NYU Langone MEDICAL CENTER

Departments of
Neurosurgery and
Radiation Oncology

A PATIENT GUIDE TO

Gamma Knife Radiosurgery

Gamma Knife® radiosurgery is the most established form of stereotactic radiosurgery (SRS), an important approach for treating brain tumors, blood vessel malformations, and other brain disorders. With this approach, the skull is not opened and no incision is needed; instead, it uses MRI or other high-resolution imaging to make a 3D picture of the targeted part of the brain. Then, the area is treated with many small beams of radiation, delivered with robotic precision, instead of a scalpel. Gamma Knife® has been considered the gold standard for radiosurgery, since it is used for the brain only, and has no moving parts to deliver the radiation. It has the longest track record in treating these conditions with published validation, and is the most accurate type of brain radiosurgery.

We believe that the Gamma Knife® procedure's use of a head frame is one of the key reasons for its excellent long-term results, since it most precisely irradiates the target tissue. We take care to keep patients safe and comfortable throughout the procedure, moving them in and out of the radiation unit, and focusing on the targeted area. In selected patients, a head mask is used instead of a head frame for fixation.

The Gamma Knife ICON™

The Gamma Knife® system installed at the Center for Advanced Radiosurgery has advanced patient treatment and safety features. All members of our staff have extensive training and experience. The team at NYU Langone Medical Center can non-invasively treat multiple brain lesions at the same time—in one procedure done in one day. It is the most efficient system available.

Gamma Knife® History

When the Gamma Knife® was first introduced in the United States in 1987, there were only five such units in the world. Dr. Douglas Kondziolka worked with that unit beginning in 1989. In 1997, Drs. John Golfinos and Bernardine Donahue established the first Gamma Knife center in the New York metropolitan area at NYU Langone. In 2012, Dr. Kondziolka, director of the Center for Advanced Radiosurgery and one of the most published researchers in the field, joined the NYU Langone team, and he has participated in refining the Gamma Knife's® design. In 2016, NYU Langone became the first center in the region to have the Icon Unit.

Patient Benefits: Safety and Effectiveness

Gamma Knife® radiosurgery is a non-invasive type of brain surgery (done without opening the skull). It allows affected tissue to be targeted with great precision while sparing healthy tissue around the treatment area. Since a surgical incision is not needed, the risks associated with open brain surgery are reduced. Patients are typically sedated without general anesthesia and can communicate during treatment. As a result, patients who undergo Gamma Knife radiosurgery are less likely to have complications, and tend to report back with positive outcomes.

Because radiosurgery is less invasive, it typically leaves no scar. While patients must come in early to register at the hospital, most are finished in time for lunch. Although individual patient outcomes may vary, patients can often resume their normal activities the day after treatment. In contrast, open brain surgery typically requires a hospital stay of several days or more. By avoiding this hospital stay, radiosurgery helps lower treatment costs.

Before Treatment

Your doctor will explain the Gamma Knife® radiosurgery procedure to you, discuss other treatment options and their associated risks, and give you the chance to ask any questions that you might have. Once you have decided on radiosurgery, you will be asked to sign a consent form to do the procedure. Please read this form carefully and ask questions if something is not clear. You will be asked to avoid eating or drinking for eight (8) hours before the procedure, starting after midnight. Depending on your wishes, you may also receive a sedative before the procedure to help you relax.

Attaching the Head Frame

The head frame acts as a "guiding device" to ensure that the Gamma Knife® beams are focused exactly where treatment is needed. This way, the target is kept still during both imaging and treatment. Radiosurgery depends on highly accurate images, and total head immobilization in a frame gives the clearest images. The aluminum frame will be attached to your head using four pins, two in the front and two in the back. These pin sites will be cleaned, and you will receive four small injections of local anesthetic to numb the sites. Plastic ear bars will temporarily be placed in each ear to balance the frame while it is being attached. Once applied, the frame feels tight for just a minute or two, then will be comfortable. If a mask is used for head fixation, it will be made for you the morning of the procedure.

Imaging and Planning

After the head frame is in place, you will undergo an MRI, CT scan, or angiogram, depending on your diagnosis. These radiology scans are obtained to precisely locate the size, shape, and location of your tumor, lesion, or abnormality. An indicator box will be attached to the head frame. Once the imaging studies are completed, you can relax while your neurosurgeon, radiation oncologist, and physicist use the information from the images to plan your treatment. This is usually the longest phase of the procedure, and may take from 15 minutes to several hours.

Treatment

Once the treatment plan is final, you will be brought into the Gamma Knife® treatment room. You will be moved onto the couch and your head frame attached comfortably to the table. You will then enter the domed section of the unit, where your treatment will begin. The computerized delivery system sends the planned radiation directly and precisely to the areas of concern using robotic precision. This treatment is silent and totally painless. Often, you can listen to music of your choice during the treatment. Treatment time will vary from patient to patient, depending on the size and number of areas to be treated. It can be as short as 15 minutes, or as long as two to three hours.

After Treatment

When the radiosurgery is completed, the head frame will be removed and the pin sites cleaned and covered with bandages. If a pin site continues to bleed, a small stitch may be used. You may also be given Decadron (dexamethasone), a medication to prevent swelling at the target area. Almost all patients are sent home the same day soon after the procedure. Some may be transferred to our hospital unit, where you will be monitored overnight and discharged the following morning. Before you leave the hospital, a nurse will review your discharge instructions with you, including permitted activity, medication, pin site care, and, most importantly, follow-up care. In the months that follow, a follow-up program will be created just for you that may include office visits, imaging studies, or other tests. For patients who live a significant distance from New York, we will work closely with your chosen doctors at home.

Patient Selection

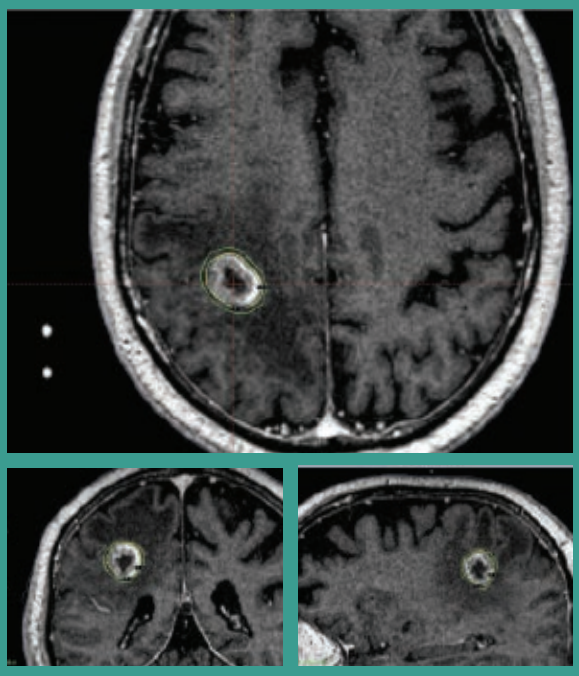
The selection of patients who are the best candidates for Gamma Knife® radiosurgery involves a team of neurosurgeons, radiation oncologists, and other specialists. Selection for Gamma Knife® radiosurgery is made based on diagnostic testing, tissue diagnosis, your age, the size and location of each tumor or lesion, the number of lesions or tumors present, prior therapy, and, of course, your own goals.

Brain Metastases

(Metastatic Brain Tumors)

The most common type of brain tumors are brain metastases that develop outside of the original site of the cancer. Brain metastases can result from many different kinds of cancer, including lung, breast, melanoma, colon, and kidney cancer. Treatment options include surgical resection, Gamma Knife® radiosurgery, and external beam radiation therapy. Gamma Knife® radiosurgery is preferred for patients with smaller tumors and without major symptoms. It can also be used in patients with more than one tumor.

Our neurosurgeons, who have published extensively on brain metastasis management, work closely with our oncologists and radiation oncologists to care for patients with brain metastases. We have cared for more than 5,000 patients with these tumors, and have found that Gamma Knife® radiosurgery can control tumors in 80-95 percent of patients. We can treat multiple tumors at the same time, and if new tumors develop in other locations, these can usually be treated as well. Though whole brain radiation is used less often today, it can still be useful for some patients.



Dose plan for a brain metastasis

Acoustic Neuromas

(Vestibular Schwannomas)

Acoustic neuromas are benign tumors near the skull base that involve the nerves responsible for facial movement, hearing, and balance. Sometimes known as vestibular schwannomas, they grow from the vestibular nerve, which controls balance, and spread out into the auditory canal, through which the cranial nerves exit the skull.

Common symptoms of acoustic neuromas include hearing loss–usually the first symptom–as well as tinnitus (ringing in the ear), balance problems, and facial weakness, pain or numbness. Though larger acoustic neuromas can put pressure on the brainstem and cause a wide variety of conditions and symptoms, such as a buildup of spinal fluid called hydrocephalus, most are small–under three centimeters in diameter–making such problems unlikely. However, some patients can have this problem even with smaller tumors.

Treatment options include surgical resection, Gamma Knife® radiosurgery, radiation therapy, or continued observation. Gamma Knife® radiosurgery has become a common treatment choice with good outcomes for patients with smaller tumors. The natural rate of tumor growth can vary from patient to patient. Meeting with surgeons experienced in acoustic neuroma care is important to help patients plan their care.

Meningiomas

Meningiomas are the most common type of benign intracranial tumors. They grow outside the brain and may cause symptoms by putting pressure on the brain. If they are located near the skull base, they can put pressure on cranial nerves. Specific symptoms caused by a meningioma depend on the size and location of the tumor.

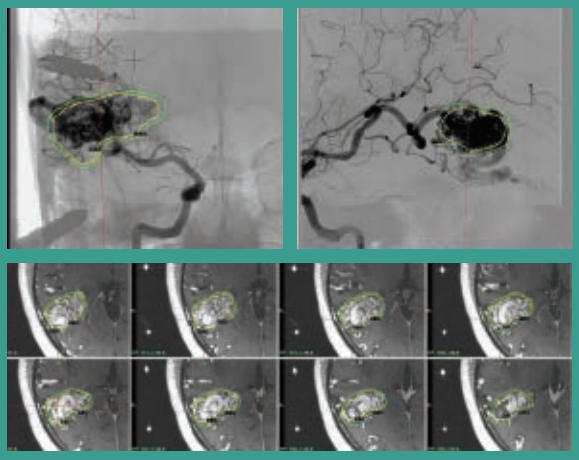
Although most meningiomas are benign and grow slowly, a small number grow more aggressively and may invade the brain.

The most common treatment options for meningiomas are surgical resection and Gamma Knife® radiosurgery. Conventional external beam radiation can be used in selected meningiomas. Specific treatments are decided on a case-by-case basis and depend on many factors, including the size, location, and grade of the tumor, as well as the patient's age.

Arteriovenous Malformations (AVMs) and Fistulas

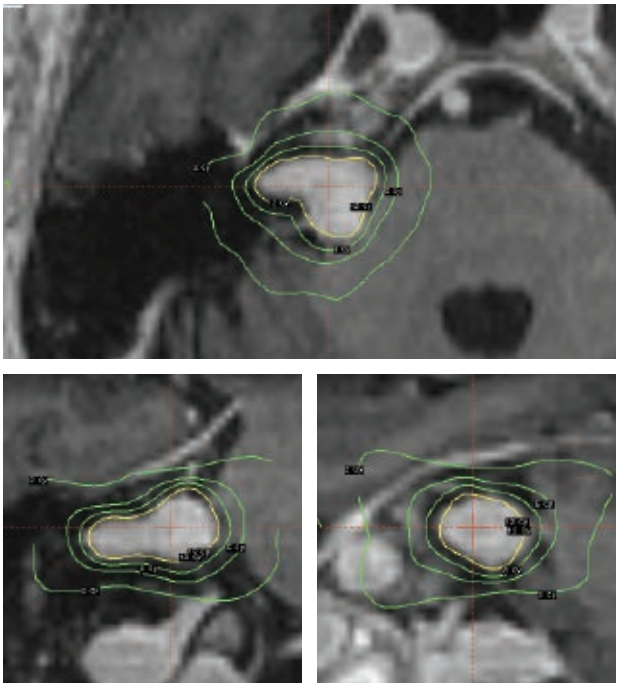
Arteriovenous malformations (AVMs) are abnormal tangles of arteries and veins. While many AVMs never cause any symptoms, there can be serious problems when they occur inside the brain as a cerebral AVM, in the brain's covering (the dura) as a dural AVM, or in the spinal cord as a spinal AVM.

In an AVM, the capillaries that normally exchange blood between the arteries and the veins do not develop in a certain area, and the arteries pass blood directly into the veins. Because veins do not have strong walls, over time the high blood pressure of arterial blood flow can cause these vessels to become engorged and rupture or hemorrhage, or cause seizures, headaches, or other symptoms. These symptoms typically develop between the second and fourth decades of life, but people of all ages can be affected. Half of all brain AVMs present with a brain hemorrhage, while the rest typically present as a seizure, a headache (usually one sided and migraine-like), or a neurological deficit.



Dose plan for an arteriovenous malformation

While direct surgery can also eliminate AVMs, radiosurgery allows treatment in hard-to-reach areas with a relatively low complication rate and no need for general anesthesia. Radiosurgery is sometimes combined with endovascular embolization or resection. Radiosurgery works by closing off the abnormal blood vessels of the malformation. Eliminating the AVM flow usually occurs over a two- to four-year period.



Dose plan for a vestibular schwannoma

Trigeminal Neuralgia

Trigeminal neuralgia (TN), also known as tic douloureux, is a pain syndrome that occurs as one-sided facial pain. A physical exam is usually normal or reveals some mild sensory loss; major sensory loss suggests another cause that an MRI or other neuroimaging can identify.

Medication therapy is the first choice to reduce pain. Carbamazepine (Tegretol) is considered the most effective treatment, though other options–such as phenytoin (Dilantin), baclofen, gabapentin (Neurontin), oxcarbazepine, and clonazepam–may work well for some patients.

Before thinking about surgery, all trigeminal neuralgia patients should have an MRI, with a close examination of the posterior fossa, to rule out other causes of trigeminal nerve compression.

For patients who are elderly, or those with multiple sclerosis, recurrent MVD-associated pain, or impaired hearing on the opposite side, Gamma Knife® radiosurgery is the least invasive option. Done on an outpatient basis, the procedure has benefits that grow over time. Patients commonly report pain relief that might start in the first day or two with improvement over the first month, on average–and the effect on the nerve builds over several months. In our vast experience with this procedure, a small number–only about 10-15 percent–of patients have some loss of feeling in the face.

Other Tumors and Indications

Gamma Knife® radiosurgery is a common choice for patients with selected pituitary tumors, pineal tumors, hemangioblastomas, hemangiopericytomas, benign or malignant gliomas, or head and neck cancers. Radiosurgery can also be used for selected patients with behavioral disorders and movement disorders, such as obsessive-compulsive disorder or tremor. In fact, virtually every type of brain tumor has been treated using this approach. We have some of the world's most extensive experience using this treatment, and will create a treatment plan targeted to your condition.

For more information, please contact:

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