



These breast images depict umbrella-strut type HDR treatments following lumpectomy. The concentric rings are “isodose lines.” The yellow line is the prescription dose (3400 - meaning 3400 cGy delivered in 10 fractions). Two fractions are delivered per day (separated by six hours minimum).

The blue ring, 6800 cGy shows the area receiving 6800 cGy — the 200% dose. In the lower left corner, six brighter spots -- the struts of the apparatus -- appear in cross-section.

The 1700 cGy is the 50% isodose line. “Brachytherapy does a great job in delivering targeted high doses to the tumor. The isodose lines are very conformal, minimizing the dose delivered to the surrounding normal tissues,” says physicist Denise Lambert.

In the upper right window, a three-dimensional display shows how the 3400 cGy isodose cloud would look on the patient.

Radiation Treatment at John Muir Health

Depending on the specifics of each case, the radiation therapy team may use one or more of the following state-of-the-art treatments:

- External Beam Radiation Therapies
- Intensity-Modulated Radiation Therapy (IMRT)
- RapidArc® Volumetric Modulated Arc Therapy (VMAT)
- Stereotactic Radiosurgery (SRS)
- Stereotactic Body Radiation Therapy (SBRT)
- Image-Guided Radiation Therapy (IGRT)
- Four-Dimensional Radiotherapy (4DRT) or Gating Internal Radiation Therapies
- High-Dose-Rate (HDR) Brachytherapy
- Low-Dose-Rate (LDR) Brachytherapy
- Accelerated Partial-Breast Irradiation (APBI)
- Intraoperative Radiation Therapy (IORT)

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<http://www.johnmuirhealth.com/services/cancer-services/what-weoffer/radiation-oncology/treatments-weoffer.html#hdr>



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Clinical Update

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Physician News

Developments in Brachytherapy Aid Cancer Treatment

John Muir Health has been using brachytherapy, a form of cancer treatment that involves placing small amounts of radioactive material within the body, for several years, as a way to deliver targeted radiation to specific areas. Recently, efforts to expand these internal treatment options have resulted in some new, advanced services for our patients.

“Expansion of the Brachytherapy Program greatly complements our comprehensive site-specific programs in Breast, Gynecologic Oncology, Lung and Prostate cancer - allowing patients to receive the full spectrum of cancer treatment within their own community,” says Brenda Carlson, executive director, Oncology.

According to William Bice, PhD, director of Radiation Oncology at John Muir Health, “We have been using low and high dose rate (HDR) brachytherapy, but have added intra-operative electronic brachytherapy for breast cancer treatment, used for post-lumpectomy irradiation in the OR. We have also just begun using a new interstitial brachytherapy treatment for cervical cancers, as well as a new approach for lung cancer. In addition, we have added improvements to existing sites, such as breast and prostate.”

To learn more, JMHPN talked with Dr. Bice, as well as Rajni Sethi, MD, a radiation oncologist who recently joined John Muir Health’s medical staff, and two physicists most responsible for building the brachytherapy program: Rebecca Graciano, PhD, and Denise Lambert, MS.

“Brachytherapy is one of the areas of medicine that is changing every day,” says Dr. Graciano. “The developments going on in our department are important, because this modality allows a great new option for patients. Delivery of radiation directly to a tumor can cut down on treatment time. Brachytherapy patients undergo just a few therapy sessions, rather than a lengthy series, as in conventional external beam radiation therapy.”

“Earlier, these procedures were done mainly at academic centers -- and now, with the services we’ve developed, a patient doesn’t have to travel far from home to be treated. For a community hospital to be able to offer this is wonderful,” she adds.

Cervical Interstitial Treatment

Physicist Denise Lambert says that “Using high dose rate (HDR) therapy, we have been treating cancers in the breast and vaginal cuff since 2011. Now, we

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have expanded our program to treat cervical cancer using interstitial implants. After the implant, the patient is transferred to the Brachytherapy Suite for a planning CT scan and HDR treatment. The new Brachytherapy Suite resides in the Radiation Oncology department at John Muir Medical Center, Walnut Creek. The main advantage to having the CT and HDR machine in the same room is that it enables us to image and treat the patient in the same location, reducing patient motion. We're excited to be expanding and bringing in a lot of new techniques to help our patients."

According to Dr. Sethi, "For women with gynecological cancers, the fact that we're doing this kind of brachytherapy at John Muir Health is a huge asset. Patients would have previously needed to travel long distances to receive these kinds of treatments."

The interstitial brachytherapy procedure she uses involves inserting hollow catheters into a tumor, and then delivering radiation with a small radioactive pellet attached to the end of a wire. The wire is pushed into the hollow catheters and then withdrawn in a series of pauses, or dwells, that have been designed to create a dose distribution that conforms precisely to the tumor. The dwell pattern is designed by computer and is individually created for each patient.

"Interstitial brachytherapy allows two very important things: we can shape the dose distribution to conform to tumors, enabling excellent tumor coverage, and we can also spare normal tissues, which limits the toxicity of treatment. Using this technique, the local control rates are around 95 percent in cervical cancers, which is outstanding."

She noted that it can also be used in uterine cancers, vulvar and vaginal cancers, and cancers of the urinary tract, and with recurrent tumors. "There is also a growing role for high dose rate brachytherapy in prostate cancer. Brachytherapy can be used alone in some cases, although it is most often used as an add-on to external radiation, to boost treatment in a specific area."

"The implants are fantastic; I love doing them," she adds, "We have been doing 1-2 cases each week and plan to continue growing our program over time. It's such an asset to patients, because tumor control is excellent, and toxicity is very low. Historically, there are other ways of doing brachytherapy, using fixed intracavitary applicators, without needles going directly into tissue. But that can limit the ability to shape the dose to properly cover the tumor and avoid normal structures, and may not be optimal in many situations."

When planning a treatment, Dr. Sethi delineates the target, creating a radiation plan, using a CT scan that shows the specific area of the patient. "On every slice of the planning CT scan, I draw the target volume, as well as nearby organs where we want to minimize the dose. We then work in conjunction with our physics team to calculate and design the dose cloud."

Innovations in Lung Cancer Tumor Treatment

John Muir Health is also using a new procedure for lung cancer treatment, under a Cornell University clinical protocol. This treatment employs a radioactive mesh, placed during lung resections into the site where the tumor was removed. "We use a flexible, soft mesh, which comes with the seeds already sutured in, and it stays forever in the tissue. The radiation decays quickly, as the half-life of Cesium-131 is only ten days. Studies looking at this procedure have been very promising," Dr. Graciano says.

"The radioactive mesh contains forty Cesium-131 seeds. Cesium-131 is a newer isotope replacing Iodine-125 (half-life is 60 days.) The radiation is deposited in the patient more quickly -- an advantage for fast-acting tumors," adds Lambert.

New Techniques in Breast Cancer Brachytherapy

Brachytherapy is also offered at John Muir Health for breast cancer patients who fit certain criteria. In this treatment, after a lumpectomy, a device which resembles umbrella struts is inserted into the cavity. Each strut has a hollow catheter attached through which the HDR radiation source can travel to deliver the radiation dose. "We program the radioactive seed to dwell for a specific amount of time at different positions within the struts," says Dr. Sethi.

As she describes it, "This device is placed into the cavity by a breast surgeon. We later can administer treatment two times per day, via a tube that remains outside the breast. It's been researched as a way to limit the toxicity of breast cancer radiotherapy in women who are at lower risk of having a recurrence, and provides a way to tailor the radiation treatment, based on a patient's recurrence risk."

Safety and Teamwork

The specialists agree that one of the greatest attributes of brachytherapy treatment at John Muir Health is the people behind its development.

Asked about the most important facet of the program, Dr. Bice says, "the answer is easily the quality and professionalism of our treatment team." Dr. Sethi agrees, saying, "I am impressed by this team. They give 110 percent in what they do. It's great to work with people who care so much about the patients and their outcomes. The nurses, therapists, and physicists are highly invested in this program. The personal touch here is wonderful."

Safety is a paramount focus. "The physicists maintain all the QA (quality assurance) on the machines. They do a specific set of daily, monthly, and yearly tests, verifying that all components function accurately and precisely before each treatment," she adds.

Looking Forward

"Brachytherapy is very versatile, and can be used in many different clinical situations. We have primarily focused on gynecologic and breast cancer treatment but are experienced in treating other areas such as prostate cancer, urethral cancers, and sarcomas. I look forward to expanding our programs," says Dr. Sethi.

According to Dr. Graciano, "It's a fun time to be in this field, as we are always learning something new, honing the best ways to treat our patients. It's really exciting, as we are really committed to state-of-the-art equipment and technology at John Muir Health, and constantly improving."

Success Stories

The physicists relate how one recent patient, who received breast HDR, only needed treatment for five days instead of the 16-25 days conventional treatment would have taken. She was able to participate in an important family event, and very excited not to have to worry about treatment through that special date. "It's great to offer something that gets patients back to their lives and goals sooner," says Dr. Graciano.