

CyberKnife Radiosurgery

Highlands Neurosurgery, in affiliation with Bristol Regional Medical Center, has brought CyberKnife radiosurgery to the Tri-State region. Using this new non-invasive device, our surgeons can treat vascular abnormalities, tumors, functional disorders, and cancers of the body with sub-millimeter accuracy. This innovative technology represents an entirely new approach to radiosurgery, incorporating a compact, lightweight linear accelerator (LINAC) mounted on a robotic arm.

CyberKnife provides our surgeons with unparalleled flexibility in targeting tumors. The CyberKnife's computer-controlled robotic arm treats areas of the body that are unreachable by other stereotactic radiosurgery systems (SRS). Head, neck, spine and whole body treatments are now possible. CyberKnife provides an enhanced ability to avoid critical structures and a broader range of clinical applications, including the ability to treat:

- Lesions in and around the cranium
- Lesions in the neck and spine
- Larger tumors
- Previously inoperable tumors
- Lesions throughout the body

With the CyberKnife, our surgeons also have the potential to target multiple tumors at different locations during a single treatment, delivering highly conformal dose distributions. The robotic arm operates with six degrees of freedom, providing unmatched maneuverability in targeting.

Opportunities for New Clinical Applications

Because older SRS rely on an external metal frame attached to the skull for target localization, SRS applications historically have been limited to the cranium. But the CyberKnife uses internal reference points in the anatomy to enable treatment of lesions anywhere in the body. The system's advanced image-guidance program uses bony landmarks or small, embedded markers to target the radiation. The unique frameless nature of the CyberKnife makes it possible to utilize radiosurgery as a potential treatment throughout the body.

Pre-operative CT images are used to define the spatial relationship between the patient's bone structure and the lesion. During treatment, real-time images are taken by the system's X-ray cameras to detect any patient movement. These radiographs show any shifts in the bony landmarks, which in turn are used to extrapolate changes in the target location. The CyberKnife compensates for any changes in target position by automatically repositioning the LINAC to ensure accurate delivery of each radiation beam.

Treatment Sites

CyberKnife provides unprecedented flexibility in targeting lesions and tumors. Potential treatment sites include:

- Brain
- Head and neck
- Pancreas
- C-spine

- T-spine
- L-spine
- Skeletal
- Lung
- Ilio-Sacral
- Liver
- Nasopharynx

Conditions that can be treated include:

- Acoustic Neuroma (NF2 and non NF2)
- AVM
- Ependymoma
- Glioma (grades 1-4)
- Glomus jugulare
- Hemangioblastoma
- Meningioma
- Metastasis - all
- Oligodendroglioma
- Trigeminal neuralgia
- Pituitary - Cushings, GH, nonsecreting and Prolactin
- Schwannoma (NF2 and non NF2)
- Sarcoma

Patient Comfort

CyberKnife provides unprecedented comfort and convenience for your patient. The developers of CyberKnife were disturbed by the tremendous patient discomfort caused by the head frame used with older SRS. The frameless design of CyberKnife completely eliminates that constraint.

In a forward treatment plan, the clinician determines what dose to deliver from a particular targeting position. The planning software then calculates the total dose within the lesion for the user.

In an inverse treatment plan, the clinician specifies the total dose to be delivered to the lesion and sets boundaries to protect critical structures. The software determines targeting positions, and the dose to be delivered from a particular targeting position. While other SRS also offer the inverse planning option, the number of possible plans is limited by the constraints of those delivery systems.

Treatment Planning

With the CyberKnife system, our physicians can customize each patient's treatment plan. The flexibility of the robotic arm makes it possible to implement a wider range of treatment plans, including the ability to use either forward or inverse treatment planning.

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History of the CyberKnife

CyberKnife was developed by a team of physicists and engineers at Stanford University lead by neurosurgeon John Adler Jr., M.D. Dr. Adler, who trained in neurosurgery at Harvard University, collaborated with leaders in the field, including the late Dr. Lars Leksell, the creator of radiosurgery. The first CyberKnife prototype was installed for clinical use at Stanford in 1994. CyberKnife technology was cleared for commercial use by the federal Food and Drug Administration in August 2001. The technology has already been used to treat more than 3,000 patients worldwide. Currently, the CyberKnife is in use at *nine* facilities across the United States.

Committed to Answering Your Questions

We believe CyberKnife technology has revolutionized stereotactic radiosurgery. We are committed to giving you the information you need to feel comfortable recommending this treatment to your patients. If you would like a personal presentation on the uses and advantages of CyberKnife, we would be happy to come to your office. If you would like to tour the Center and see a demonstration of the technology, we can arrange that as well. Please call us at 423-844-5400.

If you want to arrange a consultation or referral for a current patient, we're available at 423-844-5400.