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Phantom limb pain

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Abstract

Phantom limb pain is pain that is perceived in a part of the body which is no longer present. It is estimated that 80 percent of amputees experience phantom limb pain. Although the term is “phantom limb pain” the feeling is often more of a burning, twisting, itching, or pressure sensation than pain. The exact mechanism of phantom limb pain is unknown although proposed mechanisms include pain origination from either the central nervous system or the peripheral nervous system. Since the exact mechanism of phantom limb pain is unknown, treating this pain may be difficult. Treatments include pharmacological and non-pharmacological. Pharmacological treatments include NSAIDs, opioids, anti-convulsants, beta-blockers, and calcium channel blockers. Non-pharmacological treatments include mirror therapy, cognitive behavioral therapy, acupuncture, guided imagery, massage, and biofeedback. Amputees experiencing phantom limb pain typically have the best outcome with a multi-disciplinary approach that includes both pharmacological and non-pharmacological management.

Keywords: Pain, limb pain, phantom pain

Introduction

Phantom limb pain is perceived pain in a part of the body that is no longer present. Phantom limb pain is differentiated from stump pain in that stump pain is pain in the region of the body which is still present (1). Phantom limb pain may feel like a burning, twisting, itching or pressure (2). Phantom limb pain is believed to occur in nearly 80 percent of the amputee population worldwide (2). One study estimated that in the United States in 2005 there were about 1.6 million people with limb loss and the number is projected to increase to 3.6 million by the year 2050 (3). Trauma, vascular problems, cancer, and congenital limb deficiency are some of the common causes of limb loss (1). The conflict in Iraq and Afghanistan has contributed to a recent increase in the number of

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traumatic amputations (4). People that experience phantom limb pain may be reluctant to communicate their pain to others due to fear of being considered “crazy” (2). However, the earlier the pains are reported; the sooner treatment can be started (2).

There have been several factors that have been found, among those with absence of a limb, to be associated with increased risk for phantom limb pain. These factors include female sex, upper extremity amputation, presence of pre-amputation pain, residual pain in remaining limb, and time after amputation (1). There appears to be two peak periods of onset of phantom limb pain. The first peak is within a month of amputation (5). The second peak is a year after amputation (5). It is likely that emotional triggers such as stress, anxiety, and depression contribute to the experience of phantom limb pain (1).

Mechanism

Phantom limb pain was initially believed to be largely a psychiatric illness (1). Interestingly, phantom limb pain was first described by a sixteenth century French military surgeon named Ambrose Pare (1510-1590) (6). Silas Weir Mitchell (1829-1914), a Civil War surgeon came up with the phrase “phantom limb pain” (7). Overall, phantom limb pain continues to be a poorly understood and difficult to treat condition.

There are several proposed mechanisms for phantom limb pain. The pain is thought to be caused by mixed signals from the brain, spinal cord, or peripheral nerves (1, 2). According to the proposed peripheral mechanism, there is massive tissue and neuronal injury during amputation (8). After the amputation, the neurons undergo a process called deafferentation. This means that the proximal portion of the severed nerve sprouts and forms neuromas (8). As a result of the neuromas, the nerves are hyper-excitable and have spontaneous discharges causing stump as well as phantom limb pain (8, 9). However, this does not explain why people with congenital absence of the limbs experience phantom limb pain (4, 8).

There are several proposed mechanisms to explain phantom limb pain that are based on the central nervous system. There may be changes at the level of the spinal cord. There may be neurons that are

not responsible for pain transmission that sprout into portion of the spinal cord which is involved in pain afferent (i.e., towards the brain) signals (8, 9). The most commonly proposed mechanism to explain phantom limb pain is cortical reorganization. The cortex is part of the brain. Phantom limb pain is evidence that the limb is still represented in the brain (10). When the brain experiences pain and disability states, the brain can change quickly in the area of the body it represents (10). These parts of the brain may lose some clarity, may spread and take over surrounding areas, or may get smaller (10). The brain likely does this as a defense from the trauma (10). The brain may be trying to spread the pain or get rid of it (10). The brain may change more and more the longer a problem persists (10). Multiple imaging studies have found that the extent of cortical reorganization has been found to be directly correlated with the intensity of phantom limb pain (4, 11).

There are often triggers associated with phantom limb pain (2). Triggers may include touch, urination, defecation, sexual intercourse, angina, cigarette smoking, changes in barometric pressure, herpes zoster, and exposure to cold (2). As mentioned previously, triggers may also be emotional and include stress, anxiety, and depression (1).

Treatment

Treatment of phantom limb pain has been found to be most successful when a multidisciplinary approach is taken (1, 2). Therapies include both pharmacological and non-pharmacological. Medications that are used to treat phantom limb pain include pre-emptive analgesia and anesthesia, acetaminophen, NSAIDs, opioids, antidepressants, anticonvulsants, muscle relaxants, calcitonin, NMDA receptor antagonists, beta blockers and calcium channel blockers (1). None of these medications are curative, but may be used to manage symptoms. As with non-pharmacological approaches, treatment must be individualized and theoretical benefits must outweigh the risks.

Non-pharmacological treatments for phantom limb pain include transcutaneous electrical nerve stimulation (TENS), mirror therapy, massage, biofeedback, ultrasound, sensory discrimination training, cognitive behavioral pain management,

virtual reality therapy, surgical intervention, and electroconvulsive therapy (1). Mirror therapy is used to re-integrate the visual-proprioceptive dissociation that occurs in the brain following the absence of a limb (12). Mirror therapy cannot be undergone in patients with bilateral amputations. During mirror therapy, the patient places the mirror to visualize the reflection of the intact limb in place of the absent limb. This is thought to activate the mirror neurons in the brain which may block pain perception in the phantom limb (1). One version of mirror therapy, also referred to as mirror visual feedback (MVF) uses a mirror to visibly shrink the phantom limb, also caused phantom limb pain to “shrink” (13). Studies regarding the efficacy of mirror therapy have had mixed results.

Biofeedback, integrative and behavioral methods has also been useful for some patients with phantom limb pain. Guided imagery, relaxation techniques, and hypnosis have all been used, again with varying success (11, 14). It should be noted, however, that these studies have focused on neuropathic pain as opposed phantom limb pain in particular. While studies have found cognitive behavioral therapy to have inconclusive effectiveness, acupuncture has shown to be effective for the treatment of neuropathic pain syndromes (15-18).

Surgical intervention is an option that is usually reserved for patient’s failure of other treatment methods. One case report suggests that severing the lesioning the dorsal zone entry zone has been effective for treatment of upper limb phantom pain that resulted from brachial plexus avulsions (19). There have also been case reports of deep brain stimulation of the periventricular gray matter and somatosensory thalamus leading to improvement in phantom limb pain (20).

Conclusion

In conclusion, phantom limb pain is common among amputees. There remains much to be learned about the mechanism of phantom limb pain. Once there is a unifying theory, specific mechanism-based treatment plans can be developed (1). Currently, treatment plans are primarily based on treatment for neuropathic pain. However, patients with phantom limb pain may benefit from understanding the prevalence of those

who suffer from the pain, trigger recognition and management (as much as possible), and also from a multidisciplinary team approach which incorporates pharmacological as well as non-pharmacological treatment options.

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