A tumor pressing against a vital part of Carol Fichtner's brain must be removed. A surgery this precise requires deft hands and the best technology an operating room can have.

BY SHIRLEEN HOLT | PHOTOS BY PETE STONE

A delicate dance

Above: Carol Fichtner's brain tumor appears in vivid detail (and in reverse) on the large display monitors inside the new intraoperative MRI suite at Providence St. Vincent Medical Center. **Left:** Carol never knew when a seizure would strike, but her daughter Clara Mae helped ease the trauma.

Mother and daughter

have choreographed their response. When Carol Fichtner feels her head involuntarily turn to the right, she has two seconds to call out to her daughter. Clara Mae Fichtner rushes into the room and positions herself between her mother and any sharp corners.

Then comes Carol's involuntary "Statue of Liberty pose": Her right arm shoots skyward, her left cradles at her waist. Her knees lock, and she falls to the floor, unresponsive. Clara Mae calls 911.

Since March 2009, these seizures have become an unwelcome guest, crowding the small Tigard apartment that Carol, 60, and 19-year-old Clara Mae share. The first one arrived violently, striking Carol in the walkway outside their apartment. She was "out" for two hours. She doesn't remember taking the ambulance ride to Providence St. Vincent Medical Center, or undergoing CT and MRI scans.

She does remember, however, the doctor's diagnosis.

"He said I had a mass in my brain."

A walnut-sized tumor is growing on Carol's left frontal lobe, encroaching on an area that controls movement on her right side. It's unclear whether the tumor is benign or malignant, but it needs to be removed, and the surgery will be delicate.

"The tumor is very close to her primary motor cortex," says neurosurgeon Daniel Rohrer, M.D., as he examines a scan of Carol's brain. The tumor shines like an egg in the gray image. "There's a certain amount of language function on that side as well."

Dr. Rohrer faces a familiar challenge: If he's too conservative, the tumor is more likely to grow back; too aggressive and Carol could lose precious function. Surgery this precise requires deft hands, advanced equipment to monitor brain function, and highly detailed navigation and imaging.

A case like this is why Providence Brain Institute, with the help of private donors, has built one of the most sophisticated neurosurgical suites in the world. Housed on the first floor of Providence St. Vincent Medical Center, the operating room has advanced navigational technology and a moveable intraoperative MRI – one of just 16 in the world and the only one on the West Coast.

Unlike standard MRIs, housed in a diagnostic room elsewhere in the hospital, this state-of-the-art model sits on the other side of the operating room wall. When surgeons want to check their work, they summon the scanner, which enters the suite on ceiling tracks through stainless steel doors.

The patient isn't moved, the surgical coordinates aren't disturbed and the results are immediate.

This means that surgeons such as Dr. Rohrer, co-medical director of cranial services at Providence St. Vincent Medical Center, can confirm on the spot that they've removed as much of a diseased area as possible before the patient is wheeled out of the operating room.

Living with a brain tumor

Few things are as alarming as hearing the words "brain tumor." Yet long-term survival for people with malignant brain tumors has climbed steadily over the decades, > > >

giving hope to the more than 20,000 Americans diagnosed each year.

In the 1970s, about one in five people with a malignant brain tumor lived past five years. Today, thanks to improved diagnostics and treatment, that number has risen to nearly one in three. While the vast majority of primary brain tumors are not malignant, the distinctions can sometimes be meaningless. Some people with aggressive, or malignant, tumors can be treated surgically and go on to live several more years. On the other hand, nonmalignant tumors located in a difficult spot can turn out to be not so benign, wreaking havoc with brain function and even causing death.

The most common type of malignant primary brain tumor is a glioma, originating from the brain's glial cells, which support the central nervous system. Sen. Ted Kennedy died from one of the most lethal gliomas, a glioblastoma multiforme.

Carol Fichtner doesn't yet know the type of tumor she has, only that it has turned her and her daughter's lives upside down. A former medical receptionist, Carol can no longer work, drive or even shop. This became apparent on a visit to Costco last summer. Having just been released from the hospital after a seizure, and still wearing her hospital wristband, Carol sat on a bench outside while Clara Mae ran inside to pick up her mother's prescription. In the minutes that Clara Mae was gone, another seizure gripped Carol, tossing her onto the pavement.

Worried about leaving her mother alone, Clara Mae quit culinary school in Portland to become her full-time caretaker.

Anti-seizure medication has slowed the frequency of Carol's "Statue of Liberty" events to about one a month, but it hasn't eliminated them. Every episode is disturbing, yet mother and daughter have learned to find humor where they can. One seizure struck shortly after Carol had grabbed a bottle of water from the fridge. As the convulsions jerked her hand, the water sprayed the room.

"She looked like a sprinkler," Clara Mae says with a grin.

The moments of lightness help relieve the worry, which deepens as Carol's surgery looms. Financial obstacles had delayed her operation for months, but now a date is set: Dec. 1, 2009, two days after Carol's 60th birthday.

"You never know which way this is going to go," she says, looking down at her hands. "I have confidence in my doctor, but you never know."

No room for error

It's the morning of Carol's surgery. She and Clara Mae arrive at Providence St. Vincent before dawn. As her mother

He said I had a mass in my brain.

– CAROL FICHTNER

On an early morning in December, a surgical team prepares for the delicate task of removing Carol Fichtner's tumor, which encroaches on a critical area of her brain. The surgery takes place in the sophisticated intraoperative MRI suite, which allows the surgeon to take scans mid-procedure and get instant results.

Left: As Carol lies anesthetized, technicians align the table to clear the center of the MRI. **Above:** Neurosurgeon Daniel Rohrer, M.D., and the team must wait in the control room during scanning.

is taken to get prepped for surgery, Clara Mae grabs a seat in the waiting room, where she'll spend the next 12 hours, a period broken only by updates from a member of the surgical team.

For Dr. Rohrer, the best scenario for Carol would be to find a low-grade tumor with defined boundaries that he can remove without damaging surrounding brain tissue. It's just as possible, however, that the tumor's margins aren't that clean, that he can't remove it all, and that Carol's right side will be weak, or even temporarily paralyzed, after surgery.

At this point, Providence St. Vincent's new operating suite has been in use for two months, but already it has proved its value for patients such as Carol. In about a quarter of the cases, MRI images taken mid-procedure have revealed hidden portions of diseased tissue that might have gone undetected until after surgery was complete.

The plan for Carol is to take images before, during and after her surgery. She's lying on the operating table under general anesthesia when the surgical team does a safety check of the room to make sure no instruments or other ferrous metals are within the MRI magnet's powerful field. Then they step into an adjacent control booth. Anesthesiologist Minh Pham, M.D., monitors Carol's vital signs on a portable device he carries with him. Technologist Jeffery Kauffman pushes a button, and the stainless steel doors open, revealing the 7.5-ton magnet.

The machine moves slowly over the operating table and begins to take scan after scan. The technology allows MRI images to be converted to three-dimensional perspectives, creating in effect a "global positioning system" to help surgeons navigate the brain during surgery.

When the intraoperative MRI is safely out of the room, Dr. Rohrer begins the procedure. He carefully opens the skull to reveal the tumor – the unwanted growth that has controlled the lives of a mother and a daughter for nearly a year.

Dr. Rohrer places three tiny paper numbers – 1, 2 and 3 – on the brain adjacent to the growth. Each designates the area that controls the movement of Carol's right hand, arm and face.

A photo is taken and the numbers removed.

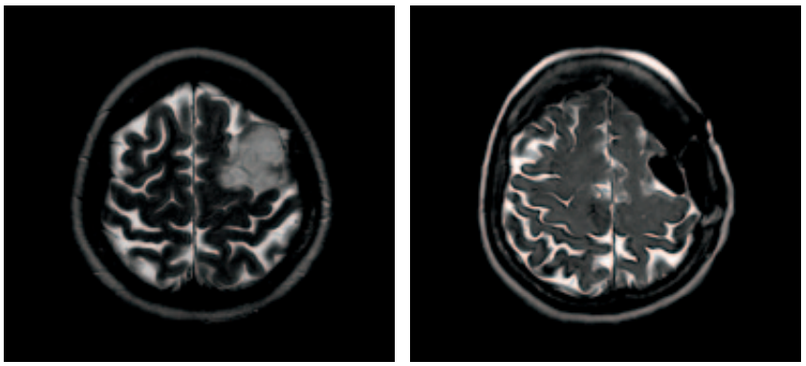
With Pink Martini playing over the audio system, Dr. Rohrer begins the slow and delicate process of separating tumor from brain. Because of the tumor's sensitive location, he holds a small electrical probe in his left hand. He tests the active parts of Carol's brain before each cut to ensure that he doesn't damage healthy tissue. When the probe touches a vital area, the lines on the EEG dance, confirming activity.

There's a risk that even this gentle stimulation could provoke a seizure. And sure enough, halfway through the operation, one strikes. Although Carol appears to be lying still, the monitors show electrical activity that's not abating. From a vat of ice, Dr. Rohrer takes a squeeze bottle containing a chilled solution that he squirts directly onto Carol's brain. Almost immediately, the erratic impulses stop, and surgery resumes.

A little white square

It's still unconfirmed what type of tumor Carol is battling. Dr. Rohrer has suspected that instead of the more common > > >

Above: Dr. Rohrer, standing at right, uses sharp eyes, high-tech imaging and a gentle electric probe to distinguish tumor from brain. **Right:** Allan Sacker, M.D., examines a slice of Carol's tumor in the pathology lab next door to determine the type.



Before-and-after scans reveal how much the brain shifts during surgery. The scan on the right shows the cavity left by Carol's tumor.

glioblastoma, this is an oligodendroglioma, a type that accounts for less than 10 percent of primary brain tumors. As he operates, a pathology lab next door tests a sample taken from Carol's brain.

Allan Sacker, M.D., medical director of pathology and laboratories at Providence St. Vincent, concurs with Dr. Rohrer's estimation, but he can't be certain without a more detailed analysis. Oligodendrogliomas don't progress as swiftly as grade IV glioblastomas, but they can be aggressive nonetheless. "It's in the gray zone between grade II and grade III," Dr. Sacker says. "I'll get a second opinion."

By now, Dr. Rohrer has removed the bulk of Carol's tumor. The closer he gets to the base of it, however, the more its look and texture blend into the brain's anatomy, making it hard to distinguish between healthy and diseased tissue. Such diffused margins make total removal impossible.

Dr. Rohrer's goal now is to take as much of the solid mass as he can and leave the remaining tendrils to chemotherapy or radiation. The magnet is brought in for more scans. The images are strikingly different from those taken before surgery. Not only do they reveal the cavity left by Carol's tumor, they show just how much the brain shifts during a procedure, changing the surgical landscape dramatically.

A small white square is visible on the edge of the cavity. It's a section of tumor indistinct to the naked eye, but visible on the scan. Before Providence St. Vincent installed the intraoperative MRI, Dr. Rohrer would have had to wait until after surgery to see this. And he might even have had to schedule a second procedure.

Today, with Carol still on the operating table, he returns to snip out that square. With that and some postoperative MRI scans, her procedure is over.

At 5:30 p.m. Dr. Rohrer heads to the waiting room to talk to Clara Mae. The good news is that her mother awoke from surgery with the full use of her right arm – no sign of paralysis or even weakness. With some inoperable tumor cells remaining, it's likely that Carol will need chemotherapy or radiation, but that won't be known until the full pathology report comes back.

For now, though, the biggest hurdle is over.

"I wanted to know more about the tumor that has been terrorizing our lives for this past year," Clara Mae says. "But this is fine. We're somewhat out of the woods now, and I'm just happy that I can take a deep breath."

Recovery and hope

It's early January, one month after surgery. Carol says her recovery was virtually pain-free, and she hasn't had a seizure since she left the hospital. The final pathology report confirmed that her tumor was an oligodendroglioma, and that it was a grade III – malignant.

Despite the disappointing finding, the tests also carried hope. Carol's tumor contained a good kind of genetic abnormality that makes the cells more receptive to chemotherapy and radiation.

While Carol weighs her treatment options, the tumor that haunted the family also brings an unexpected gift. Clara Mae has abandoned her plans to be a chef to pursue a new field – health care.

"I really enjoyed this caretaking thing, and it's something I want to continue," she says. "I wouldn't have even thought of the profession if this hadn't happened. And these qualities in me wouldn't have been developed until much later in my life. I want to keep it going." ■

A month after surgery, mother and daughter can leave the house without fear that a seizure will strike.

The mystery of seizures

Mary Grothaus's seizures crept in so slyly that she almost didn't recognize them. One moment she'd be studying for her master's degree in urban and regional planning; the next, she'd step "out of the world for a second."

Sometimes she'd regain full awareness and smell a strange chemical odor, accompanied by the sense that she had been dreaming or hallucinating. It wasn't until the 30-year-old suffered a full-blown convulsive seizure one night that she began to suspect that she had epilepsy.

Epilepsy is a familiar, if often misunderstood, neurological condition. It's a disorder designated by symptoms rather than cause.

"All that 'epilepsy' means is that you have seizures," says Paula Gerber, M.D., medical director of the Epilepsy Monitoring Unit at Providence Portland Medical Center. "If you have more than two spontaneous seizures, you have epilepsy."

The condition can be caused by a number of things – a tumor (such as Carol Fichtner's), injury, stroke, infection or some unknown reason. Seizures occur when the brain's electrical discharges misfire, creating a storm of impulses.

The types of seizures a person has depend on what part of the brain is affected. Some seizures are marked by bicycling motions; others by thrashing movements, lip-smacking, tingling or even dancing.

Grothaus doesn't know what caused her epilepsy, which was confirmed by a multitude of tests in 2008. She does know that the disturbance is in her left temporal lobe, and that medication has done little to control her seizures. As they gained frequency, Grothaus had to quit the part-time job she'd taken with the city of Forest Grove after graduation.

"It was really starting to interfere with my work," she says, sitting in the northwest Portland apartment she shares with her husband. "I would have smaller seizures at work, but after a seizure it's hard for me to think. I feel weird."

To ease some of the stress that worsened her condition, she took a job at Saint Cupcake in northwest Portland. And she counted the days until her epilepsy could be cured surgically.

In January, Daniel Rohrer, M.D., performed the procedure in the new operating suite at Providence St. Vincent Medical Center. The intraoperative MRI is useful for a variety of brain and cervical spine disorders. For epilepsy, surgeons can learn in real time if they've taken out enough misfiring brain tissue to cure the patient's seizures.

"... after a seizure it's hard for me to think. I feel weird."

MARY GROTHAUS

"It's always nice to have an MRI scan to confirm that we've taken enough because there's brain shift during the procedure," Dr. Rohrer says. "And the brain shift will skew the amount of temporal lobe that you actually end up taking out."

By February it was clear that the surgery was a success. Grothaus recovered with all of her brain function and none of the seizures that had disrupted her life and put her career on hold.

"I feel better every day," she says. "I plan to join a dragon boat team, hike and camp as much as possible, and start some committed volunteer work this summer. For now, I love sharing my enthusiasm for life by just smiling at everyone I see on my daily walks. Sometimes others catch on to that, unable to look away without grinning back and breathing deeply right along with me."