Key Points

1. It is known that chronic pain alters the neurons in the spine
2. Researchers wanted to find out if chronic pain also affected the brain
3. Used MRI's to compare the volume and density of gray matter in the brain's of 26 people with chronic back pain to 26 healthy controls
4. Using two different techniques, found that on average, the volume of gray matter was 5%-11% smaller in the pain patients than the volunteers
5. This volume reduction corresponds to 10-20 years of normal aging
6. Also found a decrease in the density of gray matter - in specific regions of the brain - among the pain group
7. Among those with neuropathic pain, the results were related to pain duration
8. Although not proven in the study, researchers believe these results indicate that chronic pain - especially neuropathic pain - causes atrophy in parts of the brain

Definitions

atrophy - wasting away

axon - thin connection which carries signals between neurons

chronic - long lasting

control - in an experiment, a group - usually healthy - used as a basis for comparison

gray matter - part of the brain composed primarily of neuron bodies, as opposed to white matter

morphology - the study of the structure and form of something as opposed to it's function

neocortex - large portion of the brain thought to be responsible for higher order functions

Chronic Pain Is Hard On The Brain

Chronic pain prematurely ages the brain. That was the most significant - and disturbing - finding of a group of researchers from Northwestern University. Scientists have known for some time that chronic pain alters neurons in the spine, but Dr. Apkarian, a neuroscience researcher, and his colleagues wanted to know if and how chronic pain effected the structure of the brain.

In order to study this, Dr. Apkarian and his team used MRI's to measure the volume and density of the brains of 26 people with chronic back pain (CBP) and compared them to the brains of 26 healthy volunteers. They published their results in the November 17, 2004 issue of the Journal of Neuroscience.

Each of the 26 members of the pain group had experienced unrelenting pain for more than a year in their lower back. In some, the pain radiated down into the legs, in others it didn't. In addition to the brain MRI's the CBP subjects reported their pain intensity and how long they had been in pain. To aid in the analysis, members of the pain group were also classified as having neuropathic pain - due to nerve damage - or non-neuropathic pain. The 26 volunteers that composed the control group were recruited to match the age and gender makeup of the CBP group as closely as possible.

The researchers used two different techniques to measure the volume of the neocortical gray matter (the part of the brain responsible for most higher order functions) from the MRI's. They found that overall, the subjects in the pain group had 5%-11% less gray matter volume than the control subjects, a statistically significant finding. People normally lose about 0.5% of their gray matter each year as they age, so this result translates to the pain patients experiencing 10-20 years of aging compared to the control group.

In looking at neuropathic versus non-neuropathic pain, the team found that in the neuropathic pain group, the volume loss was related to pain duration. In fact, in the neuropathic group, each year of pain equated to a 0.2% loss in gray matter ($1.3cm^3$). In the non-neuropathic group, pain duration was not related to volume loss.

The neuropathic pain group also fared worse when the team measured the density of the gray matter in specific regions of the brain. In the prefrontal cortex - responsible for high level functions - they found that people in neuropathic pain had gray matter that was 27% less dense than the control group, and people with non-neuropathic pain had gray matter that was 14% less dense. They also found that the thalamus - a region of the brain which relays pain and other sensations - was significantly less dense in the pain group as compared to the control group.

Although this study can not prove it conclusively, the authors believe the results mean that the chronic back pain is causing brain tissue to atrophy in certain areas. If proven to be true, this would mean that chronic pain not only alters the neurons of the spine, but has a structural effect all the way to the brain as well. While it is a significant finding, it is also important to keep in mind that this study looked at chronic back pain specifically and the results may be different for other types of chronic pain.

Still, with millions of people in the US alone suffering from chronic pain, and with neuropathic pain an all too common problem for CM/SM patients, this area of research is definitely worth paying attention to..

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neocortical - relating to the neocortex

neuron - a nerve cell

neuropathic pain - pain which is due to damage to the nervous system

prefrontal cortex - region at the front of the brain thought to be responsible for planning and other high-level thought processes

sciatic nerve - nerve which originates in the lower back and serves the legs

thalamus - part of the brain, located near the brain stem, which acts as a relay to send sensory information (like pain) to other parts of the brain

white matter - part of the brain which contains primarily axons