mdCHILDREN'S

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Stereotactic radiosurgery

Children's, UT Southwestern first to evaluate treatment

Physicians on the medical staff at Children's and UT Southwestern are using stereotactic radiosurgery for children with recurrent brain tumors. A clinical trial to begin this fall will be the first of its kind to evaluate the technology's use as treatment for children ages 3 years old and younger with newly diagnosed malignant brain tumors.

"This is a unique opportunity to bring the benefits of radiation to the pediatric population. Radiation therapy with this population has been forbidden so far because of the morbidity of patients," said Cole Giller, M.D., a neurosurgeon on the medical staff at Children's, associate professor of neurosurgery at UT Southwestern and a co-investigator of the clinical trial.

The technology

The study will incorporate chemotherapy and the immediate use of post-operative stereotactic radiosurgery using a non-invasive device called the Cyberknife®, or Accuray, developed by Accuray Inc. Located at UT Southwestern, the Cyberknife is one of only six such devices in the nation and the only one in Texas. The Cyberknife incorporates a compact, lightweight linear accelerator mounted on a precision-guided industrial robotic arm that moves around the patient in 360 degrees and emits a concentrated beam of radiation, stopping at more than 100 different locations during treatment. The radiation is focused on the tumor using three-dimensional coordinates and image-guidance technology to deliver a precise beam of radiation. The device tracks the skeletal and lesion orientations using live radiographic images with pre-operative CT scans to repeatedly determine patient and tumor position over the course of treatment. The computer's software continuously communicates the patient's precise position to the robot so that it may compensate for any patient movement while administering radiation therapy.

Daniel C. Bowers, M.D., hematologist-oncologist on the medical staff at Children's and assistant professor of pediatrics at UT Southwestern, is the principal investigator of the clinical trial. He said the clinical trial should provide the most benefit to the youngest children with malignant brain tumors who have residual tumor remaining after surgery.

Evaluating the use of Cyberknife technology are, from left, Drs. Daniel C. Bowers, Cole Giller and Joseph P. Gilio.

According to research by the Pediatric Oncology Group, the degree of primary surgical resection is the most important prognostic factor for progression-free survival among young children with malignant brain tumors, regardless of tumor histology. The most common location for tumor progression is the site of the original tumor, suggesting a need for additional therapy to better prevent tumor progression at the site of the primary tumor.

"We know that infants who have surgically unresectable brain tumors have a very poor prognosis. This is an ideal patient population to evaluate this novel therapy for its effectiveness and to identify possible treatment-related side effects," Dr. Bowers said. "I am very hopeful that stereotactic radiosurgery, using the Cyberknife, will improve their prognosis with minimal long-term side effects."

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Stereotactic radiosurgery

(Continued from front cover)

Improved outcome

An important limitation of relatively imprecise conventional radiation therapy is the result of unintended radiation of normal, developing brain. The precision of stereotactic radiosurgery with the Cyberknife limits the radiation delivered to normal brain tissue, and therefore may reduce the severity of radiation-induced injury to normal brain tissue.

"This treatment will hopefully reduce the long-term side effects of conventional radiotherapy, including the neurocognitive injury and learning problems caused by radiation therapy to a normal developing brain," Dr. Bowers said.

In this clinical trial, we have intentionally selected very low doses of radiation at first to make sure we don't harm the patient. Assuming that the children tolerate the lower doses of radiation well, we will slowly increase the dose, so that by the end of the clinical trial we will actually be treating children with brain tumors with a large dose of therapeutic radiation," he said.

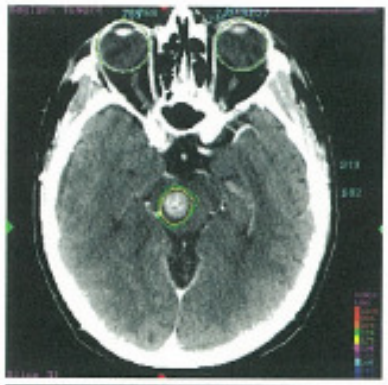
Use in pediatrics

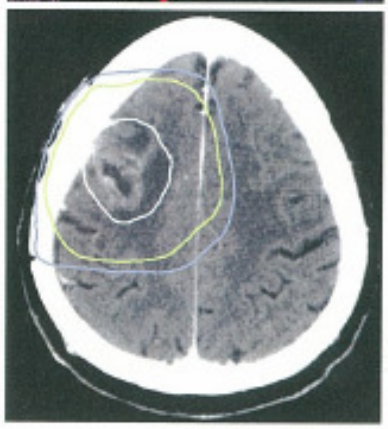
Treatment with the Cyberknife has been FDA approved for use with adults, and approval for the pediatric population is pending the clinical trials.

Roy Elterman, M.D., neurologist on the medical staff at Children's and clinical associate professor of neurology at UT Southwestern, said he is pleased to have this new therapy available for patients.

"It is so important that investigational treatments (or therapies) be made available to children. Unfortunately, children are often left out of such trials. This is really exciting news," Dr. Elterman said.

Although the use of stereotactic radiosurgery has become an accepted treatment practice in the management of primary, recurrent and metastatic brain tumors in adults, its use with pediatric patients has been limited because of the need for placement of a rigid stereotactic headframe. The advent of less invasive devices, such as the Cyberknife, which do not require rigid immobilization have allowed for expanded use of stereotactic radiosurgery in the pediatric population.





Top: Stereotactic radiosurgery using the Cyberknife treats to a lower isodose line (50-70%) around the tumor with a much smaller margin — typically 2 mm. This significantly lowers the dose to the surrounding brain tissue. Bottom: Treatment using traditional radiation therapy shows typical isodose lines of 98% and 80% of the maximum dose. There is a 2.0 cm margin designed around the tumor and the entire region is treated to a uniform dose (>98%).