UNIVERSITY OF ILLINOIS
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State-of-the-Art Technology Arrives in Radiation Oncology, Ensuring Precision, Efficacy and the Continued Highest Standard of Patient Care

This article was written by Dawn Smith, Director of Communications for the Cancer Center

The Radiation Oncology Department of the UIHHSS, is home to the new BrainLAB Novalis Stereotactic Radiosurgery System and Exactrac Image Guidance System. What this means for the UIHHSS patient population, is that our world class neurosurgeons and radiation oncologists now have the most technological, state-of-the-art stereotactic radiosurgery system. It also means a faster, more precise form of treatment for patients with malignant and non-malignant brain and spinal tumors; it is a form of treatment that eliminates the standard risks of surgery, has minimal side effects and recovery period, and an excellent rate of success.

"Stereotactic radiosurgery is a way to very sharply focus a lot of radiation to a target," states **Dr. Herb Engelhard, Associate Professor of Neurological Surgery and CTTI member of the Cancer Center,** at UIHHSS. Comparatively to traditional approaches to radiation and surgery, he notes that traditional radiation therapy delivers a smaller dose of radiation onto a larger surface area, and for shorter, repeated fractions of time. This elongates treatment into a period of approximately 3 – 8 weeks, depending on the individual treatment plan, and also poses the risk of damage to tissues surrounding a tumor. Brain and spinal surgery come with significant risks as well, among them infection, leakage of spinal fluid, and potential injury to surrounding tissue, as a result of anatomical structures that have been manipulated. As an alternative, stereotactic radiosurgery provides a quick, powerful shot of radiation to an extremely limited area, and in one dose. The difference is then a considerable reduction in treatment and recovery time, few (if any) side effects, and little to no risk of surrounding tissue damage.

The Surgery in Radiosurgery

As explained by **Dr. Konstantin Slavin, Physician and Professor of Neurological Surgery with the University of Illinois College of Medicine,** the term "radiosurgery" is reflected in the manner of precision allowed, but without the procedure or risks of standard surgery. Dr. Slavin relies on a framed headpiece, as an instrument to guide the radiation beams exactly where they will be most effective against a tumor. His patients receive a gentle anesthetic, before the frame is placed onto the head and attached to the skull. This frame stabilizes the patient and gives Dr. Slavin a roadmap, to ensure the greatest amount of accuracy in eliminating a tumor. "Where all of the beams of radiation come together," says Dr. Slavin, "is where the tumor gets destroyed."

Asked about the potential of frameless radiosurgery in the future, Dr. Slavin notes that it's not out of the question, but that there are benefits of having the frame. "The frame gives me [as the surgeon] an extra level of confidence," states Slavin. He goes on to clarify that the brain is so intricate and complex; whereas larger organs in the body can heal and overcome minor tissue damage, the regions of the brain might not respond in the same manner. The combination of the frame and the expertly controlled radiation, mean that radiation is going to an identified tumor and only the tumor. As Dr. Slavin concludes, "Radiosurgery is so attractive because of this sparing of regular tissue."

Stereotactic radiosurgery as a form of treatment is a decision made on an individual basis and with each patient's tumor in mind, by the radiosurgery team at UIHHSS. Dr. Engelhard, Dr. Slavin and **Dr. Matthew Koshy, Assistant Professor with UIHHSS Radiation Oncology,** all agree that the greatest limitation at this point is tumor size. Tumors in the brain are limited to a maximum of 4 cm. States Dr. Koshy, "anything larger could expose a greater volume of normal tissue to an unacceptably high dose of radiation. So location within the brain is taken into account, and great care is taken to minimize radiation dose to normal critical structures and eloquent areas of the brain." Adds Dr. Engelhard, "radiation can get to every point, but that's where the expertise of the neurosurgeon comes in." Additionally, in cases where tumors might be too large or are interacting with tissues that are too delicate to radiate, all three physicians note that the procedure can be adjuvant to surgery, chemo or even more standard radiation therapy, specific to the patient's needs.

The Future of Stereotactic Radiosurgery

"A recent body of evidence, including several multi-institutional trials, have demonstrated that the benefits of radiosurgery can now also be applied to tumors of the lungs and liver, with equivalent local control rates to that of an oncologic surgical resection," says Dr. Koshy. He continues, explaining that, the procedure is being explored and evolving towards a form of treatment for other cancers. Paired with the Thoracic Oncology team at UIHHSS, a stereotactic body radiotherapy program for lung cancer has been started and is showing great success. Eligibility for this procedure, like that which qualifies a patient for radiosurgery for brain tumor patients, is a decision made individually between a patient and his/her physicians, however is it most likely to be effective on "patients with early stage lung cancer and tumors less than 5 cm, who would be considered medically inoperable or are otherwise not a candidate for lobectomy."

In the past six months, UIHHSS Radiation Oncology Services has successfully completed 15 cranial radiosurgical procedures and 65 stereotactic radiotherapy procedures in the lungs. The BrainLAB system, in combination with the ExacTrac Image Guidance System, function together, to properly position the patient and ensure optimal navigation via computer guidance and 3-dimensional imaging. Of the ExacTrac Image Guidance System, states Dr. Koshy, "It allows us to visualize tumor and patient position before we begin treatment. This in turn allows us a greater deal of precision and accuracy with our radiation dose." It also greatly reduces the element of time in treatment. Koshy notes that previous lung cancer radiation treatments would require more than 30 individual visits, accompanied by side effects. Stereotactic radiosurgery minimizes the

treatment time from over 30 visits, to just three, few side effects and an increased opportunity for a cure. As an established procedure that eliminates the need for anesthesia, is well-tolerated by the patient, and can successfully eradicate malignant and non-malignant tumors, this newer technology essentially means higher levels of accuracy, greater utilization for the UIHHSS patient population, and the potential to understand how tumors respond to this manner of radiation and if the same principles can be applied to other malignancies.

“An active area of research for our department is also treating patients with oligometastatic disease, generally defined as patients with cancer that has spread to less than five sites. In the past, these patients were traditionally treated with chemotherapy alone. However, recent research suggests there is a subset of this population that will benefit from stereotactic body radiotherapy to the sites of metastatic disease, in addition to chemotherapy,” explains Dr. Koshy. Likewise, ideas are being explored to take what is known about these types of tumors and how they respond to such a direct force of radiation, and determine if this process can translate to tumors of similar size and composition, located elsewhere.

Drs. Engelhard, Koshy and Slavin unanimously agree that the greatest beneficiary of this is the UIHHSS patient population. When patients would otherwise be referred out to facilities that have this technology, UIHHSS can now continue that same high standard of patient care, performing these procedures and ensuring the same high level of efficacy. For more information about Stereotactic Radiosurgery, please contact Radiation Oncology.