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The Value of Acupuncture in Cancer Care

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In the United States, acupuncture is used to treat various symptoms and conditions associated with cancer and the adverse effects of cancer treatments. Several cancer centers in the United States, including Dana-Farber Cancer Institute (DFCI) in Boston, Memorial Sloan-Kettering Cancer Center in New York, and M.D. Anderson Cancer Center in Houston, are integrating acupuncture into cancer care. This trend parallels a broader trend of increasing use of complementary and alternative medicine (CAM) among cancer patients, estimated in some surveys to range between 48% and 83% [1–4]. Specific use of acupuncture by cancer patients is estimated to range between 1.7% and 31% [5–7]. Despite interest by conventional care providers and the public in the integration of acupuncture into cancer care, the full extent to which acupuncture can be applied to oncology care is limited by research evidence regarding its efficacy and safety in treating and preventing cancer-related symptoms.

There are a few conditions for which sound research has demonstrated acupuncture to be an effective and safe adjunct therapy for cancer care. Randomized clinical trials (RCT) have demonstrated that acupuncture is effective for chemotherapy-induced nausea and vomiting [8–10]. Research studies also suggest acupuncture may be helpful in managing cancer-related pain [11], chemotherapy-related neutropenia [12], cancer fatigue [13], and radiation-induced xerostomia [14–16].

Acupuncture, an ancient medical treatment originating in China, is gaining momentum and acceptance as a valid intervention in medical practice. In the past decade, acupuncture and other integrative medicine programs have

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been established in many major medical centers in the United States. For example, in November 2000, the Leonard P. Zakim Center for Integrative Therapies (Zakim Center) was established at DFCI, a teaching hospital of Harvard Medical School, to provide complementary therapies to patients of DFCI. The Zakim Center is named in memory of Lenny Zakim, a cancer patient and advocate for an integrative approach to cancer treatment. The mission of the center is to educate and empower patients and staff by integrating the practice of complementary therapies into traditional cancer treatments. The National Institutes of Health (NIH) has defined acupuncture as

> ''a family of procedures involving stimulation of anatomic locations on the skin by a variety of techniques. The most studied mechanism of stimulation of acupuncture points uses penetration of the skin by thin, solid, metallic needles, which are manipulated manually or by electrical stimulation'' [17].

Currently, traditional Chinese medicine (TCM) serves as the most prevalent theoretic framework guiding the clinical practice of acupuncture in the United States, in which clinical decisions are based mainly upon the unique clinical patterns that conform to TCM theory. To integrate acupuncture into conventional medical practice successfully, it is critical to develop scientific, evidence-based knowledge of acupuncture through basic and clinical research.

There has been an increase in acupuncture research in the field of oncology in the past 20 years, especially since the 1997 NIH consensus conference on acupuncture [17]. This trend is reflected in the number of acupuncture research articles published on PubMed [18]. From 1987 to 2007, PubMed published 8,276 articles that were related to acupuncture, and 320 were specific to acupuncture in oncology. PubMed publications in 2007 grew 96% since 1987. Similarly, acupuncture articles increased 157% from the 323 published in 1987 to 876 released as of the first quarter of 2007, and acupuncture in oncology articles grew 3½ times, from 12 to 42. Over this 20-year period, the United States and China published 68 (26%) and 66 (25%) of 255 articles related to acupuncture and oncology, respectively. For the United States, 53 (78%) of the 68 articles were released in the past 7 years. The United Kingdom was next most prolific, having released 21 (8%) of the 255 articles. Although absolute numbers remain small, the number of RCTs also has risen significantly in past years, with 10 studies primarily focused on nausea and vomiting (30%) and four (12%) on cancer-related pain. Seven (21%) articles from China focused on acupuncture's anesthetic role in cancer-related surgery. Although there were 12 (36%) of the 33 conducted trials on various cancers, seven (21%) were specific to breast cancer. Overall 63% of the studies reported positive results.

The rise in interest in acupuncture trials could be attributed not only to the NIH's consensus conference, but also to the increase in federal funding for CAM research since 1999.

MECHANISM OF ACTION

The mechanism of action of acupuncture has been of great interest to many researchers. Numerous mechanistic studies of acupuncture in animal models and people suggest that the effect of acupuncture is based primarily on stimulation to and the responses of the neuroendocrine system involving the central and peripheral nervous systems.

Data from animal research suggests that therapeutic acupuncture is mediated partially through opioidergic and/or monoaminergic neurotransmission involving the brainstem, thalamus, hypothalamic, and pituitary function [19–24]. Human neuroimaging data from functional MRI (fMRI), positron emission tomography (PET), and electroencephalography (EEG) have demonstrated that acupuncture stimulation moderates a wide network of brain regions, including the primary somatosensory, secondary somatosensory, and anterior cingulated, prefrontal, and insular cortices, amygdala, hippocampus, hypothalamus, and other areas [25–32]. The brain response may differ depending on *de qi*. *De qi* is a sensation experienced during acupuncture by the acupuncturist during the needle manipulation and by the patient who feels soreness, fullness, heaviness, local distension, or other sensations [28] at local needling sites [33]. A pilot study using fMRI suggests a relationship between stimulation of an acupuncture point, LI-2, located at the base of the index finger, and the activation of the brain function area that is responsible for salivary production, suggesting neural transmission [34].

In several animal models, acupuncture and other stimulation methods of acupuncture points, such as thread implantation and point injection, suggest that acupuncture could down-regulate the expression of transforming growth factor (TGF). Particularly, two independent studies on rat models of liver fibrosis and chronic renal failure found an inhibition of TGF-β1 expression in the tissues after acupuncture points were stimulated by either a thread implantation or injection with Chinese herbs [35,36].

It has been suggested that acupuncture stimulates production of granulocyte colony-stimulating factor (G-CSF) and granulocyte-macrophage colony-stimulating factor (GM-CSF) in animal models treated with myelosuppressive chemotherapy [37,38]. In one controlled nonrandomized human clinical trial, seven patients undergoing chemotherapy were treated with a course of nine daily acupuncture treatments. The serum G-CSF levels were measured before and after acupuncture treatment. There was a significant increase in G-CSF levels after acupuncture ($P < .001$), along with an increase in white blood cell (WBC) count level ($P < .01$) in this group of patients [38].

PLACE OF ACUPUNCTURE IN CLINICAL CANCER CARE

Recent advances in acupuncture clinical research suggest that acupuncture may provide clinical benefit for cancer patients with treatment-related adverse effects such as nausea and vomiting, postoperative pain, cancer-related pain, chemotherapy-induced leukopenia, postchemotherapy fatigue, xerostomia, and possibly insomnia, anxiety, and quality of life (QOL) (Table 1).

Table 1
Clinical trials and systematic review of acupuncture use in clinical cancer care (2001–2007)

Clinical conditions	Author and study design	Major outcome	Reported adverse events	Study population features
Chemotherapy- induced nausea and vomiting	Roscoe et al [9] randomized controlled multicenter trial (n = 739)	Patients in the acupressure group experienced less nausea on the day of treatment compared with controls ($P < .05$)	No adverse events were discussed	85% breast cancer, 10% hematologic neoplasms; patients undergoing chemotherapy
Postoperative nausea and vomiting	Gan et al [43] randomized clinical trial (RCT) (n = 77) (electro-acupoint stimulation, ondansetron versus placebo)	The complete response rate was 77% versus 64% and 42% ($P = .01$); electro-acupoint stimulation is more effective in controlling nausea	No difference in adverse events rate among groups	Patients undergoing major breast surgery
Cancer pain	Alimi et al [11] randomized, blinded, controlled trial (n = 90)	Pain intensity deceased by 36% at 2 months from baseline in the study group ($P < .0001$)	No infection was reported; no other adverse events were reported	Patients who have chronic peripheral or central neuropathic pain arising after cancer treatment
Postoperative pain	Mehling et al [62] RCT (n = 138) (Massage, acupuncture, usual care versus usual care alone)	Patients in the massage and acupuncture group who had usual care experienced a decrease of 1.4 points on a pain scale ($P = .038$)	No adverse events were discussed	Patients undergoing cancer-related surgery including breast, bladder, prostate, and ovarian cancers
Post-thoracotomy wound pain	Wong et al [61] RCT (n = 27) (electro-acupuncture versus sham acupuncture)	A trend for lower visual analog scale pain score in the electro-acupuncture group was observed. Postoperative morphine use was significantly lower in electro-acupuncture group ($P < .05$)	No adverse reactions related to acupuncture were observed	Patients who have operable nonsmall cell lung carcinoma

Hot flashes	Deng et al [73] RCT (n = 72) (true acupuncture versus sham acupuncture)	True acupuncture was associated with 0.8 fewer hot flashes per day than sham ($P = .3$)	Very minor slight bleeding and bruising at the needle site were reported	Breast cancer patients
Vasomotor symptoms (hot flashes) and psychological well-being	Nedstrand et al [74] RCT (electro-acupuncture versus applied relaxation) (n = 38)	Longitudinally, patients in the electro-acupuncture group experienced a decrease of hot flashes >50% at 12 weeks and at 6 months follow-up	No adverse events were discussed	Patients treated for breast cancer
Chemotherapy-induced leukopenia	Lu et al [12] systematic review on RCTs (n = 682)	WBC counts in study group were significantly higher than that in control group ($P < .05$)	No adverse effects were discussed	Patients who have nonsmall cell lung cancer or nasopharynx cancer undergoing chemotherapy
Postchemotherapy fatigue	Vickers et al [13] uncontrolled prospective study (n = 37)	The mean improvement from baseline fatigue score was 31.3% (95% CI: 20.6%–41.5%)	No adverse events were reported	Cancer patients who had completed cytotoxic chemotherapy at least 3 weeks previously but complained of persisting fatigue
Radiation-induced xerostomia	Johnstone et al [15] uncontrolled prospective study (n = 50)	Response rate as improvement of 10% or better from baseline; xerostomia inventory (XI) was 70%; 48% of patients received benefit of 10 points or more on the XI	No adverse effects were reported	Patients who have pilocarpine-resistant xerostomia after radiotherapy for head and neck cancer

Chemotherapy-Induced Nausea and Vomiting

After the NIH Consensus Conference in 1997, several well-designed clinical trials generated promising results. A randomized controlled trial further confirmed acupuncture's antiemetic effect on patients receiving chemotherapy, with a significant reduction of mean emesis episodes (5 versus 15; $P < .001$) compared with pharmacotherapy alone [10]. The results of the study confirmed the NIH consensus statement about acupuncture:

> ''There is clear evidence that needle acupuncture is efficacious for adult postoperative and chemotherapy nausea and vomiting and probably for the nausea of pregnancy'' [17].

Methods other than acupuncture needles used to stimulate acupuncture points also have been reported to have a positive effect. These stimulating methods include manual acupressure, a non-needling procedure with manual pressure on acupuncture points, acupressure wrist bands with or without electrical stimulation, and ear acupuncture [9,39–41]. For example, acupressure wrist bands have shown positive results in controlling chemotherapy-induced nausea and vomiting in a large multicenter study [9]. Another study, however, indicated that using invasive needle acupuncture at P6, an antiemesis point, showed no additional effect for the prevention of acute nausea and vomiting in high-dose chemotherapy, compared with nonskin-penetrating placebo acupuncture [42]. In addition to chemotherapy-induced nausea and vomiting, acupuncture has been shown to be effective for preventing postoperative nausea and vomiting [43].

The authoritative Cochrane systematic review on this subject states that

> ''data on postoperative nausea and vomiting suggest a biologic effect of acupuncture point stimulation. Electro-acupuncture has demonstrated benefit for chemotherapy-induced acute vomiting, but studies combining electro-acupuncture with state-of-the-art antiemetics and in patients with refractory symptoms are needed to determine clinical relevance. Self-administered acupressure appears to have a protective effect for acute nausea and readily can be taught to patients though studies did not involve placebo control. Noninvasive electrostimulation appears unlikely to have a clinically relevant impact when patients are given state-of-the-art pharmacologic antiemetic therapy'' [44].

Cancer Pain

Pain is a long-standing and unresolved clinical issue among patients who have cancer. Even after over 20 years since the World Health Organization (WHO) published its recommendation of an analgesic ladder for pain control [45], 55% of patients who have cancer still suffer from various forms of pain that significantly impact their QOL [46]. One of the reported barriers is the resistance to start opioid therapy either by the patient or the physician [47]. Alternatively, inappropriate use of opioids is associated with significant adverse effects among patients who have cancer [48].

Acupuncture analgesia has been studied actively in the laboratory and clinic for several decades. Several systematic reviews support the use of acupuncture for a range of noncancer specific pain conditions in clinical practice. These pain conditions include osteoarthritis [49], chronic knee pain [50,51], shoulder pain [52], neck pain [53], and acute dental pain [54]. Although the numbers of acupuncture clinical trials for cancer-specific pain are still small, results of these noncancer-related clinical trials may support benefit for patients who have cancer. First, cancer pain may be brought on by a combination of biological, psychological, and social components [55]. Acupuncture-induced analgesic effects can influence the psychological aspect of pain strongly [56]. Second, because most patients who have cancer are in the older population, a stage when significant numbers are reported to have chronic pain, pain reported from patients who have cancer may not necessarily be directly cancer-related and may respond to acupuncture. Third, several RCTs specifically studied acupuncture pain control during surgical procedures and found that acupuncture reduced analgesic requirement of drugs such as morphine, piritramide, and alfentanil [57–60]. Therefore, it is reasonable to believe that acupuncture could serve as a nonpharmaceutical mediator to assist the WHO analgesic ladder for cancer pain.

In the field of cancer-specific pain management, a randomized placebo-controlled trial demonstrated that auricular acupuncture is effective for cancer patients with various forms of neuropathic pain [11]. Several other randomized controlled clinical trials have suggested that acupuncture can be used for the following conditions to manage pain among cancer patients:

- Chronic constant neuropathic pain in postcancer therapies [11]
- Post-thoracotomy pain in patients who have operable nonsmall cell lung carcinoma [61]
- Other postoperative pain in patients who have breast cancer, bladder cancer, prostate cancer, and ovarian cancer [62]

In these clinical settings, acupuncture often is used as a complementary method along with usual care to provide additional pain reduction, and to lessen the need for pharmaceutical analgesic medicine.

SYMPTOM RELIEF

Depression and Anxiety

A recently published RCT reports that massage combined with acupuncture in postoperative cancer patients can improve the depressive mood of these patients when used in conjunction with usual care ($P = .003$). A short-lived improvement in tension and anxiety also was found in this study ($P = .048$) [62].

Although conducted in noncancer patients, several RCTs have found that acupuncture may reduce patient anxiety significantly during acute physical trauma (eg, radial fractures, hip fracture), hospital transportation, during or before lithotripsy and dental procedures, and cataract surgery [63–68]. In addition to acupuncture needle stimulation on traditional body acupuncture points,

ear acupuncture, ear acupressure, and acupressure on other body parts also seem to be effective in providing mild-to-moderate sedative effects in anxious patients [69–71].

Hot Flashes

Using acupuncture for hot flashes in patients who have breast cancer is another active area of clinical study. Although empiric reports suggest that acupuncture is beneficial to reduce the number of hot flashes in patients who have breast cancer [72], a recently published well-controlled clinical trial failed to demonstrate the benefit of active acupuncture as compared with sham acupuncture in reducing hot flashes [73]. Interestingly, hot flash frequency in breast cancer patients in this study was reduced following both true and sham acupuncture. The authors suggest that a longer and more intense acupuncture intervention could produce a larger reduction in all of these symptoms [73]. Another less rigorous RCT from Sweden reported a more than 50% reduction of hot flashes and other associated symptoms in breast cancer patients after receiving a 12-week electro-acupuncture intervention [74]. There was a suggestion in this study that the symptom reduction effect was durable, lasting up to 6 months.

Leukopenia

Although there is an absence of medical literature in the English language on the use acupuncture for leukopenia, several RCTs conducted in China have suggested that acupuncture could be effective in reducing marrow suppression-related leukopenia in patients undergoing chemotherapy [75–77]. An exploratory meta-analysis of clinical trials conducted in China suggests that acupuncture use is associated with an increase in leukocytes in patients during chemotherapy or chemo-radiotherapy, with a weighted mean difference of 1221 white blood cells (WBC)/μL on average (95% CI 636 to 1807; $P < .0001$) [12]. A randomized sham-controlled clinical trial exploring chemotherapy-induced neutropenia in ovarian cancer patients has been completed at DFCI, and preliminary data suggest improved neutrophil counts at the nadir and rebound points after chemotherapy [78,79].

Fatigue

Several prospective pilot trials have shown acupuncture may benefit patients who have chemotherapy-related fatigue [13,80]. In patients with persistent fatigue who previously had completed cytotoxic therapy and were not anemic, acupuncture resulted in a 31.3% improvement in the baseline fatigue score [13].

Neuropathy

Chemotherapy-induced neuropathy eg, from platinum- and taxol-related compounds, is a common problem. A small pilot study of five patients suggested a partial response to acupuncture that could not be explained by any other known neurophysiologic mechanism [81]. A positive impact from acupuncture on neuropathy in DFCI clinic patients also has been observed.

Insomnia

Insomnia is one of the most significant symptoms of patients who have cancer, along with anxiety. Acupuncture has been researched among patients with insomnia with mixed results. A small, noncancer study found acupuncture may reduce insomnia and anxiety significantly, with clear objective improvements in nocturnal melatonin secretion and in polysomnographic measures [66]. A meta-analysis showed that the improvement rate of insomnia produced by ear acupuncture was significantly higher than those from diazepam ($P < .05$) [82]. The rate of success was particularly higher when ear acupuncture was used for enhancement of sleeping hours, up to 6 hours in treatment subjects ($P < .05$). The authors of this study concluded that ear acupuncture appears to be effective for treating insomnia.

In a Cochrane systematic review of acupuncture for insomnia, however, the authors found that acupuncture or its variants were not more significantly effective than a control (relative risk (RR) = 1.66, 95% CI = 0.68 to −4.03) [83]. According to the authors, "The current evidence is not sufficiently extensive or rigorous enough to support the use of any form of acupuncture for treating insomnia." Larger high-quality clinical trials employing appropriate randomization, concealment, and blinding with longer follow-up are warranted to further investigate the efficacy and safety of acupuncture for treating insomnia.

Radiation-Induced Xerostomia

Xerostomia, or dry mouth, is considered a significant factor underlying dysphagia. Several pilot clinical studies suggest that acupuncture may improve xerostomia caused by radiation therapy in patients who have head and neck cancers. Blom first reported a small RCT with placebo acupuncture control in which acupuncture treatment induced a persistent salivary flow rate among a group of patients who had severe xerostomia. A long-term follow up (up to 32 months) further confirmed his findings [14,84,85]. Johnstone and colleagues [15,86] used acupuncture for patients who had pilocarpine-resistant xerostomia after radiotherapy for head and neck cancer. They found a 70% response rate (ie, an increase of 10% or more from the baseline Xerostomia Inventory). Wong and colleagues [16] reported a phase 1–2 study using transcutaneous electrical stimulation. Forty-six patients were randomized among three groups with different acupuncture points. After 6 weeks of treatment, for 37 patients who completed the treatment course, the salivation increase was statistically significant at both 3- and 6-month follow-ups. Studies using fMRI found a relationship between stimulating acupuncture point, LI-2, located at the base of index finger, and the activation of the brain function area responsible for salivary production [34].

Dyspnea

Although clinical evidence for acupuncture treating dyspnea in patients who have cancer is yet to come, some preliminary RCTs suggest acupuncture and acupressure may improve respiratory function and QOL among patients who have chronic obstructive asthma, bronchiectasis, and chronic obstructive

pulmonary disease [87–89]. Therefore, acupuncture/acupressure for dyspnea in patients who have cancer is a promising area for future studies.

Acupuncture in Palliative Care

A pilot study demonstrated feasibility of administering acupuncture as adjuvant palliative therapy to patients who have advanced cancer [90]. Forty ambulatory patients with advanced ovarian or breast cancer who were receiving conventional palliative care were recruited to receive acupuncture treatment for 8 weeks (12 sessions total). Twenty-six patients (65%) completed all 8 weeks of treatment, thereby achieving the study's main feasibility goal. Over time, a significant decrease in symptom severity was seen for fatigue, pain, and insomnia. QOL measures of pain severity and interference, physical and psychological distress, life satisfaction, and mood states showed higher positive scores during acupuncture treatment than before treatment and were sustained at 12 weeks relative to baseline. This pilot study warrants study in a larger population using proper controls.

CLINICAL PRACTICE

An important criterion to evaluate a therapy in clinical practice is the safety record of that therapy. Several studies on the safety of acupuncture have confirmed that acupuncture is a safe procedure in the hands of competent practitioners. One large study found only 43 minor adverse events associated with 34,407 treatments, with no serious adverse events reported [91]. Based upon the criteria proposed by Weiger and colleagues [92], in which the clinical effectiveness and the risk ratios of CAM therapies are weighed simultaneously, acupuncture for chemotherapy-related nausea and vomiting and for pain have been categorized as "safe and effective" and can be "recommended" as an adjunct to conventional therapy. The assurance of acupuncture safety is emphasized further by the US Food and Drug Administration regulation of acupuncture needles as a medical device [93], the training and licensing of clinical acupuncturists, and continuing education courses and licensing now available to physicians. Medicare has recognized acupuncture by assigning it current procedural terminology (CPT) codes, thereby promoting insurance and health expense account reimbursement.

Despite the wide use of CAM therapies among patients who have cancer and despite its safety and efficacy, acupuncture use in this population remains low. The prevalence of CAM use varied in range from 48% to 83% among patients who had cancer in several studies depending on the definition of CAM [1,2,4]. One recent study found that among insured cancer patients in Washington state, the acupuncture usage was only 1.7% in 2000 [6]. A survey among 1065 Chinese women who had breast cancer found that although 98% of patients had used at least one form of CAM therapy, the use rate of acupuncture was only 4.9% [5]. Similar findings were reported by Ganz (2.2%) and Burstein (4.0%) [94,95]. The highest use rate of acupuncture in patients who had cancer was reported by Morris and colleagues [7] as 31% of 617 responses. The use of

acupuncture is associated with the economic status of patients, because it requires patients to consult a CAM practitioner whose services generally are not covered by health insurance companies. Although some major cancer centers now provide acupuncture services to cancer patients, the scale of such services remains small. The paucity of referrals from clinicians and the need to self-pay for the acupuncture are considered two main barriers for using acupuncture.

RESEARCH ISSUES

Clinical research of acupuncture in cancer care has been supported by federal and private funding sources. A steady increase in reports from high-quality clinical trials is expected in the next few years. This will help improve clinical decision-making about acupuncture, because current available results from many studies suffer from poor study design. The shortcomings of these clinical trials exist mainly in three areas: (1) the design of the clinical trial, (2) the quality control employed in conducting the trial, and (3) the complete, detailed reporting of the clinical trial. As a result, often study results are difficult to interpret. The design of clinical trials of acupuncture should comply with the general principles of clinical trials in medicine, such as adequate sample size, power calculations, randomization, and effective concealment of treatment assignment. Clinicians who have a background in pharmaceutical trials should be made fully aware of the uniqueness of acupuncture clinical studies.

In the past, most clinical trials of acupuncture were designed by clinicians who were not trained specifically in clinical trial design. Therefore, the quality of acupuncture trials was considerably poor. For example, many systematic reviews revealed that most trials reported randomization only, which is only one of three commonly recognized key domains in quality trials; blinding and handling of dropouts and withdrawals were not mentioned [12,83,96]. It is recognized that although quality scales are important tools to assess the integrity of clinical trials, they are poor surrogates of the true quality of a specific trial. Some studies suggested that the poor quality of a trial could lead to inflated results. Trials with inadequate concealment and ineffective blinding could lead to exaggerated odds ratios by 41% and 17%, respectively [97].

Although inappropriate design of clinical trials of acupuncture remains an issue of concern, many clinician scientists have begun to get involved in the design process of acupuncture trials. Lack of familiarity with acupuncture technique, however, and the assumption that an acupuncture clinical trial is exactly the same as a pharmaceutical trial potentially may lead to inaccurate results. Currently, the largest issue in clinical trials of acupuncture is the controversy of sham acupuncture as an effective control. Choosing the appropriate control for acupuncture clinical trials is a challenging task. Although several control methods are available, there remains a lack of consensus about which one is the most effective type of sham control [98–100]. As many researchers point out, an ideal sham control should mimic verum (true) acupuncture as much

as possible, while at the same time not elicit any physiologic effect on the study subjects.

A placebo needle (Streiberger needle) has been used in many clinical trials of acupuncture, in which the needle mimics the sensation of needle insertion with its blunt tip and appears to penetrate the skin, but it actually retracts into a hollow shaft [101]. Many studies have reported that this needle produces a very high-quality and effective blinding effect on study patients [42,56]. Critics, however, point out that acupuncture essentially is based upon the sensation of needle insertion, *de qi*; while other types of acupuncture variations, such as acupressure and wrist bands, are not required to penetrate the skin, they still produce the *de qi* sensation to produce clinical results. Other sham acupuncture methods, such as superficial acupuncture needling, mock electro-acupuncture stimulation, needling at nonmeridians and nontraditional acupuncture points also have been used in many trials. These methods have their shortcomings and limitations also. Clinical trials have demonstrated that sham acupuncture has different effects on pain than a placebo pill [56]. A study of experimental pain processing also revealed that placebo needling may evoke different types of brain responses than those evoked by more conventional placebos, such as creams or pills [102].

The implementation of clinical trials of acupuncture is another important issue. Because acupuncture is essentially a procedure involving skilled hand manipulation that is highly dependent on the operator's experience and the technique used, minimizing the variations during acupuncture performance is a critical issue to ensure the success of the clinical trials. A careful and meticulous standardization of each procedure should be planned, and adequate training for such standardization should be provided before a trial starts.

Standards for Reporting Interventions in Controlled Trials of Acupuncture (STRICTA) [103], a Consolidated Standards of Reporting Trials-based recommendation on acupuncture trials, has been published. It focuses on complete reporting of interventions rather than a quality measure scale. Because of the nonpharmaceutical and procedure-like nature of acupuncture trials, a discipline-specific quality measure scale needs to be developed further.

SUMMARY

Clinical research on acupuncture in cancer care is a new and challenging field in oncology. The results of clinical research will continue to provide clinically relevant answers for patients and oncologists. The evidence currently available has suggested that acupuncture is a safe and effective therapy to manage cancer and treatment related symptoms, while giving patients the ability to actively participate in their own care plan.

Future research requires the involvement of clinical researchers, clinicians, and patients. Development of innovative research methods is also crucial. It is expected that as more evidence continues to emerge, oncology acupuncture eventually will be integrated into standard oncology practice. The successful

integration of acupuncture at major academic medical and research facilities, such as DFCI and other major cancer centers, underscores the need for and value of acupuncture in cancer care.

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