Chapter 8
Acupuncture for the Treatment of Symptoms Associated with Radiation Therapy

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Abstract Radiation therapy (RT) is the standard therapy for many cancers. This chapter summarizes the various effects of RT on different tissues of the body and presents considerations for the use of acupuncture as an integrated treatment for symptoms referable to RT in terms of traditional Chinese medicine (TCM) and Western medicine. Many common side effects of RT are presented, including xerostomia, skin irritation and burns, nausea, vomiting, neutropenia and fatigue. The mechanisms of acupuncture's effects are discussed, including increase of fibroblast, decrease of inflammatory cytokines, as well as increase of T lymphocytes, adenosine, neuropeptides, opioid peptides and peptide hormones. A brief explanation is given on how TCM theory is applied to enhance a patient's overall wellness from both the TCM and Western medical perspectives. The concept of "symptom clusters" is addressed, showing how TCM is well-suited for this phenomenon. Acupuncture may be used as a safe adjunct to help preventing and minimizing the side effects of RT, enabling cancer patients to continue and complete their RT on schedule.

8.1 Radiation Effects

The effect of radiation on living tissue is broadly recognized as the discipline of Radiation Biology and clearly exceeds full description here. Readers are suggested to refer to Hall and Giaccia (2012) for more in-depth elucidation of concepts discussed in this section.

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Radiation is delivered clinically using either particles or photons. Regardless of which method used, once radiation enters the skin and subcutaneous tissue, it interacts with atoms and molecules resulting in a shower of electrons within the tissue: these then interact with DNA within the cells.

Much of this DNA damage is repaired by inherent mechanisms in the cell, although some is not. Some of the lingering DNA damage causes the cell to die, however some does not. A portion of the non-lethal effects are of no consequence, but some are quite important. The likelihood of radiation effect in any organ is thus related to the type of radiation, the dose of radiation, the inherent repair capacity of the organ, the percentage of the organ treated, and the specific effect of interest. As an example of the last point: the total radiation dose at which skin becomes erythematous is far lower than the dose required to produce a severe radiation burn or non-healing wound.

Tumors, as a rule, have less inherent repair capacity than normal tissue. Tumor cellular mechanisms are generally shifted to emphasize reproduction (i.e. making new tumor cells). For the purpose of this chapter, however, the effect of radiation on tumors is of less importance than its normal tissue effect.

The effect of radiation at the DNA/cellular level manifests variable morbidity at the organ level since different organs serve vastly different functions. The skin and the digestive system have large stem cell populations, as there is a constant sloughing of more superficial cells requiring replacement with new cells. In these organs, radiation effects are seen relatively quickly: erythema, in the oropharynx, usually begins within the first 3 weeks of a course of radiation therapy. Other organs (e.g. brain, spinal cord) seldom or never require new cells once they are mature. In these organs, radiation effects are generally seen months after therapy is completed. Note that the time at which radiation toxicity manifests is a unique function of each organ.

Similarly, each organ has a unique minimum radiation dose at which toxicity is noted. Some organs are far more sensitive than others. This is the case for tumors as well; radiation doses used to treat seminomas are different than those for lymphomas or carcinomas.

Thus, while the goal of RT appears deceptively simple: “Give enough doses to kill the entire tumor,” each patient has a unique lesion surrounded by unique organs in a unique body. Radiation oncologists are limited by that normal tissue when they treat tumors. If the patient dies because of radiation’s effect on normal tissue we clearly have not provided them a benefit. The benefit to patients comes from maximizing dose to tumor (thus potential for cure) while minimizing normal tissue effects (thus potential for toxicity).

A particular circumstance of radiation exposure contributing to a unique set of syndromes exists when the entire body is irradiated. Understandably, this has significant consequences even under the best of circumstances because the body’s stem cell supply for white blood cells, among others, is quite limited. Whole-body radiation dose may produce fatalities after nuclear accidents and is the predominant medical concern in patients surviving the blast effect after nuclear explosions, yet this is routinely performed in the cancer clinic as pre-treatment prior to stem cell transplant

for leukemias and similar diseases. In this context, patients are closely monitored and provided supportive medicines, etc. to minimize risk of fatality from the procedure. This is an extraordinarily complex procedure requiring significant integration of services within the hospital. Radiation doses are closely scrutinized to ensure they contribute solely to hematopoietic toxicity and remain below the threshold level for the gastrointestinal syndrome. Once that threshold is exceeded, and digestive system mucosa sloughs without stem cell regeneration, patients inevitably die of fluid loss and overwhelming sepsis. At higher doses seen only in radiation accidents or incidents, a CNS syndrome leads to much more rapid death, likely due to vascular disruption.

8.2 Complementary and Alternative Medicine (CAM) and Acupuncture

Natural tribal medicines and healing techniques practiced by different cultures for millennia that have survived today fall into the category of CAM. Some types of CAM include Ayurvedic medicine from India, Tibetan medicine, Native American medicine, and traditional Chinese medicine (TCM). These medicines and healing techniques exist today as a result of thousands of years of empirical evidence.

Integrative medicine (IM) refers to the types of CAM therapies that have been proven to be effective in modern rigorous clinical trials. Acupuncture is one of those therapies. The National Cancer Institute (NCI) provides an overview of the use of acupuncture as a treatment for individuals with cancer or cancer-related disorders. The summary includes a brief history of acupuncture practice, a review of laboratory and animal studies, the results of clinical observations and trials, and possible side effects of acupuncture therapy (http://www.cancer.gov/cancertopics/pdq/cam/acupuncture/healthprofessional).

Acupuncture has been practiced for over 3,500 years. It is a healing technique of puncturing the body with small needles for the intended relief or cure of symptoms and illness. According to TCM theory, acupuncture acts to restore a balance of Qi, the vital energy of the body. Qi is subcategorized into yin Qi and yang Qi. Yin Qi is feminine in nature and refers to the cool solid nurturing energy in the body nourished by the food and water the body receives. Yang Qi is masculine in nature and refers to the active warm energy that creates movement in the body and is nourished by the air we breathe. Each organ and system is considered either yin or yang. Solid organs such as spleen, liver, and kidney are yin organs. Hollow, more active organs are categorized as yang organs, such as stomach, intestines, and urinary bladder (Kaptchuk 2000).

Meridians are pathways of Qi that house the acupuncture points. There are 12 primary bilateral meridians that are associated with each organ and system. The acupuncture points located on these meridians are chosen to restore the balance of Qi in both the meridians and in the whole body system. Acupuncture used in TCM

treatment strategy usually involves selecting points that will harmonize both the "root" of the problem (for example, increasing fluids and nutrients) and the "branch" (helping to deliver the fluids and nutrients to where they are needed) (Kaptchuk 2000).

8.2.1 Diagnosis in Acupuncture

TCM and its theories are a vast field (http://nccam.nih.gov/health/whatiscam/chinesemed.htm). A TCM diagnosis is made by collecting information, including medical history, symptoms, habits, and lifestyle. Examination involves looking at the patient to assess the sheen and color of the skin and the tongue and the shape of the body, listening to the sound and quality of the voice and the breathing, and by palpating the muscles, acupuncture points, abdomen and 12 radial pulses that correspond to each organ and system. Once the diagnosis of disharmony is made, acupuncture points are selected on the meridians affected.

8.2.2 Biological Mechanisms of Acupuncture and Acceptance in the West

Little is known about the biological mechanisms of action for the positive effects of acupuncture, though many studies have been conducted to provide a better explanation of the effectiveness of acupuncture from a Western medical perspective in recent years. Some of these mechanisms are noted here. A needle pricking the skin causes the body to react in defense of the invasion and stimulates a biochemical and bioelectric cascade of events, each of which could explain the effects. The body responds to the needle with the release of numerous chemical signals. Mast cells release histamine triggering dilation and increased permeability of the capillaries. Macrophages discharge prostaglandins, which promote blood flow to the site. The vascular changes and dilation of the capillaries allow larger antimicrobial proteins access to the site. Blood vessel endothelial cells secrete chemokines, which direct the migration of phagocytes and signal them to increase production (Campbell and Reece 2005). A recent review examines the effect of acupuncture on fibroblast cells, a decrease of inflammatory cytokines, an increase of T lymphocytes, and the increase of adenosine, neuropeptides, opioid peptides, peptide hormones, and stem cells (Stone and Johnstone 2010).

The exact mechanism of action for the positive effects of acupuncture in treating any symptom is unknown and likely a collection of events. One possible mechanism could be related to fibroblast cytoskeletal remodeling. Fibroblasts, the most common of connective tissue cells, secrete an extracellular matrix—a web rich in collagen and other macromolecules. These fibroblasts play an important role in wound healing.

An investigation of acupuncture's effect on connective tissue revealed that acupuncture induces extensive fibroblast spreading and lamellipodia formation (Langevin et al. 2006). Another possible mechanism could be an increased production and mobilization of stem cells. Though a very recent and limited area of research, it was reported that acupuncture induced mobilization of $CD133^+$ $CD34^-$ cells in healthy individuals following whole-body acupuncture for spinal cord injuries while using a spinal injury treatment regimen compared to sham treatment (Moldenhauer et al. 2010). $CD133^+$ and $CD34^-$ cells are young, non-differentiated progenitor or stem cells, which have the ability to proliferate and differentiate into several cell types depending on the growth factors present in an environment. The concentration of these cells in peripheral blood normally is very low. The results of this study indicate that acupuncture mobilized $CD133^+$ and $CD34^-$ cells. To confirm the possibility of acupuncture mobilizing stem cells, further studies should be done.

Acupuncture was validated in cancer-related symptoms in the US at a 1997 National Institutes of Health Consensus Conference (NIH Consensus Conference 1998). The conference consisted of a 12-member panel representing the areas of acupuncture, pain, psychology, psychiatry, physical medicine and rehabilitation, drug abuse, family practice, internal medicine, health policy, epidemiology, statistics, physiology, biophysics as well as representatives from the general public. During the conference, experts from these fields presented data to the panel and a conference audience.

A summary in the Journal of the American Medical Association in 1998 (NIH Consensus Conference 1998) reported that acupuncture was safe and effective in treating adult postoperative and chemotherapy nausea and vomiting and in postoperative dental pain. The report also discussed adjunct treatment or an acceptable alternative in a comprehensive medical program for addiction, stroke rehabilitation, headache, menstrual cramps, tennis elbow, fibromyalgia, myofascial pain, osteoarthritis, low back pain, carpal tunnel syndrome, and asthma. A list of credible websites for the evaluation of acupuncture for cancer patients are listed in Table 8.1.

As a result of this conference, the NIH funded more CAM and acupuncture research in medical schools and other institutions. The NCI, the Office of Cancer CAM (OCCAM), and the National Center for CAM (NCCAM) now provide grants specifically in this area. Today acupuncture is provided as an adjunct therapy for the relief of symptoms associated with cancer treatments in many well respected cancer treatment centers and academic health centers. A recent investigation by the author reveals that acupuncture to support cancer patients is provided at 26 of the 39 NCI's Designated Comprehensive Cancer Research Centers.

8.3 Radiation Therapy Side Effects

Although Western medicine regularly controls tumor growth, RT is not without potential side effects and risk. In most cases, radiation regimens are chosen for different types of cancers based on years of research and clinical trials. While it is critical for

Table 8.1 Websites about the evaluation of acupuncture for cancer patients

Credible websites for evaluation of acupuncture for cancer patients	Links
Society of Integrative Oncology	http://www.integrativeonc.org/
National Institutes of Health	http://nccam.nih.gov/health/acupuncture/
National Cancer Institute	http://www.cancer.gov/cancertopics/pdq/cam/acupuncture/healthprofessional/page1/AllPages
Consortium of Academic Health Centers for Integrative Medicine	http://www.imconsortium.org/members/home.html
NIH Consensus Conference Acupuncture	http://www.ncbi.nlm.nih.gov/pubmed/9809733

patients to follow the radiation schedule recommended by their radiation oncologist, sometimes RT side effects such as xerostomia, skin changes, nausea and vomiting, neutropenia and fatigue may be severe enough to necessitate a break in the radiation schedule to allow patients to heal before continuing. If this is the case, acupuncture may be considered to both prevent and heal these toxicities.

8.3.1 Xerostomia

Xerostomia is a frequent and potentially debilitating toxicity of RT for cancers of the head and neck. In normal use, adequate saliva is necessary to help process and swallow food. Saliva also prevents many infections of the mouth and throat and is crucial for proper dental hygiene. Patients who suffer from xerostomia, in addition to being uncomfortable due to this lack of saliva, are at risk for complications such as gingivitis and periodontal disease. There are many articles in the scientific literature supporting the use of acupuncture for xerostomia (Johnstone et al. 2001; Garcia et al. 2009; Braga Fdo et al. 2011; Meng et al. 2012).

One of the earliest topics of research in CAM for cancer symptom control was the use of acupuncture for xerostomia. In accordance with TCM theory, xerostomia is dryness of the stomach yin, causing dryness to rise into the throat and mouth. Since yin is nourished by nutrients and fluids, acupuncture treatment involves selection of points to nourish the yin, moisten the fluids, and extinguish and release heat and dryness. Many modern acupuncturists may provide additional needling locally around the salivary glands.

In a single institution study in pilocarpine resistant patients, it was found that acupuncture palliates xerostomia for many head and neck cancer patients following RT (Johnstone et al. 2001). A regimen of 3–4 weekly treatments followed by monthly sessions is now recommended, although some patients achieve lasting response without further therapy (Kahn and Johnstone 2005).

More recently, two prospective trials have been reported, concluding that doing acupuncture procedures while patients are on RT may reduce subsequent development of xerostomia (Braga Fdo et al. 2011). In the first, 24 consecutive patients scheduled to receive an RT dose > 50 Gy to the major salivary glands bilaterally

were assigned to either the preventive acupuncture (PA) group ($n = 12$), treated with acupuncture before and during RT, or a control group ($n = 12$), treated with RT and not receiving acupuncture. Although all patients exhibited some degree of impairment in salivary gland functioning after RT, significant differences were found between the groups. Patients in the PA group showed improved salivary flow rates ($p < 0.001$) and decreased xerostomia-related symptoms ($p < 0.05$) compared with patients in the control group (Braga Fdo et al. 2011).

In addition, Dr Meng's group from Fudan University Shanghai Cancer Center collaborating with Dr Cohen's group from the University of Texas MD Anderson Cancer Center conducted a sham-controlled, randomized, feasibility trial of acupuncture for prevention of radiation-induced xerostomia (RIX) among patients with nasopharyngeal carcinoma. To determine feasibility of a sham procedure, 23 patients were randomized to real acupuncture ($n = 11$) or to sham acupuncture ($n = 12$). Patients were treated 3 times per week during their course of RT. It was concluded that true acupuncture given concurrently with RT significantly reduced xerostomia symptoms and improved QOL when compared with the sham acupuncture (Meng et al. 2012).

Previous studies on acupuncture for pilocarpine resistant xerostomia (Johnstone et al. 2001; Wong et al. 2003) and neuromuscular electrical stimulation to improve swallow function in patients with chronic dysphagia as a result of head and neck RT (Linkov et al. 2011) led to the development of a recently completed study protocol that produced positive results. The protocol was designed and developed by the Radiation Therapy Oncology Group (RTOG) of the American College of Radiology. Dr Wong and Dr Sagar conducted a feasibility study entitled "A Phase II/III study comparing acupuncture-like transcutaneous electrical nerve stimulation (ALTENS) *vs* pilocarpine in treating early RIX" (Wong et al. 2012). In a study from Stockholm, researchers designed a protocol to determine the long-term effects of acupuncture in patients with xerostomia of different etiologies. The data suggests that additional acupuncture therapy can maintain this improvement in salivary function rates for up to 3 years (Blom and Lundeberg 2000).

The exact mechanism of action for the positive effects of acupuncture on xerostomia is unknown and is likely a collection of events. The relation to a subtle stimulation of the autonomic nervous system is one possible mechanism. Concurrently, many patients who receive acupuncture for xerostomia due to Sjögren's syndrome also report improvement in dryness of eyes as well (Niemtzow et al. 2002). The mechanism for this effect is unclear, since the initial publication from San Diego included only patients resistant to the potent autonomic stimulant pilocarpine (Johnstone et al. 2001).

8.3.2 Radiation Erythema and Desquamation

Both sunlight and RT are forms of electromagnetic energy, thus the effect of both on skin will be indistinguishable. Radiation erythema and desquamation will be localized to the area that is being treated by the radiation. As a rule, radiation desquamation

heals quickly but may be extremely uncomfortable for the patient. Erythema usually begins during the 3rd to 4th week of radiation, with progression to dry desquamation (flaking) and subsequently to moist desquamation. Desquamation is self-limited and will heal in 5–7 days if radiation is discontinued.

Traditional Chinese medicine theory describes a burn as toxic heat and fire at the skin level. The acupuncture points selected would attempt to nourish and cool yin and fluids in the whole body system, release and extinguish the yang heat and fire in the system, and harmonize and cool the lung, which, in TCM theory, has a direct impact on the skin and cools it as well.

There is limited evidence examining the effect of acupuncture on radiation burns in cancer patients. However, a Korean study examining the effect of acupuncture on mice shows promising results and may explain the mechanism of action for the positive effects (Lee et al. 2011). The effect of acupuncture on healing of deep second degree burns was compared to a conventional hydrocolloid dressing in mice. The expression level of inflammatory proteins were significantly reduced in the injured skin, and the number of eosinophils in blood decreased significantly following the acupuncture treatment compared to the dressing at 7 days after the burn. In addition, the acupuncture treatment was more effective in decreasing the wound size and inducing epidermal regeneration. Histological findings also revealed that there was less leukocyte infiltration and a greater reduction in the immunohistochemical reaction to macrophage inflammatory protein in the wounds treated with acupuncture *vs* dressing. This study thus demonstrates that acupuncture accelerates the skin regeneration process following deep second degree burns (Lee et al. 2011).

8.3.3 Radiation Fatigue

Radiation fatigue and the "brain fog" that accompanies it normally occur in the 3rd or 4th week of radiation (Nelson 2009). For patients who receive chemotherapy and radiation the fatigue is more pronounced. Cancer patients themselves report that the fatigue is extreme and overwhelming. Sources of fatigue are varied and may include anemia, psychological distress, concomitant symptoms and side effects, and concurrent medications. New preliminary data suggest that activation of the proinflammatory cytokine network may be responsible to some extent for fatigue that is experienced during radiotherapy (Nelson 2009).

According to a report in *Clinical Cancer Research*, there is an association between fatigue and biomarkers of cytokine activity. In particular, increased levels of the interleukin (IL)-6 cumulative exposure biomarker C-reactive protein and the IL-1β cumulative exposure biomarker IL-1 receptor antagonist were associated with a higher frequency and severity of fatigue (Nelson 2009).

The use of acupuncture to support fatigue in radiation patients is a relatively new area of research. According to TCM theory, fatigue is due to a deficiency in Qi and a disharmony of yin and yang. Diagnosis would involve determining the root of the Qi weakness and treating both the yin and yang organs and systems associated

with the weakness. The root of the problem could be related to dehydration which would correspond to the kidney Qi or the lack of nutrition relating to the organs and systems that process and assimilate the food we ingest. Once the root of the problem is identified, treatment is designed to harmonize the organ or system involved to improve the yin Qi.

The branch of the TCM diagnosis would involve determining the deficiency of yang energy involved in the patient. Weakness in the lung which receives air and oxygen could be contributing to the fatigue, or a weakness or blockage in the circulatory system could be preventing the oxygen from arriving to the tissues. Acupuncture points would then be selected to harmonize both the root of the deficiency of the yin Qi and the branch of the disharmony which would circulate the oxygen and nutrients to the brain, bones, and tissues.

Evidence suggests that clinicians and cancer survivors may find benefit in considering acupuncture as an option for managing fatigue (Johnstone et al. 2003). The particular treatment described in the article "A prospective, randomized pilot trial of acupuncture of the kidney-bladder distinct meridian for the lower urinary tract symptoms" was bladder support *via* the Mingmen technique, and a positive effect was noted on coexistent hot flashes and fatigue. The exact mechanism explaining this effect is unknown, and it is likely that different mechanisms will be necessary to relieve different causes of the fatigue. If fatigue is due to psychological distress, the neuromodulatory effect of acupuncture could be a possible explanation (Wang et al. 2008); electroacupuncture stimulation protects dopaminergenic neurons (Liu et al. 2004). Another study (Shen and Lai 2007) examined the effect of six different acupoints on dopamine in the brains of rats. One of the points, Daling (PC7), stimulated dopamine in the brain. Further studies revealed that various frequencies of PC7 electrostimulation released varying levels of dopamine.

If inflammatory cytokines contribute to fatigue, acupuncture might act to modulate the inflammatory response. In recent studies acupuncture was found to have decreased the expression of three cytokines: IL-6, β-nerve growth factor and tissue inhibitors of metalloproteinase-1 (Chae et al. 2007).

Following a feasibility study to determine rationale for studying fatigue, clinical trials were conducted to determine effect size (Balk et al. 2009; Mao et al. 2009). In a pilot feasibility study involving 16 trial participants, the average fatigue and energy domains of the Lee fatigue scale (LFS) remained stable during and after RT without any expected statistical decline owing to RT (Mao et al. 2009). A modified, double-blind, randomized, placebo-controlled trial was conducted comparing a sham acupuncture treatment with a true acupuncture treatment. The sham treatment involved needling in non-specific acupuncture points unrelated to fatigue. The study was underpowered to find a statistically significant difference between the sham and the true acupuncture groups, possibly due to the biochemical and bioelectric effect of any needle invasion. Despite being underpowered, it appeared that subjects receiving the true acupuncture may benefit more than subjects receiving sham acupuncture (Balk et al. 2009). This finding may be due to the point selection of the true acupuncture which was designed to restore homeostasis in the system. Larger clinical trials are needed to further examine the impact of acupuncture on radiation fatigue.

Acupuncture is not routinely considered in mainstream discussions of options for fatigue management. While future research will more clearly determine its relative effectiveness, given the present options available, clinicians and cancer survivors may find benefit in considering and discussing acupuncture as an approach for managing persistent fatigue (Johnston et al. 2007).

Additional research is needed to evaluate the effectiveness of these therapies as well as other intervention strategies such as the use of antidepressant and psychostimulant medications (Jacobson and Thors 2003).

8.3.4 Neutropenia and Thrombocytopenia

Neutropenia and thrombocytopenia are constant concerns in cancer treatment and are a potential cause of treatment interruptions. Neutropenia is characterized as an abnormally low number of neutrophils—the most important type of white blood cell defense against infections. Thrombocytopenia refers to an abnormally low amount of platelets which are necessary for blood clotting. In cancer treatment, the most important risk factors for radiation therapy treatment interruptions with both thrombocytopenia and neutropenia are concurrent chemotherapy and percentage of marrow irradiated. Other significant factors in these groups are bone marrow metastases and previous chemotherapy (Mac Manus et al. 1997). Chemotherapy and radiation dosages have been adjusted through clinical trials and published experiences to reduce the risk of neutropenia and thrombocytopenia. However, due to the nature of chemotherapy and RT, these problems will always be a concern.

TCM theorizes that neutropenia and thrombocytopenia are due to deficient blood and yin. A physical examination is necessary to determine which organs and systems are responsible for that deficiency: it could be due to improper nutrition or an insufficiency of the digestive system to absorb and assimilate nutrients and fluids. It may also be due to a deficiency in the kidney Qi which supports the bones that make the marrow or it could be related to a stagnation of Qi that circulates the blood and the fluids. Acupoints are selected to support the identified root cause, and others are selected for supporting and making new blood. Once the root cause is established, appropriate treatment may be considered.

Until recently, acupuncture was considered to be contraindicated in patients with neutropenia and thrombocytopenia. It was previously not recommended for cancer patients undergoing chemotherapy and radiation. Studies have now shown that not only is acupuncture safe for pediatric, adolescent, and adult populations of cancer patients undergoing chemotherapy and radiation (Lu et al. 2009; Ladas et al. 2010), but it had been shown effective in improving neutropenia (Lu et al. 2009) and increasing immune cells (Okumura et al. 1999; Mori et al. 2002; Jong et al. 2006).

The mechanism of the effect of acupuncture on immune cells is still under investigation; however, flow cytometry reveals that acupuncture reduces levels of $CD4^+$ and $CD8^+$ cells, which are known to suppress overactive immune response and to increase cytotoxic NK cell activity (Okumura et al. 1999; Mori et al. 2010). An additional

study revealed that immune related acupuncture points compared to non-immune related points modulated T cells. It also increased soluble IL-2 receptors and decreased IL-4 and IL-6. This indicates that acupuncture may modulate both peripheral blood lymphocyte populations and serum cytokine levels of the immune system (Jong et al. 2006).

8.3.5 Nausea and Vomiting

Gastrointestinal complaints, primarily nausea and vomiting, are a common problem for the cancer patient receiving chemotherapy or RT to the upper abdomen. The most thoroughly investigated acupuncture treatment for a cancer related symptom is the effect of acupuncture on hyper-emesis. This investigation is due in part to the 1998 report of the NIH consensus conference (NIH Consensus Conference 1998). Following this report many investigators have reported positive impact of acupuncture on both chemotherapy and radiation-induced nausea and vomiting (Melchart et al. 2006; Reindl et al. 2006; Enblom et al. 2011). For example, in a Swedish trial, patients undergoing abdominopelvic RT were randomized into two groups, receiving either true or sham acupuncture. All patients believed they had the true acupuncture and all experienced antiemetic effects. Most patients experienced relaxation as well as half pain-reduction and sleep improvement. Nausea was experienced by 20% of the acupuncture treated patients and 80% of the sham acupuncture treated patients (duration median 24% of the radiotherapy-days) (Enblom et al. 2011).

In 2002, researchers at the University of Rochester Cancer Center conducted a study examining the effect of acupressure bands at the location of acupuncture point Neiguan (PC6) on 739 patients undergoing chemotherapy. Data revealed that the acupressure bands decreased nausea and vomiting on the day of treatment but did not have a lasting effect (Roscoe et al. 2003). This study met the inclusion criteria to support a recommendation in clinical practice guidelines from the American Society of Clinical Oncology (Basch et al. 2011).

TCM theory refers to hyper-emesis as “reverse stomach Qi”. In a healthy individual the Qi of the stomach directs downward. If there is an imbalance, the Qi will go backwards or up, and food, fluids and saliva will thus come back up. Reverse stomach Qi is a symptom and therefore a “branch” of the diagnosis. The root of the reverse stomach Qi might be yin and blood deficiency, stomach yin deficiency, liver fire blazing upward (e.g. in rupture of esophageal varices due to cirrhosis), or a combination of two or more root causes. TCM acupuncture point selection would be based on the appropriate root diagnosis and would describe acupoints to direct the stomach Qi downward again.

When considering factors that can influence nausea and vomiting, and the neural pathways that lead to the vomiting reflex, we can see how one study on anesthetized rats might help explain the effect of acupuncture on hyper-emesis (Fig. 8.1).

Strain gauge transducers were implanted on the serosal surface of the stomach to record circular muscle contractions during acupuncture in rats. Acupuncture caused

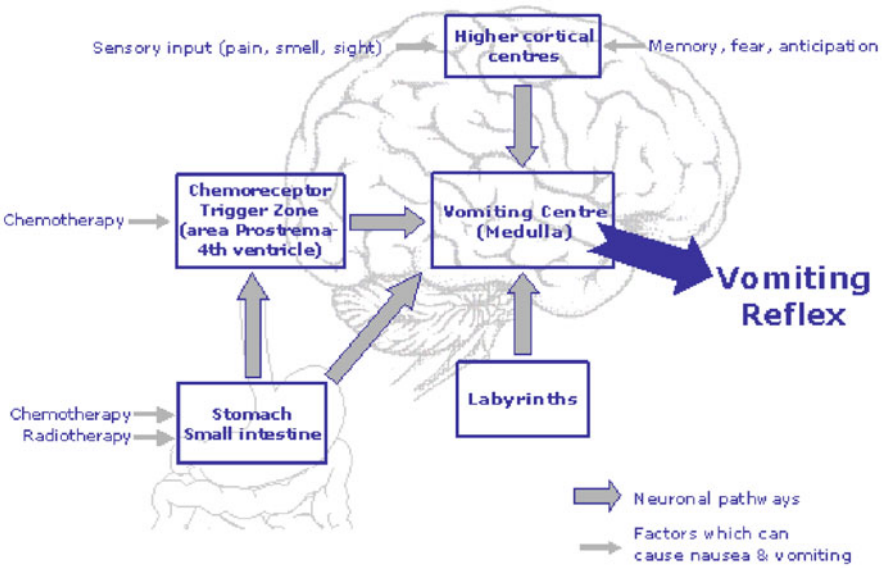

Fig. 8.1 Factors causing nausea and vomiting and neuronal pathways

transient relaxation of the stomach and increased the number of c-Fos immunopositive cells, a marker of neuronal activity, at the ventrolateral medulla (VLM). Due to the control of blood pressure, the heart, blood vessels, swallowing and breathing all being dependent on the integrity of the VLM, researchers therefore concluded that acupuncture-induced gastric relaxations are mediated *via* the somatosympathetic reflex (Tada et al. 2003).

8.4 Symptom Clusters

A relatively new term in oncology is "symptom clusters" (Dodd et al. 2001). Most cancer patients undergo several types of treatments, and experience symptoms related both to their disease and to the treatments being received. Symptom clusters refer to patients suffering three or more related and concurrent symptoms. Defined in cancer, the symptoms may be due to any disease, to its treatment, or to some unique aspect of survivorship. Simple coexistence of symptoms at the same time is necessary but not sufficient, evidence of linkage or relationship is required (Johnstone 2011).

In 2003, the NIH sponsored a grant opportunity to examine symptom clusters and further characterize the concept. An interesting example of the NIH sponsored research was published by Chow et al. (2007) in 2007. Five hundred and eighteen patients with bone metastases completed baseline data using the Edmonton symptom assessment scale (ESAS) as a metric to investigate clustering of symptoms. The four most prevalent symptoms were poor sense of well-being (93.5%), fatigue (92.3%),

pain (84.1%) and drowsiness (81.8%). Three clusters were identified and accounted for 66% of the total variance at baseline. In this study a cluster was defined as two or more symptoms that occur together, are stable, and are relatively independent of other clusters (Chow et al. 2010).

When treating symptom clusters, classic practice has been to treat each symptom separately although this contributes to polypharmacy and an increasing likelihood of drug interactions. Acupuncture presents a unique mechanism for a single therapy of symptom clusters due to the unique aspect of TCM diagnosis and treatment strategy and the reciprocal impact on the patient, the disease, and its symptoms.

8.5 Conclusion

TCM diagnosis considers the patient, the disease, the symptoms, the treatments and the psychosocial surroundings as a whole entity—a system within a universe. Underlying the practice of TCM is a unique view of the world and the human body that is markedly different from Western medicine concepts. This view is based on the ancient Chinese perception of humans as microcosms of the larger, surrounding universe—interconnected with nature and subject to its forces. The human body is regarded as an organic entity in which the various organs, tissues, and other parts have distinct functions but are all interdependent. In this view, health and disease relate to balance of the functions.

Acupuncture clearly is effective as a single modality within the whole medicine system of TCM. It is most effective in conjunction with the many therapies of the TCM system.

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