one to five stereotactic radiation treatments to the brain or spine. This treatment does not involve surgery, an incision is not made, and tissue is not surgically removed.

Toxicity – The degree to which something is harmful to a patient.



**Additional information can be found on
ASTRO's patient-focused website, RTAnswers.org.**





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