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Update for nurse anesthetists

Acupressure and postoperative nausea and vomiting

Angela G. Hickman, CRNA, MSN, APN
Donald M. Bell, CRNA, DNSc, APN
John C. Preston, CRNA, DNSc, APN
Knoxville, Tennessee

Despite great strides during the preceding 3 decades, the ability to consistently eliminate postoperative nausea and vomiting (PONV) continues to elude anesthesia practitioners. The occurrence of PONV related to anesthesia and surgery prolongs hospital stays and increases healthcare costs. Protracted recovery times place constraints on patients, healthcare systems, and healthcare financiers. Many pharmacological antiemetics have been developed and are in use in the attempt to alleviate PONV. Side effects and cost profiles of many of these interventions, however, reinforce the broadly held belief that there remains opportunity for improvement.

Because the Western culture almost exclusively favors evidence-based scientific practice and interventions, the search continues for an ideal, cost-effective, safe, and efficacious pharmacological agent to prevent PONV. Eastern culture, on the other hand, relies heavily on naturopathic remedies whose successful use has spanned thousands of years. Increasing attention has been given to the potential benefits of nonpharmacological intervention for the prevention of PONV in association with anesthesia care. Therefore, the purpose of this AANA Journal course will be to focus attention on what is known and what is unknown in the literature regarding the use of the nonallopathic remedy of acupressure as a nonpharmacological alternative to commonly utilized antiemetic prophylaxis.

Key words: Acupressure, acupuncture, anesthesia, nausea, surgery, vomiting.

Introduction

Postoperative nausea and vomiting (PONV) is a leading complication of surgery and often is viewed by patients as the single most stressful side effect of anesthesia and the operative period. The incidence of PONV varies according to several variables, including the patient’s age, weight, gender, and high-risk surgeries, such as gynecological procedures. Some report the occurrence of PONV for high-risk procedures to be as much as 60% to 70%.

While today’s healthcare system is focusing on the reduction of expenditures and resources, delayed recovery room discharge, increased hospital admissions, and the inability to quickly return to normal activities are of concern to patients, hospitals, and insurance companies alike. In fact, one study indicated that most patients are willing to pay an additional $56 to $100 to avoid PONV. All of these factors underscore the need for effective antiemetic prophylaxis.

Historically, the pharmacological treatment of PONV has involved the use of phenothiazines, anti-
histamines, anticholinergics, benzamides, and butyrophenones. The side effects associated with these drugs can include headaches, constipation, agitation, tachycardia, extrapyramidal effects, sedation, and even possibly prolonged QT intervals and fatal arrhythmias. One specific complication, cardiac arrhythmia, has been the source of a US Food and Drug Administration Black Box Warning. Fear of a potential patient risk and subsequent litigation related to the cautionary labeling has significantly affected the use of droperidol by many practitioners.

The widening disparity between benefit and risk has provided sufficient impetus for anesthesia providers to continue the search for an economical, effective, and safe alternative to some of the currently accepted pharmacological interventions for the prevention of PONV. Currently, the focus of intervention is on combination antiemetic therapies that include the aforementioned medications along with serotonin receptor antagonists and corticosteroids. In addition, a new class of antiemetic agents, neurokinin-1 receptor antagonists, holds promise for the future owing to the ability of these antagonists to enhance the efficacy of commonly applied PONV therapies, including the combination of a serotonin antagonist plus a corticosteroid.

A nonpharmacological alternative therapy, acupuncture, used for more than 3,000 years in China, has been shown to be an effective intervention for nausea and vomiting in many situations. Unfortunately, qualified acupuncturists are not readily available, and acupuncture is not accessible for home therapy following postsurgical discharge. Although they are rare, the potential side effects of acupuncture include pneumothorax, nerve damage, and infectious disease transmission. In addition, the fear of needles may prevent some patients from accepting its use, thus limiting its application in the pediatric population.

A noninvasive alternative PONV preventative is acupressure. This ancient naturopathic science is based on a nonpharmacological theory that differs radically from modern allopathic medicine. As with acupuncture, the theory of acupressure is based on the belief that the human body has 14 imaginary meridians that conduct energy to specific anatomical regions. These imaginary meridians, which originate in the fingertips, provide a direct pathway to the brain (Figure 1). In turn, the brain is able to communicate with the organ associated with a particular meridian.

Each meridian is classified according to the specific organ to which it is associated. For example, the heart meridian is connected to the heart; the lung meridian is connected to the lungs. In theory, therefore, a problem arising from the heart would indicate the possibility of an interruption along a particular meridian that limits or totally prevents the flow of energy to a specific organ. According to the theory of this science, manipulation of the tissues along a meridian has the ability to reestablish proper energy conduction to the affected organ. When acupressure is applied, the interruption is relieved, the energy flow resumes, and the organ is able to function normally.

Acupressure differs from acupuncture because it involves constant pressure on acupuncture points, but it does not puncture the skin. Acupressure points, also called potent points, are places on the skin that are especially sensitive to the conduction of bioelectrical impulses throughout the body. Because the transmission of pain occurs via bioelectrical impulses, it is postulated that pain itself also can cause nausea. In turn, acupressure placed along a meridian is thought to relieve pain through the stimulated release of endorphins, enkephalins, serotonin, and/or neuropeptides, although the exact mechanism of action has yet to be determined scientifically.

Asian cultures traditionally conceived of acupressure points as junctures of special pathways that carry human energy, called chi (Chinese) or ki (Japanese). According to Eastern belief, stimulating or interrupting the human energy is the principal mechanism for altering an individual’s response to negative stimuli. In comparison, Western ideology views the potential mechanism of action of acupressure, if accepted at all, as most likely being related to the belief that stimulat-
ing these points ostensibly triggers the release of endogenous endorphins.\textsuperscript{1,3,6}

Because acupressure stimulation brings about the release of substances capable of inhibiting pain signals to the brain, the ultimate mechanism of action has been described as closing the gates of the pain-signaling system. In turn, pain is prevented from passing through the spinal cord to the brain.\textsuperscript{1} These explanations are supported by the basic tenets of Melzac and Wall’s “gate control theory of pain” and the “theory of the reflex arc.”\textsuperscript{24}

The gate control theory of pain suggests that as nociceptive afferent pain fibers enter the spinal cord, they synapse at the dorsal horn. At this point, a gate modifies the stimulus before it is transmitted rostrally. The theory further suggests that large-fiber inputs tend to inhibit nociceptive transmission by closing the gate, whereas small-fiber inputs open it. Endogenous opioids are located in the dorsal horn and elsewhere throughout the pain pathway; thus, they are able to exert an influence on the rostral transmission of pain.\textsuperscript{25} The application of acupuncture or acupressure allows for the suppression of pain impulses by activating these endogenous opioid systems.

The theory of the reflex arc states that pain is transmitted from the periphery by means of posterior sensory neural fibers to the posterior horns of the spinal cord. From this point, pain transmission may follow 1 of 2 routes: (1) Via afferent neural fibers, pain impulses may reach the cortex through the thalamus. (2) Pain may be transmitted from the posterior to the anterior portion of the spinal cord and through the motor efferent anterior roots, where it may be directed to various organs, muscles, skin, vessels, and glands that are served by the same or neighboring neurotomes. It is believed that acupressure stimulation may follow the second route of the reflex arc. This would explain the pain impulse-blocking action of acupressure from a point in the periphery to an internal organ. Like much of science, it is conceivable that another, as yet unknown, mechanism may exist that explains the effective action of acupressure.

Review of literature
Most of the acupressure studies found in the extant literature involve the treatment point P\textsubscript{6} (Figure 2), which corresponds to the number 6 pericardial meridian point. This treatment point is located 2 inches proximal to the distal wrist crease between the palmaris longus and flexor carpi radialis tendons\textsuperscript{24} (Figure 3). Dundee et al\textsuperscript{26} studied the antiemetic efficacy of P\textsubscript{6} stimulation in women who underwent general anesthesia for minor gynecological procedures, which are known to be associated with an increased risk of PONV. Stimulation, either manual or electrical at 10 Hz, was applied at the P\textsubscript{6} point for 5 minutes at the time of administration of nalbuphine, 10 mg, for premedication. The authors use Sea Bands (Sea-Band Ltd, Leicestershire, England) for the application of acu-
pressure (Figure 4). These bands are British made, commercially available, contain a stud in an elasticized band that is applied to the P6 point (Figure 5), and have been used in several subsequent studies. When compared with untreated control subjects, P6 stimulation in study patients markedly reduced the incidence of PONV during the first 6 hours after surgery. This did not occur with stimulation of a dummy point outside recognized acupressure meridians.

Use of Sea Bands proved to be as effective as invasive electrostimulation during the early postoperative period. Beyond a 6-hour postoperative period, however, Sea Bands were less effective than invasive stimulation. It is interesting that stimulation of the P6 point was as effective as 2 standard antiemetics (cyclizine, 50 mg; metoclopramide, 10 mg). However, the antiemetics and the acupressure were similarly less effective at 6 hours postoperatively than the acupuncture but more effective than a placebo.27,28

Barsoum et al10 conducted a study in which 162 general surgery patients were randomized into 1 of 3 groups postoperatively for the purpose of determining whether the use of acupressure bands had any effect on postoperative inhibition of nausea and/or vomiting: (1) Sea Bands applied to bilateral P6 points; (2) elasticized bands without pressure buttons (dummy bands) bilaterally; and (3) bilateral application of dummy bands with the postoperative administration of prochlorperazine, a pharmacological antiemetic. All bands were applied postoperatively and remained in place until the conclusion of the study, which was defined as discharge or up to 7 days. None of the participants knew the type of band applied. Patients were assessed daily until they were consuming a diet comparable to their preoperative intake. The results showed that the nausea scores for the acupressure group were significantly lower during the first 2 days after surgery. In addition, the acupressure group required fewer antiemetic medications on a daily basis compared with the other 2 experimental groups. However, on the third and following days postoperatively, no significant difference for nausea was found. Overall, this study demonstrated that acupressure, as applied by the Sea Bands device, could be effective in reducing PONV during the immediate postoperative period.

Three separate studies focused on the effects of acupressure on PONV exclusively for patients having laparoscopic procedures, a procedure with a high incidence of PONV.4-6 All 3 studies were randomized, double-blind, and placebo-controlled. In each of these studies, stimulation of the P6 pressure point was evaluated for its role in the prevention of nausea and vomiting. In 2 studies, acupressure wristbands were placed bilaterally, and in the third study, the bands were placed unilaterally. In addition, one of the studies compared the effects of ondansetron with acupressure.4 All 3 studies showed a significant reduction in PONV with the use of acupressure stimulation of the P6 pressure point compared with the placebo group (no pressure stimulation of P6).4,6,7 Also, in the study by Agarwal et al4 that evaluated pharmacological intervention, acupressure was shown to be equally as effective for reducing PONV as a 4-mg prophylactic dose of ondansetron.

Harmon et al7 studied the effects of acupressure on subjects having spinal anesthesia for cesarean section. This was a double-blind, randomized, and controlled study involving 94 subjects. Acupressure bands were placed unilaterally on the P6 point. Subjects were questioned at 5-minute intervals intraoperatively and again at 6 and 24 hours postoperatively. Results showed a
significant reduction in intraoperative and postoperative nausea and vomiting. Even though the bands were removed 6 hours postoperatively, the effects persisted until the 24-hour period.

Ming et al\textsuperscript{11} confirmed the effectiveness of acupressure in preventing postoperative nausea and vomiting by applying pressure to the P\textsubscript{6} or H\textsubscript{7} point in subjects undergoing general anesthesia for endoscopic sinus surgery. The H\textsubscript{7} point is located between the wrist bone and the ulna (see Figure 2). The study included 150 subjects randomly and equally assigned to a finger-pressing group, a wristband group, or a control group. The acupressure points and treatment times were similar in the finger-pressing and wristband-pressing groups, whereas only conversation was used in the control group. The 2 intervention groups were treated with three 20-minute treatments: 1 hour preoperatively, just before leaving the recovery room, and 10 hours postoperatively. The results of this study demonstrated that acupressure, whether by an elasticized band or by finger pressure, effectively reduced the incidence of PONV.

Another nonpharmacological over-the-counter PONV preventative is the ReliefBand (Abbott Laboratories, Abbott Park, Ill) (Figure 6). This device is marketed as an adjunct to antiemetic medications, and is worn like a watch on the dorsal aspect of the wrist. ReliefBand emits low-voltage electrical signals to the P\textsubscript{6} acupressure point. In most circumstances, the device is placed on the patient's wrist immediately after the completion of surgery or on arrival in the postanesthesia care unit, when nausea and vomiting are likely to occur. Because the ReliefBand is not a drug and has no drug-like side effects or drug-drug interactions, the patient may continue to wear the device after discharge. A 2003 study by Treish et al\textsuperscript{29} concluded that the ReliefBand can be a valuable adjunct to antiemetics for patients who experience nausea and vomiting.

Korean hand acupressure for prevention of PONV traditionally is performed at the K-K\textsubscript{9} point (Figure 7), which is located on the fourth finger at the middle phalanx. Three double-blind, randomized, placebo-controlled studies evaluated stimulation of the K-K\textsubscript{9} point that involved subjects undergoing surgical procedures known to be associated with an increased risk of PONV: gynecological laparoscopic surgery and pediatric strabismus surgery. Each study demonstrated a significant reduction of PONV compared with the placebo group. The strabismus studies were particularly interesting because pediatric studies of acupuncture and acupressure have been limited in number and have not demonstrated consistent effectiveness.\textsuperscript{12,18,24}

Two randomized, double-blind, and placebo-controlled studies with statistically adequate numbers of subjects demonstrated that acupressure stimulation of P\textsubscript{6} alone did not result in a significant decrease in the incidence PONV. However, when ondansetron was added, the efficacy improved markedly.\textsuperscript{4,30}

Although they use different application techniques (invasive vs noninvasive), acupuncture has a strong relationship to acupressure because they stimulate the same treatment points. A 2004 study by Gan et al\textsuperscript{31} found that acupuncture, using the P\textsubscript{6} treatment point, had significantly greater efficacy than ondansetron in reducing nausea and vomiting in subjects who had received general anesthesia for major breast surgery. For that study, 75 patients who were to undergo breast augmentation, breast reduction, or mastectomy were randomized into 1 of 3 groups: one that received acupuncture, one that received ondansetron, and a group that received neither. Patients who underwent acupuncture also reported decreased postoperative pain and increased satisfaction with their postoperative recovery. It is interesting that this study used an electroacupuncture device in which an electrocardiograph-type electrode pad was attached at the P\textsubscript{6} point. Instead of actually breaking the skin with traditional needles, the electroacupuncture device delivered a small electrical pulse through the skin.\textsuperscript{31}
Discussion

Despite the ever-increasing number of empirical studies encompassing the extant literature, inconsistencies and heterogeneous results indicate that there continue to be several areas associated with the use of acupressure to effect PONV that justify further research. Although the fund of research presently suggests that acupressure applied at the P6 or K69 points may be as effective as pharmacological antiemetic management for the treatment of PONV, some studies fail to demonstrate that this nonpharmacological intervention is universally efficacious. Therefore, the evidence available is too inconsistent to permit generalizations regarding the efficacy and usefulness of acupressure for the prevention of postoperative vomiting. Further study is needed of the role of acupressure in postoperative emesis. Second, although not understood, it appears that bilateral and preanesthetic applications of acupressure may be more valuable for the prevention of PONV than unilateral and intraoperative stimulation. Therefore, further study could aid in determining the most beneficial application of this intervention.32,33

The results of the majority of studies involving acupressure stimulation of the P6 point in pediatric populations are discouraging. However, stimulation of the K69 point seems promising in this cohort, warranting further research.

Another area for future research involves determining the economical efficacy of acupressure wristbands vs pharmacological antiemetics. This sort of determination is especially significant when the one-time acquisition cost for acupressure bands is considered, which typically ranges from $7 to $10 each. Finally, while quantitative research is available concerning acupressure and PONV, qualitative research in this area would benefit the current level of knowledge. Following up patients from the holding area until a few days after discharge and understanding their thoughts and feelings regarding acupressure and PONV might help practitioners comprehend how acupressure is perceived and whether it is well tolerated in a scientifically driven Western culture. There are a limited number of acupressure studies conducted by nurses, and qualitative research is an area that would be beneficial to the profession. Recently, the National Institutes of Health (NIH) issued a consensus panel statement that clarified the use of acupuncture for the prevention of PONV. According to the summary findings, the NIH believes that promising results have emerged regarding the efficacy of acupuncture in adult postoperative and chemotherapy nausea and vomiting.28,34 Currently, the NIH is completing a phase 1 clinical trial of the use of acupressure for prevention of nausea and vomiting in patients with human immunodeficiency virus infections.27 Interest from the NIH is likely to stimulate further research related to the use of acupuncture and acupressure for prevention of PONV.

Conclusion

Empirical findings from clinical research have provided substantial elucidation concerning the mechanisms of action of acupressure, including the release of endogenous opioids. Although much remains to be accomplished, the emergence of plausible mechanisms for the therapeutic effects of acupressure is encouraging. As such, acupressure clearly holds promise as a tool in the armamentarium of PONV preventatives and should receive serious consideration for integration into clinical anesthesia practice. The implications for patients, hospitals, and insurance companies of a reliable and cost-effective treatment in this regard are enormous. Because it does not rely on the use of drugs, acupressure is an inexpensive treatment that is associated with no known side effects. Owing to the ease of application, acupressure allows anesthesia practitioners and their patients to become more involved in preventing PONV. Moreover, anesthesia practitioners and patients can easily be trained to administer acupressure, thus making it available for hospital and home use.1,6-1,10 With many potential and significant benefits and few, if any, risks, the time has come to consider the clinical integration of acupressure for PONV prophylaxis.

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AUTHORS

Angela G. Hickman, CRNA, MSN, APN, is a staff nurse anesthetist at Knoxville Anesthesia Group, Anesthesia Medical Alliance of East Tennessee, Knoxville, Tenn. Email: ahickman@bellsouth.net

Donald M. Bell, CRNA, DNSc, APN, is assistant professor and associate program director for Didactic Education, Nurse Anesthesia Concentration, The University of Tennessee, College of Nursing, Knoxville, Tenn.

John C. Preston, CRNA, DNSc, APN, is assistant professor and program director/coordinator, Nurse Anesthesia Concentration, The University of Tennessee, College of Nursing, Knoxville, Tenn.