Spine Surgeons SOLVE THE Health Care Value Equation

By Diana DeCouteau

Why do some patients who undergo spinal surgery experience no complications, get discharged the same day, go straight home, and report a swift improvement in quality of life—while others meet none of these targets?

That's a question Erica Bisson, MD, MPH, associate professor in neurosurgery and orthopedics, would like to answer. With deeper insight, she could shift more patients toward desirable outcomes while keeping a rein on surgical costs. In fact, that's the definition of value in health care: **Value = Outcome/Cost**

"Value depends on both the quality of care as the patient sees it and the cost of care that the hospital provides," says Dr. Bisson. "Improving the health care system requires us to quantify and manage value, because we can't improve what we can't measure. Many physicians have outcome information, but University of Utah Health Care (UUHC) is unique in having complete and accurate cost data too through our Value Driven Outcomes program."

For the numerator—the outcome—UUHC joined the Quality Outcomes Database (QOD) in 2012. This clinical registry provides an infrastructure for physicians and hospitals to report and analyze the quality of surgical care. At the end of July 2016, the lumbar and cervical spine registries included 37,000 patients across the country.

QOD lets physicians look at clinical outcomes in real time and compare the effectiveness of different procedures for treating the same disease. "There's not just one right operation for some disease processes, so we can see trends in how physicians are treating," Dr. Bisson says.

"We can look at outcome metrics, such as length of stay, wound infections, and surgical complications on the hospital level," she adds. "QOD also lets us gather patient-reported outcome information. It can be extremely affirming for them to see what level of pain or disability they were suffering initially and how that improves after surgery."

Dr. Bisson can also analyze data for all patients suffering from specific diseases. For example, by looking back at three years of data for all patients who have lumbar stenosis, a compression of the spinal nerves, she can see how well her treatments worked and compare that with national benchmarks. In addition, QOD is now creating a predictive calculator for lumbar spine surgery, which will help physicians estimate the risk of procedures if certain factors are present—such as high blood pressure or diabetes.

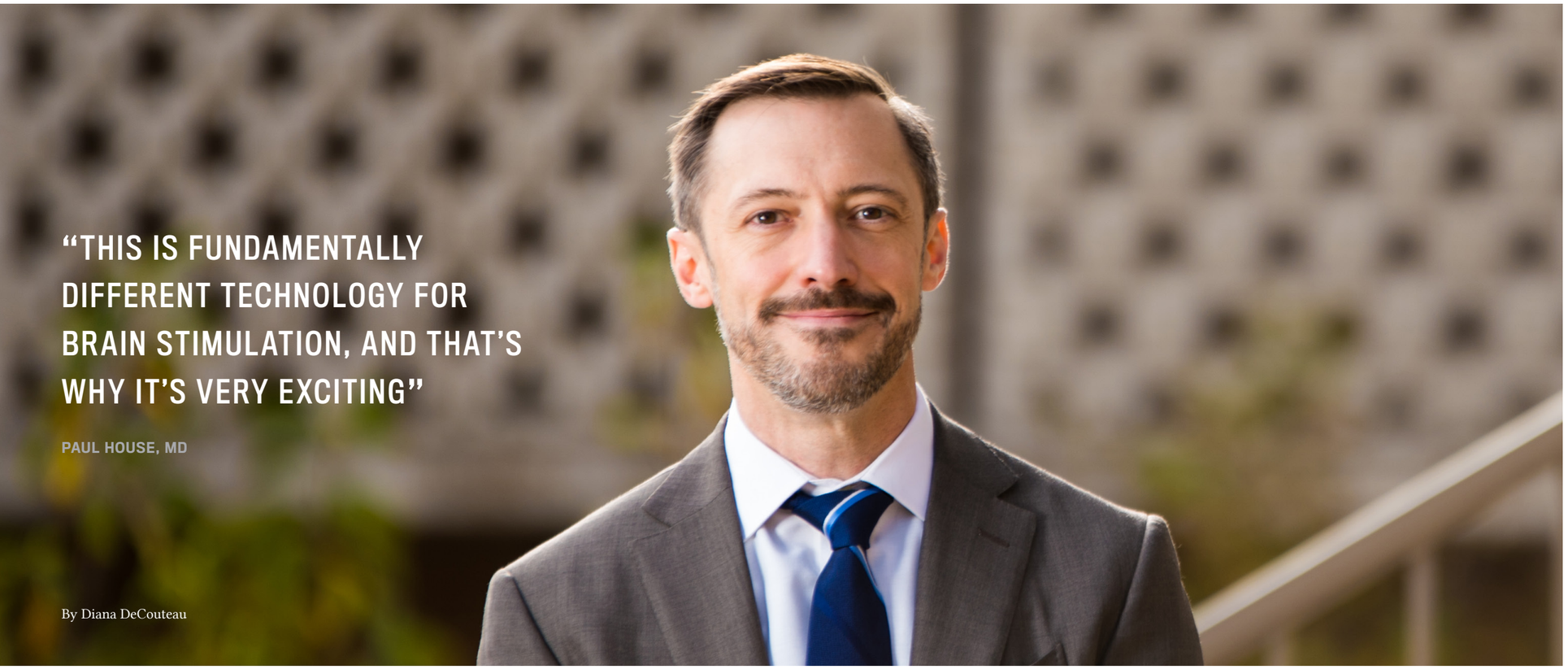
> "QOD ENCOMPASSES BOTH ORTHOPEDIC AND NEUROSURGERY, BOTH PRIVATE PRACTICE AND ACADEMIC HOSPITALS LIKE OURS, SO WE'RE SEEING WHAT'S HAPPENING IN THE REAL WORLD"
>
> **ERICA BISSON, MD, MPH**

But that's only half the equation—it's also critical to know the costs. That's where the UUHC Value Driven Outcomes (VDO) tool comes into play. VDO breaks down health procedure costs to the level of each gauze pad and minute of staff time, providing the data needed to optimize care delivery.

The goal of VDO is to create pathways of perfect care. For example, one perfect-care metric is to have patients walking on the day of spine surgery. Formerly physical therapists left for the day before all surgeries were completed, meaning some patients would not get out of bed until the day after surgery. By adjusting shifts, UUHC was able to achieve the desired care level and reduce patient length of stay and cost.

"By looking at metrics, we can evaluate where patient care is and implement small changes to improve it," explains Dr. Bisson. "Then we measure outcomes, reevaluate, and fine-tune further in a continuous cycle of improvement. Our residents and fellows work with us to determine how to improve care, so they internalize that intellectual exercise as part of being a neurosurgeon."

"We're incredibly passionate about seeing where there are possibilities for improvement and then acting to achieve better value," she adds. "That benefits everyone from students to physicians to the hospital, and especially our patients."



NEUROPACE CALMS STORMS IN THE EPILEPTIC BRAIN

By Diana DeCouteau

Electrical storms in the brain—that’s how the seizures that plague patients with epilepsy are sometimes described. As many as 3 million Americans experience these storms frequently, sometimes three or four times a week. Their quality of life diminishes dramatically, not just during seizures but overall, as they struggle to live independently, find jobs, socialize, and even drive.

Medications control seizures completely in only 60 percent of patients. For the rest, surgery may be an option when seizures originate from a single foci in the brain. But if surgery would create a neurological deficit—such as a loss of strength or speed—or if seizures originate from two or more foci, doctors and patients are forced to pursue other options.

Until recently, many patients with uncontrolled seizures had few other choices. University of Utah Health Care (UUHC) is now one of the few medical centers nationally offering a proven new treatment to control seizures: the programmable NeuroPace Responsive Neurostimulator (RNS®).

“This is fundamentally different technology for brain stimulation, and that’s why it’s very exciting,” says Paul A. House, MD, assistant professor of neurosurgery. “It has a sensing component as well as a stimulation component, and you can optimize both.”

Earlier technology stimulated the brain only. But NeuroPace also detects previously identified patterns of abnormal brainwaves and delivers responsive electrical stimulation to interrupt those patterns before the patient suffers clinical seizures. Sensing is critical, because patients don’t always know when they have seizures. NeuroPace does.

The NeuroPace device is surgically implanted in the skull and connected to seizure locations via electrodes. To qualify for the surgery, patients must be over 18, with seizures emanating from no more than two foci. They must experience frequent and disabling seizures that two or more medications have not relieved.

During the evaluation process, candidates go through several tests to determine where seizures originate. Much of the monitoring is non-invasive, but most patients undergo at least one invasive procedure —a preliminary surgery to perform a video encephalogram that records seizures. In addition, neuropsychological testing looks at the strengths and weaknesses of brain function, to determine what impact surgery might have. To make a final recommendation for or against surgery, a team including Dr. House, along with neurologists, radiologists, and neuropsychologists review the tests.

If surgery is confirmed, Dr. House secures the NeuroPace device in the skull. The device itself is a 2-by-1-inch hermetically sealed titanium enclosure containing electronic circuitry and a battery. It connects to seizure foci using paddle electrodes placed on the brain or depth electrodes inserted within.

After surgery, clinicians can noninvasively adjust detection and stimulation settings on NeuroPace using a programmer that communicates via short-range radiofrequency link.

“With NeuroPace, we’re capturing brainwaves from every seizure,” says Dr. House. “Different types of seizures from different brain areas provide different fingerprints of abnormal activity. We have known places to start when treating them.”

“By optimizing frequency, amplitude, voltage, and other stimulation parameters, we improve seizure control in patients over time. We constantly get feedback, so we can see what’s working and what’s not, and fine-tune our approach. In fact, the information provided by NeuroPace can even help fine-tune medical therapy.”

For most patients, implanting NeuroPace reduces the number of seizures within months—and the reduction increases over time. Studies confirm that most patients had 50 percent and 60 percent fewer seizures at four and five years after the implant. “Reducing the number of distinct abnormal events that the brain experiences helps calm it down,” says Dr. House.

NeuroPace surgery is just one example of UUHC’s regional leadership in epilepsy treatment, which includes clinical work, research trials, and a staff that is growing with the addition of several epileptologists. But Dr. House may be most enthusiastic about the knowledge NeuroPace provides and the improved outlook it offers patients with epilepsy.

“NeuroPace gives us information about the brain and treating epilepsy that we’ve never had,” he says. “And it’s helping patients who previously had few options.”

NEUROSURGEONS GIVE A FARMER ANOTHER CHANCE AT LIFE

By Diana DeCouteau

Over the course of two months, the sight of children at play or the sunset or even the TV news slowly dimmed in the 69-year-old farmer's right eye. Thinking he had a cataract, the farmer had bided his time and was blind in the eye before he saw a doctor. But the diagnosis was not a cataract at all—on an initial CT scan of his sinuses, the area near his right optic nerve appeared opaque, indicating inflammation in the sinuses next to the eye and its nerve that carries sight. He was referred to University of Utah Health Care (UUHC).

"In a way, he was fortunate," says Richard R. Orlandi, MD, FACS. "He came to one of the few hospitals with a team of ENT doctors and neurosurgeons skilled in the surgery ultimately necessary to save his life."

To treat the lesion, surgeons initially opened his ethmoid sinus, located between the nose and eyes, and sphenoid sinus, near the optic nerve, along with a portion of the tunnel that houses the optic nerve. A biopsy proved negative for tumors, bacteria, and fungus. Afterward the farmer showed no improvement in his vision, and doctors continued to monitor his condition with imaging.

The farmer returned home but was plagued with worsening headaches. A follow-up MRI showed that the initial area of inflammation had now extended further into his skull. Surgeons endoscopically explored the area and removed damaged tissue—and this time specimens from the surgery showed infection with the fungus Aspergillus fumigatus.

Aspergillus spores are common in the air we breathe but normally don't cause illness. But some individuals are more susceptible, including those who use steroids, immunosuppressive medications, alcohol, or illicit drugs.

"None of these applied to the farmer—he was the uncommon immunocompetent individual suffering from a fungal infection in the skull," says Dr. Orlandi. "Diagnosis is often delayed due to the rarity of the disease. Although antifungal medications are available, only 40 to 60 percent of patients respond to them."

The farmer was not one of the lucky ones. His infection spread to the orbit, which is the bony cavity containing the eyeball; the cavernous sinus, a drainage pathway for veins from the brain and parts of the face; and the petrous apex, one of the most inaccessible parts of the skull due to its location near the very center.

By now, the farmer's internal carotid artery—which supplies blood to the brain—was also narrowed by 50 percent.

"To determine if the patient can withstand permanent blocking of the carotid artery, we do an occlusion test with a small endovascular balloon," says William Couldwell, MD, PhD, FACS, and department chair of neurosurgery. "We want to determine if there is enough collateral blood circulation to supply the brain without risk of a stroke. In this case, there wasn't: The patient showed progressive left-sided weakness."

At this point, both options were grim. Without surgery, the farmer's chance of survival was almost nonexistent—but the surgery carries high risk as well. The mortality rate for removing the cavernous sinus alone approaches 25 percent, and the farmer required several other complex procedures. But at UUHC, he found hope.

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> **WILLIAM COULDWELL, MD, PhD, FACS**

With years of experience performing delicate skull-base surgeries, Dr. Couldwell led the surgical team. The first procedure was a bypass involving the external carotid artery-middle cerebral artery saphenous vein to ensure adequate blood flow to the brain. Then the team removed the right cavernous sinus and right orbit and harvested abdominal fat to pack the sphenoid sinus and orbit. Finally, an external ventricular drain was placed to relieve fluid pressure in the brain.

After overcoming post-surgery setbacks that required three weeks in the hospital, the patient was able to transfer to a rehabilitation facility. One year later, he remained free of demonstrable disease.

"Our neurosurgery department is gratified to be one of the few anywhere that can offer hope to patients suffering from tumors, infections, and other deadly diseases of the skull," says Dr. Couldwell. The experience, skill, and caring available at UUHC gave a thankful farmer another chance at life.

Top: William Couldwell, MD, PhD, FACS; Bottom: Richard R. Orlandi, MD, FACS;

UNIVERSITY LEADS THE FIGHT AGAINST COMMON BRAIN TUMOR

By Diana DeCouteau

More than 20,000 new incidences of meningioma arise each year, making it the most widespread brain tumor. This tumor typically occurs in adults in their 40s or 50s, and in women twice as often as men.

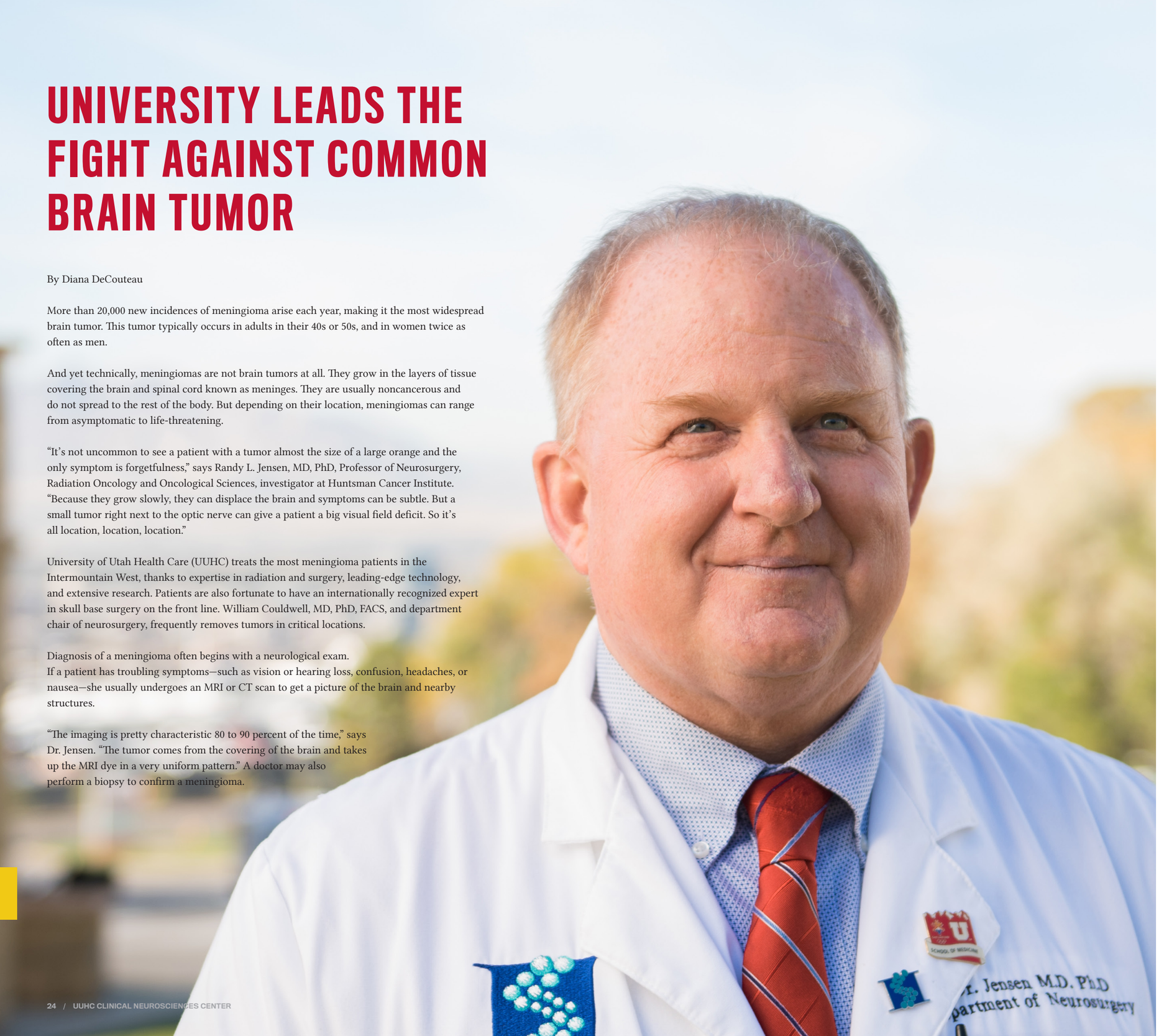
And yet technically, meningiomas are not brain tumors at all. They grow in the layers of tissue covering the brain and spinal cord known as meninges. They are usually noncancerous and do not spread to the rest of the body. But depending on their location, meningiomas can range from asymptomatic to life-threatening.

"It's not uncommon to see a patient with a tumor almost the size of a large orange and the only symptom is forgetfulness," says Randy L. Jensen, MD, PhD, Professor of Neurosurgery, Radiation Oncology and Oncological Sciences, investigator at Huntsman Cancer Institute. "Because they grow slowly, they can displace the brain and symptoms can be subtle. But a small tumor right next to the optic nerve can give a patient a big visual field deficit. So it's all location, location, location."

University of Utah Health Care (UUHC) treats the most meningioma patients in the Intermountain West, thanks to expertise in radiation and surgery, leading-edge technology, and extensive research. Patients are also fortunate to have an internationally recognized expert in skull base surgery on the front line. William Couldwell, MD, PhD, FACS, and department chair of neurosurgery, frequently removes tumors in critical locations.

Diagnosis of a meningioma often begins with a neurological exam. If a patient has troubling symptoms—such as vision or hearing loss, confusion, headaches, or nausea—she usually undergoes an MRI or CT scan to get a picture of the brain and nearby structures.

"The imaging is pretty characteristic 80 to 90 percent of the time," says Dr. Jensen. "The tumor comes from the covering of the brain and takes up the MRI dye in a very uniform pattern." A doctor may also perform a biopsy to confirm a meningioma.



Several different treatment options are available depending on factors such as size and location of the tumor and neurological problems it presents. The first option: Do nothing. "If a patient is not having symptoms and the tumor isn't large, we'll just watch it over time," says Dr. Jensen. "We'll do MRIs every six months to make sure it's either not growing or growing slowly."

Another option many patients undergo at UUHC is stereotactic radiosurgery. "It's a completely noninvasive, outpatient procedure," says Dr. Jensen. "For patients who have a small tumor, it's a very effective and easily tolerated treatment."

This technique uses an MRI scan, which is loaded into a treatment planning computer. A mask is made to hold the patient's face in a set position, and a CT scan is done with her face in the mask. The computer combines the scans and designs a plan that precisely delivers radiation to the tumor with only a minimal amount to surrounding areas.

"IT'S A COMPLETELY NONINVASIVE, OUTPATIENT PROCEDURE...FOR PATIENTS WHO HAVE A SMALL TUMOR, IT'S A VERY EFFECTIVE AND EASILY TOLERATED TREATMENT"

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Dennis C. Shrieve, MD, PhD, professor and department chair of radiation oncology, and Dr. Jensen lead the stereotactic radiosurgery program. The team of radiation oncologists, physicists, neurosurgeons, and dosimetrists is the most experienced in the Intermountain West. They've used the technique to treat almost 2,000 patients with brain tumors, including more than 250 with meningiomas.

Chemotherapy is not yet an option for meningioma treatment, due to lack of a good agent. "Chemo works by killing cells that are dividing, but meningiomas grow so slowly that cells don't turn over much on a daily basis," Dr. Jensen says.

The final option is traditional surgery, which can take up to 24 hours depending on tumor size and proximity to critical neurological structures that control functions like vision, hearing, swallowing, and facial movement. Meningiomas may also grow close to blood vessels that, if injured, could cause a stroke or neurological deficit.

The meningiomas most difficult to remove lie beneath the brain itself, a realm where Dr. Couldwell's expertise is crucial. Under his leadership, the surgical team has gained the specialized knowledge and skill to treat meningiomas and to attract outstanding new doctors as well.

Research to treat tumors without surgery remains an ongoing focus of the meningioma tumor program. "We conduct laboratory and clinical research to investigate the molecular underpinnings of meningioma biology looking for new treatment avenues," says Dr. Jensen. "We hope that soon we'll be able to offer even better options to treat meningioma patients."