Opinion

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Understanding the Brain in Chronic Pain

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ABSTRACT

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Chronic pain conditions cause among the highest levels of disability and lost work days of any class of disorders. The efficacy of current treatments has been disappointing. It has long been the hope of patients and pain clinicians that the pathophysiology of chronic pain would be better understood and lead to more effective treatments. A major step toward realizing those hopes has occurred with the identification of a brain circuit for pain. Despite longstanding controversy about the level of involvement of cortical structures in pain, we now know that there is a discreet network of cortical and subcortical structures that we recognize a pain network in the brain. The network is multilevel, involves somatosensory cortex as well as other areas, and serves as a substrate for human experience of pain [1-3].

Here are the major components of the brain network for pain, roughly in order of activation by experimental or clinical pain: thalamus, secondary Somatosensory Cortex (SII), insular cortex, anterior cingulate cortex, primary Somatosensory Cortex (SI), and ventromedial prefrontal cortex. It is at first surprising that one of the later areas activated is primary Somatosensory Cortex (SI), where most body sensation is based. This late activation, however, also underscores a fundamental feature of pain; that is, it is suffering as much or more than specific bodily sensation. The sequence of activation in the pain network first sounds an alarm that there is pain somewhere in the body and potential threat (SII), then increases body awareness (insula), next focuses attention on pain (anterior cingulate), then finally provides sensory features and location of pain (SI). The pain network in the brain therefore identifies a core feature of pain. Pain has an emotional quality, a level of suffering, not present in typical sensations that register in the post-central gyrus, where primary somatosensory cortex is found. Structures deeper than the post-central gyrus are in involved in the pain network as well as specific areas of prefrontal cortex. These deeper structures, namely insular and anterior cingulate cortex, are not only activated in pain, but also in body-focused anxiety and depression. Ventromedial prefrontal cortex is also activated in both painful and depressive states [4].

Pain is therefore an experience that affects one's cognitions, mood, body awareness, and sense of safety. Pain also represents potential danger to the individual. Where sensation may be an unpleasant bodily experience like an itch, pain is a threat to health, survival, and aspirations; that is, a threat to the self. It is not surprising, therefore, that rates of depression are high in patients struggling with chronic pain. Effective pain treatment must fortify a vulnerable sense of self as well as control intensity of physical discomfort. Effective treatment of chronic pain conditions (e.g., low back pain, migraine headaches, post herpetic neuralgia, fibromyalgia) will always require more than injections and medications because these treatments are rarely curative and pain is more than unpleasant sensation [5].

As long as pain is viewed as a discreet medical symptom only, treatments for chronic pain will continue to be inadequate. Beyond medications and interventional therapies, chronic pain treatment must also address fear of future pain and re-injury, identify and treat depression, restore a positive sense of self, train patients in meditation to gain distance from suffering, and help patients find engaging activities to replace pursuits (e.g., hiking, weight training, dancing, golf) that have become unrealistic in the context of their specific painful illness.

Demonstration of the brain pain network is a major accomplishment in clinical neuroscience that promises further advances in understanding the pathophysiology of chronic pain conditions and development of more effective treatments. The nature of the network also clarifies major neurological differences between pain and uncomfortable sensations. These differences make clear the imperative that whatever deeper understanding of central pathophysiology develops, treatment of difficult chronic pain conditions will always require attention to the emotional suffering experienced by these patients. The brain's pain network shows us that this suffering is inherent to the pain experience; indeed, it is wired into the pain circuit.

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