

Complementary and Alternative Pain Therapy in the Emergency Department

James N. Dillard, MD, DC, CAc, FAAPM&R^{a,b},
Sharon Knapp, MS, FNP, NP-C^{c,*}

^a*Columbia University College of Physicians and Surgeons, 630 West 168th Street,
New York, NY 10032, USA*

^b*Rosenthal Center for Complementary and Alternative Medicine, 630 West 168th Street,
New York, NY 10032, USA*

^c*Oregon Health and Sciences University, 3181 S.W. Sam Jackson Park Road,
Mail Code CDW-EM, Portland, OR 97239-2984, USA*

Comprehensive care of patients with pain and the complexities in treating it requires understanding the physiologic dynamics of pain, pharmacologic methods for treatment, as well as other measures available for treatment outside of the emergency department that may be part of the patients self-care and belief system. A brief review of the pathophysiology of pain pathways, a review of pain management principles, and a review of complementary and alternative medicine (CAM) therapies used will be discussed. Using CAM strategies with conventional treatments is becoming increasingly popular among patients. Understanding all treatment modalities will allow the practitioners to better meet the needs of their patients and be aware of potential interactions, which may complicate their medical management in the emergency department.

Management of pain in the emergency department is a seemingly simple task, but one that reportedly has been done poorly [1–3]. Very few medical schools have acute pain control as part of a core curriculum. With little formal training it may be assumed that pain control is not a priority. Extensive teaching is not necessarily the answer, but some focused teaching and increased awareness may be what is needed to improve pain management [4]. Pain has a predictable presence in patients, but the management of pain is often a single modality of therapy. Traditionally, a one-shot [sic] approach to pain is the approach in the emergency

* Corresponding author.

E-mail address: knappsh@ohsu.edu (S. Knapp).

department. This amounts to intravenous, intramuscular, or oral narcotics as the method of choice for most pain and injection of anesthetic agents for local or regional pain as prevention.

The Joint Commission on Accreditation of Hospitals Organizations mandates evaluation, treatment, and assessment of effectiveness of pain treatment. As of 2001, pain assessment has become the fifth vital sign (<http://www.jcaho.org/>, accessed 1/25/03). With this mandate, treating pain has become a priority of health care providers. It is estimated that as many as 75 million Americans live with chronic pain, and 22% of patients in primary care report poorly controlled pain [5,6]. Pain is a costly national problem in lost workdays, hospitalization, physical therapy, disability, and pharmaceutical cost, as well as litigation costs surrounding pain. Chronic pain accounts for 21% of all emergency room visits, and causes 25% of days lost in the workplace [6]. It is the third most common health care problem, behind heart disease and cancer, but disables more individuals than heart disease and cancer put together.

Studies indicate that, on average, only 57% of a patient's pain is relieved with the best prescribing practices (Steven Passik, PhD, presentation at APS meeting, March 2002, Baltimore). This remaining 43% then is open to improvement in prescribing or in the absence of a clear surgical or other invasive option, and presents an opportunity for the application of nonpharmacologic and complementary therapies to provide additional relief.

There are a number of key factors to be mindful of in pain management. Pain intensity and quality are important to understanding underlying pathophysiology. Pain syndromes are associated with distinct etiologies, and have prognostic and therapeutic implications. Our understanding of pain has recently moved forward with our increased knowledge of pain neuromodulators and the discovery of neurobiologic processes of pain.

Pathophysiology of pain

Two major types of pain exist: nociceptive and neuropathic. Nociceptors are free afferent nerve fibers that distinguish noxious from innocuous stimuli. These are located in the skin, subcutaneous tissue, and visceral and somatic structures.

Somatic nociceptive pain arises from bone, joint, muscle, skin, or connective tissue. Direct trauma to tissues is the typical cause of this type of pain. Visceral pain arises from visceral organs like the gastrointestinal tract or pancreas. Visceral nociceptive pain may arise from the organ or capsule or from obstruction of a hollow viscus causing intermittent, poorly localized pain. Somatic nociceptive pain is described as sharp, aching, throbbing, pressure, or vise like. Visceral nociceptive pain is often described as gnawing or cramping, or if due to obstruction of a hollow viscus, may be described as

aching, sharp, or throbbing. This is the pain often associated with appendicitis, cholecystitis, or pleurisy.

There are a number of important neuromodulator substances that act on peripheral and central receptors. Peripheral receptor activation begins with injury and the release of inflammatory substances such as mast cells, macrophages and lymphocytes, bradykinin, and histamine. There is also neurogenic activation that occurs with the inflammatory response. These substances sensitize the nociceptor, during early tissue injury. This response to injury results in the release of pro-inflammatory mediators producing vasodilation and extravasation of plasma proteins in the arachidonic acid metabolic pathway, prostaglandin, leukotriene, and other inflammatory substances such as potassium, serotonin, and substance P. These either serve to sensitize or excite primary afferent nerves or trigger vasodilation in response to the injury. Such tissue damage also results in peripheral site release of local endogenous opioids [7].

Moving from tissue injury toward the central nervous system additional neuromodulators exist that play a role in pain. Those acting on receptors in the dorsal horn include opioid (mu, kappa, and delta), alpha adrenergic, gamma-aminobutyric acid (GABA), serotonin, and adenosine, neurokinin, N-methyl-D-aspartate (NMDA), and non-NMDA receptors such as alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA). The periaqueductal gray of the midbrain is involved in central mediation of pain. This area contains both opiate or endorphin receptors and significant levels of endorphins. Receptors are located at presynaptic and postsynaptic nociceptive afferent nerves. Afferent stimulation results in the release of substance P, glutamate, and calcitonin gene-related peptide. Glutamate acts on AMPA receptors, substance P on neurokinin receptors. The activation of non-NMDA receptors appears to play a role in the development of abnormal responses to chronic pain and the altered response to stimuli. Because of these distinctions it is recommended that pain be described in terms of its physiologic as well as pathophysiologic responses [7].

Neuropathic pain can be centrally or peripherally generated. It is usually defined as pain persisting at least 3 months. Centrally generated pain may be the result of deafferentation or sympathetic stimulation, the kind of pain arising from phantom limb pain, stroke, or spinal cord injuries. Peripheral pain may occur along the distribution of many peripheral nerves or can be associated with a known peripheral nerve injury from trauma or disease such as you would see in herpetic neuralgia. Neuropathic pain is often described as burning, tingling, or lancinating. Pain can also have associated symptoms related to the affected nerves. Also, neuropathic pain may persist even though there is absence of ongoing disease. It is important to understand these associations to not only aid in diagnostic evaluation, but to effect treatment of the cause of the pain and the pain itself.

The chronic nature of neuropathic pain is a pathophysiologic response to disease or injury. Unlike nociceptive pain, neuropathic pain is not initiated

through activation of nociceptors, but is related to reduced inhibition, and thus is not always responsive to narcotics. The development of neuropathic pain continues to be an area of study. There is evidence to suggest that sensitization and cellular hyperexcitability or “wind-up” of nociceptive stimuli contributes to the development of neuropathic pain. This carries import to the practitioner. Preemptive use of narcotics may help to prevent sensitization and development of allodynia from a painful event or surgery. The use of local anesthetics, narcotics, and nonsteroidal anti-inflammatory drugs (NSAIDS) have reports of decreasing the need for postprocedure pain medication, and may benefit patients in preventing chronic pain [7].

Pharmaceutical preparations used to treat pain are many. There are three groups of drugs commonly used to treat pain. (1) Nonopioids that includes Acetaminophen and NSAIDS, (2) opioids that include those that are mu agonists and the agonists-antagonists, and (3) adjuvant drugs that includes antidepressants, anesthetics, anticonvulsants, muscle relaxants, alpha-adrenergic agonists, NMDA blockers, neuroleptics, and corticosteroids. Some of these have side effects, dose-tolerance effects, routes of administration considerations, and onset of analgesia and analgesic ceilings to be aware of. These medications offer relief for many, but not all. Those patients looking for additional relief may turn to complementary and alternative medicine for relief.

Complementary alternative medicine

Complementary and alternative medicine is defined as “those medical systems, professions, practices, interventions, modalities, therapies, applications, theories, or claims that are currently not a part of the dominant or conventional medical system” [8]. Many of these therapies may indirectly target neuromodulators and be beneficial as adjunctive treatments for pain.

CAM encompasses nonconventional approaches to healing, beyond traditional medicine. The National Center for Complementary and Alternative Medicine (NCCAM) is a component of the National Institute of Health, and is the Federal government’s proponent agency for scientific research on complementary and alternative health practices [9]. Many areas of research are now underway to examine efficacy and therapeutic benefit of some these nontraditional approaches to care. Understanding CAM and integrating its effective therapies add a multidisciplinary approach to care that meet the patients cultural and belief systems.

Patients turn to CAM for a many reasons. Many of the therapies are popular because they place an emphasis on harmony and balance of the mind, body, spirit, and external environment. Patients who choose alternative therapies are not necessarily dissatisfied with conventional medicine; rather, they may want more control and involvement in their care [10]. Many patients seen in the emergency department may be using one or

more of these CAM therapies as part of their health practices. It is important to have an understanding of these therapies, the potential benefits, limitations, and potential side effects while caring for your patients.

Complementary and alternative medicine are two different approaches: complementary medicine is any form of therapy used in combination with other alternative treatments or standard/conventional medicine. Complementary therapy usually serves to relieve symptoms and improve quality of life. It is often used to control side effects of conventional therapy.

The theoretical basis for many alternative therapies is derived from Eastern culture, tradition, and philosophy. Some practices are accepted into traditional care without much forethought or hesitation; others are scrutinized for lack of evidenced-based studies proving efficacy. For some of these therapies the benefit is derived from “hypothetical” modulation or reduction in afferent nociceptive input to higher brain centers or a theoretical release of natural endorphins [10].

Six general categories of alternative and complementary therapies have been outlined by NCCAM. These are: mind–body interventions, diet lifestyle modification, herbal remedies, manual healing, bioelectromagnetics (BEM), and pharmacologic–biologic treatments [9]. Some of the therapies included are familiar, and have gained mainstream acceptance. Diet and lifestyle modification are considered important in Healthy People 2010 guidelines. Transcutaneous electrical nerve stimulators (TENS) and acupuncture are well-known therapies. Hypnosis, biofeedback, and relaxation techniques are considered mind–body interventions and have been incorporated in psychiatric practice by many. Vitamin therapy has known preventive benefits for prevention and treatment of illness since the discovery of scurvy by early mariners, in the prevention of neural tube defects in prenatal care, and may play a role in heart disease. There are other additional therapies that exist that are cultural practices used by patients.

Traditional alternative medicine

Traditional alternative medicine has been practiced worldwide for centuries and includes acupuncture, Ayurveda, and Naturopathy, Chinese/Oriental medicine. Understanding the uses and limitations will help navigate through the waters of CAM.

Mind/body treatment approaches

Many types of mind/body treatment approaches are used to reduce pain. Precise mechanisms for pain reduction using these practices are not completely understood, but they may involve the activities of neurotransmitters, serotonin, and catecholamines that influence the mind’s perception of pain. Hypnosis, biofeedback, and relaxation techniques,

such as meditation and autogenic training, are the primary forms. In some cases, these methods have been found to be both beneficial and economical. Of all the alternative therapies used for pain relief, three techniques are the most widely accepted and are taught in medical schools, and these are available at many hospitals and outpatient clinics.

Numerous research studies support the benefits of mind/body treatment approaches. In 1995, a 35-member National Institute of Health panel was convened to determine the value of specific mind/body techniques for treating pain [11]. In particular, the panel found biofeedback to be effective in the treatment of tension headaches and other types of chronic pain, and hypnosis to be useful in adjunctive treatments for cancer pain, irritable bowel syndrome, temporomandibular joint syndrome, tension headaches, and chronic inflammatory disorders.

Systematic reviews of the literature indicate that mind/body interventions can be effective for health conditions that are caused or made worse by stress [12]. Relaxation techniques can be helpful for pain control [13]; and relaxation and visualization techniques may also be of benefit [14]. These simple techniques can be easily taught in the office or at the bedside, or used during diagnostic procedures in the emergency department, and may provide the pain relief, as well as an enhanced sense of self-efficacy in the setting of chronic pain. Patients using relaxation techniques for pain report improved sense of well-being and score higher on quality-of-life scales after receiving instruction in meditation, affirmation, imagery, and ritual [15].

A cost-effectiveness study in 1991 determined that cancer patients who participated in psychotherapy and relaxation therapies cut their costs and experienced pain reduction and decreased clinic visits by 36% when compared with patients not using these combined techniques [16]. Pediatric patients, and older patients, particularly with some cognitive impairment, may respond better to passive distractions for pain relief than active mind/body therapies, such as an engaging movie or familiar music. But generally, all forms of mind/body do have some benefit in attenuating pain [17].

Massage, body work, and postural therapies

Massage is found to be helpful both physically and emotionally. The rubbing not only soothes sore muscles but the mind as well. A review of six studies in 2004, evaluating massage and chiropractic, failed to demonstrate convincing evidence for prolonged pain relief [18]. Patients do report subjective benefit and relief from massage. The reason for the discrepancy may be emotional benefit. Massaging muscles and soft tissue stimulates nerves, increases blood flow, and relieves stress in the muscles. A number of different types of massage exist today:

- **Swedish Massage:** this massage technique involves the use of long, smooth strokes, strokes that knead and compress, deep circular movements, vibration, and tapping.

- Oriental Massage: this technique is very gentle and relaxes a person.
- Shiatsu: this Japanese form of massaging is actually a form of acupressure, exerting massaging pressure on certain key points of the body.
- Thai Massage: this massage technique also involves the use of Yoga and certain Chinese traditional medicine methods.

A small study done in 1989 by researchers in Norway measured concentration of plasma beta-endorphins after massage and found that levels increased 16% and remained elevated for approximately 1 hour [19]. This may lend support for the theories that postulate that massage helps control pain by increasing pain-reducing neurochemicals such as endorphins and serotonin in the brain and spinal cord. Variations of Swedish, deep-tissue, sports, and neuromuscular methods are frequently used.

Patients may also explore other types of massage or body work. Generally, body work is nonaerobic movement with controlled breathing that can be practiced to reduce stress and anxiety. Postural body work therapies teach patients how to realign their bodies, improve posture and movement, and reduce structural stress. Only a few controlled studies have been done on these techniques, and most of the reported benefits are subjective. There is moderate evidence of efficacy for mind–body therapies in the areas of hypertension and arthritis; however, more research is needed to determine the benefits in treating chronic back pain, sports injury-related pain, headaches, and joint pain [20].

Tai Chi, an ancient form of martial art based on Taoism, a Chinese belief system, is one form of body work. The practice of Tai Chi includes slow, graceful movements and rhythmic breathing. It is reported to have a beneficial role in pain reduction in patients with arthritis [21]. It is also reported to:

- decrease blood pressure,
- increase stamina, muscle tone, and flexibility,
- improve posture, balance, muscle mass, and strength in older people.

Yoga is an ancient posturing and breathing technique from India. Yoga means “union.” Yoga also uses slow movement, in addition to meditation and breathing exercises to reach a state of relaxation. Two limited studies of yoga of patients with osseous arthritis and carpal tunnel syndrome showed improvement in pain relief with the use of yoga. Yoga uses stretching and improves strength, so it theoretically should be beneficial for additional musculoskeletal problems [22]. Yoga is also reported to help:

- reduce stress
- reduce pain associated with some chronic illnesses
- eliminate headaches and insomnia.
- improve stamina for some athletes
- enhance quality of life for some cancer patients.

Chinese medicine

Traditional Chinese medicine is based upon descriptive metaphors for human bioenergetic properties that do not translate well or directly into the English terms used for them. Chinese medicine's basic concept is that a vital force of life surges through the body (also called Qi). Any imbalance to this life force can cause disease and illness. According to traditional Chinese medicine, pain is due to a conflict between blood and Qi, which in turn, results in stagnancy. Relieving this stagnancy, balancing the energy, nourishing the blood, and building up deficient blood are all ways that Chinese medicine treats pain. Traditional Chinese doctors use acupuncture techniques to correct the flow of Qi. They use herbal medicines to reestablish balanced Qi, blood, and moisture in organ networks, to avert excess wind, heat, cold, dryness, and dampness. Perhaps the most well-known Chinese therapy is acupuncture.

Acupuncture is the practice of puncturing the skin with needles at certain anatomic points in the body to relieve specific symptoms associated with many diseases. The anatomic points (acupuncture points) are thought to have certain electrical properties, which affect chemical neurotransmitters in the body.

Acupuncture is one of the oldest, most commonly used medical practices in the world. Originated in China more than 2500 years ago, acupuncture gained attention in this country in the 1970s, when China and the United States opened relations. The practice has been growing in popularity since. Studies support the use of acupuncture for the treatment of acute and chronic types of pain, including osteoarthritis, back pain, dysmenorrhea, and migraines [23]. In an effort to determine precisely how acupuncture works, researchers have isolated changes in the immune, neurochemical, and hormone functions, as well as in pain pathways following acupuncture treatment, but the exact mechanisms of action from a Western perspective remain elusive. Acupuncture may act as a pain preventative, theoretically, by acting on the sympathetic nervous system.

Acupuncture theories today are based on extensive laboratory research, and have become widely known and accepted. In addition, controlled studies have shown evidence of the effectiveness of acupuncture for certain conditions. Approximately 10,000 certified acupuncturists practice in the United States today. Not all certified acupuncturists are physicians, but currently, increasing numbers of certified acupuncturists are US physicians who have incorporated acupuncture into their medical practices.

Acupuncture has been shown to benefit cancer patients who are receiving a stable dose of analgesic. Patients reporting pain scores using a visual analog pain scale had observed reduction in pain intensity from auricular acupuncture [24]. Acupuncture has been shown to be effective in the treatment of facial, dental, and labor pain, knee osteoarthritis, and fibromyalgia [25–28]. Just like many therapies used, acupuncture has had

mixed reviews on the treatment of back pain, head ache, and neck pain [29–31].

Chinese herbs

Chinese herbs for pain treatment often have analgesic properties, some of which are extremely potent. In China, as here, herbal medicines are typically taken as teas, capsules, tablets, or extracts. But depending upon the type and severity of the pain, some preparations in China are given in hospitals intravenously or subcutaneously.

Corydalis yanhusuo, or corydalis tuber, is an example of a potent Chinese herb used for neuralgia, painful menstruation, and gastrointestinal spasm. Corydalis contains numerous potent alkaloids that inhibit activity in the brain stem associated with pain perception, and it has sedating properties: the powdered drug has a potency 1% that of opium. One of the predominant alkaloids responsible for these effects is tetrahydropalmatine, which has been isolated and tested on mice to determine its tranquilizing effects. It appears to inhibit postsynaptic dopaminergic receptors and simultaneously to increase the availability of *z*-aminobutyric acid receptors. These actions both reduce pain and relieve anxiety. Another corydalis alkaloid, dihydrocorydaline, was used in a clinical study to determine its effects in the treatment of dysmenorrhea. Dihydrocorydaline (50 mg) taken three times a day reduced menstrual pain in 32 of the 44 patients, to varying degrees. Exhaustion, headaches, and decreased menstrual flow were typical side effects [32].

Ayurveda

Ayurveda is a natural system of medicine that originated in India more than 3000 years ago. Ayurveda translates to “knowledge of life.” Based on the idea that disease is due to an imbalance or stress in the individual’s consciousness, Ayurveda encourages certain lifestyle interventions and natural therapies to regain a balance between the body, mind, and the environment.

Ayurveda treatment begins with an internal purification process, followed by a special diet, herbal remedies, massage therapy, yoga, and meditation. Studies have shown reductions in blood pressure, cholesterol, and reaction to stress in people who practiced Ayurvedic methods.

In India, Ayurveda is considered a form of medical care, equal to conventional Western and homeopathic medicine. Practitioners of Ayurveda in India undergo state-recognized, institutionalized training. However, Ayurvedic practitioners are not licensed in the United States.

Ayurveda can have positive effects when used as an alternative therapy in combination with standard/conventional medical care.

Ayurveda attributes pain syndromes to imbalances and stagnation in constitutional types, known as doshas. The three doshas are vata, kapha, and pitta. The location and type of pain are believed to be dependent on which of three constitutional types is aggravated or stagnant, which in turn, determines the treatment. Often, such treatment is herbal as well as dietary, and involves giving patient's botanical substances or foods that either stimulate or soothe the constitutional imbalance. These preparations are characterized as sweet, sour, salty, bitter, astringent, or pungent, and are often combinations of these types.

For example, vata, which is normally dry, cold, and light in quality, is balanced with substances that are wet, warm, and dark. In Ayurvedic practice, such substances are usually sweet. But in the case of obstructive vata, sweet substances are thought likely to exacerbate blockage, so these patients are given pungent herbs and foods to stimulate the movement of vata.

Triphala and trikatu are two Ayurvedic herbal standards that may be recommended by a practitioner to relieve blockages that cause pain. Trikatu is a blend of black pepper, ginger, and Indian pepper. The Indian pepper used in trikatu (long pepper; pippali) contains elements similar to capsaicin in cayenne pepper. It is used as a topical painkiller for arthritic conditions, and is thought to stimulate and then inhibit pain by destroying substance P. Constituents in ginger can block the cyclooxygenase pathway, preventing the formation of inflammatory prostaglandins [33]. One study done at the Miami Veterans Administration Medical Center and University of Miami found that highly concentrated extract of two ginger species had a beneficial effect on osteoarthritis of the knee [34].

Homeopathy

“Like cures like. Any substance which can produce a totality of symptoms in a healthy human being can cure that totality of symptoms in a sick human being.” — Samuel Hahneman (father of Homeopathic medicine).

The idea behind homeopathy is that if a large dosage of a certain substance produces certain symptoms, a small dosage of the same substance may cause the opposite effect. In other words, if a person suffers from throbbing headaches, he/she might be treated with a very diluted dosage of belladonna, a poisonous herb that causes throbbing headaches in high doses.

Classic homeopathy depends on the assessment of a patient's specific clinical pattern, and relies on individualized treatment strategy. Evidence for applications of homeopathic remedies exists for dental pain, sports injury, and some types of arthritis. Homeopathic remedies for pain may be taken either internally or externally. Homeopathic arnica ointment, for example, has long been recommended for sports-related injuries, such as sprains, with subjective benefit [35].

A double-blind, placebo-controlled crossover trial demonstrated that homeopathic *Rhus toxicodendron* reduced tender points by 25% in patients with fibromyalgia following 4 weeks of treatment [36]. However, another study of homeopathy and rheumatoid arthritis was negative for effect [37]. Like many treatments and therapies more study needs to be done to determine efficacy in measurable studies versus subjective reports.

Osteopathy and chiropractic

With use of manual manipulation of the spine, chiropractors believe they can improve a person's health without surgery or medication. They believe most illnesses are due to blockages along the nerve bundles in the spinal cord. Spinal manipulation as now performed has extraordinary heterogeneity, making it impossible to form sweeping conclusions about its efficacy [38]. A wide range of techniques is used, varying from extremely gentle contacts or mobilizations to very forceful manipulations. The most common and most studied form is referred to as high-velocity low-amplitude mobilization, where the slack is taken out of a spinal joint and a very rapid short thrust is applied to gap the joint. An audible click is often heard. These manipulations, using either osteopathic or chiropractic techniques, show considerable effectiveness for the treatment of various types of back pain. Research found that chiropractic is beneficial for acute back pain, but that the evidence to support its use in chronic back pain is insufficient [39].

The Agency for Health Care Policy and Research, a federal research and information agency organized in 1989, released its guidelines for the treatment of acute low back pain. The guidelines recommend spinal manipulation, either osteopathic or chiropractic, above more typical forms of physical therapy (including traction, diathermy, TENS, and ultrasound). Osteopathic and chiropractic treatments were found to have benefits that were equal to or superior to placebo. Although the specific physiologic effects of spinal manipulation are largely unknown, the The Agency for Health Care Policy and Research guidelines acknowledge that the methods used often meet with positive results [39].

Several positive meta-analyses and systematic reviews have been done on chiropractic manipulative therapy, but the final evidence of its efficacy remains dependent to some degree on the relative quality of the studies done [40–42]. Spinal manipulation remains immensely popular for back pain, and safety of the procedure is quite good [43].

Osteopathic treatment of acute low back pain has been supported by some positive findings in randomized controlled trials, although most recent studies tend to show little effect [44]. Due to its universal popularity, chiropractic care is sometimes considered the first line of alternative therapy for various types of pain, including fibromyalgia and neck and back pain. Many medical practitioners are now willing to send spinal pain patients for a trial of spinal manipulative therapy, although most would

limit the trial to no more than six to eight treatments before wanting to reassess the patient.

Nutritional and botanical dietary supplements

Calcium and magnesium are the two minerals most often recommended for supplementation in the treatment of pain syndromes. Calcium is recommended for conditions such as osteoarthritis, or more as a preventative or corrective supplement in treatment of osteoporosis than as a painkiller. Usual daily dosage is 1000 mg to 1500 mg [45].

Magnesium, a mineral required for musculoskeletal maintenance and health, is used as a tocolytic, and has long been valued in treating migraines. Because it relaxes skeletal and smooth muscles after they contract, magnesium is considered a relaxation-promoting mineral. The recommended daily allowance for magnesium is 320 mg per day for nonpregnant and lactating women, 360 mg per day for pregnant women, and 420 mg per day for men 31 years and older. Dosages up to 1000 mg magnesium a day appear to be safe in healthy women with no significant medical problems.

Current trends in supplemental treatment of pain conditions also include use of essential fatty acids—particularly gamma-linolenic acid (omega-6) and fish-derived eicosapentaenoic acid (omega-3)—and glucosamine sulfate. Essential fatty acids are the starting point from which the body makes both prostaglandins and leukotrienes. Omega-6 fatty acids convert to one- or two-series prostaglandins and to the substances similar to prostaglandin called leukotrienes. The one-series prostaglandins are considered beneficial. They appear to inhibit inflammation, lower cholesterol, and reduce blood pressure. However, the two-series prostaglandins, along with the leukotrienes, are associated with pain and inflammation. The reduction or alteration by essential fatty acids intake may help with the inflammation and pain resulting from the series-2 prostaglandin endpoints [46].

Omega-3 fatty acids, found in marine animal fats and some vegetable oils, are converted to three-series prostaglandins (generally anti-inflammatory in effect) and to a less noxious form of leukotriene. The combination of omega-3 and omega-6 oils may be especially beneficial, as the presence of omega-3 fatty acids tends to prevent the omega-6 oils from being converted to less favorable endpoints.

Fish oil and flax seed oil both provide omega-3 fatty acids. Fish oil is beneficial in the treatment of arthritis [47–49]. The benefits of flax seed oil are less clear because there are more interactions with other vegetable oils.

Glucosamine-sulfate has been shown to be more effective in reducing osteoarthritic pain than NSAIDs, shark cartilage, chondroitin sulfate, or placebo; some investigators feel glucosamine may have disease-modifying properties in osteoarthritis and actually slow the deterioration of joints characteristic of this condition [50,51]. Glucosamine typically takes 4 to

6 weeks to take effect [52]. At doses of 500 mg three times a day, glucosamine-sulfate is considered safe, although mild stomach discomfort and elevation of blood pressure due to salt content is sometimes reported.

Botanical medicine

Pain-reducing botanicals are typically spoken of in terms of their mechanisms of action or in terms of the actions in the same manner as pharmaceutical drugs. Phytochemists (plant chemists) are just beginning to develop an understanding of the mechanisms of action of the many botanical substances in use.

Long et al have reviewed herbal medicines for osteoarthritis, Ernst and Chrubasik have reviewed anti-inflammatory herbs, and Almeida and colleagues have summarized botanical products that have centrally acting analgesic properties [53–55]. Literally hundreds of plants have been found to have antinociceptive and anti-inflammatory properties, including those traditionally thought of for other medicinal purposes [56]. It remains to be seen which plant products will be born out for safety, efficacy, and tolerability in human clinical trials.

Devil's Claw has been studied, and is reported to benefit patients with knee, hip, and back pain with few adverse reactions [57–59]. White willow bark has been studied for pain relief with some success. This plant is a source of salicylate, and as such has the potential to initiate an anaphylactic response in patients with aspirin allergy [60]. Other painkilling herbs include cayenne, which can be taken either internally or rubbed onto painful arthritic joints, the active ingredient being capsaicin [61]. Ginko Biloba, an extract formula that is also gaining popularity as a possible deterrent to Alzheimer's disease and other types of dementia, has also been used for pain relief. One recent trial showed that a proprietary herbal formula, Reumalex, helped reduce chronic arthritis pain [62]. Ginko Biloba extracts have been proven to reduce leg pain associated with intermittent claudication [63]. The mechanism of action of Ginko Biloba is through inhibition of glycine and antagonism of GABA in neurologic tissue. In patients with seizures, this may lower their seizure threshold and precipitate seizures in an otherwise well-controlled epileptic [64,65]. It is these kinds of actions and interactions practitioners must be mindful in when having discussions with patients.

In general, herbal treatments for pain are used topically or internally. One useful topical agent, cajeput oil, is usually administered in combination with other oils, such as peppermint, clove, menthol, eucalyptus, St. John's wort, cayenne, or arnica oil. Cajeput has been shown to relieve musculoskeletal pain, headache, hemorrhoid pain, neuralgia, rheumatic pain, and pain resulting from sports injuries.

With multiple drug prescriptions the provider is always mindful of interactions. The same holds true for patients taking multiple herbal

treatments for their self-diagnosed or naturopathically managed conditions. St. John's wort is well known to induce Cytochrome P-450, and now evidence exists that it induces both CYP3A4-catalyzed sulfoxidation and CYP2C19-dependent hydroxylation. For patients treating their depression and pain with these multiple herbal preparations that have gastroesophageal reflux disease and take omeprazole, they may be making their gastroesophageal reflux disease worse. By inducing both CYP3A4 and CYP2C19, plasma concentrations of omeprazole decrease placing them at risk of recurrence of their erosive esophagitis. Clinically relevant interactions with other drugs may occur and must be taken into account when St. John's wort is being taken because metabolism through the CYP3A4 substrates represent at least 50% of all marketed medications [65].

Bioelectromagnetics and magnetic therapy

Electromagnetic (EM) therapy is based on the belief that an imbalance of the EM frequencies or fields of energy can cause illness. By applying electrical energy to the body, the imbalance can be corrected. Many electrical devices and nonelectrical magnetic appliances are available, and are used to treat a variety of symptoms. However, the US Food and Drug Administration do not approve most.

The theory behind BEM is that nonionizing EM fields, in the extremely low-frequency range, may benefit certain conditions, due to EM changes to ligand-receptor interactions at the cell membrane [66,67]. The effects of BEM are thought to result from a change in membrane transport and gene expression. BEM may one day prove to be the effectual factor in therapies that use energetic healing techniques, such as therapeutic touch.

Techniques of nonionizing BEM are either thermal (producing heat in biologic tissue) or nonthermal. Thermal methods are used with laser and radiofrequency (RF) surgery, RF diathermy, and RF hyperthermy. However, the nonthermal applications are more prevalent in alternative medicine. Microwave resonance therapy (MRT) is a method of nonthermal nonionizing BEM used extensively in Russia. MRT incorporates low-intensity sinusoidal microwave radiation, and has had favorable results in treating many conditions, including arthritis, pain, and hypertension. Often, MRT is applied to acupuncture points.

Transcranial EM stimulation of the prefrontal cortex has been shown in multiple studies to have an effect on pain, but this is probably not an alternative or complementary technique [68].

Stationary magnets have been studied for pain of many different body areas, with varying reports of benefit. A summary of success from a number of different studies has been reported in the treatment of knee pain, chronic pelvic pain, postpolio pain, and carpal tunnel pain [69–73]. Little to no benefit was found in treating wrist pain, fibromyalgia, and low back pain, and no benefit in treating heel pain associated with plantar fasciitis [74–77].

EM stimulation has been shown to help with knee pain [78,79]. Small studies have been done evaluating therapy on diabetic neuropathy with promising results; however, additional testing and study are needed [80]. Trock and Vallbona have reviewed literature that examined either magnet therapy or pulsed EM fields (PEMF). Trock found that PEMF was a benefit to the growth of bone and cartilage in vitro, and had potential application as an arthritis treatment. PEMF stimulation is already a proven remedy for delayed fractures, with potential clinical application for osteoarthritis, osteonecrosis of bone, osteoporosis, and wound healing. Magnet therapy has had mixed reviews and mostly anecdotal benefits [81,82]. Suffice it to say that the jury is still out on the efficacy of magnetic fields for pain, although generally PEMF seem to be more supported by the literature than are static magnetic fields.

Complementary therapies in palliative care

Attention to palliation in the setting of terminal illness has only recently come to the conventional medical community from its origins in the mid-20th century in England. Although hospice services are widely available, most US hospitals still do not have a palliative care service, including many of the oldest and most prestigious medical institutions. Efforts to remedy this are currently underway in many medical centers.

Palliative care is, by definition, multidisciplinary. The emphasis in palliative care on the social, spiritual, and psychologic needs of the patient is inherently a “holistic” approach. Integration of complementary therapies for pain and other symptoms is a natural extension of this multidisciplinary foundation, both in the hospice setting as well as the hospital units. Although it is clearly not possible to do everything for every patient, select complementary therapies may be helpful to patients approaching the end of life. Conventional nursing, pastoral care, and psychologic services may be appropriately augmented by mind/body therapies, massage, aromatherapy, acupuncture, yoga, or other techniques.

Shumay and colleagues [83] have studied the existing use of CAM techniques in the cancer population, finding more use among women, better educated, Caucasian, and having more severity of symptoms, particularly nausea and vomiting. Pan and colleagues [84] have reviewed 21 studies of CAM therapies, and concluded that although there is still a paucity of data, some CAM therapies are probably useful for the terminally ill. DiGianni and colleagues [85] have studied women with breast cancer and concluded that little evidence exists to support CAM use beyond psychosocial interventions. Power and colleagues [86] have studied the used of CAM therapies in the HIV population.

Although the evidence base may not currently be strong to justify the use of complementary therapies with the terminally ill, many patients do try to request these approaches, and some seem to find benefit from them. The

concern exists that patients may delay seeking traditional treatment for cancer and use experimental CAM as initial therapy [87]. From a research viewpoint, that which is unproven is not disproved, but should be used as adjunct to known therapies. One or more of the CAM therapies may be of benefit in the palliative care setting, despite the lack of solid evidence at this time.

Cultural practices not abuse

A number of practices in Southeast Asia Folk medicine practices such as cupping, coining, and moxibustion run counter to accepted norms and are often misinterpreted as physical abuse. These practices may leave marks or discoloration on the skin, and at first glance may appear to be bruises. Coining (*cao gio*) and cupping (*giac*) are oriental folk medicine practices, which seem to have surfaced in the country during the Viet Nam era. Coining involves rubbing the skin with a coin producing a welt, while cupping uses a suction device or a piece of cotton soaked in rubbing alcohol is ignited and placed in the cup which is then held horizontally and placed over the skin, extinguishing the flame. This creates heat within the cup. Often leaving a circular area of discoloration. Both coining and cupping bring the “bad wind” to the surface where it can escape and restore balance, and therefore health, to the body. It is generally used for the treatment of minor illnesses, such as colds and fevers. Unfortunately, both produce marks easily interpreted as physical abuse.

Summary

One primary reason patients go to emergency departments is for pain relief. Understanding the physiologic dynamics of pain, pharmacologic methods for treatment of pain, as well CAM therapies used in treatment of pain is important to all providers in emergency care. Asking patients about self-care and treatments used outside of the emergency department is an important part of the patient history. Complementary and alternative therapies are very popular for painful conditions despite the lack of strong research supporting some of their use. Even though evidenced-based studies that are double blinded and show a high degree of interrater observer reliability do not exist, patients will likely continue to seek out CAM therapies as a means of self-treatment and a way to maintain additional life control. Regardless of absolute validity of a therapy for some patients, it is the bottom line: “it seems to help my pain.” Pain management distills down to a very simple endpoint, patient relief, and comfort. Sham or science, if the patient feels better, feels comforted, feels less stressed, and more functional in life and their practices pose no health risk, then supporting their CAM therapy creates a true wholistic partnership in their health care.

CAM should be relatively inexpensive and extremely safe. Such is not always the case, as some patients have discovered with the use of botanicals. It becomes an imperative that all providers be aware of CAM therapies and informed about potential interactions and side effects when helping patients manage pain and explore adding CAM strategies for pain relief. The use of regulated breathing, meditation, guided imagery, or a massage for a pain sufferer are simple but potentially beneficial inexpensive aids to care that can be easily employed in the emergency department. Some CAM therapies covered here, while not easily practiced in the emergency department, exist as possibilities for exploration of patients after they leave, and may offer an improved sense of well-being and empowerment in the face of suffering and despair.

The foundations of good nutrition, exercise, stress reduction, and reengagement in life can contribute much to restoring the quality of life to a pain patient. Adding nondrug therapies of physical therapy, cognitive-behavioral therapy, TENS, hypnosis, biofeedback, psychoanalysis, and others can complete the conventional picture. Adding in simple mind/body therapies, touch therapies, acupuncture, or others may be appropriate in select cases, and depending on the circumstances, may effect and enhance a conventional pain management program. Armed with an understanding of pain dynamics and treatments, practitioners can better meet patient needs, avoid serious side effects, and improve care when addressing pain management in the emergency department.

References

- [1] Ducharme J, Barber C. A prospective blinded study on emergency pain assessment and therapy. *J Emerg Med* 1995;13:571–5 [Library Holdings Bibliographic Links].
- [2] Lewis LM, Lasater LC, Brooks CB. Are emergency physicians too stingy with analgesics? *South Med J* 1994;87:7–9 [Library Holdings Bibliographic Links].
- [3] Johnston CC, Gagnon AJ, Fullerton L, et al. One-week survey of pain intensity on admission to and discharge from the emergency department: a pilot study. *J Emerg Med* 1998;16(3): 377–82.
- [4] Ducharme J. Acute pain and pain control: state of the art. *Ann Emerg Med* 2000;35(6): 592–603.
- [5] Schnitzer TJ. Non-NSAID pharmacologic treatment options for the management of chronic pain. *Am J Med* 1998;105:45S–52S.
- [6] Gureje O, Von Korff M, Simon GE, Gater R. Persistent pain and well-being: a World Health Organization study in primary care. *JAMA* 1998;280:147–51.
- [7] Siddall PJ, Cousins MJ. Spinal pain mechanisms. *Spine* 1997;22(1):98–104.
- [8] Alternative Medicine. Expanding medical horizons: a report to the National Institutes of Health of alternative medical systems and practices in the United States. Washington: US Government Printing Office; 1994 [Publication No. 017-040-00053770].
- [9] National Center for Complementary and Alternative Medicine. <http://nccam.nih.gov>.
- [10] Gentz BA. Alternative therapies for the management of pain in labor and delivery. *Clin Obstet Gynecol* 2001;44(4):704–32.
- [11] Integration of Behavioral and Relaxation Approaches into the Treatment of Chronic Pain and Insomnia. NIH Technol Assess Statement; 1995. p. 1–34.

- [12] Jacobs GD. Clinical applications of the relaxation response and mind-body interventions. *J Altern Comp Med* 2001;7(Suppl 1):S93–101.
- [13] Cole BH, Brunk Q. Holistic interventions for acute pain episodes: an integrative review. *J Holistic Nurs* 1999;17(4):384–96.
- [14] Hoffart MB, Keene EP. The benefits of visualization. *Am J Nurs* 1998;98(12):44–7.
- [15] Targ EF, Levine EG. The efficacy of a mind-body-spirit group for women with breast cancer: a randomized controlled trial. *Gen Hosp Psychiatry* 2002;24(4):238–48.
- [16] Caudill M, Schnable R, Zuttermeister P, et al. Decreased clinic use by chronic pain patients: response to behavioral medicine intervention. *Clin J Pain* 1991;7(4):305–10.
- [17] Fernandez E, Turk DC. The utility of cognitive coping strategies for altering pain perception: a meta-analysis. *Pain* 1989;38(2):123–35.
- [18] Ernst E. Manual therapies for pain control: chiropractic and massage. *Clin J Pain* 2004;20(1):8–12.
- [19] Kaada B, Torsteinbo O. Increase of plasma beta-endorphins in connective tissue massage. *Gen Pharmacol* 1989;20(4):487–9.
- [20] Astin JA, Shapiro SL, Eisenberg DM, et al. Mind–body medicine: state of the science, implications for practice. *J Am Board Fam Pract* 2003;16(2):131–47.
- [21] Song R, Lee EO, Lam P, et al. Effects of tai chi exercise on pain, balance, muscle strength, and perceived difficulties in physical functioning in older women with osteoarthritis: a randomized clinical trial. *J Rheumatol* 2003;30(9):2039–44.
- [22] Garfinkel M, Schumacher HR Jr. Yoga. *Rheum Dis Clin North Am* 2000;26(1):125–32.
- [23] Kaptchuk TJ. Acupuncture: theory, efficacy, and practice. *Ann Intern Med* 2002;136(5):374–83.
- [24] Alimi D, Rubino C, Pichard-Leandri E, et al. Analgesic effect of auricular acupuncture for cancer pain: a randomized, blinded, controlled trial. *J Clin Oncol* 2003;21(22):4120–6.
- [25] Ernst E, Pittler MH. The effectiveness of acupuncture in treating acute dental pain: a systematic review. *Br Dent J* 1998;184(9):443–7.
- [26] Ezzo J, Hadhazy V, Birch S, et al. Acupuncture for osteoarthritis of the knee: a systematic review. *Arthritis Rheum* 2001;44(4):819–25.
- [27] Berman BM, Ezzo J, Hadhazy V, et al. Is acupuncture effective in the treatment of fibromyalgia? *J Fam Pract* 1999;48(3):213–8.
- [28] Skilnand E, Fossen D, Heiberg E. Acupuncture in the management of pain in labor. *Acta Obstet Gynecol Scand* 2002;81(10):943–8.
- [29] Ernst E, White AR, Wider B. Acupuncture for back pain: meta-analysis of randomised controlled trials and an update with data from the most recent studies. *Schmerz* 2002;16(2):129–39 [in German].
- [30] Leibing E, Leonhardt U, Koster G, et al. Acupuncture treatment of chronic low-back pain—a randomized, blinded, placebo-controlled trial with 9-month follow-up. *Pain* 2002;96(1–2):189–96.
- [31] White AR, Ernst E. A systematic review of randomized controlled trials of acupuncture for neck pain. *Rheumatology (Oxford)* 1999;38(2):143–7.
- [32] Arnold MD, Thornbrough LM. Treatment of musculoskeletal pain with traditional Chinese herbal medicine. *Phys Med Rehabil Clin North Am* 1999;10(3):663–71.
- [33] Suekawa M, Ishige A, Yuasa K, et al. Pharmacological studies on ginger 1. Pharmacological actions of pungent constituents, [6]-gingerol and [6]-shogaol. *Pharmacobiodynamics* 1984;7:836–48.
- [34] Altman RD, Marcussen KC. Effects of a ginger extract on knee pain in patients with osteoarthritis. *Arthritis Rheum* 2001;44(11):2531–8.
- [35] Knuesel O, Weber M, Suter A. Arnica montana gel in osteoarthritis of the knee: an open, multicenter clinical trial. *Adv Ther* 2002;19(5):209–18.
- [36] Fisher PA, Greenwood A, Huskisson EC, et al. Effect of homeopathic treatment on fibrosis f(primary fibromyalgia). *BMJ* 1989;299(6695):365–6.

- [37] Fisher P, Scott DL. A randomized controlled trial of homeopathy in rheumatoid arthritis. *Rheumatology (Oxford)* 2001 Sep;40(9):1052–5.
- [38] Gatterman MI, Cooperstein R, Lantz C, et al. Rating specific chiropractic technique procedures for common low back conditions. *J Manipulative Physiol Ther* 2001;24(7):449–56.
- [39] Bigos SJ, Bowyer OR, Braen GR, et al. Acute low back problems in adults. Clinical practice guideline No. 14. Rockville, MD: Agency for Health Care Policy and Research, Public Health Service, US Department of Health and Human Services; 1994 [AHCPR Publication No. 95-0642].
- [40] Bronfort G. Spinal manipulation: current state of research and its indications. *Neurol Clin* 1999;17(1):91–111.
- [41] Koes BW, Assendelft WJ, van der Heijden GJ, et al. Spinal manipulation for low back pain. An updated systematic review of randomized clinical trials. *Spine* 1996;21(24):2860–71 [discussion 2872–3].
- [42] van Tulder MW, Koes BW, Bouter LM. Conservative treatment of acute and chronic nonspecific low back pain. A systematic review of randomized controlled trials of the most common interventions. *Spine* 1997;22(18):2128–56.
- [43] Haldeman S. Neurological effects of the adjustment. *J Manipulative Physiol Ther* 2000;23(2):112–4.
- [44] Andersson GB, Lucente T, Davis AM, et al. A comparison of osteopathic spinal manipulation with standard care for patients with low back pain. *N Engl J Med* 1999;314:1426–31.
- [45] NIH Consensus Conference. Optimal calcium intake. NIH Consensus Development Panel on Optimal Calcium Intake. *JAMA* 1994;272:1942–8.
- [46] McCarthy GM, Kenny D. Dietary fish oil and rheumatic diseases. *Semin Arthritis Rheum* 1992;21(6):368–75.
- [47] Gibson RA. The effect of diets containing fish and fish oils on disease risk factors in humans. *Aust N Z J Med* 1988;18(5):713–22.
- [48] Cathcart ES, Gonnerman WA. Fish oil fatty acids and experimental arthritis. *Rheum Dis Clin North Am* 1991;17(2):235–42.
- [49] Henderson CJ, Panush RS. Diets, dietary supplements, and nutritional therapies in rheumatic diseases. *Rheum Dis Clin North Am* 1999;25(4):937.
- [50] Pavelka K, Gatterova J, Olejarova M, et al. Glucosamine sulfate use and delay of progression of knee Osteoarthritis—a 3-year, randomized, placebo-controlled, double-blind study. *Arch Intern Med* 2002;162(18):2113–23.
- [51] McAlindon TE, LaValley MP, Gulin JP, et al. Glucosamine and chondroitin for treatment of osteoarthritis—a systematic quality assessment and meta-analysis. *JAMA* 2000;283(11):1469–75.
- [52] Matheson AJ, Perry CM. Glucosamine: a review of its use in the management of osteoarthritis. *Drugs Aging* 2003;20(14):1041–60.
- [53] Long L, Soeken K, Ernst E. Herbal medicines for the treatment of osteoarthritis: a systematic review. *Rheumatology* 2001;40(7):779–93.
- [54] Ernst E, Chrubasik S. Phyto-anti-inflammatories—a systematic review of randomized, placebo-controlled, double-blind trials. *Rheum Dis Clin North Am* 2000;26(1):13.
- [55] Almeida RN, Navarro DS, Barbosa-Filho JM. Plants with central analgesic activity. *Phytomedicine* 2001;8(4):310–22.
- [56] Kim SJ, Kim MS. Inhibitory effects of *cimicifugae* rhizoma extracts on histamine, bradykinin and COX-2 mediated inflammatory actions. *Phytother Res* 2000;14(8):596–600.
- [57] Chrubasik S, Thanner J, Kunzel O, et al. Comparison of outcome measures during treatment with the proprietary *Harpagophytum* extract doloteffin in patients with pain in the lower back, knee or hip. *Phytomedicine* 2002;9(3):181–94.
- [58] Laudahn D, Walper A. Efficacy and tolerance of *Harpagophytum* extract LI 174 in patients with chronic non-radicular back pain. *Phytother Res* 2001;15(7):621–4.

- [59] Schmid B, Ludtke R, Selbmann HK, et al. Efficacy and tolerability of a standardized willow bark extract in patients with osteoarthritis: randomized placebo-controlled, double blind clinical trial. *Phytother Res* 2001;15(4):344–50.
- [60] Boullata JI, McDonnell PJ, Oliva CD. Anaphylactic reaction to a dietary supplement containing willow bark. *Ann Pharmacother* 2003;37(6):832–5.
- [61] Nah JJ, Hahn JH, Chung S, et al. Effect of ginsenosides, active components of ginseng, on capsaicin-induced pain-related behavior. *Neuropharmacology* 2000;39(11):2180–4.
- [62] Mills SY, Jacoby RK, Chacksfield M, et al. Effect of a proprietary herbal medicine on the relief of chronic arthritic pain: a double-blind study. *Br J Rheum* 1996;35(9):874–8.
- [63] Pittler MH, Ernst E. Ginkgo biloba extract for the treatment of intermittent claudication: a meta-analysis of randomized trials. *Am J Med* 2000;108(4):276–81.
- [64] Lidija I, Tristan T, Sands J, et al. Terpene trilactones from Ginkgo biloba are antagonists of cortical glycine and GABA(A) receptors. *J Biol Chem* 2003;278(49):49279–85 [Epub 2003 Sep 22].
- [65] Markowitz JS, Donovan JL, DeVane CL, et al. Effect of St John's wort on drug metabolism by induction of cytochrome P450 3A4 enzyme. *JAMA* 2003;290(11):1519–20.
- [66] Rubik B, Becker R, Fowler R, et al. Bioelectromagnetics: applications in medicine. In: *Alternative medicine: expanding medical horizons. A report to the National Institutes of Health on alternative medical systems and practices in the United States. Workshop on Alternative Medicine*, Chantilly, VA; 1994.
- [67] Rubik B. Bioelectromagnetics & the future of medicine. *Adm Radiol J* 1997;16(8):38–46.
- [68] Lefaucheur JP, Drouot X, Keravel Y, et al. Pain relief induced by repetitive transcranial magnetic stimulation of precentral cortex. *Neuroreport* 2001;12(13):2963–5.
- [69] Hinman MR, Ford J, Heyl H. Effects of static magnets on chronic knee pain and physical function: a double-blind study. *Altern Ther Health Med* 2002;8(4):50–5.
- [70] Segal NA, Toda Y, Huston J, et al. Two configurations of static magnetic fields for treating rheumatoid arthritis of the knee: a double-blind clinical trial. *Arch Phys Med Rehabil* 2001; 82(10):1453–60.
- [71] Brown CS, Ling FW, Wan JY, et al. Efficacy of static magnetic field therapy in chronic pelvic pain: a double-blind pilot study. *Am J Obstet Gynecol* 2002;187(6):1581–7.
- [72] Vallbona C, Hazlewood CF, Jurida G. Response of pain to static magnetic fields in postpolio patients: a double-blind pilot study. *Arch Phys Med Rehabil* 1997;78(11):1200–3.
- [73] Weintraub MI, Cole SP. Neuromagnetic treatment of pain in refractory carpal tunnel syndrome: an electrophysiological and placebo analysis. *J Back Musculoskel* 2000;15(2–3): 77–81.
- [74] Carter R, Aspy CB, Mold J. The effectiveness of magnet therapy for treatment of wrist pain attributed to carpal tunnel syndrome. *J Fam Pract* 2002;51(1):38–40.
- [75] Alfano AP, Taylor AG, Foresman PA, et al. Static magnetic fields for treatment of fibromyalgia: a randomized controlled trial. *J Altern Complement Med* 2001;7(1):53–64.
- [76] Collacott EA, Zimmerman JT, White DW, et al. Bipolar permanent magnets for the treatment of chronic low back pain: a pilot study. *JAMA* 2000;283(10):1322–5.
- [77] Winemiller MH, Billow RG, Laskowski ER, et al. Effect of magnetic vs sham-magnetic insoles on plantar heel pain: a randomized controlled trial. *JAMA* 2004;291(1):43–4.
- [78] Jacobson JI, Gorman R, Yamanashi WS, et al. Low-amplitude, extremely low frequency magnetic fields for the treatment of osteoarthritic knees: a double-blind clinical study. *Altern Ther Health Med* 2001;7(5):54–64 [66–9].
- [79] Pipitone N, Scott DL. Magnetic pulse treatment for knee osteoarthritis: a randomised, double-blind, placebo-controlled study. *Curr Med Res Opin* 2001;17(3):190–6.
- [80] Weintraub MI, Cole SP. Pulsed magnetic field therapy in refractory neuropathic pain secondary to peripheral neuropathy: electrodiagnostic parameters pilot study. *Neurorehabil Neural Repair* 2004;18(1):42–6.
- [81] Trock DH. Electromagnetic fields and magnets. Investigational treatment for musculoskeletal disorders. *Rheum Dis Clin North Am* 2000;26(1):51–62.

- [82] Vallbona C, Richards T. Evolution of magnetic therapy from alternative to traditional medicine. *Phys Med Rehabil Clin North Am* 1999;10(3):729–54.
- [83] Shumay DM, Maskarinec G, Gotay CC, et al. Determinants of the degree of complementary and alternative medicine use among patients with cancer. *J Altern Complem Med* 2002;8(5): 661–71.
- [84] Pan CX, Morrison RS, Ness J, et al. Complementary and alternative medicine in the management of pain, dyspnea, and nausea and vomiting near the end of life: a systematic review. *J Pain Sympt Manage* 2000;20(5):374–87.
- [85] DiGianni LM, Garber JE, Winer EP. Complementary and alternative medicine use among women with breast cancer. *J Clin Oncol* 2002;20(18):34S–8S.
- [86] Power R, Gore-Felton C, Vosvick M, et al. HIV: effectiveness of complementary and alternative medicine. *Prim Care* 2002;29(2):361.
- [87] Malik IA, Gopalan S. Use of CAM results in delay in seeking medical advice for breast cancer. *Eur J Epidemiol* 2003;18(8):817–22.