Magnetic Resonance Gives Better Images Of Nerves in the Body

The technique could help people avoid exploratory surgery.

By WARREN E. LEARY

Researchers have developed a new way of using magnetic resonance imaging that they say allows doctors for the first time to see nerves clearly in the human body.

The new imaging technique, which can be accomplished by modifying existing magnetic resonance scanners in hundreds of hospitals, could improve the diagnosis of such diverse nerve conditions as chronic back pain and carpal tunnel syndrome.

The researchers said the improved pictures of nerve fibers might also reduce the need for exploratory surgery to find the origin of painful conditions caused by compressed or injured nerves.

Scientists at the University of Washington in Seattle, who collaborated with researchers in England to develop the procedure, call the three-dimensional images produced by the process "neurograms"and say they fill in a substantial blank in diagnosis.

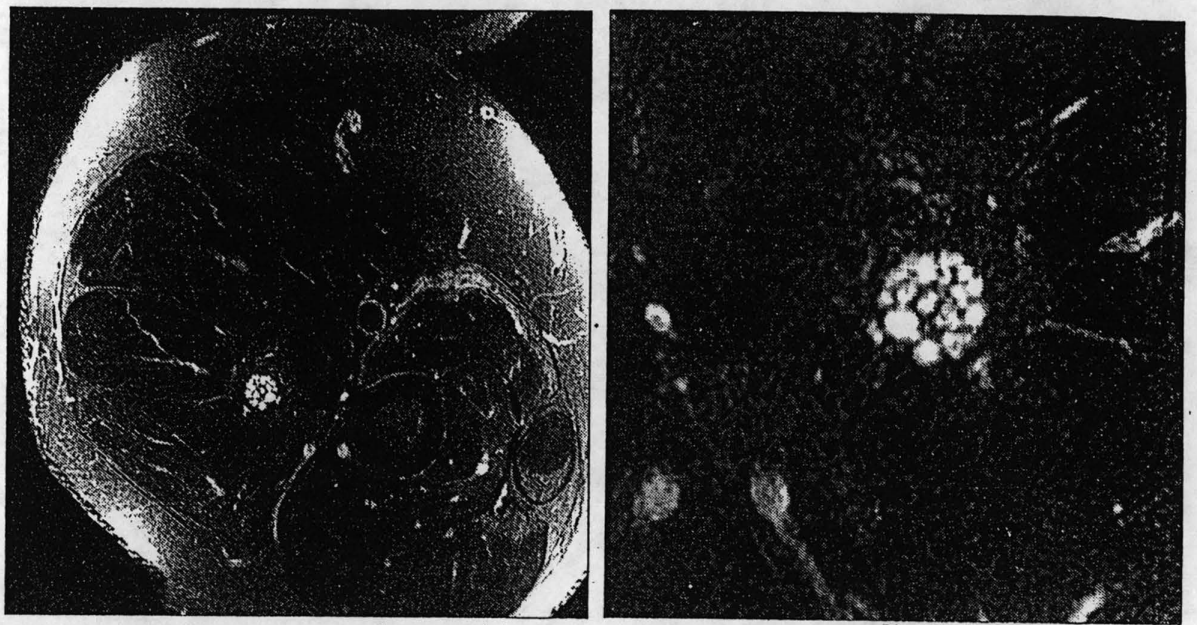
"Unlike other tissue, we really don't have a way to reliably image nerves," Dr. Aaron G. Filler, the principal scientist in the study, said in a telephone interview. "Nerves are rather nondistinct to most imaging techniques and look like tendons, blood vessels, fat and other such tissue when scanned. There are ways to enhance some of these other tissues with contrast agents, but that hasn't been true of nerves."

As outlined in a report in the current issue of The Lancet, an international medical journal published in England, the researchers said they were able to picture nerves by filtering out the image signals of various other tissues until only the signals of nerve tissue were left. By changing signal sequences to block emissions from non-neural tissue and improving the processing of the resulting data, the researchers said, they were able to make nerve fibers the brightest structures in the image.

They said they were able to view images of separate nerve bundles with standard equipment by modifying the computer programs that control the scanner and using portable signal-enhancing devices to bring out the weak electromagnetic modification pattern produced by nerve tissue. Dr. Filler said he expected the cost of computer-program changes and other needed equipment to be minimal.

Other experts in magnetic resonance imaging said the research looked promising, but added that more work would be needed to prove that it was a useful tool for diagnosis.

"This is an exciting development and I hope it holds up after further work," said Dr. Thomas J. Brady, director of magnetic resonance imaging research at Massachusetts General Hospital in Boston. "Historically, we could see nerves, but they were surrounded by fat and vessels that obscured the image. The technical capability of magnetic resonance is expanding and we're pushing back the bounds of what it can do."



Aaron Filler and Jay Tsuruda/University of Washington

Enhanced magnetic resonance imaging shows sciatic nerve in human thigh as bright cluster, left, and as bundle of fibers in enlarged view at right.

Magnetic resonance imaging, which in the last decade has revolutionized how doctors look at the soft tissues and organs of the body, produces its images by detecting radio signals from hydrogen atoms in the water molecules inside tissue. The spinning nuclei of hydrogen atoms are exposed to a strong magnetic field and then dislodged from the field by a pulse of radio waves. To return to their normal position in the magnetic field, the hydrogen nuclei give off their own radio signals at a distinct frequency that the scanner picks up and uses to construct an image.

Dr. Filler developed the new technique while working in England with Dr. Franklyn Howe, a physicist at the University of London. The researchers used an advanced custom-built magnetic resonance imaging system in a laboratory supported by Britain's Cancer Research Campaign.

When Dr. Filler returned to the University of Washington last year, he teamed up with Dr. Jay Tsuruda, Dr. Cecil Hayes, Dr. Michel Kliot and Dr. Richard Winn to develop the method using a slightly modified standard magnetic resonance machine.

In the research paper, the team said it had manipulated radio wave frequencies and magnetic fields to isolate the nerve tissue signals. The first result with a patient was an image of a nerve graft surgically inserted into the thigh of a man to repair the large sciatic nerve, which had been damaged when the man was stabbed. To bring out the weak signal of the nerve, the researchers surrounded the area of study with a group of metal bands, called phased array coils, which helped enhance the image, they said.

A new method uses existing equipment but filters out extraneous signals

The technique worked so well, the researchers said, that it not only blocked out the signals of fat and other unwanted tissue, but also signals from the sheathing tissue within the nerve bundles. This unexpected development allowed individual nerve bundles, called fascicles, to be pictured clearly, Dr. Filler said, which should help in detailed studies of nerves and lesions within them.

Dr. Filler said neurograms could help locate the exact places where nerves are crimped, making better treatment possible. The images also might spare many patients from having to endure exploratory surgery or uncomfortable diagnostic techniques like the insertion of needles to stimulate nerves electrically to see if they are blocked.