Key Points

1. It is not known how the brain constructs the experience of pain
2. Some studies have shown that pain related brain areas can be activated without any physical stimulus
3. Study examined whether non-physical pain seemed as real as physically induced pain
4. 14 subjects underwent both hypnotically induced pain and laser induced pain while being scanned with a fMRI; subjects then rated pain intensity, unpleasantness, and whether the pain seemed real
5. There were no significant differences between how subjects rated the intensity and unpleasantness of the hypnotic and laser pains
6. However, on average, the laser pain was rated as more real than the hypnotic pain
7. The brain scans showed that both types of pain activated pain circuitry
8. However, only laser pain activation strength correlated with the reality scores of pain
9. The hypnotic pain also activated brain regions associated with emotional processing and source monitoring

Definitions

activation strength - during fMRI, a numerical measure of how active a specific brain region is

correlation - a statistical relationship between two variables or measures; if two measures are highly correlated when one changes by a set amount, the other will also change by a set amount; for example there is a correlation between height and weight of people

fMRI (functional magnetic resonance imaging) - imaging technology which shows the

Is There A Difference Between Real And Imagined Pain?

One of the major differences between Western medicine and the Eastern approach to medicine (such as Traditional Chinese Medicine) is that Western medicine separates the mind from the body. In the West, a patient may have a real problem (with their body) or an imagined one (in their mind). Eastern medicine tends to not make this distinction, if a patient says they have a headache, they have a headache no matter the source.

While the difference between these approaches may seem philosophical in nature, the reality is that many Chiari patients have run head on (pun intended) into the mind-body split which dominates Western medical training and thought. Far too many people have been told the problem is in their head, the pain is not real, they're exaggerating, etc.

Given this, and the well known fact that psychological variables affect the perception of pain, it is tempting to say the Eastern approach is better; however, is it correct? Is there a difference between physical and psychological pain? Can the brain create pain in the absence of a physical stimulus? These seem like impossible questions to answer, but recently, with the use of a scanning technique known as functional MRI (fMRI), scientists are beginning to peer inside the brain and identify what happens when a person perceives pain.

fMRI is a type of MRI which can show how much blood is flowing in different regions of the brain during specific tasks. The assumption is that blood flow equates to activity. In this way scientists have begun to map out what brain regions are responsible for activities such as memory and the processing of sensory information. In the past few years, functional MRI has become extremely popular and is evolving into a standard research tool for the neuroscience community.

Recently, researchers using fMRI have demonstrated that pain related areas of the brain can be activated without any physical stimulation whatsoever (they used hypnosis). While this result is very intriguing, by itself it is not sufficient to say there is no difference between a real pinprick and the brain imagining a pinprick. In order to function, the human brain has developed sophisticated mechanisms to differentiate between events in the outside world and thoughts which exist only in the mind. Also, it is not yet known how the brain constructs the actual subjective experience - or reality - of pain. So while psychologically induced pain activates pain regions in the brain, can a person still tell the difference between this type of pain and physically induced pain?

Tuukka Raij, with the Brain Research Unit and the Advanced Magnetic Imaging Center of the Helsinki University of Technology, along with several colleagues, set out to answer this question by using fMRI to compare the responses of people to hypnotically induced pain versus pain caused by a laser. They published their findings in the February 8, 2005 issue of the Proceedings of the National Academy of the Sciences.

Raij and his co-researchers selected 14 healthy subjects (11 women and 3 men) out of a pool of 103 volunteers, based on their response to a Hypnotic Susceptibility Scale and how they responded to pain suggestions.

Each subject was placed into an fMRI machine for a series of sessions (see Table 1). In the first session, the subjects were placed into a relaxed, hypnotic state. Next, pain was induced with the following suggestion, "Sensations in the back of your left hand start to become painful, more and more painful. The unpleasant experience of pain gets stronger and stronger, and, when it reaches the limit you can tolerate, it will not increase any further but will stay stable until I tell you the pain will disappear." The subjects were given a way to signal when they couldn't tolerate the pain anymore and also when the pain was gone. They underwent a cycle of increasing pain, maximum pain, decreasing pain, and rest.

In the second session (right after the first), the subjects remained in a hypnotic state, but the pain was induced by applying a laser to the back of their hand. No hypnotic suggestions were given, and again the painful period cycled with a rest period.

In the final session, which occurred at a different time, the laser was again used to induce pain, however the subjects were awake and not in a hypnotic state. After the sessions, each person was asked to rate on a simple scale (0-100) the pain intensity, unpleasantness, and reality of each session.

The researchers found that on average there was no difference in how the subjects rated the pain intensity of the hypnotic pain and the laser pain. The same was true for the unpleasantness scale. However, there was a difference in how they rated the reality of each. All 14 subjects reported the laser pain as being more real than the hypnotically induced pain (note, the results for each laser session were essentially identical).

A similar pattern emerged when the results of the fMRI were analyzed. The Helsinki team found - as had previous researchers - that both types of pain, hypnotic and laser, activated well known pain circuitry in the brain.

amount of blood flow to specific regions of the brain during tasks; the amount of blood flow is believed to be related to how active a certain brain region is

hypnosis - a technique where a person is placed into a very relaxed, trancelike state in which they are very open to suggestions

laser - Light Amplification by Stimulated Emission of Radiation; a device which produces a very focused beam of light; can be used as a pain stimulus

statistically significant - refers to a result, from a study, which is unlikely to be due to chance (usually less than 5% probability)

pain stimulus - something which causes pain, such as a prick or a laser

subjective reality of pain (SRP) - how a person experiences pain

Source

Raij TT, Numminen J, Narvanen S, Hiltunen J, Hari R. Brain correlates of subjective reality of physically and psychologically induced pain. Proc Natl Acad Sci U S A. 2005 Feb 8;102(6):2147-51. Epub 2005 Jan 31.

In addition, the level of activation, known as the activation strength, correlated with the reported pain intensity levels.

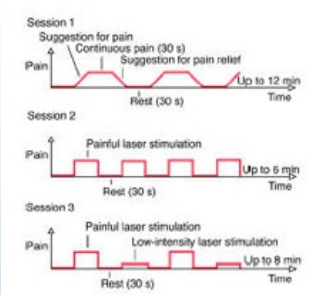
However, when it came to correlating the fMRI scans with the reported reality levels, the results differed between the laser pain and the hypnotic pain. For the laser induced pain, the activation strength (the amount of activity) of the pain circuitry in the brain was related to the reported reality scores. Interestingly, this correlation was not true for the hypnotic pain session. There was no correlation between the above mentioned pain circuitry and the reported reality scores of the psychologically induced pain. There was, however, a correlation between different brain regions and the hypnotically induced pain reality scores. It turns out that the hypnotic pain activated brain regions that weren't activated by the laser pain. These brain regions are thought to be involved with emotional processing and possibly source monitoring (meaning where something is coming from).

While the authors do not speculate much on their findings it would seem that while both physical and psychological pain produce a similar response, the conscious self may still experience them in different ways. This differentiation may have to do with portions of the brain which are capable of monitoring where information is coming from (source monitoring) and then influencing how things are perceived accordingly.

If the ability to source monitor is in fact related to the perception of pain, one then has to wonder how the subjective reality of pain is different for people with different levels of this capability. Can someone who is weak in this area actually distinguish between real and imagined pain?

The implications of this work for the Eastern-Western philosophy debate cited in the beginning of this article are not clear. In some ways it would seem to support the Western argument, yet in others the Eastern. Maybe in the end science will be able to unravel this mystery, or maybe it is just a question of philosophy after all.

Table 1
Timeline Of Events For Testing Sessions Inside fMRI



Note: During Session 1 pain was induced by hypnotic suggestion; During Session 2, subjects remained under hypnosis and pain was induced with a laser; During Session 3 subjects were not under hypnosis and pain was induced with a laser.

Table 2
Average Subject Ratings of Pain Intensity, Unpleasantness, and Reality For Hypnotic and Laser Induced Pain (0-100)

	Hypnosis	Laser	Significant?
Intensity	57	65	N
Unpleasant	51	58	N
Reality	62	87	Y

Note: Significant refers to whether the difference between the average score for the hypnotic pain and laser pain is statistically significant; meaning not likely to be due to chance