Gamma Knife® radiosurgery is the most established form of stereotactic radiosurgery (SRS), a non-invasive method for treating brain tumors, blood vessel malformations, and other brain disorders. No surgical incision is needed. The skull is not opened. Gamma Knife radiosurgery uses MRI or other high-resolution brain imaging to make a 3-D picture of the targeted part of the brain. This area is then treated with many small beams of radiation, instead of a scalpel. The radiation is given with robotic precision. Gamma Knife radiosurgery is not like other forms of SRS. It is used for the brain only and has no moving parts for giving radiation, making it safer. It is the most accurate type of brain radiosurgery and has the longest track record in treating brain tumors and other brain disorders. It is the gold standard of radiosurgical treatment for these conditions.

We believe that the Gamma Knife procedure’s use of a head frame is one of the key reasons for Gamma Knife radiosurgery’s excellent long-term results, since this is the most accurate method for providing precise irradiation to the target tissue. Both movement of the patient couch in and out of the radiation unit and opening of the shielding door are done with high precision. The patient’s head is moved in the focus point using precise robotics.
The Perfexion Gamma Knife® at NYU Langone Medical Center

The Perfexion Gamma Knife® system installed at the new 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. In 1997, Drs. John Golfinos and Bernardine Donahue at NYU Langone Medical Center established the first Gamma Knife center in the New York metropolitan area. In 2002, Douglas Kondziolka, MD, Director of the Center for Advanced Radiosurgery at NYU Langone Medical Center and one of the most published researchers in the field, joined a team of professionals to refine the Gamma Knife's design. In 2011, NYU Langone became the first center in New York to have the Perfexion 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 still 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, there typically is 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 giving your permission to undergo the procedure. Please read this form carefully and ask questions if something is not clear. You will be asked to not eat or drink for eight 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’s being attached. Once applied, the frame feels tight for just a minute or two, and then will be comfortable.
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, your doctors will use the information gathered from them to plan your treatment. At this point, you will be able to relax while your neurosurgeon, radiation oncologist, and physicist work together 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 in question 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.
Gamma Knife® Radiosurgery at NYU Langone Medical Center
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 around the target area. You will either be sent home that same day or 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 at a distance from New York, we will work closely with your chosen doctors at home.
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 small tumors and without major symptoms. It can also be used in patients with more than one tumor. Our neurosurgeons work closely with oncologists and radiation oncologists to care for patients with brain metastases. Our team has published extensively on brain metastasis management and has cared for over 5,000 patients with these tumors. Gamma Knife radiosurgery can usually control a tumor in 80-90% of patients. Multiple tumors can be treated at the same setting. If new tumors develop in other locations, these can also be treated in most patients. Whole brain radiation therapy is used less often than in the past, but can be useful in specific cases.

Acoustic Neuromas
(Vestibular Schwannomas)

Acoustic neuromas are benign tumors that involve the nerves responsible for facial movement, hearing, and balance. Sometimes known as “vestibular schwannomas,” they occur near the base of the skull and next to the brainstem, and spread out into the bony canal through which the cranial nerves exit the skull. They grow from the vestibular nerve, which controls balance. Hearing loss in the ear on the side where the tumor is located is often the first symptom that patients notice. Other common symptoms are ringing in the ear (tinnitus) or disequilibrium (new or unusual sensations when changing body position or feelings of change in balance). Acoustic neuromas can also cause symptoms of facial weakness, balance problems, and sometimes facial pain or numbness. Very large acoustic neuromas can put pressure on the brainstem and cause a wide variety of conditions and symptoms. Such tumors can occasionally cause an obstruction of the normal spinal fluid pathways, causing a buildup of spinal fluid called hydrocephalus. This condition can get worse quickly and may be a neurosurgical emergency. Most acoustic neuromas are small, however, usually less than three centimeters in diameter at diagnosis, making such problems unlikely.

Treatment options include surgical resection, Gamma Knife radiosurgery, radiation therapy, or continued observation. The natural rate of tumor growth can vary from patient to patient. Meeting with surgeons experienced in acoustic neuroma care is important to obtain information specific to the individual patient.

Gamma Knife radiosurgery has become a common choice for patients with smaller tumors due to a good record of positive outcomes.

Meningiomas (Intercranial Tumors)

Meningiomas are the most common type of benign intercranial 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 meningiomas depend on where the tumor is located, as well as its size.

Most meningiomas are benign and grow slowly. However, a small number of meningiomas are more aggressive. These grow faster and often 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 meningiomas that are malignant. 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 AV 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, or 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 don’t develop in a certain area, and as a result, the arteries dump blood directly into the veins. Unlike arteries, the veins do not have strong walls. Over time, because of the high blood pressure of arterial blood flow, these veins dilate and become engorged, creating the risk of rupture and hemorrhage, as well as seizures, headaches, and other symptoms. These symptoms typically develop between the second and fourth decades of life. Half of all brain AVMs present with a brain hemorrhage, while the rest typically present as a seizure (25%), a headache (usually one sided and migraine-like), or a neurological deficit. Studies show that untreated AVMs carry a high long-term risk of hemorrhage, stroke or death. Stereotactic AVM radiosurgery avoids the need for open surgery and general anesthesia. While direct surgery can also eliminate and cure AVMs, radiosurgery allows treatment of AVMs in hard-to-access places with a relatively low complication rate. Getting rid of the lesion occurs over a two- to four-year period. Radiosurgery is sometimes combined with endovascular embolization or resection.

Trigeminal Neuralgia

Trigeminal neuralgia (TN), also known as tic douloureux, is a pain syndrome. It occurs as one-sided facial pain. A physical exam is usually normal although some patients may have mild sensory loss. Major sensory loss suggests that the pain syndrome is happening because of something else. An MRI or other neuroimaging is then used to rule out other causes of facial pain.

Medication therapy is the first choice to reduce pain. Carbamazepine (Tegretol) is looked at as the most effective treatment. Other medications that may work well for some patients include phenytoin (Dilantin), baclofen, gabapentin (Neurontin), Trileptol and Klonazepin.

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

Gamma Knife radiosurgery or percutaneous techniques are sometimes the preferred treatment, for elderly patients, patients with multiple sclerosis, patients with recurrent pain after MVD, and patients with impaired hearing on the other side. Gamma Knife radiosurgery, as the least invasive option, has become a common choice and helps most patients.

Gamma Knife radiosurgery is done on an outpatient basis. The benefits grow over time. Patients commonly report pain relief over the first month, but can start to feel relief in a day or two. The average is one month, but the effect on the nerve builds over several months. In our vast experience with this procedure, only about 10% of our 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. Indeed, virtually every type of brain tumor has been treated using this approach. We are experienced in all of these clinical situations, but importantly, treatment decisions are individualized. Radiosurgery can also be used for selected patients with behavioral disorders and movement disorders, such as essential tremor and Parkinson’s disease.
Contact Information

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The Department of Neurosurgery at NYU Langone Medical Center is among the largest and most renowned neurosurgical programs in the country, ranked among the top ten in the nation in U.S. News & World Report’s “Best Hospitals” rankings. With a unique breadth and depth of expertise in all areas of neurosurgery, the department is known as a key referral center for some of the most complex cases. Our team of highly specialized, experienced surgeons provides compassionate, patient-centered care for individuals with a vast range of conditions.

nyulangone.org
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