

Acupuncture for Gastrointestinal and Hepatobiliary Disorders

DAVID L. DIEHL, M.D., F.A.C.P.

ABSTRACT

Acupuncture has been used for various gastrointestinal (GI) conditions. Voluminous data support the effect of acupuncture on the physiology of the GI tract, including acid secretion, motility, neurohormonal changes, and changes in sensory thresholds. Much of the neuroanatomic pathway of these effects has been identified in animal models. A large body of clinical evidence supports the effectiveness of acupuncture for suppressing nausea associated with chemotherapy, postoperative state, and pregnancy. Prospective randomized controlled trials have also shown the efficacy of acupuncture for analgesia for endoscopic procedures, including colonoscopy and upper endoscopy. Acupuncture has also been used for a variety of other conditions including postoperative ileus, achalasia, peptic ulcer disease, functional bowel diseases (including irritable bowel syndrome and nonulcer dyspepsia), diarrhea, constipation, inflammatory bowel disease, expulsion of gallstones and biliary ascariasis, and pain associated with pancreatitis. Although there are few prospective randomized clinical studies, the well-documented physiological basis of acupuncture effects on the GI tract, and the extensive history of successful clinical use of acupuncture, makes this a promising modality that warrants further investigation.

INTRODUCTION

Acupuncture has a long history of use for gastrointestinal (GI) disorders. In the *Nei Jing* (a textbook on internal medicine written over 2000 years ago), various aspects of digestive dysfunction are discussed, including differentiation between the solid viscera and hollow digestive tract, proper dietary practices to maintain health, and recommendations about elimination (Ni, 1995). Observation of the tongue coating, pulse quality, and even appearance of the anus, and correlation between these and the symptomatology of various digestive diseases were also commented on. Fur-

thermore, the treatment principles defined for these clinical presentations have remained in use in the present day clinical practice of acupuncture, including traditional Chinese medicine (TCM), and other schools of medical theory derived from TCM. The widespread use of acupuncture for GI disorders continues to this day, and is distributed worldwide.

Acupuncture treatment for nausea is one of the most extensively researched and proven techniques in the whole body of clinical research in acupuncture for any indication. The strength of this proof lends support to the concept that acupuncture may be useful for other GI conditions. Unfortunately, currently ac-

Division of Digestive Diseases, UCLA School of Medicine, Director of Gastrointestinal Endoscopy, Olive View-UCLA Medical Center, Sylmar, California.

cepted evidence-based methodologies have not been applied to most of the clinical research in acupuncture in past years. There are many examples of intriguing studies from China, involving hundreds, or even thousands, of patients treated for a particular condition, but the research methodology does not allow conclusions to be drawn that would meet current Western medical standards. Most articles describe nonrandomized, nonblinded trials. Those articles that do report randomization of subjects into different treatment groups usually include insufficient data to be able to judge whether the studies were properly controlled or blinded, or had sufficient clinical follow-up. However, decades and even hundreds of years of clinical observation may be useful in suggesting rich areas for potential clinical study. Indeed, some of these reports involve large numbers of patients, and represent decades of expert clinical experience.

Despite the paucity of well-designed prospective, randomized, controlled clinical trials, there is a plethora of information regarding the physiological basis of acupuncture effects on the digestive system. Extensive research in animal models, as well as human subjects, have shed light on how acupoint stimulation leads to changes in gastric acid secretion, GI motility, and hormone and neuropeptide metabolism. Regional or systemic autonomic nervous system changes may also contribute to the effects. These studies reveal the physiological correlates of positive clinical results that are claimed by practitioners, and described in the case report literature.

This review provides an overview of the basic scientific data regarding acupuncture effects on GI function. Also, areas of clinical application that have been reported in the medical literature are reviewed, with special attention to those areas that have prospective randomized trials. Finally, promising directions for further research that are suggested by the published data are discussed.

METHODS

A search of the medical literature available on MEDLINE was made, using the search term "acupuncture," and a variety of gastroenterol-

ogy and hepatology related terms (eg, colitis, intestine, acid, endoscopy, etc.) MEDLINE files from 1966 to present were searched using PubMed (PubMed, 1998). This search strategy yielded published articles on acupuncture. The bibliographies from several of these references were then used to identify other articles. Recognized experts in the field were also contacted, and additional references solicited. In some cases, these experts were able to provide otherwise unpublished abstracts. In addition, several English-language textbooks of acupuncture were reviewed for other references.

COMMONLY USED POINTS FOR DIGESTIVE DISORDERS

In clinical practice, acupuncture point selection may follow standard "point prescriptions," or may be based on the "pattern of illness" according to TCM (Dill, 1992). Alternatively, one may use other systems of Oriental medicine, including 5-Element theory (Moss, 1991), French Energetics (Helms, 1995), Japanese Meridian Theory (Denmai, 1990), and others.

In TCM, the essence of diagnosis lies in identification of "patterns of illness" (Maciocia, 1989). The "pattern" is arrived at by combining elements from the symptoms the patient complains of and other factors noted on the review of systems history. This information is combined with physical signs on examination, including careful attention to the pulse quality and tongue appearance. With this data, the nature of the "underlying disharmony" that the patient has is identified, and treatment is directed at this disharmony. During the long period of development of Chinese medicine, several methods to identify patterns were developed. Different schools of practice may emphasize different methods, and a particular method may be applicable in a particular clinical situation. One widely used example is "Identification of Patterns according to the Eight Principles." In this context, the eight principles are based on the categories of Interior/Exterior, Hot/Cold, Full/Empty, and Yin/Yang.

It should be pointed out that acupuncture is but one part of Chinese medicine. Herbal medicine, dietary manipulation, massage ("Tuei

Na"), and Qi Gong are all recognized and highly developed therapeutic modalities. These modalities may be used instead of, or in combination with acupuncture to execute a treatment. In current practice, practitioners commonly combine acupuncture with herbal medicine when treating GI illness.

There are over 300 acupuncture points that are described. They are named by their relationship with one of the 12 meridians (plus newly described "extra" points). For example, Stomach-36 (ST36) is the 36th point on the Stomach meridian. While this point is indeed important in treating digestive diseases, its function is not restricted to "stomach" problems. Selection of acupuncture points to treat a condition may be done in a variety of ways, depending on the "school" of acupuncture practice, or different practice styles.

Dr. Philip Rogers has abstracted a large body of published articles on acupuncture treatment, and entered the frequency of citations for the acupoints used into a computerized database (Rogers, 1990). Review of his database, and general impressions from published studies suggest that commonly used acupoints for GI diseases may be located (Fig. 1).

- Paravertebrally in a dermatomal relationship with the GI organs ("Shu points")
- Over the abdomen ("Mu points," Conception Vessel (*Ren*) points, and other points)
- On distal extremities at well-known points (eg, Stomach-36 "*Zusanli*," Spleen-6 "*Sanyinjiao*," and "Lower He-Sea points" on lower leg; Pericardium-6 "*Neiguan*" on wrist)
- On the external ear ("auricular points")
(Nogier, 1981)

Also, there are some systems of acupuncture theory and practice that treat points on the hand (eg, Korean hand acupuncture) or on the scalp.

EFFECT OF ACUPUNCTURE ON THE PHYSIOLOGY OF THE DIGESTIVE SYSTEM

GI motility and sensation

Controlled animal and human studies have shown an effect of acupuncture on gastric and intestinal motility. Different methodologies

have been used for assessing effects: implanted strain gauges (in animal models), manometry, endoscopic observation of antral motility, and fluoroscopic observation of barium passage. Acupuncture effects on electrical activity in the gut also have been measured with implanted electrodes in animals (electromyogram [EMG]) and with surface electrical measurements (electrogastrogram [EGG]).

Li et al. (1992) have summarized the effects of acupuncture on motility, EMG, and EGG. They concluded that real acupuncture has a significantly greater effect than placebo acupuncture for gastric motility, with incomplete data on small bowel motility. Effects of acupuncture on EMG and EGG are variable; they depend on the species under study, and other factors. In some, but not all studies, changes in frequency and amplitude of gastric slow waves has been seen. Restoration of disrupted interdigestive migrating motor complex (MMC) has been noted.

A self-regulating, or "homeostatic," action has been noted in some studies (Qian and Lin, 1994) with inhibitory or stimulatory effects being dependent on initial motility. A recent report (Lin et al., 1997) examined the effect of acupuncture on gastric myoelectrical activity as measured with the EGG. Electroacupuncture (electroacupuncture) significantly increased the percentage of regular slow-waves, which resulted from normalization of gastric arrhythmia. They concluded that electroacupuncture may enhance the regularity of gastric myoelectrical activity and may be an option for treatment of gastric dysrhythmia.

Sato et al. (1993) examined the neural pathways responsible for changes in gastric motility elicited by acupuncture stimulation in anesthetized rats. They showed an inhibitory effect when acupuncture-like stimulation was applied to the abdomen and lower chest region, mediated by lower thoracic spinal nerves (afferent pathway) and the gastric sympathetic nerves (efferent pathway). The inhibitory effect could be abolished with severing either of these nerves. Spinalized animals still exhibited inhibition of gastric motility, suggesting a reflex center in the spinal cord.

In distinction, acupuncture-like stimulation of points on the hindpaw elicited an excitatory effect on gastric motility that was mediated

through the femoral and sciatic nerves (afferent pathway) and the vagus nerves (efferent pathway). There was no excitatory response in spinalized animals, suggesting a reflex center in the brain (this is also suggested by the involvement of vagal afferents). Neither the inhibitory nor the excitatory gastric reflex was influenced by intravenous naloxone, suggesting that endogenous opioids are not involved in these reflexes.

There are fewer studies of acupuncture on small intestinal motility. Dai et al. (1993)

showed that electroacupuncture reversed inhibition of duodenal peristalsis induced by intrathecal morphine. Effects on motility have also been noted in the esophagus and lower esophageal sphincter (See *Esophageal diseases*).

There are some data on the effects of acupuncture on GI sensitivity to balloon distention. Most patients with functional disorders of the GI tract appear to have inappropriate perception of physiological events and altered reflex responses in different gut re-

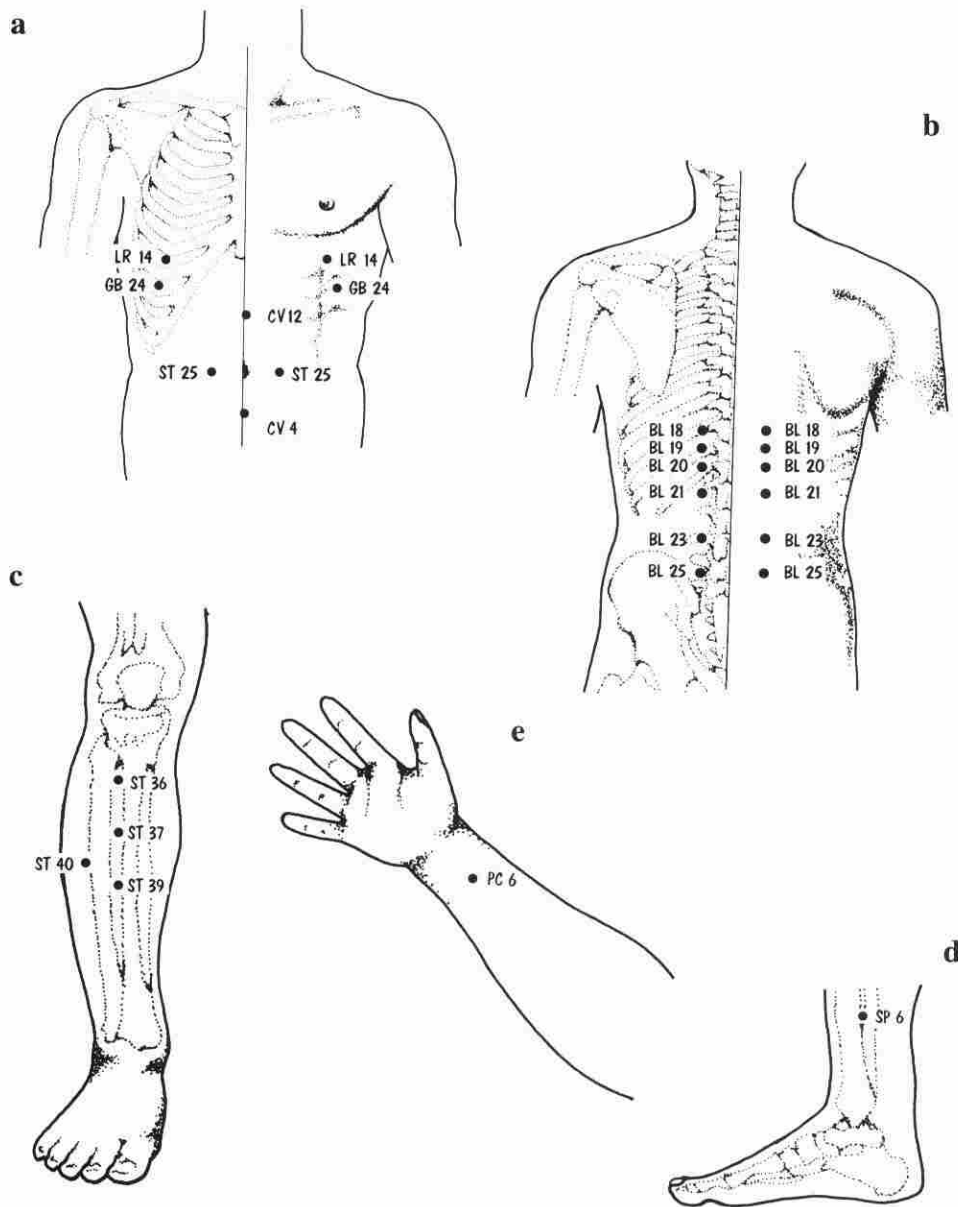


FIG. 1. Commonly used acupuncture points for digestive conditions.

gions. The “visceral hyperalgesia” hypothesis, contributing to functional bowel disease (FBD) symptoms, has been put forward on the basis of solid animal and human data (Mayer et al., 1994). One study examined the effects of transcutaneous electrical nerve stimulation (TENS) stimulation of the hand and its effects on threshold of discomfort to balloon distention of the stomach or duodenum monitored with a “barostat” device (Coffin et al., 1994). So-

matosensory stimulation by TENS raised the discomfort threshold to gastric or duodenal distention. Because patients with functional dyspepsia (NUD) have altered gastric perception—an abnormal afferent sensory pathway—(Mearin et al., 1991), acupuncture effects on gastroduodenal sensory thresholds may be an important part of the therapeutic effect. Also see below (nonulcer dyspepsia and irritable bowel syndrome).

a. Abdominal Points

Point	“ <i>Mu</i> ” (gathering) Point of:	Level of Nerve Root
*Stomach-25	Large Intestine	T10- T11
*Conception Vessel-12	Stomach	T8 - T9
Conception Vessel-4	Small Intestine	T12 - L1
Liver-14	Liver	T8 - T9
Gall Bladder-24	Gall Bladder	T7 - T8

b. Paravertebral Points

Point on Bladder (BL) meridian	“ <i>Shu</i> ” (transporting) Point of:	Level of Nerve Root
BL18	Liver	T9-10
BL19	Gall Bladder	T10-11
BL20	Spleen	T11-12
BL21	Stomach	T12-L1
BL23	Kidney	L2-3
BL25	Large Intestine	L4-5

c. Lower leg, antero-lateral

Point on Stomach (ST) meridian	Traditional function
*ST36 “ <i>Susanli</i> ”	Lower He-Sea point of Stomach meridian
ST37	Lower He-Sea point of Large Intestine meridian
ST39	Lower He-Sea point of Small Intestine meridian
ST40	Luo-connecting point of Stomach meridian

d. Lower leg, medial

*Spleen-6 (“*Sanyinjiao*”) innervation level L4

e. Arm, volar surface

*Pericardium-6 (“*Neiguan*”) Median nerve (C6-C7)
(also referred to as “Master of the Heart (MH) 6”)

footnote:

* designates one of the five most commonly used points.

← FIG. 1. continued.

Gastric acid secretion

The effect of acupuncture on acid secretion has been examined in animal models as well as in humans (Fig. 2). These studies examined the effect of acupuncture on: basal acid output (BAO), pentagastrin-stimulated maximal acid output (MAO), sham-feeding (vagally-mediated) acid output and gastric secretory volume. In one prospective randomized study on human volunteers from Great Britain (Lux et al., 1994), electroacupuncture (although not sham acupuncture, simple acupuncture, or "laser acupuncture") reduced vagally stimulated acid secretion. Another randomized, placebo controlled study from Canada (Tougas et al., 1992) showed that electroacupuncture decreased BAO compared to sham acupuncture, but had no effect on pentagastrin-stimulated MAO. This effect was blocked by pretreatment with intravenous naloxone, but not by local anesthesia of the acupoint.

The effect of electroacupuncture on acid secretion has been investigated in dogs with gastric cannulas, and compared real-point electroacupuncture with sham acupuncture (nonpoints on forelimbs and hindlimbs were

stimulated) (Jin et al., 1996). Electroacupuncture significantly inhibited acid secretion by 75%, and this effect coincided with significant increases in plasma somatostatin, vasoactive intestinal peptide (VIP) and β -endorphin, as well as a significant decrease in plasma gastrin. Naloxone completely reversed electroacupuncture-induced inhibition of acid secretion as well as the noted changes in plasma peptide. Interestingly, sham electroacupuncture inhibited acid output by 30%, as well as inducing a modest but significant increase in plasma β -endorphin. It was concluded that in dogs, electroacupuncture effects on inhibition of meal-stimulated acid secretion is mediated by the release of β -endorphin and somatostatin, and that an endogenous opioid appear to play an important role. Zhou and Chey (1984) investigated the effect of electroacupuncture and nonelectric acupuncture on gastric sodium and bicarbonate secretion in dogs with surgical esophagostomy and gastric cannulas. They found increased gastric bicarbonate secretion and sodium secretion, as well as decreased acid secretion. The electroacupuncture stimulation had a greater effect than simple acupuncture. Local anesthetic at the acupoint, as well as anticholinergic blockade (intravenous atropine) abolished the effects.

In the rat model, section of the sciatic nerve, or vagotomy, also blocked the acupuncture-specific response (Noguchi and Hayashi, 1996). This study also noted an increase in gastric acidity to electroacupuncture stimulation of the hindlimb of anesthetized rats. These data suggest that the acupuncture effect involves a somatic afferent-visceral reflex mechanism, involving somatic nerves as the afferent pathway, and branches of the vagus nerve to the stomach as the efferent pathway.

Acupuncture has also been shown to affect G-cell counts in humans with gastroduodenal disease, and enterochromaffin cell counts in the animal model (Hwang, 1980). Utilizing fluorescence histopathology, Liu et al. (1994) studied the changes in G-cell counts in patients with duodenal ulcer and atrophic gastritis. After acupuncture, the number of G-cells, and the fluorescent intensity, decreased in patients with duodenal ulcer, as compared with that before acupuncture treatment. Interestingly, the

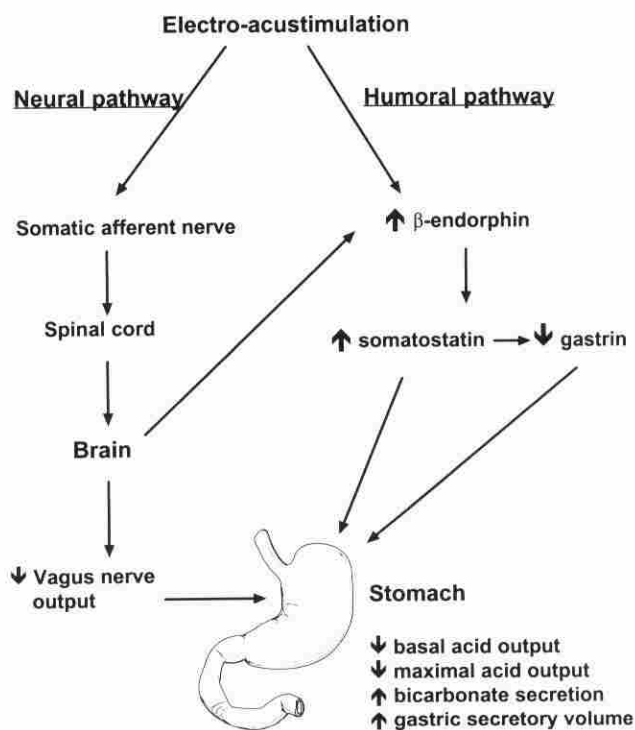


FIG. 2. Mechanism of effect of electro-acustimulation on decreasing gastric acid secretion.

number of G-cells was increased in patients with chronic atrophic gastritis (a condition associated with hypochlorhydria or achlorhydria). In this study, acupuncture tended to regulate G-cell counts in a homeostatic manner depending on the underlying disease process. Acupuncture has an effect on the secretion of gastrin, a hormone that stimulates acid secretion from the stomach (Zhou et al., 1985).

CLINICAL USES OF ACUPUNCTURE FOR GI DISEASE

Antiemesis

The strongest body of scientific literature that shows a clear-cut benefit of acupuncture in any clinical GI condition is that which examined the effectiveness of acupuncture as a therapy in, or preventative for, antiemesis. Clinical benefit of acupuncture or acupressure has been shown in nausea and emesis associated with chemotherapy, postoperative state, optokinetic stimulation, and pregnancy. No effect of acupuncture stimulation was found in 3 published studies that involved pediatric patients. Typically, the well-known "antinausea point" *Neiguan* (PC-6, pericardium-6, Master of the Heart-6) has been used. Local anesthesia (intra-dermal and subcutaneous infiltration with 1% lidocaine compared to normal saline) at PC-6 blocked the antiemetic effect of electroacupuncture stimulation of this point (Dundee and Ghaly, 1991).

Dundee has carried out many of the prospective, randomized, controlled trials in the use of PC-6 antiemesis. They have summarized the clinical usefulness of PC-6 antiemesis and also raised the possibility of self-administered TENS at PC-6 for antiemesis (TENS utilized 10–15 Hz frequency, with amplitude suited to patient tolerance—typically in the milliampere range) (Dundee and McMillan, 1990).

Recently, a prospective, sham-needle controlled trial of acupuncture for emesis associated with chemotherapy was carried out in 30 patients, and reported in abstract form (Shen et al. 1997). This study was unique in that the patients included for study received myeloablative chemotherapy prior to autologous bone marrow transplantation. This chemotherapy

regimen is especially emetogenic, and thus was a challenging test of the efficacy of acupuncture. Electroacupuncture at PC-6 and ST-36 (4 Hz for 20 minutes daily between 7–9 AM for 5 days) was used, with results compared to sham acupuncture (minimal acupuncture with mock electrostimulation at nearby control points near LU-7 and GB-34). Clinical outcomes that were followed included nurse-recorded vomiting episodes, and patient self-rated nausea and global quality of life measures using a previously validated symptom diary. The number of emesis episodes over 5 days was lower for subjects receiving specific acupuncture than for nonspecific acupuncture or no acupuncture ($p = 0.02$). Nausea severity and quality-of-life measures were also more favorable in the specific acupuncture group.

Another recent report studied acupuncture in preventing postoperative nausea and vomiting (Al-Sadi et al., 1997). Eighty-one patients scheduled for gynecological laparoscopic surgery were randomly assigned to receive acupuncture (manual stimulation at PC-6) or control (no needling). Bandages were placed at the wrist after surgery in both groups to maintain patient blinding. Acupuncture was found to decrease incidence of nausea and vomiting while in the recovery room, and also post-discharge. The authors also analyzed the incidence of nausea and vomiting in patients with a history of previous postoperative nausea and vomiting and/or motion sickness. Acupuncture was found to be useful even in this group of patients.

Vection-induced motion sickness is an interesting model of the effects of acustimulation on nausea. In this experimental model, subjects are seated inside a rotating metal cylinder that has a pattern on the inside. This induces "motion sickness" (stomach discomfort, nausea, and vomiting) associated with an increase in measurable gastric myoelectrical activity as measured by the EGG from 3 cycles per minute (cpm) to 4–9 cpm. This has been referred to as "tachygastria." In a carefully controlled study utilizing this model, Hu et al. (1992) studied the effects of electroacupuncture, sham acupuncture, or no acustimulation on the clinical manifestations of motion sickness, and changes on the EGG. Also, experiments were performed on

Chinese subjects as well as Caucasian and African-American subjects because of concerns that results may be influenced by placebo effect (with acupuncture-knowledgeable subjects) or due to a unique response of Chinese subjects. In this study, the acustimulation group reported fewer symptoms of motion sickness than the sham-acustimulation or control groups. The acustimulation group showed significantly less tachyarrhythmia than the control group, but interestingly not significantly less than the sham group. Non-Chinese subjects benefited as much as the Chinese subjects.

Peptic ulcer disease

Despite the physiological basis of acupuncture effect on acid secretion, no prospective, controlled study has been done on the treatment of peptic ulcer disease (PUD) with acupuncture. It has been used extensively, however, especially in China and the former Soviet Union. In the published literature, several case study type of reports claim usefulness of acupuncture for peptic ulcers, including perforated peptic ulcer (Zhou, 1987). A series of 21 patients with duodenal ulcer claimed efficacy of acupuncture treatment (Debreteni and Denes, 1988), but patients were also treated with H₂-blockers (cimetidine) as well as discontinuing alcohol and tobacco, thus clouding the relative contributions from the different interventions. Another nonrandomized study (Kajdos, 1977) treated 71 patients with gastric and duodenal ulcers. The authors state that 63% had a very good response, 28% improved, but had recurrence, and 8% of patients did not respond. Studies of the psychosomatic effects of acupuncture suggested that a course of acupuncture in PUD provides "psychological rehabilitation" for the ulcer patients, and that this effect may play a role in ulcer healing (Emel'ianeko, 1991; Kokurin, 1992).

Acupuncture has been found to be "cytoprotective" in experimental gastric ulcer created by water immersion of restrained rats (Hsu et al., 1987). The action of acupuncture in preventing experimental gastric ulcer has been noted to depend on the circadian rhythm of acid secretion and mucosal prostaglandin production (Cheng, 1992). Acupuncture at

"acrophase" of the circadian rhythm was mainly inhibitory, while acupuncture at the valley phase was mostly excitatory. Therefore there may be an optimal time to do acupuncture to have desired effects on GI physiology; furthermore, experimental results may be significantly affected by the time of day acupuncture is done.

Current understanding of peptic ulcer disease acknowledges the extremely important role of the bacterium *Helicobacter pylori* in the pathogenesis of ulcers (Diehl, 1997). Given the fact that eradication of *H. pylori* can cure ulcer disease and prevent ulcer recurrence, this efficient therapeutic intervention will undoubtedly remain the mainstay of ulcer treatment for years to come. If future studies of the role of acupuncture in the treatment of PUD are done, they will most likely focus on *H. pylori*-negative ulcers (for example, the majority of nonsteroidal anti-inflammatory drug (NSAID) associated ulcer disease).

Nonulcer dyspepsia

Acupuncture may have a role for a malady that is more common than peptic ulcer disease: nonulcer dyspepsia (NUD). NUD can be defined as chronic or recurrent pain or discomfort centered in the upper abdomen (ie, the epigastrium), not due to peptic ulcer disease, and considered to originate from the upper gastrointestinal tract (Talley et al., 1998). NUD may have clinical features that are "reflux-like," "ulcer-like," or "dysmotility-like" (Talley et al., 1992). Its management often consists of empirical trials of acid antisecretory medication or prokinetic agents.

NUD is probably a heterogeneous disorder, caused by different mechanisms. As a result, a standard therapeutic approach is certain to fail. TCM describes diagnostic subgroups for patients with symptoms of dyspepsia that are based on the constellation of symptoms, pulse diagnosis, and tongue analysis. Correlation of these Chinese diagnoses with Western medical diagnoses has not been done, but would be of interest. Also, there are some diagnostic terms (such as "gastroptosis") that are used in the acupuncture literature but are not currently used in Western gastroenterology. This also

serves to make correlation between the bodies of literature difficult.

Because of the proven effects of acupuncture on decreasing gastric acid secretion and modulating gastric motor activity, it seems logical that acupuncture may be useful in some cases of NUD. Patients with functional dyspepsia are hypersensitive to gastric distention (Mearin et al., 1991) and somatic stimulation (in this case, TENS) can reduce the perception of gut distention (Coffin et al., 1994). Thus, there is a physiological basis for supporting the beneficial effect of acupuncture on dyspepsia that may be mediated, in part, by raising the threshold for sensitivity to gut distention. There is a clinical report of TENS for treatment of functional abdominal pain (Sylvester et al., 1986).

Clinical studies in the literature are exclusively of the case-report type. Most use TCM syndrome differentiation on which to base treatment (No author, 1990), while others treat all dyspeptic patients with standardized points, or with point combinations (Xu and Tian, 1989; Zhang, 1992; Zhao, 1991). While these papers describe a wealth of clinical experience, prospective randomized clinical data are lacking.

Esophageal disease

Effects of acupuncture have been noted on the motility of the esophagus and lower esophageal sphincter. It is known that vasoactive intestinal peptide (VIP) is one of the main neurotransmitters implicated in the relaxation of the lower esophageal sphincter (LES). Achalasia is a condition characterized by increased LES pressure, a failure of LES relaxation with swallowing, and poor or absent esophageal peristalsis. Intravenous VIP has been shown to improve LES relaxation, and lower the elevated LES pressure in achalasia patients (Guelrud et al., 1992). An initial report showed improvement by low-frequency transcutaneous nerve stimulation dysphagia in patients with achalasia and also systemic sclerosis (Kaada, 1987). This was associated with an increase in plasma VIP.

Chang et al. (1996) studied the effect of TENS on normal volunteers, using TENS at the foot as a control group. TENS on the hand improved LES relaxation and percent of peri-

staltic contractions to swallows, and increased VIP levels. TENS on the foot did not change VIP levels or LES pressures. The authors postulated a somatovisceral pathway involving the esophagus.

This phenomenon was also studied in 6 patients with achalasia, with determination of plasma VIP levels, and manometric follow-up (Guelrud, 1991a). Transcutaneous nerve stimulation was carried out by electrical stimulation to the well-known point, *Hegu* (LI-04). There was a significant effect of TENS on resting LES pressure, LES relaxation, and VIP plasma values, all of which were sustained at manometry 1 week later. Only 1 of the 6 subjects (17%) failed to show a response.

Acupuncture treatment for achalasia was reported in a controlled but nonrandomized trial (Tusheng, 1994). The primary acupoint utilized was GB-21 (*Jianjing*), with the addition of PC-6, CV-12, ST-36, and CV-17. Improvement in swallowing was noted on the basis of improved symptoms, as well as improved passage of barium through the lower esophageal sphincter. The response to acupuncture was inversely related to duration and severity of the symptoms.

Pancreatic diseases

Acupuncture has been used for the management of pain associated with both pancreatitis and pancreatic malignancy. A previous report of benefit of TENS to the abdomen in 6 patients with chronic and acute pancreatitis in reducing pain and decrease recurrent attacks has suggested that TENS may be useful (Roberts, 1978). It is possible that any beneficial response to acupuncture may be related to effects on pancreatic exocrine function (Wang and Hou, 1985), or changes in vagal efferents to the pancreas (Ikeda et al., 1981).

In the only prospective randomized study available (Ballegaard et al., 1985), the effect of electroacupuncture versus sham acupuncture was studied in 23 patients with daily pain from pancreatitis without ongoing alcohol abuse. That study also compared TENS versus sham TENS. Neither electroacupuncture nor TENS could bring about pain relief that could substitute for, or supplement, medical treatment.

A recent study looked at a combination of Western (surgical) plus TCM for severe pancreatitis, and compared these patients to historical controls of patients treated with surgical therapy alone (Qi et al., 1995). The authors claim a decreased mortality; however, attributing the decrease to the addition of TCM alone is not possible from this type of study because of the nonrandom allocation of treatment and control groups.

Acupuncture has been used for pain associated with malignancy (Filshie and Redman, 1985). There is a report on the benefit of acupuncture for cancerous abdominal pain (Xu et al., 1995), but firm conclusions on the overall efficacy of this approach cannot be made.

Acute appendicitis

TCM has a long history of management of acute abdominal pain with acupuncture. In China, appendicitis has been commonly managed nonsurgically. Nonsurgical management (with antibiotics) has even been investigated in the Western medical literature (Eriksson and Granstrom, 1995), and was found to be as effective as surgery (although with a higher recurrence rate). The literature in the field of acupuncture suggests a benefit of acupuncture for acute appendicitis (Fan and Zhang, 1983; Tang and Fu, 1981). Unfortunately however, controlled data, on which to base a therapeutic decision in Western clinics, are lacking.

There is also a body of literature on the ability to use acupuncture for surgical analgesia in appendectomy. In a prospective study, 80 patients with acute appendicitis were randomly assigned to acupuncture analgesia (on ST-36) versus epidural anesthesia (Sun et al., 1992). There was less respiratory depression, hypotension, cardiac arrhythmia, and less intravenous fluid required than the epidural block group. Also, postoperative recovery, postoperative analgesic use, and incidence of wound infection were better in the acupuncture group. Another large case report study of acupuncture in about 2000 patients managed with surgery for appendicitis has been reported (Chen and Chen, 1990). Most patients showed favorable results. These authors acknowledged some of the important is-

ues in acupuncture analgesia for abdominal surgery, including dealing with difficulty with incomplete anesthesia, abdominal muscular tension, and pain related to traction of the viscus.

Inflammatory bowel disease

The published literature strongly suggests that acupuncture modulates the immune system (Rogers et al., 1992). Effects on specific and nonspecific cellular and humoral immunity have been identified. Activation of cell proliferation including blood cell lines and reticuloendothelial systems were found. Anti-infective function such as leukocytosis, microbicidal activity has been elicited, and antibody, complement, and interferon production under the influence of acupuncture has been shown in animal and human models. Induction of immune cells in spleens of mice has been shown to be activated via the sympathetic nervous system stimulated by acupuncture (Fujiwara et al., 1991).

There are no data analyzing the effect of acupuncture on the complex mucosal immune system that is intimately involved in the pathogenesis of inflammatory bowel disease (IBD). IBD includes ulcerative colitis and Crohn's disease, and also rarer forms of chronic colitis such as lymphocytic colitis or collagenous colitis. However, given the well-demonstrated effects of acupuncture on immune function, including immunosuppression, it seems reasonable to accept a physiological basis for the possible beneficial effects of this modality on IBD.

No prospective clinical studies on acupuncture in IBD appear in the medical literature. A case report-type series of 39 cases with favorable results has been described (Yangdong et al., 1993). Patients were aged 15 to 44, and were treated with acupuncture and moxa. The points used included: ST-25, ST-36, CV-6, CV-12, periumbilical points 1 inch above, below, and lateral; supplementary points were CV-10, CV-11, BL-20, BL-21, BL-23, ST-21, SP-14). A positive result ("cure") was noted in 72%. Unfortunately, duration of remission and length of follow-up were not stated. A second case study of 61 patients noting beneficial effects has also been reported (Zhang and You, 1987). In clini-

cal practice, selection of acupuncture points for treatment of IBD may follow symptom differentiation according to the principles of TCM (Chen, 1995), or by other acupuncture systems (Requena, 1981).

Postoperative GI dysmotility

An intriguing possible clinical application is the use of acupuncture in cases of postoperative ileus, or gastric atony after vagotomy (Matsumoto and Hayes, 1973). A positive effect has been noted in case reports in humans and animals. In a prospective, randomized trial, Liu and Zhao (1991) examined effects of acupuncture at ST-36 and SP-6 given 12 to 24 hours postoperatively on 39 abdominal surgical patients. Time to first passage of stool, and serum ALT, AST, and gamma-GT, improved significantly. Xunshi (1994) performed a prospective, randomized study of 100 patients after laparotomy (gastrectomy or cholecystectomy), utilizing tender points on the hand. Points in the real acupuncture group were needled manually 30–40 minutes daily until flatus. The treatment group passed flatus at an average of 42 hours postoperatively compared to 92 hours for the control group.

Kabanov et al. (1989) used acupuncture in 220 patients with purulent peritonitis to try to restore motor function of the stomach and intestines. Although this study was not randomized, a single session of acupuncture improved patients with local peritonitis, while 100 patients with diffuse peritonitis needed 2–3 sessions for clinical effect. Twenty patients showed no effect. Wu et al. (1974) analyzed 250 gastrectomy patients, noting advantages of using acupuncture in preventing need for routine gastric decompression, and allowing earlier refeeding. Shi (1982) described a heterogeneous group of patients with ileus and obstipation who responded to acupuncture.

Acupuncture point combinations used for postoperative ileus include ST-37, ST-39, and ST-25 (electrically stimulated with crescendo current intensity plus manual stimulation of CV-6 to CV-4) (Niboyet, 1979), and the Distinct Meridian of Spleen-Stomach (BL-1 (or ST-1), ST-30, SP-12) with focusing points on abdomen (such as ST-25 or ST-26) (Helms, 1995).

Use for analgesia in GI endoscopy

In the United States, and much of the Western world, “conscious sedation” with pharmaceutical agents is the standard for GI endoscopic procedures. In other countries, unsedated endoscopy is more common. There are several prospective randomized studies demonstrating the efficacy of acupuncture as analgesia for endoscopic procedures such as upper endoscopy (esophagogastroduodenoscopy) and colonoscopy. One prospective, randomized, controlled (sham acupuncture) trial was done in 90 patients undergoing gastroscopy (Cahn et al., 1978). The points used were ST-36, SP-5, PC-6 (all bilaterally), and CV-12, 17, 23, and 24 (these are points in the midsagittal line over the thorax and upper abdomen). Endoscopy was much easier to perform and better tolerated after real acupuncture analgesia as compared to sham acupuncture. It is noteworthy that the placebo points were very close (1 cm away) from the real points, and both sham and real groups received electrical stimulation to the needles.

A prospective and randomized (but not blinded or sham-acupuncture controlled) study in 200 patients compared electroacupuncture analgesia versus meperidine for colonoscopy (Wang et al., 1992). Because the patients were lying in the left decubitus position, the points ST-36 and ST-37 were needled manually on the right leg, in addition to application of a press-tack intradermal needle at the well-known auricular point *Shenmen*. Eighty-eight patients treated with acupuncture successfully completed the colonoscopic examination (compared to 96 in the meperidine group). Tolerance, as defined by an endoscopist’s report, was equivalent in both groups. Also, compared to the premedicated group, the acupuncture group reported a much smaller incidence of dizziness. The same investigators examined the physiological response of electroacupuncture analgesia for colonoscopy in a series of 59 patients randomized to acupuncture versus iv premedication (Wang et al., 1997). They showed comparable levels of pain tolerance in patients, increased serum levels of β -endorphin similar to that in the meperidine group, and significantly less dizziness with the electroacupuncture. A third prospective, random-

ized, and sham-acupuncture controlled study of electroacupuncture for colonoscopy in 36 patients also showed benefit (Li et al., 1991). Acupoints LI-4, PC-6, ST-36, and SP-4 were used. There was significantly lower pain sensitivity (as measured on a visual analog scale filled out by the patient), and significantly less need to add intravenous sedation in patients given acupuncture analgesia.

Another randomized, but not blinded study (Chu et al. 1987) compared electroacupuncture (2.5 Hz for 10–15 minutes) at the right ST-36 and LI-4 points while the patients were lying on their left side. The needles were removed immediately after gastroscopy was completed. These patients were compared to a second group premedicated with atropine and intramuscular diazepam. Both groups received topical xylocaine spray. The electroacupuncture gave satisfactory results during and after gastroscopy, with no side effects. The group receiving intramuscular premedication experienced some dizziness after the procedure.

In summary, several prospective, randomized, controlled trials have shown the benefit of electroacupuncture in providing analgesia for endoscopic procedures, both upper endoscopy, and colonoscopy. While this approach does not provide the depth of analgesia and the anamnestic response to benzodiazepine anesthesia (the norm when sedated endoscopy is done), it may find a role in providing another option for analgesia when a patient is going to undergo an unsedated endoscopic examination.

Constipation

Constipation is a common symptom that may mean a variety of things to different patients. In one patient, it may mean one bowel movement a week, while another patient may complain of "constipation" despite having daily or twice daily bowel movement. Western medicine has distinguished subtypes such as colonic inertia, functional outlet obstruction (paradoxical pelvic floor contraction), and IBS-related constipation. However, constipation may be an entirely subjective symptom depending on the patient's happiness with their defecatory function.

Few studies have examined the role of acupuncture on constipation. Case report series have been described. Xiong et al. (1995) treated 21 patients with constipation associated with diabetes mellitus with daily acupuncture at BL-32, TH-6, and ST-36 for 5 days. This was said to work well; only 4 patients needed a second course at 6-month follow-up. Klausner et al. (1993) studied the effects of electroacupuncture on 8 patients with colonic inertia-type constipation. Colonic transit was measured with the use of radio-paque markers, and patients had to have total colonic transit times of longer than 60 hours to be included. Electroacupuncture was performed at LI-4, ST-25, LV-3, and BL-25 for 25 minutes in 6 sessions. Stool frequencies and colonic transit times (total, right hemicolon, left hemicolon, and rectosigmoid) did not change significantly after acupuncture.

Diarrhea

Acupuncture has been shown to be of benefit in infectious diarrhea. In an animal model (preweaning piglets inoculated with enteropathogenic *E. coli*), traditional acupuncture sped recovery from the infection, and at a rate comparable to oral neomycin (Hwang and Jenkins, 1988). Acupuncture has also been investigated in veterinary medicine to control preweaning diarrhea in pigs (Lin et al., 1988). In humans, case reports have noted beneficial effects of acupuncture in treatment of infantile diarrhea (Su, 1992), and in bacillary dysentery in adults (Hua et al., 1982).

Acupuncture has also been used in what has been called "functional diarrhea" (No author, 1990). Diarrhea-predominant irritable bowel syndrome may be responsive to acupuncture (see below).

Irritable bowel syndrome

Irritable bowel syndrome (IBS, "spastic colitis") is an exceedingly common disorder of the digestive system characterized by abdominal pain or discomfort and a change in the bowel habit. IBS is "a combination of chronic or recurrent gastrointestinal symptoms not explained by structural or biochemical abnormalities ... attributed to the intestines and associated with symptoms of pain and dis-

turbed defecation and/or symptoms of bloatedness and distention" (Drossman et al., 1997).

Similar to NUD, the exact etiology of IBS is unknown; also, there seems to be clinical heterogeneity in expression. The terms "diarrhea-predominant IBS" and "constipation-predominant IBS" illustrate this lack of precise syndrome differentiation. There is evidence that symptoms in IBS correlate with specific autonomic nervous system abnormalities (Aggarwal et al., 1994). Because acupuncture is known to influence autonomic function, it is reasonable to hypothesize that it may be useful in selected cases of functional bowel disease (FBD). Psychological factors are important in many GI diseases, but even more so for the functional bowel diseases (Creed and Guthrie, 1987), of which NUD and IBS are 2 of the major examples. It is difficult to study therapeutic interventions in IBS (Klein, 1988), not the least because of the fact that clinical end points of improvement are subjective, not easily quantifiable, and that long follow-up is necessary to adequately evaluate the efficacy of an intervention. The research methodology to design appropriate clinical trials for FBD, utilizing "quality of life" measures and other advanced techniques (Glise and Hallerback, 1993), is now improving to the point where such trials for FBD can be done properly.

Western medical treatment is inadequate in many cases, and alternative therapies would be greatly welcome for this disorder. Many practitioners feel very strongly that acupuncture is effective in the management of IBS. In clinical practice, acupuncture is often combined with herbal medicine, with the choice of herbal combination usually selected on the basis of TCM diagnosis or symptom complex (Lewis, 1992). There are several reports of the use of acupuncture in IBS. One study compared real to sham acupuncture (Kunze et al., 1990), and found a greater effect with the real treatment (31% vs. 17%), but both groups were inferior to brief psychotherapy (74% response rate). In a retrospective review of acupuncture for patients with IBS (and NUD) published in abstract form, Diehl et al. (1994) reported some benefit to acupuncture treatment; of 10 IBS patients, 4 responded well, 5 responded partially, and only 1 patient was a nonresponder. Most pa-

tients required ongoing acupuncture for sustained clinical improvement.

A pilot study from England followed 7 patients with IBS who were offered a 4-week course of acupuncture (Chan, et al., 1997). The patients filled out IBS symptom diaries on a daily basis for 28 days. This study used the same points on all patients, and did not differentiate TCM diagnoses. The specific points used were: LR-3, SP-6, ST-36, ST-25, ST-27, LI-4, LI-11, LU-5 (all points taken bilaterally, with needles retained for only 3–5 seconds each). The authors found improvement in general sense of well-being and bloating, but no change in abdominal discomfort and bowel frequency. The obvious drawbacks to this study are small sample size, the absence of a control group and blinding, short follow-up, and the rather unusual needling technique involving "cookbook" selection of points and short needle retention times. Other case report studies have been reported (Gabuzian et al., 1994; DiCicco et al., 1976). There may be a role for acupuncture in the management of IBS, but wide adoption of this therapy in the Western clinic awaits controlled trials with adequate follow-up.

MANAGEMENT OF CHOLELITHIASIS AND BILIARY ASCARIASIS

Calculous biliary obstruction

Several reports have reported success in treating cholelithiasis and choledocholithiasis with acupuncture (Wang and Xiao, 1990; He, 1986). Ear acupoints (Fig. 3) are typically used, although in some reports, body acupoints are also utilized. In one large case report type series (Zhang et al., 1991), 1291 cases of ultrasonographically-proven cholelithiasis were treated with electrical stimulation of auricular acupoints. Stone expulsion was monitored by stool examination for calculi. The electric stimulation was "as strong as the patient could endure" and was given at 4 ear points 1 or 2 times daily, for 10 minutes per session. While there was not a randomized control group, 78 patients were observed for evidence of spontaneous stone expulsion without auricular electrical stimulation. Stone expulsion from the

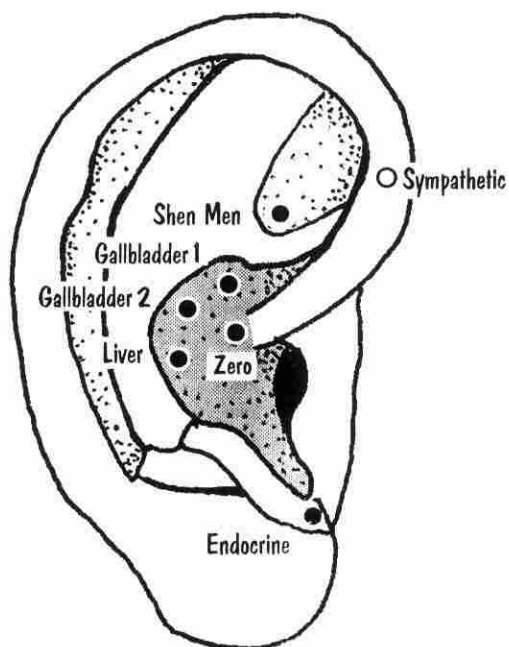


FIG. 3. Auricular acupoints for treatment of biliary tract disorders.

gallbladder was noted in 91% of cases, although complete stone clearance was only seen in 19%. Interestingly, expulsion of stones from the common bile duct was found in 87% of cases. None of the "control" cases had stone expulsion. There was symptomatic improvement in almost every case, with only 4 of 1291 patients not having improvement. Stone expulsion was found in 53% of patients treated with 1–10 sessions, and an additional 31% of patients treated with 11–20 sessions; 17% of patients needed more than 21 sessions.

Another nonrandomized report (Chen et al., 1985; comment by Wu, 1987) followed 365 patients whose gallstone disease was fully characterized by ultrasonography and cholecystography. The stones were in the gallbladder in 326, in the intrahepatic ducts in 20, common bile duct in 6, and multiple sites in 14. Four auricular acupoints ("Liver," "Gallbladder," "Bile Duct," and "Duodenum") were stimulated by thrice daily postprandial manual stimulation of the points on the ear for 30 days (the method of acupressure over small seeds taped over the point was used). After treatment, gallstones were found in the stool in 299 treated patients (82%) but in only 7 of "randomly selected" controls (15%). Follow-up ultrasonography showed the following results: complete clearance of

stones (5%); reduction in number by about half (16%); and reduction in number, but less than half (20%); no change (35%); and increase in number of stones (19%). Expulsion was higher in the common bile duct (CBD) stone group, and patients with stones smaller than 5 mm. Improved clearance was seen in patients prolonging treatment beyond 30 days.

Beside the obvious problems with nonrandomized clinical studies, the theoretic risk of inducing gallstone pancreatitis was not mentioned in these reports, so one may not comment on the safety or advisability of this treatment. However, the effect of acupuncture in inducing the expulsion of gallstones seems certain.

There are many possible mechanisms for this clinically relevant effect. Acupuncture can cause gallbladder contraction, both in animal (Zhang et al., 1993) and in human models (Liu et al., 1993). Electroacupuncture of acupoints GB-18 and LV-14 (the "Back-Shu" and "Front-Mu" points of the liver) stimulated bile secretion in patients monitored by T-tube output (Zhang et al., 1995). Acupuncture (Liu et al., 1993) and transcutaneous nerve stimulation (Guelrud et al., 1991b) both influence the sphincter of Oddi, including a lowering of basal pressure. These effects may theoretically allow stone clearance from the biliary tree.

These theoretical explanations were studied in the golden hamster, an animal model of cholelithiasis (Ma and Yang, 1996). Daily electroacupuncture significantly reduced the incidence and number of gallstones. Bile analysis showed higher cholic acid and lower cholesterol content, and higher bile volume. All of these factors would serve to decrease the lithogenicity of bile. Electromyography showed increased motility of the sphincter of Oddi.

Biliary ascariasis

It is unlikely that acupuncture will soon replace endoscopic retrograde cholangiopancreatography (ERCP) and laparoscopic cholecystectomy in the management of calculi of the gallbladder and common bile duct in Western clinics. However, it is reasonable to propose acupuncture as adjunctive therapy in the management of biliary ascariasis. *Ascaris lumbrici-*

coides is one of the most common helminthic infections in developing countries; it is usually treated with albendazole, an anthelmintic agent. A small percentage of cases are complicated by bile duct obstruction when the worms insinuate themselves through the sphincter of Oddi and lodge in the extrahepatic biliary tree, and sometimes the gallbladder (Schulman, 1998). This can present with jaundice, or even cholangitis. ERCP has been done in these cases to facilitate worm expulsion.

In many parts of the world, ERCP facilities and expertise are not available. If acupuncture treatment effectively clears the bile ducts of worms, it could simplify management of the cases complicated by ductal obstruction. Reports of success in managing biliary ascariasis with acupuncture, or with acupuncture and herbal medicine have been reported (Mo et al., 1987; Liangmin, 1996). Further investigations in endemic areas may be worthy of study.

Acute and chronic hepatitis

Infectious hepatitis is endemic in Asia, so it is not surprising that there is great interest in examining the role of acupuncture in management of these conditions. In clinical practice, acupuncture may be combined with herbal medicines, both for acute and chronic hepatitis (*A Barefoot Doctor's Manual*, 1990; Shanghai College of Traditional Medicine, 1981). There are many studies in abstract form, but no research papers have been published that are searchable through the MEDLINE database.

Acupuncture has been shown to be hepatoprotective in the α -naphthylisothiocyanate (ANIT) animal model of cholangitis and obstructive jaundice (Lin et al., 1995). Acupuncture produced significantly lower serum liver enzymes and bilirubin, while also reducing morphological parameters of liver injury.

FUTURE DIRECTIONS

Acupuncture practitioners often treat GI diseases. The whole range of conditions may be seen, and typically, herbal medicines may be combined with acupuncture treatment. Unfortunately, few prospective, randomized, and controlled trials have been done to fairly evaluate clinical response rates.

Because functional bowel disease (FBD) is so common (>10% of the general population), and may not be well-treated with Western pharmaceuticals, these conditions are often seen in the acupuncture clinic. Also, patients with IBS more commonly utilize alternative medicine, or would consider it, when compared to other (nonfunctional) GI disorders (Smart et al., 1986). Prospective, randomized, and properly performed studies are clearly needed in this area. Unfortunately, the FBDs are among the most difficult digestive diseases to study because of the lack of objective end points, high rate of placebo response, and variable clinical course of the disease. As research methodology improves, especially in the area of quality of life measures and outcomes research, these techniques can be applied to the study of acupuncture treatment of FBD.

Clinical research on the possible application of acupuncture treatment for IBD is also worthy of study, because of the known effects of acupuncture on immune function. Also, end points of therapeutic success are more clear-cut than for the FBDs, and standardized measures of therapeutic effect have been in use for several years. Acupuncture may be investigated as an adjunctive treatment for IBD, especially in cases that may be refractory to standard medical therapy.

Well-designed studies investigating acupuncture treatment of PUD have not been done, and are probably of diminishing relevance in light of current understanding of the pathophysiology of PUD, and the availability of effective treatment.

The possibility of using acupuncture therapy for stone and parasite disease of the gallbladder and bile ducts is intriguing. The possibility is supported by large clinical series, but not truly randomized data. A possible application is in areas that do not have easy access to endoscopic extraction of common bile duct stones.

There is a large body of literature pertaining to acupuncture effects on GI physiology and clinical conditions that is not accessible to the West simply because it has not been translated from Chinese to English. Also, there are many texts written in ancient Chinese that have not been translated to modern Chinese. Efforts

should be made to translate such information, so that all interested researchers and practitioners can examine it. This will also serve to stimulate new areas of research, and the identification of clinical areas that are worthy of deeper study.

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Address reprint requests to:
David L. Diehl, MD, FACP
Olive View-UCLA Medical Center
Department of Medicine
Sylmar, CA 91342