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SPEAKING OUT

Section: *Health and Science*
Edition: *EDITION: Final*
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Memo: *Perspective on PETSUNDAY: Positron Emission Tomography has faced medical, economic, regulatory and legislative hurdles. Has its time come?TODAY: Physicians and a patient tell their experiences with Positron Emission Tomography. TUESDAY: The president of CTI, Inc. says the firm is the center of the universe for commercial Positron Emission Tomography. The Business section takes a closer look.*
Caption: *How it works (diagram)Different ways of looking at body tissue (diagram) (Color) Dr. Fran Patterson is a cancer survivor who was helped by a PET SCAN. Joe Howell/News-Sentinel staff (Color) Perspective on PET; PHOTO NOT RETAINED IN LIBRARY (Color) Perspective on PET; PHOTO NOT RETAINED IN LIBRARY .*
Illustration: *diagram (2);*
photo (2)

WYNNE BROWN NEWS-SENTINEL STAFF WRITER

Usually the Bearden Middle School commons is aroar with teenage commotion -- chairs askew, backpacks scattered on tables, chairs and the floor and papers everywhere, including flying through the air. But one recent Sunday the commons is a quiet hum of adult conversation. The cafeteria tables are gone, replaced with dozens of card tables neatly lined up in rows.

It's the Volunteer State Tournament of the American Contract Bridge League, and Fran Patterson is intent on her cards, glasses pushed up on her nose.She smiles easily and jokes with her fellow players but is obviously concentrating. While considering strategy, she unconsciously reaches up, patting and running her fingers over the new blond hair that's combed down over her forehead.

Patterson calls bridge her "recreational passion."

"I'm not a good bridge player, but I really like it anyway," she said.

"I keep saying, 'If I'm going to die, I want to just keel over dead at the bridge table, and they can just carry me out.' "

In 1995 she became a Life Master in bridge.

It's a milestone that's particularly significant for Patterson. In February 1994 she was diagnosed with breast cancer, and 15 months later -- after a lumpectomy, a lymph node dissection and radiation -- the disease had spread into her liver and spine.

"Women who have liver metastases from breast cancer are usually dead," she said matter-of-factly. "I'd been doing a self-exam about once a month, but maybe I got in a hurry -- or maybe I missed a month."

A routine mammogram revealed a small abnormality, a slight firmness. Once she knew it was there, she says, "It felt as big as a potato!"

She was lucky the lump was found when it was.

"It's most important that women do self-examinations," she says. "Fifty percent of tumors detected by palpation cannot be detected by mammogram. Women will be cheating themselves if they rely on mammograms only."

Patterson should know: She's Dr. Fran Patterson, M.D., a pathologist with the University of Tennessee Medical Center since 1963, and her job is to examine other people's tissues for abnormalities.

Her own case was complicated by benign cysts in her liver as well as the malignant tumors. The conventional imaging techniques, computed tomography (CT) and magnetic resonance imaging (MRI), showed the size and shape of her lesions, but neither method can tell a physician if those lumps are malignant or growing.

UT Medical Center has two positron emission tomography scanners, so Patterson's oncologist, Dr. Wahid Hanna, recommended a whole-body PET scan to look at her liver, in addition to checking for any other metastases.

Since PET is a picture of an organ's function and not just its anatomy, the scan would show the difference between the harmless cysts and the cancerous tumors.

The morning of Patterson's PET scan, a chemist generated the day's quota of radioisotopes in the medical center's cyclotron, a mini-particle accelerator that uses a magnet the size of a large tractor tire.

Within an hour a nurse injected about 1ml of the radioisotope known as FDG (fluoro-deoxy-glucose) into Patterson's arm.

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Scheduling is an important issue in PET because the FDG only lasts a few hours. Thirty minutes later Patterson was gliding slowly through the scanner, sort of like being fed slowly through the round hole of a giant square doughnut.

``It took 20 to 30 minutes, something like that,'' she said. ``I just closed my eyes and drifted off.''

Live, growing tissue uses glucose, and malignant tumors grow more rapidly than normal tissue, so they demand more glucose. As Patterson was drifting off, positrons, or subatomic particles, were ``emitted'' from the glucose tracer.

Each positron traveled as far as it could in Patterson's body until it collided with an electron, usually only a millimeter or two. As the positively charged positron met the negatively charged electron, each was destroyed -- an event PET workers call an ``annihilation event.''

The energy from the collision was converted to two gamma rays, traveling 180 degrees from one another. Crystals in the ``doughnut hole'' surrounding Patterson detected the rays and converted them to a spark of light. The light passed through a photomultiplier tube and was converted to an electric signal. That signal can be mapped by computer.

Since malignant tumors are growing rapidly, metabolic activity increases and so does the number of collisions and gamma rays -- so growing tumors show up on the scan as ``hot'' spots.

Patterson said, ``What the PET helped (the doctors) decide was how many of the lesions in my liver were tumor and how many were cysts. . . . I think they felt better having a handle on that number.''

PET can also act as a road map for surgeons, Patterson added. ``If they were thinking of going in and needling (biopsying) a lesion, for sure they wouldn't want to needle a cyst, they'd want to needle a tumor -- they'd want to know where they were.''

Hanna said he used the PET scan to confirm the lesions in her liver were malignant. ``But what's more important -- it showed the lesion in her spine. We knew if one was positive the other would be too. We started treatment.''

PET's supporters

Patterson's case illustrates one of the most common uses of PET: ``staging'' or planning a patient's cancer treatment.

Dr. Karl Hubner, director of clinical research at UT Medical Center, has been involved with PET since 1977, when he was medical director at Oak Ridge Associated Universities. He said PET first was used in mapping brain activity, such as epilepsy, Parkinson's disease and dementia. Then its focus shifted to cardiology where it was used to determine if patients had enough functional heart tissue to benefit from bypass surgeries. Those applications are still valuable, but the technique is being used more and more for cancer.

``In 1992 we started doing whole-body applications, and that was when oncological applications started to blossom,'' Hubner said. ``Since you inject FDG and it goes all over the body, it gives a total picture of where the disease is. . . . If there is disease elsewhere, that patient is not a good surgical prospect.''

Dr. Gary Smith, director of nuclear medicine and PET at UT hospital, pointed out PET provides extra information: ``If a person already has a known tumor, and you go and look for any spread of that tumor . . . across the board you find that 30 percent of patients have serendipitous findings on the PET that weren't previously known from other imaging studies.

``In a number of studies, the PET scan changes a patient's management in somewhere between 25 to 40 percent of the time. Typically, the most common change is to change the patient from being a surgical candidate to being a nonsurgical candidate.''

Dr. Tom Gaines, a thoracic (chest) surgeon at UT, agreed. Gaines operates on both cardiac and cancer patients and said, ``It's not a test for everyone. For one thing, it's quite expensive. But for patients that are at high risk for surgery, it can make a significant difference.

``Last week we had a young woman, very young, 33, with an unusual case of lung cancer. We did a PET on her before surgery and found that she had disease beyond anything that we could take care of.

``With PET we might be able to spare someone a mutilating surgery. There have been other cases where someone's had a mass in the lung and we've done PET. Since the area in the lung had no glucose uptake, we treated it as a benign lesion, and it went away.''

Dr. Tom Sullivan, an oncologist with the Knoxville Pulmonary Group, said chest X-rays, the most commonly used screening tool, can't safely tell if a lung nodule is malignant.

``A significant percentage of nodules -- somewhere around 20 to 40 percent -- are in that indeterminate range,'' he said. ``You can't operate on all those people . . . If you've ever had chest surgery or know someone who has, it's pretty debilitating and quite painful for a short time -- and pretty expensive.

``PET's of useful benefit to help guide you, to help make decisions. And these are tough decisions to make. Many of these patients can't tolerate the stress of unnecessary surgery because they're already having respiratory difficulties.''

Hubner maintained another of PET's strengths is in monitoring disease while saving money.

``It means cost savings in therapeutic management: There's no point in using wrong therapy. For example, it costs $10,000 for a cycle of chemotherapy, and usually six cycles are done. Why keep on spending $10,000 for each if, after one cycle of chemotherapy, you can do a PET scan to see if it's working? If it's not working, you change therapy. So we're using PET to determine the effect of therapy.''

. . . And the downside

Even PET's supporters say the technique isn't always perfect. Two surgical oncologists at UT, Dr. John Gwin and Dr. John Bell, both said PET's not always accurate. It can be fooled because an inflammation can show up as a hot spot, leading doctors to think there's a malignancy. Several doctors also wish its resolution could be better.

But everyone agrees the biggest drawback to PET is its cost. The Food and Drug Administration still considers PET to be an experimental method and said there is not yet enough evidence to prove that FDG, the radiotracer, is completely safe.

Because the FDA hasn't approved PET, many private insurance companies require their patients to pay for all or part of the $1,500-$2,000 scans.

Hanna, Patterson's oncologist, said, ``If the test was cheaper, would I use it more? The answer is definitely `Yes.' ''

One strategy to make reimbursement happen is by legislation. In early June, Sen. Bill Frist, R-Tenn., a physician himself,

introduced a bill in Congress that would force the FDA to approve PET for reimbursement.

The next stop for the bill will be the Senate floor on Monday, July 21.

The future of PET

Mike Phelps, now chief of the nuclear medicine division at UCLA School of Medicine, is often called the ``father of PET.'' In the 25 years since he first developed the technique, PET has grown from being unknown to being in 70 sites around the globe.

He said he's not surprised it has taken so long for PET to get where it is now or at the number of hurdles the technique has had to face.

``In some ways, it's been a struggle,'' he acknowledged. ``But in the context of new discoveries, it's not unusual. . . . My interest was in bringing physics, chemistry and biology together in imaging -- to be able to watch living systems of the body.''

At that point, he said, he had ``to have a tremendous amount of faith -- but very little data.'' He said the development of PET was a major paradigm shift and compares it to that of silicon chips: ``There was a long period when the idea did not get accepted -- it was too complicated, too expensive. But some people had faith and perseverance and just kept at it. It was a long latent process of research, but the principles were sound.

``Now vacuum tubes aren't relevant anymore, and silicon chips have changed the world we live in.''

Phelps said his story hasn't changed and that he's still asking the same questions.

But now the rest of medicine is wanting the same answers he's after.

``For the first time, traditional nuclear medicine and PET have come together in a common objective. We have developed a way to look into the human body to see how the normal basis of cellular functions behave at the elementary biological and biochemical level.''

Next he'd like to use PET to look deeper into the human body, to the very source of disease: the genome. He believes doctors will be ``bringing modern medicine and biology together to identify the molecular error of disease -- and fix it.''

Phelps also envisions a time when PET may be used to look for breast cancer in patients who are high-risk or who aren't served well by mammograms or physician examinations. According to figures he provided, 46,000 women died of breast cancer in the United States in 1995, the same year 182,000 new cases of breast cancer were diagnosed.

Fran Patterson concurred.

``I was at one bridge tournament, and every woman at my table had breast cancer,'' she said.

She said at other tournaments at any bridge table at least one woman will have the disease.

After the PET scan, Patterson had more radiation and started chemotherapy. She was pleased to find the treatment less uncomfortable than she'd expected.

``It's much better than it used to be,'' she said. ``They have drugs to combat the nausea. I did everything I normally do, we carried on as usual and even went to a bridge tournament in Charlotte (N.C.). I just took my medication in a little fridge.''

Fran Patterson is in remission.

Since all of her tests came back normal, there was no need to do another PET scan, and she went off treatment in February 1996.

Does her remission make her feel that she's a master of life as well as a Life Master of bridge?

She laughs, ``Oh no, I don't have that sort of wisdom.

``But I can tell you that having cancer has changed my life. I appreciate everything so much more: my daughters, my husband -- and I love my work. I really notice the flowers now -- and how blue the sky is . . . They tell you you should stop and smell the roses -- and it's really true.''

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