

Acupuncture for Pain Management

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Acupuncture, an ancient form of medicine that originated in China several thousand years ago, has been used by Canadian physicians since the 1970s. Research on the neurophysiology of acupuncture analgesia supports the theory that it is mediated primarily via the selective release in the central nervous system of neuropeptides. Evidence of its anti-inflammatory effects is emerging. Meta-analyses of randomized controlled trials provide evidence for acupuncture's effectiveness in treating back pain, neck pain, and osteoarthritis. Applications of electroacupuncture using transcutaneous electrical nerve stimulation can provide good pain relief via home treatment and make management of cancer pain using acupuncture knowledge realistic.

Key words: acupuncture, pain, TENS, endorphin, anti-inflammation

Introduction

Acupuncture has probably been used in Canada since the first Chinese immigrants arrived in the 19th century. However, most Canadians had not heard of this ancient oriental medicine until U.S. President Richard Nixon made his famous trip to China in 1972. James Reston of the *New York Times* had an emergency appendectomy on that trip and apparently developed paralytic ileus. Instead of passing a nasogastric tube, the Chinese physician inserted a needle (probably in his leg); Reston passed his gas, and the rest is history. Soon photographs and films were seen around the world of awake individuals undergoing surgery in apparent comfort with only acupuncture needles to prevent pain. Within 4 years, research conducted at the University of Toronto in the laboratory of Professor Bruce Pomeranz began the long process toward acceptance of this ancient medical treatment in the West.¹

Neurophysiology of Acupuncture Analgesia

By 1987, through a series of animal experiments conducted by his team and others, Pomeranz had developed a theory of acupuncture analgesia using electroacupuncture (EA) that begins with needle activation of A delta and C afferent fibres in muscle sending signals to the spinal cord, where dynorphin and enkephalins are released (see Figure 1). The afferent pathways continue to the mid-brain, triggering excitatory and inhibitory mediators in the spinal cord. The ensuing release of neurotransmitters serotonin and norepinephrine onto the spinal cord leads to pain transmission being inhibited both pre- and postsynaptically in the spinothalamic tract. Finally, these signals reach the hypothalamus and pituitary, triggering the release of adrenocorticotrophic hormones and beta-endorphin. These effects are dependent on the rate of stimulation: low-frequency stimulation at 4 Hz releases enkephalin and beta-endorphin, and high-frequency stimulation at 100 Hz releases serotonin and norepinephrine.^{2,3}

Pomeranz's theory has been confirmed and refined by experiments in his laboratory and by other investigators.^{4,5} In recent years, basic research has included positron emission tomography, single-photon emission computed tomography, and functional magnetic resonance imaging studies to observe the effects on the brain of acupuncture needling. The effects are widespread and open to interpretation, but there is evidence that the limbic system plays a significant role in acupuncture-induced analgesia. A study comparing true and sham EA at a single acupuncture point used for analgesia showed that both activated central pain pathway regions but only true EA activated the primary somatosensory cortex, the motor cortex, and the hypothalamus while deactivating the rostral segment of the anterior cingulate cortex. This implies that EA stimulation modulates the hypothalamus-limbic system.⁶⁻⁹

Safety

Acupuncture needles are designed to be atraumatic, to slip through tissues. The tip is sharp but rounded, with no cutting edge that can slice tissue, and the needle's fineness of calibre (a commonly used size is 0.25 mm or 31 gauge) makes it difficult to puncture some tissues (Figure 2).

When considering acupuncture as a potential treatment, there is no contraindication based on risk if the therapist knows the anatomy and a clean needle technique is used (using single-use needles). An analysis by White of 12 prospective studies that surveyed more than a million treatments showed the estimated risk of a serious adverse event with acupuncture to be 0.05 per 10,000 treatments, and 0.55 per 10,000 individual patients.¹⁰ However, while the risk is low, there have been cases of pneumothorax. Additionally, in spite of sterile single-use needles being the norm, there were cases in Toronto in 2002 of transmission of *Mycobacterium abscessus* via reusable acupuncture needles.¹¹ The most common adverse effects are occasional bruising, very minor bleeding (particularly among individuals taking acetylsalicylic acid), syncope, and temporary exacerbation of symptoms.

Contraindications to Acupuncture Treatment

There are no absolute contraindications to acupuncture needling alone. Relative contraindications may include extreme frailty and concurrent febrile illness. Local skin infection or breakdown dictates that points in the area of skin involvement not be used.

There is a traditional contraindication to using acupuncture in the first trimester of pregnancy and certain points to be avoided thereafter. Some of the forbidden points are anatomically related to the uterus, and some are powerful autonomic switches, so caution is reasonable.

However, the commonly cited contraindication or precaution about the risk of needling individuals taking anticoagulants has not proven to be a realistic one, in our experience. A large number of patients with spinal cord injuries (SCI) have been treated with acupuncture in Canada for over 15 years with no adverse effects, a high percentage of whom are taking warfarin and a smaller but significant number of whom are taking heparin.

The most problematic contraindication is the presence of a cardiac pacemaker when electrical stimulation on needles is indicated. Although modern pacemakers may not be affected by EA, most practitioners and patients would not choose to test the theory.

Clinical Indications

The clinical indications for acupuncture are extensive, including internal medicine conditions, neurological dysfunctions, mood disorders, addictions, and urological problems such as urinary incontinence. However, the best-known indication for acupuncture is the management of pain.

Musculoskeletal Aches and Pains

Before using acupuncture to treat musculoskeletal aches and pains, screening for hypovitaminosis D should be done. Chronic nonspecific musculoskeletal pain is linked to low levels of 25-OH-vitamin D₃.^{12,13} The level that reduces fracture risk is now generally accepted as 75 nmol/L (30 ng/mL),^{8,14} and the optimal range is

considered by some experts to be 130–170 nmol/L (52–68 ng/mL), the level that the body maintains when most vitamin D comes from sun exposure.¹⁵

Muscle weakness, often a concomitant finding when 25-OH-vitamin D₃ is very low (<30 nmol/L), can itself be a cause of nonspecific low back pain,¹⁶ particularly among older adults; this may respond well to adequate supplementation with vitamin D₃. Monitoring of 25-OH-vitamin D₃ after 3 months' supplementation with 2,000 IU of vitamin D₃ taken daily with food containing a little fat to enhance absorption assists in dose adjustment and is safe.¹⁷

Myofascial Pain

Myofascial pain is common and is often confused with other causes of pain.¹⁸ It arises from hyperirritable loci within taut bands of skeletal muscle referred to as *trigger points*. When a muscle is injured, rather than healing in response to injury, it may *learn* to avoid pain. Developing protective habits that restrict movement and prevent the muscle from stretching to its full length may avoid pain in the short term but can result in muscular pain, stiffness, and dysfunction that can persist for years. The precipitating event may, for example, be a simple slip and near fall causing a sudden contraction of the gluteus minimus.¹⁹ Pain thereafter that refers to the buttock and down the ipsilateral leg may persist and confound the diagnosis.²⁰ That this is myofascial pain rather than true sciatica is suggested when the patient moves around without pain and does not have pain on straight leg raising. Tender trigger points are palpable in the gluteus minimus on examination.

This type of pain can be treated with acupuncture aimed at releasing the tightness either by inserting an acupuncture needle at a point that is adjacent to the peripheral nerve that supplies the muscle (the superior gluteal nerve for the gluteus minimus) or by dry-needling trigger points directly with an acupuncture needle, usually giving quick relief that is cumulative with several treatments. There is some evidence that the latter technique may produce better outcomes than traditional acupuncture approaches.²¹

Back and Neck Pain

Chronic back and neck pain are among the most common complaints of those who seek acupuncture treatment. A high percentage of individuals respond to acupuncture treatment for both conditions, usually beginning within the first few treatments. Whether there is complete resolution of symptoms depends on the underlying cause, whether there is the opportunity to treat the person enough times, and the extent to which one integrates acupuncture treatment with nutritional and lifestyle changes, exercise, good physiotherapy, attention to perpetuating factors, and ergonomic adjustments. Key nutritional issues include hypovitaminosis D and magnesium deficiency, which may actually be an imbalance of the calcium-magnesium ratio in favour of calcium, leading to tight muscles and the perpetuation of myofascial pain. Magnesium depletion may cause neuromuscular symptoms, one of which is chronic pain.²²

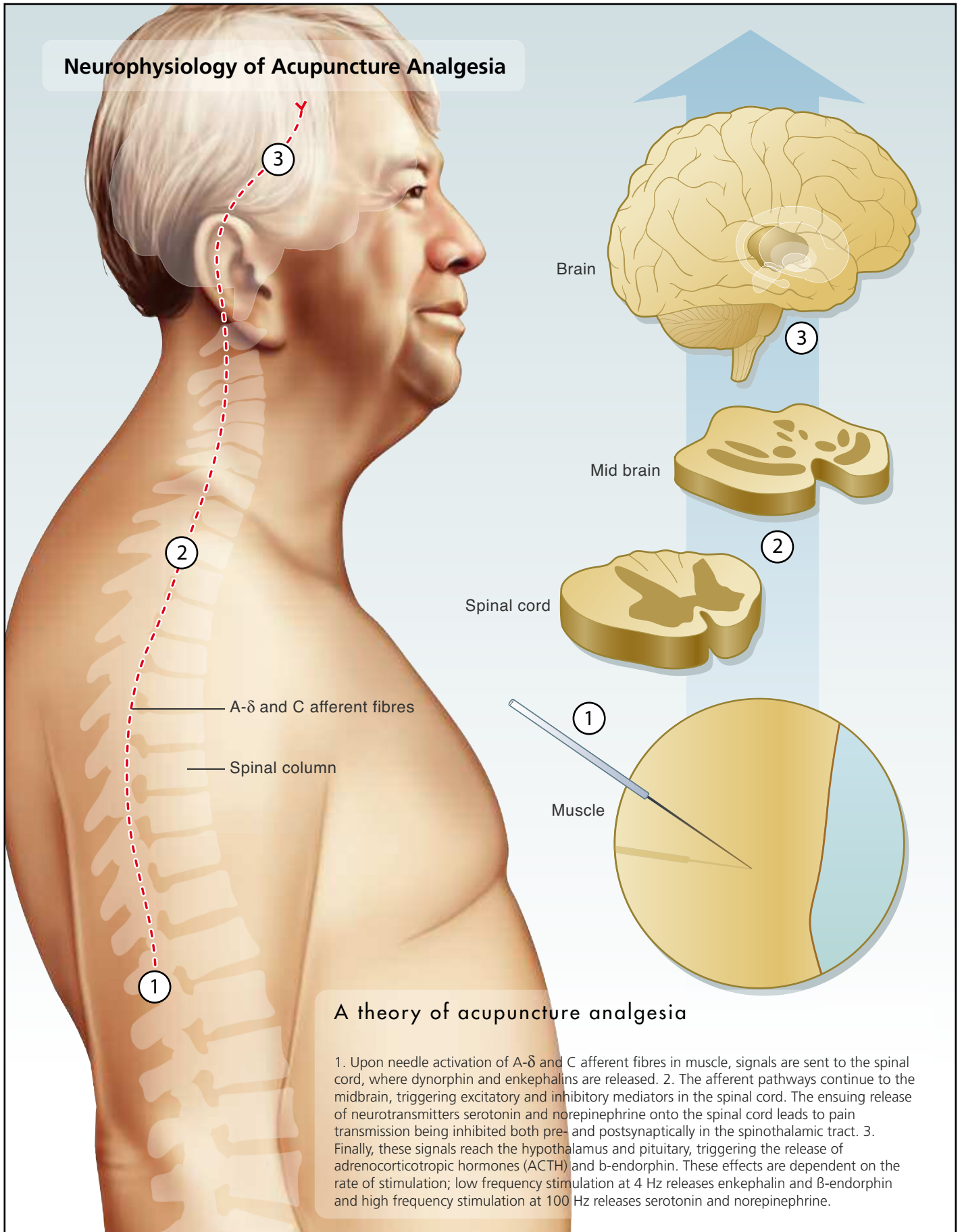
There is evidence from meta-analyses of randomized controlled trials (RCTs) to support the fact that acupuncture relieves chronic low back^{23,24} and neck²⁵ pain.

Osteoarthritis

Acupuncture has anti-inflammatory effects in addition to analgesic effects; the autonomic nervous system may be involved.^{26,27} Treating a swollen arthritic knee joint usually results in decreased swelling and increased range of motion, not just pain relief, providing objective evidence that inflammation has been reduced.²⁸

Osteoarthritis of the knee responded well to acupuncture under the rigour of a randomized placebo-controlled trial.²⁹ Berman *et al.*'s landmark 2004 study included 570 subjects in a three-arm study that involved real acupuncture (n = 190), sham acupuncture (n = 191), and an education-attention control (n = 189). Both acupuncture groups, true and sham, received 25 treatments over 6 months, starting with twice-weekly treatments. Primary outcome measurements were the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain and function scores. There was a 40% decrease from baseline in the WOMAC pain score (−3.6 units) for the

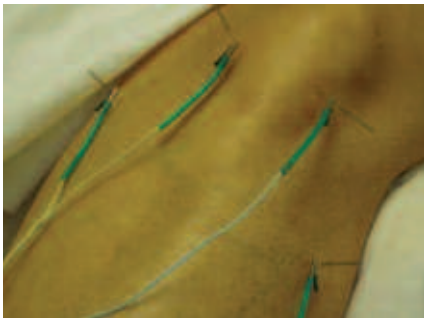
Neurophysiology of Acupuncture Analgesia



A theory of acupuncture analgesia

1. Upon needle activation of A- δ and C afferent fibres in muscle, signals are sent to the spinal cord, where dynorphin and enkephalins are released. 2. The afferent pathways continue to the midbrain, triggering excitatory and inhibitory mediators in the spinal cord. The ensuing release of neurotransmitters serotonin and norepinephrine onto the spinal cord leads to pain transmission being inhibited both pre- and postsynaptically in the spinothalamic tract. 3. Finally, these signals reach the hypothalamus and pituitary, triggering the release of adrenocorticotrophic hormones (ACTH) and β -endorphin. These effects are dependent on the rate of stimulation; low frequency stimulation at 4 Hz releases enkephalin and β -endorphin and high frequency stimulation at 100 Hz releases serotonin and norepinephrine.

Figure 2: Acupuncture Needles in Place



Source: Courtesy of Dr. Linda Rapson.

true acupuncture group compared with -2.7 for the sham group ($p = .02$) by week 14. These differences remained at 26 weeks ($p = .003$). By week 14, improvement in function in the true acupuncture group had changed more than 12 units, indicating an almost 40% improvement from baseline. The differences between the true and sham groups were significant at weeks 8 ($p = .01$), 14 ($p = .04$), and 26 ($p = .009$). There were no adverse effects attributable to either true or sham acupuncture.

Osteoarthritis of the hip responds well to acupuncture in a significant percentage of cases, but evidence for its effectiveness based on RCTs, while encouraging, does not yet include a placebo study.³⁰

Neuropathic Pain

Acupuncture is used for neuropathic pain of various etiologies. An area in which it shows promise is below-level generalized burning pain following spinal cord injury. An acupuncture protocol developed at Toronto Rehabilitation Institute Lyndhurst Centre (TRI-LC) in 1992 is known as the Lyndhurst Centre Central Neuropathic Pain Acupuncture Protocol (LCCNPAP). This protocol involves three needles inserted into the scalp along the midline at points on the occiput and near the vertex, and one between the eyebrows. This protocol evolved at TRI-LC from a treatment for burning pain learned from Chinese surgeons visiting from the China Rehabilitation Research Center in Beijing. In a retrospective case series in which the LCCNPAP was the first acupuncture

intervention used for burning below-level pain, 24 of 36 individuals responded, 18 of them after the first treatment.³¹

This acupuncture protocol can be used for neuropathic pain such as postherpetic neuralgia, postnerve injury pain, burning mouth syndrome, and perineal burning pain. It dramatically relieved severe neuropathic pain due to a spinal metastasis in a U.K. hospice patient and managed his pain for several months prior to his death.

While there are no published studies, our personal experience is that diabetic neuropathy responds less reliably to acupuncture than do other types of neuropathic pain. The neuropathy associated with medications for human immunodeficiency virus that we saw in the early days of antiretroviral drugs, such as stavudine and didanosine, in contrast, has responded reliably to acupuncture.

Cancer Pain

Acupuncture can play a role in the management of cancer pain and symptoms both related to the condition itself and caused by treatment.^{32,33} A comprehensive document, *Guidelines for Providing Acupuncture Treatment for Cancer Patients—a Peer-Reviewed Sample Policy Document*,³⁴ prepared by Dr. J. Filshie, Royal Marsden Hospital, and Dr. J. Hester, Kings College Hospital, in London, U.K., is available free from the National Health Service at www.library.nhs.uk/cam/ViewResource.aspx?resID=260469.

Since the early 1990s, chemotherapy-induced nausea and vomiting have been treated with acupuncture, and several controlled studies made this application of acupuncture one of the first indications accepted by the U.S. Food and Drug Administration, in 1997. Ezzo reviewed 11 trials on acupuncture for chemotherapy-induced nausea and vomiting ($N = 1,247$) and pooled the results for the *Cochrane Database of Systematic Reviews*.³⁵ All trials used concomitant pharmacological antiemetics, and all except the EA trials used state-of-the-art antiemetics. Overall, acupuncture-point stimulation by all methods combined reduced the incidence of acute vomiting (relative risk [RR] = 0.82; 95% confidence interval [CI] 0.69–0.99; $p =$

.04) but not acute or delayed nausea severity. Stimulation with needles reduced the proportion of acute vomiting (RR = 0.74; 95% CI 0.58–0.94; $p = .01$) but not acute nausea severity. EA reduced the proportion of acute vomiting (RR = 0.76; 95% CI 0.60–0.97; $p = .02$), but manual acupuncture did not. Note that the EA group did not receive state-of-the-art antiemetics, which makes the outcome more significant.

Transcutaneous electrical nerve stimulation (TENS) uses electrode pads on the skin over acupuncture points and can block pain when high-frequency electrical stimulation (100 Hz) is employed. This technique, when used with the knowledge of both acupuncture and anatomy, can control a variety of pains, from rib fracture to metastasis. One electrode can be applied on the skin over the anterior primary ramus of the intercostal nerve of the affected rib (four fingers' breadth from the spinous process, measured across the proximal interphalangeal PIP joints) and a second electrode applied one segment proximal to it. These points correspond to acupuncture points that are on the Urinary Bladder meridian outer line of points. The inner line of points, two fingers' breadth from the midline, correspond to the posterior primary rami of the spinal segmental nerves and are used for pain related to the spine.

Pain management during the course of progressive cancer can be managed with a sophisticated, high-technology form of TENS called Codetron. This Canadian invention has been used to treat individuals with cancer since 1985. The parameters of its electrical stimulation are based on the neurophysiology of EA and deliver current to six electrode pads at random to overcome habituation of higher centres to a repetitive signal. Putting such a device in the hands of patients, provided that they and their caregivers are well trained in its use and acupoints are wisely chosen, can provide both pain relief and a sense of control over the pain.

Regulation of Acupuncture Practitioners

At the present time, there are only three Canadian provinces in which acupuncture is regulated: British Columbia, Alberta, and

Key Points

Neurophysiology of acupuncture analgesia involves the release of neuropeptides including enkephalins, dynorphin, β -endorphin, and endomorphin.

There is clinical and experimental evidence that acupuncture has anti-inflammatory effects.


Acupuncture is safe; the risk of serious adverse events is estimated at 0.05 per 10,000 treatments.

Meta-analyses of randomized controlled trials show acupuncture works for neck pain, low back pain, and osteoarthritis of the knee.

Lower-level evidence supports the efficacy of acupuncture for neuropathic pain including cancer pain.

Quebec. Regulation of acupuncturists under a new regulatory body, the College of Traditional Chinese Medicine Practitioners and Acupuncturists of Ontario, is pending in Ontario. Unfortunately, there is no easy way to assess the training and fitness to practice of acupuncturists in unregulated provinces. In Canada, acupuncture is accepted in most provinces and territories as being within the scope of practice of appropriately trained physicians, dentists, physiotherapists, chiropractors, registered nurses, and naturopathic doctors, who are accountable to their respective regulatory bodies.

Conclusion

Acupuncture has a sound physiological basis and is safe and effective for the management of musculoskeletal, inflammatory, and neuropathic pain. Knowledge of acupuncture can make self-treatment with TENS devices a useful tool for pain management, including cancer pain. 

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