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Researchers report progress in quest to create objective method of detecting pain

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A method of analyzing brain structure using advanced computer algorithms accurately predicted 76 percent of the time whether a patient had lower back pain in a new study by researchers from the Stanford University School of Medicine.

The study, which will be published online Dec. 17 in Cerebral Cortex, reported that using these algorithms to read brain scans may be an early step toward providing an objective method for diagnosing chronic pain.

"People have been looking for an objective pain detector—a 'pain scanner'—for a long time," said Sean Mackey, MD, PhD, chief of the Division of Pain Medicine and professor of anesthesiology, pain and perioperative medicine, and of neurosciences and neurology. "We're still a long way from that, but this method may someday augment self-reporting as the primary way of determining whether a patient is in chronic pain."

The need for a better way to objectively measure pain instead of relying solely on self-reporting has long been acknowledged. But the highly subjective nature of pain has made this an elusive goal. Advances in neuroimaging techniques have initiated a debate over whether this may be possible. Such a tool would be particularly useful in treating very young or very old patients or others who have difficulty communicating, Mackey said.

In a study published last year in PLoS ONE, Mackey and colleagues used

computer algorithms to analyze magnetic resonance imaging scans of the brain to accurately measure thermal pain in research subjects 81 percent of the time. But the question remained whether this could be a successful method for measuring chronic pain.

The goal of the new study was to accurately identify patients with lower back pain vs. healthy individuals on the basis of structural changes to the brain, and also to investigate possible pathological differences across the brain.

Researchers conducted MRI scans of 47 subjects who had lower back pain and 47 healthy subjects. Both groups were screened for medication use and mood disorders. The average age was 37.

The idea was to "train" a linear support vector machine—a computer algorithm invented in 1995—on one set of individuals, and then use that computer model to accurately read the brain scans and classify pain in a completely new set of individuals.

The method successfully predicted the patients with lower back pain 76 percent of the time.

"Lower back pain is the most common chronic condition we deal with," Mackey said. "In many cases, we don't understand the cause. What we have learned is that the problem may not be in the back, but in the amplification coming from the back to the brain and nervous system. In this study, we did identify brain regions we think are playing a role in this phenomena."

An estimated 100 million Americans suffer from chronic pain, and chronic low back pain, in particular, is the most common cause for activity limitation in those younger than 45, according to the study. The prevalence of lower back pain among the U.S. population has also risen

significantly, from 3.9 percent in 1992 to 10.2 percent in 2006.

"Previous studies have shown that there are functional changes in the brain of a chronic pain patient, and we show that structural changes may be used to differentiate between those with chronic lower back pain and those without," said former research assistant Hoameng Ung, the first author of the study who is now an MD/PhD student at the University of Pennsylvania School of Medicine. "This observation also suggests a role of the central nervous system in chronic pain, and that some types of chronic low back pain may reflect pathology not within the back, but instead within the brain."

Study results suggested that lower back pain is characterized by a pattern of structural changes in the gray matter, the nervous tissue of the brain, showing indication of disease.

"Our investigation ... suggests that the pathology of lower back pain involves changes in gray matter that are present throughout a distributed system of pain processing and pain-associated areas within the brain," the study stated.

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