Understanding the differences between common radiosurgery and radiotherapy technologies can be a complex matter. Marketing and advertising campaigns often complicate the issues and create misperceptions about how each technology compares to its alternatives.

The physicians at Inova Cancer Services are committed to working hand-in-hand with you to determine what treatment plan is right for each of your patients. At Inova, you’ll find a full complement of radiation oncology technology, exceeding what is found at any other program in the DC Metro area.

We invite you to use the guide below as a tool to clarify the benefits of the various technologies, and encourage you to contact us to request a consultation with any of our physicians to clarify any questions you might have.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>CLINICAL EXAMPLES</th>
<th>GammaKnife®</th>
<th>CyberKnife®</th>
<th>TomoTherapy®</th>
<th>Trilogy®</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Target size range:</strong></td>
<td></td>
<td>0.5 to 3cm</td>
<td>1 to 6cm</td>
<td>1 to 40x140cm</td>
<td>0.5 to 40x40cm</td>
</tr>
<tr>
<td><strong>BRAIN single-dose Stereotactic Radiosurgery (surgical skull fixation)</strong></td>
<td>Arteriovenous malformation, trigeminal neuralgia, acoustic neuroma, pituitary adenoma</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BRAIN single-dose Stereotactic Radiosurgery (mask immobilization)</strong></td>
<td>1-4 brain metastases, simple meningioma</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BRAIN Stereotactic High-Dose Radiation (2-5 doses)</strong></td>
<td>Complex meningioma, extensive pituitary adenoma, recurrent glioma</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BODY Stereotactic High-Dose Radiation (2-5 doses)</strong></td>
<td>Small, medically inoperable lung cancer, liver metastasis, spinal tumor or AVM</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HEAD Intensity-Modulated Radiation Therapy (6-40 doses)</strong></td>
<td>Skull base tumors, head/neck cancers, pituitary tumor near chiasm, chordoma</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BODY Intensity-Modulated Radiation Therapy (6-40 doses)</strong></td>
<td>Prostate cancer, pelvic tumors, pancreas, lung, esophagus, other critical sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HIGHLY COMPLEX, very large or multiple targets (6-40 doses)</strong></td>
<td>Complex head/neck, whole scalp, extensive retroperitoneal or pleural-based disease</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Image Guidance Capabilities**

| X-Ray Image Guidance | Indications as noted above but requiring implanted metallic fiducials for guidance | | | | |
| CT Image Guidance | Indications as above but using CT image for guidance; no additional procedure | | | | |
| Respiratory Gating | For targets located in lower lung or near diaphragm that move with respiration | | | | |

■ = available at Inova Cancer Services

See other side >>
Common Radiosurgery and Radiotherapy Technologies

**Trilogy®**
Offered at Inova Alexandria Hospital and Inova Fairfax Hospital

Trilogy is the evolutionary result of research in intensity-modulated radiation therapy (IMRT) over the past decade. It is a high-energy linear accelerator built with very close tolerances and a variety of devices for shaping the radiation beam and modulating its intensity. Trilogy has the ability to precisely reproduce patient position with biplane X-rays, using either bones or implanted gold seeds for fiducials. In addition, it can produce CT scans for precise location of internal organs and tumors just before treatment, significantly reducing the radiation dose to adjacent structures. A daily treatment with image guidance takes about 20 minutes.

**TomoTherapy®**
Offered at Inova Fairfax Hospital

The first treatment method actually designed from the ground up for intensity modulated radiation therapy (IMRT), TomoTherapy has been in clinical use since 2004. The unit resembles a large CT scanner and, as in a CT, the radiation beam rotates in a helical pattern about the central treatment couch. Patient position is checked and adjusted immediately before each treatment with a brief CT scan. The high-energy treatment beam is composed of 64 tiny “beamlets,” each of which can be modulated independently, every 7 degrees, as the array rotates around the patient in a helix. This enormous number of variables, driven by a parallel-processing computer, achieves complex radiation dose distributions surpassing CyberKnife and even Trilogy. TomoTherapy can also treat extremely large volumes when needed. A daily treatment with image guidance takes about 20 minutes.

**GammaKnife®**

In use for almost half a century, the GammaKnife employs 201 small radio-cobalt sources in a hemispheric array surrounding a central chamber for the head. Despite many improvements in hardware and software over the decades, it remains a single-purpose machine for treatment of brain lesions, always requiring surgical fixation of the skull in a rigid head frame. It is almost never used for multiple treatments, because of the need for a frame each day. Field size is very limited. GammaKnife is very good for small, spherical tumors, but later intensity-modulation technology achieves more uniform dose distribution when treating larger or irregular targets.

**CyberKnife®**

Developed in the 1990s, the CyberKnife consists of a small linear accelerator on a robotic arm. It can be aimed with great precision, but only from the front and sides of the supine patient. Patient position is checked regularly with biplane X-rays during treatment, and the robot can adapt to small patient movements, making it possible to treat without surgical fixation. However, this usually requires that small, gold fiducial seeds be implanted into or near the tumor, necessitating a surgical procedure. Beam size (and therefore target size) is very limited. Outside the brain, Cyberknife is generally used only for palliative treatment. The safety and efficacy of using CyberKnife to treat curable prostate cancer with five very large doses is unproven. Treatments are long, requiring the patient to lie still for up to two hours. CyberKnife charges are several times higher, per treatment, than alternatives below.

To refer a patient or request a consultation with any of our physicians, contact the radiation oncology programs at one of our world-class cancer centers.

**Inova Alexandria Hospital Cancer Center**
Featuring Trilogy® technology
4320 Seminary Road
Alexandria, Virginia 22304
703-504-7900

**Inova Fairfax Hospital Cancer Center**
Featuring TomoTherapy® and Trilogy technologies
3300 Gallows Road
Falls Church, VA 22042
703-776-3731

**Inova Loudoun Hospital Cancer Center**
Featuring IMRT and IGRT
44035 Riverside Parkway, Ste 100
Leesburg, VA 20176
703-858-8850