Phantom pain

Possible development of phantom pain [1, 2]

A

Control circuits of the brain no longer intact

5 **Brain reorganises itself:**

Neighbouring regions trigger perceptions in the amputated body part

Neuropathic pain in the amputated body part

4

Signals to muscles have no proper destination

Sensory impulses to the brain are absent

2 **Spinal cord** becomes hypersensitive due to increased pain impulses

3 New pain is constantly generated by **sympathetic nervous system activity**

1 Severed nerve fibres are **over-repaired** (formation of neuromas)

Spontaneous pain impulses

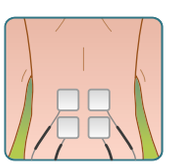
Treatment [2, 3]

B

Calcitonin infusions or nasal spray in acute phantom pain

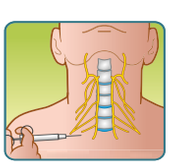
Co-analgesics (antidepressants, anticonvulsants)

Opioids in combination with co-analgesics in very severe pain



TENS (transcutaneous electrical nerve stimulation)

Mirror therapy



Sympathetic blocks in the early phase

Phantom pain

A Possible development of phantom pain [1, 2]

The details of how phantom pain develops have not yet been clarified. The mechanisms described appear to play a significant role.

(1) The body wants to repair the severed nerves, but often over-compensates. **Neuromas** (benign clumps of nerve tissue) may develop that are hyperactive, over-react and are sensitive to pressure. These give rise to functionless **spontaneous pain impulses** that are perceived as shooting neuropathic pain.

(2) The central nervous system becomes hypersensitive as a result of the constant bombardment with pain impulses. This is known as **central sensitisation.** The nerves also change in structure: for example, through new ion channels being created. Pain-conducting nerve fibres induce pain signals in non-conducting fibres (ephapses). Such spontaneous activities may cause spasms.

Pain is consequently perceived more strongly than normal. The pain qualities observed (e.g. burning, shooting, stabbing) differ widely.

(3) The damage or injury to pain fibres may lead to "short circuits" between the pain-conducting nerve fibres and fibres of the sympathetic nervous system. It is suspected that the sympathetic nerves grow onto the pain-conducting fibres.

This means that pain develops as soon as the sympathetic nervous system becomes active (e.g. during stress). The sympathetic nervous system therefore continuously maintains the neuropathic pain. Because of the persistent pain impulses, neuropathic pain tends to become chronic.

(4) As a result of amputation the corresponding sensory impulses are absent, and signals to the remote muscles have no proper destination. **The corresponding control circuits in the brain** (which generate signals for muscle contraction and receive feedback on the result) **are no longer intact.**

(5) In order to solve this problem, the brain reorganises the corresponding allocations in the regions of the brain. This leads to regions of the brain that are then adjacent being able to trigger perceptions in the amputated part of the body. **"Conflicts" in the allocations may possibly trigger pain.**

B Treatment [2, 3, 4]

Specific treatment guidelines for phantom limb pain are yet to evolve.

Calcitonin generally leads to effective pain relief in phantom pain. The mechanism of action has not been clarified.

Co-analgesics (antidepressants and anticonvulsants) combat the neuropathic pain by supporting the body's own inhibition of pain.

TENS (transcutaneous electrical nerve stimulation) can raise the pain threshold as a counter-irritation technique.

Mirror therapy is a highly effective technique for pain relief and relaxation. The optical illusion of two healthy body parts is produced by a mirror and various exercises are performed using this set-up. Mirror therapy is intended to correct errors in the reorganisation of the brain.

Sympathetic blocks are used to block sympathetic nervous system activity and thereby break the vicious circle of sympathetically maintained pain. This technique is used quite rarely, and then only in the early phase of phantom pain.

If these techniques are not sufficiently effective, **opioid painkillers combined with co-analgesics** can be used in very severe pain.

[1] Flor H. Lancet Neurol (2002) 1: 182-189.

[2] Chahine L, Kanazi G. Middle East J Anesthesiol (2007) 19(2): 345- 355.

[3] Subedi B, Grossberg GT. Pain Res Treat (2011) doi:10.1155/2011/864605.

[4] Cohen S. J Pain (2011) 12(8): 859- 867.