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IGEA Brain and Spine:

Innovative Neurological Treatment for Central New Jersey

David Poulad, MD, FAANS, and Adam Lipson, MD, FAANS, remove a meningioma.

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By Michael Ferguson

THE NEURO EXPERTS PRESENT NEW DIAGNOSTIC AND TREATMENT OPTIONS TO THE LOCAL PATIENT POPULATION.

ACADEMIC CENTERS HAVE traditionally been at the forefront of research and innovative care for brain tumors. But according to Adam Lipson, MD, FAANS, neurosurgeon and partner at IGEA Brain and Spine, formerly Union County Neurological Associates, the extensive reliance on residents at these centers can create a middle-man barrier between patients and experienced neurological specialists.

Practices like IGEA represent a new generation of private practice neurosurgeons who deliver the most innovative care for brain tumors in a patient-centered, community setting.

"We pride ourselves on offering more personalized, hands-on contact than patients receive at academic medical centers," Dr. Lipson says. "We perform all treatments ourselves as board-certified attending physician experts in brain and spinal tumor care."

Neurosurgeons' broad range of treatment options at IGEA Brain and Spine enhances their ability to treat a remarkable assortment of tumors, even those located in remote areas of the brain or in proximity to vital structures responsible for speech or motor function.

"We treat all types of neurological disease," adds David Poulad, MD, FAANS, neurosurgeon and partner at IGEA Brain and Spine. "We've seen a new evolution in terms of the technology available to treat deep-seated brain tumors."

Opening New Territory

The sella turcica, for example, is a difficult-to-reach area in the skull base part of the brain where pituitary tumors commonly originate. Other tumor types, including craniopharyngiomas, cysts and

meningiomas, can also develop in this area behind the sphenoid sinus, according to Ronit Gilad, MD, FAANS, neurosurgeon at IGEA Brain and Spine.

Pituitary tumor presentations differ depending on whether they produce hormones. Non-hormone-producing tumors might cause peripheral vision changes, while those that produce hormones often cause side effects related to hormonal dysfunction, including changes in facial features, hand or foot size, heat/cold intolerance, nipple discharge, and unusual weight gain.

Physicians can use MRI and endocrine hormone tests to confirm prolactin-producing pituitary tumors, which are the only such tumors that respond to front-line medical therapy, commonly cabergoline or bromocriptine.

Endoscopic access to the sella turcica provides neurosurgeons a minimally invasive surgical treatment option for large tumors that cause visual deficits or small tumors secreting hormones. Previously, this remote area could only be reached via craniotomy.

"I can get to the sella turcica through a small incision in the nose and, using an endoscope or different speculum, can reach it through the sphenoid sinus," Dr. Gilad says. "X-ray, fluoroscopic or neuronavigational guidance make it possible to reach all the way back to the pituitary gland."

Teamwork is essential when performing this type of skull base surgery. Working in concert with an otolaryngologist, who makes the incision in a nostril, neurosurgeons guide an endoscope and devices for suction and resection through the nasal passage.

Traditional approaches required a conduit — typically a tube — through which neurosurgeons guided retractors and specula. The conduit's diameter restricted visualization and limited surgical dexterity and range.

"Imagine taking two instruments and working through a long tube," Dr. Gilad says, highlighting the difficulty of the traditional approach. "Endoscopes allow neurosurgeons more flexibility with which to work. Angled endoscopes allow access to areas that were otherwise unreachable via minimally invasive approaches."

Dr. Gilad points out that angled endoscopes extend the operating range beyond the sphenoid sinus and sella turcica.

"With these flexible, angled endoscopes, we can tackle procedures in a wide range throughout the skull base," she says. "We can work in lateral crevices of the sphenoid sinus and below in the clivus. These are areas which would otherwise require traditional open surgery."

Silent Foes

Acoustic neuromas, or vestibular schwannomas, are benign but very dangerous tumors. They often grow silently until they cause symptoms,with may patients initially presenting with hearing loss on the side of the growth. These tumors also grow in a difficult-to-reach area within the skull.

Dr. Lipson corrects a complex scoliosis in a 12-year-old girl during his 2011 trip to Vietnam with Project Butterfly.

NEUROLOGICAL EXPERTISE AT LARGE

IGEA Brain and Spine brings academic center-level neurological care to the Union County area, but its physicians' spheres of influence extend locally and globally.

David Poulad, MD, FAANS, neurosurgeon and partner at IGEA Brain and Spine, helped bring robotic spinal fusion to New Jersey. Having completed his surgical fellowship in 2005, Dr. Poulad's training coincided with the blossoming of minimally invasive technology.

"Patients can now stay in the area to receive the same care — if not better — for which they once had to travel to New York City," he says.

Ronit Gilad, MD, FAANS, neurosurgeon at IGEA Brain and Spine, is also a retired Lieutenant Commander in the United States Navy. For four years, she treated neurological conditions at the Naval Medical Center in Portsmouth, Va.

Dr. Gilad was awarded a Navy and Marine Corps Commendation Medal for her service as an exemplary patient advocate, as demonstrated by receipt of the highest number of patient compliments through a command-wide interactive customer evaluation. The award also recognizes Dr. Gilad for assuring the highest standard of care for complex neurosurgical patients by orchestrating a multidisciplinary tumor board while in the service.

Adam Lipson, MD, FAANS, neurosurgeon and partner at IGEA Brain and Spine, has subspecialty interests in brain and spine tumors, complex spine surgery, and deep brain stimulation for movement disorders. He participates in a charitable organization called the Butterfly Foundation, through which physicians travel to communities in the Dominican Republic and Vietnam to train local physicians in pediatric scoliosis treatment. As a part of that effort, Dr. Lipson recently spent two weeks in Vietnam operating on children with scoliosis.

"This work is incredibly rewarding," he says. "It's medicine at its purest."

Originating on the eighth cranial nerve — a 2-cm highway through which the brain and inner ear exchange sound and balance information — and never actually penetrating the brain, acoustic neuromas outgrow their indigenous environment and gradually extend into the cerebellopontine angle (CPA). There, behind the temporal bone, CPA tumors can encroach upon the facial and trigeminal nerves, which are responsible for facial motor and sensory function. Traditional, aggressive approaches to remove the entire tumor could result in damage to these nerves.

The newest member of the IGEA Brain and Spine team, Ciro Randazzo, MD, MPH, FAANS

DUALLY TRAINED NEUROSURGEON ON STAFF

The newest member of the IGEA Brain and Spine team, Ciro Randazzo, MD, MPH, FAANS, received training in both neurological surgery and neuroendovascular medicine. His dual expertise allows him to treat aneurysms, spinal cord injuries, and brain and spine tumors, as well as provide general neurosurgery care. He earned a degree in biology from Johns Hopkins University in 1999 and went on to attend the University of Medicine and Dentistry of New Jersey. There, he completed both the MPH and MD programs. Dr. Randazzo completed his neurosurgery residency and neuroendovascular fellowship at Thomas Jefferson University Hospital in 2009 and 2010.

Combining both his passion for practicing medicine and an entrepreneurial spirit, he spearheaded the establishment of a comprehensive neuroscience center at Atlanticare, where he served as division director. He most recently held the position of assistant professor of neurological surgery at Thomas Jefferson University.

Dr. Randazzo is widely published regarding current trends in neurological medicine, and he regularly reaches out to the medical community to present on new practices in neurology and neuroendovascular procedures.

"Benign CPA tumors such as acoustic neuromas once required skull base surgery with the goal of gross total resection," explains Dr. Poulad. "Sometimes that could be dangerous because surgeons had to take extra measures to remove every last bit of tumor, risking injury to cranial nerves. If the tumor surrounded the facial nerve, patients could suffer paralysis on one side of the face, which could be disfiguring and difficult to live with."

Advances in radiation delivery systems have greatly improved treatment strategies for acoustic neuromas.

"Now, if we are unable to remove the entire tumor without risking an injury to the nerve, we can do a debulking surgery, which means we don't have to dissect every last tumor cell and risk injuring critical structures," he says. "We can then use stereotactic radiosurgery to treat the remaining tumor."

Ronit Gilad, MD, FAANS, evaluates a patient's cervical MRI prior to performing a cervical decompression.

Precise Radiation

IGEA Brain and Spine neurosurgeons have access to CyberKnife technology at Overlook Medical Center, as well as linear accelerator radiosurgery at Saint Barnabas Medical Center and Trinitas Regional Medical Center. Each methodology carries equivalent efficacy for tumor control while minimizing complication rates and ensuring expedient recoveries, Dr. Lipson says.

After debulking an acoustic neuroma, neurosurgeons use radiosurgery to more accurately deliver high-dose radiation to the precise area of the remaining tumor cells.

"Traditional radiation treatment required delivering small doses of radiation every day for a month," Dr. Lipson says. "Radiosurgery allows us to deliver one large radiation dose because advances in radio processing and computer guidance allow us to map sensitive structures in the brain to aid with targeting the treatment. There is a sharp dose falloff outside the target area, allowing us to only radiate the tumor and leave normal brain tissue relatively unaffected and free from radiation exposure."

Dr. Poulad sets up a neurosurgical microscope in preparation for a minimally invasive procedure.

Combining Modalities

Radiosurgery's precision makes it invaluable in the fight against difficult-to-treat tumors. However, some malignant tumors, such as grade 3 and 4 astrocytomas, scatter tumor cells throughout the brain and cannot be readily treated exclusively with surgery or radiosurgery. Glioblastomas arise from astrocytes, which comprise the supportive tissue of the brain. These

particularly malevolent growths make up 17 percent of brain tumors and reproduce very quickly.

Glioblastomas have tendrils extending into the brain, potentially endangering critical structures. Such challenging delineation and location complicates treatment. MRI scans do not reveal the full extent of cellular invasion, and, Dr. Poulad notes, pathology reports often show these tumor cells in other areas of the brain.

"Resecting glioblastomas has been challenging due to the lack of a clear, distinct border," he says.

Surgery enables debulking and removal of as much as 99 percent of the tumor, if all enhancing tissue on MRI is removed. According to Dr. Lipson, "as an example, we can decrease the tumor cells from 10 million cells down to 100,000 cells with aggressive surgery," but other tools are required for further treatment. Patients usually receive radiation under the guidance of the radiation oncologist, followed by chemotherapy, coordinated after surgery by the neuro-oncologist, to kill the remaining tumor cells.

While the blood-brain barrier can prevent some chemotherapy agents from effectively treating brain tumors, glioblastomas cause the barrier to break down at its interface.

IGEA Brain and Spine physicians stay at the forefront of this type of multidisciplinary treatment.

"We work closely with large institutions to bring nationally recognized clinical trials to the local community," Dr. Lipson says. "We coordinate in a multidisciplinary fashion with the medical and radiation oncologists to collaboratively treat these and all other brain tumors."

Scouting the Approach

When deep-seated tumors invade the brain, successful surgery depends on knowing exactly where speech and motor pathways — known as eloquent structures — are located. Neurosurgeons at IGEA Brain and Spine employ stereotactic guidance to map the tumor's location and any nearby eloquent structures.

"We merge MRI, diffusion tensor imaging [DTI] and functional MRI [fMRI] to give us a computer-generated functional map, which shows us where the tumor is located relative to other structures in the brain," Dr. Lipson explains. "Based on that information, we can plan the optimal approach that maximizes successful treatment and minimizes risk to eloquent structures."

IGEA Brain and Spine neurosurgeons Ronit Gilad, MD, FAANS; Adam Lipson, MD, FAANS; David Poulad, MD, FAANS; and Ciro Randazzo, MD, MPH, FAANS

The resulting 3-D maps can prove critical when benign meningiomas crowd the optic nerve. Because surgery could result in visual impairment, the map identifies precisely where the tumor is in relation to the optic nerve.

In the operating room, neurosurgeons use real-time stereotactic navigation to register the patient's head in 3-D space. Relying on preoperative MRI images as a guide, Dr. Lipson uses microsurgical techniques to avoid damage to the optic nerve and remove most of the tumor.

The rest of the tumor can be treated with stereotactic radiosurgery, which also uses stereotactic navigation to precisely deliver radiation.

Speech Is Complicated

Neurosurgeons are similarly cautious when navigating the labyrinthine pathways speech and motor signals follow. When tumors develop in areas suspected of being proximal to these critical information highways, neurosurgeons take great care to identify the best route to the tumor, avoiding any harm to eloquent structures. To chart their course, IGEA Brain and Spine neurosurgeons rely on sophisticated imaging processes.

"We know from functional imaging data and a wealth of research that there's a high probability speech expression is located in the inferior frontal lobe, and if the patient is right-handed, it's on the left side," Dr. Gilad explains. "But in reality, speech association areas could be anywhere. If we suspect tumors are located near these centers, functional imaging can help. Sometimes functional imaging reveals these speech centers centimeters or even millimeters away from a tumor."

"If I won the lottery tomorrow, I'd still be doing what I'm doing. There's nothing more rewarding than getting involved in patients' complex brain or spine care and being able to look them in the eyes and tell them they will experience the same care I would provide my family or myself. At the end of the day, our patients are better off because of our efforts."

— Adam Lipson, MD, FAANS, neurosurgeon and partner at IGEA Brain and Spine

"We try to offer patients a friendlier approach to dealing with neurosurgeons. Patients shouldn't be left to guess the basic principles of their surgeries, disease processes or pathologies. By working on an individual basis with patients, we make sure there's never a problem of accessibility."
— David Poulad, MD, FAANS, neurosurgeon and partner at IGEA Brain and Spine

When mapping areas of the brain for speech function centers, neurologists aren't looking for memory or cognition — it's not about *why* we speak, but rather, *how* we speak — so patients go through an extensive rehearsal process, responding to cues on flashcards.

"Patients go through a series of tests during a functional MRI," Dr. Poulad says. "The fMRI shows increased metabolic activity in areas of the brain corresponding to the tasks we're asking them to perform. In the operating room, we merge this data with that from the MRI, which we use to guide our surgery. We then construct an approach that will allow us to avoid damaging those parts of the brain."

The rehearsal process is critical. Neurologists and neurosurgeons must have accurate data to look for deficits or changes in speech as signs that speech pathways have been breached.

Nuanced States of Sleep

To ensure best outcomes during function mapping, IGEA Brain and Spine neurosurgeons collaborate with skilled anesthesiologists to perform awake craniotomies. Patients must be placed in a delicate sleep state during the initial cranial opening — deep enough to not feel pain, but not so deep they don't wake up when necessary, according to Dr. Gilad. Positioned comfortably, patients receive local anesthesia and meticulous nerve blocks in their head area.

After opening the cranium, the surgical team wakes the patient, and the delicate procedure begins in earnest. While the neurologist and patient go through flashcards, neurosurgeons touch exposed parts of the brain with a stimulator.

"It's quite impressive," Dr. Gilad remarks. "When you hit the speech areas, patients lose their capacity to talk. It's not quite like it looks on TV, but patients are answering questions naturally, and then all of a sudden, they can't say the word anymore. When we find those areas, we mark them and avoid them during tumor removal."

Anesthesiologists then return patients to a sleep state, and neurosurgeons proceed with the tumor resection, making sure to avoid the marked areas. Awake craniotomies are the gold standard for performing surgery near eloquent structures responsible for speech expression.

Mapping Motor Function

Like speech pathways, motor signals travel patient-specific routes through brain tissue, which can be displaced by a tumor's growth. Neurosurgeons at IGEA Brain and Spine use an innovative imaging technique to preoperatively map motor pathways, from their origin in the motor homunculus through the white matter tracts through the brain stem and spinal cord to various parts of the body.

Neurosurgeons use DTI and fMRI techniques to pinpoint the tumor's position in relation to motor signal locations. Working with the neuroradiologists, they can then reconstruct a 3-D map of the brain and motor pathways to determine an approach to surgical resection that avoids damaging any part of the motor pathway.

"You can remove a lesion safely if you know the white matter tracts are displaced and away from the tumor," Dr. Gilad explains. "If a patient has a deep-seated tumor, you have to traverse white matter tracts to reach it, which means you may have to cross visual pathways, for example. DTI and tractography help neurosurgeons avoid these eloquent tracks and prevent permanent visual field deficits following surgery."

Physician Accessibility

Throughout the treatment process, patients often have many questions. At IGEA Brain and Spine, neurosurgeons closely follow patients throughout treatment and are always available to answer questions via cell phone or face-to-face conversation.

"As a private practice neurosurgical group, we take great pride in our physician-patient relationships," Dr. Lipson says. "We offer patients high-end care with a personalized approach. There's no need to travel for this kind of care."

For more information about IGEA Brain and Spine, please visit www.IGEAneuro.com.

Dr. Lipson and Dr. Poulad, partners at IGEA Brain and Spine