Medical and surgical modalities have long comprised the majority of therapeutic interventions for various neurologic disease states. However, rapid advances in technology have resulted in the development of various device-based modalities that offer alternative means of treatment. In fact, laser procedures have emerged as viable interventions in conditions such as epilepsy and brain tumors for which they were developed simultaneously.

At the 2015 Congress of Neurological Surgeons (CNS) Annual Meeting in New Orleans, new data were presented, suggesting that a minimally invasive robotic laser thermotheraphy tool improves outcomes in patients newly diagnosed with brain tumors. Ahead, Joseph Neimat, MD, Associate Professor of Neurological Surgery at Vanderbilt Medical Center, who led a investigator team in the first successful ablation of the hippocampus and amygdala using the NeuroBlate SideFire directional laser from Monteris Medical, offers insights on how this technology can be beneficial in the treatment of brain tumors. He also reflects on how the rising tide of new technologies and treatment modalities is positively impacting how physicians interface and approach treatment to achieve optimal care for each patient.

Can you talk about the latest advances in neuro-oncology and survey current interventions for brain tumors?

Surgical resection, chemotherapy and radiation remain the cornerstones of therapeutic intervention in neuro-oncology, according to Dr. Neimat. “These modalities are most often used sequentially or in conjunction with each other in order to control the malignancy,” Dr. Neimat explains. However, he observes further, “Treatment strategies and expected outcomes are complex and may range depending on tumor type, location, and other factors.”

Where does laser therapy fit within the current treatment spectrum?

According to Dr. Neimat, laser therapy offers an alternative or sometimes even an adjunct to traditional therapy. Moreover, its applications are varied. “In epilepsy, for example, we have had established procedures for 50 years as well as medications for primary treatment, but when anti-seizure treatments fail, physicians now have more options than just invasive surgical procedures,” says Dr. Neimat. “A laser can offer a minimally invasive way to treat specific areas and contours,” he notes. For epilepsy, traditional surgical modalities include temporal lobectomy to take out a majority of the temporal lobe, but according to Dr. Neimat these procedures may have significant side effects. “When you’re removing a significant portion of the brain, you can have problems, from emotional and memory changes to more dramatic surgical complications,” he notes. Lasers offer the ability to treat these areas, “with a high success rate of roughly 50-70 percent,” according to Dr. Neimat. However, he points out that laser procedures are not without risks. “Since laser therapy requires an incision, there is some risk of infection, and of deep brain hemorrhage for example.” Nevertheless, he notes that in many scenarios where surgery would typically serve an integral part in management, laser ablation presents an alternative.

How does the NeuroBlate system work? Can you elaborate on the risks associated with the procedure?

The NeuroBlate system works in two steps, the first of which, Dr. Neimat states, involves a probe that is inserted very precisely into the brain. “You then use the device to heat that tissue at a specific temperature for a certain amount of time and it kills the cells.” He notes further that this approach seems to be equivalent to resecting these portions and taking them out.
Another technology that has emerged as a major player in the neurological treatment spectrum is Deep Brain Stimulation (DBS). Used primarily in Parkinson’s disease and other movement disorders, DBS has become accepted as an integral part of the treatment paradigm over the past 10 years, according to Dr. Neimat. “As many as 120,000 patients have been treated with DBS worldwide,” Dr. Neimat explains, and that number is increasing every week. “At most centers, after patients are presented with their range of options, they tend to start with traditional medical therapies, and then DBS becomes an important contributor to control symptoms for longer,” says Dr. Neimat.

As DBS is increasingly adopted in the movement disorder realm, Dr. Neimat expects continued advances in technology and delivery to broaden its reach. “Right now, DBS is under FDA review as a potential modality for the treatment of epilepsy. There are also studies using DBS for Alzheimer’s as well as some very preliminary data showing its potential benefit in psychiatric diseases, such as refractory obsessive compulsive disorder,” he says. There have been other studies using DBS for chronic refractory depression, nevertheless it remains “a tougher nut to crack,” Dr. Neimat notes.

Expanded applications for DBS will also likely be aided by the continued development of the technology itself. “The technology is improving dramatically, and we will see new devices that improve direct stimulation, which could make it both easier and safer,” Dr. Neimat observes. Additionally, “smart” devices may enable treatment of specific neuronal panels in a targeted fashion rather than indiscriminately. “There is a lot of interest in this technology, and there are likely a lot of new indications for DBS coming to the fore,” says Dr. Neimat. “We had probes for decades but we didn’t have a good way to know how much tissue we had killed with the heating. Now, we can do this procedure essentially within an MRI with the fiber optic laser,” he explains. “The MRI reads the temperature of the tissue in every area of the brain, and you can watch as it heats and then calculate the time required to produce a lesion.”

Regarding safety, Dr. Neimat notes that the risks with a procedure such as laser ablation are low and similar to risks posed by modern surgery. “Thankfully, we’ve been performing surgeries for so long that adverse events associated with the procedure happen relatively infrequently.” With laser ablation the insertion of the probe poses a one percent risk of hemorrhage, with approximately one in 500 cases resulting in dramatic injury,” he says.

It is worth noting, however, that when it comes to more minor risks, those associated with laser ablation are improved over surgery, says Dr. Neimat. “Post-op pain, infection, CSF leakage—all are a little better,” he says, which is likely due to the small size of the hole that’s drilled. There also appear to be fewer cognitive side effects, because, as Dr. Neimat notes, “You’re taking out less tissue and are much more focal.” The other great advantage of the procedure is that it is much easier on patients. There is significantly less post-op pain, and patients return to home and even to work much more rapidly.

How do you see this modality figuring into the treatment paradigm for brain tumors as well as other neurological conditions?

Even though laser ablation is in relative infancy for the treatment of brain tumors, epilepsy, and various other neurological conditions, Dr. Neimat believes that its therapeutic profile will rapidly elevate it to increased relevance. “I recently received an email from my epilepsy surgery coordinator with a list of patients to be operated on this month at our center—there were seven patients on the list, and six were designated for laser procedures, and we’ve just been doing this for about a year,” Dr. Neimat recalls. He believes that many more opportunities will emerge when physicians become more comfortable with the modality.

Can you reflect on how the emergence of new modalities is impacting treatment approaches and reshaping care?

The growing spectrum of therapies will likely cultivate more team-based approaches to treatment, according to Dr. Neimat, which he feels is a very positive development. “More and more I am seeing in clinical neurosciences a tendency for physicians to work not as individuals but as teams and groups,” says Dr. Neimat. This will result in more comprehensive care for patients, he believes. “At our epilepsy center, we have regular conferences incorporating around 20 specialists—including neurologists, surgeons, neuropsychologists—all involved in the care of a patient. We review many factors including video of a patient’s seizure type, MRI, EEG, and neuropsychological testing and then make a collaborative decision regarding the most appropriate intervention.” Dr. Neimat feels this is directly attributable to increased advances and innovations in technology, development, and delivery. “We have many tools now, each with its own complexities, and as a result we have so many options for patients across disciplines to make the best decision for each individual case.” These developments, in turn, are having a significant effect on how therapy and patient care are conceived and executed. “I think we’re seeing a paradigm shift where the whole treatment process is shared among various sub-disciplines.”