Brachytherapy

“Brachy” is Greek for “close”. Brachytherapy is a type of radiation treatment where the radioactive source is placed at a close distance to the tumor, usually within 10cm. This is accomplished by placing radioactive material within the tumor (interstitial), inside a space surrounded by tumor (intracavitary), or on the surface of the tumor (en plaque). Brachytherapy techniques allow a high dose of radiation to be delivered close to the tumor with very low levels to adjacent healthy tissue.

High dose rate (HDR) brachytherapy allows for a very rapid treatment time (usually under 15 minutes) and is the most commonly used type of brachytherapy at Kettering Health Network. With HDR the radioactive source (Iridium 192) is fixed to a wire and housed in a remote after-loading device. When it is used, the wire is deployed through a series of transfer tubes to the tumor region via devices placed in the tumor by the radiation oncologist or surgeon. The HDR source wire sits, or dwells, there for a fixed period of time based on the plan created by the radiation oncologist and medical physics team. The wire and source are then retracted and the procedure is completed. These procedures are typically outpatient, with no hospital stay required.

With HDR brachytherapy, the radiation oncologist can vary the radiation dosage with different dwell times and positions along the length of the tumor, resulting in very precise high treatment doses to the tumor while minimizing doses to healthy tissue distant to the tumor. At Kettering Health Network, HDR brachytherapy is utilized to treat patients with gynecologic, lung, breast, skin, and other cancers.

Stereotactic Radiosurgery

Stereotactic Radiosurgery (SRS) is a non-invasive treatment that allows the radiation oncologist to deliver a very high dose of radiation precisely to a tumor with accuracies of less than 1mm within 1-5 treatments. At Kettering Health Network, we offer the most precise radiosurgical treatment available in the world with our Gamma Knife Perfexion treatment unit for Brain Radiosurgery, and our Synergy Radiosurgery treatment unit for Body Radiosurgery. This head to toe approach allows us to deliver SRS anywhere in the body.

The accurate nature of this treatment allows brain tumors to be treated with very high doses of radiation while surrounding normal brain tissue is left minimally affected. Control rates of tumors in the brain treated with Gamma Knife can exceed 90%.

At Kettering Health Network, over 1,000 patients have been treated with Gamma Knife and we are the largest Gamma Knife center in Southern Ohio.

During the Gamma Knife procedure, a stereotactic frame is applied by a neurosurgeon under local anesthetic without the need for any general anesthesia. A patient’s tumor is then imaged with high resolution MRI and CT images. The Radiation Oncologist and Medical Physicist optimize the optimal configuration of over 200 individual pinpoint radiation beams, and the patient is then treated.

The machine makes no significant noise, and patients do not feel anything during the treatment. The patient goes home the same day and recovery is minimal with most patients returning to normal activities and work schedules within 2 days.

Gamma Knife Perfexion

With Gamma Knife radiosurgery, a team of Radiation Oncologists, Neurosurgeons, Medical Physicists, and Nurses deliver pinpoint high dose brain treatments with accuracies of less than 0.2mm in the outpatient setting with no hospital stay required.

Gamma Knife has been successfully applied to many tumors including acoustic neuromas, meningiomas, brain metastases, and gliomas.
Gamma Knife radiosurgery is also used to treat conditions such as trigeminal neuralgia, essential tremors, and arteriovenous malformations. In the past, conventional invasive neurosurgical techniques performed in an operating room were used to treat tumors and conditions that are now non-invasively treated with Gamma Knife Radiosurgery with control rates that often exceed those of surgical resection and much lower side effects profiles.

At Kettering Health Network, in 2012, the most advanced version of Gamma Knife that exists in the world was installed, highlighting the commitment of Kettering Health Network to bringing world-class cancer care to our region.

**Synergy Body Radiosurgery**

Complementing the Kettering Health Network Gamma Knife Brain Radiosurgery unit, Kettering Health Network completed a multi-million dollar installation of the Synergy Body Radiosurgery Unit in 2010 to treat tumors outside the brain with the same pinpoint radiosurgery that Gamma Knife uses to treat brain tumors.

The Synergy has a built-in CT scanner that allows the Radiation Oncologist to continuously image a patient’s tumor and adjust the radiation beams during a radiosurgery session to ensure precision sub-millimeter radiosurgical accuracy.

Synergy Body Radiosurgery is completely non-invasive for a patient. During the treatment, which usually lasts about 30 minutes, a patient lies down in a customized Body-Fix cradle with vacuum immobilization that minimizes any patient movement. The patient sees the Synergy machine move around them, but feels nothing more than an x-ray during the entire treatment. There is no need for anesthesia, IV’s, or any invasive metal marker placement since the on-board CT scanner provides exquisitely detailed non-invasive continuous pictures of the tumor during each treatment.

After treatment is complete, there is no recovery time, and patients can often return to work or normal activities the next day. The Synergy Body Radiosurgery platform is used to treat many tumors outside the brain that are not amenable to conventional surgical resection such as inoperable lung cancer, liver cancer, and cancer that has spread to the spine or bones. Synergy Body Radiosurgery can even be used to treat tumors that have recurred despite previous conventional radiotherapy.

**Intensity Modulated Radiation Therapy (IMRT)**

Intensity Modulated Radiation Therapy is a technology available at Kettering Health Network that allows the team of Radiation Oncologists, Medical Physicists, Medical Dosimetrist, and Radiation Therapists to maximize the dose of radiation to a tumor while sparing healthy tissue surrounding the cancer. IMRT allows the radiation to be tightly shaped around the tumor so that there is minimal co-lateral normal tissue injury. This has allowed the Radiation Oncologist to increase cancer control rates by increasing radiation dose to tumors while at the same time minimizing side effects by decreasing normal tissue dose. IMRT is being used to increase tumor control and decrease toxicity in most body sites including the brain, head, neck, spine, pancreas, liver, lung, pelvis, and prostate.

**Image Guided Radiation Therapy (IGRT)**

Image Guided Radiation Therapy (IGRT) is being used extensively at Kettering Health Network often in combination with IMRT to verify the exact position of a tumor internally within a patient immediately prior and during their daily radiation treatment.

Kettering Health Network has the most state of the art IGRT available, using a built-in CT scanner in the treatment machine to take detailed low-dose CT scan images of a patient’s tumor during their treatment. These images are transmitted to sophisticated computers systems, which analyze the position of the tumor and compare it to images of the tumor prior to treatment. The information is then fed back to the machine to adjust the patient’s position so that the tumor is precisely within the focus of the radiation. This happens before each and every treatment, thus maximizing the treatment accuracy.

IGRT is used at Kettering Health Network for every patient who is treated with the highly conformal IMRT treatments as well as the pinpoint Synergy Body Radiosurgical treatments.

**Respiratory Gating**

Respiratory Gating in the process of timing the delivery of radiotherapy to a patients breathing cycle so that treatment is delivered only at a certain level of inspiration or expiration. This is
beneficial in treating some tumors that move substantially when a patient breathes.

At Kettering Health Network we utilize the Elekta Active Breathing Control system to perform respiratory gating. A patient wears a small snorkel-like devise that converts a patient's respiration to a digital signal that is transmitted to the treatment machine. This allows the Radiation Therapist at the machine to time the delivery of the radiation to a certain point of the patient’s breathing cycle.

At Kettering Health Network we have the most experience in the region utilizing respiratory gating. We utilize it for several tumor types including left-sided breast cancer. By using Respiratory Gating for our Left sided breast cancer patients, we are able to virtually eliminate any significant radiation dose to the heart by treating the breast at a point in the breathing cycle when the breast is farthest away from the heart. This certainly decreases long-term side effects from breast radiotherapy treatment.

**Digital Image Fusion Using Deformable Registration**

When a patient starts the planning process for their radiation treatments, a treatment planning CT simulation is performed. This involves positioning a patient in the exact position that they will be treated on a daily basis and taking a limited CT scan of the tumor region. Often a patient's tumor can be better seen on other scans such as PET or MRI. In this case, these other scans are imported into sophisticated radiation planning computer systems and are digitally fused with the CT simulation scan. Sometimes a patient is in a different position for their PET or MRI scan compared to the CT simulation scan.

At Kettering Health Network we have state-of-the-art computer software called Deformable Registration which enables the exact fusion of these scans despite any differences in patient position. After these scans have been digitally registered, the radiation oncologist and the dosimetry team precisely define the tumor region and optimally design the radiation treatment plan so that the tumor receives the maximum radiation dose and the surrounding normal tissue receive minimal radiation.