A Tale of chnology

Advancing brain tumor surgery at Portsmouth Regional Hospital

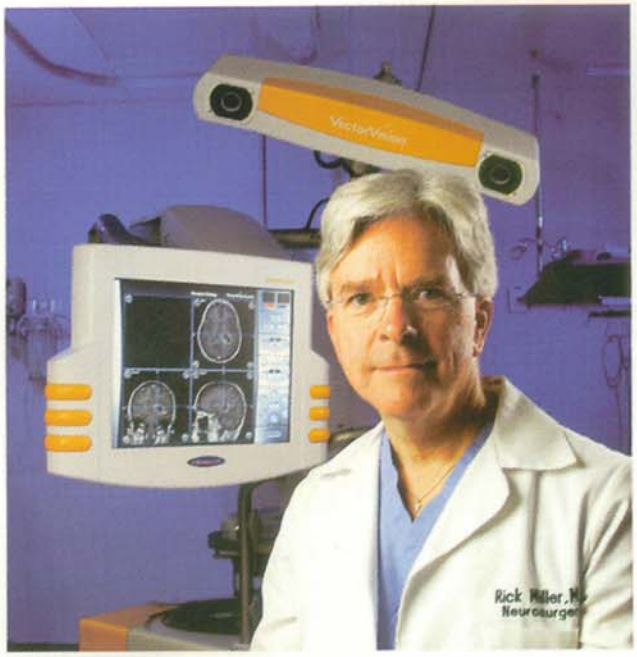
When Claudia Sylva Reynolds first started having minor dizzy spells, she just shook them off as nothing to worry about. Still, they continued for another six to eight months, and last April the 47-year-old massage therapist had a major convulsion in the middle of the night—an experience that brought her to the Emergency Department at Portsmouth Regional Hospital.

Using a computerized tomographic (CT) scan, the emergency-room staff concluded that Reynolds's problem was a brain tumor. They quickly referred her to neurosurgeon Clinton Frederick Miller, M.D., of Coastal New Hampshire Neurosurgeons in Portsmouth.

The CT scan and a subsequent magnetic resonance imaging (MRI) scan showed a benign, slow-growing tumor, called a meningioma, about the size of a chickpea, located in a sensitive area of her brain's right temporal lobe. While not cancerous, its presence and continued growth would mean more convulsions for Reynolds, likely paralysis on one side of her body and, ultimately, death. She would need surgery to remove it.

"I talked with my primary care physician over the weekend, and he confirmed that Dr. Miller was the right man for my case, rather than my going to Boston," Reynolds says. "Dr. Miller explained the nature of the surgery and the technology he would be using, so I did have a good understanding of the situation and strong confidence in him. I've lived in Portsmouth most of my life and my family and friends, my support, are all here. I felt good about having the procedure done here."

In preparing for Reynolds' surgery at Portsmouth Regional Hospital, Dr. Miller did something he wouldn't have previously done even a year ago: he ordered a special high-density MRI scan of her head.

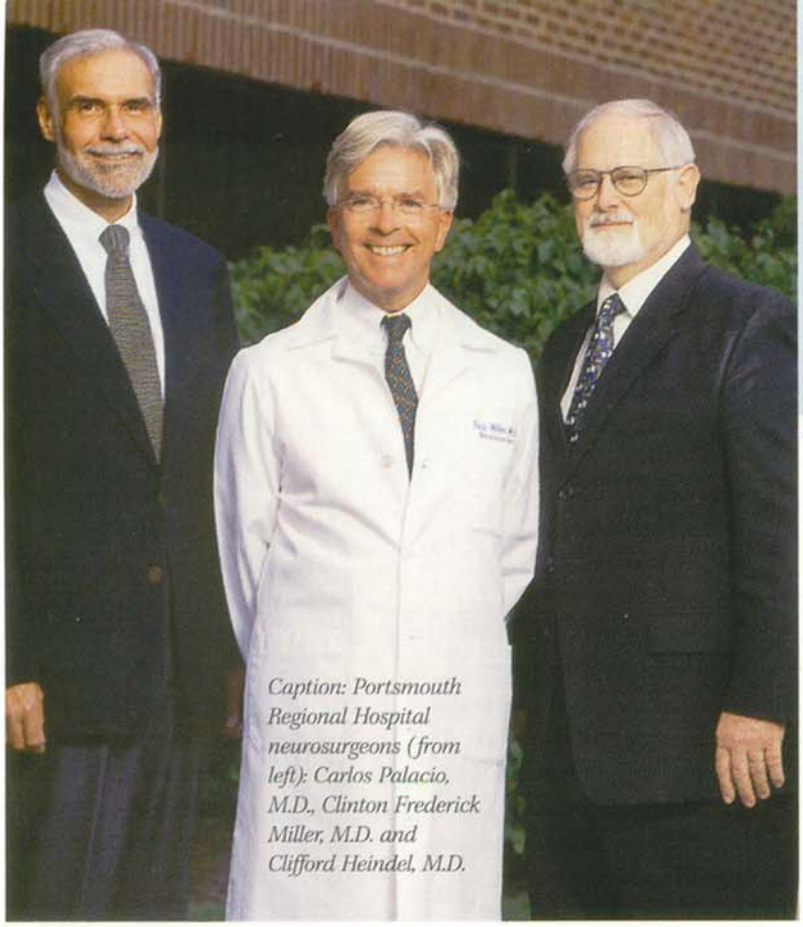


Clinton Frederick Miller, M.D., and Portsmouth Regional Hospital's new VectorVision system.

A New Frontier

Dr. Miller has begun using new technology in the operating room called VectorVision, to ensure the most effective and least intrusive cranial procedure available. VectorVision uses computer data drawn from high-density MRI scanning of a patient's brain to tell the surgeon where he and his surgical tools are in relation to the tumor he is removing.

Manufactured by BrainLAB, a German medical technology company, VectorVision is image-guided surgery at a very sophisticated level. Using the high-density MRI or CT scans to map the anatomy of the patient's head and brain in very fine detail, the software utilizes the anatomy



Caption: Portsmouth Regional Hospital neurosurgeons (from left): Carlos Palacio, M.D., Clinton Frederick Miller, M.D. and Clifford Heindel, M.D.

"This is really the leading edge, it's a **quantum leap** in **comfort, safety and accuracy** of neurosurgical procedures. —Clinton Frederick Miller, M.D.

of the patient's face to register the surgeon's position in the operating field and guide him or her throughout the operation on the brain. MRI uses ordinary radio waves passed through a powerful magnetic field and fed into a computer to create a continual series of images of the tissue in question. (CT scanners use radiation to create similar images.) The computer can then manipulate this data to provide the surgeon with views of the brain from many angles. A traditional diagnostic MRI scan makes its images at 3-millimeter or 4-millimeter intervals; a VectorVision scan records images at intervals of 1 millimeter.

"For 40 years, neurosurgeons have faced the dilemma that we knew full well what was needed to be done to remove a lesion but without an ability to precisely pinpoint its location and the best entry point and approach to it," Dr. Miller explains.

According to Dr. Miller, any incursion into the brain substance inevitably causes permanent, irrevocable damage to the tissue, and the challenge is to find a pathway that minimizes that damage. "VectorVision helps us accomplish this by telling us exactly where the abnormality is in reference to the scalpel, brain and bone. It allows us to plan a much smaller opening in the skull to access the lesion as delicately and efficiently as possible. This is a major step forward," he says.

How It Works

VectorVision relies on infrared cameras on a stand next to the operating table, a touch-screen computer and a laser-equipped "z-touch" wand. Passing the z-touch over the patient's face allows the VectorVision computer to use the facial topography recorded in the MRI scan as a reference point. By sending a signal back to the camera, it establishes a map for navigating the patient's brain. After this, the computer screen can be used to tell the surgeon where his instruments are at all times with regard to the tumor and adjacent brain tissue.

"We know the anatomy and now we know exactly where we are in relation to the anatomy," Dr. Miller says. "We want to be careful, for example, not to get too close to the motor speech area or the Wernicke's area, a section of the brain that controls one's ability to retrieve specific words and then put them together to express thought."

In Reynolds' two and a half hour procedure, Dr. Miller removed a section of bone about the size of a 50-cent piece just above her right ear, followed a careful approach to the tumor, which was close to the surface, and then fixed the bone back in place with titanium fixators. The bone will heal to become a solid repair.

Leading the Way

Image-guided surgery is not a new concept. Other technologies have existed for some years aimed at improving surgical capabilities, but VectorVision is by far the most advanced.

Some advantages of VectorVision include the ease of set-up, the ability to show its images in three dimensions and to rotate them, continuous control by the surgeon through a sterile computer touch-screen and the fact that it is entirely wireless. Unlike previous image-guided systems, the surgeon's instruments don't need wires attached to them in order to communicate with the system. And VectorVision can be tied into other operating-room equipment, such as Portsmouth Regional Hospital's state-of-the-art Zeiss NC-4 operating microscope.

"This is really the leading edge," Dr. Miller says. "It's a quantum leap in comfort, safety and accuracy of neurosurgical procedures. Now I can comfortably and in good conscience go in and do complicated cases here on the Seacoast that, in the absence of this technology, I would previously have felt obliged to refer to my colleagues at the teaching hospitals in Boston."

Back on Track

Reynolds spent two and a half days in the hospital and has recovered very successfully. Fifteen minutes after the surgery, she remembers speaking to people. Her family was able to come in and see her right away.

"They even spared my hair," she says. "They made an incision like an inverted 'C' right above my ear, and my hair falls to cover it. You wouldn't even know I had had surgery."

She adds, "I can't say enough about the quick detection, and the staff at the hospital. Everyone was very sharp. I feel like I was really blessed." ✤