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**INTRAOPERATIVE GASTRIC
SUCTIONING AND POSTOPERATIVE
NAUSEA, RETCHING, AND VOMITING**

A clinical research project submitted in partial
fulfillment for the degree of Master of Science
in Nurse Anesthesiology at Virginia Commonwealth University

by

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ABSTRACT

INTRAOPERATIVE GASTRIC SUCTIONING AND POSTOPERATIVE NAUSEA, RETCHING, AND VOMITING IN THE OUTPATIENT SETTING

Peter W. Ogren, B.S.N., C.R.N.A.

Medical College of Virginia - Virginia Commonwealth
University, 1983

Major Director: Salvatore Ciresi, M.S.N., C.R.N.A.

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Director of Thesis

Committee Member

Committee Member

School Director of Graduate Study

Department Chairman

School Dean

Date

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LIST OF ABBREVIATIONS

ANOVA	-	Analysis of Variance
ASA	-	American Society of Anesthesiologists
CTZ	-	chemoreceptor trigger zone
IV	-	intravenous
kg.	-	kilogram
LES	-	lower esophageal sphincter
mg.	-	milligram
ml.	-	milliliter
NG	-	nasogastric
NPO	-	non per os
N/R/V	-	nausea, retching or vomiting
N/V	-	nausea or vomiting
pH	-	negative log of the hydrogen ion concentration
µg.	-	microgram

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→ vomiting during the first twenty-four hours at home; or for overall emetic symptoms during the total recovery period. ↗ Emetic symptoms for both groups combined were more apt to occur after ambulation than before ambulation ($p = 0.004$) possibly suggesting the role of a vestibular component from either the laparoscopic insufflation of nitrous oxide or from fentanyl. Antiemetic requirements in the recovery room or a previous surgical history of nausea and vomiting were not significant factors.

CHAPTER 1

Introduction: Background and Significance of the Problem

"(The patient's) dread of the anaesthetic is not because of its danger...but because of the sickness which he anticipates as an inevitable consequence."

Blumfeld, Lancet, 1899

Blumfeld made the above observation in 1899 referring to his study describing a 75 percent incidence of nausea and vomiting after ether anesthesia. With the advent of modern anesthetic techniques, it is often assumed that sickness after surgery is not a common problem today and is rarely severe when surgical causes are excluded. However, recent studies reveal that postoperative nausea and vomiting continue to be prevalent minor complications or side effects of anesthesia with reported incidence of 16 percent - 80 percent depending on the circumstances involved (Belleville, 1960; Brindle, 1975; Epstein, 1975; Gold, 1969; Kortilla, 1979; Mckie, 1970; Mortenson, 1982; Rita, 1981). Roughly one-third of all patients anesthetized can be expected to have some symptoms of nausea and vomiting within the postoperative period. Furthermore, even though Smith and Young (1976) stated that "perhaps nausea and vomiting are still regarded as expected and acceptable postanesthetic symptoms," Cronin's (1973) analysis of the significance of

postoperative complaints found that 50 percent of the patients studied were distressed by postoperative nausea and vomiting.

In addition to anticipatory and actual psychological and physical discomfort for the patient, there are other potential adverse effects of nausea and vomiting, especially in the ambulatory (outpatient) surgery setting. Prolonged postoperative nausea and vomiting can result in delayed return of oral intake and associated necessary oral medications. Protracted vomiting can lead to fluid and electrolyte imbalances. There may also be significant financial implications for the outpatient with persistent nausea and vomiting which may necessitate an overnight hospital admission (Fishbourne, 1974) delaying the patient's return to work. In some instances, active retching and vomiting can cause serious complications and physical damage to the surgical repair, such as: pharyngeal bleeding from a tonsillectomy; hematoma formation at the operative site; or pain, tension, pressure, dehiscence, or evisceration at abdominal incision sites. Finally, immediately postoperatively when patients' airway reflexes are somewhat obtunded from the residual anesthetic effects, patients are at risk for aspiration pneumonitis, often referred to as Mendelson Syndrome, named after Mendelson's classic description (Mendelson, 1946). Outpatients may be at greater risk for Mendelson Syndrome since they often do not receive preoperative medications which decrease gastric acidity, decrease gastric volume, or enhance gastric emptying (e.g., antacids, cimetidine, ranitidine,

glycopyrrolate, metoclopramide), and since they have been shown to have a greater gastric volume than corresponding inpatients who have had nothing to eat or drink (NPO: abbreviation for Latin - non per os) the same length of time (Ong, 1978).

During four years of clinical anesthesia experience, the researcher has observed that patients whose stomachs are evacuated by suction through a gastric tube tend to have a lower incidence of vomiting in the immediate anesthetic recovery period. Therefore, this study was undertaken to answer the following question:

Problem Statement

What is the effect of intraoperative gastric suctioning on the incidence of postoperative nausea, retching, and vomiting (N/R/V) in ASA I or II adult female patients having surgery in the outpatient setting?

Hypotheses

Nausea

- I. ASA I or II adult female patients having surgery in the outpatient setting who receive intraoperative gastric suctioning will be less apt to experience nausea during the immediate postoperative recovery period than those who do not receive intraoperative gastric suctioning.
- II. ASA I or II adult female patients having surgery in the outpatient setting who receive intraoperative gastric suctioning will be less apt to experience

nausea during the extended postoperative recovery period than those who do not receive intraoperative gastric suctioning.

Retching

- III. ASA I or II adult female patients having surgery in the outpatient setting who receive intraoperative gastric suctioning will be less apt to experience retching during the immediate postoperative recovery period than those who do not receive intraoperative gastric suctioning.
- IV. ASA I or II adult female patients having surgery in the outpatient setting who receive intraoperative gastric suctioning will be less apt to experience retching during the extended postoperative recovery period than those who do not receive intraoperative gastric suctioning.

Vomiting

- V. ASA I or II adult female patients having surgery in the outpatient setting who receive intraoperative gastric suctioning will be less apt to experience vomiting during the immediate postoperative recovery period than those who do not receive intraoperative gastric suctioning.
- VI. ASA I or II adult female patients having surgery in the outpatient setting who receive intraoperative gastric suctioning will be less apt to experience

vomiting during the extended postoperative recovery period than those who do not receive intraoperative gastric suctioning.

Variables

Dependent: nausea, retching, vomiting.

Independent: intraoperative gastric suctioning.

Definition of Terms

Nausea - vague awareness of the urge to vomit. It was measured as frequency of episodes on the nausea, retching, vomiting scale (N/R/V Scale - Appendix B: Data Collection Tools) during specified postoperative intervals. (Lay term is "feeling sick to your stomach.")

Retching - "rhythmic, labored, spasmodic respiratory movements involving the diaphragm, chest wall, and abdominal muscles." (Seigel, 1981) It often precedes vomiting but does not involve expulsion of stomach contents. (Lay term is "dry heaves.") It was measured as frequency of episodes on the N/R/V Scale during specified postoperative intervals.

Vomiting - synonymous with emesis. "Emesis is the forceful expulsion of gastrointestinal contents through the mouth and is associated with descent of the diaphragm with powerful sustained contractions of the abdominal muscles and opening of the cardia." (Seigel, 1981) (Lay term is "throw-up.") It was measured as frequency of episodes on the N/R/V Scale during specified postoperative intervals.

Outpatient surgery - synonomous with ambulatory care surgery or day care surgery. In this setting, patients arrive for surgery the morning of the operation and return home the same day after an immediate recovery period.

Intraoperative period - time frame during the surgical procedure from placement of the tracheal tube until the tracheal tube is removed.

Postoperative period - time frame from removal of the tracheal tube until 24 hours after dismissal from the ambulatory care center recovery room.

Immediate postoperative recovery period - time frame from removal of the tracheal tube until dismissal from the ambulatory surgery center recovery room.

Extended postoperative recovery period - time frame from dismissal from the ambulatory care center recovery room until 24 hours later.

Gastric tube - intragastric placement through the nose or mouth of a multiorificed, vented tube such as a Salem Sump Tube.(R)

ASA I - American Society of Anesthesiologists patient classification I: healthy patients with no disease.

ASA II: American Society of Anesthesiologists patient classification II: patients with some disease or pathology which does not impair normal lifestyle.

Control Group - patients not receiving intraoperative gastric suctioning.

Experimental Group - patients receiving intraoperative gastric suctioning.

Assumptions

The following assumptions were made concerning the study:

1. The patient would accurately and honestly understand and complete the preoperative history and consent form.
2. The anesthetist would know that the gastric tube had been appropriately passed into the stomach and not in the trachea or coiled in the mouth.
3. The patient would accurately and honestly reveal post-operative nausea, retching, and vomiting symptomatology verbally to the recovery room rater and during the post-operative telephone interview.
4. The gastric tubes had no manufacturing defects and functioned according to design.
5. The operating room suction system worked according to specifications, and small fluctuations of line suction pressure would make no difference in the outcome of the study.

Limitations

The limitations of the study include the following:

1. Subjects studied were chosen from those that presented to the ambulatory care surgery center of a mid-atlantic university-based medical center during the first six months of 1984, met the requirements of the sample, and volunteered for the study.

2. The rater had to rely on the patient's subjective interpretation of nausea.
3. If the patient does not volunteer information about nausea, questions were asked about nausea symptomatology. This could have influenced the patient's response.
4. The rater had to depend on a combination of his own and the patient's ability to interpret and differentiate between retching (no expulsion of gastric contents) and vomiting. (i.e. Did the patient vomit or regurgitate and swallow the gastric contents without the rater knowing it?)
5. There might have been slight interrater variability in interpretation of nausea, retching, and vomiting.
6. During the extended postoperative recovery period, the researcher had to depend on the patient's ability to accurately recall and recount the episodes of nausea, retching, and vomiting in response to a telephone questionnaire.
7. There were no reliability or validity statistics for the data collection tools.

Delimitations

The delimitations of the study include:

1. Patient sample selection and exclusion criteria were rigorous and are listed in the "Methodology" section.
2. Only one outpatient surgery clinic was chosen for the study.
3. A limited time for completion of the study was selected.

Theoretical Framework

The theoretical framework for the hypotheses of this study is aptly described from: (1) anatomic and physiologic theories of causation of nausea, retching, and vomiting, and (2) the impact of the surgical experience and anesthetic theory on these theories of causation.

Vomiting and Nausea Causation: Anatomy and Physiology

"Distention or irritation of the stomach or duodenum provides the strongest stimulus for vomiting" (Guyton, 1981). Sensory impulses originating in the upper gastrointestinal tract nerve plexuses stimulate sensory afferent fibers in the myenteric plexus of the gut. These sensory fiber transmissions travel by way of sympathetic nervous system or parasympathetic nervous system (vagal) pathways to the bilateral vomiting center of the medulla. A motor response to initiate vomiting is then transmitted from the vomiting center through the fifth, seventh, ninth, tenth, and twelfth cranial nerves to the upper gastrointestinal tract and through the spinal nerves to the diaphragm and abdominal muscles. The complex coordinated response of the vomiting act results in opening of the cricoesophageal and gastroesophageal sphincters, closure of the glottis to protect the airway, and downward contraction of the diaphragm with simultaneous contraction of all abdominal muscles. The squeezing of the stomach by these muscles and the opening of the sphincters result in the rapid expulsion of gastric contents. Retching involves a similar mechanism

sometimes opposed by a voluntary effort to suppress the expulsion of gastric contents. Retching may precede vomiting but never results in the expulsion of gastric contents.

Aside from gastrointestinal irritation as a cause for vomiting, impulses from other parts of the brain may initiate vomiting. Stimulation of the chemoreceptor trigger zone (CTZ) located bilaterally on the floor of the fourth ventricle with certain drugs such as apomorphine and morphine can initiate vomiting. The CTZ can also be stimulated from rapidly changing body motions which trigger receptors in the labyrinth of the ear via a pathway through the cerebellum. Finally, undefined pathways from the cortex from various psychic stimuli including disquieting scenes or various odors can cause vomiting.

Nausea, the conscious awareness of the subconscious stimulation of the medulla, often a prodrome of vomiting, "can be caused by irritative impulses coming from the gastrointestinal tract, impulses originating in the lower brain associated with motion sickness, or impulses from the cerebral cortex to initiate vomiting" (Guyton, 1981). Distention or irritation of the duodenum may cause nausea and can result in intestinal contraction during gastric relaxation allowing reflux of intestinal contents into the stomach. Contribution to the gastric distention may be caused by gases such as carbon dioxide from the neutralization of gastric acid by pancreatic enzyme bicarbonate or from swallowed air.

Anesthesia and the Surgical Experience

Several factors associated with the anesthetic experience have been demonstrated to contribute to the possibility of having gastrointestinal distention or irritation (Churchill-Davidson, 1978). Drugs such as morphine, demerol, atropine, and most anesthetic agents inhibit gastrointestinal motility which can prolong gastric emptying. Emotional states such as the fear and anxiety associated with surgery, can decrease gastric emptying and increase secretions through pathways of the autonomic nervous system. Finally, gases may enter the stomach during mask ventilation at the induction of anesthesia; or nitrous oxide, which is much more soluble than nitrogen, may diffuse out of the gastrointestinal tissue and expand trapped gases already in the gut.

In summary, several factors associated with anesthesia can lead to increased volume, distention, and irritation of the gastrointestinal tract. Furthermore, distention or irritation of the gastrointestinal tract is a theorized cause of nausea and vomiting. Thus, this study attempted to determine if gastric suctioning during surgery could effectively decrease the incidence of postoperative nausea, retching, and vomiting.

CHAPTER 2

Literature Review

Review of the literature on nausea, retching, and vomiting would not be complete without at least describing the significance of the problem, causation factors, preventive measures, and treatment. Therefore, the following literature review includes these areas of discussion.

SIGNIFICANCE OF NAUSEA, RETCHING, AND VOMITING

As mentioned, the degree and severity of N/R/V vary (16 percent - 80 percent) but frequently occur with an incidence of 30 percent (Bellville, 1960; Bonica, 1958; Burtles, 1957; Dent, 1955; Gold 1969; Holmes, 1965; Mckie, 1969; Purkis, 1964; Reed, 1981; Smessaert, 1959; Winning, 1964; Wetchler, 1982). Fluid and electrolyte imbalance or esophageal tears (Mallory-Weiss Syndrome) are possible complications from particularly severe episodes of retching and vomiting (Laszlo, 1982). The benefit of financial savings of outpatient surgery (Shah, 1980; Shields, 1969) will be negated if the patient requires hospitalization for prolonged episodes of N/R/V (Fishbourne, 1973; Meridy, 1982) or the resulting complications. Perhaps, the most serious complication of N/R/V is the potential it poses for aspiration of gastric contents.

Aspiration pneumonitis or Mendelson Syndrome (Mendelson, 1946) has long been recognized as a serious complication of anesthesia (Culver, 1951). Damage to the lungs and resultant morbidity and mortality is dependent on the acidity as reflected by the negative log of the hydrogen ion concentration (pH), character, and volume of the gastric aspirate. Aspiration of gastric contents with a pH less than 1.7 has been associated with 100 percent mortality (Lewis, 1971). Teabeaut (1952) and Roberts & Shirley (1974) stated that an aspirated volume of 25 milliliters (ml.) with a pH of less than 2.5 is life-threatening. Aspiration of less than 25 ml. with a pH greater than 2.5 result in much milder pulmonary damage. However, damage will be more severe if particulate food matter is aspirated or if a particulate antacid is aspirated (Bond, 1979; Gibbs, 1979; Kumar, 1982). Utting (1979) reported the results of a seven-year study of 602 anesthesia accidents reported to the Medical Defense Union of the United Kingdom which included twenty-two incidents of cerebral damage or death directly linked to the acid aspiration syndrome. Aspiration may occur during induction of anesthesia, during surgery, during emergence from anesthesia, or during the recovery phase when reflexes may be obtunded. Detailed reviews of aspiration pneumonitis are frequently published (e.g. Modell, 1982).

PREDISPOSING FACTORS FOR NAUSEA, RETCHING, AND VOMITING

Causation factors for N/R/V include any factor that somehow interacts with or disrupts the normal anatomy and

physiology of the gastrointestinal tract, or any factor that impacts upon the system to initiate the reflexes previously discussed that elicit nausea, retching, and vomiting. Children and adolescents have a greater incidence of N/R/V than adults, and incidence decreases above the age of 20 (Burtles, 1957; Purkis, 1964). Females are two to four times more likely to have nausea or vomit than are men (Adriani, 1961; Holmes, 1965; Janhunen, 1972; Robbie, 1959) which may be related to higher gonadotropin levels (Bellville, 1961). Obesity which is associated with delayed gastric emptying, increased intragastric pressure, and delayed emergence from inhalation anesthesia due to slow and prolonged release of the anesthetic agent from fat stores, predisposes individuals to N/R/V (Bellville, 1960; Vaughan, 1975). Delayed gastric emptying is a common factor in many situations linked to postoperative N/R/V which include: intestinal obstruction, acute inflammation in the abdomen (e.g. appendicitis), irritation of gastrointestinal mucosa, intra-abdominal mass (e.g. gravid uterus), increased intracranial pressure, pain (Anderson, 1976; Parkhouse, 1963), anxiety and medication. However, a recent study by Marsh, Spencer, and Nimmo (1984) seemed to indicate that pre-operative pain and anxiety did not delay gastric emptying. Narcotics, including morphine (Mckie, 1969; Riding, 1960), meperidine (Burtles, 1957; Dundee 1962), and fentanyl (Cohen, 1984; Epstein, 1975; Parkhouse, 1963; Scammon, 1984) cause an increased incidence of N/R/V by delaying gastric

emptying (Chase, 1948; Todd, 1983) and by directly stimulating the chemoreceptor trigger zone (CTZ). A normal preoperative dose of narcotic with an anticholinergic doubles the gastric emptying time (Chase, 1948). Anesthesia and surgery delay gastric emptying also (Arandia, 1980) as shown by an increase in gastric volume and a decrease in pH (Christensen, 1975) at the end of surgery compared to the beginning. Thus, the longer the anesthetic and surgery, the higher the incidence of N/R/V (Bodman, 1960; Burtles, 1957; Mortensen, 1982; Smessaert, 1959; Smith, 1945).

Anesthetics have varying effects on N/R/V. Diethyl ether and cyclopropane were particularly associated with N/R/V (Bellville, 1961; Dent, 1955; Ellis, 1970). Halothane and enflurance anesthesia are associated with less N/R/V than ether, cyclopropane, or nitrous oxide-narcotic anesthesia (Howat, 1960; Purkis, 1964; Riding, 1963). Intravenous induction with barbiturates is associated with less N/R/V than is an induction with an inhalation agent (Gold, 1969; Riding, 1975). The greater frequency of N/R/V for mask inductions is probably related to the greater risk of gastric dilatation with anesthetic gases (Parkhouse, 1960).

Many drugs given in association with anesthesia adversely affect the normal competency of the lower esophageal sphincter (LES) which acts as a normal barrier against retrograde movement of gastric contents out of the stomach (Cotton, 1984). A decrease in LES tone increases the chances of passive regurgitation and possible aspiration.

This loss of tone may also increase the chance of reflex initiated nausea from irritation of the esophagus and thus increase the chance of vomiting. Nitrous oxide, halothane, and enflurane all decrease LES tone (Sehhati, 1980). Morphine and meperidine (Hall, 1975) as well as diazepam (Hall, 1975; Rubin, 1982) decrease LES tone. The anti-cholinergics: atropine, scopolamine, and glycopyrrolate (Brock-Utne, 1977; Brock-Utne, 1978), and the antiemetics: droperidol and promethazine (Brock-Utne, 1978) all decrease LES tone. Succinylcholine fasciculations, which increase intragastric pressure, also cause a rise in the LES barrier pressure; thus, the gradient is not decreased (Smith, 1978).

Patients with a history of motion sickness or previous N/R/V with other surgeries are about three times more likely to have N/R/V than patients without this history (Janhunen, 1972; Purkis, 1964; Robbie, 1959). Nausea and vomiting are also very common in patients being treated for cancer with radiation or chemotherapeutic agents, and extensive reviews of this problem have been presented (Aapro, 1981; Laszlo, 1982; Seigel, 1981).

The site of operation affects the incidence of N/R/V with the highest incidence associated with intra-abdominal surgery (Bellville, 1960; Dent, 1955; Purkis, 1964). Surgery for termination of pregnancy (Cohen, 1984; Levin, 1980; Mckie, 1969) and head and neck (especially eye and inner ear) procedures are also more likely to be followed by sickness (Burtles, 1957; Smessaert, 1959).

A high volume of dextrose infusion over a short period of time, as often occurs during preanesthetic hydration and induction, has been shown to cause reactive hypoglycemia due to high levels of insulin output, and this condition can cause nausea (Thompson, 1973).

PREVENTION OF NAUSEA, RETCHING, AND VOMITING

An overlap exists between those factors that prevent N/R/V and those factors that minimize the risk of aspiration pneumonitis. Overnight fasting has long been recognized as an important factor in reducing the risk for aspiration, as well as minimizing postoperative nausea and vomiting as evidenced by studies showing a decreased incidence of N/R/V after elective surgical procedures compared to emergency surgery (Blumfeld, 1899; Purkis, 1964). However, many elective surgical patients present to the operating room with large gastric volumes with low pH (Brock-Utne, 1977; Coombs, 1982; Hester, 1977; Manchikanti, 1982; Morrison, 1982), and vomiting and aspiration may occur (Duffy, 1979). Ong (1978) demonstrated that outpatients who have fasted have a larger volume, more acidic gastric content than inpatients. Patients known to be at risk for vomiting and aspiration should be intubated awake or with the use of a rapid sequence induction with the "Sellick maneuver" (Sellick, 1961) using compression on the cricoid cartilage to compress the esophagus. Presence of a cuffed endotracheal tube is not a guarantee against aspiration (Berson, 1954;

Blitt, 1970; Culver, 1951; Turndorf, 1974) which indicates the presence of a significant enough gastric volume to cause aspiration.

Preoperative pharmacologic agents can also be used to decrease the potential for, and the danger of, nausea, vomiting, and aspiration. Although the anticholinergics, atropine, scopolamine, and glycopyrrolate may have a deleterious effect on the tone of the lower esophageal sphincter, they have also been shown, when given with narcotics, to decrease the nausea associated with narcotic administration (Gold, 1969). Anticholinergics also decrease gastric acidity (i.e. increase pH) with glycopyrrolate being more effective than atropine (Baraka, 1977; Salem, 1976). Antacids are used to decrease gastric acidity (Taylor, 1966) but at the same time add to gastric volume (Stoelting, 1978). Non-particulate antacids such as sodium citrate are recommended (Gibbs, 1982) since they cause less pulmonary damage than particulate antacids if aspirated (Bond, 1979; Gibbs, 1979; Kumar, 1982). One class of drugs particularly effective in decreasing gastric acidity are the histamine H₂ receptor antagonists. The prototype H₂ antagonist cimetidine is very effective in raising gastric pH (Coombs, 1979; Coombs, 1982; Manchikanti, 1982; McCammon, 1982) and ranitidine, a new H₂ blocker just released, shows more promise because of fewer side effects and longer duration of action (Andrews, 1982; Francis, 1982; Morrison, 1982).

Some preoperative medications provide a beneficial effect against N/R/V by decreasing nausea, by increasing lower esophageal sphincter tone, or by promoting gastric emptying. Preoperative medications shown to decrease nausea and vomiting include: barbiturates - pentobarbital (Knapp, 1956); antihistamines - diphenhydramine (Dent, 1955); phenothiazines - chlorpromazine, prochlorperazine, and promethazine (Burtles, 1957; Howart, 1960; Knapp, 1956; Loeser, 1979); and hydroxyzine (McKenzie, 1981). The butyrophenones, haloperidol (Loeser, 1979) and droperidol, even given in small doses are extremely potent and effective antiemetics (Abramowitz, 1981; Kortilla, 1974; Mortensen, 1982; Patton, 1973; Prescott, 1976; Rita, 1981; Shelley, 1978; Wetchler, 1982; Winning, 1977). Domperidone, a benzimidazole derivative, is an effective antiemetic (Fragen, 1978; Zegfeld, 1978) with the added benefit that droperidol does not have of increasing the lower esophageal sphincter tone (Brock-Utne, 1980). Metoclopramide is being used preoperatively for its effects of enhancing gastric emptying, increasing lower esophageal sphincter tone, and decreasing postoperative nausea and vomiting (Kortilla, 1979; Laitenen, 1978). However, Adriani (1961) believes that "the facts do not justify the routine use of antiemetics as part of the preoperative medication." Finally, oral premedication with diazepam and water did not significantly increase gastric volume or acidity compared to a preoperative injection of morphine and scopolamine (Risbo, 1982).

Minimizing the movement of patients postoperatively is one factor that may decrease nausea and vomiting (Bellville, 1961) since a vestibular component has been identified in the etiology of postoperative nausea and vomiting. Narcotics are particularly prone to potentiate nausea and vomiting secondary to vestibular stimulation (Dobkin, 1961; Goodman, 1980). Therefore, slow movements of the patient are beneficial after anesthesia and narcotic administration.

Gastric Suctioning: Use of gastric suctioning to decrease stomach contents preoperatively and intraoperatively has been suggested and discussed as a method for reducing aspiration and postoperative nausea, retching, and vomiting. Emptying the stomach before surgery of patients particularly at risk by using a nasogastric tube has been suggested (Culver, 1951) but is often not done. Holdsworth (1974) and Ong (1978) state that the nasogastric tube cannot guarantee an empty stomach. Arandia (1980) and Clark (1982) suggest that the use of gastric suctioning intraoperatively will decrease the risk of aspiration. Presence of a gastric tube with suctioning intraoperatively was shown by Burtles (1957) and Smessaert (1959) to decrease postoperative vomiting but not nausea and retching. However, Knapp (1956) found no decrease in nausea, retching, and vomiting during the first four hours postoperatively in patients who had a gastric tube intraoperatively. Similarly, Dent (1955) found that the presence of a gastric tube did not decrease nausea and vomiting postoperatively. Most studies commenting

on the use of gastric suctioning are retrospective in nature. The author could find no studies which specifically controlled other factors and addressed the use of gastric suctioning in a prospective manner as an etiological factor in decreasing postoperative nausea, retching, and vomiting.

TREATMENT OF NAUSEA, RETCHING, AND VOMITING

Treatment for postoperative nausea, retching, and vomiting is generally supportive in nature with a primary goal to prevent aspiration. Placement of a gastric tube postoperatively is rarely indicated for the treatment of vomiting. The primary means of treatment for nausea, retching, and vomiting is a pharmacological one with the use of antiemetics. Droperidol, hydroxyzine, promethazine, or compazine are probably the most frequently used antiemetics in the immediate postoperative period. It is beyond the scope of this study to discuss in detail the role and actions of antiemetics in the treatment of nausea and vomiting. The interested reader is referred to several excellent reviews of this topic (Aapro, 1981; Adriani, 1961; Laszlo, 1982; Purkis, 1964; Riding, 1975; Seigel, 1981; Simonson, 1962).

CHAPTER 3

Research Design

The research design for this study is "experimental." Three well defined criteria must be present for an investigation to be a true experiment: 1) Manipulation, 2) Control, and 3) Randomization (Polit, 1978). "Manipulation" is that process which is done by the experimenter to at least some of the subjects. This process, which constitutes the independent variable, is often referred to as the experimental treatment or intervention, and in this study was intraoperative gastric suctioning. The effect of the intervention (dependent variable) in this study was postoperative nausea, retching, and vomiting. "Control" implies the use of a comparison or control group which does not receive the experimental intervention, and in this study is represented by a group of patients which did not receive intraoperative gastric suctioning. "Randomization" is the third criterion and involves the assignments of subjects into the experimental or control group on a random basis. Even though selection of patients for this study was not random (only one clinic and specific patient selection criteria), once subjects met the criteria and agreed to participate in the study, the subjects had an equal chance of being assigned

to either group. The randomization method for this study is described in the methodology section.

Experimental research can either be conducted in the "laboratory" or in the "field." Laboratory research is done in an artificial setting, while field research is done in the real situation in which the phenomena of interest normally occur (Polit, 1978). This study, done in the actual outpatient surgery setting, qualifies as field research. The degree of control over all possible influencing factors is not as tight in the field experiment as the laboratory experiment and is a weakness of this type of experiment due to possibility of "contamination" by uncontrollable situational variables. However, this also can be viewed as a strength of the field experiment since the very realism of the setting often makes the findings more generalizable and meaningful.

The greatest strength of experimental research lies in the confidence in which causal relationships can be inferred (Polit, 1978). The three criteria of causality are: 1) temporal - cause (gastric suctioning) must precede the effect (nausea, retching, vomiting), 2) empirical relationship - an association between cause (gastric suctioning) and effect (nausea, retching, vomiting), and 3) the relationship cannot be explained as being due to the influence of a third variable. Manipulation, control, and randomization as described in the methodology are attempts to avoid the influence of a third variable. Findings are

analyzed and discussed in relation to possible "third" variables that might have led to the results.

Experimental research also has several weaknesses (Polit, 1978). Certain human characteristics are not amenable to experimental manipulation (e.g. sex, height, intelligence). Female subjects were chosen in this study to control for a predisposing factor in postoperative nausea and vomiting as described in the literature review which are more frequent symptoms in females than males. The weaknesses of ethical consideration, practicality, feasibility, and artificiality did not seem to apply to this study. The so-called "Hawthorne effect," the change in behavior or response by individuals who realize they are being studied, may have applicability in this study in two ways. Control to minimize this effect on the subjects was attempted by telling the subjects preoperatively that the study was being done to observe postoperative side effects without specifically mentioning nausea, retching, and vomiting. The raters (recovery room nurses) may also have more critically evaluated nausea, retching, and vomiting using the research tool than they might normally have done on a day-to-day basis. A double-blind experiment, one in which neither the subjects nor the individuals who participate in the treatment or evaluation know who is in the experimental or control group, was not feasible for this study.

Finally, limitations of this study are listed separately, and patient selection and exclusion criteria are listed in the methodology section.

Population, Sample, Setting

Sample subjects for this study were drawn from a convenience (accidental) sample chosen from adult (age 18 to 64), healthy (ASA I or II) female patients requiring minor surgical procedures under general anesthesia with endotracheal intubation in an ambulatory surgery center of a university-based hospital in a mid-atlantic city.

Further selection criteria include the following:

1. Subjects must have had a negative history of epilepsy, renal disease, psychiatric history of anorexia or bulimia, hepatitis, ulcer, hiatal hernia, or other esophageal, gastric, intestinal disease, or obstruction and must not have been pregnant.
2. Subjects must not have received antiemetic medication within two weeks prior to the surgery.
3. Subjects must not have been treated with radiation or chemotherapeutic agents for cancer within two weeks prior to the surgery.
4. Any outpatient surgical procedure was acceptable except eye surgery, oral surgery that resulted in fixation of the mandible to the maxilla, dilation and evacuation of the uterus for spontaneous or elective termination of pregnancy, and surgery on the intestines or upper gastrointestinal tract.

Subjects were randomly assigned to either a control or experimental group of 11 subjects each using a table prepared by drawing 22 numbers from a container, every other number being placed in the control group and the remaining numbers being placed in the experimental group.

The setting for the manipulation of the independent variable (intraoperative gastric suctioning) was the outpatient surgical suite. The dependent variables (nausea, retching, vomiting) were assessed in the recovery room and were assessed using a telephone questionnaire the day following the surgical procedure.

Plan of Investigation

Patients meeting the criteria for selection were approached the morning of their scheduled surgery at the time of the preanesthetic interview. Explanation of the purpose of the study was provided and questions were answered. The terms nausea, retching, and vomiting were not used in an effort to avoid suggestion. Rather, the purpose was identified as being more generally to determine how the use of gastric suctioning during surgery would affect the recovery from anesthesia and surgery. Permission for inclusion into the study using voluntary informed consent was then obtained according to the guidelines of the Committee on the Conduct of Human Research of the institution.

An 18 gauge intravenous (IV) catheter was placed, secured, and occluded with an obturator until the time of surgery. At the appropriate time, patients were accompanied

to the surgical suite and were assisted into position on the operating room table. An intravenous solution of five percent dextrose solution in lactated ringers was then connected to the IV catheter for the induction and maintenance of anesthesia. No preoperative medication was given.

Anesthesia was induced using a rapid sequence induction to prevent the introduction of oxygen or anesthesia gases into the stomach.

Induction proceeded as follows:

1. Preoxygenation with 100 percent oxygen for a minimum of four breaths.
2. Pretreatment with d-tubocurarine 3 mg.
3. Sodium brevital 2 mg./kg. followed by succinylcholine 1.5 mg./kg. for intubation.
4. Cricoid pressure until confirmation of correct intubation (with a cuffed #7.0 endotracheal tube) by auscultation of breath sounds.

Maintenance of anesthesia included:

1. Oxygen 30 percent and nitrous oxide 70 percent with controlled ventilation.
2. Low dose fentanyl at the discretion of the anesthetist not to exceed 5 micrograms/kg.
3. Isoflurane, if needed, in concentrations not to exceed 0.5 percent.
4. Muscle relaxation maintained with a 0.2% succinylcholine infusion.

Control group (Group 1) patients received no intraoperative gastric suctioning of any type.

Experimental group (Group 2) patients did receive intraoperative gastric suctioning. After intubation and before surgical incision, a #16 or #18 french multiorificed, vented, nasogastric tube (e.g. Salem Sump^(R)) was placed orally into the stomach. The tube was suctioned in an effort to totally empty the stomach using the wall suction system. Suctioning was done after tube placement, at thirty minute intervals, and just prior to its removal before extubation.

Following extubation, patients were transported to the recovery room for post-anesthesia care and observation.

Data Collection

Observation and the recording of the occurrence and frequency of nausea, retching, and vomiting commenced with the arrival of the patient in the recovery room using the tool provided. Observation by the recovery room personnel or the investigator, continued until the patient was discharged to home. Patients were asked to continue self-assessment for any symptoms or problems until the following day when telephone follow-up was accomplished. During the telephone conversation, patients were questioned about post-operative symptoms with questions progressing from the general to the specific. The symptoms of nausea, retching, and vomiting were recorded when verbalized by the patient as having occurred.

Confidentiality was maintained during the study. In addition to the symptoms of nausea, retching, and vomiting, information regarding patient age and weight, dosages of fentanyl given, type and length of surgery, and the time when patients were first allowed to sit or stand, were recorded. Administration of antiemetics was not denied to any patient if the patient had particularly persistent and severe nausea, retching, and vomiting.

The independent variable (gastric suctioning) was measured nominally with the patient groups being categorized according to whether gastric suctioning was or was not done.

Instrumentation

A "Postanesthetic Recovery Room Record" checklist (see Appendix B) was adopted and was used to measure the dependent variables nausea, retching, and vomiting (Prather, 1983). Presence of symptomatology in the recovery room was measured in 15-minute intervals. The subjective symptom of nausea was recorded as being either spontaneously voiced or as elicited (e.g. being voiced after being asked: "How do you feel?") without mentioning the word nausea. Within either category, nausea was noted as being slight, moderate, or severe. The tool was explained to the recovery room personnel prior to the beginning of the study and was used on a trial basis with non-study patients for use familiarity.

For data analysis purposes the symptoms for each 15-minute interval were recorded but were not scored in the manner described by Bellville (1959) and Patton (1974) (no symptoms = 0, nausea = 1, retching = 2, vomiting = 3). This author believes that it would be inappropriate to use this N/R/V scoring system since the variables of nausea, retching, and vomiting are nominal variables and not interval variables. Therefore, an absolute value with a constant difference between each symptom in terms of severity cannot be assigned or implied.

Twenty-four hours after discharge from the recovery room, subjects were contacted by telephone and questioned using the "Home Call Questionnaire" (see Appendix B) (Prather, 1983). Responses were noted on the reverse side of the recovery room checklist. As noted on the questionnaire, questioning began from the general and proceeded to the specific.

Data Analysis

The results of the study were analyzed to determine the acceptance or rejection of the null hypothesis that there was no difference between the two groups in respect to nausea, retching, and vomiting. The independent variables of age, weight, anesthesia length, and fentanyl dose were examined as to their effect on the dependent variable of N/R/V. The parametric test, One-Way Analysis of Variance (ANOVA) was used to measure the distance between the means

of the two groups (interval variables) for the above mentioned variables using the ratio of "between groups" variation to "within groups" variation (F-statistic) (Steel, 1980).

Fisher's Exact Test was used to detect significant differences in the frequencies of symptoms in the control versus the experimental group. This test of homogeneity (independence) for a 2 x 2 contingency table of nominal variables (nausea, retching, vomiting) was used instead of the chi-square test since the expected cell counts were small (Steel, 1980).

The level of statistical significance was set at $p < 0.05$.

CHAPTER 4

Results

Population

Twenty-two subjects, eleven in each group, participated in the study after informed consent was obtained.

One patient was eliminated from the control group because of a surgical complication of gas embolization. Two other patients in the control group underwent breast biopsies, while all other patients in both groups underwent laparoscopic surgery. Therefore, these two patients were also eliminated to provide homogeneity with respect to the type of surgical procedure.

Age

Control group (n = 8): The mean age was 29 (S.E. \pm 1.8) years with a range of 22-38 years.

Experimental group (n = 11): The mean age was 31 (S.E. \pm 1.2) years with a range of 25-37 years.

One-Way Analysis of Variance (ANOVA) revealed no significant difference ($p > 0.10$) between the groups with respect to age (Table 1).

Weight

Control group: The mean weight was 62.9 (S.E. \pm 4.2) kilograms with a range of 47-76 kilograms.

Experimental group: The mean weight was 64.3 (S.E. \pm 2.3) kilograms with a range of 54-75 kilograms.

ANOVA revealed no significant difference ($p > 0.10$) between the groups with respect to weight (Table 1).

Anesthesia Length

Control group: The mean length of anesthesia was 45.0 (S.E. \pm 5.0) minutes with a range of 30-75 minutes.

Experimental group: The mean length of anesthesia was 46.4 (S.E. \pm 8.5) minutes with a range of 25-120 minutes.

ANOVA revealed no significant difference ($p > 0.10$) with respect to anesthesia length between the two groups (Table 1).

Fentanyl Dose

Control group: The mean fentanyl dose was 4.4 (S.E. \pm 0.3) milliliters with a range of 3-5 milliliters.

Experimental group: The mean fentanyl dose was 3.9 (S.E. \pm 0.4) milliliters with a range of 2-6 milliliters.

ANOVA revealed no significant difference between the groups with respect to fentanyl dose (Table 1).

Gastric Volume

Control group: No gastric suctioning was done.

Experimental group: The mean gastric volume was 32.3 (S.E. \pm 12.4) milliliters with a range of 10-150 milliliters. Three patients had gastric volumes greater than 30 milliliters. Gastric content pH was not tested.

Previous History of N/R/V After Surgery

Two patients in each group revealed a history of N/R/V after a previous surgical experience which was not a statistically significant difference ($p > 0.10$) (Table 2).

N/R/V - Immediate Recovery Period

After extubation, patients were transported to the recovery room where they remained on their stretchers for approximately one hour. They were then assisted to the sitting position and walked to a recliner where they remained for an hour. During this time they were encouraged to drink clear liquids. Subsequently, the patients ambulated to a dressing room to prepare for discharge.

The data was examined in relation to occurrence before or after change of position or ingestion of fluids. Symptoms of nausea whether spontaneously voiced or elicited were not effectively categorized in terms of severity. Therefore, the presence or absence of nausea was categorized and analyzed (Table 2), as well as combinations of symptoms (Table 3).

Nausea (Hypothesis I)

Control group: Nausea was voiced by 7 of 8 patients (87.5%) in the recovery room.

Experimental group: Nausea was voiced by only 4 of 11 patients (36.4%) in the recovery room.

Fisher's Exact Test revealed a significant difference ($p = 0.0371$) between the groups indicating patients who received gastric suctioning intraoperatively were less apt to experience nausea in the recovery room (Table 4).

Retching (Hypothesis III)

Control group: Retching was observed in 2 of 8 patients (25%) in the recovery room.

Experimental group: Retching was observed in 3 of 11 patients (27.3%) in the recovery room.

Fisher's Exact Test revealed no significant difference ($p = 0.6641$) between the groups with respect to retching in the recovery room (Table 5).

Vomiting (Hypothesis V)

Control group: Vomiting was observed in 7 of 8 patients (87.5%) in the recovery room.

Experimental group: Vomiting was observed in 7 of 11 patients (63.6%) in the recovery room.

Fisher's Exact Test revealed no significant difference ($p = 0.2668$) between the groups with respect to vomiting in the recovery room (Table 6).

Vomiting was also examined in relation to movement:

Control group: Vomiting before sitting or standing was observed in 1 of 8 patients (12.5%).

Experimental group: Vomiting before sitting or standing was observed in 2 of 11 patients (18.2%).

There was no significant difference between the groups ($p = 0.6244$) with respect to vomiting before sitting or standing (Table 7).

Control group: Vomiting during or after the change in position to the recliner was observed in 5 of 8 patients (62.5%).

Experimental group: Vomiting during or after the change in position to the recliner was observed in 5 of 11 patients (45.4%).

There was no significant difference ($p = 0.3950$) between the groups with respect to change in position to the recliner (Table 8).

Control group: Vomiting after drinking fluids and then ambulating was observed in 3 of 8 patients (37.5%).

Experimental group: Vomiting after drinking fluids and then ambulating was observed in 3 of 11 patients (27.3%).

There was no significant difference ($p = 0.8344$) between the groups with respect to vomiting after drinking fluids and ambulating (Table 9).

Vomiting-Both Groups Combined: Before vs After Ambulation

Vomiting before ambulation: Prior to ambulation, to the recliner, only 3 of the total 19 patients (15.8%) vomited.

Vomiting during or after ambulation: During or after ambulation to the recliner, 14 of 19 patients (73.7%) vomited.

Thus, change of position (ambulation) was highly predictive ($p = 0.0004$) of vomiting in both these groups combined (Table 10).

Antiemetics in the Recovery Room

Particularly severe episodes of N/R/V required the administration of antiemetics to 2 patients in each group during their recovery room stay. There was no significance ($p = 0.8320$) between the groups (Table 11).

History N/R/V

Of the 19 total patients, 4 reported a history of N/R/V symptoms with a previous surgery. All 4 of these patients (100%) experienced some symptoms of N/R/V in the recovery room. Of the 15 other patients, 11 (73.3%) experienced N/R/V symptoms in the recovery room. However, this difference was not statistically significant ($p = 0.3522$) (Table 12).

N/R/V - Extended Recovery Period

Nausea (Hypothesis II)

Control group: Nausea was experienced by 7 of 8 patients (87.5%) during the extended recovery period at home.

Experimental group: Nausea was experienced by 5 of 11 patients (45.4%) during the extended recovery period at home.

Fisher's Exact Test revealed no significant difference ($p = 0.0799$) between the groups with respect to nausea at home (Table 13).

Retching (Hypothesis IV)

Control group: Retching was experienced by 3 of 8 patients (37.5%) during the extended recovery period at home.

Experimental group: Retching was experienced by 1 of 11 patients (9.1%) during the extended recovery period at home.

Fisher's Exact Test revealed no significant difference ($p = 0.9819$) between the groups with respect to vomiting at home (Table 14).

Vomiting (Hypothesis VI)

Control group: Vomiting was experienced by 5 of 8 patients (62.5%) during the extended recovery period at home.

Experimental group: Vomiting was experienced by 3 of 11 patients (27.3%) during the extended recovery period at home.

Fisher's Exact Test revealed no significant difference ($p = 0.1438$) between the groups with respect to vomiting at home (Table 15).

History N/R/V

All 4 of the patients (100%) with a history of previous N/R/V after surgery had some symptoms of N/R/V during the

extended recovery period. Symptoms of N/R/V were experienced by 6 of 15 patients (40%) of the patients without this history. However, this was not a statistically significant difference ($p = 0.0542$) (Table 16).

N/R/V - Total Postoperative Period

Control group: All 8 patients (100%) experienced some symptoms of N/R/V during the total postoperative period.

Experimental group: 7 of 11 patients (63.6%) experienced some symptoms of N/R/V during the total recovery period.

Fisher's Exact Test revealed no significant difference ($p = 0.0851$) between the groups with respect to symptoms of N/R/V during the total recovery period (Table 17).

TABLE 1: Descriptive Statistics for Each Group

Group I: Control, no NG tube (n = 8)			
Variable	Mean	S.E.	Range
Age (years)	29.0	1.8	22-38
Weight (kilograms)	62.0	4.2	47-76
Anesthesia length (minutes)	45.0	5.0	30-75
Fentanyl dose (milliliters)	4.4	0.3	3-5
Group II: Experimental, NG tube (n = 11)			
Variable	Mean	S.E.	Range
Age (years)	31.0	1.2	25-37
Weight (kilograms)	64.3	2.3	54-75
Anesthesia length (minutes)	46.4	8.5	25-120
Fentanyl dose (milliliters)	3.9	0.4	2-6
Gastric volume (ml)	32.3	12.4	10-150

TABLE 2: Summary of Patients with Positive Responses

VARIABLE	CONTROL (n = 8)	NG TUBE (n = 11)
Immediate Recovery Period:		
Nausea	87.5% (6 pts.)*	36.4% (4 pts.)
Retching	25.0% (2 pts.)	27.3% (3 pts.)
Vomiting:	87.5% (7 pts.)	63.6% (7 pts.)
Before ambulation	12.5% (1 pt.)	18.2% (2 pts.)
After ambulation	62.5% (5 pts.)	45.4% (5 pts.)
After liquids	37.5% (3 pts.)	27.3% (3 pts.)
Antiemetics required	25.0% (2 pts.)	18.2% (2 pts.)
Extended Recovery Period:		
Nausea	87.5% (7 pts.)	45.4% (5 pts.)
Retching	37.5% (3 pts.)	9.1% (1 pt.)
Emesis	62.5% (5 pts.)	27.3% (3 pts.)
Total Recovery Period:		
Nausea, retching or vomiting	100.0% (8 pts.)	63.6% (7 pts.)
History of N/R/V	25.0% (2 pts.)	18.2% (2 pts.)

*Only category with a statistically significant difference
p = 0.037

TABLE 3: Distribution of Patients by Treatment, Group and Specific Combinations of Nausea (N), Retching (R), and Vomiting (V)

CONDITION	CONTROL	NG TUBE
N alone	1	0
R alone	0	0
V alone	0	1
N and R only	0	0
N and V only	3	3
V and R only	0	0
N and R and V all	4	3
No symptoms	0	4
Total	8	11

TABLE 4: 2 x 2 Contingency Table for Nausea in the Recovery Room

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Nausea	7 87.5%	4 36.4%	11
No Nausea	1 12.5%	7 63.6%	8
Total	8	11	20

Fisher's Exact Test $p = 0.0371$

TABLE 5: 2 x 2 Contingency Table for Retching in the Recovery Room

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Retching	2 25%	3 27.3%	5
No Retching	6 75%	8 72.7%	14
Total	8	11	19

Fisher's Exact Test $p = 0.6641$

TABLE 6: 2 x 2 Contingency Table for Vomiting in the Recovery Room

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Vomiting	7 87.5%	7 63.6%	14
No Vomiting	1 12.5%	4 36.4%	5
Total	8	11	19

Fisher's Exact Test $p = 0.2668$

TABLE 7: 2 x 2 Contingency Table for Vomiting Before Ambulation in the Recovery Room

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Vomiting	1 12.5%	2 18.2%	3
No Vomiting	7 87.5%	9 81.8%	16
Total	8	11	19

Fisher's Exact Test $p = 0.6244$

TABLE 8: 2 x 2 Contingency Table for Vomiting After Ambulation but Before Ingestion of Fluids

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Vomiting	5 62.5%	5 45.4%	10
No Vomiting	3 37.5%	6 54.5%	9
Total	8	11	19

Fisher's Exact Test $p = 0.3522$

TABLE 9: 2 x 2 Contingency Table for Vomiting After Ingestion of Fluids in the Recovery Room

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Vomiting	3 37.5%	3 27.3%	6
No Vomiting	5 62.5%	8 72.7%	13
Total	8	11	19

Fisher's Exact Test $p = 0.3950$

TABLE 10: 2 x 2 Contingency Table, Both Groups Combined, for Vomiting Before Ambulation versus After Ambulation

OCCURRENCE	BEFORE AMBULATION	AFTER AMBULATION	TOTAL
Vomiting	3 15.8%	14 73.7%	17
No Vomiting	16 84.2%	5 66.3%	21
Total	19	19	38

Fisher's Exact Test $p = 0.0004$

TABLE 11: 2 x 2 Contingency Table for Antiemetic Administration in the Recovery Room

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Antiemetic	2 25%	2 18.2%	4
No Antiemetic	6 75%	9 81.8%	15
Total	8	11	19

Fisher's Exact Test $p = 0.8230$

TABLE 12: 2 x 2 Contingency Table for N/R/V in the Recovery Room versus History of N/V After a Previous Surgery

OCCURRENCE	HX N/V	NO HX N/V	TOTAL
N/R/V	4 100%	11 73.3%	15
No N/R/V	0 0%	4 26.7%	4
Total	4	15	19

Fisher's Exact Test $p = 0.3522$

Table 13: 2 x 2 Contingency Table for Nausea During the Extended Recovery Period

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Nausea	7 87.5%	5 45.4%	12
No Nausea	1 12.5%	6 54.6%	7
Total	8	11	19

Fisher's Exact Test $p = 0.0799$

TABLE 14: 2 x 2 Contingency Table for Retching During the Extended Recovery Period

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Retching	3 37.5%	1 9.1%	4
No Retching	5 62.5%	10 90.9%	15
Total	8	11	19

Fisher's Exact Test $p = 0.9819$

TABLE 15: 2 x 2 Contingency Table for Vomiting During the Extended Recovery Period

OCCURRENCE	CONTROL	NG TUBE	TOTAL
Vomiting	5 62.5%	3 27.3%	8
No Vomiting	3 37.5%	8 73.7%	11
Total	8	11	19

Fisher's Exact Test $p = 0.1438$

TABLE 16: 2 x 2 Contingency Table for N/R/V During the Extended Recovery Period versus History of N/V After a Prior Surgery

OCCURRENCE	HX N/V	NO HX N/V	TOTAL
N/R/V	4 100%	6 40%	10
No N/R/V	0 0%	4 60%	9
Total	4	15	19

Fisher's Exact Test $p = 0.0542$

TABLE 17: 2 x 2 Contingency Table for Any Episode of N/R/V During Any Time of the Total Recovery Period

OCCURRENCE	CONTROL	NG TUBE	TOTAL
N/R/V	8 100%	7 63.6%	15
No N/R/V	0 0%	4 36.4%	4
Total	8	11	19

Fisher's Exact Test $p = 0.0851$

CHAPTER 5

Discussion

Intraoperative gastric suctioning: The only parameter examined in terms of presence or absence of gastric suctioning which displayed statistical significance was the occurrence of nausea during the immediate recovery period. Nausea occurred in the control group with a frequency of 87.5% versus only 36.4% for the experimental group ($p < 0.05$). There were no differences between the groups in the frequency of retching or vomiting during this time frame, nor were there differences between the groups in N/R/V during the extended recovery period.

These findings were different from Burtles (1957) and Smessaert (1959) who found that vomiting was decreased by the use of an intraoperative NG tube, but that there was no effect on nausea or retching. Dent (1955) and Knapp (1956) found that intraoperative NG tube use did not decrease nausea, retching, or vomiting which is more consistent with the findings of this study. Janhunen (1972) found the NG tube to be useful in decreasing vomiting, but only in patients having cholecystectomies; outpatients having vein strippings did not exhibit less vomiting after NG tube use.

Three factors might explain the fact that 45.4% of the experimental group patients vomited prior to ingesting liquids even though their stomachs were suctioned in an effort to totally evacuate them. Swallowed saliva and continued production of gastric secretions may have provided the source of the emesis. Retrograde flow of intestinal contents back into the empty stomach may have been the source, or as Holdsworth (1974) and Ong (1978) have shown, gastric suctioning with an NG tube does not guarantee complete evacuation of the stomach.

Even though NG tube use in this study did decrease nausea in the recovery room, it did not decrease the frequency of other emetic symptoms for the first 24 hours. Furthermore, retching and vomiting in the recovery room occurred just as frequently in the control as experimental group. These two events are certainly more discomforting for most patients and also pose a greater risk for aspiration than would nausea alone.

Previous History of NRV: In spite of finding no statistical significance between the frequency of N/R/V in patients with a prior post-surgical history of N/R/V versus those without a history, the findings are consistent with other researchers. Janhunen (1972), Purkis (1964), and Robbie (1959) have all described a greater frequency of emetic symptoms in patients with a prior history of motion sickness or N/R/V after previous surgeries. In

this study, all four patients possessing this type of history experienced emetic symptoms during the 24-hour recovery period.

Gastric volume: The findings of Ong (1978) indicating that a preoperative fast in outpatients would not guarantee an empty stomach, can be reemphasized from those results. The gastric aspirate was greater than 30 ml. in three of the eleven experimental group patients and in one patient was 150 ml. Although pH's were not determined, it is important to protect the airway utilizing a rapid sequence induction when indicated. Since volume of the aspirate is critical in determining severity of pulmonary damage following aspiration, this author is in agreement with Arandia (1980) that emptying the stomach during surgery will decrease the chances of a severe episode of aspiration during the early post-extubation period when airway reflexes may not be fully intact.

Antiemetic use: Two patients in each group required the use of low dose droperidol for persistent retching and vomiting in the recovery room. One patient (in the control group) required a compazine suppository in addition to the droperidol. In general, the droperidol rapidly and effectively relieved the symptoms. However, all four patients experienced further symptoms of N/R/V during recovery at home, indicating the droperidol effect was short-acting. Only one of these four patients revealed a prior history of N/R/V with surgery. As discussed previously,

droperidol is an effective antiemetic in low doses. In fact, the recovery room nurses were not pleased with the protocol of the study, since normally in this ambulatory surgical unit, all laparoscopic surgical patients receive a low dose of droperidol prior to extubation. Observations by the recovery room nurses revealed a great deal more N/R/V in study patients not receiving droperidol as part of their anesthetic.

Factors causing the high incidence of N/R/V: The overall incidence of N/R/V for all patients was 79%. This was higher than the 30% - 50% often reported for outpatient surgery. Several factors might be responsible for this degree of N/R/V:

1. Sex - All patients were females who are more apt to experience N/R/V than males (Bellville, 1960; Burtles, 1957; Holmes, 1965; Janhunnen, 1972; Knapp, (1960).
2. Methohexital (Brevital) induction - Studies have found it difficult to determine the role of the induction agent due to the many other factors involved. Methohexital is used in place of thiopental for outpatients because it has a shorter elimination half-life allowing patients a more rapid return to preoperative levels of consciousness. Although Clarke (1971) found a higher incidence of N/R/V with methohexital (30%) than thiopental (20%) the difference was not significant.

Furthermore, Knapp (1956) and Stewart (1963) suggest that barbiturates probably have an anti-emetic effect. Dental anesthesia with methohexital, nasal oxygen and nitrous oxide resulted in only a 3% incidence of vomiting (Young, 1964). It would be difficult to stipulate that methohexital played a role in the frequency of N/R/V in this study.

3. Nitrous oxide - Again, it is difficult to determine the role of nitrous oxide in N/R/V since it is routinely given with either narcotic or inhalation anesthetic techniques. As mentioned, Young's study (1964) of nasal oxygen and nitrous oxide showed only a 3% incidence of vomiting. Smessaert (1959) described a lower incidence of emetic symptoms with a thiopental/nitrous oxide technique than with a potent inhalational agent. However, Parkhouse (1960) found that the greater the concentration of nitrous oxide, the greater the frequency of nausea.
4. Fentanyl - A key finding of this study was the significant ($p = 0.0004$) difference of vomiting in the recovery room, pre-ambulation (16%) versus post-ambulation (74%). Parkhouse (1963) observed that "any hypotensive patient is liable to vomit or feel nauseated, and this nausea is characteristically relieved by lying down." Bellville (1960) also observed a higher incidence of N/R/V in recovery room patients who became hypotensive.

However, vital signs of patients in the present study did not reflect episodes of hypotension as possible causes for the vomiting. One possible contributing factor for the incidence of N/R/V was the use of fentanyl. Narcotics delay gastric emptying as well as directly stimulate the chemoreceptor triggering zone (CTZ) (Todd, 1983). They also initiate a considerable vestibular component for emetic symptoms (Dobkin, 1961; Rubin, 1958). Thus, a patient without symptoms may suddenly develop N/R/V when moved to the sitting or standing position. The recommendation of minimal patient movement and change of position is highly unrealistic in the outpatient setting. The goal in the outpatient setting is to move the patient into a chair and to have the patient ingest liquids in an effort to determine readiness for discharge. Fentanyl has been recommended for outpatient surgery due to its short elimination half-life. Many studies have shown no difference in the recovery times between potent inhalation anesthesia and low dose balanced fentanyl anesthesia (Azar, 1982; Meridy, 1982). However, the role of fentanyl dose and N/R/V as well as a possible prolonged narcotic action in regards to CTZ or vestibular stimulation has not been addressed.

An incidental review of several studies that have used narcotics as part of the anesthetic has revealed some interesting findings. Riding (1960) found an increase in N/R/V with morphine. Bellville (1961) found a low incidence of N/R/V in patients who received a low dose of meperidine, but those who received a high dose of meperidine exhibited a high incidence of N/R/V. Mckie (1969) in a study of 110 patients for dilation and curettage found less frequent N/R/V with meperidine as a supplement than with morphine. Soni (1981) compared different techniques of anesthesia for laparoscopic tubal ligation. Greater than 60% of the patients receiving fentanyl 0.002 mg./kg. IV plus 0.001 mg./kg. supplements as part of their anesthetic required antiemetics in the recovery room while less than 20% of the patients receiving meperidine 1-1.5 mg./kg. required antiemetics. There were no differences in length of recovery. Dhamee (1982) also found an increase in vomiting following laparoscopies with fentanyl (43%) versus halothane (28%) or enflurane (22%). Epstein (1975) also showed an increase in the incidence of nausea and vomiting when fentanyl was added to thiopental/nitrous oxide/oxygen for therapeutic abortions (fentanyl 41% nausea versus control 16%; fentanyl 32% vomiting versus control 16%). Addition of fentanyl to etomidate

or thiopental also increased nausea and vomiting (Horrigan, 1980). Recently, (Scamman, 1984), a study was conducted to compare the ventilatory and mental effects of alfentanil and fentanyl. Healthy young volunteers not undergoing surgery received various doses of the narcotics. Fentanyl 1.5 $\mu\text{g./kg.}$ IV produced nausea in 4 of 8 subjects with no vomiting; however, 7 of 8 subjects receiving fentanyl 3.0 $\mu\text{g./kg.}$ IV were nauseated with 3 subjects vomiting. The alfentanil subjects exhibited less N/R/V. Protracted vomiting occurred with the higher dose of fentanyl, and ambulation at the end of the testing session also played a part. The mean fentanyl dose range for the present NG tube study was between 3.0 and 3.5 $\mu\text{g./kg.}$ which parallels the dose that resulted in increased emetic effects in Scamman's study. Coe (1983) compared alfentanil to fentanyl in outpatient therapeutic abortions and found an equally high incidence of nausea and vomiting (52-69%) in each group. It appears that fentanyl plays an important role in postoperative N/R/V and that this effect is probably dose related and may continue into the first postoperative day (Dhamee, 1982). As a comparison, Tracy (1982) examined three different inhalational agents for minor gynecological surgery. The overall incidence of nausea/vomiting (halothane 8%/4%,

enflurance 12%/4%, isoflurane 32%/12%) was generally much lower than techniques using narcotics for similar procedures.

Although fentanyl may contribute to the incidence of N/R/V, it probably cannot be blamed for the high incidence of N/R/V in this study. Fentanyl is used by many outpatient centers for all types of surgery. When used for procedures other than dilation and curettage, strabismus surgery, inner ear surgery, or laparoscopy, a much lower incidence of N/R/V is reported. As an example, the two patients not included in the study results who had breast biopsies, had no N/R/V at any time during the recovery period. Both of these patients received fentanyl and were ambulated early just like the other patients.

5. Laparoscopic surgery - Probably the most significant factor that explains the high incidence of N/R/V in this study can be attributed to the surgical procedure, laparoscopy. It is well recognized that the insufflation of nitrous oxide (or carbon dioxide) into the peritoneum necessary to perform this surgery is associated with a high incidence of postoperative N/R/V (Fishbourne, 1974; Wetchler, 1982). Because of its high solubility relative to nitrogen, nitrous oxide rapidly dissolves in the body's tissues and fluids. It has not been elucidated whether nitrous oxide in the peritoneum provides the stimulus for

N/R/V by way of direct irritation to the peritoneum or abdominal viscera; by way of diffusion into and expansion of trapped pockets of bowel gas; or by way of a central effect from nitrous oxide in the blood. Furthermore, it is not known whether the addition of fentanyl to this type of surgery provides an additive or synergistic effect, or possibly even a potentiating effect for stimulation of N/R/V.

Conclusions

In this study of female patients undergoing laparoscopic surgery with a methohexital/oxygen/nitrous oxide/fentanyl/succinylcholine anesthetic technique, the following conclusions were made:

1. Intraoperative gastric suctioning with a nasogastric tube did not significantly decrease the overall incidence of nausea, retching and vomiting during the postoperative period.
2. Administration of low dose droperidol intraoperatively or postoperatively to patients having laparoscopic surgery with a fentanyl narcotic anesthetic may be considered due to the high expected incidence of N/R/V.
3. Outpatients may present for surgery with significant gastric volumes in spite of overnight fasting. Maneuvers including rapid sequence intubations and extubation following return of glottic reflexes

should be considered to prevent aspiration pneumonitis.

4. Early ambulation and position changes can be expected to precipitate episodes of N/R/V in patients having laparoscopic surgery with this anesthetic technique.

Recommendations

Although intraoperative gastric suctioning did not effectively decrease N/R/V during the postoperative period for patients receiving a fentanyl/nitrous oxide/ relaxant anesthetic technique for laparoscopic surgery, the value of intraoperative gastric suctioning should be determined for other types of surgery and anesthetic techniques. A study is needed to examine the effects of gastric suctioning for inpatients, particularly those having intra-abdominal surgery.

Furthermore, the findings of such a high frequency of N/R/V in this study has brought attention to the need to examine in a controlled manner the relationship of various causative factors for N/R/V for the outpatient having laparoscopic surgery. In an effort to decrease the N/R/V frequency, several studies should be considered: 1) a study comparing various doses of fentanyl; 2) a study comparing fentanyl to meperidine, morphine or perhaps a narcotic agonist/antagonist such as nalbuphine; and 3) a study comparing fentanyl to a pure inhalational

anesthetic technique. Perhaps the selection of fentanyl as an adjunct for outpatient laparoscopic anesthesia makes logical sense in terms of rapidity of emergence and postoperative residual analgesia, but perhaps in terms of N/R/V in a patient needing to ambulate early, it does not make sense.

Investigations are needed to further identify the causative factors for N/R/V in the outpatient in an effort to minimize these discomforting and potentially harmful symptoms.

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APPENDIX A
CONSENT/EXPLANATION OF PROCEDURE
TO THE PARTICIPANT

CONSENT/EXPLANATION OF PROCEDURE
TO THE PARTICIPANT

The purpose of this study is to determine if suctioning of your stomach while you are asleep under anesthesia will affect your recovery from anesthesia.

You will randomly be assigned to one of two groups:

- Group 1 will not have their stomachs suctioned during anesthesia.
- Group 2 will have their stomachs suctioned during anesthesia.

You will be unaware of which group you are in. The anesthetic induction (process of going to sleep) will be performed routinely in a manner to prevent filling your stomach with anesthesia gases. The stomach suction tube is a small diameter soft plastic tube, and it will be placed into your stomach (group 2) after you are asleep under anesthesia and will be removed before you are awake. All patients will have a breathing tube placed through their mouth into their trachea (wind-pipe) after asleep under anesthesia. This is routine for the type of surgery you will be having. Your anesthetic management will proceed in the same manner whether or not you choose to participate in the study.

You will be monitored in the recovery room until your discharge for the pleasantness of your recovery. You will also be contacted by phone sometime during the day after your surgery to see if you have experienced any problems since your discharge.

The side effect of the suction tube might be a mild sore throat. However, this mild sore throat is also a side effect of the breathing tube which you would have whether you participate in the study or not.

The results of this study will enable us to evaluate the potential of stomach suctioning towards providing a smoother, safer recovery from surgery and anesthesia.

A summary of the results of this study will be available to you at your request.

If you agree to participate in this study, please sign your name and date on the line below. Confidentiality will be maintained at all times. If at any time during the anesthesia your safety is compromised, the study will be discontinued.

I understand that I may at any time during the course of this research study revoke my consent, and withdraw from the study without prejudice.

I understand that in the event of any physical and/or mental injury resulting from my participation in this research project, Virginia Commonwealth University will not offer compensation or medical treatment.

Signature

Date

I was present during the explanation referred to above, as well as the Volunteer's opportunity for questions, and hereby witness his signature.

Signature

Date

APPENDIX B
DATA COLLECTION TOOLS

HOME CALL QUESTIONNAIRE

Patients will be contacted as soon as possible the day after surgery regarding their recovery once they were discharged. Questions will proceed from general to specific, leaving the subjective symptom "nausea" until last to eliminate as much suggestive input as possible. If "nausea" is mentioned as an event that occurred, either spontaneously or from questioning, it will be noted as slight, moderate, or severe through the three qualifying statements indicated below.

1. How was your recovery from your surgery once you were home?
2. Did you experience any vomiting?
3. Did you experience any retching?
4. Did you experience any nausea? If the answer is yes:
Present, but not enough to be considered troublesome (slight)
Present, and enough to be unpleasant (moderate)
Present, and enough to be unpleasant and interfered with other activities (severe)
5. Have you ever experienced retching, vomiting or nausea after other surgeries you have had?

APPENDIX C
LETTERS

November 15, 1983

Kay Ann Prather, Maj., USAF N.C.
SGHSAA
Wilford Hall USAF Medical Center
Lackland AFB, TX 78236

Dear Maj. Prather:

As you know, I am presently enrolled at the Medical College of Virginia in the graduate program of Nurse Anesthesia.

My proposed thesis is titled "The Effect of Intra-operative Gastric Suctioning on Postoperative Nausea, Retching, and Vomiting in the Outpatient Setting." At the suggestion of Mr. Ciresi, I would like to adapt and use your data collection tools ("Postanesthetic Recovery Room Record" and "Home Call Questionnaire" which you developed for your thesis) for my study.

I would appreciate written confirmation or rejection of this request. Thank you very much for your consideration in this regard.

Sincerely,

Peter W. Ogren, Capt., USAF N.C.
658 Luton Lane
Richmond, VA 23225
Tel. No.: (804) 323-1703

November 28, 1983

Surrindar Kallar, M. D.
Director of Anesthesia
Ambulatory Surgery Clinic
Medical College of Virginia Hospitals

Dear Dr. Kallar:

As per your conversation with Mr. Ciresi and myself, I am officially requesting permission to conduct my research project (titled "The Effect of Intraoperative Gastric Suctioning on Postoperative Nausea, Retching, and Vomiting in the Outpatient Setting") in the ambulatory surgery clinic to commence the beginning of 1984. Approval from the Committee on the Conduct of Human Research should be obtained by then.

I will meet with you to outline the details of my study before beginning the project. I am looking forward to this opportunity and will work closely with you and your clinic staff so as to minimally disrupt the normal flow of patient care.

Please leave word with the secretary of the Nurse Anesthesia Department, Mrs. Paula Oslin, should you need to reach me for any reason.

Thank you for your consideration on my behalf.

Sincerely,

Peter W. Ogren, CRNA
Postgraduate Nurse
Anesthesia Student
Medical College of Virginia



DEPARTMENT OF THE AIR FORCE
WILFORD HALL USAF MEDICAL CENTER (AFSC)
LACKLAND AIR FORCE BASE, TEXAS 78236

77

30 November 1983

Captain Peter W. Ogren
658 Linton Ln
Richmond, VA 23225

Dear Peter

You are herein given consent to utilize any investigative tool, protocol on consent form which I employed in my study (The Effect of Pre-Induction Parental Metoclopramide on the Incidence of Post-Operative Nausea, Retching and Vomiting) in 1982-1983 at Medical College of Virginia.

Sincerely

A handwritten signature in cursive script, reading "Kay A. Prather".

KAY A. PRATHER, Captain, USAF, NC
Staff Instructor
Nurse Anesthetist Course

VITA

Peter W. Ogren was born on August 8, 1951, in Rockford, Illinois, and is an American citizen. He received his Baccalaureate of Science in Nursing from the University of Southern Mississippi, Hattiesburg, in August, 1975 and his Certificate in Anesthesia from the U. S. Air Force Nurse Anesthesia Program in San Antonio, Texas, in 1977. After practicing clinical anesthesia for two years, Captain Ogren returned as a faculty member for the U. S. Air Force Anesthesia Program from 1981-1983.

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