Merging clinical practice guidelines for chronic pain with insights from noninvasive neuroimaging

Next steps

Maureen Allen MD CCFP(EM)(PC) FCFP

All health care providers, regardless of their areas of interest, will see and evaluate clients experiencing pain. By far, most chronic pain cases are managed in primary care.[1] In an extensive review of the best available evidence, Korownyk et al acknowledged that "despite the prevalence of chronic pain and the subsequent search for effective therapies, an optimal approach in primary care management remains elusive."[2] Now what? Do we abandon ineffective therapies and develop new strategies, perhaps by incorporating data from noninvasive neuroimaging and fully embracing a biopsychosocial model of care? To do so, we need to integrate how the human brain generates, attenuates, and modulates chronic pain into our clinical approach. This article will explore recent advances in noninvasive neuroimaging and how clinicians can use this knowledge when applying clinical practice guidelines to advance individual-specific therapies that build confidence and resiliency for patients experiencing pain.

Chronic pain is generated by the brain

All pain, 100% of the time, is processed by the brain. The technology offered by noninvasive neuroimaging is giving researchers an objective view of the brain when it is experiencing pain and of the forces that contribute to the development and maintenance of persistent or centralized pain states.

Centralized pain can be attributed to the activation of the brain's "danger alarm system."[3] Using functional magnetic resonance imaging (fMRI), Hashmi and colleagues demonstrated a shift in brain representation from nociceptive circuity to emotional or central-based circuits, in particular those that processed negative emotions such as fear, anger, and sadness.[3] Once generated, the pain was reinforced by conditioning and fear-motivated reactions to pain. The brains of subjects became more pain-focused, with increased responsiveness in areas that processed anticipation and attention.[3] Similar changes could be found in the brains of individuals with clinical conditions such as agoraphobia, fear of flying, and kinesiophobia.[3]

What is noninvasive neuroimaging?

Noninvasive neuroimaging uses imaging techniques to evaluate brain function. There are 5 types of imaging tools available: positron emission tomography, near-infrared spectroscopy, magnetoencephalography, electroencephalography, and fMRI. In general, neuroimaging is based on the ability of the researcher to measure changes in neuronal activity by measuring alterations in either metabolism (blood flow, volume, oxygen, or glucose metabolism) or neurochemistry (neurotransmitter precursor uptake or receptor binding).[4] The most commonly used techniques rely on the fact that increased brain activity leads to increased energy metabolism and a disproportionate increase in regional cerebral blood flow.[4] Functional magnetic resonance imaging is the most commonly used imaging method in pain research.[4] In its primary form, fMRI uses blood oxygen level–dependent contrast imaging. This imaging technique is an extremely useful measure in acute and experimental pain cases in which the patient experiences short periods of pain followed by short periods that are pain free, which cause a rapidly changing hemodynamic response. For chronic pain conditions, an alternative fMRI technique utilizing arterial spin labeling is more appropriate.[4] Arterial spin labeling allows for improved quantification of regional cerebral blood flow, resulting in better estimation of ongoing blood flow. This technique has been used consistently in individuals with chronic migraine and chronic low back pain.[4]

Case study

Jennifer is a 47-year-old woman with chronic low back pain. She describes being active throughout her life despite pain. In the past year, her low back pain has prevented her from sticking to an activity plan. She has tried unsuccessfully to get 10,000 steps in daily with her tracker and has gained 20 pounds during the COVID-19 pandemic, which she feels is contributing to her ongoing pain. She describes retreating to her bedroom and spending hours "resting" her back.

Jennifer has 2 teenage sons. Both boys are supportive at home with chores but spend most of their time hanging out with friends. She has been separated from her partner, Kevin, for 3 years. He has remained an active participant in the boys' lives. Jennifer describes not wanting to go out with friends. She worries about catching COVID-19 and aggravating her back pain. In the past year, the intensity of her

low back pain increased without warning. At times she has "total body pain." Jennifer worries that she is causing damage when she is exercising and is fearful of worsening pain and disability. She also describes feelings of loneliness and guilt at not being more involved in her sons' lives.

Before Jennifer's office visit, you review recent laboratory and diagnostic imaging findings. During the visit, you listen to Jennifer's pain story and examine her carefully, looking for new pathology or progression of a pre-existing condition. You determine that the increasing pain she is experiencing is associated with nociplastic or chronic pain. You explain to her that experiences such as fear, uncertainty, and loneliness can increase the danger signal in her pain system, causing it to become more sensitized and reactive.[5] You encourage Jennifer to talk about fears related to movement and how they affect her pain.

You develop an activity strategy with Jennifer through a lens of safety exploring different types of activities. Jennifer loves being in the water. She has agreed to join a walking program in her community pool. She agrees to put away her step counter for now and wear a life jacket when she is in the water. She also agrees not to attach conditions or goals that are weight-based to her activity. Her focus will be on the joy and pleasure of movement.

You also begin the process of helping Jennifer to think differently about her chronic pain and to differentiate her chronic pain (nociplastic) from structural triggers (low-level soreness or achiness from engaging weak or asymmetric muscle groups) and acute pain (nociceptive).[6] Sending messages of safety and reassurance when she is experiencing chronic pain and structural triggers can help desensitize or "dial down" her pain intensity. Although continuing with her activity when she feels pain from structural triggers might feel unnatural to Jennifer, it is an important first step in her pain recovery journey.[7] In a follow-up visit, Jennifer tells you that she has been getting to the local pool 3 times a week and has begun to make new friends. She recognizes that she has a long way to go in her recovery but feels more hopeful about her future and her ability to manage her chronic pain with your support.

Conclusion

The antidote to fear is safety. Promoting therapies for centralized pain that are individual-specific begins with the question, "How safe does the therapy or activity feel to my body?" Recent guidelines recognize the importance of physical activity. Meeting individuals where they are in their pain journeys with curiosity and compassion is the best place to start.

Dr Maureen Allen is a family physician in Antigonish, NS, and Assistant Professor in the Departments of Emergency Medicine and Family Medicine in the Faculty of Medicine at Dalhousie University in Halifax, NS.

Competing interests
None declared

Correspondence
Dr Maureen Allen; e-mail **jimandmoe@eastlink.ca**

References

1. Morlion B, Coluzzi F, Aldington D, Kocot-Kepska M, Pergolizzi J, Mangas AC, et. al. Pain chronification: what should a non-pain medicine specialist know? *Curr Med Res Opin* 2018;34(7):1169-78. Epub 2018 Apr 12.
2. Korownyk CS, Montgomery L, Young J, Moore S, Singer AG, MacDougall P, et al. PEER simplified chronic pain guideline. Management of chronic low back, osteoarthritic, and neuropathic pain in primary care. *Can Fam Physician* 2022;68:179-90 (Eng), e63-76 (Fr).
3. Hashmi JA, Baliki MN, Huang L, Baria AT, Torbey S, Hermann KM, et al. Shape shifting pain: chronification of back pain shifts brain representation from nociceptive to emotional circuits. *Brain* 2013;136(Pt 9):2751-68.
4. Morton DL, Sandhu JS, Jones AK. Brain imaging of pain: state of the art. *J Pain Res* 2016;9:613-24.
5. Greco JA, Liberzon I. Neuroimaging of fear-associated learning. *Neuropsychopharmacology* 2016;41(1):320-34. Epub 2015 Aug 21.
6. Campbell F, Hudspith M, Anderson M, Choinière M, El-Gabalawy H, Laliberté J, et al. Section 1: the nature of pain and its impacts on Canadians. In: *Chronic pain in Canada: laying a foundation for action. Report by the Canadian Pain Task Force, June 2019*. Ottawa, ON: Health Canada; 2019. p. 7-11. Available from: **https://www.canada.ca/content/dam/hc-sc/documents/corporate/about-health-canada/public-engagement/external-advisory-bodies/canadian-pain-task-force/report-2019/canadian-pain-task-force-June-2019-report-en.pdf**. Accessed 2023 Mar 8.
7. Lumley MA, Schubiner H. Psychological therapy for centralized pain: an integrative assessment and treatment model. *Psychosom Med* 2019;81(2):114-24.

This article is eligible for Mainpro+ certified Self-Learning credits. To earn credits, go to **https://www.cfp.ca** and click on the Mainpro+ link.
This article has been peer reviewed.
Can Fam Physician 2023;69:158-9. DOI: 10.46747/cfp.6903158
Cet article se trouve aussi en français à la **page 162**.

Scan to listen to the podcast with Drs Fraser and Allen.

SCAN TO PLAY