Key Points

1. Syringomyelia patients often suffer from central neuropathic pain which is difficult to treat
2. The mechanisms underlying central pain are poorly understood
3. Study used quantitative sensory testing to see if there was a difference in sensory deficits between syringomyelia patients with central pain and those without
4. Found no significant difference between the pain and no pain groups, however found significant differences within the neuropathic pain group
5. Specifically, both the magnitude and extent of thermal deficits were less severe in patients with evoked pain (allodynia) compared with patients with spontaneous pain
6. In the spontaneous pain patients, there was a direct relationship between the intensity of the burning pain and the extent of thermal deficits
7. There were also differences in the thermal deficits depending on the type of allodynia (cold, brush)
8. fMRI during evoked pain in the allodynia patients revealed distinct patterns of brain activity
9. Central neuropathic pain due to syringomyelia is a complex entity and may involve several distinct mechanisms

Definitions

allodynia - pain in response to something that is not normally painful, such as a brushing stroke, cold, or pressure

central pain - pain associated with damage to the central nervous system (the brain and spinal cord)

dermatome - an area of skin which is mapped to, and supplied

Why Do Some People With SM Develop Neuropathic Pain?

February 20, 2006 -- If syringomyelia has an overarching characteristic, it would have to be pain. Some people suggest that up to 90% of syringomyelia patients suffer from one or more types of pain. Headaches, musculoskeletal pain, non-descript pain, and neuropathic pain are all too familiar to the syringomyelia community.

Since pain is inherently subjective, it may seem difficult to compare types of pain; however, within the pain spectrum, neuropathic pain is particularly troublesome. Neuropathic pain is due to actual damage to the nervous system. When this damage is in the central nervous system - meaning the brain and spine - it is referred to as central pain (or central neuropathic pain).

Central pain can be spontaneous or evoked. Spontaneous means that pain, often a burning pain, is felt in response to nothing,. Evoked pain, also called allodynia, happens when something that is not normally painful, such as cold, or a brushing touch, causes pain. What makes neuropathic pain so difficult, whether it is spontaneous or evoked, is that it is not well understood and can be very difficult to treat.

It has been noted that people with central pain almost always have thermal sensory deficits in the painful area, meaning they can not sense temperature on their skin in a specific location very well. This has led some people to focus on what is called the spinothalamic tract as a mechanism for central pain. This tract carries sensory information from the spine to the thalamus, which is a kind of relay station in the brain. Another interpretation of this holds that with central pain, the brain's integration of pain and temperature becomes disrupted.

Since syringomyelia almost always damages the spinothalamic tract, and often causes central pain, Dr. Denis Ducreux from the Kremlin-Bicetre Hospital in France and colleagues decided to study central pain in syringomyelia patients. Specifically, they wanted to compare the sensory deficits of syringomyelia patients with central pain to those without. They recently published their findings in the on-line version of the journal Brain, in January, 2006.

The research team recruited 46 syringomyelia patients from a neurosurgery department and a pain clinic. Of these, 27 had Chiari related SM, 15 had trauma related SM, and 4 patients had SM due to other causes. The patients were given pain surveys to characterize their pain and underwent quantitative sensory testing to evaluate their sensory deficits.

The sensory tests used mechanical and thermal stimulations to assess the extent, magnitude, and symmetry of any deficits. The scientists devised a simple scoring method to measure the extent of deficits, whereby they counted the number of dermatomes affected (a dermatome is a region of the skin which is supplied by a single nerve root). The magnitude of the deficits were established by recording the thresholds of sensation. In other words at what cold or hot temperature, or at what pressure, could someone feel the stimulation. Symmetry was assessed by comparing the number of affected dermatomes on each side of the body. Finally, response to painful stimulus was also measured by applying pressure and temperature known to be in the painful range and having the patients record their pain on a scale of 0-100.

For the purposes of this study, central neuropathic pain was defined as pain in an area of sensory deficit directly related to the location of a spinal cord injury. Using this definition, 31 of the 46 SM patients suffered from central pain (see Table 1, Table 2), most often in the arms/shoulders and sometimes in the neck, trunk area, and legs. Eleven patients reported spontaneous pain, meaning pain without stimulation, and twenty patients reported a combination of spontaneous and evoked pain (allodynia). Interestingly, 24 out of the 31 patients had been previously treated with antidepressants or antiepileptics without success.

When the researchers compared the patients with central pain to the patients without central pain, they found no significant differences in the extent or magnitude of their sensory deficits. The authors interpret this finding to mean that damage to the spinothalamic tract may be necessary to cause central pain, but it is not sufficient. In other words, not everyone with this type of damage will develop central pain.

Although there were no real differences between the pain and no pain group, they did find, however, significant differences within the pain group. Specifically, there were major differences between those suffering from only spontaneous pain and those with both spontaneous and evoked pain. On average, the group with evoked pain had significantly less sensory deficits, in terms of magnitude and extent, than the spontaneous pain group. In addition, for 82% of the spontaneous group, the deficits were only on one side of their body. This was the case in only 55% of the evoked pain group, and 27% of the no central pain group.

The researchers also found that for the spontaneous pain group, there was a direct relationship between the

by, a single nerve root

fMRI - functional magnetic resonance imaging; type of MRI which can show patterns of brain activity by recording the amount of blood which flows to different brain regions during an activity

mechanical - in terms of sensory testing/deficits, refers to touch and movement

neuropathic pain - pain due to nerve damage

spinothalamic - refers to a signaling tract from the spine to the thalamus in the brain, also called the pain tract

thalamus - part of the brain which acts as a relay station by processing sensory information and sending it to other parts of the brain

thermal - having to do with temperature

cerebellar tonsils - portion of the cerebellum located at the bottom, so named because of their shape

cerebellum - part of the brain located at the bottom of the skull, near the opening to the spinal area; important for muscle control, movement, and balance

cerebrospinal fluid (CSF) - clear liquid in the brain and spinal cord, acts as a shock absorber

Chiari malformation I - condition where the cerebellar tonsils are displaced out of the skull area into the spinal area, causing compression of brain tissue and disruption of CSF flow

decompression surgery - general term used for any of several surgical techniques employed to create more space around a Chiari malformation and to relieve compression

syringomyelia (SM) - neurological condition where a fluid filled cyst forms in the spinal cord

syrinx - fluid filled cyst in the spinal cord

Source

Ducreux D, Attal N, Parker F, Bouhassira D. Mechanisms of central neuropathic pain: a combined psychophysical and fMRI study in syringomyelia. Brain.

extent of thermal deficits and the intensity of the burning pain they felt. This relationship did not exist for the evoked pain group.

Finally, they even found differences within the evoked pain, or allodynia, group, depending on the type of stimulation that was painful. The thermal deficits of people who found cold to be painful were less severe than people who found brush strokes to be painful. The research team decided to explore this difference further by using functional MRI (fMRI) to study the pain responses of people with cold allodynia versus brush evoked allodynia.

Functional MRI is a type of MRI which can show patterns of brain activation by measuring the blood flow in different brain regions. The team compared the brain responses to painful stimulation (painful to them, but not to healthy people) of 6 people with cold allodynia and 6 people with brush allodynia. They found, like the sensory data indicated, distinctly different patterns of brain activity between the two groups. They also noted that these patterns did not always involve what are considered to be the pain regions of the brain.

Given their results, the authors believe that central neuropathic pain due to SM is a complex entity, and it is likely that several distinct mechanisms are at work. If this is true, it highlights the importance for physicians to thoroughly evaluate central pain in patients, because different symptoms may respond to different treatments.

Table 1
Characteristics Of Neuropathic Pain Patients (31 Total)

Average Pain Duration (Yrs)	10.4
Average Pain Rating (0-100)	56
Avg. Maximum Pain Rating (0-100)	76
Avg.Number of Dermatomes Involved	5.8

Table 2
Description of Neuropathic Pain (31 Patients)

Descriptor	# of Patients	% of Patients
Burning	23	74
Pressure, squeezing	14	45
Electric shocks, stabbing	19	63
Tingling, pins & needles	24	77
Brush allodynia	12	39
Cold allodynia	11	35
Pressure allodynia	7	22

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