New Test Distinguishes Physical From Emotional Pain in Brain for First Time

By Maia Szalavitz @maiasz | May 06, 2013 | 14 Comments

New research suggests physical pain may have a distinct brain “signature” that distinguishes it from emotional hurt.

In the brain, the pain from broken leg and the anguish of a broken heart share much of same circuitry. But the latest evidence points to distinct ways that the brain processes each type of pain and could lead to a greater understanding of how to detect and treat them.

“Of all the things I’ve observed in the brain, nothing is more similar to physical pain than social pain,” says lead author Tor Wager, associate professor of neuroscience at the University of Colorado in Boulder, “What we’ve done in the latest paper is to develop something that predicts physical pain at a much more fine-grained level.”

(MORE: Can Doctors Feel Their Patients’ Pain?)

The research, which was published in the New England Journal of Medicine, included 114 young adults who participated in several different experiments. The first test involved scanning the brains of 20 people while they experienced varying degrees of warmth or painful heat on their left forearms. These were calibrated to the individual to be either not painful or mild, moderately or severely painful—but they were not harmful. The second experiment included another 33 people, also exposed to varying levels of painful heat or mild warmth. Using data from the brain activity in the first participants, the researchers developed a program to predict whether people in the second experiment were experiencing pain. The model accurately determined whether they had been subjected to pain or to just warmth 93% of the time.

The third study, however, provided the most revelatory information about how physical and emotional pain may differ. In that experiment, 40 people who had recently been dropped by their romantic partners underwent the same type of physical pain testing while their brains were scanned. They were also scanned while viewing either an image of a close friend or a picture of the person whom they still loved, but had lost.

What Wager wanted to know, he says, is “Does this physical pain pattern [detector] get fooled into thinking that [social rejection] is
physical pain? The answer we get is, no, not at all. What we find is that there are different patterns. There’s a pattern of response to physical pain, but [it isn’t seen] with emotional pain stimuli at all.”

(MORE: In the Brain, Broken Hearts Hurt Like Broken Bones)

“It’s certainly an interesting avenue for future research,” says Daniel Randles, a PhD candidate at the University of British Columbia, who has studied pain processing but was not associated with the study. He says that more data will be needed to determine whether the differences observed in the study actually relate to differences between physical and emotional pain or were related to another distinction between the groups. For instance, the people seeing images of their exes weren’t being actively rejected by them while in the scanner, but they were experiencing current physical pain during the scan. Therefore the difference between memory and current experience might also explain the results.

Tor, however, says that the rejected people did express current distress upon seeing the pictures, so the scans were likely recording current pain, not just pain from the past. “That may be why social pain is so painful: every time you remember it, you feel it all over again and that’s not true for physical pain,” he says.

He is reassured that the brain responses he recorded during physical pain were indeed reflecting a distinct pattern of processing from emotional or social pain because the signal was remarkably consistent. “You could take the signature developed on one group and apply it to another and make accurate predictions,” Wager says, “It was surprisingly generalizable.”

(MORE: Can You Hear Me Now? Training the Brain to Hear Better)

But he cautions that this doesn’t mean that lack of the signature suggests that a patient is faking. “This can’t be used as a pain lie detector,” he says, “If it doesn’t show up, [it may just mean] that people’s brains are wired differently.” Chronic pain, for example, could actually look very different from the acute pain studied here — some types clearly involve the activation of pain circuitry long after the initial source of the pain has been removed and this almost certainly includes emotional brain regions.

Additional research on far larger samples of different types of people with different types of pain are needed before these findings could be useful in the clinic. But the study suggests that brain patterns might be able to detect and diagnose different types of pain, particularly for people who cannot describe it, such as children, those who cannot speak or are unconscious. “It’s proof of principle and a bit more, an initial stage of development of a biomarker for physical pain,” says Tor. Whether a brain scan could ever distinguish between an addict faking physical pain (but, typically in real emotional pain) and a chronic pain patient who needs medication, however, remains to be seen.