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The Effect of Pre-emergence Gastric Aspiration on Postoperative Nausea and Vomiting Following Abdominal Surgery

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This is to certify that the thesis prepared by Marc A. Friedberg entitled: **THE EFFECT OF PRE-EMERGENCE GASTRIC ASPIRATION ON POSTOPERATIVE NAUSEA AND VOMITING FOLLOWING ABDOMINAL SURGERY** has been approved by his committee as satisfactory completion of the thesis requirement for the degree of Master of Science in Nurse Anesthesia.

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at Virginia Commonwealth University

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Abstract

THE EFFECT OF PRE-EMERGENCE GASTRIC ASPIRATION ON POSTOPERATIVE NAUSEA AND VOMITING FOLLOWING ABDOMINAL SURGERY

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School of Allied Health Professions--Virginia Commonwealth University, 1992

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An investigation was undertaken to determine the effect of pre-emergence gastric aspiration on the incidence of postoperative nausea and vomiting in abdominal surgery patients. Thirty female ASA I and ASA II patients were randomly assigned to either a control group (n = 16) or a treatment group (n = 14). Those patients in the treatment group received pre-emergence gastric aspiration with a suction catheter; those patients in the control group did not. The incidence of postoperative nausea and vomiting was determined at various time intervals. Data were analyzed using Student's t test and the Chi-square statistic. Results indicated that there was no difference in the occurrence of postoperative nausea and vomiting between the groups.

Chapter One

Introduction

Surgery and anesthesia are not benign processes. The possibility of complications is inherent in surgery and anesthesia. Nausea and vomiting are frequent postoperative complications. Although the incidences reported vary considerably, authors note incidences of postoperative nausea and vomiting ranging from 4.5% to 23% (Adriani, Summers, & Antony, 1961; Gewolb, Hines, & Barash, 1987).

Eltringham, Coates, and Hudson (1982) examined the need for pharmacologic treatment of postoperative complications in the post anesthesia recovery room. The authors noted a 15% incidence of anti-emetic medication administration, an incidence second only to the administration of narcotics. Vomiting caused distress to patients, and although usually self limiting, sometimes led to more serious disorders. For example, postoperative vomiting sometimes led to aspiration of vomitus, wound disruption, or increased bleeding from the surgical site (Clarke, 1984).

Nausea, retching, and vomiting are the simple response end points of a complex physiologic process. This reflex

process involved the processing and integration of a large amount of input to the vomiting center, located in the medulla. Input included afferent impulses from the gastrointestinal tract, mediastinum, vestibular complex (via the 8th nerve), the cerebral cortex, and the chemoreceptor trigger zone (CTZ) (see Figure 1). This input arrived at the vomiting center via cholinergic, adrenergic, seratonergic, and histaminic pathways. The CTZ was affected by input usually resultant from drug or metabolic disturbances, and influences the vomiting center via dopaminergic pathways (Borison & Wang, 1953; Palazzo & Strunin, 1984a).

The entire gastrointestinal tract sent afferent input to the vomiting center. Borison and Wang (1953) noted that both vagal (cholinergic) and sympathetic input are present, but vagal input predominates. The authors state that visceral irritation or distention of the stomach results in vomiting. This response was also vagal in nature.

Various demographic and idiosyncratic factors may confer on any given individual an increased propensity for postoperative nausea and/or vomiting. Female gender, obesity, younger age, individual predisposition, and gastrointestinal disease increase the likelihood of postoperative nausea and vomiting. Persons undergoing intra-abdominal surgery experience postoperative nausea and vomiting more frequently than any other group when

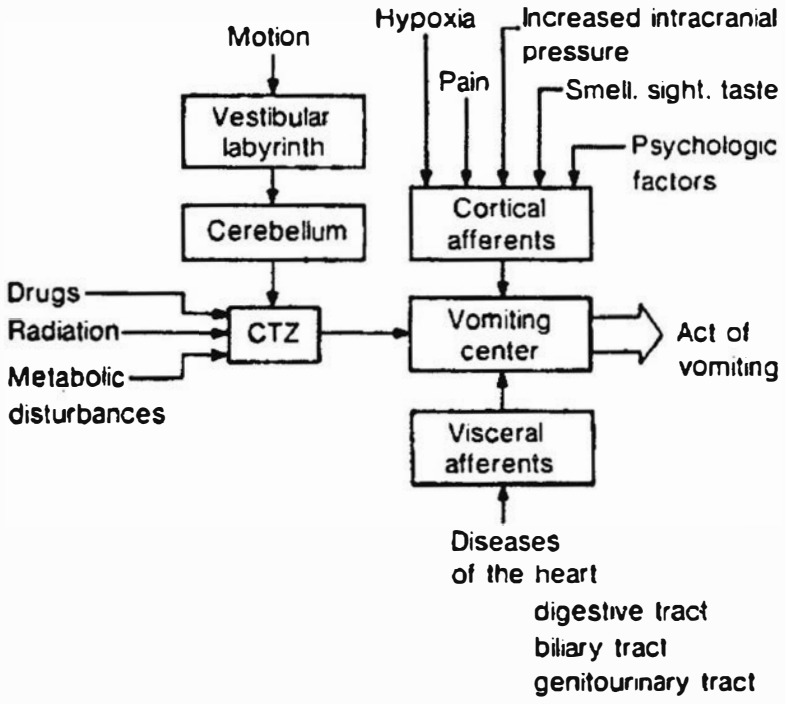

Figure 1. Input to the vomiting center.

Note. From Complications in Anesthesiology (p. 429) by E. J. Swenson and F. K. Orkin, 1983, New York: Lippincott.

compared with bias to operative procedure (Bellville, Bross, & Howland, 1960; Litwack & Parnass, 1988; Palazzo & Strunin, 1984a).

The postoperative, post-anesthetic state also contributes to the vomiting problem. Anesthetic drugs and method of anesthetic management influence the incidence of postoperative nausea and vomiting in a variety of ways. Preoperative preparation, premedication, choice of anesthetic agent, and the duration of anesthesia affect the incidence of postoperative nausea and vomiting. In addition, anesthetic procedures distend the gastrointestinal tract theoretically increasing the likelihood of postoperative nausea and vomiting (Bellville et al., 1960; Palazzo & Strunin, 1984a; Purkis, 1964).

Modulation of input to the CTZ and the vomiting center is the hallmark of antiemetic therapy. A plethora of anti-emetic treatments exist. There is abundant research documenting the effectiveness, or lack thereof, of pharmacologic agents used for prophylaxis and treatment of nausea and vomiting (Cramb, Fargas-Babjak, & Hirano, 1989; Dipalma, 1990; Litwack & Parnass, 1988; Tripple, Holland, Hassanein, 1989).

Perioperative gastric suctioning (aspiration) is another method of prophylaxis and treatment of postoperative nausea and vomiting (Palazzo & Strunin, 1984a). Research findings, however, offer conflicting results with regard to the

efficacy of this treatment (Hovorka, Kortilla, & Erkola, 1990; Michowitz, Chen, Waizbard, & Bawnik, 1988).

Gastric distention and irritation are direct causes of nausea and vomiting. It theoretically follows that the reduction of either of these factors would thereby decrease the tendency of any individual toward nausea and vomiting. Many anesthesia providers use gastric aspiration for empiric prophylaxis against postoperative nausea and vomiting. Existing reports of research offer conflicting and confusing results about the effectiveness of this therapy.

Statement of Purpose

The purpose of this study was to test whether pre-emergence gastric aspiration decreased the incidence of postoperative nausea and vomiting in female patients receiving general anesthesia for intra-abdominal surgery.

Statement of the Problem

Will the pre-emergence aspiration of gastric contents decrease the incidence of postoperative nausea and vomiting in American Society of Anesthesiologist physical classification (ASA) I and II female patients between 20 and 65 years of age receiving general anesthesia for intra-abdominal surgery?

Hypothesis

There is no difference in the incidence of postoperative nausea and vomiting between those patients receiving general anesthesia for intra-abdominal surgery who receive pre-emergence aspiration of gastric contents and those who do not.

Variables

Independent. The independent variable was the pre-emergence aspiration of gastric contents.

Dependent. The dependent variable was postoperative nausea and vomiting.

Definition of Terms

Pre-emergence. Pre-emergence referred to the 10 minutes preceding recovery and awakening from general anesthesia.

Aspiration. Aspiration was the removal of gastric contents by mechanical suctioning via a nasally or orally inserted gastric tube. The tubes used were 16 French suction tubes, designed specifically for this purpose.

Gastric contents. Gastric contents were the liquid and solid materials contained in the stomach.

Nausea. Nausea is the unpleasant feeling of impending vomiting.

Vomiting. Vomiting is the mechanical ejection of stomach contents through the mouth.

General anesthesia. General anesthesia is a state characterized by analgesia, amnesia, and loss of consciousness established by the direct action of anesthetic agents on the nervous system.

Intra-abdominal surgery. Intra-abdominal surgery is any surgery in which an incision is made through the peritoneum.

ASA I patient. According to the system of patient classification employed by the American Society of Anesthesiologists, an ASA I patient is a surgical patient with no organic, physiologic, biochemical, or psychiatric disturbances.

ASA II patient. According to the system of patient classification employed by the American Society of Anesthesiologists, an ASA II patient is a surgical patient with mild to moderate systemic disturbances caused either by the condition to be treated surgically or another pathologic process.

Assumptions

1. All patients in the study were NPO a minimum of 8 hours prior to surgery.

2. The prescribed anesthetic techniques were adhered to by involved anesthesia providers.

3. Nasally or orally inserted gastric tubes were properly placed.

4. Aspiration of the gastric tube was properly performed, and this procedure decompressed and emptied the stomach.

5. Involved patients were truthful during the postoperative interview.

Limitations

1. Individual differences existed in gastrointestinal function.

2. The postoperative interviews were conducted at varying lengths of time after the completion of surgery.

3. Different modalities of postoperative pain control were used.

4. Anesthetic techniques were slightly different.

Delimitations

1. Data were collected only from ASA I and ASA II patients 20 to 65 years of age.

2. Data were collected only from patients receiving general anesthesia for intra-abdominal surgery.

3. Anti-emetic and gastrokinetic medications were withheld from patients included in the study.

4. Patients denied any history of gastrointestinal problems.

Conceptual Framework

Physiology of nausea and vomiting: The vomiting center and CTZ. Much of the current understanding of the central nervous system structures associated with the vomiting process arose from the classic research and reporting of Borison and Wang (1953). The authors, through research of their own and through analysis of the research of others, described the vomiting center as a medullary structure located in the lateral reticular formation. This anatomic location placed the center strategically amidst other loci associated with the performance of the vomiting act, including the spasmodic respiratory center, the inspiratory center, the expiratory center, the vasomotor center, the salivatory nuclei, the vestibular nuclei, and the bulbofacilitory and inhibitory centers (Barnes, 1984; Borison & Wang, 1953). The proximity of the vomiting center to these loci allowed for the center to receive, process, and integrate input from a variety of sources, and to serve as the beginning of a final common pathway in the vomiting process (Barnes, 1984; Gibbs, 1976; Leslie, Shah, Thejomayen, & Murphy, 1990).

There are several neurochemical mechanisms that exert an influence on the vomiting center. In general, dopaminergic, cholinergic, seratonergic, and histaminic mechanisms elicit stimulatory responses. Adrenergic stimulation, conversely, results in inhibition of the center

(Barnes, 1984; Borison & Wang, 1953; Leslie et al., 1990). Another structure involved in the nausea/vomiting process is the CTZ. Located bilaterally on or near the floor of the fourth ventricle, the CTZ provides direct input to the vomiting center. Impulses from the CTZ to the vomiting center result in the vomiting reflex. The CTZ is adjacent to the area postrema, a section of the brain with a deficient blood brain barrier that allows blood borne substances to activate the CTZ. This receptive ability makes the CTZ especially subject to the influence of drugs, hypoxemia, and metabolic by-products (Borison & Wang, 1953; Gibbs, 1976; Palazzo & Strunin, 1984a).

Neurophysiology of nausea and vomiting: Afferent input. The vomiting center performs its integrative functions on a large body of afferent information. Afferent input to the vomiting center originates from the cerebral cortex, CTZ, gastrointestinal tract, genitalia, mediastinum, and the vestibular complex. Although afferent pathways have been widely studied, they are not completely understood. Impulses originate from multiple sites in response to a single stimulus (Clarke, 1984; Gibbs, 1976).

Excluding the gastrointestinal tract, visceral impulses that contribute to nausea and vomiting may arise from gallbladder and bile duct distention, irritation of the peritoneum, or from occlusion or compression of coronary blood vessels. These responses, mediated by the vagus

nerve, provide cholinergic input to the vomiting center. Input from abdominal organs, provided by splanchnic adrenergic afferents occurs, but this input is less important than adrenergic input (Barnes, 1984; Borison & Wang, 1953).

Another source of afferent input to the vomiting center is the CTZ. The CTZ is an afferent subsystem of the vomiting center; it is a separate sensory apparatus with probable anatomic and electrophysiologic neuronal connections to the vomiting center. As the site of emetic response to many blood borne substances, the CTZ is responsible for emesis associated with drugs, metabolic products, and bacterial/viral toxins. The CTZ system is most likely a dopaminergic system, although there exists evidence that disputes this (Barnes, 1984). The CTZ is also responsive to histamine. However, excitation of the CTZ by histamine alone is not a sufficient stimulus to cause an emetic response. Since a wide variety of non-similar substances excite the center, many different types of specific chemoreceptor are present (Barnes, 1984; Borison & Wang, 1953).

Another area of the nervous system with direct neural connections to the vomiting center is the vestibular complex. The neural connections occur via the cerebrum and the hypothalamus and pass through the CTZ. Many types of repetitive motions result in nausea and vomiting mediated by

this pathway, including rotational, horizontal, vertical, or visual field movements. Input from the vestibular complex to the vomiting center is cholinergic (Barnes, 1984; Borison & Wang, 1953; Clarke, 1984).

Afferent impulses, from the gastrointestinal tract, also cause nausea and vomiting through direct stimulation of the vomiting center. Mechanoreceptors and chemoreceptors mediate this input and vomiting can be elicited either by direct exogenous chemical irritation of the tract or by mechanical forces such as compression or distention (Barnes, 1984; Borison & Wang, 1953). Barnes (1984) noted that input to the vomiting center from the gut is vagal and sympathetic in origin. However, sympathetic ablation did not prevent vomiting while vagal ablation did. Therefore, vagal (cholinergic) afferents were primarily responsible for emetic stimuli arising from the gut. Borison and Wang (1953) stated that distention of the intestine or the stomach by any medium induces vomiting. Other researchers stated that blockage of gastrointestinal cholinergic impulses from the gut reduces the incidence of nausea and subsequent vomiting (Leslie et al., 1990).

Although distention of the stomach or bowel results in nausea and vomiting, the effect of gastrointestinal motility is less clear. The vomiting process causes a decrease in intestinal motility, but it is uncertain if the reverse is true, barring the existence of obstruction and distention.

Sympathetic input to the vomiting center is more important when it arises from the intestine, and is possibly part of a reflexive pathway initiated by the vomiting process (Barnes, 1984; Borison & Wang, 1953).

Effects of Anesthesia and Surgery on Nausea and Vomiting

Various medications decrease the incidence of postoperative nausea and vomiting. Effective pharmacologic agents include anticholinergics, dopamine receptor antagonists, serotonin receptor antagonists, phenothiazines, and certain gastrokinetics (Dipalma, 1990; Goodman, Rall, Nies, & Taylor, 1990). Many of these medications are acceptible perioperatively as prophylaxis for postoperative nausea and vomiting. Some studies offer encouraging results (Palazzo & Strunin, 1984b; Tigerstedt, Salmela, & Aromaa, 1988; Tripple et al., 1989; White & Shafer, 1987). Unfortunately, use of these medications may result in untoward side effects (Goodman et al., 1990). Therefore, routine, prophylactic use of these medications is less than justified. Adriani et al. (1961), Clarke (1984), and Palazzo and Strunin (1984b) caution against the routine use of these drugs.

Medications used in the provision of general anesthesia may contribute to the occurrence of postoperative nausea and vomiting. Etomidate and ketamine are more likely to potentiate vomiting postoperatively; propofol is less likely

to potentiate postoperative nausea and vomiting (White & Shafer, 1987). Thiopental is associated with an intermediate range of incidence (Clarke, 1984).

White and Shafer (1987) noted that the three commonly used inhalation agents, halothane, enflurane, and isoflurane, all cause postoperative nausea and vomiting. Although the incidence of nausea differed, the rate of vomiting was essentially identical after anesthesia using any of these volatile agents. The role nitrous oxide played in postoperative nausea and vomiting was less clear. Alexander, Skupski, and Brown (1984), and Felts, Poler, and Spitznagel (1990) concluded that the inclusion of nitrous oxide in an anesthetic increased the incidence of postoperative nausea and vomiting. Other research, however, disputed these findings. In these studies, no correlation existed between the use of nitrous oxide and the occurrence of postoperative nausea and vomiting (Kortilla, Hovorka, & Erkola, 1987; Muir et al., 1987).

Narcotics, a part of most anesthetics, caused nausea and vomiting. Stoelting (1991) noted nausea and vomiting as a side effect of every pure narcotic agonist used in anesthesia. White and Shafer (1987) stated that the incidence of postoperative nausea and vomiting after a narcotic based anesthetic is 2 - 3 times that of other anesthetic techniques. Results of other research confirmed these findings (Barnes, 1984; Clarke, 1984; Purkis, 1964).

Factors other than medications affect the incidence of postoperative nausea and vomiting. Mask ventilation increases this incidence when compared to endotracheal ventilation, presumably due to air forced into the stomach causing distention and vagal stimulation. The level of expertise of the anesthesia provider also affects the occurrence of postoperative nausea and vomiting. Less experienced providers cause a higher incidence than those with more experience, due to their poor control of the airway causing gastric distention. The length of the anesthetic is directly proportional to the incidence of postoperative nausea and vomiting (Bellville et al., 1960; Purkis, 1964; White & Shafer, 1987).

Physical and emotional traits of the patient impact on the frequency of postoperative nausea and vomiting. Females have a higher incidence than males. The morbidly obese have a higher incidence than those of other body/mass indices. People who are prone to motion sickness are also more prone to postoperative sickness. Anxiety and physical or emotional trauma slows gastric emptying and increase gastric volume, thereby increases the incidence of vomiting. Patients who experience hypoxia, hypotension, or pain are more prone to postoperative nausea and vomiting. Younger patients, especially those less than 19 years of age, have increased rates of postoperative vomiting (Clarke, 1984; Purkis, 1964; White & Shafer, 1987).

The duration of the surgical procedure correlates positively with the incidence of postoperative nausea and vomiting. In addition, the site of the surgical procedure influences the incidence of postoperative nausea and vomiting. Intra-abdominal and head and neck procedures cause a higher incidence of nausea and vomiting after surgery than procedures performed elsewhere. These two types of procedures cause approximately the same incidence of postoperative nausea and vomiting (Purkis, 1964; White & Shafer, 1987).

Summary

Postoperative nausea and vomiting occur frequently, and cause untoward consequences. Although only partially understood, the physiologic basis of this process is the result of a complex interaction of afferent neurological input to the medullary vomiting center. There are further influences on the system by the postoperative, post-anesthetic state and by individual traits of the patient.

Alteration of the input to the vomiting center is the standard treatment for nausea and vomiting. Usually, this treatment is pharmacologic in nature but other modalities, including aspiration of stomach contents, may be effective. The use of gastric aspiration at the end of anesthesia as empiric prophylaxis for emergence and postoperative nausea and vomiting is commonplace. The efficacy of this treatment

in the female, intra-abdominal surgical patient is questionable.

Chapter Two

Review of Literature

Incidence of Postoperative Nausea and Vomiting

Dent, Ramachamdra, and Stephen (1955) examined the incidence of postoperative nausea and vomiting. The authors noted that, as early as 1936, Waters determined the incidence of nausea and vomiting after cyclopropane anesthesia was 40.6%. They also noted that, in research done in 1952, this incidence decreased to 22.2%. In their own research, the authors examined 3,000 patients and found that the overall incidence of postoperative vomiting was 27.2%. They noted a higher incidence when the anesthetic included ether or cyclopropane versus pentothal or regional anesthesia. Muscle relaxants had no effect on the incidence.

Bellville (1961) noted other research that corroborated these figures. Citing earlier works, he stated postoperative nausea and vomiting occurred with incidences of 29.2% (1959), 32% (1957), and 30.5% (1958). The studies cited used a cyclopropane anesthetic, and Bellville described a direct influence on the incidence of

postoperative nausea and vomiting by the duration of surgery.

Since these early reports, many studies have examined the incidence of postoperative nausea and vomiting. In the United Kingdom, Eltringham et al. (1982) made observations on 10,000 consecutive admissions to a post-anesthesia recovery unit. The authors noted a 15% incidence of postoperative nausea and vomiting that necessitated intervention. The subjects received general anesthesia 94.3% of the time, and consisted of patients that had general surgical, gynecological, orthopedic, urologic, and dental procedures. Sixty-two per cent of the patients remained in the postanesthesia recovery room for less than 1 hour, 37% for 1 - 2 hours, and 1% for longer than 2 hours. The short duration of observation may account for the lower incidence of nausea and vomiting observed.

In a Canadian hospital, Cohen, Duncan, Pope, and Wolkenstein (1986) examined 112,000 anesthetics and postoperative recoveries. The observations took place in two time frames, 1975 - 1978, and 1979 - 1983. In the first period, the incidence of postoperative nausea and vomiting was 5.12%, and during the second period was 5.54%.

These similar rates occurred despite changes in anesthetic technique. In the second time frame, there were less anesthetics that employed nitrous oxide, less that used halothane, more that used enflurane, and there was an almost

two-fold increase in the use of narcotics. The use of a balanced technique that employed a minimum of four anesthetic agents and adjunct drugs was marginally greater in the second period. The rate of use of barbiturates and muscle relaxants was the same in both periods.

Other factors that contributed to the incidence of postoperative nausea and vomiting occurred with the same incidence in both periods, except for hypotension. Intraoperative hypotension occurred 1.5 times as often, and postoperative hypotension twice as often in the second time frame.

Experiences in the United States have been comparable to those in Canada. In a recent study, Gewold et al. (1987) found a similar incidence of postoperative nausea and vomiting. The authors examined 3,224 consecutive admissions to the postanesthesia recovery room. There was an overall complication rate of 17.6%, of which nausea and vomiting was the most frequently noted postoperative complication. The authors cited an incidence of postoperative nausea and vomiting of 4.5%. A higher incidence of all postoperative complications occurred after general anesthesia as opposed to regional or local anesthesia. In addition, the authors noted that abdominal procedures caused the highest overall complication rate, as well as the highest incidence of nausea and vomiting (20%).

In a larger and more recent study, Hines, Barash, Watrous, and O'Connor (1992) examined complications occurring in the postanesthesia recovery room. The study employed a prospective design and examined 18,473 consecutive patients entering the postanesthesia recovery room at a university teaching hospital. The authors cited an overall postoperative complication rate of 23.7%. Of this percentage, nausea and vomiting occurred most frequently with a 9.8% rate of occurrence. Patients of ASA II status became nauseated and vomited more frequently than those of other ASA classifications. The authors also noted that the occurrence of nausea is more likely to be associated with the type of operative procedure than other complications. Intra-abdominal and gynecological procedures are cited by the authors as those most likely to cause postoperative nausea and vomiting. In addition, they stated that site of operation influenced the rate of postoperative nausea and vomiting more than the anesthetic technique employed.

The Use of Gastric Aspiration in Abdominal Surgery Patients

In the past, postoperative gastric aspiration to decompress the abdominal tract was a commonly employed treatment in intra-abdominal surgery. However, as long ago as 1963, the efficacy of routine gastric aspiration was questioned. Gerber (1963) questioned the use of gastric

decompression even in the treatment of paralytic ileus. He cited 2,000 patients that had successful recovery from ileus without the use of gastric suction. He also stated that patients without indwelling suction catheters usually experienced a much lower complication rate than those with indwelling suction devices. Nausea and vomiting, however, occurred at a slightly higher rate in those patients without gastric aspiration devices.

Reasbeck, Rice, and Herbison (1984) also questioned the use of routine gastric aspiration. In their study, patients who underwent surgery for intestinal resection either received perioperative gastric suction or did not. Although the authors concluded that there was no difference in the incidence of postoperative complications between the groups, they noted a slightly higher rate of nausea and vomiting in the group that had not received gastric suctioning.

Sandrucci et al. (1987) examined the need for postoperative nasogastric suction in patients undergoing biliary or colo-rectal surgery. The authors determined that the presence or absence of a nasogastric tube postoperatively caused no difference in the incidence of postoperative complications, with one notable exception. The authors found that, in the group not receiving gastric aspiration, there was a significantly higher incidence of nausea and vomiting. The non-suctioned group had an incidence of 48%, and the suctioned group had an incidence

of 24%. Clearly, in this study, the elimination of gastric distention by aspiration decreased the incidence of nausea and vomiting.

Other authors, however, did not note such a drastic impact of gastric suction on nausea and vomiting. Michowitz et al. (1988) studied the impact of gastric suction on postoperative nausea and vomiting, and also examined the impact of duration of suctioning. The authors randomized subjects into three groups, all undergoing intra-abdominal surgery. The first group received no aspiration, the second group received intra-operative suction and suction up to 2 hours postoperatively, and the third group received intra-operative suction and suction for 12 hours postoperatively. A control group received intra-operative suction, as well as 2 to 3 postoperative days of suction. The authors concluded that there was a difference between groups in the incidence of nausea and vomiting, but that these differences were not statistically significant (Control = 14%, Average of treatment groups = 20%).

In the most recent and largest of these types of studies examined, Wolff et al. (1989) determined the effect of gastric decompression on postoperative nausea and vomiting in 535 patients undergoing colon and rectal surgery. The patients either received or did not receive intraoperative and postoperative gastric suctioning via a suction tube. There were significant differences between

the two groups in abdominal distention, nausea, and vomiting. In the group receiving decompressive treatment, 16% experienced abdominal distention, 17% were nauseated, 11% vomited, and 5% required replacement of the tube after its discontinuation. In the group receiving no treatment, 28% experienced abdominal distention, 27% were nauseated, 19% vomited, and 13% required initiation of decompressive therapy.

The Impact of Gastric Aspiration During Anesthesia on Postoperative Nausea and Vomiting

In a review of postoperative vomiting, Jahunen and Tammisto (1972) studied the effectiveness of intraoperative gastric suctioning in reducing postoperative vomiting. Patients undergoing various intra-abdominal surgeries had suction tubes placed and received gastric aspiration during the surgical procedure. The suction tubes were removed immediately after surgery to eliminate postoperative pharyngeal irritation which can cause nausea, retching, and vomiting. Patients were grouped according to surgical procedure. Patients subjectively judged the quality of nausea. The authors concluded that intraoperative gastric suction was beneficial in reducing some types of postoperative nausea and vomiting in certain populations. They determined that postoperative nausea and vomiting decreased most in persons undergoing intra-abdominal

surgery, especially in patients who had upper abdominal surgery (cholecystectomies). The authors found that intraoperative gastric aspiration was most effective in reducing postoperative nausea and vomiting of the moderate to severe types, but less effective in reducing mild nausea.

In a more recent study, Hovorka et al. (1990) investigated the impact of pre-emergence gastric aspiration on the incidence of postoperative nausea and vomiting. The subjects were women undergoing general anesthesia for total abdominal hysterectomy. The women received similar anesthetics that included thiobarbiturates, narcotics, nitrous oxide, isoflurane, and an anticholinergic premedication. Approximately one-half of the subjects had their stomachs aspirated at the end of the anesthetic.

Gastric aspiration took place just prior to the reversal of neuromuscular blockade, and then again a few minutes later. The authors claimed that in all cases, they obtained only a small amount of aspirate. The volume was usually less than 30 milliliters.

The authors examined the incidence of postoperative nausea and vomiting for 24 hours at 2, 6, 12, and 24 hours after surgery. The authors found an unusually high incidence of nausea and vomiting in both groups. In the stomach aspirated group there was a 79% incidence of nausea and vomiting, and in the stomach not aspirated group, there was a 70% incidence. The groups were similar in demographic

characteristics, anesthetics received, duration of the anesthetic, and amounts and types of postoperative pain medications received. The authors concluded that gastric aspiration at the end of anesthesia did not decrease the incidence of postoperative nausea and vomiting.

The overall incidence of postoperative nausea and vomiting found in this study was considerably higher than that noted by others. The authors stated that this high incidence was the result of meticulous reporting, and stated that they have noted similar incidences in other research. Loss of the childbearing organ and fear of losing female identity were cited as other contributing factors.

It is apparent that nausea and vomiting are frequently occurring postoperative complications. The literature reviewed reveals conflicting and perplexing information on the efficacy of gastric aspiration in the abdominal surgery patient. Most of this literature originates in the surgical journals, and concerns long term use of gastric aspiration devices. To date, there are few published studies that address the effect of gastric aspiration during the pre-emergence phase of anesthesia and the occurrence of postoperative nausea and vomiting. However, it seems theoretically possible that pre-emergence aspiration of stomach contents should decrease the incidence of postoperative nausea and vomiting.

Chapter Three

Methodology

Purpose of the Study

The purpose of this study was to test whether pre-emergence gastric aspiration decreased the incidence of postoperative nausea and vomiting. The population studied consisted of female patients receiving general anesthesia for intra-abdominal procedures.

Research Design

This study employed a quasi-experimental design with manipulation of the independent variable (gastric aspiration) to determine the effect on the dependent variable (postoperative nausea and vomiting). A post-test only design was used. Subjects were randomly assigned to either the control group or the experimental group.

Setting, Population, and Sample

Experimentation and data collection took place in the operating rooms, post anesthesia recovery unit, and nursing units of a large, mid-Atlantic, university teaching

hospital. A sample was chosen from the population consisting of female patients receiving general anesthesia for intra-abdominal surgery. Additional criteria for inclusion were: ASA I or II status, age between 20 and 65 years, and NPO status for a minimum of 8 hours at the time of surgery. Exclusionary criteria were: history of gastrointestinal pathology or the use of any anti-emetic, gastrokinetic, or narcotic medication in the 48 hours preceding surgery. Based on these criteria, a sample of convenience consisting of 30 subjects was obtained.

Treatment Groups

Subjects were randomly assigned to either the control or experimental group. Subjects in the experimental group had a suction tube placed into their stomach and had their stomach contents aspirated just prior to emergence from anesthesia. Control subjects did not receive this treatment. Neither group received anti-emetic or gastrokinetic medication. All received the same anesthetic induction, and had similar, but not identical, anesthetics.

Procedure

Approval for the study was obtained from the Committee on the Conduct of Human Research. The need for informed consent was waived by the Chairman of the committee. A total of 30 female patients receiving general anesthesia for

intra-abdominal procedures participated in the study. All patients were between the ages of 20 and 65, were NPO for a minimum of 8 hours prior to surgery, received no anti-emetic or gastrokinetic medications, and denied any history of gastrointestinal pathology.

Prior to surgery, subjects were randomly assigned to either the control or experimental group. Upon arrival in the preoperative holding area, NPO status, the absence of gastrointestinal pathology, and absence of undesirable medications were verified. The involved anesthesia providers received and reviewed an instruction sheet (see Appendix A). All patients received an anesthetic that satisfied the guidelines of the study. Subjects in the experimental group had a 16 French suction tube placed orally. Placement was verified by the air injection/auscultation method. Just prior to emergence, stomach contents were aspirated. No subjects received anti-emetic or gastrokinetic medications during the anesthetic.

Upon completion of surgery, subjects were taken to the post anesthesia recovery unit, and then to the medical/ surgical wards of the hospital. From the time of their arrival in the post anesthesia recovery unit until the time of their discharge from the hospital, no manipulation of medical treatment was attempted.

A researcher visited each patient between 12 and 24 hours postoperatively, and a data collection instrument was

completed (see Appendix B). Data were obtained from the anesthesia records, the post anesthesia care unit records, the patient progress notes, the nurses notes, and from the patient. Data collected included the occurrence of nausea/vomiting, postoperative and intraoperative treatments, and demographic data.

Instrumentation

All experimental subjects received gastric intubation with a 16 French suction catheter. Just prior to emergence, 80 - 120 mm Hg suction was applied and continued until no further aspirate was observed for 5 seconds. All data collected were objective in nature, except for the patient interview. These questions required only yes or no answers, and were concerned with easily recognizable events. Therefore, the validity of the instrument was to be high.

Statistical Analysis

The variable data obtained were of two types. Most of the variables were categorical variables, such as yes/no answers and frequency counts. Some of the variables were of the continuous type, such as age, weight, and length of anesthesia.

Comparisons were made between continuous/continuous, continuous/categorical, and categorical/categorical variables. Those comparisons between continuous/

continuous variables were made using Student's *t* test. Comparisons between continuous and categorical variables employed logistic regression. The comparisons of categorical/categorical variables were made using contingency tables and the chi-square statistic. A significance level of .05 was used.

Chapter Four

Results

Statistical Analysis

To determine the effect of pre-emergence gastric aspiration on postoperative nausea and vomiting, a sample of convenience consisting of 30 ASA I and II female patients undergoing abdominal surgery was used. The patients were randomly assigned to either a control group, Group I, (n = 16), or a treatment group, Group II, (n = 14). Group II received pre-emergence gastric aspiration; Group I did not.

The groups were compared with respect to age and weight, with the results presented in Table 1. An alpha level of .05 was chosen, therefore a p value of .05 or less was considered to be statistically significant in this study. The patients in Group I weighed an average of 69.5 kilograms, and patients in Group II weighed an average of 72.6 kilograms. The p value was .368. There was no significant difference between the groups in weight. There was a significant difference in age between the two groups. The p value for age was found to be .034, a statistically significant difference.

Table 1

Demographic Variables by Group

	Group I (n = 16)		Group II (n = 14)		
Variable	M	SD	M	SD	p
Age (yrs)	46.2	9.2	39.5	6.9	.034*
Weight (kg)	69.5	10.8	72.6	7.3	.368

Note: * $p < .05$

The effect of pre-emergence gastric aspiration on postoperative nausea and vomiting during different postoperative time frames was evaluated. The data were evaluated using 2 x 2 contingency tables and the Chi-square statistic. These results are in Tables 2 and 3. Again, a p value of .05, and a Chi-square value of 3.84 were considered statistically significant. There was no significant difference at any time in the occurrence of postoperative nausea and vomiting (N/V) between groups.

In addition, other categorical data were collected regarding differences among the groups. The occurrence of

Table 2

Overall Incidences of Nausea and Vomiting (N/V)

	Group I (n = 16)		Group II (n = 14)	
Variable	n	(%)	n	(%)
N/V @ 2 hrs	4	(25)	1	(7)
N/V @ 2 - 6 hrs	3	(19)	3	(21)
N/V @ > 6 hrs	3	(19)	1	(7)
Total	10	(63)	5	(36)

Table 3

Occurrence of Postoperative Nausea and Vomiting (N/V)

Variables	Chi-Square	p
Group/ N/V @ 2 hrs	1.714	.336
Group/ N/V @ 2 - 6 hrs	.033	1.000
Group/ N/V @>6 hrs	.871	.602

postoperative nausea and vomiting was related to the use of different anesthetic drugs and techniques, the length and location of the operation, and methods of postoperative pain control.

The use of nitrous oxide, propofol infusions, epidural anesthesia in combination with general anesthesia, the location of the surgery performed, the use of postoperative narcotics, and the use of postoperative epidural analgesia were examined with respect to their effect on postoperative nausea and vomiting. Each was examined using a 2 x 2 contingency table, and the Chi-square statistic. The statistical results are summarized in Table 4. Significant p and Chi-square values are as mentioned above. None of these variables had a statistically significant effect on the incidence of postoperative nausea and vomiting, with the exception of one. The use of postoperative epidural anesthesia approached significance at the 2 - 6 hour time interval.

In addition to categorical variables, continuous variables were also investigated. These variables included maximum end expiratory isoflurane (MEEI), weight, and the duration of anesthesia (DA). These variables were related to the categorical variables of postoperative nausea and vomiting (N/V) in 2 x 2 contingency tables, and the relationships examined statistically using logistic regression. The results may be found in Table 5.

Table 4

Occurrence of Postoperative Nausea and Vomiting (N/V) with Regard to Anesthetic Categorical Variables

Variables	Chi-square	p
Nitrous/ N/V @ 2 hrs	.718	.476
Nitrous/ N/V @ 2 - 6 hrs	2.907	.156
Nitrous/ N/V @ >6 hrs	.353	.611
Propofol/ N/V @ 2 hrs	.136	1.000
Propofol/ N/V @ 2 - 6 hrs	.384	.655
Propofol/ N/V @ >6 hrs	.007	1.000
Epidural/ N/V @ 2 hrs	1.000	.622
Epidural/ N/V @ 2 - 6 hrs	2.222	.184
Epidural/ N/V @ >6 hrs	.192	1.000
PO narcotic/ N/V @ 2 hrs	.480	.640
PO narcotic/ N/V @ 2 - 6 hrs	.938	.633
PO narcotic/ N/V @ >6 hrs	.144	1.000
PO epidural/ N/V @ 2 hrs	1.714	.190
PO epidural/ N/V @ 2 - 6 hrs	4.051	.073
PO epidural/ N/V @ > 6 hrs	.021	1.000
Location/ N/V @ 2 hrs	1.920	.300
Location/ N/V @ 2 - 6 hrs	.938	.633
Location/ N/V @ > 6 hrs	.144	1.000

Table 5

Relationship of Postoperative Nausea and Vomiting (N/V) with Regard to Anesthetic Continuous Variables

Variable	p	R^2
Weight/ N/V @ 2 hrs	.624	.009
Weight/ N/V @ 2 - 6 hrs	.242	.046
Weight/ N/V @ >6 hrs	.913	.001
DA/ N/V @ 2 hrs	.074	.118
DA/ N/V @ 2 - 6 hrs	.743	.004
DA/ N/V @ > 6 hrs	.662	.008
MEEI/ N/V @ 2 hrs	.738	.004
MEEI/ N/V @ 2 - 6 hrs	.882	.001
MEEI/ N/V @ >6 hrs	.494	.020

A Chi-square p value of .05 and a Rho-square value of .2 or greater were considered significant. There were no statistically significant relationships noted.

Many variables were examined, and the influence of each variable on the occurrence of postoperative nausea and vomiting was calculated. None one of the variables was found to have a statistically significant impact.

Chapter Five

Discussion

The purpose of this study was to determine if pre-emergence gastric aspiration decreased the incidence of postoperative nausea and vomiting in female, ASA I and II patients between the ages of 20 and 65 receiving general anesthesia for intra-abdominal surgery. The hypothesis stated that there was no difference in the occurrence of postoperative nausea and vomiting between those patients that received gastric aspiration and those patients that did not. Using the Chi-square statistic, the hypothesis failed to be rejected at the .05 level of significance.

The control and treatment groups were similar in weight but differed in age. However, this difference in age should not have affected the incidence of postoperative nausea and vomiting. Despite the provision of pre-emergence gastric aspiration to the treatment group, there was not a significant difference in the incidence of postoperative nausea and vomiting between the groups in any time frame. The effect on postoperative nausea and vomiting by numerous other variables unrelated to the hypothesis was examined.

Of these, only the effect of the duration of surgery on the incidence of nausea and vomiting in the first two postoperative hours, and the impact of postoperative epidural analgesia on nausea and vomiting in the 2 - 6 hour postoperative time frame approached significance.

Correlations with Previous Studies

Incidence of postoperative nausea and vomiting. In this study, there was an overall incidence of postoperative nausea and vomiting of 50.3%. Group I (control) had an incidence of 63%, and Group II (treatment) had an incidence of 36%. In Group I, nausea and vomiting was more common in the first 2 hours postoperatively than in the 2 - 6 or greater than 6 hours postoperative time frames (25%, 19%, 19%, respectively). In Group II, the highest incidence of nausea and vomiting was noted in the 2 - 6 hours postoperative time period (7% in first 2 hours, 21% 2 - 6 hours, 7% > 6 hours).

A review of the relevant literature revealed varying incidences of postoperative nausea and vomiting. Dent et al. (1955), and Bellville (1961) cited incidences of postoperative nausea and vomiting ranging from 22.2% to 40.6%. These incidences were noted after cyclopropane anesthesia but no mention of time frames or surgical procedures is given. Paradoxically, these incidences were lower than those found in the current study, where

anesthetic agents that result in much lower emetic stimulation were used.

In 1982, Eltringham et al. reported a 15% incidence of postoperative nausea and vomiting. However, observations were made only in the recovery room, and nausea and vomiting were considered a complication only if pharmacologic intervention was necessary. Ninety-nine per cent of the 10,000 patients studied were observed for 2 hours or less, and patients receiving regional anesthesia were included in the study.

Cohen et al. (1986) observed a much lower incidence of postoperative nausea and vomiting in the postanesthesia recovery room. The authors cited incidences of 5.12% and 5.54% during two different time periods. Once again, patients were observed for only a short time, and patients receiving regional and local anesthesia were included in the data.

Studies by Gewolb et al. (1987), and Hines et al. (1992) cited similar rates of postoperative nausea and vomiting. The earlier of these studies cited an incidence of 4.5%, and the more recent study noted a 9.8% rate. Both studies took place in a post anesthesia recovery room, limiting the time of patient observation to a few hours. Also, both studies included patients receiving anesthetics other than general. In both studies, abdominal surgery was

implicated as producing the highest rate of nausea and vomiting, with incidences approaching 20%.

The incidences of postoperative nausea and vomiting cited above are much lower than those found in this study. A comparatively shortened duration of observation, the inclusion of anesthetic techniques other than general anesthesia, and the inclusion of operative sites other than abdominal may partially account for the discrepancy. It is noted that the incidences of postoperative nausea and vomiting during the initial two postoperative hours found in this study are similar to those of previous studies.

The use of gastric aspiration in abdominal surgery patients. Postoperative gastric aspiration is commonly used as a method to decrease nausea and vomiting. Gerber (1963), Reasbeck et al. (1984), and Sandrucci et al. (1987) noted that although the use of postoperative gastric suctioning may increase the occurrence of some complications, it decreases the incidence of postoperative nausea and vomiting.

Michowitz et al. (1988) did not note a significant impact by gastric aspiration on postoperative nausea and vomiting. Although a higher incidence of nausea and vomiting was noted in the non-suctioned group, the difference did not approach statistical significance. Wolff and colleagues (1989), however, did find a statistically significant difference in postoperative nausea and vomiting

between patients who received gastric aspiration and those who did not.

The studies mentioned above evaluated the effect of postoperative gastric aspiration on nausea and vomiting, and are mentioned to address the issue of the impact of gastric aspiration on nausea and vomiting in the abdominal surgery patient. All the authors noted that gastric aspiration decreases the incidence of nausea and vomiting, although not always to a statistically significant degree. The data obtained in the current study also indicated that gastric aspiration reduces postoperative nausea and vomiting, but not to a statistically significant degree.

The impact of gastric aspiration during anesthesia on postoperative nausea and vomiting. Few authors have addressed the topic of the impact of gastric aspiration during anesthesia on the occurrence of postoperative nausea and vomiting. In their 1972 study, Jahunen and Tammisto reported that intraoperative gastric aspiration was effective in reducing postoperative nausea and vomiting. This effect was most beneficial in reducing moderate and severe nausea in patients who received upper abdominal surgery.

Conversely, Hovorka et al. (1990) reported that gastric aspiration during general anesthesia for total abdominal hysterectomy did not reduce the incidence of postoperative nausea and vomiting. In their findings, the authors noted

unusually high incidences of postoperative nausea and vomiting in patients that received gastric aspiration as well as in those who did not. Patients who had their stomach aspirated experienced postoperative nausea and vomiting 79% of the time, and those who did not receive gastric suction were nauseated and vomited 70% of the time.

The findings in the current study supported those of Hovorka et al. Pre-emergence gastric aspiration did not significantly affect the incidence of postoperative nausea and vomiting in female patients receiving general anesthesia for intra-abdominal surgery.

Limitations and Generalizability

The study examined a cause and effect relationship in a small sample. In addition, many extraneous variables, such as choice of anesthetic, type and duration of surgery, and method of postoperative pain control may have influenced the outcome of this study. Therefore, it would be impossible to generalize the findings obtained in this study to any population other than the one used.

Recommendations for Further Studies

The purpose of this study was to test the effect of pre-emergence gastric aspiration on postoperative nausea and vomiting. There exist many other studies that obliquely address this issue, and a small number that examine it

directly. Unfortunately, the findings in these studies are often contradictory and unreplicated. Future studies should be either easily replicated or replications of studies already done. Further research should be done in a more standardized fashion, examining the effect of pre-emergence gastric aspiration on specific samples receiving a specific anesthetic for a specified procedure, and using standardized data collection and analysis techniques.

Conclusion

Gastric aspiration is commonly employed by anesthesia providers as a means of prophylaxis against emergence and postoperative nausea and vomiting. To date, attempts to scientifically validate this practice have yielded confusing and contradictory results. In the current study, pre-emergence gastric aspiration did not affect the incidence of postoperative nausea and vomiting.

Summary

The results of this study demonstrated that pre-emergence gastric aspiration did not significantly affect the incidence of postoperative nausea and vomiting in the population examined. Therefore, there was a failure to reject the hypothesis using the Chi-square statistical analysis at the .05 level of significance.

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Appendix A

Appendix A

Nausea/Vomiting Study
Marc Friedberg RRNA
Dept. of Nurse Anesthesia
Medical College of Virginia

Patient Control #_____

Anesthesia Provider: Please conduct the anesthetic within the guidelines mentioned below. If deviations are needed, please note them on this form. Return this form to the Department of Nurse Anesthesia Clinical Office at the west end of the PACU. Your assistance is greatly appreciated.

Anesthetic Technique

(In combination with, or without epidural anesthesia/analgesia)
Pentothal 3-7 mg/kg for induction
Muscle Relaxant: Succinylcholine Atracurium Vecuronium
(Please circle those used)
Fentanyl Total dose not to exceed 7mg/kg
DO NOT USE NITROUS OXIDE
Isoflurane Minimum Concentration 0.2% Not to exceed end tidal concentration of 1.5%
Neostigmine/Glycopyrrolate as needed for reversal of neuromuscular blockade
Propofol infusion for maintainance is acceptable

DO NOT ADMINISTER ANY ANTI-EMETIC OR GASTROKINETIC MEDICATIONS UNLESS ABSOLUTELY WARRANTED BY CLINICAL CONDITIONS; IF NEEDED AND GIVEN, PLEASE NOTE ON THIS FORM!

PLEASE DO/DO NOT INSERT A NASO/OROGASTRIC TUBE (16 FR. SALEM SUMP), ASPIRATE THE STOMACH CONTENTS TO THE GREATEST EXTENT POSSIBLE, AND REMOVE THE TUBE IMMEDIATELY PRIOR TO EMERGENCE.

Once again, thank you for your assistance.

Appendix B

Appendix B

Nausea/Vomiting Study
Marc Friedberg RRNA
Department of Nurse Anesthesia
Medical College of Virginia

DATA COLLECTION INSTRUMENT

Patient Control #____
Age:____
Weight:____
Height:____
Time/Date surgery completed:_____
Length of surgery_____
Time/Date of Data Collection:_____
Maximun concentration expired
Isoflurane:_____

CHART REVIEW

	Nausea Y/N	Vomiting Y/N
Treatment		

Anesthesia Record

Time(s) Noted

PACU nurses notes

Time(s) Noted

Floor/unit nurses notes

Time(s) Noted

Amount/type of pain medication received intraoperatively:

_____

_____

Amount/type of pain medication received postoperatively:

_____

_____

Did patient receive epidural anesthesia/analgesia?_____

Was Propofol used for maintainance?_____Total Dose_____

PATIENT INTERVIEW

Nausea Y/N:

Approximate time of occurrence

Vomiting Y/N:

Approximate time of occurrence

Vita