HIGHLY LOGICAL

Futuristic advances in neurosurgery enable Tampa General Hospital to tackle the most complex challenges in brain surgery

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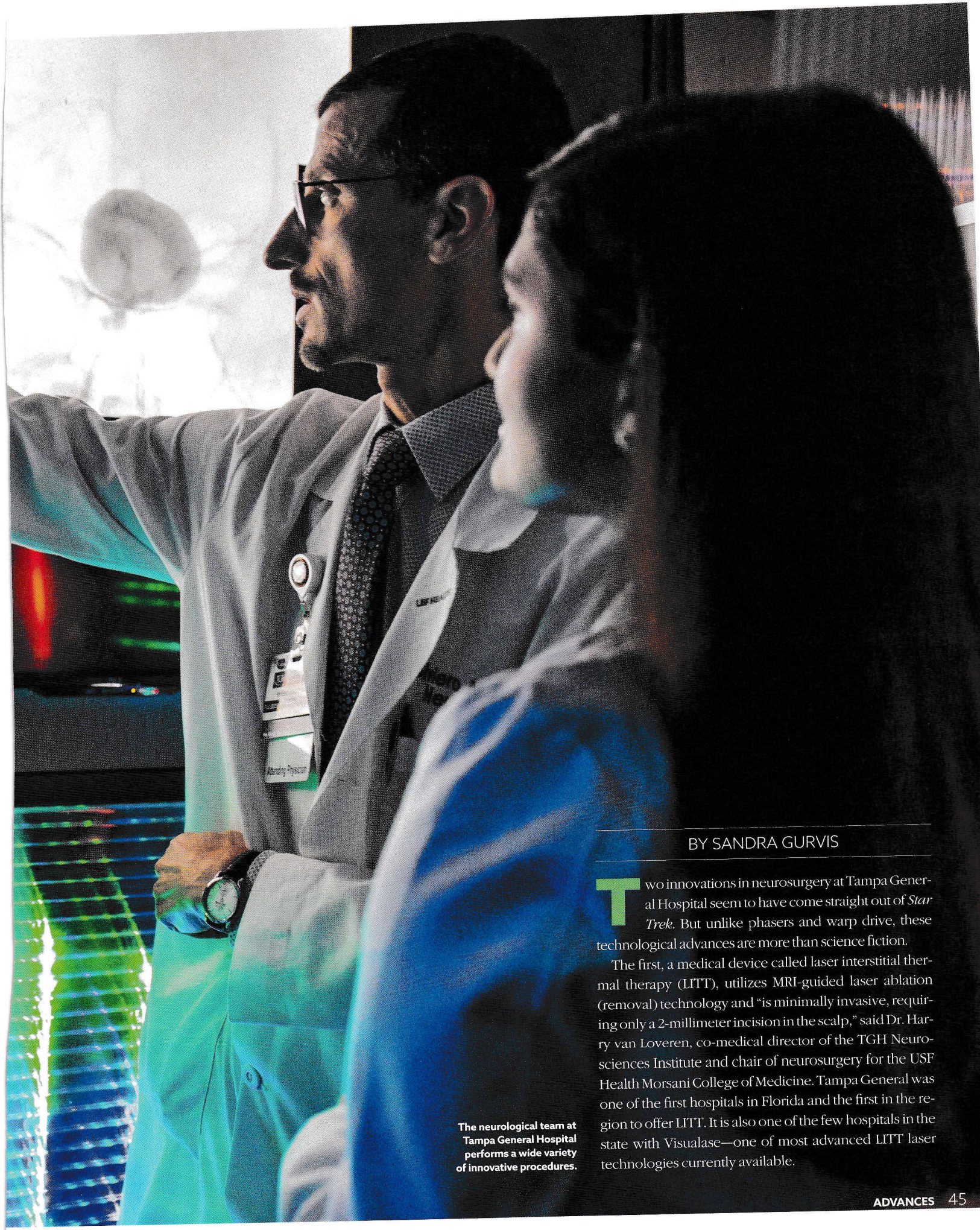
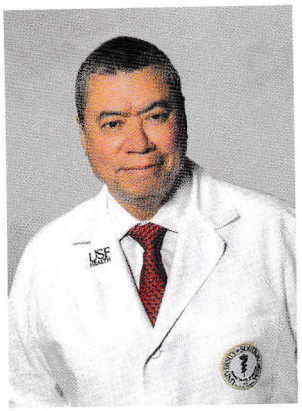


The neurological team at Tampa General Hospital performs a wide variety of innovative procedures.

BY SANDRA GURVIS

Two innovations in neurosurgery at Tampa General Hospital seem to have come straight out of *Star Trek*. But unlike phasers and warp drive, these technological advances are more than science fiction.

The first, a medical device called laser interstitial thermal therapy (LITT), utilizes MRI-guided laser ablation (removal) technology and "is minimally invasive, requiring only a 2-millimeter incision in the scalp," said Dr. Harry van Loveren, co-medical director of the TGH Neurosciences Institute and chair of neurosurgery for the USF Health Morsani College of Medicine. Tampa General was one of the first hospitals in Florida and the first in the region to offer LITT. It is also one of the few hospitals in the state with Visualase—one of most advanced LITT laser technologies currently available.



Right: Dr. Harry van Loveren
Left: TGH is using innovative technologies that demand the neurosciences team to perform with a high degree of expertise and accuracy.

LITT is safe, effective, and, in some cases, can go where no neurosurgeon has gone before. "Because LITT targets a precise area deep inside the brain, it can reach places that might otherwise be considered inoperable," van Loveren said.

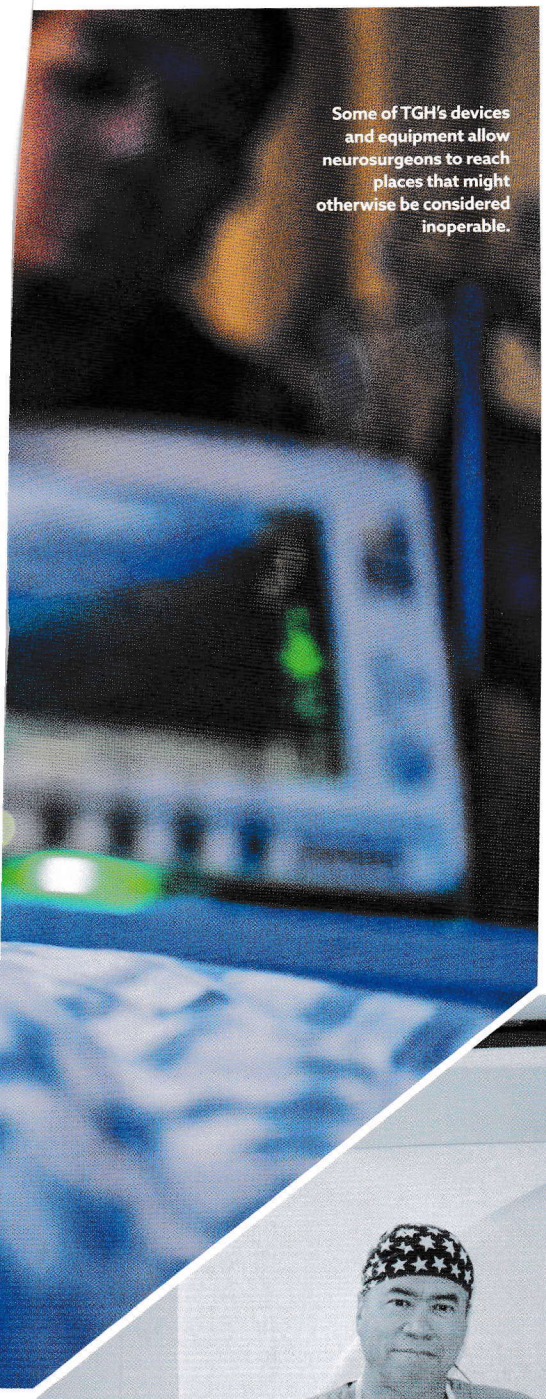
The technology is used to treat primary and metastatic brain tumors, including those that frequently recur, as well as lesions responsible for epileptic seizures. LITT can also benefit people with health conditions such as heart disease or cancer that render them too high-risk for traditional brain surgery.

LITT has other advantages as well. Because no ionizing radiation is involved, van Loveren said, "LITT is especially beneficial for patients with radiation necrosis"—loss or damage to healthy tissue resulting from radiation therapy that can sometimes occur even after treatment has ended. Another bonus of no radiation: "LITT can be repeated multiple times with no need for a bone flap." In a traditional craniotomy, a bony section of the skull is removed to access the brain underneath, and it may require a longer recovery time, resulting in possible surgical complications and/or changes within the brain itself.

Even Dr. Leonard "Bones" McCoy, who was often suspicious of new technology in the original *Star Trek*, might be impressed with LITT's machinations. "Surgeons use the MRI to guide a microscopic laser catheter through the surgical incision hole to the brain," explained van Loveren. Using real-time information shown on the MRI monitor, "they then place cursors around the tumor or lesion on the monitor to specify where the heat should go."

Van Loveren likens this thermographic imaging to the GPS mapping system used in a phone or car. "The equipment automatically recalibrates so that you can precisely locate, then destroy, the tumor or lesion. It also protects healthy tissue."

As the laser light is delivered, temperature in the targeted area rises, "creating a color-coded heat map that



Some of TGH's devices and equipment allow neurosurgeons to reach places that might otherwise be considered inoperable.

anesthetic is used while a standard, stereotactic head frame (a halo fixation device) is applied. The patient then lies down in the MRI machine with his or her head in the ExAblate Neuro helmet and cold water is circulated around the scalp to keep the patient's head cool. Except for the attachment of the halo, FUS is completely noninvasive. Bezchlibnyk added that, in most instances, the patient should be awake so that the physician can get immediate feedback as to how the treatment is progressing.

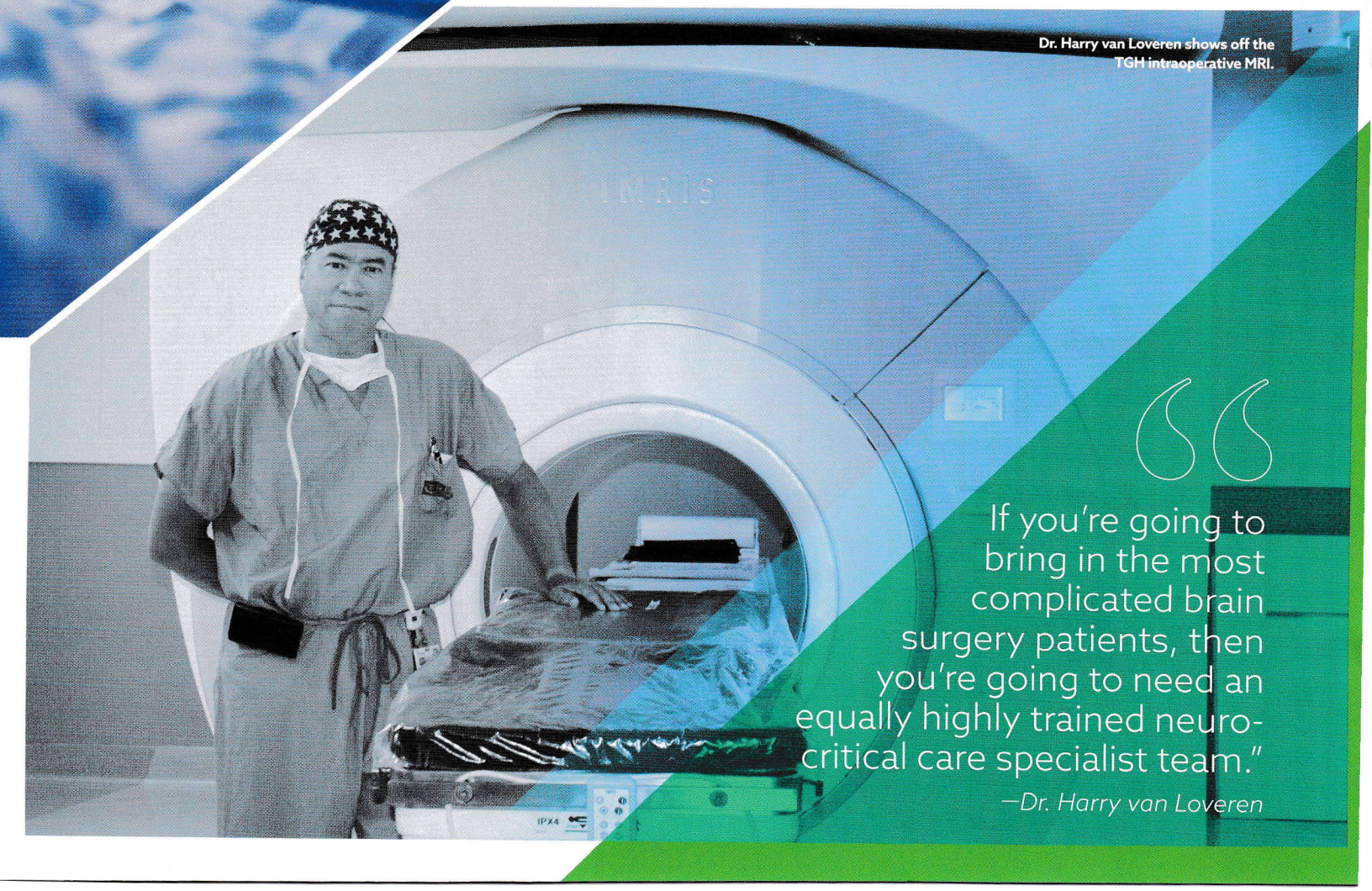
The targeted area, known as the ventral intermediate nucleus of the thalamus, is first subjected to low energy. This results in temporary tremor improvement, enabling the physician to identify any potential side effects and adjust the target accordingly. The physician then proceeds to dispatch multiple high-energy beams, leaving healthy tissue undisturbed. After each one, the patient will perform tasks, such as touching his or her nose, allowing the physician to evaluate the tremor improvement until the targeted area is completely ablated. Results are immediate and long-lasting.

There are similarities between FUS and LITT. Both use an MRI, which automatically adjusts to pinpoint targeted areas; have minimum recovery time and side effects; and are safe and effective. "Focused ultrasound is a treatment for a specific condition, whereas LITT is a medical device and has several uses," Bezchlibnyk said.

Both require high levels of expertise and accuracy. "We are essentially learning a new technology," van Loveren said. "With traditional surgery, we relied on what we could see with the naked eye. Now, not only are we getting a great deal more data from the MRI screen, it is far more precise than even looking through a microscope—the information is at the micro-microscopic level."

Introducing such technology not only requires a financial commitment, he noted, "but a willingness to invest in human capital and recruit the best and the brightest" neuroscience professionals who can provide top-tier care. "If you're going to bring in the most complicated brain surgery patients, then you're going to need an equally highly trained neurocritical care specialist team," van Loveren said.

This ecosystem, he concludes, needs to blend almost seamlessly—not unlike the crew of the *Enterprise*. ➤



Dr. Harry van Loveren shows off the TGH intraoperative MRI.

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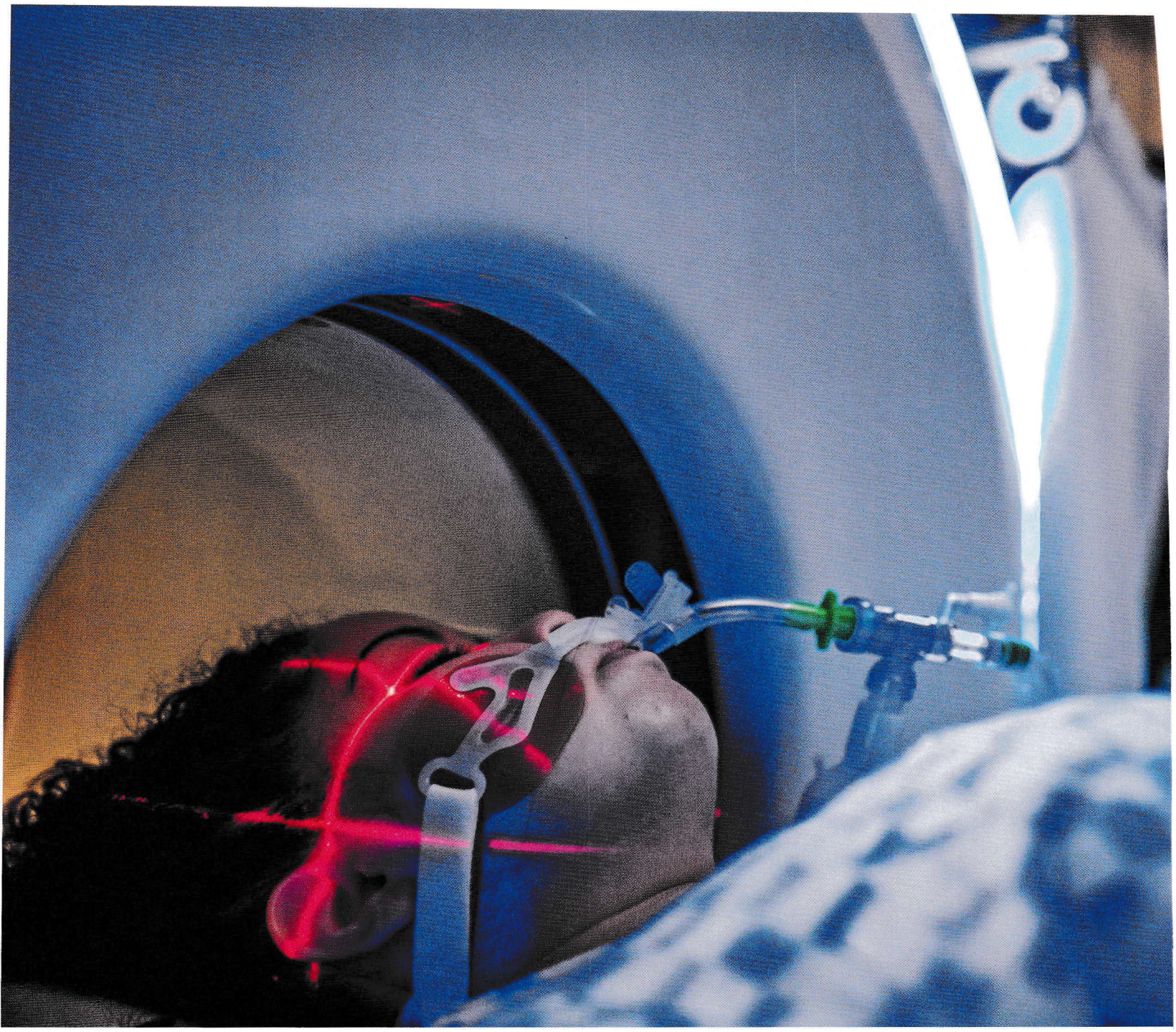

shows the targeted tissue turning from blue [cold] to red [hot]," said Dr. Yarema Bezchlibnyk, co-director of TGH's Comprehensive Epilepsy Program and Movement Disorders Neuromodulation Center. "At the same time, we can make sure that healthy brain tissue stays cool."

With three different components and technologies, LITT is definitely Starship *Enterprise*-ready.

As Bezchlibnyk explained, the LITT procedure at TGH includes the IMRIS magnet (part of the iMRI Suite), the ClearPoint targeting system (or sometimes the Vertek arm or ROSA robot), and the Visualase laser. "Each provides a unique function during the procedure to make it as safe and effective as possible," he noted.

Not only is there little to no pain, less scarring—only one stitch is generally required—and minimal hair removal, LITT patients are usually released after a single night's hospital stay and have few, if any, complications.

A second TGH innovation, focused ultrasound (FUS)—also known as high-intensity focused ultrasound (HIFU)—is somewhat different, although it too ventures into *Star Trek* territory. Initially approved by the Food and Drug Administration in 2016 and scheduled for implementation at TGH in early 2022, the ExAblate Neuro FUS focuses many beams of ultrasound on a single target to heat up and destroy the tiny section deep inside the brain that controls tremor. Also known as familial, idiopathic, or benign tremor, essential tremor causes uncontrollable shaking that can greatly hinder quality of life. Focused ultrasound "represents a breakthrough for patients with Parkinson's or other conditions that have not responded to medication," Bezchlibnyk said.

Unlike LITT, the patient's head is completely shaved before the two-and-a-half-hour procedure. According to the ExAblate website, a local