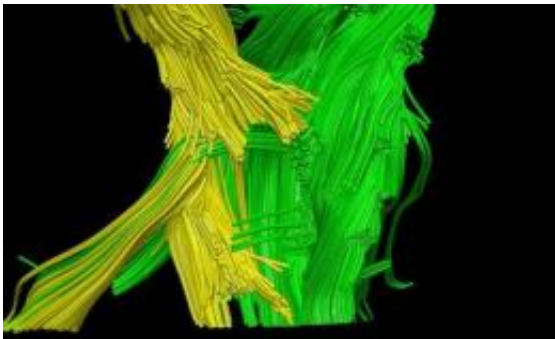


# Finding unseen damage of traumatic brain injury

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This undated handout artist rendering provided by the Schneider Lab, University of Pittsburgh shows an experimental type of scan showing damage to the brain's nerve fibers after a traumatic brain injury. The yellow shows missing fibers on one side of the brain, as compared to the uninjured side in green, in a man left with limited use of his left arm and hand. The soldier on the fringes of an explosion. The survivor of a car wreck. The football player who took yet another skull-rattling hit. Too often, only time can tell when a traumatic brain injury will leave lasting harm — there's no good way to diagnose the damage. Now scientists are testing a tool that promises to light up breaks that these injuries leave in the brain's wiring, much like X-rays show broken bones. (AP Photo/Schneider Lab, University of Pittsburgh)

The soldier on the fringes of an explosion. The survivor of a car wreck. The football player who took yet another skull-rattling hit. Too often, only time can tell when a traumatic brain injury will leave lasting harm — there's no good way to diagnose the damage.

Now scientists are testing a tool that lights up the breaks these injuries leave deep in the brain's wiring, much like X-rays show broken bones.

Research is just beginning in civilian and military patients to learn if this new kind of MRI-based test really could pinpoint their injuries and one day guide rehabilitation. It's an example of the hunt for better brain scans, maybe even a [blood test](#), to finally tell when a blow to the head causes damage that today's standard testing simply can't see.

"We now have, for the first time, the ability to make visible these previously invisible wounds," says Walter Schneider of the University of Pittsburgh, who is leading development of the experimental scan. "If you cannot see or quantify the damage, it is hard to treat it."

About 1.7 million people suffer a [traumatic brain injury](#), or TBI, in the U.S. each year. Some survivors suffer obvious disability, but most TBIs are concussions or other milder injuries that generally heal on their own. TBI also is a signature injury of the wars in Iraq and Afghanistan, affecting more than 200,000 soldiers by military estimates.

Not being able to see underlying damage leads to frustration for patients and doctors alike, says Dr. Walter Koroshetz, deputy director of the National Institute of Neurological Disorders and Stroke.

Some people experience [memory loss](#), [mood changes](#) or other problems after what was deemed a mild concussion, only to have CT scans indicate nothing's wrong.

Repeated concussions raise the risk of developing permanent [neurologic problems](#) later in life, a concern highlighted when some retired [football players](#) sued the [National Football League](#). But Koroshetz says there's no way to tell how much damage someone is accumulating, if the next blow "is really going to cause big trouble."

And with more serious head injuries, standard scans cannot see beyond bleeding or swelling to tell if the brain's connections are broken in a way it can't repair on its own.

"You can have a patient with severe swelling who goes on to have a normal recovery, and patients with severe swelling who go on to die," says Dr. David Okonkwo, a University of Pittsburgh Medical Center neurosurgeon who is part of the research. Current testing "doesn't tell you what the consequence of that head injury is going to be."

Hence the increasing research into new options for diagnosing TBI. In a report published Friday in the Journal of Neurosurgery, Schneider's team describes one potential candidate, called high-definition fiber tracking.

Brain cells communicate with each other through a system of axons, or [nerve fibers](#), that acts like a telephone network. They make up what's called the white matter of the brain, and run along fiber tracts, cable-like highways containing millions of connections.

The new scan processes high-powered MRIs through a special computer program to map major fiber tracts, painting them in vivid greens, yellows and purples that designate their different functions. Researchers look for breaks in the fibers that could slow, even stop, those nerve connections from doing their assigned job.

Daniel Stunkard of New Castle, Pa., is among the first 50 TBI patients in Pitt's testing. The 32-year-old spent three weeks in a coma after his all-terrain vehicle crashed in late 2010. CT and regular MRI scans showed only some bruising and swelling, unable to predict if he'd wake up and in what shape.

When Stunkard did awaken, he couldn't move his left leg, arm or hand. Doctors started rehabilitation in hopes of stimulating healing, and

Okonkwo says the high-def fiber tracking predicted what happened. The scan found partial breaks in nerve fibers that control the leg and arm, and extensive damage to those controlling the hand. In six months, Stunkard was walking. He now has some arm motion. But he still can't use his hand, his fingers curled tightly into a ball. Okonkwo says those nerve fibers were too far gone for repair.

"They pretty much knew right off the bat that I was going to have problems," Stunkard says. "I'm glad they did tell me. I just wish the number (of missing fibers) had been a little better."

The new tool promises a much closer look at nerve fibers than is now possible through a technique called diffusion tensor imaging, says Dr. Rocco Armonda, a neurosurgeon at Walter Reed National Military Medical Center.

"It's like comparing your fuzzy screen black-and-white TV with a high-definition TV," he says.

Armonda soon will begin studying the high-def scan on soldiers being treated for TBI at Walter Reed, to see if its findings correlate with their injuries and recovery. It's work that could take years to prove.

Other attempts are in the pipeline. For example, the military is studying whether a souped-up kind of CT scan could help spot TBI by measuring changes in blood flow inside the brain. The National Institutes of Health is funding a search for substances that might leak into the bloodstream after a [brain injury](#), allowing for a blood test that might at least tell "if a kid can go back to sports next week," Koroshetz says.

He cautions that just finding an abnormality doesn't mean it's to blame for someone's symptoms.

And however the hunt for better tests pans out, Walter Reed's Armonda says the bigger message is to take steps to protect your brain.

"What makes the biggest difference is everybody - little kids riding their bicycles, athletes playing sports, soldiers at war - is aware of TBI," he says.

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