Being diagnosed with a tumor or cancer is devastating. Immediately after the shock, the patient enters a foreign world of medical terms, insurance problems and referral issues. Simply trying to differentiate between similar treatments can be confusing.

This is especially true in the field of radiation, where one treatment is a “surgery” and requires a neurosurgeon and the next treatment is a “therapy” and requires a radiation oncologist, yet the various pieces of equipment look similar.

In response to all of the inquiries we receive about the different types of radiation and radiosurgery treatments that are available, we are making this small attempt to add some clarity to a complicated area. Knowledge and understanding about a treatment can reduce patient anxiety and restore a feeling of control.

Patients tell us that they cannot speak knowledgeably to their physicians and do not know what to ask. They are overwhelmed with the “jargon” that is routinely used by the medical profession when discussing equipment and methods of treatment. Most do not realize they may have options available to them at their treating medical institution because they lack the information to ask the right questions.

When searching for consensus among professionals, journal articles and current research studies, it becomes apparent that there is none. Often, there is no single best treatment that will work for a person. Perhaps the best that can come of all the education and research is that a person is able to ask informed questions and apply them to his or her specific condition and family situation.

At IRSA, we have become increasingly aware that the treatment chosen for a specific person at a specific time must meet the needs of the person, his family and his community situation. For two people with the same condition, the answer will be different given their situation and comfort level with the issues involved. We encourage people to talk with their families and carry all options to their long-time family physician for discussion. After all, it is the family physician who will continue to care for this person in the long run. Because of this, our Association spends as much time educating the person seeking options as it does educating the family physician.

It is easy for a patient to be confused and upset by the lack of consensus in the medical community but there are usually some benefits. The patient learns more about his disease through this process and begins to develop a sense of comfort with some of the available treatment options.

We hope the articles in this issue will increase our readers’ understanding about the various treatments.

—Editor
Radiosurgery has surgical effect on target area

Stereotactic radiosurgery is a way of treating brain disorders with a precise delivery of a single high dose of radiation in a one-day session. Treatment involves the use of focused radiation beams delivered to a specific area of the brain to treat abnormalities, tumors or other functional disorders. Body stereotactic radiosurgery does not exist because there is no way to immobilize the body to treat a tumor in one session the way the head can be secured. Fractionated stereotactic radiation treatments — which are received over a period of days or weeks — may be administered in the body with the assistance of removable masks and frames that achieve some degree of lesser mobilization. Stereotactic radiosurgery is limited to the head and neck as these areas can be immobilized with skeletal fixation devices that completely restrict the head’s movement, permitting the most precise and accurate treatment. Treatment without a skeletal fixation device for a one-session treatment is not recommended because of the high potential for damage to healthy brain tissue, cranial nerves (optic, hearing, etc.) and the brain stem.

Radiosurgery has such a dramatic effect on the target zone that the changes are considered “surgical.” Through the use of three-dimensional computer-aided planning and the high degree of immobilization, the treatment can minimize the amount of radiation to healthy brain tissue. Stereotactic radiosurgery is routinely used for brain tumors and lesions. It may be the primary treatment; utilized where a tumor is inaccessible by surgical means; or as a boost or adjunct to other treatments with a recurring or malignant tumor. In some cases, it may be inappropriate.

Stereotactic radiosurgery works the same as all other forms of radiation treatment. It does not remove the tumor or lesion, but it distorts the DNA of the tumor cells. The cells then lose their ability to reproduce and retain fluids. The tumor reduction occurs at the rate of the normal growth rate of the specific tumor cell. In lesions such as AVMs (a tangle of blood vessels in the brain), radiosurgery causes the blood vessels to thicken and close off. The shrinking of a tumor or closing off of a vessel occurs over a period of time. For benign tumors and vessels, this will usually be 18 months to two years. For malignant tumors and metastatic tumors, results may be seen as soon as a couple of months as these cells are very fast-growing.

As with all radiation treatments, the cells of the irradiated tumors lose their ability to regulate fluids and edema or swelling may occur. This does not happen in all treatments. If the swelling does cause symptoms that require abating, then a course of steroid medication is usually given to reduce the fluid within the tumor cavity. Because all forms of radiation treatments work over time, they may be inappropriate if symptoms are severe or life-threatening. Relief of acute symptoms may drive the first treatment choice to open skull surgery or medication. In cases where cells are extremely fast growing (with or without severe symptoms), such as in brain metastases, radiosurgery can quickly control the brain tumors to allow time to treat the primary cancer site. Medication can be given for the side effects of edema and radiation therapy may be used over a period of time to help eliminate the stray cancer cells from the brain.

Stereotactic radiosurgery can be used in patients who have failed standard radiation techniques or in patients who have already received the maximum radiation dose permissible or whole brain radiation. At this time, there are no known cases of radiation-induced new tumors from stereotactic radiosurgery in 30 years of treatments. This may be attributed to the preciseness of the treatment and the sparing of healthy nerves and tissues. A patient who has had stereotactic radiosurgery for a brain tumor or condition may later have open skull surgery without problems. In many cases, if necessary, additional treatments of stereotactic radiosurgery can be performed.

There are three basic forms of stereotactic radiosurgery represented by three different technological instruments. Each instrument operates differently, has a different source of radiation and may be more effective under different circumstances. The three are:

- **Particle beam (photon)**
- **Cobalt® based (proton)**
- **Linear accelerator based**

The particle beam or cyclotron is in limited use in the United States. In addition to brain tumors, it also treats body cancers in a fractionated manner. There is not much material available on the technology and outcomes at this time. The particle beam is extremely large and funded by public research.

The cobalt® based machines are located at dedicated neuroscience centers in the United States and throughout the world. These machines provide extremely accurate targeting and precise treatment for brain cancers. They are dedicated to treating only brain tumors and dysfunctions in a one-day treatment. The most well-known machine is the Gamma Knife®.

Continued on page 3

Here are some things to keep in mind before radiosurgery

Here are some things to consider prior to radiosurgery of brain tumors or dysfunctions:

- For stereotactic radiosurgery, be evaluated for treatment and obtain treatment with the most precise instruments available to your specific condition.
- Receive stereotactic radiosurgery within the brain only under the direction of both a neurosurgeon and a radiation oncologist.
- The facility should perform at least 50 stereotactic radiosurgery treatments within the brain each year.
- Ask if the equipment has been modified in any way from manufacturer’s standards.
- If the treatment is being given in more than one session, it is not stereotactic radiosurgery.
- At this time, skeletal fixation devices that are “pinned” into the cartilage results in the most accurate targeting available. The frames do not hurt and are removed within a few hours.
- One-session stereotactic body radiosurgery does not exist and body treatment can only be performed with a fractionated stereotactic radiation therapy method over many treatments. The ability to immobilize the body in the way that we are able to immobilize the brain for a one-session treatment does not seem feasible in the foreseeable future.
Thirty or 40 years ago, the ability to diagnose and treat an individual with a brain tumor was limited by crude surgical and radiological tools. Modern neurosurgical tools and techniques and advanced imaging modalities such as CT and MRI now allow brain tumors to be identified much earlier in the course of the disease. Even when cure is not possible, an earlier diagnosis can result in an improved outcome for the patient through more appropriate utilization of radiation therapy.

Radiation therapy uses high energy light beams (X-rays or gamma rays) or charged particles (electron beams or proton beams) to damage critical biological molecules in lesion cells. If enough damage is done to the chromosomes of a cell, it will spontaneously die or it will die the next time it tries to undergo division into two cells. Radiation therapy is usually done on an outpatient basis with treatment occurring each workday for a period of several weeks. If the patient has had surgery for the tumor, radiation therapy typically begins a week or two afterward.

Radiation therapy is an effective cancer therapy. In surgery, a surgeon may be constrained in resecting cancer by the presence of critical structures that cannot be removed. In chemotherapy, side effects on normal tissues far away from the brain may limit the ability of a medical oncologist to deliver intensive enough treatment to a brain tumor. In radiation therapy, a non-invasive treatment can be given repetitively over several weeks to months and can be aimed specifically at the area where treatment is needed, minimizing or avoiding side effects for uninvolved normal tissues.

This repetitive treatment is called fractionation — a small fraction of the total dose is given with each treatment. The skills of the radiation oncologist, the physicist and the dosimetrist allow complex plans to be devised to minimize side effects for normal tissues.

Conventionally administered external beam radiation therapy gives a uniform dose of radiation to the entire region affected by the tumor. There is only a small variation of the dose delivered to various parts of the tumor. There is little chance that not enough or too much radiation will be given to any part of the tumor.

Treatment of brain tumors with external beam radiation therapy has been an area of intense research activity over the past several decades. Through clinical research, conducted on patients, much has been learned about how to appropriately use radiation therapy for various types of brain tumors. External beam radiation therapy is a valuable component of therapy for nearly all brain tumors; treatment can be delivered to any part, or all, of the central nervous system. The ability to assure uniform doses of radiation to the areas being treated is one of the major strengths of modern external beam radiation therapy.

Some side effects possible
There are some side effects that may be seen with radiation therapy for a brain tumor. Specific side effects may also vary with the part of the brain being treated. Radiation therapy for a brain tumor is usually associated with hair loss in the area of the scalp that the X-ray beams are going through; this may be temporary or permanent. It may cause some reddening and scaling of the scalp as well.

Since the linear accelerator moves during treatment, the degree of precision is less than with the Gamma Knife® machines.

Stereotactic radiosurgery may or may not be appropriate for a condition. It may be used as the primary treatment or recommended in addition to other treatments that are needed. Only a treating neurosurgeon who operates radiosurgery equipment can make the evaluation as to whether someone can be treated. A neurosurgeon must always be present during treatment and should work with a radiation oncologist when the brain is being targeted. Some of the most common indications for treatment are:

- Arteriovenous malformations
- All benign brain tumors including: Acoustic neuromas Meningiomas Pineal and Pituitary
- All malignant brain tumors including: Glial and astrocytomas Low grade tumors
- Metastatic brain tumors
- Functional disorders including: Trigeminal Neuralgia Essential Tremors Parkinson’s tremors/rigidity

Current research areas include epilepsy, headaches and neuro-psycho conditions.
Fatigue is commonly seen and there may be loss of appetite or a change in one’s sense of taste. There is occasionally nausea and rarely vomiting; medications usually alleviate these symptoms.

If the inner ear is given radiation while the tumor is being treated, there may be fluid build-up behind the eardrum, which is usually treated with decongestants. Following radiation therapy, there may be persistent fatigue that can occasionally last for several months. Steroids (dexamethasone) may lessen some of these symptoms, but the minimum effective dose should be used because of possible systemic side effects.

The most noticeable long-term side effect is a gradual decline in some higher brain functions, which will occur over a period of years. This is most noticeable to many patients as a memory problem. It would seem reasonable that the area of the brain irradiated and the dose given would be important factors that might influence this late side effect, but this has never been conclusively proven. It is not certain whether this gradual decline stabilizes after several years, but many patients believe it does.

Very occasionally, radiation therapy given in doses that are safe for the vast majority of patients can cause damage to normal brain tissue, resulting in its destruction.

A brief discussion of radiation therapy for some of the more common types of brain tumors follows.

Brain Metastases

Cancers arising outside the brain in such diverse organs as the lung or breast can travel through the blood vessels to grow in the brain. Tumors that have spread in this fashion are known as metastases. Metastases may be discovered before or after they cause symptoms; a CT scan or an MRI are the tests most frequently used to diagnose brain metastases. Brain metastases may develop at different times (early or late) in the course of the disease in different patients.

Whole brain irradiation is frequently prescribed for patients with brain metastases. This treatment uses radiation to treat the visible lumps of tumor and the presumed invisible tumor deposits that are so small they may not be seen on even a sensitive MRI scan. Therefore, large areas of the brain may be treated to stop the spread of the tumors. Symptoms caused by tumors metastatic to the brain usually respond to whole brain radiation therapy; different studies have reported response rates of 50 to 70 percent.

Another Perspective

Whole brain irradiation is frequently combined with whole brain radiation therapy for brain metastases. The whole brain radiation therapy will treat the visible metastases and any presumed microscopic tumor deposits as well. This is possible because whole brain radiation therapy is given as a low dose to a larger volume and targeted to the tumor and the area of possible tumor spread, while stereotactic radiosurgery is a high dose given to a very small volume and targeted only within the tumor itself. The two treatment techniques can be thought of as complementary in achieving control of metastases to the brain.

Whole brain radiation therapy can cause shrinkage of visible brain metastases, sometimes making them more amenable to stereotactic radiosurgery or microsurgery. The addition of whole brain radiation therapy to stereotactic radiosurgery can decrease the possibility of additional metastatic lesions and decrease the chance that visible lesions treated with radiosurgery may have recurrences after radiosurgical treatment. Omission of whole brain radiation therapy for brain metastases is slightly controversial, but this is an area of ongoing intensive research.

Recently, some investigators have tried stereotactic radiosurgery alone without whole brain radiation therapy for selected patients with brain metastases to avoid causing the side effects of whole brain radiotherapy. Because whole brain radiation therapy can be given at a later date to these patients if their metastases are not controlled by the radiosurgery, this strategy may relieve symptoms effectively while not adversely affecting survival.

There is a widely accepted belief that for melanoma, kidney cancer and sarcomas that spread to the brain, stereotactic radiosurgery may be more effective at controlling the lesions than whole brain radiation therapy. The Eastern Cooperative Oncology Group (ECOG) is evaluating radiosurgery as a solitary treatment for patients with one to three brain metastases of these types of tumors.

The technical articles in this issue were provided courtesy of Dr. Jonathan Knisely and Dr. Harish V. Thakrar.

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The Radiation Therapy Oncology Group (RTOG) performed randomized studies that showed a course of 10 treatments over two weeks to give a total dose of 30 Gray — the same as 3000 centiGray or 3000 rads, to use older terms — was as good as more extended courses of radiation therapy that give higher doses. In some situations, a shorter or longer course of treatment than two weeks may be preferable. For patients who have a single brain metastasis that is removed surgically, whole brain radiation therapy was found in a randomized study to give great improvements in preventing cancer from regrowing in the brain and in prolonging survival.

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Meningiomas

Meningiomas are tumors arising from the meninges, one of the protective layers surrounding the brain and its cushioning cerebrospinal fluid. They are usually slow-growing tumors that do not spread to other places in the brain or elsewhere in the body. It is generally acknowledged that an operation that completely removes a meningioma does not require radiation therapy afterwards to prevent regrowth. An operation in an area where it is difficult for the surgeon to completely remove the meningioma from the surface of the brain can leave tumor cells behind that can lead to tumor regrowth. For meningiomas that are completely removed, approximately 20 percent will regrow in 10 years and 33 percent by 15 years’ time. Up to one third of patients with meningiomas who undergo an operation will be left with obvious residual tumor. More than half of patients with residual tumor after an operation will have regrowth of the tumor by 10 years’ time and about 10 percent will not have had regrowth by 15 years’ time.

Patients with meningiomas that are unresectable because of the extent or location of the tumor may be offered radiation therapy to try to prevent its further growth. There have been no randomized controlled (phase III) trials evaluating the effectiveness of a course of irradiation in preventing meningiomas from recurring after an operation, but radiation therapy is recognized as helpful in this role. Various researchers have found the control rates for incompletely resected meningiomas treated with radiation therapy as being in the range of 75 to 90 percent at 10 years. A significant decrease in post-radiation recurrences occurred when radiation oncologists started using MRI and CT scans to plan the radiation therapy. It was then possible to avoid accidentally missing the meningiomas when administering treatment! The University of California San Francisco has reported that the five-year recurrence rate for incompletely resected meningiomas after radiotherapy in the modern era is only 2 percent.

Radiosurgery is not frequently combined with radiation therapy for meningiomas. Rather, if one treatment technique does not succeed in controlling the meningioma, the other method of delivering radiation therapy may be recommended in order to prevent any further tumor growth.

Pituitary Adenomas

There has been less of a role for radiation therapy in the management of pituitary tumors in recent years because of progress in multidisciplinary medical management of the benign tumors arising in this important endocrine organ. Improved neurosurgical technology and microsurgical techniques have also led to less of a need for postoperative radiation therapy to prevent regrowth of incompletely removed tumors. High-resolution MR imaging and sensitive hormone analyses can help assess the completeness of resection of tumors. Medications can help suppress hormone hypersecretion from some pituitary adenomas.

Many patients who have pituitary tumors that cannot be completely removed with surgery are offered stereotactic radiosurgery to try to prevent recurrence or further growth of the tumor. This is sometimes not possible because of proximity of the optic nerves to the pituitary tumor and because treating the tumor with an effective dose of irradiation may cause damage to the optic nerves, resulting in a loss of vision. A five- to six-week course of external beam radiation therapy has been shown to be effective in preventing further growth of these tumors with a low risk of damage to vision and has even been shown to improve vision when unresectable tumor is pressing on the optic nerves.

There have been no randomized controlled (phase III) trials evaluating the effectiveness of radiation therapy to prevent regrowth of pituitary tumors and there have been no similar trials to comparatively evaluate stereotactic radiosurgery and external beam radiation therapy. Stereotactic radiosurgery with its precise targeting may offer a good alternative after surgery for these types of tumors. As with meningiomas, it is most common to use either radiosurgery or radiation therapy for a pituitary adenoma, reserving the other treatment technique for any failures to control the pituitary tumor.

Radiation therapy for pituitary tumors has been associated with delayed side effects. The normal pituitary gland can produce decreased hormone levels following a course of radiation therapy, resulting in the need for hormone supplementation. It has been argued that this results from the radiation being given to the hypothalamic region of the brain (just above the pituitary). Follow-up of patients currently being treated with stereotactic fractionated radiotherapy may help determine whether this technological advance decreases these late side effects by more precise irradiation of the pituitary gland. Long-term follow-up has shown that patients treated with radiation therapy for residual pituitary tumors have a slightly increased risk of developing second tumors a decade or more after their irradiation. More precise, modern irradiation techniques may decrease the incidence of second tumors.

Gliomas and Malignant Tumors

This group of tumors arises from the cells supporting the neurons in the brain. Some of these tumors initially present as low-grade, slowly-growing masses and can eventually progress to more aggressive, high-grade tumors.
Radiation Therapy

Continued from page 5

There are also tumors that are more aggressive and malignant at their outset. This group includes astrocytoma and oligodendrogloma as well as tumors in which these cell types are combined — oligoastrocytomas or mixed gliomas. More aggressive tumors have the word “anaplastic” in their descriptive name. The most aggressive type of glioma is called glioblastoma multiforme. Anaplastic gliomas and glioblastoma multiforme are termed malignant gliomas and represent approximately 40 percent of all brain tumors.

Malignant gliomas will spread from the site of origin to other areas in the brain but will almost never spread outside the brain. There is typically a gradient of infiltrating tumor cells that decreases as the distance from the margin increases. Most commonly, the tumor will recur at the same location that it started or immediately adjacent there to. Radiation therapy treatment recommendations for malignant gliomas currently advise that several centimeters of apparently normal brain tissue around the tumor be treated to try to prevent these tumors from recurring at the edge of the area where the radiation is given.

A trial being run by the RTOG is randomizing patients with glioblastoma to receive either the conventional postoperative therapy of partial brain irradiation with BCNU chemotherapy or this same therapy and a stereotactic radiosurgical boost to any obvious residual tumor. This study will answer the question of whether the highly focused radiosurgical treatment benefits patients with glioblastoma multiforme by prolonging their lives or decreasing the rate at which their tumor recurs.

Over 20 years ago, radiation therapy was demonstrated to be the most effective therapy for treating patients with malignant gliomas. In these trials, patients diagnosed to have glioblastoma multiforme were treated after their operation with either a regimen including approximately six weeks of radiation therapy and chemotherapy, chemotherapy alone or simple supportive care. Survival was significantly prolonged in the group of patients receiving radiation therapy and there appeared to be a small incremental benefit from certain types of chemotherapy given concurrently. While approximately 30 percent of patients in a Scandinavian trial continued to work, all the nonirradiated patients progressively deteriorated without recovering their prior performance level.

A current study being run by the RTOG is using 3D conformal treatment and dose escalation to evaluate whether this promising technology can safely deliver higher doses of radiation to the tumor in patients who have had an operation for glioblastoma multiforme. Prior studies have not shown any benefit from higher doses of radiation than is conventionally given in six weeks’ time, but it is hoped that modern technology may help limit the dose of radiation to normal brain tissue to a greater extent than was previously possible. If this can be safely done, one outcome may be improved survival from lower failure rates, but this remains to be proven.

Radiation therapy’s obvious benefit for malignant gliomas is harder to discern for low-grade gliomas. A pair of randomized studies recently completed in Europe by the European Organization for Research and Treatment of Cancer (EORTC) have helped to clarify management issues for patients with low-grade tumors. One study split patients into two groups to try to determine whether a higher dose of radiation given to the portion of the brain where the tumor was located would result in better control of these tumors than a lower dose. This study showed no benefit for higher doses of radiation. A similar randomized study conducted in the United States by the RTOG also came to this conclusion. From these two studies, it has been shown that there is no significant benefit to extending radiation therapy treatment beyond approximately 5 to 5 1/2 weeks for a low-grade glioma.

The second European study compared the timing of radiation therapy for low-grade brain tumors. Some patients were given radiation therapy just after their surgery and other patients got their radiation therapy at the time that their tumors progressed. This study found that although early administration of radiation therapy delayed the progression of the brain tumor, there was no advantage in terms of an improved survival. It would thus seem that for many patients with low-grade gliomas, delaying radiation therapy will not affect survival and can defer side effects associated with additional post-surgical therapy. For patients with persistent problems such as seizures, progressive weakness, etc. that are caused by tumors that could not be resected, earlier treatment may help prevent further symptoms from occurring and decrease current symptoms that adversely affect quality of life. This may be true for older patients as well.

Current trials are underway evaluating the role of chemotherapy in the treatment of malignant gliomas and low-grade gliomas. Oligodendrogliomas seem to be more responsive to chemotherapy than other gliomas. There have been promising initial results. New drugs active against gliomas will be found through these trials and physicians will learn how best to integrate them with surgery and radiation therapy.

Here are some useful definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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<tr>
<td>Stereotactic</td>
<td>Precise positioning in three-dimensional space.</td>
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<tr>
<td>Radiosurgery</td>
<td>High-dose radiation that creates a surgical strike within a tumor or nerve.</td>
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<tr>
<td>IMRT</td>
<td>Intensity Modulated Radiation Therapy; the intensity of the radiation can be changed during treatment to spare adjoining normal tissue and increase the dose to the tumor.</td>
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<tr>
<td>Conformal</td>
<td>Shapes in three dimensions to the shape of the tumor.</td>
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<tr>
<td>SRS</td>
<td>Stereotactic radiosurgery, a one-session treatment with high dose radiation within the brain only.</td>
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<tr>
<td>FSR or SRT</td>
<td>Fractionated stereotactic radiotherapy; high dose radiation treatments received over a number of sessions.</td>
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<tr>
<td>XRT</td>
<td>Conventional external beam radiation therapy; small amounts of radiation therapy given over an area to eliminate stray cells and future growth.</td>
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<tr>
<td>Radiosensitive</td>
<td>Responsive to radiation therapy.</td>
</tr>
<tr>
<td>Radioresistant</td>
<td>Resistant to radiation therapy.</td>
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Radiation offers several benefits

In general, here are some of the benefits of all types of radiation treatments:

- No risks of anesthesia or infection
- Treatment is painless
- Reduced costs
- No rehabilitation or affects of surgery
- Immediate return to normal activities
Combination of treatments may be best for malignant tumor

In many instances, the best treatment for a malignant tumor or a metastases may be a combination of many treatment modalities. Recent research suggests that the best outcomes and best quality of life may occur when combinations of surgery, radiation therapy (brain and body), stereotactic radiosurgery (brain only), conformal radiation (brain and body) and chemotherapy are all utilized or some combination of these are utilized to treat body cancer or brain tumors. Research also suggests that the less time between each of these various treatments, depending upon the specific patient’s condition, may provide the best result for a cure or lengthening survival with substantial quality to life.

Adjunct treatments such as surgery and radiosurgery in combination may also be the best treatment available when an aggressive or recurring benign brain tumor is being treated.
One night six years ago, John, 37, of Oak Forest, Illinois, USA, woke up in the throes of a grand mal seizure. He had never had any previous indication that he had an oligodendroglioma, a tumor arising from supportive brain tissue.

One doctor at the hospital did not know what he was dealing with. “He wanted to pull the lymph nodes out of my chest!” John exclaims, still amazed at the initial misdiagnosis.

An MRI revealed John had a tumor the size of a small orange in his left frontal lobe. He underwent his first craniotomy at the University of Chicago in May 1993.

Then five years ago, another glioma showed up on John’s right frontal lobe. He had brain surgery for that as well. John had two more craniotomies at Chicago Institute of Neurosurgery and Neuroresearch in Chicago, Illinois, with adjuvant treatment of conformal radiation with the Peacock system in August 1998 and April 1999.

“The doctors are treating it pretty hard,” he says. This past January, John started having seizures again. “I just signed up for disability,” he says. “I signalled cranes for a living but I’m on seizure medication” so he can’t continue doing that.

John is still working, however, running his own remodeling business. He’s currently on chemotherapy. “I feel fine,” he says. However, “I get headaches once in a while and I’m tired all of the time.”

Asks how he’s coping with his brain tumors, John says, “I’m not going to be a martyr about it.” His family and friends ask him, “How do you take it so well?” But he notes, “That’s all you can do. What else can you do? You’ve got to take what’s given to you.”

In his free time, John enjoys playing softball. He and his wife, Denise, a nurse, have two girls, 7 and 10 years old.

Conformal radiation & IMRT

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Side effects are the same as with conventional radiation therapy (see related article on radiation therapy), but tend to occur less frequently and with less intensity in the short and long term.

IMRT and conformal radiation therapy is deliverable anywhere within the body with proper immobilization of the affected area. As with conventional radiation therapy, there is no limit to the size of tumor that can be treated. Patients who have previously received the maximum amount of radiation deliverable by conventional radiation therapy are able to be treated with conformal and IMRT radiation therapy.

Around 5,000 treatments have been performed in the United States in the last five years. The most commonly treated areas today are:

- Metastatic brain tumors
- Primary brain tumors
- Prostate

"Life is a ribbon. Are you tying yours in knots or bows?"

— Unknown

- Spine
- Lung
- Breast
- Kidney
- Pancreatic tumors
- Liver
- Larynx, tongue, sinus and spine

As with conventional radiation therapy, treatment with IMRT and conformal radiation always involves a radiation oncologist and the physicist. Should the treatment site be within the brain, a neurosurgeon is required to be a part of the team and the patient should insist upon it.

As previously stated, the maximum radiation dosage before conformal radiation and IMRT was constricted by the impact or tolerance it would have on nearby tissues. For instance, when conventional radiation therapy is utilized to treat lung or breast cancer, some overlap of radiation may occur to the arteries of the heart. In some instances, this can cause those arteries to begin to “thicken” over time, restricting blood flow. This may not be a problem, depending on the patient’s overall health and the blood flow within the other heart arteries. For a few patients, this may necessitate a bypass operation in the future to allow for better blood flow. With conformal and IMRT radiation therapy for the lung or breast tumor, the radiation overlap to the heart arteries is shown to be minimal or nonexistent, thus possibly eliminating the need for further invasive care and/or heart problems.

Future studies will be able to further confirm or negate these potential positives of treatment with IMRT and conformal radiation.
Glioblastoma multiforme changed young lawyer's life

If her family had not come to her rescue, 32-year-old Lisa might have died on the floor of her New York City apartment last summer.

“I was very exhausted because I had slept poorly through the week,” Lisa recalls.

Lisa, who practiced employment discrimination litigation in a law firm in Manhattan, had resigned from her job earlier that summer but had one week remaining.

The weekend of Aug. 1-2, 1998, returning home from a family reunion at the shore, “I suffered severe brain seizures.” Members of her family “became more and more alarmed as the weekend progressed” because they had not heard from her.

Her landlord had a set of keys to her apartment but was away for the weekend. Her sister, a doctor in Baltimore, had the other set of keys. She arranged to have them special-delivered, by way of the Northeast Amtrak, to their stepmother in New York early Monday morning. Lisa says her sister thought about flying up to New York on Sunday but decided against it “because she wasn’t ready to admit that something might be very wrong.”

Lisa says her stepmother found her “on the floor semiconscious late Monday morning. My eyes were crossed and I was trying to pull myself up by the side of my Stairmaster.” Lisa was also severely dehydrated.

She says she can’t remember if she had headaches before the seizures that weekend. While working at her law firm, Lisa occasionally suffered from what she thought were stress headaches. Each time she felt one coming on, she would “pop a few Advil.”

Lisa says she resigned because she “did not find the work terribly fulfilling after a while.” She decided she would buy a car, “some kind of clunker from the ’60s or ’70s,” and travel, “to clear my mind and figure out what I wanted to do in the ‘60s or ‘70s,” and travel, “to clear my mind and figure out what I wanted to do the weekend pro-
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But that first weekend in August — with only one week of law practice remaining — changed all that. In the hospital, MRI scans revealed a glioblas-
toma multiforme in her right frontal lobe.

“I was so out of it for about a week that nothing really registered,” Lisa says. “At a certain point, I was told I was going into surgery.”

She underwent a craniotomy at Memorial Sloan-Kettering Cancer Center in New York City on August 12. The tumor was the size of a chestnut. The neurosurgeon told Lisa he removed everything he could see with his naked eye.

“Because both my parents live around New Haven,” Lisa says, “I moved to my mother’s house in Branford, Connecticut, right on Long Island Sound.”

Beginning in September, she received external beam radiation therapy under the care of Dr. Jonathan Knisely at Yale. At that time, she also underwent her first of six rounds of chemotherapy. The radiation treatment lasted six weeks, ending in mid-October.

Lisa also receives the chemotherapy for three hours once every eight weeks and was scheduled to complete the sixth and final cycle in late June or early July. “I’m a bit tired for 24 to 36 hours afterward,” she says. She takes medication for nausea during this period. “Then I’m good as new,” Lisa says.

The worst part of the radiation, she says, occurred when she began to lose the hair on her scalp after about five weeks of treatment. Although her doctor told her there was a 50 percent chance the hair would not grow back, she now has virtually a full head of hair.

“That’s when I learned,” Lisa says, “how doctors rely on statistics and how statistics don’t mean anything; you can always beat the odds if YOU’RE determined to.”

“I’m doing well,” she adds. “I’ve had three MRIs since the surgery, all clear except for scar tissue. Apparently, there had been a bit of bleeding during the operation.”

Lisa stays active, walking or running several miles each day and practicing yoga. “I’ve always been an athlete,” she explains. In 1997, she finished the New York Marathon in under four hours.

“I decided early on to be strong, to live my life as if I’m clean of cancer, of which there is every indication,” Lisa says.

While she was recovering from the craniotomy, another patient told Lisa she was entering “a cauldron of fire” and should resign herself to poor health and great suffering. Lisa says that thought was so offensive to her that she became determined to prove the woman wrong. She says she found members of a support group she tried had a similar attitude. “They defined themselves as cancer vic-
tims. That somehow struck me as defeatist.

“What I’ve learned from all this is that bad things are always going to happen in life, even if you’re not diagnosed with cancer,” she says. “It’s how you deal with them that matters.

“My life is simply an aggregation of moments until I die. Those moments are mine to control and to fill,” Lisa says. “Being hit with a life-threatening illness made me realize how precious those moments are.”

A few months ago, she visited her old law firm. “I felt sort of free,” she relates. The fluorescent lights and atmosphere “sort of drain you. I looked at these peo-
ple and their lives being sucked away.”

Although she did end up buying a car, Lisa says she no longer feels the need to travel and engage in the soul searching by traveling.

“I think I want to write,” she says. “I feel like that’s what I would have found out if I had been able to stick to my original plan. In that way, the illness was a sort of blessing; it sort of short-circuited the whole process.”

“In our interpersonal relations we should never forget that all our associates are human beings and hunger for appreciation. It is the legal tender that all souls enjoy.”

— Dale Carnegie

Another Perspective 9
Radiation is measured by the amount of energy absorbed by the body. The unit of measurement is the Gray, abbreviated Gy. The term Gray replaced an older term, rad. Other units of measurement are the centiGray (cGy) and the rad. One cGy equals one rad. Thus one Gray equals 100 cGy or 100 rad. The average X-ray used for diagnosis exposes a person to about .0072 cGy.

Radiation used to treat brain tumors in conventional radiation therapy in the past was about 6000 cGy or 60 Gy. Today, new research is showing that 3000 cGy or 30 Gy received over a period of 10 sessions may be as effective as the larger 60 cGy received over a period of 30 or so sessions. While these doses may seem high, they are spread over a relatively large target region.

With one session of stereotactic radiosurgery, the radiation dosage can range from very small (15 Gy) to very large (70 Gy). The dosage is a function of the type of tumor or lesion being treated and the effect that is desired.

With stereotactic radiosurgery, the targeting is the most precise available, allowing large amounts of radiation to be targeted within the tumor with minimal effects to surrounding normal tissues.
Astrocytoma patient wishes he had taken first symptoms seriously

Jeffrey, 30, of Mishawaka, Indiana, USA, wishes he had taken his symptoms more seriously when his astrocytoma first manifested itself.

At age 21, he suffered major seizures and leg cramps.

"Being young and dumb, I thought it was nothing," Jeffrey recalls. "I thought they would go away on their own. Being young, I was scared to go to the doctor."

He was living in South Carolina at the time, away from his family.

When the symptoms persisted, Jeffrey finally saw a doctor. An MRI showed an elongated grade II astrocytoma in the left parietal lobe, about 4.3 cm long and less than 2 cm wide.

"The specialists all agreed radiation therapy would take care of the problem," Jeffrey says. He had 32 doses of radiation over a period of weeks.

A subsequent MRI in December 1992 indicated a possible tumor extension. By July 1998, this had grown to 4.2 cm long and 3.3 cm wide. It was a grade III anaplastic astrocytoma, malignant and infiltrating.

"I believe when it was first diagnosed, if they gave me chemotherapy as a backup this never would have recurred," Jeffrey says.

He started having seizures again about one and a half years ago. After conferring with some specialists near his home, Jeffrey went to Chicago Institute of Neurosurgery and Neuroresearch in Chicago, Illinois.

"They said I would be a good candidate," Jeffrey says. He was treated with a one-session radiosurgery boost to the tumor using the Peacock system at CINN by Drs. Tomasz Helenowski and Harish Thakrar in October 1998.

CINN is "a two-hour drive from here," Jeffrey says. "I was driving up every other day for tests and stuff. I’m still on the chemo."

He says the chemotherapy is no problem for him. "I have to go to the chemo room to get my shots and I’m there for five minutes."

His last MRI showed no regrowth in the tumor.

"With the first astrocytoma, I had no symptoms other than the seizures," Jeffrey says.
Here are some helpful patient support groups

**CANADA**
Brain Tumor Foundation of Canada
111 Waterloo Street
Suite 600
London, Ontario N6B 2M4
Phone: 519-642-7755
Fax: 519-642-7192

**FRANCE**
Association de Recherche contre le Cancer
16 av Paau Vaillant Couturier
94801 Villejuif Cedex
Paris, France
Phone: 45 59 59 59
Fax: 47 26 04 75

**MALAYSIA**
Malaysian Medical Association
124 Jalan Pahang
53000 Kaula Lumpur
Phone: 60 03 442 0617

**NETHERLANDS**
Stichting Voorlichting Patienten
Atoomweg 100
Postbus 8153
3505 RD Utrecht, Netherlands
Phone: 31 030 474 545

**SINGAPORE**
Singapore Cancer Society
15 Enggor Street
Realty Centre
#04-01 to 04
Singapore 079716
Phone: 65-221-9577
http://cancer.org.sg/

**SPAIN**
Asociacion Espanola contra el Cancer
Amador Rios, 5
28010 Madrid, Spain
Phone: 34 1 319 41 38
Fax: 34 1 319 09 66

**SWEDEN**
Cancerfonden
Box 17096
104 62 Stockholm, Sweden
Phone: 46 8 772 28 00

**TAIWAN**
Yon Tjing Ling Medical Foundation
C/o Veterans General Hospital-Taipei
Shih-pai 11217 Taipei, Taiwan

**UNITED KINGDOM**
British Brain & Spine Foundation
7 Winchester House
Kennington Park
Cranmer Road
London SW9 6EJ
Phone: 0171-582-8917
Fax: 0171-582-8712

CancerBACUP
3 Bath Place
Rivington Street
London EC2A 3JR
Phone: 0171 696 9003

Gammmaknife Surgery Support Association
25 Sutton Close, Milton
Cambridge CB4 6DU
England
Phone: 1223-863-047
Fax: 1223-863-347

**UNITED STATES**
American Brain Tumor Association
2720 Rivers Road
Des Plaines, IL 60018
Phone: 847-827-9910; 800-886-2282

American Chronic Pain Association
P.O. Box 850
Rocklin, CA 95677
Phone: 916-632-0922
Fax: 916-632-3208

The Brain Tumor Society
124 Watertown Street
Watertown, MA 02472
Phone: 800-770-8287

Dana Alliance for Brain Initiatives
745 5th Avenue, Suite 700
New York, NY 10151
Phone: 212-223-4040
www.dana.org

MGI Pharma Inc.
Suite 300 E. Opus Center
9900 Bren Road East
Minnetonka, MN 55343-9667
Phone: 612-935-7335

National Brain Tumor Foundation
785 Market Street, Suite 1600
San Francisco, CA 94103
Phone: 415-284-0208; 800-934-2873

National Institute of Neurological and Communicative Disorders and Stroke
Building 31, Room 8A-06
Bethesda, MD 20205
Phone: 301-496-5751
or 800-352-9424

International Radiosurgery Support Association
Delivery: 3540 N. Progress, S. 207, Harrisburg, PA 17110 USA
Mailing: P.O. Box 60950, Harrisburg, PA 17106-0950 USA
Phone: +(717) 671-1701 Fax: +(717) 671-1703

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