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Stopping Seizures: A New Treatment Approach for Epilepsy

Announcer:

Welcome to *Medical Breakthroughs from Penn Medicine, Advancing Medicine Through Precision Diagnostics and Novel Therapy*.

Dr. Caudle:

This is Medical Breakthroughs from Penn Medicine on ReachMD. I'm your host, Dr. Jennifer Caudle, and joining me on this episode is Dr. Timothy Lucas, Assistant Professor of Neurosurgery at the Perelman School of Medicine at the University of Pennsylvania. Dr. Lucas, welcome to the program.

Dr. Lucas:

I'm delighted to be here.

Dr. Caudle:

Well, we're happy that you're here, as well. So to start, could you share some of your clinical background and research interest with our audience?

Dr. Lucas:

Absolutely. So, I am a board-certified neurosurgeon and tenured neuroscientist at the University of Pennsylvania. I am also the surgical director of the Penn Epilepsy Center and, as such, I perform all the diagnostic and therapeutic surgeries for our epilepsy patients.

Dr. Caudle:

Excellent. So you mentioned epilepsy. Can you talk us through what the current therapeutic options are for our patients with epilepsy?

Dr. Lucas:

So there are several therapeutic options, depending on where an individual's seizures originate within the brain. Much of our work as their providers is to find out where exactly in their brain their seizures arise. So that involves diagnostic procedures, a number of tests that are performed before we are able to make a final therapeutic decision, and once we've made that therapeutic decision, we have a host of options available to us. Those include minimally invasive strategies such as laser neurosurgery and a host of neuromodulatory devices that are FDA approved to treat seizures.

Dr. Caudle:

Excellent. So your research also has a specific focus on the management of patients with drug-resistant epilepsy. What new modalities have you and your team developed here at Penn Medicine?

Dr. Lucas:

Some of the major breakthroughs at Penn Medicine have included new mathematical techniques that allow us to pin down exactly where seizures originate within the brain using network control theory. These are mathematical techniques that were developed by Dr. Brian Litt and Dani Bassett and they allow us to identify important critical nodes within the brain where seizures may propagate. These are brand new techniques, and they have really revolutionized the way we look at brain organization. These techniques also allow us to perform something which is entirely novel and that is a virtual brain resection, a virtual brain treatment. So here, we can identify the seizure-onset zone, perform a virtual surgery mathematically, and see what the long-term outcome would be without ever having to lift a knife. And that saves the patient a tremendous amount of work, and then we can take that information to them and advise them appropriately.

Dr. Caudle:

So I'd like to dive deeper into Visualase. You know, how is this laser ablation method designed to detect, manage, and treat drug-resistant epilepsy?

Dr. Lucas:

So it's important to realize the background of epilepsy surgery to understand the importance of Visualase. For the past 70 years, the standard of care was to perform a craniotomy, which is where you make an open section of the skull, you visualize the brain tissue, and you remove an entire lobe. While that was the standard for 70 years and was very efficacious, it also came with significant side effects. Laser neurosurgery achieves the same seizure controlled rate, but through a 2.0-mm puncture wound in the scalp. It is a substantial improvement for our patients. Patients just stay in the hospital for one day as opposed to a week. They lose more blood in the preoperative type and screen than they do during the surgical procedure itself. The wound is closed with a single suture and it's too small even for a Band-Aid. And there is no hair shave. Not to mention, patients have superior cognitive results. As you might imagine, when you remove a large portion of the brain, there's going to be cognitive consequences, and thankfully those are not present to the same degree with laser. Nevertheless, the long-term seizure outcomes are essentially the same. So it has been a landmark change for us for epilepsy.

Dr. Caudle:

How long have you been doing this procedure? How long has this been an innovation that we've had?

Dr. Lucas:

We've offered this since about 2012. Now we've wrapped up to the point where we do these every Friday, and multiple cases every Friday. There's a long list of patients for whom this is appropriate, and people are very eager to get this treatment modality.

Dr. Caudle:

Wow, that's so interesting. You know, from your experience, what have been the major benefits of this laser ablation treatment approach for physicians and their patients? I know you mentioned some, but any more that you would like to elaborate on?

Dr. Lucas:

Well, the first is that the cure rate from intractable epilepsy ranges to about 60-80%. That's far superior than the cure rate from the patients trying yet another anti-seizure medication. As you know, the cure rate there is only about 3%. That's a substantial improvement. In addition, there is substantially less pain and discomfort because of its very minimal nature. There's much superior cognitive long-term outcomes. If you need to have a second or third treatment, it's entirely possible, so you don't close any door with laser thermal therapy. And we can treat lesions that we can't treat with open craniotomy, such as multiple metastatic cancers, radiation necrosis, cavernous malformations in the brain stem and other locations, and so on. So a number of people who have no other treatment options are able to have laser effectively.

Dr. Caudle:

Have you and your team encountered any particular challenges with these new innovations?

Dr. Lucas:

Well, as with any new technology, there are new challenges of course. One of the challenges with laser is that it's a highly precise application of light energy. Very spatially specific. That is an issue only in that the lesion is very small. So sometimes you have to come back and treat a side of the target area, an edge here or there, much like a dermatologist might treat a small area on your skin and then have you come back and treat the corner of it or an edge here or there in a few months' time. We do offer that occasionally with laser, again because the treatment is very, very precise.

Dr. Caudle:

That's interesting. You talked a little bit about other conditions that this therapy could be used for. Can you maybe expand on this? For what other conditions could this therapy be implemented?

Dr. Lucas:

So the FDA labeling for this therapy is very broad. Specifically, it states brain lesions. I personally have treated individuals who have metastatic cancer, who have primary brain tumors, who have vascular lesions like cavernous malformations, who have radiation necrosis, people who have seizure disorders and an epileptic focus. These are just some of the indications.

Dr. Caudle:

So let's go back to epilepsy in particular for a moment. What do you think is on the horizon for epilepsy? And how will this really shift the therapeutic landscape of neurosurgery?

Dr. Lucas:

We will see more application of these minimally invasive strategies. They are so beneficial to patients with very low-risk profiles that I think we will be able to treat conditions that previously were deemed untreatable. And I suspect that in five or ten years' time, the vast majority of all neurosurgical cranial procedures will be these minimally invasive procedures. In fact, Penn Medicine agrees with this strategic mission, and in our new hospital, we've designed an MRI suite that sits between operating rooms on either side, specifically designed so that we can get more patients through than current capabilities allow.

Dr. Caudle:

That's interesting. And How readily available is this for patients throughout the country?

Dr. Lucas:

We were the first Center of Excellence for laser thermal therapy in the country, so we're very proud of that designation. We have a tremendous demand, so we see patients every single day who need this sort of therapy. And, as I say, we schedule them weekly now.

Dr. Caudle:

They're coming from all over the country then.

Dr. Lucas:

That's right. We know from the literature that there are a number of candidates for epilepsy surgery who have never been referred for the procedure. The reason for that historically is because both the referring doctors and the patients have heard stories about these large craniotomies that again go back 70 years. If you think back to the time when craniotomy was developed at the turn of the century, Turkey didn't even exist as a country. It was the Ottoman Empire, so we're talking about a modality that preceded World War I. Now, the landscape has entirely changed. It's much safer for individuals. We can treat people who were never candidates for treatment in the past. So if you have a patient who has a seizure disorder and they have not responded to two medications, then they should be referred to an epilepsy center for this evaluation.

Dr. Caudle:

Before we come to a close, can you tell our audience about how physicians can refer their patients to Penn Medicine? And also how we select the right patient for this procedure and to be evaluated at Penn?

Dr. Lucas:

If we know that there are a number of patients who would be excellent candidates for laser therapy who have not been referred because of the historical nature of the types of treatments that used to be available, specifically large craniotomies, those treatments are treatments of the past, and now we use minimally invasive strategies. So if the neurologists see a patient who is having seizures after having tried two anti-epileptic medications, now is the time to refer them for a proper evaluation.

Dr. Caudle:

Excellent. Well, I'd really like to thank you, Dr. Timothy Lucas, for sharing your insights on this exciting new approach to treatment and implications for the future for neurological diseases. So it's very interesting and it was really wonderful having you on the program today.

Dr. Lucas:

I'm honored to be here.

Announcer:

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