

Auricular Acupuncture to Reduce Postoperative  
Nausea and Vomiting in Sleeve Gastrectomy Patients:

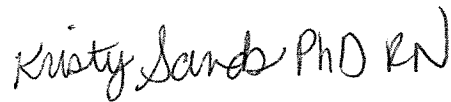
A Quality Improvement Project

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### Abstract

Bariatric surgery is increasing in popularity as an effective treatment for obesity and obesity-related conditions. Sleeve gastrectomy has emerged as the most common bariatric surgery because it delivers comparable weight reduction to gastric bypass, is performed laparoscopically, and has fewer complications. One of the most common complications of sleeve gastrectomy surgery is postoperative nausea and vomiting (PONV). A quality improvement project was completed to evaluate auricular acupuncture (AA) (needles placed in specific meridians in the cartilage of the ears), in addition to current antiemetic treatment to further reduce nausea and vomiting immediately following Laparoscopic Sleeve Gastrectomy (LSG) surgery.

A retrospective chart review was completed to assess episodes of PONV from the end of LSG surgery until discharge from the post-anesthesia care unit. All patients scheduled for LSG surgery were offered AA in addition to traditional antiemetic treatment. Thirty-three patients were included in the study, nine patients chose to have AA and fourteen patients chose not to have AA. Results showed a statistically significant relationship and reduction of postoperative nausea in the AA group from the end of surgery until transfer from the post-anesthesia care unit. No relationship was found between AA patients and vomiting, however, none of the AA patients experienced vomiting postoperatively. These findings suggest that AA is a cost effective and safe treatment for reducing nausea and vomiting in this small group of patients. Further research is needed to determine effectiveness of AA without other interventions, in a larger group of patients and for different types of surgeries.

## **Chapter I: Introduction**

### **Introduction to the Problem**

Laparoscopic gastric sleeve surgery patients experience PONV at a much higher rate, 50-75% than average for surgical patients 30-50% (Halliday, Sundqvist, Hultin, & Wallden, 2017; Pierre & Whelan, 2013). The presentation of vomiting in LSG patients is also different from others, more sudden, without warning, intense and intractable to medications. Vomiting with 85% less of a new postoperative surgical stomach increases risk for complications.

Bariatric surgery is increasing in popularity as an effective treatment for obesity and obesity-related conditions. Auricular acupuncture (AA) is an ancient form of traditional Chinese medicine used for thousands of years to promote balance, harmony, well being and to treat illness. A resurgence in its popularity and subsequent recent research suggest AA is efficacious in the treatment of anxiety and PONV with an added benefit of pain reduction and opioid requirements in surgical patients (Kim, 2015; Usichenko & Streitberger, 2014; Quinlan-Woodward et al., 2016). All of these factors reduce the risk of vomiting and complications.

### **Background and Significance**

Obesity is reaching pandemic proportions worldwide with obesity-related medical conditions causing a surge in demand for bariatric surgeries. Laparoscopic sleeve gastrectomy (LSG) is currently the most commonly performed bariatric surgery surpassing gastric bypass surgery (GBS) because of comparable weight reduction with fewer complications and no alteration in normal digestive patterns (ASMBS Staff, 2016). PONV are the most common complications of all bariatric surgeries due to multiple factors. Halliday et al. (2017) found LSG patients vomited despite optimal and supra-optimal antiemetic prophylaxis and attributed this to abdominal insufflation and stomach manipulation, disturbance of branches of the vagus nerve

and perioperative treatment with opioids as contributors to increased rates of PONV often refractory to antiemetic pharmacology and altered anesthetic techniques (Halliday et al., 2017). Abundant research exists on antiemetic pharmacology and anesthetic techniques for reducing PONV following LSG surgery, however, much less research has been done on complementary and alternative medicine, including auricular acupuncture to reduce PONV. Current existing research has determined auricular acupuncture (AA) is effective in reducing nausea, vomiting, pain, anxiety, agitation, and stress at a lower cost with less side effects (Kim, 2015; Usichenko & Streitberger, 2014; Quinlan-Woodward et al., 2016).

### **Statement of the Problem**

LSG patients have a higher than average rate of PONV refractory to antiemetic pharmacology and alternative anesthetic techniques (Chandrakantan & Glass, 2011; Moussa & Oregan, 2007; Obrink, Jidenstal, Oddby, & Jakobsson, 2015). Vomiting following LSG surgery is detrimental because forceful expulsion of stomach contents following surgery on the stomach with a fresh staple line causes pain and increases the risk for serious post-surgical complications, pain, bleeding, dehiscence of surgical pouch, dehydration, electrolyte imbalance, death, dissatisfaction and increased length of stay.

### **Purpose of the Project**

The purpose of this project was to observe whether there was a decrease in PONV following LSG surgery by combining current antiemetic interventions with AA. This combination has been effective in several studies and anecdotally to reduce PONV and subsequent postoperative risk in LSG patients.

**Impact of the Project**

AA has been studied in various populations and has been shown to effectively reduce PONV, anxiety, pain and decrease anesthetic and opioid requirements (Arai et al., 2013; Cheong, Zhang, Huang, & Zhang, 2013; Sahmeddini & Fazelzadeh, 2008). AA is inexpensive, quick and easy to perform treatment with few side effects. Results of this project will expand both patient and provider's knowledge of alternatives to enhance the traditional treatment of PONV.

**Definition of Terms**

Auricular acupuncture (AA): Placement of acupuncture needles in the auricle/cartilage of the ears with the intention of opening specific meridians in the body allowing the unobstructed flow of Qi thereby placing the body in balance and harmony and placing the body in its best condition to heal itself.

Laparoscopic sleeve gastrectomy (LSG): Laparoscopic surgery and removal of part of the stomach to decrease caloric intake and reduce obesity and obesity related conditions.

Nausea: Unpleasant sensation of stomach upset and potential vomiting.

Vomiting: Retching, expulsion or attempted expulsion of stomach contents.

**Chapter II: Review of the Literature****Database Search**

A literature search was conducted from May 2017 to December 2018 in the following databases, PubMed, CINAHL, MEDLINE, Wiley Cochran CENTRAL, Allied and Complementary Medicine (AMED), Science Direct and Google Scholar. Search terms included acupuncture, auricular acupuncture, postoperative nausea and vomiting, laparoscopic sleeve gastrectomy, and bariatric surgery.

### **Laparoscopic Sleeve Gastrectomy**

Laparoscopic sleeve gastrectomy (LSG) surgery is performed to decrease calorie intake for reduction in body weight and treatment of obesity related co-morbidities. According to the New York Surgical Home page on Bariatric and Metabolic Surgery, appropriate candidates for this surgery are between the ages of 18 and 65 years old, have no physical or psychological contraindications for surgery and suffer from obesity for greater than two years. Obesity is defined as a Body Mass Index (BMI) greater than  $40 \text{ kg}/\text{m}^2$  or 100 pounds or more over the patient's ideal body weight. Patient's with a BMI of 35 are considered for surgery if they have comorbid diseases such as diabetes, hypertension, hyperlipidemia, heart disease, obstructive sleep apnea, depression, acid reflux and stress incontinence (Belsley, 2019).

During LSG a portion of the stomach is surgically stapled and removed. This is a non-reversible surgery performed through the laparoscope with visualization provided by a camera. The abdomen is insufflated with carbon dioxide to improve visualization and the stomach is reduced to about 15 percent of its original size leaving the patient with a small banana like pouch. This smaller stomach size enhances weight reduction in three ways; first, it causes patient's to feel satiated with small amounts of food, second, food cravings are decreased by a modification in body metabolism, and third, removal of this part of the stomach reduces the hormone ghrelin implicated in increasing hunger (Sarkhosh, Birch, Sharma, & Karmali, 2013). LSG does not bypass the stomach or alter the normal digestive route so there is less chance for dumping syndrome and better chance for vitamin and nutrient absorption. The most common problem with LSG patients is vomiting which presents differently from other post-surgical patient's presentations, more immediate and severe, without warning and it is often intractable



despite treatment with known antiemetics and therapies. Vomiting places the patients at an increased post-surgical risk.

### **Auricular Acupuncture**

AA has been a part of traditional Chinese medicine (TCM) for thousands of years. It effectively reduces PONV because: AA unblocks meridians or channels throughout the body allowing Qi to flow freely providing energy, life force, balance and harmony to all parts of the body. Traditional Chinese theory believes surgery is a serious insult to the body resulting in the reversal of stomach Qi causing contents to go up. AA returns stomach Qi to normal downward direction by this means reducing nausea and vomiting (Cheong et al., 2013). Additional studies found AA also provides pain reduction which lessens perioperative opioid consumption and speeds up postoperative recovery of intestinal function, both known to reduce PONV (Tan, Molassiotis, Wang, & Suen, 2014). An anatomical basis for AA's role in vagal regulation is explained by using AA to stimulate the afferent projections of the vagus nerve's auricular branch ending signals to the nucleus of the solitary tract (Lu, Dong, Wang, & Xiong, 2013). Both the autonomic and the central nervous system have the potential to be modified by auricular vagal stimulation (Lu et al., 2013). The preceding explains why AA may be effective in LSG patients when other modalities are not.

### **Preoperative Prevention and Scoring of PONV Risk**

PONV is one of the most concerning factors for bariatric patients preparing to having LSG surgery. Vomiting increases the risk of surgical complications such as bleeding, disruption of the surgical closure and gastric leakage as well as increasing patient discomfort. Patients surveyed reported nausea and vomiting as the most undesirable of common surgical risks above all others. Rahman and Beattie (2008) also discovered that many patients are more concerned

with controlling PONV than controlling pain. Feng et al. (2017) cites multiple studies in which patients listed avoidance of PONV as their highest priority outranking pain, death, heart attack, and stroke.

There are many studies on PONV with medications and anesthetic techniques linked to moderate reductions in PONV in the surgical population (Chandrakantan & Glass, 2011; Moussa & Oregan, 2007; Obrink et al. 2015). The PONV reductions were greatest with combinations of multiple antiemetic medications and inconsistent evidence supporting anesthetic techniques with opioid sparing/total intravenous anesthesia technique (TIVA) (Ziemann-Gimmel, Goldfarb, Koppman, & Marema, 2014). Further evidence suggests even with implementation of these evidence-based improvements, there continues to be a high incidence of PONV following bariatric surgery (Halliday et al., 2017).

Apfel, Läärä, Koivuranta, Greim, and Roewer (1999) verified the validity and reproducibility of the Apfel's Simplified Risk score for preventing PONV by using a logistic regression model to compare results of the simplified risk scores from two centers. The sample size was adequate, and researchers analyzed information from both sample sets to determine four factors relevant in predicting PONV risk. These factors include female gender, history of PONV or motion sickness, non-smoking and the use of postoperative opioids (Apfel et al., 1999). Although this study is from 1999, it has twenty years of validation and is still widely used in current research for accurately predicting patients at high risk for PONV.

A prospective observational study by Halliday et al. (2017) used Apfel's Simplified Risk Score to calculate PONV risk along with an algorithm developed and used by their institution years earlier adapting prophylactic PONV treatment to patient's Apfel score. Each risk factor a patient has is equal to one point. One point equals no treatment, two points equals one

prophylactic treatment, three points equals two prophylactic treatments and four points equals three prophylactic treatments. The first two treatments were pharmacologic; ondansetron, betamethasone, and droperidol, the last treatment was anesthetic avoidance of volatile gases by using TIVA technique. The authors described an appropriate cohort size of 74 bariatric surgery patients, 65 percent of whom had PONV despite optimal or supra-optimal prophylactic pharmacologic and anesthetic treatment. The authors attribute this high rate of PONV, despite treatment, to three factors, incisions through branches of the vagus nerve, surgery on the stomach and opioid medications (Halliday et al., 2017).

### **Anesthetic Technique and PONV**

Ziemann-Gimmel et al. (2014) studied PONV differences between TIVA technique in comparison to traditional volatile agents with opioid anesthesia in bariatric surgery patients. The research hypothesis was that LSG surgical bariatric patients receiving opioid-free TIVA anesthesia would have reduced PONV when compared with those anesthetised with inhalational agents and opioids. All patients were treated with the same triple pharmacologic antiemetic prophylaxis. Using a prospective, randomized parallel-group design, both patients and nurses were blinded to the group designation of the 124 patients in the final study. The research showed a decrease in absolute risk of developing PONV to 17.3% in the opioid free TIVA group. The limitations of this study include assessment of two variables in the experimental group. Both TIVA and non-narcotic anesthesia making it difficult to determine which of the two or both resulted in the change. The authors also assessed PONV only one time in the recovery room leaving multiple opportunities for additional research in this area.

**Acupuncture to Reduce PONV**

Cheong et al. (2013) published a systemic review and meta-analysis on the effectiveness of acupuncture in preventing and treating PONV. The review included 33 randomized control trials (RCT) with 4,810 patients. The authors restate PONV morbidity including dehydration, electrolyte imbalance, bleeding, suture tension, wound dehiscence and esophageal rupture. Although these complications are rare, the cost of PONV is not. Increased costs include prolonged PACU stay by an average of 25 minutes, prolonged time until hospital discharge, the cost of antiemetic rescue medications with side effects, and surgical complications. Cheong et al. (2013) explains that in traditional Chinese medicine, surgery is an insult to the body because it breaks the balanced state of harmony disturbing both blood and Qi. It also causes stomach Qi to reverse direction moving upward instead of down leading to nausea and vomiting. In auricular acupuncture there are multiple points effective in reducing nausea and vomiting by redirecting Qi. The RCTs in this meta-analysis focused on acupuncture for reducing PONV with three of the trials specifically focused on auricular acupuncture. One of the studies cited AA's effect on reducing pain, but all three described a significant reduction in PONV. The authors also determined that when AA is performed before the painful stimulus, while the patient is awake, it is more effective than AA performed while the patient is under anesthesia citing the experience of feeling the needle placement as part of the therapy (Cheong et al., 2013).

Sahmeddini and Fazelzadeh (2008) concluded AA reduced vomiting in female patients after transabdominal cholecystectomy. PONV in this patient population was near 70 percent with post-surgical complications related to PONV including dehydration, increased length of stay and increased nursing time, patient discomfort and dissatisfaction. Patients reported avoiding PONV was more important to them than avoiding pain (Sahmeddini & Fazelzadeh, 2008). The study

was a randomized, prospective, single-blind, sham-controlled study of 100 female patients scheduled for open cholecystectomy. AA points used were Sympathetic, Shen Men, Stomach and Occiput with placement of the needles occurring prior to the induction of general anesthesia. During the first 24 hours 74% of the sham control group experienced nausea and 66% of them proceeded to vomit. The AA group had a 6% incidence of nausea over the first 24 hours with 0% vomiting (Sahmeddini & Fazelzadeh, 2008). The authors discussed pharmacologic management and side effects of medications including 91% of patients with scopolamine patch having side effects, sedation and lethargy from antihistamines, and Metoclopramide side effects including tachycardia, restlessness and dystonic reactions. AA is described in research as equally effective as medications for preventing PONV without the side effects (Sahmeddini & Fazelzadeh, 2008).

Different anesthesia techniques have also been analyzed and tested to determine their impact on PONV. Obrink et al. (2015) reviewed current literature intending to predict and minimize PONV in the ambulatory surgical population. The research reviewed suggested the type of surgery, abdominal, breast, ophthalmologic, ear, nose and throat surgeries as having the greatest PONV risk. The authors reviewed current literature to both confirm and dispell common notions of anesthetic interventions thought to reduce PONV. Techniques previously considered to be effective at reducing PONV such as nasogastric tube suction of gastric contents, anesthesia airway type, laryngeal mask airway versus endotracheal tube, controlled or spontaneous ventilation and propofol-based TIVA compared to volatile agent anesthesia have not been shown to influence PONV when patients are followed for 24 hours after discharge from an ambulatory care center. Nausea and vomiting do increase by 60 percent with each additional 30 minutes of surgical time. Techniques that have shown efficacy include prophylactic antiemetic therapy and titrating anesthetic depth to provide adequate but not excessive depth of anesthesia. Other

anesthetic pearls are to avoid hypotension and bradycardia which influence PONV and treat with ephedrine which reduces hypotension, bradycardia, and emesis. Multimodal and opioid-free anesthesia, as well as acupressure and acupuncture, have also shown a reduction in PONV (Obrink et al., 2015). This systematic review was an update on available research up to 2015 and was written from the perspective of a surgical center. Surgical centers plan on same day discharge for patients, refractory PONV increases costs and complications of care due to increased length of stay, patient transfer and hospital admission (Obrink et al., 2015).

Tan et al. (2014) studied the adverse events of auricular therapy (AT) in a systematic review. A study protocol was developed and data was critically reviewed by two experts in AT. Adverse events were described as an undesirable experience associated with use of a medical product in a patient per the FDA description. Thirty-two studies from 12 countries were evaluated, 18 were on auricular acupuncture. The most common adverse events were needling site tenderness/pain, site bleeding/inflammation, dizziness, and headache. Most of these events were considered transient and tolerable (Tan et al., 2014). In discussion, the authors describe the adverse events as short-term and mild, requiring no treatment, and have determined AA to be safer than body acupuncture, moxibustion or cupping. AA is safe and effective but adverse events can potentially cause harm. Events such as dizziness, transient hypotension, vagal stimulation with blood vessel dilatation, reduced venous return and slow heart rate can occur. The literature review shows that AA is an effective, inexpensive alternative treatment for PONV, pain, anxiety, agitation and also reduces patient's opioid and anesthetic requirements (Tan et al., 2014).

## **Nursing Theory**

Waking from anesthesia, beginning to determine where you are, what has happened, and feeling some discomfort can be unsettling. Waking from anesthesia, unsure of place, time and event and immediately vomiting following surgery places patients in a vulnerable and frightening position. The initial reason and motivation for this study was to improve the care of post-surgical bariatric patients by decreasing their frequency and severity of PONV. Katherine Kolcaba's comfort theory provides the intended theoretical guidance for this work (Wilson & Kolcaba, 2004).

Kolcaba defines holistic nursing art as providing the path for patient's comfort needs to be met in three categories, relief, ease and transcendence. Viewing LSG surgical patients from an anesthesia perspective, relief is decreasing anxiety, pain and PONV. Relief may be the day of surgery when their weight loss journey begins. LSG patients' usually present nervous but excited to have the surgery and begin their weight loss journey. Ease occurs when the patients trust their providers and feel relaxed knowing they are safe and cared for before they drift into a comfortable sleep. Transcendence is when they awaken from surgery feeling comfortable with minimal pain or nausea. They have risen above their fears, safely and successfully finished their surgery. Providing patients holistic comfort involves first assessing the physical, psychospiritual, social and environmental needs of the patient. This begins during the pre-operative assessment for the anesthesia providers. Assessment of patient's physical needs include a past medical/surgical history and physical exam that provide a basis for anticipation and prevention of potential problems such as airway management, patient positioning, and optimization of ongoing medical problems. Patients' physical needs along with surgical requirements determine the pre-operative testing, type of anesthesia, and perioperative medications. Evaluating patient's Apfel

score identifies their risk and helps guide treatment for PONV including the need for AA.

Psychospiritual considerations include the patient's level of anxiety, trust and preparation. They may request prayer or clergy visits prior to surgery. The patient may have valuable insight into their anesthetic plan based on their psychosocial/spiritual history, surgical history, energy or current feelings about their surgery such as impending doom.

Pre-surgical attitude influences outcomes in many ways. Their sociocultural needs may be to have certain rituals or family/friends to spend time with pre-operatively. Environmental needs of surgical patients include feeling warm, safe and secure and comfortably positioned. Kolcaba's Comfort Theory provides a framework for the importance of nursing care in patient outcomes (Wilson & Kolcaba, 2004).

### **Conceptual Framework**

The plan, do, study, act (PDSA) provides an organizational framework for the study of AA in bariatric patients transitioning from the operating room to the post-anesthesia care unit. The "plan" is preparation to achieve the goal. Developing the PICOT question, planning the study design, CITI training, Internal Review Board (IRB) approval and planning the methodology. "Do" is the intervention (AA) intended to generate the change. All laparoscopic sleeve gastrectomy patients are offered AA for a fee of 75 dollars if done during a scheduled appointment time the day prior to surgery. AA is offered the morning of LSG surgery pending the availability of the acupuncturist, there is no charge but also no guarantee. Those who choose to have AA are scheduled accordingly, AA is provided by experienced, licensed, physician medical acupuncturists. Surgery proceeds as scheduled with all patients receiving general anesthesia according to plan by anesthesia providers, the only variable or procedural change is AA.



“Study” is the collection of information to assess the outcome. The information will be retrieved from retrospective electronic record review of the anesthesia record and PACU electronic record and quality assessment form. Data will be mined by the operating room information technologist and separately, manually by the researcher. “Act” is the refinement of the study based on initial information gathered. Changes are made to the study to ensure the information is complete, accurate & measuring the data necessary to answer the PICOT question.

Changes were made to this study design and data collection during the preparation stage of the project. The acupuncture was originally scheduled for the morning of the LSG surgery, however the physician acupuncturists were not always available at this time requiring an additional procedure time the evening before surgery ensuring consistent availability of providers allowing all patients the opportunity to schedule an appointment to have AA performed. Cost, or charging patients for acupuncture was another discussion and debate. The hospital normally charges 75 dollars for an outpatient acupuncture session; administration agreed to include the office visit and evaluation in this charge with no co-pay for the study patients. The information will be gathered through electronic chart review and PACU quality assessment form reviews.

### **Chapter III: Methodology**

This retrospective chart review began following internal review board (IRB) evaluation by two separate boards reaching the same decision that IRB approval was not needed because this is a quality improvement project, retrospective chart review design of a therapy currently provided at this facility. Patients experienced no additional risks by the confidential mining of data from their charts. There is no IRB in the facility where the study was conducted. All patients were informed of the ongoing AA project with LSG patients.

Auricular acupuncture for PONV in gastric sleeve patients began in December 2017 at this facility. Review of records began in December 2018 and finished in January 2019. Risks, benefits and consent for AA and surgery were obtained by the physicians performing the interventions. All information was stored without names or identifiers on a password protected computer.

### **Data and Search Strategies**

All patients undergoing laparoscopic sleeve gastrectomy surgery from December 2017 to March 2019 were included in this study. Patients were over eighteen years old and American Society of Anesthesiologists class I-III. Exclusion criteria included patients with, chronic nausea or vomiting, those taking daily antiemetics, a pacemaker or AICD, active auricular infection, auricular swelling or cochlear implants, immune compromise, those taking anticoagulants and those with current opioid addiction.

### **Setting**

This research was conducted in a community hospital in rural north central Pennsylvania. The hospital has 132 inpatient beds, an eight-bed main OR with four off site areas in hospital, and a separate surgical and endoscopy center. A bariatric/general surgeon and a general surgeon work together to perform approximately 40 LSG surgeries per year.

### **Measurements**

PONV was assessed and documented by registered nurses in the post anesthesia care unit (PACU). The documentation was placed in the patient's electronic chart via nurses' notes and again in the continuous quality improvement (CQI) document, also in the electronic record. The CQI is a separate section for PACU nurses, so PONV data can easily be mined by information technologists. Nausea is defined as a patient's verbal expression of upset stomach or feeling of

nausea, or impending vomiting. Vomiting is defined as the attempt or expulsion of stomach contents. Measurements included patients' demographic data, AA received versus no AA treatment, and episodes of nausea and/or vomiting.

### **Intervention**

All patients in the bariatric program interested in sleeve gastrectomy surgery were educated on auricular acupuncture by one bariatric nurse, the bariatric surgeon, and other patients in the bariatric support group. Patients electing to have acupuncture were scheduled for their acupuncture appointment the afternoon before LSG surgery or the morning of surgery with a medical acupuncturist/anesthesiologist. Patients were charged 75 dollars when treated at the outpatient pain clinic because of the standard fee for acupuncture services in the clinic. There was no charge for those receiving AA the morning of surgery due to physician acupuncturist preference. The acupuncture points most commonly used included, Shen Men, Omega 1, Stomach, Occiput, Thalamus, Esophagus and Sympathetic Autonomic point all points were left to the discretion of the acupuncturist. Patients, physicians, providers, CRNAs, nurses and hospital staff were all aware of the acupuncture status of all patients involved.

### **Project Implementation**

Anesthetic management began with pharmacologic antiemetic prophylaxis which was determined by the anesthesia providers caring for each patient. All patients received general anesthesia to maintain adequate analgesia, lack of awareness and paralysis. There were no interventions influencing the anesthetic providers choice of anesthetic, antiemetic medications, or anesthetic care plan decisions during this study.

**Ethical Considerations**

Patient safety and understanding of the AA procedure, why it was offered to them and recognition of the potential benefit and altruistic nature of this treatment were of paramount importance. There was no coercion, gifts or payment offered to patients. All patients were informed of the procedure, risks, benefits and alternative treatments by the AA procedural acupuncturist physicians prior to obtaining signed consent for AA. There was no patient consent to participate in the study because all patients were deidentified and the data collected was not linked to patient identifiers. Confidentiality of patients was strictly maintained by both the researcher and the information technologist as directed by CITI training.

**Data Collection**

PONV data was acquired by data mining electronic medical records following IRB and facility approval following a presentation at the medical executive committee meeting. Data obtained included, age, gender, type of surgery, AA versus no AA, and episodes of nausea and/or vomiting occurring in the PACU. Data collection was performed by an information technologist and records were manually reviewed by the researcher.

**Data Analysis**

Data was analyzed using the Statistical Package for the Social Sciences (SPSS). Data analysis included a statistical description of the sample including age, gender, and AA treatment versus non-AA treatment outcomes. A Pearson's Chi-Squared and Fishers Exact test analysis were used to determine whether there was a relationship between AA and either postoperative nausea or vomiting. Normally, a Pearson's Chi-Squared statistic would be used to determine if a relationship exists between the variables. However, comparison of AA and vomiting violated an assumption of the Chi-Squared test because two cells have less than five counts. This violation

was due to the small sample size and infrequency of vomiting within the entire sample. Due to this violation of assumptions, a Fisher's Exact test was used for accurate results.

### **Timeline**

The AA project began in December 2017 and finished January 2019. During this time there were several weeks where no LSG surgeries were done due to physician vacation or other occurrences.

### **Cost-Benefit Analysis**

Costs associated with the AA project included, the physician acupuncturists time; however, both were in salaried positions and did not request additional reimbursement for this service. The physicians were employed by the hospital and had access to staff, offices, supplies, exam space, and computers which were previously purchased for their use. ASP titanium semi-permanent AA needles cost 130 dollars for a box of 80 (\$1.63 per needle), which is enough to treat 10 patients. These were initially purchased by the physicians and the researcher, but are now being purchased by the facility. The cost of the needles is without a discount or bulk pricing.

Benefits of AA include reduction of PONV, decreased cost of antiemetic medications (Emmend costs \$132.00/dose), decreased length of stay in both PACU and in the hospital, possible decrease in opioid medications and anesthetic requirements thereby decreasing medication side effects. Reduction of PONV also lessens the risk for developing surgical complications such as bleeding, staple line rupture, pulmonary embolism and reduces the potential for returning to surgery. Intangible factors combined with increased patient safety and satisfaction indicates the project will run with no additional cost to the organization but an increase in publicity.

## **Chapter IV: Results**

The goal of this study was to determine if auricular acupuncture in combination with current antiemetic therapy would further decrease episodes of PONV following LSG surgery from end of surgery until discharge from PACU.

### **Descriptive Statistics**

The study sample included a total of 33 patients ranging in age from 25 to 52 years with an average age of 44 years old. Gender distribution of the sample consisted of 28 (85%) females and 5 (15%) males. Auricular acupuncture was performed on 14 (42%) of the patients and 19 (58%) patients elected not to have AA. Postoperative nausea was experienced by about 14 (42%) of the patients, while 19 (58%) patients did not report the sensation of nausea. Postoperative vomiting was reported by 4 (12%) patients and 29 (88%) did not experience vomiting. None of the AA patients experienced vomiting.

### **Data Analysis**

Due to the categorical nature of the variables, a Chi-Squared test was chosen to determine if AA was associated with postoperative nausea and postoperative vomiting. Normally, a Pearson's Chi-Squared statistic would be the best choice to run on categorical variables, however, when comparing AA's association with vomiting, two cells have less than five counts which violates an assumption of the Chi-Squared test.

Therefore, a Fisher's Exact test was used to determine non-random associations between two categorical variables. The significance value of ( $p = 0.119$ ) was found to be not statistically significant, therefore, there is no significant non-random association between AA and postoperative vomiting (Table 1; Figure 1).

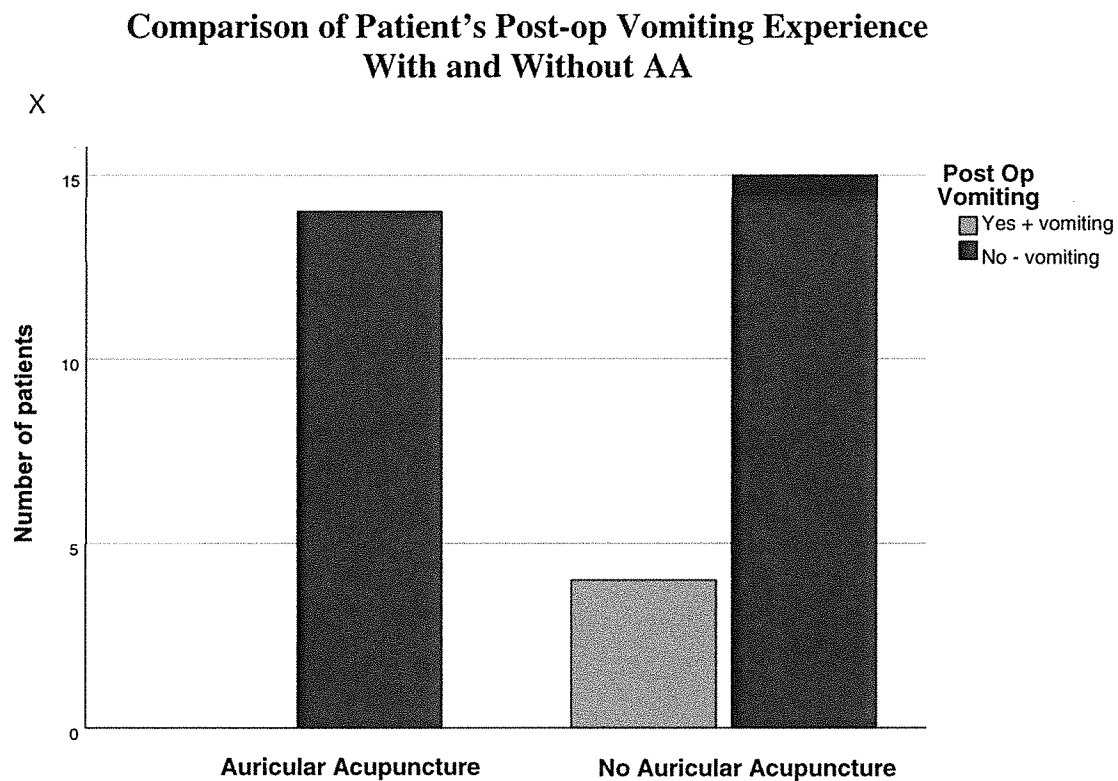
Table 1

	Value	Df	Asymptomatic Significance (2-sided)	Exact Significance (2-sided)	Exact significance (1-sided)
Pearson Chi-Squared	3.354 (a)	1	.067		
Continuity Correction (b)	1.669	1	.196		
Likelihood Ratio	4.819	1	.026		
Fisher's Exact Test				.119	.095
Linear-by-Linear Assoc.	3.252	1	.071		
N of Valid Cases	33				

a. 2 cells (50%) have expected count less than 5. The minimum expected count is 1.7.

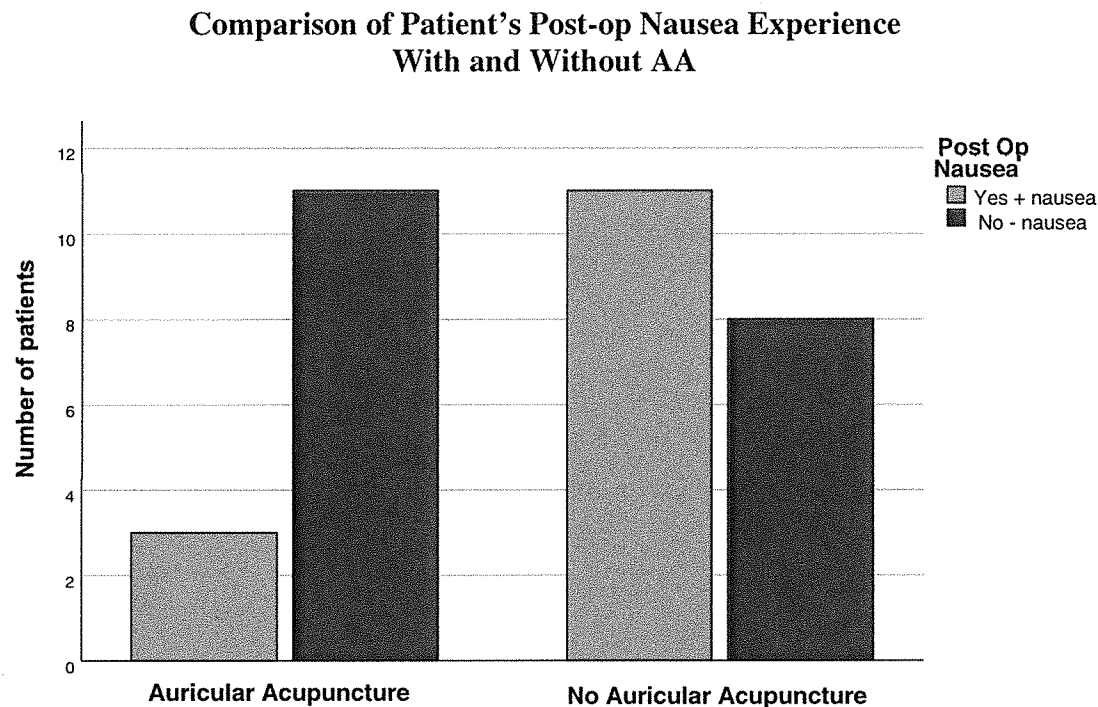
b. Computed only for a 2x2 table

Figure 1



There were no violations of assumptions for the Chi-Squared test of AA and postoperative nausea. The Pearson Chi-Squared with a significance value of ( $p = 0.036$ ) is statistically significant indicating there is a non-random relationship between AA and postoperative nausea (Figure 2).

Figure 2



## Chapter V: Implications, Discussion and Conclusions

### Limitations

This clinical site averages 40 LSG surgeries per year limiting the number of patients available for this study during the allotted time frame. Patients may have been reluctant to have acupuncture for three identified reasons. First, patients scheduling AA the evening prior to surgery in the pain clinic office and were charged 75 dollars cash out of pocket at the time of the visit. This is the normal charge for acupuncture provided at the pain clinic, because acupuncture is not usually covered by insurance. Patients deciding to have acupuncture the



morning of surgery did not pay at the time of treatment, but may have been billed later. Second, insertion of ASP needles in the auricle of the ear is painful. The literature and acupuncturists agree AA is more effective when performed awake as experiencing the sensation of needle placement is part of the therapy (Cheong et al., 2013). Third, it was discovered, from patients, later in the study that one or two patients who had traditional antiemetic therapy, including scopolamine patches did not experience vomiting. They told the rest of the LSG group through Facebook that ‘the patch’ (scopolamine) was as effective as AA. They were basing this information on their own fortunate outcomes. Later patients found this to be untrue and patients again began requesting AA.

### **Sustainability**

Sustainability of this project is on track because surgeons, patients, nurses and anesthesia providers have requested AA to continue after witnessing and experiencing the results. The program will grow slowly by design and advance based on surgeon/patient request and acupuncturist availability. Currently AA is offered to bariatric, gynecology, breast, and plastic surgical services as well as to any patients with significant history of PONV. Providers are encouraged to request this service at the time of scheduling to ensure acupuncturist availability.

### **Dissemination**

Dissemination of this quality improvement project and impact AA can afford surgical patients will be beneficial to other patients and providers in the future. To date, information and outcomes from this study have found their way to other patients, providers and local hospitals through word of mouth. There have been many requests for this therapy because of positive outcomes and patient satisfaction. Further dissemination will include poster presentations, power point presentations to medical and acupuncture groups and submission for publication.

### **Future Research**

The impact of AA on healthcare quality, effectiveness of treatment, enhancement of current therapies and safety has great potential. Combining traditional Chinese medicine and theory with Western medicine embraces multimodal treatment and improves patient outcomes. Future directions for research may include, performing the study on a larger scale with a greater sample size, a double-blind study, using AA instead of antiemetic medications, and lengthening the duration of the study after surgery for further evaluation of patients. AA may also have an impact with enhanced recovery after surgery, opioid free anesthesia, pain and opioid reduction during and following surgery. It would also be interesting to compare AA performed awake to AA performed asleep to determine if there is a statistically different outcome. One thing is certain, this modality is inexpensive, takes less time than writing an order and waiting for a medication to be given and is an effective treatment when combined with current antiemetic treatments for PONV in LSG patients.

### **Conclusion**

AA presents an alternative opportunity to decrease PONV for minimal cost and with less side effects than medications. The review of literature supports the pre-study findings of increased incidence of PONV in LSG patients' refractory to conventional treatment. Adding multiple antiemetic medications, changing anesthetic techniques, maintaining hydration, normotension, and avoiding bradycardia in these patients moderately improved this condition.

The results as described in chapter four, show a statistically significant relationship between AA and postoperative nausea. The Pearson's Chi-Squared test was chosen for analysis of categorical data and a significance value of 0.036, confirmed a statistically significant non-

random relationship between AA and postoperative nausea. There were significantly less patients in the AA group (3) who experienced nausea when compared to the non-AA group (11).

The Fisher's Exact test determined there was no statistically significant non-random relationship between postoperative vomiting and AA. Both the total number of study patients and number of patients experiencing vomiting were small. Four patients reporting vomiting, none of them were treated with AA prior to surgery. Despite the results showing no vomiting patients in the AA group, the low number of patients were factors in the lack of statistical significance. Another consideration is the anesthetic technique used in these cases was intentionally not manipulated in any way and the anesthesia teams were already practicing TIVA and multi antiemetic therapies doing their best to prevent PONV with their practice.

Economically AA has the potential to both save money and increase patient satisfaction. The cost of AA includes ASP needles, time to explain the procedure, obtaining consent and placing the needles. The needles cost about ten dollars per patient and the provider's time involved is ten to fifteen minutes. Compared to the cost of medications, side effects, synergistic effects, refractory vomiting, increased length of stay, and increased risk of complications, AA is a beneficial cost saving therapy. The benefits of AA include prolonged mechanism of action over seventy-two hours, no risk of medication interaction, intolerance or allergic reaction.

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