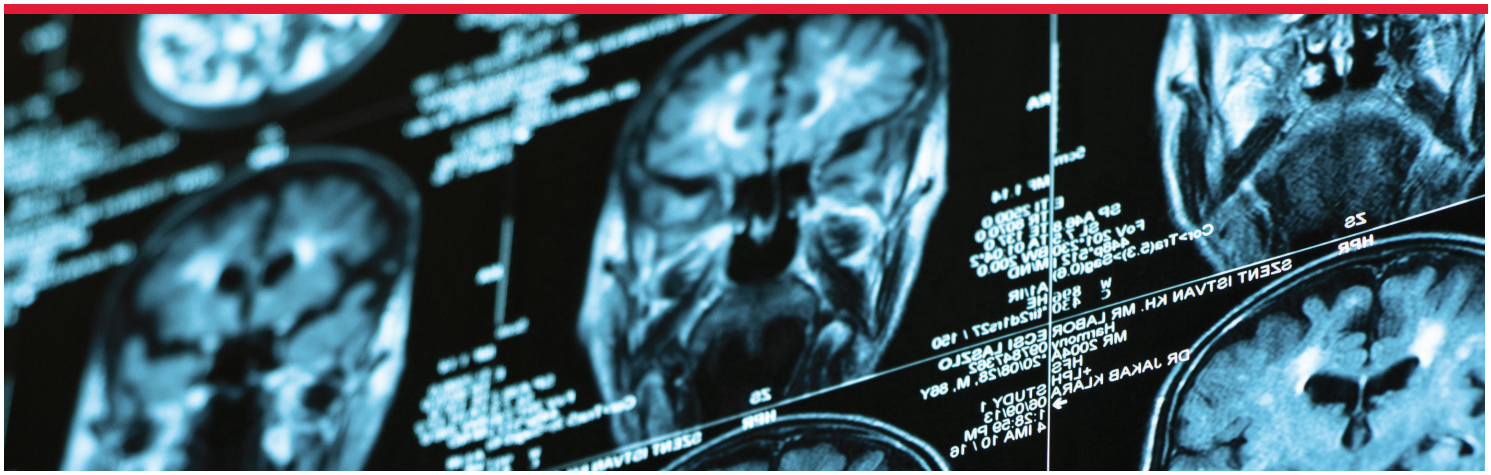
FEATURED ARTICLE

Killing Cancer at the Speed of Light

Laser Interstitial Thermal Therapy (LITT)



Ct scan of the human brain [Image Credit: ©Sved Oliver/ Adobe Stock]

BY LILIANA CALDERO

The National Cancer Institute (NCI) estimates that in the U.S., about 1,735,350 new cases of cancer will be diagnosed in 2018 alone, and according to their estimation, 609,640 people in the U.S. will die from this disease this year. Despite these overwhelming numbers, there is hope. Between 1990 and 2014, the overall cancer death rate has dropped by 25% in the U.S., and is falling a little more each year as research and technology continue to produce new life-saving procedures and treatments.

Over the years, media depictions of cancer have imprinted upon the popular imagination a picture of traditional treatments such as radiation therapy and chemotherapy, along with their unpleasant and sometimes painful side effects. Today, we see that these are often part of broader treatment programs involving a range of therapies and procedures. Research institutes such as Moffitt Cancer Center are leading the way with numerous cutting-edge techniques for treating cancer patients. Among the tools they are using – lasers.

LITT

Brain cancers make up about 1.4% of all new cancer cases in the U.S. (NCI, 2018). Surgery is an important part of managing these cancers, with the goal of removing the tumor when possible. Doing this safely can present a challenge when the tumor is located in critical areas of the brain such as the brainstem, basal ganglia, or thalamus. This is where Laser Interstitial Thermal Therapy, or LITT, is offering hope to patients.

According to Dr. Arnold B. Etame, a Neurological Surgeon and Scientist at Moffitt Cancer Center, Magnetic Resonance Imaging (MRI) guided LITT is being used to treat brain tumors that were once considered inoperable with traditional surgery due to their location. LITT can be used to destroy tumors in critical areas, while minimizing the potential for damaging healthy brain tissue and also offering an incredibly short recovery time.

HOW IT WORKS

Using highly advanced MRI-guidance technology, the surgeon identifies critical areas of the brain in relation to the tumor, and then maps out the entryway and target. A very small incision, about 3-4 mm wide, is made at the entryway, and a laser fiber probe is inserted and guided into the target. New technology allows the MRI to occur at the same time, providing the guidance needed for precision during the procedure. From behind a protective barrier, the surgeon operates the laser remotely while monitoring the patient. Using pulsed laser energy, the tissue of the tumor is ablated, or burned away, while the surrounding healthy brain tissue remains.

As incredible as this treatment approach is, Etame is sure to point out that LITT is only one of many important techniques used in the treatment of brain cancers, and that there are many situations in which traditional surgery would be effective based on the treatment goals. “Traditional approaches have come a long way – we use MRI-guided functional mapping for language or movement, we also use tractography to look at white matter fibers in relation to the tumors, as well as keep patients awake during procedures to monitor their functioning. The laser is reserved for more challenging situations.” Situations like radiation necrosis.

"It's a new technique," says Etame, "which over the past few years has been shown to have some utility in specific cases. These scenarios include tumors or lesions in difficult-to-reach areas of the brain, tumors near critical structures where precise targeting is required, radiation irritation of the brain (this is known as radiation necrosis), or recurrent aggressive tumors that progress despite prior surgery and radiation." Etame also refers to several studies in which LITT has been effective with recurrent gliomas and glioblastomas in challenging locations such as the Thalamus. He explains that when compared with standard craniotomies for resection of brain tumors, the recovery time after LITT is significantly quicker, and there are significantly fewer complications. "Patients can resume other important cancer therapies, such as chemotherapy and radiotherapy, very quickly."

THE NEED FOR RESEARCH

Continued research is shedding light on the other potential applications of LITT. "One area where it has been applied heavily," Etame says, "has been the destruction of seizure causing tissue. When an area of the brain that causes the epileptic seizures can be identified, removal or destruction of that area with the laser can help with seizure control. This is currently used a lot for epilepsy of the temporal lobe in children, as well as in some adults."

Moffitt Cancer Center is one of the few facilities in the U.S. currently utilizing LITT. "Not every center has the technology; that in itself could be a limitation," says Etame. "For certain things, traditional surgery can be used as an alternative to [LITT] and surgeons may use a technique based on their comfort level with that technique." So what would it take for more facilities to adopt LITT as a treatment modality? "I think what is important is conduction of large prospective studies to better understand which tumor pathologies are much more amenable to the long-term benefits of laser ablation, which will improve patient selection."

Like other treatments, LITT is only as effective as the selection of the patient and the tumor. For example, there are situations where a tumor is highly vascular, meaning that a lot of blood is flowing to it. This essentially turns it into a heat sink, which would make LITT ineffective. There are also situations in which a biopsy of the tumor tissue is needed to identify which treatments the cancer will respond to best. In that case, destroying the tissue with the laser would cause the loss of valuable information, although Etame notes that it is possible to perform a biopsy first and then ablate the tumor after, if the situation calls for it.

Photonic materials processing continues to change lives for the better; in this case the material is living tissue. LITT, Photodynamic Therapy (PDT) and Photobiomodulation (PBM) are becoming increasingly familiar terms within the medical community. Stay tuned for future articles about how lasers are changing cancer treatment!

ABOUT

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Dr. Etame is a Neurological Surgeon and Scientist specializing in Neuro-Oncology at the Moffitt Cancer Center, and is an Assistant Professor of Oncology at the University of South Florida, College of Medicine. He directs the awake-brain tumor surgery program, minimally invasive laser-guided ablation program, and image-guided surgery program at the Moffitt Cancer Center for brain tumors.

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National Cancer Institute
https://www.cancer.gov/

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https://moffitt.org/cancers/brain-cancer/your-brain-tumor-specialists/

LITT for Epilepsy
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